A Brief Worldwide Look at CCS Technology & Plans

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by

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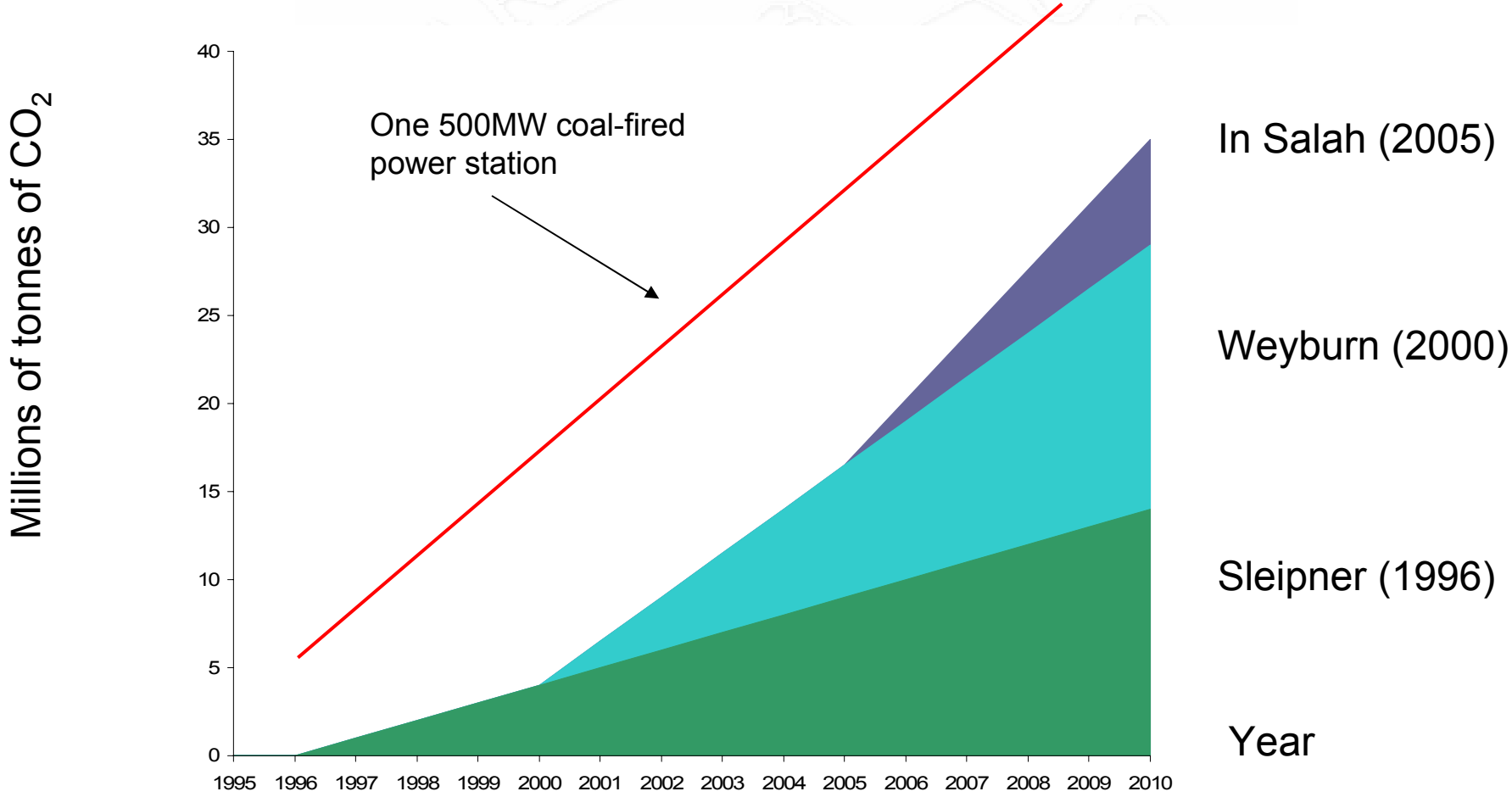
Existing CCS 'Commercial'* Projects

- There are 3 projects that can be said to be operating 'commercially' at a significant scale.
  - Sleipner
  - Weyburn
  - In Salah
- These schemes each capture and store approximately 1 million tonnes CO_2/year
- This total of 3 million tonnes CO_2/year is roughly equivalent to the annual emissions from one modern coal-fired power plant.

*'Commercial' as opposed to non-commercial demonstrations

Monitored CO_2 Stored Underground



Commercial CCS Projects

Sleipner

Snøhvit

In-Salah

Weyburn

Images Courtesy of BP, Statoil, and PTRC

These 3 'Early-opportunity' CCS Projects

- Are integrated with an existing infrastructure/project
- Have a convenient store for CO_2
- The cost of CO_2 is considerably less than the cost of capturing it at a power station.
  - Low-cost CO_2 sources:
    - Where it has to be removed from raw natural gas to meet pipeline specifications or for LNG production
    - Synthesis gas clean-up e.g. in hydrogen production.

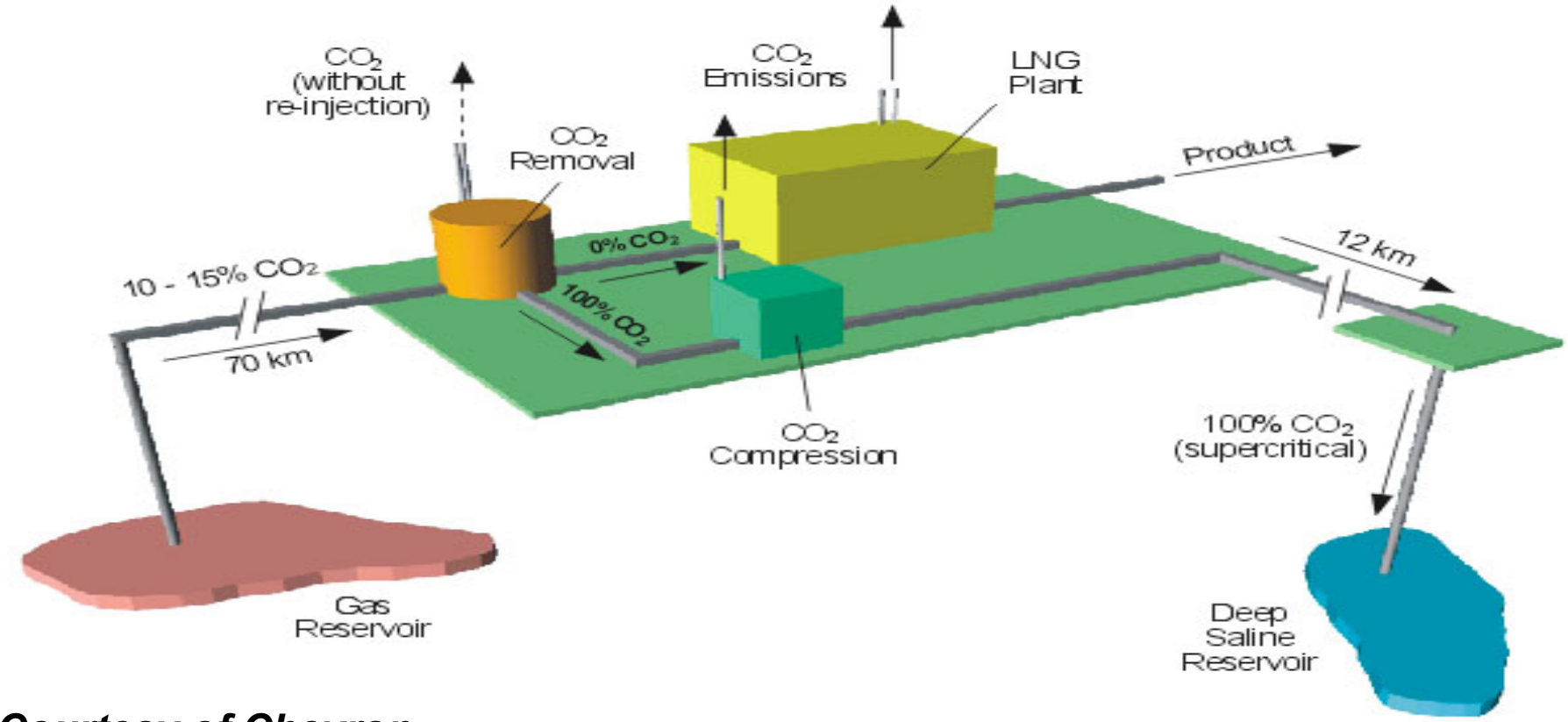
Other Commercial CCS Projects Underway

- Snøhvit (start-up 2006)
- Gorgon (operation start 2008-2010)
- Miller-Peterhead –DF1 (operation start 2009)
- Carson - DF2 (operation start 2009)
- Draugen (operation start 2010)

Total CO_2 to be stored by the above:

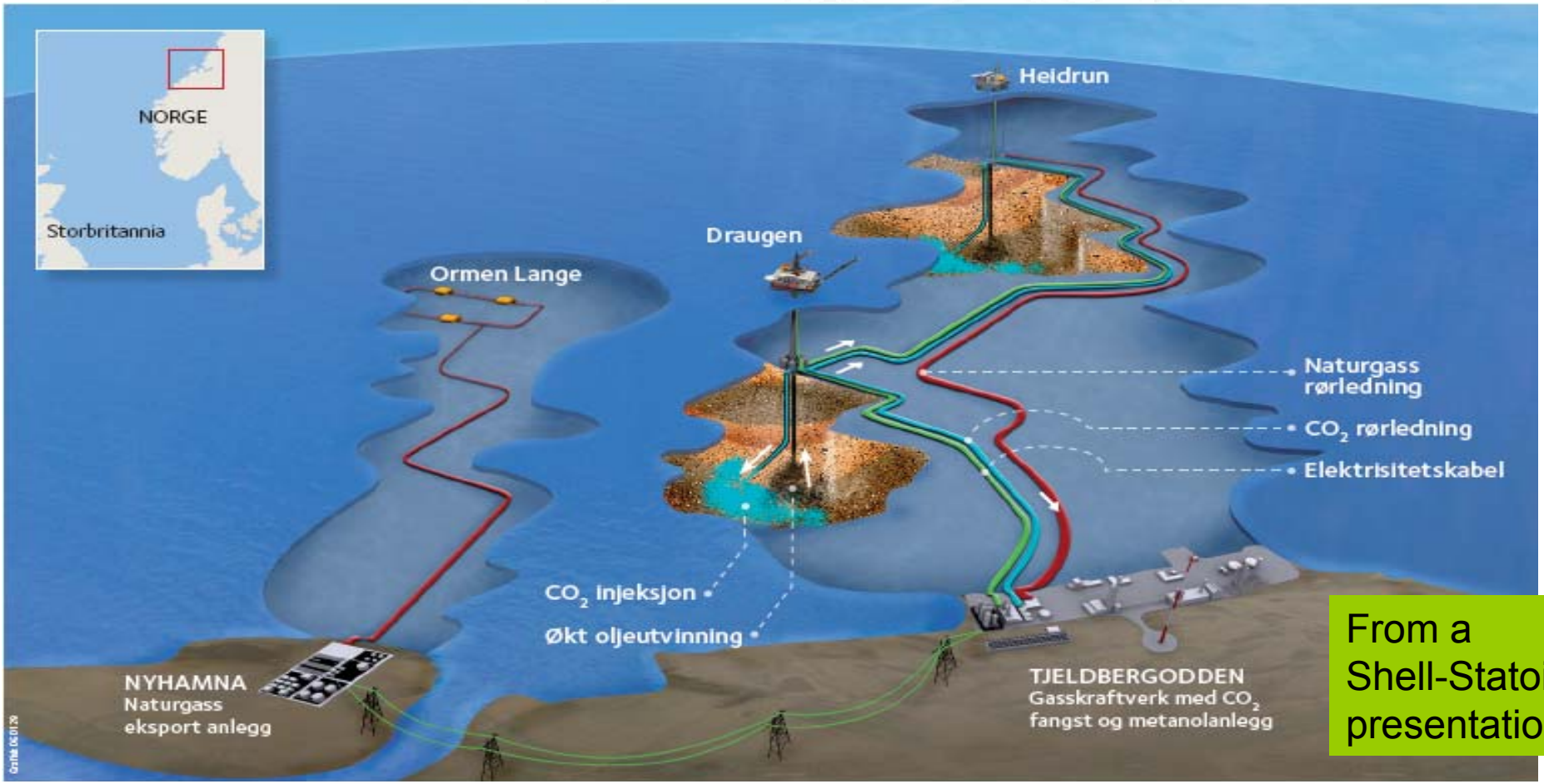
12.5 million tonnes CO_2 / year

Gorgon LNG plant with CO_2 capture



Courtesy of Chevron

Schematic of the Shell/Statoil – Draugen Project

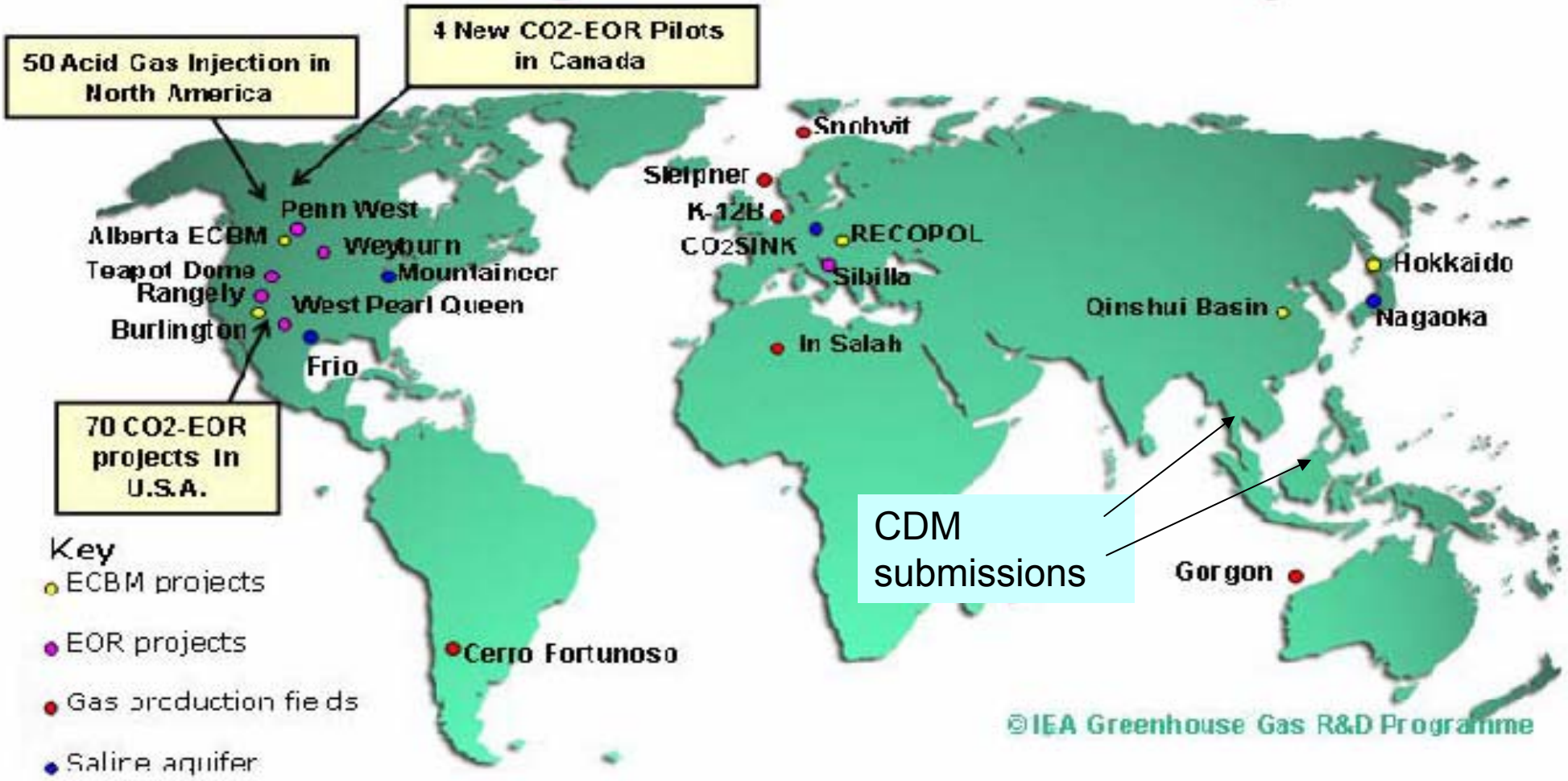


From a Shell-Statoil presentation

Key considerations for early-day CCS projects

- Applicable state/national/international incentives
  - 2 CCS projects have been submitted under the Kyoto CDM (Clean Development Mechanism)
- Taxes applicable to incremental oil/gas
- Risk sharing
- Finance sourcing/cost
- Long-term liability issues

CO_2 Storage Demonstration Projects

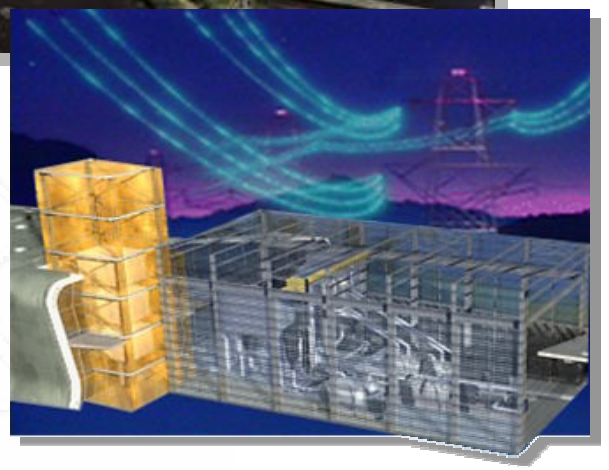


Coal-based CCS 'Demonstration' activity outside the USA

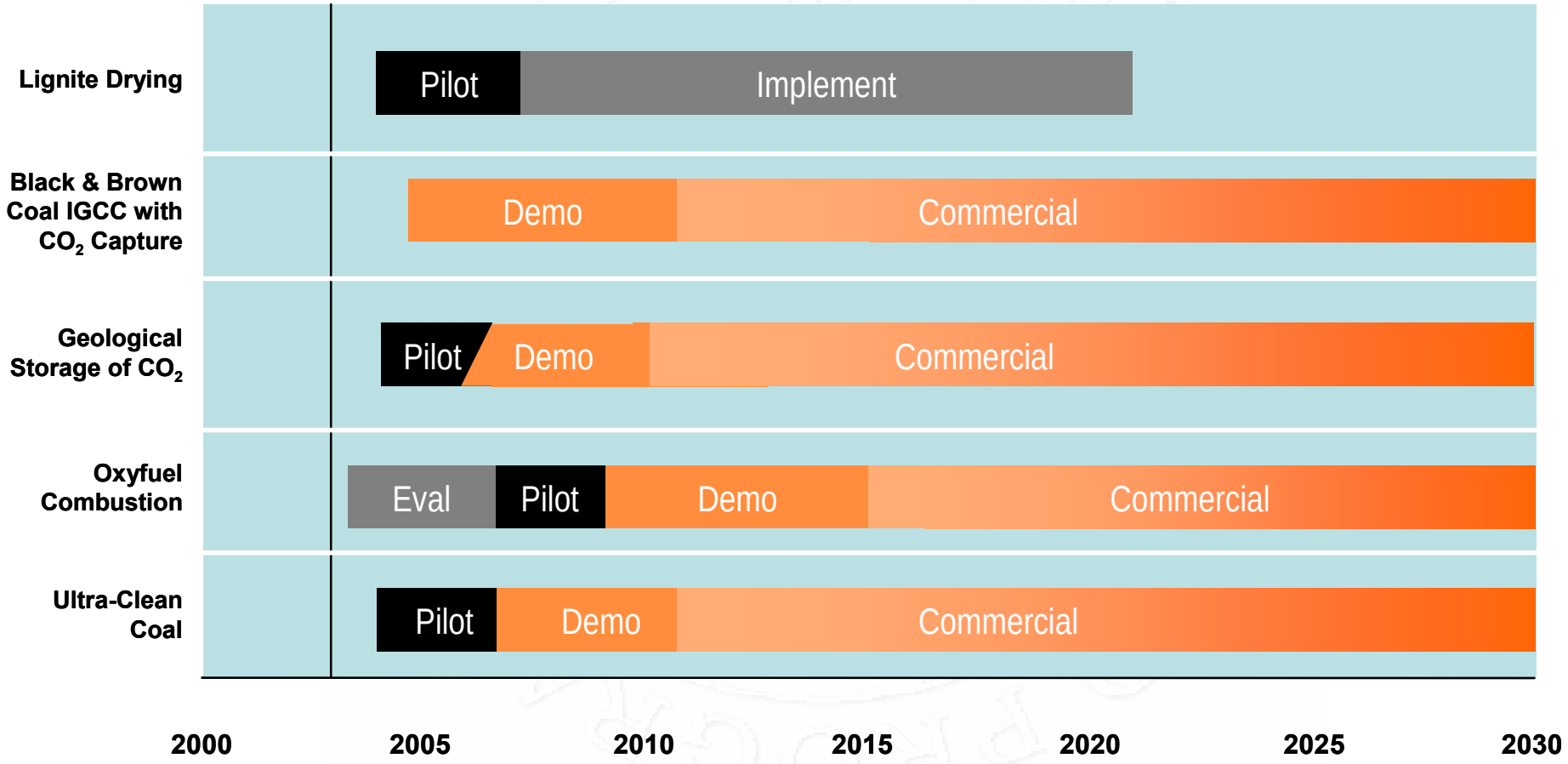
- Stanwell, Australia (operation start 2010)
- SaskPower, Canada (operation start 2012)
- HYPOGEN/DYNAMIS (operation start after 2012)
- RWE
  - Germany
  - UK
- E.ON UK

USA Roadmap Development Principle

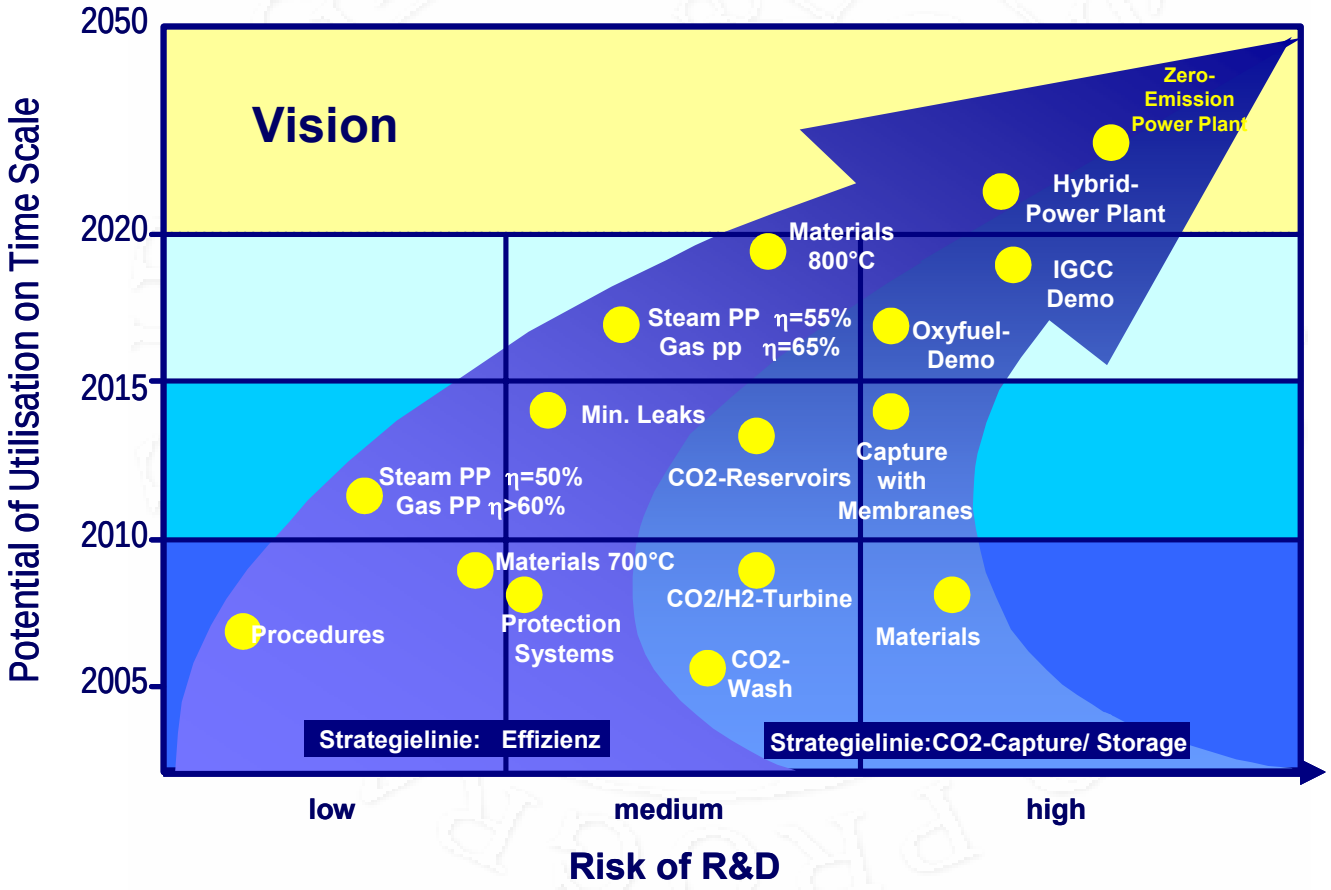
- *Short-term:* keep existing fleet in service; prepare for transition to near-zero-emission future
  - SO_2, NO_x, Hg
  - Plant optimization and control
  - Reduced carbon intensity
- *Long-term:* add near-zero emission energy plants
  - IGCCs to market
  - Advanced materials
  - Ultra-high efficiency hybrid systems
  - CO_2 capture and storage



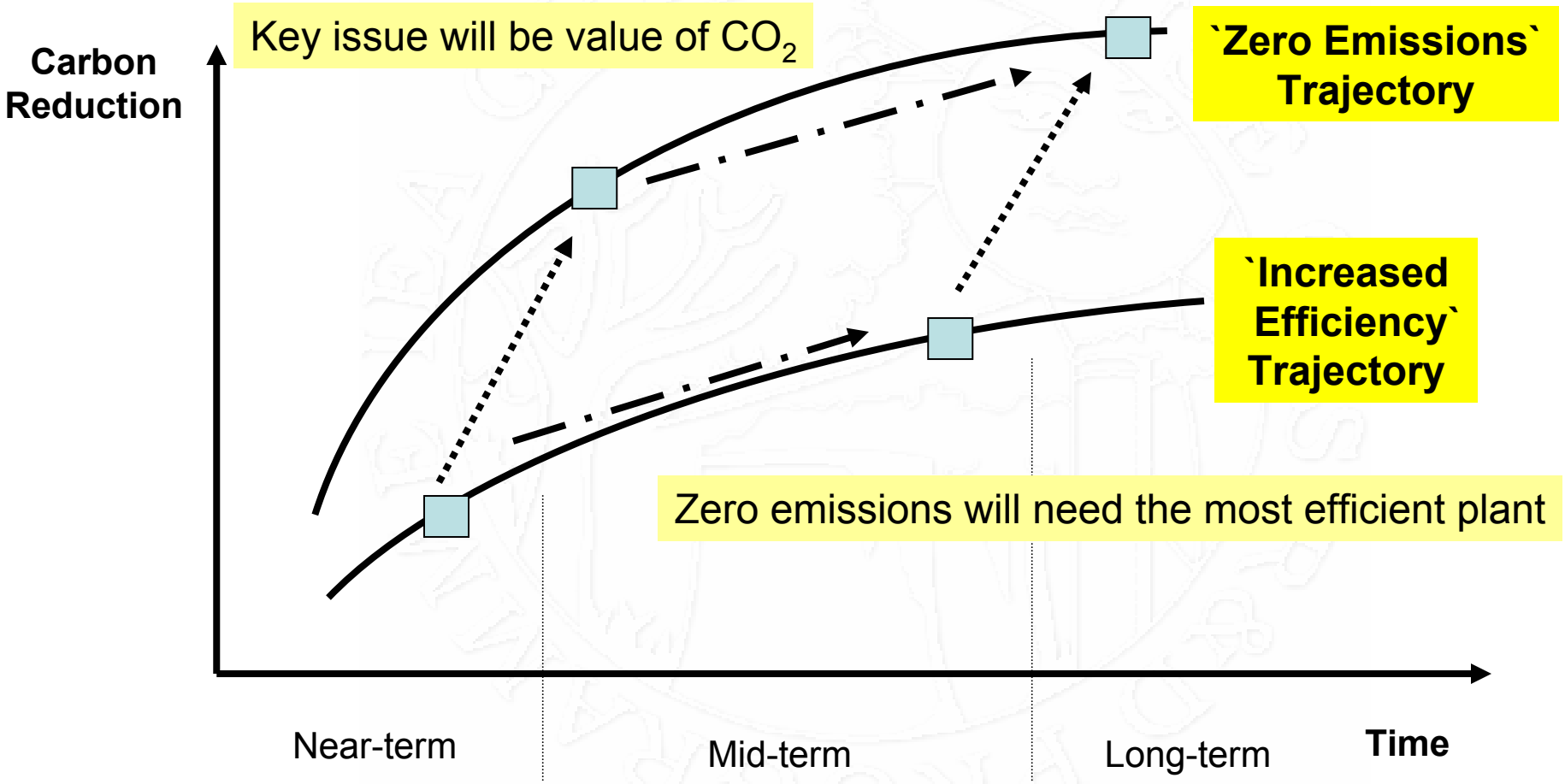
Australia – Coal21 Action Plan



German: COORETEC Programme



UK: CAT* Options are complementary



*Carbon Abatement Technologies

Coal-based Road Maps

Coal-based road maps based on:

COMMON THEME: CLEAN COAL VISION

Components of European Commission's FP7

- Continued focus on Carbon Capture and Storage
- Re-introduction of Clean Coal Technology in recognition of the drive for greater efficiency whilst CCS is developed and deployed
- Industrial Technology Platform to advise on strategy and direction of these two elements

European Based R&D Programme

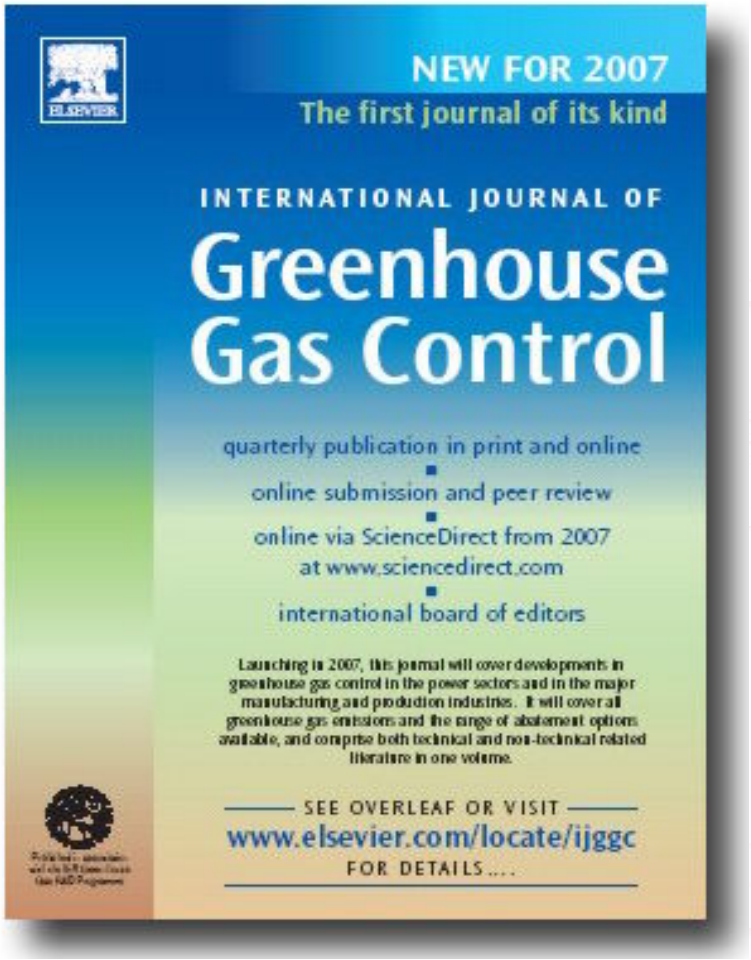
- CCS pilot plant projects
  - Enhanced Capture of CO_2 in Large Power Plant (ENCAP) Project – FP6 funded project
  - CO_2 from Capture and Storage (CASTOR) – FP6 funded project dealing with post-combustion capture
  - Vattenfall taking the initiative – 30 MWth oxyfuel pilot plant study

- Material Development Programme: us/c Pf combustion
  - Component Test Facility for a 700^{o}C Power Plant (COMTES700) – RFCS funded project – continuation of AD700 programme

CONCLUSIONS

- CCS firmly on Worldwide policy agenda
- Significant CCS activity:
  - Oil & Gas industry – driven by ‘early opportunities’
  - Coal industry – driven by ‘clean coal’ visions

ADVERT: NEW JOURNAL



Thank You

Any Questions?

Reference material on CCS can be found at

www.co2captureandstorage.info

GENERAL WEB SITE: www.ieagreen.org.uk