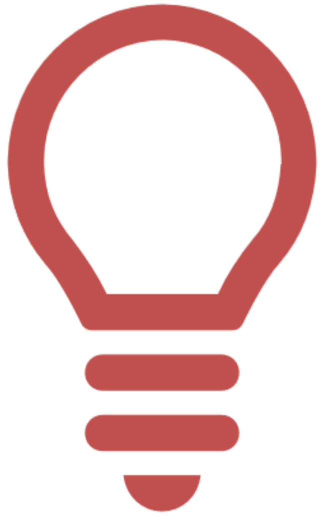
CCS IN ASIA

SECOND ASIA CCUS NETWORK MEETING

ALEX ZAPANTIS
GENERAL MANAGER COMMERCIAL, GLOBAL CCS INSTITUTE

GLOBAL CCS INSTITUTE

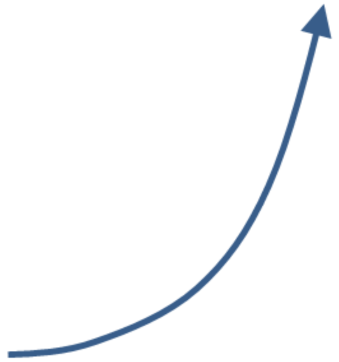
THE GLOBAL CCS INSTITUTE



International think tank

150 Members

Backed by governments, businesses and NGOs

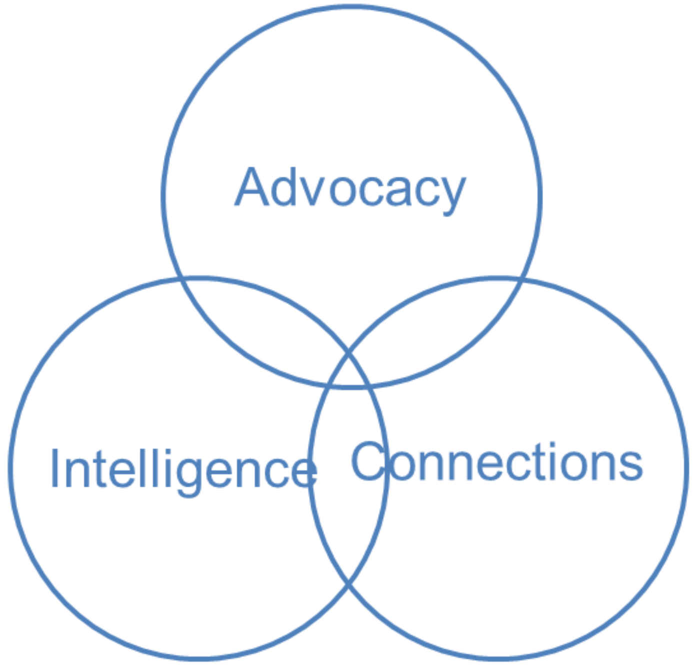


Mission: To accelerate deployment of CCS

Consulting Services

Policy
Legal/Regulation
Technology
Geology
Market

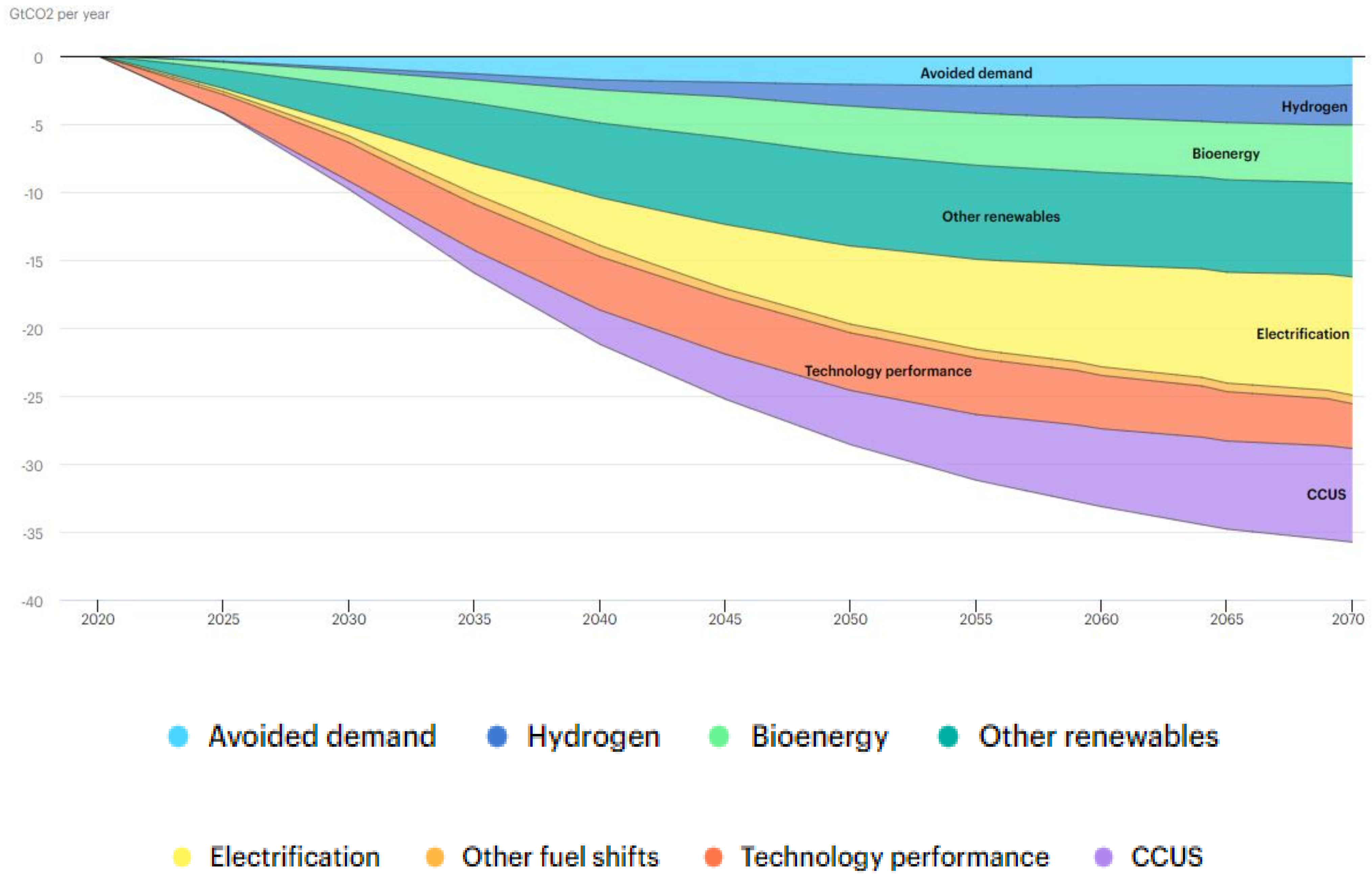
7 locations



GLOBAL CCS INSTITUTE

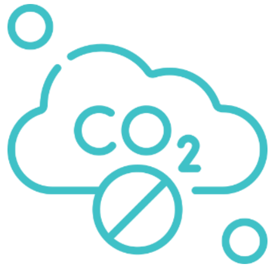
WHY CCS?

- Scientific consensus that CCS is necessary to achieve our climate goals.
- Three of four IPCC illustrative pathways require CCS.
- IEA suggests up to 15% of global emissions could be abated through CCS.



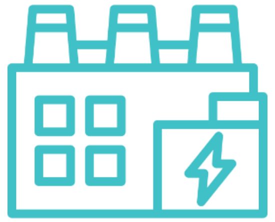
IEA 2020: Energy Technology Perspectives 2020

CCS: REACHING NET-ZERO AND DRIVING THE LOW-CARBON ECONOMY

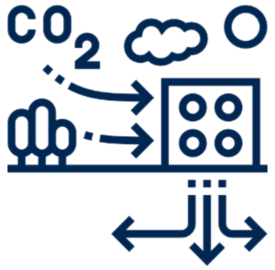


Achieving deep decarbonisation in hard-to-abate industry.

Enabling the production of low-carbon hydrogen at scale.



Providing low carbon dispatchable power.



Delivering negative emissions.

CCS FACILITIES

- CCS- EOR 50 years old (Terrell)
- CCS – dedicated storage 26 years old (Sleipner)
- Lower partial pressure CO_2 capture becoming commercially feasible

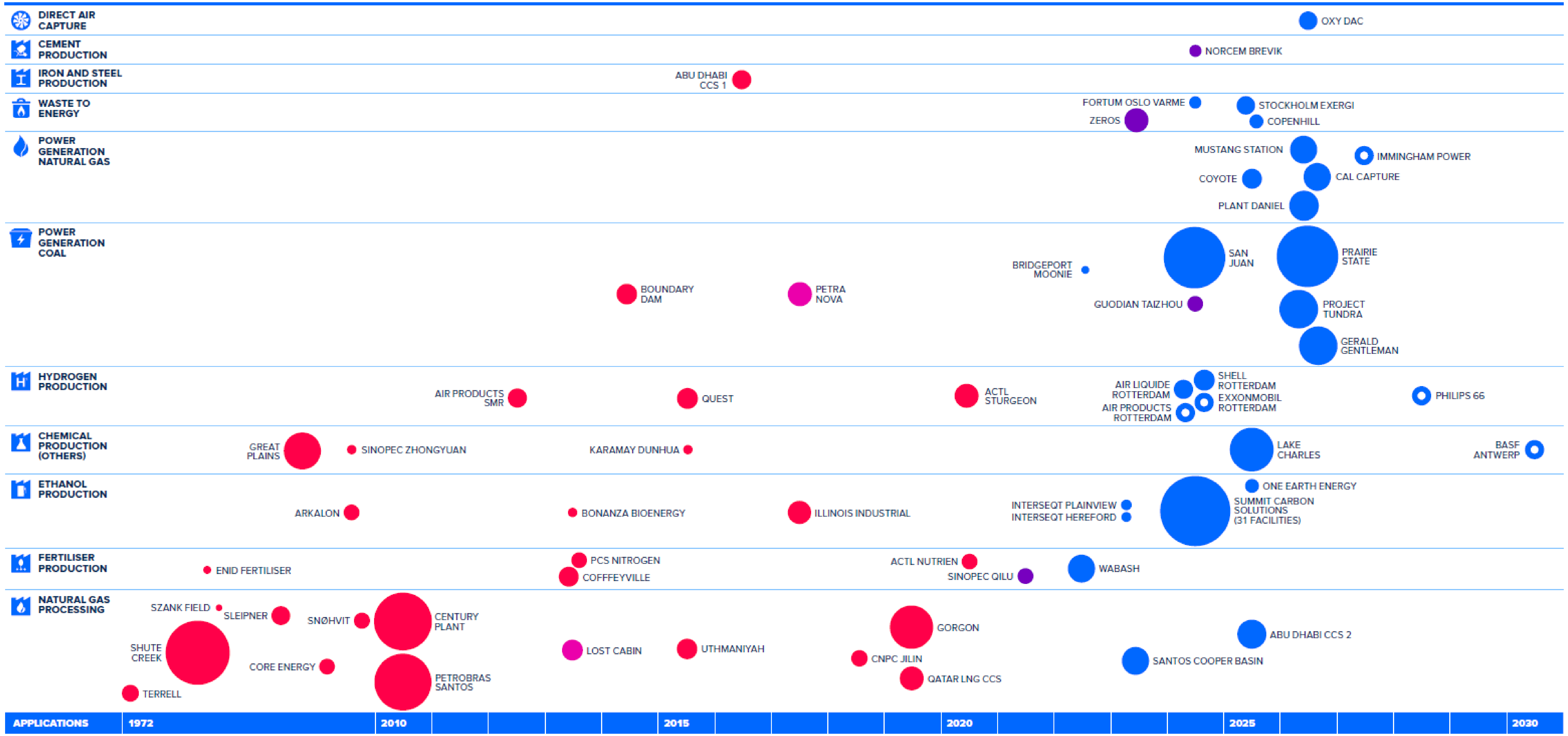


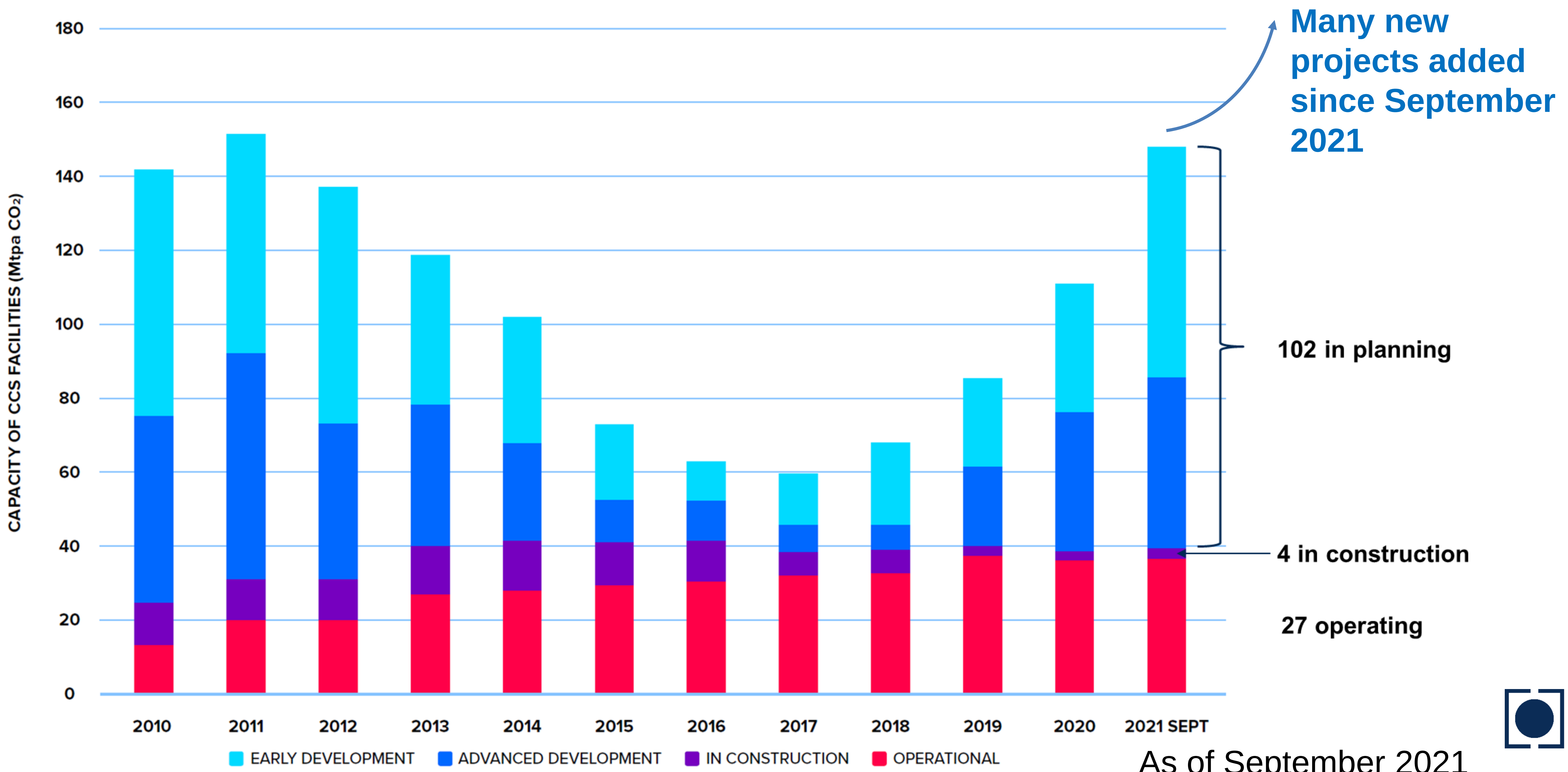
Chart indicates the primary industry type of each facility among various options.

IN OPERATION · OPERATION SUSPENDED · IN CONSTRUCTION · ADVANCED DEVELOPMENT · CAPTURE CAPACITY TBC

As of September 2021

Size of the circle is proportionate to the capture capacity of the facility. 0.2 · 1.0 · 5.0 Mtpa OF CO_2

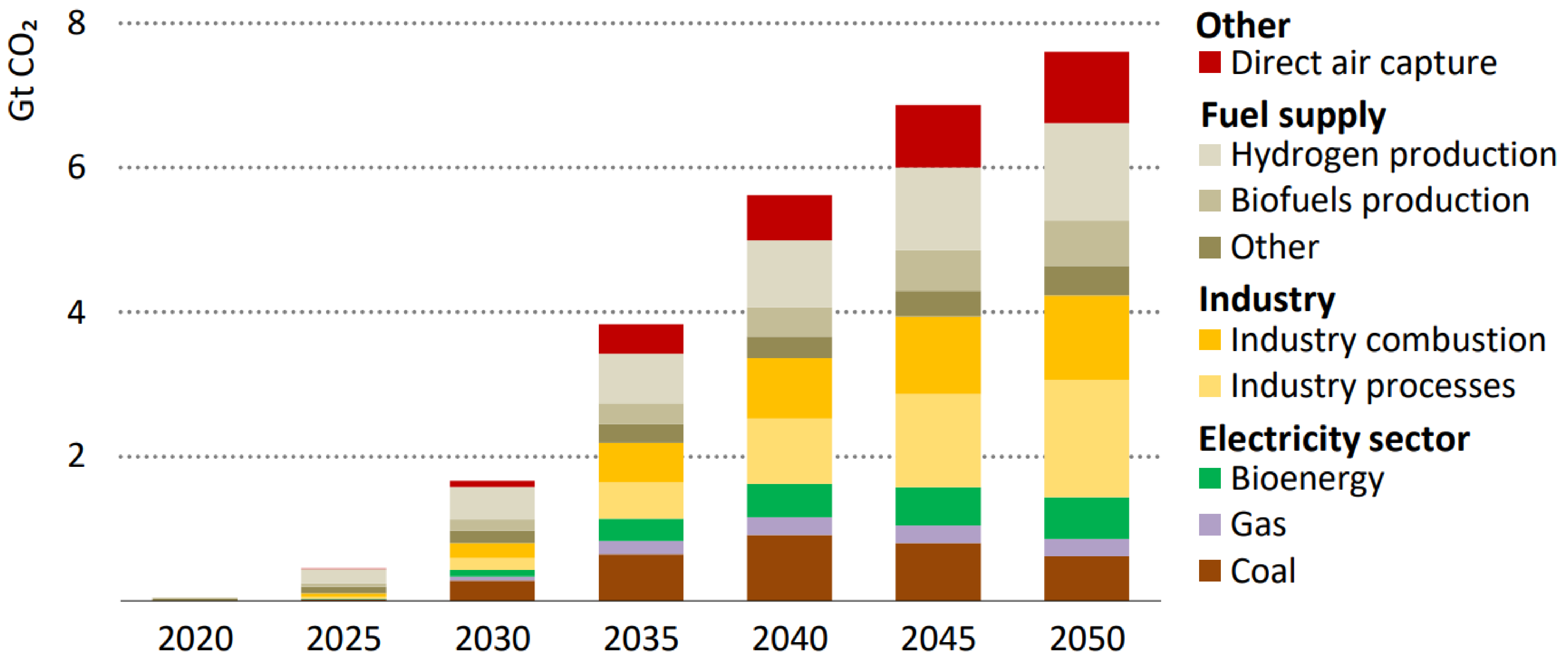
CAPACITY OF CCS PROJECTS



As of September 2021

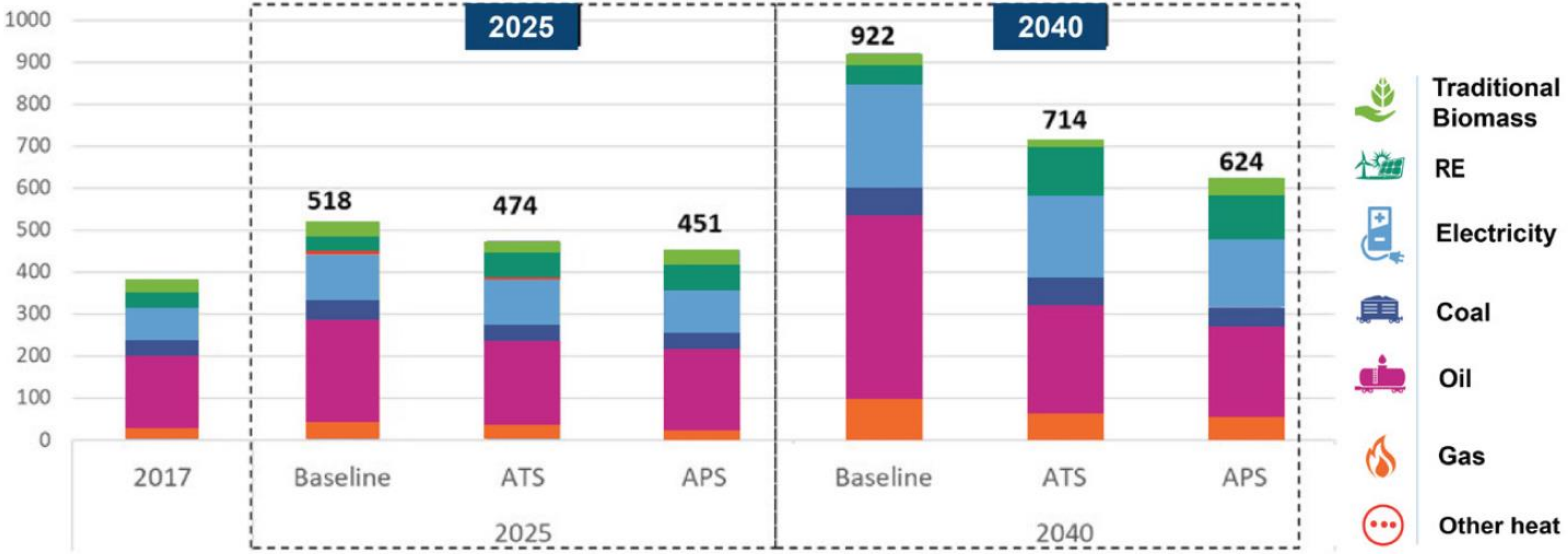
CCS ACCELERATION NEEDED

- According to IEA NZE, by 2050 7.6 GtCO_2 captured per year, including 2.4 Gt removal from BECCS and DACCS.
- CCUS across diverse sectors and increasingly important to industry.
- Stronger policy to incentivise rapid CCS investment is required.



ASEAN – DYNAMIC ECONOMIES WITH STRONG ENERGY DEMAND GROWTH

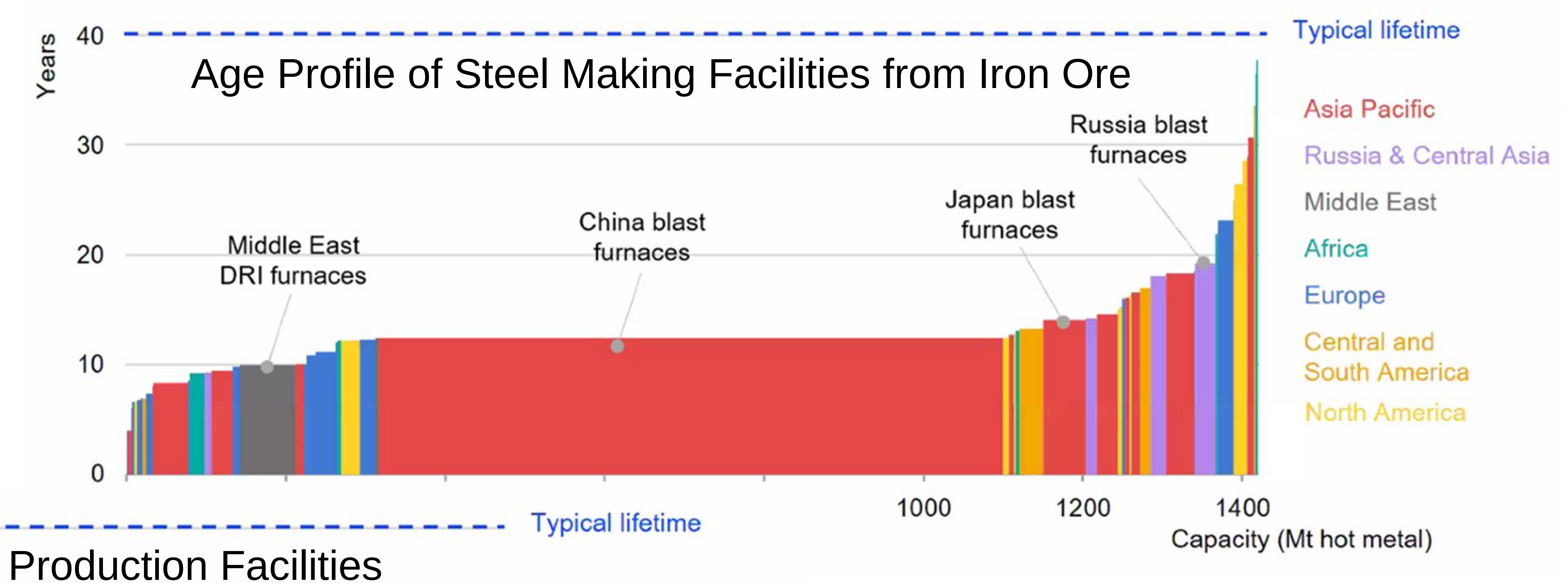
ASEAN Total Final Energy Consumption

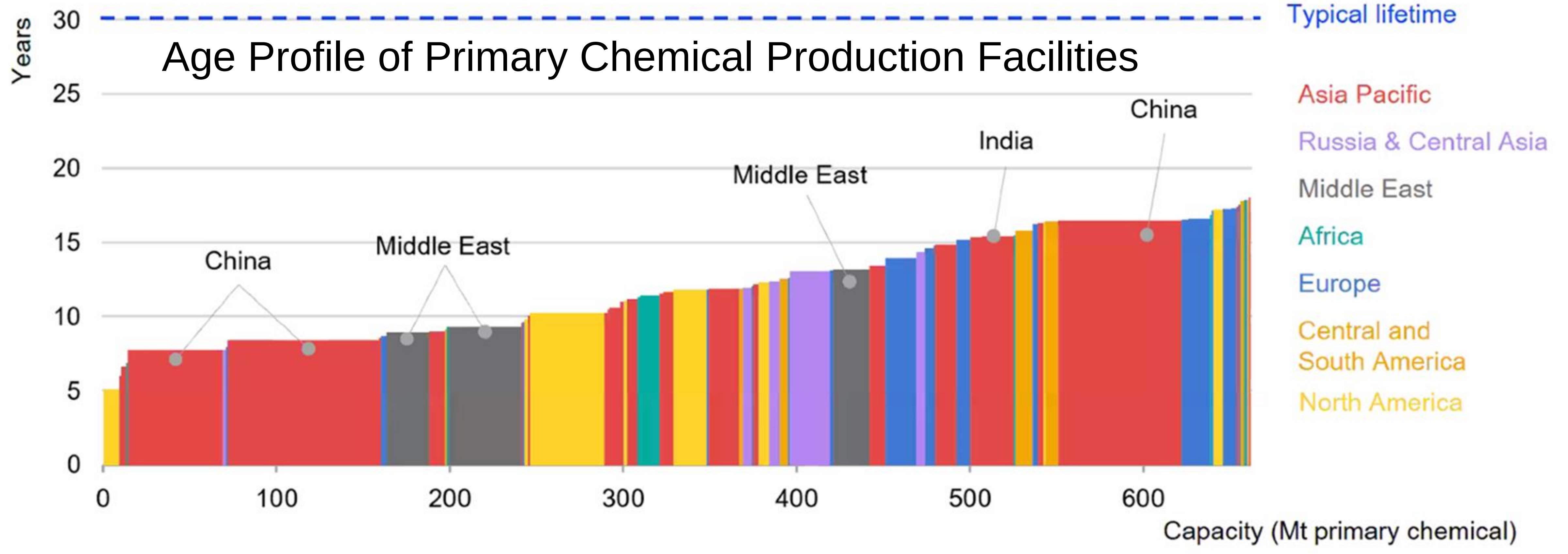


Source: ASEAN Plan of Action for Energy Cooperation 2016 – 2025; Phase II: 2021-2025

APAC; ~HALF GLOBAL STEEL & CHEMICAL PRODUCTION

Most APAC industrial capacity has decades of economic life



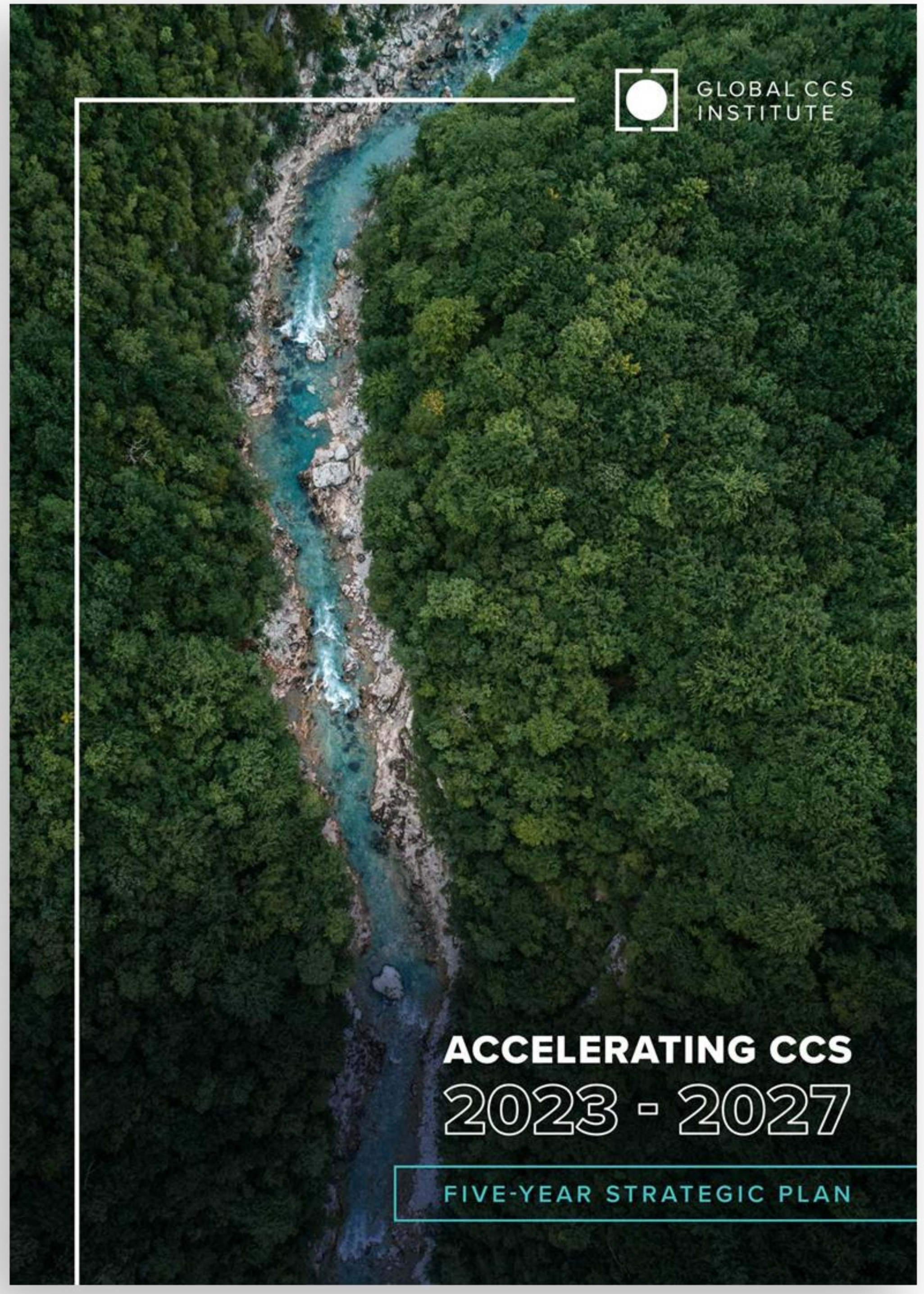


Source: IEA 2020

GCCSI – INCREASED FOCUS ON ASIA

GCCSI 2023-2027 Five Year Strategy includes:

- Expansion of efforts in South East Asia directly and through supporting new networks
- Expand global footprint of GCCSI into South East Asia



SOUTHEAST ASIA CCS ACCELERATOR

SEACA Pillars		
CCS Regulation	Enabling Policy	Geological Storage
To develop fit-for-purpose guidance on CCS regulation in Southeast Asia to support the development and promulgation of legislation.	To identify and define specific policy options that will enable investment in commercial CCS projects in Southeast Asia and to support their development and implementation by relevant governments.	To discover and where possible, release data relevant to geological storage resource appraisal and materially advance geological storage resource development in Southeast Asia. To complete a Geological Storage Resource Assessment Gap Analysis for Southeast Asia.
Engage Stakeholders → Identify Projects → Define Specific Barriers → Develop Specific Solutions		
Focus on Near-Term Deployment		

SOUTHEAST ASIA CCS ACCELERATOR

Workplan – Year One

	CCS Regulation	Enabling Policy	Geological Storage
Seed Analysis by GCCSI	Summary paper on CCS regulation	Quantitative modelling of role and economic value of CCS in Southeast Asia	Identification & description of prospective basins in Southeast Asia
1st Workshop 23Q1	Initial engagement and introduction to SEACA, secure support/participation of stakeholders, presentation of seed analysis, initial definition of barriers and opportunities, identification of near-term projects, prioritisation of work/analysis/consultation, agree governance and next steps		
2nd Workshop 23/Q3	Report on progress on agreed work/analysis/consultation, more refined definition of barriers and opportunities, first discussion of potential solutions, agree next steps		
3rd Workshop 24Q1	Report on progress on agreed work/analysis/consultation, barriers clearly defined and agreed, menu of solutions for further analysis/consultation defined, priorities for year two agreed		

SOUTHEAST ASIA CCS ACCELERATOR

Outcomes

- Ambition is to accelerate near-term investment in CCS in Southeast Asia
- Focussed collaboration between stakeholders to advance specific CCS projects
  - Common understanding of opportunities, barriers and solutions
  - Commitment to action
  - The art of the possible applied to CCS!
- Identification of synergies between potential CCS investments
- Strong advocacy for CCS in SE Asia
- Business relationships, networks

THANK YOU

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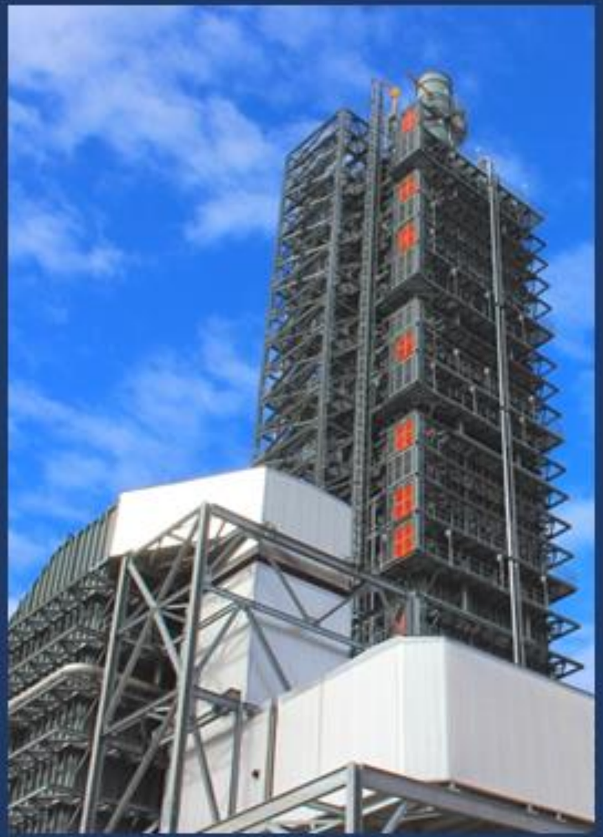
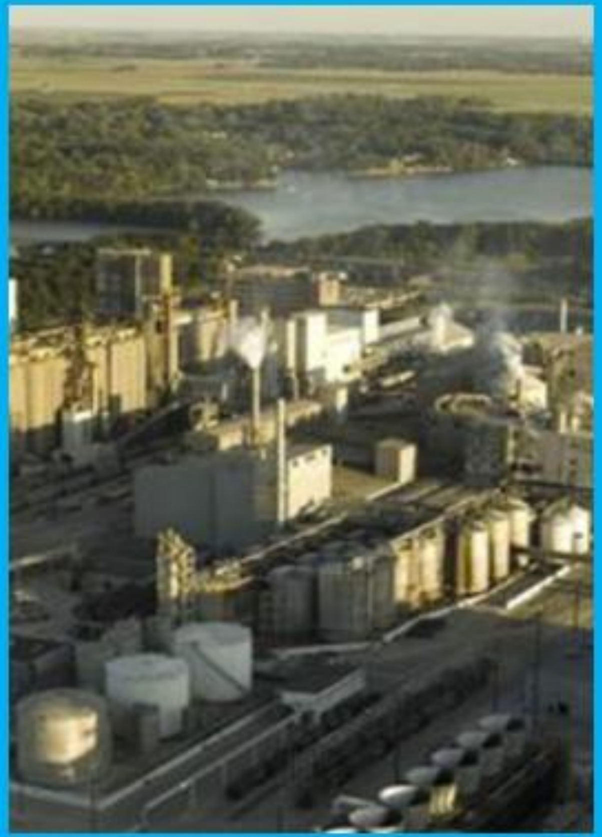
CCS - VERSATILE

Power Sector



Coal (Bound. Dam)
Gas (Peterhead)
Biomass (Drax)

Industry



Steel (Al Reyadah)
Fuels (ADM, Qatar)
Chemicals (Enid)

Zero-C Hydrogen

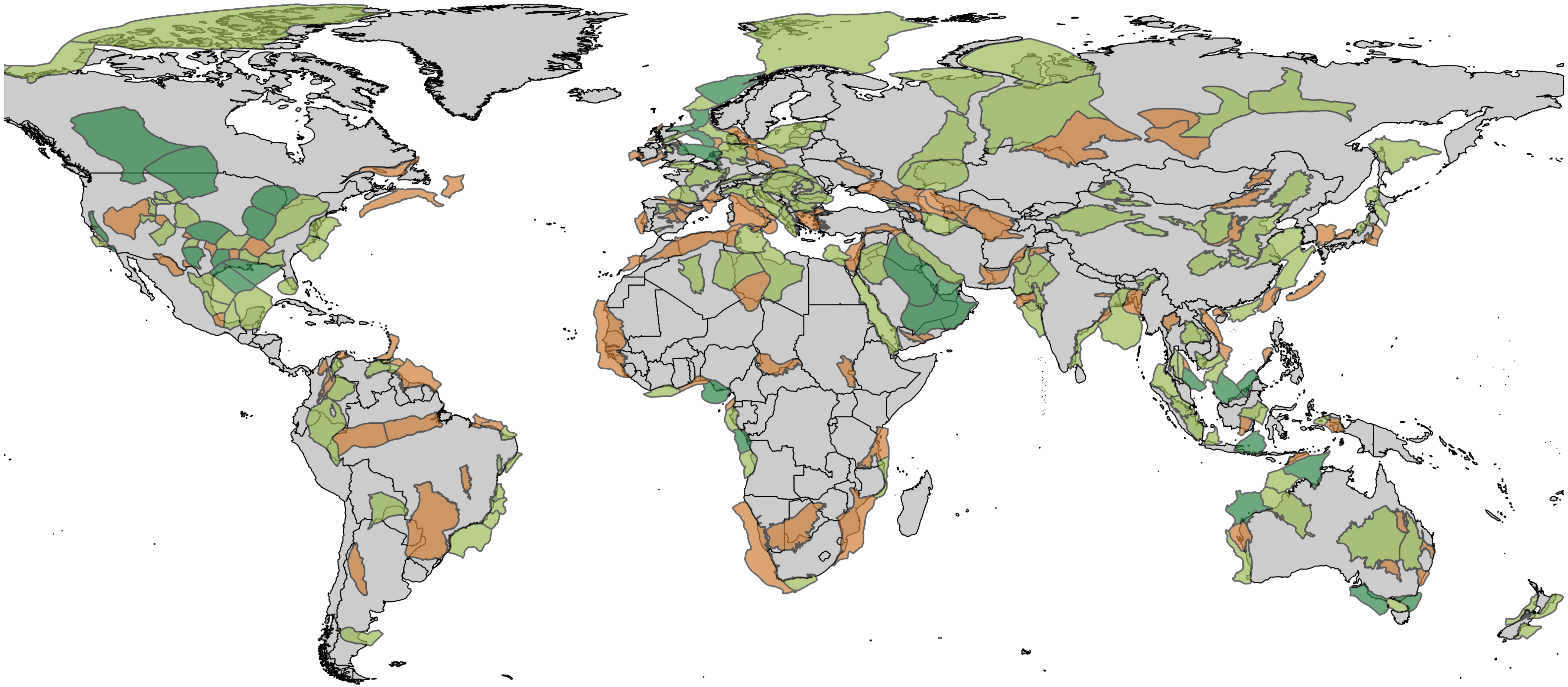
Port Arthur (USA)
Quest (Canada)
Sinopec Qilu (China)

CO_2 removal

Direct Air Capture
Bioenergy + CCS
C Mineralization

GEOSPHERE C STORAGE – AMPLE CAPACITY

CO_2 Geological Storage Capacity – Global Distribution

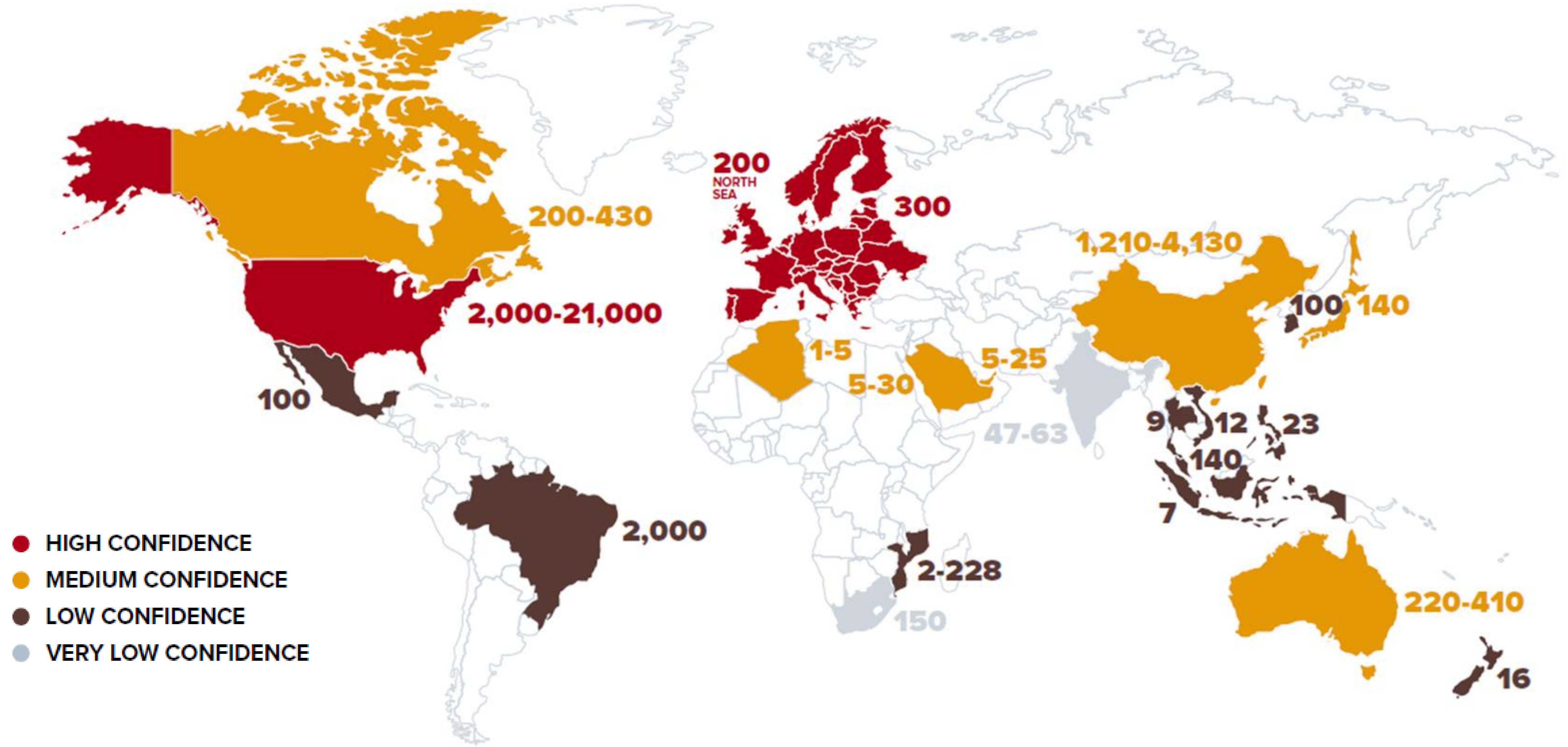


Storage Basin Potential (GCCSI, 2022)

Highly Suitable   Suitable   Possible

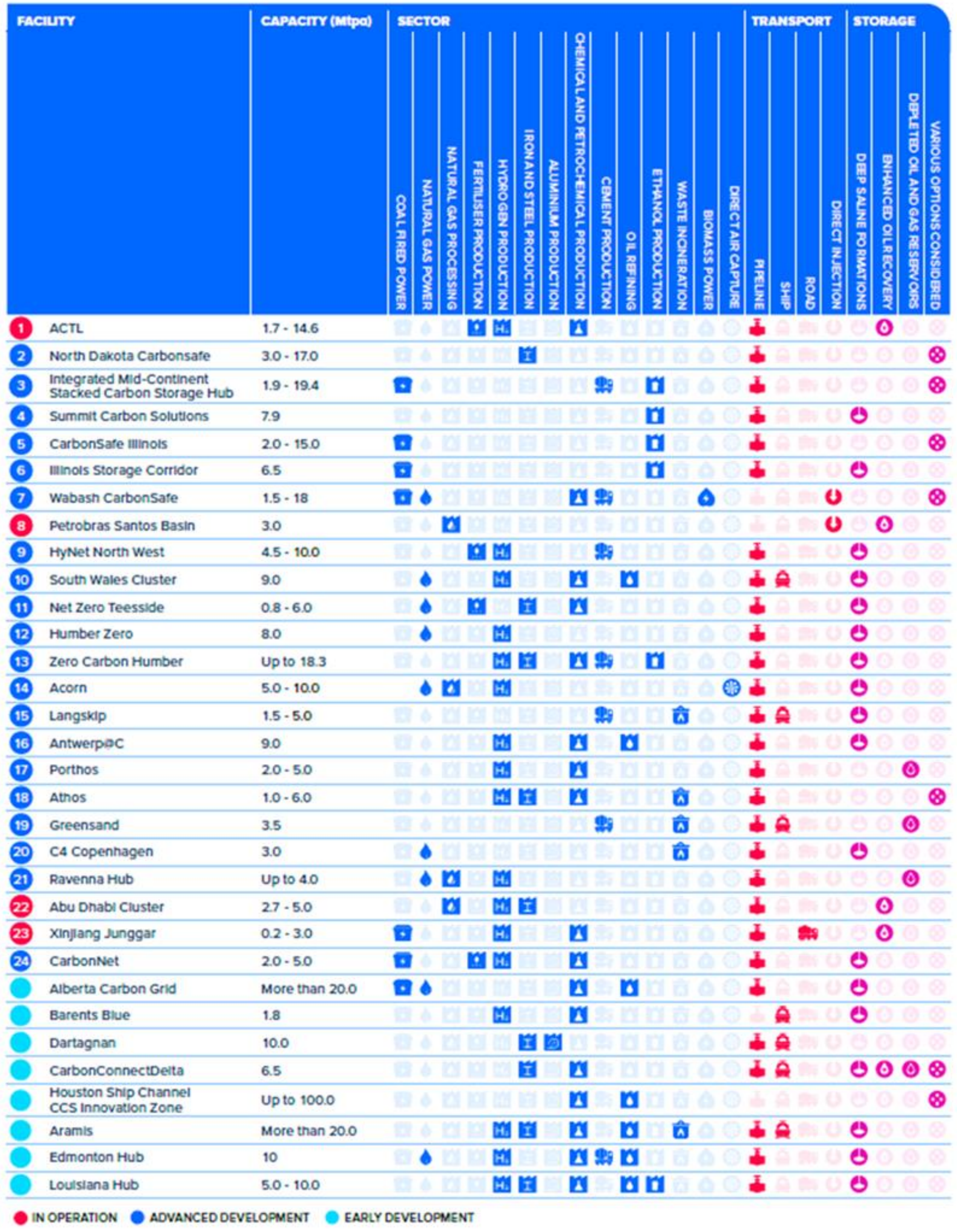
GEOSPHERE C STORAGE – AMPLE CAPACITY

CO_2 Geological Storage Capacity – Billion of Tonnes



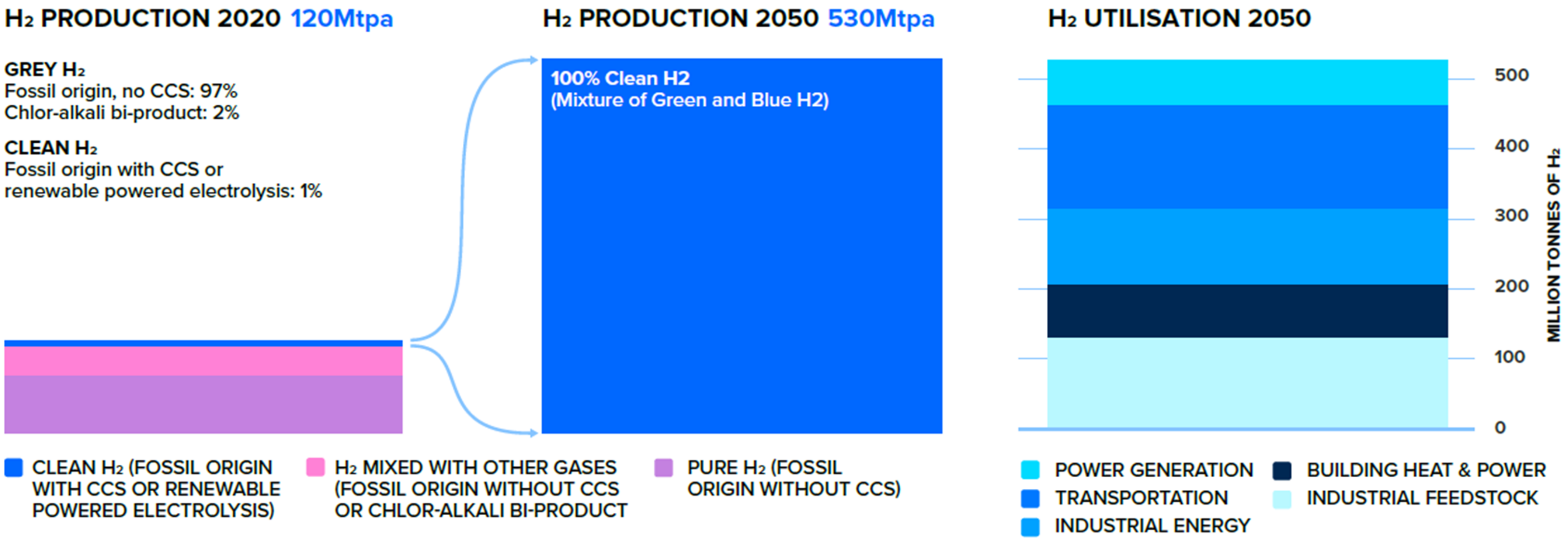
THE CONTINUED RISE OF CCS NETWORKS

- Over 30 CCS Networks in Development
- Unit cost reductions through economies of scale
- Risk reduction through multi-party business ecosystems
- Smaller capture sources become feasible
- CO_2 transport and storage as a business



As of September 2021

CLEAN H_2: FROM 1MTPA TO 500MTPA



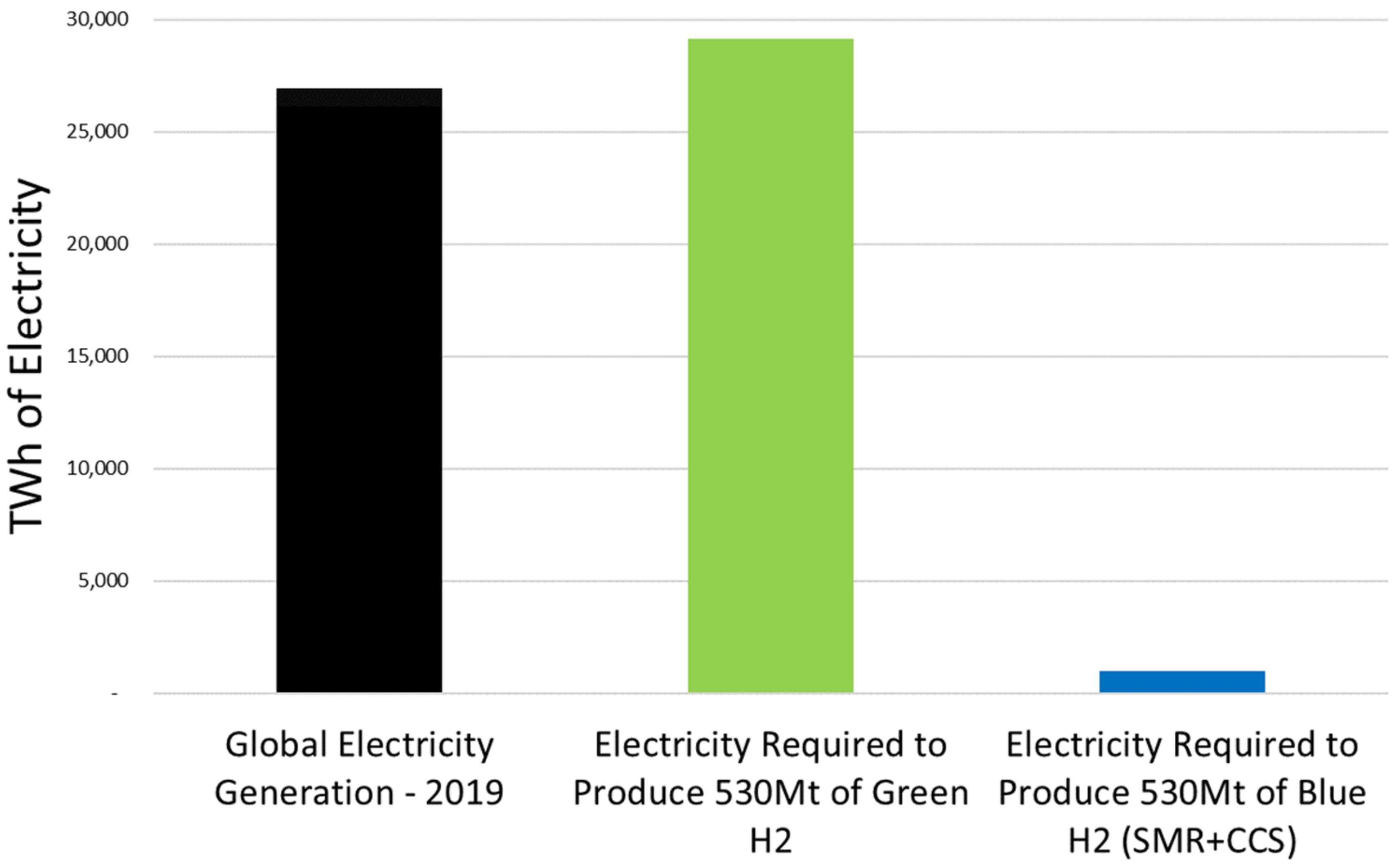
All figures are approximate. 2050 utilisation taken from Hydrogen Council 2017.

PRODUCING 530MT CLEAN H_2REQUIRES..

0.01 million km^2 for Blue H_2,
1.73 million km^2 for Green H_2

Green H_2 land requirement based on land required by AREH project in North-West Australia. Blue H_2 land requirement assumes 530 500km x 20m corridors for CO_2 pipelines plus area for plant & CO_2 injection

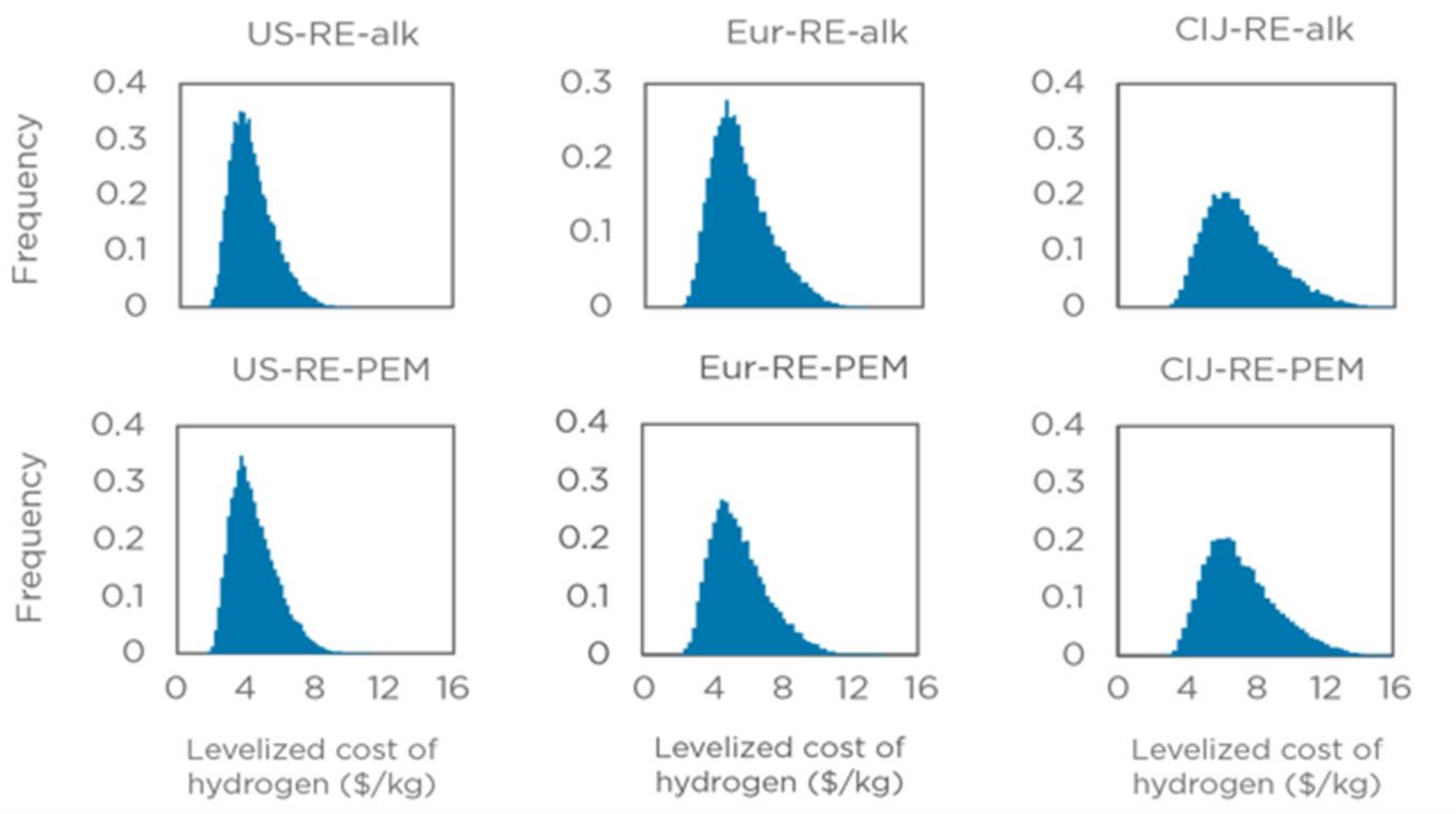
1,000TWh for Blue H_2
29,000TWh for Green H_2



Assumes 55kWh to produce 1kg of H_2 via electrolysis. Includes electricity for upstream gas production for Blue H_2

BLUE H_2 IS LOWER COST ALMOST EVERYWHERE

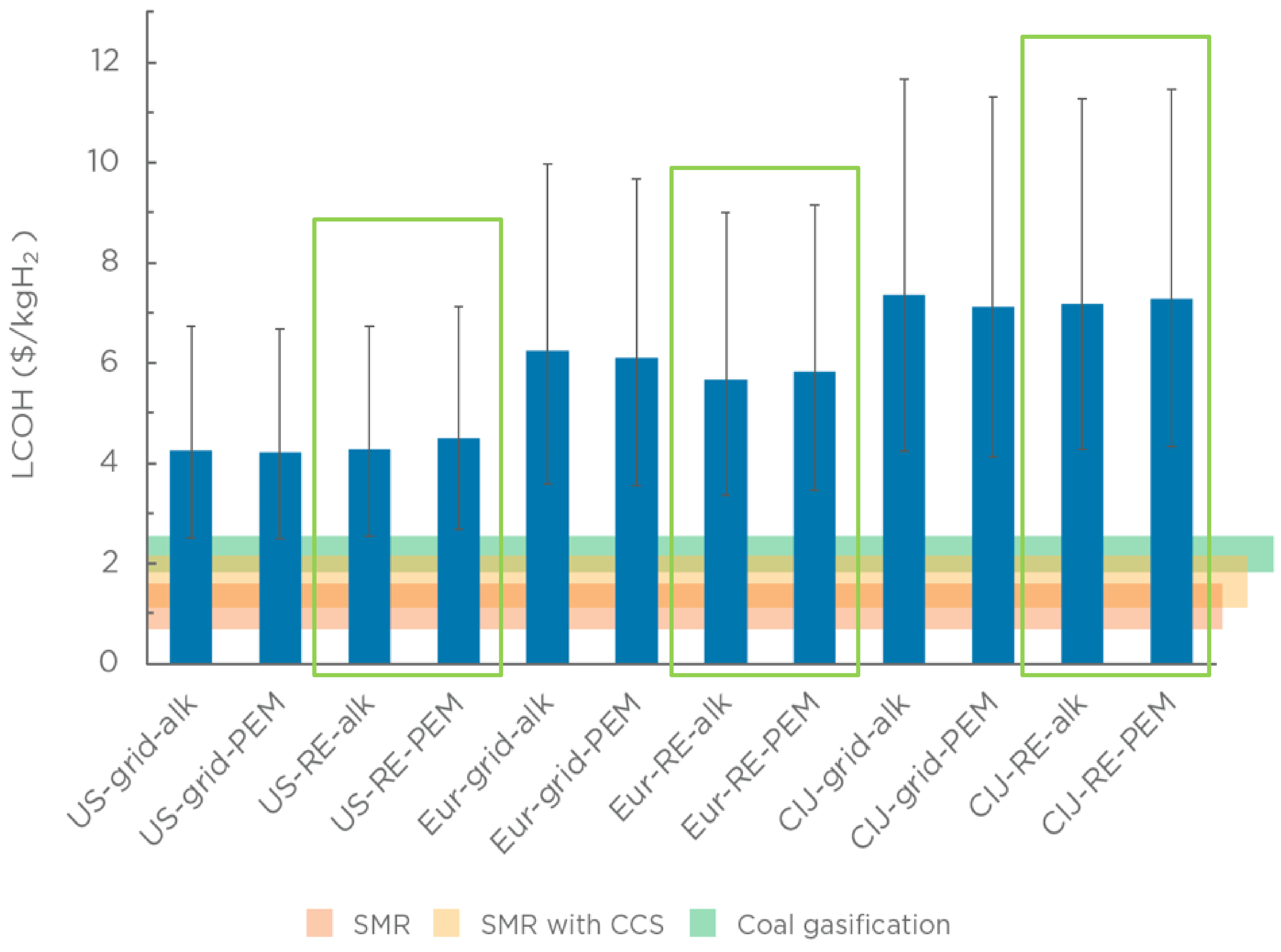
Cost Distribution by Case



Monte Carlo Simulation

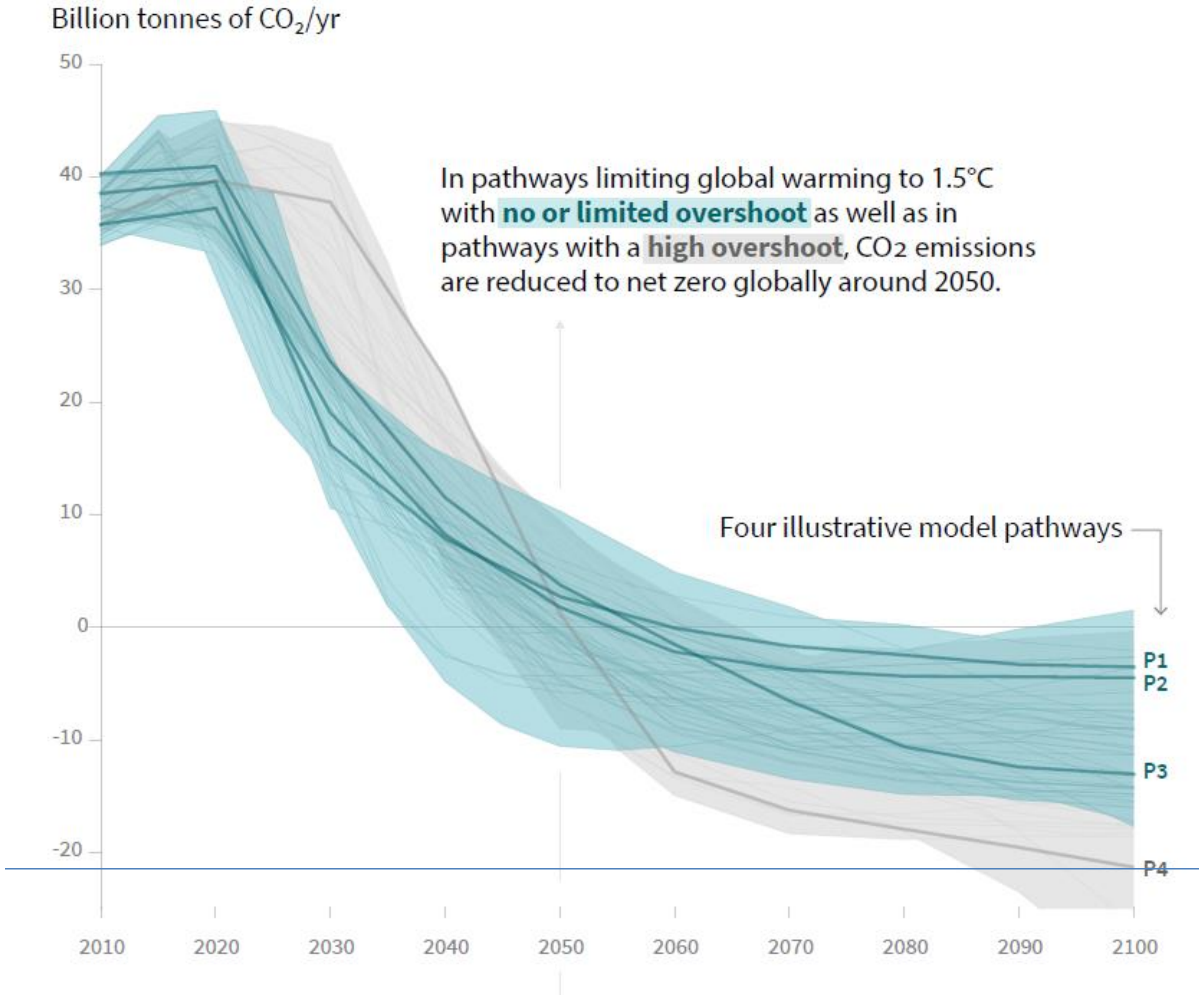
- Electrolyser efficiency
- Capital cost
- Electricity price
- Capacity factor

Estimated 2030 Costs (US, EU, CIJ)



Source: Fan et al 2021 (Center on Global Energy Policy, Columbia University)

CDR- ESSENTIAL FOR 1.5°C



- All IPCC Illustrative Pathways to limit warming to 1.5° Celsius require CDR
- Depending on the scenario…
  - Between ~3Gtpa and >20Gtpa by 2100
  - Cumulative CO_2 removed ~ 100 to 1000 $GtCO_2$ this century
  - 0-8Gtpa CO_2 removed via BECCS by 2050
  - 1-11Gtpa* CO_2 removed via AFOLU by 2050
- DACCS and other CDR options not considered by IPCC due to immature literature

* Exceeds real world constraints

Source: IPCC 2018, Special Report on Global Warming of 1.5 °C

REALISING CCS AT SCALE GLOBALLY

- Define the role of CCS and CDR in meeting national climate strategies and plans, set and communicate targets.
- Create a long-term, high value on the storage of CO_2.
- Support the identification and appraisal of geological storage resources.
- Develop specific CCS laws and regulations.
- Identify opportunities for CCS networks and facilitate the establishment of transport and storage infrastructure.
- Enable investment in CCS through appropriate policy and market mechanisms.

DRIVERS OF CCS MOMENTUM

- Net Zero Commitments
- Emergence of Strategic Business Partnerships
- Strengthening policy support for CCS
- Blue Hydrogen Projects
- Rise of CCS Networks
- Technology-based Carbon Dioxide Removal