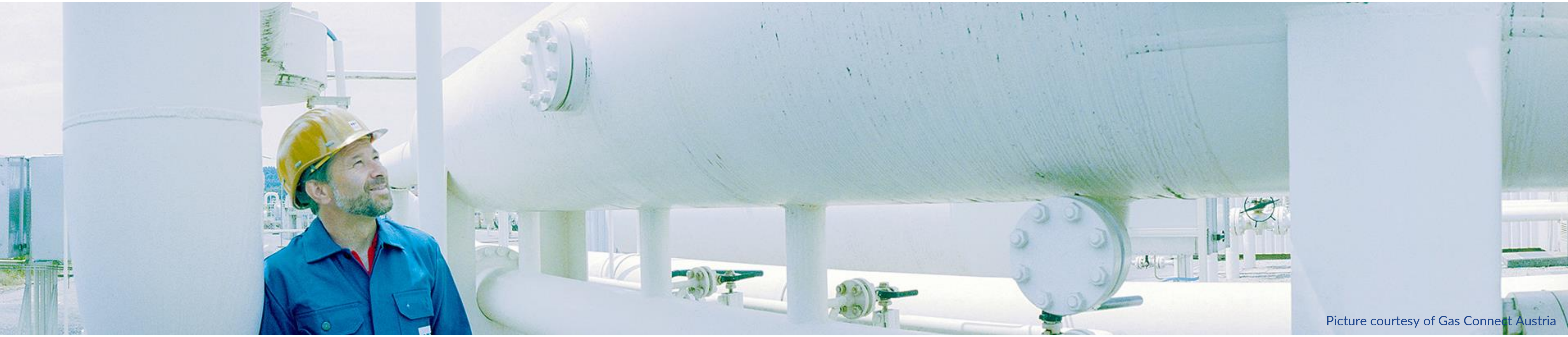
05 May 2023


Picture courtesy of Gas Connect Austria

11th meeting of Advisory Panel for Future Gas Grids

Meeting on 16 October 2023

ENTSOG

Introduction

Welcome

entsog

Hydrogen Europe

eurogas

CEER Council of European Energy Regulators

International Association of Oil & Gas Producers

ifiec europe international federation of industrial energy consumers

GEODE

Gas Distributors GD4S For Sustainability

cefic

fertilizers europe

ehi association of the European Heating Industry

Gas Infrastructure Europe

C.E.F.A.C.D

GAS FOR CLIMATE A path to 2050

EFET European Federation of Energy Traders SO YOU CAN RELY ON THE MARKET

European Engine Power Plants Association EUGINE

CEDEC

EUROFER The European Steel Association

EASEE-gas Streamlining the gas business

EUTurbines

H2GAR

EBA European Biogas Association

entsoe

marcogaz

GERG THE EUROPEAN GAS RESEARCH GROUP

FSR Florence School of Regulation

Copenhagen School of Energy Infrastructure (CSEI)

GASSCO

European Commission

ACER Agency for the Cooperation of Energy Regulators

Agenda

	Description	Time
1.	**Introduction and welcome by Piotr Kuś**	14:00-14:05
2.	**Current status of CCUS works by Chris Bolesta, DG ENER**	14:05-14:20
3.	**Report of CCUS WG by Caterina De Matteis, IOGP**	14:20-14:30
4.	**Discussion: CCUS market models for transport and storage**	14:30-15:55
5.	**Closure of meeting**	16:00

Chris Bolesta – European Commission

European Commission – Work On CCUS

Chris Bolesta

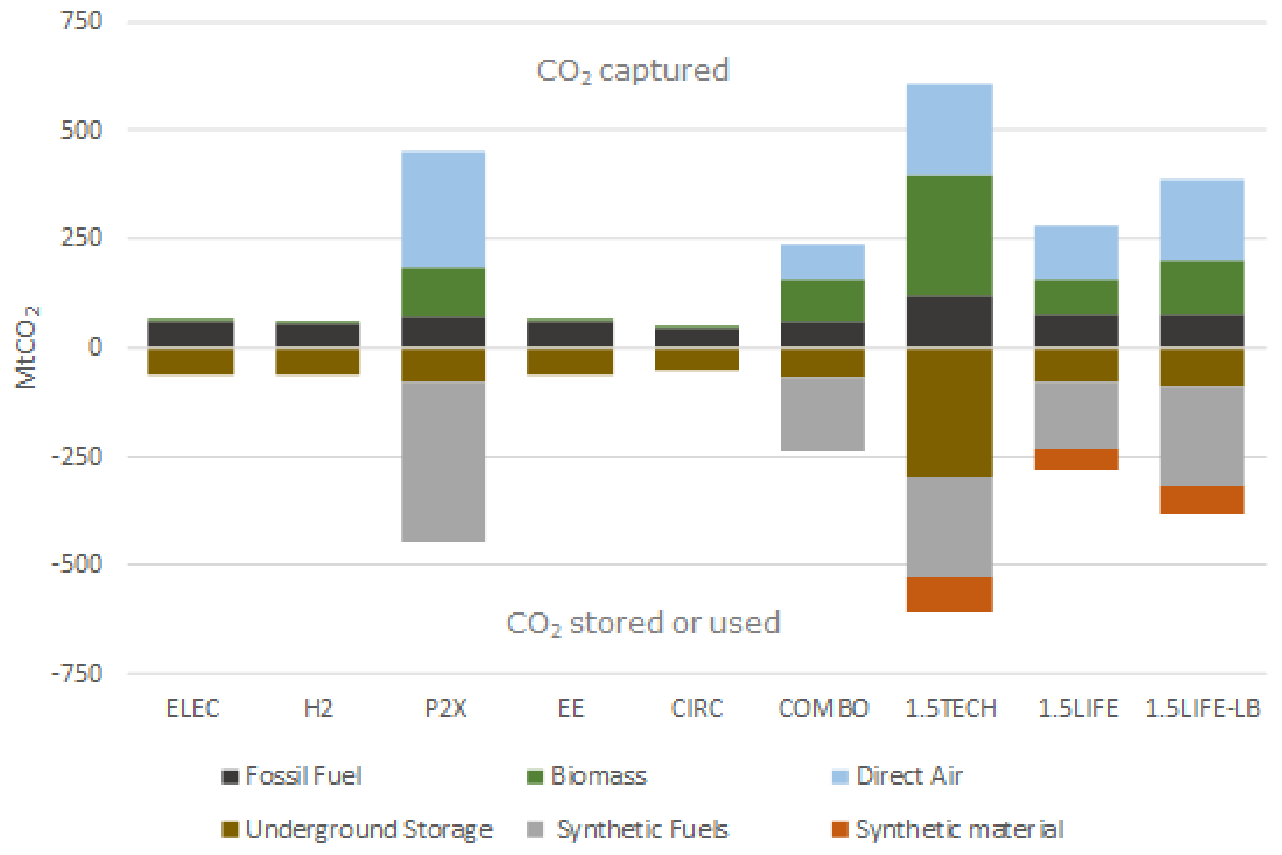
CCUS Team Leader

DG ENER, European Commission

Towards the Industrial Carbon Management Strategy for the EU

Chris Bolesta, CCUS Team Leader
Directorate-General for Energy
European Commission

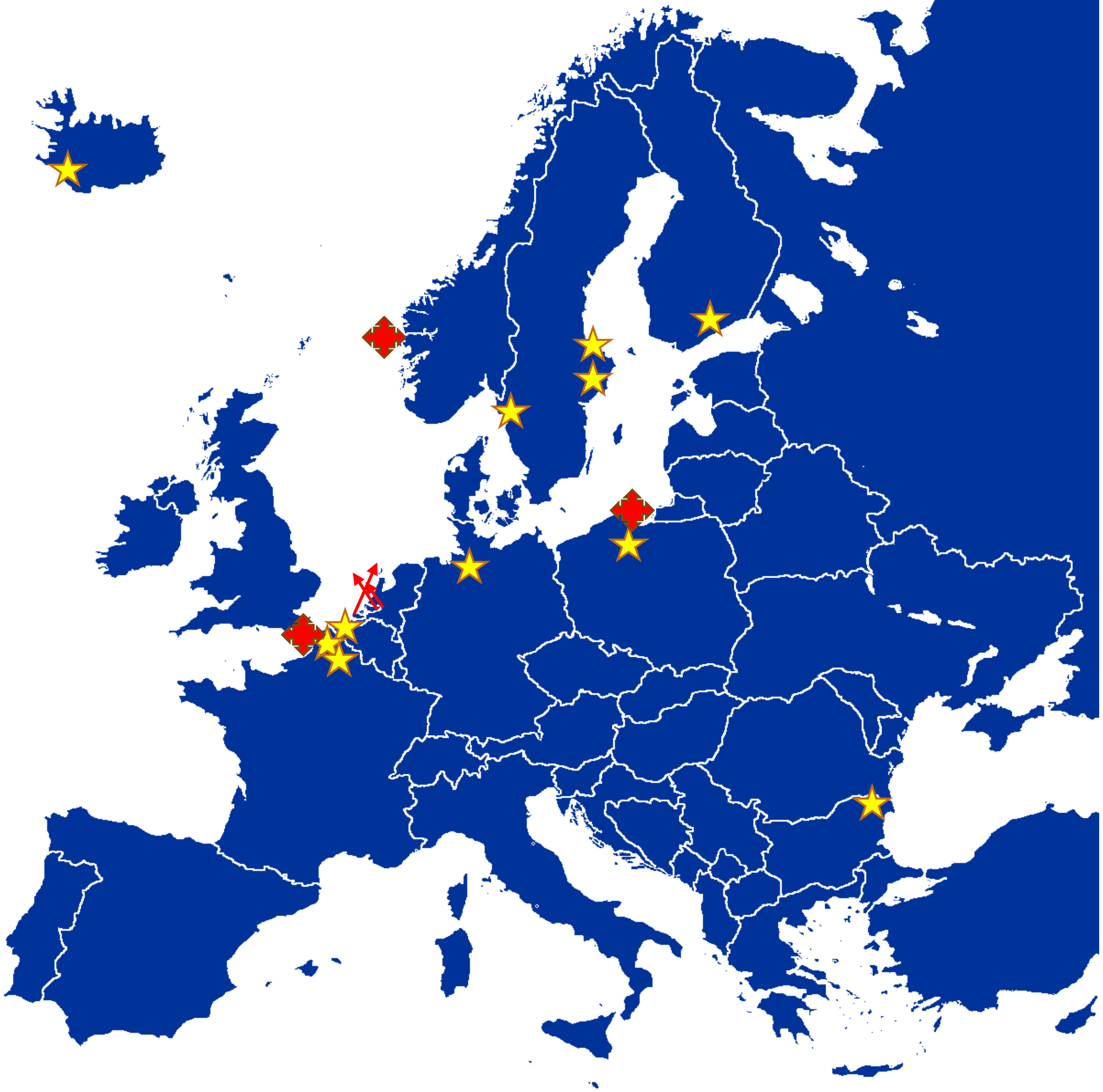
Green Deal modelling reality



- Hard-to-abate sectors
- Carbon removals
- Bridge to H2 market
- Power sector
- Fuels and other products

- … with 0 CO_2 captured in 2030

Source: Scenario Analysis Results for CCUS, Vision for a Clean Planet by 2050



EU sponsored projects

11 Innovation Fund projects

6 TEN-E projects

+12 further candidate capture projects under IF

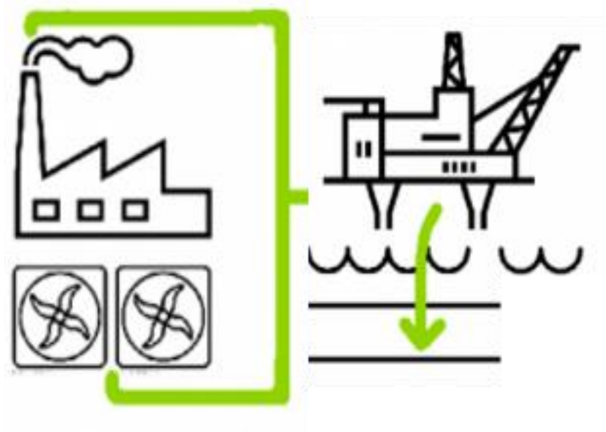
18 candidate transport projects to replace 6 TEN-E projects

Total storage needed ca. 12 Mt CO_2 p/a

European Commission

CO_2 storage obligation proposal

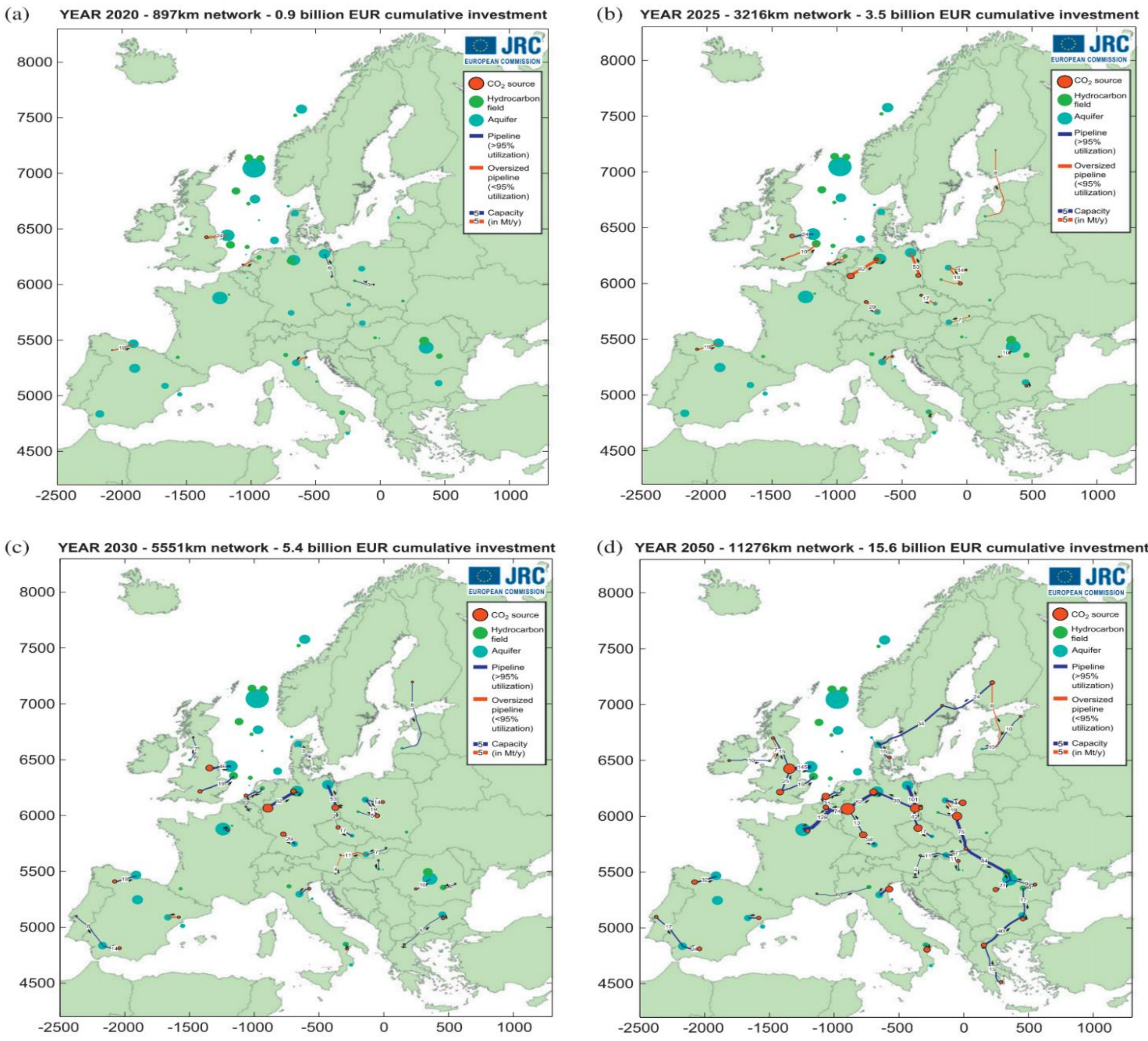
- Net Zero Industry Act proposal with a CCS chapter
- EU-wide objective to achieve an annual CO_2 storage capacity of **50 million tonnes by 2030** (EOR/EGR excluded)
- Oil and gas producers to provide an individual contribution for reaching the target
- When NZIA becomes EEA relevant – target will be revised



Stakeholder dialogue

- CCUS Forum Working Groups – 5 issue papers
- Open Public Consultation

Cross-border CO_2 transport set-up



- Connecting sources and sinks
- Future regulatory environment

Strategy pillars

CCS

CCU

Industrial Carbon Removals

Possible elements of the Strategy

- Network regulation and planning needs
- Common CO_2 stream standards
- Market set-up
- What comes after 50 mt storage target proposed for 2030
- How to speed up storage development

Milestones

- Public consultation wrap up on 6 October
- CCUS Forum plenary – 27-28 November
- NZIA – 1Q 2024
- Strategy published – 1Q 2024

Thank you!

Caterina De Matteis - Presentation of WG CO2 infrastructure report, CCUS Forum

Presentation – Report of CO2 Infrastructure WG

Caterina De Matteis

Senior Policy Manager

IOGP

CCUS Forum WG CO2 infrastructure – Final report

Towards a European cross-border CO_2 transport and storage infrastructure: Recommendations ahead of the EU Industrial Carbon Management Strategy

Report of the CCUS Forum Working Group on CO_2 Infrastructure

September 2023

Chairs: Bellona Europa, IOGP Europe, Zero Emissions Platform

Contact: wg.co2infrastructure@gmail.com

CCUS Forum WG CO2 infrastructure – Background

- Objective: Clear recommendations to the EC on how to sustainably develop and deploy European CO_2 transport and storage infrastructure to reach climate neutrality by 2050 – urging the EC to respond with concrete actions
- Basis: Europe-wide perspective – Technical, regulatory and economic dimensions – considering all CO_2 flows in the planning and development of the infrastructure
- Discussions and input from WG members, existing reports and studies: 4 meetings, the Forum In Oslo and issue paper 2022 – 3 thematic workshops and a final meeting in June 2023
- Coordination with WG Vision, JRC and EnTEC studies and the DNV CO_2 Storage Directive's Guidance Documents review
- Expert group on CO2 specifications
- Final paper published September 2023

CCUS Forum WG CO2 infrastructure - Final report

Key findings:

- Non-discriminatory, open-access, cross-border Europe-wide CO2 T&S infrastructure
- CO2 Storage Directive a good basis – not to be opened for review
- Need for EU regulatory framework for CO2 transport infrastructure
- Interoperability is crucial – first instalment of standards/network codes for CO2 transport
- Access to crucial (non-confidential) information for CO2 storage appraisal
- Capacity building within competent authorities
- Efficient permitting processes and ensuring sufficient number of permitting rounds
- Need for clarity regarding conversion of hydrocarbon fields to CO2 storage
- Need for further clarify regarding the London protocol within the EU/EEA area
- Proper allocation of liabilities and contracts (de-risking/balancing risks) between entities along the CCUS value chain

CCUS Forum WG CO2 infrastructure – Next Steps

- Third edition of EU CCUS Forum in Aalborg 27-28 November
- Industrial Carbon Management Strategy Q1 2024

Discussion: CCUS Market Models for CO2 Transport and Storage

Discussion

Chris Bolesta
CCUS Policy Lead
DG ENER

Christopher Jones
Professor
Florence School of Regulation

Axel Scheuer
Head of Energy & Climate Policy
IOGP

Pieter Tavenier
Head of CCUS
Gasunie

Per Sandberg
Senior Adviser
Equinor Low Carbon Solutions

Claude Mangin
Director Market
ENTSOG

Moderator

Piotr Kuś
General Director
ENTSOG

Axel Scheuer, IOGP

International Association of Oil & Gas Producers

CCUS market models for CO2 transport and storage

16 October 2023

Overview of existing and planned CO_2 storage projects in Europe

BULGARIA
1. ANRAV [IF]

CROATIA
1. Petrokemija Kutina*
2. Bio-Refinery Project*
3. CCGeo [IF]
4. **CO_2 EOR Project Croatia***

DENMARK
1. **Greensand***
2. Bifrost*
3. Stenlille demo CO_2-storage
4. Norne
5. Ruby

FRANCE
1. Pycasso*

GREECE
1. Prinos CCS

HUNGARY
1. MOL-Hungary CCS Project*

ICELAND
1. **Orca**
2. **Silverstone** [IF]
3. Coda Terminal [IF]
4. Mammoth

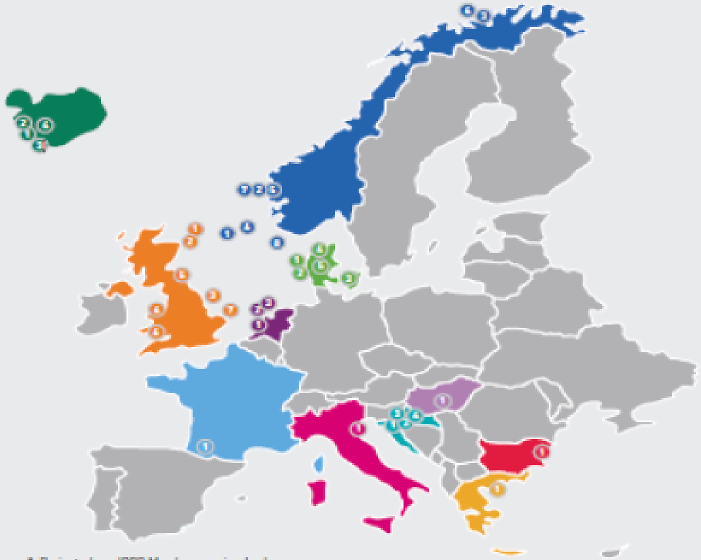
ITALY
1. Ravenna CCS*

THE NETHERLANDS
1. Porthos* [PCI]
2. Aramis* [PCI]
3. L10 CCS*

NORWAY
1. **Sleipner***
2. Longship (includes Northern Lights)* [PCI]
3. Barents Blue
4. **Snøhvit***
5. Smeaheia*
6. Trudvang*
7. Luna*
8. Havstjerne*

UK
1. Acorn*
2. Caledonia Clean Energy
3. Zero Carbon Humber*
4. HyNet*
5. [illegible]
6. South Wales Industrial Cluster
7. Bacton Thames Net Zero initiative*

Many CO2 storage projects in NOR, UK



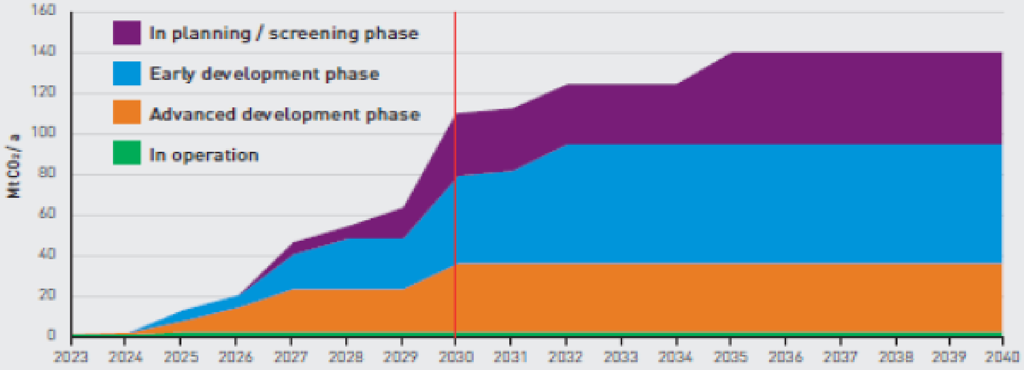
* Project where IOGP Members are involved
Projects listed in **bold** are in operation
[PCI] – Project of Common Interest
[IF] – Project supported by the EU Innovation Fund

EU	**17 projects** - 35 $MtCO_2$/yr by 2030
Europe	**36 projects** - 110 $MtCO_2$/yr by 2030

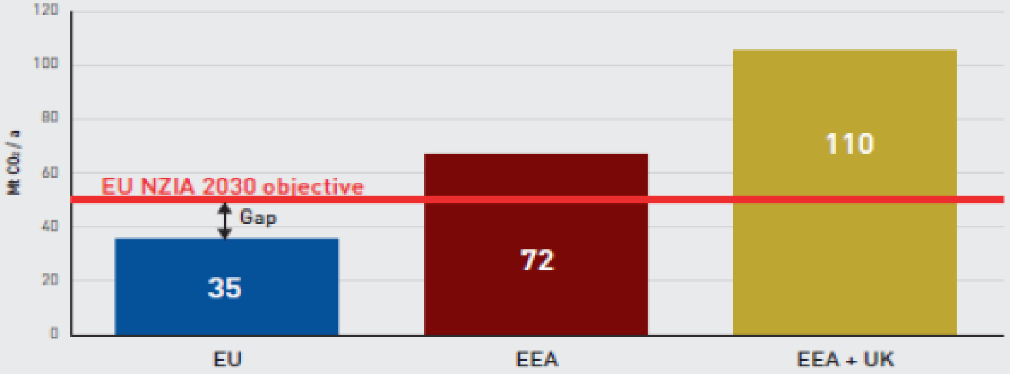
Key numbers

EU	17 CO_2 STORAGE PROJECTS	8 COUNTRIES WITH CO_2 STORAGE PROJECTS	35 MT CO_2/YEAR CO_2 storage injection capacity by 2030
Europe	36 CO_2 STORAGE PROJECTS	11 COUNTRIES WITH CO_2 STORAGE PROJECTS	110 MT CO_2/YEAR CO_2 storage injection capacity by 2030

Build-up of CO_2 storage injection capacity in Europe

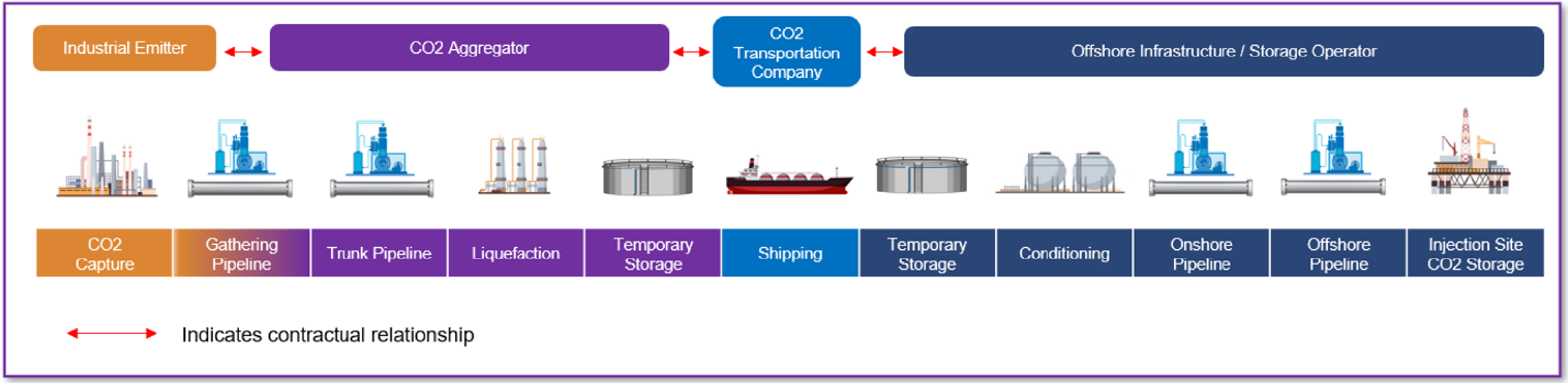


Regional breakdown of CO_2 storage injection capacity by 2030



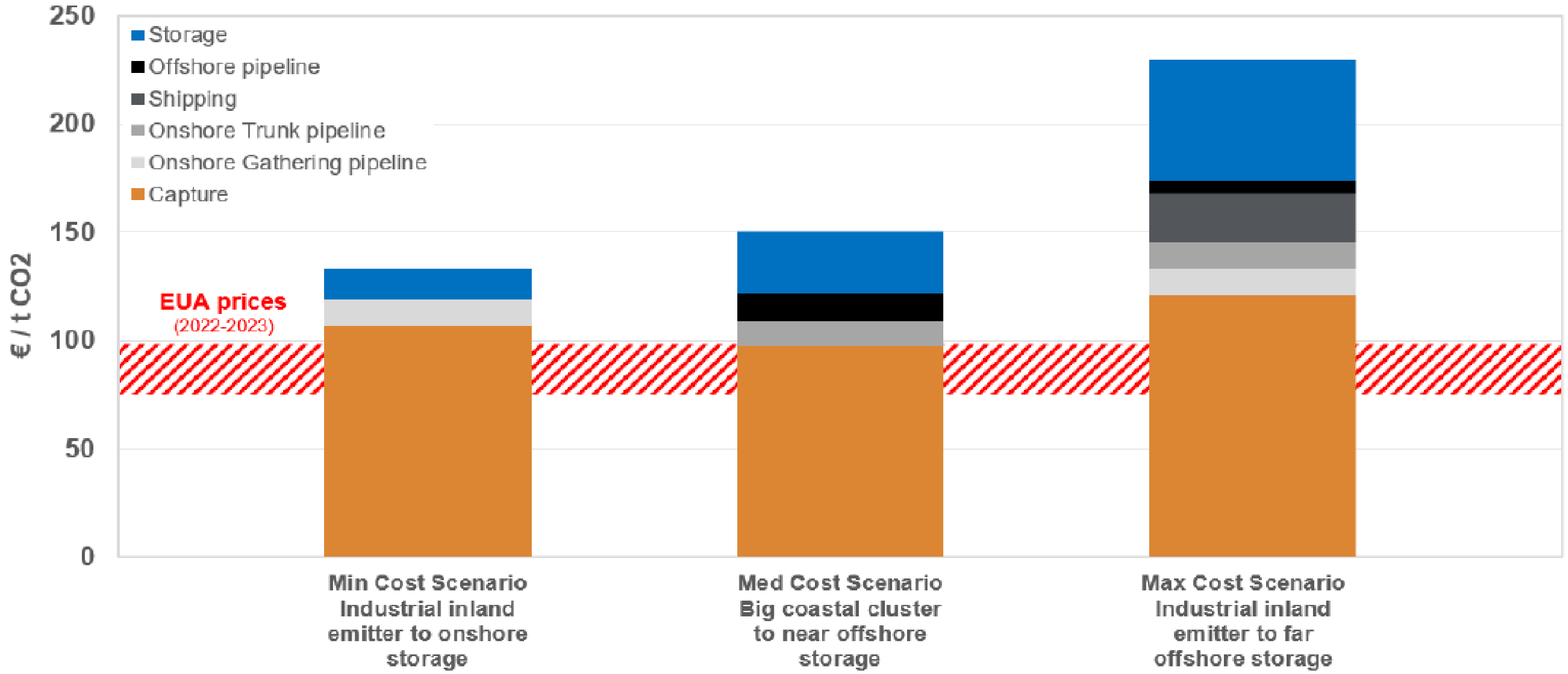
International Association of Oil & Gas Producers

Complex and long CCS value chains with multiple entities



- CCS value chains are long, complex, and involve investments and operations by multiple business entities
- Long-term back-to-back capacity bookings and store-or-pay contracts are typically needed underpinning investment decisions along the value chain

Levelized cost of CCS value chains range from 130 to 230 €/t$_{CO2}$
3 scenarios based on Rystad Energy data



- ➢ **Current ETS allowances prices are insufficient for emitters to underpin CCS value chains**
- ➢ While ETS prices may increase and CCS cost may reduce, **there is a need for funding and de-risking mechanisms supporting CCS investments** at least in the industry's build-up phase (as for RES in past)

International Association of Oil & Gas Producers

Each segment of CCS value chain needs targeted support

Key de-risking & funding mechanisms along the CCS value chain

- CCfDs
- Targeted funding
- Long term CO_2 offtake contracts

Emitter with capture

- Government backed guarantees
- CO_2 aggregators with public banking
- Long term back-to-back capacity bookings
- Regulated tariffs

Transportation infrastructure operators

- Targeted funding
- Long term store-or-pay contracts

Storage & offshore infrastructure operators

Recommendations on CO_2 transportation infrastructure

Onshore

- **Lessons can be learned** from the inclusion of Hydrogen in the Decarbonized Gas Market Package
- Revenue stream uncertainties for investors into onshore pipeline infrastructure can be reduced by **fit-for-purpose tariff regulation** to facilitate investments
- **While 'natural monopolies' justify regulator regimes, regulation should provide for exemptions to allow flexible solutions** where investors can build infrastructure without a regulated regime
- **Transportation modes such as barges/ships or via rail** should not be regulated but operate under market-based commercial arrangements
- **State ownership, state financing / grants, or state backed loan guarantees** can support investments into transportation infrastructure

Offshore

- Generally, **CO_2 storage projects should compete** against each other stimulating economic and tailored solutions
- Offshore pipelines are generally an **integral part of CO_2 storage projects**
- **TPA to offshore infrastructure should be based on 'light-touch' non-discriminatory and transparent access conditions** as provided for by Article 19 of the CCS Directive and for Upstream Pipeline Networks in the Gas Package
- **Tariffs should be based on negotiated terms** and not on regulated regimes

International Association of Oil & Gas Producers

For more information please contact:

Axel Scheuer

Head of Energy & Climate Policy, IOGP Europe

asc@iogp.org

www.iogp.org

Registered Office
City Tower
Level 14
40 Basinghall Street
London EC2V 5DE
United Kingdom
T +44 (0)20 3763 9700

Brussels Office
Avenue de Tervuren 188A
B-1150 Brussels
Belgium
T +32 (0)2 790 7762

Houston Office
19219 Katy Freeway
Suite 175
Houston, TX 77094
United States
T +1 (713) 261 0411

reception@iogp.org

Christopher Jones, Florence School of Regulation

Capture facities	Monopoly, and (r)TPA in principle essential (temporal element)	Basically monopoly, and (r)TPA in principle required (exemptions)	Depends on situation and competitive alternatives (n)TPA plus exemptions?	Essentially competitive; NRA may require TPA on grant of license if market requires?	Always competitive, TPA and unbundling never required
CO2 capture and Associated temporary storage					
Local networks					
Onshore pipelines					
Offshore pipelines					
Onshore storage					
Offshore storage					

Per Sandberg, Equinor Low-Carbon Solutions

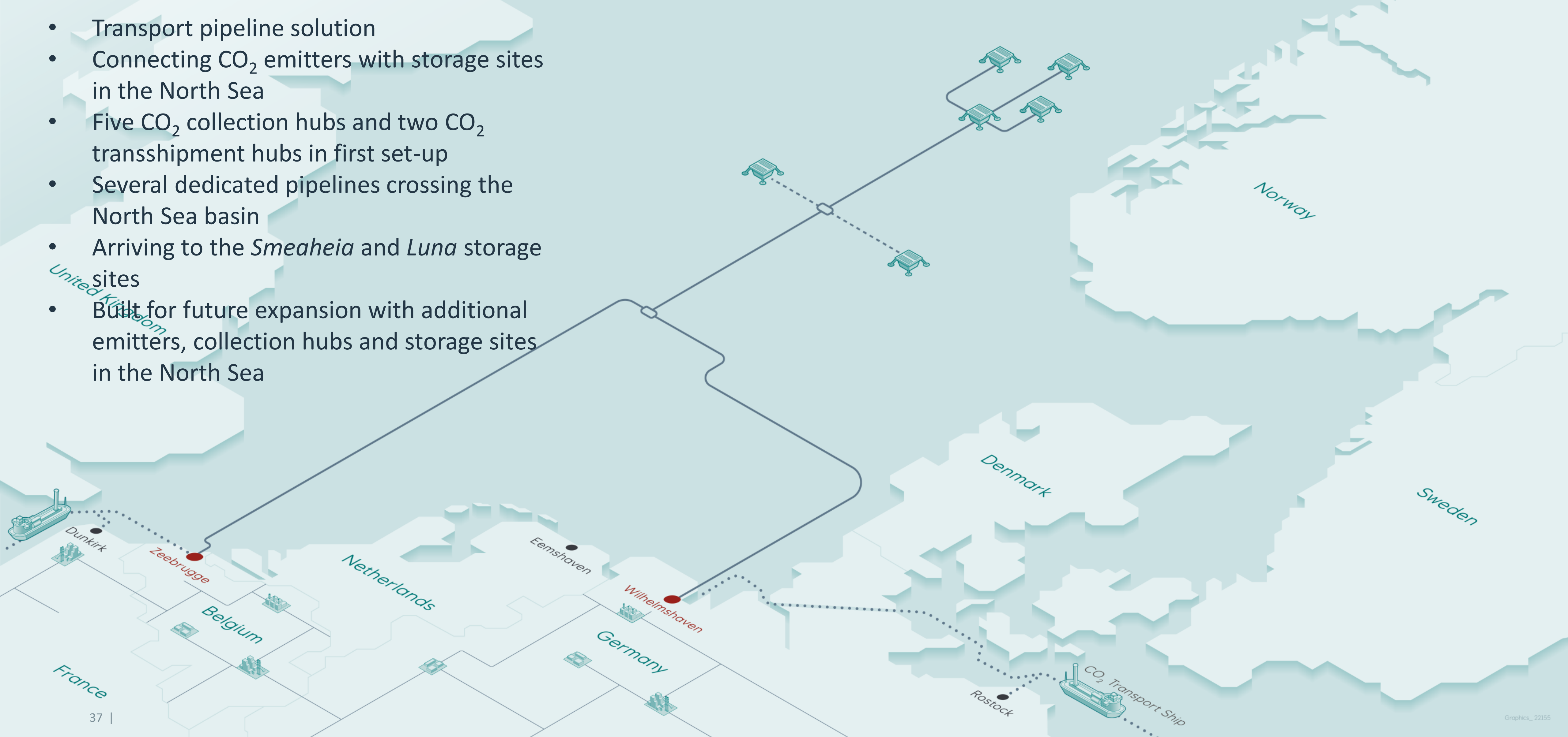
Introductory remarks on «CCUS market models for CO2 transport and storage”

@ Advisory Panel for Future Gas Grids, ENTSOG
16 October 2023

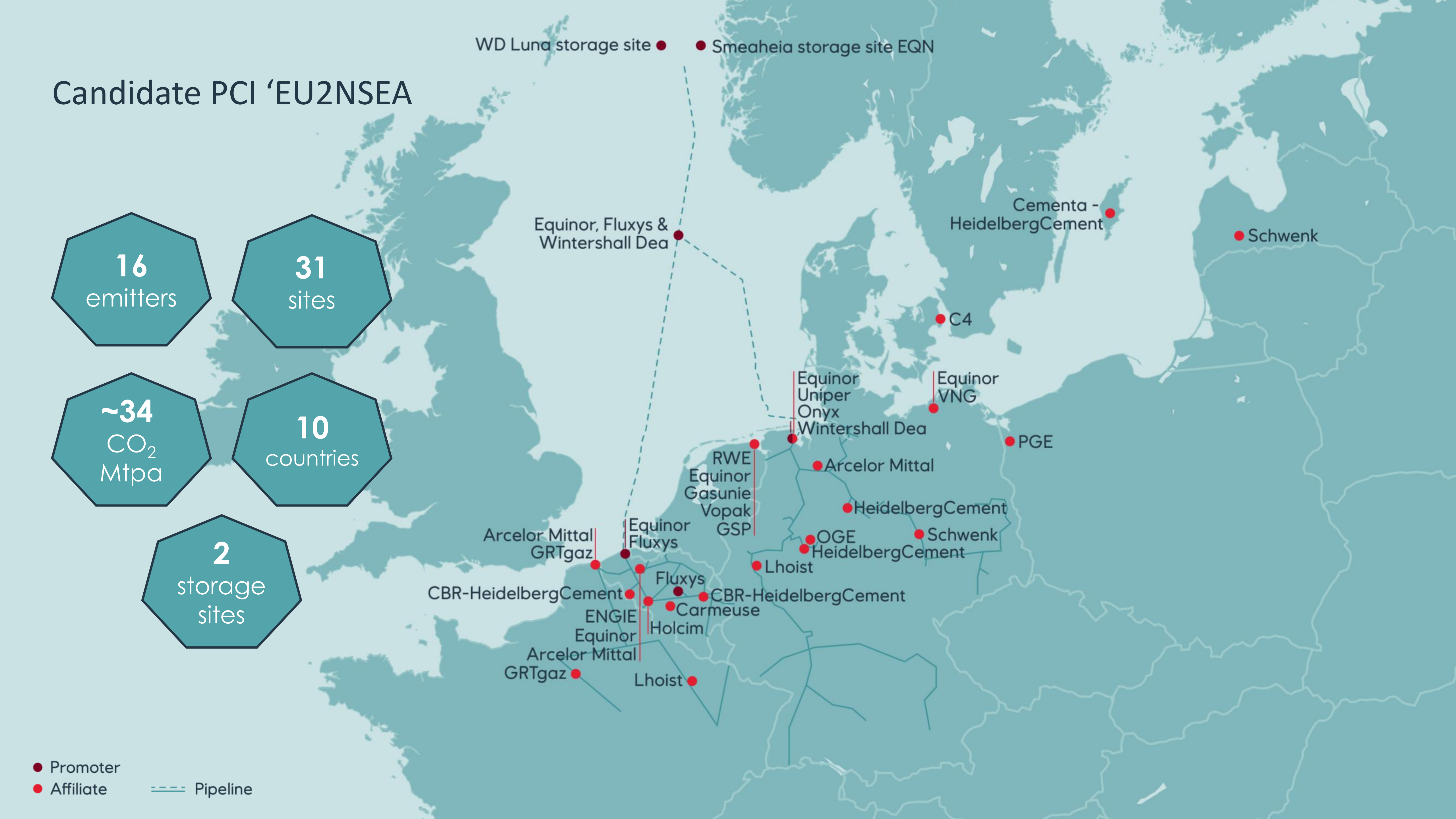
By Dr Per Sandberg
Senior Advisor, Low Carbon Solutions, Equinor
prsa@equinor.com

EU PCI application unites the CCS value chain - from North Europe Emissions to North Sea Storage

- Transport pipeline solution
- Connecting CO_2 emitters with storage sites in the North Sea
- Five CO_2 collection hubs and two CO_2 transshipment hubs in first set-up
- Several dedicated pipelines crossing the North Sea basin
- Arriving to the *Smeaheia* and *Luna* storage sites
- Built for future expansion with additional emitters, collection hubs and storage sites in the North Sea



Candidate PCI 'EU2NSEA



Some preliminary remarks on “CCUS market models for CO2 transport and storage”

- **Market models include many dimensions**, much more than commercial principles and public support schemes
  - E.g. market models in US, UK and EU are radically different

- **As provider of CO2 T&S, we need the following:**
  - **Be welcome and wanted -** NZIA & Carbon Management Strategy
  - **Security of demand**
  - **Value chain approach to solve “co-ordination challenge”**
  - **Efficient permit-granting and access to storage sites**
  - **Supportive commercial frameworks**
  - **Technical & financial requirements designed for CCS success**

Discussion points

Discussion areas

- CO_2 transport/storage acceptance. CO_2 injection targets trajectory.
- Business cases and funding gaps. Regulation level.
- Infrastructure planning.
- Standards for CO_2 transport.

Summary and next steps

Next steps

Compile key takeaways from this session

Recommendation Report

Setting agenda for 2024

Next meeting

Thank you for your attention

ENTSOG

ENTSOG - European Network of Transmission System Operators for Gas
Avenue de Cortenbergh 100, 1000 Bruxelles

www.entsog.eu | info@entsog.eu