

Carbon Geo-storage & CO₂-EOR; A UK Perspective

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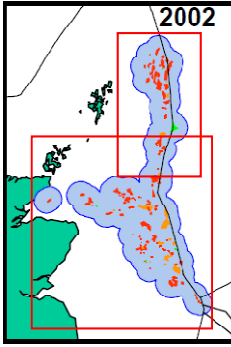
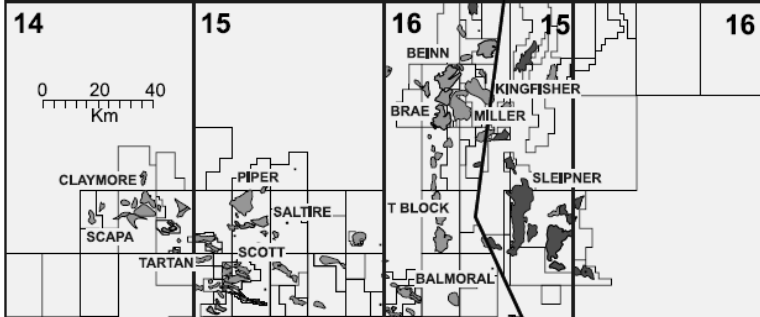
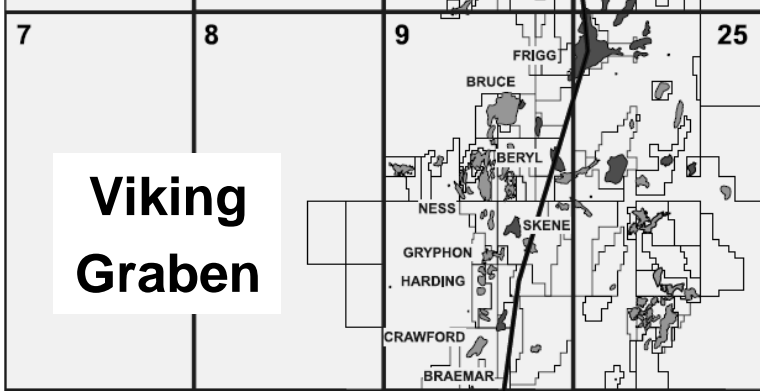
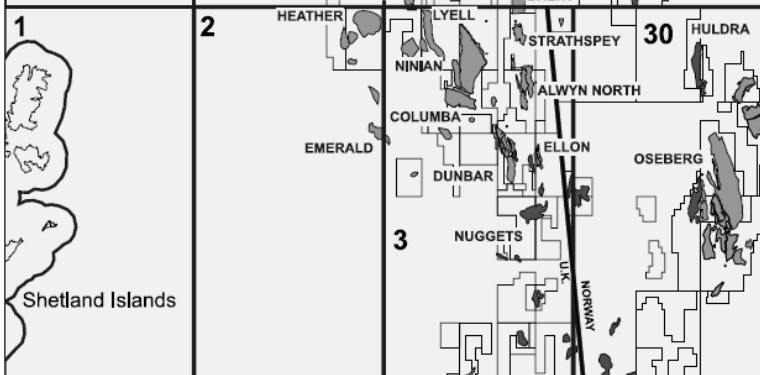
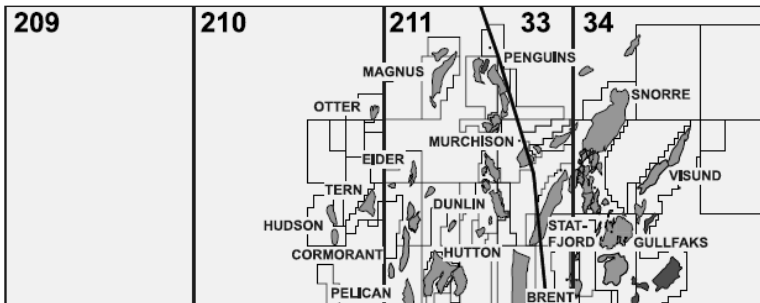
7th Annual EOR Carbon Management Workshop
- Houston 5-8th December 2009 -



CO₂-EOR – A Long History

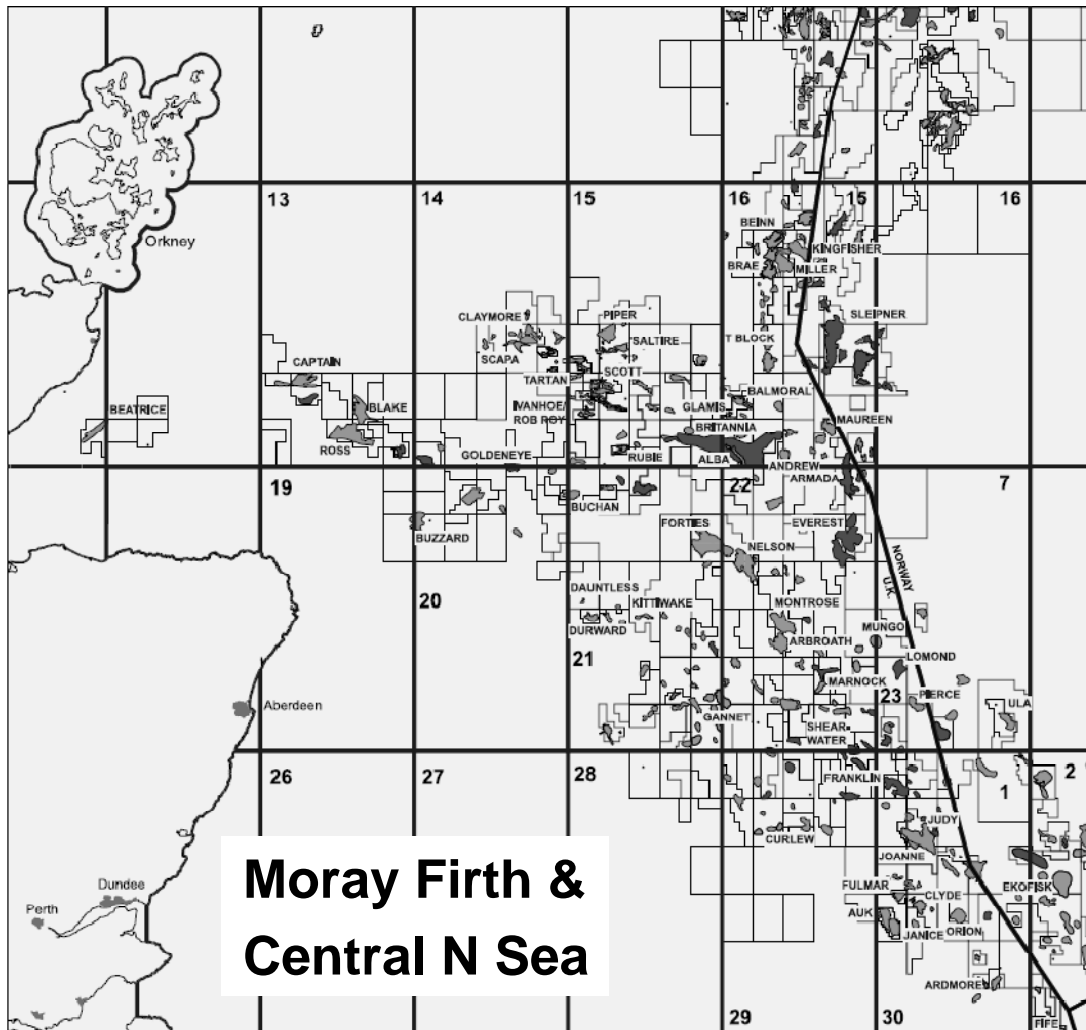
- Initiated 1970s in response to oil crisis
- Texas at forefront of technology & leads the way today
- Permian Basin in NW Texas is the primary injection area
- Prize 4-12% of STOIPP additional recovery
1000s km 32" pipeline & associated infrastructure developed
- Natural & anthropogenic CO₂ sources used





UK Oil Fields

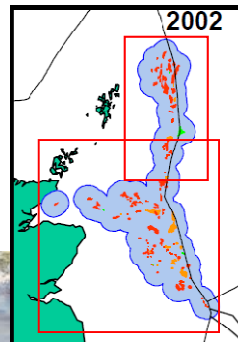
From Gluyas & Hichens, 2003



Moray Firth & Central N Sea

UK Offshore Oil Reserve

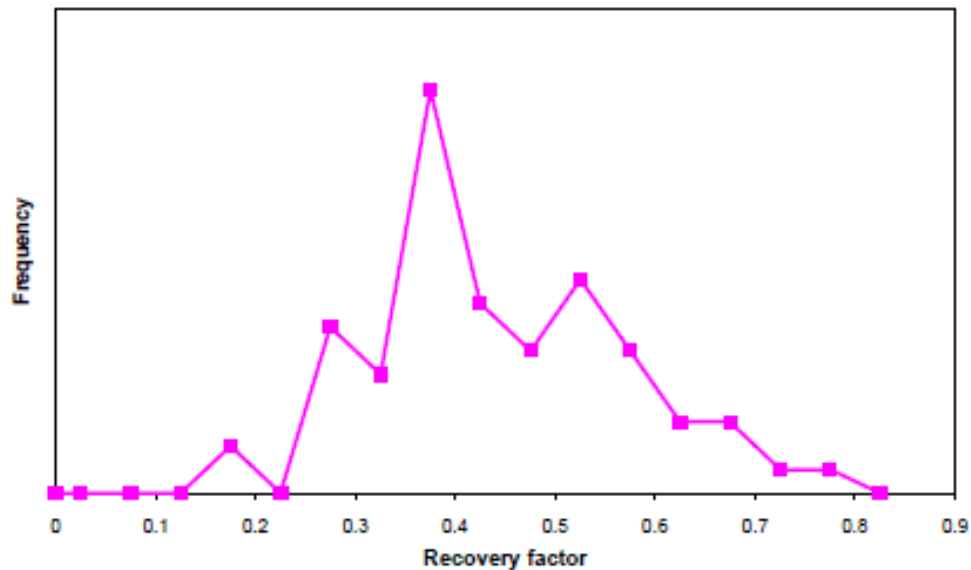
	Proven	Probable	P+P	Possible	Maximum
Cumulative Oil Production in millions tonnes (bnbbl)	3315 (24.9)				
Estimated Ultimate recovery in millions tonnes (bnbbl)	3723 (27.9)	361 (2.7)	4048 (30.4)	360 (2.7)	4444 (33.3)



https://www.og.decc.gov.uk/information/bb_updates/chapters/Table4_3.htm

UKCS Recovery Factors ~45%

- Typically high quality reservoirs (perm – 100s mD)
- Line drive water floods for secondary recovery
- Low well density of West Texas



Jayasekera &
Goodyear SPE 75171

UKCS vs West Texas

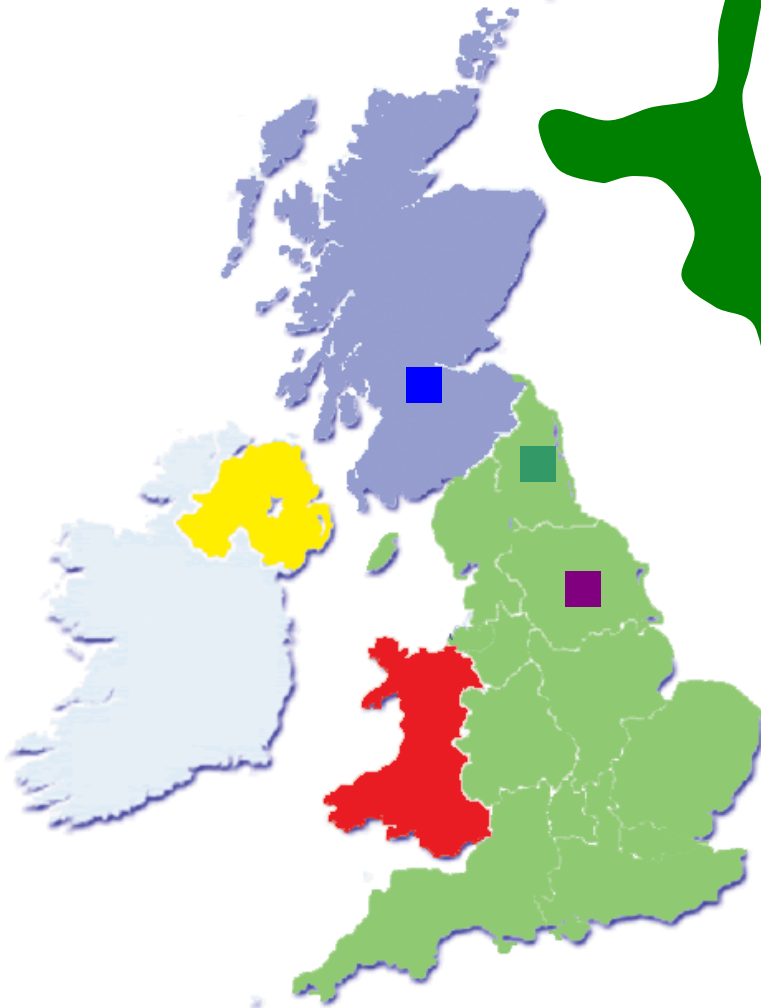
- West Texas – incremental oil recovery 4-12% of STOIIP
- CO₂ is expected to be miscible (or nearly so) with current conditions in the UKCS oil reservoirs
- UKCS has higher T&P compared with West Texas but impacts cancels so similar quantities of CO₂ required to sweep a given reservoir

From Goodyear *et al*, IEA EOR Caracas 2002

UKCS – The Prize

- Assuming UKCS:
 - Reserve of 30,000mmbbl
 - STOIP $30,000/0.45 = 67,000$ mmbbl
- From West Texas 4-12% additional recovery of STOIP
 - Yields **2,700 – 8,000** mmbbl technical reserves
 - Requiring ~1 tonne CO₂ per 5bbl (Balbinski *et al*, 2003)
- For ~5,000 mmbbl, ~1,000 mm tonnes of CO₂ required

UK Industrial CO₂ production 2007



- Scotland 19mm tonnes
- North East 21mm tonnes
- Yorkshire & Humberside 27mm tonnes

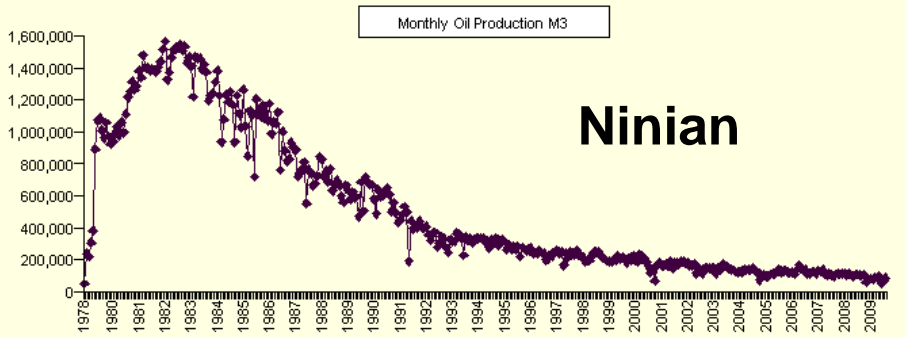
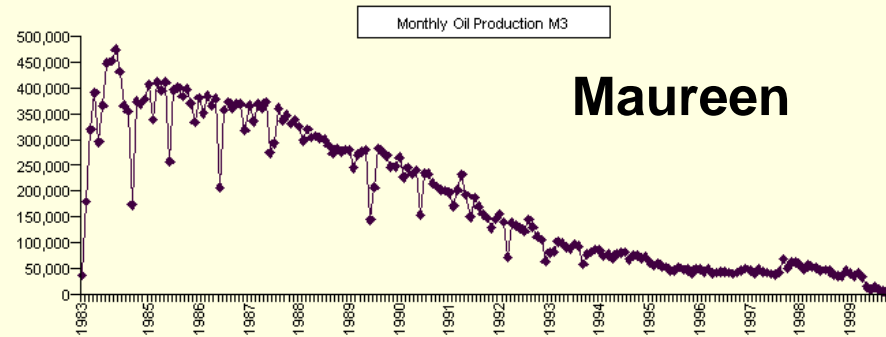
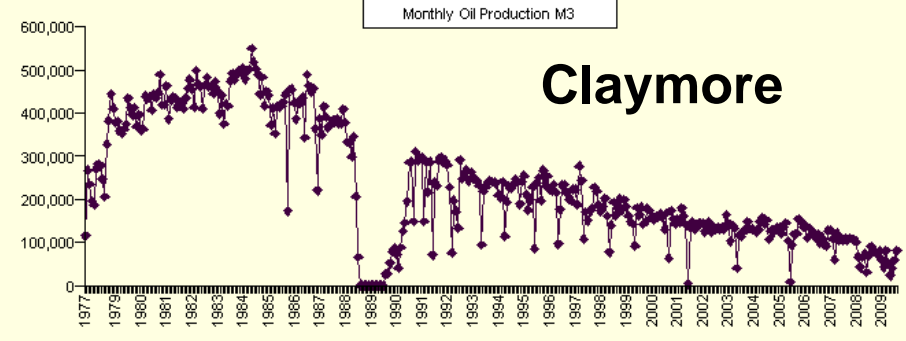
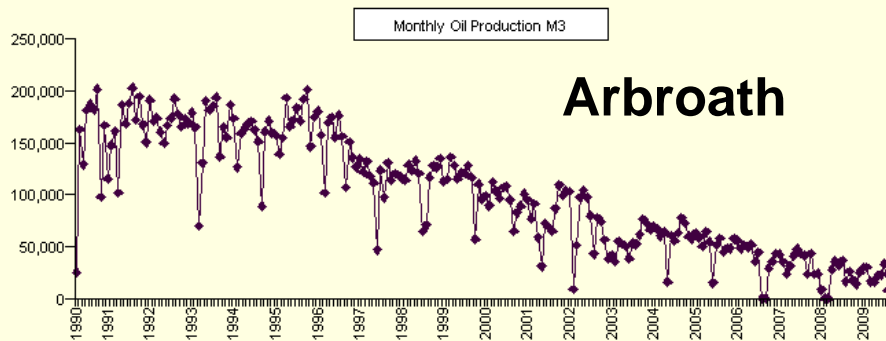
 UK oil province

www.decc.gov.uk/en/content/cms/statistics/climate_change/climate_change.aspx

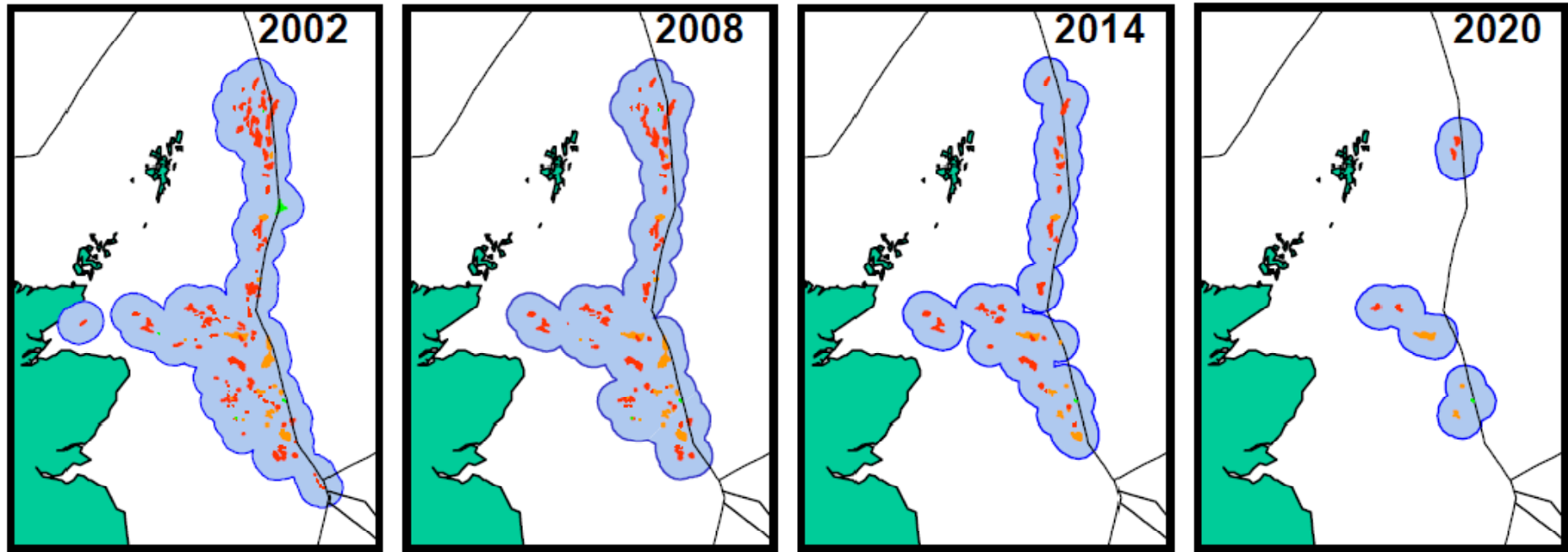
Supply & Demand

- Assuming all industrial CO₂ from the eastern UK could be available for CO₂-EOR yields 60-70mm tonnes per annum
- Over a 15 year period (ie typical CO₂-EOR project length) this would use 1 billion tonnes CO₂ the quantity required to optimise CO₂-EOR in the North Sea

Are UK Oil Fields Ready For CO₂-EOR?



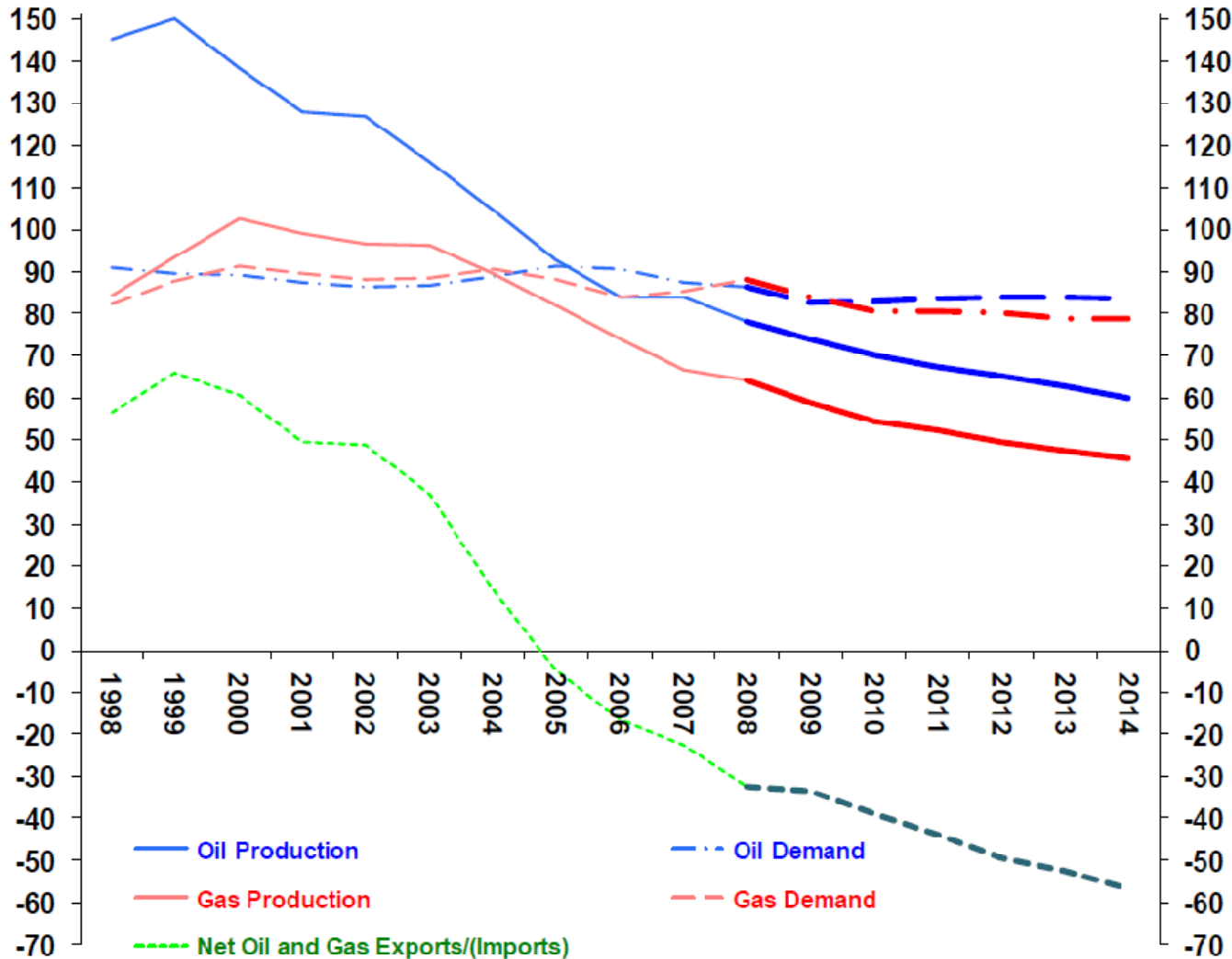
The Time is Right (but don't wait)



UKCS Shrinking Infrastructure

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Actual/Projected UK Oil and Gas Production and Demand (million tonnes of oil equivalent)



DECC publication 2008

UK Security of Supply

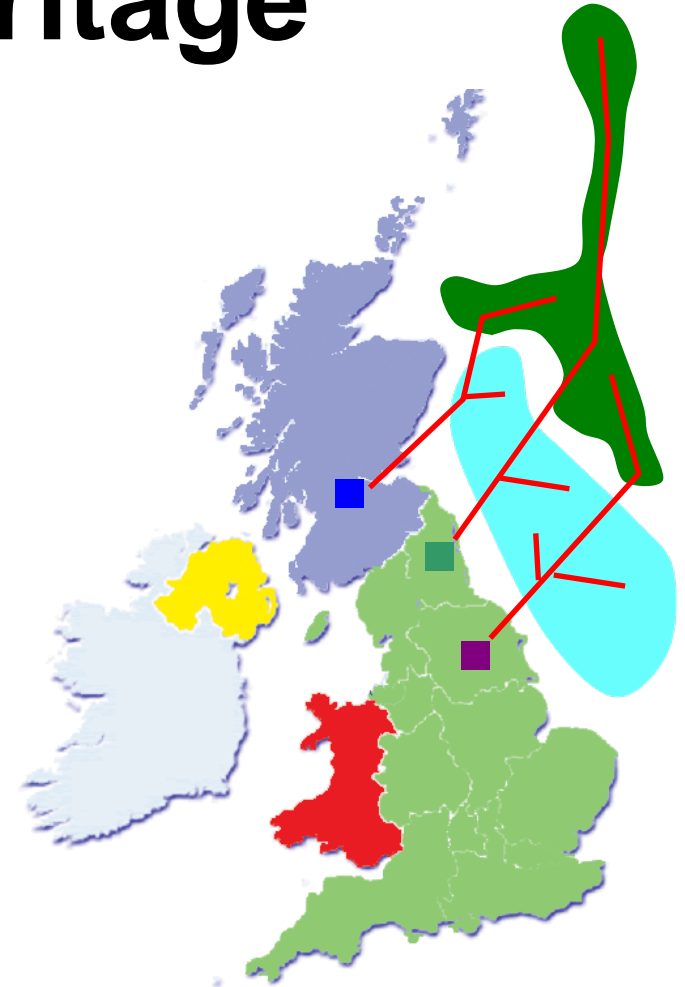
Shortfall in 2010
~15 mm tonnes

Equivalent to
~300,000 bopd

Equivalent to
Initiating ~1/3
potential CO₂-EOR projects

CO₂-EOR Heritage

- The CO₂ production from eastern UK could 'power' CO₂-EOR in the North Sea for 10-15 years per project, over ~30 year period
- It could deliver:
 - Improved security of oil supply
 - Infrastructure usable for carbon capture
 - Increased tax revenues over current projections



Deep aquifer storage area