Worldwide Shale Developments: What makes them work and is there a sweet spot in Europe?

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### Who are RISC?

RISC London has the same capability in UK and Europe.

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#### Completed deals with due diligence supplied or managed by RISC Advisory’s London Office

<table>
<thead>
<tr>
<th>Year</th>
<th>Acquirer</th>
<th>Seller &amp; Asset/Company</th>
<th>Value (USD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>BlackRock</td>
<td>ADNOC oil pipelines</td>
<td>$4 Billion</td>
</tr>
<tr>
<td>2018</td>
<td>Vitol, Delonex, Africa Oil Corp</td>
<td>Petrobras Nigeria</td>
<td>$1.5 Billion</td>
</tr>
<tr>
<td>2018</td>
<td>Ophir</td>
<td>Santos SE Asia assets</td>
<td>$ 205 million</td>
</tr>
<tr>
<td>2015</td>
<td>Premier Oil</td>
<td>E.On UK</td>
<td>$120 million</td>
</tr>
<tr>
<td>2015</td>
<td>First Reserve</td>
<td>EMAS Offshore Lewek FPSO</td>
<td>$166 million</td>
</tr>
<tr>
<td>2013</td>
<td>Qatar Petroleum</td>
<td>Total E&amp;P Congo assets</td>
<td>$1.6 Billion</td>
</tr>
<tr>
<td>2012</td>
<td>Premier Oil</td>
<td>Rockhopper Falklands assets</td>
<td>$1 Billion</td>
</tr>
<tr>
<td>2009</td>
<td>Centrica plc</td>
<td>Venture Production plc</td>
<td>$2.1 Billion</td>
</tr>
<tr>
<td>2009</td>
<td>Premier Oil</td>
<td>Oilexco</td>
<td>$505 million</td>
</tr>
</tbody>
</table>
Where it all started: Growth of the Eagle Ford

Eagle Ford 2007

Eagle Ford 2019

- OIL WELL
- GAS WELL

50km

50km
Growth in US natural gas production

US dry shale gas production

“The US is destined to become a key LNG import market” (BG)

“North America emerges as a major importer of LNG” (EIA, IEEJ & others)

“Natural Gas prices will remain high in the US for the foreseeable future” (EIA)

Source: EIA
History repeating itself on Australia’s east coast

"The US is destined to become a key LNG import market" (BG)

"North America emerges as a major importer of LNG" (EIA, IEEJ & others)

"Natural Gas prices will remain high in the US for the foreseeable future" (EIA)

Australia's east coast needs to urgently start importing LNG: EnergyQuest

Sydney — Australia’s gas-strapped east coast needs to urgently start importing LNG in order to mitigate a range of risk factors stretching from supply issues to regulatory uncertainties, energy consultancy EnergyQuest said Wednesday.

When insanity makes sense: Australia's best option is LNG imports

Australia has painted itself into a corner with its natural gas industry and faces the stark reality that there are no easy choices to alleviate the dual problem of a looming supply crunch and the associated higher prices.

LNG import terminal approval — an Australian first — a sign of hope for NSW manufacturing

ABC Newswire By Kelly Fuller and Glenn Cote

Source: EIA
Major North American unconventional plays

- Discrete zones of higher porosity /higher resistivity
- Plays are laterally heterogeneous
- Over-pressure. Rate more important than in-place
- Finding the balance in GOR. Rate versus product
- Areas of very mature conventional production – data / infrastructure / tolerant community stakeholders

*Logs presented at same scale. Source PXD*
Heterogeneity in unconventional plays

Source: Consensus view from public domain information
Break-even oil prices for new wells in North American plays

Source: Consensus view from public domain information
Unconventional play systems

There are no hard lines between conventional and unconventional resources.

Unconventional reservoirs share a lot of similar characteristics to conventional reservoirs:

- Zones of higher porosity / permeability
- Zones of higher resistivity
- Zones of higher pressure
- Regional structures or structural highs

Understanding heterogeneity is key - it's not just a game of finding a shale and fracking the bejeezus out of it.
Common recovery segment mapping

**Common Recovery Segment Map** (Sweet Spot Map)

**Recovery Potential is the Combined Effect of Multiple Attributes**

- Reservoir Quality
- Hydrocarbon Generation
- Reservoir Thickness
- Structure
- Depth/Pressure

Example from the Murteree shale, Cooper basin
Break-even gas price mapping

**Example from the Murteree shale, Cooper basin**
Eagle Ford break-even analysis

100% of Eagle Ford break-even at $70 > Oil (8,000,000 acres)

Source: Consensus view from public domain information
Break-even price development of the Murteree play

MURTEREE ESTIMATED ULTIMATE RECOVERY POTENTIAL

Break-even analysis assuming NPV10 well head price at 2019 development costs
Break-even price development of the Murteree play

Depending upon gas price:

<table>
<thead>
<tr>
<th>Resource Volume (Tcf)</th>
<th>Required Wells</th>
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</thead>
<tbody>
<tr>
<td>5 Tcf</td>
<td>1,000 wells</td>
</tr>
<tr>
<td>900 km²</td>
<td>5,400</td>
</tr>
<tr>
<td>16 Tcf</td>
<td>4,300</td>
</tr>
</tbody>
</table>

Mutteree is one of 6 shale plays in Cooper Basin

Mutereee Shale, Cooper Basin, Australia

Break-even analysis assuming NPV10 well head price at 2019 development costs
Cooper basin resource totals (all prospective units) at $8/GJ break-even

Low estimate: 106 Tcf
Mid estimate: 288 Tcf
High estimate: 548 Tcf

Total resource estimates for Cooper unconventional plays at $8/GJ

-10% for inert gas and assuming 40% of maximum development

Low estimate: 33 Tcf
Mid estimate: 99 Tcf
High estimate: 192 Tcf
Cooper basin resource totals (all prospective units) at $12/GJ break-even

Low estimate | Mid estimate | High estimate
---|---|---
158 Tcf | 427 Tcf | 829 Tcf

Total resource estimates for Cooper unconventional plays at $12/GJ

-10% for inert gas and assuming 40% of maximum development

52 Tcf | 149 Tcf | 294 Tcf
Some closing thoughts

- Proven unconventional systems are typically extensions of conventional petroleum systems.

- Heterogeneity is key. Resource potential is tied to wells drilled – which is tied to demand and pricing. The ‘unconventional accordion’

- Rising gas prices in the Eastern Australian gas market are driving speculation about LNG import requirements for the market. The same speculation occurred in the US in the mid 2000’s. The US responded by developing unconventional resources.

- We need to quantify and understand unconventional potential to determine in what gas price environment it make sense to develop our unconventional resources.