3-2. Blue Hydrogen: Economics and Current Activity

APERC Clean Hydrogen Workshop

associated with EGNRET 60 Meeting

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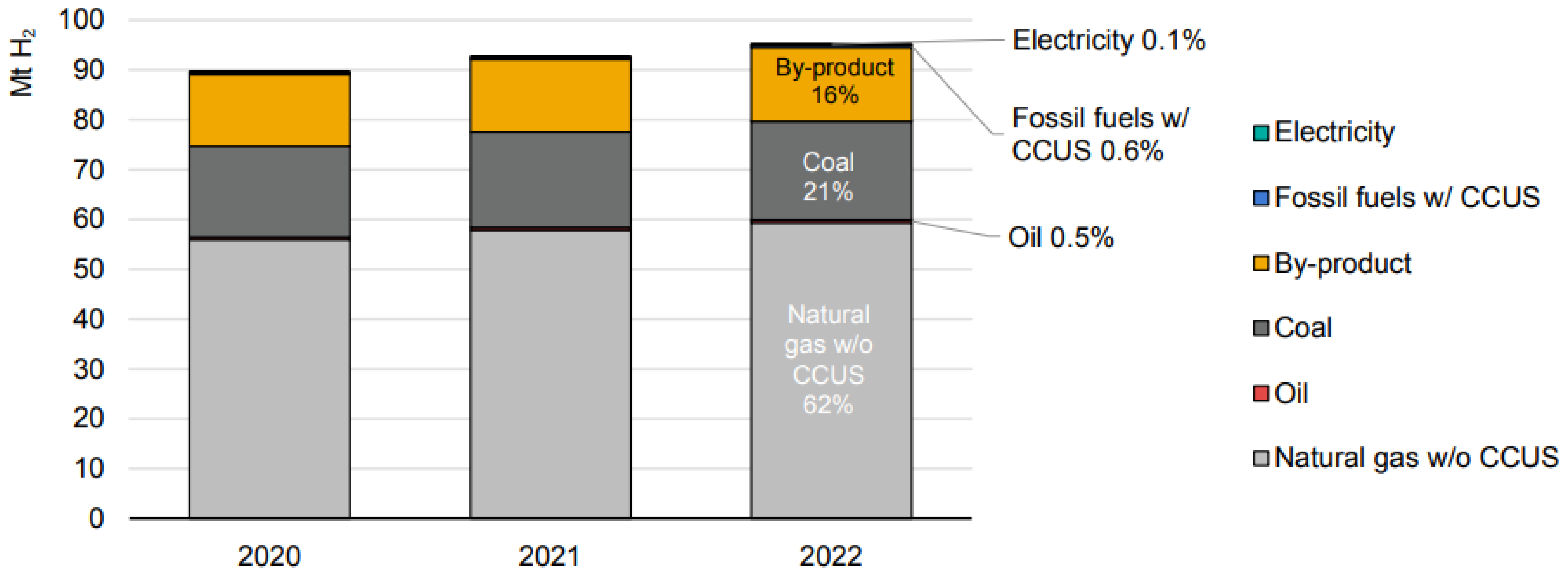
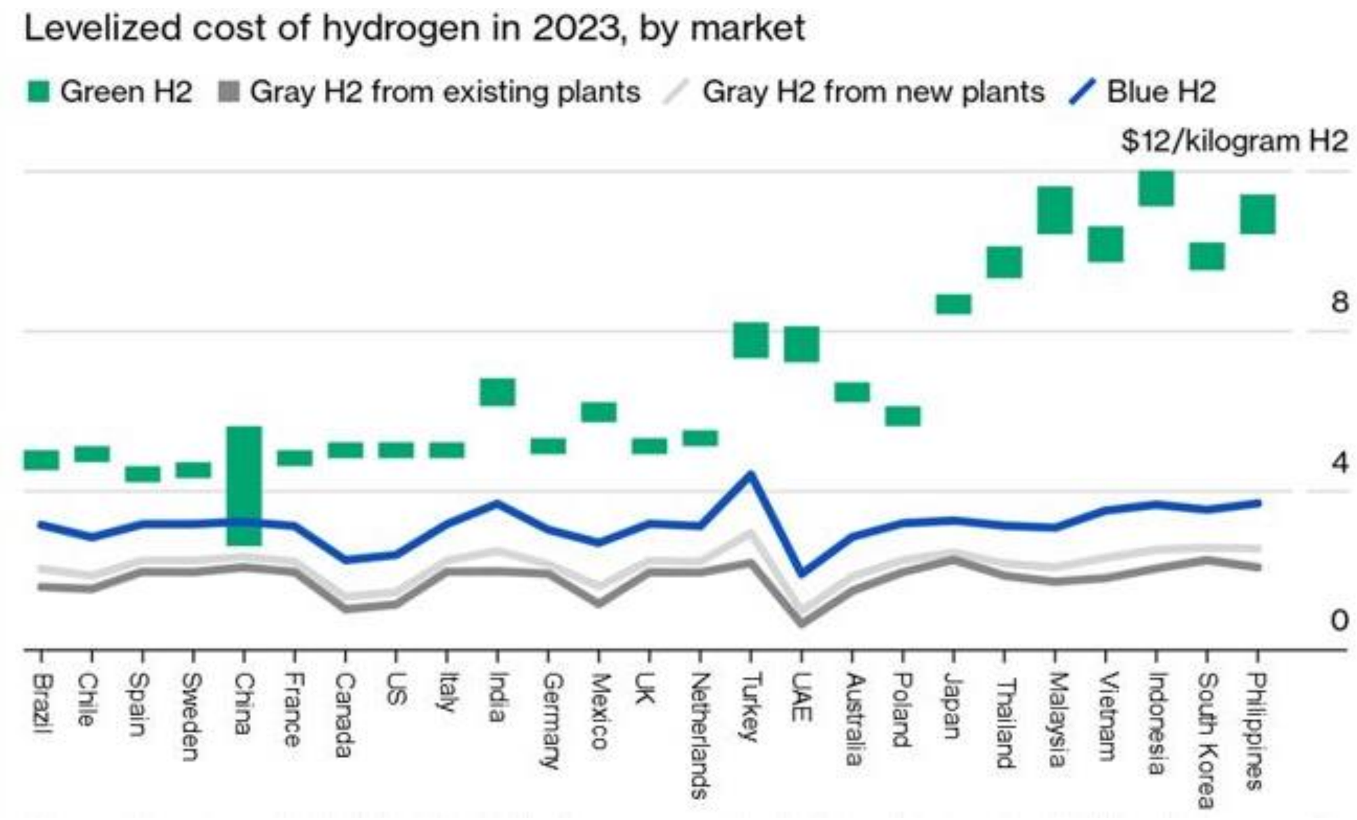
Hydrogen production by technology

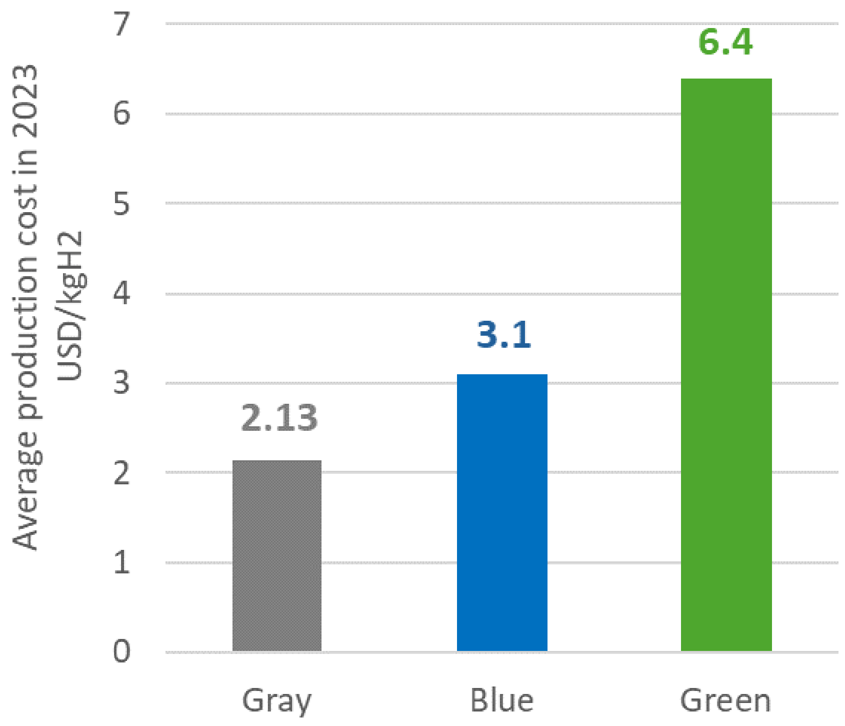


Source: IEA

Low-emission hydrogen production accounted only for less than 1% of all production. Therefore, CCS technology has great role to decarbonize the existing fossil-based hydrogen production plants.

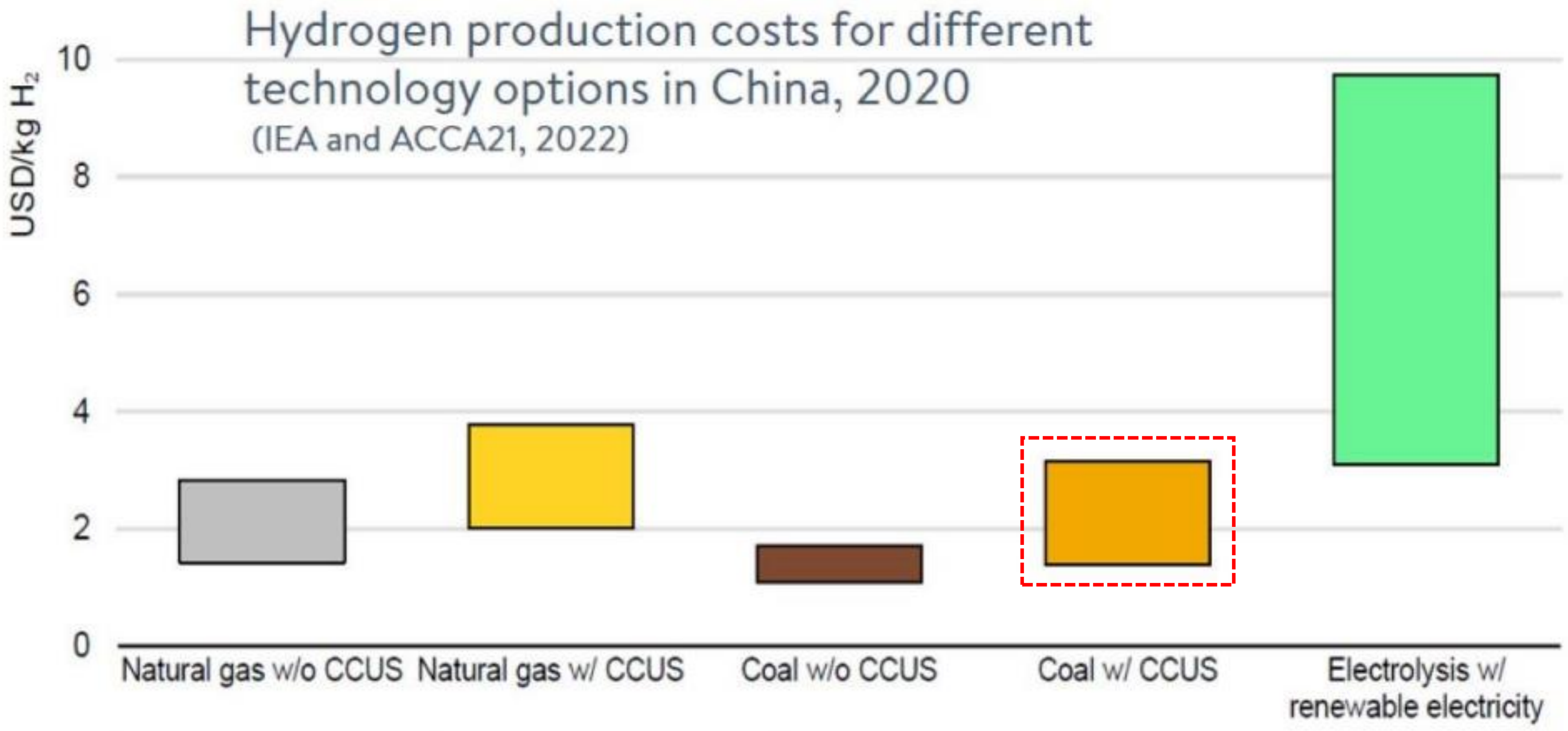
Today, green hydrogen is more expensive than gray and blue H_2





Source: BloombergNEF

Blue hydrogen produced from coal is less expensive than green hydrogen



Source: IEA, ACCA21 (2022).

In regions with abundant coal and access to CO_2 storage sites but limited available renewable energy, hydrogen produced from coal with CCUS will be the best low-carbon option

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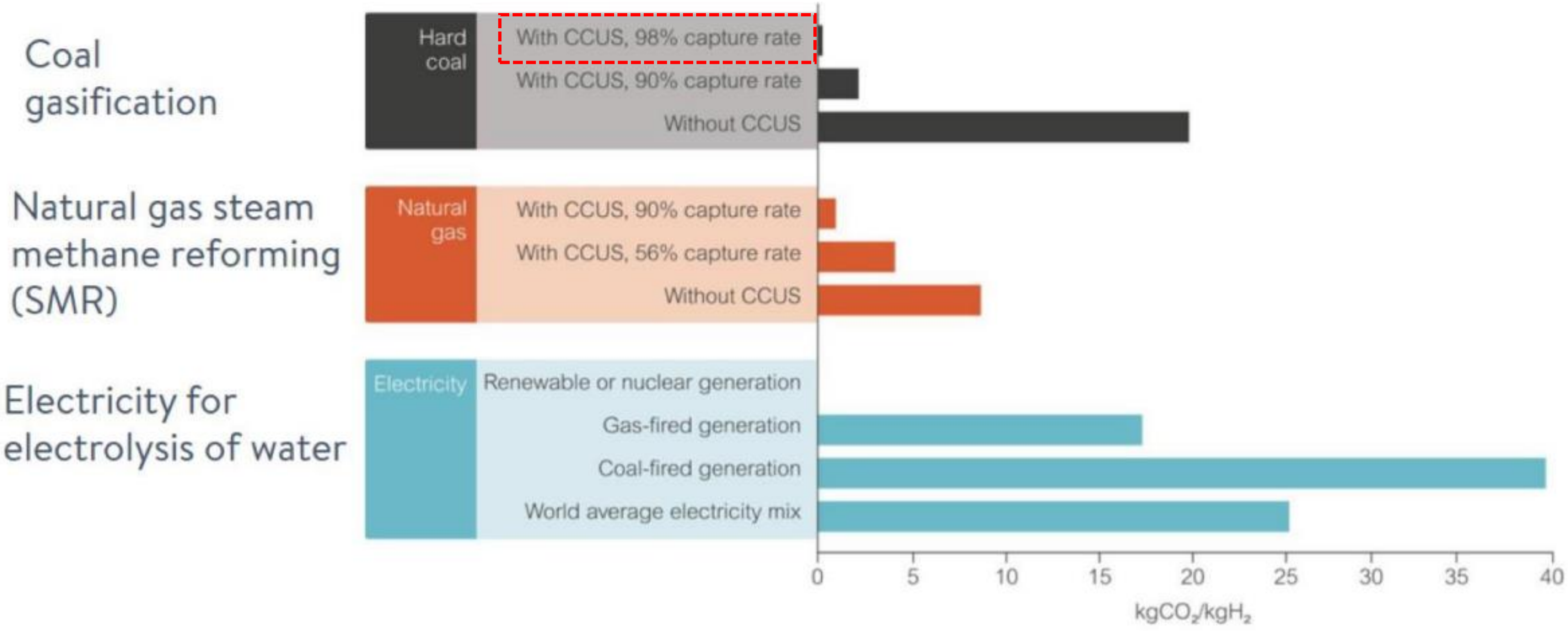
CO_2 emission intensity of hydrogen production



Source: Kelsall, 2021

Coal gasification with 98% CO_2 capture has carbon intensity below 0.6 $kgCO_2/kgH_2$

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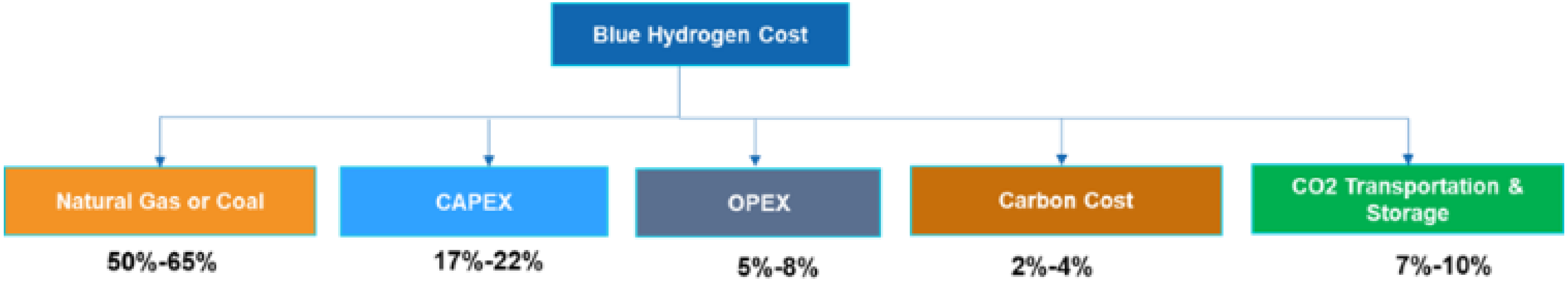
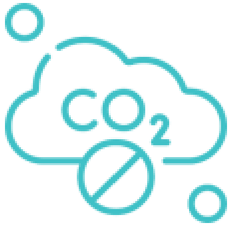
Fuel cost accounts for over half of total blue hydrogen production cost



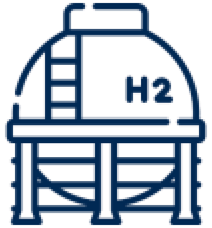
Source: GEP

Reduction of carbon capture and storage cost could contribute to lower the blue hydrogen production cost

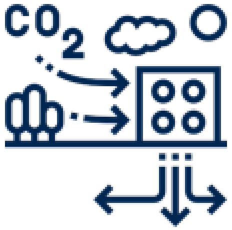
Why do we need CCS?



Providing potential way to decarbonize hard-to-abate sectors

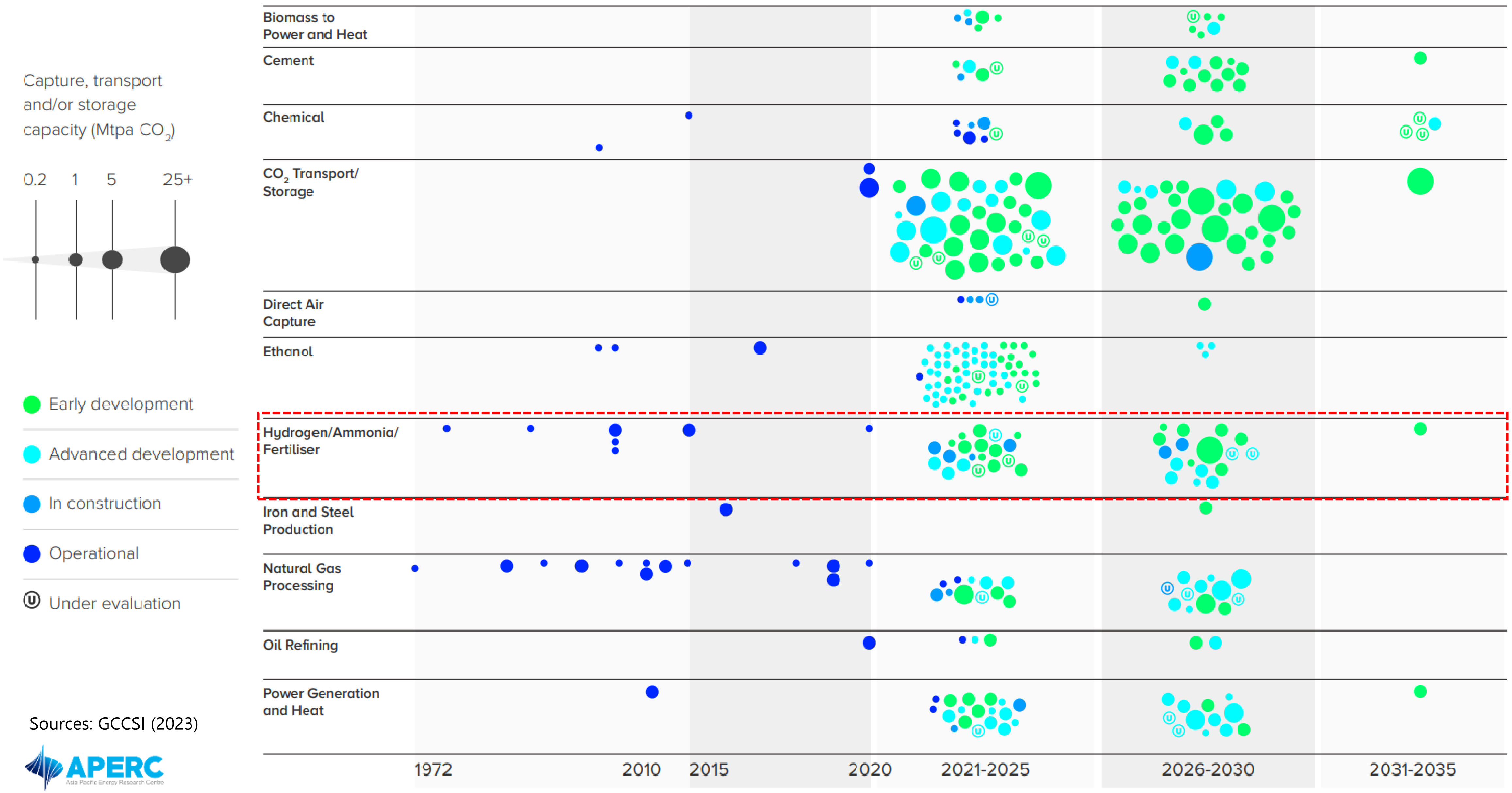


Enabling low-emissions hydrogen production from fossil fuels



Delivering carbon removal technologies

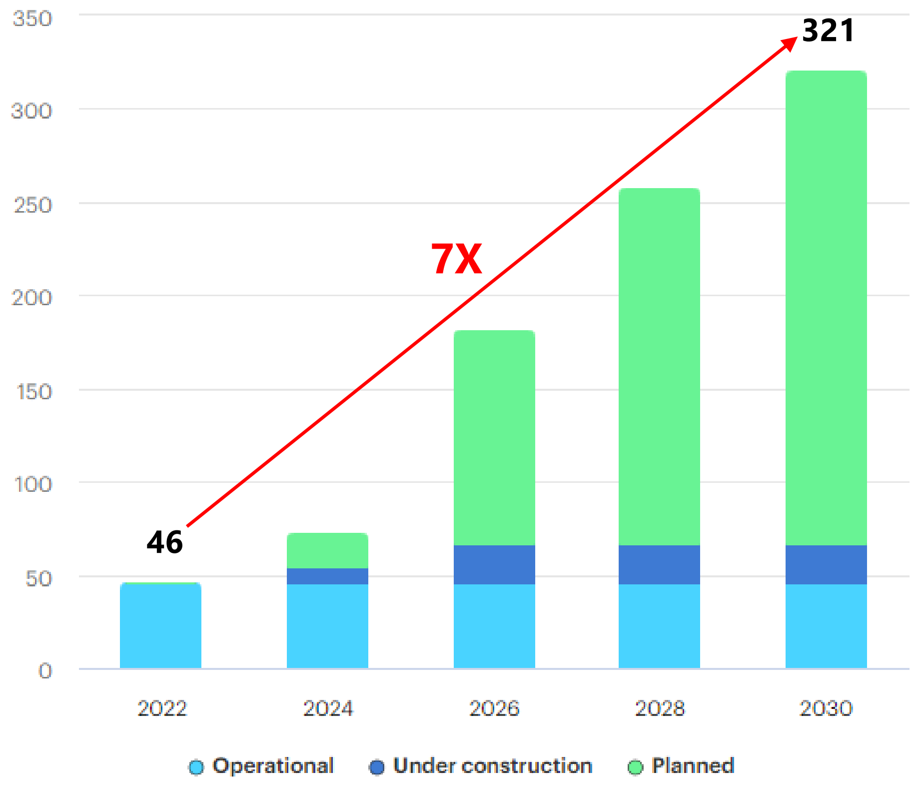
CCS project pipeline



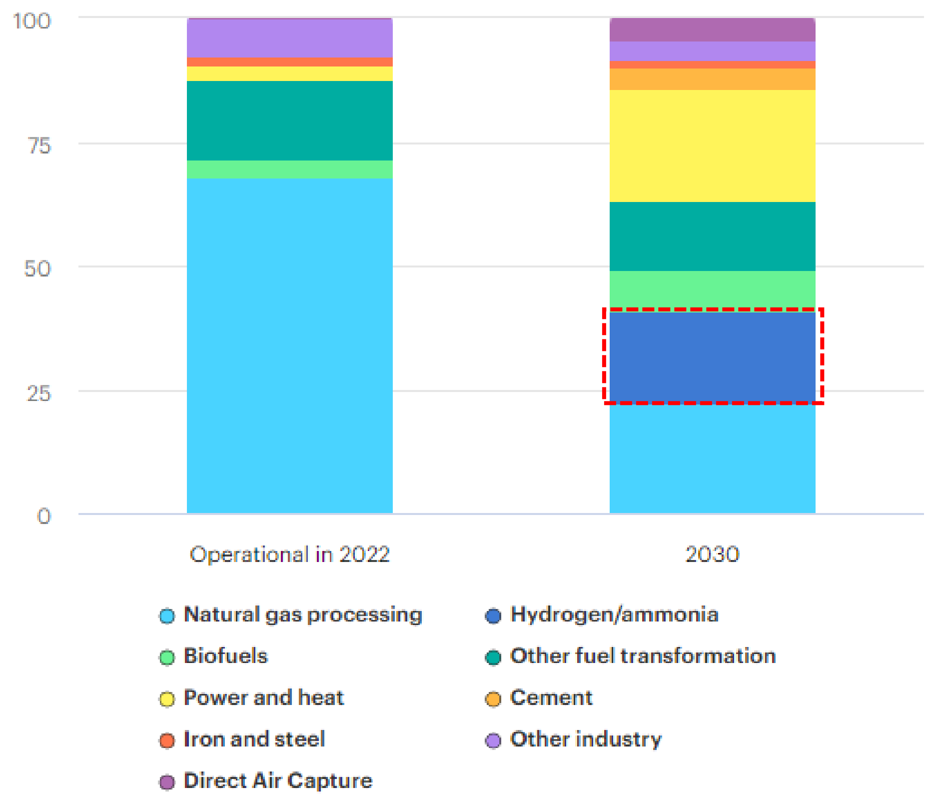
Sources: GCCSI (2023)

Global CCS development

Announced capacity of CCS facilities, Mt CO_2/y



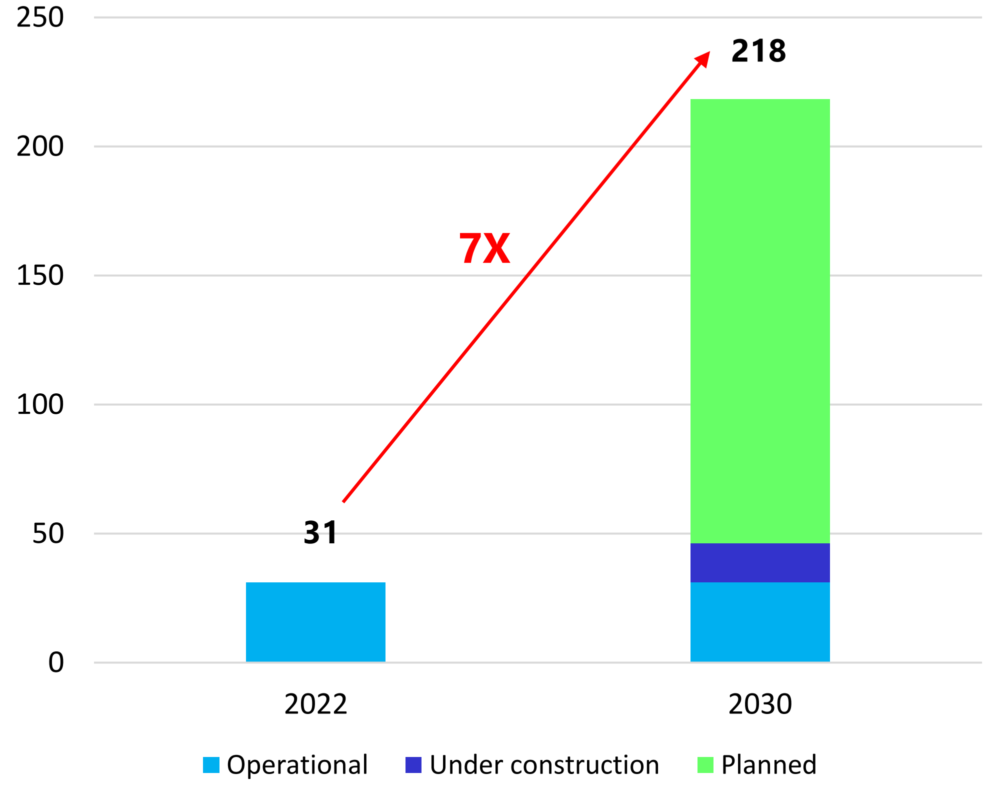
Share of CCS facilities by sector, %



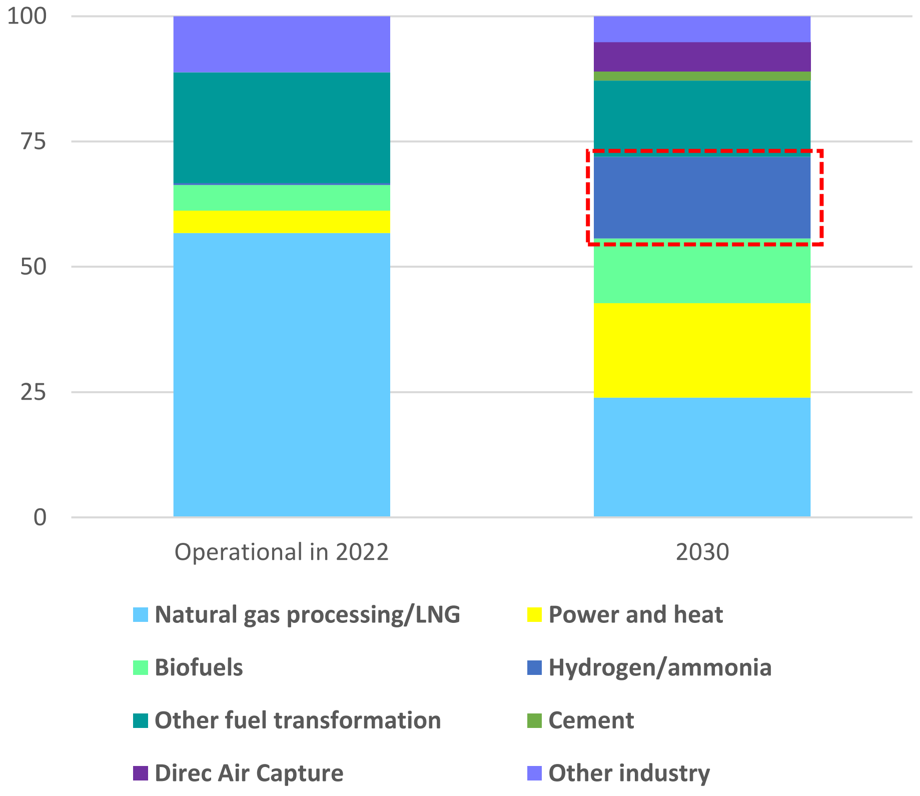
Sources: IEA (2023)

APEC CCS development

Announced capacity of CCS facilities, Mt CO_2/y

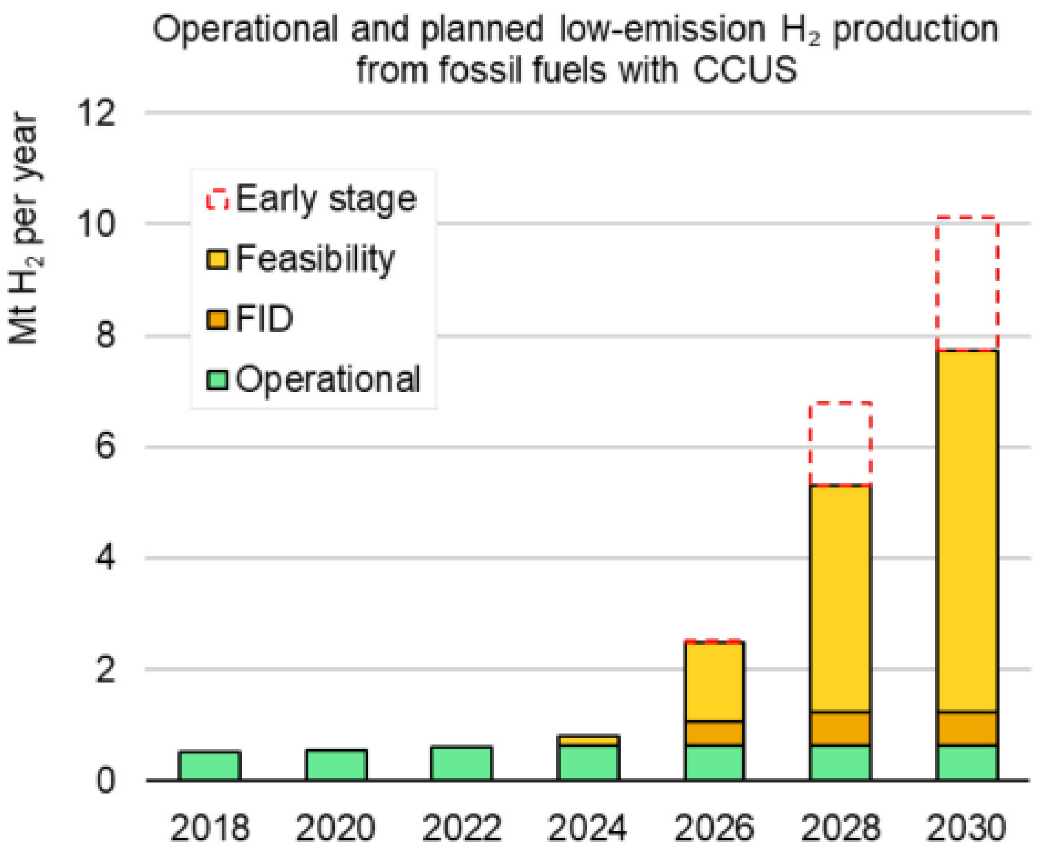


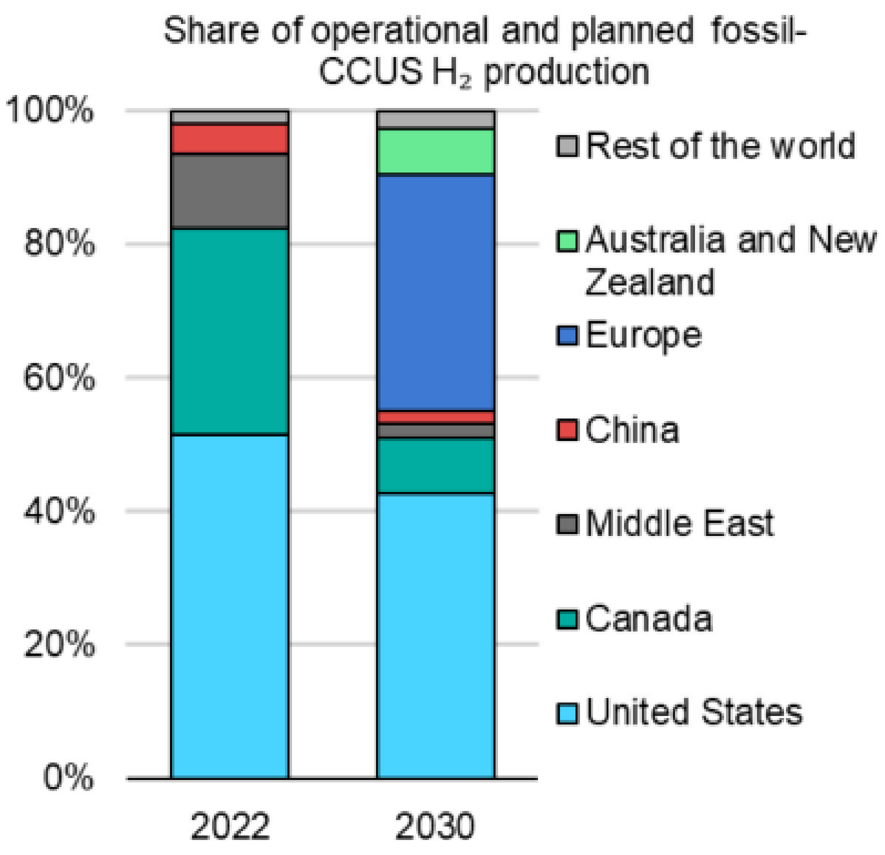
Share of CCS facilities by sector, %



Sources: IEA (2023), APERC analysis.

U.S. and Canada account for a half of global fossil-CCUS H_2 production by 2030





Source: IEA

Low-emission hydrogen production from fossil fuels with CCUS could increase almost 17-fold from around 0.6 Mt per year in 2022 to around 10 Mt H2/yr if the early-stage projects are

Planned clean hydrogen/ammonia projects in the U.S. Guff Coast

Facility	Product	Capacity (NH_3) Mt/yr	Target operational commencement
CF Industries Blue Point*	Clean ammonia	1.2	2030
CF Industries Donaldsonville	Clean ammonia	1.2	2025
Linde Beaumont hydrogen plant	Clean ammonia	1.1	2025
Yara Hydrogen Texas	Clean ammonia	1.4	2027
Clean Hydrogen Works Ascension Clean Energy	Clean ammonia	7.2	2027
RWE Lotte Blue Ammonia Corpus Christi*	Clean ammonia	10	2030
Grannus Blue	Clean ammonia	0.15	2027
Air Products and Chemical Louisiana Clean Energy Complex	Clean hydrogen/ammonia	1.4	2026
ExxonMobil Baytown Low Carbon Hydrogen	Clean hydrogen/ammonia	6	2027
St. Charles Clean Fuels Hydrogen Louisiana	Clean ammonia	5	2027
Total		34.65	

Sources: GCCSI (2023)

Conclusions

- CCS technology could play an important role in decarbonising existing fossil-based hydrogen production plants.
- Fossil-based hydrogen production plants with CCS are expected to increase substantially to meet high demand of low-carbon hydrogen.
- Current efforts to lower CCS costs would help to further reduce blue hydrogen production cost.
- Blue hydrogen has an advantage over green when it comes to storage and production on demand.
- While CCS technology is an effective tool for reducing carbon emissions intensity in hydrogen production plants, it is significant to be aware that it is not a silver bullet. It is likely a short, medium-term solution during the transition period toward green hydrogen.

Thank you.

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