THE OFFER

A new petroleum exploration licence (PEL) in the Cooper and Eromanga Basins is being offered by the South Australian Government on the basis of work program bidding.

The bid block CO2005A covers 1598.5 km² (394 998 acres). It contains seismically defined prospects and abuts producing gas fields located in Santos Joint Venture production licences.

Previous exploration data and reports are readily available from PIRSA in digital format, including:

- well completion reports
- GIS datasets including wells, seismic, tenements, pipelines
- seismic survey shot point location data
- seismic survey reports and archive stack data (SEGY format)
- digital well logs
- velocity survey check shot information
- structure maps and datasets
- Petroleum Exploration & Production System (PEPS) database with production, well, seismic and engineering data
- company prospectivity reports
- research reports on tight gas potential.

COOPER AND EROMANGA BASINS

The Cooper Basin is a Permo-Carboniferous to Triassic intracratonic basin located 800 km north of Adelaide. It is overlain by the prospective Jurassic to Cretaceous Eromanga Basin. The Cooper and Eromanga Basins collectively contain up to 3700 m of predominantly fluvial, glaciofluvial, lacustrine and deltaic sediments with some marine sediments. Targets are 1200–3700 m deep. The basins represent Australia’s largest onshore oil and gas province, with >1400 wells drilled and over 71 580 line kilometres of 2D and 5890 km² of 3D seismic recorded.

PROVEN HYDROCARBON PROVINCE

Cooper Basin gas supplies markets in Adelaide, Sydney, Brisbane and Melbourne. Cooper oil and gas liquids are exported via facilities at Port Bonython. Over 4.3 Tcf of gas, 123 mmbbl of oil, 7.5 mmbbl of condensate and 92 mmbbl of LPG have been produced to end of June 2004.

A free acreage release CD will be available from September 2004.

To order:
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EXECUTIVE SUMMARY

Petroleum exploration licence area CO2005-A is being offered in the Cooper Basin on the basis of work program bidding. Bidding closes at 4.00 pm on Thursday 13 October 2005, and the winning bid will be announced by early November 2005.

Cooper Basin gas supplies markets in South Australia, New South Wales, Queensland and Victoria via an extensive pipeline network. The Cooper Basin Liquids Project (1980–84) was initiated to market the oil and existing gas liquids. A liquids pipeline links Moomba to a processing plant and storage and export loading facilities at Port Bonython. The remaining reserves estimated by Santos Ltd are provided in Table 1.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales gas</td>
<td>1.126 PJ</td>
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<tr>
<td>Ethane</td>
<td>140 PJ</td>
</tr>
<tr>
<td>LPG</td>
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<tr>
<td>Condensate</td>
<td>2.38 x 106 kL</td>
</tr>
<tr>
<td>Oil</td>
<td>3.34 x 106 kL</td>
</tr>
</tbody>
</table>

Table 1 Estimated remaining Proven + Probable reserves in Santos’ Operated Production Licences, South Australian Cooper Basin (after Santos, 1/1/04).

Opening up the Cooper Basin to a new phase of exploration has attracted national and international interest. A phased acreage release of 27 blocks commenced in February 1999, when all of the exploration tenements held by the Santos Joint Venture since 1954 expired without right of renewal. Winning work program bids for the 26 exploration licences in the South Australian Cooper Basin entail 180 exploration wells, 5170 km of 2D seismic and 320 km of 3D seismic over the term 2001–07. The successful bidding round for the CO2003-A exploration block during late July 2004 proved that Cooper Basin remains an attractive investment destination.

The new entrants in the Cooper Basin have drilled 31 exploration wells, 2 appraisal wells and 1 development well since 2002 to the end of July 2004. Twenty-six of the exploration wells encountered at least shows of hydrocarbons; 16 of the 31 wildcats discovered new oil or gas pools, of which 13 are commercial and justified casing the new pool discovery wells (Acrasia, Aldinga, Christies, Derrilyn, Flax, Harpooono, Kiwi, Nutmeg, Paranta, Reg Spigg West, Sellicks, Worrior and Yarrow).

Stuart Petroleum operates the Acrasia Field (in Joint Venture (JV) with Beach Petroleum) and Worrior Field (in JV with Cooper Energy). Beach operates the Sellicks and Christie Field (in JV with Cooper Energy) and the Aldinga Field (in JV with Magellan Petroleum). Significantly, the new entrant fields (Acrasia, Sellicks, Worrior) were brought into production less than six months after discovery. Oil from all fields is being trucked to Moomba and subsequently transported to Port Bonython via the Santos liquids pipeline.

The CO2005-A release block is located north-east of Moomba around the township of Innamincka. Most of the current gazetted area lies within the Innamincka Regional Reserve, in the core of Australia’s arid region.

PETROLEUM GEOLOGY

The intracratonic Cooper Basin comprises a Late Carboniferous to Triassic non-marine succession, overlain disconformably by the Jurassic to Cretaceous Eromanga Basin and the Cenozoic Eyre Basin. In the Nappamerri Trough, the Cooper Basin unconformably overlies Mid-Carboniferous Big Lake Suite granite intrusives, which form basement. The granite has elevated heat flow in the Trough, and is currently being evaluated as a source of geothermal hot rock energy.

The Nappamerri Trough was a major depocentre, and contains the deepest and thickest Cooper Basin sediments. Up to 2500 m (8200 ft) of Cooper Basin deposits are overlain by >2180 m (7150 ft) of Eromanga Basin section.

Cooper Basin

The Late Carboniferous to Late Permian succession consists of basal glaciofluvial clastics and proglacial outwash deposits, overlain by thick peat swamp, floodplain, lacustrine and high sinuosity fluvial facies. Uplift and erosion at the end of the Early Permian resulted in a depositional break and Late Permian to Early Triassic fluvial and floodplain facies were deposited on the unconformity surface. Deposition in the region was terminated at the end of the Early Triassic with slight but widespread deformation, regional tilt and erosion.

Eromanga Basin

The Jurassic–Cretaceous Eromanga Basin can be divided into three sequences — lower non-marine, marine and upper non-marine. Exploration is concentrated on the productive lower non-marine sequence, which consists of basal high-sinuosity fluvial and floodplain deposits, overlain by extensive and thick low-sinuosity fluvial sandstones. Two intervening floodplain and lacustrine units occur within this sand package, which is overlain by extensive lacustrine and shoreline facies, deposited in a large lake which extended throughout the Cooper Basin region. This lower nonmarine sequence is overlain by Early Cretaceous marine shales that form a regional seal, and Late Cretaceous non-marine deposits.

Lake Eyre

Tertiary to Recent fluvial to lacustrine deposits of the Lake Eyre Basin unconformably cover the Eromanga Basin. The unconformity at the top of the Eromanga Basin is often difficult to distinguish in wells and seismic.

SOURCE ROCKS

Numerous producing wells and significant gas and oil shows in wells throughout the region indicate that sufficient mature source rocks have generated and expelled vast volumes of hydrocarbons.

Organo-rich units in both the Permian and Mesozoic are source rocks for oil accumulations in the Eromanga Basin. The thick sedimentary section plus relatively high heat flow in the Nappamerri Trough has placed organic-rich Jurassic and Lower Cretaceous shales in the oil generation and expulsion window. Permian coal measures and shales, especially in the deep Patchawarra and Nappamerri Troughs, have high Total Organic Content and represent the main hydrocarbon source for Cooper Basin oil and liquids rich gas accumulations.

Assessments of available information, including geochemical biomarker studies lead to conclusion that a considerable volume of oil in several Jurassic- and Cretaceous-level accumulations located on the Moomba and Big Lake high fields has migrated from Jurassic shales in the Nappamerri Trough. Nonetheless, each Eromanga oil prospect needs to be assessed in terms to its juxtaposition to potential source kitchens, to assess the likelihood of Permian and/or Mesozoic sources.
Geological summary of the Cooper-Eromanga Basins in South Australia.

**RESERVOIRS**

Around the margins of the Nappamerri Trough, the braided fluvial sandstones of the Hutton and Namur are good to excellent reservoirs. Fair to excellent quality sandstones in the Poolowanna, Birkehead, McKinlay, Murta and Cadna owie units also persist on the margins of the Nappamerri Trough.

In the central Nappamerri Trough, due to their burial depth, sandstones of the Jurassic – Early Cretaceous succession of the Eromanga Basin generally exhibit lower reservoir quality (than on the margins of the Nappamerri Trough). To date, oil shows (but no commercial flows of oil) have been encountered at Hutton, Birkehead, Namur, Murta and Cadna-owie levels in the Nappamerri Trough. One reason for this lack of commercial success to date is that all exploration wells drilled in the central Nappamerri Trough (to date) had primary targets in the Permian rather than within the Eromanga Basin succession. Minor fluorescence has also been recorded in sandstones at Daralingie and Nappamerri Group levels.

Gas has been encountered in wells drilled in the central Nappamerri Trough, mainly reservoired in multi-zone low permeability sandstones of the Toolachee and Patchawarra Formations. Natural or induced fractures are expected to increase deliverability from these reservoirs to commercial levels of sustained flow.

Shoreface and delta distributary sands of the Permian Epsilon and Daralingie Formations in the central Nappamerri Trough contain gas-saturated intervals.

Sandstones in the Tirrawarra and Merrimelia Formations (where intersected) are gas reservoirs in the wells around the margin of the Nappamerri Trough. Gas has been encountered in wells drilled in the central Nappamerri Trough, mainly reservoired in multi-zone low permeability sandstones of the Toolachee and Patchawarra Formations. Natural or induced fractures are expected to increase deliverability from these reservoirs to commercial levels of sustained flow.

Gas production occurs on the GMI Ridge and in the northern Cooper Basin. Structure–stratigraphic and stratigraphic pinchout traps are proven in the surrounding areas.

**TRAPS**

**Basement**

Petroleum may have migrated across faults from downthrown Cooper/ Eromanga Basin source rocks and accumulated in fractured Big Lake Suite basement and in Warburton Basin sediment in structural highs and on the margins of the Nappamerri Trough. Overlying Merrimelia Formation glaciolacustrine shale would form an effective seal. While the presence of naturally fractured gas reservoirs in analogous structural settings elsewhere in the Nappamerri Trough. Given effective offset juxtaposition to source rocks, fractured basement also represents a plausible petroleum exploration target in the bid block area.

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Most Permian gas production in the region has been from the Patchawarra, Toolachee/Daralingie, Tirrawarra and Epsilon Formations in fields on the flanks of the Nappamerri Trough, while Permian oil is mainly produced from the Tirrawarra Sandstone.

The Triassic Nappamerri Group forms an excellent seal to underlying Permian reservoirs, and also contains intraformational seals. The Nappamerri Trough was a major depocentre for the Nappamerri Group, and it is up to 500m thick. Anticlinal and fault traps are proven at Triassic levels in the Cooper Basin. Structure–stratigraphic and stratigraphic pinchout traps at Triassic levels are also possible. Most Triassic oil production occurs on the GMI Ridge and in the northern Cooper Basin.
A basin–centered gas play is also recognized but is yet to be proven. The characteristics consistent with a basin-center gas play in the Nappamerri Trough include thick gas-charged sandstones with high resistivities in favourable juxtaposition to coal-rich source rocks. Flow tests from VXFK1DSSDPHUUL7URXJKVHFWLRQVKDYHÀRZHGVPDOOYROXPHVRIJDV Opportunities exist to successfully explore for reservoir sweetspots within this potential basin-centered gas play trend in CO2005-A.

Eromanga

Trapping mechanisms within the Eromanga Basin are dominantly structural (anticlines with four-way dip closure or drapes over pre-existing highs) with a stratigraphic component (e.g. Poolowanna Formation, Hutton–Birkhead transition, McKinlay Member and Murta Formation). Seals consist of intraformational siltstones within the Poolowanna, Birkhead and Murta Formations. To date - the Birkhead-Hutton interval has been the most oil productive section in the Eromanga Basin.

Stacked oil pay in the McKinlay/Namur, Hutton and Birkhead occurs southwest of the CO2005-A block in Moomba and Big Lake fields, as well as to the west in Gidgealpa and Merrimela fields. The Eromanga Basin also contains rare gas accumulations, where Permian gas has migrated upwards along faults and been trapped higher in the section (e.g. Namur Gas Field).
INFRASTRUCTURE AND TRANSPORT

A total of 5240 km of pipeline have been laid to gas markets in South Australia, New South Wales and Victoria and to the liquids load out facility at Port Bonython. Gas from individual wells passes via field gathering systems (flowlines) to satellite stations which separate gas, free water and condensate. Evaporation ponds are used for water disposal. The essentially water-free gas and condensate pass to the Moomba treatment plant through trunklines. Approximately 1010 km of trunklines and 1135 km of flowlines have been laid to date in the region. Crude oil is transported by either pipeline or truck to the Moomba plant which has been designed to process 25.4 x 10³ m³ (902 mmctd) of raw gas and 6000 kL/42 m³ of treated crude oil per day. Nine oil and 11 gas satellites are currently in operation.

Unprocessed gas produced around Ballera (Queensland) is carried to Moomba through the South West Queensland Pipeline (PL 5), which runs through the CO2005-A block. The 182 km long, 400 mm diameter pipeline, owned by the Santos Joint Venture, has been operating since 1993.

The new entrant Cooper Basin explorers have secured access to Moomba facilities operated by Santos Ltd. Oil is trucked from the Acrasia, Sellicks, Aldinga, Christies and Woarrior fields to Moomba. Condensate, LPG, crude and some ethane are transported as a cocktail from Moomba via a pipeline to Port Bonython where they are separated and exported.

The township of Innamincka is located in the middle of the release block, 65 km NE of Moomba. It offers a hotel, general store, and light-aircraft airstrip, and is accessible by good quality roads. The causeway at Innamincka provides the major crossing point for the Cooper Creek, which in times of flood is impassable by vehicle.

Accommodation and support facilities are located at the Moomba Production Facility, operated by the Cooper Basin Joint Venture, and not open to the general public. Access is by arrangement with the operator. The full range of support services are located at the Moomba camp including, logging, wireline, fraccing, cementing, transport, fuel supply, aviation (including helicopter) and emergency services. There is a sealed airstrip at the Moomba Production Facility.

LAND ACCESS

National parks and reserves

A large portion of the CO2005-A block lies within the Innamincka Regional Reserve. This is a reserve classification proclaimed in 1987 under amendments to the National Parks and Wildlife Act 1972, that specifically accommodates multiple land use. A PEL application incorporating any portion of the Innamincka Regional Reserve will be referred to the Minister for Environment and Conservation and the views of such Minister are required to be taken into account when granting the PEL. In the case of Petroleum Production Licences within the Innamincka Regional Reserve, approval must be obtained from the Minister for Environment and Conservation. Failing such Minister’s approval, the issue is referred to the Governor for decision.

Parts of the Cooper Creek system are also listed as wetlands of international significance under the Ramsar Convention (1971). The Ramsar area overlies the northern part of CO2005-A. South Australia’s obligations are to manage the wetlands wisely to maintain their ecological character, this does not necessarily restrict exploration access.

Environmental regulation

One of the key environmental requirements of the Petroleum Act 2000 is the need for all regulated activities to be covered by an approved Statement of Environmental Objectives (SEO), whether in a Regional Reserve or on pastoral leases. The purpose of the SEO is to address all risks associated with activities and to address issues and concerns addressed by stakeholders detailed in a supporting document - an Environmental Impact Report (EIR). The SEO is prepared on the basis of the EIR through stakeholder consultation. The SEO also provides an effective mechanism for establishing ‘one-window-to-government’ for the industry by engaging the other agencies in the SEO consultation process.

An SEO does not have to be prepared for every individual activity proposal in the case where a licensee can demonstrate that their proposed activity is covered by an existing approved SEO, such as the current regional Cooper Basin SEOs for drilling and seismic activities, available from PIRSA.

Heritage and Native title

The PEL cannot be granted until the right-to-negotiate process pursuant to the Commonwealth Native Title Act 1993 has been concluded with any relevant registered native title claimants.

It may be necessary to access adjoining accessible areas to conduct regulated activities relative to the PEL. The right-to-negotiate process will include negotiation for facilitation of appropriate access to such adjacent accessible areas reasonably necessary to conduct such regulated activities, and will also include negotiation for facilitation of access relative to the grant of any ensuing licence for future production and necessary infrastructure development.

Breakthrough native title access agreements for 11 Cooper Basin exploration licence application areas were signed in late 2001, enabling the grant of new Cooper Basin licences. In late 2002 through to early 2003, additional native title access agreements (modelled on the deeds established in late 2001) enabled the grant of an additional 16 licences. All these native title access agreements are:

1. conjunctive, e.g. cover all petroleum licence activities from exploration through to production
2. considered both fair to the native title claimants and sustainable with respect to petroleum exploration, development and production.

These Cooper Basin native title access agreements sustain efficient processes to protect Aboriginal heritage in relation to field operations and provide appropriate benefits to the registered native title claimants. The native title deeds for all South Australian petroleum exploration licences are available for public scrutiny from the PIRSA website.

For further details of the right-to-negotiate process contact Joe Zabrowany, Manager, Petroleum Licensing and Royalties, email <zabrowenny@sa.gov.au>, phone (08) 8463 3203.

A number of sites of European heritage significance such as historical buildings, structures and geological monuments may also occur in the area. The majority of sites are small, and easily avoided by exploration activities.

Geothermal Exploration Licences

Geothermal Exploration Licences (GELs) 97 and 98 coincide with the CO2005-A block. The GEL licensee must be notified of activities in the PEL issued as a result of the CO2005-A release. The GEL licensee may object to the activity. PIRSA will facilitate consultation to resolve any such dispute. Nonetheless, the GEL licensee may be able to claim appropriate compensation if their activities or resources are affected. Likewise analogous requirements apply to GEL holders, who must notify the PEL holder of their activities.

Associated Facilities Licences

Associated Facilities Licences (AFLs) are available under the Petroleum Act 2000. These licences allow explorers to establish facilities or undertake surface surveys (e.g. seismic surveys) in proximity to petroleum exploration, retention and production licences. AFLs are typically used to enable the recording of full-fold seismic control within a PEL by recording tails of seismic lines outside the licence area.

CLIMATE AND LAND USE

Australia’s seasons are opposite to those of the northern hemisphere – the hottest months are January-February and the coldest month is July. At Moomba temperatures can range as high as 48 °C (118 °F) in summer, while overnight temperatures can drop to 2 °C (36 °F). The Cooper Basin is located in the core of Australia’s arid region. The average annual rainfall in far northern South Australia is 176 mm (7 in), with the heaviest rainfall during December–February.

The northern part of South Australia is sparsely populated and relatively undeveloped due to its remoteness and harsh climate. The main industries are petroleum exploration and development, followed by large pastoral leases producing cattle and tourism.
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