Meeting of the Roundtable for O & G Projects
23rd October 2014

1. Welcome & Introductions

2. What brought us together?

3. Agenda

4. What’s been done?

5. What’s next

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

Ted Beaumont,
President AAPG
(July 2012 Explorer pp 3)

.....outside North America, industry is just beginning to explore resource plays.

.....organic matter, maturity and brittleness

.....the USA is now producing more gas than ever

Australia leads in using CSG as feedstock for LNG
### Technically Recoverable Shale Resource Estimates

<table>
<thead>
<tr>
<th>Rank</th>
<th>Region</th>
<th>Gas (TCF)</th>
<th>Oil (Billion Bbls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USA</td>
<td>1,161</td>
<td>1 Russia</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
<td>1,115</td>
<td>2 USA</td>
</tr>
<tr>
<td>3</td>
<td>Argentina</td>
<td>802</td>
<td>3 China</td>
</tr>
<tr>
<td>4</td>
<td>Algeria</td>
<td>707</td>
<td>4 Argentina</td>
</tr>
<tr>
<td>5</td>
<td>Canada</td>
<td>573</td>
<td>5 Libya</td>
</tr>
<tr>
<td>6</td>
<td>Mexico</td>
<td>545</td>
<td>6 Australia</td>
</tr>
<tr>
<td>7</td>
<td>Australia</td>
<td>437</td>
<td>7 Venezuela</td>
</tr>
<tr>
<td>8</td>
<td>South Africa</td>
<td>390</td>
<td>8 Mexico</td>
</tr>
<tr>
<td>9</td>
<td>Russia</td>
<td>285</td>
<td>9 Pakistan</td>
</tr>
<tr>
<td>10</td>
<td>Brazil</td>
<td>245</td>
<td>10 Canada</td>
</tr>
<tr>
<td>11</td>
<td>Others</td>
<td>1,535</td>
<td>11 Others</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7,795</td>
<td>Total 335</td>
</tr>
</tbody>
</table>

### Fast follower criteria outside North America

- The right rocks (liquids rich better)
- Markets
- Supportive investment frameworks
- Trusted regulatory frameworks
- Pre-existing infrastructure
- Two ends against the middle – descend cost & ascend productivity curves
Overview – Oil and gas onshore and offshore South Australia

- 4 Cooper CO2013 blocks attracted aggregate $103 million work program bids (Senex x 2, Strike, Bridgeport)
- Western Flank oil play in the Cooper-Eromanga continues with 50+ % success in finding avg. 2.5 mln bbls oil
- $510 million accelerated investment with enhanced tenure terms
- Huge potential for gas in unconventional reservoirs in the Cooper Basin
- Encourage results from Otway Basin exploration (Beach/Cooper)
- Bight Basin attracting the majors – massive investment
- Frontier basins’ plays include:
  - Conventional oil and gas
  - Unconventional regional plays
Vision for Nirvana: Centuries of safe, secure, competitive energy supplies that meet community expectations for net outcomes

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 projects to inform: the PUBLIC, GOVERNMENTS, INVESTORS, AND REGULATORS and in doing so – enable/attract welcomed oil and gas projects.

• South Australia’s Roadmap (Dec. 2012)

560 members in SA’s Roundtable for O&G Projects
Informed by a Roundtable including: industry; governments; peak bodies for protecting environments and aboriginal people; research institutions and a few individuals

Now under the auspices of the Roundtable for Oil and Gas Projects

6 working groups to enable cooperation amongst competitors

**Strategic actions:** demonstrate where the net present value of cooperation (JVs for JVs) exceeds the value of go-it-alone planning / investment
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
## Top 5 of 125 Roadmap Recommendations

- **☑️** = significant progress

<table>
<thead>
<tr>
<th></th>
<th>Recommendation</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Deploy fit-for-purpose licence terms and conditions</td>
<td>☑️</td>
</tr>
<tr>
<td>2</td>
<td>Enable fit for purpose skills</td>
<td>☑️</td>
</tr>
<tr>
<td>3</td>
<td>Use water wisely</td>
<td>☑️</td>
</tr>
<tr>
<td>4</td>
<td>Communicate effectively to demonstrate the efficacy of managing environmental risks</td>
<td>☑️</td>
</tr>
<tr>
<td>5</td>
<td>Regulation simultaneously meets public and investor expectations for net outcomes</td>
<td>☑️</td>
</tr>
<tr>
<td>Rank</td>
<td>Recommendation</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bolster public understanding re: hazards and risk management via FAQ on web ✓</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pave roads between Moomba and Qld</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pave roads between southern ports &amp; Moomba</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Water crossings more passable</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Streamlined approvals for imported equipment - especially road and wiring regulations</td>
<td></td>
</tr>
</tbody>
</table>
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

#6 Suppliers’ Forum
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00-08:20</td>
<td>Guests arrive and register</td>
</tr>
<tr>
<td>08:20-08:30</td>
<td>Guest seated</td>
</tr>
<tr>
<td>08:30-09:00</td>
<td><strong>1. WELCOME (B Goldstein)</strong></td>
</tr>
<tr>
<td></td>
<td>• Welcome and introductions</td>
</tr>
<tr>
<td></td>
<td>• Update on the Roadmap for Unconventional Gas Projects in SA</td>
</tr>
<tr>
<td></td>
<td>• Roundtable now for all oil and gas projects both onshore and offshore South Australia</td>
</tr>
<tr>
<td></td>
<td>• Will hear of key progress by Working Groups</td>
</tr>
<tr>
<td></td>
<td>• Workshop this afternoon is to review/ re-load recommendations for ranking</td>
</tr>
<tr>
<td>09:00-9:50</td>
<td><strong>2. ROADMAP RECOMMENDATIONS</strong> – Implementation update</td>
</tr>
<tr>
<td></td>
<td>• Status of implementation of the 125 recommendations contained in the December 2012 Roadmap for Unconventional Gas Projects in SA (B Goldstein)</td>
</tr>
<tr>
<td></td>
<td>• See enclosure 1 with its attachments</td>
</tr>
<tr>
<td></td>
<td>• Recap funding for unconventional reservoirs and water research</td>
</tr>
<tr>
<td>9:50-10:10</td>
<td><strong>3. WORKING GROUP 1 – Training</strong></td>
</tr>
<tr>
<td></td>
<td>Onshore Petroleum Centre of Excellence (OPCE) training facility at Tonsley</td>
</tr>
<tr>
<td></td>
<td>• A collaboration between Santos, Beach Energy, Senex Energy, the State Government and TAFE SA (Fiona Mossman, Senex /Bettina Venner)</td>
</tr>
<tr>
<td>10:10-10:30</td>
<td><strong>MORNING TEA</strong></td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>4. WORKING GROUP 5 - Cost-effective &amp; Trustworthy GHG Detection</td>
</tr>
<tr>
<td></td>
<td>• Annie Ngo, DSD – NGERS (5 mins)</td>
</tr>
<tr>
<td></td>
<td>• David Ottaway, University of Adelaide – Photonics/Lasers – ARC Grant (6 mins)</td>
</tr>
<tr>
<td></td>
<td>• Martin Kennedy, University of Adelaide – Sprigg Geobiology – ARC Grant (6 mins)</td>
</tr>
<tr>
<td></td>
<td>• Ady James, UCL – Mullard lab research (6 mins)</td>
</tr>
<tr>
<td></td>
<td>• Q&amp;A (5 mins)</td>
</tr>
<tr>
<td>11:00-noon</td>
<td>5. WORKING GROUP 3 - Water Use in the Cooper-Eromanga Basins</td>
</tr>
<tr>
<td></td>
<td>• Water Balance Study (Santos – Leigh Staines/Golder Associates) – (40 minutes)</td>
</tr>
<tr>
<td></td>
<td>• Q&amp;A (5 mins)</td>
</tr>
<tr>
<td></td>
<td>• Project being implemented: The Impact of Unconventional Gas on Water Resources: Replacing Myths with Scientific Evidence (Peter G. Cook – National Center for Groundwater Research &amp; Training) – 7 minutes</td>
</tr>
<tr>
<td></td>
<td>• Plans for the Otway Basin (Tony Hill, DSD, State Government of South Australia) – 3 minutes</td>
</tr>
<tr>
<td></td>
<td>• Q&amp;A (5 mins)</td>
</tr>
<tr>
<td>12:00-12:45</td>
<td>LUNCH</td>
</tr>
</tbody>
</table>
## Agenda 23 October 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 12:45-13:25| **6. WORKING GROUP 2** – Supply Hubs, Roads, Rail-links and Airstrips to/in the Cooper-Eromanga Basins  
|            | • Don Hogben, DPTI - roads, rail, etc (20 min)                           |
|            | • Luke Jamieson, KJM - logistic hubs (10 min)                            |
|            | • Bettina Venner, DSD- air transport (1 slide) (10 min)                  |
| 13:25-14:05| **7. WORKING GROUP 4** – Safe sustainable transport and reduced red tape on SA-Qld 'Wharfl to Well' Corridors to the Cooper-Eromanga Basins  
|            | • Transport: Don Hogben DPTI – State Government of South Australia (30 minutes including Q&A) |
|            | • Wiring Standards: Rob Faunt, OTR, State Government of South Australia (5 minutes) |
|            | • Qld’s perspectives: A representative of the State Government of Queensland (5 minutes) |
| 14:05-14:20| **AFTERNOON TEA**                                                        |
| (80 minutes)| An opportunity to reinvigorate recommendations for the upstream petroleum industry going forward.  
|            | ~ 8 to 10 people per table). With > 300 people, >30 tables. Will appoint 1 moderator and 1 scribe at each table. Barry Goldstein to facilitate |
| 15:40 – 16:30| **9. WRAP UP**  
|            | • Action Items Recap AND CLOSE (B Goldstein to Lead)                      |
Many of the recommendations are for evergreen action.

Industry options for competition vs cooperation (JVs for JVs) are subject to industry positions, though g’ment will assist.
Top (#1) recommendation - Provide fit-for-purpose licences

- Giant gas (‘00s of TCF) resource potential in unconventional reservoirs
- 52% post-3D success rate 2002-14 for oil exploration in western flank of Cooper – Eromanga (avg. 2.5 mmbo find size)
- Western Flank Oil play: 11 operators for 25 companies
- Cooper Gas plays: 9 operators for 31 companies

Proven Cooper-Eromanga oil play

Western Flank Operators
- Ambassador Oil & Gas Ltd
- Outback Energy Hunter Pty Ltd
- Beach Energy Ltd
- Bridgeport Energy Ltd
- Discovery Energy SA Ltd
- Drillsearch (513) Pty Ltd
- Terra Nova Energy Ltd
- Linc Energy Ltd
- PNC Australia Pty Ltd
- Santos Ltd
- Senex Energy Ltd
- Strike Energy Ltd

- Oil well
- Gas well
- Western Flank proven oil play
- Gas pipeline
- Gas and liquids pipeline
- Liquids pipeline
- Coongie Lakes control zone – no access
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

\[ y = 16418e^{-0.03x} \]

\[ R^2 = 0.6809 \]
The #1 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 now manage resource project life cycle. This is equally relevant to all mineral and energy resource sectors. Grouped Petroleum Retention Licences (PRLs):

- Avoid 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 competitive levels of investment without the perverse outcome of ‘winner’s curse’ bidding;
Grouped Petroleum Retention Licences – PRLs (continued):

- Have a competitive array of enterprises in the South Australian Cooper-Eromanga:
  - 21 companies under 10 operators in the western flank oil play
  - 16 companies under 8 operators in multiple deep gas unconventional reservoir plays;
- Have negotiated levels of investment benchmarked with guaranteed winning bids for oil and with even stronger investment for deep gas plays (that are more expensive to explore and appraise);
- PRL investment is a multiple of what would otherwise be attracted through surrender of smaller areas for re-cycling through work program bids;
- Greater levels of ‘guaranteed’ activity drive more extensive contracts and efficiencies;
- Nurtures small enterprises to become medium to large in size enterprises;
- Attracts secure investment at a time the State needs stronger investment;
- Overcomes a looming issue: Ever-smaller licences attracting bids that too easily stretch the financial competence of ASX IPOs and private capital raisings. The foible of financial competence of bid parties is real;
- Certainty of tenure makes PRLs more valuable than PELs – underpinning capital raisings, farm-outs and M&A— an excellent net economic outcome;
- Farm-in’s and acquisition remain options to get-in
- Underspends result in proportional relinquishments for re-cycling at 5-yr junctures
Recommendation #2: Manage the risk of a shortage of skills and people

Evergreen responsibility of industry and government. Implemented in part through:

• Industry and the State Government’s Department of State Development (DSD) under the auspices of Roundtable Working Group #1
  - Santos, Beach Energy and Senex Energy are working with the DSD and TAFE SA to establish an Onshore Petroleum Centre of Excellence (OPCE) training facility at Tonsley, co-located with the new State Core Library (More on this later in the agenda)
  - A South Australia State chair for unconventional reservoir research has been established in at the University of Adelaide — complimented with funding for international expert lecturers, the State Chair in Petroleum Geology, funding for the CO2CRC, and funding for the State Chair in Geothermal Energy at the University of Adelaide.
  - Suppliers’ study tours of oil and gas facilities in the USA in 2014 will be leveraged-on in another tour in 2015 under the auspices of the Industry Participation Office.

• User-pays fees to sustain the competence and capacity for trustworthy regulations. Enabled by popularity of PRLs. After providing $s for time-writing for upstream petroleum regulation by DSD, DEWNR, EPA, SafeworkSA, and Health — still cut PRL fees by 20%
Evergreen responsibility of industry and government. Implementedin part through:

• Industry and the State Government’s Department of State Development (DSD) under the auspices of Roundtable Working Group #3
  - Santos, Beach Energy, Senex Energy and Drillsearch have shared their historical and forecast water production and use in the SA-Qld Cooper-Eromanga basins. DSD called for tenders and provided $ support for a water balancing model. CSIRO and DEWNR providing peer review.
  - Independent expert scientific research review of international oil and gas operations impacts on water to decipher what are significant versus insignificant risks to water resources
  - Regional water studies in the Otway underway and more planned

• Demonstrate safe conduct through outcomes: No evidence or realistic expectation of fracture stimulation resulting in the contamination of fresh water supplies or damaging induced seismicity in the far northeast of South Australia where 717 deep petroleum wells and a few geothermal (hot rock) wells have been fracture stimulated through August 2014 (next slide)

• Regulation must be trustworthy to ban anything everywhere until it is clear all significant risks posed to social, natural and economic environments can be managed to meet community expectations for net outcomes
Separation of fracture stimulation in the Cooper Basin from fresh water supplies

No evidence or realistic expectation of fracture stimulation resulting in the contamination of fresh water supplies or damaging induced seismicity in the far northeast of South Australia where 700+ deep petroleum wells and a few geothermal (hot rock) wells have been fracture stimulated.

Number of fracture stimulated stages in 716 fracture stimulated wells in the Cooper Basin to end Aug.’14
5th, 11th and 12th Highest Ranked Recommendations –
Ensure legislation, regulation, policies & programs are
trustworthy, efficient and effective

Evergreen responsibility of government. **Implemented through the leading practice South Australian Petroleum and Geothermal Energy Act 2000 (PGEA):**

- South Australia’s **PGEA** defines the **environment** as: land, air, water, soil; plants and animals; social, cultural and heritage features; visual amenity; economic and other land uses.
- Activities cannot start without an approved SEO in place.
- SEO’s set standards for outcomes from operations
- SEOs are objective-based, transparent drivers for risk management and the protection of environments.
- ‘Owner of land’ means all people and enterprises potentially directly affected by activities, entitling them to notices of entry, the right to dispute entry (in court) and compensation.

~ 14,000 notices of entry for operations issued – without a single person or enterprise taking up their rights to take the matter to Court (E²)
Vision: Centuries of safe, secure, competitive energy supplies that meet community expectations for net outcomes

- 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;

- Potentially affected people & enterprises get timely information describing risks & rewards to enable informed opinions (2x’s: post-research and pre-notice of entry);

- Convened roundtable to deliver a roadmap to inform: the PUBLIC, GOVERNMENTS, INVESTORS, AND REGULATORS and in doing so—enable/attract welcomed oil and gas projects.
5th, 11th & 12th top recommendations – Aspiring to attain regulatory Nirvana via Statements of Environmental Objectives (SEOs)

- South Australia’s *Petroleum and Geothermal Energy Act 2000* defines the environment as: land, air, water, soil; plants & animals; social, cultural & heritage features; visual amenity; economic & other land uses.

- Activities cannot start without an approved SEO in place.

- SEO’s set standards for outcomes from operations

- SEOs are objective-based, transparent drivers for risk management and the protection of environments.

- ‘Owner of land’ means all people and enterprises potentially directly affected by activities, entitling them to notices of entry, the right to dispute entry (in court) and compensation.

- ~14,000 notices of entry for operations issued – without a single person or enterprise taking up their rights to take the matter to Court
Vision for Nirvana: Centuries of safe, secure, competitive energy supplies that meet community expectations for net outcomes

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;

• Potentially affected people & enterprises get timely information describing risks & rewards to enable informed opinions (2x’s: post-research and pre-notice of entry);

• Convened roundtable to deliver a roadmap to inform: the PUBLIC, GOVERNMENTS, INVESTORS, AND REGULATORS and in doing so – enable/attract welcomed oil and gas projects.
Productivity Commission concluded: One-Stop-Shops are the most efficient regulatory approach when well managed without ‘CAPTURE’

“Recommendation – Establish lead agencies”

South Australia is widely seen as a model for other jurisdictions to emulate”.

“With appropriate governance, experience in South Australia suggests that such an agency can achieve an appropriate balance between enforcing legislative provisions and expediting approvals”.

[Diagram showing One Window for Government Processes with license, operator activity, legal delegation, memorandum of understanding, SEO Process, Health, EPA, National Parks, Native Vegetation, Water, Safety, Planning]
6th Highest Ranked Recommendation –  
Bolster public understanding (with reliable information) re: hazards and risk management via FAQ on web

Informing stakeholders is an evergreen function of regulators through:

- timely stakeholder engagement jointly by DMITRE-PIRSA-DEWNR-EPA (reading off the same evidence-based pages)

- area- and activity specific SEOs (prepared by PGE Act licence holders) and the SEO approvals process to inform potentially affected people and enterprises.

- published the Roadmap for Unconventional Gas Projects in South Australia in December 2012 – and sustaining the Roundtable that informed that Roadmap – to keep the information-flow at the leading edge of evidence/objective based decision-making;

- publish accounts of the PGE Act and stay contestable;


- routinely update answers to frequently asked questions (FAQs) for historical and potential upstream petroleum operations to inform the public. (refer to papers and see: http://www.petroleum.dmitre.sa.gov.au/__data/assets/pdf_file/0003/218109/FAQ_-_South_East_Unconventional_Gas_and_Oil.pdf)
### 7th, 8th, 9th & 10th Highest Ranked Recommendations – Improved transport, supply-chain depots, heavy vehicle road and wiring regulation

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Progress to mid Oct 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td># 7, # 8 &amp; #9 Paved, wide roads more passable year-around</td>
<td>More under Agenda Item # 6. Implementation in progress through Roundtable Working Group #2.</td>
</tr>
<tr>
<td></td>
<td>• Options for improving roads from ports to operations in the Cooper-Eromanga basins established in dialogs involving the State Government, key operators of petroleum licences in the Cooper-Eromanga basins.</td>
</tr>
<tr>
<td></td>
<td>• Load modelling enabled with equipment lists for wells construction for deep gas in the Cooper Basin (<a href="#">Appendix 2a and 2b of the Roadmap for Unconventional Gas</a>)</td>
</tr>
<tr>
<td>#10: Streamline heavy vehicle road and wiring regulations</td>
<td>More under Agenda Item #7. Implementation in progress through Roundtable Working Group #4</td>
</tr>
<tr>
<td></td>
<td>• Queensland and South Australia State governments cooperating to enable wharf to wellhead transport corridors without extraneous regulation. Discussions also involving the National Heavy Vehicle Regulator.</td>
</tr>
</tbody>
</table>
Progress on recommendations #31 & #52
Updated CO₂ and Gas Wetness Maps, South Australian Cooper Basin
(Epsilon, Patchawarra, Tirrawarra, and Merrimelia Formations)

% CO₂

Barrels of Propane + Butane (LPG) per MMcf Gas

Barrels of Condensate per MMcf Gas

Patchawarra Absent
Offshore Bight Basin Commonwealth Waters
$1.2 bln guaranteed 2011-16 + $1.1 bln non-guaranteed 2017-20

BP & Statoil
EPPs 37 to 40

CHEVRON
EPP44 &
EPP45

SANTOS &
MURPHY
EPP43

BIGHT
PETROLEUM
EPP 41 and
EPP 42
Key Conclusions

1. Huge potential in unconventional reservoirs in the Cooper. ~$3.5 bln investment 2014-19.

2. Huge potential offshore in the Bight Basin. ~$2.3 Bln investment to 2020.

3. Trustworthy regulation / regulators

4. The Roundtable for Oil & Gas Projects will continue to expedite fit-for-purpose outcomes to benefit all South Australians.
Meeting of the Roundtable for O & G Projects
23rd October 2014

Barry Goldstein,
Executive Director – Energy Resources
South Australian State Government
Background information
(with engagement in relation to oil and gas operations in the Coonawarra Wine District – Otway Basin as an example)

Nirvana Outcomes

The kid is good
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

Nappamerri Group

Roseneath Shale

Murteree Shale

Patchawarra Formation

Regional Seal

Regional Seal

Regional Seal

Gas saturated composite play

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).
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 Energy: Est. 75-110 TCF gas in place in tight sandstone, shales & coals. Origin now partner in 3 PEL

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 project capital and a sales agreement for 237 bcf over 20 years

Drillsearch Energy and BG in Qld deep gas play:
Conclusions for the Cooper-Eromanga Basins

1. >50% success rate in finding average 2.5 mmbo post 3D
2. Huge shale, tight sandstone and deep coal gas plays.
3. Proven 1,000+ metre gas columns can be developed with a mix of (mostly) verticals and (fewer) horizontal wells
4. Initial unconventional resource estimates for the Cooper Basin are high:
   • EIA potential sales gas from shales: 93 TCF
   • Rough estimate of sales gas in Composite Play: ~300 TCF
5. Exploration and appraisal ramping up with several E&Ps and gas customers now funding exploration. Expect deals
6. $3.5 bln ‘spend’ in Cooper - Eromanga 5 yrs from 1/7/14
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. Co-located with new core library

Strengthening capabilities in local Universities –
• SA Research Fellow in Unconventional Resources
• SA Chair – Petroleum Geology
• $s for Visiting Experts
• CO2CRC (cognate)
• SA Centre for Geothermal Energy Research (cognate)
Recap Working Groups #2 - Supply hubs, roads, rail and airstrips, Cooper-Eromanga basins

- Have mapped existing supply options (road, rail, air, ship);
- Used *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. Also accounting for oil.
- Special facility licences (SFLs) enable additional depots, airstrips and petroleum handling facilities.
- DPTI has estimated requirements to seal the Strzelecki Track as part of SA’s Integrated Transport and Land Use Plan. Looking at intra-basin requirements, too.
- Building economic models to elucidate public vs private benefit in context of Infrastructure Australia criteria for Federal funding.
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.

Santos coordinating. Golders contracted for modelling with South Australian Government funding.
Recap Working Groups #4 SA-Qld 'wharf to well' corridors for the Cooper-Eromanga basins

Need traction with colleagues in Qld

Qld regulators at Roundtable in Adelaide, 2-3 Dec 13

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

Transport: DPTI in direct discussions with new National Heavy Vehicle Regulator and Qld counterparts
ARC Linkage grants worth ~A$1 million awarded for University of Adelaide 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. SA Government providing resources for this compilation and assessment
## Best Practice Regulatory Principles

Delivering Regulatory Best Practice through 6 Principles:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Certainty</td>
</tr>
<tr>
<td>2)</td>
<td>Openness</td>
</tr>
<tr>
<td>3)</td>
<td>Transparency</td>
</tr>
<tr>
<td>4)</td>
<td>Practicality</td>
</tr>
<tr>
<td>5)</td>
<td>Flexibility</td>
</tr>
<tr>
<td>6)</td>
<td>Efficiency</td>
</tr>
</tbody>
</table>
Appropriate range of regulatory enforcement tools to elicit compliant behaviour.

- **PGE Act compliance policy**
- **PGE Act Annual Compliance report**