

BELLONA



**MANUFACTURING OUR
FUTURE: INDUSTRIES,
EUROPEAN REGIONS AND
CLIMATE ACTION**

**Just and achievable industrial
decarbonisation**



@Bellona_EU

A typical wind turbine is 89% steel

The high renewable scenario of the EU energy 2050 roadmap anticipates 1,000 GW of wind power to be installed. This will require 100 million tonnes of steel

Deeply decarbonising steel requires CO₂ transport and storage infrastructure

Energy efficient and passives buildings use materials like cement to increase thermal mass, heating the building in winter and cooling it in summer

Deeply decarbonising cement requires CO₂ transport and storage infrastructure

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Nitrogen fertilisers are responsible for 1% of global CO₂ emissions

Using less will improve the climate and the environment

To deeply decarbonise what remains requires CO₂ transport and storage infrastructure

Decarbonising industry in Sweden
an assessment of possibilities and policy needs

Max Åhman*
Alexandra Nikoleris
Lars J Nilsson

RICARDO-AEA

Quantification of heat in industry
search evidence



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A STEEL ROADMAP FOR A
LOW CARBON EUROPE 2050

INTERGOVERNMENTAL PANEL ON climate change
ipcc
CLIMATE CHANGE 2014
Mitigation of climate change
Summary for Policymakers
and Technical Summary



WGIII
WORKING GROUP III CONTRIBUTION TO THE
FIFTH ASSESSMENT REPORT OF THE
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



This report has been prepared for the
Department of Energy and Climate Change and
the Department for Business, Innovation and Skills
**Industrial Decarbonisation &
Energy Efficiency Roadmaps
to 2050**
Iron and Steel
MARCH 2015

A Systematic Review
Cost for Industrial C...

pathways to
deep decarbonization

2014 report



DNV-GL

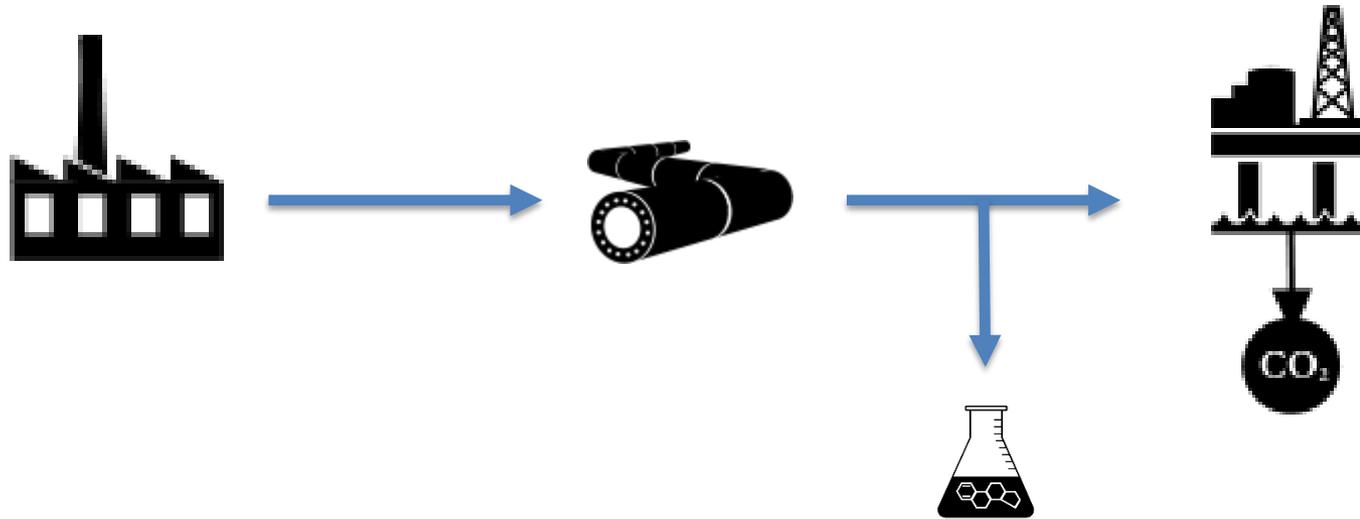


**LOWEST COST DECARBONISATION FOR THE
INDUSTRY**
Report to the Secretary of State for
Industrial Strategy from the Panel
on...

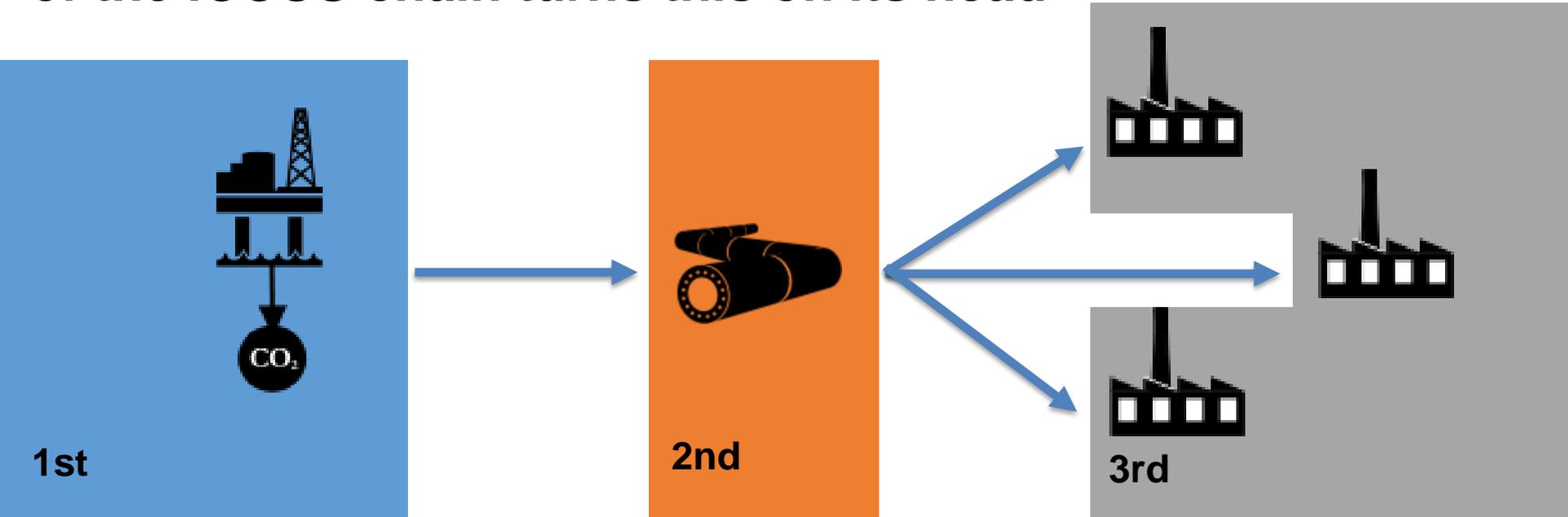
**Energy Technology
Perspectives 2015**
Mobilising Innovation to Accelerate Climate Action



What is Industrial Carbon Capture Use and Storage?



Reviewing the investment and delivery profile of each part of the iCCUS chain turns this on its head



How is CCS development going in Europe?

Two CO₂ storage projects – one dating from 1996 and both oil and gas related



No commercial scale transport of CO₂



No CO₂ capture at industrial facilities



Can European emissions trading (ETS) CO₂ price drive iCCUS and the development of CO₂ networks?

The price signal comes late after storage and transport should be developed = delay

The price signal does not encourage future planned sizing of infrastructure = no sharing and increased cost

CO₂ storage and infrastructure is around and in use for a long time. Much longer than most industries plan commercial investment = reluctance to invest

Can European emissions trading (ETS) CO₂ price drive iCCUS and the development of CO₂ networks?

Result: Less decarbonisation, later, and at a higher cost

In the interim industries will be paying the ETS with little options to deeply reduce emissions

What are Europe's goals for industrial development and policy tools for decarbonisation ?

EU industrial policies and targets (20 % increase in industrial output by 2020)

EU goals: reduction CO₂
40% - 2030, 80-95% - 2050

There is tension between these two goals

Global competitiveness & Employment



What are the outcomes if a feasible decarbonisation pathway does not materialise ?

Bad for industry – added uncertainty,
disincentive to investment

Bad for climate - less action and at higher cost

Bad for industrial regions and employment –
Reduced investment, added uncertainty

What are the outcomes if a feasible decarbonisation pathway does not materialise ?

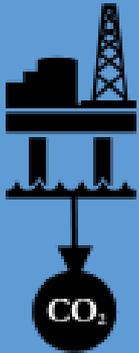
The core reason for the tension is there is currently no accessible cost effective pathway for most CO₂ intensive industries to deeply decarbonise

There is a role for Regional, National Governments and EU to enable timely development of enabling CO₂ networks

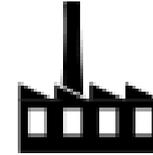
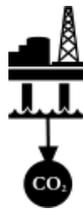
Shared networks for wider and lower cost decarbonisation

Certainty of decarbonisation pathway

Lower the effective ETS price to decarbonise



We propose using state-owned and/or -funded CO₂ Market Makers to break the current inertia. Regional CO₂ transport and storage infrastructure development organisations



Storage operators need a **guarantee of income** before they can invest in exploration, appraisal and feasibility work

Transport operators need to have **confidence** in income in order to perform feasibility and routing studies, including public engagement

Capture operators need to have a **guaranteed CO₂ storage solution**, at a known price, before they can gain finance

Counterparty risk flows from each segment of the value chain to the other, making timely investment risky and more costly if they do occur



Solution: Remove counterparty risk with regional **coordination** bodies to deliver each segment of the CCUS value chain in a timely and **strategic** manner



The **Market Maker** is a regional CCUS coordination body

- Manages the development of primary infrastructure on behalf of the state (trunk pipelines, shipping terminals + back-up storage site)
- Has a duty to take all contracted captured CO₂ and ensure corresponding storage is available.

The Market Maker is ideal for developing required storage volumes during the pre-commercial phase.

Network effect: Larger CO₂ networks provided **better societal value, lower risk** and greater participation for CO₂ emitters and CO₂ stores. Commercial risk is reduced through greater participation, market size and commercial maturity.

The **Market Maker** will require a mandate and capitalisation to place the foundations for a mature CO₂ network at an industrial emissions cluster.

The Market Maker will:

- a) Tender for the development of CO₂ storage
- b) Tender for the development of strategic CO₂ transport infrastructure
- c) Tender for the initial supply of CO₂ to the CO₂ network. Using this CO₂ to develop CO₂ stores
- d) Build out the CO₂ storage and transport network to CO₂ sources in a planned stepwise way

Lower societal cost of decarbonisation and increased decarbonisation

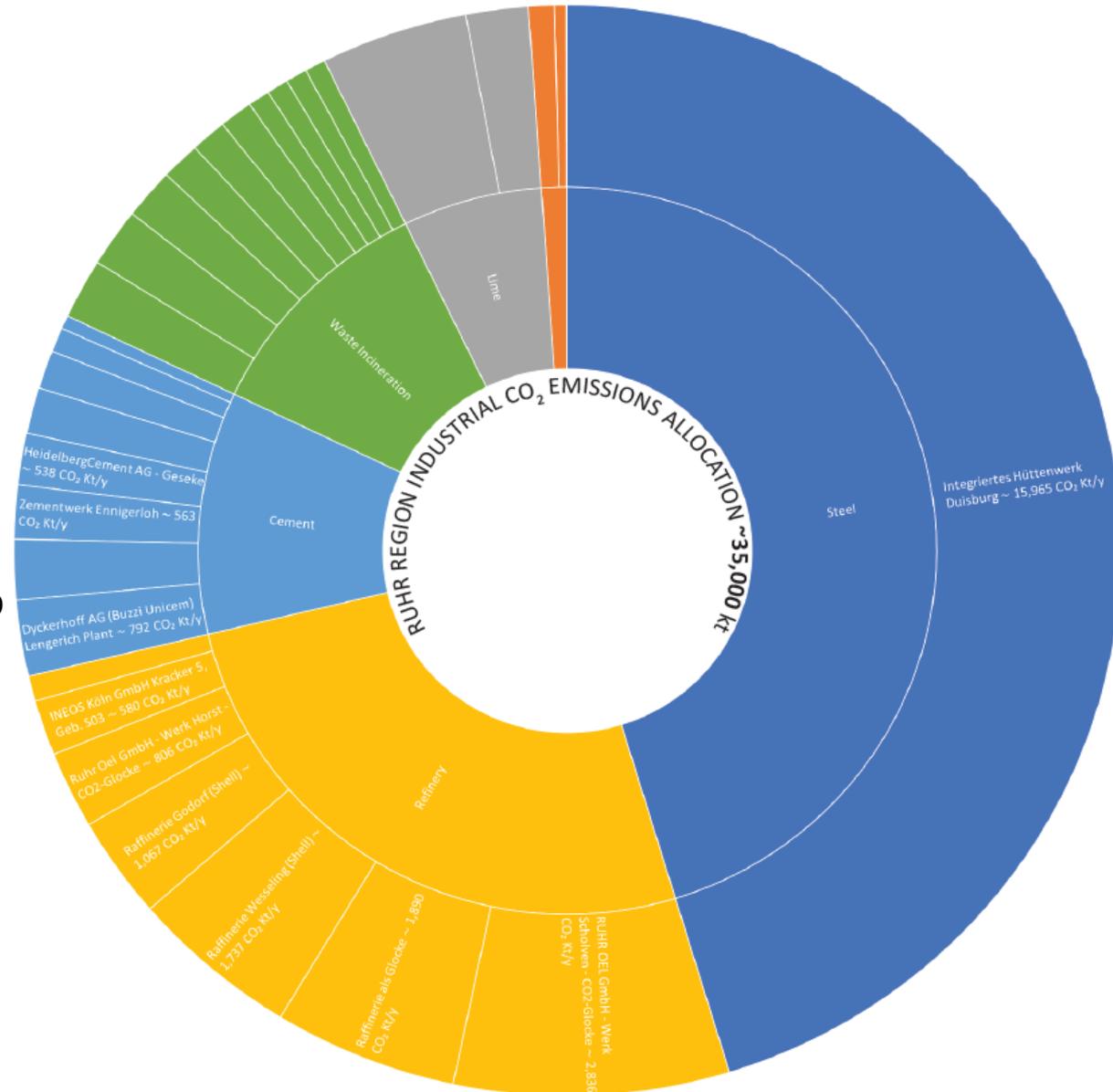


**CO₂ Market Makers
need to serve
industrial regions
(Hubs)**



The case of the Ruhr Germany

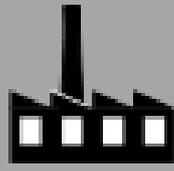
- a) Very large industrial CO₂ cluster, including Europe's largest steel complex.
- b) Inland shipping already extensive for industrial products, inland shipping of CO₂ on barges is a scalable and affordable connection to CO₂ storage in North Sea through Rotterdam.
- c) **CO₂ storage onshore in Germany currently not permitted!**



Example: the CO₂ Market Maker will start by:



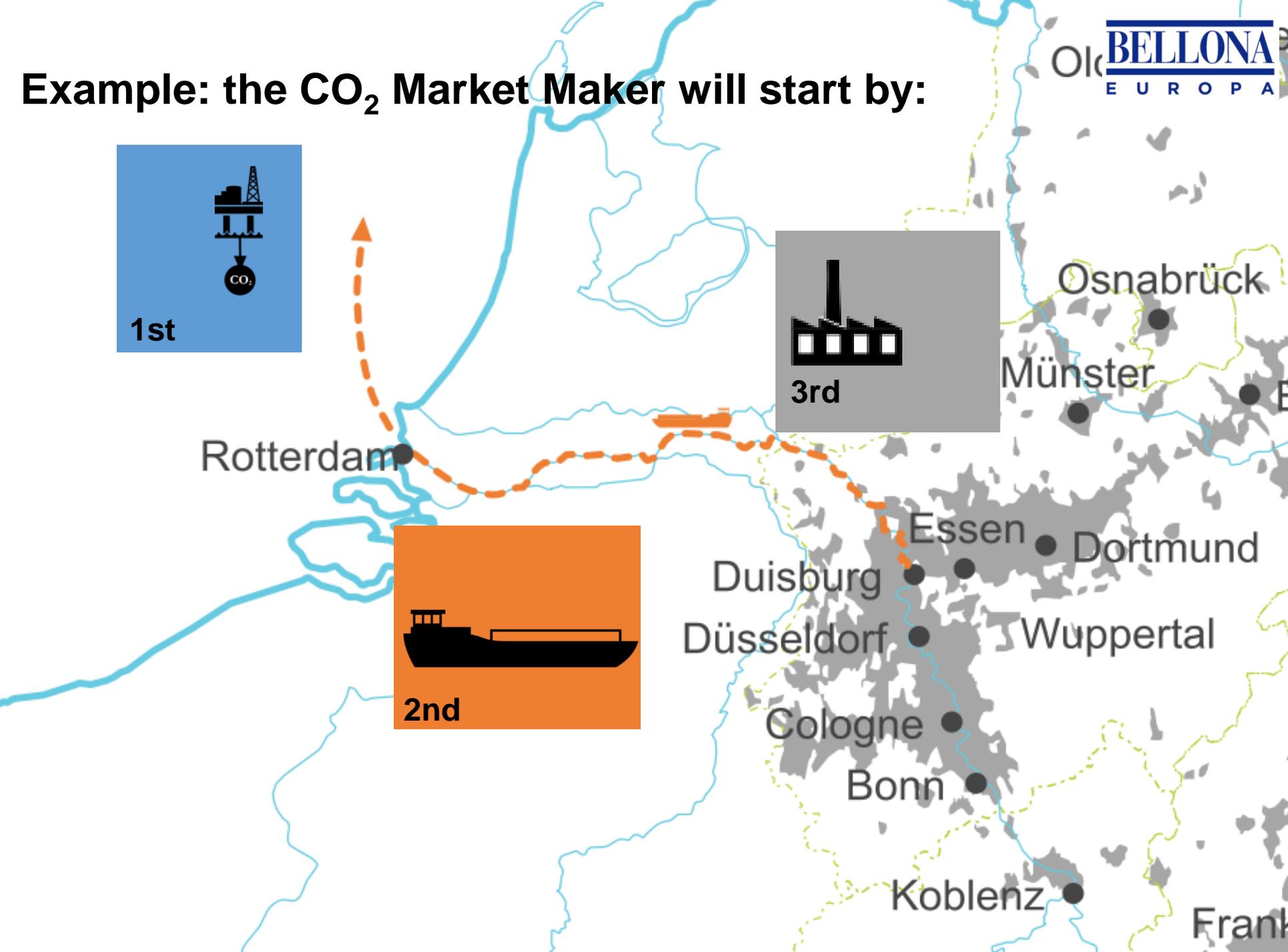
1st



3rd



2nd

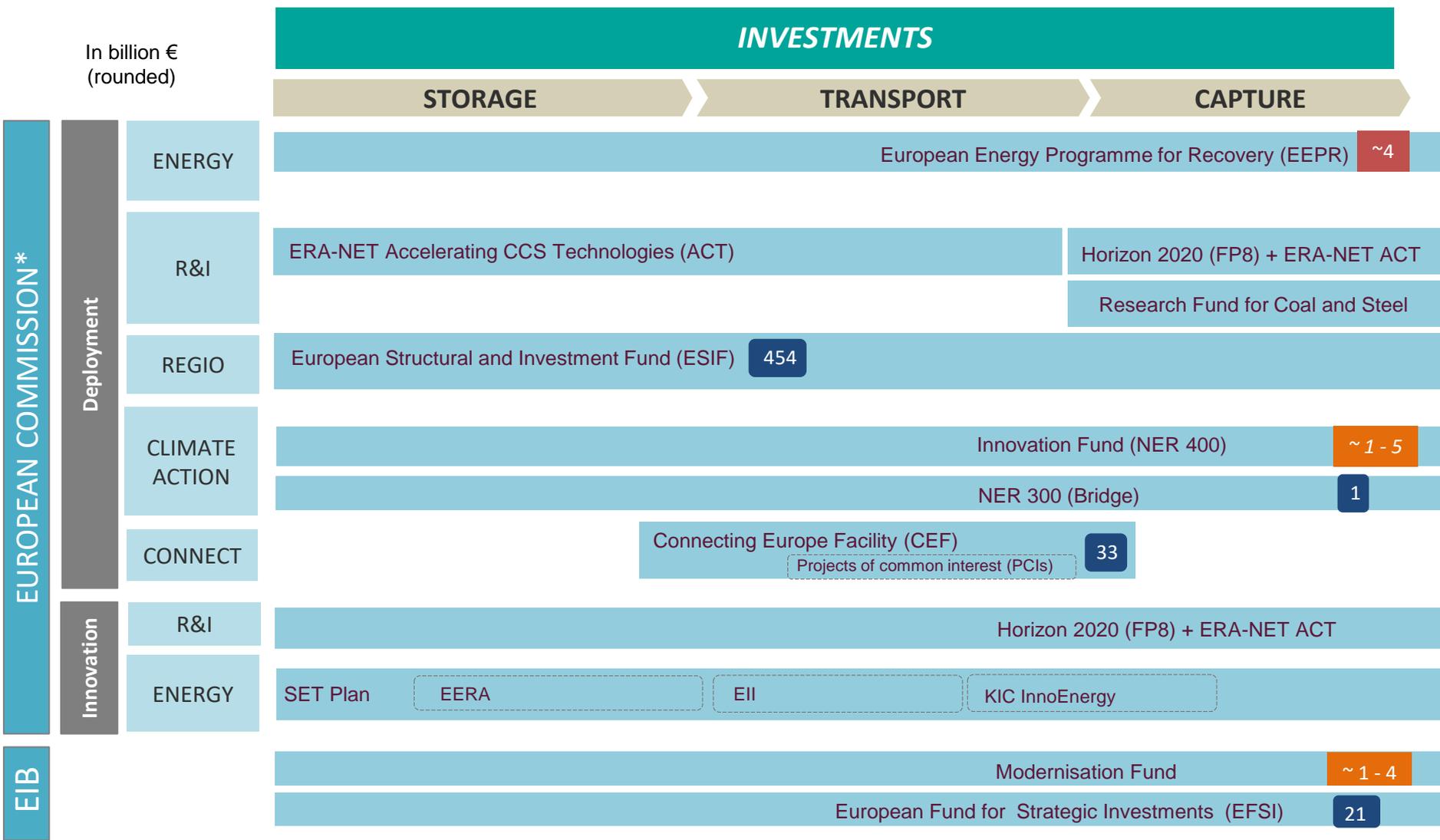


How can a regional CO₂ Market Maker be capitalised ?

EU funding schemes eligible for CCS projects and that could possibly be accessed to capitalise/fund CO₂ Market Makers exist, yet they are highly fragmented

As the main benefactors, it is imperative that Europe's strategic industrial regions take ownership in prioritising the delivery of CO₂ networks

EUROPEAN INSTRUMENTS CAN AID STRATEGIC DEVELOPMENT OF CO₂ CAPTURE, TRANSPORT AND STORAGE



Caption



From ~2020



Between 2014-2020



Since 2009

These three industrial facilities alone produce **5% of Norway's CO₂ pollution**. We need to Deeply Decarbonise Society to reach 1.5°C

A plan to capture, transport and store the CO₂ will solve that



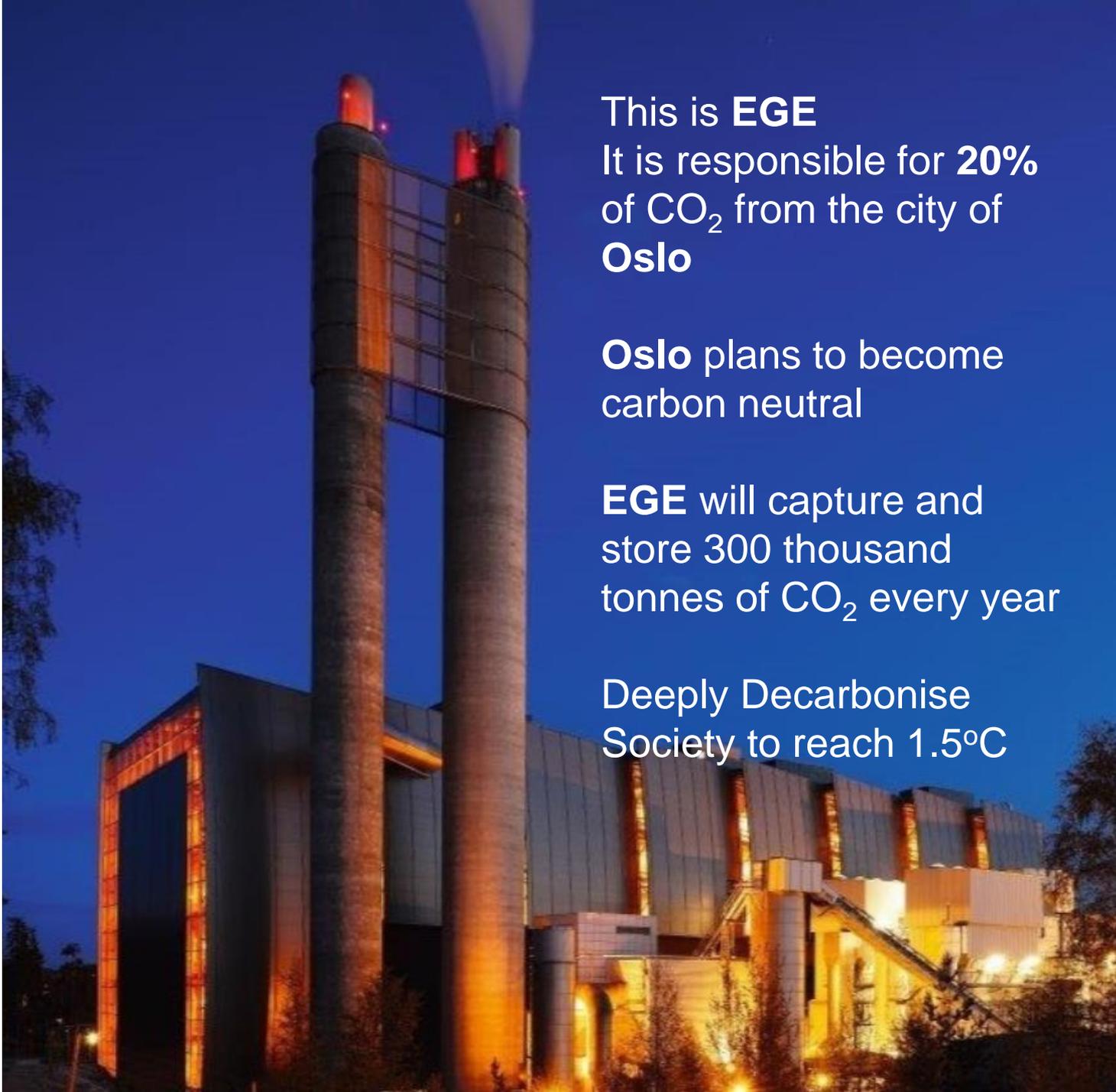


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This is **EGE**

It is responsible for **20%**
of CO₂ from the city of
Oslo

Oslo plans to become
carbon neutral

EGE will capture and
store 300 thousand
tonnes of CO₂ every year

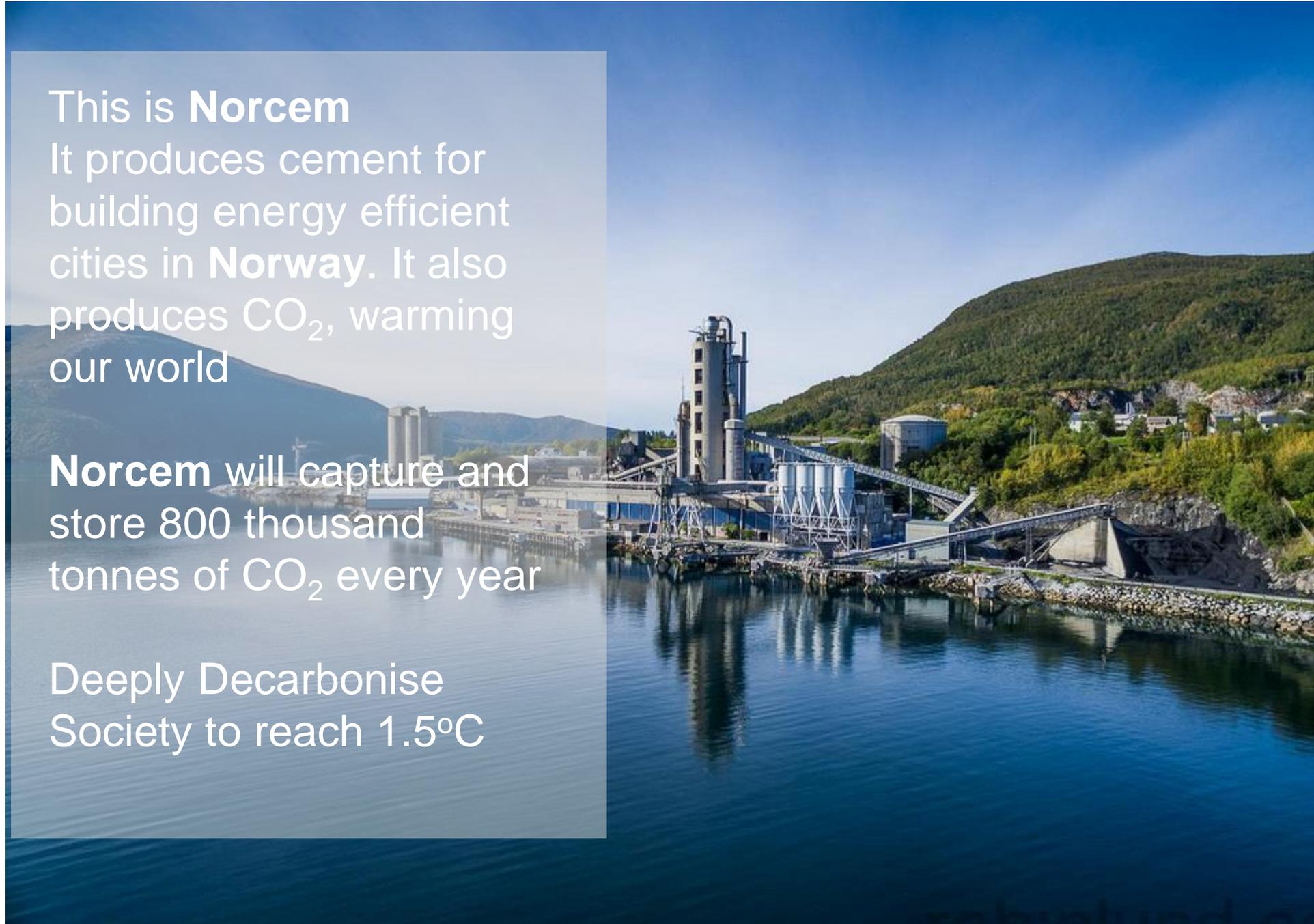
Deeply Decarbonise
Society to reach 1.5°C

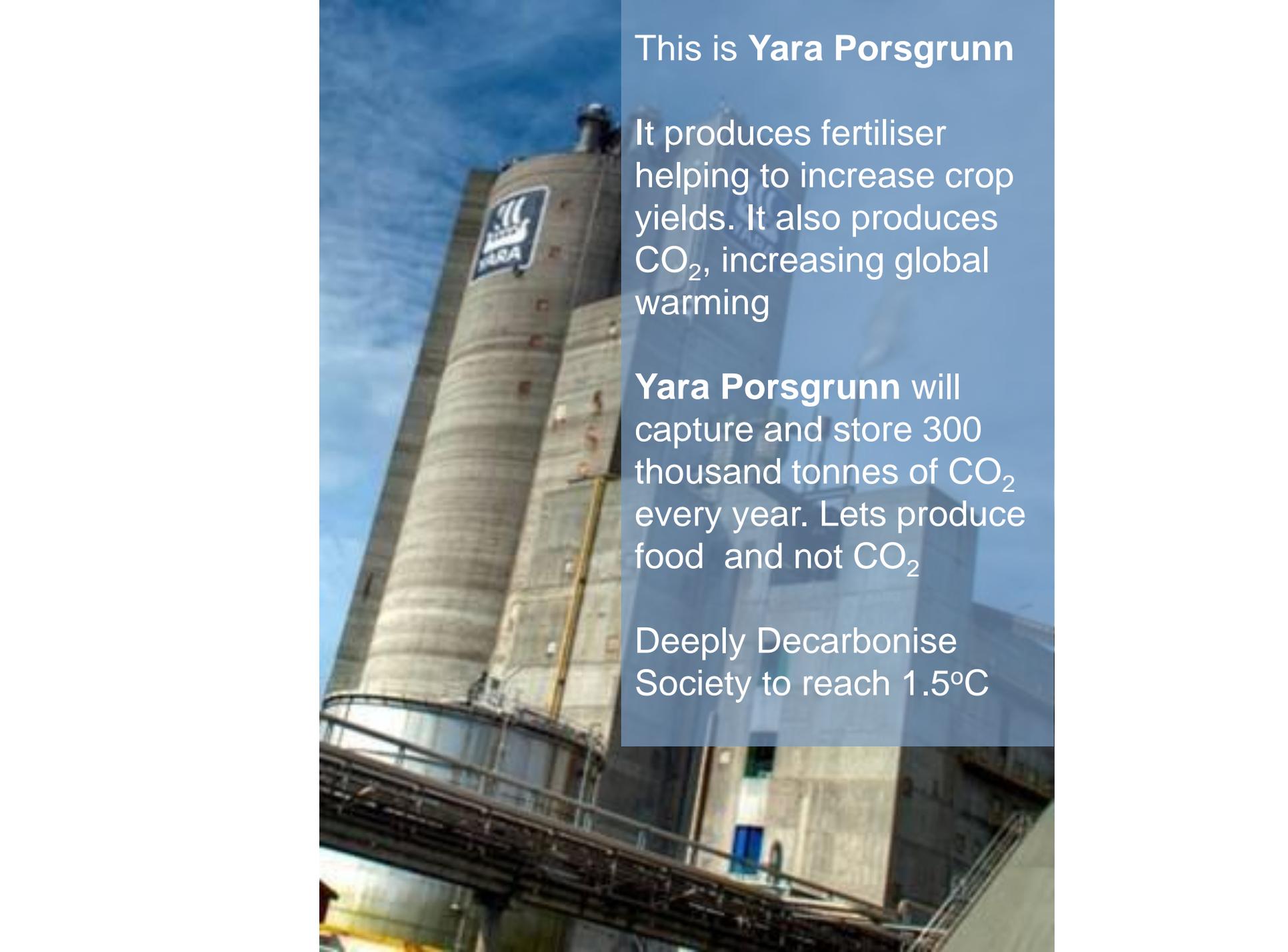
This is **Norcem**

It produces cement for building energy efficient cities in **Norway**. It also produces CO₂, warming our world

Norcem will capture and store 800 thousand tonnes of CO₂ every year

Deeply Decarbonise Society to reach 1.5°C





This is Yara Porsgrunn

It produces fertiliser helping to increase crop yields. It also produces CO₂, increasing global warming

Yara Porsgrunn will capture and store 300 thousand tonnes of CO₂ every year. Lets produce food and not CO₂

Deeply Decarbonise Society to reach 1.5°C