1. Unconventional Petroleum
2. Roundtable
3. Conventional Oil
4. Q and A

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South Australian State Government

www.petroleum.dmitre.sa.gov.au
EIA / ARI 2013

Technically Recoverable Shale Resource Estimates

<table>
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<th>Gas (TCF)</th>
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<td>Total</td>
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<td>7,795</td>
<td>Total</td>
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Fast follower criteria outside North America

- The right rocks (liquids rich better)
- Markets
- Supportive investment frameworks
- Trusted regulatory frameworks
- Pre-existing infrastructure
- Capacity to move down cost curve
Australia:

Shale gas - technically recoverable potential:
- 437 tcf in 6 basins (avg 21% RF), EIA 2013
- > 1000 tcf in all prospective basins, Cook, 2013

Shallow CSG, Queensland & New South Wales
- 235 TCF est. tech. recov. resource (Santos ‘13)
- 42.8 tcf 2P reserves, YE ’12 (Core Energy, 2013)

Shale oil plays
- 17.5 BBO in 6 basins (avg 4% RF), EIA 2013

In South Australia - prospects targeted in the onshore Otway and Arckaringa basins

Tight gas - technically recoverable potential:
- Still to be assessed nationally. Estimated 300+ tcf gas-in-place resource target in just PEL 218, South Australian Cooper Basin (Beach Energy)

Deep coals - technically recoverable potential:
- Still to be assessed nationally. Considerable gas resource targets. 9+ tcf targeted in just PEL 96, South Australian Cooper Basin (Strike Energy)
Cooper Basin Composite and Deep Coal Plays

Nappamerrri Group

Roseneath Shale

Murteree Shale

Patchawarra Formation

Regional Seal

Regional Seal

Regional Seal

Gas saturated composite play
Patchawarra Formation pressure gradient data derived from DSTs and other data sources. Water pressure gradient is 0.43 psi/ft. Gradients exceeding ~0.45 psi/ft are indicative of overpressured gas. Overpressured gas in the Patchawarra Formation occurs at depths exceeding ~9500’ (~2900m).
Cooper Basin, South Australia

Patchawarra Fm. Pressure Gradient

Composite Play below ~2,900m

Base Patchawarra depth structure map showing unconventional gas wells
**CO₂ and Gas Wetness, South Australian Cooper Basin**

(Epsilon, Patchawarra, Tirrawarra, and Merrimelia Formations)

- **% CO₂**
- **Bbls Propane + Butane per MMcf Gas**
- **Bbls Condensate per MMcf Gas**

*Patchawarra Absent*
Deep Cooper Basin (Gidgealpa Coals): Enormous Generation Capacity

Patchawarra Formation Cumulative Coal Thickness

Toolachee Formation Cumulative Coal Thickness

Senex’s Paning 2 (May 2013): Single 63,000 pound proppant fracture stim. in Toolachee coal (~2900m). Up to 90,000 scf/d, over 4 days.

Santos, Beach, Origin JV
DEEP GAS IN THE COOPER BASIN

**EIA (2013):** 93 TCF sales gas in Cooper shales

**Beach Energy: PEL 218:** Potential 300 TCF gas in place in just PEL 218 (Nappamerri Trough, SA) ~100 TCF in shales and >200 TCF in sands. Chevron now PEL 218 partner

**Santos:** High-side 200+ TCF recoverable raw gas. Moomba 191 (vertical well): 2.6 MMscf/d from unconventional reservoirs at line pressure flowing to market. Santos – Beach – Origin JV have domestic and export markets.

**Senex Petroleum:** Est. 75-110 TCF gas in place in tight sandstone, shales & coals.

**Strike Energy:** Est. 9 TCF gas resource in deep coal in PEL 96 and has attracted a major gas customer (Orica) to back its appraisal program versus terms for 142 bcf
Conclusions for the Cooper Basin

1. Huge unconventional resource play in the deep troughs of the Cooper Basin.


3. Initial unconventional resource estimates for the Cooper Basin are high:
   - Company 2C contingent unconventional gas resources: ~5 TCF
   - EIA potential sales gas from shales: 93 TCF
   - Rough estimate of sales gas in Composite Play: > 175 TCF

4. Exploration and appraisal ramping up with several E&Ps and gas customers now funding exploration.
VISION: The unconventional gas revolution will deliver decades of safe, secure, competitive gas

To reach the vision

• Potential risks to social, natural and economic environments are reduced to as low as reasonably practical (ALARP); and meet community expectations for net outcomes BEFORE IT IS PERSONAL – before approval sought for land access;

• Affected people and enterprises get timely information describing risks and rewards to enable informed opinions;

• Convene roundtables to deliver roadmaps for unconventional petroleum projects to inform: the PUBLIC, GOVERNMENTS, INVESTORS, AND REGULATORS and in doing so – enable welcomed unconventional petroleum projects.

• South Australia’s Roadmap published Dec. 2012

• 5 working groups formed in 2013
Priorities to foster sustainable, profitable projects
roundtable and roadmap for unconventional gas

Top priorities to build trust:

• Legal frameworks provide certainty and simultaneously meet community and investor expectations for outcomes
• Trustworthy, people implement and regulate projects
• Environmental sustainability
• Manage supply-chain risks (people and facilities)
• Bolster understanding of risks, risk management and rewards

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Recap 5 Working Groups

#1 Training

#2 Supply hubs, roads, rail and airstrips for the Cooper-Eromanga basins

#3 Water use in the Cooper-Eromanga basins

#4 SA-Qld 'wharf to well' corridors for the Cooper-Eromanga basins

#5 Cost-effective, trustworthy GHG detection
Through Paul Goiak (DMITRE Industry Participation Office) - Leading Operators in the Cooper Basin (Santos, Beach and Senex) have agreed to contribute an aggregate of > $1million in cash and in kind to establish shared training facilities at Tonsley.

Research capabilities aligned with unconventional petroleum development feature in 3-4 Dec 13 Roundtable meetings

Strengthening capabilities in local Universities – Research Fellow in Unconventional Resources and more
Recap Working Groups #2 - Supply hubs, roads, rail and airstrips, Cooper-Eromanga basins

Getting very active in 4Q13-1Q14:

• Map existing supply routes (road, rail, air, ship); and
• Use Roadmap details to inform probabilistic dimensions, weights and timing for transport scenarios – in turn enabling optimisation modelling for road, rail and air for minimum 6,000 pj unconventional gas ex-Cooper Basin to supply a 15 year gas contract

Special facility licences (SFLs) are/will enable additional depots, airstrips and petroleum handling facilities

DPTI is now estimating what it will take to seal the Strzelecki Track as part of SA’s Integrated Transport and Land Use Plan. Needs to understand loads/timing.
Supply-chain goal posts:
2,800 wells @ 3Pj / well over 15 yrs to attain 8,422 Pj
(~10% of 93 TCF EIA estimate for gas from shales)

<table>
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<tr>
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<th>2015</th>
<th>2016</th>
<th>2017-2028 (12 years)</th>
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<td>5</td>
<td>9</td>
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<tr>
<td>Type of wells</td>
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<td>Horizontal</td>
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<td>Horizontal</td>
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<tr>
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Work for government-industry:

- Discover competence possibly without capacity to supply rigs, pipe, roads, rail, materials, services, people, etc, etc.
- Foster pre-qualification for tenders; and
- Enable clusters and IPOs for budding multi-nationals
Recap Working Group #3
Water use in the Cooper-Eromanga basins

Leading operators have met / are planning to pool water use forecasts for Cooper-Eromanga (SA-Qld) basin-wide modelling of water supply: demand balance, to deduce cost- and water-saving options.

This is a first, fundamental step towards life-cycle water-use planning – will inevitably foster environmental sustainability, project economics, transparency/trust, and business opportunities.

Leigh Staines (Santos) coordinating
Recap Working Groups #4 SA-Qld 'wharf to well' corridors for the Cooper-Eromanga basins

Now getting traction with colleagues in Qld

Two Qld regulators attended Roundtable in Adelaide, 2-3 Dec 13

**Upstream:** Mike Malavazos (DMITRE) in direct discussions with Qld’s Coal Seam Gas Compliance Unit, Department of Natural Resources and Mines

**Transport:** Don Hogben’s (DPTI) in direct discussions with new National Heavy Vehicle Regulator and Qld counterparts
Recap Working Groups #5
Cost-effective, trustworthy GHG detection

Met 22 November to hear results of measuring and monitoring fugitive GHG emissions in the USA (URS, Matt Harrison) and Qld (from both the CSIRO and the University of Adelaide Sprigg Geobiology Centre). Minutes and presentations will be posted on WG# 5 web-page ‘soon’.

Grants are sought for University research to develop more cost-effective GHG monitoring, including detection of natural seeps.

Subsequent to discussions – a sub-set of WG#5 members agreed revisit NGERS and other data develop FAQ s to better inform the public, business leaders and policy makers as to the materiality of various sources of GHG emissions. No doubt, all mitigation contributes to lowering carbon intensity. The objective of market-based GHG emissions mitigation policies are to reduce maximum GHG at the lowest costs.
To download the Roadmap for Unconventional Gas Projects in South Australia - go to:


or Google DMITRE & Unconventional Gas
Conventional Oil
Field Size Distribution – Proven Productive Oil Play in the Cooper-Eromanga Basins

Swanson's Mean = 2.53 million barrels per new field discovery

Proven + Probable (2P) Million Barrels
Case Study – Petroleum Retention Leases for Oil

Winner’s Curse?

Know your market!

Average for High Bids:
$4,435 per sq km per year

$4,500 / km² pa

y = 16418e^{-0.03x}
R² = 0.6809
Oil exploration wells (2000-13), western Cooper – Eromanga

- 56% located with 3D were discoveries (and find-size ⬆)
- 30% located with 2D were discoveries
Key Matters Considered in Decision-Making for the Regulation of PRLs

- The highest priority defined by the Roundtable for Unconventional Gas is the appropriate recognition of the life-cycle for finding, appraising, developing and producing resources. Fit-for-purpose licenses terms are the most direct way to recognize this life cycle. This is equally relevant to all mineral and energy resource sectors.

**The Subject Area Arrangement:**

- Avoids 18-24 months delay in exploration/discoveries after: intermittent relinquishments; call for bids; bids; negotiation of land access agreements; and grant of successively smaller PELs;
- Accelerates investment at contestable levels through renewal terms in ways not achieved with PELs;
- Delivers investment, jobs, production and royalties, sooner - clearly in the interest of the People of South Australia;
- Industry as a whole has greater investment efficiency;
- Attains very competitive levels of investment without the perverse outcome of ‘winner’s curse’ bidding;
The Subject Area Arrangement (continued):

- Based on DMITRE’s mapping of the proven oil play trend - 21 companies in JVs under 10 Operators may opt into Subject Area Agreements (e.g. cross-section of industry will benefit, including service companies who will get more extensive contracts);
- Nurtures small enterprises to become medium to large in size enterprises;
- Overcome a looming issue: Ever-smaller licences attracting circa $20 million bids (400 sq km 3D + 4 exploration wells) stretch the financial competence of ASX IPOs – and financial competence is a requirement for compliant licence-holders;
- Seeks secure investment at a time the State needs stronger investment;
- Farm-outs and sales are expected to further accelerate investment than is likely to be attracted through success, intermittent work program bids;
- A company approached Government with a proprietary request to progress applications for PRLs;
- Undertook targeted consultation with a cross-section of key Operators, at least one non-Operator and service companies active in the Cooper-Eromanga basins;
- The clear majority of enterprises considered the concept of PRLs for oil as a significant (even visionary) step worth taking;
- With regret, there little chance that all regulatory decision will please all stakeholders, always;
Oil and Gas in South Australia
December 2013

Look – it is possible to herd cats

Nirvana Outcomes

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South Australian State Government

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