GeoConvention 2015
GEOSCIENCE
new horizons
Telus Convention Centre • 4-8 May 2015 • Calgary, AB Canada

Giant Tight Gas in Australia: The Challenges and Opportunities of Bringing North American Unconventional Expertise 'Down-Under'

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Summary

The Warro Gas Field is one of the largest undeveloped gas fields in Australia. Recent studies have estimated Warro contains between eight trillion cubic feet (tcf) and 10tcf of gas in place and 3tcf to 4tcf of recoverable gas. The field is located 200km north of Perth, Western Australia in the Perth Basin and 30km east of major natural gas pipeline infrastructure providing gas to Western Australia's robust domestic energy market. Four wells have been drilled in the field to date. Warro 1 and 2, both drilled in 1977, confirmed a 400m Gas column in fluvial sandstones of the Jurassic Lower Yarragadee section. Warro 3 and 4, drilled in 2009 and 2011, appraised the field and established that the sands could flow gas at potentially commercial rates. A new phase of exploration at Warro will be commencing in 2015 with the drilling of Warro 5 and 6.

Australia is vast and covers a land area similar to the lower 48 States of the USA. Most of Australia is desert with the population and industry concentrated in a few cities around the coast. Although Australia has an active oil and gas sector, much of the work is offshore where the large LNG projects dominate. Onshore activity occurs in four main areas which are separated by thousands of kilometres. As a result, the industry is much disseminated and the logistics of moving equipment around presents a major challenge for the industry. Often rigs and frac spreads must be moved from one side of Australia to the other. In addition, there is rarely a nearby trained workforce so all the operations must be self-sustained. Rig crews of over 40 people are common.

Exploration drilling is often carried out in a stop-start fashion. Groups of operators usually work together to achieve critical mass of wells for a continued drilling and fraccing campaign but this takes time to amass and coordinate. This is particularly the case in Western Australia and the Northern Territory. Even with this type of cooperation, the cost base is high with well costs often 2-3 times equivalent costs in North America. Another hurdle is a lack of gas pipeline infrastructure for extended testing. Most long term tests result in gas being flared. There are the usual environmental challenges which can result in seismic and wells requiring over 18 months to gain approval and community awareness of the industry is increasing along with concerns about its impact on water resources. All these issues are surmountable with experience and patience; however it may be prudent for any new entrants to leverage off the local operators to avoid repeating the mistakes of the past.

The Perth Basin is a Permian to Early Cretaceous aged rift basin formed on the western margin of the Australian Shield. The Warro structure is formed on a large regional north-south orientated structure on the east side of the Dandaragan Trough; a major half-graben depocentre formed adjacent to the basin-bounding Darling Fault.

The gas at Warro is reservoired in tight fluvial sandstones at a depth of between 3700 – 4200m. The wells require fracture stimulation to flow gas. Well test rates at Warro-3 (2009) exceeded 3 mmcfd over a sustained period through 4 ½ " casing. Unfortunately a decision to frac a deep seated fault at the base of the reservoir section resulted in water flows of 200-300 bwpd. This water could not be closed off due to poor hole conditions and eventually led to the cessation of testing operations after almost 90 days. Warro-3 was an important confirmation of the potential of the field especially as the fracture stimulation approach used (100,000lb gel fracs) was relatively small due to a lack of pumping capacity available in Australia at the time.

Warro 4 (2011) was approached differently as significantly more pumping capacity was available at the time. Slick water fracs were used to create a more extensive fracture network from the wellbore. The results of this well were disappointing with high water flows and low gas rates and, unlike Warro-3, this well could not sustain gas flow without artificial lift.

With these well results, and a newly acquired 3D seismic survey, a thorough technical review was undertaken. The work concluded that like Warro-3, Warro-4 had also fracced into a deep seated fault located near the wellbore. The clear finding of the review was to confirm the presence of a very large gas resource which had not been adequately appraised. Further wells were needed in areas which the 3D data show are away from deep faults.

The Warro Joint Venture has recently agreed to drill, frac, and test another two wells on the field. The Warro-5 and Warro-6 locations have been chosen to be at least 1 km distant from faults in the reservoir section. The wells are also positioned approximately 150m down dip of previous well penetrations of the gas reservoirs. As none of the previous wells have encountered any gas-water interfaces, the down-dip position of the new wells may also clarify the configuration and aerial extent of the field.

The wells will be aiming to evaluate a representative portion of the reservoir though the emplacement of up to 6 frac stages over an interval of 100-150m. These fracs will be designed to ensure good well bore communication with the reservoir section and aim for height and width rather than length to reduce the possibility of linking into any faulted areas away from the wells.

Exploration and appraisal at Warro, and other unconventional opportunities in Australia, has been inhibited by a lack of in-country technology and expertise. The Warro Field provides an excellent example of some of the challenges and opportunities that exist for Unconventional exploration in Australia.

Figure 1 – Location of the Warro Gas Field, Perth Basin, Western Australia

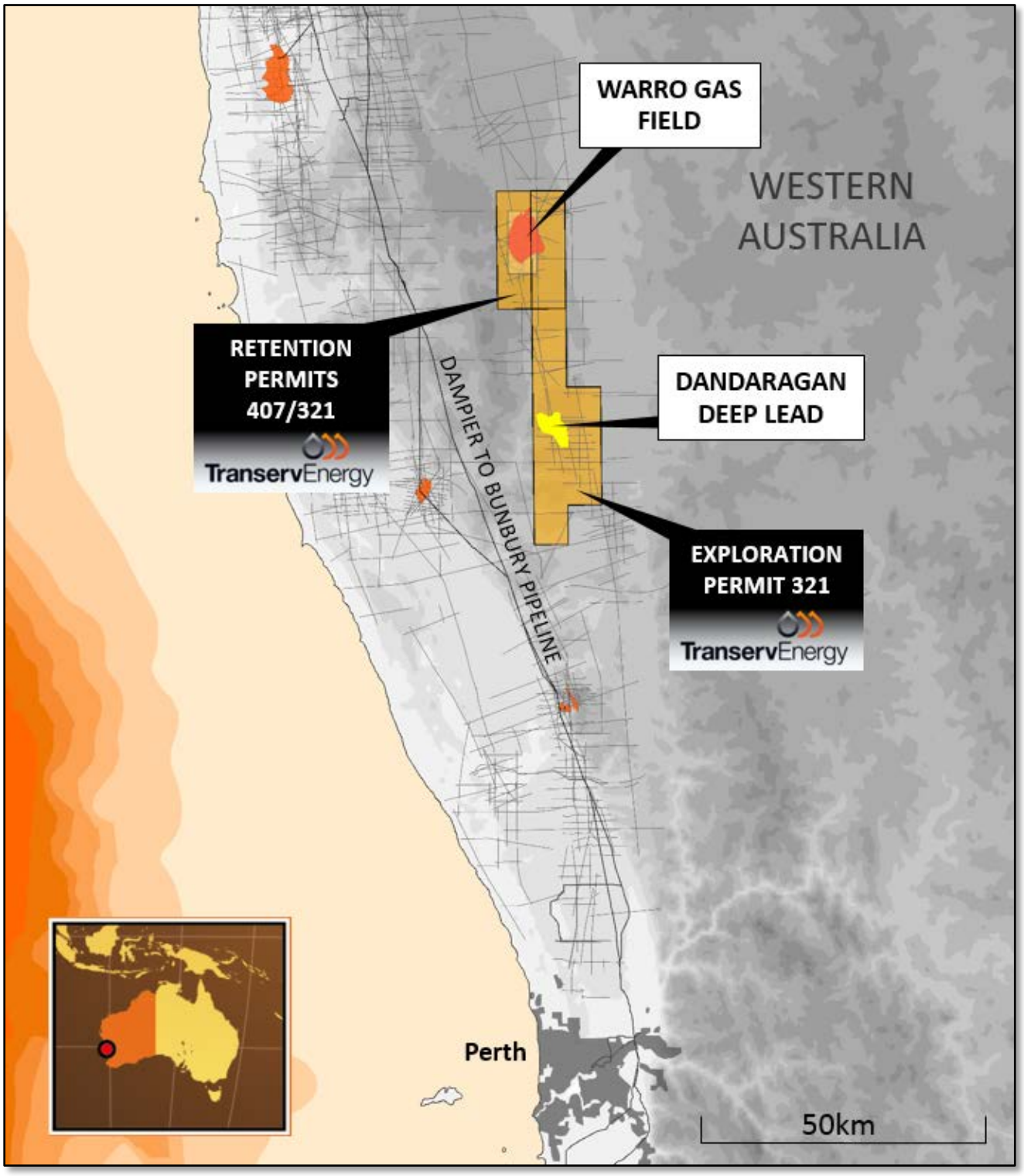
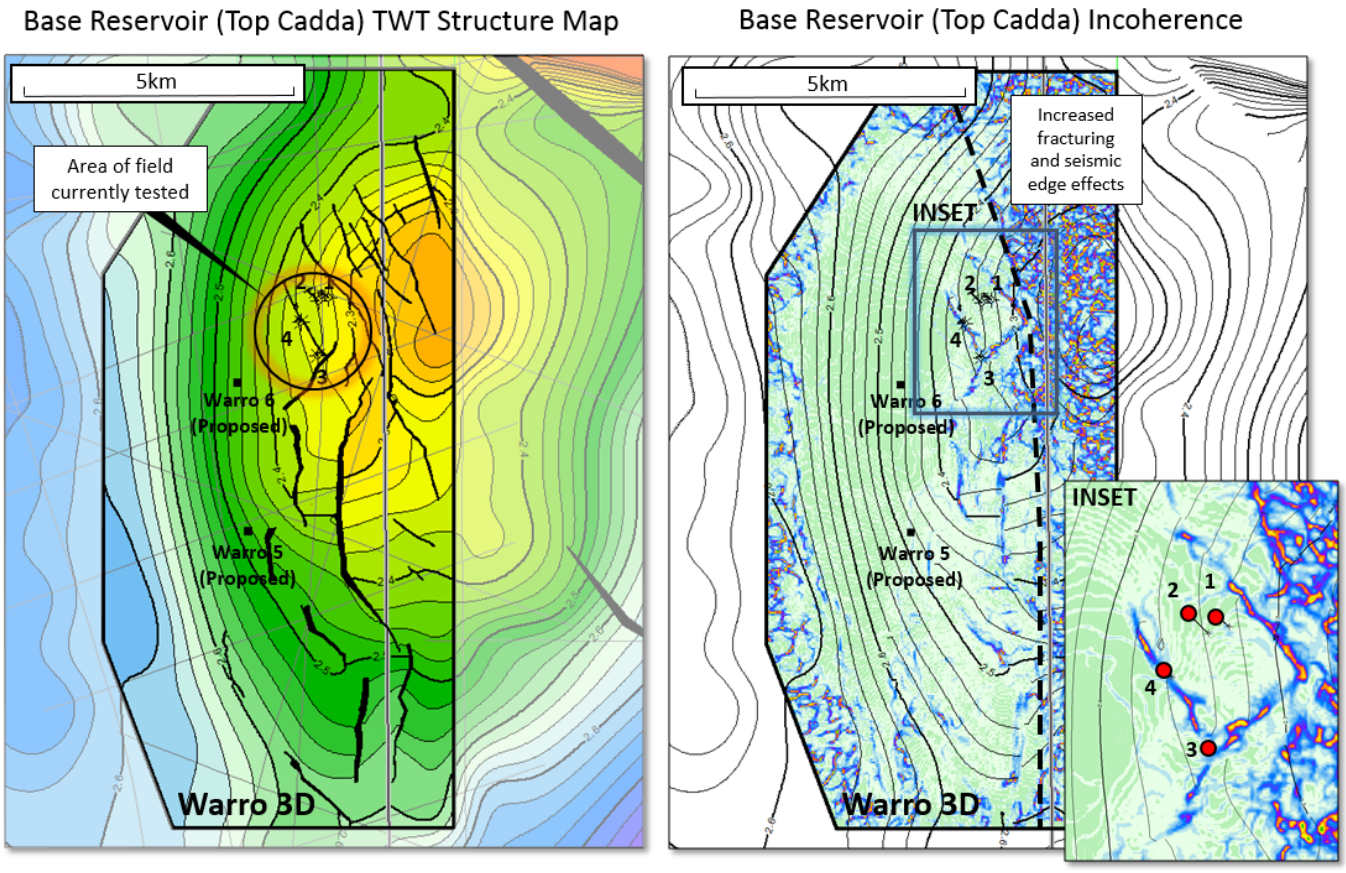


Figure 2 – Warro 3D – Structure and Fault image Analysis



Acknowledgements

The Warro Joint Venture is between Transerv Energy (ASX) and Alcoa of Australia Limited. The authors thank the support of both companies in this work and are grateful to them for permission to present this paper.