

Shell Exploration & Production

Petroleum Industry Response to Climate Change



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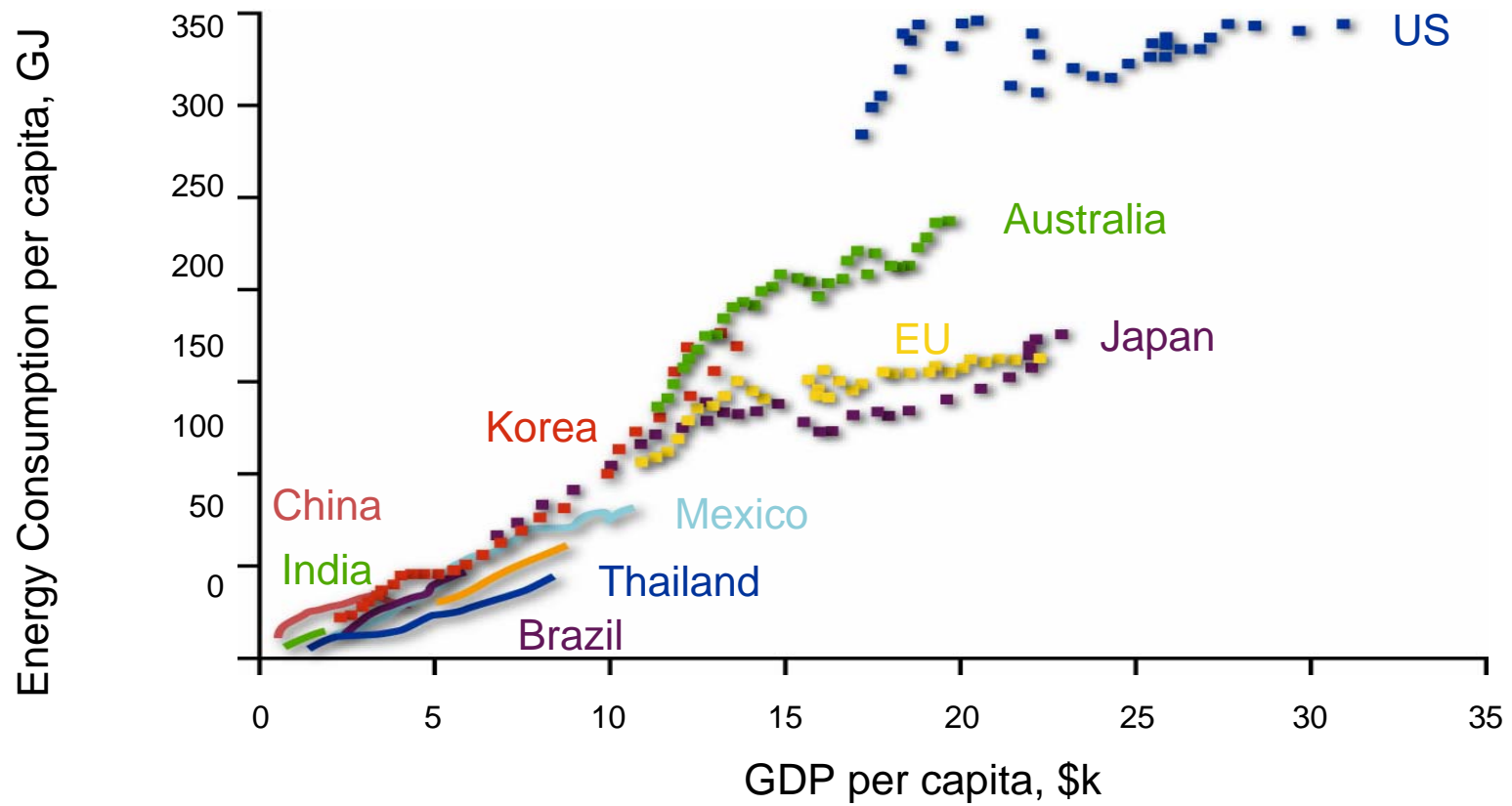


Outline

- Global context
- CO2 management “pathways”
- Energy Efficiency
- Focus on CCS, and its challenges
- What now needs to be done by companies, and by governments



The Energy Ladder



Source: IMF, BP



What firms can do to manage CO₂

6 REDUCTION PATHWAYS

Internal

- Lead with energy efficiency
- Acceleration of CO₂ Capture & Storage (CCS) solutions
- Effective and sufficient deployment of R&D resources
- Develop low CO₂ sources of energy

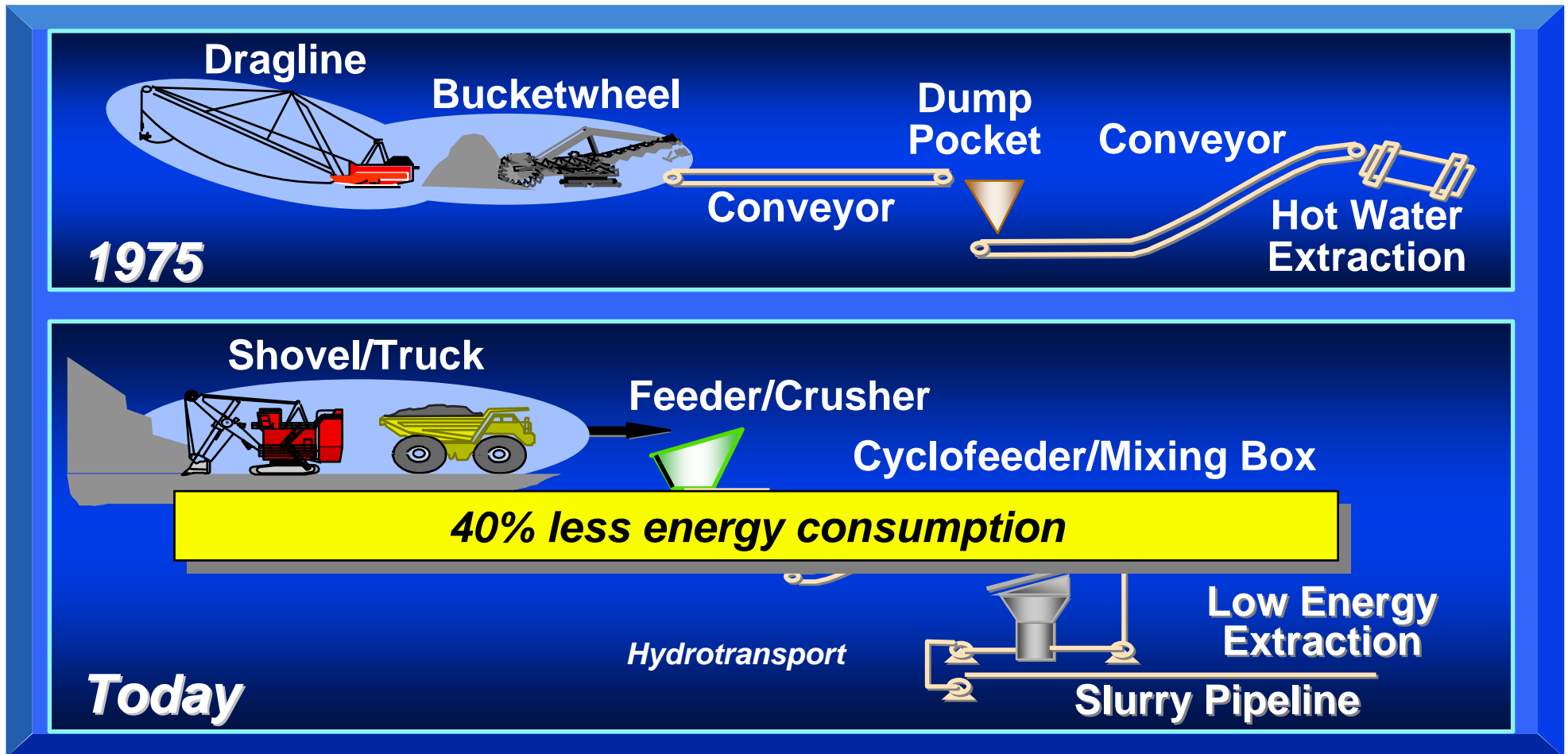
External

- Reduction in energy demand
- Alliances and advocacy with governments & regulators



CO2 management starts with energy efficiency

Mining/extraction Technology example - Canada



Energy Efficiency in new platforms offshore

Southern North Sea

- Unmanned platforms
- 40% less weight than previous designs, more than 50% cost saving
- Power from renewables
 - Wind
 - Solar



Impact of not doing CCS

(source: Prinn et al, MIT, September2008)

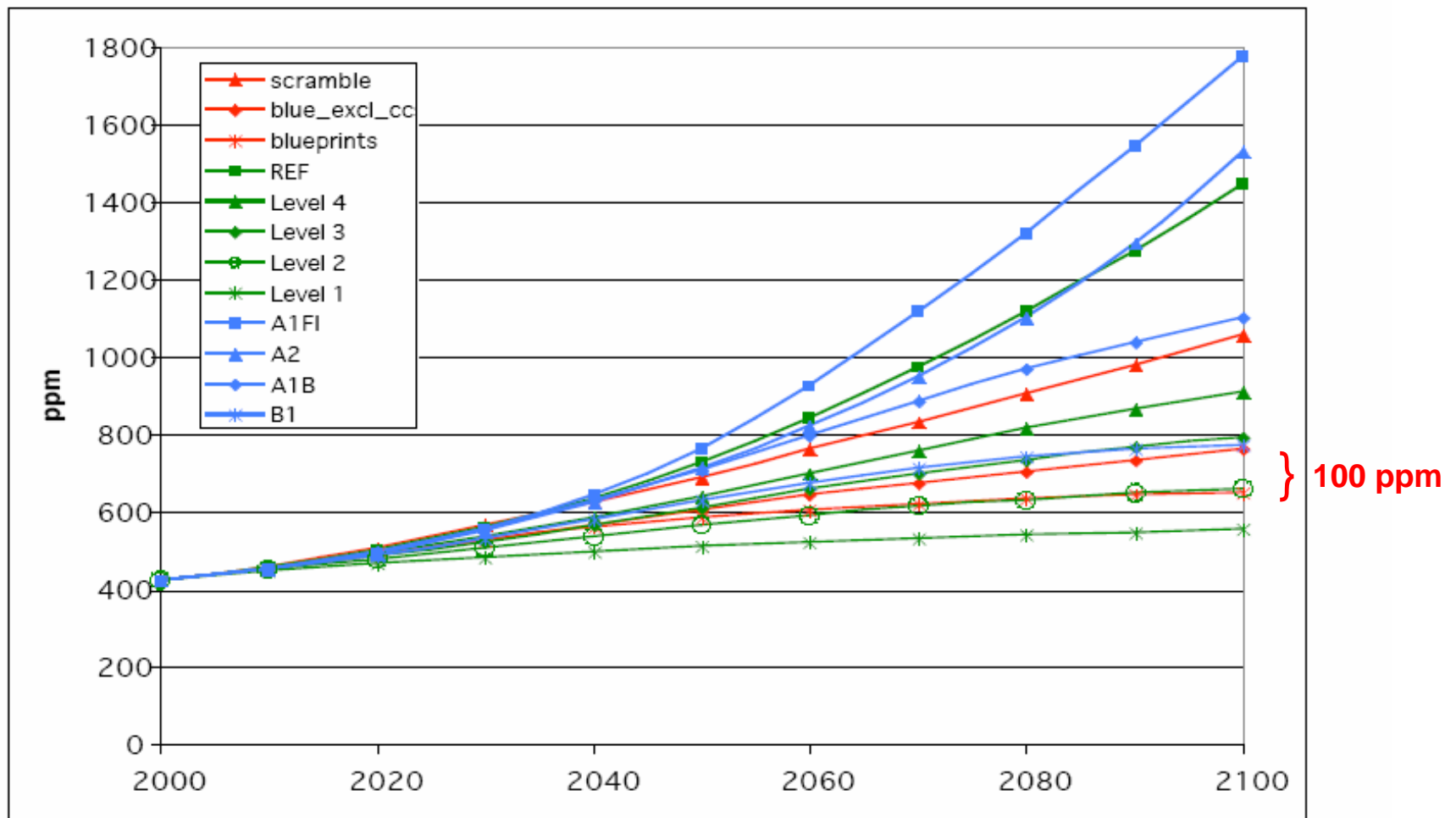
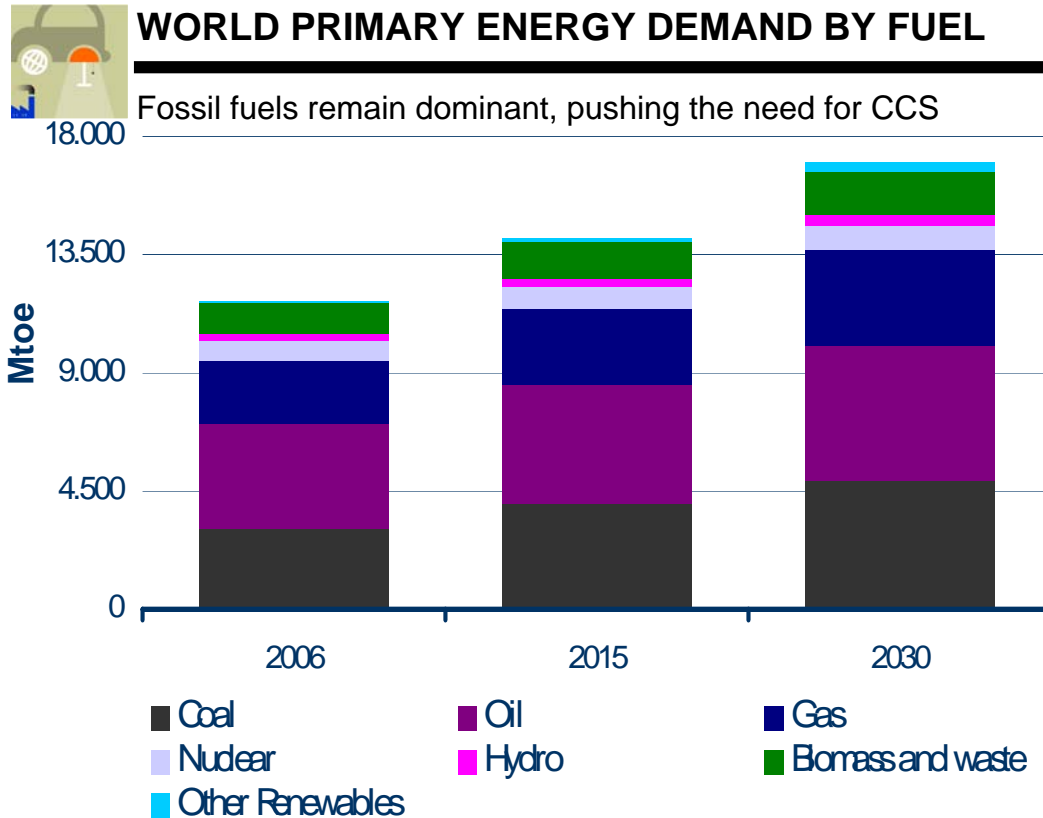


Figure 6. Total (in CO₂ equivalents) concentrations of GHGs (Shell in red, CCSP in green, SRES in blue).



CCS is a part of the solution



Source: World Energy Outlook 2008, International Energy Agency

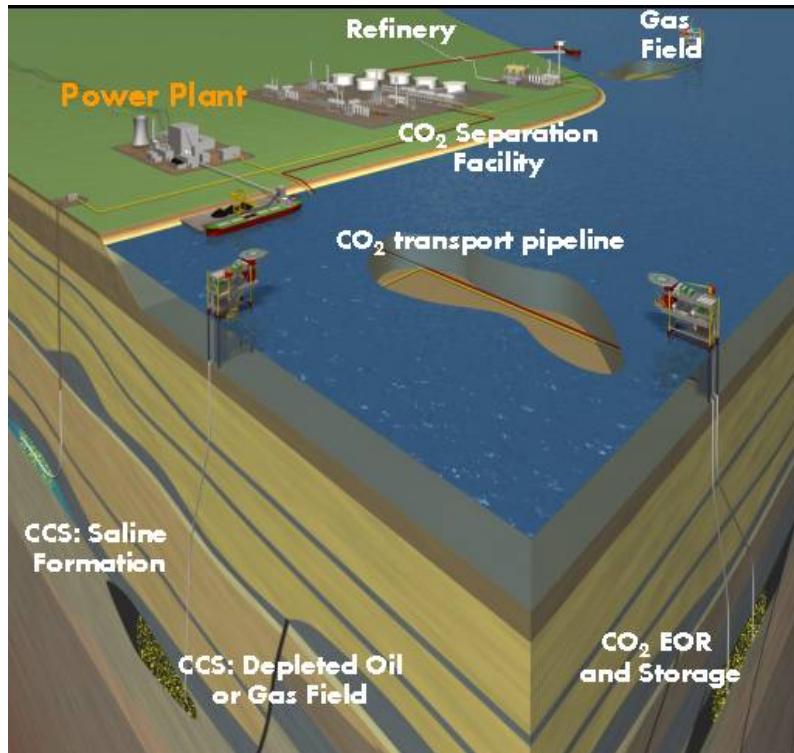
MEETING DEMAND WITH LESS CO₂

The world will need ALL options it has

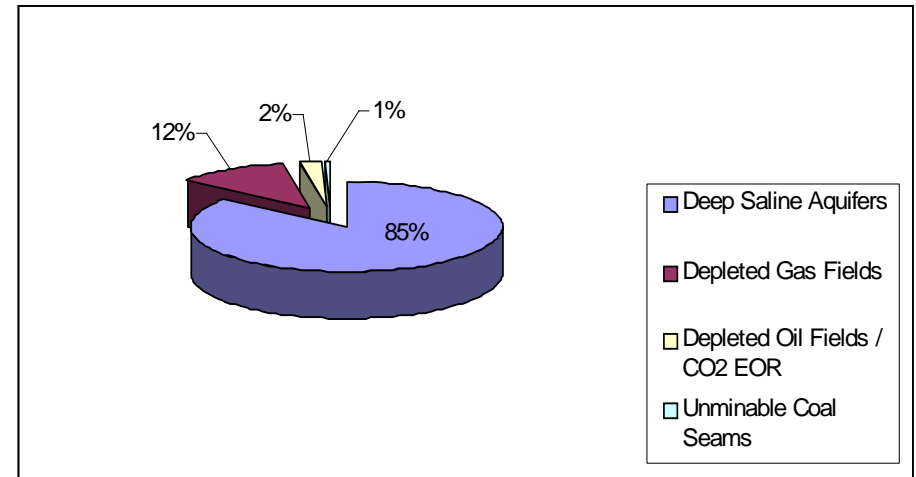
- Energy efficiency
- AND
- Renewables
- AND
- Nuclear
- AND
- CO₂ Capture and Storage



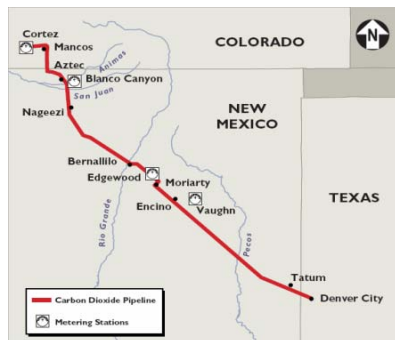
Overview of CCS : Transport & Storage



Worldwide Storage Capacity Estimates



Source: IPCC 2005



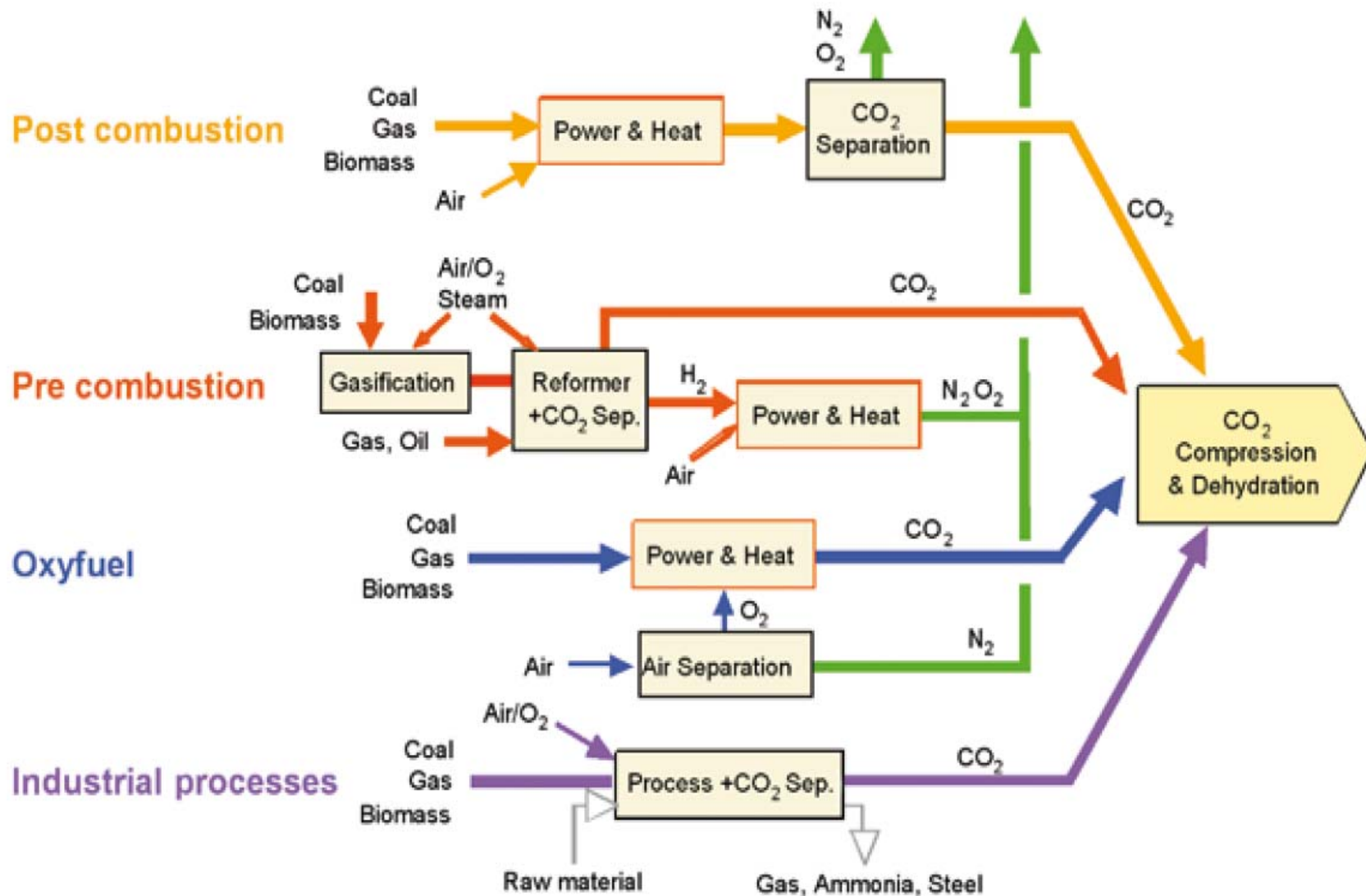
CO₂ transport,
Cortez pipeline



CO₂ transport
(Cortez pipeline booster, USA)

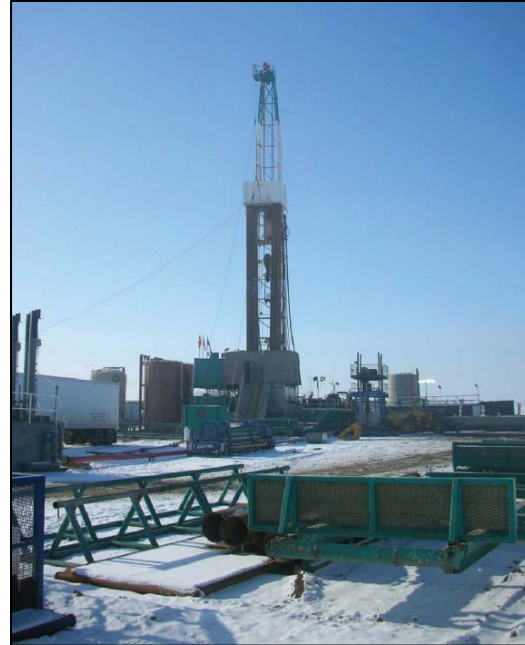


Overview of CCS : Capture



Challenges of CCS : Technical

- Site selection
- Storage capacity
- Contaminants
- Driving down cost
- Monitoring



CCS appraisal drilling, Canada



IGCC plant – onstream since 1994 (Netherlands example)

Net output 253 MW; heat rate 8300 Btu/kWh (HHV)



Challenges of CCS : Non-Technical

- Public acceptance
- Commercial framework
- Regulatory framework for pore space access
- Long-term liabilities

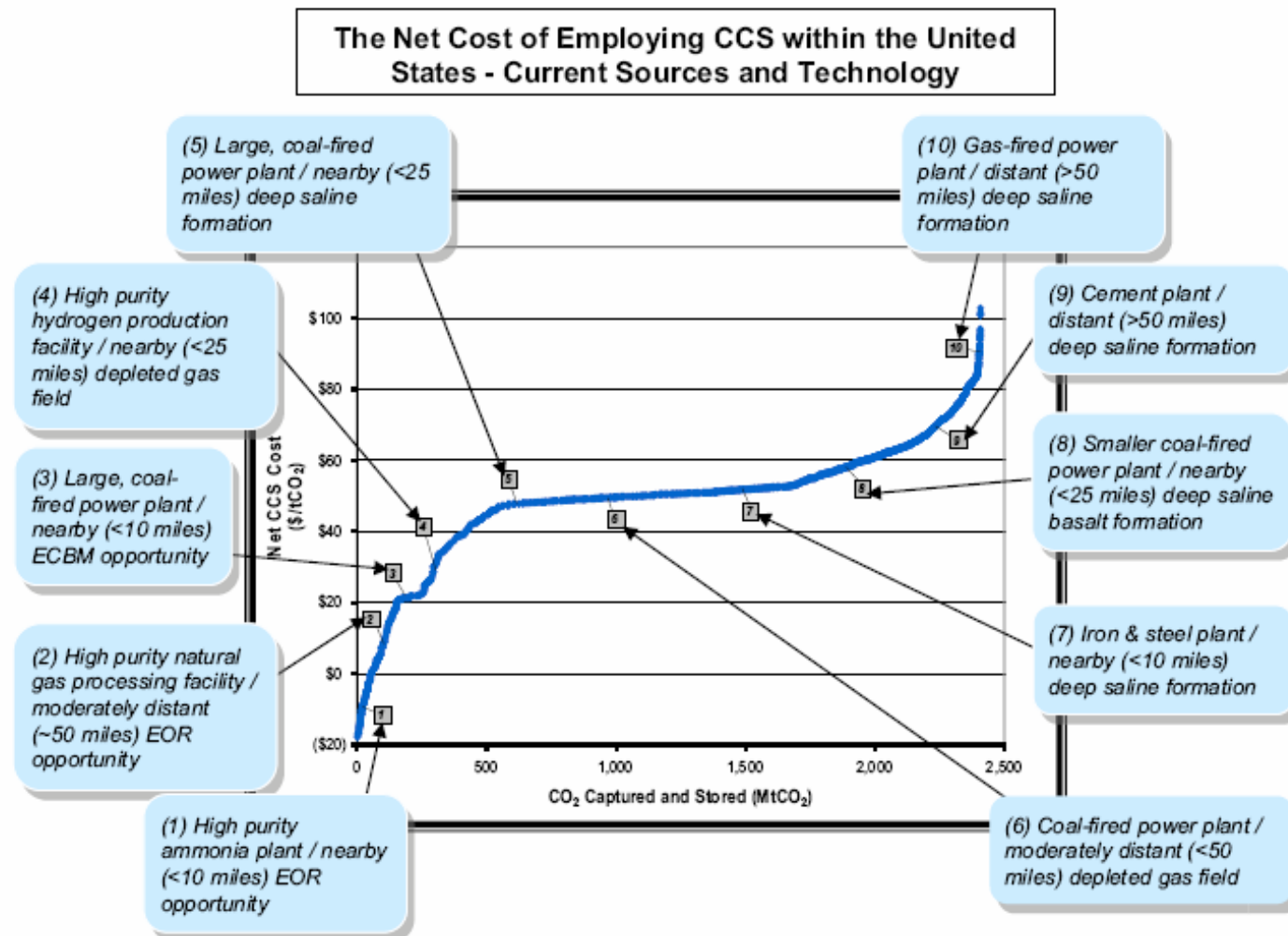


Karl-Heinz Wolf was shocked by the way he was heckled and called a “traitor” at the Barendrecht meeting.

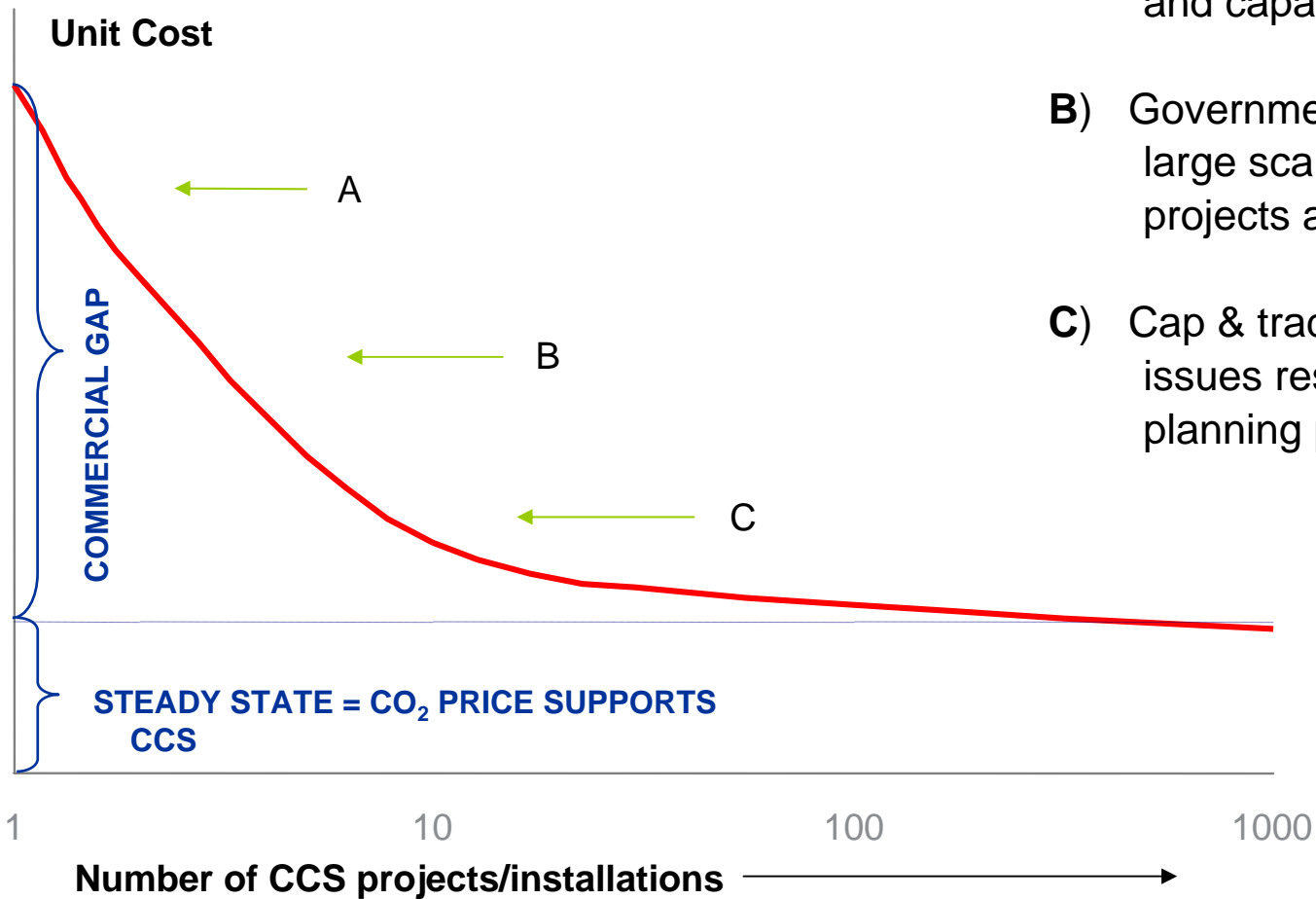
“I’m not used to things like that, I’m a teacher and a scientist.”



How much does it cost? - No single answer!



Cost Drivers and Trends



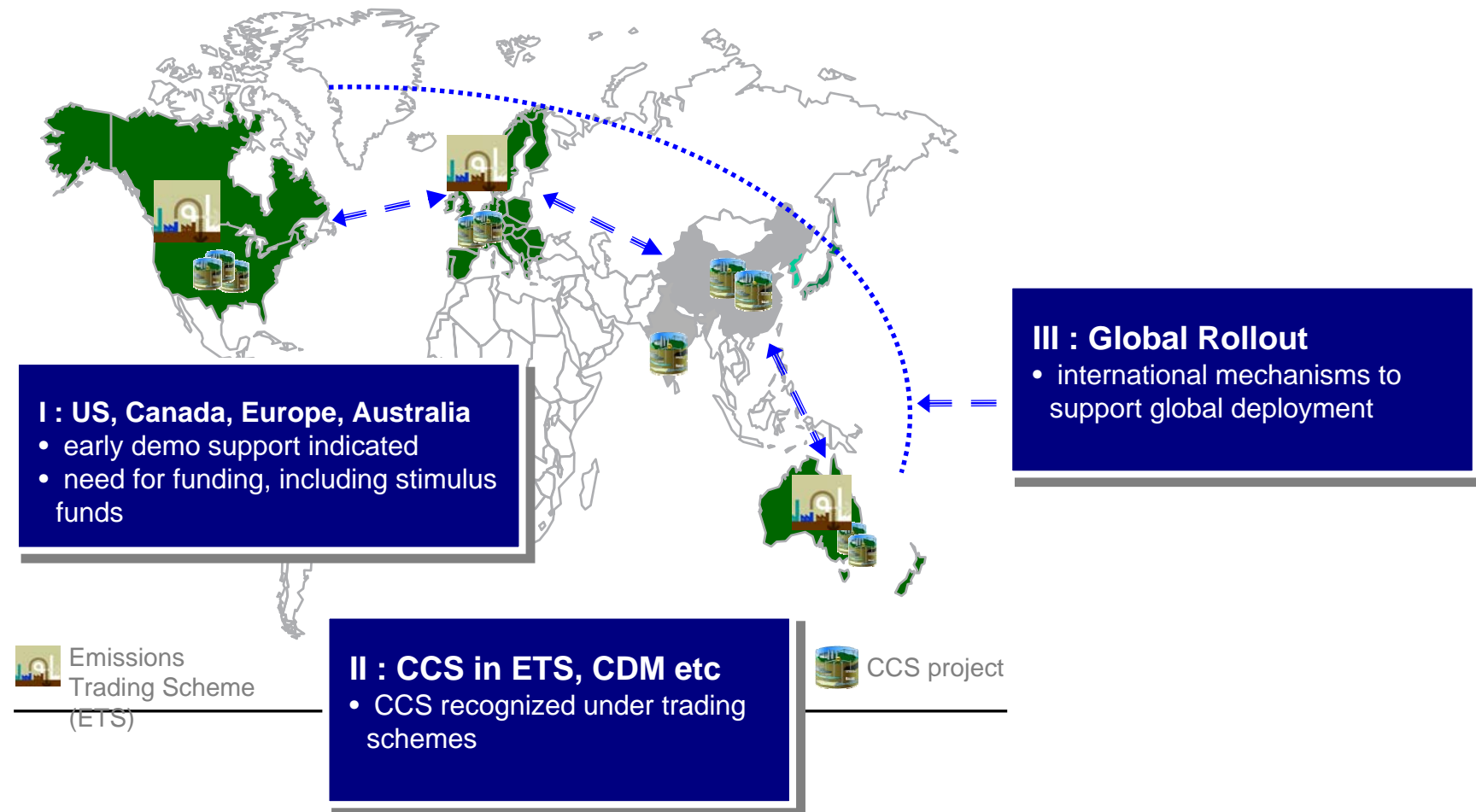
- A) Industry developing technology and capabilities
- B) Government financial support for large scale demonstration projects and infrastructure
- C) Cap & trade framework, liability issues resolved, fast track planning permission process



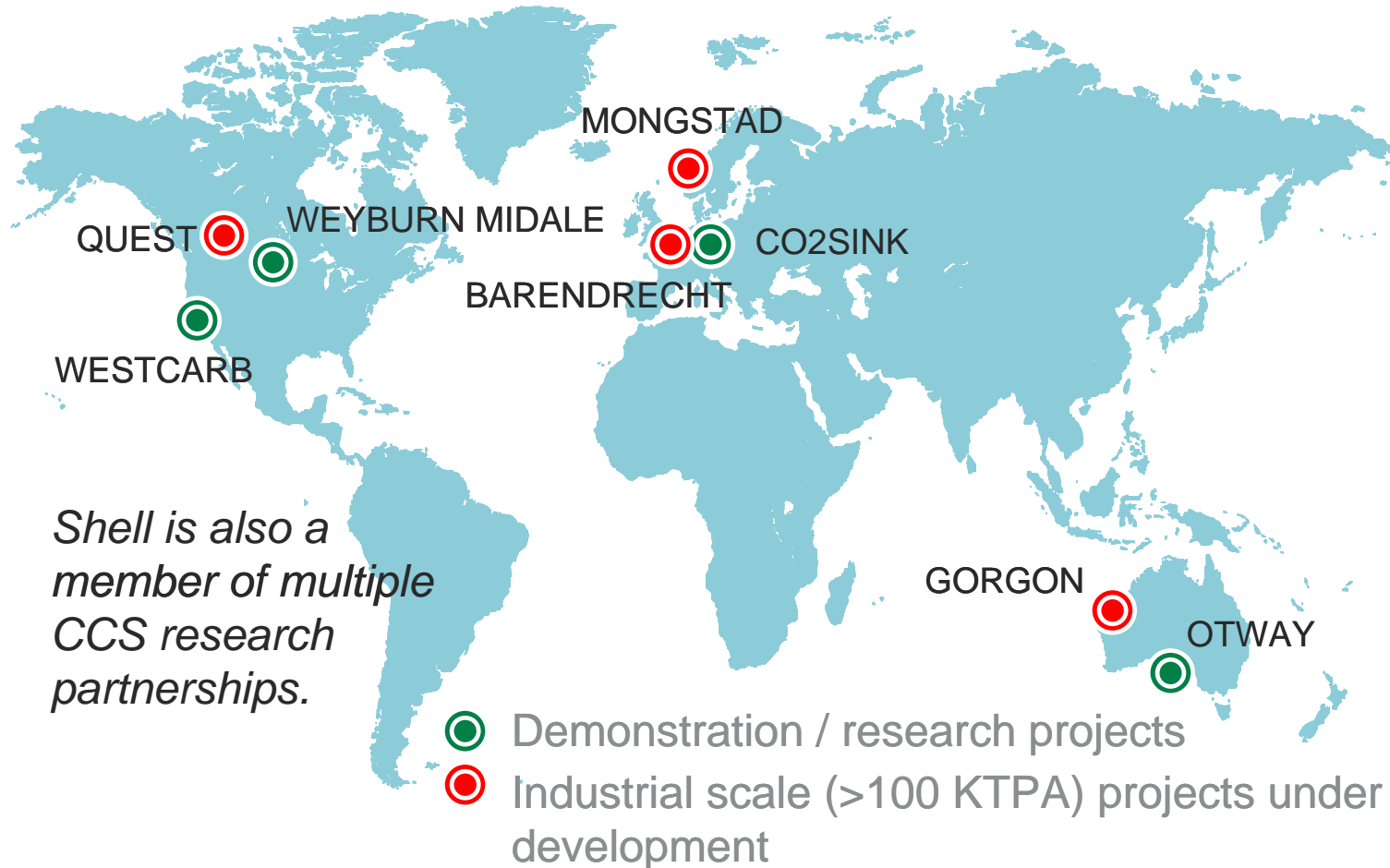
The Role of CO₂ Markets

FUNDING CCS PROJECTS THROUGH EMISSIONS TRADING

Graphics are illustrative



Shell's Portfolio of Projects to address CCS



CO2SINK Germany, 2008 first European onshore C2O injection

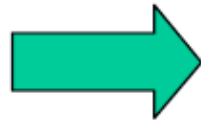


Quest CCS project – Alberta, Canada

CO2 Capture



Scottford Base plant +
Expansion-1 Upgrader
(270,000 bpd)
3 SMR's to capture
up to 1.2 mtpa of CO2



Pipelines



Sequestration near Scottford



Commercial enhancements
to be evaluated



Managing CO₂ – key messages

- Shell has defined 6 “pathways” for managing CO₂
- Energy Efficiency should be the starting point – for existing assets, and for the new asset fleet
- But energy efficiency alone will not suffice, and CCS will be required
- Oil companies bring relevant skills and technology to CCS, but governments need to play a strong leadership role, too
 - Funding for early demonstration
 - Regulatory frameworks which address pore space access and long term liability
 - Bringing the public to acceptance of CCS
 - International agreements to ensure CCS happens outside the developed world
- Shell’s demonstration portfolio is designed to test a wide range of storage types and capture technologies



