



Executive Summary

Context

The development of unconventional gas is proving to be positively transformational for North American economies and Australia is a first mover in developing shallow coal seam gas as feedstock for liquefied natural gas (LNG) export. In addition, when developed to leading practice standards for well integrity, gas is a much less carbon intensive fuel (than coal) for electricity supplies.

The progress already made with the development of unconventional gas is underpinned by significant technological advances and the emergence of export liquefied natural gas (LNG) markets. Most recently, supply-side competition in North America is seeing a shift to unconventional gas resources that also contain petroleum liquids to cushion the commerciality of projects.

Given these investment drivers, more than 20 companies/Joint Ventures are now focusing on exploring unconventional gas plays with giant discovery potential in South Australia. This is in addition to exploration for conventional oil and gas plays in proven producing basins and the State's frontier basins. With such diversification, the chance at least one of these unconventional gas plays will lead to a major discovery is high. Realistic expectations are held for economic success in one or more of South Australia's unconventional gas plays, and each of at least nine plays has potential to yield at

least one giant gas field¹, that can underpin domestic gas, export LNG and/or synthetic transport fuel (synfuel) supplies from South Australia.

With these drivers for commercialising unconventional gas in mind, the South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) convened a South Australian Roundtable for Unconventional Gas in October 2010. A total of 212 organisations (and one individual) are now² participating in the Roundtable, covering: peak representative bodies focused on economic, social and natural environment outcomes; companies, universities, and key agencies from all States, the Northern Territory and Commonwealth governments. A list of Roundtable members is provided in Appendix 1 to this Roadmap.

Last but not least, this Roadmap will be concluded in the context of the South Australian Government's [Strategic Priorities and Strategic Plan Targets](#).

¹ A giant gas field has at least 3 trillion cubic feet of recoverable sales gas (Giant Oil and Gas Fields of the Decade 1990-2000: An Introduction, by Michel T. Halbouty, Energy Company, Houston, TX., AAPG Search and Discovery Article #20005 (2001). Download from: www.searchanddiscovery.com/documents/halbouty03/

² 5th November 2012

Objectives

This Roadmap will inform stakeholders and sets the course for environmentally sustainable development of South Australia's large endowment of unconventional gas. This Roadmap transparently lays out the factors that will be taken into account in considering whether or not to approve unconventional gas projects so as to ensure compatibility with co-existing natural, social and economic environments.

Some unconventional Australian and international gas projects have, or have been perceived to have significant environmental, health or social impacts. Whilst it is not feasible to identify each and every potential local to regional impact of unconventional gas project activities in this document, this Roadmap informs stakeholders of the prevailing:

- (a) regulatory framework;
- (b) robust and transparent processes for environmental impact assessments that are precedents to activity approvals; and
- (c) how people and enterprises potentially affected by prospective unconventional gas operations are given information and time to draw considered views, so their rights to object in part or full to activity- and location-specific land access are supported.

Indeed, regulation, in South Australia requires risks to be reduced to as low as reasonably practical (ALARP) and to also be managed to meet community expectations for net outcomes.

The Roundtable was tasked with producing a *Roadmap for Unconventional Gas Projects in South Australia* to clarify opportunities (rewards) and threats (risks) to: inform markets; inform people and enterprises that may someday compatibly co-exist with unconventional gas projects; and to reduce critical uncertainties that may

impede efficient, profitable and welcomed investment.

The first draft of the Roadmap was the subject of public comment in the term 14th May – 27th July 2012. A meeting of the Roundtable was convened to consider and add to draft recommendations on 27th July 2012. All stakeholders who sought an extension of time to make submissions for the first draft Roadmap in August 2012, and the second draft Roadmap in September 2012 were given extensions to provide comments. This input from the public plus advice from the Roundtable has informed this third and final draft of the Roadmap.

Objectives of this final Roadmap are to credibly inform: industry strategies; government policies; and public perceptions. This will facilitate the efficient, profitable and welcomed deployment of capital, technologies and infrastructure for the commercialisation of unconventional gas in the South Australia, to supply: domestic and international markets for gas (including LNG); petroleum liquids; manufactured synthesis gas (syngas); and synthetic liquid transport fuels (synfuel).

Rhodri Thomas, from international energy analyst Wood Mackenzie, commented in 2010 *"It is too early to say how the future of unconventional gas will play out, but it is clear that stakeholders across the gas value chain—gas suppliers, resource holders, buyers and policy makers—need to understand the possible impact of future developments. Those that do this early and monitor key signposts will be best placed to benefit from the unconventional gas revolution."*

South Australia has certainly moved early and this Roadmap for Unconventional Gas Projects will ensure that people and businesses in the State are well-positioned to understand and benefit from the unconventional gas revolution.

KEY FINDINGS

Roadmap for Unconventional Gas Projects in South Australia

1. Welcomed investment in the development of unconventional gas will effectively reduce risks to as low as reasonably practical while simultaneously meeting community expectations for net outcomes.

This will be achieved with, amongst other actions, astute investment in economic unconventional plays, and by adhering to the golden rules for the golden age of gas, as published by the International Energy Agency³ – which are:

- Measure, disclose, engage;
- Watch where you drill;
- Isolate wells – protect against leaks;
- Treat water responsibly;
- Eliminate venting and minimise flaring;
- Think big;
- Consistent high environmental performance;

A key element in implementing these 'golden rules' (and leading practice more generally) is early, effective, informative stakeholder consultation by both project operators and regulators. This engagement is best initiated well ahead of land access. South Australia's regulatory framework drives operators to explain their planned activities and any potential risks, seek feedback on areas of interest or concern for the community, and establish relationships and terms for land access with stakeholders well before applying for activity approval from DMITRE. For details – see Chapter 5.

2. This roadmap could never be exhaustive or provide all salient information relevant for every unconventional gas play in the State. It does at least alert people, enterprises and government agencies as to the nature of unconventional gas plays and projects in South Australia as understood in December 2012.
3. Australia should adopt international standards for unconventional gas resource and reserve definitions. For details – see Chapter 1.
4. At least nine unconventional gas plays are being explored by more than twenty joint ventures in South Australian sedimentary basins. There is a high probability for two or more unconventional gas plays being profitably developed in the next five years.
5. The most advanced unconventional gas projects in South Australia are located in the Cooper Basin. Gas has been flowed during production tests of shale gas, tight gas and deep coal seam gas in the Cooper Basin and shale gas reservoirs in Moomba 191 have already been commercialised by the Santos operated Joint Venture that includes Origin Energy and Beach Energy. Other operators in the Cooper Basin (especially Beach Energy and Senex Energy) are also actively exploring and appraising multiple unconventional gas plays. Elsewhere in South Australia, attractive unconventional gas plays are recognised in the Arckaringa, Pedirka, Eromanga, Otway, Simpson, Officer and Gambier basins. In particular, the Altona – CNOOC Arckaringa Coal-to-Liquid and Power Project has advanced to the Project Bankable Feasibility Study phase, with sampling and testing expected to commence shortly. For details – see Chapter 4.

³ Download from www.worldenergyoutlook.org/media/weowebiste/2012/goldenrules/WEO2012_GoldenRulesReport.pdf

6. The US Government's Energy Information Agency estimates the shale gas play in the Cooper Basin could yield 85 tcf of sales gas⁴. Geoscience Australia (2012⁵) estimates there is potential to develop Australia-wide unconventional gas reservoirs to recover 716,540 PJ of sales gas.
7. Santos estimates a potential range for its net recoverable raw gas from unconventional resources in its licences in the Cooper Basin to be between a low of 15 tcf to a high of 125 tcf (raw gas)⁶. The high-side estimate corresponds to a gross total of more than 200 tcf raw recoverable unconventional gas.
8. Eastern Australian Proven and Probable (2P) gas reserves currently total over 51,000 PJ, over 85 percent of which are CSG reserves. This estimate does not account for future discoveries which would extend the current reserves. For South Australia, gas demand is forecast to be 106 PJ for 2012, 15 percent of the eastern Australian demand. Demand growth in SA is forecast to reach 117 PJ by 2025. This is not accounting for possible gas demand for potential future industrial projects. For details – see Chapter 3.
9. Onshore unconventional gas development is expected to be higher cost than present onshore conventional gas resources. Supply-side competition in both domestic and LNG markets, and gas liquids richness in domestic unconventional gas production will factor into the spot and long-term (contracted) market price paid by gas buyers. For economic modelling – see Chapter 8.
10. Effective regulation (to enable trusted land access) and attractive investment settings (resulting in multiple joint ventures independently marketing gas) are the most effective inputs from governments to beget safe, secure, and competitively priced gas for domestic and international gas markets for decades to come. For details of regulation – see Chapter 5. For details of investment settings – see Chapter 7.
11. Regulators must have relevant and up-to-date capabilities (competence and capacity) to be trusted to act in the interests of the public in protecting natural, social and economic environments in relation to the full-cycle of mineral and energy resource projects, including unconventional gas operations.
12. One-stop-shops (lead agencies) are the most efficient regulatory approach when well managed without capture. The *Petroleum and Geothermal Energy Act 2000* (PGE Act) is designed to enable a one-stop-shop to deploy compliance enforcement policies and actions to simultaneously meet the objectives of all relevant legislation, not just the PGE Act. This enables a step-change in both efficiency of regulation, without diluting the rigor or the effectiveness of regulation.
13. Upstream gas producers, contractors to those producers, and gas users have a common interest in efficient,

4 85 tcf is roughly equivalent to 93,500 PJ

5 Hashimoto, T (Riko), Stacey, A. and Bernecker, T., (2012) Assessing the unconventional hydrocarbon resource potential of central Australian basins, Presented to the Roundtable in Adelaide on 27th July 2012. Download from: www.misa.net.au/_data/assets/pdf_file/0006/175317/CABS_2012_Unconventional_hydrocarbon_resources_Hashimoto_et_al_120629.pdf

6 Santos' equity in the Cooper Basin production licences is 66.6% in South Australia and 60.1% in Queensland. Hence, Santos' estimate of the potential range for recoverable raw gas from its licences in the Cooper Basin is, in gross terms, at least 22 tcf to a high of more than 200 tcf (raw gas). Santos' November 2012 estimates of its unconventional resources in the Cooper Basin can be accessed from: http://www.santos.com/library/121112_EABU_Cooper_Basin_Unconventional_Gas_Opportunities_and_Commercialisation.pdf

high quality and competitive supply chains. The difference in the cost of exploration and development for gas to markets between scenarios with efficient, high quality supply chains that leverage on economies of scale and scenarios with uncompetitive supply chains is easily AUD 1 per GJ. Such a difference can result from a variety of factors such as well costs and/or well productivity profiles. A competitive gas price that is, for example, \$6 per GJ rather than \$7 per GJ would provide more than double the value of royalties to South Australians through lower energy bills, and the associated flow-on effect of competitive energy prices.

14. Unconventional gas development demonstrably creates opportunities for competitive local, national and international content in supply chains. This Roadmap and the implementation of its recommendations will foster informed risk-taking by people and enterprises to prepare to compete for supply-chain opportunities associated with unconventional gas development in South Australia. For details – see Chapter 6.

The path to this publication reveals 125 recommendations to smooth the road to environmentally sustainable and profitable development of unconventional gas in the State of South Australia. These recommendations can be generalised under the following categories:

- Investor and public trust (41)
- Subsurface knowledge (21)
- Environmental protection (18)
- Supply-chains (17)
- Infrastructure (17)
- Innovation in gas markets (16)
- Efficiency (16)
- Red tape reduction (8)
- Fiscal framework (4)

The numbers in brackets () are the count of overlapping recommendations in each of these nine categories. That said, each and every one of the recommendations is worth progressing by industry, or by governments, or by industry-government partnerships. In particular, there is considerable scope for cooperation to:

- demonstrate the efficacy of risk management, and in doing so, sustain trusted land access for unconventional gas projects;
- support efficient supply chains for materials, equipment and services while bolstering local content in projects;
- enable informed public understanding of unconventional gas projects. Key stakeholders are: investors in unconventional gas projects; people and enterprises potentially affected by unconventional gas projects; and government policy-makers.
- share facilities through commercial arrangements to reap economies of scale;
- enhance transparency in markets to foster efficiencies; and
- share experience and innovate to minimise both the cost and time taken while progressing through learning curves.

For details – see Chapter 9.

