1. Welcome / Introductions
2. Context for Unconventional Petroleum
3. Working Groups
4. Your Comments

Barry Goldstein,
Executive Director – Energy Resources
South Australian State Government
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

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Priorities to foster sustainable, profitable projects roundtable and roadmap for unconventional gas

- **Outcome:**
  **Attain the vision**

- **Strategy:**
  **Cooperate to compete**

- **Roundtable:**
  **List what to do by priority** (125 recommendations)

- **Working Groups:**
  **Implement priority recommendations.**

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### Technically Recoverable Shale Resource Estimates

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Gas (TCF)</th>
<th>Oil (Billion Bbls)</th>
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<tbody>
<tr>
<td>1</td>
<td>USA</td>
<td>1,161</td>
<td>Russia</td>
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<tr>
<td>2</td>
<td>China</td>
<td>1,115</td>
<td>USA</td>
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<td>3</td>
<td>Argentina</td>
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<td>707</td>
<td>Argentina</td>
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<td>5</td>
<td>Canada</td>
<td>573</td>
<td>Libya</td>
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<td>Others</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7,795</td>
<td>Total</td>
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</table>

**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

Gas saturated composite play

Nappamerri Group
Regional Seal

Roseneath Shale
Regional Seal

Murteree Shale
Regional Seal

Patchawarra Formation
PRIMARY SOURCE INTERVAL
Patchawarra Formation Overpressure

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).
Composite Play below ~2,900m

Base Patchawarra depth structure map showing unconventional gas wells

Cooper Basin, South Australia
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

Patchawarra Absent

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.

Moomba 77 – Coal Frac, 100,000 scf/d, 9000 ft

Santos, Beach, Origin JV
Deep Gas in the Cooper Basin

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.

EIA (2013): 93 TCF sales gas in Cooper shales.
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: 85 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.
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
Call on 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 will feature at the 3 - 4 Dec 13 Roundtable meetings

Strengthening capabilities in local Universities – Research Fellow in Unconventional Resources and more
In coming months – will get very active:

- Map existing supply chain 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

Will hear about *shale rail* from G&W today

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>
<thead>
<tr>
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<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017-2028 (12 years)</th>
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<tr>
<td>Drilling rigs</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>15</td>
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<tr>
<td>Type of wells</td>
<td>Vertical</td>
<td>Horizontal</td>
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<td>Horizontal</td>
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<tr>
<td>Rig Years @ 50% vertical vs horizontal</td>
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<tr>
<td>Wells/yr/rig</td>
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<tr>
<td>Wells Tally</td>
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<td>16.5</td>
<td>43.75</td>
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</tbody>
</table>

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
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) will discuss water use today
Recap Working Groups #4  SA-Qld 'wharf to well' corridors for the Cooper-Eromanga basins

In coming months – will get more active

**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

or hand me you business card
Roundtable for Unconventional Gas Discussions on 2 December 2013

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Barry Goldstein,
Executive Director – Energy Resources
South Australian State Government
• First commercial gas discovered in 1963.
• Has produced over 5 tcf of gas
• >1,800 O&G wells
• Large unconventional gas resource targets.
• Existing infrastructure
• Sales gas netbacks from LNG exports reported to be AUS$9/GJ. Impacts domestic gas prices;
• Some Cooper gas already committed to export from Gladstone
Composite Resource Play, Cooper Basin

Base Patchawarra depth structure map showing unconventional gas wells

Roseneath, Epsilon and Murteree (REM) Shales

Gidgealpa Group

Composite Play

Figure sourced from Beach Energy