CO_2 Enhanced Oil Recovery

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UKCCSRC Biannual

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ERP Overview

Co-Chairs

Public
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Prof John Loughhead
Chief Scientific Advisor, DECC

Private

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Independent Co-chair, formerly SSE

Members

bp, Shell, Hitachi, ABB, nationalgrid, Arup, Atkins, ofgem, SSE, Innovate UK Technology Strategy Board, Ricardo, Carbon Trust, GE, Bosch, energy saving trust, UKERC, Department for Transport, origamienergy, University of Cambridge, Friends of the Earth, Llywodraeth Cymru Welsh Government

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ERP Analysis Team






Hosted by Imperial College London

Project Steering Group

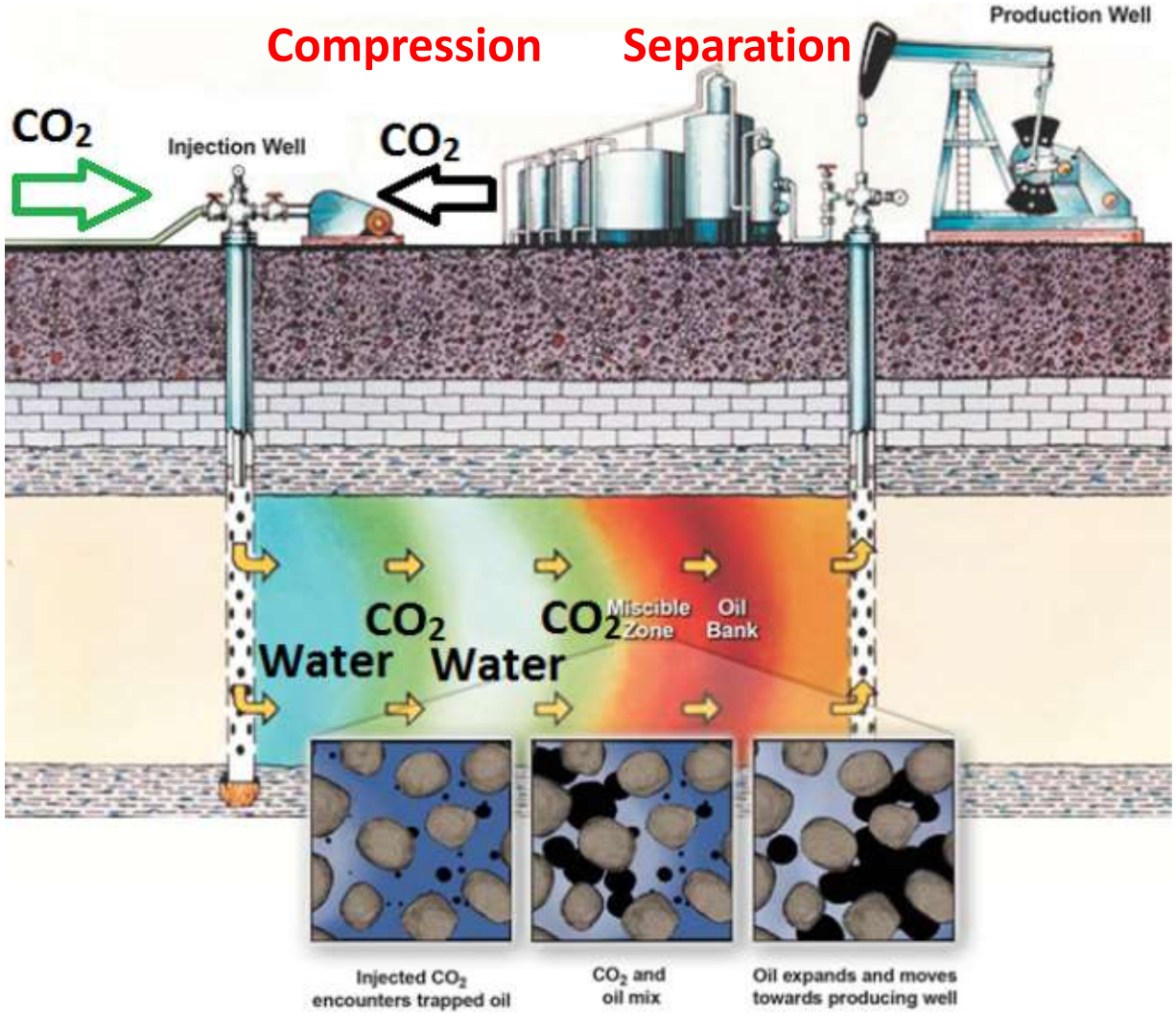
Angus Gillespie	**Shell International**
Tony Espie	**BP Group Technology**
Julien Hailstone	**Nexen Petroleum**
Andy Leonard	**Oil & Gas UK**
Paul Freeman	**OCCS DECC**
Jonathan Thomas	**Oil & Gas Authority**
Peter Emery	**Drax Power Ltd**
Paul Sullivan	**National Grid**
David Rennie	**Scottish Enterprise**
Ward Goldthorpe	**The Crown Estate**
Steven Fogg	**Atkins**
Tassos Vlassopoulos	**GE Oil & Gas**

Outline

- Technical challenges
  - CO_2-EOR is not easy, and expensive
- Synchronisation issue
  - Timing of CO_2 supply
- Geographical disconnect
  - CO_2-EOR is in the North, most emissions in South

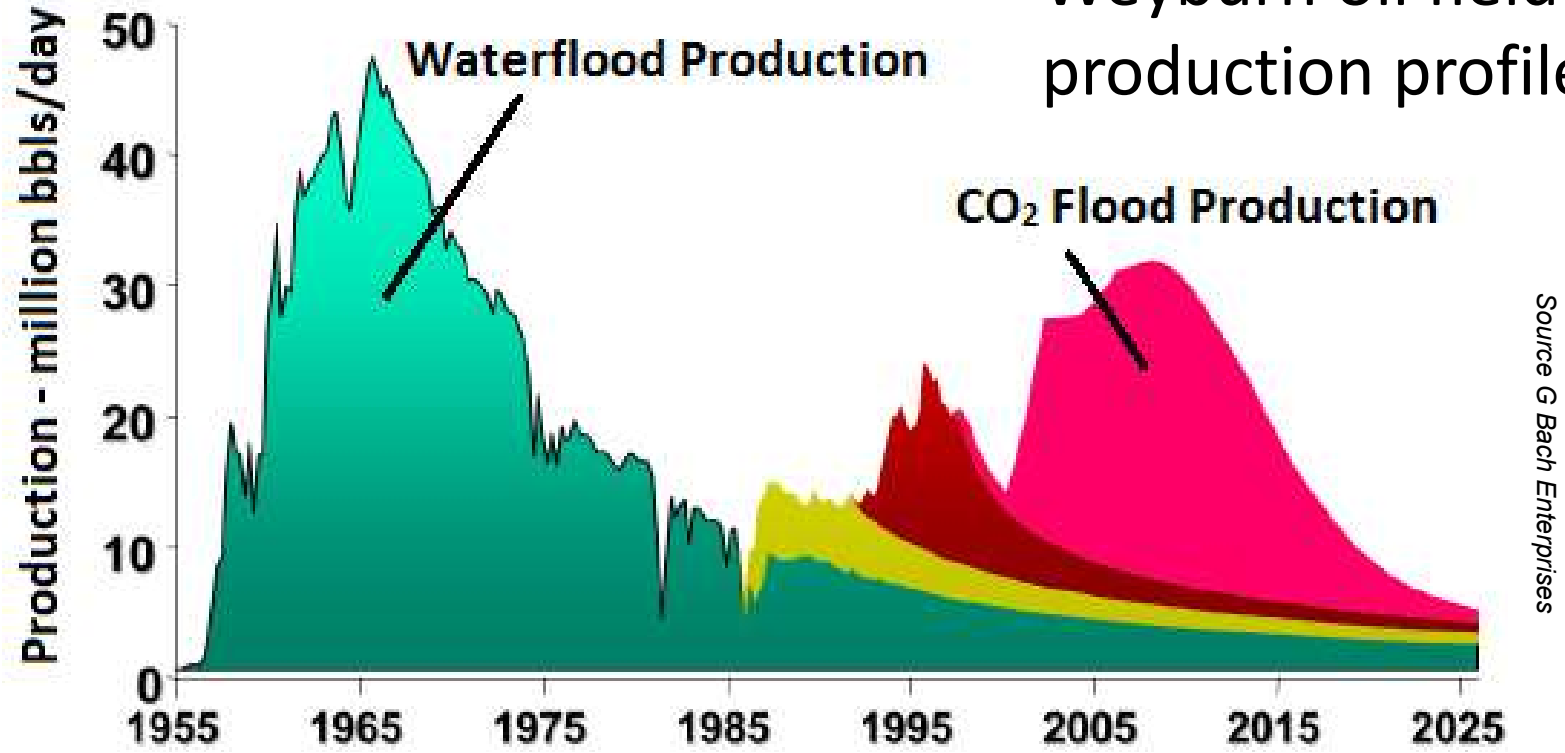
CO_2-EOR

Additional Equipment



Successful in USA

Weyburn oil field production profile



US Oil Yields ~6% of total production >300,000 barrels/day

Injecting CO_2 >70 Mt/yr – mainly from natural sources

Benefits of CO_2-EOR in UK

Additional oil

- ~500 million barrels
- ~10% extra oil from suitable fields
- increase revenue from North Sea
- revenue -> potential return on public investment

CO_2 storage

- additional storage space
- lower cost

Accelerate CCS

- transition to a low carbon energy system
- transformation of the North Sea

Barriers in the UK

No CO_2

- limited time window

Offshore challenge

- higher CAPEX and OPEX
- fewer wells – delay cost recovery
- uncertain oil recovery

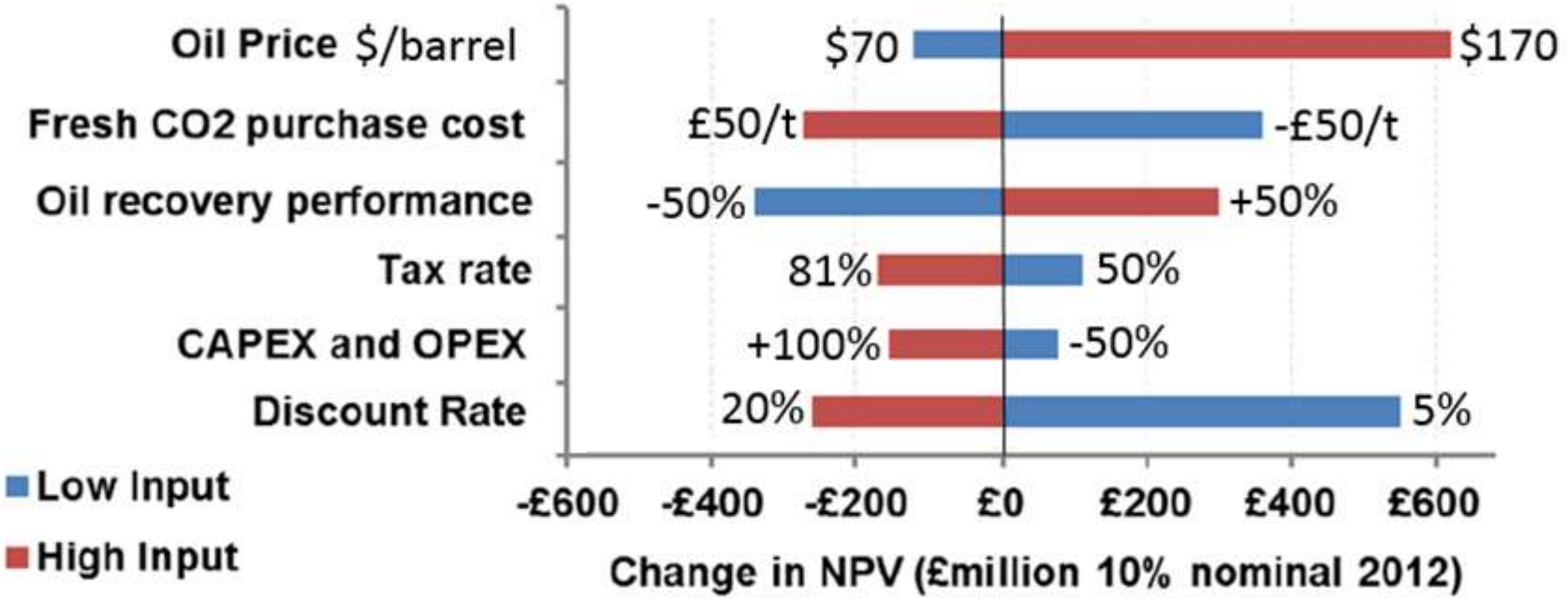
Economics

- oil price
- tax regime

Public acceptance

- additional hydrocarbons and CO_2 emissions

CO_2-EOR economic risks

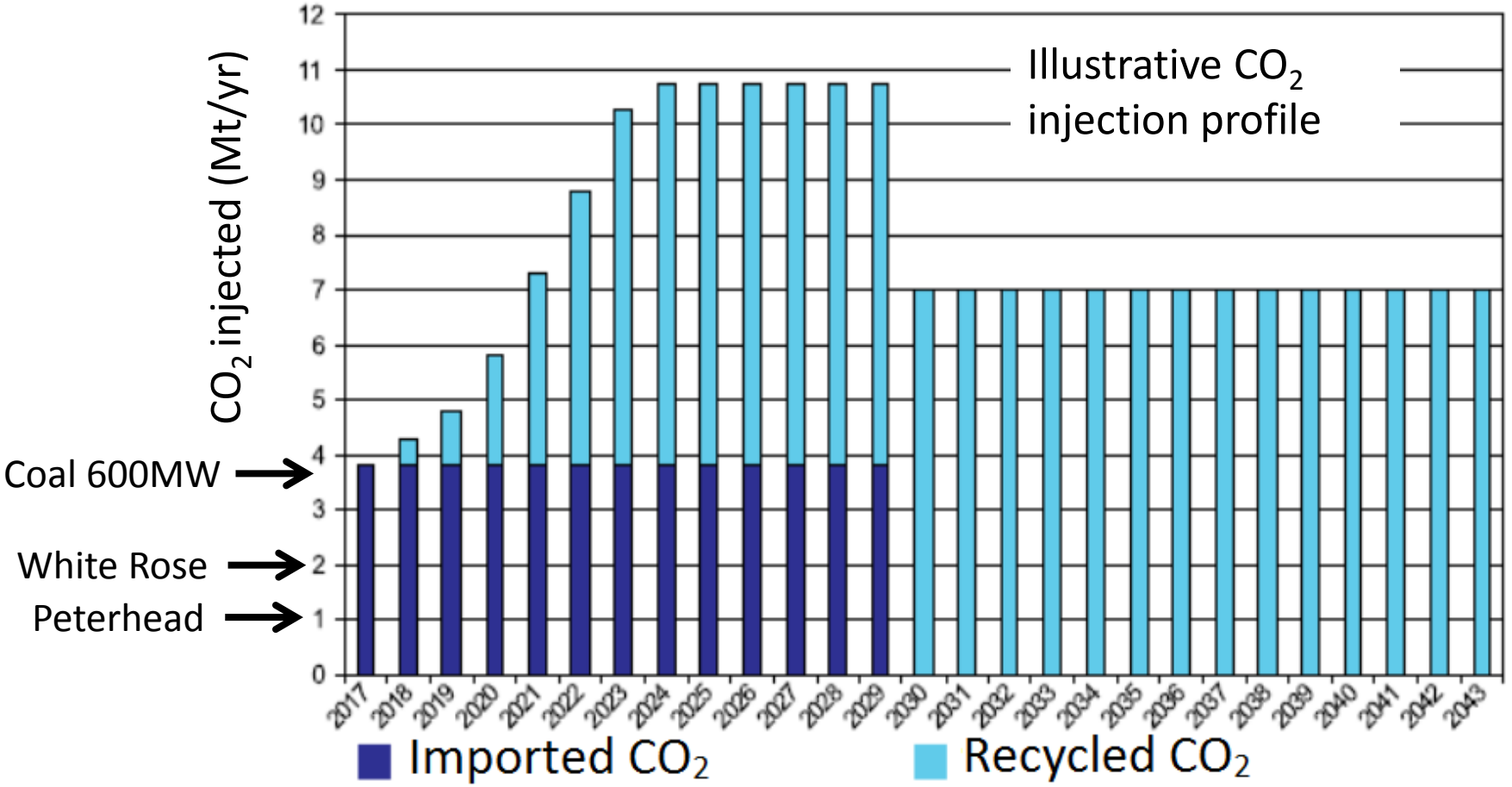


Source Element Energy

Some risks are inherent – reservoir performance

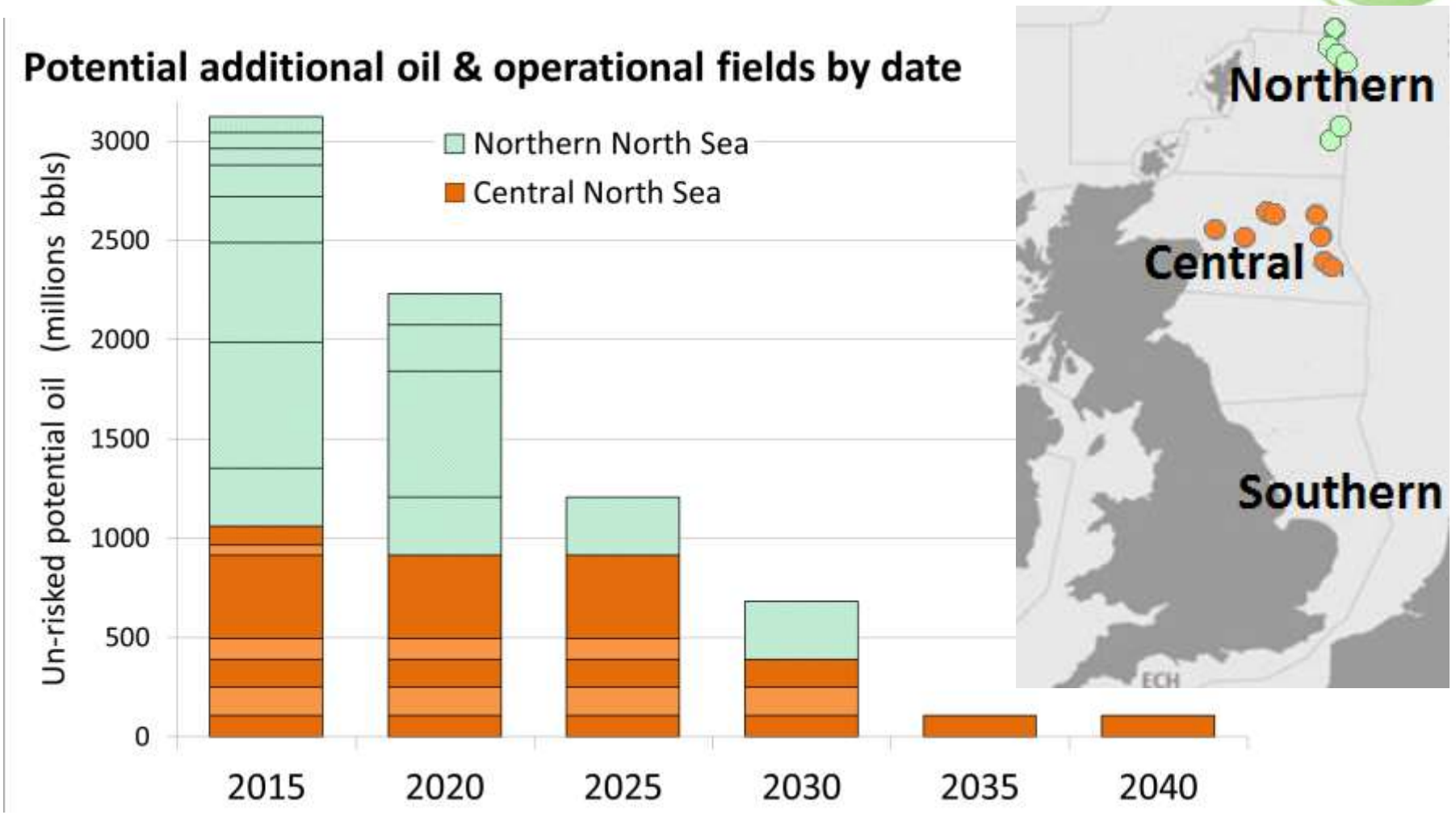
Others need negotiating – CO_2 price

Demand for CO_2



CO_2 demand profile differs from emitter -> back-up storage needed

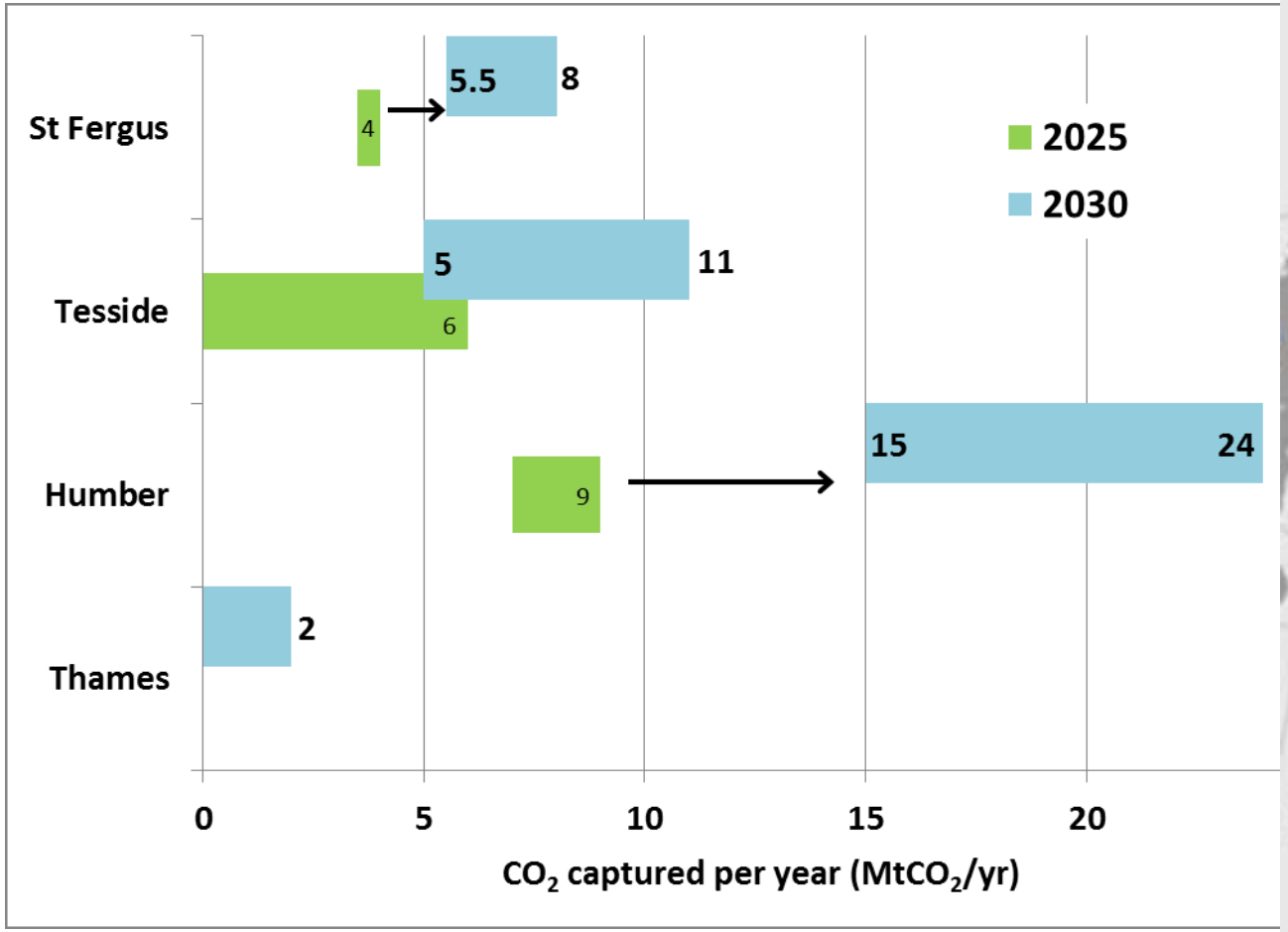
Central North Sea only real prospect

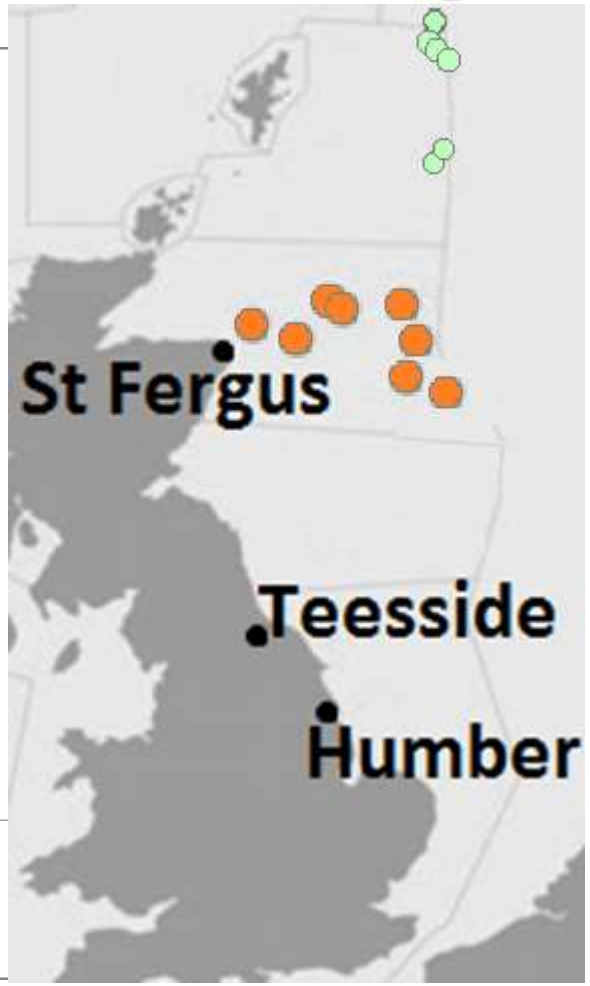


CO_2 supply unlikely to reach critical mass until 2025

Supply won't reach Northern North Sea

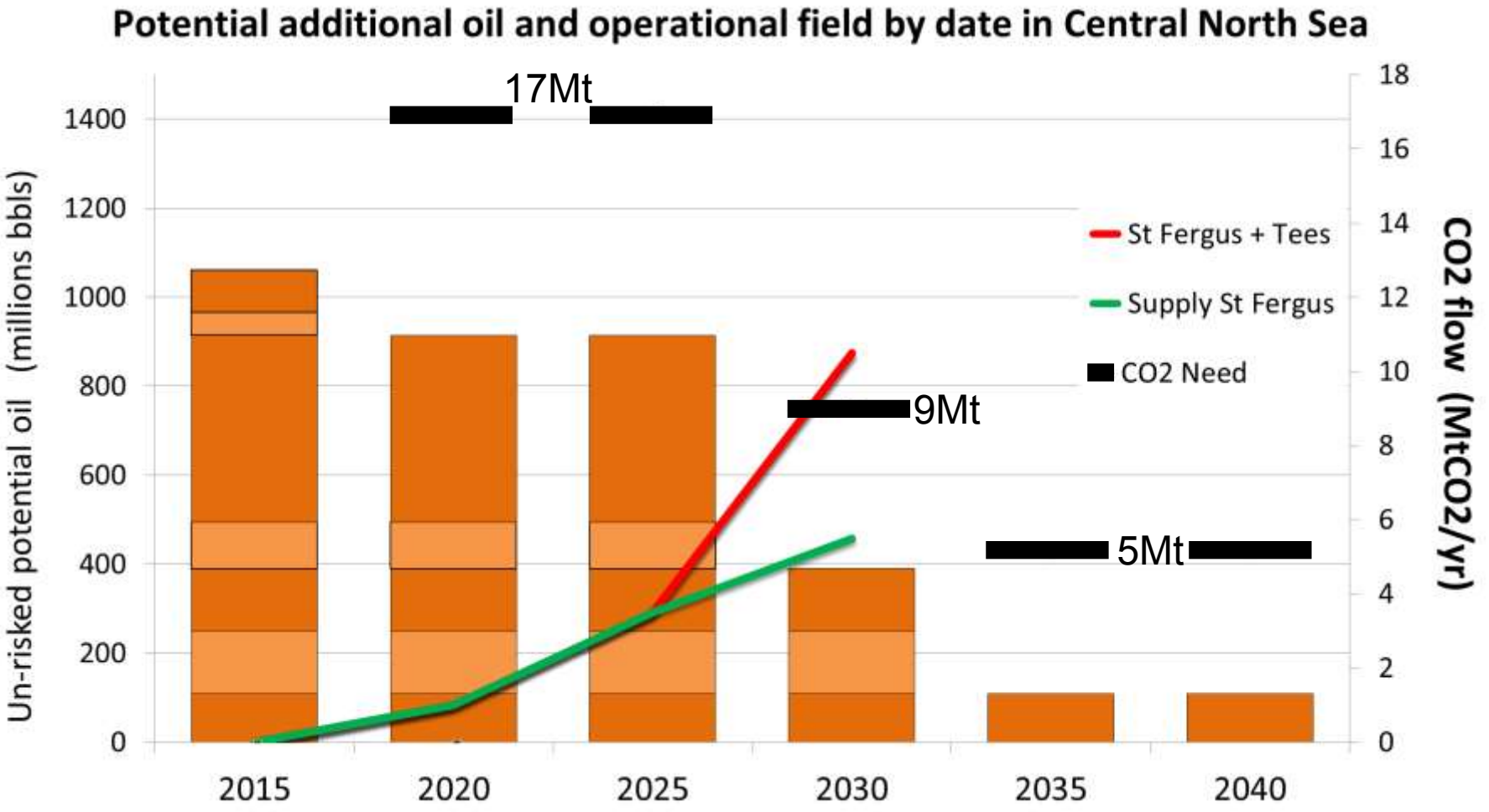
Geographical disconnect





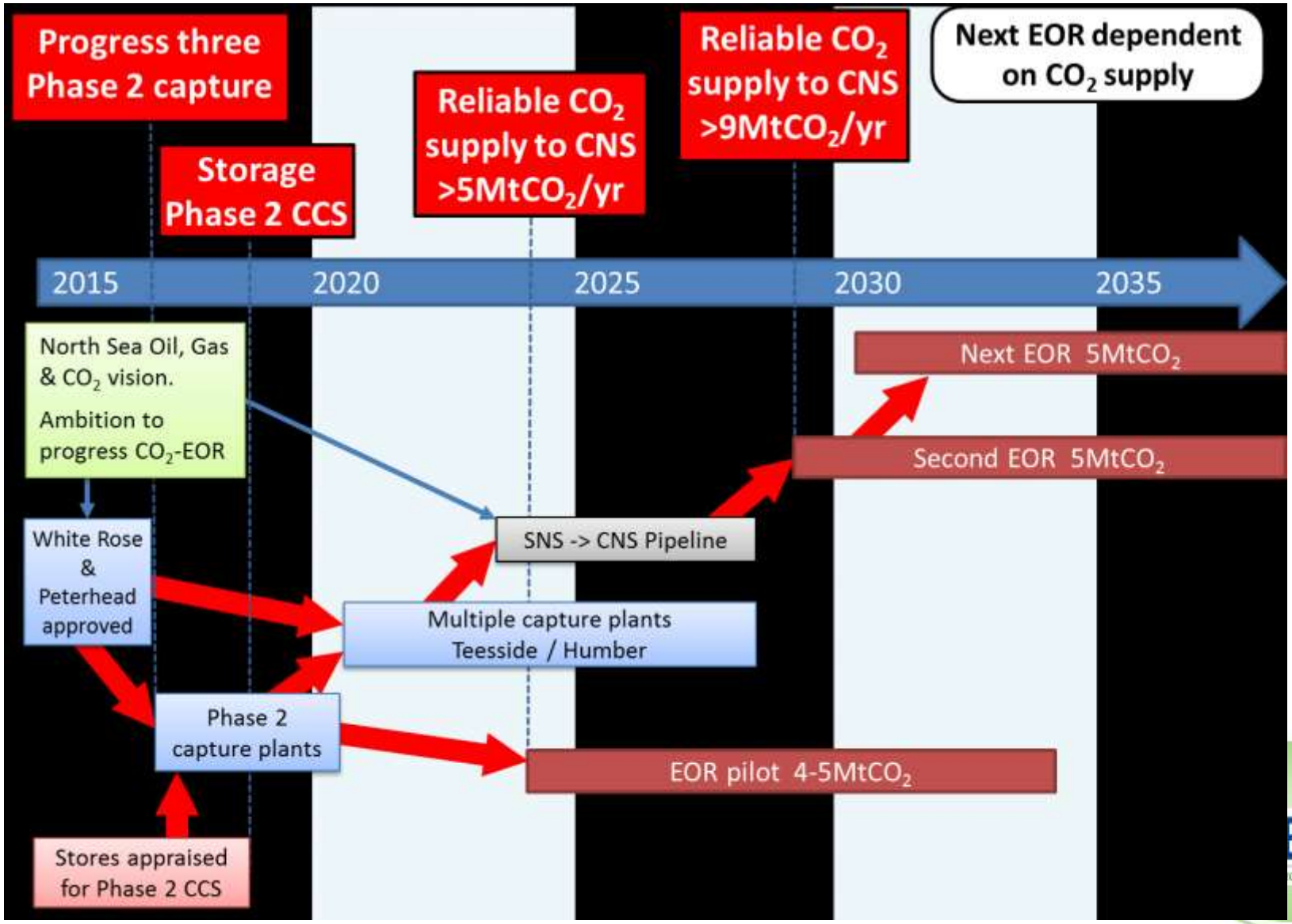
Uncertainty about CO_2 from CCS to St Fergus
Teesside pipeline would secure CO_2 supply

Timing CCS is critical for CO_2-EOR

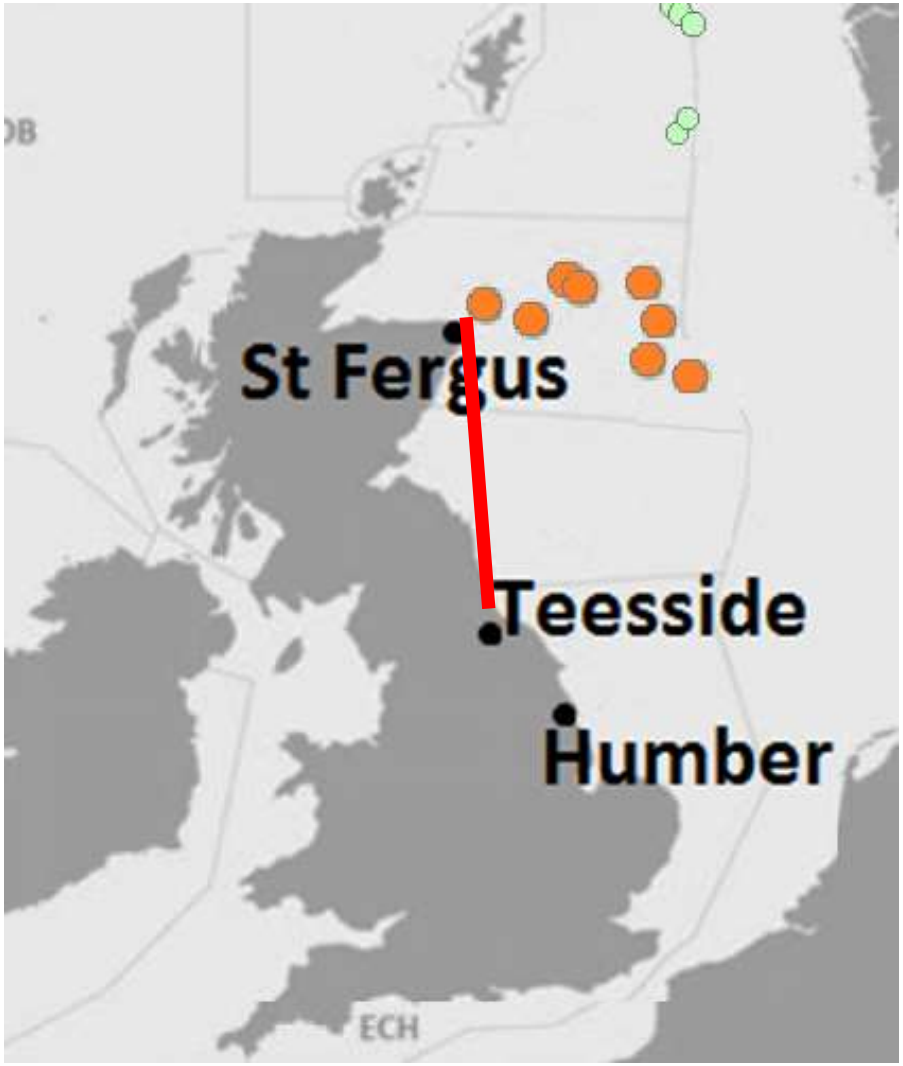


Multiple capture projects needed to secure reliable supply. Pipeline from Teesside to CNS could reduce risks.

Critical timeline for CO_2-EOR



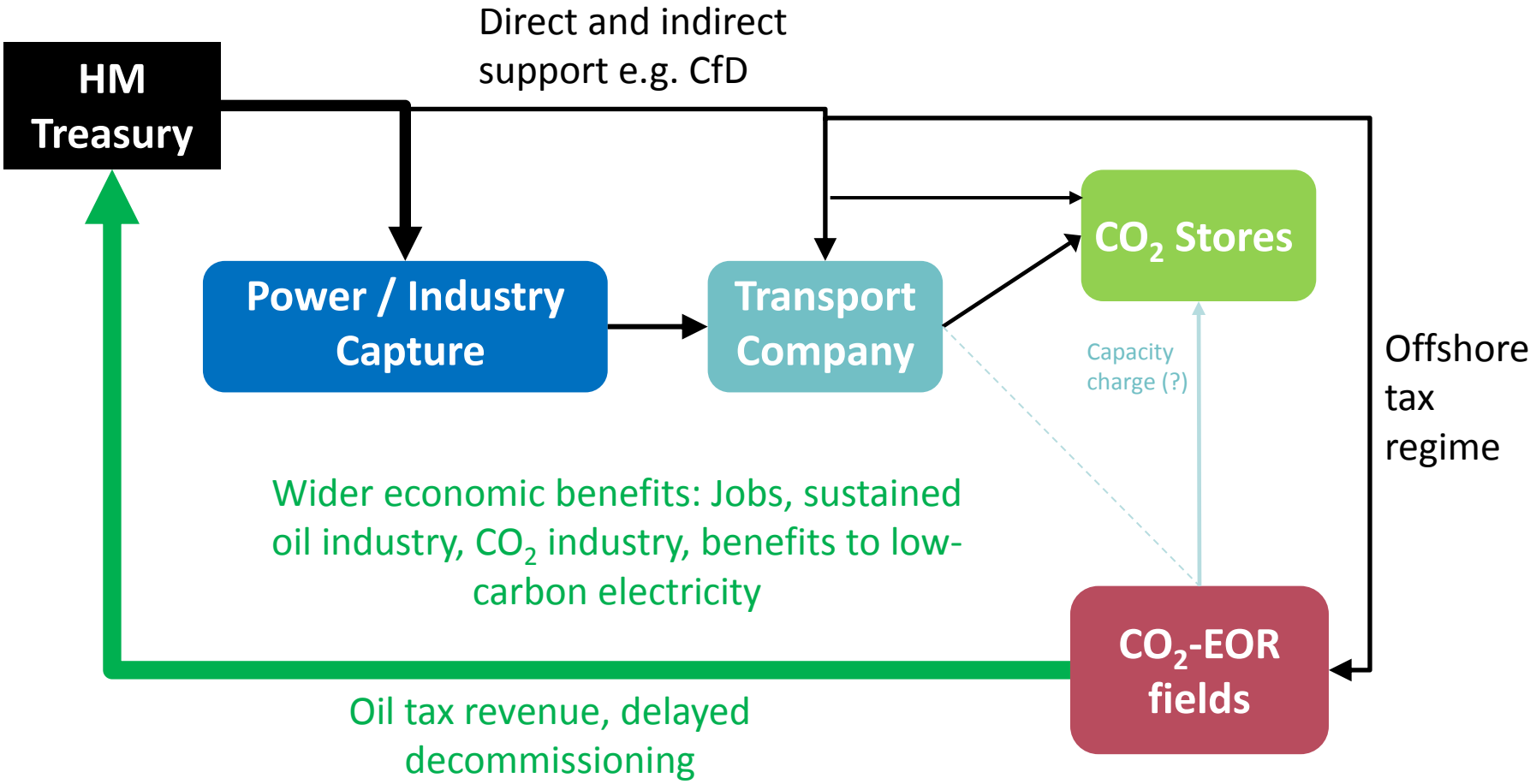
Mitigating transportation risks



Pipeline Teesside to CNS
- additional cost
- enhance CO_2 supply

CO_2 transport company
- de-risk interdependencies
- 'Market Maker'
- public support

Wider economic return on investment



Adapted from Element Energy

Recommendations

Co-ordinate oil extraction, CCS and CO_2 network in North Sea

Oil & gas operators need active role in CCS development – role for OGA
A North Sea CO_2 network could open up a new offshore industry

Early policy decisions on CCS Phase 1 & 2 will determine CO_2-EOR outcomes

Approving both CCS Commercialisation projects will help ensure CO_2 supply
Government to create environment to progress Phase 2 CCS by 2017
De-risk storage to support Phase 2 capture

Ensure offshore tax regime supports CO_2-EOR's high expense and risks

Additional support for early CO_2-EOR projects – essential for learning
Define role for OGA in incentivising development

CO_2 network to reduce risks and cost for emitters, sinks and CO_2 users

Enable a CO_2 transport company, with public support
'Market maker' role to accelerate deployment of CCS and CO_2-EOR