

16 NOVEMBER 2022

# GLOBAL STATUS OF CCS 2022



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 @GlobalCCS

 GLOBAL CCS  
INSTITUTE

# THE GLOBAL CCS INSTITUTE

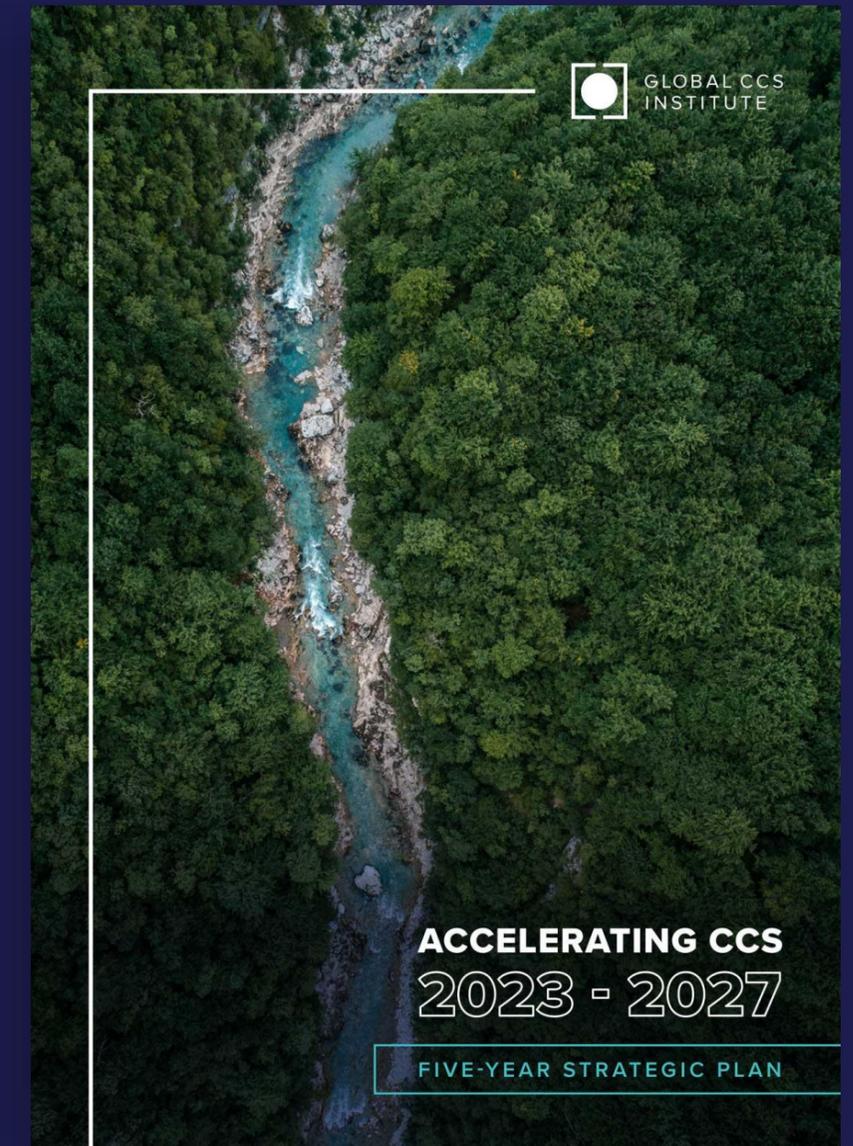
**Accelerating the deployment of ccs for a net-zero emissions future**

## WHO WE ARE

- International, non-profit climate change think tank
- HQ in Melbourne (offices in Washington D.C., Houston, London, Brussels, Abu Dhabi, Beijing, and Tokyo)
- >150 members comprising governments, global corporations, technology companies, research institutions, and NGOs

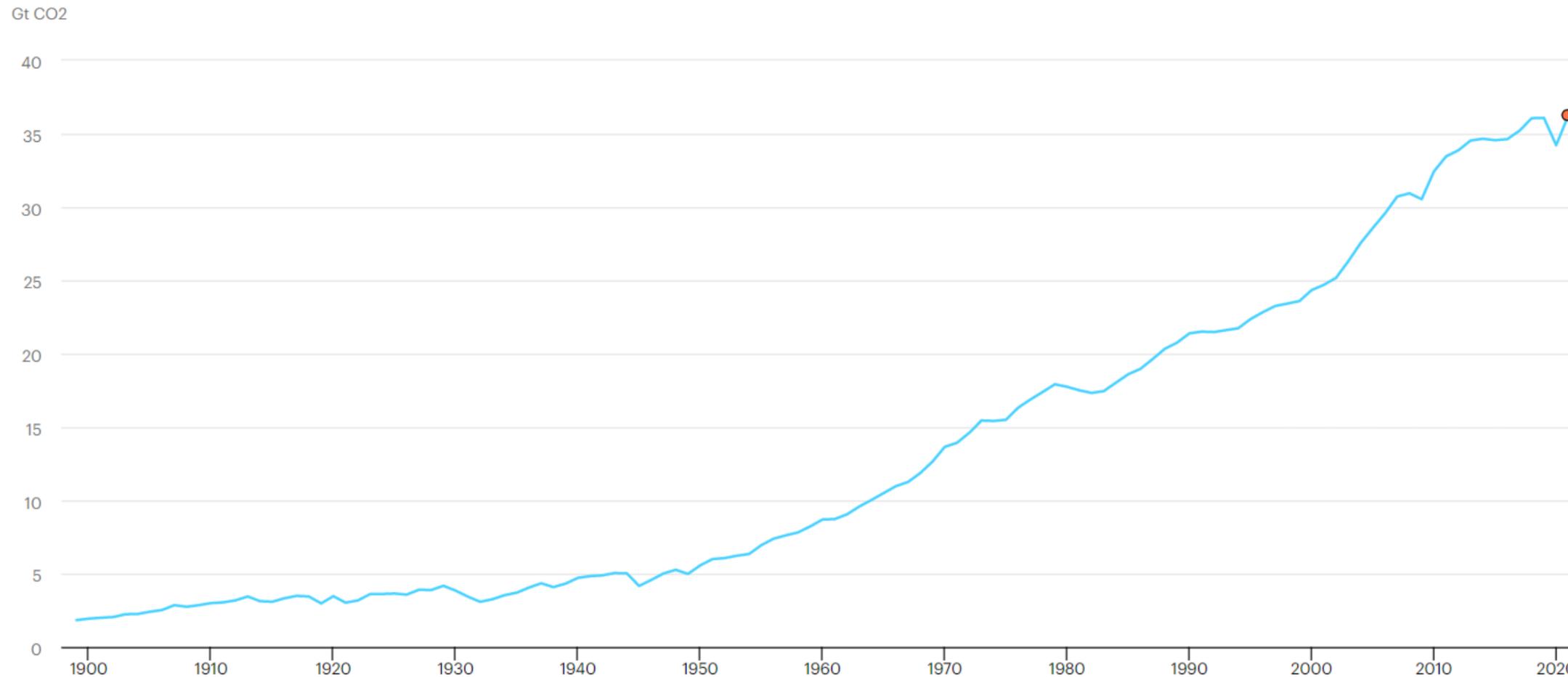
## WHAT WE DO

- Fact-based CCS advocacy
- Catalytic thought leadership
- Authoritative knowledge-sharing



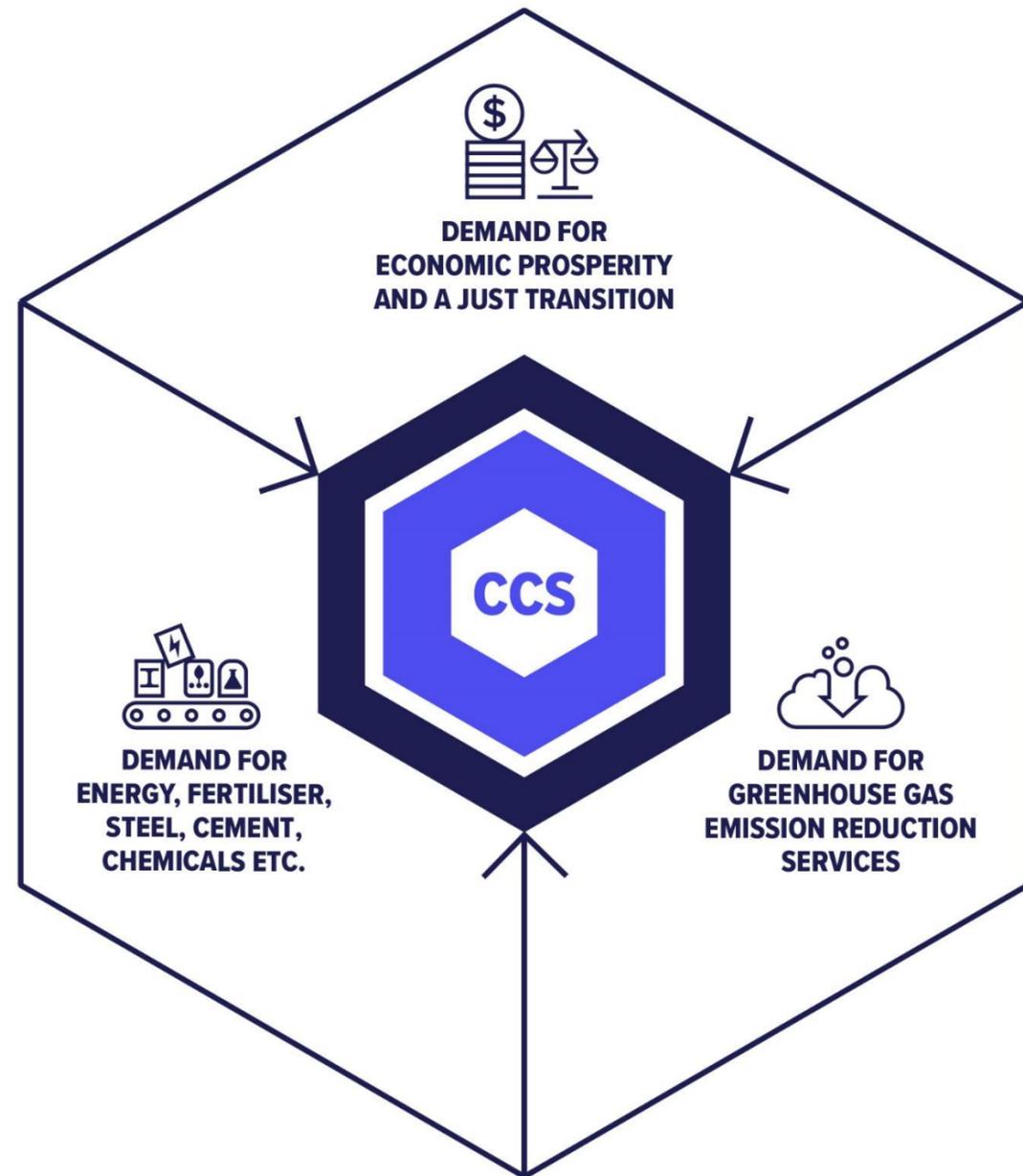
# NOW MORE THAN EVER

## CO<sub>2</sub> EMISSIONS FROM ENERGY COMBUSTION AND INDUSTRIAL PROCESSES, 1900-2021



Source: IEA <https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2>

# THE DEMAND DRIVERS FOR CCS



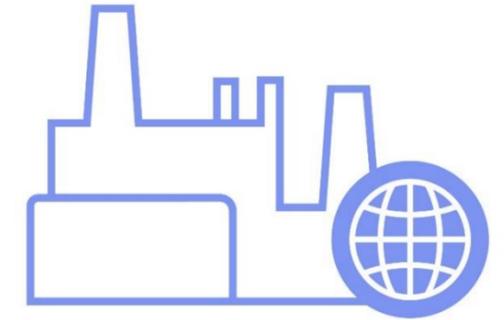
- Net-zero commitments from governments and corporations (driven by increasing climate awareness and public pressure).
- Need for low-carbon footprint commodities and energy.
- Economic prosperity, including growth and a just transition as we move to net-zero.

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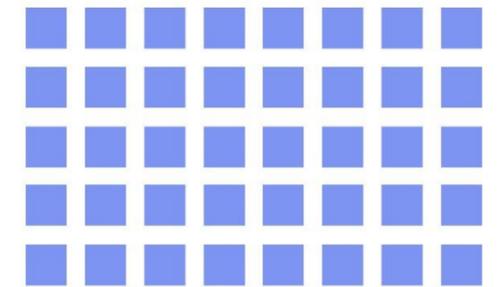
# CCS: AMBITION TO ACTION

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- In 2022, the number of commercial CCS facilities in operation or under development grew for the **5th year** in a row.
- The capture capacity of CCS projects in the project pipeline is 244 million tonnes per annum (Mtpa) – a **44% increase** from 2021.
- Policy and funding support for CCS continued – dramatically in North America and Europe, but also notable progress in the APAC region.
- This CCS growth trend appears to be “signal,” not noise. Nevertheless, the growth needs to accelerate.

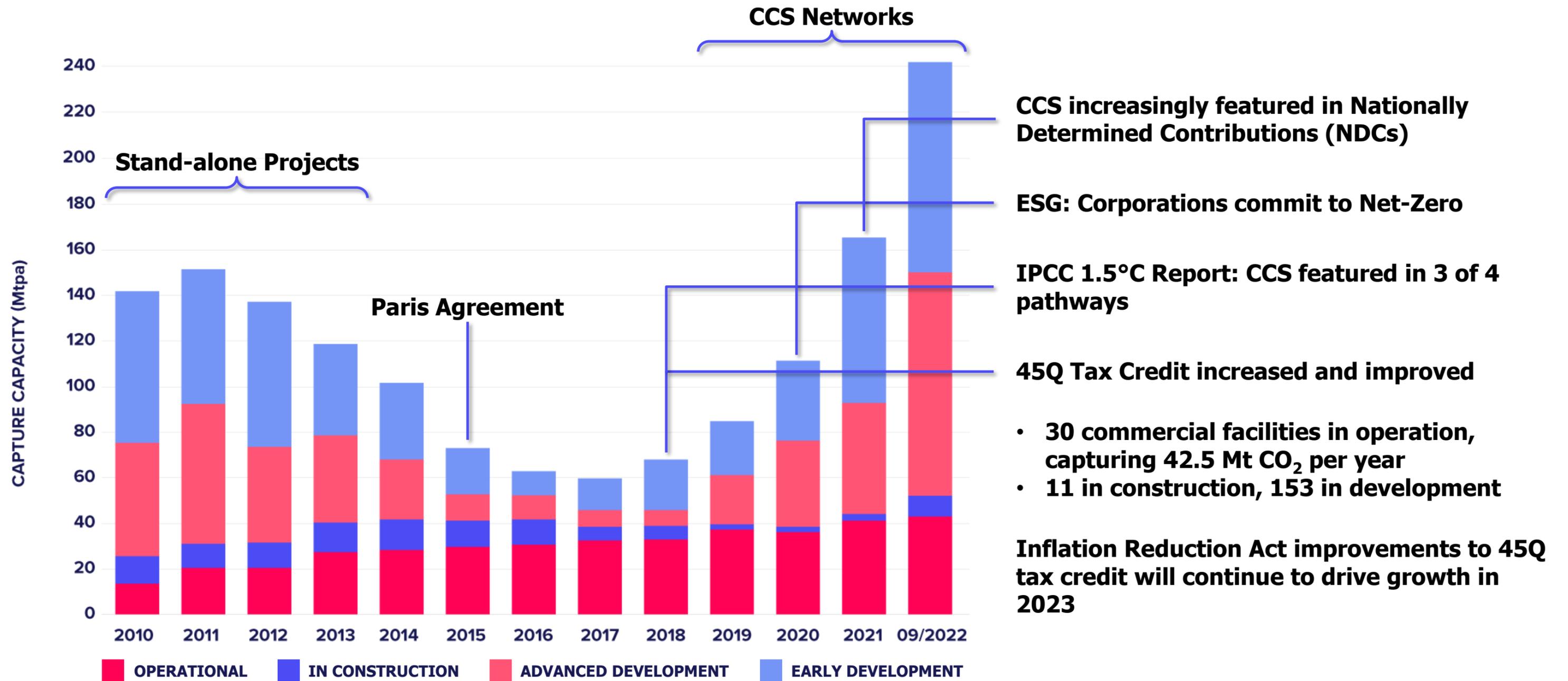


**196 CCS  
FACILITIES  
WORLDWIDE**



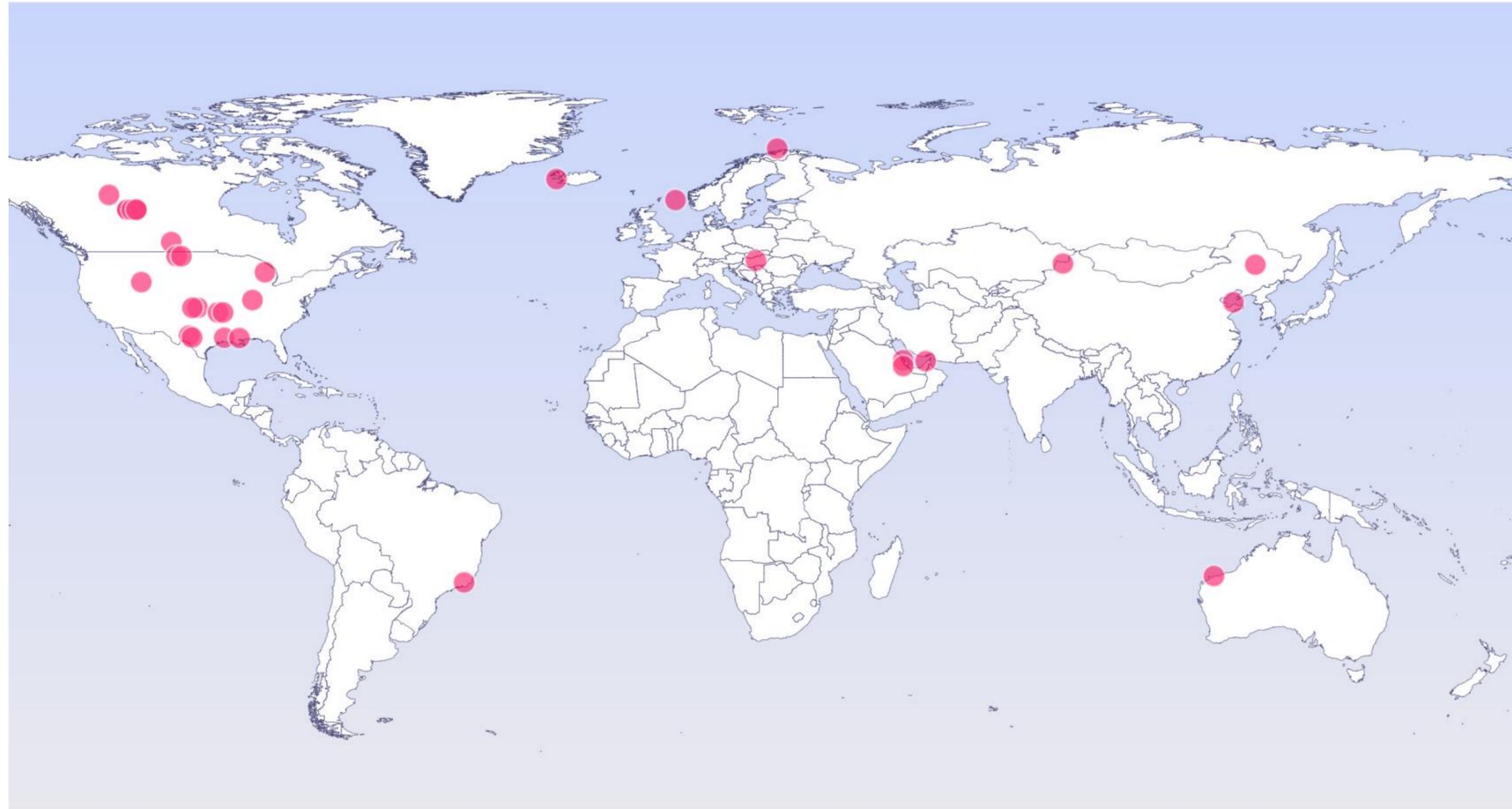
**244 MT  
CAPTURE  
CAPACITY**

# THE JOURNEY TO GROWTH IN 2022

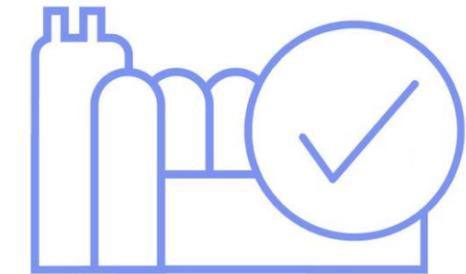


Note: bar chart does not include suspended facilities, but 244 Mtpa capture capacity statistic does

# CCS FACILITIES – OPERATING



● OPERATIONAL

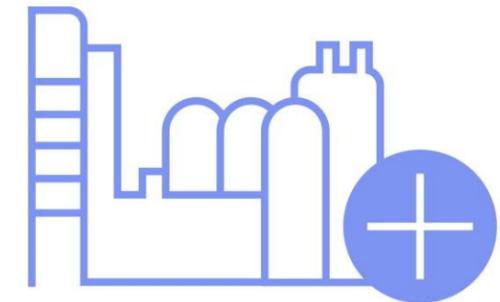
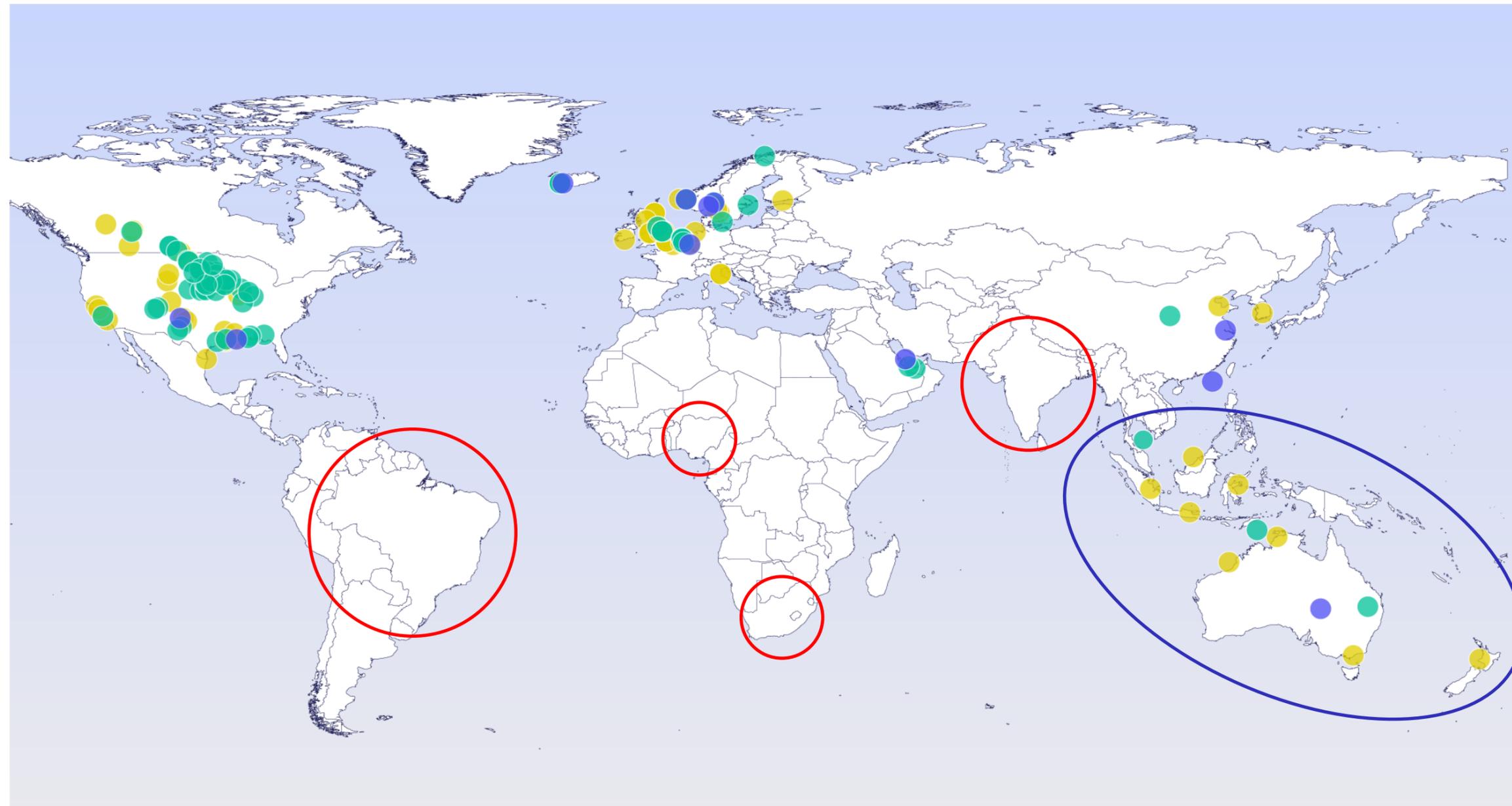


**30 CCS FACILITIES  
OPERATIONAL**



**20+ COUNTRIES WITH  
COMMERCIAL CCS &  
DACCS FACILITIES  
IN OPERATION OR UNDER DEVELOPMENT**

# CCS FACILITIES – IN DEVELOPMENT



**61 NEW CCS FACILITIES ADDED**



**20+ COUNTRIES WITH COMMERCIAL CCS & DACCS FACILITIES IN OPERATION OR UNDER DEVELOPMENT**

**● EARLY DEVELOPMENT ● ADVANCED DEVELOPMENT ● UNDER CONSTRUCTION**

# THE GLOBAL STATUS OF CCS

## SIGNIFICANT DEVELOPMENTS IN THE PAST 12 MONTHS

- 4 new facilities in operation.
  - First commercial DACCS and post-combustion gas facilities.
  - New operational facilities in Canada, China, Iceland, US.
- 11 new facilities in construction.
- **75** Mtpa of new capture capacity.
- Major project progress: Australia, Iceland, Indonesia, Malaysia.
- Major policy progress: Canada, Denmark, US.
- Several countries completed storage licensing rounds: Australia, Canada, Denmark, UK.



*Glacier Phase I (Image courtesy Entropy, Inc.)*

# NETWORK AND INFRASTRUCTURE DEVELOPMENT

- Shipping an emerging component in CCS value chain.
  - Northern Lights (Norway): two dedicated 7,500 m<sup>3</sup> CO<sub>2</sub> carrier ships under construction.
  - LCO<sub>2</sub> carrier designs by Dan-Unity, Daewoo, Ecolog, Hyundai HI, Mitsubishi HI, Stella Maris, etc.
  - The Hydrogen Energy Supply Chain (HESC) pilot project demonstrated the transport of liquid hydrogen from Australia to Kobe in Japan in February 2022.
- In Iceland, CarbFix's Coda Terminal will expand its projects storing CO<sub>2</sub> in basalt.
- Announced transportation projects in Europe:
  - Equinor, Fluxys subsea pipeline (Belgium to Norwegian North Sea)
  - Shipment hub in Bremen, Germany



*LCO<sub>2</sub> Carrier Design (image courtesy Northern Lights)*

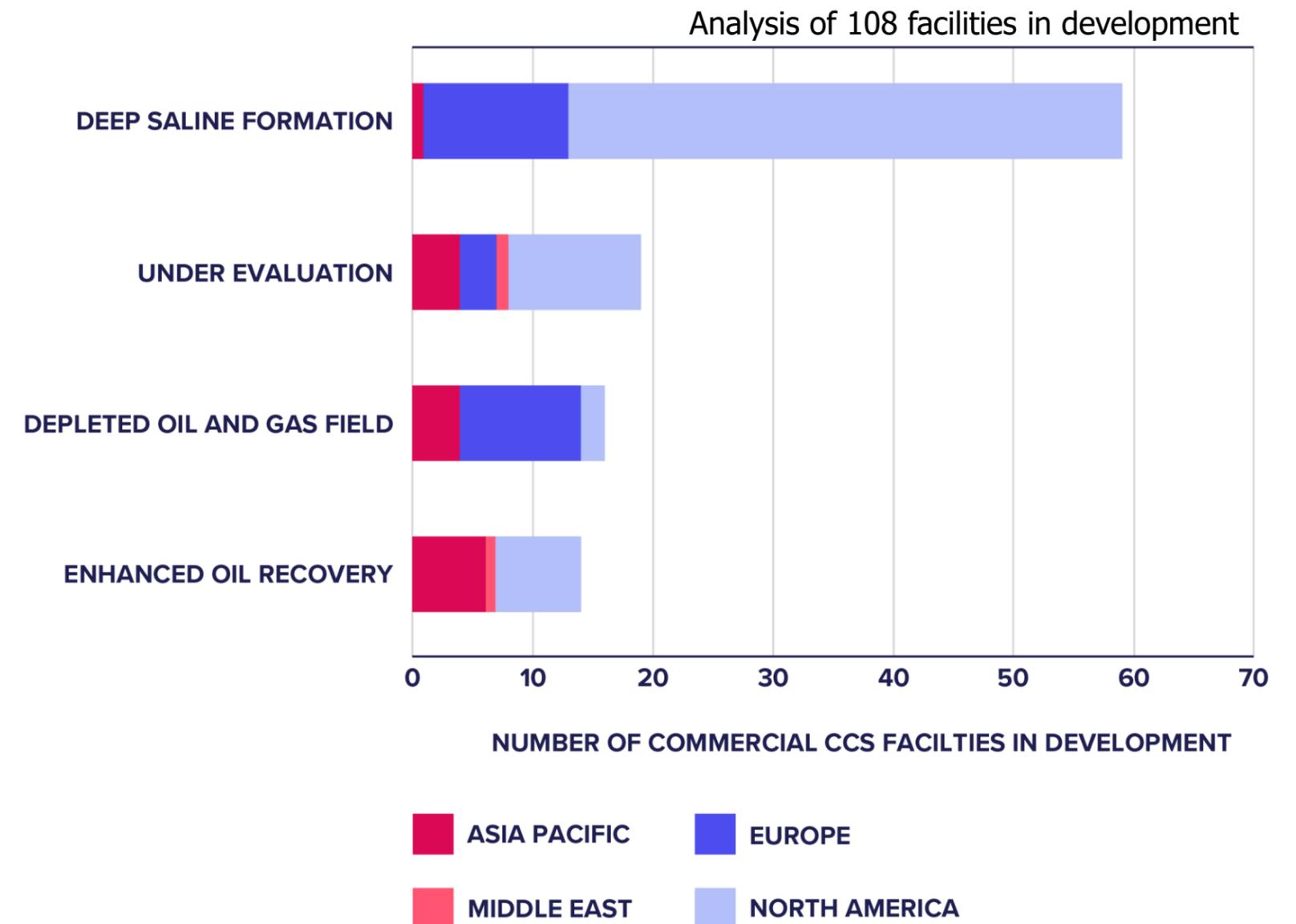


*Coda Terminal, Straumsvik, Iceland (image courtesy CarbFix)*

# EVOLUTION OF STORAGE

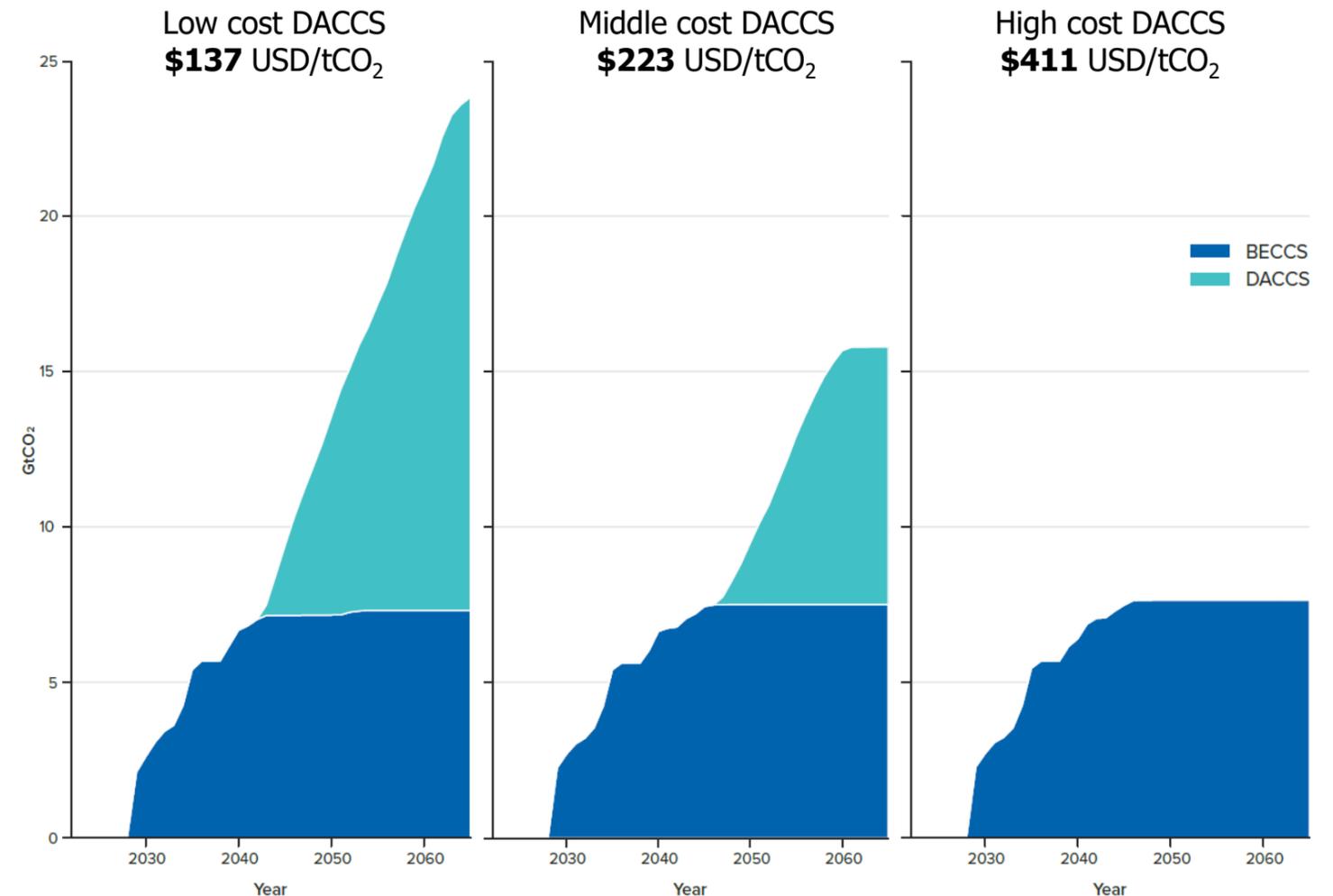
## LESS ENHANCED OIL RECOVERY (EOR), INCREASING STORAGE RATES

- Only 9 of the 30 operational facilities utilize dedicated geological storage (saline formations, depleted oil and gas fields) - the remainder utilize EOR.
- 70% of the commercial CCS projects in development will utilize dedicated geological storage.
- On average, operational facilities inject  $\sim 1$  Mtpa CO<sub>2</sub>; CCS networks in development have nameplate rates of  $\sim 5$  Mtpa.



# CARBON DIOXIDE REMOVAL (CDR)

- CDR continues to gain momentum and is viewed as critical to net-zero.
- Engineered-CDR costs (specifically of DACCS) are currently relatively high but projected to fall over time.
- Deployment will be determined by the extent to which DACCS costs fall.
- CDR will play an important role in drawing down historical emissions (safety net if we overshoot our carbon budget).



Results of modelling completed by GCCSI

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# CCS DEVELOPMENTS IN THE U.S.

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- Infrastructure Investment and Jobs Act (IIJA)
  - \$12bn for hydrogen hubs, direct air capture hubs, CCS demonstration projects, pipeline FEED studies and infrastructure, and EPA permitting
  - Outer Continental Shelf Lands Act amended (BOEM developing regulations)
- Inflation Reduction Act (IRA)
  - Significant enhancements to 45Q
  - Multiple early analyses suggest the IRA could increase the deployment of CCS by 13-fold, or well over 110 Mtpa, by 2030 compared to existing policy.
- CHIPS and Science Act: \$1bn for CO<sub>2</sub> removal R&D.
- First Class VI permits issued in North Dakota.
- California: S.B. 905 establishes framework for CCUS in the state, S.B. 1314 bans injection of CO<sub>2</sub> in Class II wells for purposes of EOR.



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# CCS DEVELOPMENTS IN CANADA

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- 2030 Emissions Reduction Plan established.
- CCUS Strategy under development – includes funding, research, investment.
- 2022 Federal Budget included CCUS investment tax credit (2022 – 2030).
- Move to mandatory climate-related (ESG) financial disclosures across broad spectrum of the economy as part of net-zero 2050 strategy.
- Clean Fuel Regulations to start in 2023 - targeting 15% reduction in carbon intensity of gasoline and diesel by 2030.



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# CCS DEVELOPMENTS IN EUROPE

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- More than 70 commercial facilities in various stages of development across Europe – almost doubling from 2021.
- **EU** through the Innovation Fund to invest in 11 CCS and CCU projects, supplemented by individual member state policies.
- **NETHERLANDS** allocated €2bn SDE++ subsidy to capture facilities in the Port of Rotterdam (Porthos) network.
- **DENMARK** allocated €5bn for CCS projects over 10 years under Energy Technology Development and Demonstration Project.
- **The UK** aims to establish 4 CCUS networks by 2030 capturing 20-30 Mtpa, with £1 billion allocated to support CCUS development. First two recipient clusters announced in late 2021.

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# CCS DEVELOPMENTS IN THE MENA REGION

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- 3 facilities in operation in the region, capturing 3.7 Mtpa CO<sub>2</sub>, equivalent to ~10% of global capture capacity. Each have announced plans for expansion.
- CCUS in MENA region being driven by multiple factors:
  - Government ambition and vision - reflected in Nationally Determined Contributions (NDCs) and net-zero commitments
  - Potential to take a significant share of low-carbon hydrogen market
  - Low-carbon industrialization plans
- Kingdom of Saudi Arabia, United Arab Emirates, and Egypt have announced voluntary carbon markets and carbon trading schemes.



# CCS DEVELOPMENTS IN THE ASIA-PACIFIC

## CHINA

“1+N” policy mechanism provides high-level policy support for CCS. State-owned energy enterprises driving CCS development, yet require enhanced policy and technology support.

- SINOPEC Qilu-Shengli CCUS project became operational.
- CNOOC began injection at China’s first offshore CCS project (demonstration).
- CNPC announced intent to build 3 Mt of demonstration projects and formulating plans for a pipeline network.



*Qilu Petrochemical Facility (Image courtesy SINOPEC)*

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# CCS DEVELOPMENTS IN THE ASIA-PACIFIC

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## **JAPAN**

Strong support for CCUS. Limited domestic storage. Reliant on imports of low-carbon energy and export of captured CO<sub>2</sub>. Looking for storage in countries with strong regulatory regimes.

## **INDONESIA**

CCUS regulatory framework is in development and the anticipated carbon pricing mechanism will launch its first phase later this year.

## **MALAYSIA**

Ambition to become a regional storage hub for CCS. Announced a carbon tax and development of a regulatory framework in late 2021.

## **AUSTRALIA**

CCS projects now eligible to generate carbon credits through the Emissions Reduction Fund. Regulatory frameworks being developed at the state level (WA, NT).

## **THAILAND**

PTTEP announced first project this year, regulatory frameworks under development.

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# INTERNATIONAL POLICY AND REGULATION

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- Publication of IPCC Working Group III Report: 'Mitigation of Climate Change' highlights the effectiveness and viability of CCS.
- 21 countries included CCS in their Nationally Determined Contributions (NDCs) with more expected.
- More than 80% of countries that submitted Long-Term Low-Emission Development Strategies (LT-LEDs) included CCS.
- Trend toward closer regional cooperation, particularly surrounding transboundary storage activities (e.g., North Sea, Southeast Asia).

# THE CHALLENGE BEFORE US

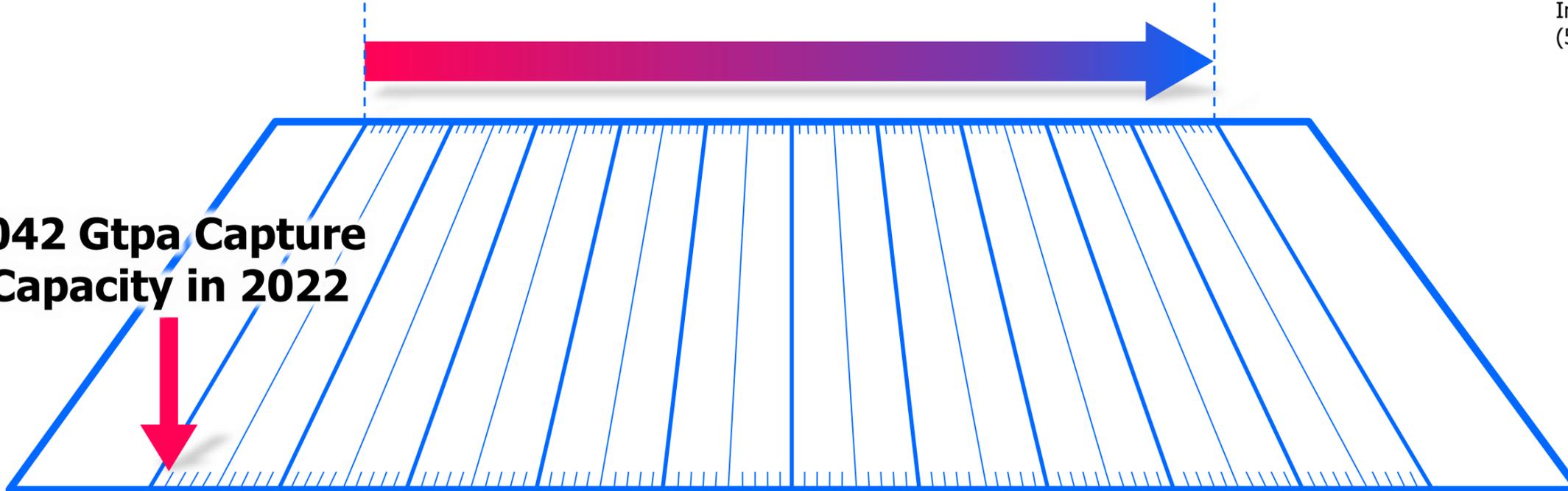
Despite progress, we are far short of the scale required to achieve net-zero.

## IEA'S 2020 SUSTAINABLE DEVELOPMENT SCENARIO\*

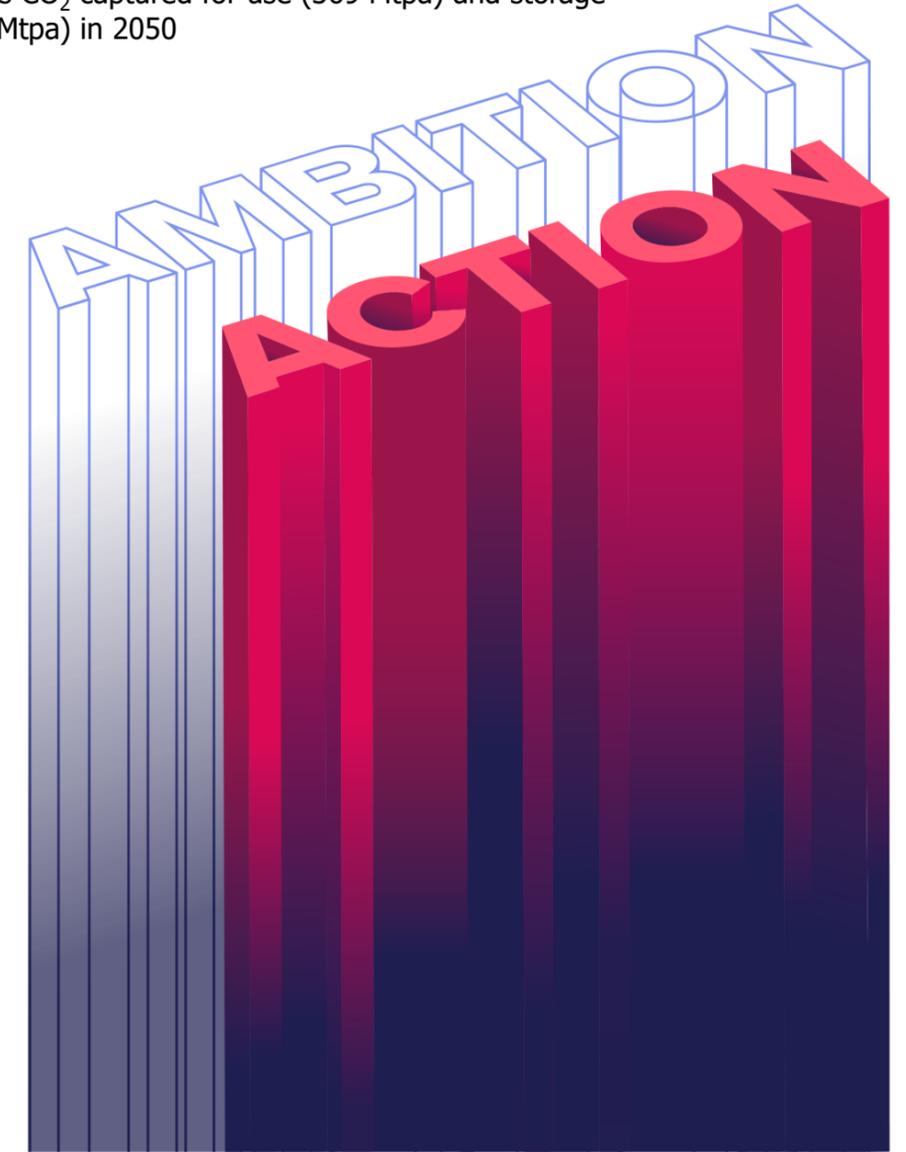
**5.6 Gtpa Capture Capacity by 2050**

\*International Energy Agency. (2020). Energy Technology Perspectives 2020, Special Report on Carbon Capture Utilisation and Storage. Includes CO<sub>2</sub> captured for use (369 Mtpa) and storage (5,266 Mtpa) in 2050

**.042 Gtpa Capture Capacity in 2022**



- **Stronger CCS-specific policy and market mechanisms to enable investment**
- **A long-term, high value on storage of CO<sub>2</sub>**
- **Identification and characterization of geological storage resources**
- **More CCS networks and more transport and storage infrastructure**



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# THANK YOU

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