

South Australian coal potential - CSM, ISG, CTL and CTG

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PART 1

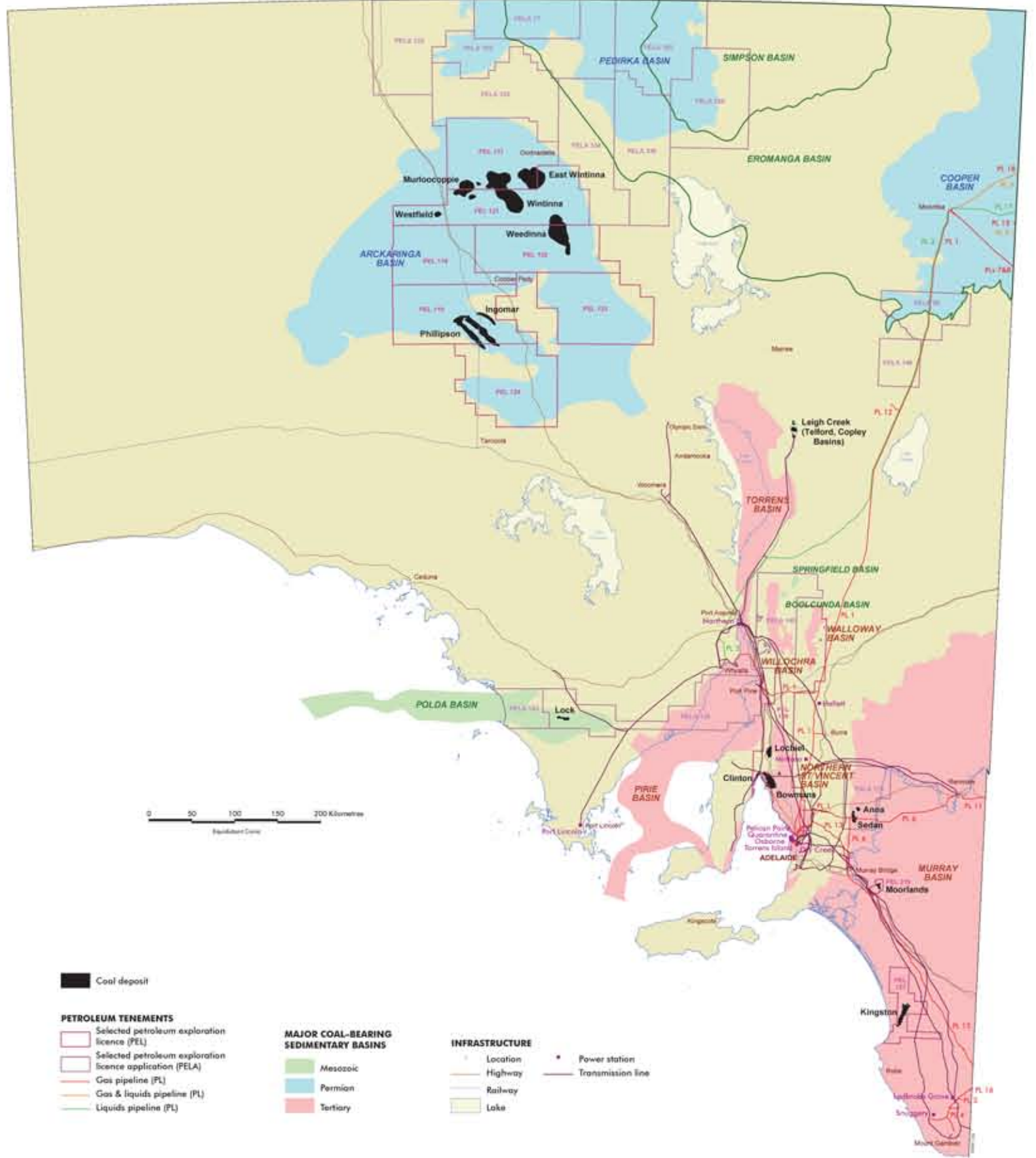
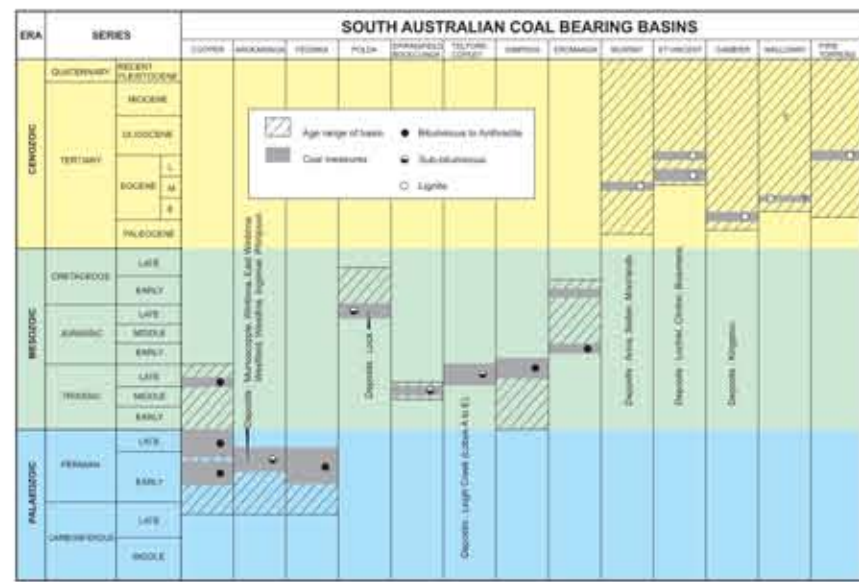
Introduction

Coal measures in South Australia are primarily of Permian, Triassic, Jurassic and Tertiary age (South Australia Department of Mines and Energy, 1987; Drexel and Preiss, 1995). Almost all known deposits have been evaluated for coal extraction potential, but not for coal seam methane potential (CSM, also known as coal seam gas or coal bed methane). The majority of this coal is of low rank and poor quality, often high in impurities and generally expensive to extract, but most is suitable for local electricity generation (Minerals and Energy, 2004). The coals fall into two broad categories – Sub-bituminous C/Lignite A and Lignite B. South Australia currently produces ~2.7 Mt of low-grade sub-bituminous black coal for power generation from a single mine at Leigh Creek.

The depth and maturity of the coal deposits and distance to infrastructure and markets have prevented economic exploitation of all except the Leigh Creek Coalfield. Over the last 20 years, coal research in the state has focused on proving up known deposits for mining and power generation, and only limited greenfield coal exploration has taken place. CSM is now an important source of gas in eastern Australia and is being produced primarily from the Bowen and Surat basins in Queensland and New South Wales. CSM exploration is under way in South Australia, Tasmania, Victoria and Western Australia.

Interest has been shown by a number of companies to explore for CSM in South Australia over the last five years, as a result of increasing CSM production from black coals in the eastern states and success achieved in producing biogenic methane from low-rank coal in the United States. Currently there are nine PELs and 6 PELAs under consideration for exploration rights to evaluate the CSM potential and/or underground coal gasification potential (UCG) of South Australian coals (Fig. 1). The determination of some PELs has been delayed pending resolution of conflicting entitlements between coal leases under the *Mining Act 1971* and/or native title access agreements.

On-the-ground CSM exploration has not yet commenced in South Australia, however drilling and sampling in the next few years are important elements of work programs for current PELs and PELAs. Characteristics requiring consideration include coal seam depth, thickness, continuity, maturity, vertical distance to aquifers, maceral content, gas content indications based on water geochemistry, and coal seam permeability. The technology involved in CSM and UCG has been evolving over the last decade – optimal conditions based on numerous criteria can be developed for each application. In addition, technology exists to produce both synthetic natural gas and oil from coal, and the feasibility of this process is currently being investigated for a number of SA coal deposits.



PERMIAN

Introduction

Permo-Carboniferous to Early Triassic basins in SA overlie early Palaeozoic basins in northern and southern parts of SA. These include the Cooper, Pedirka and Arckaringa basins in northern South Australia. Extensive and thick Early-Late Permian coal measures were deposited in the Cooper, Pedirka and Arckaringa basins in SA. Permian coals range from being deeply buried in the Cooper Basin (from 1110 m) to mineable depths (from 30 m depth) in the Arckaringa Basin.

Arckaringa Basin

The Arckaringa Basin contains an estimated 10 billion tonnes of low grade sub-bituminous coals which have features (coal thickness, continuity and suitable depth) which make them appealing for CSM feasibility projects. The coal is Early Permian in age and occurs in the Mount Toondina Formation (equivalent to Patchawarra Fm, Cooper Basin and Purni Formation, Pedirka Basin).

Weedina Deposit

Thickness of overburden to top coal seam 140 m. Six coal seams have been delineated, with a cumulative thickness of 8 m over a stratigraphic interval of 35 m.

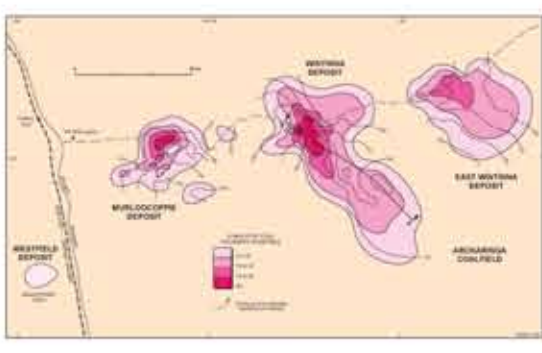
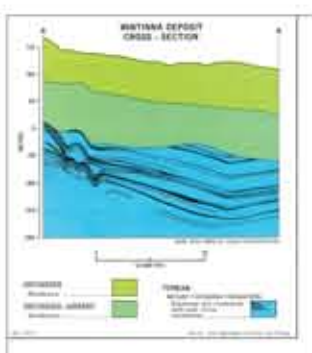
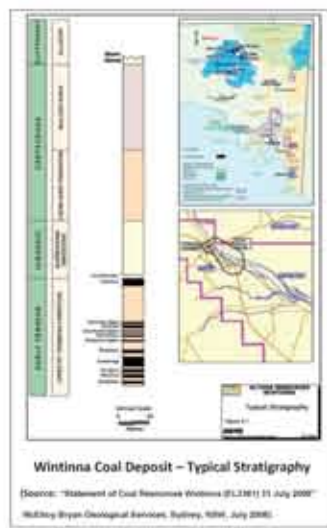
Wintinna Deposit

Thickness of overburden to top coal seam ranges are 140 to 240 m. Eight flat lying persistent coal seams have been delineated, with a cumulative thickness of 25 m over a stratigraphic interval of 75 m. EL operator, Arckaringa Energy quote the following resource quality data for Wintinna:

- Total moisture: 36.6%
- Raw ash: 8.2%
- Volatile matter: 23.6 %
- Total sulphur: 1.19%
- Chlorine: 0.03%
- Specific energy: 17.1 MJ/kg
- Relative density: 1.25 g/cc

Arckaringa Energy Pty Ltd quote the following JORC Resources (note: area of resources estimate covers only 25% of the known area of the Wintinna Deposit):

- Measured: 187 million tonnes
- Indicated: 650 million tonnes
- Inferred: 450 million tonnes
- Total: 1287 million tonnes.

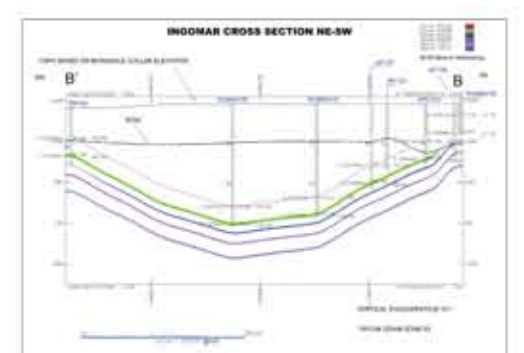
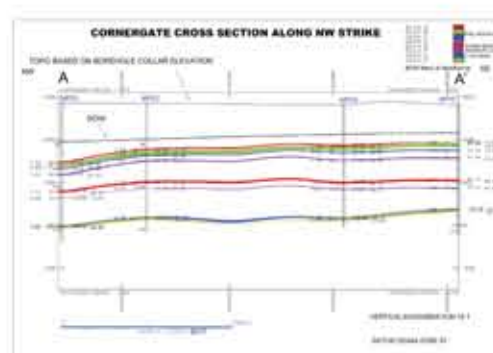


Arckaringa Energy Pty Ltd (100% Australian subsidiary of Altona Resources Plc) operate EL 3361, 3362, 3360 for coal mining and coal to liquids projects. In EL 3361, Altona Resources are undertaking a Final Feasibility Study for a coal to liquids and power project based on the Wintinna coal deposit aiming for financial close by end 2010 and commencement of operations by 2014. The base case comprises:

- 10 million tonne per annum open cut coal mine
- 30 000 barrels per day (10 million barrels per annum) coal to liquids plant producing mainly zero sulphur diesel fuel
- 560 MW power for export.

Cooper Basin

The Cooper Basin contains thick Early-Late Permian coal measures of bituminous to anthracite rank, the highest rank coal in SA. The depth to top coal is 1100 - 1600+m and seams are up to 25 m thick. The Cooper Basin coal resource is billions of tonnes and dwarfs all other known deposits in Australia. It is likely that coal seam gas has contributed to conventional gas production.



The Weena Trough in the southern Cooper Basin contains the shallowest occurrences of thick Patchawarra Formation sub-bituminous coal seams (e.g. ~1500 m depth in Tinga Tingana 1 and Weena 1). Minor mud gas indications have been recorded while drilling through coal seams in Kumberie 1, and the water chemistry in Tinga Tingana 1 suggests some methane is present (Nitschke, 2006).

Tinga Tingana 1: Cumulative thickness of 62 m, individual seams up to 18 m in Patchawarra Formation

Weena 1: Cumulative thickness of 41 m, individual seams up to 16 m.

Reserves

Strike Oil Limited have calculated coal seam methane potential of 8- 20 Tcf and coal to liquid potential of >20 000 bpd. The project involves cored drillholes to evaluate gas content, coal thickness, and identification of seal-reservoir and seal-coal pairs in the Weena Trough. Strike Oil Limited are also considering in situ gasification.

Licensing

The Weena Trough is currently under application by Strike Oil Limited (PELA 96) for coal seam methane and conventional petroleum exploration. The company applied for the block in March 1999 as part of the CO98 acreage release, granting of this licence has been delayed pending resolution of native title.

Pedirka Basin

Most of the coal in the eastern Pedirka Basin appears to be too deep for CSM extraction using current technologies (e.g. 2506 m deep in Oolarinna 1 in the Poolowanna Trough). However, in the western part of the basin, Purni Formation sub-bituminous coals are well developed at suitable depths in Mt Hammersley 1 (~600 m) and Purni 1 (~1500 m). Slightly elevated mud gas was recorded in the Purni Formation coals during drilling of these wells.



In Mt Hammersley 1 approximately 30.5 m of coal occurs at depths of between 604.7 m to 762 m, including a 6 m thick seam. In Dalmatia 1, a cumulative coal thickness of 3.3 m occurs between 593 m and 698 m with multiple thin seams <1 m. In Purni 1, 24 m of coal occurs over 1417 to 1524 m with one thick seam of 6m 1417 -1423 m.

The Pedirka Basin is now fully under application for conventional oil and gas and CSM by Merlin Energy Pty Ltd (PELA 77), Stuart Petroleum Limited (PELA 288) and Tri-Star Energy Company (PELAs 159, 160),Pty Ltd (PELA 77), Stuart Petroleum Limited (PELA 288) and Tri-Star Energy Company (PELAs 159, 160).

PACE

plan for accelerating exploration

HOT PROSPECTS



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