GLOBAL PROGRESS ON CCS

CCSA/Net Zero Week

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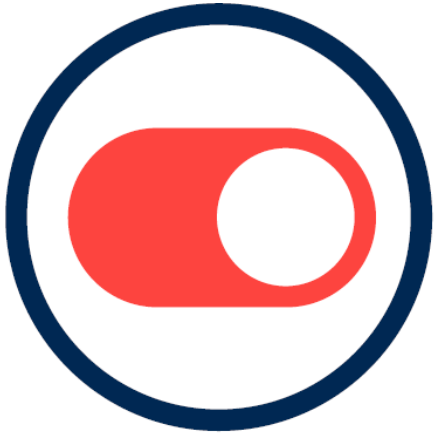
Agenda

Global Scientific Consensus on CCS

CCS International Policy & Trends

Global Status of CCS

CCS IS VITAL FOR NET ZERO



- Achieves deep decarbonisation in **hard-to-abate** sectors
- Enables production of **low-carbon hydrogen** at scale
- Provides low-carbon **dispatchable power**
- Delivers **negative** emissions

GLOBAL SCIENTIFIC CONSCENSUS ON CCS

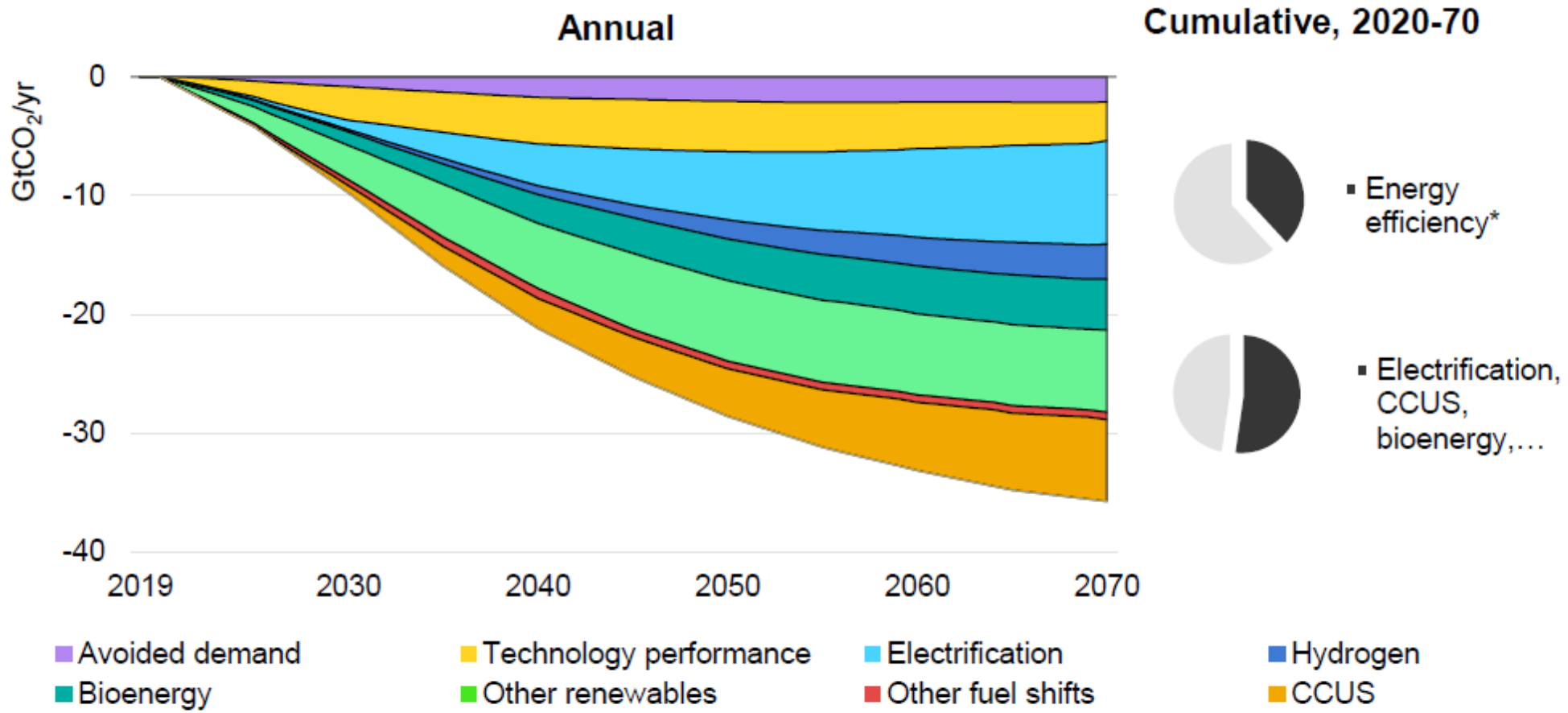
Key takeaways from IPCC Working Group III:

- **CCS is an option to reduce emissions** from large scale fossil-based energy and industry sources, provided geological storage is available.
- The technical **geological CO_2 storage capacity** exceeds the CO_2 storage requirements through 2100 to limit global warming to 1.5°C, although regional availability could be a limiting factor.
- Compared to the **oil and gas** sector, CCS is less mature in the **power** sector as well as **cement** and **chemical** production, where it is a critical mitigation option.

GLOBAL SCIENTIFIC CONSCENSUS ON CCS

- Current **global rates of CCS deployment** are far below those in modelled pathways to limit global warming to 1.5°C or 2°C. Policy instruments, greater public support and technological innovations could reduce barriers.
- When CO2 is captured directly from the atmosphere through **Direct Air Carbon Capture and Storage (DACCS)** or from **Bioenergy with Carbon Capture and Storage (BECCS)**, CCS provides the storage component of these carbon dioxide removal (CDR) methods.
- CCS may kick-start the **hydrogen (H_2) economy**.

Figure 2.1 Global energy sector CO_2 emissions reductions by measure in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-70



CCS POLICY TRENDS

CCS policy and project activity remains high in many parts of the world

- Activity in Europe and North America predominates.
- Many governments and business around the world continue to advance CCS projects and/or policy, including new entrants in Russia, SE Asia.

Interest in role of Voluntary Carbon Markets for CCS is growing

- COP26 progress on Article 6 could be catalyst for trans-national project interest.
- Task Force on Scaling Voluntary Carbon Markets as driving force for supportive market developments.

National CO_2 policy archetypes strengthening

- Dichotomy between incentive (or “carrot”) and penalty (or “stick”) based regulatory systems.
- Current project numbers might suggest incentives-based work best for CCS, but that could change.
- Party-driven NDCs increasingly include CCS

Implications of the Ukrainian crisis for CCS are still unclear

- Increased emphasis on energy security.
- CCS could prove key to increased energy production complementing net zero aspirations.

CCS IN NATIONAL CLIMATE PLANS UNDER THE PARIS AGREEMENT

2021 NDCs: 18 include CCS

- Some countries that have CCS facilities in pipeline don't have it in their NDCs (e.g. Malaysia, New Zealand)
- Other countries that have CCS in NDCs don't have commercial CCS facilities in development (e.g. Egypt, Kuwait)

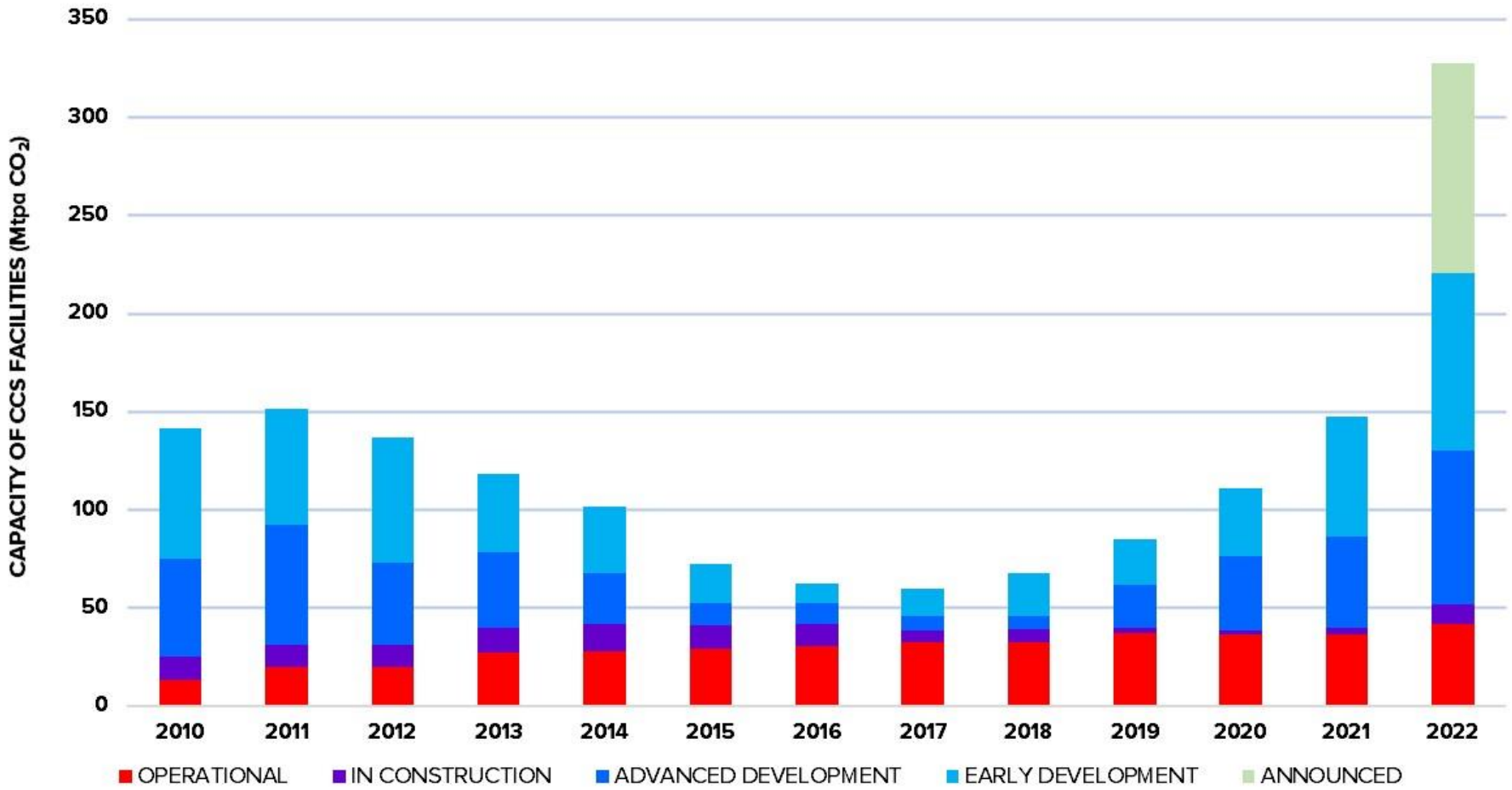
- LT-LEDs (mid-century): Almost 80% of submitted (>40) LT-LEDs have CCS

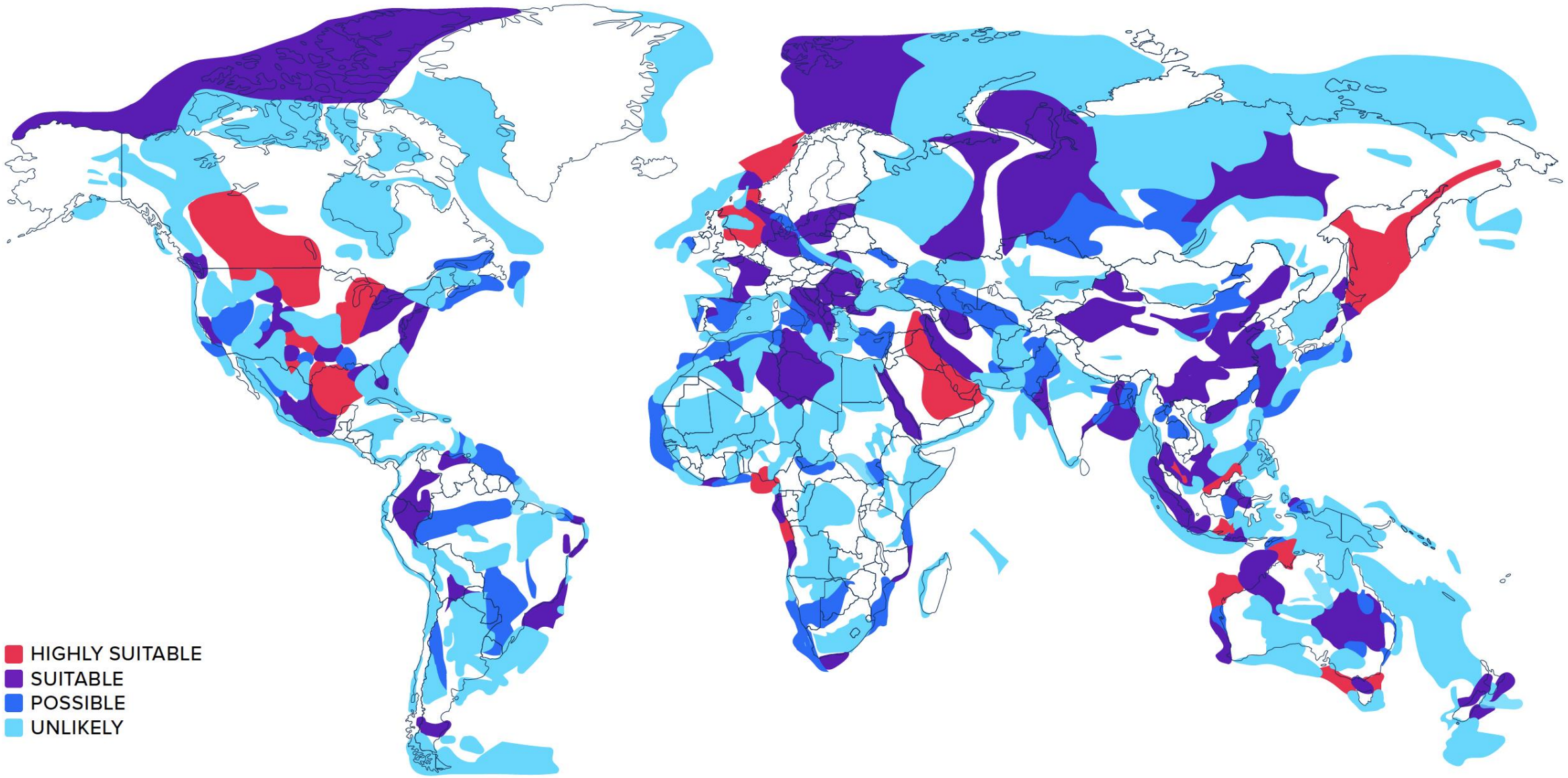
		1st NDC	1st NDC update	2nd NDC
1	Australia	×	✓	
2	Bahrain	✓	✓	
3	Canada	×	✓	
4	China	✓	✓	
5	Egypt	✓		
6	Iceland	×	✓	
7	Kuwait	×	✓	
8	Malawi	✓	✓	
9	Mongolia	×	✓	
10	Norway	✓	✓	
11	Pakistan	×	✓	
12	Qatar	-	✓	
13	Saudi Arabia	✓	✓	
14	South Africa	✓	×	
15	Togo	×	✓	
16	Tunisia	×	✓	
17	UAE	✓	-	✓
18	United States	✓		

✓	NDC mentions CCS
×	NDC does not mention CCS
-	not available

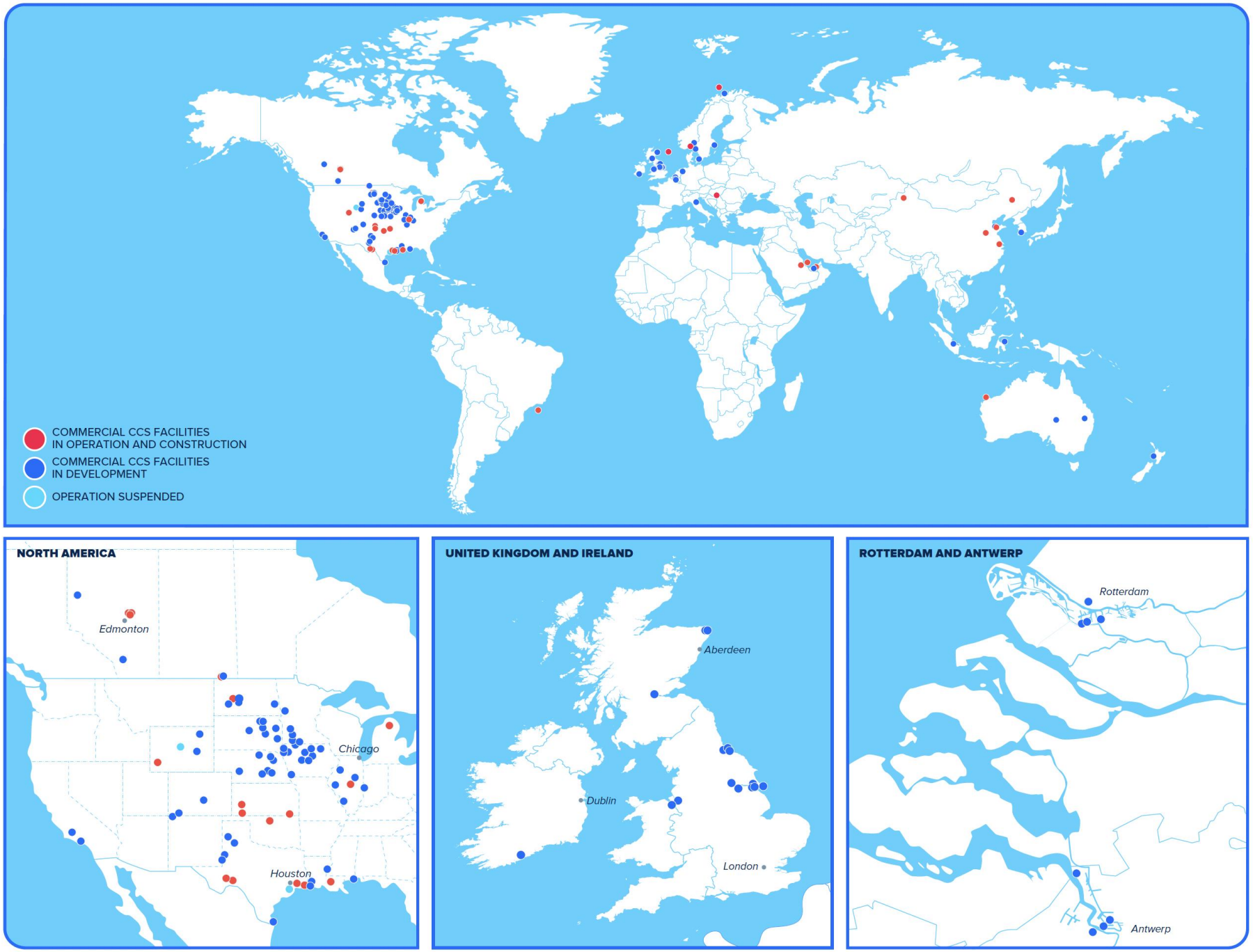
Nationally Determined Contributions (NDCs) and Long-Term Low Greenhouse Gas Emission Development Strategies (LT-LEDs)

GLOBAL STATUS OF CCS





SUITABLE STORAGE REGIONS OF THE WORLD BASED ON THE GLOBAL CCS INSTITUTE'S STORAGE BASIN ASSESSMENT DATABASE



WORLD MAP OF CCS FACILITIES AT VARIOUS STAGES OF DEVELOPMENT

DRIVERS FOR CCS MOMENTUM

Rise of CCS networks

Net Zero commitments from countries and companies

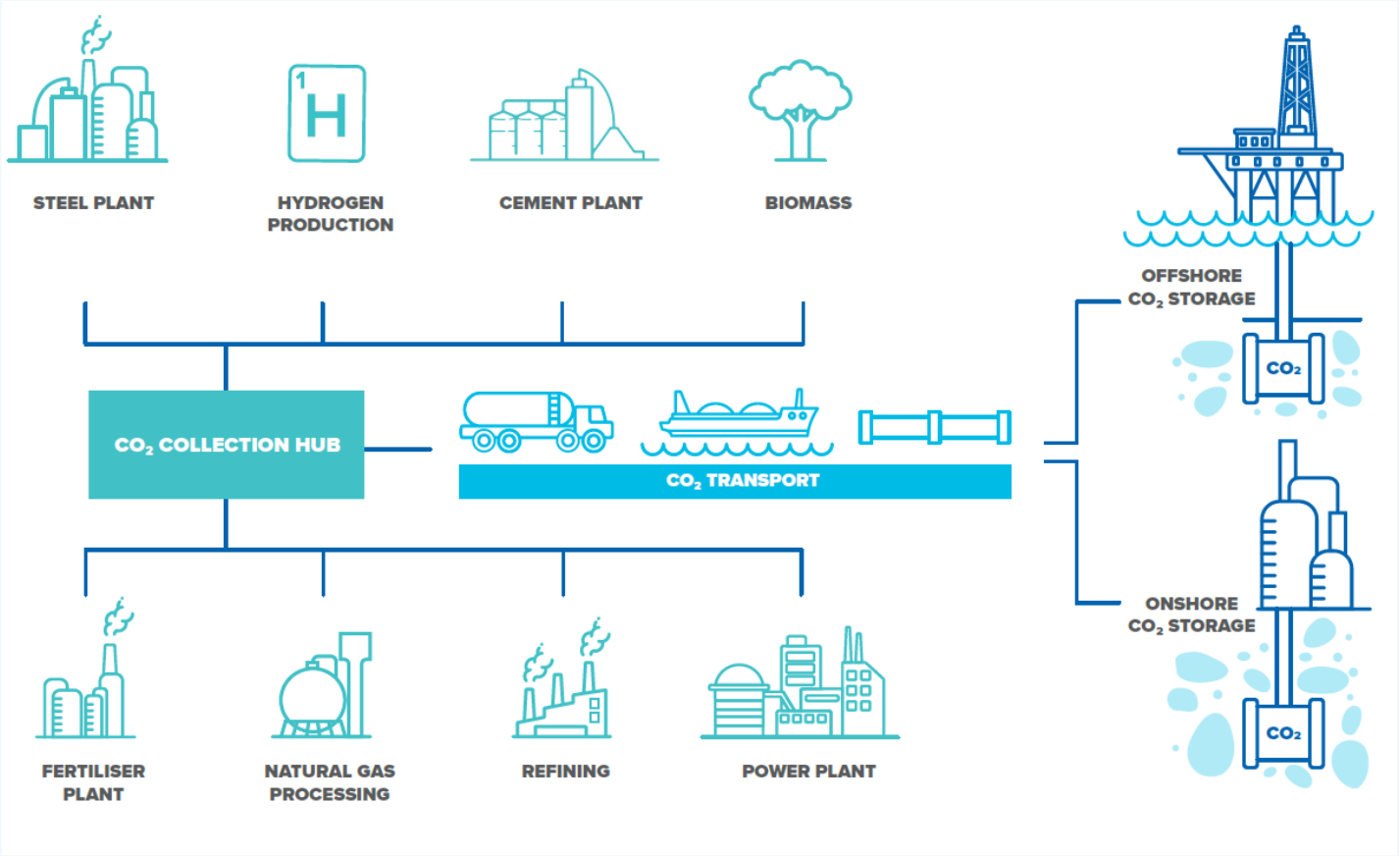
Emergence of strategic business partnerships

Blue Hydrogen projects

Technology-based carbon removal

CCS NETWORKS TAKING OFF GLOBALLY

- **Multiple industrial point sources** of CO_2 connected to a CO_2 transport and storage network.
- Access to **large geological storage resources**
- **Economies of scale** deliver lower unit-costs for CO_2 storage.
- Reduce **cross chain risks and support commercial viability**.



	FACILITY	CAPACITY (Mtpa)	SECTOR															TRANSPORT				STORAGE			
			COAL FIRED POWER	NATURAL GAS POWER	NATURAL GAS PROCESSING	FERTILISER PRODUCTION	HYDROGEN PRODUCTION	IRON AND STEEL PRODUCTION	ALUMINIUM PRODUCTION	CHEMICAL AND PETROCHEMICAL PRODUCTION	CEMENT PRODUCTION	OIL REFINING	ETHANOL PRODUCTION	WASTE INCINERATION	BIOMASS POWER	DIRECT AIR CAPTURE	PIPELINE	SHIP	ROAD	DIRECT INJECTION	DEEP SALINE FORMATIONS	ENHANCED OIL RECOVERY	DEPLETED OIL AND GAS RESERVOIRS	VARIOUS OPTIONS CONSIDERED
1	ACTL	1.7 - 14.6				●	●			●							●					●		
2	North Dakota Carbonsafe	3.0 - 17.0						●									●							●
3	Integrated Mid-Continent Stacked Carbon Storage Hub	1.9 - 19.4	●								●		●				●							●
4	Summit Carbon Solutions	7.9											●				●				●			
5	CarbonSafe Illinois	2.0 - 15.0	●										●				●							●
6	Illinois Storage Corridor	6.5	●										●				●				●			
7	Wabash CarbonSafe	1.5 - 18	●	●						●	●				●					●				●
8	Petrobras Santos Basin	3.0			●															●		●		
9	HyNet North West	4.5 - 10.0				●	●				●						●				●			
10	South Wales Cluster	9.0		●			●			●		●					●	●			●			
11	Net Zero Teesside	0.8 - 6.0		●		●		●		●							●				●			
12	Humber Zero	8.0		●			●										●				●			
13	Zero Carbon Humber	Up to 18.3					●	●		●	●		●				●				●			
14	Acorn	5.0 - 10.0		●	●		●									●	●				●			
15	Langskip	1.5 - 5.0									●			●			●	●			●			
16	Antwerp@C	9.0					●			●		●					●				●			
17	Porthos	2.0 - 5.0					●			●							●						●	
18	Athos	1.0 - 6.0					●	●		●				●			●							●
19	Greensand	3.5									●			●			●	●					●	
20	C4 Copenhagen	3.0		●										●							●			
21	Ravenna Hub	Up to 4.0		●	●		●										●						●	
22	Abu Dhabi Cluster	2.7 - 5.0			●		●	●									●					●		
23	Xinjiang Junggar	0.2 - 3.0	●				●			●							●		●			●		
24	CarbonNet	2.0 - 5.0			●	●	●							●		●	●				●			
	Alberta Carbon Grid	More than 20.0	●	●						●		●					●				●			
	Barents Blue	1.8					●			●							●				●			
	Dartagnan	10.0						●	●								●							
	CarbonConnectDelta	6.5						●		●							●				●	●	●	●
	Houston Ship Channel CCS Innovation Zone	Up to 100.0								●		●												●
	Aramis	More than 20.0					●	●		●		●		●			●				●			
	Edmonton Hub	10		●			●			●	●	●					●				●			
	Louisiana Hub	5.0 - 10.0					●	●		●		●	●				●				●			

● IN OPERATION ● ADVANCED DEVELOPMENT ● EARLY DEVELOPMENT

FIGURE 10 CCS NETWORKS AROUND THE WORLD

TOWARDS ACHIEVING GLOBAL CLIMATE TARGETS

- To achieve net-zero emissions, CCS capacity must increase more than a **hundredfold by 2050.**
- CCS capacity needs to scale from **40 million tons to multiple gigatons** by mid-century.
- Stronger **policy with strong action by 2030** is crucial.

Policy priorities include:

- ✓ Creating conditions for **investment**
- ✓ Facilitating development of CO_2 **infrastructure**
- ✓ Clarifying key **legal and regulatory** issues
- ✓ Unlocking CCS in **carbon markets**

COP27 OUTLOOK – WHAT TO WATCH

Global Stocktake

- Opportunity for **conversations between countries and technical experts** through the Global Stocktake (GST) Technical Dialogues (TDs).

Article 6

- Significant **technical intersessional work** before Sharm El Sheikh.
- **Supervisory Body** are scheduled to meet at the end of July.

THANK YOU

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