



International
Association
of Oil & Gas
Producers

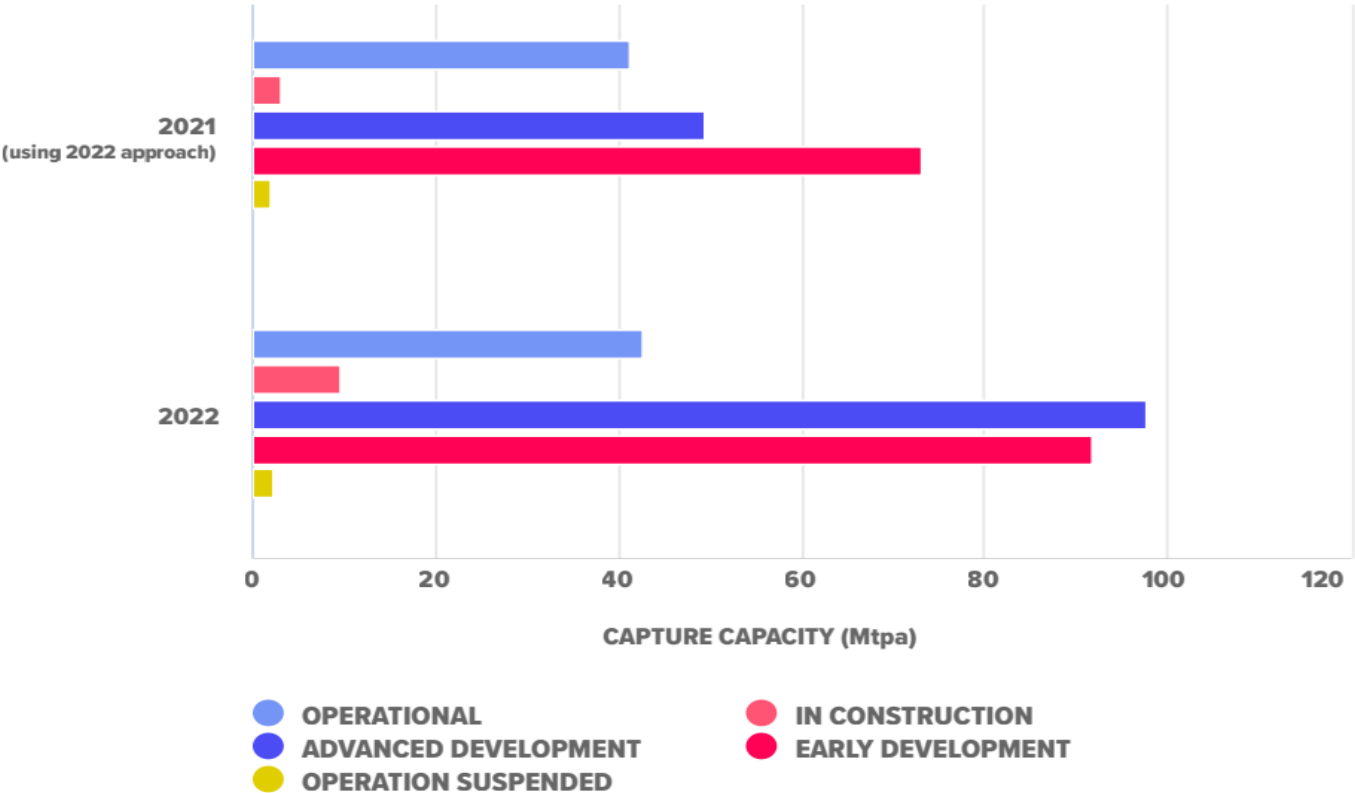
CCS Group of Experts on Gas

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Regional Director Europe, IOGP
24 March 2023

Projects

CCUS in the world

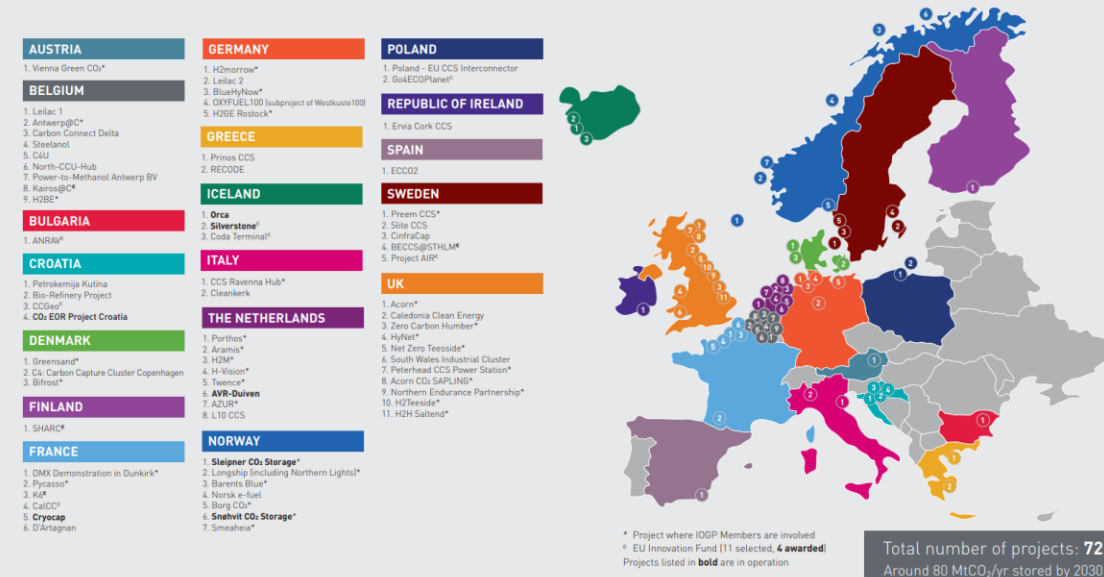
- Most projects are in the United States and Europe
- Others in Australia, China, Korea, the Middle East and New Zealand



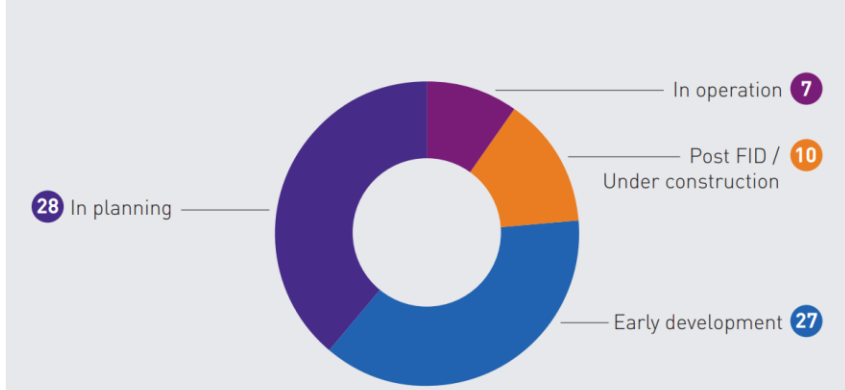
Source: Global CCS Institute

CCUS in Europe (see www.iogpeurope.org)

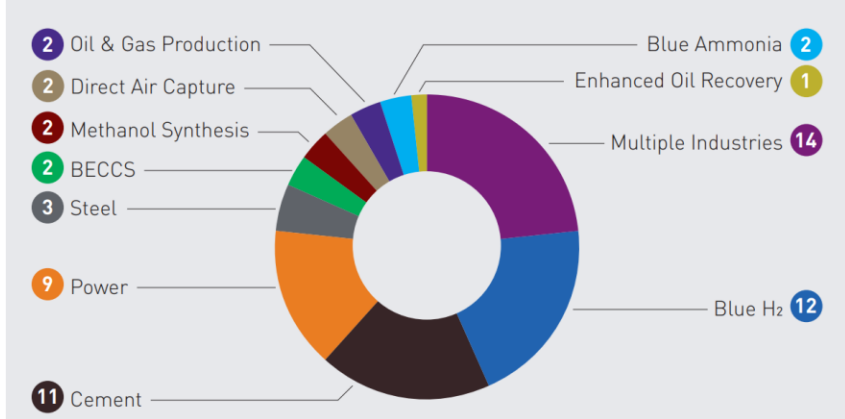
Overview of existing and planned CCUS facilities in Europe



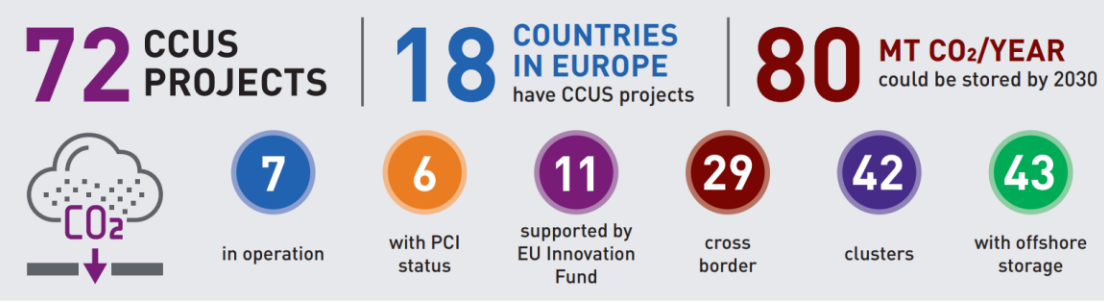
Status of CCUS projects



Type of CO₂ capture projects



Key numbers



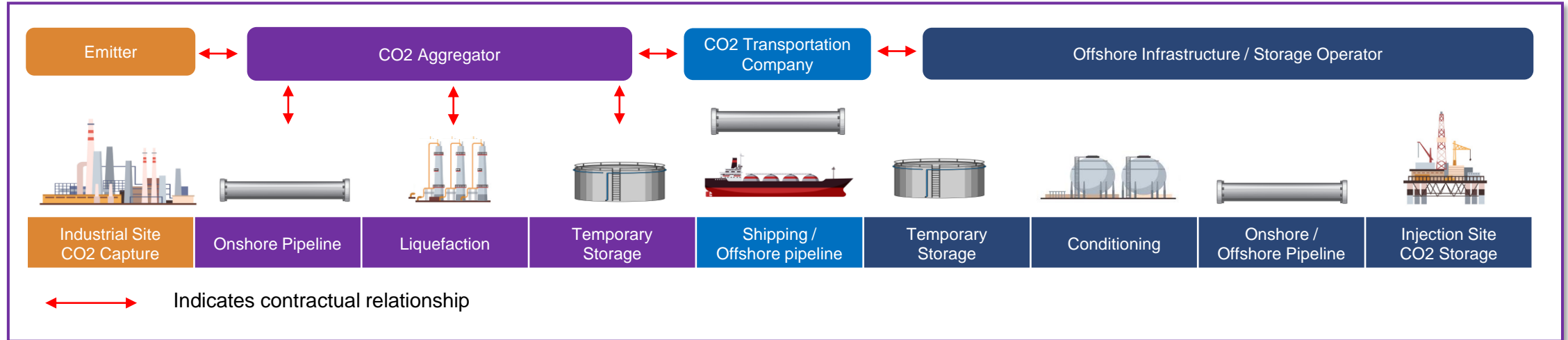
Value chain costs

Data sources

Data Sources			Capture	Transport	Storage
	IEA	1. Levelized cost of CO2 capture by sector and initial CO2 concentration (2019) 2. Shipping and offshore pipeline transportation costs of CO2 by distance (2022)	✓	✓	
	Great Plains Institute	Transport Infrastructure for Carbon Capture and Storage (2020)	✓		
	National Petroleum Council	A Roadmap to At-Scale Deployment of CCUS (2021)	✓		
	Rystad Energy	CCUSCUBE (2022)	✓	✓	✓
	Global CCS Institute	Technology Readiness and costs of CCS (2021)	✓		
	ZEP	1. The costs of CO2 transport: post-demonstration CCS in the EU (2011) 2. The costs of CO2 storage: post-demonstration CCS in the EU (2011)		✓	✓
	International Journal of Greenhouse Gas Control (IJGGC)	1. The Status and Challenges of CO2 Shipping Infrastructures (2020) 2. Towards improved cost evaluation of CCS from industry (2021)		✓	
	Intergovernmental Panel on Climate Change (IPCC)	Special Report on Carbon Dioxide Capture and Storage (2005)		✓	
	Clean Air Task Force (CATF)	CCS in Europe – mapping of costs (2022)			✓

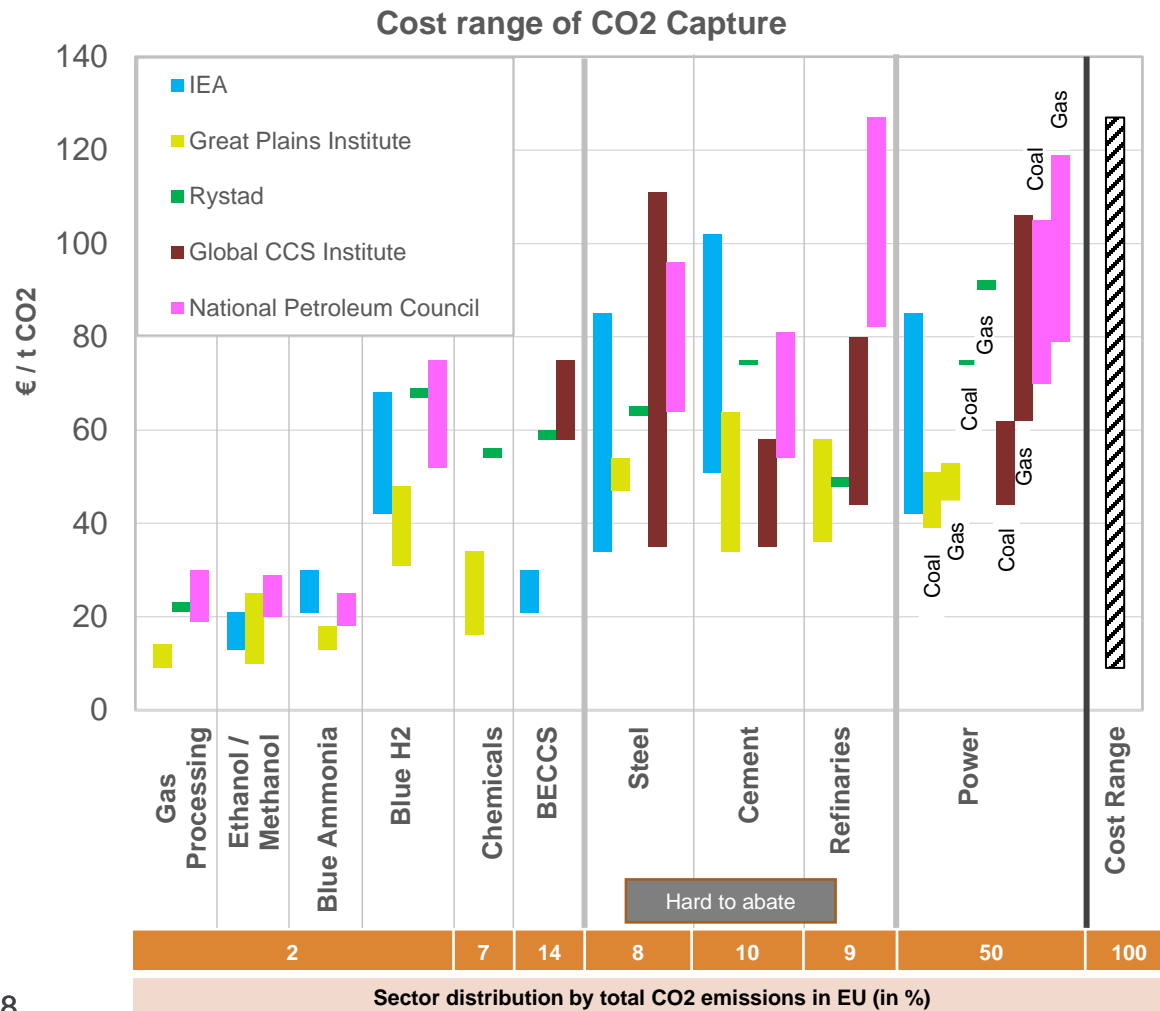
CCS Value Chain

From onshore emitter to offshore storage



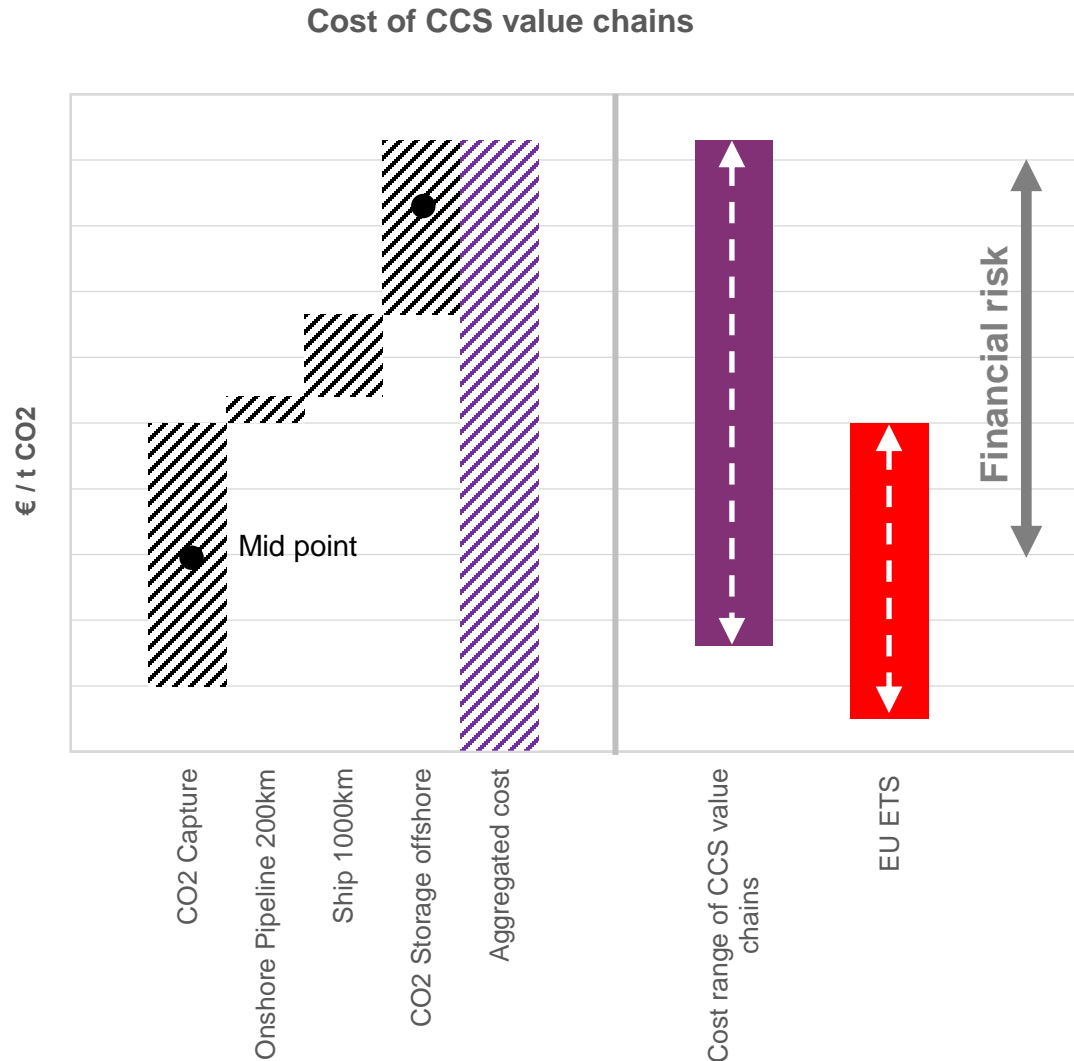
- **CCS Value Chains** involve multiple business activities conducted by different entities linked to a 'chain' through contractual relationships which balance the economic risks & rewards between them
- Each of the businesses along the value chain have individual business risk profiles suggesting different risk & reward related returns on investments

Cost of CO2 Capture based on industry type



- **Capture cost** vary between 10 – 130 €/tCO2 depending on:
 - source of emission
 - capture technology used
 - density / concentration of CO2 in the exhaust gas stream
- **Capture cost** in the hard to abate sectors (**steel, cement and petrochemicals**) are relatively high ranging from **35 – 130 €/tCO2**
- **CO2 storage + transportation cost** vary between **35 – 55 €/tCO2** (offshore)
 - Onshore storage typically lower cost than offshore; offshore fields have wider cost range
 - Depleted Oil & Gas fields but also Saline aquifers

Cost ranges of CCS value chains



- Based on publicly available data and some assumptions, aggregated cost of CCS value chains assessed to range from about 40 to 190 €/tCO₂
- EU ETS allowances varied from about 10 to 100 €/tCO₂ in past decade
- **Significant financial risks for investors into CCS value chain businesses**
- **De-risking / funding mechanisms needed to support CCS projects and secure project revenue streams**

New momentum in Europe

Why hasn't CCS taken off in Europe so far?

1. Lack of political ambition and regulatory drivers

- No vision/ambition/target
- CCS seen as last resort only (focus on EE and RES)
- CO2 transport considered via pipeline only
- Complex application processes and criteria for funding eligibility

2. No incentives for industry to invest

- Low carbon price
- No tax credits
- Low-carbon H2 not considered

3. Single plant approach of projects

- No cost-shared = risk-concentration

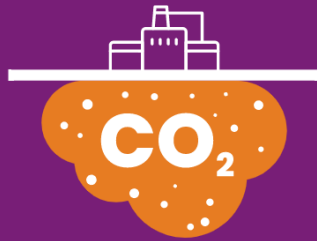
Project Greensand, DK

- Led by IOGP member Wintershall Dea and Ineos, Greensand is a consortium including business, academia, government and start-ups
- World's first cross-border storage site, located off the Danish coast, expected to store up to 8 MTCO₂ p/a by 2030
- Inaugurated March 8th with prominent State and Commission President endorsement and support. Ursula von der Leyen:
 - *“The science is clear. Carbon removal is a necessary part of our climate toolbox”*
 - *“300 MTCO₂/y EU storage capacity objective by 2050”*



A European ambition for CCS

- President Ursula von der Leyen called for a 300 Mtpa/CO₂ EU storage capacity objective by 2050
- This is a great start: we believe it can be higher



Ambition level of **0.5 to 1.0**
GtCO₂ storage availability per
year by 2050



Scope covering
EU, EEA and the UK



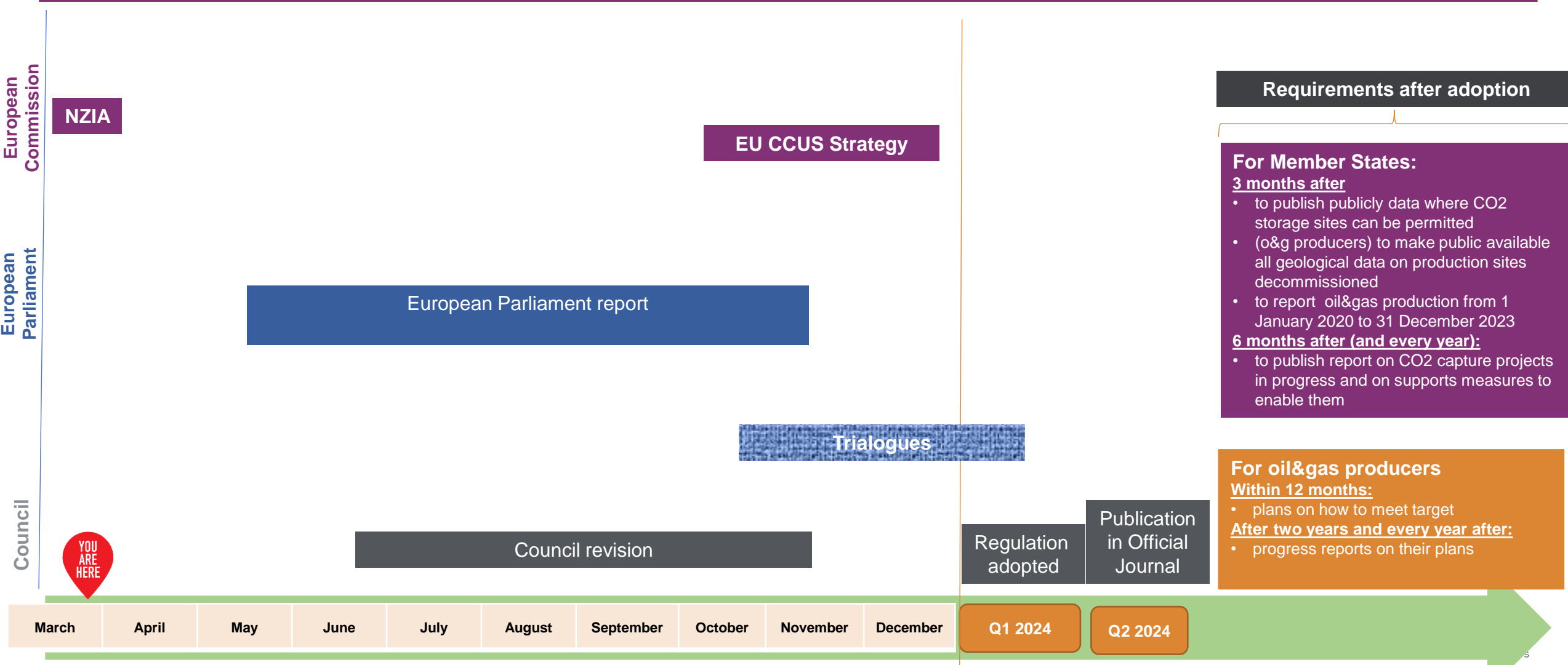
Requires a
comprehensive EU policy
framework

Net-Zero Industry Act – a potential step change

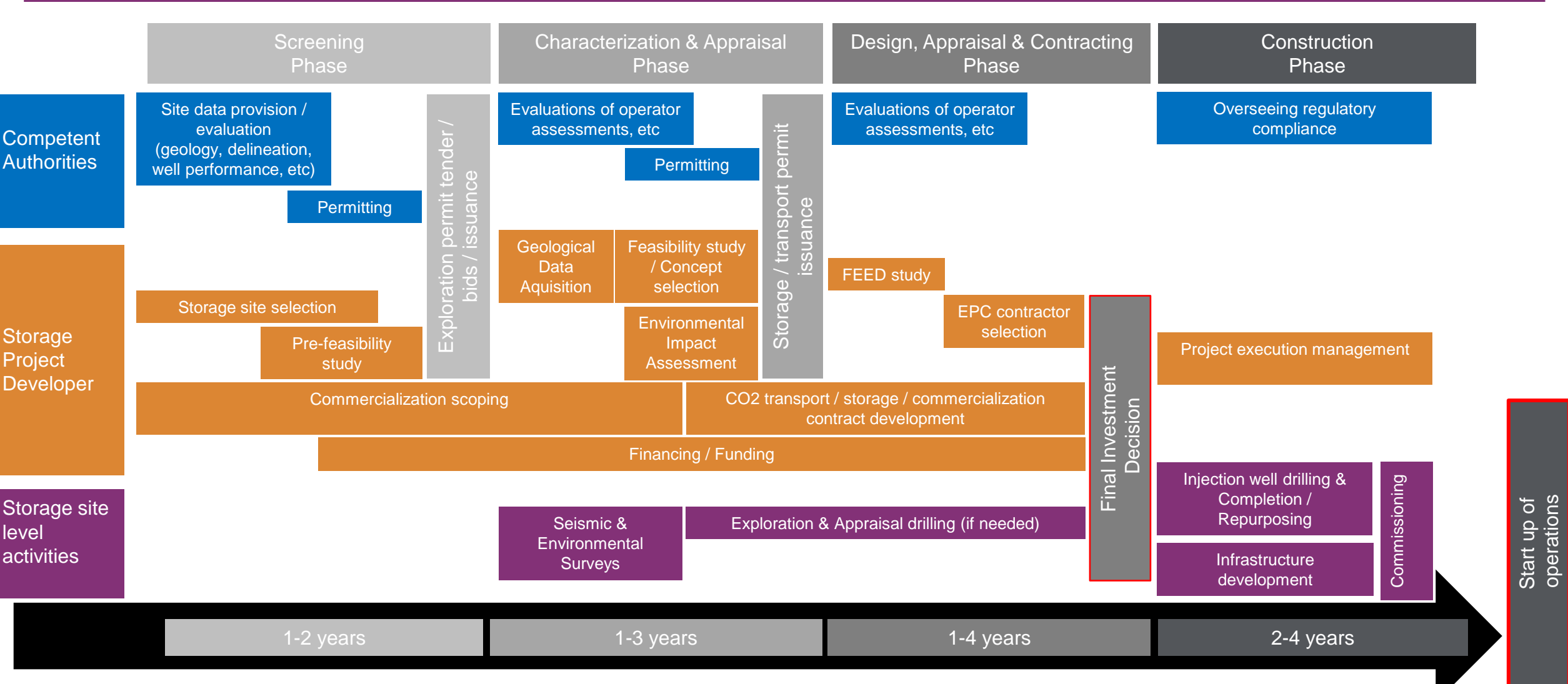
- Adopted 16 March 2023
- CCS recognized as a net-zero tech for sustainable competitiveness
- 50 Mtpa CO2 storage capacity by 2030
- O&G companies to contribute pro rata to this total (based on % of each entity's EU O&G production)
- CO2 storage sites recognised as net zero strategic projects
- Potentially paves way for scale-up of carbon capture and storage
- CCUS Forum and upcoming 2023 Strategic Vision will be instrumental



NZIA & CCUS strategy Legislative Timeline

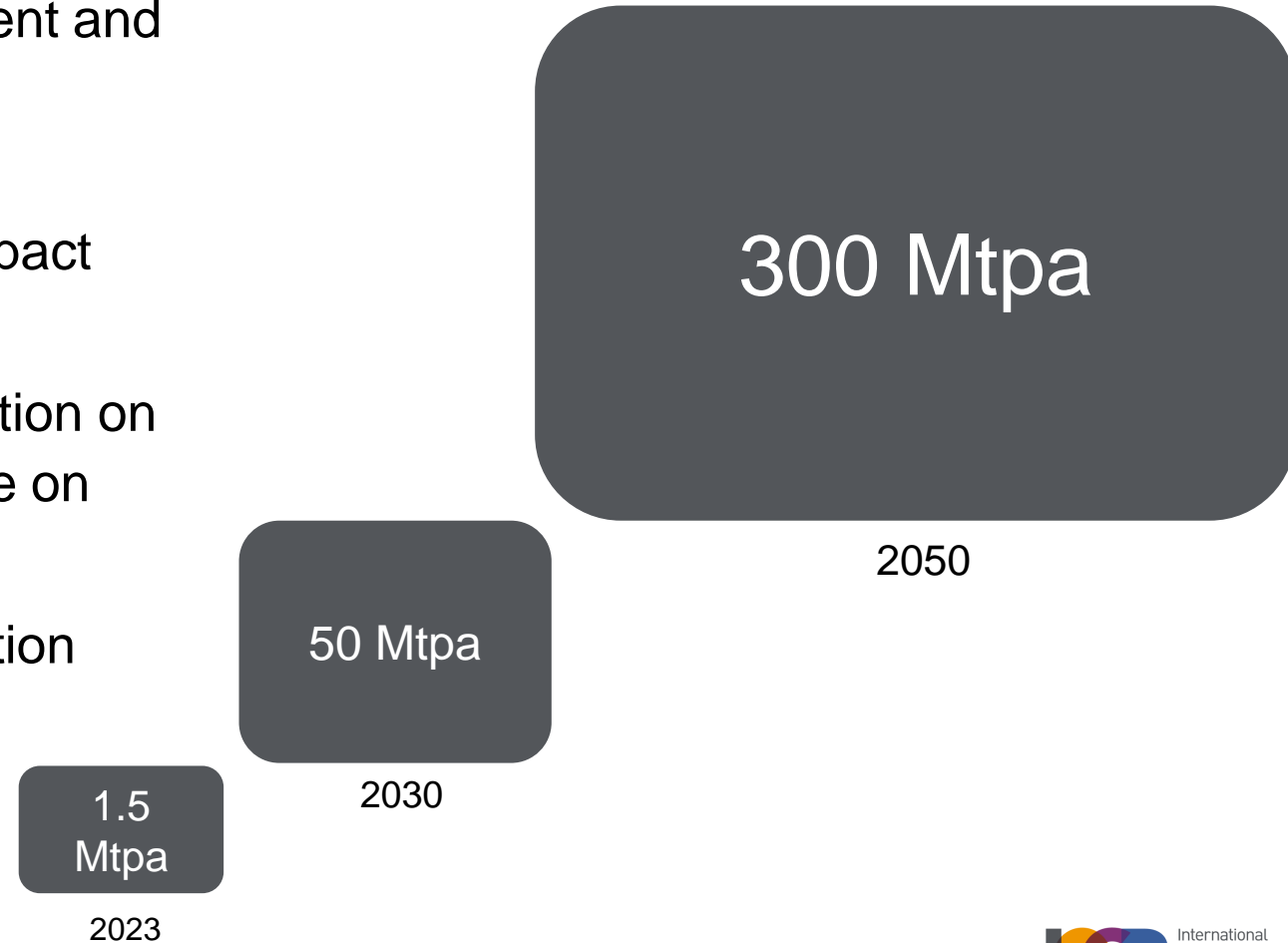


Timeline of CO2 Storage projects development



Open challenges

- Reaching the ambition will be difficult – the current and proposed framework doesn't match it
- The acceleration of CCS permitting is a positive however hurdles remain (e.g. Environmental Impact Assessment Directive could delay projects).
- Mandate/obligation: why only propose an obligation on O&G producers for storage capacity? A mandate on storage alone will not incentivize scale up...
- EU's depleted fields are not the only storage option



IOGP Europe recommendations

1. **Create a business case** which matches the ambition
2. **Incentivize emitters** so that a **value chain can emerge**
idle storage capacity will not help
3. Establish **de-risking instruments and financial support**
need to incentivize investments
4. **Recognize the role of low carbon hydrogen** in all relevant EU legislation
this will strengthen the business case for CCS
5. **Open licensing rounds for saline aquifers for CO2 storage**
6. **Complementary policies at Member State level** will also be needed



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