The innovation and collaboration imperatives of the upstream oil and gas industry in Australia

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AIRG Annual Conference - 26 February 2014
*Industrial Technology and Innovation: the Western Australian Perspective*
Presentation outline

• State of play and challenges
  – Global, Australia & WA

• Cooperation & innovation opportunities:
  – The proposal for an oil and gas centre of excellence
State of play: global oil & gas

- Global energy demand remains high
- Continued dominant role of oil and gas
- Transformational role of “unconventionals”
- Global energy security challenges
Energy demand growth: driven by SE Asia

China is the main driver of increasing energy demand in the current decade, but India takes over in the 2020s as the principal source of growth

Source: IEA World Energy Outlook 2013
Global oil supply: a role for unconventional oil

The United States (light tight oil) & Brazil (deepwater) step up until the mid-2020s, but the Middle East is critical to the longer-term oil outlook

Source: IEA World Energy Outlook 2013
Global gas supply: a role for unconventional gas

Indicative economics of LNG export from the US Gulf Coast (at current prices)

New LNG supplies accelerate movement towards a more interconnected global market, but high costs of transport between regions mean no single global gas price

Source: IEA World Energy Outlook 2013
State of play: Australian oil & gas

• An unprecedented surge in LNG developments, with the world’s first CBM to LNG developments

• The hunt for unconventional oil & gas begins

• Rejuvenation of onshore activity

• Future LNG developments threatened by high costs
### Australian gas: dominated by LNG

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>TRAINS</th>
<th>PRODUCTION CAPACITY (mtpa)</th>
<th>CAPEX (A$B)</th>
<th>START DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Operating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North West Shelf</td>
<td>5</td>
<td>16.3</td>
<td>60*</td>
<td>1989</td>
</tr>
<tr>
<td>Darwin LNG</td>
<td>1</td>
<td>3.7</td>
<td>1.6**</td>
<td>2005</td>
</tr>
<tr>
<td>Pluto</td>
<td>1</td>
<td>4.3</td>
<td>15.3</td>
<td>2012</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7</strong></td>
<td><strong>24.3</strong></td>
<td><strong>66.8</strong></td>
<td></td>
</tr>
<tr>
<td><strong>B. Committed / Under Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qld Curtis LNG</td>
<td>2</td>
<td>8.5</td>
<td>20.4</td>
<td>2014</td>
</tr>
<tr>
<td>Gladstone LNG</td>
<td>2</td>
<td>7.8</td>
<td>18.5</td>
<td>2015</td>
</tr>
<tr>
<td>Aust Pacific LNG</td>
<td>2</td>
<td>9</td>
<td>24.7</td>
<td>2015</td>
</tr>
<tr>
<td>Gorgon</td>
<td>3</td>
<td>15</td>
<td>54</td>
<td>2015</td>
</tr>
<tr>
<td>Ichthys</td>
<td>2</td>
<td>8.4</td>
<td>34</td>
<td>2016</td>
</tr>
<tr>
<td>Wheatstone</td>
<td>2</td>
<td>8.9</td>
<td>29</td>
<td>2016</td>
</tr>
<tr>
<td>Prelude FLNG</td>
<td>1</td>
<td>3.5</td>
<td>13</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>61.1</strong></td>
<td><strong>193.6</strong></td>
<td></td>
</tr>
</tbody>
</table>

* In 2012 dollars

** In 2006 dollars

Coal seam gas to LNG

- 3 Megaprojects
- Manufacturing Mindset
- Water production
- Social challenges
- Production uncertainties

Source: Santos Investor Seminar Dec 2013
Onshore Australia: exploration revival

Exploration wells: onshore vs offshore

Exploration spend: onshore vs offshore
Australian shale / tight gas: opportunities

- Cooper Basin
- Canning Basin
- Perth Basin
- Beetaloo Basin
- Georgina Basin
- Amadeus Basin
Australian shale / tight gas: challenges

- Infrastructure
- Remoteness
- Expertise
- Community acceptance
- Cost environment
- Capital requirements
- Quality of resources

Estimates of Technically Recoverable Shale Gas Resources (Tcf)

Source: IEA 2012
WA offshore: success dominated by LNG

- 50 Tcf, 485 Mmbbl discovered in last decade
- **Browse Basin**: Ichthys, Prelude, WPL Browse, Poseidon, Crown
- **Northern Carnarvon Basin**: Pluto, Gorgon, Wheatstone
- **Offshore Canning Basin**: Frontier exploration
- Development challenges
An oil & gas centre of excellence

• A legacy from Australian oil and gas investment
  – Across all sectors (SME, major industry, academia)
  – Commercial outcomes
  – Material and internationally relevant
  – Sustainable competitive advantage
## Initial core partners

<table>
<thead>
<tr>
<th>Operators</th>
<th>Contractors</th>
<th>Universities</th>
<th>SME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodside</td>
<td>Clough</td>
<td>WA:ERA</td>
<td>Consultancies</td>
</tr>
<tr>
<td>Shell</td>
<td>WorleyParsons</td>
<td>UWA</td>
<td>BCG</td>
</tr>
<tr>
<td>BP</td>
<td>GE Oil and Gas</td>
<td>Curtin</td>
<td>S2V Consulting</td>
</tr>
<tr>
<td>Total</td>
<td>Schlumberger</td>
<td>CSIRO</td>
<td>Associations</td>
</tr>
<tr>
<td>Santos</td>
<td>Chiyoda</td>
<td>UQ</td>
<td>APPEA</td>
</tr>
<tr>
<td>Vermillion</td>
<td>Thiess</td>
<td>QUT</td>
<td>ICN (NT)</td>
</tr>
<tr>
<td>Conoco Phillips</td>
<td>Transfield Services</td>
<td>Charles Darwin</td>
<td>Brisbane Mkting</td>
</tr>
<tr>
<td>Origin</td>
<td>Chemistry Centre</td>
<td></td>
<td>AMC BOA</td>
</tr>
<tr>
<td>Murphy</td>
<td></td>
<td></td>
<td>AIG</td>
</tr>
</tbody>
</table>
What are the core partners seeking?

- **Education, knowledge & integration hub**
- **Collaboration**
  - R&D focus & industry impact
  - Skills development and training
  - Specialist knowledge, experience & expertise
  - Business development
  - Capability building & best practice
  - Perth / WA benefits
  - Assistance to SMEs
  - Achieve global growth
  - Sharing experience from OS

- **Aus. competitive advantage**
- **Innovation**
  - Customers & company growth
  - R&D focus & industry impact
  - Skills development and training
  - Specialist knowledge, experience & expertise
  - Business development
  - Capability building & best practice
  - Assist SMEs
  - Achieve global growth
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- **Technology solutions**
  - Engineering centre of excellence & design
  - HSE inc oil spill & fracking
  - Aus. subsea industry
  - Supply chain and logistics
  - Risk management
  - Commercialisation & IP
  - Operations & maintenance performance
  - Aus. deepwater industry
  - Aus. LNG industry
  - Project management

- **Alignment**
  - Industry support
  - Societal benefits & sustainable development
  - Aust. competitive advantage
  - Customers & company growth
  - R&D focus & industry impact
  - Skills development and training
  - Specialist knowledge, experience & expertise
  - Business development
  - Capability building & best practice
  - Assist SMEs
  - Achieve global growth
  - Sharing experience from OS
What will the core partners bring?

**Global contacts & expertise**
- Policy experience
- Co-funding initiatives
- Training

**Skills**
- Expert advice
- Specialist skills
- Services/logistics
- R&D/IP
- Understanding/knowledge

**Networks & linkages**
- In-kind staffing
- Training

**Funds**
- Technology access

**Leadership/governance/management**
Focus areas

• Design, construction and operation of projects
  – Lean construction, project management, contracts, supply chains, prequalification and risks, maintenance and operability

• Training & workforce development
  – Course development, skills improvement, local workforce capability

• Sustainable development
  – Baseline monitoring, oil spill modelling & response, onshore HSE, community engagement & co-existence, heritage, decommissioning, material science, remote operations

• FLNG & subsea technologies
  – Simulation, subsea acceptance, support systems, operations, flowline fabrication, material science, fatigue, corrosion, flow assurance, installation and repair
Next steps

• Confirm government support
• Post confirmation / pre funding:
  – Establish interim operating team
  – Communicate goals and plan
  – Expand networks, add core partners
• First 30 days:
  – Establish initial management
  – Communicate to key stakeholders
  – Establish corporate structure
  – Establish operating structure and budget
• Next 60 days:
  – Establish office, focus areas and working teams
  – Communicate goals and progress
  – Add detail to corporate design
Aim is to connect, not duplicate