New Business Opportunities from Carbon Neutral & How DL E&C-CARBONCO Approaches

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Speaker Profile

Sang-il Kim

CARBONCO Pte. Ltd
General Manager, Head of Sales & Marketing Team I

- 17 years of experience in business development, sales & marketing, and project execution in petrochemical sector and power generation sector
- Executed 1,000 MW CFPP project as Project Control Manager, and Sales & Marketing Manager of DL E&C
- Leading the project development teams tasked with the business of CCUS, Clean Hydrogen and Ammonia in CARBONCO

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Limiting Global Warming to 1.5°C

Over 190 nations and multinational companies have voluntarily agreed to reach net zero by 2050 to minimize irrecoverable climate damages by reaching net zero carbon emission and limiting global warming to 1.5°C above pre-industrial level.

Impacts from 1.5°C vs. 2.0°C Temperature Rise

Category		Impact	1.5°C	2.0°C	Comparison
Direct Impacts	Extreme Heat	Exposure to sever heat at least once every five years	14%	37%	3x
Direct Impacts	Sea-Ice-Free Artic	Number of Ice free summers	Every 100 years	Every 10 years	10x
Direct Impacts	Sea-level Rise	Amount of sea level rise by 2100	0.40m	0.46m	+0.06m
Species	Vertebrates	Vertebrates that lose at least half of their range	4%	8%	2x
Species	Plants	Plants that lose at least half of their range	8%	16%	2x
Species	Insects	Insects that lose at least half of their range	6%	18%	3x
Land	Ecosystems	Land where ecosystems shift to a new biome	7%	13%	2x
Land	Permafrost	Artic permafrost that will thaw	4.8Mkm	6.6Mkm	38%
Land	Crop Yields	Reduction in maize harvest in tropics	3%	7%	2x
Oceans	Coral Reefs	Decline in coral reefs	>70%	99%	>29%
Oceans	Fisheries	Decline in marine fisheries	1.5Mt	3.0Mt	2x

Source: Climate Council, IPCC

✓ **Greenhouse gas ("GHG") emissions has skyrocketed since the industrial revolution, causing global warming and climate change**

- Land and ocean temperature has increased on average of 1.04°C
- Atmospheric carbon dioxide concentration are 50% higher

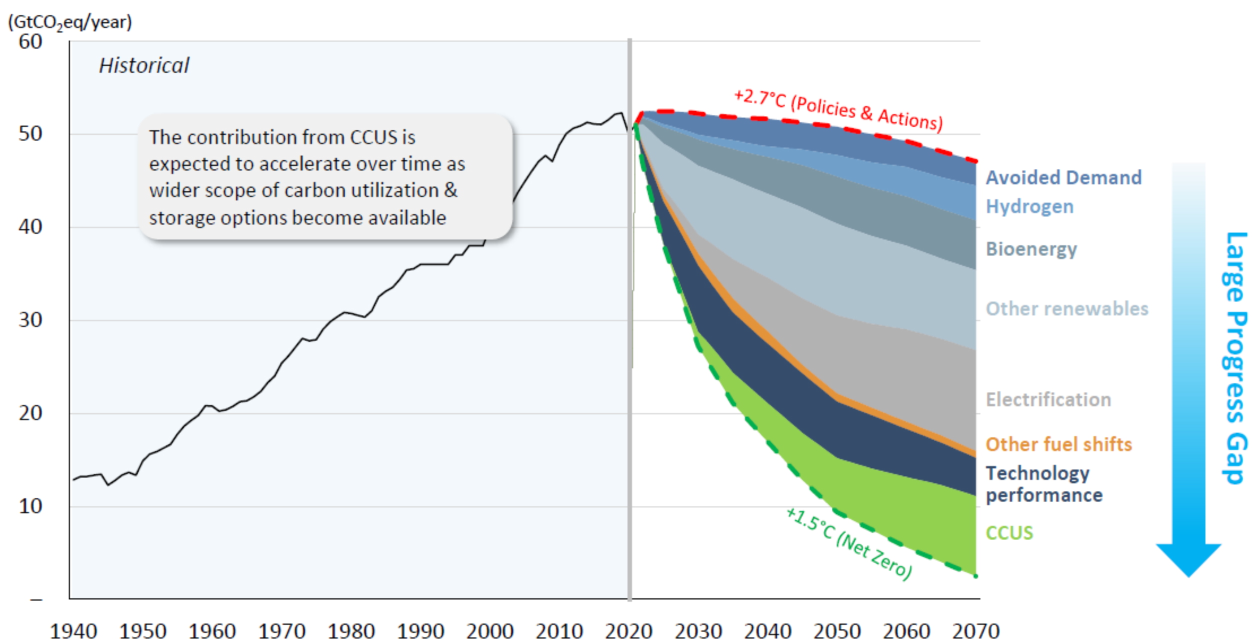
✓ **As a global initiative to mitigate future climate damages, 194 nations have signed 2015 Paris Agreement to reduce GHG emissions to net zero by the second half of the 21st century**

- The signed countries represent over 98% of global GHG emissions as of September 2022
- Every five years, each country is expected to submit an updated Nationally Determined Contribution ("NDC"), which outlines strategic pathway towards net zero

Progress for Net Zero is falling Behind

Announced GHG mitigation measures such as electrification are insufficient to meet the net zero requirements. To bridge the gap, CCUS technology is expected to play an essential by reducing net carbon emissions for carbon intensives industries.

Required CO_2 Reduction by Technology: Net Zero vs. Stated Policy[1]



	2030 NDC Target (Reduction %)	~ 2050
	55% (compared to 1990)	67%
	68% (compared to 1990)	67%
	52% (compared to 2005)	56%
	45% (compared to 2005)	56%
	46% (compared to 2013)	46%
	40% (compared to 2018)	40%

⋮

Source: Climate Action Tracker, IEA

1. CO_2 reduction by measures from IEA are adjusted pro rata to the emission gap between the expected emission and warming are based on median value for Policies & Actins (based on current policies) and 1.5C compatible benchmark developed by Climate Action Tracker.

Source: ROK Government Report 2021

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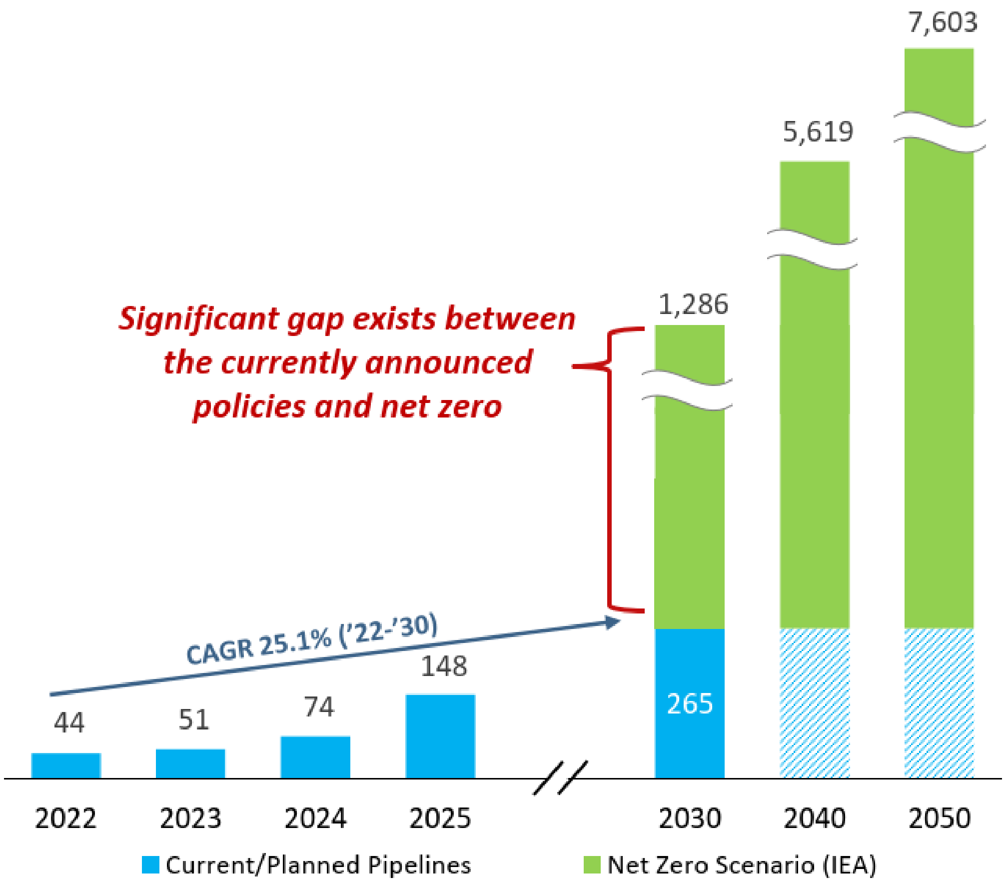
[CCUS] Market Size

Net Zero scenario requires the current global CCUS project pipeline to be ramped up nearly five-fold and annual investment to reach US$100bn by 2030.

CO_2 Capture Capacity: Project Pipeline vs. Net Zero

(Mtpa)



Addressable Market

(Annual CO_2 capture capacity)

7.6Gtpa by 2050

1.3Gtpa by 2030

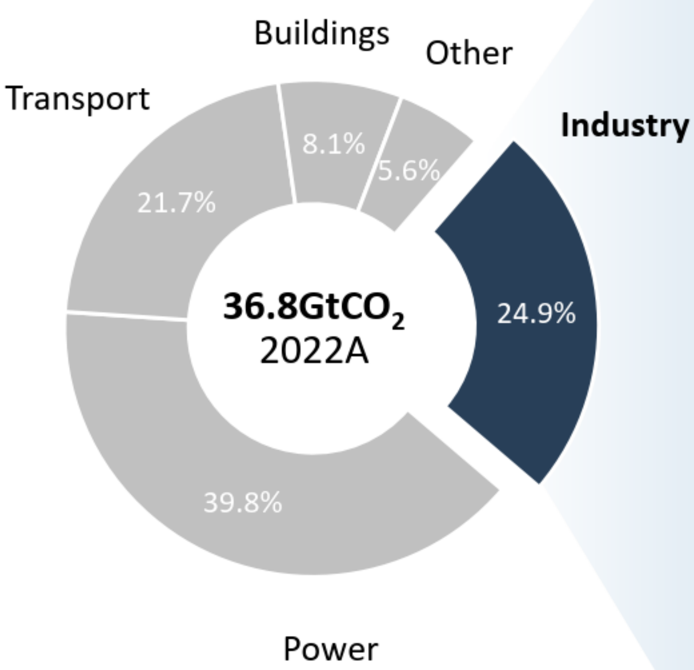
- ✓ **CCUS may be the only economically viable solution for carbon reduction in hard-to-abate sectors such as cement, steel and chemicals, that are facing more imminent regulatory warming and climate change**
- ✓ **Fossil fuel including coal, natural gas and oil accounts for >60% of the required CO2 capture capacity in 2050**
  - The remaining 40% are from industrial process, biomass, oil/gas and direct air capture

Source: Global CCS Institute, Company disclosure, News run

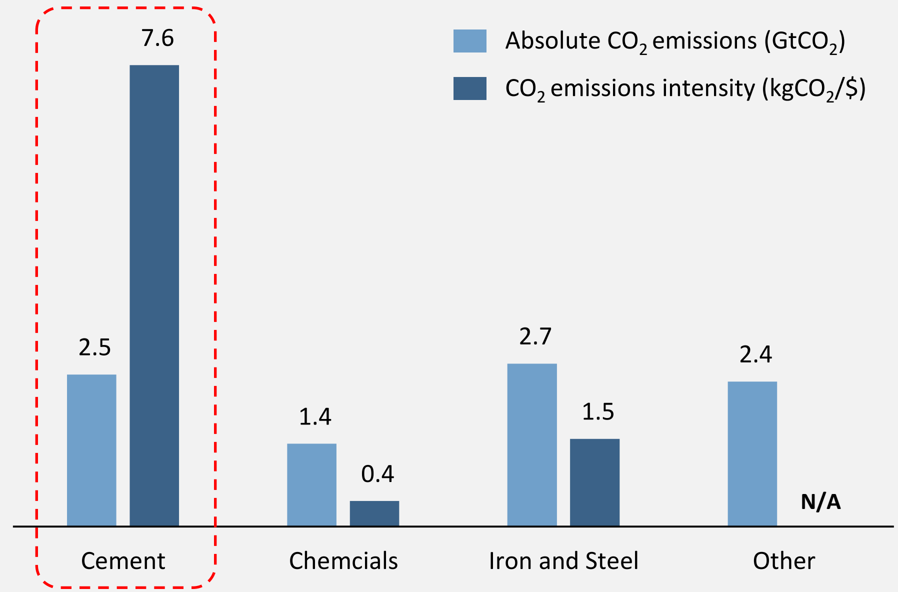
[CCUS] CO_2 Emission By Industry

Industrial sectors are the major carbon emitters, accounting for total 24.9% of the total CO_2 emission, led by iron, steel and cement production.

Annual CO_2 Emission by Sector



Absolute CO_2 emissions and CO_2 emissions intensity[1]



- ✓ **Cement** production and **iron & steel** production are one of the largest industrial emitter of carbon which accounts for 6.9% and 7.4% of total CO_2 emissions in 2021, respectively
- ✓ **Cement** functions as a key input to manufacturing concrete production as a binder between aggregates and **has the highest carbon emission intensity** amongst industrial materials

Sources: IEA, McKinsey, News run

1. CO_2 emission intensity is calculated based on 2017 McKinsey report and adjusted pro rata up to 2021 by reflecting growth rate by sector from IEA

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[CCUS] Growth Catalysts

CCUS market is one of the fastest growing markets with positive outlook that is forecasted to reach the size of US$4tn by 2050 on a global basis.

1 Supportive Government Policies	▶ 48 jurisdictions implemented or have plan to implement carbon pricing instruments to that can potentially improve profitability of CCUS projects and overcome the green premium ▶ CCUS projects are further benefited by favorable policies such as carbon tax, ETS and CCUS de-risking mechanism including contracts-for-difference, incentives and grants
2 Development of Value Chain and Project Pipeline	▶ Increasing number of industry participants are filling gaps across the CCUS value chain, making the industry more robust and driving momentum for new projects ▶ Large capital is flowing into CCUS as industry leaders embrace CCUS as a critical solution to achieve Net Zero by 2050
3 Improvement in Project Economics	▶ Governments and companies across the globe are collaborating to launch larger-scale CCS projects and expand relevant infrastructures to alleviate bottlenecks and improve economics ▶ CCS operation costs are also drastically decreasing due to maturing technologies across the CCUS value chain and scale of economies backed by forward-looking industrial tailwind
4 Technological Development	▶ Carbon capture and transportation technologies have matured and commercialized through decades of investment and experiences, largely driven by players in the oil and gas industry ▶ In order to facilitate the deployment of CCUS solution, there is a growing emphasis on directing R&D support and investment towards carbon utilization and storage technologies to develop economically viable captured CO_2 treatment solutions

Source: Exxon Mobil, Energy Transition Commission, IEA, News run

[CCUS] Supporting Policies Are Being Adopted Globally

CCUS industry may benefit from increasing number of countries that announce more advanced net zero pledges and decarbonization roadmaps, which will form favorable political landscape.

Major Countries	Net Zero Target		Net Zero Policies	GHG Emission in 2021 ($MtCO_2e$)
	Year	Legal Status		
China	Pre-2060	Proposed	▪ 14th Five-Year Plan which outlined plans to increase share of non-fossil share of electricity generation to c.39% by 2025	11,939
United States	2050	In law	▪ Enacted the Inflation Reduction Act which includes US$369bn in funding for climate energy	4,551
EU	2050	In law	▪ Outlined "Fit for 55" package including to increase for the share of renewables in energy consumption from 32% to 40% by 2030	2,658
India	2070	Proposed	▪ Released the Draft National Electricity Plan highlighting a plan for renewables	2,537
Russia	2060	In law	▪ Released the Transport Strategy Until 2030 including measures for energy-efficient or electric vehicles, low-carbon infrastructure, etc.	1,860
Japan	2050	In law	▪ G7 members including Japan agreed to decarbonize electricity by 2035 and to end fossil fuel subsidies by 2025	1,039
Iran	N/A	No targets	▪ Iran expressed its intension to modify national laws and policies to reform energy consumption patterns during COP26	681
Korea	2050	In law	▪ Announced the 10th Electricity Plan setting share of renewable energy to c.23.3% by 2030	600
Saudi Arabia	2060	Proposed	▪ Promoting the concept of a Circular Carbon Economy (CCE) to reduce emissions from oil and gas production	562
Canada	2050	In law	▪ Revised 2030 Emissions Reduction Plan to accommodate its enhanced Paris Agreement Target to reduce emission by c.40% from 2005	540
Australia	2050	Proposed	▪ Released its Long-Term Emissions Reduction Plan to achieve net zero emissions by 2050 through a green technology-led approach	352

Legal status: ● In law ● Proposed ● No targets

Source: Climate Action Tracker, European Commission, IEA, News run

[Hydrogen] Fuel for the Future

Hydrogen is the only renewable energy source with stable supply that can replace fossil fuel across wide spectrum of industries and will play a central role in achieving net-zero emissions by 2050.

Overview

✓ **Hydrogen is mainly used for chemical feedstock and as a low-carbon energy fuels**

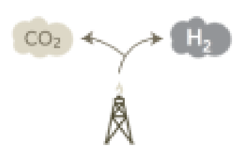
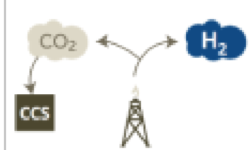
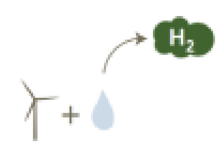
- Hydrogen is predominately utilized as a feedstock for oil refining, ammonia production for fertilizer, methanol production and steel production
- Application as low-carbon energy fuels includes transport and power generation, in which still requires further technological advancement for wider adoption

✓ **Hydrogen's value as a versatile solution lies in its potential to play a significant role in decarbonization of hard-to-abate sectors where carbon abatement solutions are challenging to be implemented**

- Hydrogen is a low-carbon energy source, with water being the only by-product produced during energy transition processes
- Hydrogen offers a stable supply and mobile applications through fuel cell technology

✓ **Hydrogen can currently be produced in multiple forms, ranging from grey (fossil fuels), blue (fossil fuels + CCS) and green (renewable energies), offering a range of options for sustainable energy production**

Major Types of Hydrogen

	Grey Hydrogen	Blue Hydrogen	Green Hydrogen
Overview	Produced from fossil fuels, which directly emits CO_2 into the air as they are combusted	Produced from fossil fuels with carbon capture storage ("CCS") technology to limit CO_2 emission	Produced from water/renewables through application of electrolyser and zero carbon energy
Feedstock	▪ Fossil fuels (oil, natural gas, coal)	▪ Fossil fuels (oil, natural gas, coal)	▪ Renewable energies ▪ Water
Method	▪ Steam methane reforming ("SMR") ▪ Partial oxidation ▪ Coal gasification	▪ SMR and CCS ▪ Coal gasification and CCS	▪ Electrolysis ▪ Biorefinery
CO_2 Emission	▲ ***High***	▼ ***Low***	***Zero emissions***
Process Illustration			

Source: World Energy Council, IEA, Hydrogen Council, McKinsey

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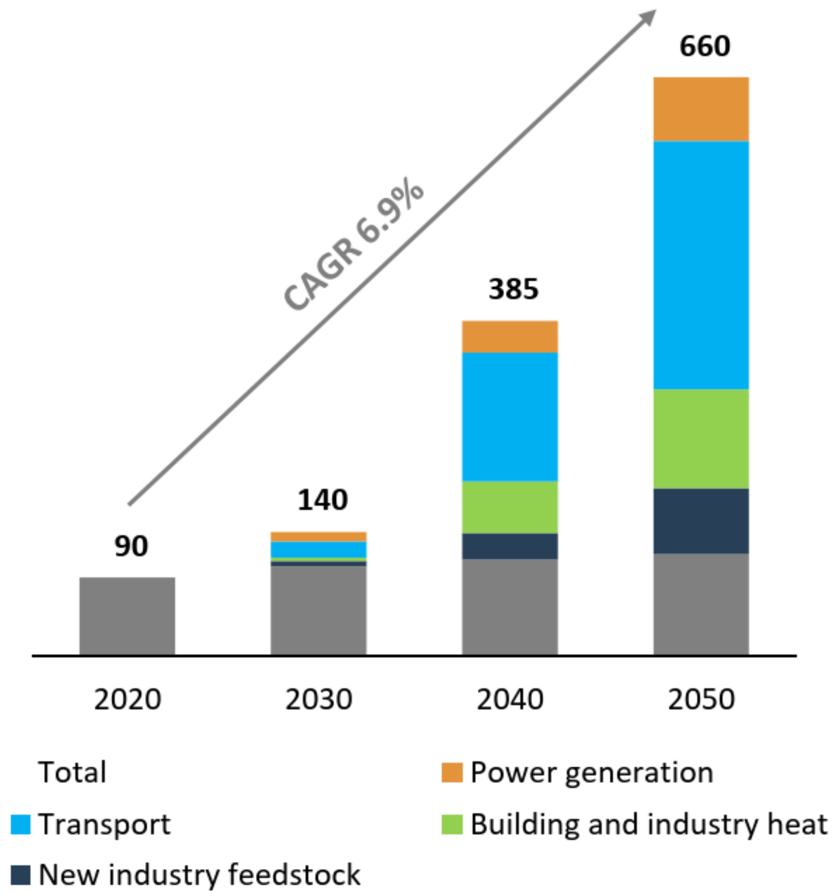
[Hydrogen] Global Hydrogen Economy

Net zero scenario projects hydrogen to be globally adopted for decarbonization of hard-to-abate sectors, such as steel, cement and chemicals, that are not readily be electrified.

Global Hydrogen Demand by Segments

(Mtpa)



Addressable Market by 2050

(CO_2 capture capacity per annum, unless specified otherwise)

7Gtpa by 2050

1Gt cumulative CO_2 abatement by 2030

22%

of global final energy demand

✓ **Hydrogen is expected to play a critical role in achieving carbon neutrality as a versatile and scalable energy fuel/vector with a cumulative abatement of 80GtCO_2 by 2050**

✓ **>60% of the hydrogen demand will be supplied through long distance transport such as international cross-border and domestic long-distance transportation in 2050**

Sources: Global CCS Institute, Company disclosure, News run

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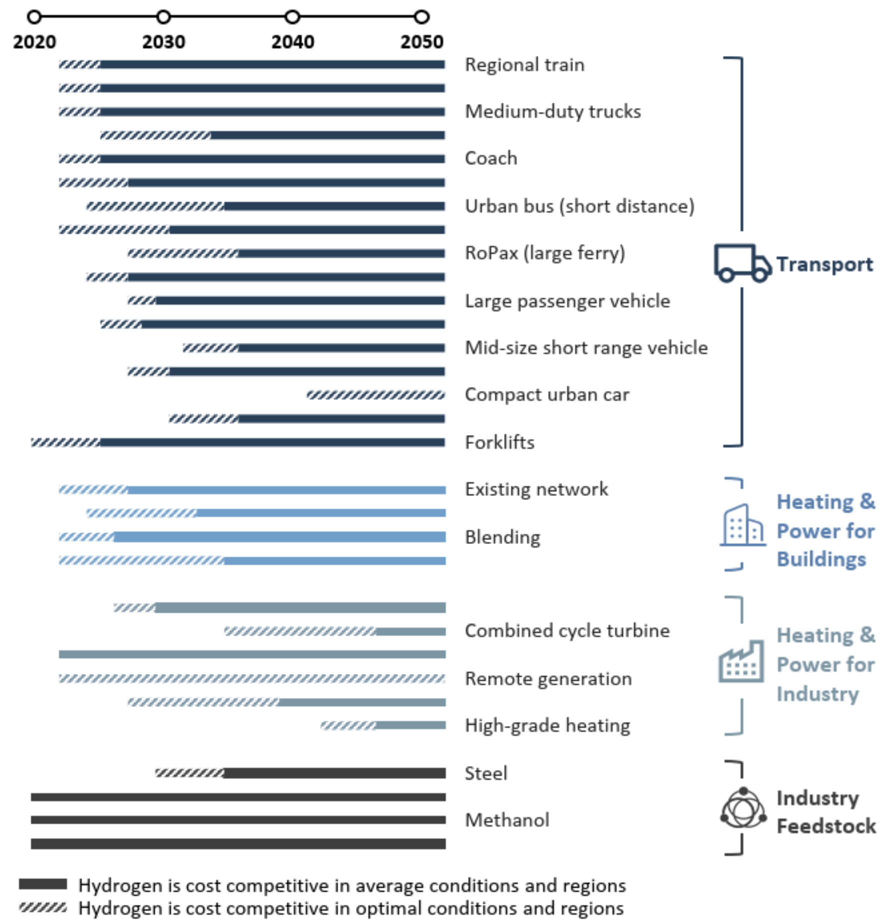
Securing core technical capability related to hydrogen at early stage would be a key as global transition to hydrogen economy is inevitable but would require improved cost competitiveness and technology developments.

Why Hydrogen?

1 Wide Range of Application	▸ Hydrogen can be utilized as chemical feedstock and fuel in a range of sectors ▸ Offers decarbonization solutions in hard-to-abate sectors where it is challenging to implement abatement solution
2 Stable Supply	▸ Most abundant element in the universe with a quasi-infinite supply ▸ Free from seasonal fluctuations and associated power intermittency
3 High Energy Efficiency	▸ Suitable for mobility due to high energy capacity per unit fuel weight ▸ Hydrogen fuel cells offer higher efficiency up to c.65% vs. 35% from fossil fuel-based generators
4 Mobile & Transportable	▸ The only renewable power source that can be efficiently stored and transported in various forms, scales and methods

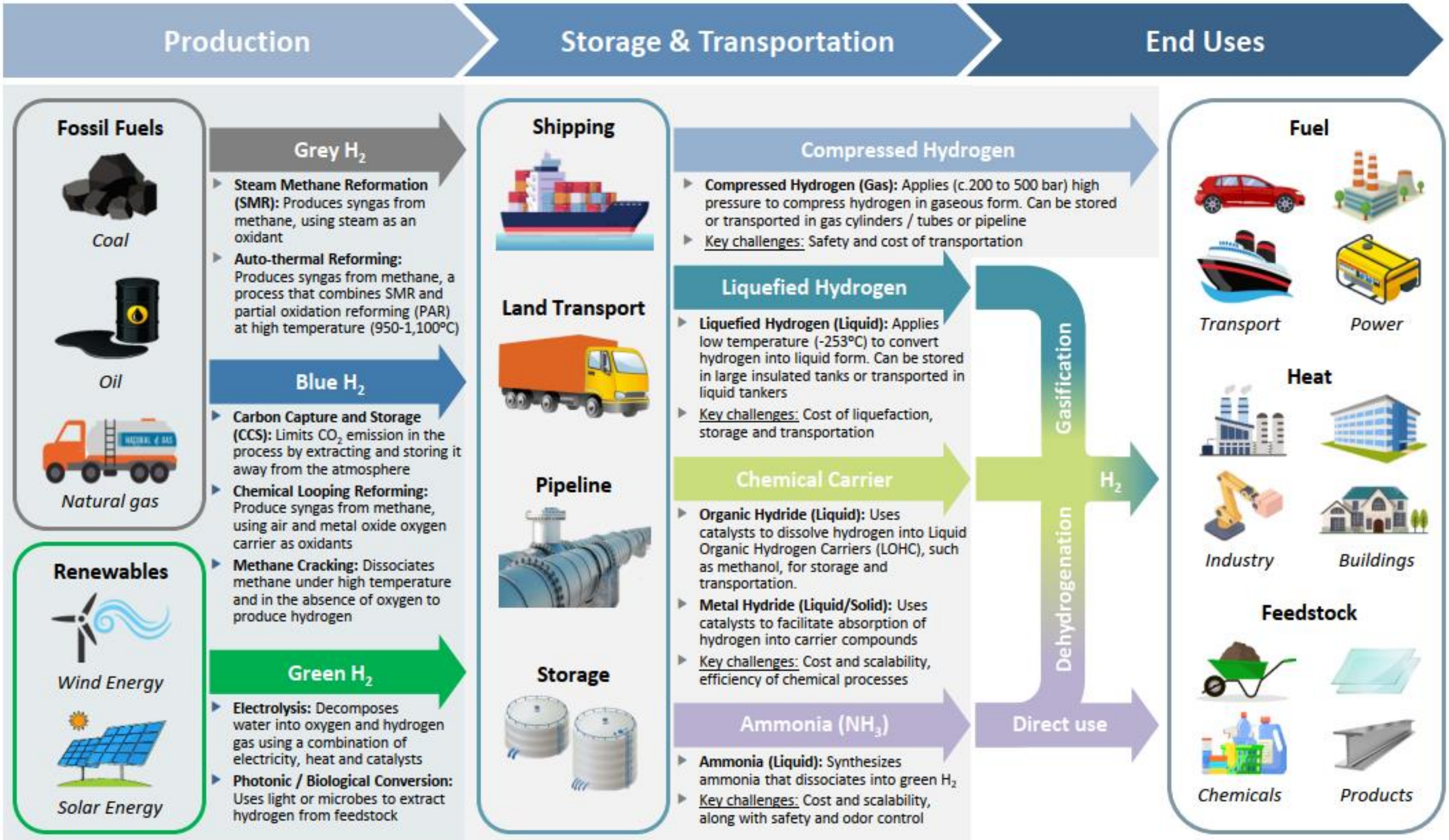
Hydrogen Application Cost Competitive Trajectories



Sources: Hydrogen Council, McKinsey, IEA, IRENA, broker report

[Hydrogen] Value Chain

Hydrogen covers a wide spectrum of industries from production to end applications, providing opportunities to diverse industry participants.



Sources: Hydrogen Council, IRENA, IEA

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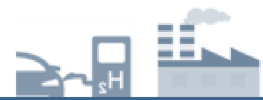
Hydrogen related technologies are evolving rapidly, projecting strong potential for improved affordability and accessibility across future hydrogen value chain.





Production

Carbon capture system

Improved carbon capture process

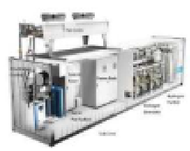
- Improve alternative carbon capture processes, such as metal oxide reforming, methane pyrolysis and calcium looping

Integrated carbon capture system

- Integrate CCS technology into hydrogen production process, such as steam methane reformation and autothermal reforming

Electrolyser

Mass manufacturing



- Shift to mass electrolyser production methods such as tape casting, expanded metal cutting and hydroforming

Electrolyser architecture and materials

- Improve electrolyser designs and materials, such as reduced anion exchange membrane, inter-electrode gap and low platinum catalysts

Novel hydrolysis methods

- Develop improved hydrolysis methods, such as thermochemical water decomposition

Storage & Transportation

Storage & Transportation

High-pressure pipeline and vessel

- Develop high-pressure (>70 bar) pipelines and vessels for more efficient transportation repurposing existing distribution networks

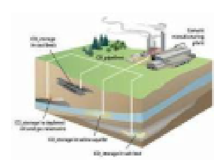
Novel hydrogen carriers

- Develop novel hydrogen carriers and improve efficiency of existing chemicals that can be used as carriers, such as ammonia, methanol and toluene/MCH

Compression & liquefaction process

- Redesign centrifugal compressors and mixed-refrigerant pre-cooling processes such as ionic liquid, electrochemical compressors, PRICO-type, Kleemenko-type and cascade-type

Carbon sequestration / storage



- Identify and convert depleted oil, gas field and aquifer sites that are suitable for carbon sequestration and storage

End Uses

Fuel cell

Mass manufacturing

- Scale up of production rates for various fuel cell components and shift the process from batch to continuous manufacturing

Innovative materials and structures

- Develop improved fuel cell structure and materials such as nanostructured thin film micro solid oxide FCs, strain-engineered materials, bio-inspired catalysts and transition metal oxides

Refueling stations

Improved distribution system

- Enhance reliability and efficiency of hydrogen refueling system and related equipment including purity control, safety and odorant management

Industrials

Power-to-chemicals

- Identify and repurpose compatible infrastructures to utilize hydrogen as an energy source to produce various industrial and chemical materials, such as chlorine, ammonia, methanol and synfuels

Sources: Hydrogen Council, Element Energy for BEIS, DOE Hydrogen Production Roadmap, News run

[Hydrogen] Global Hydrogen Production

As production technology matures, hydrogen demonstrate strong momentum and growth potential to become a multi-trillion dollar market across the globe.

Overview

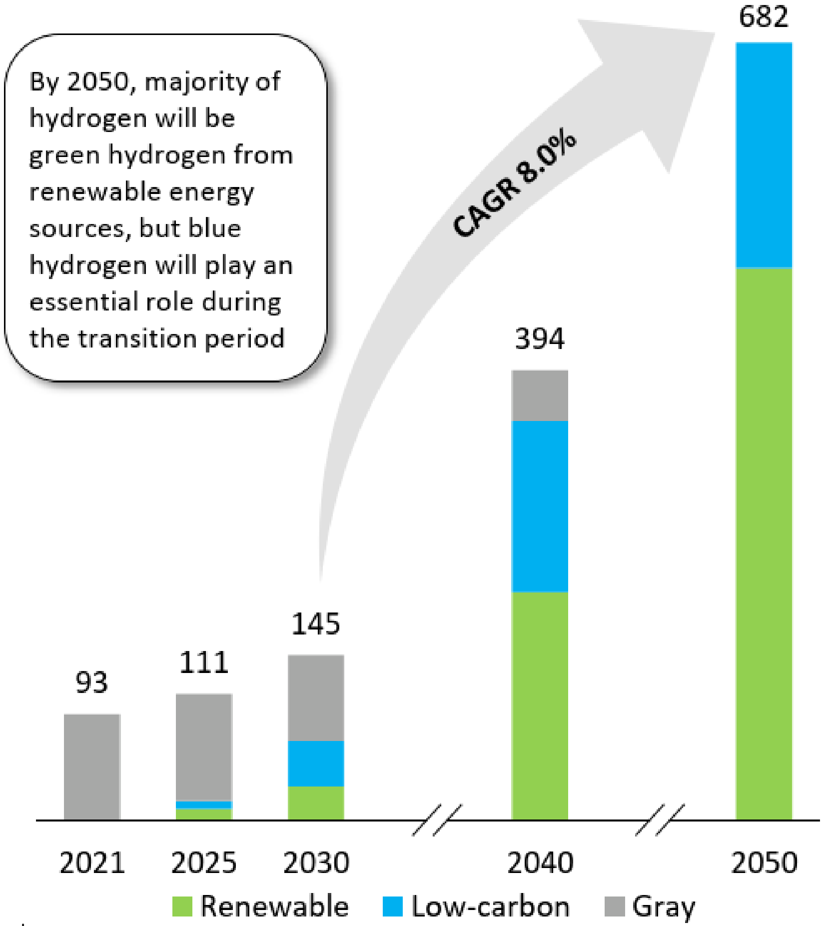
- ✓ **Hydrogen adoption is expected to grow as hydrogen-based technologies mature and scalability improves**

- ✓ **As of Nov 2022, 140 countries have announced net-zero targets, and 26 countries have committed to adopt hydrogen as a clean energy vector in their national energy system**

- ✓ **As of May 2022, over 680 large-scale hydrogen projects have been announced globally with a focus on industrial usage and transport projects**
  - 80% of the project pipelines announced full or partial commissioning before 2030
  - The total number of project announcements increased by 146 since end of 2021, demonstrating a strong industry momentum
  - The number of giga-scale production and large-scale projects industrial usage[1] has increased from 51 to 61 and 262 to 332, respectively

Projected Global Hydrogen Production

(Mtpa)



Sources: Hydrogen Council, McKinsey, IEA, IRENA, broker report

1. Giga-scale project is >1 GW or >200 kiloton p.a. of hydrogen production capacity; large-scale project is >1 MW or equivalent

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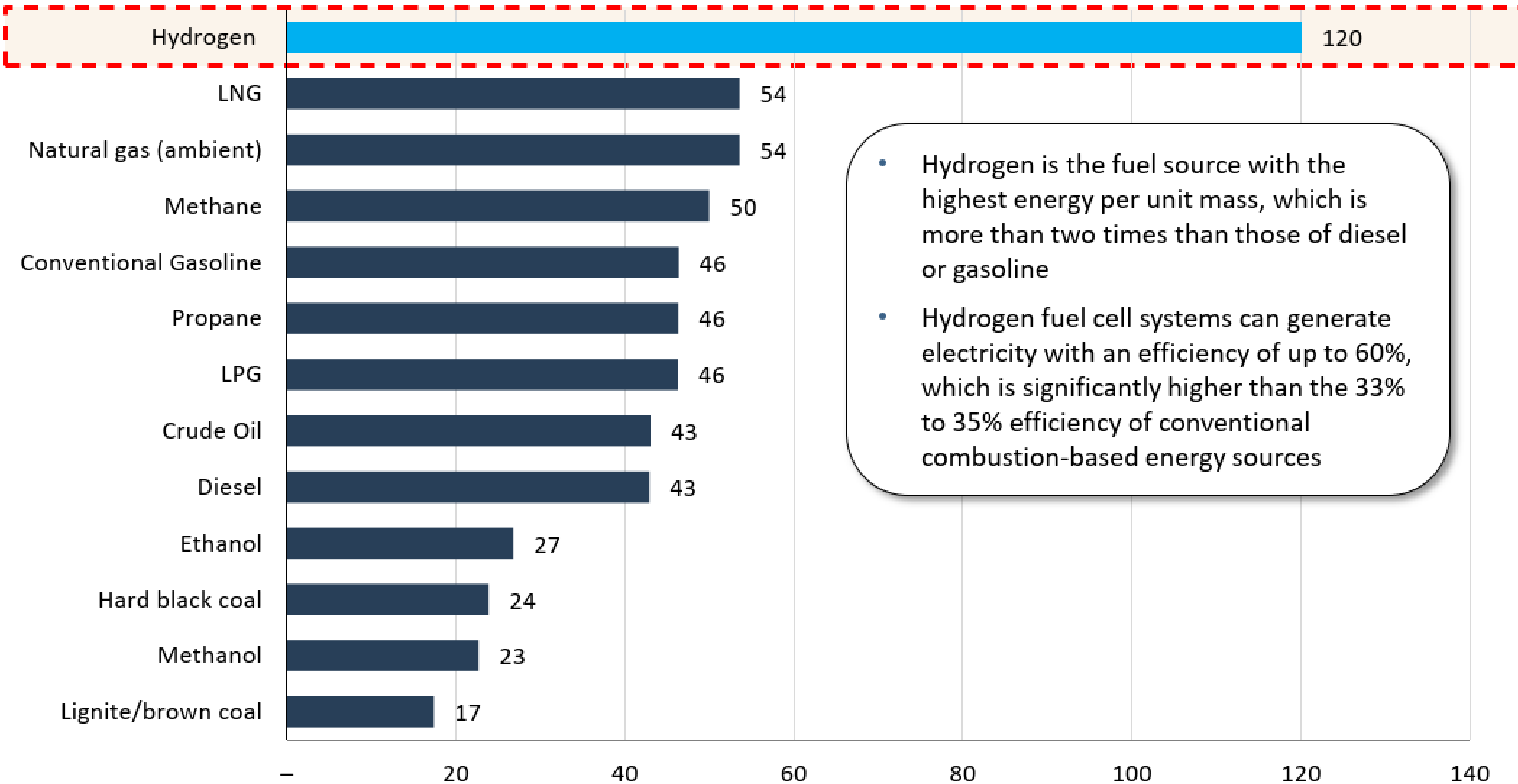
[Hydrogen] Energy Efficiency Comparison

Due to its high energy density, hydrogen can be efficiently transported and stored at large-scale. This makes hydrogen the most prominent renewable energy source for sectors that are hard to be electrified due to with high energy requirements.

Energy per Unit Mass by Fuel Source (MJ/kg)



- Hydrogen is the fuel source with the highest energy per unit mass, which is more than two times than those of diesel or gasoline
- Hydrogen fuel cell systems can generate electricity with an efficiency of up to 60%, which is significantly higher than the 33% to 35% efficiency of conventional combustion-based energy sources

Sources: DOE, IEA, World Nuclear Association, broker report, News run

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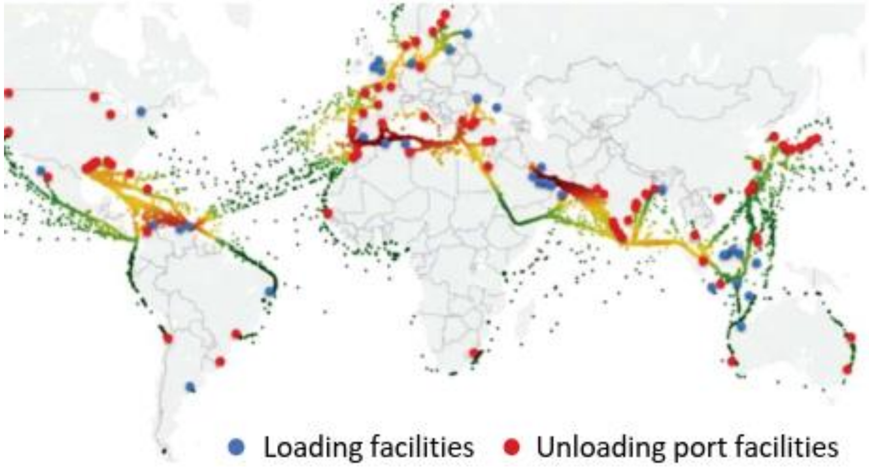
Ammonia's superior energy efficiency and existing port and shipping infrastructure could enable the deployment of large-scale transportation of ammonia as a hydrogen carrier.

Major Types of Hydrogen Transportation Options

	Compressed Hydrogen	Liquefied Hydrogen	Chemical Carrier	Ammonia (NH_3)
Density (kg/m^3)	• 39	• 70.8	• 769	• 682 (1 bar)
Hydrogen content	• 100	• 100	• 6.16	• 17.8
Extraction Temperature	• N/A	• N/A	• 200-400	• 350-900
Energy Density (to H_2)	• x463	• x865	• x574	• x1,467
Required Infrastructure	• N/A	• Facility investment required	• Compatible with existing oil & gas infrastructure	• Compatible with existing propane infrastructure
Pros	+ Low CAPEX + Low conversion loss	+ Storage stability	+ Compatibility + Long-term storage	+ Compatible with propane infrastructure + High energy density
Cons	- Safety and cost of transportation - Low energy density	- Safety and cost of transportation - Cost of liquefaction	- Cost and scalability - Efficiency of chemical processes - Conversion losses	- Odour - Toxicity - Conversion losses

A Heat Map of Liquid Ammonia Carriers and Existing Ammonia Port Facilities



✓ **The ammonia storage and transport infrastructures exist extensively across the globe to supply feedstock for inorganic fertilizers production**

✓ **As ammonia is compatible with propane infrastructure, retrofitting and repurposing of existing propane infrastructure present significant opportunity to expand the infrastructure networks as a hydrogen carrier**

Sources: Hydrogen Council, Royal Society, broker reports, News run

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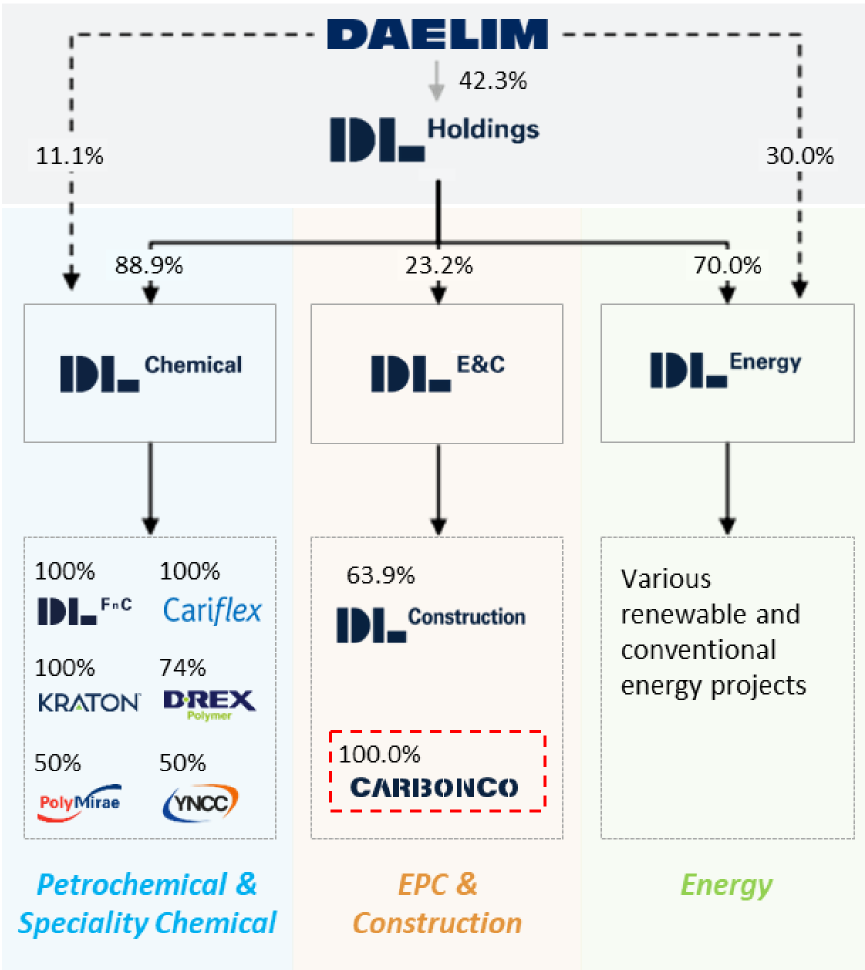
DL Group with CARBONCO

DL Group boasts a dazzling catalog of multiple landmark projects globally and domestically, including the world's largest ammonia production plant in Saudi Arabia.

DL Group Structure



DL Group Overview

✓ **Founded in 1939, DL Group was the first domestic construction company in Korea and grew to become a diversified conglomerate with an extensive global presence in 40+ countries**

✓ **DL E&C is one of Asia's leading EPC contractor for companies in the petrochemical, power, energy, housing and civil works industries**

- DL E&C has completed >600 projects in 35 countries around the world with >49 years of experience in plant design and engineering

✓ **CARBONCO was formed to address the growing need for decarbonization solutions**

- Only Korean company able to provide full scope EPC services for commercial scale CCUS projects
- Oversaw the first carbon capture pilot plant project in Korea

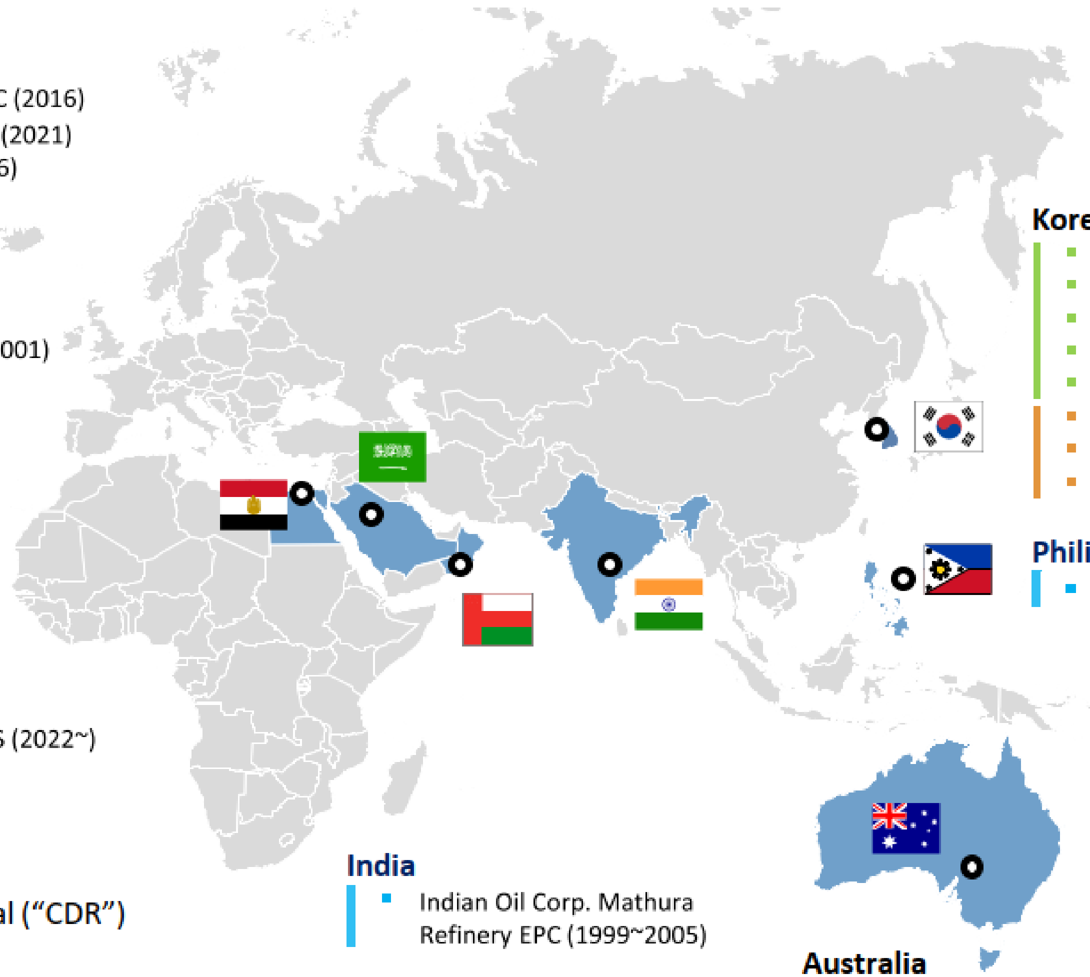
Collaboration Potential Across DL Group

There are significant strategic collaboration opportunities across the DL Group that could potentially accelerate the value creation and create significant synergies in CARBONCO's business ecosystem.

	Company Description	CCS/Carbon Products	Hydrogen/Ammonia
DAELIM	▪ Trading company specializing in petrochemical products, shipping and logistics services	▪ Logistic service for captured CO_2 by leveraging off its cross-border shipping and an extensive global network	▪ Off-taker of clean hydrogen, ammonia and fertilizer through long term agreement
DL Chemical	▪ Petrochemical company producing basic chemicals and synthetic resins	▪ Decarbonizing emitted CO_2 from chemical plants ▪ Production of CO_2 conversion chemical products	▪ Distributor of clean hydrogen, ammonia and fertilizer to the market for energy source
DL Energy	▪ Energy company developing and operating a diverse power generation business, from gas combined cycle to renewable energy	▪ Decarbonizing emitted CO_2 from power plants across the globe	▪ Renewable energy provider for clean hydrogen/ammonia production ▪ Off-taker of produced clean hydrogen/ammonia
DL Construction	▪ Construction company specializing in EPC services, primarily in Korea	▪ Off-taker of produced recycled aggregates	▪ Construction for ammonia hub terminal
DL E&C	▪ Construction company specializing in EPC services for housing, civil, and plant project across the globe	▪ Off-taker of produced recycled aggregates ▪ EPC (Hub, Pipeline, Plant etc.)	▪ EPC (hydrogen/ammonia/cracking plant, hub, pipeline, etc.) ▪ Small Modular Reactor (for pink/purple hydrogen)

DL Group's 20+ Years of Monumental Track Record

DL Group boasts a dazzling catalog of multiple landmark projects globally and domestically, including the world's largest ammonia production plant in Saudi Arabia.



Saudi Arabia
- Saudi Butanol / Syngas EPC (2016)
- Ma'aden Ammonia III EPC (2021)
- Ma'aden Ammonia II (2016)

Egypt
- Middle East Oil Refinery
  MIDOR Oil Refinery EPC (2001)

Oman
- ORPIC SRIP (2014 ~ 2017)
- Oman Green Ammnoia F/S (2022~)

Korea
- SK E&S LNG CCUS Basic/FEED (2022~)
- SEOHAE GREEN CCUS Basic/EPC (2022~)
- KEPRI CCS 2014 Basic/FEED (2014)
- KEPRI Boryeong CCS Basic/O&M (2010)
- KEPRI Danginri CCS EPC (2002)
- Lotte BP CO FEED (2020)
- Hyundai Chem. HPC NCC FEED (2019)
- Hyundai Oil-Bank EPC (2008~2011)

Philippines
- PETRON RMP II EPC (2014)

India
- Indian Oil Corp. Mathura
  Refinery EPC (1999~2005)

Australia
- NeuRizer Fertilizer FEED EPC (2022~)
- NeuRizer Fertilizer CCUS Basic/EPC (2023~)

- CCUS
- Carbon Dioxide Removal ("CDR")
- Hydrogen
- Ammonia

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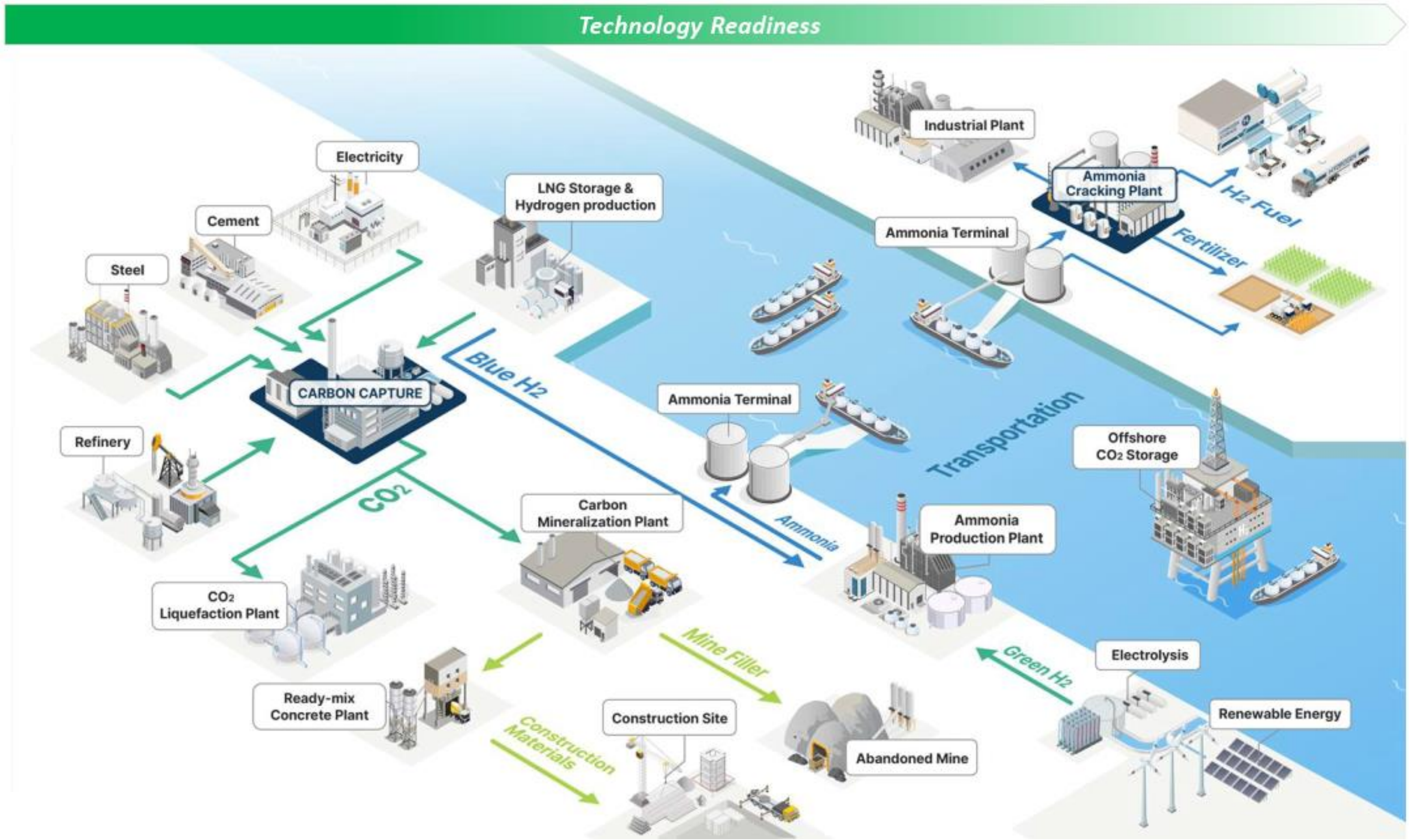
CARBONCO will transition its legacy EPC-centric business model inherited from DL E&C to a developer business model, providing long-term services and supplying diversified products along the CCUS and hydrogen value chains.



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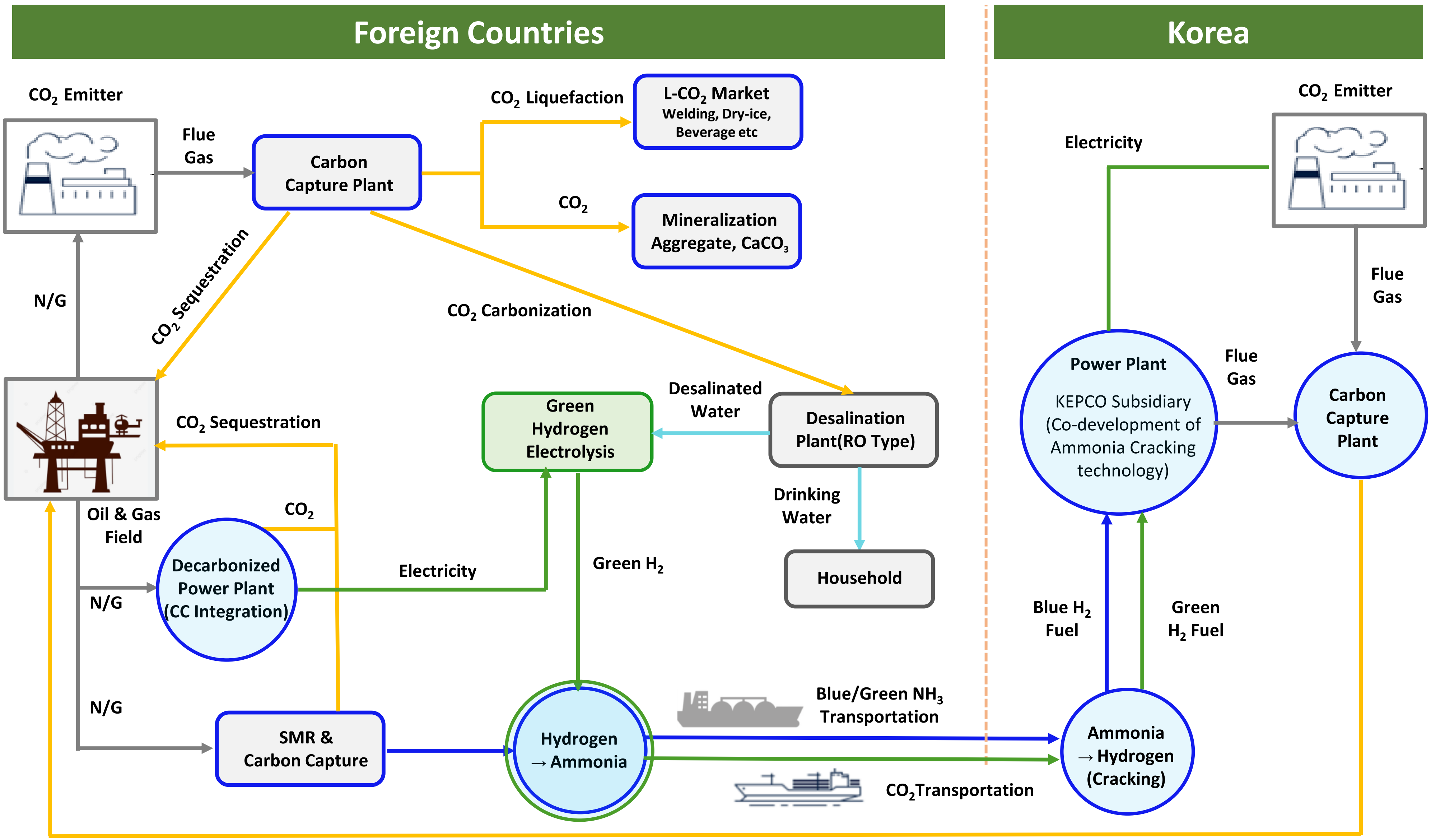
Ecosystem of DL Group & CARBONCO (2/2)



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Business Model of CARBONCO

Building on an impressive legacy of 20+ years EPC track record in carbon capture and ammonia facilities, CARBONCO strives with vigorous steps to become a leader in providing solutions and developing facilities across the CCUS and hydrogen/ammonia value chains. CARBONCO aims to position itself as a leader with pioneering ideas to achieve a global goal.

CARBONCO Strategic Direction

EPC and Others

- Feasibility Study
- Basic / FEED
- EPC / EPCM
- O&M
- Advisory & Consulting
- Construction Management
- Project Developing & Organizing
- Commissioning & Start-up

Carbon Capture and Storage ("CCS")

Catalyst development and global CCS project participation

Carbon Products

Green construction materials and chemicals production

Hydrogen / Ammonia

Blue/green hydrogen fuel production
Ammonia production and cracking

Developer

- Lead project development and technology commercialization
- Take ownership of plants under development and capture upside potential

Product Sales

- License
- Green aggregates
- Chemicals and catalysts
- Hydrogen and ammonia
- Major equipment

Decarbonization Technology Offerings of CARBONCO

CABONCO is a total CCUS solution provider based on wide range of proprietary decarbonization technologies and strong EPC capability.

Services			CARBONCO Solutions		Description	Partners
EPC	Plant Design Optimization		1 Standardisation		Standardized plant design library for carbon capture capacity up to 3,000tpd	DL E&C
EPC	Plant Design Optimization		2 Modularization		Customizable modular designs that minimizes design period and costs	DL E&C
EPC	Recurring Service	CCS	3 Carbon Capture Solvent		High performance amine-based solvents for carbon capture developed by KEPCO	KEPCO KEPRI
EPC	Recurring Service	Carbon Products	4 Carbon Mineralization	CSA Cement	Replaces cement limestones with coal ash residuals with low carbon footprint	KIGAM Korea Institute of Geoscience and Mineral Resources
EPC	Recurring Service	Carbon Products	4 Carbon Mineralization	Green Aggregate	Recycles industrial waste into green aggregates, which can be used as mine fillers and construction materials	KIGAM Korea Institute of Geoscience and Mineral Resources
EPC	Recurring Service	Hydrogen/ Ammonia	5 Blue Hydrogen Production		Chemical looping water splitting ("CLWS") based hydrogen production technology developed by KEPCO	KEPCO KEPRI
EPC	Recurring Service	Hydrogen/ Ammonia	6 Ammonia	Production	Feasibility, FEED and EPC works for coal gasification-based urea/ammonia production facility in Australia	NeuRizer
EPC	Recurring Service	Hydrogen/ Ammonia	6 Ammonia	Cracking	Ammonia cracking process that yields high conversion rate (>99%) and low cost	KEPCO KEPRI

Carbon mineralization is currently the only scalable and economical viable solution to address intermediate demand for carbon storage and CARBONCO has secured two technologies capable of producing different carbon derivatives for construction applications.

CARBONCO Carbon Products

KIGAM

Carbonate Mixture (Calcium Carbonate)

- Can be utilized as abandoned mine filler and construction materials
- Feedstocks include industrial waste, such as coal ash and steel slag

KIGAM

CSA Cement (Calcium Sulfoaluminate)

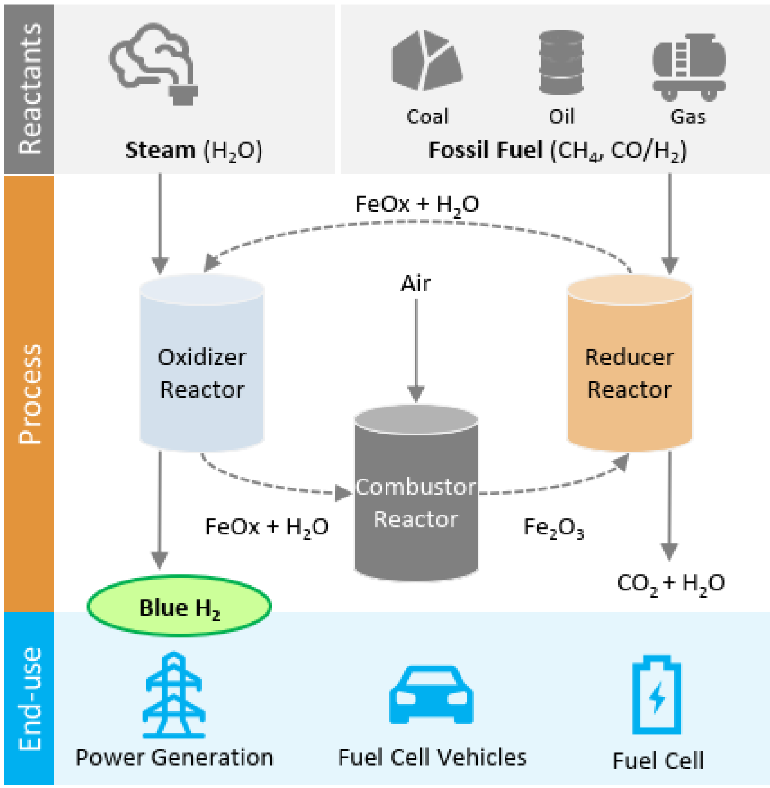
- Replaces limestone with coal ash residues in cement
- Reduces hardening times and improves shrinkage compensation compared to Portland cement

1. Recycled concrete aggregate

Blue Hydrogen Production

Korean government announced national hydrogen economy roadmap, targeting 5.3Mtpa hydrogen production capacity by 2040. CARBONCO has partnered with KEPCO to co-develop CLWS-based blue hydrogen production technology to preemptively secure the market leadership.

Process Overflow



✓**CLWS-based process produces high-purity blue hydrogen without separate carbon capture facility**

CLWS Technology Comparison: KEPCO

	Details[1]		
Companies	B&W Babcock & Wilcox	RG H2	CARBONCO KEPCO
Key Partners	clearSkies, American Electric Power, The Ohio State University	Uni Graz, TU Wien	KOWEPO, KOMIPO
System Configuration	Coal gasification & CLWS	SMR & CLWS	SMR & CLWS
Reaction Stage	3 (Fuel-H2O-Air)	3 (Fuel-H2O-Air)	2 (Fuel-H2O-Air)
O_2 Transfer Capacity/Rate	4wt% / Fast	10wt% / Lower	**≥14wt% / Faster**
Fuel	Coal/Syngas	NG/Syngas	NG/Syngas
H2 Production Capacity	4kW (2018, + Heat 200kW)	60kW (2021)	**20kW (2022)**
Development Start	2007~ (Ohio State University)	2000~ (Graz University)	**2020~**

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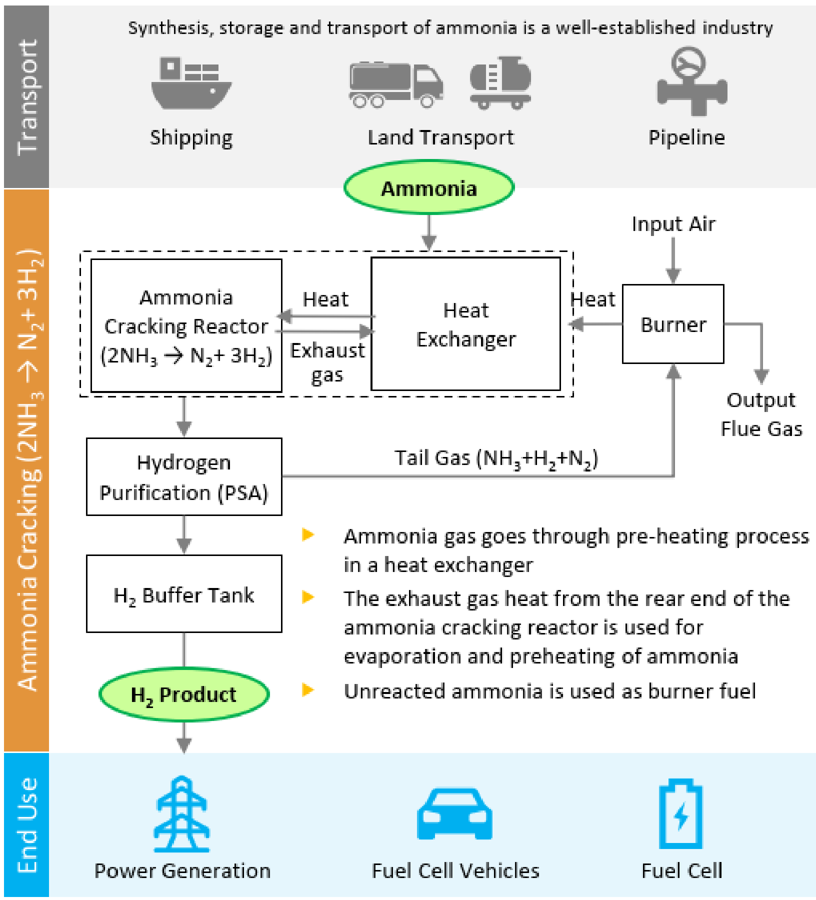
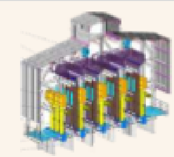
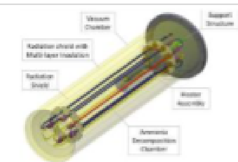
Ammonia Cracking

Leveraging its experience as the leader in developing ammonia facilities by capacity, CARBONCO is developing the ammonia-hydrogen supply chain and its own proprietary ammonia cracking technology in collaboration with KEPCO.

Process Overflow



Ammonia Cracking Technology: KEPCO

	Specification	
Companies	CARBONCO / KEPCO KEPRI	Government/Industry
Design	 **Large-capacity expandable design**	 Small/medium capacity compact design
Catalyst Technology	Use of commercial catalyst technology/facilities	Use of laboratory catalyst /manufacturing methods
Heat Supply	NH_3/H_2 combustion (carbon-free)	NH_3/NG combustion (carbon emitted)
Product	NH_3 partial reformed hydrogen	High-purity hydrogen
Applications	Gas turbine of hydrogen co-fired/fired power generation	Hydrogen charging station (transportation, etc.)
Demonstrated Scalability	**470tpd**	2tpd

✓ **CARBONCO is co-developing an ammonia cracking process that yields high conversion rate >99%**

Table of Contents

Case 1: Coal-Fired Power Plant "CCU" Project

CARBONCO proposes carbon capture and mineralization solution for coal-fired power plant. Coal-fired power stations emit over 10 billon tons of carbon dioxide each year, about one fifth of world greenhouse gas emissions. This makes these stations the single largest cause of climate change.

Project Overview

Coal-Fired Power Plant

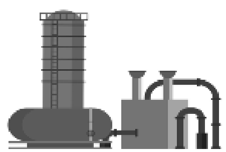
↓ Flue Gas

Carbon Capture

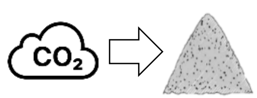
↓ CO_2

Carbon Mineralization

CFPP



Carbon Capture Plant



CO_2→Carbonates

Coal-Fired Power Plant

- ✓ The coal is fed into a power plant as fuel, and its flue gas is released to atmosphere.
- ✓ Coal-fired power stations emits high concentration and volume of carbon dioxide.

CCU Plant

- ✓ Flue gas is pumped into a CCU plant and CO_2 is absorbed through capture process.
- ✓ Captured CO_2 is then transported to carbon mineralization plant.

Carbon Mineralization Plant

- ✓ Through carbonization process, the CO_2 is mineralized with the byproducts (ash) from CFPP as calcium carbonates. Besides calcium carbonates, rare earth elements like scandium, praseodymium, neodymium, etc. By-products can be separated.

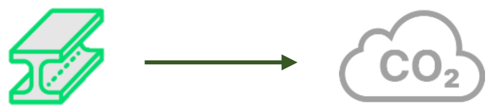
Case 2: Waste Energy Power Plant "CCU" Project

CARBONCO offers tailor-made decarbonization solutions. CCUS technology is a ready-to-adopt technology that can be directly applied to existing various industries to reduce greenhouse gases and create added value simultaneously. CARBONCO presents consulting services to assist clients in finding customized decarbonization solutions.

Project Overview

Steel Mill

✓ The IEA estimates that direct CO_2 emissions due to crude steel production are approximately 1.4 tons of CO_2 per ton of steel produced.



Waste Energy Recovery Co-Generation Plant, Off-gas power plant

✓ DL E&C provided the consultation and the solution to one of Korea's major steel mills to develop a Waste Energy Recovery Co-generation plant (Off-gas power plant) to recycle energy 10 years ago.

✓ Waste Energy Recovery Co-generation plant runs on byproduct gases, which include gases produced by blast furnaces (BFG), Coke Oven Gas (COG), and Converter Gas (LDG) from Steel Mills.

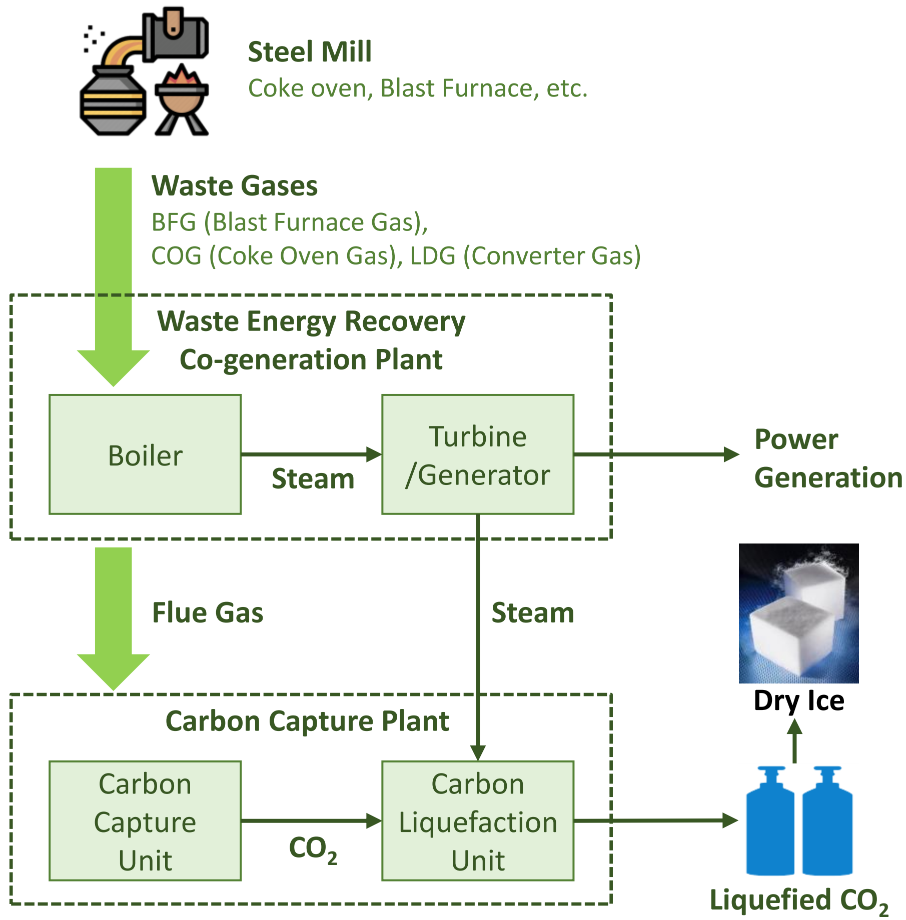
✓ The off-gas power plant emits high concentrations and volumes of CO_2.

Carbon Capture Plant

✓ Flue gas from the off-gas power plant is pumped into a CCU plant and CO_2 is absorbed through the capture process.

✓ Captured CO_2 is then sold to off-takers as Liquefied CO_2 or Dry Ice.

Process Overview



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Case 3: Desalination Plant CCU Project

CARBONCO is a strategic partner with major players in the Middle East's Power Plants and Desalination plants, and they consistently attempt to incorporate CCU plants into their plants. The CO_2 produced by CCU plant can be steadily supplied to the post-treatment system of the desalination plant.

Project Overview

Power Plant

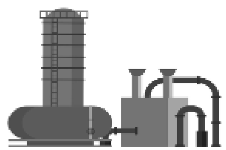
Flue Gas

Carbon Capture

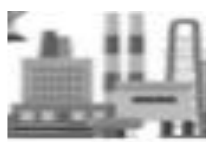
CO_2

CO_2 Injection to Desalination

Power Plant



CCU Plant



Post-Treatment

Power Plant

- ✓ Power and steam are produced by a power plant.
- ✓ NG is fed into a power plant as fuel, and its flue gas is released into the atmosphere.

CCU Plant

- ✓ Flue gas is fed into a CCU plant.
- ✓ Captured CO_2 is converted into the liquid phase (L-CO2) for transportation.

SWRO* Desalination Plant

- ✓ The CO_2 is pumped into a post-treatment of SWRO desalination plant. The CO_2 is utilized to mineralize the desalination water to meet drinking water regulation.

*SWRO : Seawater Reverse Osmosis

Case 4: Waste-to-Energy “CCU” Project

CARBONCO is elevating the circular economy with Waste-to-Energy (WTE) projects, diverting waste from landfills, reducing greenhouse gases from landfills, particularly methane (84 times more potent as a global warming gas than CO_2), offsetting emission from fossil fuel for electricity production and extracting profit from waste.

Project Overview

- ✓ In a landfill, waste is buried and bacteria break down the biogenic materials in the waste, generating methane and carbon dioxide.
- ✓ Landfills emit less CO_2 than the waste incineration facility, however, methane emitted by landfills is far greater and methane is far more potent than CO_2 as it traps heat more efficiently.
- ✓ Over a 100-year period, methane is 28-34 times as warming as CO_2 and 84 times more potent.

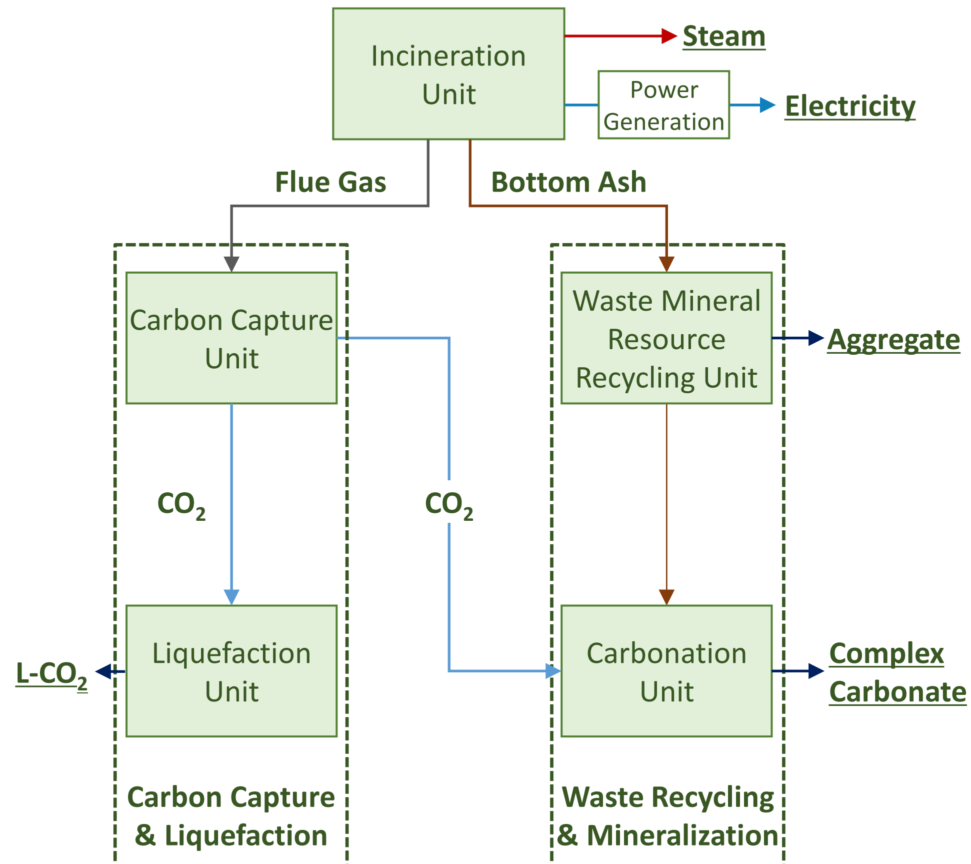
Waste Incineration

- ✓ Methane and CO_2 emission
- ✓ Fossil Fuel use for Incineration
- ✓ Unwanted Public Infrastructure (incl. landfill)

Waste-to-Energy “CCU”

- ✓ Carbon capture and utilization
- ✓ Circular economy by recovering values from waste
- ✓ Steam & Power Production
- ✓ Clean and sustainable facility with profitable business

Process Overview



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Rapidly growing as a leading group in the world,
DL is developing pioneering solutions
for decarbonization business
to remarkably reduce GHG emissions