
dti

CCS Activities in the UK – a Perspective

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CCS Activities in the UK – a Perspective

Policy related activities:

- Legal and regulatory
- Carbon Abatement Technology (CAT) strategy, 2005
- Energy Review, Stern Report, Treasury Consultation

Technology related activities:

- Research
- R&D
- Component demonstration
- Commercial project activity

Policy Related Activities

Policy – Legal and Regulatory

Key Objectives:

- Enable CCS to be part of portfolio of measures to achieve UK's 20% and 60% CO_2 reduction goals
  - Overcome legal and/or regulatory impediments to a large-scale deployment
  - Push for inclusion in Kyoto CDM and EU ETS
- Tackle future CO_2 emissions from developing countries with burgeoning fossil fuel use
- Engage with other parties on CCS (e.g. EU, UNFCCC Parties, Norway, Australia)

Needs action at **International**, **EU** and **UK** levels

Policy – Legal and Regulatory

- International
  - UNFCC: Status under Kyoto Protocol CDM, adoption of IPCC inventory guidelines for CCS
  - International marine conventions: London, OSPAR
  - CSLF
  - IEA
  - International collaboration, eg China ('nZEC')
- EU
  - 2nd EU Climate Change Programme
  - CCS in EU Emissions Trading Scheme Phase 2
  - North Sea Basin Task Force

Policy – Legal and Regulatory

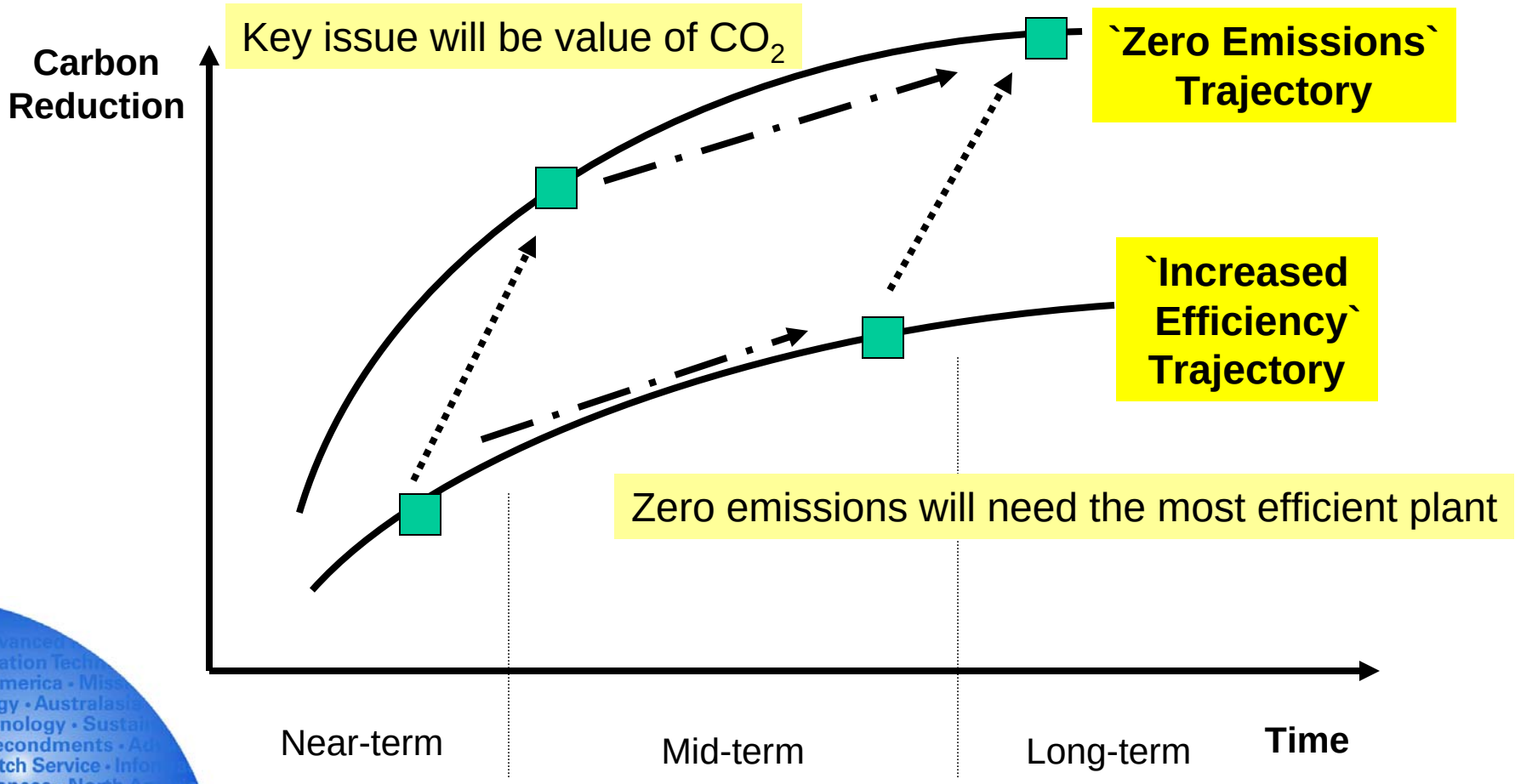
- UK
  - CAT Strategy, 2005
  - Regulatory Task Force on CCS
  - Marine Bill
  - Energy Review, 2006 (White Paper, 2007)
  - Stern Report
  - Treasury Consultation on CCS

Policy – CAT Strategy

CAT options:

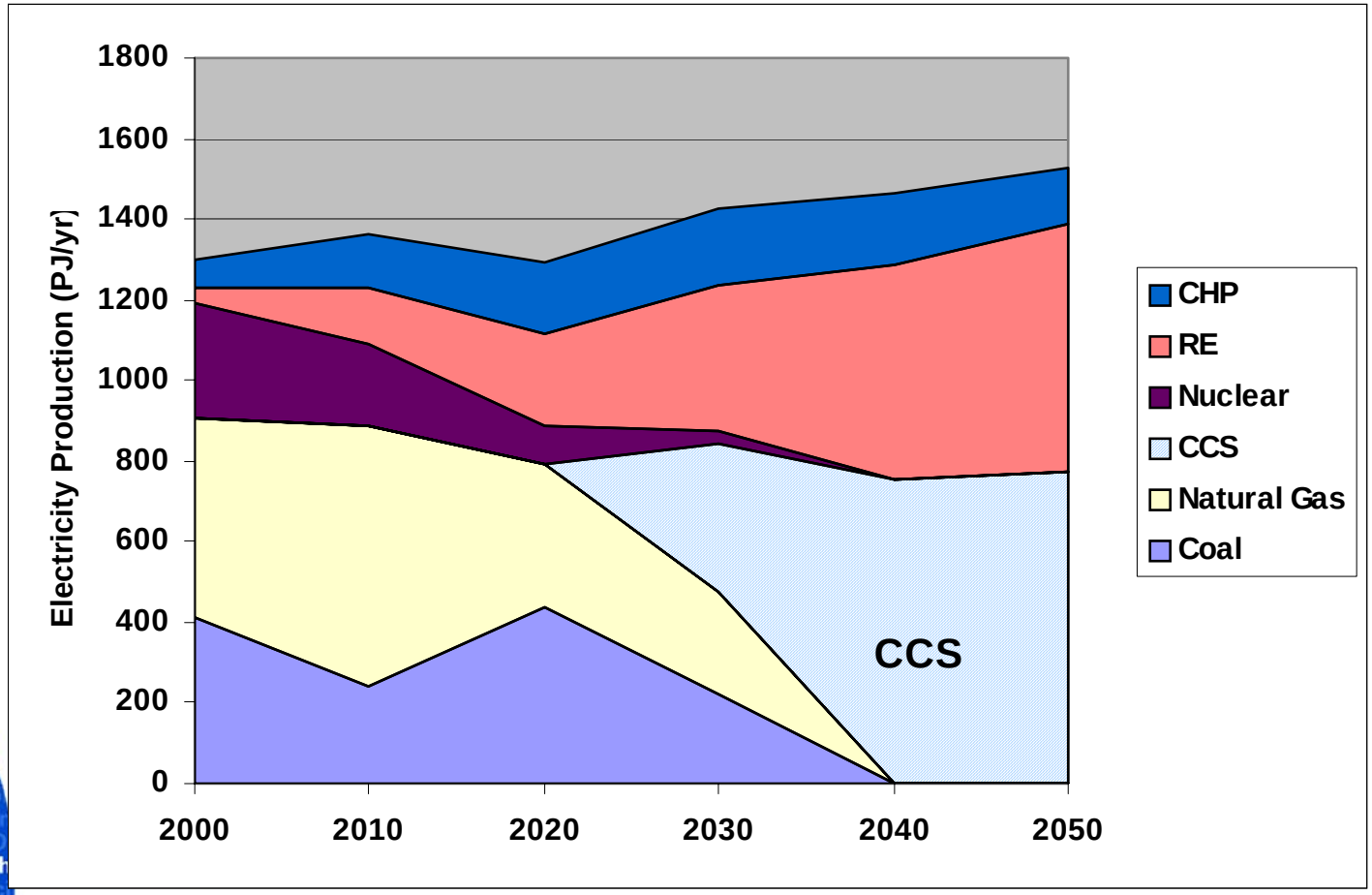
- Improved efficiency (15-20% CO_2 reduction)
- Fuel switching (5-10% CO_2 reduction)
- CCS (90% CO_2 reduction)

CAT Options are complementary



When are CATs needed?

Fuel Mix in Electricity Generation - 60% CO_2 Reduction in 2050 (no new nuclear)



Policy – CAT Strategy

Scope:

- 10 tasks covering technical development and non-technical issues
- Industrial uses as well as power
- All fossil fuels
- Demonstration as well as R&D
- 10-year programme.
- Industry-led

Policy – CAT Strategy

Tasks:

- R&D of CATs
- Demonstration of ‘capture-ready’ plant
- Demonstration CO_2 storage
- International collaboration in UK projects
- UK collaboration in international projects
- Examine measures to encourage initial commercial deployment
- Acquisition and transfer of knowledge/know-how
- National/international reg. frameworks and market systems
- Public awareness
- Technology roadmap

Policy – Energy Review, 2006

Background analysis included:

- Cost of UK electricity generation from CCS
  - Refurbish existing PF coal plant + CCS
  - New PF coal plant + CCS
  - New coal gasification plant + CCS
  - New gas-fired plant + CCS
- Comparison with other generation options
- Cost sensitivities
- ‘First-of-a-kind’ projects
  - Technical risk (eg scale-up, new operation modes)
  - Higher infrastructure costs
  - New and different business relationships

Policy – Energy Review, 2006

Key results:

- CCS generally more expensive than conventional generation – unlikely to be deployed without explicit carbon pricing
- Has intermediate carbon abatement costs – comparable with nuclear and generally lower than renewables (within range of the damage costs of carbon)
- Could make cost-effective contribution to carbon targets
- No mechanism yet to reward abatement through CCS
- Inclusion in EU-ETS will help but not be enough at current carbon prices
- Need for greater policy and carbon market certainty
- Early projects likely to be more expensive

Technology Related Activities

Technology – Research: the Energy Challenge….

- Increase expenditure on energy research from £40m/a now to £70m/a by 2007/08
- UK Research Councils will commit £70m+ for energy research over this same period
- Continue to partner with DTI and industry
- EPSRC will coordinate the

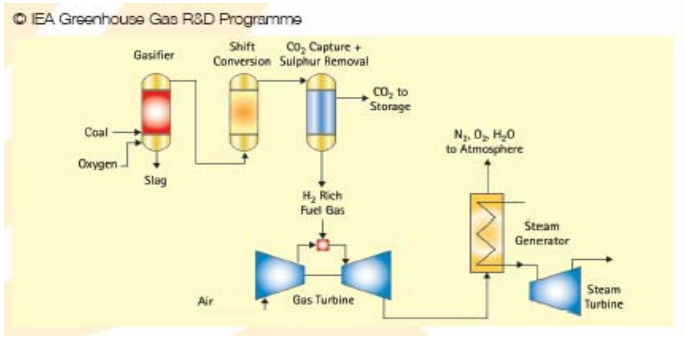
RESEARCH COUNCILS' energy PROGRAMME

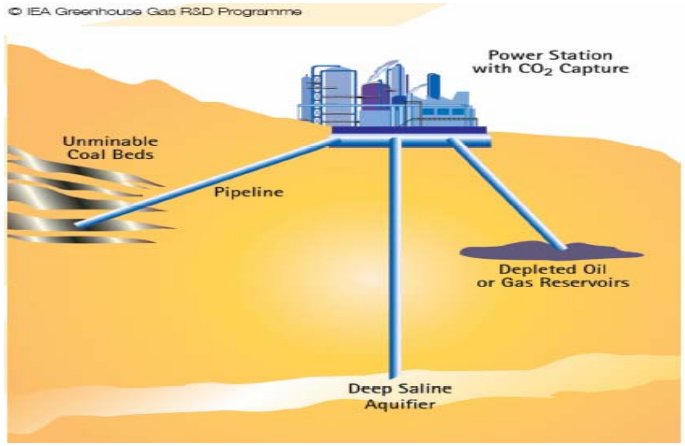
Clean Coal and Carbon Abatement Technologies:

- SUPERGEN
  - 'conventional' power plant (existing consortium)
  - biomass (existing consortium)
  - renewed, expanded, consolidated activity?
- TSEC
  - carbon capture and storage (existing consortium)
  - renewed, expanded activity?
- UK Energy Research Centre (UKERC)
  - research and technology road-mapping
- Other/underpinning research (eg BGS, process engineering)
- Strategic partnerships
- International collaboration

PROFILE: TSEC – UK Carbon Capture and Storage Consortium

- Context: Potential of CCS to contribute to national energy/climate change targets
- Aim: to promote understanding of how using CCS to decouple fossil fuel use from carbon emissions could assist the UK in achieving a sustainable energy system
- Undertaking integrated research on engineering, technological, natural, environmental, social and scientific issues
- Expanding UK research capacity in CCS, commensurate with the opportunities





Technology – R&D

Various DTI Programmes:

- Cleaner Coal Technology Programme (1999-2006)
  - Coverage included efficiency, co-firing and CCS (from ~2001)
  - 4th Call included 2 'design studies':
    - Coal-fired advanced supercritical boiler/turbine retrofit (with CO_2 capture) – led by Mitsui Babcock
    - Coal gasification based plant (included impact on CO_2 removal) – Led by Jacobs Engineering
- Various studies in support of CAT Strategy and TRM
  - CCS risk study - DNV
  - UK 'Source-Sink' study – BGS
  - etc

Technology – R&D

Various DTI Programmes (continued):

- DTI Technology Programme (2005 onwards)
  - 1st Competition (Nov 2005) – CATs included: 4 projects
    - Oxyfuel firing with coal (Phase 1) – Mitsui Babcock
    - Separation and optimisation of hydrogen – Alstom Power
    - Amine optimisation – RWE npower
    - IGCC – Jacobs Engineering
  - 2nd Competition (April 2006) – CATs included: 4 full proposals
    - Oxyfuel firing with coal (Phase 2) – Mitsui Babcock
    - CO_2 capture and monitoring – Scottish Power
  - 3rd Competition (Nov 2006) – CATs not included

Public-Private Partnerships:

- Energy Research Partnership
- Energy Technologies Institute: 10-year PPP, £1 billion

Technology – Demonstration

DTI Hydrogen, Fuel Cells and Carbon Abatement Technologies 'HFCCAT' Demonstration Programme

- Launched September 2006
- Components demonstration
- £50m - £35m for CATs, £15m for H_2 and FCs -'Linked'
- 2-3 calls over 3 years
- 1st Call open, 23 October 2006

Technology – Commercial Project Activity

A number of projects being developed, including:

- BP: Miller-Peterhead project
- Progressive Energy/Centrica Teesside project
- RWE npower (Tilbury)
- E.ON UK (Killingholme, Kingsnorth)
- Scottish & Southern Energy (Ferrybridge)
- Hatfield IGCC

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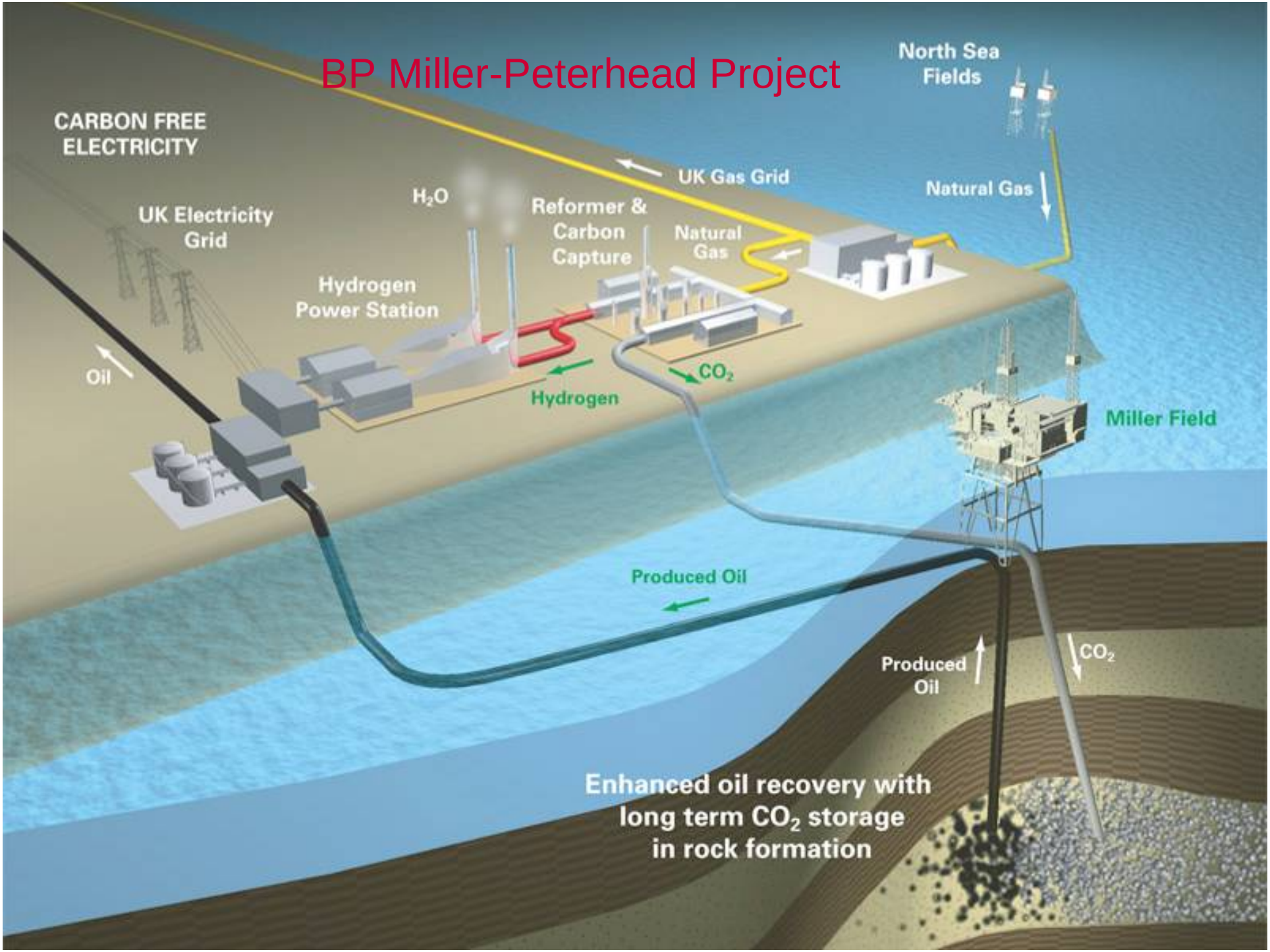
BP Miller-Peterhead Project
North Sea Fields
CARBON FREE ELECTRICITY
UK Gas Grid
Natural Gas
H_2O
Reformer & Carbon Capture
Natural Gas
UK Electricity Grid
Hydrogen Power Station
Oil
CO_2
Hydrogen
Miller Field
Produced Oil
Produced Oil
CO_2
Enhanced oil recovery with long term CO_2 storage in rock formation