

Current Status of CCUS in the Middle East and North Africa (MENA) Region

The 3rd CCUS & Hydrogen International Symposium
August 25th and 26th, 2022

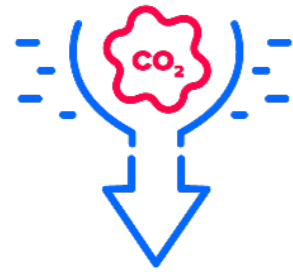
Dr. Mohammad Abu Zahra
Head of MENA Region - Global CCS Institute

 @GlobalCCS

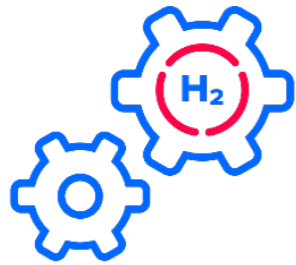
 Global CCS Institute



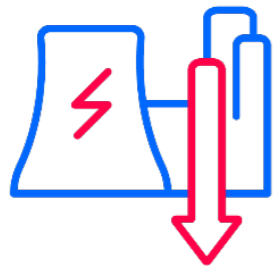
CCS: REACHING NET-ZERO AND DRIVING THE LOW-CARBON ECONOMY



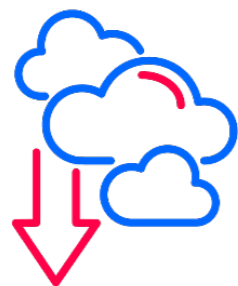
Achieving deep decarbonisation in hard-to-abate industry.



Enabling the production of low-carbon hydrogen at scale.

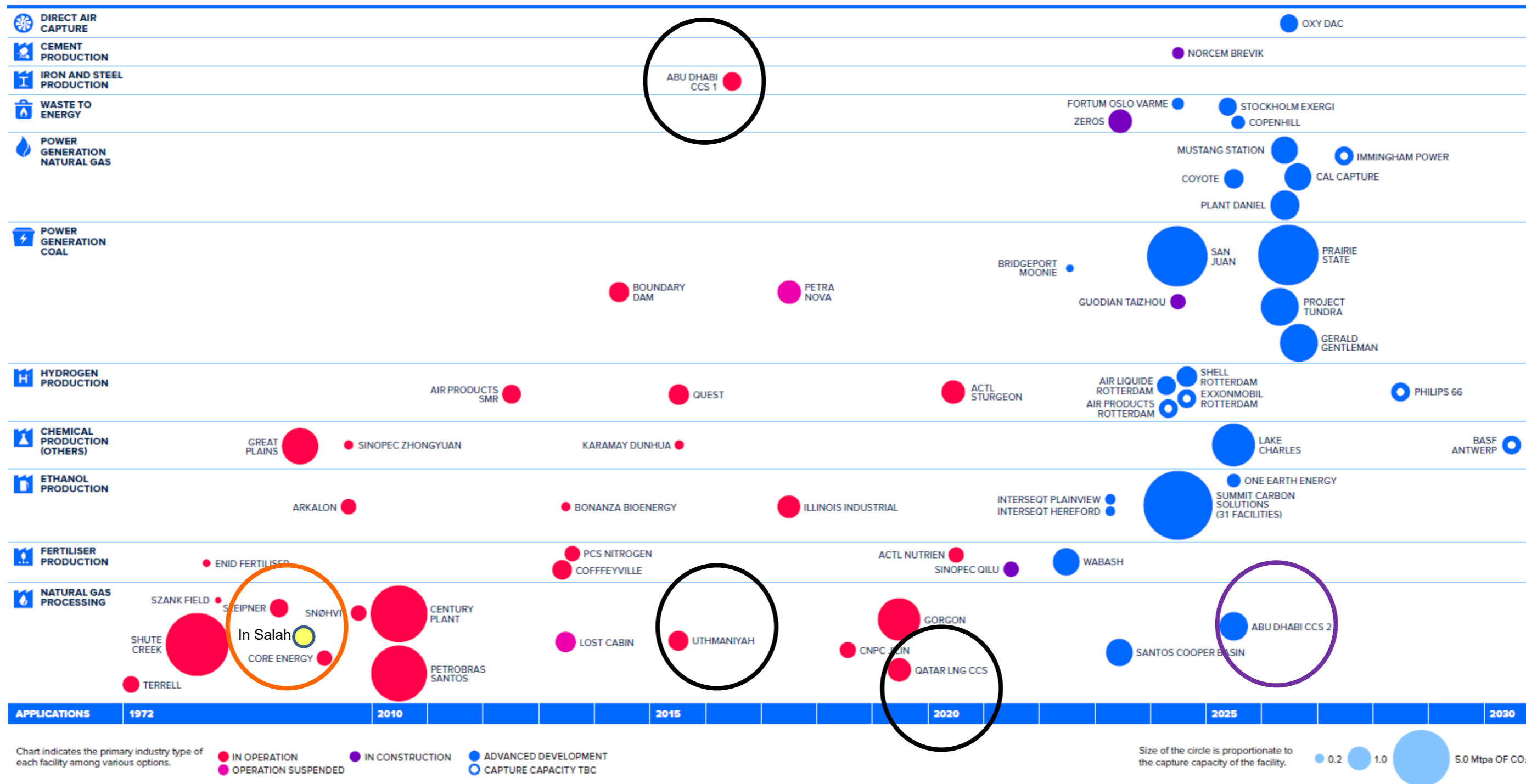


Providing low carbon dispatchable power.




Delivering negative emissions.

GLOBAL SNAPSHOT – DIVERSITY



THE MARKET – SCORECARD



	OPERATING	IN DEVELOPMENT	SUSPENDED	TOTAL
North America	16	60	2	78
China	3	3	-	6
Europe	3	35	-	38
Gulf Cooperation Council	3	1	-	4
Rest of World*	2	7	-	9
Total	27	106	2	135

DRIVERS OF CCS MOMENTUM IN 2021



Strengthening policy support for CCS



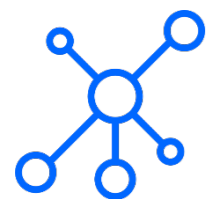
Blue Hydrogen Projects



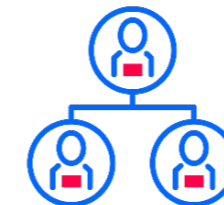
Net Zero Commitments from countries and companies



Technology-based Carbon Removal



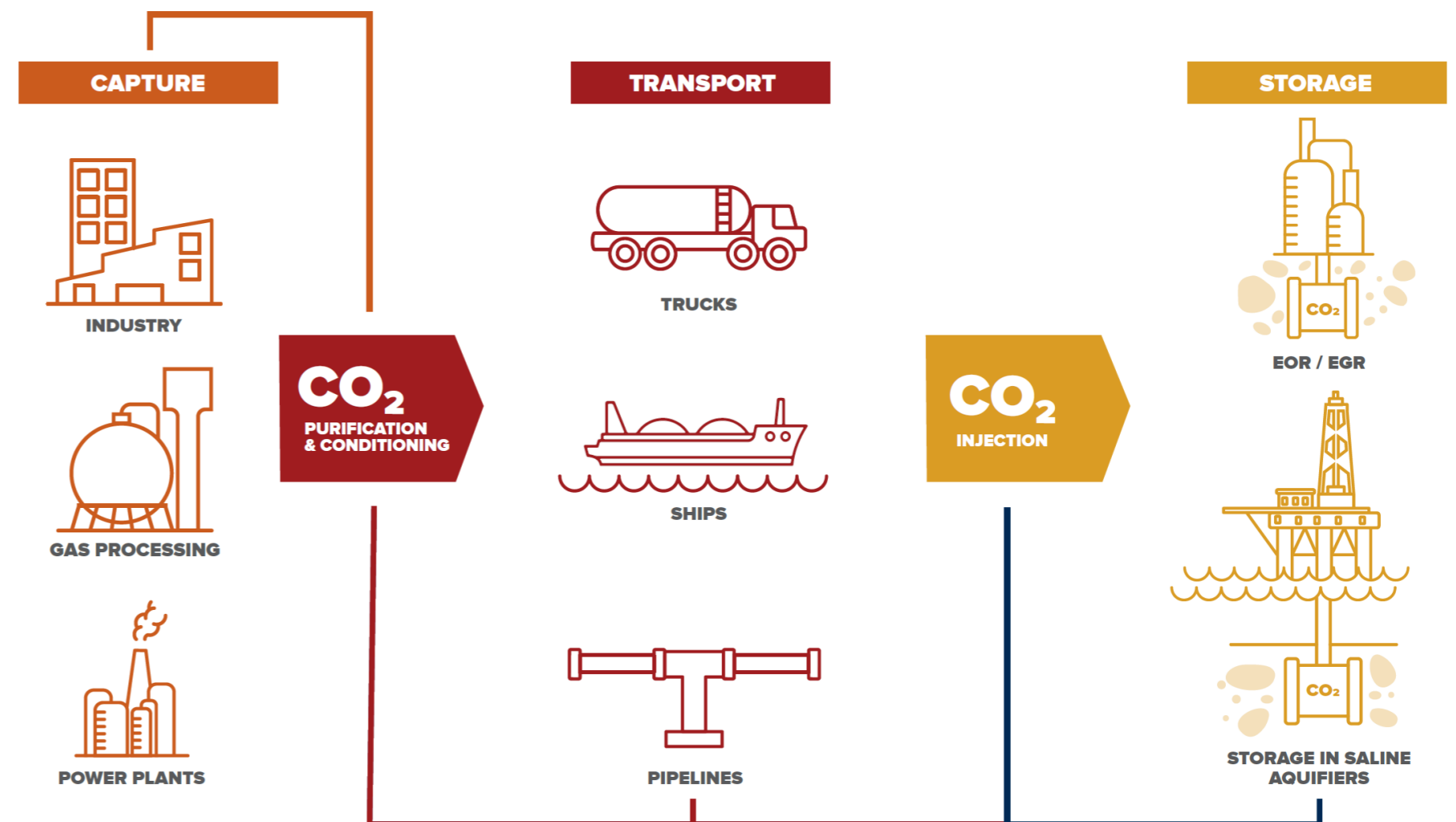
Rise of CCS Networks



Emergence of Strategic Business Partnerships

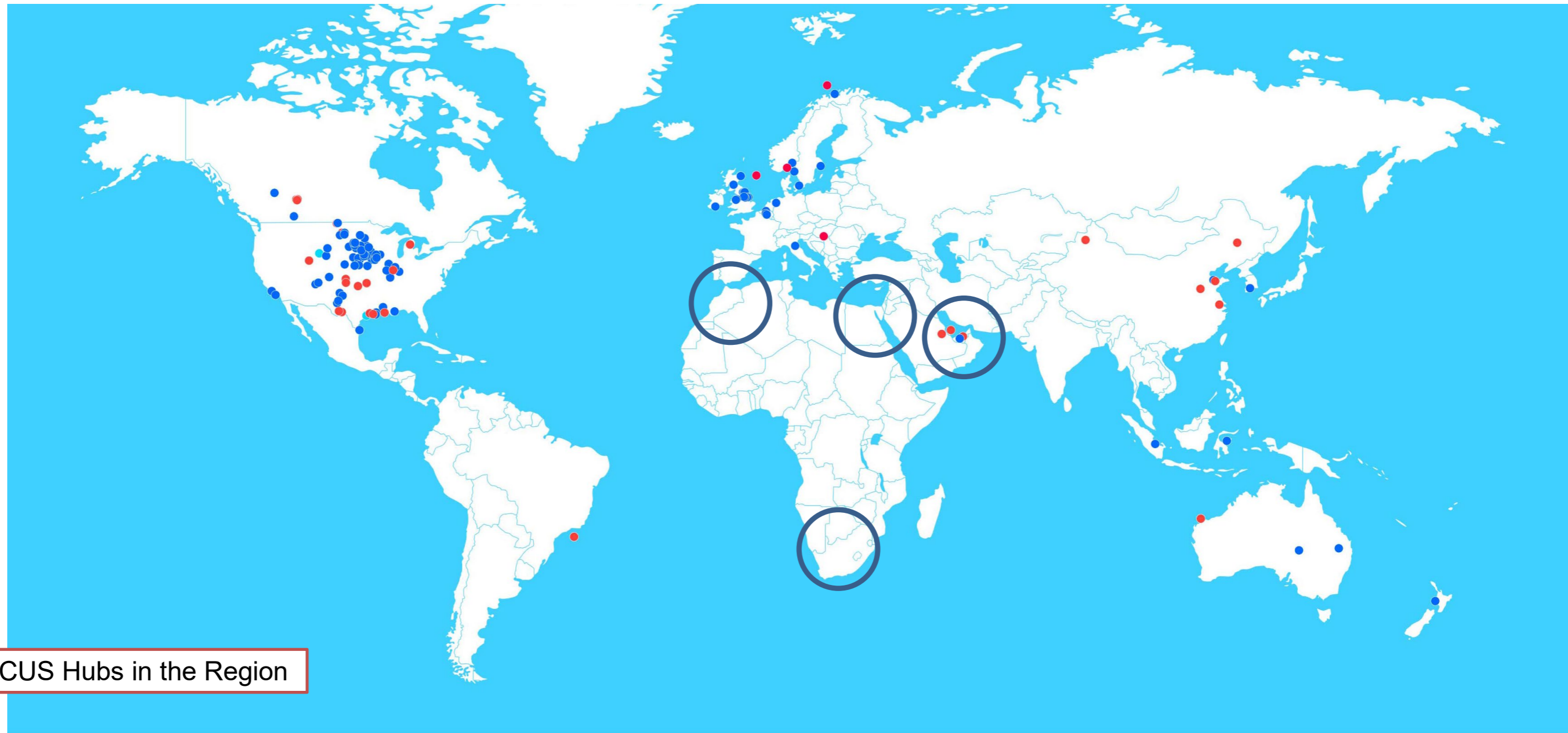
THE MARKET – CCS ECOSYSTEM/PLAYERS

- Emitters
- Capture Technology Providers
- Transport/Storage providers
- Project Developers/CO₂ Management
- Services
 - Financiers
 - Carbon accountants
 - Geoscientists
 - Engineering/EPC
 - Lobbyists
 - Lawyers
 - Permit Expeditors



The development of full supply chain is required

THE MARKET



Potential for CCUS Hubs in the Region

● COMMERCIAL CCS FACILITIES
IN OPERATION AND CONSTRUCTION

● COMMERCIAL CCS FACILITIES
IN DEVELOPMENT

● OPERATION SUSPENDED

THE MARKET POTENTIAL IN MENA REGION



GCC STATES

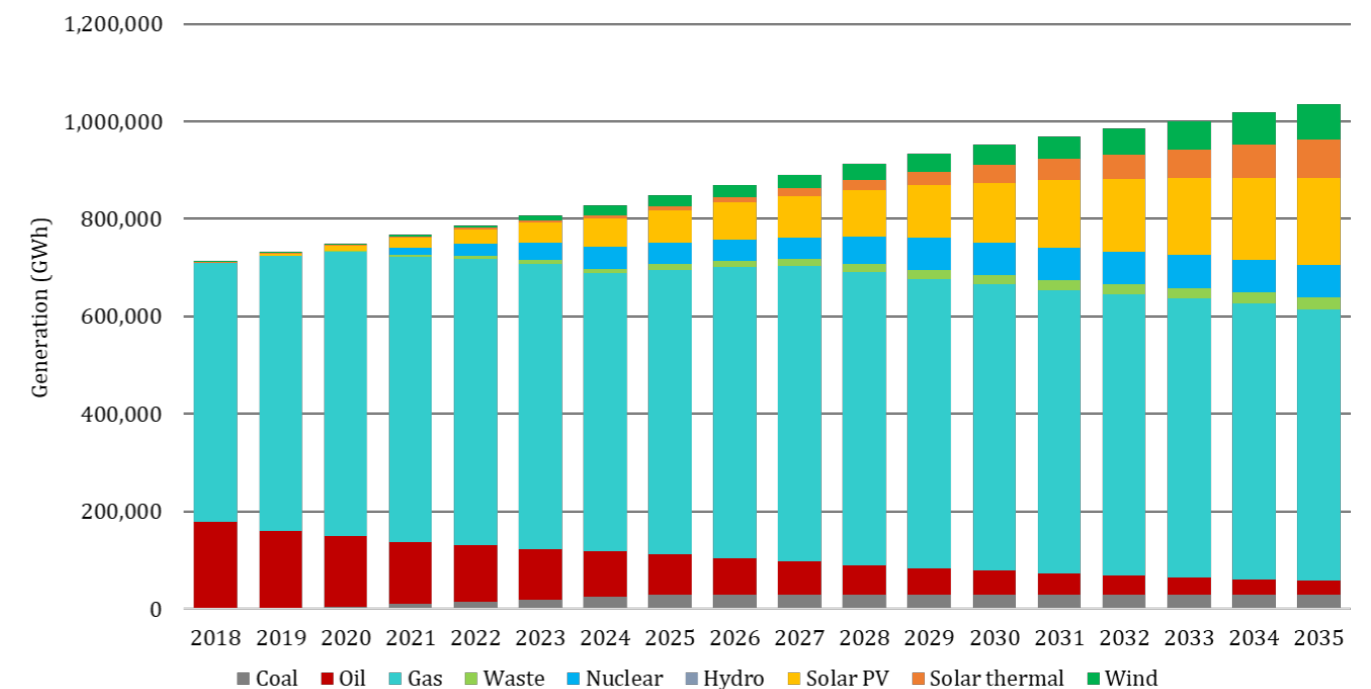
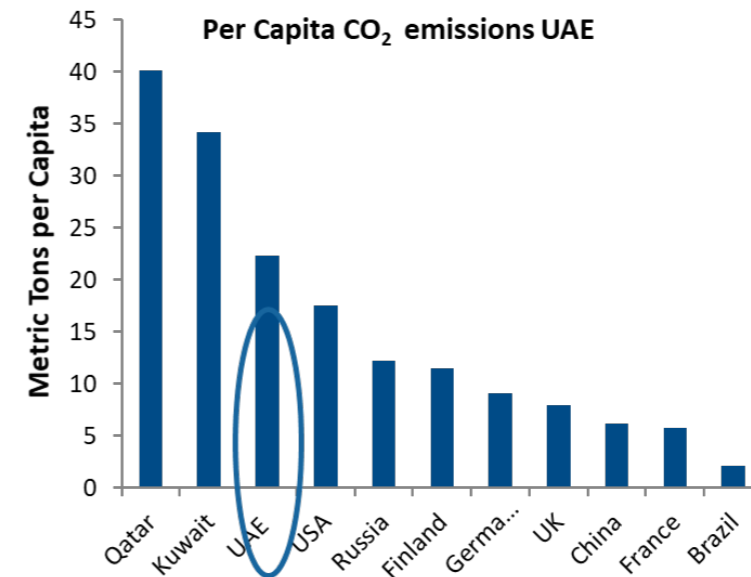
- 3 CCS facilities in operation in the GCC States, capturing 3.7 Mtpa of carbon dioxide, equivalent to 10% global capture capacity.
- Qatar Ras Laffan and UAE Al Reyadah facilities are developing expansion plans.
- Bahrain, Qatar, Saudi Arabia and UAE include CCS in their NDCs* under the Paris Agreement.
- Power generation and blue hydrogen are expected to emerge as new CCS drivers in the region.
- The Global CCS Institute is opening its inaugural GCC office in Abu Dhabi.
- COP 27 in Egypt and COP 28 in UAE



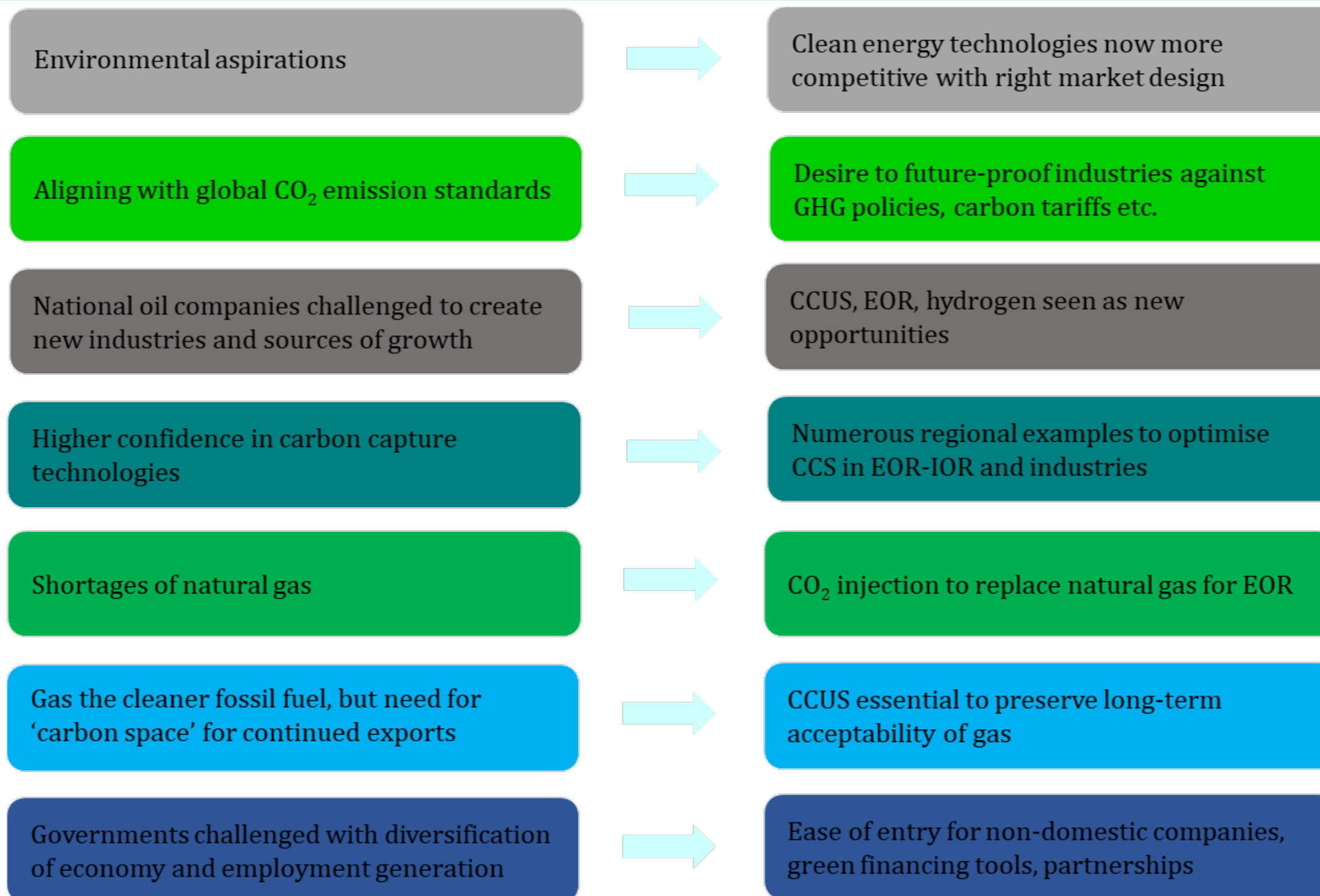
* Nationally Determined Contributions: climate plans of signatory countries to the Paris Agreement.

DRIVERS FOR CCUS IN THE REGION

- High CO₂ emissions per capita.
- Expected increase of emissions due to economic and industrial development
- Countries goals for zero emissions, targets for emissions reductions and NDCs.
- Current and future interest in EOR
- Natural gas availability
- Plans for industrialization
- Blue hydrogen potential
- Potential for circular carbon economy
- In general, high-energy demand for power, desalination, domestic and industrial sectors.
- Fossil fuel remains the main source of energy.



CLEAN ENERGY AND CCUS GAINING TRACTION IN THE REGION



CCUS IN MENA VARIES SIGNIFICANTLY FROM THE WEST

KEY CCUS DRIVERS	GCC + MENA REGION	EU, NORTH AMERICA, AUSTRALIA
Hydrogen production	Immature, but growing interest	Considered unsustainable if produced from fossil fuels
Industrial capture and use	First commercial-scale industrial application; numerous low-cost sources	Growing interest for hard-to-decarbonise sectors
CO ₂ for EOR Potential	Attractive and low cost; increasing use of CO ₂ for EOR-IOR	Attractive in North America but economically challenging elsewhere
Terrain suitability	Flat deserts and shallow offshore, straightforward, few local communities	Onshore faces community opposition; offshore often harsh environments
CO ₂ Storage Potential	Multiple well-characterised giant storage formations, close to emission sites	Varies, may not be near major emission sites, but generally adequate
Tax incentives	None; strong government + NOC control	Tax credits to boost money for CCUS companies
Energy pricing	Heavily subsidised; no free market in gas	Deregulated markets; limited energy subsidies mostly for renewables
Carbon pricing	None	Rising in Europe; introduced in some US states/Canadian provinces
Societal acceptance	Low public opposition to CCUS; public acceptance of oil industry	Medium-high opposition to CCUS; oil industry regarded as unsustainable

Most promising drivers for CCUS in the MENA region

Source: Qamar Energy analysis

KEY AREAS OF CCUS INTEREST

COUNTRY	AREAS OF INTEREST			
	Gas processing CCUS	CCUS for EOR	Gas power CCUS	CCUS for Industry
Bahrain	LOW	MODERATE-HIGH	LOW	MODERATE
Kuwait	MODERATE	MODERATE	LOW	MODERATE
Oman	LOW	HIGH	LOW	MODERATE
Qatar	MODERATE	MODERATE	LOW	MODERATE
Saudi Arabia	HIGH	HIGH	LOW	MODERATE
UAE	HIGH	HIGH	MODERATE	HIGH

Source: Qamar Energy analysis

OPERATIONAL CCUS PROJECT IN UAE

PROJECT	Al Reyadah / Emirates Steel	
STATUS	Operational	
INDUSTRY	Iron and Steel	
TRANSPORT TYPE	Pipeline	
PARTNERS	ADNOC (100%) – bought Masdar’s 49% share in 2018	
LOCATION	Abu Dhabi, Emirates Steel facility	
ONLINE	2016	
CAPTURE CAPACITY	0.8 Mt/year	
DESCRIPTION	Capture, compress, and dehydrate 0.8 Mtpa of CO ₂ from Emirates Steel	Pipe captured CO ₂ to ADNOC Onshore for EOR at Bab and Rumaitha oilfields
CCUS APPROACH	Amine solvent-based absorption	Regeneration system
OFFTAKER	ADNOC Onshore	

OPERATIONAL CCUS PROJECTS IN KSA

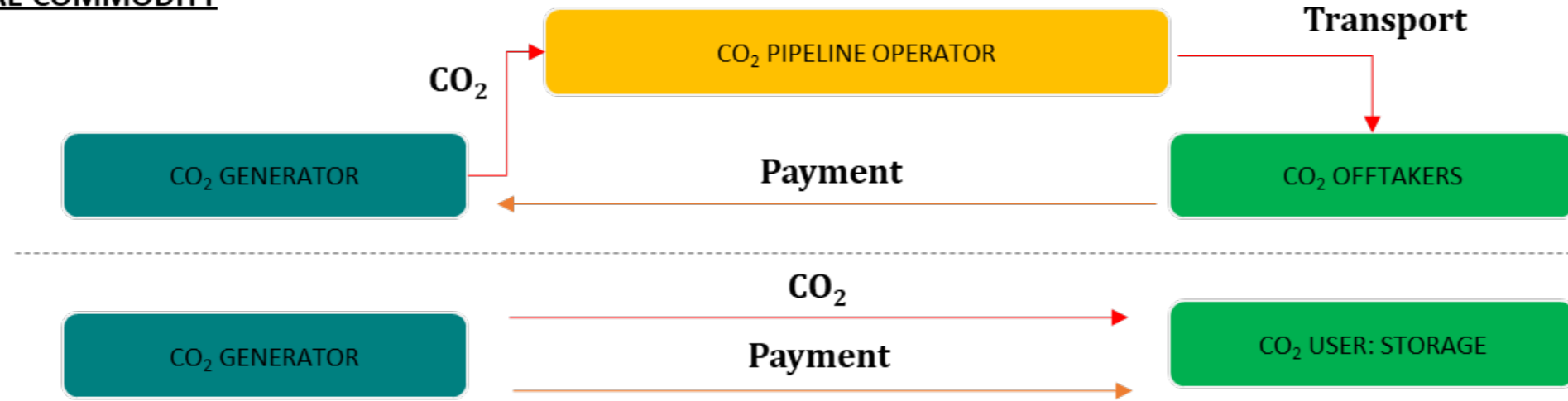
PROJECT	Aramco's Uthmaniyah CO ₂ EOR Project	SABIC Carbon Capture & Utilisation Project
STATUS	Operational	Operational
INDUSTRY	EOR-IOR	Industry
SOURCE	Natural Gas Processing	Oil products refining
TRANSPORT TYPE	Pipeline	Pipeline
LOCATION	Uthmaniyah	Jubail
ONLINE	2015	2015
CAPTURE CAPACITY	0.8 Mt/year	0.5 Mt/year
DESCRIPTION	<ul style="list-style-type: none"> • Capturing CO₂ from Hawiyah NGL plant for injection into the Uthmaniyah in the Ghawar oilfield • Oil recovery between 7-9% and permanently sequester roughly 40% of injected CO₂ 	<ul style="list-style-type: none"> • More than 1,500 t/d of CO₂ will be captured from ethylene glycol facility and transported via pipeline, for production of methanol, urea, oxy-alcohols, and polycarbonates • Food-grade CO₂ is also a product

OPERATIONAL CCUS PROJECT IN QATAR

PROJECT	Qatar Gas
STATUS	Operational
INDUSTRY	Petroleum
SOURCE	Natural gas processing
TRANSPORT TYPE	Pipeline
PARTNERS	Qatar Gas; QP
LOCATION	Dukhan, Qatar
ONLINE	2021
CAPTURE CAPACITY	1.18 Mt/year
DESCRIPTION	<ul style="list-style-type: none">• Capture of CO₂ and H₂S from gas processing; re-injected into Dukhan oilfield
CCUS APPROACH	Acid gas injection

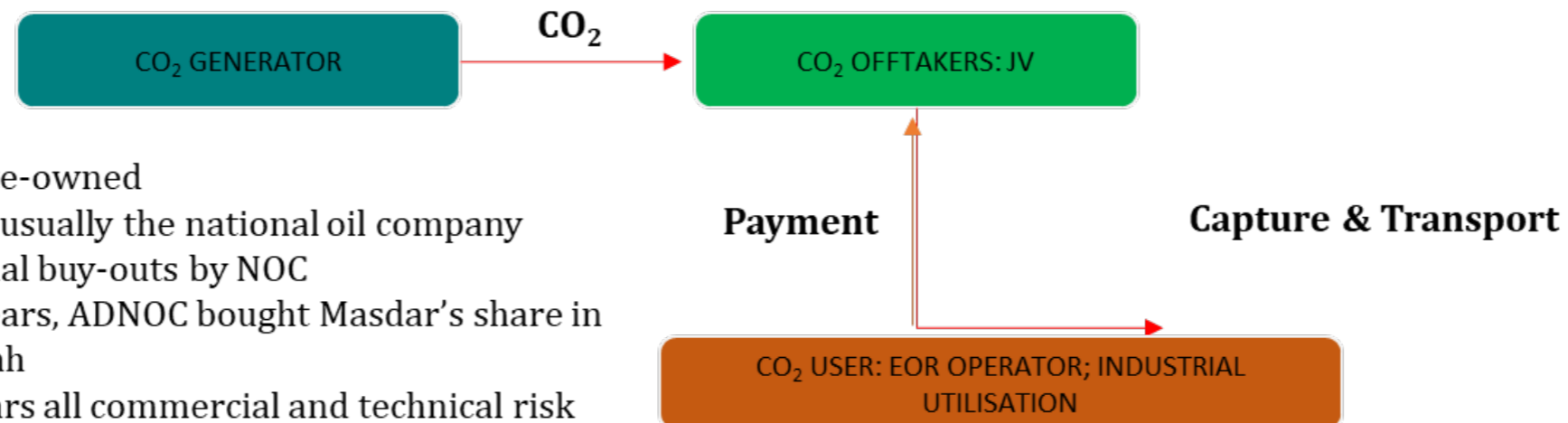
POSSIBLE CCUS COMMERCIAL MODELS IN THE GCC

1. PURE COMMODITY



- The CO₂ generator captures and transports the CO₂ to the off-takers, who could be EOR operators or industries
- There could be a CO₂ pipeline operator would most likely be the NOC
- For purely storage purposes, the CO₂ will likely be handled by the NOC and the CO₂ generator would pay for the service of storage

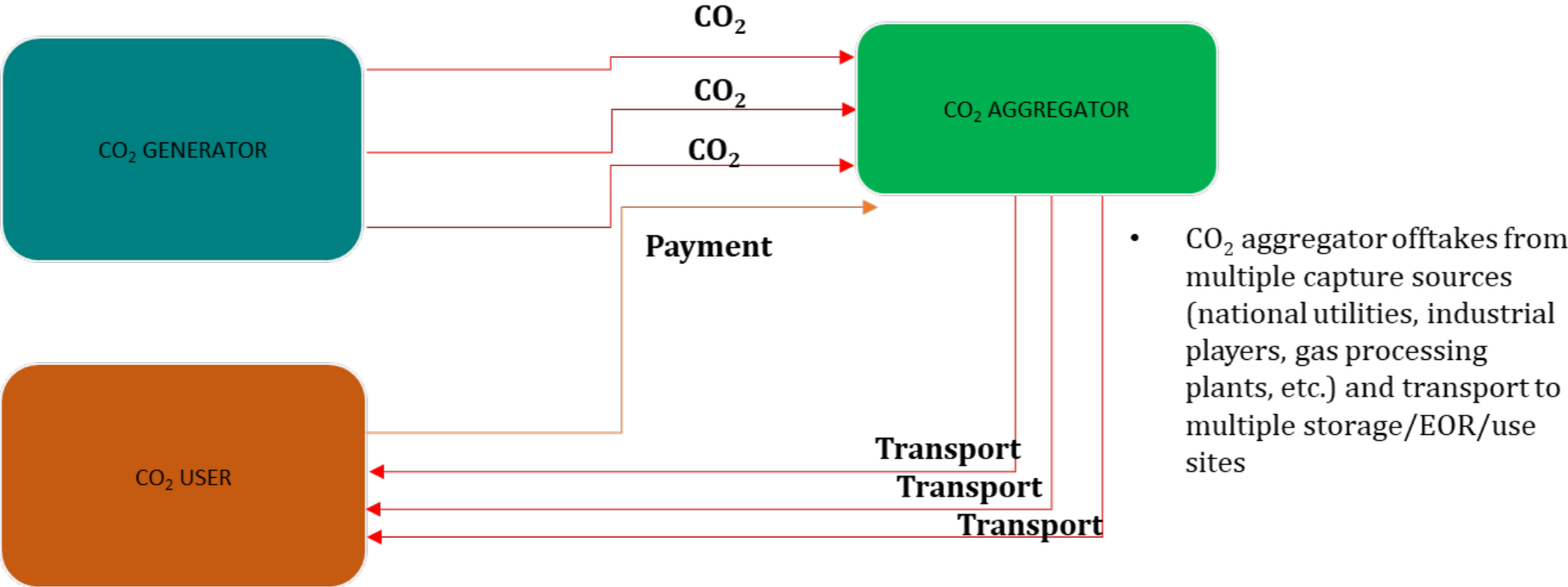
2. JOINT VENTURE



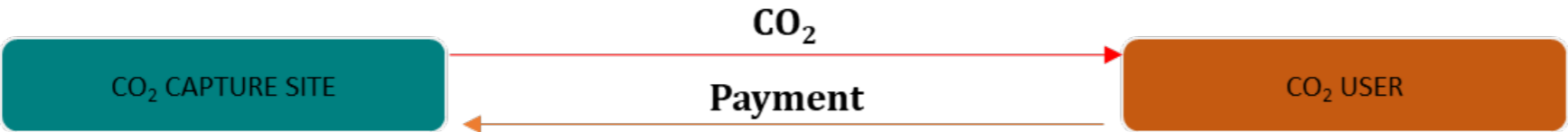
- JV is usually state-owned
- EOR operator is usually the national oil company
- Probable eventual buy-outs by NOC
 - After 2 years, ADNOC bought Masdar's share in Al Reyadah
- Government bears all commercial and technical risk (state-owned)

POSSIBLE CCUS COMMERCIAL MODELS IN THE GCC

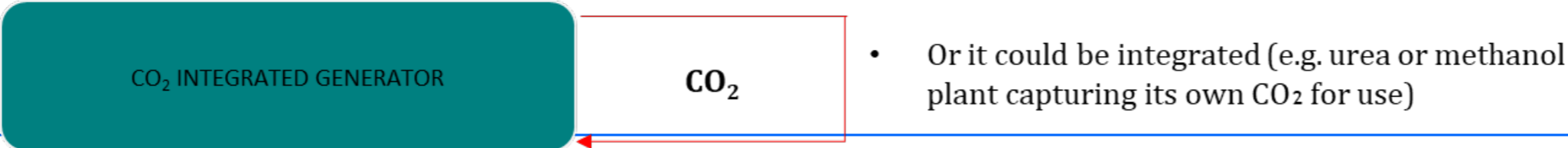
3. INTEGRATED PROJECTS



4. CO₂ TO PETROCHEMICALS



- Could be one capture site selling CO₂ to a user





THANK YOU

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