North Sea EOR – A UK Perspective

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EOR “Size-of-the-Prize” (mmbls)

- CO2 Injection/Miscible Gas: 900
- Polymer/Surfactant: 300
- Heavy Oil: 250
- Others: 70
EOR – Onshore versus Offshore

EOR – Has been very successful onshore
Offshore EOR Challenges

• Expensive facilities upgrades needed on ageing platforms
• Limited “window-of-opportunity” for mature fields / high well spacing
• EOR increment often “long & lazy”
• Need source of cheap EOR injectant
Magnus – An Offshore EOR Success

- Injects miscible hydrocarbon gas to increase recovery
- Unlocking Key – “stranded” gas from the West of Shetlands – a source of cheap EOR injectant
The Magnus EOR Project
“Work with the grain” of CCS

• Take advantage of growth in CCS
• Imaginative use of “hub facilities” to accelerate uptake
• Look at the whole CCS Value Chain
A Conceptual CO2 EOR “Core Area”

<table>
<thead>
<tr>
<th>Field name</th>
<th>CO₂ storage capacity/Mt CO₂</th>
<th>Close of Production date</th>
<th>Potential for EOR</th>
<th>Projected additional oil recovered (million barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunlin Oilfield</td>
<td>27</td>
<td>2015</td>
<td>Good</td>
<td>83</td>
</tr>
<tr>
<td>Thistle Oilfield</td>
<td>27</td>
<td>2015</td>
<td>Good</td>
<td>82</td>
</tr>
<tr>
<td>Claymore Oilfield (Central, Main and Northern)</td>
<td>47</td>
<td>2030</td>
<td>Good OK</td>
<td>142</td>
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<tr>
<td>Cormorant Oilfield</td>
<td>52</td>
<td>2020</td>
<td>Good</td>
<td>157</td>
</tr>
<tr>
<td>Scott Oilfield</td>
<td>31</td>
<td>2015</td>
<td>Good</td>
<td>95</td>
</tr>
<tr>
<td>Statfjord (UK) Oilfield</td>
<td>209 (UK + Norway)</td>
<td>2020</td>
<td>Good</td>
<td>635 (UK + Norway)</td>
</tr>
<tr>
<td>Beryl A Oilfield</td>
<td>77</td>
<td>2020</td>
<td>Good</td>
<td>232</td>
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<tr>
<td>Ninian Oilfield</td>
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<td>2030</td>
<td>Good</td>
<td>292</td>
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<tr>
<td>Brent Oilfield</td>
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<td>2015</td>
<td>Good</td>
<td>501</td>
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<tr>
<td>Murchison (UK) Oilfield</td>
<td>26</td>
<td>2020</td>
<td>OK</td>
<td>79</td>
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<td>Miller Oilfield</td>
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<td>2008</td>
<td>OK</td>
<td>52</td>
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<td>Buzzard Oilfield</td>
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<td>2025</td>
<td>OK</td>
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<td>Piper Oilfield</td>
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<td>2030</td>
<td>OK</td>
<td>140</td>
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<td>Forties Oilfield</td>
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<td>2015</td>
<td>OK</td>
<td>420</td>
</tr>
</tbody>
</table>

A Conceptual CO2 EOR “Core Area”
UK Chemical EOR

- Something of a “Renaissance”!
- Captain - Polymer
- Clair – LoSal
- DECC-NPD Joint Study on “Designer EOR”
Heavy Oil

- Mariner – Bressay
  
  – UK’s Biggest Undeveloped Reserves
  
  ~ 500 million barrels of recoverable reserves
  ~ $10 billion development cost
Key Barriers include:

- More R&D needed to reduce the costs of facilities upgrades
- Promoting lower cost EOR techniques
- Better exploiting the “window of opportunity” for EOR in mature fields.
Conclusion

• Offshore EOR is technically & economically complex

• EOR prize is substantial, but a limited window-of-opportunity remains

• Government & industry needs to work cooperatively to deliver North Sea EOR