

# CO<sub>2</sub> Market Makers for Strategic European CCS Hubs & Clusters

Keith Whiriskey

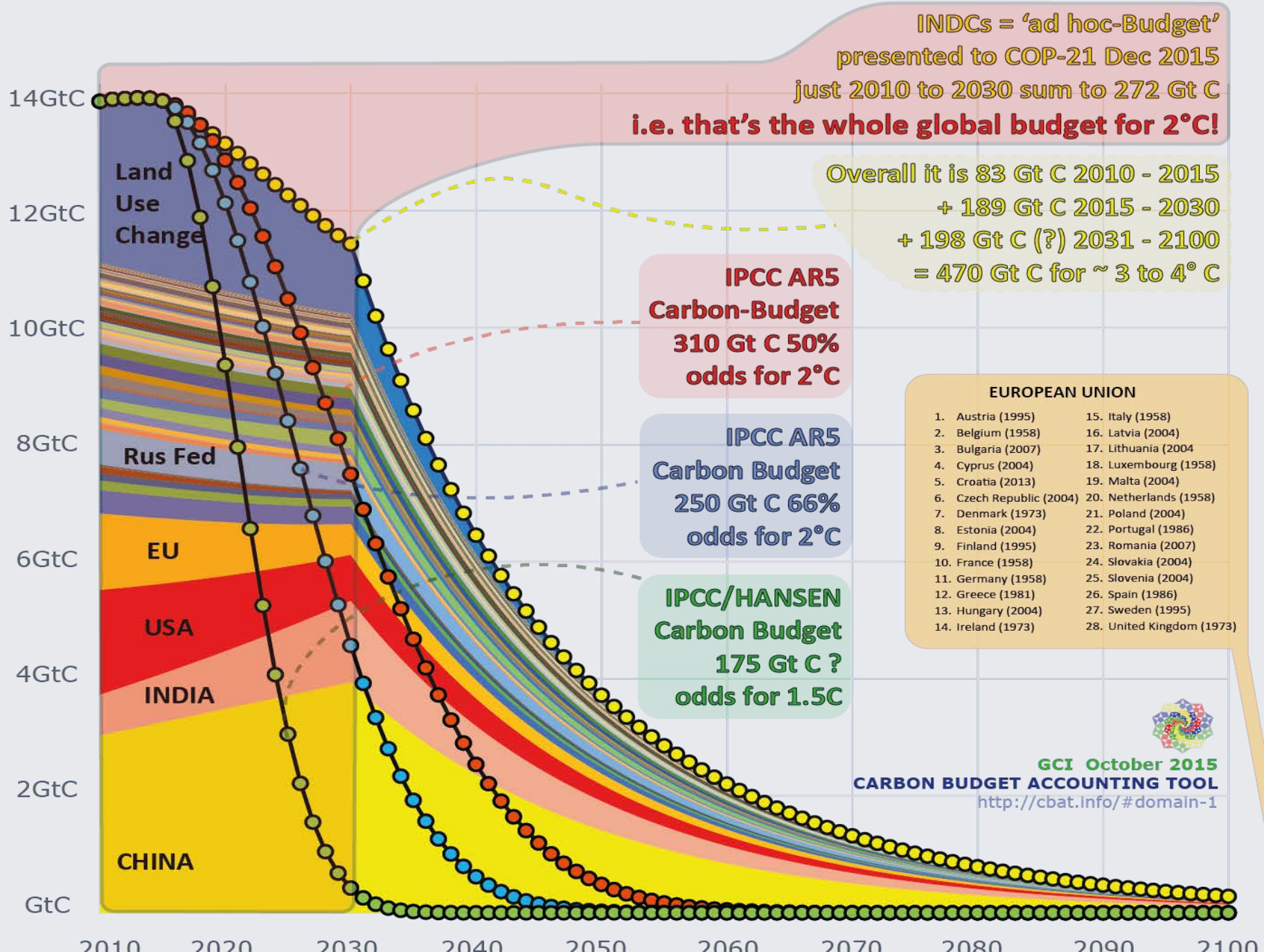
# OUTLINE OF PRESENTATION

- Why *CCS*
- Why storage and pipeline first
  - Timing, confidence, decarbonisation pathway
- How
  - Member state narrative
  - EU funding engagement
  - Industry and their role of deep decarbonisation



By 2014 global CO<sub>2</sub> emissions had increased by **63%** from 1990 levels

**Deep Decarbonisation** needed in all segments of society to reach 2°C or lower



INDCs = 'ad hoc-Budget' presented to COP-21 Dec 2015 just 2010 to 2030 sum to 272 Gt C i.e. that's the whole global budget for 2°C!

Overall it is 83 Gt C 2010 - 2015 + 189 Gt C 2015 - 2030 + 198 Gt C (?) 2031 - 2100 = 470 Gt C for ~ 3 to 4° C

**IPCC AR5 Carbon-Budget 310 Gt C 50% odds for 2°C**

**IPCC AR5 Carbon Budget 250 Gt C 66% odds for 2°C**

**IPCC/HANSEN Carbon Budget 175 Gt C ? odds for 1.5C**

- EUROPEAN UNION**
- |                          |                           |
|--------------------------|---------------------------|
| 1. Austria (1995)        | 15. Italy (1958)          |
| 2. Belgium (1958)        | 16. Latvia (2004)         |
| 3. Bulgaria (2007)       | 17. Lithuania (2004)      |
| 4. Cyprus (2004)         | 18. Luxembourg (1958)     |
| 5. Croatia (2013)        | 19. Malta (2004)          |
| 6. Czech Republic (2004) | 20. Netherlands (1958)    |
| 7. Denmark (1973)        | 21. Poland (2004)         |
| 8. Estonia (2004)        | 22. Portugal (1986)       |
| 9. Finland (1995)        | 23. Romania (2007)        |
| 10. France (1958)        | 24. Slovakia (2004)       |
| 11. Germany (1958)       | 25. Slovenia (2004)       |
| 12. Greece (1981)        | 26. Spain (1986)          |
| 13. Hungary (2004)       | 27. Sweden (1995)         |
| 14. Ireland (1973)       | 28. United Kingdom (1973) |

**Industries provide us the materials and tools to build a low carbon society, from passive homes, wind turbines, solar panels, fertilisers to electric vehicles.**

- *A typical wind turbine is reported to contain 89% steel. The high renewable scenario of the EU energy 2050 roadmap anticipates ~ 1000 GW of wind power to be installed. This deployment alone will require ~100 million tonnes of steel.*

**Industry also contributes to increasing CO2 concentrations in the atmosphere.**

- *In Europe one tonne steel produced emits ~ **1.3 tonnes of CO2***
- *Cement production is ~ **0.8 and 0.9 tonnes of CO2** per tonne*

# Do we need CCS to decarbonise industry?

**Example: Molten Oxide Electrolysis** when coupled with carbon-free electricity, drastically mitigates the global warming impact of steel production.

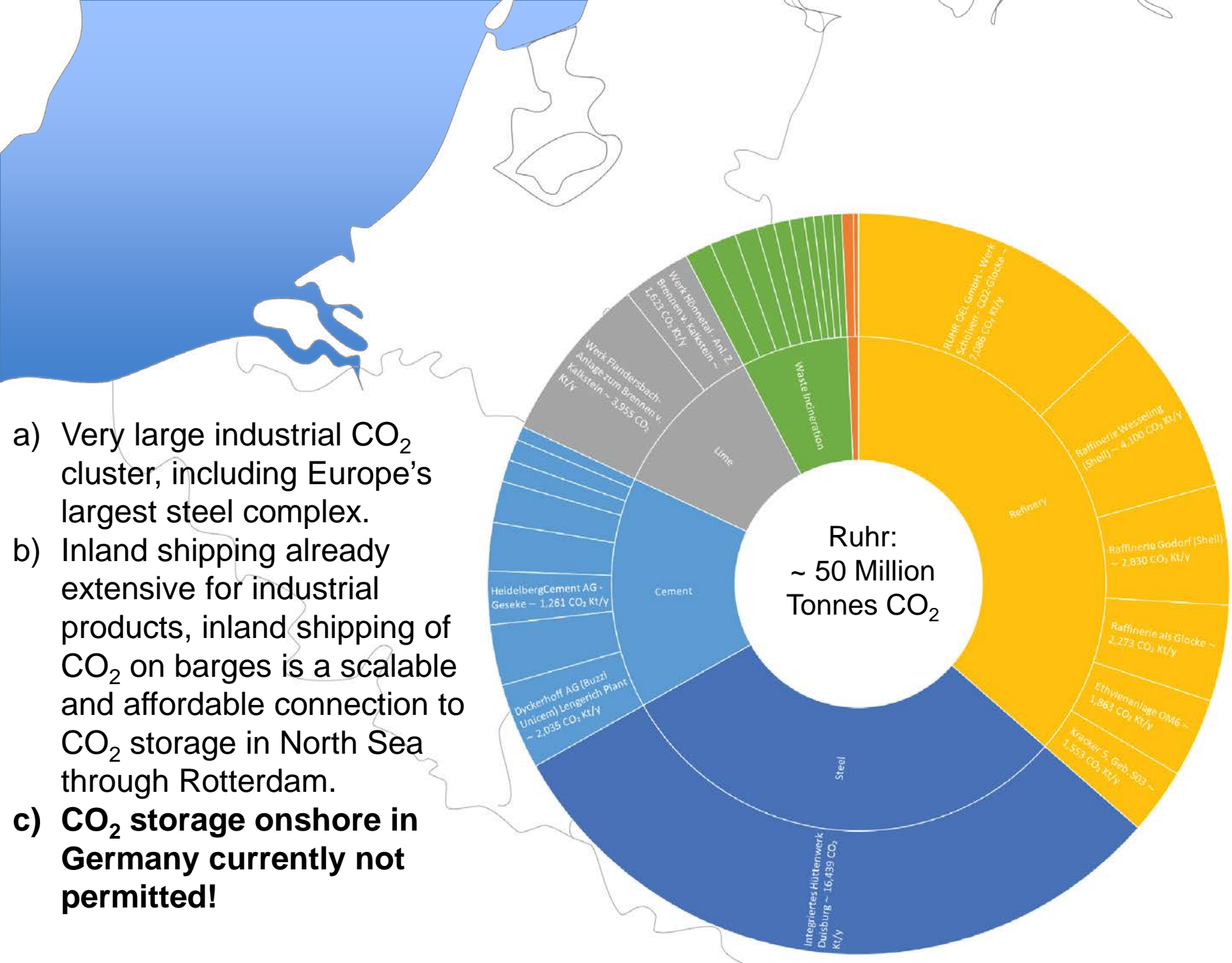
- Producing all German steel in this way would require ~ 159 TWh of electricity, equivalent to the addition of **~24 nuclear plants**

## **Example: Hydrogen**

EU Joint Research Centre estimates **1,000 petajoules of hydrogen** will be needed to decarbonise parts of European industrial production.

- Generated by electrolysis alone this will be equivalent to **10 times the energy produced by all German solar today.**

**Regardless of what mix of technologies that are deployed, CCS will be central in the decarbonisation of industries**



- a) Very large industrial CO<sub>2</sub> cluster, including Europe's largest steel complex.
- b) Inland shipping already extensive for industrial products, inland shipping of CO<sub>2</sub> on barges is a scalable and affordable connection to CO<sub>2</sub> storage in North Sea through Rotterdam.
- c) **CO<sub>2</sub> storage onshore in Germany currently not permitted!**

# CO<sub>2</sub> Capture, Transport and Storage (CCS) is required to deeply decarbonise many industries

## At present in Europe:

Two CO<sub>2</sub> storage projects – one dating from 1996 and both oil and gas related



No large scale transport of CO<sub>2</sub>



No CO<sub>2</sub> capture at industrial facilities





# We urgently need to *enable* a discussion

Bloomberg ▼

Germany Vows Help for Battered Steelmakers Ahead of Carbon Bill

## Germany Vows Help for Battered Steelmakers Ahead of Carbon Bill

by Brian Parkin  
bparkx

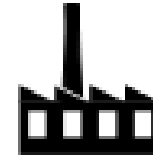
April 29, 2016 – 4:12 PM CEST



- ▶ Germany seeks exemptions for steel industry in ETS reform
- ▶ German steelers face EU1 billion bill p.a. for CO2 permits



Germany's ruling coalition is backing calls from steel producers like Thyssenkrupp AG and Salzgitter AG to shield them from financial risks from the European Union's revamp of the emissions trading system.



**Storage operators** need a **security 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 CO<sub>2</sub> 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 CO<sub>2</sub> and ensure corresponding storage is available.

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

**Network effect:** Larger CO<sub>2</sub> networks provided **better societal value, lower risk** and greater participation for CO<sub>2</sub> emitters and CO<sub>2</sub> 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 CO<sub>2</sub> network at an industrial emissions cluster.

**The Market Maker will:**

- a) Tender for the development of CO<sub>2</sub> storage
- b) Tender for the development of strategic CO<sub>2</sub> transport infrastructure
- c) Tender for the initial supply of CO<sub>2</sub> to the CO<sub>2</sub> network. Using this CO<sub>2</sub> to develop CO<sub>2</sub> stores
- d) Build out the CO<sub>2</sub> storage and transport network to CO<sub>2</sub> sources in a planned stepwise way

*Lower societal cost of decarbonisation and increased decarbonisation*



## Requirements for development of a regional market maker in Europe:

### European Union

**Clarity** on long term climate goals and industrial policy  
Funding mechanisms fit for Market Maker and further directed funding for each segment of CCS value chain

### National

National industrial decarbonisation plan to **2050**  
Long term climate goals and industrial retention strategy  
Willingness to play a active role in the development of CO<sub>2</sub> infrastructure  
Willingness to capitalise Market Maker (with EU funding aid)

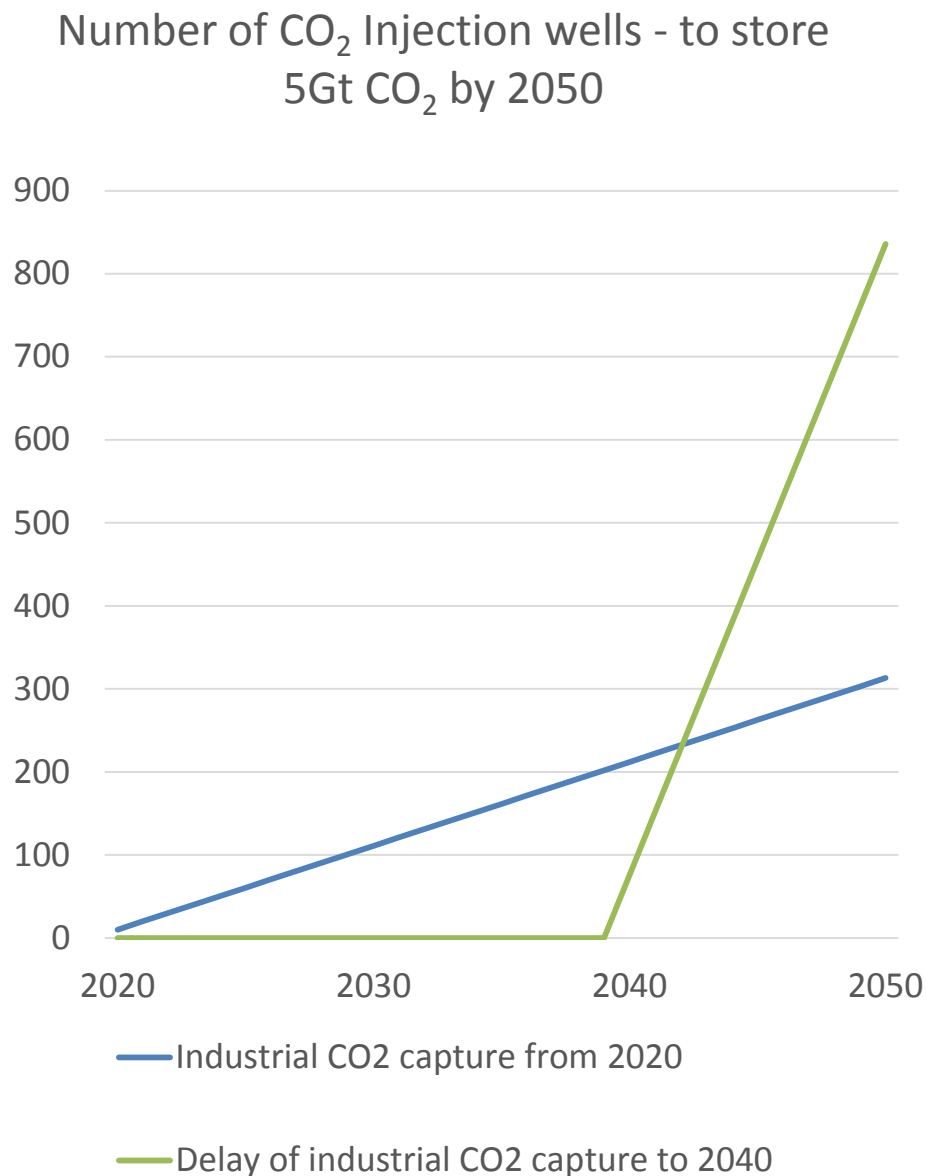
### Regional

Market Maker needs to fit with near term and long term industrial goals of region  
Market Maker to be seen as **beneficial for competitiveness, new business opportunities** and direct investment  
Market Maker as a tool for job retention and growth

### Industrial

**Engagement with deep decarbonisation agenda**  
No single emitter singled out, gradual rollout  
Pathway to increased competitiveness in decarbonised world

# DOES DELAY IN THE ESTABLISHMENT OF CO<sub>2</sub> TRANSPORT AND STORAGE INFRASTRUCTURE LIMIT CLIMATE ABATEMENT?



## Industrial CO<sub>2</sub> capture from 2020

CO<sub>2</sub> storage development to begin immediately

Steady build out pace of CO<sub>2</sub> storage sites and CO<sub>2</sub> transport and CO<sub>2</sub> capture.

CO<sub>2</sub> injection rate in 2050 of  $\approx$  300 Million tonnes, equivalent to  $\approx$  300 CO<sub>2</sub> storage wells. Gradual build out

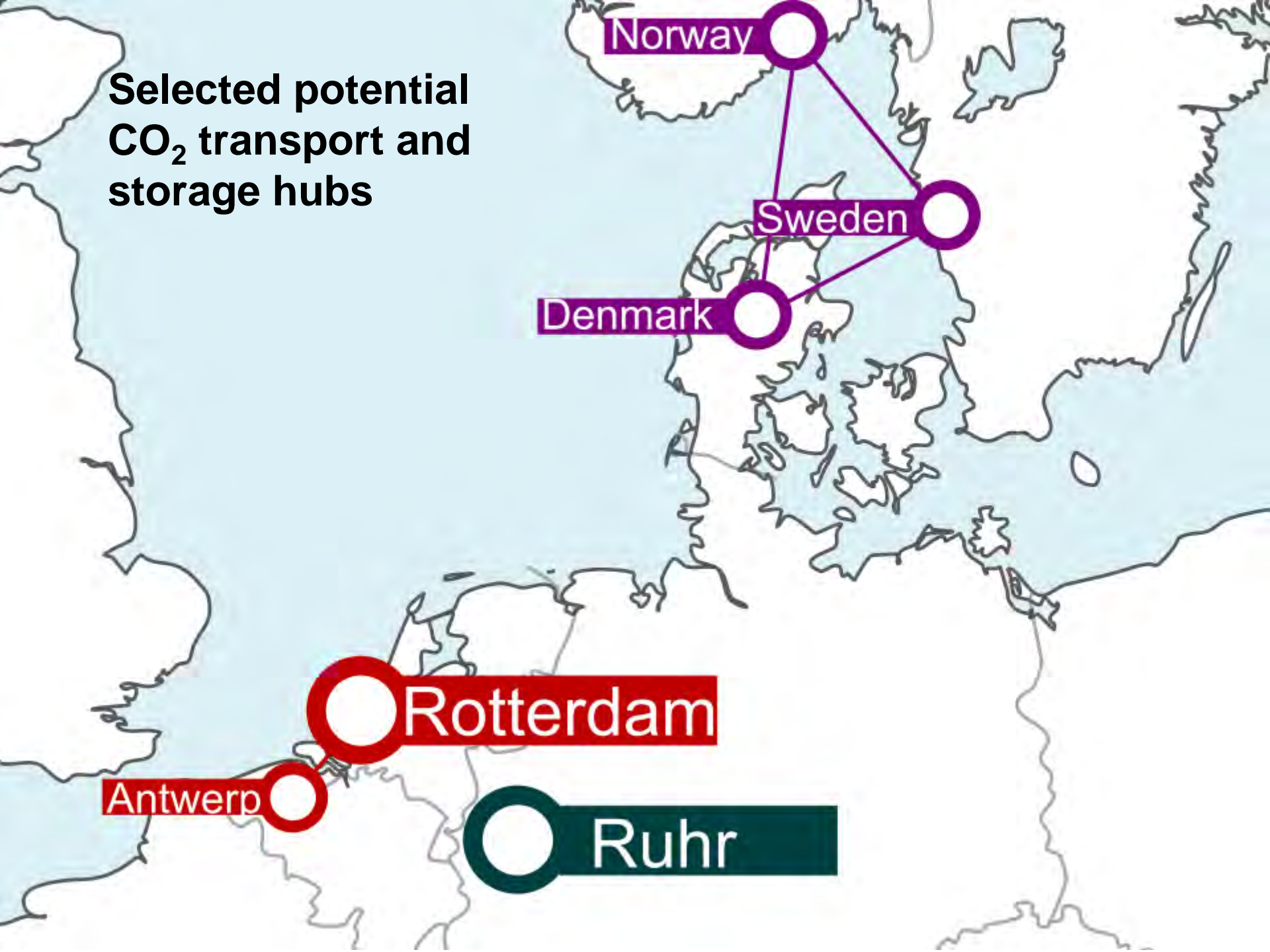
## Delay of industrial CO<sub>2</sub> capture to 2040

CO<sub>2</sub> storage development to begin  $\approx$  early 2030

Rapid scale up required, **dozens of CO<sub>2</sub> storage** sites to be commissioned every year from 2040.

CO<sub>2</sub> injection rate in 2050 of  $\approx$  800 Million tonnes, equivalent to  $\approx$  800 CO<sub>2</sub> storage wells. CO<sub>2</sub> storage development to grow from zero in 2039 to **30% the scale** of the North Sea oil and gas in 2040

**Selected potential  
CO<sub>2</sub> transport and  
storage hubs**





Thank You!

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