

# UPSIDE VIEW OF UKCS

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# Waterflood is not the ultimate solution for UKCS

## Comparison of Oil Recovery by Water Injection, Gas Injection and WAG Injection in Water-Wet and Mixed-Wet Rocks

Mehran Sohrabi, Heriot Watt University, October 2011

### Conclusions – wettability effect

- Water Flood Oil recovery:  
Mixed-Wet > Water-Wet
- Continuous Gas Injection Oil recovery:  
Mixed-Wet < Water-Wet
- WAG Injection Oil recovery:  
Mixed-Wet ~ Water-Wet

### Conclusions – oil recovery order

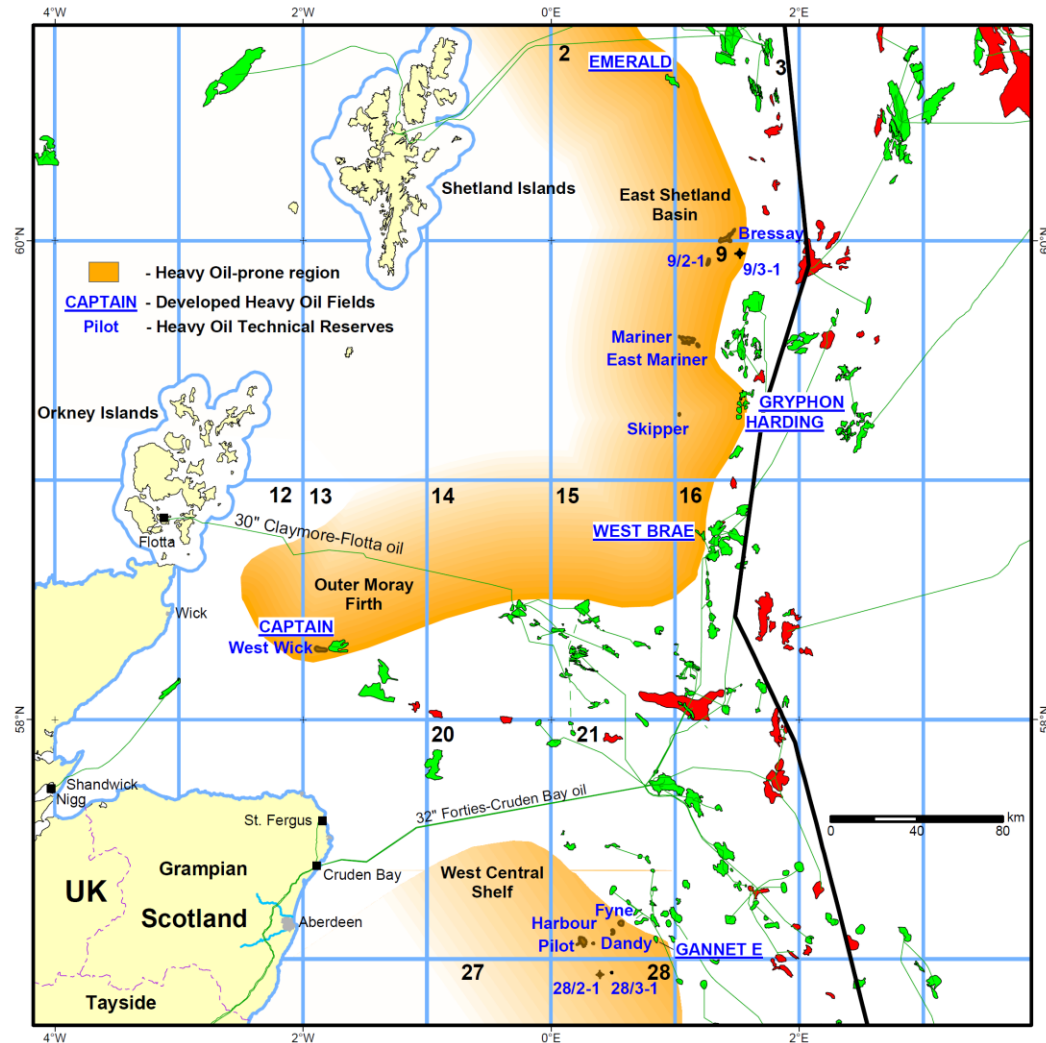
- Oil recovery in Water-Wet:  
 $GI > WAG > WI$
- Oil recovery in Mixed-Wet:  
 $WAG > WI > GI$

# Low Cost EOR/IOR target is >5% of STOOIP

- Water-Alternate-Gas (WAG) has been applied in UKCS at Thistle, S. Brae, Miller & Magnus (tested in others?)
  - Norway (including FWAG) at Brage, Ekofisk, Gullfaks, Oseberg Ost, Statfjord, Snorre, Ula, + Siri in Denmark
- Carbon Dioxide (or flue gas) injection has been considered but retrofit to non-sour operations may be too costly
- Surfactant and 'LoSal' water injection is being installed in Schiehallion and Clair Ridge respectively
- Bright Water injection pilot planned for one UKCS field

# 19 Heavy oil fields with 9 Billion Bbl STOOIP

- Mariner and Kraken developments underway
  - Cold (or warm) water injection with horizontal oil producers
  - Phased developments pending operational performance
- Bressay and Bentley fields nearby, share fuel gas import?
- Gravity stable gas injection/re-injection successful in Harding, Gryphon, Pearce, Grane,
  - Application for untapped viscous oils worth considering; Methane, Carbon Dioxide, Nitrogen injection with or without additional water injection +/- surfactants



Source: Xcite

# Re-inventing UKCS Exploration

- When we had \$15-18 oil in 1990's, Finder Wells concept
  - Limit casing strings, evaluation & borehole size on “finder” well, expect certain % not to achieve all goals
  - Appraisal wells to optimize evaluation and field development
- What would a 2015 Finder well cost today?
  - \$750,000/day all up day rate (summer only?)
  - 4 days mob/demob (rig club to minimize distances)
  - 20 days to drill to 10,000' (onshore USA 7-10 days!)
  - \$2MM consumables (casing etc.)
  - Total Cost \$20MM
    - 10% for contingency = \$22MM
- Thin oil pays within source rocks

# Possible Tax Incentives and Changes to SC & PRT

- Investment Incentives
  - New shared facilities can be offset against existing production
  - Reduce/remove existing tax from new/renewal blocks, potentially replace with a progressive tax as is common world practice
    - Production or profit based taxes
- Production and Revenue incentives
  - Reduce or void tax payments if production increases Y/Y from development
  - Tax benefits for incremental reserves
- Operating Incentives
  - Reduce or void tax payments with per barrel operating cost reductions
  - Reduce or void tax payments with increases to operating efficiency
- Effect is to move towards a tax regime more comparable to other industry
  - Incentivize Maximum Economic Recovery, not maximum NPV to state
  - Incentivize investment in mature basin, allow it to reinvent itself

# Thank You

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