QUEENSLAND COALS

Physical and Chemical Properties,
Colliery and Company Information

14th Edition
2003

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The Department of Natural Resources and Mines gratefully acknowledges the cooperation and contributions of representatives from both government and industry, particularly the various coalmining companies, who provided much of the information contained in this publication.

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ABBREVIATIONS

A	ash	m	metres
ad	air-dried basis	M	moisture
A_d	dry basis ash	M_{as}	moisture as sampled
AFT	ash fusion temperature	mg/kg	milligrams per kilogram
ar	as received	MJ/kg	megajoules per kilogram
as	as sampled	MM	mineral matter
Bt	billion tonnes	Mt	million tonnes
CHPP	coal handling preparation plant	Mtpa	million tonnes per annum
CO	coking	MW	megawatt
CSN	crucible swelling number	OC	open-cut
CSR	coke strength after reaction	PCI	pulverised coal injection
daf	dry ash free basis	ROM	run of mine
ddm	dial divisions per minute	S	sulphur (total)
dmmf	dry, mineral matter free	SE	specific energy
dwt	dead weight tonnes	t	tonnes
GJ/t	gigajoules per tonne	TH	thermal
GWh	gigawatt hour	tpa	tonnes per annum
HGI	Hardgrove grindability index	tph , t/h	tonnes per hour
kcal/kg	kilocalories per kilogram	UG	underground
km	kilometres	VM	volatile matter
kt	thousand tonnes		

INTRODUCTION

Queensland is endowed with over 30 billion tonnes (Bt) of identified resources of black coal. The coals include a wide range of types and ranks, from high-volatile sub-bituminous coal to anthracite. Approximately half of the identified resources are amenable to open-cut extraction. This extensive endowment, coupled with a history of efficient and productive mining, a well-developed infrastructure and a highly skilled workforce, has resulted in the Queensland coal industry becoming the largest exporter of seaborne coal in the world, and continuing to be a major contributor to the State's prosperity.

Queensland currently produces approximately 195 million tonnes (Mt) of raw coal per year from 41 mines. After processing, about 150Mt of this production is sold to the export and domestic markets. The value of coal exported from Queensland in 2002–03 was around A$8 billion, representing over 30% by value of the State's total overseas exports of goods. Additionally, the value of the domestic sales of coal in 2002–03 amounted to about A$0.5 billion.

The Queensland Department of Natural Resources and Mines provides assistance to the coal industry through the collation and provision of coal resource and production data, and the promotion of greater awareness of Queensland's coals in the marketplace. This publication, the 14th edition of *Queensland Coals*, updates the ownership, the coal resources and mining information, and coal quality data for each operating mine in the State as at 31 July 2003. It also provides summaries on the location, ownership and geology of many of the undeveloped identified coal deposits and, where available, indicative coal qualities for these deposits.

The assistance of companies in providing information and analytical data is gratefully acknowledged. More specific information on available coal products can be obtained directly from the operating companies.

QUEENSLAND COAL INDUSTRY OVERVIEW

PRODUCTION, SALES AND EMPLOYMENT

Thirty-one open-cut and 10 underground coal mines were operating in Queensland at 30 June 2003. Of the underground mines, nine utilised longwall mining methods, while one mine used bord and pillar extraction. About 85% of the State's coal is produced from the mines in the Bowen Basin in central Queensland. Mines in the Tarong, Callide, Clarence–Moreton and Surat Basins provide the remaining production.

Table 1 summarises the production and consumption of Queensland coal, and employment within the coal industry, during 2002–03. For detailed statistical information on Queensland's coal production, exports and consumption, refer to the Department of Natural Resources and Mines publication *Queensland Coal Industry Annual Review.*

Production

During 2002–03, the Queensland coal industry achieved record production levels. Total raw coal production in Queensland was about 195Mt from which a record 153.6Mt of saleable coal was produced. This represents almost 80% more saleable coal production compared with ten years earlier (1993–94).

Approximately 80% of the production is mined by open-cut methods with underground mining accounting for the remaining production. Coking coal accounts for about 50% of the open-cut production and 80% of the underground production, or about 60% of the overall production.

Exports

Coal exports in 2002–03 accounted for 84% of the total saleable production, increasing to a record 129.2Mt. On a coal-type basis, metallurgical coal exports, comprising coking coal used in steel-making and coal used for pulverised coal injection (PCI) into the blast furnace, represented 70% of the total exports, while thermal coal exports accounted for the remainder. Coal remains Queensland's largest export earner, with the industry achieving overseas sales revenue of around A$8 billion free on board (FOB) in 2002–03.

Table 1: Queensland Coal Production Summary 2002–03

Saleable production		
•	Open-cut	126.35Mt
•	Underground	27.25Mt
•	Total	153.60Mt
Exports		
•	Coking	86.92Mt
•	Thermal	42.30Mt
•	Total	129.22Mt
Domestic consumption		
•	Queensland	24.19Mt
•	Interstate	0.05Mt
Employment (at 30 June 2003)		
•	Open-cut	8 185
•	Underground	2 528
•	Total	10 713
Productivity — saleable coal (tonnes per employee year)		
•	Open-cut	15 289
•	Underground	11 082
•	Overall	14 325
Number of mines (at 30 June 2003)		
•	Open-cut	31
•	Underground	10

Queensland exports coal to 35 countries worldwide. The largest purchasers of Queensland coal are Japan (40% of total exports), Korea (15%), and India (10%). Other major purchasers are Taiwan, the United Kingdom, France, the Netherlands, and Brazil. Collectively, shipments to Asia amount to about 70% of Queensland's coal exports, while exports to Europe represent about 20% of the total exports.

Domestic coal consumption

During 2002–03, domestic coal purchases in Queensland amounted to 24.2Mt. Approximately 90% of the domestic consumption was used in the State's electricity industry. A small quantity of Queensland coal is sold to customers in other Australian states. The value of the domestic sales of thermal coals is approximately $0.5 billion per year (ex-mine).

Employment and productivity[1]

The Queensland coal industry directly employed a workforce (including contractors) of 10 713 people at 30 June 2003. Open-cut operations accounted for 76% of the total workforce, with 24% of employees associated with underground operations.

Productivity per person for the Queensland coal industry was 14 325 tonnes per annum (tpa) in 2002–03. On a mine-type basis, productivity in the open-cut operations was 15 289 tonnes per person year, while productivity from underground operations was 11 082 tonnes per person year.

TRANSPORT AND SHIPPING

An extensive rail network links Queensland's coal mines to six coal export terminals at four ports on the State's eastern seaboard, as well as to domestic coal users. The **Frontispiece** shows the locations of the rail network and ports in relation to the operating mines and coal measures

Coal rail network

The coal rail network in Queensland is owned and operated by QR (formerly Queensland Rail), a Queensland Government-owned corporation. Although QR is presently the sole service provider using the network to service the coal industry, it is possible for other operators to access the network through third party access agreements that came into force in January 2002.

QR transports about 140Mt of coal per year. Driven primarily by the growth in the Queensland coal industry, QR in the past ten years has implemented major capital expenditure programs and improved productivity of the rail systems, resulting in substantial increases in coal railings.

For coal haulage operations, the interconnected system is divided into five rail systems comprising approximately 2000km of rail line, of which about 70% is electrified. Five rail systems make up the network (from north to south):

- The Newlands rail system is a non-electrified line connecting coal mines in the northern Bowen Basin to the Abbot Point coal terminal, north of Bowen. Trains operating on this system typically haul 4600 tonnes of coal.
- The Goonyella rail system is an electrified line connecting coal mines in the central Bowen Basin (i.e. from Oaky Creek mine in the south, to North Goonyella mine in the north and Blair Athol mine in the west) to the Dalrymple Bay and Hay Point coal export terminals, south of Mackay. Trains operating on this system typically haul 9000 tonnes of coal.
- The Blackwater rail system is an electrified line connecting coal mines in the southern Bowen Basin, from Gregory mine in the north to Blackwater in the south, to the RG Tanna and Barney Point coal export terminals at Gladstone, and to domestic coal users in the Rockhampton area. Trains operating on this system typically haul 6700 tonnes of coal.
- The Moura rail system is a non-electrified line connecting the Moura, Callide and Boundary Hill mines to the RG Tanna and Barney Point coal export terminals at Gladstone. It also links the three mines with the Callide and Gladstone power stations, and to domestic users in the Gladstone area. Trains operating on this system typically haul 4000 tonnes of coal.
- The Moreton rail system is a non-electrified line connecting coal mines in the Moreton Basin, west of Brisbane, to the Fisherman Islands coal export terminal and Swanbank power station. The system also extends to the west of Toowoomba to service the New Acland and Wilkie Creek mines. Trains operating on this system typically haul 1800 tonnes of coal.

Export terminals

Coal destined for the export market is handled through six coal terminals at four deepwater ports located along the Queensland coast (see **Frontispiece**). From north to south, these are the port of Abbot Point, the port of Hay Point (incorporating the separate Dalrymple Bay and Hay Point coal terminals), the port of Gladstone (incorporating the RG Tanna and Barney Point terminals) and the port of Brisbane (Fisherman Islands).

During 2002–03, a record 129.2Mt of coal was exported from the six terminals. The Dalrymple Bay, Hay Point and RG Tanna terminals collectively handled more than 108Mt, or approximately 85% of Queensland's coal exports.

Total handling capacity of the ports continues to increase, with expansions at Dalrymple Bay and RG Tanna terminals scheduled for completion during 2003. These expansions incorporate the construction of a third berth at each terminal, and will increase the capacity to 54.5 million tonnes per annum (Mtpa) at Dalrymple Bay, and to 40Mtpa at RG Tanna, resulting in a total annual loading capacity of approximately 150Mt. **Table 2** summarises the main specifications and capacities of each terminal, and the coal exports handled in 2002–03.

1 For reporting purposes the Department of Natural Resources and Mines has retained the convention previously used for the determination of productivity, i.e. dividing the total tonnage of saleable coal produced in a year by the average total number of employees for that year. By definition, the number of employees includes: people directly engaged in production; all other on-site employees (e.g. maintenance, administration and wash plant staff); staff working for the mine operator, or for on-site mining contractors; and off-site employees whose activities are directly related to mining and marketing of the coal produced.

Table 2: Queensland coal ports
(capacities as at December 2002)

Port/Terminal	Coal exports for 2002–2003 Mt	Annual loading capacity Mt	Hourly loading rate t/h	Vessel size (max) dwt	Berth length (total) m
Abbot Point					
Abbot Point	12.8	12.0	4 600	200 000	264
Brisbane					
Fisherman Islands	3.5	5.0	3 000	90 000	317
Gladstone					
Barney Point	38.2	5.0	2 000	150 000*	320
RG Tanna (2 berths)		30.0#	8 000	220 000	750
Hay Point					
Dalrymple Bay (2 berths)	42.9	45.5#	7 200	230 000	662
Hay Point (2 berths)	31.8	34.0	11 000	230 000	709
Total	**129.2**	**131.5**			

dwt — dead weight tonnes
* maximum coal capacity 90 000 dwt (part-loaded)
# capacities at RG Tanna and Dalrymple Bay increased during 2003

ELECTRICITY INDUSTRY

Three separate Queensland Government-owned corporations (Stanwell Corporation Ltd, Tarong Energy Corporation Ltd and CS Energy Ltd) and several private power producers supply the electricity produced in Queensland from a number of power stations. These include the coal-fired power stations located (from north to south) at Collinsville, Stanwell, Gladstone, Callide, Tarong, Swanbank and Millmerran. Plans for a proposed power station at Kogan Creek west of Brisbane are progressing.

The **Frontispiece** shows the locations of the operating coal-fired power stations in Queensland. **Table 3** lists details of the output capacities and amount of coal purchased by these power stations, and **Table 4** shows the typical quality specifications of the coals purchased and consumed in each power station.

Callide

The 840 megawatt (MW) base load super-critical Callide C power station became fully operational in November 2001. Callide C is owned by Callide Power Management, a joint venture owned in equal shares by CS Energy, and InterGen (Australia). The station is an expansion of mine-mouth power plant operations adjacent to Anglo Coal Australia's Callide Mine, providing additional capacity to the 700MW Callide B power station owned by CS Energy. The 120MW capacity Callide A power station has been mothballed. The combined coal requirement for both Callide B and Callide C is approximately 6Mtpa.

Collinsville

Transfield Services Limited owns and operates the 192MW Collinsville coal-fired power station, located approximately 80km west of the coastal township of Bowen.

Gladstone

The Gladstone power station provides 1680MW of base/intermediate load from six 280MW turbines, largely to supply local industries and domestic users in the Gladstone area. NRG Gladstone Operating Services operates the plant on behalf of its present owners, which include Comalco Ltd, NRG Energy Inc. and a group of aluminium traders.

Millmerran

The 840MW Millmerran power station and adjacent Commodore mine, south-west of Toowoomba, became fully operational in late 2002. The power station is operated by the Millmerran Operating Company (a wholly owned subsidiary of InterGen (Australia) Pty Ltd) on behalf of Millmerran Power Partners, a partnership of InterGen (a Shell-Bechtel associate), Marubeni Corporation, GE Structured Finance, EIF Group, and Tohoku Electric Power Co. Inc.

The Millmerran plant is among the first in Australia to use a sophisticated super-critical boiler technology and air-cooled system design. Super-critical boilers increase plant efficiency compared to conventional Australian coal fired boilers. Air-cooling was adopted to reduce water consumption to a fraction of that used by conventional plant. Millmerran is the first major super-critical power station in Australia designed specifically to burn low sulphur coals from the Walloon Coal Measures of the Surat and Moreton basins of southern Queensland.

Stanwell

Stanwell Power Station, 22km west of Rockhampton, is owned and operated by Stanwell Corporation Ltd. The fully automated coal-fired power station became fully operational in 1996, with an original capacity of 1400MW. Recent modifications have allowed the station to reach a total output of 1440MW.

Swanbank

The Swanbank power station near Ipswich is owned and operated by CS Energy. The station consists of a 500MW coal-fired facility (Swanbank B), with additional capacity available from the 385MW gas-fired Swanbank E station. This has replaced the capacity previously provided by the mothballed 396MW Swanbank A station.

Table 3: Queensland power stations — coal fired capacity and coal purchases

Power station	Installed capacity ([1]MWe)	Coal purchases (Mt)		Main coal sources
		2001–02	2002–03	
Callide A*	120	0.017	-	-
Callide B	700	3.088	2.753	Callide
Callide C*	840	2.817	2.404	Callide
Collinsville	192	0.427	0.309	Collinsville
Gladstone	1 680	4.647	3.985	Blackwater, Callide, Curragh, Ensham, Gregory-Crinum
Millmerran #	840	0.246	1.691	Commodore
Stanwell	1 440	3.532	3.431	Blackwater, Cook, Curragh, Burton, Ensham
Swanbank B	500	1.157	0.891	Ebenezer, Jeebropilly, New Acland, New Oakleigh
Tarong	1 400	5.225	6.194	Meandu
Total	**7 760**	**21.157**	**21.659**	

[1] Megawatts of electrical power

* Callide A mothballed in 2002; Callide C started commercial generation in November 2001.

Millmerran started commercial generation in late 2002.

Table 4: Typical coal quality supplied to Queensland power stations

Power station	[1]S.E. GJ/t	Volatile matter %	Moisture %	Sulphur %	Ash %
Callide	19	22	15.6	0.3	21
Collinsville	24.2	16	8	0.7	18.5
Gladstone	19–29	17–29	6–20	0.2–0.8	10–20
Millmerran	17.6	33	9	0.45	35
Stanwell	26–30	17–30	8–10	0.4–0.6	12–18
Swanbank B	24.8	35	10.5	0.5	17
Tarong	19.6	23.5	12	0.35	28

[1] S.E. = Specific energy; GJ/t = Gigajoules per tonne, which is equivalent to Megajoules per kilogram (MJ/kg)

All figures on an 'as received' basis (unless otherwise stated)

Tarong

The 1400MW Tarong power station, 180km north-west of Brisbane near the township of Yarraman, is a mine-mouth operation owned and operated by Tarong Energy Corporation Ltd. The power station became fully operational in 1986, and uses coal supplied by the nearby Meandu Mine. The Tarong North project is a 450MW super-critical power station being constructed adjacent to the existing Tarong Power Station. Construction commenced in 1999, and the station is scheduled for commissioning in 2003.

The combined coal requirements for both Tarong and Tarong North power stations will be approximately 7Mtpa from 2003, to be sourced initially from increased production at the Meandu mine. Tarong Energy is investigating the development, including the associated transport infrastructure, of its Glen Wilga coal deposit in the Surat Basin near Chinchilla, as a longer-term option for the supply of coal to the power station.

Kogan Creek

Plans for the proposed 750MW power station adjacent to the Kogan Creek coal deposit near Chinchilla in south-east Queensland were postponed in 2000 by the previous owners. In May 2002, CS Energy acquired 100% of the power project and coal deposit, and is positioning the project to be ready to proceed as a base load power generation project to meet future increases in power demand. All environmental and regulatory approvals for the project are in place.

QUEENSLAND'S COAL RESOURCES

GEOLOGICAL DISTRIBUTION

Queensland's coals range in age from Carboniferous to Tertiary. The commercially significant black coals are restricted to deposits within sedimentary basins of Permian, Triassic and Jurassic age, located mainly in the central and eastern portions of the State.

Figure 1 shows the locations of the State's sedimentary basins that contain the known coal measures of current or potential economic interest. The locations of existing mines and identified coal deposits in Queensland are shown in **Figures 2, 3, and 4**. The **Frontispiece** portrays the approximate distribution of coking and thermal coals in the main coal producing basins.

PALAEOZOIC COAL MEASURES

Carboniferous

The oldest known coal-bearing strata in Queensland are the Pascoe River beds, of Early Carboniferous age, which were deposited in the Pascoe River Basin at the northern end of the Coen Inlier on Cape York Peninsula in the far north of the State. The coal has no economic significance.

Permian

The stratigraphic distribution of coal-bearing formations in the major Permian basins of Queensland is summarised in **Table 5**. The coal deposits of Permian age are by far the most commercially important. Of the State's black coal inventory totalling in excess of 30Bt (measured and indicated resources), Permian coal measures account for approximately 75% of the total resources, including almost 100% of the coking coal and about 60% of the thermal coal resources.

The most important Permian coal basin is the **Bowen Basin**, which is exposed in a large, triangular-shaped area of central Queensland, 600km long and up to 250km wide (**Figure 1**). The basin extends south in the subsurface beneath Mesozoic sediments of the Surat Basin, and connects with the Gunnedah and Sydney Basins in New South Wales.

Coal seams in the Bowen Basin exhibit major variations in rank and quality, reflecting both the depositional and tectonic history of the basin. A broad trend of increasing rank from west to east has long been recognised, and was used as a guide for coal exploration targets during the late 1950s and early 1960s.

Table 5: Permian coal measures

Coal Group	Bowen Basin and Structural Outliers				Galilee Basin	Cooper Basin
	North	Central	South-east	South-west		
IV (Youngest)	Rangal Coal Measures	Rangal Coal Measures	Baralaba Coal Measures	Bandanna Formation	Bandanna Formation correlatives Betts Creek beds	Toolachee Formation
III	Moranbah Coal Measures	German Creek Formation		Freitag Formation		
II	Collinsville Coal Measures	Blair Athol and Wolfang Coal Measures				
	Coal Measures at Rugby	Coal Measures in the Miclere, Karin and Moorlands Basins				
I (Oldest)		Reids Dome beds		Reids Dome beds	Aramac Coal Measures	Patchawarra Formation

Legend: Producing or highly prospective interval; Moderately prospective interval; Poorly prospective interval

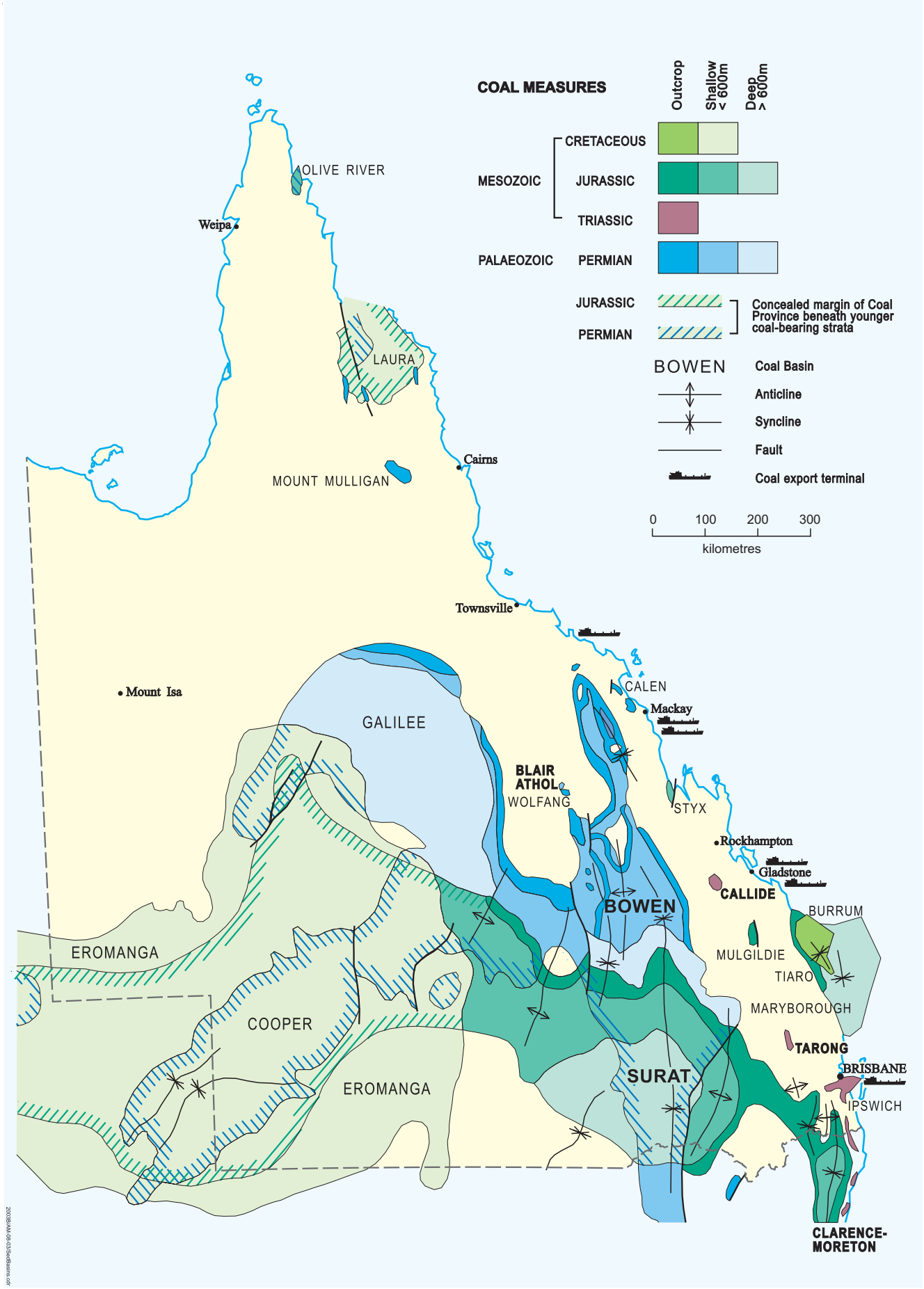


Figure 1: Queensland sedimentary basins and known coal measures

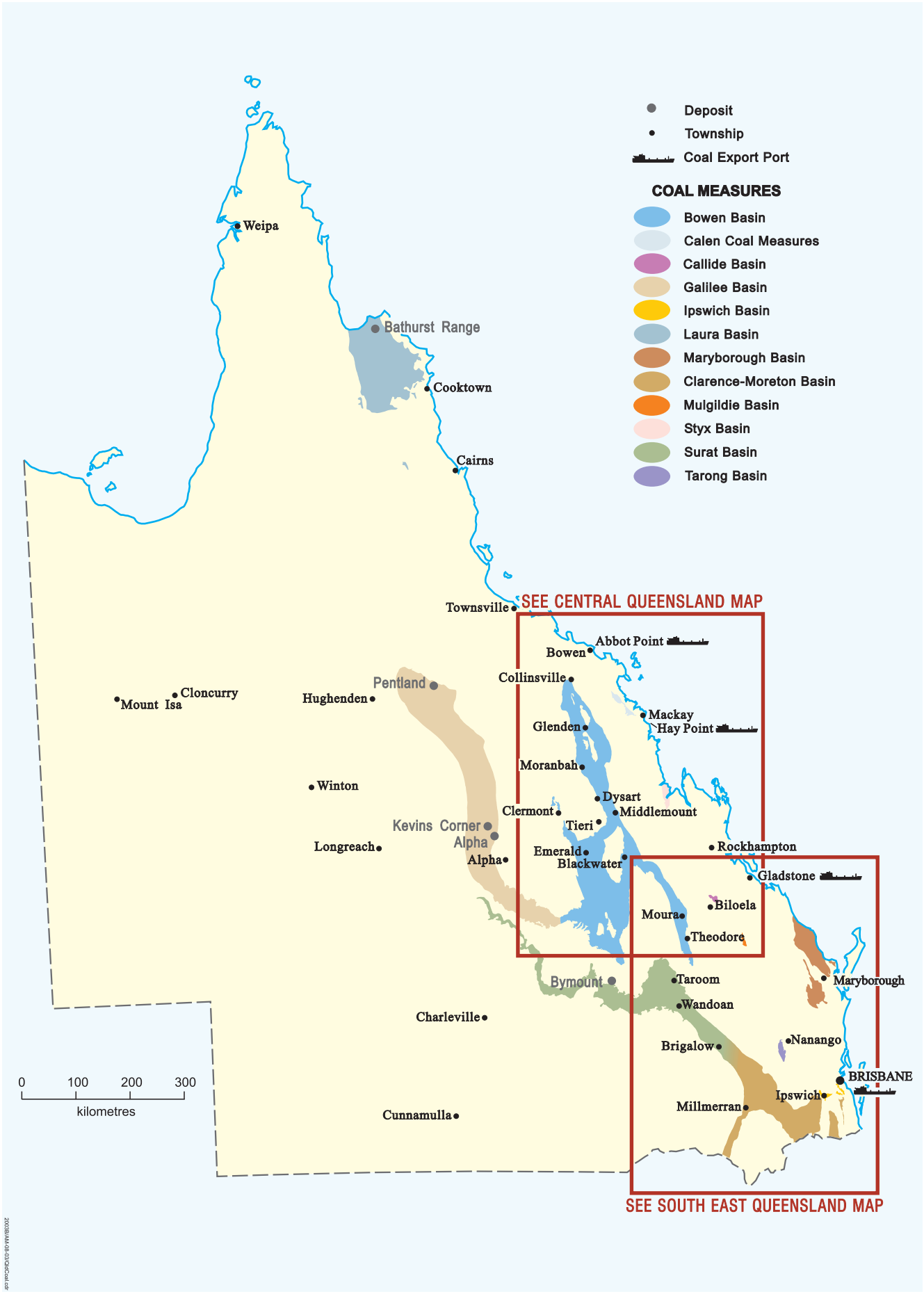


Figure 2: Index to Queensland coal areas and coal measures

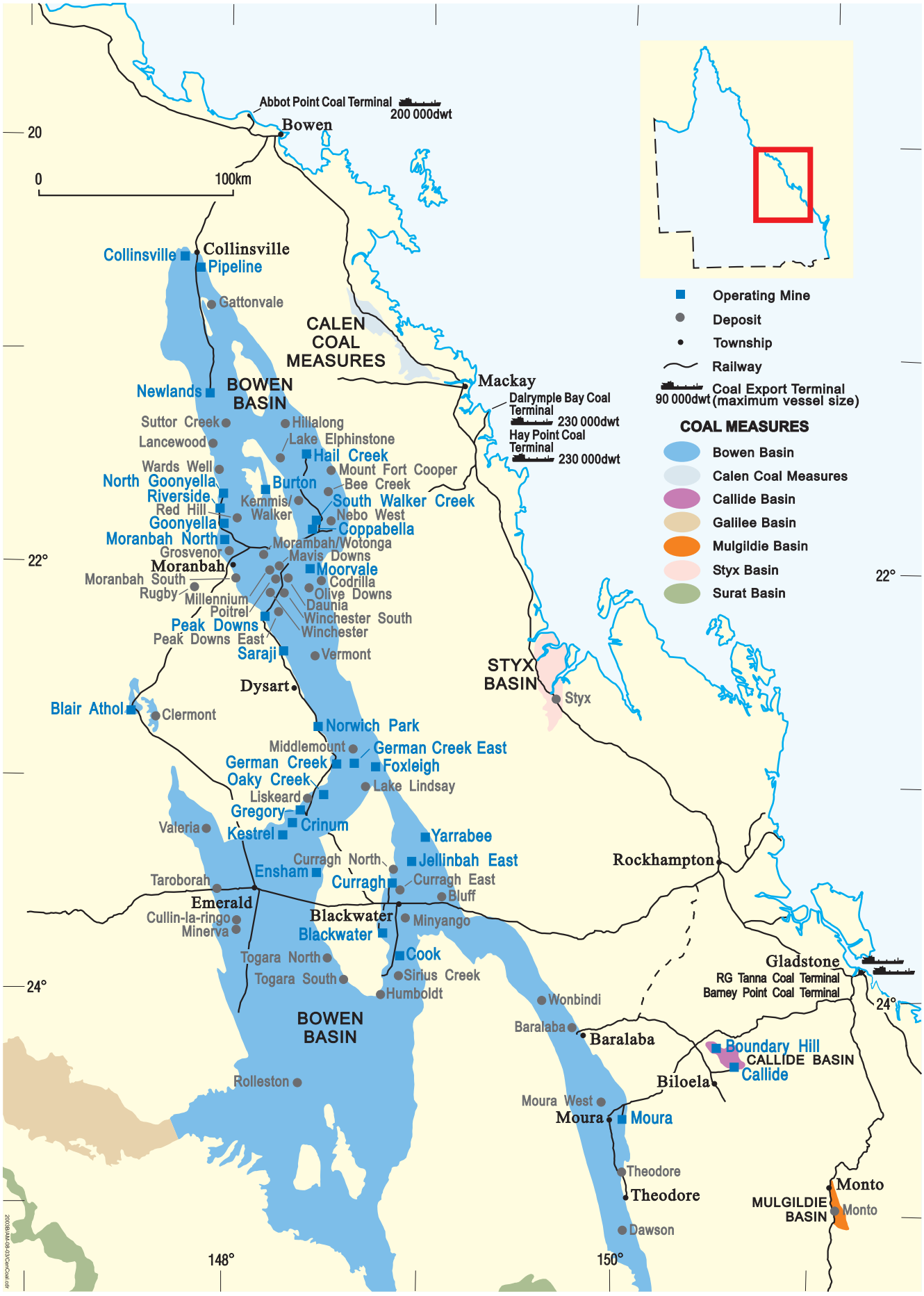


Figure 3: Central Queensland coal areas, showing locations of operating coal mines and undeveloped coal deposits

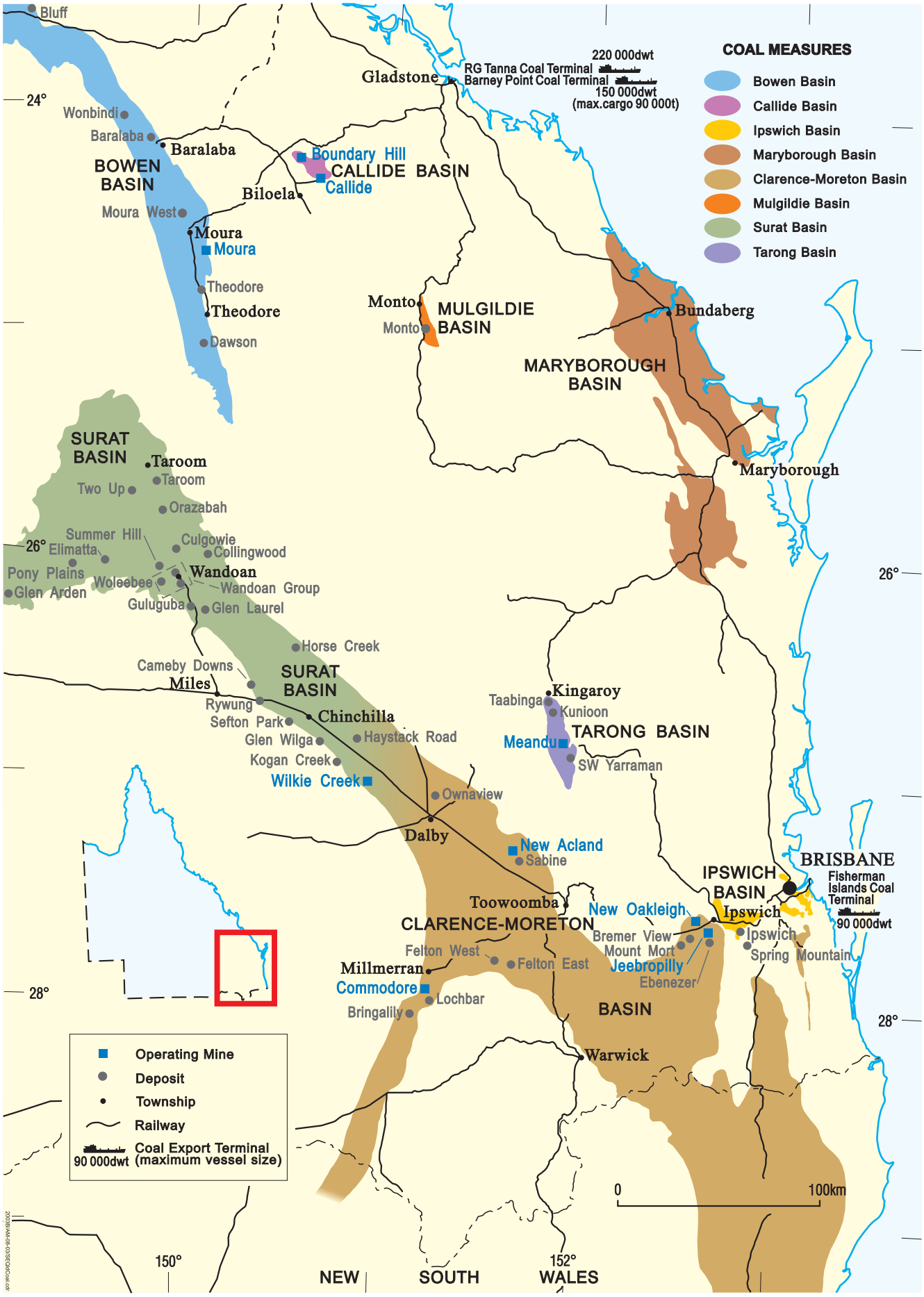


Figure 4: South-east Queensland coal areas, showing locations of operating coal mines and undeveloped coal deposits

Along the structurally disturbed north-eastern edge of the Bowen Basin, the coals range in rank from anthracite to low volatile bituminous, and deposits tend to exhibit a complex structure. Coals in the central part of the basin are medium to high volatile bituminous and include the best coking coals. Structural deformation in these deposits is generally relatively mild.

In the south-west, the coal rank falls below the coking range with a consequent loss of coking properties. The more significant deposits in this region are usually low ash non-coking coals and generally are not affected by major structural deformation apart from normal faulting. The westerly decrease in rank continues across the Springsure Shelf and into the Galilee Basin.

Coal-bearing horizons have been preserved at many stratigraphic levels throughout the Bowen Basin, but deposits of economic importance are restricted to four groups.

The oldest coals (Group I) of Early Permian age are represented by the Reids Dome beds, a unit of highly variable thickness and lithology. Distribution is restricted to the south-western part of the Bowen Basin. In the extreme south-west of the basin, seams can be up to 30m thick, but only occur at considerable depth. Further north the seams are thinner and at shallower depth. Near surface resources of good quality thermal coal have been delineated in the Capella area, and at Cullin-la-ringo near Emerald. No Group I coal seams have been mined to date.

Group II coal measures, also of Early Permian age, occur as several unconnected deposits located around the northern and western margins of the basin. These include the Collinsville Coal Measures in the north, the Rugby Coal Measures south-west of Moranbah, and a group of deposits in the Clermont area, including the Blair Athol and Wolfang Basins, which are structural outliers of the Bowen Basin. The Calen Coal Measures, which occur near the coast north of Mackay, are also considered to be of similar age.

Coal has been mined at Collinsville and Blair Athol for many years. Collinsville produces both coking and steaming coal, while at Blair Athol the product is low rank, medium volatile, low ash thermal coal.

Group III coals of Late Permian age were deposited on the Collinsville Shelf, under conditions which varied from a marine-influenced deltaic environment in the German Creek Formation, to dominantly fluvial flood plain environments in the Moranbah Coal Measures. These formations contain most of the high-grade coking coal deposits mined in Queensland, extending from Kestrel mine near Emerald to North Goonyella mine, north of Moranbah.

Other mines in this group include Gregory, Crinum, Oaky Creek, German Creek, Norwich Park, Saraji, Peak Downs, Moranbah North, Goonyella and Riverside. The underground mines at Kestrel, Crinum, Oaky Creek, German Creek, Moranbah North and North Goonyella demonstrate the importance and quality of these coal measures to support viable mining operations. Seams of slightly older age occur in the Freitag Formation and Aldebaran Sandstone in the central western and south-western parts of the basin, but rarely attain a thickness sufficient to warrant consideration.

A marine transgression, which halted deposition of Group III coals in the south, did not extend into the northern part of the Basin where coal measures continued to be deposited. Volcanism at this time resulted in major outpourings of tuffaceous material, which contaminated seams in the Fair Hill Formation and Fort Cooper Coal Measures, rendering them uneconomic at present, despite their considerable thickness.

The final phase of coal deposition in the Bowen Basin in the Late Permian resulted in the formation of Group IV coals. These include the Rangal Coal Measures, Baralaba Coal Measures and the Bandanna Formation. The coals in this group are the most diverse in terms of quality, and also the most widely distributed within the basin. Group IV coals were deposited under fluviatile, lacustrine and paludal conditions.

Although the quality and rank of Group IV coals vary greatly, they are characterised by comparatively low reactives content and low sulphur. They are of major economic importance as a source of coking, PCI and thermal coal and have been mined intensively over the past 30 years. Fourteen open-cut mines (Moura, Blackwater–South Blackwater, Curragh, Ensham, Jellinbah East, Yarrabee, Foxleigh, German Creek East, Moorvale, Coppabella, South Walker, Burton, Hail Creek and Newlands) and two underground mines (Cook and Newlands) currently work the Group IV coal seams.

The **Galilee Basin**, which is connected to the Bowen Basin across the Springsure Shelf, contains large quantities of high volatile, low rank thermal coal. Exploration to date has been limited because of its remote location. In excess of 1Bt of high volatile thermal coal has been identified to date, and additional unquantified tonnages undoubtedly exist in areas still to be tested.

The Group IV coals occur in the eastern Galilee Basin as correlatives of the Bandanna Formation. Near the northern margin, the Betts Creek beds are of similar age and contain at least two seams, one of which was mined briefly at Oxley Creek, near Pentland.

The Betts Creek beds in the vicinity of Hughenden contain one seam at least 10m thick at depth. Drilling by petroleum companies has also identified an older coal-bearing sequence in the Galilee Basin. This unit, known as the Aramac Coal Measures, is correlated with the Reids Dome beds (Group I) of the Bowen Basin, but only occurs at considerable depth, and is not economically significant.

Coal measures are present in the **Cooper Basin** of south-west Queensland and inferred tonnages are vast: an estimated 1000Bt *in situ* would be conservative. However, the coal measures all lie at depths well beyond economic extraction limits (more than 1000m). These measures range in age from Early to Late Permian.

Small deposits of similar age to the Group IV coals of the Bowen Basin occur in North Queensland at Mount Mulligan in the **Ngarrabullan Basin**, and in small, faulted blocks of Little River Coal Measures and Normanby Formation, which subcrop around the western and southern margins of the Jurassic–Cretaceous **Laura Basin**.

The coal at Mount Mulligan is high volatile bituminous coal of variable quality. Three separate seams were mined by underground methods, including a hand-worked longwall, from 1914 to 1957. The seams in the Little River Coal Measures and Normanby Formation are of poor quality, steeply dipping and structurally complex with little potential for development.

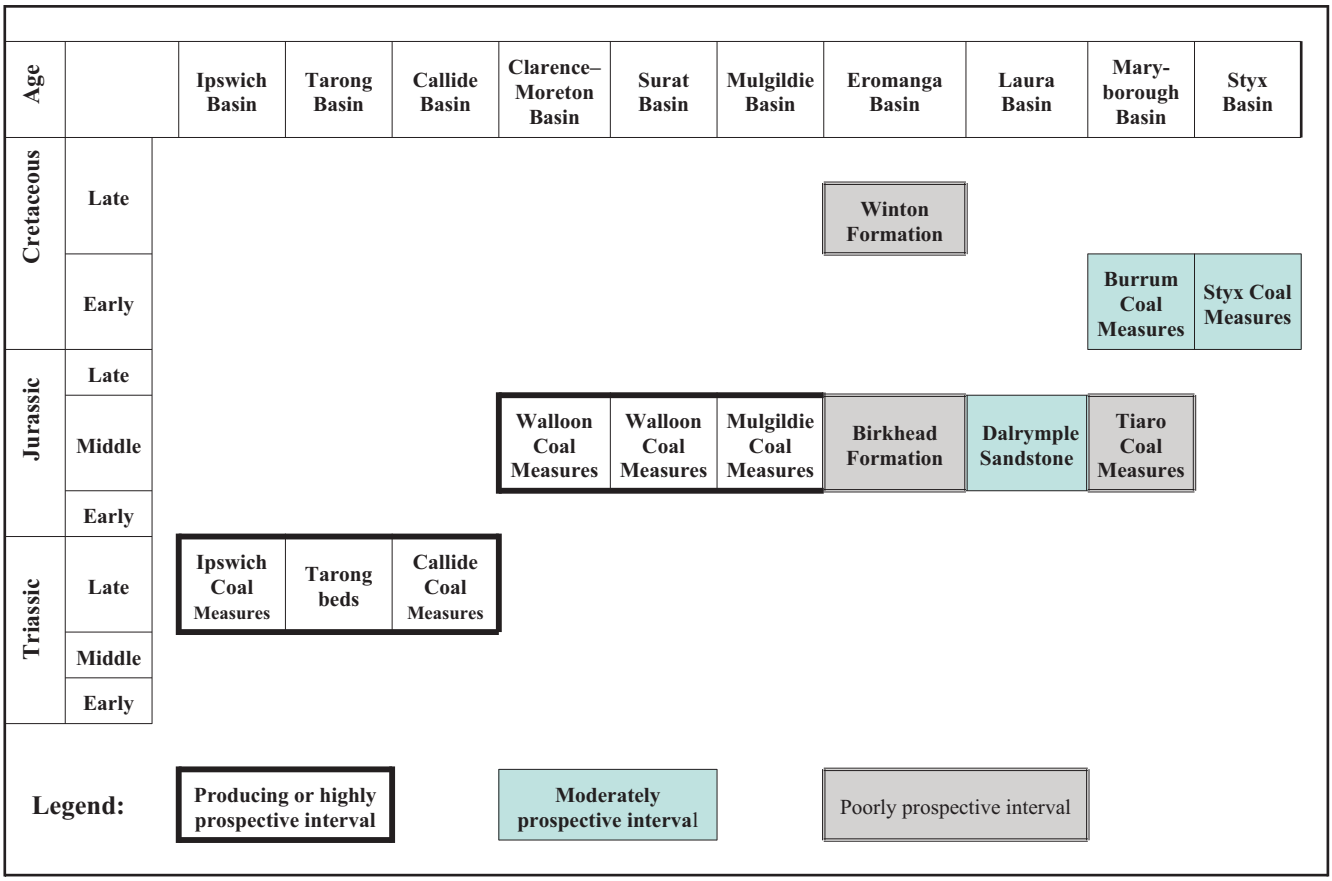
MESOZOIC COAL MEASURES

The stratigraphic distribution and economic significance of Queensland's Mesozoic coal measures is summarised in **Table 6**.

Triassic

The Triassic was a period of restricted coal deposition in Queensland. Minor occurrences in the Moolayember Formation of the Bowen Basin and in the Esk Trough in south-east Queensland are of Middle Triassic age. More significant deposits of Late Triassic age occur in intermontane basins in the south-eastern and

Table 6: Mesozoic coal measures



central regions of the State, the most notable being in the Callide, Tarong and Ipswich Basins.

The **Callide Basin**, which is located near Biloela in central Queensland, contains the Callide Coal Measures of Late Triassic age. The measures include four persistent seams, one of which, the Callide seam, is important. It ranges up to 26m thick but can contain numerous shale and sandstone partings. In some places, the seam divides into two or three major splits. Coal is mined within the Callide Basin from open-cut mines in the Dunn Creek, Trap Gully and The Hut areas (the Southern mine area), and from the Boundary Hill mine located at the northern end of the basin. Typical mine product is a medium ash, low sulphur coal used mainly for power generation.

The **Tarong Basin** is a small fault-bounded basin located near Yarraman, about 190km north-west of Brisbane. The basal rock unit in the basin, the Tarong Beds, consists mainly of sandstone and conglomerate, with at least six coal seams. The sequence has been dated as Late Triassic and correlated with the Tivoli Formation in the Ipswich Coal Measures, and is slightly older than the Callide Coal Measures. The coal is contained mainly in two seams, the King (up to 16m thick) and the Queen seams (34m thick). All seams have high raw coal ash contents, ranging from 25–45%, and require washing to maintain product specification. The Meandu open-cut mine produces over 5Mt of saleable coal per annum from these measures for use in the nearby Tarong and Tarong North power stations.

The **Ipswich Basin** near Brisbane has had a long history of coal mining and figured prominently in the development of Queensland. More than 20 seams have been worked at various times over the past 150 years. The seams were typically banded, with mining generally by underground methods. Some undeveloped coal resources remain, but these are generally only accessible by underground mining, and the coalfields are essentially exhausted of economically extractable coal. The only remaining mining operation — a small open-cut in the Swanbank area — closed in July 2003.

Jurassic

Jurassic coal measure sequences are widely distributed in southern Queensland, with proven coal resources only second in size and extent to those of the Permian. These deposits have been little mined to date because the Permian resources are more accessible. The principal coal-bearing sequences of economic interest occur in the Clarence–Moreton and Surat Basins of south-east Queensland.

In the **Clarence–Moreton Basin**, coal deposits of economic importance lie within the Walloon Coal Measures of Middle Jurassic age. The seams in the Walloon Coal Measures occur in thick, banded intervals, in which lenticular beds of carbonaceous shale, mudstone, siltstone and sandstone of varying thickness separate the individual coal bands. Mining operations have generally been based on extracting the better quality seams within such banded sections. The main mining area to date has been the Rosewood–Walloon coalfield west of Ipswich, where extensive small-scale underground mining was carried out in the past, and production from open-cut operations continues at present. Two open-cut mines (Jeebropillly and New Oakleigh) currently operate in this area, while a third (Ebenezer) ceased production in December 2002.

Underground mining within the Clarence–Moreton Basin was also carried out previously at Oakey, Acland and Tannymorel on the Darling Downs. These mines are now abandoned, but a new large open-cut mine (New Acland) north of Oakey commenced

operations in 2002. Additionally, a 3Mtpa open-cut mine (Commodore), just south of the town of Millmerran, commenced production in 2001 to supply coal to the new 840MW Millmerran power station. Further significant coal resources amenable to open-cut extraction have been delineated in the Clarence–Moreton Basin in the Acland and Millmerran areas, and at Felton to the south-west of Toowoomba.

The Walloon Coal Measures extend across the Kumbarilla Ridge into the **Surat Basin**, where they crop out in an arcuate zone between Warra (near Dalby) and Injune to the west. In this region, the coal measures contain the Juandah (upper) and Taroom (lower) Coal Members of Middle Jurassic age. During the early part of last century a small underground mine was opened up at Warra, producing some 27 000 tonnes of coal between 1914 and 1919. A second underground mine, the Maranoa Colliery, was established near Injune in 1933 to supply coal to the Queensland Railways and local consumers. The mine closed in 1963 when it lost sales to the railways following the introduction of diesel-electric trains. Saleable coal production from the mine totalled 542 000 tonnes.

In the mid-1990s the Wilkie Creek open-cut mine, about 45km north-west of Dalby, was developed in the Juandah Coal Member. The mine produces coal for both the domestic and export thermal coal markets. Significant resources of thermal coal have been delineated at Kogan Creek, and in the Chinchilla, Wandoan and Taroom areas, with a total coal inventory exceeding 4Bt of surface-mineable coal. The coal typically occurs in two intervals of interbedded mudstone, siltstone and sandstone, with lenticular coal seams up to 6m thick. The intervals are separated by approximately 100m of sandstone.

The Walloon Coal Measure coals in both the Clarence–Moreton and Surat Basins are high volatile with excellent combustion and burnout characteristics, ideal for blending with lower quality coals to improve boiler performance and at the same time lower stack emissions for power generation. The coal is also perhydrous and is consequently a good feedstock for the production of synthetic liquid fuels, and for gasification.

Further to the west in the **Eromanga Basin**, the Birkhead Formation (the lowest unit in the Injune Creek Group) correlates with the Walloon Coal Measures of the Surat Basin. The formation crops out in a zone extending from Injune north-west to about latitude 24°S near Blackall. Although seams up to 1.5m thick have been intersected, they are generally much thinner. No coal from the Birkhead Formation has been mined and prospects of identifying workable deposits are poor.

The **Mulgildie Basin** is a narrow, north-easterly offshoot of the Surat Basin containing Lower to Middle Jurassic sediments. The uppermost unit in this sequence is the Mulgildie Coal Measures, which are equivalent in age to the Walloon Coal Measures. The Mulgildie Coal Measures contain several banded seams within an interval of approximately 400m thickness. Between 1949 and 1966, one of the upper seams was mined by underground methods in the now abandoned Selene mine. Recent exploration in the region has located large tonnages of thermal coal at shallow depths, about 10km south of Monto. Seven seam groups have been defined, with individual seams generally 1–2m thick. Design work commenced in 2003 for an open-cut mining operation to produce high volatile, low nitrogen thermal coal for both the domestic and export markets.

In the north-eastern part of the **Laura Basin** in far north Queensland, the Dalrymple Sandstone of Middle Jurassic age contains approximately 45Mt of coking coal potentially amenable to underground extraction. Company exploration has identified several seams, one of which attains an average thickness of about 1.6m. The coal can be washed to produce a low ash, high swelling coking coal with a good yield. However, due to the location, depth, relatively high organic sulphur content, and other factors, economic extraction of the coal is not considered viable in current market conditions.

Cretaceous

Although Cretaceous strata are widely distributed in Queensland, few coal deposits of this age are known. Thin seams of high volatile bituminous coal occur in the Burrum Coal Measures of the **Maryborough Basin**, and in the Styx Coal Measures of the **Styx Basin**. Both areas have been mined by underground methods in the past, but remaining resources are very small, with the last colliery (Burgowan) at Burrum closing in 1997.

The Winton Formation (Late Cretaceous) in the **Eromanga Basin** contains lignitic coal seams but exploration to date indicates that the potential for significant discoveries is poor.

Cainozoic

Considerable tonnages of low rank lignitic coal are known to occur associated with oil shale in several small Tertiary basins located in the coastal areas of central and southern Queensland. These are of interest mainly in the context of synthetic transport fuel production, the feasibility of which is under continuing investigation. A demonstration plant to test the commercial viability of extracting oil from oil shales has been constructed at the Stuart oil shale deposit in the Gladstone region. The plant is currently being operated to confirm design parameters for a proposed full-scale commercial plant at the site.

COAL INVENTORY

Estimates of the amount of raw coal *in situ* for Queensland's coal basins have been compiled from available company information by the Department of Natural Resources and Mines to assist government with strategic planning, and to assist with land and mineral tenure management for the State. The tonnage estimates, presented on a basin-wide basis in **Table 7**, have been derived by aggregating yet-to-be-mined resources and/or reserves estimates at operating coal mines, with estimates of identified coal contained within other undeveloped coal deposits within the State. Details of the tonnage estimates for each mine or deposit contributing to the aggregate figures in **Table 7** are included in Appendix A.

Base information for the compilation has been obtained from a variety of sources and falls into two broad groups comprising:

- Estimates which have been publicly reported by companies as complying with the Australasian Joint Ore Reserves Committee (JORC) Code[2] for Reporting of Mineral Resources and Ore Reserves — 1999, herein referred to as JORC estimates.
- Estimates obtained from information supplied to the Department of Natural Resources and Mines by exploration and mining companies, but not nominated as being compliant with JORC requirements. Generally, companies provide estimates within this group ('Provisional' category) to the department to comply with statutory requirements for exploration reporting. Estimates have been prepared in accordance with accepted practice, following guidelines such as those described by Galligan & Mengel (1986).

It is important to note that estimates from these two groups are derived using different parameters and, as such, may not be

2 A copy of the JORC Code can be obtained from: www.jorc.org/main.php

Table 7. Queensland coal inventory — summary
(million tonnes raw coal *in situ*)

Period/Basin	Coking coal		Thermal coal**		Total
	Open-cut M+I*	Underground M+I	Open-cut M+I	Underground M+I	M+I
Permian					
Bowen	4 114	7 079	3 227	6 561	20 981
Galilee	-	-	1 678	530	2 208
Subtotal	**4 114**	**7 079**	**4 905**	**7 091**	**23 189**
Mesozoic					
Callide	-	-	970	-	970
Clarence–Moreton	-	-	2 250	-	2 250
Ipswich	-	-	4	561	565
Laura	-	47	-	-	47
Mulgildie	-	-	122	-	122
Styx	-	-	-	4	4
Surat	-	-	4 198	-	4 198
Tarong	-	-	1 384	-	1 384
Subtotal	**-**	**47**	**8 928**	**565**	**9 540**
Total	**4 114**	**7 126**	**13 833**	**7 656**	**32 729**

* M+I = Measured + Indicated status (combined)

** includes pulverised coal injection (PCI) coals

directly comparable. Consequently, as the rounded aggregate totals in **Table 7** contain estimates from *both groups*, the information provides a *guide only* to the State's inventory of identified coal, and is not intended to demonstrate or imply potential commercial viability.

The individual estimates for each coal deposit or mine used in compiling the totals in the table (Appendix A) are on a raw coal *in situ* basis, with no allowance made for potential losses from mining or beneficiation. For those operating coal mines where JORC compliant estimates were not available, tonnage estimates have been reduced by subtracting raw coal mined up to 30 June 2002.

Only resources classified as Measured or Indicated category, as defined under either the JORC or the alternative guidelines, are included in the figures presented in Appendix A and aggregated in **Table 7**. Estimates of Inferred coal resources, which would add significantly to the total coal inventory tonnage, are not included in these figures.

In April 2003, the *Australian guidelines for the estimating and reporting of inventory coal, coal resources and coal reserves* (the guidelines) were issued for subsequent inclusion with the 2003 edition of the JORC Code, which is due for release towards the latter part of 2003. The guidelines define a new term, inventory coal, which has been introduced to enable government bodies and other statutory authorities to quantify, record and inform on estimates of all identified coal regardless of economic potential. The figures presented in **Table 7** and Appendix A do not at this stage (and are not intended to) represent the total estimates of *inventory coal* in Queensland.

Of the State's coal inventory as presented in **Table 7**, Permian coals within the Bowen Basin in central Queensland account for approximately 70%, while Mesozoic coals found mainly in the Clarence–Moreton, Surat, Callide and Tarong Basins make up the remainder. Shallow coal potentially amenable to open-cut mining makes up about 55% of the inventory, with the remaining 45% present at greater depths.

Thermal coals (including PCI coals) represent about 65% of the inventory, with the remainder being identified as coking coal. The Permian coal measures contain almost 100% of the identified coking coal resources. Approximately 40% of the coal inventory occurs at or within close proximity to operating mines within the State.

The total coal inventory of approximately 33Bt represents a decrease of about 5Bt on the total figure quoted in the previous edition of *Queensland Coals* (13th edition — 2001). The main reason for this reduction is the change of reporting to JORC specification for many of the companies reporting their resources and reserves. Significant reductions in tonnages are largely attributed to the decrease or exclusion of underground resources, which under JORC reporting are now either no longer considered 'reasonable prospects for eventual economic extraction', or have been re-classified as inferred resources only. This is highlighted by the decrease — from about 55% of the total inventory in 2001 to 45% currently — in the proportion of underground coal now included in the inventory.

Reference

GALLIGAN, A.G. & MENGEL, D.C., 1986: Code for reporting of identified coal resources and reserves. *Queensland Government Mining Journal*, **87**, 201–03.

EVALUATION OF COALS

UTILISATION OF COAL

The principal uses of coal are:

- Carbonisation to make coke for industrial purposes — these coals are commonly known as coking coals or metallurgical coals.
- Combustion, steam raising including power generation and general furnace heating — these coals are commonly known as thermal or steaming coals.
- Pulverised coal injection (PCI), the direct combustion of coal in a blast furnace — these coals can be either thermal coals or low grade coking coals and are normally referred to as PCI coals. In recent years demand has been steadily increasing for semi-anthracite coals for PCI use.

Blending of various types of coking coal has been used extensively in the production of coke for many years, and blending of thermal coals for use in power generation is becoming more common. Some of the issues relating to the impact of certain properties of coals on the properties of coal blends are discussed in this section.

Laboratory testing of coals has an important role in evaluating the utilisation potential of new coal resources, and for routine coal quality control during production. It is important, though, to be aware of the limitations of laboratory data in relation to the prediction of plant performance at commercial scale. Testing chemical and physical properties of a coal in isolation does not provide a proper assessment of its value in use for metallurgical coke-making or its potential impact on power station performance. For coking coals, the quality of the resultant coke also depends on the quality of other coals (that are carefully matched) in the blended feed, and on the coking conditions. Similarly, the performance of a thermal coal in a power station is strongly influenced by the design and operating conditions of the boilers in that power station.

A reliable assessment of the performance by a coal in a particular application can only be gained from full-scale tests, although a good understanding of a coal's strengths and weaknesses, under conditions that closely simulate full-scale, can be gained from pilot-scale testing. Pilot-scale facilities are available in Queensland for testing both coking and thermal coals at the Australian Coal Industry Research Laboratories (ACIRL) facilities at Riverview, near Ipswich. In addition, CSIRO operates a pilot-scale pressurised entrained flow gasifier at the Queensland Centre for Advanced Technologies at Pullenvale, in Brisbane, to assess the properties of Queensland's thermal coals for use in advanced power generation technologies. The Queensland and Commonwealth governments sponsor this facility through the Cooperative Research Centre for Coal in Sustainable Development (CCSD).

COKING COALS

Coke types and processes

Three main types of coke are produced from coking coals:

- **Metallurgical coke** is produced in coke ovens and is mainly used in the reduction of iron ore to pig iron in blast furnaces. It is also consumed in blast and electric furnaces for ferro-alloy production, reduction of metal oxides to metals and chlorides, reduction of phosphates and sulphates, and in the reduction of carbonates to carbides.
- **Foundry coke** is produced in beehive or non-recovery coke ovens and is used at foundries to melt iron and various copper, lead, tin and zinc alloys in cupolas. The basic coke requirements are the same as for metallurgical coke but the size specification varies, depending on the size of the cupola. Foundry coke is almost always of larger size than metallurgical coke.
- **Domestic coke**, or more often semi-coke, is used as a fuel. A low ash, easily ignited coke of high specific energy with a very low sulphur content is required.

The coking processes may be carried out in either slot-type ovens, beehive ovens, travelling grate ovens, rotary kilns or in formed-coke plants. Only the first two processes have widespread commercial application. Slot ovens are generally located adjacent to or close to the steelworks where valuable by-product gases can be collected and used. Beehive (non-recovery) ovens that produce larger and less reactive cokes for foundry use can be located at any convenient site. Formed-coke processes have been developed but have not been commercially implemented because the qualities of that coke have been proven to be inferior to slot-oven and beehive oven cokes.

Aspects of current coking practice that influence coke properties are heating rate and duration, charge bulk density, final temperature, and degree of preheating the charge.

The value of by-products from carbonisation fluctuates, depending on the oil price, and is secondary to the value of the coke. Nevertheless, the production of by-products is important to the overall economics of a steelworks. The composition and level of production of the by-products is dependent on the types of coals used in the coking blend.

Metallurgical coke

The steel industry is the largest consumer of coke, using it to reduce iron ore to pig iron in blast furnaces where the coke has three roles:

- source of heat through combustion with the hot air blast at the tuyeres
- source of reducing gas after reaction with the hot air blast to form carbon monoxide, or by reaction with carbon dioxide produced during the high temperature stage of iron ore reduction
- permeable granular material with sufficient strength to support raw materials (known as the burden) in the blast furnace through which gas can percolate, particularly in the lower regions of the furnace. Poor permeability affects furnace stability, output and fuel efficiency.

During the movement of the burden down the furnace, the coke within it is subjected to mechanical degradation and chemical attack. Coke size decreases by:

- reaction with carbon dioxide, which occurs in the temperature range 900–1100°C
- reaction with alkali metal vapours at temperatures of up to 1450°C, which cause a reduction in the abrasion resistance of the coke
- thermal effects at temperatures of up to 1500°C, which may further weaken the strength of the coke and reduce its size.

Table 8: Desired properties of metallurgical coke

Coke property		Typical ranges	Australian Standard
J.I.S. drum indices	D_{15}^{30}	>90	AS 1038.13
	D_{15}^{150}	>80	
Micum indices	M_{40}	>74.9	
	M_{10}	<8.8	
Reactivity to carbon dioxide (CRI)	%	<35	
Strength after reaction (CSR)	%>10mm	>50	
Size range	mm	25–75	AS 1038.18
Mean size	mm	50±5	
Size <25mm	%	<5	
Moisture	%	4.0±1.5	AS 1038.2
Ash	%	10.0±0.5	AS 1038.4
Total sulphur	%	Target ±0.02	AS 1038.6.3.2

Table 8 lists various properties that are used to evaluate coke quality. Typical properties for Queensland coking coals are presented in Appendix B.

Increasing trends by the steel industry to use pulverised coal injection (PCI) to reduce coke requirements has placed more stringent requirements on the burden quality, in particular on the coke quality. The industry uses layer charging of different coke size ranges. It is also recognised that larger coke particles with a relatively uniform size distribution are required to reduce blast resistance. It is also important that the coke has high and consistent impact strength and abrasion resistance at the furnace operating temperature, as the presence of fines increases the burden resistance, increases slag viscosity and increases carbon loss through the off-gases. Low and consistent coke moisture content is desirable as water vapour catalyses the oxidation of carbon monoxide to carbon dioxide and reduces the extent of direct reduction of the iron ore. Also, high moisture diminishes the carbon feed rate for a constant gravimetric or volumetric coke input. Lower coke reactivity is also required at high PCI rates.

Pulverised coal injection (PCI)

In modern blast furnace technology, the use of supplementary fuel injection is essential to maintain high productivity. Injected fuels lower coke consumption and control the energy balance in the furnace combustion zone (raceway). PCI is a very competitive replacement for fuel oil as a supplementary fuel and is now used in most countries.

The rate of injection is expressed as units of fuel (kg or m^3) per tonne of hot metal (tHM) and the replacement ratio as kilogams of coke replaced per kilogram of fuel. Current Japanese technology uses injection rates of up to 230kg/tHM, which is similar to that achieved in European facilities. Average injection rates are around 130kg/tHM in Japan and 160kg/tHM in Europe.

At high injection rates a significant amount of the coke is consumed by reactions occurring in the shaft and the bosh areas of the blast furnace, leading to greatly reduced coke size in the raceway area. A reduced coke size in the lower region of the furnace and increased generation of fines due to the blast momentum and unburnt coal char can cause furnace instability and lead to lower furnace productivity. The use of better coke quality with lower coke reactivity can reduce the impact of high injection rates on furnace stability.

The coal quality specifications required for PCI coals relate to operational aspects associated with replacement ratio, coal grinding, combustion efficiency and interaction of mineral matter with the furnace slag.

Much research has shown that the replacement ratio, and therefore the commercial benefit, increases with the rank of the coal. One relationship that was determined from data gathered at the Hoogovens Ijmuiden blast furnace, based on the gross air-dried energy, is:

$$\text{Replacement Ratio} = \frac{-83.5 + 0.02 \times SE\ (kcal/kg)}{100}$$

As injection rates increase, higher throughputs from the existing coal milling plant must be achieved. Softer coals with a Hardgrove Grindability Index (HGI) greater than 60 can increase mill capacity without greatly impacting on the size distribution of the pulverised coal. This does not adversely affect the transport properties of the pulverised coal through delivery systems to the blast furnace.

As the rank of a coal increases, its energy content and HGI increase. However, at carbon contents above 90% (daf) the HGI starts to decrease again. Also, as rank increases, the reactivity of the coal char that remains after devolatilisation decreases, and therefore lowers the combustion efficiency of the coal. This perceived adverse impact is generally offset by the very high temperatures in the raceway, and consumption of resultant coal char in the overall reduction process.

Coal properties used in evaluating coking coal

Table 9 lists the main quality parameters commonly used in the evaluation of coking coals. Indicative values for various Queensland coals are presented in Appendix B. Coking properties are mainly affected by rank, maceral types and inorganic matter of the coal. Rank is best determined by the mean maximum reflectance of vitrinite (Rv,max) in the coal. Volatile matter on a dry mineral matter free basis is also an indicator of coal rank. Measurement of the plastic properties during carbonisation (e.g. Gieseler fluidity) is commonly used in evaluating component coals to be used in a coking blend, though there is some debate on how fluidity influences the important coke properties of coke strength after reaction (CSR) and the size of the stabilised coke.

In blending coals for coke manufacture, the properties of the blend can be estimated as follows:

- Rv,max is determined from the percentage-weighted average of vitrinite
- the log of the Gieseler maximum fluidity is additive
- the proximate and ultimate analyses are additive.

THERMAL COALS

Most thermal coals exported from Queensland are utilised as pulverised fuel (PF). Some thermal coals are also used in stokers and fluidised bed boilers.

Coal qualities impact significantly on operating costs of coal-fired installations. Generally coals with low total moisture, ash and sulphur, high specific energy and good combustion performance can minimise total plant costs. **Table 10** summarises some of the more significant coal properties used in the evaluation of thermal coals.

Table 9: Influence of coal properties on coke-making

Coal property	Typical ranges			Standard	Influence on coke-making
	Non-coking	Soft-coking	Hard-coking		
Total moisture	Max.12%			AS 1038.1	Moisture is inert in coke-making but consumes energy to evaporate. Surface moisture lowers the bulk density of the coke charge.
Proximate analysis Volatile matter (daf)% Ash (ad)%	 12–45 <10.0	 30–40 <10.0	 20–30 6.0–10.0	AS 1038.3	Volatile matter aids in the classification of coking coals and largely determines fixed carbon. Increased ash (or more strictly mineral matter) decreases coke yield, increases slag volume in the furnace and consumes more coke in the smelting operation.
Ultimate analysis Sulphur (ad)%	 <1.0	 1.0	 1.0	AS 1038.6 Parts 1, 2, 3	Ultimate analysis, carbon per cent and hydrogen per cent (dmmf basis) are good rank indicators. Oxygen per cent affects coke yield and, during carbonisation, part of the oxygen reacts endothermically with hydrogen to produce water. Both sulphur and phosphorus are retained in the coke, in varying degrees, and have a deleterious effect.
Ash analysis				AS 1038.14 Parts 1, 2, 3	Certain ash constituents can catalyse undesirable reactions in coke with carbon dioxide. Ash analysis can also be used to decide the quantities of materials required to control slag chemistry and viscosity.
Maceral analysis				AS 2856.2	In coke making the fusible macerals vitrinite, liptinite and some semi-inertinite bind mineral matter and non-fusible matter together. The quality of the coke depends on the rank of the coal and also on the relative proportions of the reactives and inerts.
Vitrinite reflectance				AS 2856.3	Vitrinite reflectance is an accurate measure of coal rank. It is used in conjunction with maceral analysis and plasticity data to determine the constituents of coking blends, and also to predict the quality of the resultant coke.
CSN Gray-King coke type Roga index	0–1	3–6	6–9	AS 1038.12.1 AS 1038.12.2 ISO 335	The ability of a coal to pass through a plastic stage and to form a coherent residue on cooling is termed caking. It is an essential prerequisite for a coking coal. Caking power is measured by these different tests.
Plasticity Maximum fluidity dd/min Dilatation %	 0 < 0	 50–1000 0–50	 >500 0–100	 AS 1038.12.4 Parts 1 & 2 AS 1038.12.3	The fluidity of the plastic stage of a coking coal (as measured by e.g. the Gieseler plastometer) is one important parameter used to determine what proportions of a coal will be used in a blended feed to a coke oven. Loss in fluidity (e.g. of weathered coal or exposure of stockpiled coal to the natural elements) also indicates the degree of oxidation of a coking coal.

Blending

Blending coals of different qualities or ranks can be a vital procedure at many coal-fired power plants. It offers many advantages, such as:

- produces a uniform fuel possessing better combustion properties than the individual coals that make up the blend
- is a valuable method, either independently or together with physical coal cleaning, of controlling the mineral content of coal
- burns coals outside the normal thermal coal specifications in boilers that would otherwise be unable to efficiently fire many sub-bituminous coals
- helps utilities meet increasingly stringent sulphur dioxide emissions limits by blending low-sulphur coals with high-sulphur coals
- helps utilities meet nitrogen oxides (NO_X) emissions limits by blending low-nitrogen coal with high-nitrogen coals, and high volatile coals with coals of lower volatile matter. However, the control of furnace operating conditions and the use of low NO_X burners have a much greater impact on NO_X emissions.

Handling

Handling problems can occur in coal bunkers, coal hoppers, and coal transfer chutes to and from the coal pulverising mills. Handling characteristics generally can be related to the percentage of fine coal (minus 2mm), total moisture content and the presence of clays in the product.

Under certain conditions, coal may spontaneously combust in stockpiles, bins and bunkers. Such problems can be minimised by good housekeeping to reduce exposure to air and to exclude water from the stored coal.

Milling

In a PF boiler system, coal is pulverised to typically 70–75%, passing 75 micron and entrained in preheated primary air for

Table 10: Influence of coal properties on thermal coal combustion

Coal property	Standard	Influence on combustion
Sizing		Coal having more than 30% of minus 2mm fine particles can cause handling problems with the frequency increasing as the fines percentage increases.
Total moisture	AS 1038.1	High moisture content increases transportation costs per unit of energy and may increase handling problems, depending on the clay content of the coal.
Proximate analysis	AS 1038.3	The ratio of fixed carbon to volatile matter (**fuel ratio**) indicates the ease of ignition and burnout, but the heat content of the volatile matter is a more reliable guide to ignition. The volatile matter content influences NO_X formation. Generally for the same burner and constant nitrogen content, the higher the volatile matter the lower the NO_X. Low values of ash are generally sought; however, in stoker firing a minimum ash level of 5% or more is necessary to protect the grate from overheating.
Ultimate analysis	AS 1038.6 Parts 1, 2, 3	This analysis is required for calculating stoichiometric air requirements and the volume and composition of the products of combustion, with the exception of NO_X which also depends on combustion conditions.
Forms of sulphur	AS 1038.11	These figures give the distribution of the total sulphur between organic, inorganic and sulphate. Total sulphur can be used to estimate SO_X emissions, though some SO_2 is absorbed by calcium in the ash.
Specific energy	AS 1038.5	The heat derived from the combustion of coal is of prime importance and can be reduced by high levels of ash and moisture, or poor utilisation efficiency. The net specific energy is obtained by subtracting the latent heat of water in the combustion products from the gross specific energy. See Appendix F for formulae for calculating net specific energy.
Ash fusion temperatures	AS 1038.15	Low ash fusion temperatures may lead to slagging (deposits within the furnace chamber) or to fouling (deposits in the convective passes of a boiler).
Ash analysis	AS 1038.14 Parts 1, 2, 3	The composition of the ash of a coal influences the slagging and fouling behaviour and also the performance of the fly ash collection plant. **Table 15** gives the relationship between ash analysis and fouling and slagging indices.

conveying to the burners. In some small-scale operations indirect firing, in which pulverised coal is stored in a bin before feeding to the burners, is used.

The three types of coal pulveriser are generally identified by the speed of their rotation:

- Low speed mills are of the ball/tube design with a large steel cylinder and a charge of hardened balls. Coal is ground as it is crushed and abraded between the balls.
- Medium speed pulverisers are typically vertical spindle mills that grind the coal between rollers or balls and a bowl or race.
- High speed mills have a high-speed rotor, which impacts on and breaks the coal.

Vertical spindle mills are commonly used in large-scale power plants and to pulverise coal for injection into blast furnaces. **Table 11** shows the preferred coal properties for each type of pulveriser.

Mill performance curves for throughput and fineness can be used on coal blends by estimating the HGI of the blend by assuming, for this purpose, that HGI is an additive property. It should be noted that the fineness of individual coals in a blend can vary e.g. more of a softer coal will report to the finer fractions. The fineness of individual coals in a blend will also impact on the burnout characteristics of that blend. The addition of a high moisture coal to a coal with medium to high abrasion characteristics could result in a blend with high to very high mill erosion potential due to the interaction of abrasion and corrosion in the mill.

Firing systems

Three different types of pulverised fuel-firing systems are used in large boilers:

- Horizontal or slightly angled swirl burners located in the front and/or rear walls of the furnace. In a swirl burner the air, normally secondary air, is given a strong swirl about the axis of the burner. The swirling action increases the

Table 11: Desired coal properties for pulverisers

Pulveriser type		Low speed	Medium speed	High speed
Example		Tube mill	Vertical spindle mill	Impact mill
Coal feed top size	mm	25	40	32
Coal moisture	(as) %	0–10	0–20	0–25
Coal ash	(as) %	1–50	1–30	1–15
Coal quartz content	(as) %	0–10	0–3	0–1
Hardgrove grindability index		30–50 80–100	40–60	60–100
Abrasion index	mg/kg	50–100	10–60	5–30

mixing of combustion gases, air and fuel and produces a short intense flame.

- Tangential corner-fired burners introduce the fuel and primary air at a tangent to an imaginary circle in the centre of the combustion chamber. They produce a long low intensity flame that swirls about a vertical axis.
- Vertical or downshot firing burners are located in the roof of the combustion chamber with the flame projected downwards into the combustion chamber. This firing method is normally used for anthracite.

Low NO_X burners are modified swirl burners that create a fuel-rich combustion zone followed by a leaner burnout zone. The degree of NO_X reduction that can be achieved for a given coal is limited by the requirement to produce a stable flame and maintain adequate burnout.

Coal initially decomposes in the furnace chamber into volatile components and char. There the combustion of volatile matter and the char are ideally both completed. Heat generated is transferred to the water-filled walls of the furnace chamber (by radiation) and to water tubes (by convection) located after the furnace chamber in the convective passes of the boiler.

In the burner region coal particles are rapidly heated to approximately 1300°C in about 0.1 of a second and devolatilise. The heat transferred to this region (derived from the hot product gases, by radiation from the surroundings, and from the energy generated in this early stage of combustion) plays a very important role in stabilising the flame, especially in low NO_X swirl burners.

Char burnout takes place in the furnace chamber. Combustion efficiency is determined by the time-temperature history (i.e. furnace design), the char particle size, and char reactivity. The char particle size is determined mainly by the fineness of grind of the pulverised fuel. Char reactivity is dependent on the rank and the maceral composition of the original coal, but may be enhanced by some minerals. The heat content of the volatile matter is also dependent on the rank, type and mineral matter content of the coal.

Char burnout for blends made from coals of similar rank can be estimated from the burnout characteristics of the component coals. Where the ranks of the blended coals differ significantly, then the lower rank coal can react with the available oxygen faster and therefore impede the burnout of the higher rank coal.

Deposits

Two types of deposits form in a boiler from mineral matter in the coal. These deposits are defined as:

- Slagging: the uncontrolled build-up of ash deposits in the radiant section of the boiler. This causes problems such as closure of burners, which increases requirements for desuperheater spray, which can lead to derating of boiler capacity.
- Fouling: the uncontrolled build-up of ash deposits in convection passes of the boiler. This causes boiler efficiency to fall due to a fall in steam temperature and a rise in flue gas temperature.

A wide variety of slagging and fouling indicators has been proposed to assist in categorising coals. Most indicators represent a particular deposition mode in a particular boiler and apply only to a narrow range of coals. Care should be taken in the selection and use of indices for slagging and fouling of individual coals, especially with blended coals.

Further information on slagging characteristics, and guidelines on the coal quality parameters relating to slagging, are presented in *Thermal coal technology – a manual for Australian coal* (see Bibliography at end of this section).

Table 12: Typical characteristics of stokers

	Mass rate (kg/hm^3)	Heat rate (MW/m^2)	Capacity (MWth)
Retort	170–250	1.3–1.9	0–3
Travelling grate	170–220	1.3–1.7	4–80
Spreader stoker	220–300	1.7–2.3	10–120

Mechanical stokers

A variety of mechanical stokers is used. They differ in the way coal is fed onto the grate and ash is removed from the grate. Each method of firing has its own unique operating characteristics.

Stokers can be sorted into three categories, based on the way in which fuel is fed onto the grate. These categories are:

- Overfeed stokers — the coal is fed onto the grate above the point of air entry. The two basic types are chain or travelling grate stoker and vibrating grate stoker.
- Underfeed stokers — the fresh fuel is supplied from below the bed, e.g. the retort stoker.
- Spreader stokers — the fresh fuel is thrown onto the incandescent bed. Technically, a spreader is a type of overfeed stoker but it is normally classified separately because of its unique features.

The rating of different types of stokers is given in the grate heat release rate, in terms of the (gross) energy released per unit time per unit area. Typical recommended values for bituminous coals are given in **Table 12**.

Fluidised bed combustion

A major factor promoting development of atmospheric fluidised bed combustion systems (AFBC) is their ability to fire high ash coals, retain sulphur within the bed through the addition of limestone and low NO_X emissions. The main types of fluidised bed combustors (**FBC**) used for large-scale plants are known as bubbling beds and circulating beds.

Operating conditions for fluidised beds appear in **Table 13**.

In a bubbling fluidised bed the gas velocity is increased until the whole bed becomes a turbulent mass of solids and bubbles, but there is no carry-over of bed material with the combustion gases.

When the gas velocity is increased further, some bed material is entrained in the gas stream and leaves the combustor. The bed material is separated in an external cyclone and most of the solids

Table 13: Typical operating conditions for fluidised bed combustion

	Bubbling beds	Circulating beds
Top feed size (mm)	50	10
Bed particle size (mm)	0.1–4.0	0.1–0.8
Fluidising velocity (m/s)	1–3	4–12
Bed temperature (°C)	750–1000	750–1000

are returned to the combustor. These fluidised beds are known as circulating or fast fluidising systems.

Pressurised fluidised bed combustors (PFBC) are based on fluidised bubbling technology. This technology gives the same fuel flexibility and reduced emissions as AFBC, but with enhanced thermal efficiency and greater heat input for the same bed area. The thermal efficiency enhancement results mainly from expanding hot flue gas, at pressures in the range of 10–16 bar, through a turbine. The greater heat input possible with PFBC means a smaller unit, in terms of physical size, can be built for a given generating capacity, reducing construction time and costs. Hot gas cleaning is needed before the turbine and is a major development issue.

EMISSIONS

Emissions from large modern power stations can be controlled to meet regulatory limits set by governments. Proven technology exists for emissions of particulates (fly ash) and acidic gases (oxides of sulphur and nitrogen).

Particulate emissions

Fly ash is usually collected by electrostatic precipitators or fabric filters, which operate at efficiencies of greater than 99%. In electrostatic precipitators the electrical resistivity of the fly-ash is an important factor affecting the performance of the precipitator. Resistivities greater than 10^{12}W.cm are considered undesirable, since high electrical resistance can lead to back ionisation, which reduces collection efficiency. The collection efficiency of high resistivity fly ashes may be improved by dosing the flue gas with additives such as SO_3 or NH_3, or by using intermittent or pulse-energising techniques to control the voltage in the precipitator.

The precipitator performance of blends generally is near to or slightly better than the component coal with the best precipitator performance.

Fabric filters are made of a woven, knitted or felted textile in the shape of cylindrical bags through which the flue gas is passed. The flyash is collected on the bag and then removed by shaking, reversed gas flow, sonic horns or air pulses. The properties of the flyash that affect the performance of fabric filters relate to how the flyash compacts on the bag. This influences the pressure drop through the bag and the flyash adhesive strength, which influences the force required to remove the dust layer.

Nitrogen oxide emissions

Nitrogen oxides (NO_X) are minor components of the products of combustion. Nitric oxide (NO) is the principal species formed but is rapidly converted to nitrogen dioxide (NO_2) in the atmosphere. The NO_X emissions are derived both from nitrogen contained in the fuel (fuel NO_X) and from nitrogen in the air (thermal NO_X). The amount of NO_X formed from coal combustion varies, depending on the coal used, the combustion intensity and type of combustion process. It is very difficult to accurately predict emission levels, particularly for coal blends.

NO_X emissions from coal-fired power generating plant are governed by:

- coal properties — rank, volatile content and nitrogen content,
- design features of plant — type, number and geometry of burners and furnace size
- operating conditions of plant furnace stoichiometry and combustion temperature.

NO_X emissions can be reduced by modifying the combustion system and/or by installing post combustion NO_X conversion units. Coal-blending can also assist in the reduction of NO_X emissions.

The combustion system can be modified through delayed combustion, decreasing temperature and restricting oxygen availability so that the flame is fuel-rich. These modifications can be achieved by using overfire air or low NO_X burners. Modern low NO_X burners with staged combustion appear capable of reducing NO_X emissions by more than 50%, to 300–600 mg/Nm^3 of flue gas, and even lower when burning particular coals such as those from the Walloon Coal Measures of south-east Queensland.

Where very strict limits on NO_X emissions are imposed (e.g. at certain sites in Japan and elsewhere), processes such as selective catalytic reduction (SCR) are used. SCR uses ammonia injection to convert the NOx to nitrogen gas water. This process is capable of chemically removing up to 90% of these emissions.

Sulphur oxide emissions

The yield of sulphur oxides (SO_X) may be estimated from the sulphur content of the coal after making allowances for the absorption of SO_X onto the surface of coal ash (typically 5% of total SO_X for bituminous Queensland coals). Generally, the SO_X emissions of a blend can be determined from the emissions of the individual coals.

SO_X emissions may be reduced by direct injection of a sorbent directly into the furnace chamber and/or by flue gas desulphurisation (FGD) systems attached to the back end of the boiler. All FGD systems involve intimately mixing the SO_X emissions with an absorbing chemically reactive material, which converts them into a solid or liquid product. This product may have a marketable value.

Trace elements

To further reduce the environmental impact of modern coal-fired power stations, most countries now require trace element analysis to be provided when considering a new coal supply. Trace elements of possible environmental concern are listed in **Table 14**. Typical ranges for Australian and international competitor coals are shown. A CSIRO ranking of the environmental impact of trace elements in coals placed all ten Australian export coals tested in

Table 14: Important trace elements in coals*

	Australian		International	
	Average (mg/kg)	Range (mg/kg)	Average (mg/kg)	Range (mg/kg)
As	1.26	0.65–2.7	2.69	0.36–9.8
B	24	12–47	47	11–123
Cd	0.067	0.055–0.09	0.093	0.010–0.19
Hg	0.042	0.020–0.076	0.091	0.030–0.19
Mo	1.71	0.40–2.6	1.57	0.21–4.2
Pb	6.8	4.5–9.5	7.0	1.1–22
Se	0.50	0.30–0.84	2.15	0.15–5.0
S (%)	0.409	0.24–0.58	0.635	0.43–0.98

* ACARP, 1996

Table 15: Coal properties required by different commercial gasification processes

Properties	Lurgi Moving Bed	Winkler Fluidised Bed	Entrained – Phase Gasifiers	
			Koppers - Totzek	Texaco
Caking properties	Non-caking to weakly caking coal	Non-caking to medium caking coal	n/a	Preferably non-caking
Particle size	Particles between 6 and 40mm required; no fines	0–8mm	Grinding to 90% < 0.1mm (bituminous coal) or 80–85% < 0.1mm (lignite)	Grinding to 90% < 0.5mm 50% < 0.09mm
Ash % db	Up to 40%	Up to 50%	Up to 40%	Up to 40%
Ash fusion	Deformation temperature above temperature in combustion zone	Deformation temperature markedly above gasification temperature	Flow temperature below 1500°C	Flow temperature below 1300°C
Moisture	Up to 40%	Up to 8%	1–2% (bituminous coal) or 8–10% (lignite) before grinding	Equilibrium moisture less than 4%
Sulphur	n/a	n/a	n/a	n/a
Shatter index	High	High	n/a	n/a
HGI	n/a		Greater than 40	Greater than 40
Rank	Lignite - HV bituminous	Lignite - HV bituminous	All	All
Volatile matter	n/a	n/a	High	High

n/a = not applicable

the lower half (lowest impact) of 28 coals evaluated. Australian thermal coals generally have significantly lower levels of arsenic, selenium and mercury.

INTEGRATED GASIFICATION COMBINED CYCLE PROCESS

Interest in the integrated gasification combined cycle (IGCC) process is based principally on its potential environmental benefits. When the gasifier is supplied by oxygen instead of air, IGCC plant offer the potential to capture relatively pure carbon dioxide (without nitrogen dilution) that could then be sequestered to virtually eliminate greenhouse gas emissions. There are several gasification processes in operation as well as in development. These can be broadly divided into three main categories: fixed bed, moving bed (e.g. fluidised bed) and entrained flow processes.

In IGCC power plants, the coal is gasified and the off-take gas is combusted in gas turbines to generate electricity. The hot combustion gases are then passed through boilers to produce steam for further power generation or other industrial use. Thermal efficiencies of 45% higher heat value (HHV) or greater have been achieved in such plant. Several full-scale demonstration plants are operating commercially in the USA and in Europe.

The main thrust of current IGCC research is to increase the reliability and reduce the overall cost of these units, and at the same time increase the flexibility to operate using a wide range of coal types. A pilot-scale pressurised, entrained flow, coal gasification reactor has recently been established at the Queensland Centre for Advanced Technologies in Brisbane to test various Australian coals.

Testing of a pressurised, air-blown, fluidised bed gasifier has been carried out at HRL Limited's research facility at Mulgrave, Victoria, utilising Walloon coals from the Surat Basin of southern Queensland. The tests produced very encouraging results for low temperature gasification of the coals, for use in IGCC operations. This technology was originally developed for low rank coals, but can also be applied to high reactivity bituminous coals, such as those from the Walloon Coal Measures.

Table 15 summarises the typical coal properties suitable for several commercial gasification processes.

COAL-LIQUID MIXTURE FUELS

Coal-oil mixtures (COM) have been developed, mainly in Japan, as an alternative fuel for oil in the power industry. COM is a mixture of 50% pulverised coal (70% passing 70 micron) and 50% heavy oil by weight. Its main advantage is the ability of the preparation process to de-ash coal using oil agglomeration, and at the same time produce a pumpable fuel oil substitute.

Coal-water mixture (CWM) uses water instead of heavy oil and is a mixture of 70% pulverised coal with 30% water by weight. CWM has a cost advantage over COM. The use of emerging technologies in de-ashing coals using conventional coal preparation (to 5% ash), or perhaps using chemical treatment (to less than 1% ash), will make CWM the most likely substitute for fuel oil in the future.

In converting an oil-fired installation to CWM the major factors to be considered are the rheology of the CWM, its specific energy, ash content and ash fusion temperatures.

The rheology is dependent on the solids loading, natural clays present with the coal, pH, dispersant and gelling agent additive concentrations, as well as particle size distribution.

A power station requirement for COM or CWM would typically be:

- viscosity less than 2000cp, normally 1000cp
- boiler not de-rated more than 35%
- combustion efficiency greater than 95%.

Extensive trials and limited commercial applications of COM and CWM to fuel power plant were conducted in Japan but these operations have been largely discontinued.

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OPERATING COLLIERIES AND MINES

Collieries and coal mines operating in Queensland at **31 July 2003**, or which are in an advanced stage of development, are described in this section. Yet to be mined (*in situ*) coal resources for the mine projects are detailed in Appendix A. Coal quality data for typical coals produced are presented in Appendix B.

Information on the various companies associated with the mine projects are presented in this section. The following terminology is used:

Mine operators: These are the companies that manage the mining operations, usually on behalf of the mine proprietor. All enquires relating to the purchase of coal should be addressed to the mine operator. Contact details for the mine operators are included in Appendix C.

Mine proprietor: These are the mine owners, which may be an individual company or a joint venture between several independent or associated companies. Generally, the mine proprietor holds the legal title to the tenure over the mine or colliery.

Beneficial owners: This details the companies holding either a direct and/or beneficial equity interest in the mine proprietor. Note that details printed in this publication regarding the ownership of collieries, mines and deposits are valid as at 31 July 2003. Major changes in ownership of some of the mine owners have recently been announced. This information has been noted under each project where applicable, and where the information has been made public. Changes occurring since July 2003 have generally not been included.

Address: In general, this is the address and contact details for the mine site. Contact details for the mine operators are listed separately in Appendix C. Note that the contact phone and facsimile numbers reported in this section show the full international number.

Production: The figures presented are indicative annual production of saleable coal (unless otherwise specified). The detailed mine production figures for raw and saleable coal in a particular year are available in the *Queensland Coal Industry Review*, published annually by the Department of Natural Resources and Mines.

Workforce: The numbers shown are indicative only, as they may include contract personnel as well as permanent site employees (unless otherwise specified). The information is presented as provided by the companies, or has been extracted from the *Queensland mines and quarries safety performance and health report (1 July 2001 to 30 June 2002)*, published annually by the Department of Natural Resources and Mines.

BLACKWATER (including South Blackwater)

Basin	Bowen
Location	24km south of Blackwater, and 195km west of Rockhampton.
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1759, 1760, 1762, 1767, 1771, 1773, 1792, 1800, 1829, 1860, 1862, 1907, 70091, 70103, 70104, 70139, 167; MDLs 155, 189
Address	Blackwater Mine, Private Mail Bag, Blackwater Qld 4717
Phone	+61 7 4980 5666
Fax	+61 7 4982 6825
Transport	320km by rail to the port of Gladstone
Geology	Rangal Coal Measures of Late Permian age, dipping 3–5° to the east. Three major coal seams are present: Top (Aries) — 0.8–1.5m; Middle (Castor) — 2–3.5m; Main Lower (Taurus/Argo) — 5–7m. Complex seam splitting occurs along the 35km strike length of the mine. In the **South Blackwater** mine area, the strike of the coal measures swings westerly around the nose of the Memooloo Anticline, where the major coal seams are: Aries — 1–4m; Castor — 0–3.5m; Pollux — 3.2–3.8m; and Orion — 0.5–1.5m. The latter two seams can combine to form the Argo seam — 4.5–6m over part of the mine area.
Mining method	Open-cut using up to six draglines and a shovel and truck operation for overburden removal
Preparation plant	Blackwater: heavy medium cycloids, spirals and froth flotation circuits (capacity 900tph) South Blackwater: dense medium bath, heavy medium cyclones and spirals
Product coals	Medium volatile hard coking coal, medium volatile weak coking coal, and medium volatile thermal coal
Markets	Export primarily to Japan, and other markets in Asia, South America, Europe and the Middle East; Thermal coal to domestic market (Stanwell and Gladstone power stations).
Production	Up to 14Mtpa (from combined Blackwater/South Blackwater operation)
Workforce	625 (for combined operation)

Comments The integration of mining activities on the Blackwater and South Blackwater mining leases was completed by BMA during 2002, following the acquisition of QCT Resources Limited by BHP and Mitsubishi in 2000. The combined open-cut operation reached the targeted production rate of 13.5Mtpa of saleable coal early in 2002. The integration also resulted in the closure of the Laleham and Kenmare underground mines during 2001 and 2002. Contiguous down-dip coal resources in the **Sirius Creek**, **Humboldt** and **Togara South** areas are being investigated as part of the longer-term resource development plans for the Blackwater project.

The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

BLAIR ATHOL

Basin	Bowen
Location	20km north-west of Clermont, and 280km south-west of Mackay
Mine operator	Pacific Coal Pty Limited
Mine proprietor	Blair Athol Coal Joint Venture
Beneficial owners	Rio Tinto Limited 71.2380% UniSuper Limited 15.3940% EPDC (Australia) Pty Ltd 9.9513% JCD Australia Pty Ltd 3.4167%
Tenements	ML 1804; ML 1881
Address	Blair Athol Coal Project, PO Box 177, Clermont Qld 4721
Phone	+61 7 4983 4444
Fax	+61 7 4983 4380
Transport	282km by rail from the Dalrymple Bay Coal Terminal at Hay Point
Geology	Blair Athol Coal Measures of Early Permian age deposited in a small intracratonic basin near the western margin of the Bowen Basin. Dips are generally between 0–2°. Three coal seams of interest are present. Average thicknesses of these are: No.2 seam — 1.2m; No.3 seam — 29m; and No.4 seam — 3m (the No.1 seam has been mined out). Currently only the No.3 seam is worked.
Mining method	Open-cut using one dragline (45m^3) for overburden removal
Preparation plant	ROM coal is crushed and screened to produce a saleable product
Product coals	Low ash and low sulphur, high volatile thermal coal
Markets	Export and minor domestic
Production	12Mtpa
Workforce	Approximately 190
Comments	Feasibility studies to develop a new open-cut mine at the **Clermont** deposit, 10km to the east of Blair Athol, are progressing, with production proposed to begin in 2008, to progressively replace that from Blair Athol as its economically extractable coal reserves are depleted.

BURTON

Basin	Bowen
Location	40km north-east of Moranbah; 120km south-west of Mackay
Mine operator	Burton Coal Pty Ltd
Mine proprietor	Burton Coal Joint Venture
Beneficial owners	RAG Australia Coal Pty Ltd 95% Thiess Investments Pty Ltd 5%
Tenements	ML 70109; ML70252; MDL167; MDL 308; MDL 315; EPC 497; EPC 647; EPC 857
Address	Burton Coal Pty Ltd, PO Box 108, Glenden Qld 4743
Phone	+61 7 4940 5555
Fax	+61 7 4940 5561
Transport	35km to the Mallawa Siding on the Goonyella Rail system, which is some 170km from the Dalrymple Bay Coal Terminal at Hay Point
Geology	An easterly dipping inlier of Rangal Coal Measures of Late Permian age; two coal seams, the Leichhardt and Vermont coalesce in the northern part of the area to form the 11m thick Burton Seam, which dips at an average of 25° to the east-north-east. The deposit is bound by the Burton Range Fault to the west and is located between the Burton and Kerlong Ranges.
Mining method	The open-cut mining operations utilise truck and shovel terrace mining to a planned maximum highwall depth of 120m. Coal is mined currently from three pits: Burton, Ellensfield and Wallanbah.
Preparation plant	Heavy medium cyclones, spirals and flotation
Product coals	Medium volatile hard-coking, semi-hard coking and thermal coals
Markets	Exports both coking and thermal coals to Asia, South Africa, South America and Europe
Production	4Mtpa
Workforce	368
Comments	Future development potential exists to the south (**Plumtree** area) and east (**Kerlong** area).

CALLIDE/BOUNDARY HILL

Basin	Callide
Location	15km north-east of Biloela; 120km south-west of Gladstone
Mine operator	Anglo Coal (Callide Management) Pty Ltd
Mine proprietor	Anglo Coal Australia Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 100%
Tenements	MLs 5632, 5641, 5653 to 5655 (incl.), 5662, 6993, 6994, 80030; MDLAs 203, 241; EPC 188
Address	Callide Mine, PO Box 144, Biloela Qld 4715
Phone	+61 7 4990 1699
Fax	+61 7 4990 1687
Transport	Callide has two railheads at 110km and 140km from the port of Gladstone to service the Boundary Hill and Southern (formerly Callide) pit areas respectively.
Geology	The Late Triassic Callide Basin comprises the Callide Coal Measures up to 150m thick and dipping generally at less than 10°, with local steeper dips near faults. Four coal seams are present: Marker — 3.5m; Callide — 16m; Sawmill — 3m; Bottom — <3m. Only the upper three seams are worked. Coal is sourced from open-cut mines in the Dunn Creek, Trap Gully and The Hut areas (the Southern mine area), and from the Boundary Hill mine located at the northern end of the basin.
Mining method	Open-cut using two draglines (80m^3 and 33m^3) with truck and shovel pre-strip for overburden removal
Preparation plant	Crushing and screening at Boundary Hill, and ROMJIGS at Southern
Product coals	Medium ash sub-bituminous thermal coal
Markets	Domestic supply — Callide and Gladstone power stations, and the Queensland Alumina Limited refinery at Gladstone. The coal is also used to bunker coal-fired ships on the Weipa–Gladstone bauxite run.
Production	10.5Mtpa
Workforce	350
Comments	The annual production rate from the Callide coalfield increased during 2001–02 from approximately 9Mt to 10.5Mt, following the commissioning in late 2001of the Callide C Power Project, located adjacent to the mining operations.

COLLINSVILLE

Basin	Bowen
Location	4km west of Collinsville, and 86km by road south-west of Bowen
Mine operator	Xstrata Coal Queensland Pty Ltd
Mine proprietor	NCA Joint Venture
Beneficial owners	Xstrata Queensland Limited 75% Itochu Corporation 25%
Tenements	ML 1005 to 1009 (incl), 1015, 1037, 1064, 10111
Address	Collinsville Mine, PO Box 60, Collinsville Qld 4804
Phone	+61 7 4785 4211
Fax	+61 7 4785 4420
Transport	106km by rail to the port of Abbot Point
Geology	Collinsville Coal Measures of Early Permian age, containing up to nine coal seams; extensive faulting and igneous intrusions have affected all seams to varying extents, with five seams currently worked; average thicknesses of these are: Garrick — 2.6m; Scott — 1.8m; Denison — 2.8m; Bowen — 6.5m; and Blake — 10m
Mining method	The Collinsville operations comprise the Collinsville open-cut mine, and the small **Pipeline** mine about 15km to the south-east. The mining method for both mines is truck and shovel for overburden removal, as well as a dragline at Collinsville open-cut. A contractor operates the mining, coal handling, and preparation plant operations. An additional dragline (BE 1370) will be relocated from Newlands Mine in 2004.
Preparation plant	Dense medium and classifying cyclones (capacity 400tph)
Product coals	Medium volatile hard coking coal medium volatile thermal coal.
Markets	Export — coking and thermal coal; domestic — thermal coal.
Production	6.0Mtpa (ROM)
Workforce	370 (including contractors)
Comments	In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

COMMODORE

Basin	Clarence–Moreton
Location	10km south of Millmerran, and approximately 180km south-west of Brisbane
Mine operator	Roche Mining Pty Ltd
Mine proprietor	Millmerran Power Partners
Beneficial owners	InterGen (Australia) 53.69% Marubeni Corporation 30% GEC 6.31% EIF Group 5% Tohoku Electric Power Co. Inc. 5%
Tenements	ML 50151; MDL 301
Address	Commodore Mine, PO Box 48, Millmerran Qld 4357
Phone	+61 7 4612 0500
Fax	+61 7 4612 0524
Transport	1.4km overland conveyor to the Millmerran power station
Geology	Gently folded Walloon Coal Measures of Middle Jurassic age, dipping generally at less than 3°. Three banded seams are present: Kooroongarra — up to 3m thick; Commodore — 5.2m average thickness; Bottom Rider — 0.5–0.9m.
Mining method	Open-cut using scrapers, dozers, graders, excavators and trucks
Preparation plant	Coal crushing and stockpiling to feed mine mouth power station
Product coals	High volatile, low sulphur bituminous thermal coal
Markets	Domestic supply — Millmerran power station
Production	3.6Mtpa
Workforce	Approximately 50 (mine only)
Comments	Construction of the mine commenced in May 2001, and coal supply to the 840MW Millmerran power station commenced in 2002. Millmerran is the first major supercritical power station in Australia designed specifically to burn the environmentally friendly coals from the Walloon Coal Measures. Coal reserves at the Commodore mine are estimated to be sufficient to fuel the plant, with enough low-sulphur coal for at least 50 years operation at current capacity.

COOK

Basin	Bowen
Location	29km south of Blackwater, and about 200km west of Rockhampton
Mine operator	Cook Resource Mining Pty Ltd
Mine proprietor	Cook Resource Mining Pty Ltd
Beneficial owners	Xstrata Coal Australia Limited 50% Centennial Coal Company Ltd 45% Tokyo Boeki Australia Pty Ltd 5%
Tenements	MLs 1768, 1769, 1779, 1799, 7357
Address	Cook Colliery, PO Box 119, Blackwater Qld 4717
Phone	+61 7 4986 1600
Fax	+61 7 4986 1655
Transport	318km by rail to the port of Gladstone
Geology	Rangal Coal Measures of Late Permian age, dipping east at generally 3–5°, though local structures can increase this to 3°. Two significant coal seams are present: Castor — thickness 2.7-3.2m; Argo — 4m average thickness.
Mining method	Underground — bord and pillar extraction using continuous miners
Preparation plant	Jig, dense medium cyclones, spirals and classifying cyclones (capacity 500tph)
Product coals	Medium volatile coking coal, and medium volatile thermal coal
Markets	Washed product coking coal (about 50% of total production) is sold for export to niche markets around the world. The thermal coal is sold locally to the Stanwell or Gladstone power stations.
Production	Approximately 0.8Mtpa
Workforce	About 70 permanent employees
Comments	In February 2002, Swiss-based commodities group Xstrata Plc purchased the share previously held by Glencore International AG.

COPPABELLA

Basin	Bowen
Location	25km south-west of Nebo
Mine operator	Australian Premium Coals Pty Ltd
Mine proprietor	Coppabella Joint Venture
Beneficial owners	Macarthur Coal Limited 50% AMCI Australia Pty Ltd 30% CITIC Australia Pty Ltd 5% Marubeni Corporation 5% Nissho Iwai Corporation 5% Kawasho Corporation 3% Nippon Steel Trading Co Ltd 2%
Tenements	MLs 70161, 70163–64, 70236–37
Address	Australian Premium Coals Pty Ltd, PO Box 7057, Riverside Centre Qld 4001
Phone	+61 7 3239 7666
Fax	+61 7 3239 7699
Transport	140km by rail to the Dalrymple Bay Coal Terminal
Geology	Rangal Coal Measures of late Permian age, dipping north-east at approximately 5°. The Macarthur Seam, which is the result of the coalescence of the Leichhardt and Phillips Seams, ranges in thickness from 9–12m in the Johnson Pit area.
Mining method	Open-cut using dragline, excavators and trucks, supplemented by scrapers
Preparation plant	Dense medium cyclones, spirals and froth flotation (capacity 800tph)
Product coals	Low volatile, low ash and sulphur, high energy PCI coal, and high energy thermal coal
Markets	Export to Asia, Europe and South America
Production	4.2Mtpa
Workforce	Approximately 300
Comments	Civil works commenced late 2002 for the relocation of a 6km section of the Peak Downs Highway and Goonyella–Hay Point railway line adjacent to the Coppabella mine, to allow access to additional open-cut resources amounting to almost 20Mt. An 18-month construction phase is anticipated for the replacement infrastructure.

CURRAGH

Basin	Bowen
Location	14km north of Blackwater, 200km west of Rockhampton
Mine operator	Curragh Queensland Mining Pty Ltd
Mine proprietor	Wesfarmers Curragh Pty Ltd
Beneficial owners	Wesfarmers Limited 100%
Tenements	MLs 1878, 1990, 80086; MDLs 328, 329
Address	Curragh Mine, Private Mail Bag, Blackwater Qld 4717
Phone	+61 7 4986 9211
Fax	+61 7 4986 9327
Transport	315km by rail to the port of Gladstone
Geology	Rangal Coal Measures of Late Permian age, with a regional dip of 3–5° to the east. The mine geology is complex due to local faulting, which causes variations in seam thickness and dips over localised areas. Five coal seams are present, but only the upper three mined. These are: Aries — 2.4m (average thickness); Castor — 1.9m; Pollux — 2.9m. The Orion and Pisces seams are not mined.
Mining method	Conventional multiple-pass open-cut mining is employed using four large draglines (2 x Marion 8200, and 2 x Marion 8750) for overburden, plus a small diesel electric dragline ($15m^3$) assists the other draglines and is also used for spoil pile rehabilitation.
Preparation plant	Dense medium cyclones and flotation circuits (capacity 1200tph)
Product coals	Low/medium volatile coking coal, and medium volatile thermal coal
Markets	Thermal coal is supplied to the domestic power stations at Stanwell and Gladstone, and metallurgical coals are exported to Asia, Europe and South America.
Production	Approximately 6Mtpa of saleable coal
Workforce	460 (including contractors)
Comments	In January 2003, an agreement was announced under which Wesfarmers Curragh Pty Ltd will develop Stanwell's **Pisces** coal resource, located 10km from the Curragh mine. Development of the deposit, now re-named **Curragh North**, will be integrated with the Curragh mine to ensure a secure supply of domestic steaming coal to the Stanwell power station until 2025.

ENSHAM

Basin	Bowen
Location	40km north-east of Emerald; 200km west of Rockhampton
Mine operator	Ensham Resources Pty Limited
Mine proprietor	Ensham Coal Project
Beneficial owners	Idemitsu Kosan Co Ltd 85% EPDC (Australia) Pty Ltd 10% LG International (Australia) Pty Ltd 5%
Tenements	MLs 70049, 7459, 7460; MDLs 217, 218
Address	Ensham Mine, PO Box 1565, Emerald Qld 4720
Phone	+61 7 4987 3601
Fax	+61 7 4987 3622
Transport	340km by rail to the port of Gladstone
Geology	Rangal Coal Measures of Late Permian age, dipping at up to 5° to the west; the coal seams in the mine leases split and recombine, both along strike and down dip, with six combinations of economic interest. The most important combination is the 4.5–6.5m thick Aries2 — Castor seam, which is mined within ML 7459.
Mining method	Open-cut operation utilising three draglines (a Marion 8050 and two P&H 9020 draglines) and a shovel/truck fleet for overburden removal
Preparation plant	There is no wash plant and all coal is of direct shipping quality. Run-of-mine coal is crushed and sized at site before stockpiling and transport by rail.
Product coals	High-energy thermal coal
Markets	Export primarily to Asia and Europe
Production	6.5Mtpa
Workforce	Approximately 240 (including contractors)
Comments	In addition to the open-cut resource, a very large resource only amenable to underground development has been delineated.

FOXLEIGH

Basin	Bowen
Location	25km by road east of Middlemount; about 200km north-west of Rockhampton
Mine operator	Foxleigh Mining Pty Ltd
Mine proprietor	Foxleigh Joint Venture
Beneficial owners	CAML Resources Pty Ltd 63% ICRA Foxleigh Pty Ltd 20.6% Bowen Basin Investments Pty Ltd 16.4% ICRA Foxleigh is a wholly owned subsidiary of Itochu Corporation
Tenements	EPC 617; ML 70171; MLAs 70309 and 70310
Address	Foxleigh Mine, PO Box 105, Middlemount Qld 4746
Phone	+61 7 4985 9000
Fax	+61 7 4985 9640
Transport	Raw coal is trucked 28km to the German Creek mine washplant for processing. The product coal is then railed 270km to the Dalrymple Bay Coal Terminal for export.
Geology	Rangal Coal Measures of Late Permian age, sub-cropping in a north-westerly direction over a 15km strike length. Four coal seams/seam combinations, dipping at 6–13° to the north-east, are present: Roper (0.8–2.5m thickness); Middlemount (3.5–7.5m); Tralee 1-2 (1–1.5m); and Pisces 1A-B (1.5-5m). Faulting has duplicated the sub-crop over much of the area, increasing the potential resource tonnages available to open-cut extraction. The mine production is derived mainly from the Middlemount seam.
Mining method	Open-cut shovel and truck operation, operated by contractors
Preparation plant	None on site; the raw coal is processed at the nearby German Creek mine washplant.
Product coals	Low ash, low volatile, high fixed carbon PCI coal for the export market
Markets	Exports to steel mills in Asia, Europe and South America
Production	Approximately 3Mtpa
Workforce	140 (including contractors)
Comments	This mine commenced production in February 2000, based on a moderate sized resource of high quality low volatile PCI coal. Additional resources have been identified to the east and south-east of the mine area, and are being evaluated for future development.

GERMAN CREEK

Basin	Bowen
Location	25km south-west of Middlemount, and 200km west-north-west of Rockhampton
Mine operator	Anglo Coal (Capcoal Management) Pty Ltd
Mine proprietor	Capricorn Coal Development J/V
Beneficial owners	Anglo Coal Australia Pty Ltd 70% Mitsui & Co. Ltd 30%
Tenements	MLs 1831, 1894, 70047
Address	German Creek Mine, Private Mail Bag, Middlemount Qld 4746
Phone	+61 7 4985 0200
Fax	+61 7 4985 0962
Transport	249km by rail to the port of Hay Point
Geology	German Creek Formation of Late Permian age, dipping east at approximately 5°, comprising six seams: Pleiades — 1.2m; Aquila — 1.6m; Tieri — 2.9m; Corvus1 — 1.0m; Corvus2 — 0.6m; and German Creek — 2.5m. Dykes and sills, which intrude all seams, affect mine planning. Only the lower five seams are currently worked.
Mining method	The German Creek operations comprise two underground mines (**Central** and **Southern**) and a third (**Grasstree**) under development, and one operating open-cut mine (**German Creek East** — see separate entry). The Central and Southern collieries are single longwall operations using continuous miners with either shuttle cars or battery haulers for development work.
Preparation plant	Dense medium cyclones, spirals and froth flotation (capacity — 1400tph)
Product coals	Low to medium volatile hard coking coal The coal brands produced are a blend of coals from the two underground mines and the German Creek East open-cut mine, and are produced from the one coal preparation plant.
Markets	Exports to Asia, Europe and South America. India and Korea are the largest purchasers of German Creek coal.
Production	Approximately 6.0Mtpa
Workforce	550
Comments	Construction is progressing on the Grasstree underground mine, down-dip from Southern Colliery. The first longwall coal production is expected during 2006, to progressively replace production from the Southern Colliery. When fully operational, production from the Grasstree mine is expected to be 3–5Mtpa of saleable coal. In July 2002, Mitsui & Co. Ltd acquired a 30% interest in the German Creek mines from Anglo Coal Australia, as part of an exchange in equity ownership of the other coal projects in Australia. This followed Anglo Coal Australia's move to 100% ownership of the German Creek operations, on its purchase of RAG Australia Coal's 27.19% interest in June 2001.

GERMAN CREEK EAST

Basin	Bowen
Location	13km south-south-west of Middlemount; the mine is located about 5–10km east of the German Creek underground operations.
Mine operator	Anglo Coal (Capcoal Management) Pty Ltd
Mine proprietor	German Creek East Joint Venture
Beneficial owners	Anglo Coal Australia Pty Ltd 86.36% Marubeni Coal Pty Ltd 13.64%
Tenements	ML 1998; MDL 331 (Oak Park)
Address	German Creek Mine, Private Mail Bag, Middlemount Qld 4746
Phone	+61 7 4985 0200
Fax	+61 7 4985 0962
Transport	ROM coal is trucked to the German Creek mine for beneficiation.
Geology	Rangal Coal Measures of Late Permian age, dipping east at less than 10°. Three coal seams are present of which only the upper two are mined. The seams are: Middlemount 1 seam — 4.5m; Middlemount 2 seam — 0.7m; Tralee seam — not worked.
Mining method	Open-cut, using a dragline (46m^3) for overburden removal
Preparation plant	Uses the German Creek preparation plant
Product coals	Low volatile coking coal
Markets	As for German Creek mine
Production	Approximately 1Mtpa
Workforce	Included with German Creek operations
Comments	The open-cut mine is operated in conjunction with the Capricorn Coal Development JV underground mines at German Creek. Potential for future development is being investigated to the south-east at the Oak Park deposit, and also at the Lake Lindsay (formerly Girrah) deposit, acquired by the Capricorn Coal Development JV from Wesfarmers in January 2003.

GOONYELLA

Basin	Bowen
Location	25km north of Moranbah, and 150km south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1763, 70038; MLAs 70287, 70288, 70289
Address	Goonyella Riverside Mine, Private Mail Bag, Moranbah Qld 4744
Phone	+61 7 4940 4333
Fax	+61 7 4940 4688
Transport	198km by rail from the port of Hay Point near Mackay
Geology	Moranbah Coal Measures of Late Permian age dipping east at 3–5°; three coal seams are present, but only the lower two are mined. The seams are: Goonyella Upper — 3.9m (not mined); Goonyella Middle — 7.5m; Goonyella Lower — 8.5m.
Mining method	Open-cut using shovel crusher system (2000m^3/hr), plus 5 draglines (3 x 48m^3, 2 x 36m^3), and two shovel/truck fleets for overburden removal
Preparation plant	Dense medium cyclones and froth flotation (capacity — 2000tph)
Product coals	Medium volatile hard coking coal
Markets	Export primarily to India, Japan, Europe and South Africa and, and other markets in South America, Asia, and the Middle East
Production	Approximately 10Mtpa (combined with Riverside mine)
Workforce	646 (combined Goonyella/Riverside)
Comments	Mining operations at Goonyella are integrated with the adjacent **Riverside** open-cut mine, owned by the BHP Mitsui Coal (BMC) joint venture. The combined workforce is administered under one management structure, although coal from each mine is marketed separately. In July 2003, BMA announced plans to develop a new underground longwall coal mine, the **Broadmeadow** mine, located within BMA's Goonyella mine lease. The operation, which is planned to produce up to 3.6Mt of high quality coking coal a year, will feature BMA's first application of punch longwall mining, utilising the existing opencut pit for longwall panel access. Development is scheduled to start in the third quarter of 2003, with the commencement of longwall operations planned for the second half of 2005. The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

GREGORY /CRINUM

Basin	Bowen
Location	62km north-east of Emerald, approximately 200km west of Rockhampton
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance (formerly Gregory JV)
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1789, 1923, 70061
Address	Gregory Mine, Locked Bag No 1, Emerald Qld 4720
Phone	+61 7 4982 8200
Fax	+61 7 4982 8274
Transport	379km by rail to the port of Gladstone
Geology	German Creek Formation of Late Permian age contained within several fault bounded blocks. Dips are relatively flat though variable in direction. One seam of economic interest is present: Lilyvale (German Creek) seam — 3.5m average thickness.
Mining method	The mine uses a dragline for overburden removal in the Gregory open-cut mine. Coal from the associated Crinum underground mine is extracted using a single retreat longwall at a rate of about 4Mtpa and processed through the Gregory wash plant.
Preparation plant	Heavy medium cyclones, spirals and froth flotation
Product coals	Low-ash, hard and weak coking coals, plus a high volatile thermal coal
Markets	Export primarily to Asian and European markets
Production	Approximately 5Mtpa (combined operations)
Workforce	290
Comments	The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

HAIL CREEK

Basin	Bowen
Location	35km north-west of Nebo, and 90km south-west of Mackay
Mine operator	Pacific Coal Pty Limited
Mine proprietor	Hail Creek Joint Venture
Beneficial owners	Rio Tinto Limited 92% Marubeni Australia Ltd 5.33% Sumitomo Corporation 2.67%
Tenements	ML 4738
Address	Pacific Coal Pty Limited, GPO Box 391, Brisbane Qld 4001
Phone	+61 7 3361 4200
Fax	+61 7 3229 5087
Transport	A 52km rail spur to link into the existing Goonyella electrified rail system has been constructed to service the mine. The coal will be railed approximately 170km to the Dalrymple Bay Coal Terminal at Hay Point.
Geology	Resources occur in the Rangal and Fort Cooper Coal Measures of Late Permian age, contained in an asymmetric, south plunging syncline. Dips are 8–10° along the western limb and up to 35° along the eastern limb. Two coal seams of economic interest are present: Elphinstone seam — average thickness 6.5m; and Hynds seam — average thickness 8.5m.
Mining method	Open-cut, initially using truck and shovel for overburden and coal removal. Dragline overburden removal operations are planned to commence late in 2004, following commissioning of a new P&H MinePro 9020 dragline.
Preparation plant	Dense medium cyclones, teetered bed separators and Jameson flotation cells
Product coals	The washplant will batch process two primary coking coal products comprising Hail Creek Brand hard coking coal and Brumby Brand higher ash coking coal.
Markets	Both products will be exported to buyers in Asia and Europe.
Production	Building to 5.5Mtpa over several years
Workforce	Construction workforce about 170
Comments	Construction of the A$425 million mine project commenced soon after final approval for the development in June 2001, and project engineering was substantially completed by early 2003. The construction is expected to be completed in the first half 2003, and the first shipment of coal is expected in September 2003.

JEEBROPILLY

Basin	Clarence–Moreton
Location	10–17km south-west of Ipswich
Mine operator	Jeebropilly Collieries Pty Ltd
Mine proprietor	New Hope Corporation Limited
Beneficial owners	Washington H Soul Pattinson & Co 69.337%, and various minority owners
Tenements	MDL 157; MDL 171; ML 4577; ML 4677; ML 4689-90; ML 4705; ML 4710-11; ML 4715; ML 7186; ML 50082; ML 50093; ML 5013;2 ML 50133
Address	Jeebropilly Collieries Pty Ltd, PO Box 47, Ipswich Qld 4305
Phone	+61 7 3810 0500
Fax	+61 7 3202 4315
Transport	83km by rail to the port of Brisbane
Geology	Walloon Coal Measures of Middle Jurassic age dipping south to south-east at up to 3°. Twelve coal 'seams' are worked covering the Amberley series seams 3 to 7 (in the south-east), and the Jeebropilly series seams A-A3, B1-B3, C-C1, and D1-D4 which occur in the northern and western portions of the mine area. A series of north-north-west and east–west trending faults are also present.
Mining method	Open-cut using excavators, front-end loaders and trucks for overburden removal. The areas being mined include **Jeebropilly**, **Jeebropilly North**, **Smithfield** and **Thagoona**.
Preparation plant	Jig, classifying cyclones, dense medium cyclones and spirals
Product coals	High volatile thermal coal; the coals are washed and blended to produce a range of products under the Tivoli brand name suitable for export and for domestic power generation. The processed coal exhibits very low pollutant levels, typical of the Walloon coals.
Markets	Domestic and export to Japan, USA, New Caledonia, Philippines and South America
Production	0.5Mtpa
Workforce	64
Comments	Jeebropilly mine production was scaled down from the end of 2002, due to start-up at the New Acland mine, and expanded output from the nearby New Oakleigh coal mining operations.

JELLINBAH EAST

Basin	Bowen
Location	20km north-east of Blackwater, and approximately 160km west of Rockhampton
Mine operator	Jellinbah Mining Pty Ltd
Mine proprietor	Jellinbah East Joint Venture
Beneficial owners	Queensland Coal Mine Management Pty Ltd 70% (which includes 40.1% through Tremell Pty Ltd); Marubeni Corporation 15%; Nissho Iwai Corporation 15%. Both the operator, Jellinbah Mining Pty Ltd, and the coal marketer and administrator, Jellinbah Resources Pty Ltd, are 100% subsidiaries of Queensland Coal Mine Management Pty Ltd (QCMM).
Tenements	MLs 2418, 6992, 80018, 80053, 80068; MDL 185; EPC 730
Address	Jellinbah East Mine, PO Box 63, Bluff Qld 4702
Phone	+61 7 4986 1144
Fax	+61 7 4986 1553
Transport	22km by road to Boonal Siding on the Blackwater rail system, then 280km by rail to the RG Tanna coal terminal at the port of Gladstone
Geology	Rangal Coal Measures of Late Permian age. Coal seams present are: Aries, Castor, Pollux and Pisces. The Pollux is the main seam of economic interest, ranging from 5–8m in thickness.
Mining method	Open-cut using trucks and excavators for overburden removal
Preparation plant	ROM coal was previously crushed and screened to produce a blended saleable coal products without beneficiation. In early 2003, construction of a 350tph coal wash-plant at the mine site was completed. The plant includes a dense medium cyclone circuit for the coarse coal, and a teetered bed separator to treat fines.
Product coals	Low volatile bituminous-rank coals, with high specific energy, low ash and low sulphur. The coals are suitable to be used for pulverised coal injection (PCI), blending for metallurgical coke manufacture, and in coal boilers specially designed to operate on low volatile coal.
Markets	Primarily Japan and Brazil, and other markets in Asia and Europe
Production	Approximately 3.5Mtpa
Workforce	About 130
Comments	In early 2002, Anglo Coal Australia Pty Ltd acquired a 23% interest in the Jellinbah East project through its purchase of one-third of QCMM. Potential extensions of the mineable resource exist to the north of the current mining operations. Expansion of production capacity is possible subject to market demand.

KESTREL

Basin	Bowen
Location	40km north-north-east of Emerald
Mine operator	Pacific Coal Pty Limited
Mine proprietor	Kestrel Joint Venture
Beneficial owners	Rio Tinto Limited 80% Mitsui & Co Ltd 20%
Tenements	ML 1978; MDLs 176, 182
Address	Kestrel Mine, PO Box 1969, Emerald Qld 4720
Phone	+61 7 4982 8609
Fax	+61 7 4982 8577
Transport	365km by rail to the RG Tanna coal terminal at the port of Gladstone
Geology	German Creek Formation of Late Permian age. The strata dips gently to the south with the only seam of economic interest being the German Creek seam, which has an average seam thickness of 3m. A major fault (Ti Tree fault) separates the developed eastern portion of the deposit from large undeveloped deposits to the west.
Mining method	Underground — longwall
Preparation plant	Dense medium bath, dense medium cyclones and froth flotation
Product coals	High volatile, low ash, hard coking coal and medium ash, high-energy thermal coal
Markets	Export to Japan, Taiwan, Korea, Mexico and Europe
Production	4Mtpa
Workforce	Approximately 220 (not including contractors)
Comments	With the planned completion during 2003 of extraction of economic reserves of coal from the underground mining area east of the Ti Tree Fault, underground development commenced during 2002 across the fault into the Ti Tree area. The first longwall coal production accessing the significant tonnage of high quality coking and thermal coal from this portion of the mine is expected towards the end of 2003.

MEANDU

Basin	Tarong
Location	30km south of Kingaroy, about 180km north-west of Brisbane
Mine operator	Pacific Coal Pty Limited
Mine proprietor	Queensland Coal Pty Limited
Beneficial owners	Rio Tinto Limited 100%
Tenements	ML 6674; MDL 200
Address	Meandu Mine, PO Box 36, Nanango Qld 4315
Phone	+61 7 4160 7211
Fax	+61 7 4160 7200
Transport	1km overland conveyor to the Tarong power station
Geology	Tarong Beds of Late Triassic age with dip normally up to 5° to the south-south-east, although local variations due to faulting and seam splitting are common. Up to 15 seams are present with the King and seams A to J (inclusive) being the principal seams mined. The bulk of the mine area has no Tertiary cover except for a small area on the eastern side where deep pre-Tertiary erosion and infill has occurred.
Mining method	Open-cut using one dragline (45m^3) for overburden removal. The coal is mined from several mining areas, including: King 1,2,4; north-west A and B; West; and south-west.
Preparation plant	Jigs and classifying cyclones
Product coals	High-ash bituminous thermal coal
Markets	Domestic supply — Tarong Power Station
Production	5.4Mtpa
Workforce	Approximately 240
Comments	The Meandu mine was developed to supply coal to the Tarong power station. The mine has a contract with the power station operator, Tarong Energy Corporation Ltd, for coal supply to 2010 for the existing 1400MW power station, and to the adjacent 450MW Tarong North station which commenced operating in early 2003. The mine is ramping up production to around 7Mtpa to supply all units at the power stations.

MOORVALE

Basin	Bowen
Location	10km south of the Coppabella Mine, and about 150km south-west of Mackay
Mine operator	Australian Premium Coals Pty Ltd
Mine proprietor	Moorvale Joint Venture
Beneficial owners	Macarthur Coal Limited 77% AMCI Australia Pty Ltd 13.8% CITIC Australia Pty Ltd 2.3% Marubeni Corporation 2.3% Nissho Iwai Corporation 2.3% Kawasho Corporation 1.38% Nippon Steel Trading Co Ltd 0.92%
Tenements	MLs 70290, 70291
Address	Australian Premium Coals Pty Ltd, PO Box 7057, Riverside Centre Qld 4001
Phone	+61 7 3239 7666
Fax	+61 7 3239 7699
Transport	Rail distance to the Dalrymple Bay Coal Terminal at the port of Hay Point is approximately 160km.
Geology	Rangal Coal Measures of Late Permian age dipping north-west at 7–15°; splits of the Leichhardt and Phillips Seams coalesce into a single seam up to 11m thick.
Mining method	Open-cut using hydraulic excavators and trucks
Preparation plant	Raw coal will be processed through a 600tph preparation plant using dense medium cyclones, spirals and flotation cells to produce the various coal products for export.
Product coals	The mine plans to produce three different products — a low volatile, high energy pulverised coal injection (PCI) coal, a high energy medium ash thermal coal, and an 8% ash soft-coking coal — by selective mining of sections of the coal seam.
Markets	Export to Asia, Europe and South America
Production	During the 2003–04 financial year, the mine is planned to produce 1.5Mt of saleable coal.
Workforce	90
Comments	Construction of the mine commenced in December 2002 and is scheduled to be complete in the last quarter of 2003.

MORANBAH NORTH

Basin	Bowen
Location	16km north of Moranbah; 140km south-west of Mackay
Mine operator	Anglo Coal (Moranbah North Management) Pty Ltd
Mine proprietor	Moranbah North Joint Venture
Beneficial owners	Anglo Coal Australia Pty Ltd 88% Nippon Steel Australia Pty Ltd 5% Tomen Coal Resources Pty Ltd 3.75% NS Resources Australia 1.25% Sumikin Bussan Coal Australia Pty Ltd 1% Shinsho Australia Pty Ltd 0.5% Kokan Kogyo (Australia) Pty Ltd 0.5%
Tenements	ML 70108; MDL 166 (part)
Address	Moranbah North Mine, PO Box 172, Moranbah Qld 4744
Phone	+61 7 4968 8615
Fax	+61 7 4968 8678
Transport	180km by rail to the Dalrymple Bay Coal Terminal at Hay Point
Geology	Moranbah Coal Measures of Late Permian age, dipping gently east at 3–5° beneath a veneer of Tertiary strata. Principal seam of interest is the Goonyella Middle seam, which is up to 6m thick in the mine area and generally exceeds 5.5m.
Mining method	Underground longwall (single face), extracting 4.5m high panels
Preparation plant	Dense medium bath, cyclones and froth flotation cells
Product coals	Prime low-ash hard coking coal
Markets	Export to Asia and Europe
Production	Approximately 4Mtpa
Workforce	Approximately 450

MOURA

Basin	Bowen
Location	10km east of Moura; 140km south-west of Gladstone
Mine operator	Anglo Coal (Moura) Limited
Mine proprietor	Moura Joint Venture
Beneficial owners	Anglo Coal Australia Pty Ltd 51% Mitsui & Co. Ltd 49%
Tenements	MLs 5591 to 5593, 5596 to 5601, 5603, 5604, 5606, 5607, 5611, 5630, 5643, 5646, 5650, 5656, 80032, 80034, 80070; EPCs 520, 578
Address	Moura Mine, PO Box 225, Moura Qld 4718
Phone	+61 7 4990 9700
Fax	+61 7 4990 9800
Transport	179km by rail to the port of Gladstone
Geology	Baralaba Coal Measures of Late Permian age dipping at 5–16° to the west; up to 7 seams and seam splits are present, of which 5 are worked: Seam A — 4.2m; Seam B — 3.6m; Seam C — 3.4m; Seam D — 3.2m; Seam E — 2.1m.
Mining method	Open-cut using three draglines (72, 58 and 47m^3 respectively) and a contract pre-strip fleet for overburden removal. In addition the mine also operates a steep dip add-car system and an archveyor highwall mining system is in use.
Preparation plant	A 16km, 2000tph overland conveyor transports coal to the preparation plant which uses a dense medium bath, water-only, and dense medium cyclones, spirals and froth flotation.
Product coals	Medium volatile coking coal, high volatile semi-soft coking coal and low ash thermal coal
Markets	Exports mainly to Japan, Korea and Taiwan
Production	6.0Mtpa (50/50 metallurgical coal and thermal coal)
Workforce	402
Comments	The current Moura joint venture was established in July 2002, following Mitsui's pre-emptive rights purchase from Coal and Allied of its 55% interest in the mining operation. Anglo Coal acquired a 51% share of the mine following agreement with Mitsui on an exchange in equity in other coal mining projects. Since 1996 Moura has been commercially extracting coal bed methane, which is piped into the State gas pipeline, enabling Moura to utilise its underground coal resources.

NEW ACLAND

Basin	Clarence–Moreton
Location	46km north-west of Toowoomba and 10km north of Oakey in south-east Queensland
Mine operator	New Acland Coal Pty Ltd
Mine proprietor	New Hope Corporation Limited
Beneficial owners	Washington H Soul Pattinson & Co 69.337%, and various minority owners
Tenements	MDL 244; ML 50170
Address	New Acland Coal Pty Ltd, PO Box 47, Ipswich Qld 4305
Phone	+61 7 3810 0500
Fax	+61 7 3202 4315
Transport	Coal is railed from Jondaryan, which is 221km from the port of Brisbane.
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently to the south-west; numerous relatively thin, banded coal seams in a coal-bearing interval up to 16m thick; several seam intervals have been recognised, these being (in descending order) Upper and Lower Acland; Upper, Middle and Lower Sabine; and Balgowan seam intervals. The main deposits include Glen Roslyn, Sabine and Manningvale. Identified coal resources in excess of 300Mt are amenable to open-cut mine development.
Mining method	Open-cut bench mining using hydraulic shovels, front-end loaders and rear-dump trucks
Preparation plant	Jig, classifying cyclones, dense medium cyclones and spirals
Product coals	High volatile thermal coal; the coals are washed and blended to produce a range of products under the Tivoli brand name suitable for export and for domestic power generation. The processed coal exhibits very low pollutant levels, typical of the Walloon coals.
Markets	Domestic and export
Production	2.1Mtpa of saleable product
Workforce	69
Comments	Coal mining operations commenced at the New Acland mine in August 2002. The first product coal was railed from the load-out facility near Jondaryan to the coal export terminal at the Port of Brisbane in October 2002. Production from New Acland is forecast to rise to approximately 4Mtpa by about 2006. Approximately 60% of production is earmarked for export, with the remainder for the domestic market.

NEW OAKLEIGH

Basin	Clarence–Moreton
Location	24km west of Ipswich and 2.5km north of Rosewood
Mine operator	New Oakleigh Coal Pty Ltd
Mine proprietor	New Hope Corporation Limited
Beneficial owners	Washington H Soul Pattinson & Co 69.337%, and various minority owners
Tenements	EPC 642; MDL 53; MDL 54; ML 4568; ML 4584; ML 4675; ML 4683; ML 4698; ML 4699
Address	New Oakleigh Coal Pty Ltd, PO Box 47, Ipswich Qld 4305
Phone	+61 7 3810 0500
Fax	+61 7 3202 4315
Transport	83km by rail to the port of Brisbane
Geology	Walloon Coal Measures of Middle Jurassic age with a gentle regional dip to the south; local dips vary due to minor faults and structures; up to eight coal seams are mined, from the Butler to the Bruce seams.
Mining method	Open-cut using dozers, front end loaders and trucks; mining areas include **New Oakleigh** and **Rosewood**
Preparation plant	McNally Baum jig and classifying cyclones
Product coals	High volatile thermal coal; the coals are washed and blended to produce a range of products under the Tivoli brand name suitable for export and for domestic power generation. The processed coal exhibits very low pollutant levels, typical of the Walloon coals.
Markets	Domestic and export
Production	0.5Mtpa of saleable product
Workforce	25
Comments	Expansion of the existing open-cut operations on the New Oakleigh coal mining leases is planned. The expansion will replace some of the production from the Jeebropilly operations, which was scaled down from end 2002.

NEWLANDS

Basin	Bowen
Location	32km north-west of Glenden and 130km west of Mackay
Mine operator	Xstrata Coal Queensland Pty Ltd
Mine proprietor	NCA Joint Venture
Beneficial owners	Xstrata Queensland Limited 75% Itochu Corporation 25%
Tenements	MLs 4748, 4754, 4755, 4771, 4774, 10176; EPCs 588, 734
Address	Newlands Mine, PO Box 21, Glenden Qld 4743
Phone	+61 7 4940 5200
Fax	+61 7 4940 5211
Transport	176km by rail to the port of Abbot Point
Geology	Rangal Coal Measures and Fort Cooper Coal Measures of Late Permian age dipping generally east at 2–8°; two coal seams of economic interest, the Newlands Upper — 6m av. at the base of the Rangals, and the Newlands Lower — 3.4m av. at the top of the underlying Fort Cooper Coal Measures. The seams are separated by 1–2m of parting in the central portion of the mine area.
Mining method	The Newlands operations comprise the **Newlands** and **Eastern Creek** open-cut mines and the **Southern Underground** longwall mine. The open-cut mines use two BE 1370 draglines (46m^3). The underground mine uses longwall retreat mining methods. In 2003, MIM commenced construction of a second longwall mine (the **Northern Underground**). A larger dragline (Marion 8750) is being acquired for open-cut mining at Newlands to replace one BE 1370 machine in 2004. The BE 1370 will be relocated to the **Collinsville** open-cut mine.
Preparation plant	Coal brands blended from the production from each mine are produced in the one coal preparation plant, comprising Batac jigs with froth flotation for fines recovery.
Product coals	Medium volatile, high-energy bituminous thermal coal
Markets	Exports to Japan, Korea, South-east Asia and Europe
Production	10.6Mtpa (ROM)
Workforce	661 — includes contractors
Comments	The Newlands operations presently incorporate the Southern underground and two open-cut mines, as well as the Northern underground mine (under construction), and the proposed Suttor Creek open-cut mine located approximately 17km south of the Newlands railhead. The Northern underground is expected to replace production from the Southern underground upon its depletion at the end of the 2005 financial year. In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

NORTH GOONYELLA

Basin	Bowen
Location	40km north of Moranbah; 180km west-south-west of Mackay
Mine operator	North Goonyella Coal Mines Pty Ltd
Mine proprietor	RAG Australia Coal Pty Ltd
Beneficial owners	RAG Australia Coal Pty Ltd 100%
Tenements	ML 6949
Address	North Goonyella Coal Mines Pty Ltd, PO Box 41, Glenden Qld 4743
Phone	+61 7 4949 2888
Fax	+61 7 4949 2811
Transport	Approximately 215km by rail to the port of Dalrymple Bay
Geology	Moranbah Coal Measures of Late Permian age dipping at 3° to the east; the coal measures contain three coal seams considered workable in the mine area. They are: Goonyella Upper — 2.6–3.2m; Goonyella Middle — 4.5m; Goonyella Lower — 2.0–3.2m.
Mining method	Underground — longwall extraction in the Goonyella Middle seam
Preparation plant	Dense medium cyclones, spirals and froth flotation designed in four parallel modules of 150tph capacity for each module
Product coals	Medium volatile hard coking coal
Markets	Asian, South Africa and European markets
Production	2–3Mtpa
Workforce	Approximately 300
Comments	Development is in plan of a small open-cut mine (**Eaglefield**) to extract the relatively shallow coal resources at the southern extension of the North Goonyella mining lease area. In January 2003, RAG Australia Coal, a division of RAG Coal International AG, acquired full ownership of the mine on purchasing the 40% share formerly held by Thiess Pty Ltd.

NORWICH PARK

Basin	Bowen
Location	25km south-east of Dysart, and about 200km south-south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1782 (part) 70127; MLAs 70126, 70135
Address	Norwich Park Mine, PMB, Dysart Qld 4745
Phone	+61 7 4941 1222
Fax	+61 7 4958 2357
Transport	256km by rail from the port of Hay Point
Geology	German Creek Formation of Late Permian age; up to seven coal seams present, of which the Dysart seam and one to two upper splits are the main seams worked. Average seam dips are 1–5° to the east. Typical working seam thicknesses are: Rider seam — 1.2m; Dysart seam — 3–5m.
Mining method	Open-cut using five draglines (all 48m^3 capacity) for overburden removal, with 20 and 13m^3 excavators and trucks used for parting removal and pre-strip as required.
Preparation plant	Heavy medium cyclones, spirals and froth flotation
Product coals	Low volatile coking coals
Markets	Export primarily to European and Asian markets
Production	Approximately 4Mtpa
Workforce	272
Comments	The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

OAKY CREEK

Basin	Bowen
Location	17km east of Tieri and 200km west north-west of Rockhampton
Mine operator	Oaky Creek Coal Pty Ltd
Mine proprietor	Oaky Creek Coal Joint Venture
Beneficial owners	Xstrata Queensland Limited 75% Sumisho Coal Australia Pty Ltd 15% Itochu Corporation 10%
Tenements	MLs 1832, 2004, 70241; MDL 163
Address	Oaky Creek Coal Pty Ltd, PO Box 1, Tieri Qld 4709
Phone	+61 7 4984 7200
Fax	+61 7 4984 7455
Transport	297km by rail from Dalrymple Bay, or 394km by rail from Gladstone
Geology	German Creek Formation of Late Permian age dipping from east to south-south-east at 4–12°. The strike of the coal measures swings from north to north-west in the northern portion of the lease. Seven coal seams are present, but only the Aquila — 0.9m; Pleaides; and German Creek seams are currently worked. The Oaky Creek No 1 and Oaky North underground mines work only the German Creek seam.
Mining method	The Oaky Creek operations comprise the **Oaky Creek No.1** and **Oaky North** underground mines, and the **Oaky Creek** open-cut mine. The underground mines use longwall retreat mining for panel extraction, while the open-cut mine uses draglines for overburden removal.
Preparation plant	Dense medium cyclones, flotation and spirals; coal brands are specific to each mine, and are produced from the one preparation plant.
Product coals	Medium volatile, low ash, high fluidity coking coal
Markets	Export to Japan, South-east Asia, India, Europe and South America
Production	11Mtpa (ROM)
Workforce	917 (includes contractors)
Comments	The Alliance Colliery, a punch longwall sub-contract mining operation on the Oaky Creek lease, closed in February 2002 due to depletion of reserves. In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

PEAK DOWNS

Basin	Bowen
Location	40km south-east of Moranbah, and 160km south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1775 (part), 1783, 1885, 70142 (part)
Address	Peak Downs Mine, PMB, Moranbah Qld 4744
Phone	+61 7 4968 8211
Fax	+61 7 4968 8160
Transport	192km by rail to the port of Hay Point
Geology	Moranbah Coal Measures of Late Permian age dipping at 2–12° to the east; up to eleven coal seams/major seam splits are present. They are the S, R, Q, P1, P2, Harrow Creek Upper and Lower, Dysart K, Dysart Upper 1 and 2, and the Dysart Lower 2 seams. Mining is mainly confined to the Harrow Creek and Dysart seam sequences, which average 4–5m each in thickness.
Mining method	Open-cut using six draglines (5 x 48m^3 and 1 x 109m^3) and shovel/truck fleet for overburden removal; a 12m^3 Marion 195M-2 dragline is used for parting removal.
Preparation plant	Heavy medium cycloids, froth flotation and classifying cyclones
Product coals	Medium volatile hard coking coal
Markets	Export primarily to Asian and European markets
Production	Approximately 7.5Mtpa
Workforce	568
Comments	The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

PIPELINE

Basin	Bowen
Location	About 15km south-east of the Collinsville mine
Mine operator	Xstrata Coal Queensland Pty Ltd
Mine proprietor	NCA Joint Venture
Beneficial owners	Xstrata Queensland Limited 75% Itochu Corporation 25%
Tenements	ML10250
Address	Collinsville Mine, PO Box 60, Collinsville Qld 4804
Phone	+61 7 4785 4211
Fax	+61 7 4785 4420
Transport	The mined coal is trucked to the coal processing facilities at **Collinsville** mine, which is 106km by rail to the port of Abbot Point.
Geology	Moranbah Coal Measures of Late Permian age dipping at 3–5° to the south; a single coal seam of economic interest, the Q seam consists of 1.5–2m of thermal coal overlying approximately 3m of high quality coking coal. The thermal coal section has resulted from partial devolatilisation of the upper part of the seam caused by igneous intrusions.
Mining method	Open-cut using truck and shovel for overburden removal
Preparation plant	As for Collinsville operations
Product coals	Coal from the Pipeline deposit is blended with Collinsville coal to meet customer requirements.
Markets	As for Collinsville operations
Production	Integrated with Collinsville operations
Workforce	As for Collinsville operations
Comments	Only a small quantity of economically mineable coal remains in the deposit. Mining operations are expected to conclude during 2003.

RIVERSIDE

Basin	Bowen
Location	30km north of Moranbah, and about 150km south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Mitsui Coal Pty Ltd (BMC)
Beneficial owners	BHP Billiton Limited 80% Mitsui & Co Ltd 20%
Tenements	MLs 1764, 1802, 1900, 70121; MLA 70194
Address	Goonyella Riverside Mine, PMB, Moranbah Qld 4744
Phone	+61 7 4940 4333
Fax	+61 7 4940 4688
Transport	198km by rail from the port of Hay Point near Mackay
Geology	Moranbah Coal Measures of Late Permian age dipping at 3–5° to the east; two coal seams are present: Goonyella Middle seam — 6m (limited extent); Goonyella Lower seam — 8m. Mining is mainly on the Goonyella Lower seam.
Mining method	This open-cut strip mining operation uses a truck and shovel pre-stripping fleet, plus two 48m^3 draglines. The coal is loaded by front-end loader into 220 tonne bottom dump trucks for haulage to the preparation plant.
Preparation plant	Heavy medium cyclones, froth flotation and spirals
Product coals	Medium volatile coking coal, which has good plastic properties and blending characteristics.
Markets	Export primarily to India, Japan, Europe and South Africa and, and other markets in South America, Asia, and the Middle East
Production	Operations in this mature mine have been reduced to a production capacity of about 3.0Mtpa due to limited mineable reserves remaining within the lease area.
Workforce	646 (combined workforce for Goonyella/ Riverside)
Comments	Mining operations at Riverside are integrated with the adjacent Goonyella open-cut mine, owned by the BHP Billiton Mitsubishi Alliance (BMA). The combined workforce is administered under one management structure, although coal from each mine is marketed separately. BMA operates the mine on behalf of BMC.

SARAJI

Basin	Bowen
Location	22km north of Dysart, and 165km south-south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Limited 50% Mitsubishi Development Pty Ltd 50%
Tenements	MLs 1775(part), 1782(part), 1784, 70142 (part), 70294, 70298
Address	Saraji Mine, Private Mail Bag, Dysart Qld 4745
Phone	+61 7 4941 2350
Fax	+61 7 4968 9760
Transport	213km by rail from the port of Hay Point
Geology	Moranbah Coal Measures of Late Permian age dipping at 3–5° to the east; up to 11 coal seams are present but only the two lowermost have been worked: Dysart K seam — 1–1.8m; Dysart seam — 3–6m.
Mining method	Open-cut using four draglines (46m^3) and a two shovel/truck fleet for overburden removal
Preparation plant	Heavy medium cycloids and froth flotation
Product coals	Low volatile coking coal
Markets	Export primarily to Asian and European markets
Production	Approximately 5Mtpa
Workforce	438
Comments	The BHP Billiton Mitsubishi Alliance (BMA) commenced operations on 1 July 2001, following finalisation of the agreement between BHP Billiton Limited and Mitsubishi Development to move to equal ownership of the Central Queensland Coal Associates and the Gregory Joint Ventures.

SOUTH WALKER CREEK

Basin	Bowen
Location	35km west-south-west of Nebo, and about 100km south-west of Mackay
Mine operator	BHP Billiton Mitsubishi Alliance (BMA)
Mine proprietor	BHP Mitsui Coal Pty Ltd (BMC)
Beneficial owners	BHP Billiton Limited 80% Mitsui & Co Ltd 20%
Tenements	MLs 4750, 70131
Address	South Walker Creek Mine, Locked Bag 1014, Nebo Qld 4742
Phone	+61 7 4950 5311
Fax	+61 7 4950 5313
Transport	Coal is railed approximately 140km to the port of Hay Point. A new rail loop and coal loading facility were commissioned at the mine in June 2002, as part of an expansion of production.
Geology	Rangal Coal Measures of Late Permian age dipping west at 5–10°; the coal is a high-energy semi-anthracite which occurs in a 9–14m thick seam locally referred to as the Main seam.
Mining method	Mining conditions over the area are favourable for open-pit extraction with soft overburden and relatively low stripping ratios. Overburden is removed using a dragline, hydraulic backhoes and rear dump trucks.
Preparation plant	Raw coal is processed in dense medium cyclones and spirals, or bypassed directly for a raw product.
Product coals	The coal can be marketed raw as a thermal coal product, but the bulk of the production is beneficiated to produce a high yield, low ash product suitable as a metallurgical (PCI) coal for the export market.
Markets	Markets for South Walker Creek coal have been developed in Europe, Japan and Brazil, principally for use in the iron and steel industry as a PCI fuel, but also in coking blends.
Production	3.8Mtpa
Workforce	159
Comments	Following the creation of the BHP Billiton Mitsubishi Alliance (BMA) in June 2001, BMA assumed operation of the South Walker Creek mine on behalf of BMC.

WILKIE CREEK

Basin	Surat
Location	14km west of Macalister, about 220km north-west of Brisbane
Mine operator	Peabody (Wilkie Creek) Pty Ltd
Mine proprietor	Peabody (Wilkie Creek) Pty Ltd
Beneficial owners	Peabody Surat Pty Ltd 100%
Tenements	MDL 174; ML 5908; EPC 770
Address	Wilkie Creek Mine, PO Box 260, Dalby Qld 4405
Phone	+61 7 4663 5555
Fax	+61 7 4663 5549
Transport	280km by rail from Macalister to the Port of Brisbane
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently to the south and south-west; the Wilkie Creek Mine covers the former Kogan, Braemar, and Tarcoola deposits; four principal coal seams are present: Macalister 1 — 3.5m average thickness; Macalister 2 — 3.5m; Macalister 3 — 1.5m; Macalister 4 — 1.5m. The seams coalesce in various combinations to an aggregate thickness ranging between 9–11.5m.
Mining method	Open-cut using scrapers, dozers, graders, excavators and trucks
Preparation plant	Jigs, dense medium cyclones and spirals (capacity — 270tph)
Product coals	High volatile, medium ash, low sulphur bituminous thermal coal
Markets	The mine produces export quality thermal coal primarily for the Asia–Pacific markets.
Production	Approximately 1.3Mtpa (saleable)
Workforce	46
Comments	The Wilkie Creek mine was previously owned by Allied Queensland Coalfields Pty Ltd (AQC), a wholly owned subsidiary of Mirant Asia-Pacific Ltd. In August 2002, Peabody Energy (USA), through Peabody Surat Pty Ltd, acquired AQC.

YARRABEE

Basin	Bowen
Location	Approximately 40km north-east of Blackwater, and 160km west of Rockhampton
Mine operator	Yarrabee Coal Company Pty Ltd
Mine proprietor	Yarrabee Coal Company Pty Ltd
Beneficial owners	Resource Management and Mining Pty Ltd 100% (Yarrabee Coal Company Pty Ltd is a wholly owned-subsidiary of Resource Management and Mining Pty Ltd)
Tenements	MLs 1770, 80049, 80050, 80096; MLA 80104; MDL 160; EPCs 621, 717
Address	Yarrabee Mine, PO Box 431, Blackwater Qld 4717
Phone	+61 7 4982 7730
Fax	+61 7 4982 5793
Transport	35km by road to Boonal, then 280km by rail to Gladstone
Geology	Rangal Coal Measures of Late Permian age, dipping at up to 14° around the southern culmination of the Yarrabee Anticline; the only seam of economic interest in the current mine area is the Pollux seam, which ranges in thickness from 3.0–4.8m.
Mining method	Open-cut, using bulldozers, front-end loaders, excavators and trucks for overburden removal
Preparation plant	The coal is generally crushed to specification and sold as unwashed product. A premium product is also produced when required, by contract washing at a nearby coal preparation plant.
Product coals	Yarrabee coal is a low ash semi-anthracite coal. Its high energy and high carbon content make it suitable primarily as a PCI coal for blast furnace iron-making, but it is also used in specific power generating plants and for other industrial applications.
Markets	Export primarily to Japan and Europe; minor domestic sales
Production	Approximately 1Mtpa
Workforce	4 (permanent), plus 60 contractors
Comments	Additional resources to the north and south of the current mining operations are being evaluated for future development or expansion of mine capacity.

UNDEVELOPED COAL DEPOSITS

Details of selected coal deposits have been included in this section to provide an overview of the extent of undeveloped identified coal resources present in Queensland. In general, only deposits for which a Measured or Indicated resource has been identified are included. Except in some cases, deposits with Inferred resources only are not included.

In situ tonnage estimates for the undeveloped coal deposits, are presented in Appendix A (Coal Inventory). Indicative coal quality information for many of these deposits is provided in the Appendix B.

Company Information

Information on the companies associated with the listed coal deposits is presented in this section, using the following terminology:

Operators: these are the companies that manage the exploration and evaluation work, on behalf of the **Tenement Owner**(s). Contact details for the Operators are included in Appendix C.

Tenement Owner: the principal holder of the legal title over the deposit. This may be an individual company or a joint venture between several independent or associated companies.

Beneficial Owners: details the companies holding either a direct and/or beneficial equity interest in the deposit. Note that details printed in this publication in regard to the ownership of collieries, mines and deposits are valid as at the July 2003. Major changes in ownership of some of the project owners have recently been announced. This information has been noted under each project where applicable, and where the information has been made public. Changes occurring since July 2003 have generally not been included.

ALPHA

Basin	Galilee
Location	55km north-north-west of Alpha, which is 550km by rail from the port of Gladstone
Operator	Hancock Prospecting Pty Ltd
Tenements	EPC 570; MDLA 285
Tenement holder	Hancock Prospecting Pty Ltd
Beneficial owners	Hancock Prospecting Pty Ltd 100%
Geology	Bandanna Formation and Colinlea Sandstone of Late Permian age, dipping gently to the west; five coal seams are present, the upper two occurring in the Bandanna Formation, and the lower three in the Colinlea Sandstone. The seams are: Seam A — 5m average thickness; Seam B — 6.5m; Seam C — 8.5m; Seam D — 5m; Seam E — 2m.
Potential	A large tonnage of thermal coal amenable to open-cut mining has been identified. There are also substantial resources suitable only for underground extraction.

BATHURST RANGE

Basin	Laura
Location	150km north-west of Cooktown on Cape York Peninsula
Operator	n/a
Tenements	Untenured (formerly EPC 463)
Tenement holder	n/a
Geology	Thin coal seams occur in the Dalrymple Sandstone of Mid- to Late Jurassic age. The Bathurst seam, which is the basal seam, ranges up to 2m thick and is the only seam of possible economic significance.
Potential	A small resource of coking coal amenable to underground extraction has been identified.

BARALABA (Dawson Valley)

Basin	Bowen
Location	3km north-west of Baralaba, which is 160km by rail to the port of Gladstone
Operator	Baralaba Coal Pty. Ltd.
Tenements	MDL 184; MLs 5580, 5581, 5590, 5605
Tenement holder	Baralaba Coal Pty Ltd
Beneficial owners	Peabody Baralaba Investments Australia Pty Ltd 62.5% Republic Coal Pty Ltd 37.5%
Geology	Resources occur in the Baralaba Coal Measures of Late Permian age. Dips are variable and are controlled by a series of plunging synclinal folds, which are generally separated by thrust faulting. Nine coal seams are present: Moody — 1m average thickness; Boyd — 2.5m; Cameron — 2m; Reid — 3.4m; Doubtful — 3m; Dawson — 2.3m; Dunstan — 3.4m; Wright — 1.5m; Coolum — 2.2m.
Potential	Trial pits were developed and bulk tonnage samples were exported from an area within the mining leases in the early 1990s. Most of the identified resources are only amenable to underground mining, but a proposal to develop a short mine-life open-cut mine to initially extract 0.5Mtpa was assessed in 2001. No decision on development has been made as yet. Baralaba semi-anthracite product has been targeted into the growing low volatile PCI market for use in the steel production industry.
Comments	Baralaba Coal Pty Ltd was previously owned by Allied Queensland Coalfields (AQC), a wholly owned subsidiary of Mirant Asia-Pacific Ltd. In May 2001, Republic Coal Pty Ltd purchased Baralaba Coal Pty Ltd from AQC. Republic Coal approached Peabody Coal Trade Inc, a subsidiary of Peabody Energy Corporation, to form a joint venture to develop the Baralaba deposit. The management of the project was transferred to Peabody Energy Australia's subsidiary Peabody Baralaba Investments Pty Ltd.

BEE CREEK

Basin	Bowen
Location	20km west of Nebo and 20km north of the main railway line to Dalrymple Bay. Rail distance to port is 140km.
Operator	BHP Coal Pty Ltd
Tenements	ML 4751
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Rangal Coal Measures of Late Permian age dipping north-east to north at 8–14° around the faulted southern culmination of the Hail Creek Syncline. Two coal seams are present: Elphinstone seam — 3–9m; Hynds seam — 3–9m.
Potential	Potential opencut along an 8km strike length, which could produce both low volatile coking and thermal coals.

BLUFF

Basin	Bowen
Location	about 20km north-east of Blackwater, and 280km from the port of Gladstone
Operator	Christopher Wallin
Tenements	EPC 729
Tenement holder	Christopher Wallin
Beneficial owners	Christopher Wallin 100%
Geology	Rangal Coal Measures of Late Permian age
Potential	Inferred resources with a combined total exceeding 100Mt of coal have been delineated in several separate deposits over a wide area. The Bluff deposit has a small, indicated resource of coal amenable to underground extraction. Coal quality ranges from semi-anthracite to low volatile PCI and low volatile coking coal. Further work is required to determine if a mineable resource exists.

BOWEN RIVER

Basin	Bowen
Location	Incorporates several deposits, located from approximately 10–40km south of Collinsville, and 110–140km from the port of Abbot Point.
Operator	QCOAL Pty Ltd
Tenements	EPCs 586, 639
Tenement holder	QCOAL Pty Ltd
Beneficial owners	QCOAL Pty Ltd 100%
Geology	Moranbah Coal Measures and basal Fort Cooper Coal Measures of Late Permian age; coal seams are identified alphabetically in ascending stratigraphic order. Seam thicknesses range up to 11m with dips around 6° to the east or south-east.
Potential	Ten separate small shallow deposits of both coking and thermal coals have been identified. Mining feasibility studies incorporating open-cut shovel/truck mining of some deposits have been completed. All the deposits are conveniently located to rail infrastructure.
Comments	Inferred resources with a combined total exceeding 200Mt of coal have been delineated in the ten deposits. The target for initial development is the area immediately south of Collinsville, where recent work has defined open-cut resources of coking and thermal coal.

BREMER VIEW/MOUNT MORT

Basin	Clarence–Moreton
Location	43km south-west of Ipswich, and about 90km by rail from the port of Brisbane
Operator	Ebenezer Mining Company Pty Ltd
Tenements	EPC 424; MDLA 172
Tenement holder	Ebenezer Mining Company Pty Ltd
Beneficial owners	Idemitsu Kosan Co Ltd 100%
Geology	Walloon Coal Measures of Middle Jurassic age dipping gently east; the area contains typically thin banded coal seams referred to as the Mount Mort seam group by the tenement holders. Three seams — C, D, and E — are considered to have some economic potential. The deposits cover the Bremer View East, Bremer View West and Mount Mort deposits.
Potential	Small to medium size resources of thermal coal amenable to open-cut extraction have been identified in three separate deposits — Bremer View East, Bremer View West and Mount Mort. Preliminary mining feasibility studies have been carried out.
Comments	The closure in December 2002 of the nearby Ebenezer mine by the operator has restricted further work on these deposits for the time being, pending improvements in market conditions.

BRINGALILY NORTH

Basin	Clarence–Moreton
Location	About 10km south-west of the Commodore mine, which is 10km south of Millmerran in south-east Queensland.
Operator	Millmerran Power Partners
Tenements	MDL 300
Tenement holder	Millmerran Power Partners
Beneficial owners	InterGen (Australia) 53.69% Marubeni Corporation 30% GEC 6.31% EIF Group 5% Tohoku Electric Power Co. Inc. 5%
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently west; three coal seams are present: T seam — 0.5–1m thick; MU seam — 1.49m average thickness; and ML seam — 0.5–2m.
Potential	Northern part of large resource of thermal coal, similar in quality to the Commodore deposit to the north, amenable to large-scale open-cut mining. The southern portion of the deposit (Bringalily South) is held under a separate lease.

BRINGALILY SOUTH

Basin	Clarence-Moreton
Location	20km south-west of Millmerran
Operator	Newmont Pacific Energy Pty Ltd
Tenements	EPC 467; MDLA 299
Tenement holder	Newmont Pacific Energy Pty Ltd
Beneficial owners	Newmont Mining Corporation 100%
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently west; three coal seams are present: T seam — 0.5–1m average thickness; MU seam — 1.49m; and ML seam — 0.5–2m.
Potential	Southern part of large resource of thermal coal, similar to the Commodore deposit to the north, amenable to large-scale open-cut mining. The operators of the Millmerran power station hold the northern portion of the deposit under a separate lease.
Comments	Ownership of the project changed following acquisition of Normandy Mining by Newmont Mining Corporation in early 2002.

BROADMEADOW

Basin	Bowen
Location	South of Burton mine, about 120km south-west of Mackay
Operator	RAG Australia Coal Pty Ltd
Tenements	MDL 167; MLA 70257
Tenement holder	RAG Australia Coal Pty Ltd
Beneficial owners	RAG Australia Coal 95% Thiess Investments Pty Ltd 5%
Geology	Rangal Coal Measures of Late Permian age. Coal occurs in two seams, the Leichhardt and Upper Vermont Seams.
Potential	Extension of **Burton/Plumtree** resource, based on previously identified indicated resources of thermal and coking coal.
Comments	This deposit is separate from BMA's proposed Broadmeadow underground mine development, adjacent to the **Goonyella** mine operated by BMA.

CAMEBY DOWNS

Basin	Surat
Location	30km north-west of Chinchilla, and about 340km by rail from the port of Brisbane
Operator	Syntech Resources Pty Ltd
Tenements	EPC 732
Tenement holder	Syntech Resources Pty Ltd
Beneficial owners	Syntech Resources Pty Ltd 100%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age, dipping gently to the south-west; the main coal seams of interest are the Kentucky A and B seams.
Potential	A small resource of thermal coal amenable to open-cut extraction has been identified.

CLERMONT

Basin	Bowen
Location	10km north of Clermont and 10km south-east of the Blair Athol to Dalrymple Bay railway; rail distance to Dalrymple Bay will be approximately 280km.
Operator	Pacific Coal Pty Limited
Tenements	MLs 1884, 1904
Tenement holder	Clermont Coal Joint Venture
Beneficial owners	Rio Tinto Limited 55% Mitsubishi Development Pty Ltd 45%
Geology	Wolfang Coal Measures of Lower Permian age, essentially flat lying, but with steep dips near faults along the western margin of the deposit. The main seam of economic interest, the Wolfang seam, averages 38m in thickness in the initial mine area. A further five relatively thin unnamed seams of variable thickness and distribution also occur, but these contain less than 5% of the planned mining reserves.
Potential	Exploration has identified a large resource of thermal coal of similar quality to that produced at Blair Athol. Detailed design work is well advanced for a deep open-cut mine producing up to 10Mt of coal per annum.
Comments	Production from the Clermont deposit is proposed to begin in 2008, replacing the production from Blair Athol as its coal reserves are depleted.

CODRILLA

Basin	Bowen
Location	25km south of the Peak Downs Highway along the Fitzroy Developmental Road, and 25km east of the Moorvale rail load out where the approximate rail distance to Dalrymple Bay would be 160km.
Operator	Macarthur Coal Limited
Tenements	EPC 676
Tenement holder	Moorvale Coal Pty Ltd/Moorvale Interest Pty Ltd
Beneficial owners	Macarthur Coal Limited 100%
Geology	Rangal Coal Measures of Late Permian age dipping south and west at 2–10° around the nose of a small syncline; principal seam is the Vermont Upper averaging >6.5m, although the Leichhardt Lower 2 Seam averaging 2.5m and lesser Leichhardt Seam splits are present.
Potential	Potential open-cut and underground resources in a compact area 5km x 3km that could produce export quality low volatile PCI and thermal coals.

COLLINGWOOD

Basin	Surat
Location	16km north-east of the existing railhead at Wandoan, which is approximately 400km north-west of Brisbane.
Operator	Ribfield Pty Ltd
Tenements	EPC 640; MDLA 346
Tenement holder	Ribfield Pty Ltd
Beneficial owners	Ribfield Pty Ltd 100%
Geology	Lower Walloon Coal Measures (Taroom Coal Member) of Middle Jurassic age, dipping gently west-south-west at 2°. Coal occurs in one coal-bearing zone, the Pelham seam horizon, which contains three lenticular seams having an aggregate coal thickness of 4.3m. The seams split towards the margins of the deposit and along strike, with up to 12 splits recognised.
Potential	A medium size resource of perhydrous thermal coal amenable to open-cut extraction has been identified. Mineable resources occur in two blocks, designated North and South, extending over a 10km strike length.

CULLIN-LA-RINGO

Basin	Bowen
Location	30km south-south-west of Emerald and 10km west of the Emerald to Springsure railway; approximate rail distance to the port of Gladstone would be 420km.
Operator	Department of Natural Resources and Mines
Tenements	Departmental Restricted Area (RA) 279
Tenement holder	Department of Natural Resources and Mines
Geology	Coal resources occur in two major coal seams up to 7m thick, and several minor seams about 2.5m thick in Reids Dome Beds of Early Permian age, dipping approximately 3° to the north-east in a series of east-north-east trending fault blocks. The coal measures are unconformably overlain by varying thicknesses of Cainozoic cover, including extensive basalt. Seam continuity and structural complexity are poorly defined.
Potential	Inferred resources of approximately 800Mt have been estimated from the two major seams. The thicknesses of Cainozoic cover would appear to preclude economic open-cut extraction, but there is potential for underground mining based on the limited data available.

CURRAGH NORTH (formerly Pisces)

Basin	Bowen
Location	22km north of Blackwater, 10km north of Curragh mine
Operator	Curragh Queensland Mining Pty Ltd
Tenements	MDLs 162, 306
Tenement holder	Stanwell Corporation Limited
Beneficial owners	Stanwell Corporation Limited/Wesfarmers Curragh Pty Ltd
Geology	Rangal Coal Measures of Late Permian age, dipping east off the Comet Ridge; coal seams present in the southern portion of the project area are: Aries — 0.3–2.3m (average thickness 1.3m); Castor — 0.5–3.8m (2.3m); and Pisces ('working section') — 2.0–10m (6.1m). In the north the Aries and Castor seams coalesce to form a single seam 1.2–6.8m thick (average 4.7m). The area is located on the western side of the Jellinbah Fault, and has been affected by low angle thrusts. These have caused disruption in coal seam continuity as well as seam thickening and seam duplication.
Potential	A large resource of thermal coal, much of which is amenable to open-cut extraction, has been identified.
Comments	In January 2003, an agreement was announced between Stanwell Corporation and Wesfarmers, under which Wesfarmers Curragh Pty Ltd will develop the Pisces coal resource, now re-named Curragh North. Development of the deposit will be integrated with the Curragh mine to ensure a secure supply of domestic steaming coal to the Stanwell power station until 2025.

DAUNIA

Basin	Bowen
Location	30km east-south-east of Moranbah and adjacent to the main railway for coal haulage to the port of Hay Point, some 170km distant
Operator	BHP Billiton Mitsubishi Alliance
Tenements	MLs 1781, 70115; MLA 70116 (part)
Tenement holder	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Ltd 50% Mitsubishi Development Pty Ltd 50%
Geology	Resources occur in the Rangal Coal Measures of Late Permian age, in a graben-like structurally deformed basin. Dips in the coal measures are variable and range from 5–30°. Two seams are present: Leichhardt — 5.1m average thickness; Vermont — 2.8m average thickness.
Potential	Potential open-cut areas where the dips are relatively flat

DAWSON (formerly Theodore South)

Basin	Bowen
Location	25km south of Theodore; 170km south-west of Gladstone
Operator	Anglo Coal Australia Pty Ltd
Tenements	ML 5657 (part), MDL 216
Tenement holder	Anglo Coal (Dawson) Pty Ltd, Mitsui Moura Investment Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 51% Mitsui Moura Investment Pty Ltd 49%
Geology	Baralaba Coal Measures of Late Permian age dipping west at 7–14°; 12 coal seams (Seams 1 to 12) have been recognised for correlation purposes. Seam splitting and coalescing is common. Seams 3–4 and 6 are most consistent in thickness and quality, averaging 7.0m and 5.25m respectively. There is little structural disturbance of the coal measures, although Seams 3–4 and 6 have had their crop lines burnt in part down to depths of 70m.
Potential	Anglo Coal Australia is planning a staged development program for the Theodore Coalfield, under which the development of Dawson will follow that of the Theodore deposit. The deposit has both open-cut and underground potential.
Comments	In July 2002, Mitsui & Co. Ltd acquired a 49% interest in the project from Anglo Coal Australia, as part of an exchange in equity ownership of other coal projects in Australia.

EAGLEFIELD

Basin	Bowen
Location	Immediately south-south-west of the North Goonyella mine; 180km west-south-west of Mackay
Operator	RAG Australia Coal Pty Ltd
Tenements	ML6949
Tenement holder	RAG Australia Coal Pty Ltd
Beneficial owners	RAG Australia Coal Pty Ltd 100%
Geology	Moranbah Coal Measures of Late Permian age dipping at 2–5° to the east; the coal measures in this area contain two coal seams: Goonyella Middle — average thickness 6.6m; Goonyella Lower — 8.5–9m thick. Seam splits are present in some areas.
Potential	Southern extension of **North Goonyella** mining area; development of an open-cut mine to extract the relatively shallow coal resources is in plan.

ELIMATTA

Basin	Surat
Location	About 40km west of Wandoan, which is about 400km by rail from the port of Brisbane.
Operator	Taroom Coal NL
Tenements	EPC 650
Tenement holder	Taroom Coal NL
Beneficial owners	Taroom Coal NL 100%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age.
Potential	A medium size resource of thermal coal amenable to open-cut extraction has been identified.

FELTON

Basin	Clarence–Moreton
Location	10km south of Pittsworth, which is 170km by rail from the port of Brisbane.
Operator	Newmont Pacific Energy Pty Ltd
Tenements	EPC 485; MDLA 304
Tenement holder	Newmont Pacific Energy Pty Ltd
Beneficial owners	Newmont Mining Corporation 100%
Geology	Walloon Coal Measures of Middle Jurassic age, occurring as a series of gently folded north-east trending synclines and anticlines with gentle dips up to 3°. Six lenticular banded coal seams are present: G seam — 2.3m average thickness; H seam — 1.7m; T seam — 2m; M seam — 2.5m; N seam — 2.3m; and P seam — 2.1m. Pre-Tertiary erosion, basalt flows, and thick Quaternary cover effectively divide the area into East and West deposits.
Potential	A very large resource of thermal coal, amenable to open-cut mining, has been identified.
Comments	Ownership of the project changed following acquisition of Normandy Mining by Newmont Mining Corporation in early 2002.

FOXLEIGH SOUTH

Basin	Bowen
Location	Immediately south-east of the southern boundary of the Foxleigh mine, about 10km south of Middlemount
Operator	Foxleigh Mining Pty Ltd
Tenements	EPC 692
Tenement holder	CAML Resources Pty Ltd
Beneficial owners	CAML Resources Pty Ltd 63% ICRA Foxleigh Pty Ltd 20.6% Bowen Basin Investments Pty Ltd 16.4%. ICRA Foxleigh is a wholly owned subsidiary of Itochu Corporation.
Geology	Rangal Coal Measures of Late Permian age containing the Roper, Middlemount, Tralee and Pisces seams
Potential	The deposit is a continuation of coal measures present in the Foxleigh mine.

GATTONVALE

Basin	Bowen
Location	30km south-east of Collinsville, which is about 100km by rail to the port of Abbot Point.
Operator	Megajoule Mining Pty Ltd
Tenements	EPC 610; MDLA 279
Tenement holder	Megajoule Mining Pty Ltd
Beneficial owners	Megajoule Mining Pty Ltd 100%
Geology	Rangal Coal Measures of Late Permian age, dipping to the south-east at 5°; the main seam of interest is the 3m thick Gattonvale seam (also called the Rangal Seam), which is equivalent to the Upper Newlands seam to the south. The southern limit of the deposit is truncated by igneous intrusion.
Potential	Potential exists for an open-cut mine development along a 3km strike length. To date, only a very small resource of thermal coal has been identified.

GLEN WILGA

Basin	Surat
Location	152km south-east of Chinchilla, and approximately 220km north-west of Brisbane
Operator	Tarong Energy Corporation Limited
Tenements	EPCs 468, 700; MLAs 50157 to 59
Tenement holder	Tarong Energy Corporation Limited
Beneficial owners	Tarong Energy Corporation Limited 100%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age, dipping at up to 5° to the south-west; some seven seam groupings are identified, these being: Q, X, Y, A0 to A3, B1-B2, C1-C2, and D1-D2. The seams thicken, thin, and coalesce over short distances, and deterioration to carbonaceous mudstone is common. Four working seam sections have been delineated. These range in thickness from 1.4–4.0m, with an overall average thickness of 3.0m. Wide-spaced normal faulting is present.
Potential	A medium size resource of thermal coal amenable to open-cut extraction has been identified.
Comments	Tarong Energy is investigating the development of the Glen Wilga deposit, including the associated transport infrastructure, as a longer-term option for the supply of coal to the Tarong power station near Yarraman, about 100km to the east.

GROSVENOR

Basin	Bowen
Location	Adjacent to, and immediately south of, the Moranbah North mine, and 190km by rail from the Dalrymple Bay Coal Terminal at Hay Point; the town of Moranbah is located centrally within the lease.
Operator	Anglo Coal Australia Pty Ltd
Tenements	EPC 552; MDLs 273, 166 (part)
Tenement holder	Anglo Coal (Grosvenor) Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 100%
Geology	The coal seams are contained within the Moranbah Coal Measures, which range in thickness from 250–330m and dip gently north-east. The area contains eight seams, which split and coalesce to form up to 16 coal horizons. A small area of the resources is amenable to open-cut extraction. The principal seam is the Goonyella Middle Seam with an average thickness of 4–5m.
Potential	Significant resources of prime coking coal potentially suitable for underground extraction. A pre-feasibility study has been completed for an underground longwall mine to extract the Goonyella Middle Seam. A small area with open-cut potential is also present. Further feasibility studies are planned.

GULUGUBA

Basin	Surat
Location	19km south of Wandoan, which is about 400km by rail from the port of Brisbane
Operator	Surat Coal NL
Tenements	MDL 187
Tenement holder	Surat Coal NL
Beneficial owners	Surat Coal NL 100%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age, dipping gently west; two seams — 3–4m and 4–5m thick — are present.
Potential	A small resource of thermal coal amenable to open-cut extraction has been identified.

HAYSTACK ROAD

Basin	Surat
Location	30km south-east of Chinchilla, and approximately 200km north-west of Brisbane; the deposit occurs 20km east of the Glen Wilga deposit.
Operator	Tarong Energy Corporation Limited
Tenements	EPC 585
Tenement holder	Tarong Energy Corporation Limited
Beneficial owners	Tarong Energy Corporation Limited 100%
Geology	Lower Walloon Coal Measures (Taroom Coal Member) of Middle Jurassic age, dipping at very shallow angles to the south-west; one coal seam of potential economic interest, the B seam, occurs at depths below 54m. The average cumulative thickness of coal in the seam is 7.1m. Some structural disturbance due to normal faulting has been detected during exploration.
Potential	A medium size resource of high ash, high volatile perhydrous thermal coal amenable to open-cut extraction has been identified. The coal is suitable for beneficiation for either domestic or export use.
Comments	The deposit is considered a possible back-up resource to supplement the Glen Wilga deposit, development of which represents a longer-term option for the supply of coal to the Tarong power station near Yarraman.

HILLALONG

Basin	Bowen
Location	20km east of Glenden, and about 90km west of Mackay
Operator	Cuba Mining Pty Ltd
Tenements	MDL 324
Tenement holder	Cuba Mining Pty Ltd
Beneficial owners	Cuba Mining Pty Ltd 30% Qld Coal Exploration Pty Ltd 25% Qld Coal Resources Pty Ltd 24% Happyclam Pty Ltd 21%
Geology	Rangal and Fort Cooper Coal Measures of Late Permian age, contained in the southern limb of the Exevale Syncline; dips from field measurements are from 12–28° to the north-east. The main seam of interest is the Hynds seam, which ranges in thickness from 4.5m to >6.0m along a strike length of 7km.
Potential	A small resource of thermal coal partially amenable to open-cut extraction has been identified. Potential open-cut resources exist over a 7km strike length.
Comments	Proximity to new coal transport infrastructure associated with the development of the Hail Creek mine, about 20km to the south-east, may improve the project viability and influence the further evaluation of the deposit.

HORSE CREEK

Basin	Surat
Location	25km north of Chinchilla, 290km by rail from the port of Brisbane
Operator	Peabody Wilkie Creek Pty Ltd
Tenements	MDL 173
Tenement holder	Peabody Wilkie Creek Pty Ltd
Beneficial owners	Peabody Surat Pty Ltd 100%
Geology	Lower Walloon Coal Measures (Taroom Coal Member) of Middle Jurassic age, dipping gently to the south-west; three coal horizons are identified — Burndwidth, Kywanna, and Pelham. Aggregate coal thickness can total up to 10m.
Potential	An indicated open-cut resource of about 300Mt of thermal coal has previously been identified, based on <60m primary overburden and <10:1 cumulative linear waste/coal ratio.
Comments	The deposit was previously owned by Allied Queensland Coalfields Pty Ltd (AQC), a wholly owned subsidiary of Mirant Asia-Pacific Ltd. In August 2002, Peabody Energy (USA), through Peabody Surat Pty Ltd, acquired AQC.

KEMMIS/WALKER

Basin	Bowen
Location	40km west of Nebo, and up to 30km north of the main railway to the port of Dalrymple Bay, some 120km by rail to the north-east
Operator	BHP Coal Pty Ltd
Tenements	ML 4750
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Resources occur in the Rangal Coal Measures of Late Permian age, dipping west at variable angles. The rank of coal increases southward from low volatile (19%) thermal/weak coking coal to very low volatile (12.5%) thermal/semi-anthracite coal. Two coal seams are present: Elphinstone seam — 7m; Hynds seam — 2.8m. Resources are amenable to open-cut mining along the deposit.
Potential	Mining conditions over most of the area are relatively favourable for open-cut operations with soft overburden and low stripping ratios. The deposit is a northern extension of the South Walker Creek mine area.

KEVINS CORNER

Basin	Galilee
Location	70km north-west of Alpha, which is 550km by rail from the port of Gladstone. The deposit occurs immediately to the north of the Alpha deposit.
Operator	Hancock Prospecting Pty Ltd
Tenements	MDLA 333
Tenement holder	Hancock Prospecting Pty Ltd
Beneficial owners	Hancock Prospecting Pty Ltd 100%
Geology	Bandanna Formation and Colinlea Sandstone of Late Permian age dipping gently to the west; five coal seams are present, the upper two (Seams A and B) in the Bandanna Formation, and the lower three (Seams C, D and E) in the Colinlea Sandstone.
Potential	A large tonnage of thermal coal amenable to open-cut mining has been identified. The resources are contiguous with those of the Alpha deposit to the south.

KOGAN CREEK

Basin	Surat
Location	30km south-east of Chinchilla, and approximately 230km north-west of Brisbane
Operator	CS Energy Pty Ltd
Tenements	ML 50074; MDL 335
Tenement holder	Aberdare Collieries Pty Ltd
Beneficial owners	CS Energy Pty Ltd 100%
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently south-west at less than 3°; two coal seam horizons are present: the Upper group (seams K, M, N, and O) — 11.5m average thickness; the Lower group (seams S, T and U) — 3m average thickness. The Lower group is separated from the Upper group in the proposed open-cut area by up to 14m of strata.
Potential	A medium to large resource of high volatile thermal coal, suitable for open pit extraction, has been identified. The coal can be beneficiated to relatively low ash levels for export markets if required. Mining feasibility studies include options to supply large tonnage domestic markets as well as smaller export markets, or produce run of mine coal for a planned 750MW mine mouth power station.
Comments	Plans for the proposed 750MW power station adjacent to the Kogan Creek coal deposit were postponed in 2000 by the previous owners, a joint venture between Mirant Corporation (60%) and CS Energy (40%). In May 2002, Mirant sold its share of the power project and coal deposit to CS Energy, who are positioning the project to be ready to proceed to meet power demand increases. All environmental and regulatory approvals for the project are in place.

KUNIOON

Basin	Tarong
Location	15km west of Nanango, and 15km north-west of the Tarong Power Station and the Meandu Mine
Operator	Pacific Coal Pty Limited
Tenements	MDL 201
Tenement holder	Queensland Coal Pty Limited
Beneficial owners	Rio Tinto Limited 100%
Geology	Coal bearing sequence in the Tarong Beds of Late Triassic age, dipping at 2–6° within the Tarong Basin; two coal intervals are of economic interest: Kunioon seam — 13m average; and Swain-Goodger seam — 13m average.
Potential	Exploration has identified a large resource of thermal coal amenable to open-cut extraction.
Comments	The resource represents a potential supplementary coal supply for the Tarong Power Stations, in addition to that from the Meandu Mine.

LAKE ELPHINSTONE

Basin	Bowen
Location	35km north-west of Nebo, and 86km west of Mackay
Operator	Pacific Coal Pty Limited
Tenements	ML 4738
Tenement holder	Hail Creek Joint Venture
Beneficial owners	Rio Tinto Limited 92% Marubeni Coal Pty Ltd 5.33% Sumisho Coal Development Pty Ltd 2.67%
Geology	Resources occur in the Rangal and Fort Cooper Coal Measures of Late Permian age and connect to coal measures in the Hail Creek Syncline.
Potential	Exploration has identified a small to medium size resource of thermal coal amenable to both open-cut and underground extraction.
Comments	The deposit is located within the same mining lease covering the Hail Creek mine.

LAKE LINDSAY (formerly Girrah)

Basin	Bowen
Location	25km south of Middlemount, and 30km to the nearest rail link at Tieri; the deposit is located approximately 16km south-east of the German Creek East mine and adjacent to the Oak Park deposit.
Operator	Anglo Coal (Capcoal Management) Pty Ltd
Tenements	MDL 170
Tenement holder	Anglo Coal (German Creek) Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 70% Mitsui & Co. Ltd 30%
Geology	Resources occur in the Rangal Coal Measures of Late Permian age, in the Roper Pisces seam and in combinations of the Middlemount and Tralee seams.
Potential	The potential for staged development of the Oak Park and Girrah deposits to the south-east of the German Creek East mine is being investigated by the Capricorn Coal Development JV.

Comments	In January 2003, Anglo Coal (German Creek) Pty Limited and Mitsui German Creek Investments Pty Limited, the joint owners of the German Creek mining leases, purchased the Girrah coal deposit from Wesfarmers, following the completion of a competitive tender process. The deposit is favourably situated with respect to the operations at German Creek.

LANCEWOOD

Basin	Bowen
Location	50km north of Moranbah, and 25km north of rail facilities at the Goonyella/Riverside Mine, which is 210km by rail to the port of Dalrymple Bay.
Operator	BHP Coal Pty Ltd
Tenements	ML 4752
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Flat lying Upper, Middle and Lower coal seams in the Moranbah Coal Measures of Late Permian age; coal resources limited to the north by intrusion and coking of seams of interest.
Potential	The Lancewood deposit is considered to be the northern section of the Wards Well resource. Any development at Lancewood would follow development of the Wards Well deposit, which is closer to the rail head at North Goonyella.

LISKEARD

Basin	Bowen
Location	30km north-north-east of Emerald, immediately to the north of the Gregory/Crinum mine area
Operator	BHP Billiton Mitsubishi Alliance
Tenements	ML 7007; MDL 133
Tenement holder	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Ltd 50% Mitsubishi Development Pty Ltd 50%
Geology	The main coal resource is the 1.5m thick flat-lying Liskeard Seam, which occurs near the top of the Late Permian Freitag Formation. The seam is approximately 200m stratigraphically below the Lilyvale (German Creek) seam in the German Creek Formation.
Potential	A small resource with open-cut potential has been delineated. The deposit represents an extension of coal resources in the Gregory mine area.

LOCHBAR

Basin	Clarence–Moreton
Location	10km south of Millmerran
Operator	Newmont Pacific Energy Pty Ltd
Tenements	EPC 467; MDLA 299
Tenement holder	Newmont Pacific Energy Pty Ltd
Beneficial owners	Newmont Mining Corporation 100%
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently to the west; the deposit covers an area of approximately 10km^2, and coal occurs in three seams: T seam — 0.8m average thickness; MU seam — 1.1m; and ML seam — 1.75m.
Potential	A moderate size resource of thermal coal, similar to the nearby Commodore deposit and amenable to open-cut mining, has been identified.
Comments	Ownership of the project changed following acquisition of Normandy Mining by Newmont Mining Corporation in early 2002.

MAVIS DOWNS

Basin	Bowen
Location	25km east-north-east of Moranbah
Operator	BHP Coal Pty Ltd
Tenements	MDL 136
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Rangal Coal Measures of Late Permian age
Potential	A small open-cut /underground resource has been identified.

MIDDLEMOUNT

Basin	Bowen
Location	5km west of Middlemount, which is about 200km north-west of Rockhampton; the deposit is located about 15km from the railhead at German Creek.
Operator	Ribfield Pty Ltd
Tenements	MDL 282
Tenement holder	Ellrock Pty Ltd
Beneficial owners	Ribfield Pty Ltd 99% Ellrock Pty Ltd 1%
Geology	Rangal Coal Measures of Late Permian age
Potential	A medium size resource of mainly thermal coal has been identified. Only a small portion of the resource is amenable to open-cut extraction.

MILLENNIUM

Basin	Bowen
Location	20km south-west of Coppabella township and approximately 160km by rail from the Dalrymple Bay coal terminal
Operator	Millennium Coal Pty Ltd
Tenements	EPCs 728, 765, 784; MLAs 70312, 70313
Tenement holder	Millennium Coal Pty Ltd
Beneficial owners	Millennium Coal Pty Ltd 100%
Geology	Rangal Coal Measures of Late Permian age, dipping about 3–6° to the west; as a result of upthrust faulting, several shallow deposits occur to the west of the New Chum Fault. The main seams of economic interest are the Leichhardt (4–5m thick), Millennium (0.6m thick) and Vermont seams (1.8–2.0m thick). The upper part of the Leichhardt seam contains PCI coal, and the lower part of the seam and the Millennium and Vermont seams have coking and PCI quality coal.
Potential	Exploration has identified a resource of up to 50Mt, which can be mined by both open-cut and underground mining methods to produce export quality coking and PCI coals. Mining is planned to be initially by truck and shovel method in two small open-cuts, at a proposed ROM mining rate of 1.9Mtpa.

MINERVA

Basin	Bowen
Location	45km south of Emerald and 20km north of Springsure; approximate rail distance to the port of Gladstone is 406km.
Operator	New Hope Corporation Ltd
Tenements	EPC 553; MDL 232; ML 70145
Tenement holder	New Hope Exploration Pty Ltd/Minerva Coal Pty Ltd
Beneficial owners	New Hope Corporation Ltd 70% Winnin Pty Ltd 30%
Geology	Multi-seam deposits in the Reids Dome beds of Early Permian age; exploration drilling has located a small area of near surface coal in the Lexington Dome region at Minerva, beneath thin black soil cover. The Minerva deposits are an extension of the coal seams identified in the Cullin-la-ringo area. Six seam groups of economic significance have been identified at Minerva. Substantial tonnages of coal are also indicated to be present at depth in the Gindie area to the north, beneath Cainozoic volcanic rocks.
Potential	A pre-feasibility study has been completed for an open-cut truck and shovel mining operation at Minerva, producing up to 1Mtpa, based on a delineated resource of approximately 30Mt of open-cut reserves. Inferred resources of around 500Mt suitable for underground extraction are estimated to occur to the north of the open-cut resource.

MINYANGO

Basin	Bowen
Location	5km south of Blackwater, and 300km from the port of Gladstone
Operator	QCOAL Pty Ltd
Tenements	EPC 699A
Tenement holder	QCOAL Pty Ltd
Beneficial owners	QCOAL Pty Ltd 100%
Geology	Rangal Coal Measures of Late Permian age, with a regional dip of about 5° to the east; the seams present are the Aries, Castor, Pollux, Orion, and Pisces seams. The area as a whole is structurally disturbed, although drilling and high-resolution seismic surveys indicate that blocks of relatively undisturbed coal measures are present.
Potential	Exploration has identified a potential underground resource of low ash coking coal and thermal coal at depths from 50–450m. A medium size inferred resource has been defined above 300m depth.
Comments	The available data are derived mainly from the Departmental Restricted Area (RA) 55 release of 1993 as RA 281.

MONTO

Basin	Mulgildie
Location	10km south of Monto and 180km by rail from the port of Gladstone
Operator	Macarthur Coal Limited
Tenements	EPC 613; MLA 80101 (lodged April 2002)
Tenement holder	Monto Coal 2 Pty Ltd
Beneficial owners	Macarthur Coal Limited 51% Sanrus Pty Ltd 39.2% Edge Developments Pty Ltd 4.9% H&J Enterprises (Qld) Pty Ltd 4.9%
Geology	Mulgildie Coal Measures of Middle Jurassic age contained in a fault controlled basin. Seven seam groups have been defined with individual seams generally 1–2m thick. Large tonnages of thermal coal exist at depths from 12–150m. Dips are generally less than 3°.
Potential	Design work for an open-cut shovel/truck mining operation and coal preparation plant commenced in 2003. The mine is planned to produce initially around 1Mtpa (saleable) of high volatile, low nitrogen thermal coal for both the domestic and export markets. Product coal will be railed to the Barney Point facility at Gladstone, following upgrade of the existing Monto to Gladstone railway line. Applications for a Mining Lease and Water Licence are being progressed. Immediate development plans were suspended in August 2003 due to unfavourable market conditions.
Comments	Macarthur Coal Limited, through wholly owned subsidiary Monto Coal 2 Pty Ltd, acquired a 51% controlling interest in the project from Burnett Coal in early 2002.

MORAMBAH

Basin	Bowen
Location	10km north-east of Moranbah
Operator	BHP Coal Pty Ltd
Tenements	MDLs 135, 137
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Rangal Coal Measures of Late Permian age
Potential	A small open-cut/underground resource has been identified.

MORANBAH SOUTH

Basin	Bowen
Location	10km south-east of Moranbah, and 10km east of the Blair Athol to Dalrymple Bay railway line; approximate rail distance to Dalrymple Bay would be 220km.
Operator	Kumba Australia Pty Ltd
Tenements	EPCs 548, 602; MDLA 277
Tenement holder	Kumba Australia Pty Ltd
Beneficial owners	Kumba Resources Ltd 100%
Geology	Moranbah Coal Measures of Late Permian age, dipping gently east; the main seam of economic interest in the proposed mine area is the 3m thick Harrow Creek seam, although potential working sections from 3–4.5m thick are present in the P and Harrow Creek seams.
Potential	A medium size resource of medium volatile bituminous coal, which can be washed to a prime coking coal, has been identified. The resource is only amenable to underground extraction. Pre-feasibility studies have been completed.
Comments	The interest formally held by Iscor Australia Pty Ltd was transferred to the present owner in 2001 following a re-structure of Iscor Ltd.

MOUNT FORT COOPER/CARRINYAH

Basin	Bowen
Location	15km north-west of Nebo; about 100km south-west of Mackay
Operator	Mt. Robert Coal Pty Ltd
Tenements	EPCs 658, 689
Tenement holder	Mt. Robert Coal Pty Ltd
Beneficial owners	Mt. Robert Coal Pty Ltd 57% Itochu Coal Resource Australia Pty Ltd 26.6% IBA Coal Investments Pty Ltd 16.4%
Geology	Moranbah and Rangal Coal Measures of Late Permian age, dipping west on the eastern flank of the Hail Creek Syncline
Potential	Exploration work has identified a small resource of PCI coal. Further work is required to determine the economic potential of the resource.
Comments	Mt. Robert Coal Pty Ltd is part of the CAML Group, which holds a major interest in the Foxleigh Mine near Middlemount.

NEBO WEST

Basin	Bowen
Location	20km south-west of Nebo and approximately 120km by rail from the Dalrymple Bay Coal Terminal at Hay Point
Operator	BHP Coal Pty Ltd
Tenements	MDL 235
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Coal occurs in the Moranbah Coal Measures of Late Permian age, dipping at 20–50°. Folding and shearing of the steeper dipping strata is common. Some 30 seams ranging up to 10m in thickness have been identified from exploration, though only three are considered to have economic significance. They are: T40 — 2.5m; T50 — 6.5m; and T63 — 5.2m.
Potential	Conceptual open-cut mine plans have been prepared, although alternative extraction techniques may be considered. Any development would use existing infrastructure at the South Walker Creek Mine.

OLIVE DOWNS

Basin	Bowen
Location	25km south of Coppabella, and 10km east of the main rail line to Dalrymple Bay; approximate rail distance to Dalrymple Bay would be 180km
Operator	Macarthur Coal Limited
Tenements	EPC 649
Tenement holder	Moorvale Coal Pty Ltd/Moorvale Interest Pty Ltd
Beneficial owners	Macarthur Coal Limited 100%
Geology	Rangal Coal Measures of Late Permian age dipping east-south-east at an average 1°. Two main seams — Leichhardt Lower 2 averaging >4.5m and the Vermont Upper averaging >3.5m are present.
Potential	Potential open-cut and underground resources along a strike length of >20km that could produce export quality low to medium volatile coking, PCI and thermal coals.

OWNAVIEW

Basin	Clarence–Moreton
Location	10km north of the railhead at Dalby, which is approximately 180km north-west of Brisbane.
Operator	Ribfield Pty Ltd
Tenements	MDL 283
Tenement holder	Ellrock Pty Ltd
Beneficial owners	Ribfield Pty Ltd 99% Ellrock Pty Ltd 1%
Geology	Walloon Coal Measures of Middle Jurassic age, dipping gently to the south; four coal intervals, which have been tentatively correlated to the Balgowan, Sabine, Acland and Waipanna seam groups in the Acland area to the south-east, are recognised. Only the Acland group has any significant thickness, ranging from 0.9–3.1m, although thicker coal intersections have been made in the central potion of the deposit where the seam combines with plies from the underlying Sabine group.
Potential	A medium size resource of thermal coal amenable to open-cut extraction has been identified.

PEAK DOWNS EAST

Basin	Bowen
Location	30km south-east of Moranbah, and 175km by rail to the port of Hay Point; the deposit area adjoins the Peak Downs mine leases.
Operator	BHP Billiton Mitsubishi Alliance
Tenements	MDL 321
Tenement holder	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Ltd 50% Mitsubishi Development Pty Ltd 50%
Geology	Moranbah Coal Measures of Late Permian age dipping east at relatively shallow angles down dip of the Peak Downs Mine; five coal seams, the R, Q, P, Harrow Creek, and Dysart seams plus splits of the Harrow Creek and Dysart are present. Only the Harrow Creek, Harrow Creek Lower and Dysart seams are of economic interest in the Moranbah Coal Measures. Seams above the Harrow Creek are not considered significant. A small area of Rangal Coal Measures, which may have limited opencut potential, subcrops in the north-east corner of the tenement.
Potential	Exploration has identified a large resource having the potential to produce very low volatile coking coal from an underground mining operation in the Harrow Creek and Dysart seams, down dip of the Peak Downs Mine leases.

PENTLAND

Basin	Galilee
Location	10km south-south-west of Pentland, which is 250km from Townsville
Operator	Xstrata Coal Queensland Pty Ltd
Tenements	EPCs 526 (Lauderdale), 771 (Milray)
Tenement holder	Xstrata Coal Queensland Pty Ltd (earning a right to 50% of EPC 526) / Mount Isa Mines Limited (EPC 771)
Beneficial owners	Xstrata Queensland Limited 100%
Geology	Coal bearing sequence in the Betts Creek beds of Late Permian age dipping gently to the south-south-west beneath varying thicknesses of Cainozoic and Triassic sedimentary cover; up to 7 seams are present with an aggregate coal thickness of 18m.
Potential	Exploration to date has identified a medium-size resource of thermal coal amenable to open-cut extraction. Further exploration and evaluation of the deposit has been proposed. The work is designed to bring the resource estimates up to JORC reporting standard, and to assess the coal quality and washability.
Comments	In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

POITREL

Basin	Bowen
Location	20km south-east of Moranbah, and approximately 170km by rail to the Dalrymple Bay Coal Terminal at the port of Hay Point
Operator	BHP Coal Pty Ltd
Tenements	MLs 4749, 70016 (part)
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Coking and thermal coal resources are contained within seams in the Rangal Coal Measures of Late Permian age, located in a drag syncline on the upthrown eastern side of an extension to the Burton Range Fault. Two coal seams are present: Leichhardt seam — 4–6m of durainous coal and; the Vermont Upper seam — 1–2m of bright coking coal. The latter is underlain by up to 5m of high ash dull coal, which contains the Yarrabee tuff marker.
Potential	Exploration has identified a moderate size resource amenable to open-cut mining, with the potential to produce both coking and thermal coal products.

PLUMTREE

Basin	Bowen
Location	South of Burton mine, about 120km south-west of Mackay
Operator	RAG Australia Coal Pty Ltd
Tenements	ML 70109; EPC497; MDLA 245
Tenement holder	RAG Australia Coal Pty Ltd
Beneficial owners	RAG Australia Coal 95% Thiess Investments Pty Ltd 5%
Geology	Rangal Coal Measures of Late Permian age. Coal occurs in two seams, the Leichhardt and Upper Vermont Seams.
Potential	Extension of **Burton/Ellensfield** resource, based on previously identified indicated resources of thermal and coking coal.

RED HILL

Basin	Bowen
Location	35km north of Moranbah, immediately to the east, and down dip of the Goonyella Mine; rail distance to the port of Hay Point would be approximately 225km.
Operator	BHP Billiton Mitsubishi Alliance
Tenements	EPC554; MDL307
Tenement holder	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Ltd 50% Mitsubishi Development Pty Ltd 50%
Geology	Moranbah Coal Measures of Late Permian age, dipping gently east at 3–5°; principal coal seams of economic interest are: Goonyella Upper, Goonyella Middle and Goonyella Lower seams. Aggregate coal thickness is about 20m.
Potential	A large underground coal resource is contained in the Moranbah Coal Measures between depths of 200–500m down-dip of the Goonyella Mine.

ROLLESTON

Basin	Bowen
Location	100km south-east of Emerald; on completion of the construction of a 110km rail line to Blackwater, the proposed mine will be 420km from the port of Gladstone.
Operator	Xstrata Coal Queensland Pty Ltd
Tenements	ML 70307; MDL 227; EPCs 538, 595, 737
Tenement holder	Mount Isa Mines Limited
Beneficial owners	Xstrata Queensland Limited 100%
Geology	Gently dipping and folded coal bearing sequence in the Bandanna Formation of Late Permian age (equivalent to Rangal Coal Measures); three coal seams of potential economic significance are present: A seam — 3.5m; B seam — 3.1m; D seam — 4.9m.
Potential	Exploration has identified a large resource of high volatile thermal coal suitable for production of a low ash product for the export market. During 2002, the company continued feasibility studies on the deposit and some 250 000t of coal was mined from a sample pit and sold to customers both overseas and in Australia for testing. In March 2003, following the success of the trial pit, MIM announced that it would proceed with the commercial development, with production from the proposed open-cut mine scheduled to begin in the second half of calendar 2004. The production rate is planned to ramp up to 8Mtpa over four years. The very low ash content of Rolleston coal will enable it to be exported raw, eliminating the need for a wash-plant and minimising the water requirement of the operation. The capital cost of the mine is estimated to be A$250 million from initial development to full production over four years, and it is anticipated that about 180 personnel will be employed at the mine when it becomes fully operational.
Comments	In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited. Xstrata announced in July 2003 it will conduct a further review of the project before committing to proceed with the development.

RUGBY

Basin	Bowen
Location	30km south-west of Moranbah, and approximately 210km by rail from the port of Hay Point; the deposit is adjacent to the Blair Athol–Hay Point railway.
Operator	QCOAL Pty Ltd
Tenements	EPC 709
Tenement holder	QCOAL Pty Ltd
Beneficial owners	QCOAL Pty Ltd 100%
Geology	Rugby Coal Measures, which are equivalent to the Collinsville Coal Measures of Early Permian age, dipping gently to the south-east. One coal seam ranging from 2–10m in thickness is present.
Potential	Exploration has identified a medium size resource of coking and thermal coal, at depths greater than 30m. The coal exhibits excellent coking and thermal properties, being ultra low in phosphorus with high energy content and low ash levels. The relatively high sulphur content of 1.7% after washing can be reduced by blending to meet market specifications.
Comments	Recent exploration has increased confidence in the size and quality of the resource, and proven the coking properties of the coal.

RYWUNG

Basin	Surat
Location	15km west of Chinchilla, and 320km by rail from the port of Brisbane
Operator	Chinchilla Coal Pty Ltd for Surat Basin Joint Venture
Tenements	MDL 247
Tenement holder	Chandail Pty Ltd
Beneficial owners	Chandail Pty Ltd 50% Ecarlate Pty Ltd 50%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age, dipping gently to the south-west; three main coal seams are present: B1; B2; and C seams. The average aggregate thickness of these seams is 5.5m.
Potential	A small resource of thermal coal amenable to open-cut extraction has been identified.
Comments	Development of other coal resources and augmentation of rail coal haulage capacity or local power station requirements in the Chinchilla area will influence development plans for the resource.

SEFTON PARK

Basin	Surat
Location	5km south of Chinchilla, and 300km by rail from the port of Brisbane
Operator	Chinchilla Coal Pty Ltd for Surat Basin Joint Venture
Tenements	EPC 562; MDLA 246
Tenement holder	Chandail Pty Ltd
Beneficial owners	Chandail Pty Ltd 50% Ecarlate Pty Ltd 50%
Geology	Upper Walloon Coal Measures (Juandah Coal Member) of Middle Jurassic age, dipping gently to the south-west; three main coal seams present: A — 0.8–4.7m thick; B — 4.1–6m; and C — 0.6–4m.
Potential	A small resource of thermal coal amenable to open-cut extraction has been identified. Feasibility studies to produce 2Mtpa of high volatile thermal coal suitable for both export and domestic markets have been completed.
Comments	Development of other coal resources and augmentation of rail coal haulage capacity or local power station requirements in the Chinchilla area will influence development plans for the resource.

SIRIUS CREEK

Basin	Bowen
Location	40km south of Blackwater
Operator	BHP Billiton Mitsubishi Alliance
Tenements	ML 1771
Tenement holder	BHP Billiton Mitsubishi Alliance
Beneficial owners	BHP Billiton Ltd 50% Mitsubishi Development Pty Ltd 50%
Geology	Rangal Coal Measures of Late Permian age
Potential	Large underground resources occur to the east of, and down-dip of the South Blackwater mine area.
Comments	Formerly on leases held by South Blackwater Coal Ltd, this resource now forms part of, and is inclusive within, the Blackwater mine resource area. This follows the acquisition of QCT Resources Limited by BHP and Mitsubishi in November 2000, and the subsequent integration of mining activities on the Blackwater and South Blackwater mining leases, which was completed by BHP Billiton Mitsubishi Alliance (BMA) during 2002.

SW YARRAMAN

Basin	Tarong
Location	5km south of the Meandu Mine, adjacent to the Tarong Power Station
Operator	Pacific Coal Pty Limited
Tenements	MDL 200
Tenement holder	Queensland Coal Pty Limited
Beneficial owners	Rio Tinto Limited 100%
Geology	Same as for Meandu
Potential	Exploration has identified a small to medium size resource of thermal coal amenable to open-cut extraction.
Comments	The resource represents a potential supplementary coal supply for the Tarong Power Stations, in addition to that from the Meandu Mine.

SPRING MOUNTAIN

Basin	Ipswich
Location	15km south-east of Ipswich
Operator	New Hope Collieries Pty Ltd
Tenements	MDL 148
Tenement holder	New Hope Corporation Limited
Beneficial owners	New Hope Corporation Limited 100%
Geology	Ipswich Coal Measures of Late Triassic age, dipping to the north-east; the deposit consists of two coal seams of potential interest, the Brett and Woods seams. Interburden between the seams ranges from 0.3–13.0m.
Potential	The deposit is based on an identified resource of approximately 100Mt amenable to underground mining methods.

STYX

Basin	Styx
Location	Near Ogmore, which is about 90km north-west of Rockhampton, and about 170km south of Mackay.
Operator	OME Coal Pty Ltd
Tenements	EPC 822A
Tenement holder	OME Coal Pty Ltd
Beneficial owners	OME Coal Pty Ltd 100%
Geology	Styx Coal Measures of Cretaceous age; characterised by thin seams of high volatile bituminous coal
Potential	Previous underground mining has resulted in limited remaining identified resources. New exploration work would be required to identify additional economic resources.

SUTTOR CREEK

Basin	Bowen
Location	14km west of Glenden, and approximately 17km south of the Newlands mine railhead
Operator	Xstrata Coal Queensland Pty Ltd
Tenements	ML 4761; EPC 727
Tenement holder	NCA Joint Venture
Beneficial owners	Xstrata Queensland Limited75% Itochu Corporation 25%
Geology	Faulted sequence containing Rangal, Fort Cooper and Moranbah Coal Measures of Late Permian age; regional dip is to the east at 5–15°. The Leichhardt seam (the only mineable seam) occurs in the Rangal Coal Measures and has economic open-cut resources identified, which are virtually doubled by a north-west trending reverse fault. The Vermont and Girrah seams are also present but are high in inherent ash. Five coal seams — Seams 1 to 5 — containing moderate tonnages of coking coal are present in the underlying Moranbah Coal Measures, but have limited economic potential as they have been partly intruded, and subcrop beneath thick Tertiary basalt.
Potential	A large resource of primarily thermal coal has been identified at depths amenable to open-cut extraction, with some underground potential. Development of this operation is planned as a satellite operation to the Newlands mining operations. The development proposal includes transport of the raw product by haul road to the Newlands washplant.
Comments	In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

TAABINGA

Basin	Tarong
Location	5km south-west of Kingaroy, and 25km north-west of Tarong power station
Operator	None
Tenements	Untenured (formerly EPC 686)
Tenement holder	n/a
Geology	Gently folded Tarong Beds of Late Triassic age, dipping east at less than 5°; two coal seams of possible economic significance are present: A seam ranges up to 15.7m, and the B seam up to 8m in thickness.
Potential	A moderate size resource of thermal coal amenable to open-cut extraction has been identified from previous exploration work.

TAROBORAH

Basin	Bowen
Location	20km west of Emerald, and 400km by rail from the port of Gladstone.
Operator	Department of Natural Resources and Mines
Tenements	Departmental Restricted Area (RA) 290
Tenement holder	Department of Natural Resources and Mines
Geology	Two unnamed coal sequences of Early Permian age contained in a small north trending half graben on the western edge of the Denison Trough; five seams (A to E) are present in the upper sequence, with seams A and B averaging 1.1m and 3m respectively. The second sequence occurs 150m below the upper sequence, and contains up to 8 seams (F to M) ranging from 0.2–2.25m thick, with seam K averaging 1.3m.
Potential	Moderate size resources of thermal coal amenable to both open-cut and underground extraction have been identified.

TAROOM

Basin	Surat
Location	5km south of Taroom, and 90km south-west of a railhead at Theodore, which is 240km by rail from the port of Gladstone.
Operator	Anglo Coal Australia Pty Ltd
Tenements	MDLs 158, 275
Tenement holder	Anglo Coal (Taroom) Pty Ltd, Mitsui Moura Investment Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 51% Mitsui & Co. Moura Investment Pty Ltd 49%
Geology	Thermal coal resources are contained within seams of the Lower Walloon Coal Measures (Taroom Coal Member) of Middle Jurassic age, dipping at 5° to the west. Three coal seams are present: Seam 1 — <1m; Seam 2 — average 5m; Seam 3 — 2–3m.
Potential	Mining feasibility studies to produce up to 4Mtpa of saleable coal from an open pit operation have been completed. The deposit incorporates an adjacent area previously referred to as Boxvale.
Comments	In July 2002, Mitsui & Co. Ltd acquired a 49% interest in the project from Anglo Coal Australia, as part of an exchange in equity ownership of other coal projects in Australia.

THEODORE

Basin	Bowen
Location	The deposit is adjacent to and north of the town of Theodore, which is 240km by rail from the port of Gladstone.
Operator	Anglo Coal Australia Pty Ltd
Tenements	ML 5657 (part)
Tenement holder	Theodore Coal (Assets) Pty Ltd, Mitsui Moura Investment Pty Ltd
Beneficial owners	Anglo Coal Australia Pty Ltd 51% Mitsui Moura Investment Pty Ltd 49%
Geology	Baralaba Coal Measures of Late Permian age dipping west at 13–19°. Twelve coal seams (Seam X and Seams 1 to 11) have been recognised for correlation purposes. Seam thicknesses range from 1–6m with an average cumulative coal thickness in the measures of 17m. Despite the relatively high dips there appears to have been little structural deformation of the coal measures over a 30km strike length. A major west-north-west trending fault of unknown displacement is located just north of the town of Theodore, where the Dawson River cuts across the coal measures. Another major fault having a similar strike occurs 5km further north. Displacements of up to 45m have been recorded on this fault.
Potential	Mining feasibility studies to produce 3Mtpa of saleable coal from an open pit operation have been completed, as part of a staged development, south of the Moura mine, of the Theodore and Dawson deposits. Mining of the Theodore deposit is planned to commence towards the end of 2003.
Comments	In July 2002, Mitsui & Co. Ltd acquired a 49% interest in the project from Anglo Coal Australia, as part of an exchange in equity ownership of other coal projects in Australia.

TOGARA NORTH

Basin	Bowen
Location	40km south of Comet, which is about 330km by rail from the port of Gladstone.
Operator	Togara North Joint Venture
Tenements	EPC 550; MLA 70149; MDLAs 316, 317
Tenement holder	Enex Togara Pty Ltd (and others)
Beneficial owners	Xstrata Coal Australia Pty Ltd 33.33% Mitsui Mining 33.33% Hyosung Corporation 8.33% SK Corporation 8.33% Korea Resources Corporation 8.33% Dongbu Corporation 8.33%
Geology	Coal occurs in Rangal Coal Measures of Late Permian age, dipping gently at approximately 2° to the south-west. Four coal seams, which are variable in distribution and thicknesses due to seam splitting, are present: Aries, Castor, Pollux and Orion seams. The Pollux seam is the only continuous seam, with a typical seam thickness generally exceeding 3m and up to 7m in two local areas. Thick Cainozoic basalt overlies much of the area.
Potential	A large resource of thermal coal has been identified. However, the thick basalt cover, particularly in the south, will restrict development of the coal resources to mainly underground mining, although a small resource of coal amenable to open-cut mining has been identified in the central part of the deposit. Preliminary feasibility studies for a $350 million, 6Mtpa underground longwall mining operation the have been completed.
Comments	In February 2002, Swiss-based commodities group Xstrata Plc purchased the share previously held by Glencore International AG through Enex Togara Pty Ltd. In June 2002, a native title agreement was reached between the mining company, the local peoples, and the Gurang Land Council, paving the way for the project to proceed. Development is now pending further environmental and feasibility studies, and the grant of a mining lease.

TOGARA SOUTH

Basin	Bowen
Location	60km south-west of Blackwater, which is 300km from the port of Gladstone.
Operator	Coal Mines Australia Limited
Tenements	MDL 340
Tenement holder	Coal Mines Australia Limited
Beneficial owners	BHP Billiton Ltd 100%
Geology	Coal occurs in the Rangal Coal Measures of Late Permian age, dipping gently to the south-west. The only seam of economic interest is the Pollux seam (4m) or composite Castor–Pollux (7m).
Potential	Exploration has delineated a large resource of thermal coal with high calorific medium-high volatile matter, low ash and very low sulphur content, extractable by underground mining methods. The potential integration of this resource with the adjacent Blackwater operations managed by BMA is being investigated.
Comments	Coal Mines Australia Limited is a wholly owned subsidiary of BHP Billiton Ltd.

VALERIA

Basin	Bowen
Location	30km south-west of Capella and 15km west of the Emerald to Capella railway, and approximately 420km from the port of Gladstone
Operator	Pacific Coal Pty Limited
Tenements	MDL 219
Tenement holder	Blair Athol Coal Joint Venture
Beneficial owners	Rio Tinto Limited 71.238% UniSuper Limited 15.394% EPDC (Australia) Pty Ltd 9.9513% JCD Australia Pty Ltd 3.4167%
Geology	Coal occurs in the Aldebaran Sandstone and the Reids Dome beds of Early Permian age. Up to 11 coal seams have been identified, though only the upper 4 in the Aldebaran Sandstone, the Rider, the Theresa, and the Carbine Upper and Lower seams have any commercial significance in the foreseeable future. Average thickness of these seams are: 0.9m, 5.5m, 3.2m, and 1.5m respectively. Dips range from 2–15° to the east. The coal is amenable to open-cut mining in some areas.
Potential	Exploration has identified a large resource of thermal coal amenable to open-cut extraction.
Comments	The Valeria and Clermont deposits are possible replacements for Blair Athol coal when resources there are exhausted.

VERMONT (formerly Lake Vermont)

Basin	Bowen
Location	25km north-east of Dysart and approximately 20km from the railway line at Saraji; distance to the port of Dalrymple Bay would be approximately 220km.
Operator	Bowen Basin Coal Pty Ltd
Tenements	MDL 303, EPC 549
Tenement holder	Bowen Basin Coal Pty Ltd
Beneficial owners	Queensland Coal Mine Management Pty Ltd 70% AMCI Metal & Kohle AG 10% Marubeni Coal Pty Ltd 10% Winning Pty Ltd 10%
Geology	Rangal Coal Measures of Late Permian age, dipping to the north-east at shallow angles. Two coal seams of economic interest are present: Leichhardt seam — 2.9m average thickness; and Vermont seam — 5.8m. The latter splits gradually down dip into two (and in some areas three) splits, to form the Vermont Upper and Vermont Lower (or Vermont Lower 1 and Vermont Lower 2) seams. The area is structurally disturbed, being cut by north-west trending reverse faults, which appear to be a continuation of the Isaac and Burton Range fault systems, as well as normal faults to produce repeated and interrupted seam subcrops, particularly east of the Isaacs Fault.
Potential	Extensive exploration has been completed, resulting in the identification of a medium sized resource of thermal coal, partially amenable to open-pit extraction. A low ash, medium volatile bituminous coal, which includes a coking fraction, can be produced after beneficiation.
Comments	Drilling and pre-feasibility studies are continuing.

WANDOAN DEPOSITS

Basin	Surat
Location	Wandoan area, some 60km north of Miles, and approximately 400km north-west of Brisbane; a possible 200km rail link to join the Moura to Gladstone railway is being evaluated. Total rail distance to the port of Gladstone would be 385km.
Operator	Xstrata Coal Queensland Pty Ltd
Tenements	MDLs 221 to 224; EPCs 787 to 792; EPCA 838
Tenement holder	Xstrata Coal Queensland Pty Ltd
Beneficial owners	Xstrata Queensland Limited 100%
Geology	The Wandoan project comprises several shallow deposits within the Middle Jurassic Upper Walloon Coal Measures (Juandah Coal Member), spread over an area extending from 30km north-west to 20km south-east of the township of Wandoan. The deposits include **Austinvale, Woleebee, Frank Creek, Summer Hill, Turkey Hill** and **Mud Creek** to the north-west of Wandoan, and **Wubagul, Burunga, Stanley Park,** and **Glen Laurel** to the south-east. Each of these deposits contains a number of seams, with aggregate seam thicknesses up to 10m being typical. All of the deposits are relatively flat-lying with a low regional dip to the south and west.
Potential	Exploration of the various deposits has identified a combined very large resource of thermal coal amenable to open-cut extraction. Several feasibility studies have been completed for an open-cut mine to supply raw coal for a domestic power station. The current focus is to determine the viability of an export coal mine utilising the Gladstone port. The coal will require washing. Xstrata's EPC holdings in the Wandoan area also incorporate several other smaller but less explored deposits (including **Glen Arden, Pony Plains, Two-Up, Orazabah**, and **Culgowie**), which occur at greater distances from the identified resources. Further assessment of these deposits by Xstrata is planned as part of the on-going evaluation of the Wandoan area.
Comments	In June 2003, MIM shareholders approved a scheme of arrangement by which Swiss-based commodities group Xstrata Plc acquired the assets of MIM Holdings Limited.

WARDS WELL

Basin	Bowen
Location	50km north of Moranbah, and 10km north of rail facilities at the North Goonyella Mine, which is 215 rail km to the Dalrymple Bay Coal Terminal at Hay Point.
Operator	BHP Coal Pty Ltd
Tenements	ML 1790
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Coking coal occurs in five coal seams, numbered 1 to 5 in descending order, in the Moranbah Coal Measures of Late Permian age dipping east at 6–9°. Only seams 2, 4 and 5 are of economic interest and can be equated to the Goonyella Upper, Goonyella Middle and Goonyella Lower seams respectively. Thick Tertiary basalt in the area precludes surface mining of the seams.
Potential	The deposit has potential to support a high productivity longwall mining operation and may ultimately replace production from Riverside mine at up to 6Mtpa.

WINCHESTER

Basin	Bowen
Location	25km south-east of Moranbah
Operator	BHP Coal Pty Ltd
Tenements	ML 1791
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Rangal Coal Measures of Late Permian age; the deposit is a southern extension of the Poitrel deposit.
Potential	Winchester is one of four satellite deposits associated with the Poitrel deposit, to be developed sequentially after Poitrel.

WINCHESTER SOUTH

Basin	Bowen
Location	30km south-east of Moranbah and 180km by rail from the port of Dalrymple Bay.
Operator	Winchester South Development Co. Pty Ltd
Tenements	MDL 183
Tenement holder	Winchester South Joint Venture
Beneficial owners	Rio Tinto Limited 75% Westfield Limited 25%
Geology	Rangal Coal Measures of Late Permian age crop out in a shallow synclinal structure associated with north-north-west trending thrust faults. Two coal seams are present: Leichhardt — 4.3m, and the Vermont Upper — 1.6m.
Potential	Exploration has identified a small to medium size resource of thermal coal amenable to open-cut extraction.
Comments	Feasibility studies to produce up to 4Mtpa of low sulphur, high energy thermal coal have been completed.

WONBINDI (also called "Baralaba")

Basin	Bowen
Location	Extending north and south from town of Baralaba, which is 160km by rail to the port of Gladstone.
Operator	Mt. Robert Coal Pty Ltd
Tenements	EPC 674 and EPC 742
Tenement holder	Mt. Robert Coal Pty Ltd
Beneficial owners	Mt. Robert Coal Pty Ltd 57% Itochu Coal Resource Australia Pty Ltd 26.6% IBA Coal Investments Pty Ltd 16.4%
Geology	Resources occur in the Baralaba Coal Measures of Late Permian age. Dips are variable and are controlled by a series of plunging synclinal folds, which are generally separated by thrust faulting.
Potential	Small to moderate size shallow resources of thermal coal have been identified at three locations: Northern, Central, and Southern areas. Further work is required to determine the economic potential of these resources, the development of which may be influenced by future plans to develop the separate Baralaba coal deposit, located adjacent to the town of Baralaba, and associated infrastructure.
Comments	Mt. Robert Coal Pty Ltd is part of the CAML Group, which holds a major interest in the Foxleigh Mine near Middlemount.

WOTONGA

Basin	Bowen
Location	20km south-east of Moranbah
Operator	BHP Coal Pty Ltd
Tenements	MDL 137
Tenement holder	BHP Mitsui Coal Pty Ltd
Beneficial owners	BHP Billiton Ltd 80% Mitsui & Co Ltd 20%
Geology	Rangal Coal Measures of Late Permian age
Potential	Wotonga is one of four satellite deposits associated with the Poitrel deposit and could be developed sequentially after Poitrel. It could alternatively be developed as a small truck/shovel mine in conjunction with the nearby Morambah deposit.

PHYSICAL AND CHEMICAL PROPERTIES OF QUEENSLAND COALS — SUMMARY TABLES

Coal quality data from all the operating mines and many of the deposits included in the previous section have been made available to the Department of Natural Resources and Mines over a period of several years, and updated from time to time. The objective in compiling and presenting these data is to provide, as complete as possible, an information guide for potential purchasers of Queensland coal consistent with marketing information produced by the operating companies. Potential purchasers are advised to contact the marketing divisions of the operating companies for more detailed information and product specifications for their individual requirements.

Appendix B presents the full set of coal quality data for each mine and deposit. The information presented includes a comprehensive range of physical and chemical properties, most of which are discussed in the section *Evaluation of Coals* in relation to their influence on coal utilisation.

Tables 16, 17 and **18** include summary information[3], on a product type basis, of the most important physical and chemical properties for the coal products available from all the producing coal mines in Queensland. **Table 16** includes the properties for the coking coal products, **Table 17** includes a group of low volatile coals produced primarily for the PCI market, and **Table 18** lists the key properties of the thermal coals produced for both the export and domestic markets.

The data in Appendix B pertaining to undeveloped coal deposits are largely interpreted from available analyses from exploration drill cores and/or trial pit samples, and should be considered as indicative only.

Evaluation of the **conversion potential** of Queensland coals (in particular coals from the Surat and Moreton Basins) for oil and gas production is not covered in this publication. The reader is referred to the booklet *Survey of Australian Black Coals of Conversion Potential* published by the Queensland Coal Board and the Joint Coal Board in 1976 and revised in 1981.

3 For key to operating companies see Appendix B

Table 16. Summary of coking coals produced in Queensland

PROJECT	OPERATOR	BRAND NAME	Total Moisture (% as)	Moisture (% ad)	Ash (% ad)	Volatile Matter (% ad)	Fixed Carbon (% ad)	Gross Specific Energy (MJ/kg, ad)	Total Sulphur (% ad)	Phosphorus (% db)	Grindability (HGI)
BLACKWATER	BMA	B'water Coking	10	2	8	27	63	32.0	0.5	0.06	70
BLACKWATER	BMA	B'water Weak	9.5	2	9.5	25.5	63	31.2	0.5	0.07	68
BURTON	RAG	Burton Premium	10	1.5	8.3	22.9	67.3	32.7	0.4	0.06	85
BURTON	RAG	Burton Standard	10	1.5	8.5	22.6	67.4	32.2	0.45	0.06	80–85
COLLINSVILLE	XST	Collinsville	8	1.5	9.5	26	63		0.9	0.03	70
COOK	CRM	Coking	9	1.4	6	27.5	64.1	32.8	0.35	0.055	74
CURRAGH	CQM	Coking	9.5	1.5	7	21.5	70		0.5	0.05	78
ENSHAM	ENS	Semi-soft	9.5	3.5	9.5	29	58	30.2	0.55	0.07	60
GERMAN CREEK	ANG	German Creek	11	2	9	19.5	69.5	32.3	0.7	0.07	90
GERMAN CK EAST	ANG	German Creek	10	2	9.5	20	68.5	31.8	0.5	0.06	80
GOONYELLA	BMA	Goonyella	10	1	8.9	23.8	66.3	32.5	0.52	0.02	90
GREGORY -CRINUM	BMA	Gregory Coking	8.5	2	6.5	33.5	58	32.4	0.6	0.032	55
GREGORY -CRINUM	BMA	Gregory UHV	8	2	9	32.5	56.5	31.6	0.6	0.03	57
HAIL CREEK	PAC	Hail Creek	10.0	1.0	8.5	20.4	70.1	32.9	0.35	0.063	90
HAIL CREEK	PAC	Brumby	9.5	1.0	11.0	20.2	67.8	31.6	0.31	0.07	83
JELLINBAH EAST	QCM	Semi- soft	8	1.5	9.5	15.5	73.5	32.0	0.65	0.06	85
KESTREL	PAC	Kestrel	8.0	2.0	6.5	33.5	58.0	32.5	0.70	0.025	58
MOORVALE	APC	Coking	9	1.4	8	16.8	73.8	32.7	0.3	0.05	83
MORANBAH NORTH	ANG	Moranbah North	10	1.5	8.5	25	65	32.5	0.6	0.04	80
MOURA	ANG	K/coal	10.5	2.5	8.3	32	57.2	31.0	0.42	0.02	53
MOURA	ANG	Moura	10.5	2	6.8	26.5	64.7	32.6	0.5	0.03	70
NORTH GOONYELLA	RAG	North Goonyella	9	1.5	8.5	22.7	67.3	33.0	0.6	0.05	88
NORWICH PARK	BMA	Norwich Pk Coking	10	1	9.9	17.8	71.3	32.3	0.65	0.04	95
NORWICH PARK	BMA	Norwich Pk ULV	10	1	11.3	16.8	70.9	31.7	0.65	0.06	90
OAKY CREEK	XST	Oaky Creek	10	1.2	9	27	62.8	32.5	0.7	0.06	77
OAKY CREEK	XST	Oaky North	10	1.2	9	24	65.8	32.8	0.6	0.05	94
PEAK DOWNS	BMA	Peak Downs	9.5	1	9.7	20.5	68.8	32.5	0.6	0.035	90
RIVERSIDE	BMC	Riverside	10	1.1	9.8	22	67.1	32.3	0.55	0.007	85
SARAJI	BMA	Saraji	10	1	9.7	19	70.3	32.4	0.62	0.03	95

Table 17. Summary of low volatile PCI coals produced in Queensland

PROJECT	OPERATOR	BRAND NAME	Total Moisture (% as)	Moisture (% ad)	Ash (% ad)	Volatile Matter (% ad)	Fixed Carbon (% ad)	Gross Specific Energy (MJ/kg, ad)	Gross Specific Energy (kCal/kg, ad)	Total Sulphur (% ad)	Grindability (HGI)
COPPABELLA	APC	PCI	9	1.2	8.5	12	78.3	32.5	7750	0.5	80
FOXLEIGH	FOX	PCI	9	1.5	7	12.5	79	33.1	7900	0.5	77
JELLINBAH EAST	QCM	Semi-Anthracite	8	1.5	10	14.5	74	31.6	7550	0.65	80–85
MOORVALE	APC	PCI	9	1.4	8.5	16.6	73.5	32.2	7700	0.3	82
SOUTH WALKER CREEK	BMC	PCI	9	1.1	8.5	13.7	76.7	32.6	7775	0.45	84
YARRABEE	YAR	MPA	8.5	1.5	10.5	10.5	77.5	31.0	7400	0.65	70
YARRABEE	YAR	MPB	8.5	1.5	14.5	10.5	73.5	29.1	6960	0.65	80

Vitrinite (% by volume)	Liptinite (% by volume)	Semi-inertinite	Mean max Vitrinite Reflectance ($R_{v,max}$)	Crucible Swelling Number (CSN)	Gray-King coke type	Gieseler Maximum Fluidity (dd/min)	Maximum dilatation (%)	Coke strength after reaction (CSR)	BRAND NAME	PROJECT
55	2	30	1.03	6	G1	400	10	35	B'water Coking	BLACKWATER
45	1	40	1.02	3.5		50	-15		B'water Weak	BLACKWATER
53	0.1	23	1.2	7 to 8	G4–G7	300(min)	40	65	Burton Premium	BURTON
47.3	0.2	25	1.18	6 (min)	G1–G3	>70	2	55–60	Burton Standard	BURTON
56	3	36	1.1	6		1200	72	59.4	Collinsville	COLLINSVILLE
60	2	18	1.1	7.5		1500	80		Coking	COOK
55	1	29	1.27	7.5		150	10		Coking	CURRAGH
70	2.2		0.85	3.0– 7.0	E–G	85	-19		Semi-soft	ENSHAM
70.3	0.1	23	1.51	8.5	G6	250	39		German Creek	GERMAN CREEK
32		60	1.33	2		1			German Creek	GERMAN CK EAST
60	1	25	1.17	8	G6	1100	90	68	Goonyella	GOONYELLA
76	3	9	0.92	9	G8	7500	125	60	Gregory Coking	GREGORY -CRINUM
72	3	11	0.92	8		3000	90		Gregory UHV	GREGORY -CRINUM
52.9			1.33	8	G5	230	20	68	Hail Creek	HAIL CREEK
42.7			1.29	5 to 6	G4	160	5	56.5	Brumby	HAIL CREEK
50		41.5	1.72	2.0–3.0		1			Semi-soft	JELLINBAH EAST
75	4	10	0.93	9	G9	>10000	145		Kestrel	KESTREL
52.3			1.49	4					Coking	MOORVALE
59.3	1.7		1.15	8	G4	2500	120		Moranbah North	MORANBAH NORTH
62	3	27	0.8	6	G2	100	-10		K/coal	MOURA
62	1	33	1.03	7.5	G6	700	60		Moura	MOURA
60	0.1	20	1.24	8–9	G7–G9	900	>100	68–70	North Goonyella	NORTH GOONYELLA
71	0	16	1.63	9	G6	100	55	67	Norwich Pk. Coking	NORWICH PARK
71	0	15	1.65	8.5		20	20		Norwich Pk. ULV	NORWICH PARK
75	2	17	1.1	8	G9	>5000	240	57.4	Oaky Creek	OAKY CREEK
79	2	13	1.3	9	G9	>2000	180	69	Oaky North	OAKY CREEK
68	0	18	1.4	8.5	G7	350	80	74	Peak Downs	PEAK DOWNS
58	1	24	1.2	7.5	G5	500	65	72	Riverside	RIVERSIDE
70	0	19	1.55	8.5	G7	200	75	74	Saraji	SARAJI

Phosphorus (% db)	Ultimate Analysis Carbon (% daf)	Ultimate Analysis Hydrogen (% daf)	Ash Fusion Temp. (Reducing Atmosphere) Deformation (°C)	Ash Fusion Temp. (Reducing Atmosphere) Sphere (°C)	Ash Fusion Temp. (Reducing Atmosphere) Hemisphere (°C)	Ash Fusion Temp. (Reducing Atmosphere) Flow (°C)	Mean max Vitrinite Reflectance ($R_{v,max}$)	Crucible Swelling Number (CSN)	BRAND NAME	PROJECT
	90.5	4.1	1450	1540	1550	1570	1.9	1	PCI	COPPABELLA
0.07	91	4.1	1360	1480	1510	1580	1.95	0.5–1.0	PCI	FOXLEIGH
	89.5	4.7	1250	1500	>1600	>1600			Semi-Anthracite	JELLINBAH EAST
0.08	89.6	4.3							PCI	MOORVALE
0.08	90.6	4.2	1440	1480	1500	1520	1.85	1	PCI	SOUTH WALKER CREEK
0.08	90.76	3.76	1200		1300	1400	2.59		MPA	YARRABEE
0.08	90.76	3.76	1200		1300	1400	2.59		MPB	YARRABEE

Table 18. Summary of thermal coals produced in Queensland

PROJECT	OPERATOR	BRAND NAME	Total Moisture (% as)	Moisture (% ad)	Ash (% ad)	Volatile Matter (% ad)	Fixed Carbon (% ad)	Gross Specific Energy (MJ/kg, ad)	Gross Specific Energy (kCal/kg, ad)	Total Sulphur (% ad)	Grindability (HGI)	Abrasion Index (mg/kg)
BLACKWATER	BMA	B'water Thermal	8	2	15	24	59	29.3	7000	0.65	70	
BLAIR ATHOL	PAC	Blair Athol	18.0	5.5	8.7	27.6	58.2	28.3	6760	0.36	60	14
BURTON	RAG	Thermal	9	1.5	14	20	64.5	29.5	7045	0.5	75	
CALLIDE	ANG	Southern	15.5	10.9	18.9	23.7	46.5	20.8	4975	0.26	85	7
CALLIDE	ANG	Boundary Hill	19	11.7	14.4	25.3	48.6	22.2	5305	0.33	89	3
COLLINSVILLE	XST	Collinsville	6	1.3	20	19.5	59.2	27.6	6600	0.82	82	15
COMMODORE	MPP	Raw Coal		8.31	34.8	33.1	23.8	18.2	4350	0.42	41	
COMMODORE	MPP	Fls @ 1.60		4.9	15.9	42.1	37.1	26.8	6410	0.53	30	
COMMODORE	MPP	Fls @ 1.80		4.6	19.8	40.2	35.3	25.3	6040			
COOK	CRM	Thermal	8.5	1.6	12.5	24	61.4	30.1	7190	0.32	70	
COPPABELLA	APC	Thermal	9	1.2	15	11.5	72.3	29.3	7000	0.6		
CURRAGH	CQM	Thermal		1.7	16	18.6	63.7	25.6	6120	0.5	75	
ENSHAM	ENS	Ensham	11.5	4	11	26.5	58.5	29.3	7000	0.6	57	
ENSHAM	ENS	Ensham Tops	11.5	4	13	25.5	57.5	28.1	6700	0.6	57	
GREGORY -CRINUM	BMA	Lilyvale	8	2	13	30.5	54.5	29.6	7070	0.65	52	
JEEBROPILLY	NHC	Tivoli	10	5	13	40	42	28.1	6700	0.65	40	12
KESTREL	PAC	Kestrel	6.0	2.0	13.0	31.0	54.0	29.9	7150	0.75	55	
MEANDU	PAC	Washed	12.0	5.5	30.1	27.0	37.4	21.1	5030	0.29	53	
MOORVALE	APC	Thermal	9	1.5	15	15.4	68.1	29.6	7080	0.3	77	
MOURA	ANG	Moura	10.5	2.5	10.9	30.5	56.1	30.1	7200	0.5	53	
NEW ACLAND	NHC	Washed		3.7	13	40.8	42.5	28.9	6900	0.48	40	
NEW OAKLEIGH	NHC	Oakleigh	10	5.7	14	39	41.3	27.7	6600	0.48	36–45	
NEWLANDS	XST	Newlands	8.3	2.3	14.5	26.3	56.9	28.5	6800	0.5	53	13
SOUTH WALKER CK	BMC	Sth Walker	8.8	1.2	13.5	13.7	71.6	30.0	7175	0.55	84	
WILKIE CREEK	PWC	Domestic	12	8	14	40	38	25.8	6190	0.39	35	15
WILKIE CREEK	PWC	Surat Premium	12	7.5	11.5	41.5	39.5	26.8	6400	0.37	35	15
YARRABEE	YAR	MPA	8.5	1.5	10.5	10.5	77.5	31.0	7400	0.65	70	
YARRABEE	YAR	MPB	8.5	1.5	14.5	10.5	73.5	29.1	6960	0.65	80	

Ultimate Analysis Carbon (% daf)	Ultimate Analysis Hydrogen (% daf)	Ultimate Analysis Nitrogen (% daf)	Ash Fusion Temp. (Reducing Atmosphere) Deformation (°C)	Ash Fusion Temp. (Reducing Atmosphere) Sphere (°C)	Ash Fusion Temp. (Reducing Atmosphere) Hemisphere (°C)	Ash Fusion Temp. (Reducing Atmosphere) Flow (°C)	Mean max Vitrinite Reflectance ($R_{v,max}$)	Crucible Swelling Number (CSN)	BRAND NAME	PROJECT
86.5	5	2	1200	1250	1300	1400			B'water Thermal	BLACKWATER
82.4	4.6	1.90	1550		1570	1580	0.69	0.5	Blair Athol	BLAIR ATHOL
88.4	4.72	1.64	1570	>1600	>1600	>1600	1.24	1	Thermal	BURTON
78.1	3.9	1.1	1334	1517	1543	1570	0.53	0	Southern	CALLIDE
76.8	3.8	1.2	1270	1390	1440	1500	0.49	0	Boundary Hill	CALLIDE
85.6	4.7	1.9	1410	1500	>1600	>1600		1.5	Collinsville	COLLINSVILLE
								0.5	Raw Coal	COMMODORE
79	6.6	1.2	1590		>1600	>1600		1	Fls @ 1.60	COMMODORE
									Fls @ 1.80	COMMODORE
86.9	4.8	2	1250	1350	1370	1450	1.1		Thermal	COOK
90.5	4.1	1.6							Thermal	COPPABELLA
88.3	4.7	1.7	1175		1300	1360		1.5	Thermal	CURRAGH
84.8	4.9	1.9	1350	1400	1500	>1600	0.81	0.0–1.0	Ensham	ENSHAM
84.2	5	1.9	1350	1400	1500	>1600	0.81	0.0–1.0	Ensham Tops	ENSHAM
84.5	5.4	2.1	1500	>1550	>1550	>1550			Lilyvale	GREGORY -CRINUM
80.2	6	1.5	1300	>1600	>1600	>1600	0.57	1	Tivoli	JEEBROPILLY
85.0	5.7	2.17	>1600	>1600	>1600	>1600	0.92	7	Kestrel	KESTREL
80.5	5.3	1.50	1485		>1600	>1600		1	Washed	MEANDU
89.4	4.4	1.7	1380	1450	1470	1520			Thermal	MOORVALE
84.5	5.7	1.9	1250	1380	1420	1440			Moura	MOURA
81.3	6.2	1.2	1572	>1600	>1600	>1600	0.53		Washed	NEW ACLAND
80	6.5	1.5	1320	>1600	>1600	>1600	0.54	1.5	Oakleigh	NEW OAKLEIGH
85.1	5	1.8	1300	1360	1400	1600	1.02		Newlands	NEWLANDS
90.1	4.1	1.6	1345	1400	1415	1440			Sth Walker	SOUTH WALKER CREEK
81.8	6.7	1.1	1500	>1600	>1600	>1600	0.4		Domestic	WILKIE CREEK
78.3	6	1.1	1320	1550	1570	>1600	0.4		Surat Premium	WILKIE CREEK
90.76	3.76	1.85	1200		1300	1400	2.59		MPA	YARRABEE
90.76	3.76	1.85	1200		1300	1400	2.59		MPB	YARRABEE

Appendix A
Queensland Coal Resource Inventory

The Department of Natural Resources and Mines has compiled estimates of the identified coal resources for each operating mine or deposit from available company information. The estimates presented here are on a raw coal *in situ* basis, with no allowance made for potential losses from mining or beneficiation, and are either classified as JORC or provisional estimates. For those operating coal mines where JORC compliant estimates were not available, tonnage estimates have been reduced by subtracting raw coal mined up to 30 June 2002. Only resources classified as Measured or Indicated category, as defined under either the JORC or the alternative guidelines, are included. Estimates of Inferred coal resources, which would add significantly to the total coal inventory tonnage, are not included in these figures.

Operator/Owner Codes:

ANG	Anglo Coal Australia Pty Ltd
APC	Australian Premium Coals Pty Ltd
AQL	Aquila Resources Limited
BAR	Baralaba Coal Pty. Ltd.
BHP	BHP Billiton Ltd
BMA	BHP Billiton Mitsubishi Alliance
BMC	BHP Mitsui Coal Pty Ltd
CHA	Chandail Pty Ltd
CQM	Curragh Queensland Mining Pty Ltd
CRM	Cook Resource Mining Pty Ltd
CSE	CS Energy Pty Ltd
CUB	Cuba Mining Pty Ltd
EBN	Ebenezer Mining Company Pty Ltd
ENS	Ensham Resources Pty Limited
FOX	Foxleigh Mining Pty Ltd
HKP	Hancock Prospecting Pty Ltd
KUM	Kumba Australia Pty Ltd
MCL	Macarthur Coal Limited
MEG	Megajoule Mining Pty Ltd
MIL	Millennium Coal Pty Ltd
MPP	Millmerran Power Partners
MRC	Mt. Robert Coal Pty Ltd
NHC	New Hope Corporation Limited
NPE	Newmont Pacific Energy Pty Ltd
NRM	Department of Natural Resources and Mines
OME	OME Coal Pty Ltd
PAC	Pacific Coal Pty Limited
PWC	Peabody (Wilkie Creek) Pty Ltd
QCM	Queensland Coal Mine Management Pty Ltd
QCO	QCOAL Pty Ltd
RAG	RAG Australia Coal Pty Ltd
RIB	Ribfield Pty Ltd
SUR	Surat Coal NL
SYN	Syntech Resources Pty Ltd
TAR	Tarong Energy Corporation Limited
TCN	Taroom Coal NL
UNT	Untenured
WAL	Christopher Wallin
XCA	Xstrata Coal Australia Pty Ltd
XCQ	Xstrata Coal Queensland Pty Ltd
YAR	Yarrabee Coal Company Pty Ltd

Key to qualifiers:

%	open-cut/underground split estimated
$	includes coking coal component
^	includes thermal coal component
#	includes unspecified tonnage amenable to surface mining
&	thermal coal component includes PCI utilisation

Reporting Codes:

J	Publicly reported Resources (inclusive of Reserves) under JORC Code
R	Recoverable Reserves tonnage added to Measured Resource tonnage
X	Marketable Reserves tonnage added to Measured Resource tonnage
P	Provisional estimate (not stated as JORC compliant)
P(d)	Provisional estimate reduced by depletion based on raw coal production
M	Measured Resources
I	Indicated Resources

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Alpha	Galilee	Permian	Deposit	EPC 570	HKP	TH	OC/ UG					525	140	530		1195		P		
Baralaba (Dawson Valley)	Bowen	Permian	Deposit	MLs; MDL 184	BAR	TH	OC/ UG					12	2	65	54	133	&	P		
Bathurst Range	Laura	Mesozoic	Deposit	Untenured	UNT	CO	UG				47					47		P		Ex EPC 463
Bee Creek	Bowen	Permian	Deposit	ML 4751	BMC	TH	OC						55			55		J	Jun-03	
BLACKWATER	Bowen	Permian	Mine-Operating	MLs 1759 1762 1800 & others	BMA	CO	OC	227	147							374	^	J	Jun-03	does not incl. Sth. Blackwater
BLAIR ATHOL	Bowen	Permian	Mine-Operating	MLs 1804 1881	PAC	TH	OC					95	3			98		JR	Dec-02	2002 RioTinto Ann Report
Bluff	Bowen	Permian	Deposit	EPC729	WAL	TH	UG								12	12		P		inferred resources >100Mt
BOUNDARY HILL	Callide	Mesozoic	Mine-Operating	MLs	ANG	TH	OC					340	257			597		J	Dec-02	includes Kilburnie
Bremer View East	Moreton	Mesozoic	Deposit	EPC 424	EBN	TH	OC						108			108		P		
Bremer View West	Moreton	Mesozoic	Deposit	EPC 424	EBN	TH	OC						23			23		P		
Bringalily North*	Moreton	Mesozoic	Deposit	MDL 300	MPP	TH	OC						41			41		P		
Bringalily South*	Moreton	Mesozoic	Deposit	EPC 467	NPE	TH	OC						83			83		P		
Broadmeadow	Bowen	Permian	Deposit	ML 70252; MDLs 167 308	RAG	CO/ TH	OC	12				8				20		P		includes Wallanbah
BURTON	Bowen	Permian	Mine-Operating	ML70109; MDL315; EPCs 647 857 497	RAG	CO/ TH	OC/ UG	35		54	75					164	^	P		includes Kerlong & Plumtree
Bymount	Surat	Mesozoic	Deposit	Untenured	UNT	TH	OC						22			22		P		
CALLIDE	Callide	Mesozoic	Mine-Operating	MLs	ANG	TH	OC					225	148			373		J	Dec-02	
Callide - other	Callide	Mesozoic	Deposit	EPC 188	ANG	TH	OC/ UG													206Mt UG, 229Mt OC inferred
Cameby Downs	Surat	Mesozoic	Deposit	EPC 732	SYN	TH	OC						57			57		P		
Clermont	Bowen	Permian	Deposit	ML 1884 1904	PAC	TH	OC					197				197		JR	Dec-02	2002 RioTinto Ann Report
Codrilla	Bowen	Permian	Deposit	EPC 676	MCL	TH	OC/ UG					42	3		15	59		P	Dec-02	

* The northern and southern portions of the Bringalily deposit are held by different owners.

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Collingwood	Surat	Mesozoic	Deposit	EPC 640	RIB	TH	OC					86	31			117		P		
COLLINSVILLE	Bowen	Permian	Mine-Operating	MLs	XCQ	CO/TH	OC/UG	18	9	13	29	45	5		77	196		J	Dec-02	includes Pipeline
COMMODORE	Moreton	Mesozoic	Mine-Operating	ML 50151; MDL301	MPP	TH	OC					175				175		P(d)	Dec-02	
COOK	Bowen	Permian	Mine-Operating	MLs 1768-69 1779 1799 7357	CRM	CO	UG				59					59	^	J		Centennial Coal 2002Ann Rep
COPPABELLA	Bowen	Permian	Mine-Operating	EPCs 531 646; MLs 70161 70163-64 70236-37	APC	TH	OC/UG					69	36	74	48	227	&	J	Jun-02	2001/02 MCL Ann Report
CRINUM	Bowen	Permian	Mine-Operating	ML 1923	BMA															included with Gregory
Culgowie	Surat	Mesozoic	Deposit	EPC 787	XCQ	TH	OC						9			9		P		
CURRAGH	Bowen	Permian	Mine-Operating	MLs 1878 1990; MDLs 328 329	CQM	CO/TH	OC/UG	21		13		41		13		88		P(d)		includes Curragh West
Curragh East	Bowen	Permian	Deposit	ML 80086	CQM	CO/TH	OC/UG	20		17		27		18		82		P		
Curragh North	Bowen	Permian	Deposit	MDL 162	CQM	TH	OC/UG					40			100	140		P		
Curragh Nth (Pisces)	Bowen	Permian	Deposit	MDL 162 306	CQM	TH	OC/UG						20		415	435		P		
Daunia	Bowen	Permian	Deposit	MLs 1781 70115	BMA	CO	OC	75	24							99	^	J	Jun-03	
Dawson	Bowen	Permian	Deposit	MDL 216; ML 5657(pt)	ANG	TH	OC/UG					66	6	377	205	654		P	Dec-02	
EBENEZER	Moreton	Mesozoic	Mine-Closed	ML 4712; MDL 150	EBN	TH	OC					11	10			21		P(d)		mining ceased Dec 2002
Elimatta	Surat	Mesozoic	Deposit	EPC 650	TCN	TH	OC						115			115		P		
ENSHAM	Bowen	Permian	Mine-Operating	MLs 7459-60 70049; MDLs 217 218	ENS	TH	OC/UG					62	55	330	1030	1477	$	P(d)		
Felton	Moreton	Mesozoic	Deposit	EPC 485	NPE	TH	OC					610	373			983		P		Felton East & West deposits
FOXLEIGH	Bowen	Permian	Mine-Operating	ML 70171; EPC 617	FOX	TH	OC					74			28	102	&	P	Jun-03	includes Foxleigh East
Foxleigh South	Bowen	Permian	Deposit	EPC 692	FOX	TH	OC					14			71	85		P	Jun-03	

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Gattonvale	Bowen	Permian	Deposit	EPC 610	MEG	TH	OC/ UG						3		6	9		P		
GERMAN CREEK	Bowen	Permian	Mine-Operating	MLs 1831 1894 70047	ANG	CO	OC/ UG	4	4	202	38					248		J	Dec-02	includes Grasstree
GERMAN CREEK EAST	Bowen	Permian	Mine-Operating	ML 1998; MDL 331	ANG	CO	OC	37	26							63		J	Dec-02	includes Oak Park
Glen Arden	Surat	Mesozoic	Deposit	EPC 789	XCQ	TH	OC						35			35		P		
Glen Wilga	Surat	Mesozoic	Deposit	EPCs 468 700	TAR	TH	OC					132	30			162		J	Aug-02	
GOONYELLA	Bowen	Permian	Mine-Operating	MLs 1763 70038	BMA	CO	OC/ UG	599	245		587					1431		J	Jun-03	includes Broad-meadow UG mine
GREGORY-CRINUM	Bowen	Permian	Mine-Operating	MLs 1789 1923 70061	BMA	CO	OC/ UG	17	6	70	66					159	^	J	Jun-03	
Grosvenor	Bowen	Permian	Deposit	EPC 552; MDLs 273 166(pt)	ANG	CO	OC/ UG		20	205	110					335		J	Dec-02	northern UG area only
Guluguba	Surat	Mesozoic	Deposit	MDL 187	SUR	TH	OC						33			33		P		
HAIL CREEK	Bowen	Permian	Mine-Operating	ML 4738	PAC	CO	OC/ UG	430			540					970	%	JR	Dec-02	2002 RioTinto Ann Report
Haystack Road	Surat	Mesozoic	Deposit	EPCs 585	TAR	TH	OC						172			172		P		
Hillalong	Bowen	Permian	Deposit	MDL 324	CUB	TH	OC/ UG					10	1	11	41	63		P	Jun-03	Ex EPC600
Horse Creek	Surat	Mesozoic	Deposit	MDL 173	PWC	TH	OC						295			295		P	2003	
Ipswich (other)	Ipswich	Mesozoic	Deposit	MLs		TH	OC/ UG					1	3	400	52	456		P		various ownership
JEEBROPILLY	Moreton	Mesozoic	Mine-Operating	MLs; MDLs 157 171	NHC	TH	OC					3				3		P	2003	
JELLINBAH EAST	Bowen	Permian	Mine-Operating	MLs; MDL 185; EPC 730	QCM	TH	OC/ UG					71	30	65	30	196	$ &	P(d)		
Kemmis-Walker	Bowen	Permian	Deposit	ML 4750	BMC															included with South Walker Ck mine
KESTREL	Bowen	Permian	Mine-Operating	ML 1978; MDLs 176 182	PAC	CO	UG			158						158	^	JR	Dec-02	2002 RioTinto Ann Report
Kevin's Corner	Galilee	Permian	Deposit	MDLA333	HKP	TH	OC					280	630			910		P		
Kogan Creek	Surat	Mesozoic	Deposit	ML 50074 MDL 335	CSE	TH	OC					310	120			430		P		

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Kunioon	Tarong	Mesozoic	Deposit	MDL 201	PAC	TH	OC					471	213			684		JR	Dec-02	2002 RioTinto Ann Report
Lake Elphinstone	Bowen	Permian	Deposit	ML 4738	PAC	TH	OC/ UG													part of Hail Creek resource
Lake Lindsay	Bowen	Permian	Deposit	MDL 170	ANG	CO/ TH	OC/ UG	33	14	8	23	12	15	1	10	116		P	Dec-02	formerly Girrah
Lancewood	Bowen	Permian	Deposit	ML 4752	BMC	CO	UG				112					112		J	Jun-03	
Liskeard	Bowen	Permian	Deposit	ML 7007; MDL 133	BMA	CO	OC	6								6		J	Jun-03	Gregory mine extension
Lochbar	Moreton	Mesozoic	Deposit	EPC 467	NPE	TH	OC					29	13			42		P		adjacent to Commodore mine
Mavis Downs	Bowen	Permian	Deposit	MDL 136	BMC	TH	OC					18	6			24		J	Jun-03	
MEANDU	Tarong	Mesozoic	Mine-Operating	ML 6674	PAC	TH	OC					405	64			469		JR	Dec-02	2002 RioTinto Ann Report
Middlemount	Bowen	Permian	Deposit	MDL 282	RIB	CO/ TH	OC/ UG	4	3	5	4	19		95	29	159		P		
Millennium	Bowen	Permian	Deposit	EPCs 728 765 784	MIL	CO/ TH	OC/ UG	15			25	4			5	48	&	P		
Minerva	Bowen	Permian	Deposit	EPC 553; MDL 232; ML 70145	NHC	TH	OC/ UG					28			500	528		P	2003	
Monto	Mulgildie	Mesozoic	Deposit	EPC 613	MCL	TH	OC					56	66			122		P	Jun-02	
MOORVALE	Bowen	Permian	Mine-Operating	EPCs 646 649 680; MLs 70290-91	APC	TH	OC					37	8			44	$ &	J	Jun-02	2001/02 MCL Ann Report
Morambah	Bowen	Permian	Deposit	MDLs 135 137	BMC	TH	OC						9			9		J	Jun-03	
MORANBAH NORTH	Bowen	Permian	Mine-Operating	ML 70108; MDL 166(pt)	ANG	CO	UG			166	95					261		J	Dec-02	
Moranbah South	Bowen	Permian	Deposit	EPCs 548 602	KUM	CO	UG				465					465		P		estimated to 420m depth
Mount Mort	Moreton	Mesozoic	Deposit	EPC 424	EBN	TH	OC					20				20		P		
MOURA	Bowen	Permian	Mine-Operating	MLs; EPCs 520 578	ANG	CO/ TH	OC	33	25			51	120			228		J	Dec-02	OC and highwall mining only
Moura West	Bowen	Permian	Deposit	EPC 783	AQL	CO	UG				557					557		P		old data — no recent work
Mt Fort Cooper/Carinyah	Bowen	Permian	Deposit	EPCs 658 689.	MRC	TH	OC						70			70	&	P	Jun-03	

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Nebo West	Bowen	Permian	Deposit	MDL 235	BMC	TH	OC						178			178		J	Jun-03	
NEW ACLAND	Moreton	Mesozoic	Mine-Operating	MDL 244; ML50170	NHC	TH	OC					242	271			513		P	2003	commenced production Aug 2002
NEW OAKLEIGH	Moreton	Mesozoic	Mine-Operating	MLs; MDLs 53 54; EPC 642	NHC	TH	OC					16	5			21		P	2003	
NEWLANDS	Bowen	Permian	Mine-Operating	MLs; EPCs 588 734	XCQ	TH	OC/UG	6	0			95	5	122	184	413		J	Jun-02	includes Suttor Creek
NORTH GOONYELLA	Bowen	Permian	Mine-Operating	ML 6949	RAG	CO	OC/UG	21		154						175		P		incl. resources in BMA overlap area
NORWICH PARK	Bowen	Permian	Mine-Operating	MLs 1782(pt) 70127; EPC 626	BMA	CO	OC/UG	82	6	173	162					423		J	Jun-03	
OAKY CREEK	Bowen	Permian	Mine-Operating	MLs 1832 2004 70241; MDL 163	XCQ	CO	OC/UG	9	13	160	106					288		J	Jun-02	
Olive Downs	Bowen	Permian	Deposit	EPC 649	MCL	TH	OC/UG					15	19		268	302	$	P	Jun-02	
Orazabah	Surat	Mesozoic	Deposit	EPC 788	XCQ	TH	OC						45			45		P		
Ownaview	Moreton	Mesozoic	Deposit	MDL 283	RIB	TH	OC						113			113		P		
PEAK DOWNS	Bowen	Permian	Mine-Operating	MLs 1775(pt) 1783 1885 70142(pt)	BMA	CO	OC/UG	905	272		345					1522		J	Jun-03	
Peak Downs East	Bowen	Permian	Deposit	MDL 321	BMA	CO	UG				668					668		J	Jun-03	
Pentland	Galilee	Permian	Deposit	EPCs 526 771	XCQ	TH	OC						103			103		P		est. *in situ* tonnage at <6:1 ratio
PIPELINE	Bowen	Permian	Mine-Operating	ML 10250	XCQ	CO/TH	OC													included in Collinsville data
Poitrel	Bowen	Permian	Deposit	MLs 4749 70016(pt)	BMC	TH	OC					77	4			81	$	J	Jun-03	
Pony Plains	Surat	Mesozoic	Deposit	EPC 791	XCQ	TH	OC						55			55		P		
Red Hill	Bowen	Permian	Deposit	EPC 554; MDL 307	BMA	CO	UG			90	406					496		J	Jun-03	
RIVERSIDE	Bowen	Permian	Mine-Operating	MLs 1764 1802 1900 70121	BMC	CO	OC	11	2							13		J	Jun-03	part of Goonyella mine operations
Rolleston	Bowen	Permian	Deposit	ML 70307; MDL 227; EPCs 538 595 737	XCQ	TH	OC					201	58			259		J	Dec-02	
Rosewood	Moreton	Mesozoic	Mine-Operating	MDLs 53, 54	NHC	TH	OC					10	5			15		P	2003	part of New Oakleigh mine

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Rugby	Bowen	Permian	Deposit	EPC 709	QCO	TH	UG								180	180	$ #	P		
Rywung	Surat	Mesozoic	Deposit	MDL247	CHA	TH	OC					30	45			75		P		
Sabine	Moreton	Mesozoic	Deposit	MDL 244	NHC	TH	OC						72			72		P	2001	New Acland area
SARAJI	Bowen	Permian	Mine-Operating	MLs 1775(pt) 1782(pt) 1784 70142(pt) 70294 70298	BMA	CO	OC/UG	351	142	9	146					648		J	Jun-03	
Sefton Park	Surat	Mesozoic	Deposit	EPC 562	CHA	TH	OC					25	5			30		P		
Sirius Creek	Bowen	Permian	Deposit	ML 1771	BMA															included with South Blackwater
Smithfield	Moreton	Mesozoic	Mine-Operating	MDL 171	NHC	TH	OC						13			13		P	2003	part of Jeebropilly Collieries
SOUTH BLACKWATER	Bowen	Permian	Mine-Operating	MLs; MDLs 155 189	BMA	CO	OC/UG	97	89		344					530	^	J	Jun-03	includes Sirius Creek
SOUTH WALKER CK	Bowen	Permian	Mine-Operating	MLs 4750 70131	BMC	TH	OC/UG					100	125		73	298	&	J	Jun-03	includes Kemmis-Walker deposit
Spring Mountain	Ipswich	Mesozoic	Deposit	MDL 148	NHC	TH	UG							77	32	109		P	2001	
Styx	Styx	Mesozoic	Deposit	EPCA 822	OME	TH	UG							4		4		P		
Suttor Creek	Bowen	Permian	Deposit	ML 4761; EPC 727	XCQ	TH	OC									0				included in Newlands data
SW Yarraman	Tarong	Mesozoic	Deposit	MDL 200	PAC	TH	OC					67	37			104		JR	Dec-02	2002 RioTinto Annual Report; previously reported with Kunioon
SWANBANK	Ipswich	Mesozoic	Mine - Closed	MLs	NHC	TH	OC/UG									0			2003	mining ceased July 2003
Taabinga	Tarong	Mesozoic	Deposit	Untenured	UNT	TH	OC					80	47			127		P		Ex EPC 686
Taroborah	Bowen	Permian	Deposit	RA290	NRM	TH	OC/UG						70		87	157		P		
Taroom	Surat	Mesozoic	Deposit	MDLs 158 275	ANG	TH	OC					126	57			183		P	Dec-02	
Thagoona	Moreton	Mesozoic	Mine-Operating	MDL 157	NHC	TH	OC					4				4		P	2003	part of Jeebropilly Collieries
Theodore	Bowen	Permian	Deposit	ML 5657(pt)	ANG	TH	OC					94	16			110		J	Dec-02	north of the Dawson River only
Togara North	Bowen	Permian	Deposit	EPC 550	XCA	TH	UG								770	770	#	P		

MINE/Deposit	Basin	Age	Status	Title	Operator	Coal Type	Deposit Type	Coking				Thermal				Total	Qualifier	Reporting	Report Date	Comments
								Opencut		U/ground		Opencut		U/ground						
								M	I	M	I	M	I	M	I					
Togarah South	Bowen	Permian	Deposit	MDL 340	BHP	TH	UG							317	639	956		J	Jun-03	
Two Up	Surat	Mesozoic	Deposit	EPC 788	XCQ	TH	OC						85			85		P		
Valeria	Bowen	Permian	Deposit	MDL 219	PAC	TH	OC					334	100			434		JR	Dec-02	2002 RioTinto Ann Report
Vermont	Bowen	Permian	Deposit	MDL 303; EPC 549	QCM	TH	OC/ UG					80		195		275	$	P		
Wandoan**	Surat	Mesozoic	Deposit	MDLs 221-224; EPC 787-792	XCQ	TH	OC					784	1109			1893		P	Jun-00	
Wards Well	Bowen	Permian	Deposit	ML 1790	BMC	CO	UG			331	289					620		J	Jun-03	
WILKIE CREEK	Surat	Mesozoic	Mine-Operating	ML5908; MDL174; EPC 770	PWC	TH	OC					265	120			385		P	2003	
Winchester	Bowen	Permian	Deposit	ML 1791	BMC	TH	OC						16			16		J	Jun-03	
Winchester South	Bowen	Permian	Deposit	MDL 183	PAC	TH	OC					90				90		J	Dec-02	2002 RioTinto Ann Report
Wonbindi (Baralaba)	Bowen	Permian	Deposit	EPCs 674 742.	MRC	TH	OC					29				29		P	Jun-03	Dawson Valley deposits
Wotonga	Bowen	Permian	Deposit	MDL 137	BMC	TH	OC						6			6		J	Jun-03	
YARRABEE	Bowen	Permian	Mine-Operating	MLs; MDL160; EPCs 621 717	YAR	TH	OC					12	17			29	&	J	Mar-03	
TOTAL TONNAGE								**3068**	**1046**	**1828**	**5298**	**7494**	**6339**	**2695**	**4961**	**32729**				

** Wandoan project includes Austinvale, Frank Creek, Woleebee, Glen Laurel, Stanley Park, Turkey Hill, Summer Hill, Mud Creek, Burunga and Wubagul deposits

Appendix B

Physical and Chemical Properties of Queensland Coals

The Department of Natural Resources and Mines has compiled coal quality data from the operating mines and many of the identified coal deposits within Queensland. The information presented here includes a comprehensive range of physical and chemical properties, most of which are discussed in the section *Evaluation of Coals* in relation to their influence on coal utilisation.

The objective in compiling and presenting these data is to provide, as completely as possible, an information guide for potential purchasers of Queensland coal consistent with marketing information produced by the operating companies. Summaries of these data for the operating mines are presented in Tables 16, 17 and 18 of this publication, categorised on a product type basis.

The product data presented here are not necessarily the only coal products available from a particular mine. Potential purchasers are advised to contact the marketing divisions of the operating companies for more detailed information and product specifications for their individual requirements.

The data in the appendix pertaining to undeveloped coal deposits are largely interpreted from available analyses from exploration drill cores and/or trial pit samples, and should be considered as indicative only.

Operator/Owner Codes:

ANG	Anglo Coal Australia Pty Ltd
APC	Australian Premium Coals Pty Ltd
BAR	Baralaba Coal Pty. Ltd.
BHP	BHP Billiton Ltd
BMA	BHP Billiton Mitsubishi Alliance
BMC	BHP Mitsui Coal Pty Ltd
CHA	Chandail Pty Ltd
CQM	Curragh Queensland Mining Pty Ltd
CRM	Cook Resource Mining Pty Ltd
CSE	CS Energy Pty Ltd
CUB	Cuba Mining Pty Ltd
EBN	Ebenezer Mining Company Pty Ltd
ENS	Ensham Resources Pty Limited
FOX	Foxleigh Mining Pty Ltd
HKP	Hancock Prospecting Pty Ltd
KUM	Kumba Australia Pty Ltd
MCL	Macarthur Coal Limited
MEG	Megajoule Mining Pty Ltd
MIL	Millennium Coal Pty Ltd
MPP	Millmerran Power Partners
MRC	Mt. Robert Coal Pty Ltd
NHC	New Hope Corporation Limited
NPE	Newmont Pacific Energy Pty Ltd
NRM	Department of Natural Resources and Mines
PAC	Pacific Coal Pty Limited
PWC	Peabody (Wilkie Creek) Pty Ltd
QCM	Queensland Coal Mine Management Pty Ltd
QCO	QCOAL Pty Ltd
RAG	RAG Australia Coal Pty Ltd
RIB	Ribfield Pty Ltd
TAR	Tarong Energy Corporation Limited
TCN	Taroom Coal NL
XCA	Xstrata Coal Australia Pty Ltd
XCQ	Xstrata Coal Queensland Pty Ltd
YAR	Yarrabee Coal Company Pty Ltd

COLLIERY / DEPOSIT	ALPHA			BARALABA (DAWSON VALLEY)		BEE CREEK	BLACKWATER			BLAIR ATHOL	BURTON			CALLIDE	
BASIN	Galilee			Bowen		Bowen	Bowen			Bowen	Bowen			Callide	
OPERATOR / OWNER	HKP			BAR		BMC	BMA			PAC	RAG			ANG	
PROJECT STATUS	Deposit			Deposit		Deposit	Mine - Operating			Mine - Operating	Mine - Operating			Mine - Operating	
BRAND NAME	Seam B	Seam C	Seam D	Low Vol PCI	Thermal	Bee Creek	B'water Coking	B'water Weak	B'water Thermal	Blair Athol	Burton Premium	Standard	Thermal	Southern	Boundary Hill
MARKET							Export	Export	Export/ Dom	Export/ Dom	Export	Export	Export	Domestic	Domestic
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Coking (weak)	Thermal	Thermal	Coking	Coking	Thermal	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)															
Moisture	7.6	8.5	8.8	1.5	1.5	1.6	2	2	2	5.5	1.5	1.5	1.5	10.9	11.7
Ash	11.3	7.3	7.2	10.5	16.5	11.5	8	9.5	15	8.7	8.3	8.5	14	18.9	14.4
Volatile Matter	33.8	35.8	33.6	11.4	11.8	13.5	27	25.5	24	27.6	22.9	22.6	20	23.7	25.3
Fixed Carbon	47.3	48.4	50.4	76.6	70.2	73.4	63	63	59	58.2	67.3	67.4	64.5	46.5	48.6
TOTAL MOISTURE (% as)				9.0	9.0		10	9.5	8	18.0	10	10	9	15.5	19
EQUILIBRIUM MOISTURE (% as)														13.6	16
SPECIFIC ENERGY															
Gross (MJ/kg, ad)	26.4	27.6	28.5	31.8	29.5	31.2	32.0	31.2	29.3	28.3	32.7	32.2	29.5	20.8	22.2
Gross (MJ/kg, daf)	32.5	32.8	34.0	36.1	26.0	35.9	35.5	35.3	35.3	33.1	36.25	35.78	34.91	30.1	29.4
Gross (kCal/kg, ad)	6300	6600	6810	7600	7050	7450	7635	7455	7000	6760	7810	7691	7046	4975	5305
ULTIMATE ANALYSIS (% daf)															
Carbon			79.8	90.9	90.9	89.4	87.2	87.5	86.5	82.4	89.1	89.1	88.4	78.1	76.8
Hydrogen			5.1	4.3	4.3	4.3	5	4.9	5	4.6	4.96	4.93	4.72	3.9	3.8
Nitrogen			1.8	1.78	1.78	1.7	2.1	2	2	1.90	1.81	1.72	1.64	1.1	1.2
Sulphur			0.5	0.68	0.68	0.5	0.6	0.6	0.85	0.40	0.44	0.5	0.59	0.2	0.4
Oxygen			12.8	2.34	2.34	4.1	5.1	5	5.65	10.70	3.69	3.75	4.65	16.7	17.9
Total				100	100				100						
SULPHUR (% ad)															
Pyritic				0.09	0.09		0.11	0.16		0.09	0.13	0.15		0.17	0.2
Sulphate				0.19	0.19		0.02	0.01		0.01	0.02	0.02		0.01	0.04
Organic				0.32	0.32		0.37	0.33		0.21	0.25	0.28		0.08	0.09
Total				0.6	0.6	0.65	0.5	0.5	0.65	0.36	0.4	0.45	0.5	0.26	0.33
RELATIVE DENSITY (ad)	1.5	1.5	1.5	1.5	1.5					1.4	1.35	1.35	1.4	1.5	1.4
HARDGROVE GRINDABILITY INDEX	51	46	48	80	78	95	70	68	70	60	85	80–85	75	85	89
ABRASION INDEX (mg/kg)				24	24					14				7	3
ASH FUSION TEMPERATURE Reducing atmosphere (°C)															
Deformation	1480	1380	1350	1250	1250	1400	1230	1320	1200	1550	1570	1550	1570	1334	1270
Sphere	1340			-	-		1340	1430	1250		>1600	>1600	>1600	1517	1390
Hemisphere	1550	1510	1510	1360	1360	1570	1380	1450	1300	1570	>1600	>1600	>1600	1543	1440
Flow	1570	1530	1560	1390	1390	>1600	1440	1490	1400	1580	>1600	>1600	>1600	1570	1500
PETROGRAPHIC ANALYSIS															
Vitrinite (% by volume)				58	58	51	55	45		29	53	47.3	25.3	23.7	30.9
Liptinite (% by volume)				0	0	0	2	1		3	0.1	0.2	0.2	1.1	3.8
Inertinite (% by volume)				34	34	46	39	49		66	43.7	49	69.8	68.4	55.5
Coke (% by volume)				0	0						78	77			
Mineral (% by volume)				8	8	3	4	5		2	3.6	3.5	4.7	6.8	9.8
Mean max Vitrinite Reflectance ($R_{V,max}$)						1.76	1.03	1.02		0.69	1.2	1.18		0.53	0.49
Semi-inertinite (low reflecting inertinite)				29	29	35	30	40		53	23	25	35	39.5	48.8

COLLIERY / DEPOSIT	ALPHA			BARALABA (DAWSON VALLEY)		BEE CREEK	BLACKWATER			BLAIR ATHOL	BURTON			CALLIDE	
BRAND NAME	Seam B	Seam C	Seam D	Baralaba Low Vol PCI	Baralaba Thermal	Bee Creek	B'water Coking	B'water Weak	B'water Thermal	Blair Athol	Burton Premium	Standard	Thermal	Southern	Boundary Hill
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Coking (weak)	Thermal	Thermal	Coking	Coking	Thermal	Thermal	Thermal
ANALYSIS OF ASH (%)															
SiO_2	78.9	62.5	46.9	51.05	51.05	69.5	51	52	53	61.3	50.1	49.2	50.9	43.53	38.1
Al_2O_3	14.5	25.3	34	24.47	24.47	21.5	27	27	25	30.2	37.2	36.7	33.0	32.19	33.8
Fe_2O_3	2.12	7.1	13.2	8.7	8.7	2.91	12.5	9	9.4	4.2	3.9	4.3	5.1	16.49	15.55
TiO_2	0.56	1.46	1.64	1.66	1.66	0.84	1.3	1.3	1.2	1.58	1.34	1.37	0.83	1.65	1.29
Mn_3O_4	<0.01	0.12	0.16	0.15	0.15	0.04	0.2	0.1	0.2	0.1	0.05	0.05	0.07	1.25	0.3
CaO	1.32	1.41	1.88	5.06	5.06	1.86	3	3.2	3.5	0.54	2.29	2.67	3.42	0.78	2.83
MgO	0.88	0.47	0.54	1.25	1.25	0.55	1.2	1.2	1.4	0.5	0.73	0.82	0.87	0.28	2.02
Na_2O	0.76	0.89	0.74	0.38	0.38	0.24	0.3	0.4	0.4	0.21	0.35	0.46	0.30	0.13	0.25
K_2O	0.29	0.21	0.17	3.63	3.63	0.35	1.7	1.4	2.2	0.3	0.85	0.9	0.81	0.3	0.1
P_2O_5	<0.01	0.05	0.08	2.17	2.17	0.48	1.6	1.5	1.8	0.24	1.54	1.6	1.26	0.26	0.92
SO_3	0.47	0.49	0.7	1.4	1.4	1.68	0.8	0.9	1.7	0.15	0.44	0.78	1.56	1.33	2.52
Loss on ignition or undetermined	0.18			0.3	0.3	0.05				0.68	1.235	1.15	1.89	1.81	2.32
Total	100	100	100.01	100	100	100				100	99	100	100	100	100
MINOR CONSTITUENTS (db)															
Phosphorus (%)	0.007			0.08	0.08	0.07	0.06	0.07		0.01	0.06	0.06		0.02	0.059
Chlorine (%)		0.04	0.04	0.06	0.06	0.08			0.05	0.01		0.05	0.076	0.02	0.025
Fluorine (%)				50	50					0.006		0.014	0.014		0.025
Arsenic (ug/g)		1.4	1	2	2					2.5	n/a	n/a	n/a	2	2.54
Boron (ug/g)				21	21					20	17	13	13		49
Cadmium (ug/g)	0.07	<0.100		0.05	0.05					0.02		0.041	0.041		0.059
Mercury (ug/g)		0.014	<0.050	-	-					0.02		0.082	0.082		0.025
CAKING & COKING PROPERTIES															
Crucible swelling number (CSN)						0.5	6	3.5		0.5	7 to 8	6 min	1	0	0
Gray-King coke type							G1				G4–G7	G1–G3			A
Roga index											73	70			
GIESELER PLASTOMETER VALUES															
Initial Softening Temperature (ºC)						434	415	425			415	415			
Maximum Fluidity (dd/min)						5	400	50			300min	>70			
Maximum fluidity temperature (ºC)						446	455	455			460	460			
Resolidification temperature (ºC)						457	485	480			465	490			
Temp. range soften to resolidification (ºC)						23	70	55			50	75			
DILATOMETER VALUES															
Initial softening temperature (ºC)							390	400			395	395			
Temperature of max. contraction (ºC)							435	450			435	445			
Temperature of max. dilatation (ºC)							470	455			465	460			
Maximum contraction (%)							21	20			20	18			
Maximum dilatation (%)							10	-15			40	2			
COKE PROPERTIES															
Micum M_{40} index							76				80.5	78			
Micum M_{10} index							8.5				7.5	8.7			
IRSID I_{20} index							74				76.5	74			
IRSID I_{10} index							25				21.5	24			
ASTM coke strength - stability factor							55				65	60			
ASTM coke strength - hardness factor							64				70	66			
Coke reactivity index (CRI)							44				25	30–35			
Coke strength after reaction (CSR)							35				65	55–60			

COLLIERY / DEPOSIT	CLERMONT	COLLING-WOOD	COLLINSVILLE		COMMODORE			COOK		COPPABELLA		CULGOWIE	CULLIN-LA-RINGO
BASIN	Bowen	Surat	Bowen		Clarence–Moreton			Bowen		Bowen		Surat	Bowen
OPERATOR / OWNER	PAC	RIB	XCQ		MPP			CRM		APC		XCQ	NRM
PROJECT STATUS	Deposit	Deposit	Mine - Operating		Mine - Operating			Mine - Operating		Mine - Operating		Deposit	Deposit
BRAND NAME	Clermont	Collingwood	Collinsville	Collinsville	Raw Coal	Fls @ 1.60	Fls @ 1.80	Coking	Thermal	PCI	Thermal	Washed	Fls @ 1.60
MARKET			Export/Dom	Export	Domestic	Domestic	Domestic	Export	Export	Export	Export		
TYPE	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Coking	Thermal	PCI	Thermal	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)													
Moisture	6.0	11	1.3	1.5	8.31	4.9	4.6	1.4	1.6	1.2	1.2	8.2	3.7
Ash	10.0	17	20	9.5	34.8	15.9	19.8	6	12.5	8.5	15	14.6	6.5
Volatile Matter	27.6	38.2	19.5	26	33.1	42.1	40.2	27.5	24	12	11.5	41.3	31.8
Fixed Carbon	56.4	33.8	59.2	63	23.8	37.1	35.3	64.1	61.4	78.3	72.3	35.1	58
TOTAL MOISTURE (% as)	14.5		6	8				9	8.5	9	9		
EQUILIBRIUM MOISTURE (% as)													
SPECIFIC ENERGY													
Gross (MJ/kg, ad)	28.2	23.8	27.6		18.2	26.8	25.3	32.8	30.1	32.5	29.3	24.7	30.2
Gross (MJ/kg, daf)	33.3	33.1	34.8		31.5	33.9	33.5	35.8	35.3	35.9	35.0	32.0	33.6
Gross (kCal/kg, ad)	6740	5680	6600		4350	6410	6040	7830	7190	7750	7000	5900	7210
ULTIMATE ANALYSIS (% daf)													
Carbon	83.1	76.6	85.6	87.5		79		87.9	86.9	90.5	90.5	77	82.4
Hydrogen	4.9	6.1	4.7	5.2		6.6		5	4.8	4.1	4.1	6.1	5.3
Nitrogen	1.80	1.1	1.9	1.7		1.2		2.1	2	1.6	1.6	1.2	2.2
Sulphur	0.40	0.5	0.8	0.8		0.7		0.4	0.4	0.5	0.8	0.4	0.5
Oxygen	9.80	15.2	7	4.8		12.5		4.6	5.9	3.3	3.0	15.3	9.7
Total		100						100					
SULPHUR (% ad)													
Pyritic	0.08		0.52	0.4		0.04							
Sulphate	0.01		0.09	0.1		0.01							
Organic	0.24		0.21	0.4		0.48							
Total	0.33	0.4	0.82	0.9	0.42	0.53		0.35	0.32	0.5	0.6	0.29	0.4
RELATIVE DENSITY (ad)	1.4	1.4	1.4	1.3	1.6								
HARDGROVE GRINDABILITY INDEX	56	42	82	70	41	30		74	70	80			44
ABRASION INDEX (mg/kg)			15										
ASH FUSION TEMPERATURE Reducing atmosphere (°C)													
Deformation	1540	1380	1410	1490		1590			1250	1450		1337	1220
Sphere	1580	1600	1500						1350	1540		1429	1350
Hemisphere	1590	1440	>1600	1570		>1600			1370	1550		1444	1380
Flow	1600	1470	>1600	1600		>1600			1450	1570		1480	1420
PETROGRAPHIC ANALYSIS													
Vitrinite (% by volume)	35.5			56				60	34				
Liptinite (% by volume)	4			3				2	3				
Inertinite (% by volume)	55.5			38				35	57				
Coke (% by volume)								0	0				
Mineral (% by volume)	5			3				3	6				
Mean max Vitrinite Reflectance ($R_{V,max}$)	0.74			1.1				1.1	1.1	1.9			0.83
Semi-inertinite (low reflecting inertinite)				36				18	45				

COLLIERY / DEPOSIT	CLERMONT	COLLING-WOOD	COLLINSVILLE		COMMODORE			COOK		COPPABELLA		CULGOWIE	CULLIN-LA-RINGO
BRAND NAME	Clermont	Collingwood	Collinsville	Collinsville	Raw Coal	Fls @ 1.60	Fls @ 1.80	Coking	Thermal	PCI	Thermal	Washed	Fls @ 1.60
TYPE	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Coking	Thermal	PCI	Thermal	Thermal	Thermal
ANALYSIS OF ASH (%)													
SiO_2	60.2	54.1	53.1	58	55	58.1		52.9	51.5	43.6		47	54.3
Al_2O_3	32.2	28.2	36.6	31.1	34.2	30.6		24.9	26.9	38		29	25.8
Fe_2O_3	2.79	2.97	2.6	6.2	3.3	3.1		8.8	7.89	5.36		4.5	4.3
TiO_2	1.89	1.16	1.5	1.45	1.73	2.4		1.2	1.23	1.86		1.4	1.17
Mn_3O_4	0.02	0.02	0.01	0.03	0.05	0.1		0.1	0.1	0.09		0.06	
CaO	0.57	6.72	0.8	0.8	2.8	2.1		4.8	6.71	4.32		8.5	5.1
MgO	0.51	0.84	0.4	0.4	0.7	0.8		1.3	1.4	0.81		1.95	2.4
Na_2O	0.22	0.91	0.2	0.15	0.25	0.5		0.5	0.23	0.51			0.5
K_2O	0.59	0.91	0.3	0.25	0.45	0.5		0.9	1.12	1.54		0.68	0.46
P_2O_5	0.53	0.06	1.3	0.6	0.08	0.1		1.3	1.32	2.15		0.48	1.67
SO_3	0.17	3.55	0.3	0.8	0.93	0.8		1.2	1.04	1.08		4.31	3.02
Loss on ignition or undetermined	0.31	0.57		0.22	0.51	0.9		2.1	0.56	0.68			
Total	100	100		100	100	100		100	100	100			
MINOR CONSTITUENTS (db)													
Phosphorus (%)	0.018	0.004	0.11	0.03	0.01	0.07		0.055	0.08				
Chlorine (%)	<0.010	0.04	0.03	0.03	0.04	0.03		0.01	0.04			0.03	
Fluorine (%)	0.002	40	130		40	30							52
Arsenic (ug/g)	1.7	1	1.1	3		2		0.21	0.1				1
Boron (ug/g)	74		7		49								
Cadmium (ug/g)	0.015	0.004	0.06		0.01	0.07							0.01
Mercury (ug/g)	0.017	0.01	0.05			0.02							0.01
CAKING & COKING PROPERTIES													
Crucible swelling number (CSN)	0		1.5	6	0.5	1		7.5		1			1
Gray-King coke type													
Roga index			25					77					
GIESELER PLASTOMETER VALUES													
Initial Softening Temperature (ºC)				400				405					
Maximum Fluidity (dd/min)				1200				1500					
Maximum fluidity temperature (ºC)				455				455					
Resolidification temperature (ºC)				495				490					
Temp. range soften to resolidification (ºC)				90				85					
DILATOMETER VALUES													
Initial softening temperature (ºC)				370				365					
Temperature of max. contraction (ºC)				420				425					
Temperature of max. dilatation (ºC)				460				465					
Maximum contraction (%)				28				30					
Maximum dilatation (%)				72				80					
COKE PROPERTIES													
Micum M_{40} index				69.1				82					
Micum M_{10} index				10.3				7.5					
IRSID I_{20} index				70.5									
IRSID I_{10} index				26.7									
ASTM coke strength - stability factor				53.9				59					
ASTM coke strength - hardness factor				61.4				67					
Coke reactivity index (CRI)				26									
Coke strength after reaction (CSR)				59.4									

COLLIERY / DEPOSIT	CURRAGH		CURRAGH NORTH (PISCES)			DAUNIA		DAWSON	EBENEZER		ELIMATTA	ENSHAM		
BASIN	Bowen		Bowen			Bowen		Bowen	Clarence–Moreton		Surat	Bowen		
OPERATOR / OWNER	CQM		CQM			BMA		ANG	EBN		TCN	ENS		
PROJECT STATUS	Mine - Operating		Deposit			Deposit		Deposit	Mine - Closed		Deposit	Mine - Operating		
BRAND NAME	Thermal	Coking	Aries/ Castor RoM	Castor RoM	Pisces RoM	Coking	Thermal	Raw	Domestic	Washed Export	Raw	Ensham	Semi-soft	Ensham Tops
MARKET	Domestic	Export							Domestic	Export		Export	Export	
TYPE	Thermal	Coking	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal
PROXIMATE ANALYSIS (% ad)														
Moisture	1.7	1.5	2.2	1.7	1.8	2.1	2.2	6	4	4	7.6	4	3.5	4
Ash	16	7	14.3	20.8	17.1	9	12.5	6.5	22.4	14	21.1	11	9.5	13
Volatile Matter	18.6	21.5	17.7	17.5	17.8	21.5	20	32.3	35.7	39	36.9	26.5	29	25.5
Fixed Carbon	63.7	70	65.8	60	63.4	67.4	65.3	55.2	37.9	43	34.4	58.5	58	57.5
TOTAL MOISTURE (% as)		9.5				8	8	8.4	11	10		11.5	9.5	11.5
EQUILIBRIUM MOISTURE (% as)								8						
SPECIFIC ENERGY														
Gross (MJ/kg, ad)	25.6		29.4	27.2	28.5	31.8	30.8	27.9	24.6	28.1	22.7	29.3	30.2	28.1
Gross (MJ/kg, daf)	31.1		35.2	35.1	35.1	35.8	36.1	31.8	33.5	34.2	31.8	34.1	34.5	33.8
Gross (kCal/kg, ad)	6120		7020	6490	6800	7600	7360	6650	5880	6700	5415	7000	7200	6700
ULTIMATE ANALYSIS (% daf)														
Carbon	88.3	88.7	88.8			88.7	88.9	79	80.4	81		84.8	84	84.2
Hydrogen	4.7	5	4.8			4.7	4.5	4.8	6.4	6.2		4.9	5.1	5
Nitrogen	1.7	1.7	1.8			1.6	1.5	1.9	1.5	1.4		1.9	2	1.9
Sulphur	0.8	0.6	0.6			0.4	0.4	0.3	0.7	0.6		0.6	0.6	0.6
Oxygen	4.5	4	4.1			4.6	4.7	14.1	11	10.6		7	8.3	8.3
Total														
SULPHUR (% ad)														
Pyritic			0.2						0.03					
Sulphate			0						<0.01					
Organic			0.24						0.43					
Total	0.5	0.5	0.44	0.43	0.59	0.43	0.37	0.24	0.47	0.5	0.27	0.6	0.55	0.6
RELATIVE DENSITY (ad)	1.4		1.4					1.3			1.4			
HARDGROVE GRINDABILITY INDEX	75	78	83	81	82	75	75	48	39	40		57	60	57
ABRASION INDEX (mg/kg)			4											
ASH FUSION TEMPERATURE Reducing atmosphere (°C)														
Deformation	1175		1390	1190	1210	>1550	1440	1290	1285	1570		1350		1350
Sphere			1430	1320	1280	>1550	>1550	1380	1530	>1600		1400		1400
Hemisphere	1300		1440	1340	1290	>1550	>1550	1395	1545	>1600		1500		1500
Flow	1360		1450	1380	1330	>1550	>1550	1410	1570	>1600		>1600	>1500	>1600
PETROGRAPHIC ANALYSIS														
Vitrinite (% by volume)		55				47	27	62		76.7		31.8	70	32.6
Liptinite (% by volume)		1						2		10.1		2.8	2.2	3.2
Inertinite (% by volume)		40				48	67	33		0.4		62.3	22	59.2
Coke (% by volume)														
Mineral (% by volume)		4				5	6	3		12.8		3.1	5.8	5
Mean max Vitrinite Reflectance ($R_{V,max}$)		1.27				1.28	1.27	0.65				0.81	0.85	0.81
Semi-inertinite (low reflecting inertinite)		29				33	45	31		0.2				

COLLIERY / DEPOSIT	CURRAGH		CURRAGH NORTH (PISCES)			DAUNIA		DAWSON	EBENEZER		ELIMATTA	ENSHAM		
BRAND NAME	Thermal	Coking	Aries/Castor RoM	Castor RoM	Pisces RoM	Coking	Thermal	Raw	Domestic	Washed Export	Raw	Ensham	Semi-soft	Ensham Tops
TYPE	Thermal	Coking	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal
ANALYSIS OF ASH (%)														
SiO_2	51.1	57	42.5	49.3	50.93	46.1	45.6	46.4	67.6	59.6		52	56.5	50
Al_2O_3	22.8	22	23.8	22.8	23.11	39.2	36.3	25.9	24.3	27.8		27.2	26.7	27.2
Fe_2O_3	14.2	11.5	15.1	17.1	13.18	5.7	3.5	9.8	2	1.8		10.5	7.5	10.8
TiO_2	1	1.2	0.8	1.6	1.77	2	1.9	1.32	1.5	2		1	1.1	1
Mn_3O_4	0.1	0.1	0.5	0.8	0.74	0.01	0.02	0.08	0	0.1		0.5	<0.02	0.5
CaO	3.9	3.2	6	2.2	3.62	2.7	6.1	8.57	1.8	1.3		3.2	2.9	5.8
MgO	1.4	1.5	1.6	2	1.67	0.9	0.7	1.55	1	1.1		0.6	1.2	0.7
Na_2O	0.2	0.2	2.3	0.5	0.35	0.1	0.1	0.8	0.8	0.9		0.9	0.3	0.7
K_2O	0.9	0.9	1.7	1.2	0.92	0.3	0.2	0.51	0.7	0.6		0.3	0.8	0.5
P_2O_5	1.5	1.5	2.6	1.6	0.9	1.3	1.1	0.98	0.1	0.4		2	2.2	2.2
SO_3	1.2	1	4.2	0.6	2.38	0.79	1.7	2.31	0.8	0.3		0.5	0.4	0.9
Loss on ignition or undetermined	1.7		0	0.3	0.43	0.9	2.78	1.78		4.1		1.38	0.38	
Total	100	100.1	101.1	100	100	100	100	100	100.6	100		100	100	100.3
MINOR CONSTITUENTS (db)														
Phosphorus (%)	0.09	0.05	0.045			0.05	0.06	0.03	0.004			0.05	0.07	0.05
Chlorine (%)		0.05	0.06		0.02	0.04	0.04	0.03	0.06					
Fluorine (%)						100	100							
Arsenic (ug/g)	0.3		1					1	1.5					
Boron (ug/g)							13	115						
Cadmium (ug/g)		0.09					0.06	<0.100				0.05		0.05
Mercury (ug/g)								<0.100						
CAKING & COKING PROPERTIES														
Crucible swelling number (CSN)	1.5	7.5	1		1.5	4	1			1.0–1.5		0.0–1.0	3.0–7.0	0.0–1.0
Gray-King coke type													E-G	
Roga index		70												
GIESELER PLASTOMETER VALUES														
Initial Softening Temperature (ºC)		405				425							407	
Maximum Fluidity (dd/min)		150				25							85	
Maximum fluidity temperature (ºC)		465				460							450	
Resolidification temperature (ºC)		495				485							475	
Temp. range soften to resolidification (ºC)		90				60							68	
DILATOMETER VALUES														
Initial softening temperature (ºC)		390				420							405	
Temperature of max. contraction (ºC)		435				470							445	
Temperature of max. dilatation (ºC)		470				480							475	
Maximum contraction (%)		25				25							40	
Maximum dilatation (%)		10				-20							-19	
COKE PROPERTIES														
Micum M_{40} index		83												
Micum M_{10} index		7												
IRSID I_{20} index														
IRSID I_{10} index														
ASTM coke strength - stability factor		63												
ASTM coke strength - hardness factor		67												
Coke reactivity index (CRI)														
Coke strength after reaction (CSR)														

COLLIERY / DEPOSIT	FELTON		FOXLEIGH	GATTONVALE		GERMAN CREEK	GERMAN CK EAST	GLEN WILGA	GOONYELLA	GREGORY-CRINUM			GROSVENOR	HAIL CREEK	
BASIN	Clarence–Moreton		Bowen	Bowen		Bowen	Bowen	Surat	Bowen	Bowen			Bowen	Bowen	
OPERATOR / OWNER	NPE		FOX	MEG		ANG	ANG	TAR	BMA	BMA			ANG	PAC	
PROJECT STATUS	Deposit		Mine - Operating	Deposit		Mine - Operating	Mine - Operating	Deposit	Mine - Operating	Mine - Operating			Deposit	Mine - Construction	
BRAND NAME	Washed	Raw	PCI	Raw	Washed	German Creek	German Creek	Glen Wilga	Goonyella	Gregory Coking	Gregory UHV	Lilyvale	Washed	Hail Creek	Brumby
MARKET			Export			Export	Export		Export	Export	Export	Export		Export	Export
TYPE	Thermal	Thermal	PCI	Thermal	Thermal	Coking	Coking	Thermal	Coking	Coking	UHV	Thermal	Coking	Coking	Coking
PROXIMATE ANALYSIS (% ad)															
Moisture	5.8	6.6	1.5	4.4	4.7	2	2	5.6	1	2	2	2	1.4	1.0	1.0
Ash	25	43	7	22.4	14.4	9	9.5	14.8	8.9	6.5	9	13	9.2	8.5	11.0
Volatile Matter	37.5	29	12.5	27.1	29.0	19.5	20	42.3	23.8	33.5	32.5	30.5	23	20.4	20.2
Fixed Carbon	31.8	21.4	79	46.2	52.0	69.5	68.5	37.2	66.3	58	56.5	54.5	66.4	70.1	67.8
TOTAL MOISTURE (% as)			9			11	10	12	10	8.5	8	8		10.0	9.5
EQUILIBRIUM MOISTURE (% as)													3		
SPECIFIC ENERGY															
Gross (MJ/kg, ad)	23.1	16.1	33.1	23.4	26.7	32.3	31.8	25.6	32.5	32.4	31.6	29.6	32.4	32.9	31.6
Gross (MJ/kg, daf)	33.4	31.9	36.2	32.0	33.0	36.1	35.9	32.2	36.1	35.4	35.5	34.8	36.3	*36.3*	35.9
Gross (kCal/kg, ad)	5530	3850	7900	5592	6379	7720	7590	6110	7765	7735	7540	7070	7740	*7855*	7535
ULTIMATE ANALYSIS (% daf)															
Carbon	78.8		91			89.8	89.6	78.5	88.4	85.1	85.4	84.5	87.9	89.6	89.0
Hydrogen	6.9		4.1			4.37	4.7	6.2	5	5.5	5.3	5.4	5.23	4.9	4.9
Nitrogen	1.4		1.9			2.14	1.6	1.1	1.9	2.1	2.2	2.1	1.85	1.59	1.53
Sulphur	0.6		0.7			0.58	0.6	0.6	0.6	0.7	0.8	0.75	0.59	0.39	0.36
Oxygen	12.3		2.3			3.11	3.5	13.6	4.1	6.6	6.3	7.25	4.63	3.61	4.26
Total	100							100							
SULPHUR (% ad)															
Pyritic						0.36	0.17		0.06	0.06					
Sulphate						0.01	0.03		<0.02	0.02					
Organic						0.35	0.3		0.44	0.52					
Total			0.5	0.46		0.7	0.5	0.63	0.52	0.6	0.6	0.65	0.54	0.35	0.31
RELATIVE DENSITY (ad)		1.6				1.4	1.4	1.55					1.35		
HARDGROVE GRINDABILITY INDEX	35		77			90	80	35	90	55	57	52	88	90	83
ABRASION INDEX (mg/kg)															
ASH FUSION TEMPERATURE Reducing atmosphere (°C)															
Deformation	1400		1360		>1540			1387	1350	>1550	1550	1500	+1600	1410	
Sphere	>1600		1480		>1540			1442	>1600	>1550	>1550	>1550	+1600	1580	
Hemisphere	>1600		1510		>1540			1460	>1600	>1550	>1550	>1550	+1600	1590	
Flow	>1600		1580		>1540			1497	>1600	>1550	>1550	>1550	+1600	>1600	
PETROGRAPHIC ANALYSIS															
Vitrinite (% by volume)			43	35		70.3	32		60	76	72		66	52.9	42.7
Liptinite (% by volume)			0	9		0.1			1	3	3				
Inertinite (% by volume)			55	41.6		26.5	64		35	18	21		30.1	42.1	50.3
Coke (% by volume)															
Mineral (% by volume)			2	14.4		3	3		4	3	4			5.0	7
Mean max Vitrinite Reflectance ($R_{V,max}$)			1.95	0.75		1.51	1.33		1.17	0.92	0.92		1.1	1.33	1.29
Semi-inertinite (low reflecting inertinite)						23	60		25	9	11				

COLLIERY / DEPOSIT	FELTON		FOXLEIGH	GATTONVALE		GERMAN CREEK	GERMAN CK EAST	GLEN WILGA	GOONYELLA	GREGORY-CRINUM			GROSVENOR	HAIL CREEK	
BRAND NAME	Washed	Raw	PCI	Raw	Washed	German Creek	German Creek	Glen Wilga	Goonyella	Gregory Coking	Gregory UHV	Lilyvale	Washed	Hail Creek	Brumby
TYPE	Thermal	Thermal	PCI	Thermal	Thermal	Coking	Coking	Thermal	Coking	Coking	UHV	Thermal	Coking	Coking	Coking
ANALYSIS OF ASH (%)															
SiO_2	63		50.1			49.2	47	57.3	60.3	51.8	54.9	52.5	52.1	56.04	46.3
Al_2O_3	25.9		32.7			34.6	35	25.6	31.3	36.8	35.1	38.6	34.7	30.2	35.6
Fe_2O_3	1.7		6.1			5.5	9	2.6	2.6	4.4	4	3.7	5.5	4.08	5.24
TiO_2	1.6		1.3			2	1.8	1.44	1.8	2	1.7	1.8	1.7	1.5	1.87
Mn_3O_4			0.1			0.04	0.1	0.03	<0.10	<0.10	<0.1	<0.1	0.02	0.05	0.02
CaO	1.2		3.3			2.8	2.4	6.1	0.6	1.1	0.8	1	1.2	2.82	3.2
MgO	0.9		1.1			0.83	1.6	1.48	0.5	0.3	0.4	0.3	1.4	0.93	1.7
Na_2O	0.7		0.8			0.92	0.4	1.09	0.4	0.3	0.3	0.3	0.22	0.26	0.26
K_2O	0.5		0.8			1	0.8	0.84	0.8	0.8	0.9	0.9	0.61	0.9	1.35
P_2O_5	0.1		1.8			1.8	1.8	0.05	0.5	1.1	1	0.8	0.82	1.65	1.44
SO_3	0.1		0.8			0.37	0.1	2.59	0.3	0.2	0.3	0.1	0.2	1.02	1.76
Loss on ignition or undetermined						0.96							1.53	0.55	1.26
Total						100	100						100	100	100
MINOR CONSTITUENTS (db)															
Phosphorus (%)	0.01		0.07			0.07	0.06		0.02	0.032	0.03		0.03	0.063	0.07
Chlorine (%)			0.07						0.04	0.05		0.03		0.01	0.01
Fluorine (%)														0.013	0.011
Arsenic (ug/g)														0.44	0.58
Boron (ug/g)															
Cadmium (ug/g)															
Mercury (ug/g)															
CAKING & COKING PROPERTIES															
Crucible swelling number (CSN)	0.5		0.5–1.0	0.5		8.5	2		8	9	8		8.0–9.0	8	5 to 6
Gray-King coke type						G6			G6	G8			G3–G9	G5	G4
Roga index						70	58						82	72	60
GIESELER PLASTOMETER VALUES															
Initial Softening Temperature (ºC)						425	440		410	395	400		401	430	425
Maximum Fluidity (dd/min)						250	1		1100	7500	3000		2400	230	160
Maximum fluidity temperature (ºC)						470	470		460	445	440		455	475	470
Resolidification temperature (ºC)						510	585		500	480	480		493	500	500
Temp. range soften to resolidification (ºC)						85	45		90	85	80			70	75
DILATOMETER VALUES															
Initial softening temperature (ºC)						400	410		395	355	370		380	400	395
Temperature of max. contraction (ºC)						450	470		430	415	420		420	450	455
Temperature of max. dilatation (ºC)						480			470	450	450		475	485	480
Maximum contraction (%)						15	15		21	27	26		23	28	26
Maximum dilatation (%)						39			90	125	90		170	20	5
COKE PROPERTIES															
Micum M_{40} index									80	72				85	83.5
Micum M_{10} index									7	8				7.4	9.3
IRSID I_{20} index									77	74				78.5	75
IRSID I_{10} index									20	22				20.6	24
ASTM coke strength - stability factor									60	51				61.5	58.5
ASTM coke strength - hardness factor									68	65				64.2	61.5
Coke reactivity index (CRI)									22	25				22.3	30.5
Coke strength after reaction (CSR)									68	60				68	56.5

COLLIERY / DEPOSIT	HAYSTACK ROAD	HILLALONG	HORSE CREEK	JEEBROPILLY	JELLINBAH EAST		KEMMIS/WALKER		KESTREL		KEVIN'S CORNER	KOGAN CREEK		MEANDU
BASIN	Surat	Bowen	Surat	Clar-Moreton	Bowen		Bowen		Bowen		Galilee	Surat		Tarong
OPERATOR / OWNER	TAR	CUB	PWC	NHC	QCM		BMC		PAC		HKP	CSE		PAC
PROJECT STATUS	Deposit	Deposit	Deposit	Mine - Operating	Mine - Operating		Deposit		Mine - Operating		Deposit	Deposit		Mine - Operating
BRAND NAME	Haystack Rd	Hillalong Raw	Horse Creek	Tivoli	Semi-Anthracite	Semi-soft	Kemmis	Walker	Kestrel	Kestrel	Kevins Corner	Washed	Raw	Washed
MARKET				Export	Export	Export			Export	Export				Domestic
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)														
Moisture	4.7	1.7	7	5	1.5	1.5	1.5	1.5	2.0	2.0	8	7.8	8.4	5.5
Ash	13.2	15	14.6	13	10	9.5	12.7	10	6.5	13.0	11	11.3	26.6	30.1
Volatile Matter	43.4	23.8	42.1	40	14.5	15.5	17.9	15	33.5	31.0	33	42.2	35.0	27.0
Fixed Carbon	38.6	59.5	36.3	42	74	73.5	67.9	73.5	58.0	54.0	48	38.7	30.0	37.4
TOTAL MOISTURE (% as)		7	12	10	8	8			8.0	6.0		13.0	12.4	12.0
EQUILIBRIUM MOISTURE (% as)							2.9						12.0	
SPECIFIC ENERGY														
Gross (MJ/kg, ad)	27.7	29.5	26.0	28.1	31.6	32.0	30.6	32.1	32.5	29.9	25.4	26.4	21.1	21.1
Gross (MJ/kg, daf)	33.7	35.4	33.2	34.6	35.7	35.4	35.6	36.3	35.5	35.2	31.4	32.7	32.4	32.7
Gross (kCal/kg, ad)	6620	7045	6210	6700	7550	7650	7300	7670	7750	7150	6070	6310	5030	5030
ULTIMATE ANALYSIS (% daf)														
Carbon		86.5		80.2	89.5	89.3	89.1		85.0	85.0	78.2	77.5	76.5	80.5
Hydrogen		5.04		6	4.7	4.7	4.8		5.7	5.7	4.7	6.07	6.45	5.3
Nitrogen		1.53		1.5	1.9	1.9	1.5		2.20	2.17	1.7	1.05	0.95	1.50
Sulphur		0.39		0.7	0.7	0.6	0.2		0.70	0.88	0.6	0.43	0.53	0.40
Oxygen		6.6		11.6	3.3	3.5	4.4		6.40	6.25	14.8	14.95	15.57	12.30
Total				100								100	100	
SULPHUR (% ad)														
Pyritic				0.14	0.38	0.32	0.1		0.13			0.09	0.13	0.07
Sulphate	1.15			0.01	0.02	0.03	0.01		0.02			0.01	0.01	0.03
Organic				0.5	0.25	0.3	0.18		0.55			0.25	0.21	0.19
Total	0.5	0.35	0.47	0.65	0.65	0.65	0.29	0.4	0.70	0.75		0.35	0.35	0.29
RELATIVE DENSITY (ad)	1.7	1.41	1.45	1.4			1.4				1.5	1.3		1.6
HARDGROVE GRINDABILITY INDEX	28	67	35	40	80–85	85	95	100	58	55	46	33	40	53
ABRASION INDEX (mg/kg)				12	7							10	20	
ASH FUSION TEMPERATURE Reducing atmosphere (°C)														
Deformation	1315		1500	1300	1250	1200	1270	1300	>1600	>1600	1380	1350	1320	1485
Sphere	1550		1410	>1600	1500	1400			>1600	>1600		> 1600	1550	
Hemisphere	>1600		1470	>1600	>1600	1550		1450	>1600	>1600	1510	> 1600	1560	>1600
Flow	>1600	>1600	>1600	>1600	>1600	>1600	1375	1500	>1600	>1600		> 1600	1570	>1600
PETROGRAPHIC ANALYSIS														
Vitrinite (% by volume)	89			74.5		50	26	50	75	66.4		49.6		
Liptinite (% by volume)	6			7.9					4	3.1		20.3		
Inertinite (% by volume)	1			1.3		45		45	18	26		20.9		
Coke (% by volume)				0										
Mineral (% by volume)	4			16.3		5		5	3	4.5		9.2		
Mean max Vitrinite Reflectance ($R_{V,max}$)	0.5			0.57		1.72	1.58		0.93	0.92		0.35		
Semi-inertinite (low reflecting inertinite)				1.1		41.5		35	10					

COLLIERY / DEPOSIT	HAYSTACK ROAD	HILLALONG	HORSE CREEK	JEEBROPILLY	JELLINBAH EAST		KEMMIS/WALKER		KESTREL		KEVIN'S CORNER	KOGAN CREEK		MEANDU
BRAND NAME	Haystack Rd	Hillalong Raw	Horse Creek	Tivoli	Semi-Anthracite	Semi-soft	Kemmis	Walker	Kestrel	Kestrel	Kevins Corner	Washed	Raw	Washed
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal
ANALYSIS OF ASH (%)														
SiO_2	55	57.6		61.4	50.5	55.3			51	53		53.1	57.8	72.3
Al_2O_3	33.7	34.2		30.29	37.2	33.3			38.1	38.7		36.9	30.1	23.3
Fe_2O_3	2.18	1.81		1.7	5.5	4.3			5.2	3.8		3.07	2.53	0.9
TiO_2	4.24	1.65		1.9	1.7	1.5			2	1.4		2.32	1.27	1.4
Mn_3O_4	0.02	<0.01		0.01	0.01	0.01			0.1	0.1		0.01	0.04	0.1
CaO	1.3	0.79		0.9	0.6	0.5			1.2	0.8		1.35	3.75	0.1
MgO	0.52	0.64		0.73	1.1	1.1			0.6	0.3		0.76	1.21	0.2
Na_2O	0.92	0.1		0.99	0.8	0.6			0.4	0.3		0.75	0.86	0.1
K_2O	0.31	1.35		0.6	0.9	1.6			0.6	0.8		0.34	0.66	0.3
P_2O_5	0.14	1.29		0.07	1.5	1.5			0.8	0.6		0.06	0.06	0.1
SO_3	1.15	0.09		0.4	0.2	0.1			0.2	0.2		0.84	1.32	0.1
Loss on ignition or undetermined	0.52	0.48		1.01		0.29			0.1	0		0.50	0.40	1.1
Total	100			100	100.01	100			100	100		100.00	100.00	100
MINOR CONSTITUENTS (db)														
Phosphorus (%)	0.005			0.006		0.06	0.04	0.9	0.025	0.025	0.003			0.01
Chlorine (%)		0.05		0.01			0.04		0.02	0.02	0.08	0.02	0.03	0.04
Fluorine (%)				30					0.005	0.005		100		
Arsenic (ug/g)				0.8			0.1				0.7	2	2	1.5
Boron (ug/g)				30								20		
Cadmium (ug/g)				0.06								< 1		
Mercury (ug/g)				0.03								< 1		
CAKING & COKING PROPERTIES														
Crucible swelling number (CSN)		2.5		1		2.0–3.0	1.5	3	9	7		0	0	1
Gray-King coke type									G9	G4				
Roga index									82	68				
GIESELER PLASTOMETER VALUES														
Initial Softening Temperature (ºC)								440	390					
Maximum Fluidity (dd/min)						1		1	>10000	2000				
Maximum fluidity temperature (ºC)						475		465	435					
Resolidification temperature (ºC)						500		485	475					
Temp. range soften to resolidification (ºC)								45	85					
DILATOMETER VALUES														
Initial softening temperature (ºC)									360					
Temperature of max. contraction (ºC)									415					
Temperature of max. dilatation (ºC)									450					
Maximum contraction (%)									34					
Maximum dilatation (%)									145					
COKE PROPERTIES														
Micum M_{40} index														
Micum M_{10} index														
IRSID I_{20} index														
IRSID I_{10} index														
ASTM coke strength - stability factor														
ASTM coke strength - hardness factor														
Coke reactivity index (CRI)														
Coke strength after reaction (CSR)														

COLLIERY / DEPOSIT	MILLENNIUM		MINERVA		MONTO	MOORVALE			MORANBAH NORTH	MORANBAH SOUTH	MOURA			MT FORT COOPER/ CARRINYAH	NEBO WEST	NEW ACLAND
BASIN	Bowen		Bowen		Mulgildie	Bowen			Bowen	Bowen	Bowen			Bowen	Bowen	Clarence–Moreton
OPERATOR / OWNER	MIL		NHC		MCL	APC			ANG	KUM	ANG			MRC	BMC	NHC
PROJECT STATUS	Deposit		Deposit		Deposit	Mine - Construction			Mine - Operating	Deposit	Mine - Operating			Deposit	Deposit	Mine - Operating
BRAND NAME	Millennium	Millennium	PCI	Washed	Monto	PCI	Thermal	Coking	Moranbah North	Harrow Ck LV	K/coal	Moura	Moura	PCI	Nebo West	Washed
MARKET						Export	Export	Export	Export		Export	Export	Export			Export
TYPE	Coking	PCI	Thermal	Thermal	Thermal	PCI	Thermal	Coking	Coking	Coking	Coking	Coking	Thermal	PCI	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)																
Moisture	2.0	2.0	3.5	3.5	4.5	1.4	1.5	1.4	1.5	0.9	2.5	2	2.5	1.5	2	3.7
Ash	8.0	9.5	9	12	10	8.5	15	8	8.5	8.5	8.3	6.8	10.9	9.5	8.5	13
Volatile Matter	24.0	22.0	31	31	41	16.6	15.4	16.8	25	19.2	32	26.5	30.5	12	7	40.8
Fixed Carbon	66.0	66.5	56.5	53.5	44.5	73.5	68.1	73.8	65	71.4	57.2	64.7	56.1	77	82.5	42.5
TOTAL MOISTURE (% as)			10	10	10	9	9	9	10		10.5	10.5	10.5	9		
EQUILIBRIUM MOISTURE (% as)															5	
SPECIFIC ENERGY																
Gross (MJ/kg, ad)			29.7	28.6	28.1	32.2	29.6	32.7	32.5	32.8	31.0	32.6	30.1	31.5	31.6	28.9
Gross (MJ/kg, daf)			33.9	33.8	32.8	35.8	35.5	36.0	36.1	36.2	35.1	36.1	34.8	35.4	35.3	34.7
Gross (kCal/kg, ad)			7090	6820	6700	7700	7080	7800	7760	7830	7400	7780	7200	7510	7550	6900
ULTIMATE ANALYSIS (% daf)																
Carbon				83.3	79.5	89.6	89.4	89.2	88.5	81.7	84.6	87.6	84.5	92	91.8	81.3
Hydrogen				5.2	6	4.3	4.4	4.4	4.68	4.3	5.3	5	5.7	3.8	3.1	6.2
Nitrogen				2.5	1.3	1.6	1.7	1.6	1.9	1.7	1.9	1.8	1.9	1.6	1.6	1.2
Sulphur				0.4	0.6	0.3	0.3	0.4	0.6	0.5	0.5	0.5	0.55	0.7	0.7	0.6
Oxygen				8.6	12.6	4.2	4.3	4.4	4.32	11.8	7.8	5.1	7.3	1.9	2.8	10.7
Total					100											100
SULPHUR (% ad)																
Pyritic									0.12	0.04	0.11	0.14	0.15		<0.05	
Sulphate									0.01	0.02	0.01	0.05	0.02		<0.02	
Organic									0.47	0.51	0.3	0.26	0.33		0.57	
Total	0.45	0.45	0.4	0.4	0.5	0.3	0.3	0.3	0.6	0.57	0.42	0.5	0.5	0.5	0.65	0.48
RELATIVE DENSITY (ad)					1.45				1.4	1.4					1.5	
HARDGROVE GRINDABILITY INDEX			50	50	45	82	77	83	80		53	70	53	80	49	40
ABRASION INDEX (mg/kg)															7.7	
ASH FUSION TEMPERATURE Reducing atmosphere (°C)																
Deformation			1450	1380	1500		1380			1347			1250	1360	1280	1572
Sphere				>1600	>1600		1450						1380	1500	1480	>1600
Hemisphere				>1600	>1600		1470			1488			1420	1520	1440	>1600
Flow				>1600	>1600		1520			1536			1440	1550	1490	>1600
PETROGRAPHIC ANALYSIS																
Vitrinite (% by volume)					76			52.3	59.3		62	62		75	78	65
Liptinite (% by volume)					16				1.7		3	1		0	0	4
Inertinite (% by volume)					2			44.6	35.6		31	35		15	19	1
Coke (% by volume)																
Mineral (% by volume)					6			3.1	3.4		4	2		10	3	30
Mean max Vitrinite Reflectance ($R_{V,max}$)	1.15	1.15	0.82		0.52			1.49	1.15	1.44	0.8	1.03		2.2	3.1	0.53
Semi-inertinite (low reflecting inertinite)											27	33			2	

COLLIERY / DEPOSIT	MILLENNIUM		MINERVA		MONTO	MOORVALE			MORANBAH NORTH	MORANBAH SOUTH	MOURA			MT FT COOPER / CARRINYAH	NEBO WEST	NEW ACLAND
BRAND NAME	Millennium	Millennium	PCI	Washed	Monto	PCI	Thermal	Coking	Moranbah North	Harrow Ck LV	K/coal	Moura	Moura	PCI	Nebo West	Washed
TYPE	Coking	PCI	Thermal	Thermal	Thermal	PCI	Thermal	Coking	Coking	Coking	Coking	Coking	Thermal	PCI	Thermal	Thermal
ANALYSIS OF ASH (%)																
SiO_2				58.6	56.2	49.7	44.2	47.6	49	53.4	52.7	52.1	51	64.3	51.0	68.9
Al_2O_3				27.8	30.24	30.8	32.6	32.2	36.2	30.9	27.6	30.9	27	23.4	26.0	26
Fe_2O_3				3.89	2.52	3.72	4.90	9.63	6.3	6.5	8.8	5.9	10	2.8	7.0	1.2
TiO_2				1.44	1.79	1.02	1.00	0.87	1.34	1.63	1.4	1.6	1.4	1.16	1.3	2.3
Mn_3O_4				0.01	0.02	0.03	0.06	0.07	0.03	0.02	0.1	0	0.1	0.02	0.1	0.03
CaO				1.33	3.4	6.76	8.12	2.54	2.23	3	2.6	2.1	3.8	2.42	6.0	0.5
MgO				0.32	1.12	0.89	1.11	1.42	0.71	1.6	1.1	0.7	1.2	1.09	2.0	0.4
Na_2O				0.23	0.84	0.73	0.35	0.51	0.86	0.27	0.6	0.7	0.5	0.48	1.3	0.1
K_2O				0.69	0.54	0.66	1.24	1.77	0.4	0.46	2.4	3.3	2.5	1.3	0.9	0.3
P_2O_5				2.5	0.43	2.27	2.97	1.01	1.08	2.03	0.5	1.1	0.6	0.18	1.3	0.13
SO_3				0.35	1.9	2.51	2.67	1.12	0.72	0.15	0.9	0.6	1.1	1.66	1.0	0.12
Loss on ignition or undetermined				2.84	1				1.13	0.04	1.3	1	0.8	1.19	2.1	0.02
Total				100	100				100	100	100	100	100	100	100	100
MINOR CONSTITUENTS (db)																
Phosphorus (%)					0.02	0.08		0.05	0.04	0.06	0.02	0.03	0.03	0.04	0.05	0.01
Chlorine (%)				0.01	0.04								0.04	0.02	0.04	0.09
Fluorine (%)													80			
Arsenic (ug/g)															2.8	0.64
Boron (ug/g)															10	
Cadmium (ug/g)															0.03	
Mercury (ug/g)															0.04	
CAKING & COKING PROPERTIES																
Crucible swelling number (CSN)	6	2			1			4	8	8	6	7.5		1.0	0	
Gray-King coke type									G4	G9	G2	G6				
Roga index									65	66						
GIESELER PLASTOMETER VALUES																
Initial Softening Temperature (ºC)									405	461	400	410				
Maximum Fluidity (dd/min)									2500	550	100	700				
Maximum fluidity temperature (ºC)									460	480	440	455				
Resolidification temperature (ºC)									490	497	465	490				
Temp. range soften to resolidification (ºC)									85	36	65	80				
DILATOMETER VALUES																
Initial softening temperature (ºC)									375	417	395	390				
Temperature of max. contraction (ºC)									425	469	430	430				
Temperature of max. dilatation (ºC)									470	490	450	470				
Maximum contraction (%)									25	24	20	26				
Maximum dilatation (%)									120	6	-10	60				
COKE PROPERTIES																
Micum M_{40} index																
Micum M_{10} index																
IRSID I_{20} index																
IRSID I_{10} index																
ASTM coke strength - stability factor																
ASTM coke strength - hardness factor																
Coke reactivity index (CRI)																
Coke strength after reaction (CSR)																

COLLIERY/DEPOSIT	NEW OAKLEIGH	NEWLANDS	NORWICH PARK		NORTH GOONYELLA	OAKY CREEK		PEAK DOWNS	PEAK DOWNS EAST	PENTLAND	PIPELINE	POITREL/WINCHESTER		RED HILL
BASIN	Clar-Moreton	Bowen	Bowen		Bowen	Bowen		Bowen	Bowen	Galilee	Bowen	Bowen		Bowen
OPERATOR/OWNER	NHC	XCQ	BMA		RAG	XCQ		BMA	BMA	XCQ	XCQ	BMC		BMA
PROJECT STATUS	Mine - Operating	Mine - Operating	Mine - Operating		Mine - Operating	Mine - Operating		Mine - Operating	Deposit	Deposit	Mine - Operating	Deposit		Deposit
BRAND NAME	Oakleigh	Newlands	Norwich Park Coking	Norwich Park ULV	North Goonyella	Oaky Creek	Oaky North	Peak Downs	Peak Downs East	Pentland	Washed	Poitrel	Poitrel	Red Hill
MARKET	Domestic	Export	Export	Export	Export	Export	Export	Export			Export/Dom			
TYPE	Thermal	Thermal	Coking	Coking	Coking	Coking	Coking	Coking	Coking	Thermal	Thermal	Coking	Thermal	Coking
PROXIMATE ANALYSIS (% ad)														
Moisture	5.7	2.3	1	1	1.5	1.2	1.2	1	1.2	8	1.5	2	2.4	1.4
Ash	14	14.5	9.9	11.3	8.5	9	9	9.7	9	30	10.8	8.7	12	9
Volatile Matter	39	26.3	17.8	16.8	22.7	27	24	20.5	18.5	22.4	22.8	25.5	22	20.6
Fixed Carbon	41.3	56.9	71.3	70.9	67.3	62.8	65.8	68.8	71.3	39.6	64.9	63.8	63.6	69
TOTAL MOISTURE (% as)	10	8.3	10	10	9	10	10	9.5						
EQUILIBRIUM MOISTURE (% as)														
SPECIFIC ENERGY														
Gross (MJ/kg, ad)	27.7	28.5	32.3	31.7	33.0	32.5	32.8	32.5	31.5	18.4	31.1	30.7	30.0	
Gross (MJ/kg, daf)	34.3	34.2	36.2	36.1	36.7	35.8	36.6	36.3	35.1	29.7	35.4	34.4	35.1	
Gross (kCal/kg, ad)	6600	6800	7710	7560	7882	7760	7840	7750	7520	4400	7420	7300	7170	
ULTIMATE ANALYSIS (% daf)														
Carbon	80	85.1	89.6	89.6	88.8	86.8	88.1	89.1		78.9	86.6		86.2	89.3
Hydrogen	6.5	5	4.6	4.6	5	5.5	5.1	4.9		4	4.3		4.7	4.7
Nitrogen	1.5	1.8	2	2	1.92	2	2.2	2		1.7	1.6		1.6	1.8
Sulphur	0.5	0.6	0.7	0.7	0.67	0.8	0.6	0.7		0.4			0.6	0.58
Oxygen	11.5	7.5	3.1	3.1	3.61	4.8	4	3.3		15			6.9	3.6
Total							100							
SULPHUR (% ad)														
Pyritic			0.09		0.24	0.18		<0.05		0.11			0.1	
Sulphate			<0.02		0.01	0.01		<0.02		0.11			0.02	
Organic			0.54		0.35	0.51		0.54		0.08			0.23	
Total	0.48	0.5	0.65	0.65	0.6	0.7	0.6	0.6	0.55	0.3	0.44		0.35	0.58
RELATIVE DENSITY (ad)	1.4				1.3	1.3				1.6				
HARDGROVE GRINDABILITY INDEX	36–45	53	95	90	88	77	94	90		63	76		71	
ABRASION INDEX (mg/kg)		13												
ASH FUSION TEMPERATURE R educing atmosphere (°C)														
Deformation	1320	1300	1500	1350	1585			1500		>1600	1220		1400	
Sphere	>1600	1360	>1600	1550	>1600			>1550						
Hemisphere	>1600	1400	>1600	>1550	>1600			>1550		>1600	1390		1450	
Flow	>1600	1600	>1600	>1550	>1600			>1550		>1600	1460		1470	
PETROGRAPHIC ANALYSIS														
Vitrinite (% by volume)	76	39.6	71	71	60	75	79	68		26		61	39	57
Liptinite (% by volume)	4	3.6	0	0	0.1	2	2	0		10		3	2	1
Inertinite (% by volume)	1	46.8	24	23	36.9	20	16	27		34		33	50	39
Coke (% by volume)					78.5									
Mineral (% by volume)	19	10	5	6	3	3	3	5		30		3	9	3
Mean max Vitrinite Reflectance ($R_{V,max}$)	0.54	1.02	1.63	1.65	1.24	1.1	1.3	1.4		0.54		1.16	1.12	1.45
Semi-inertinite (low reflecting inertinite)	1	36	16	15	20	17	13	18						28

COLLIERY / DEPOSIT	NEW OAKLEIGH	NEWLANDS	NORWICH PARK		NORTH GOONYELLA	OAKY CREEK		PEAK DOWNS	PEAK DOWNS EAST	PENTLAND	PIPELINE	POITREL/WINCHESTER		RED HILL
BRAND NAME	Oakleigh	Newlands	Norwich Park Coking	Norwich Park ULV	North Goonyella	Oaky Creek	Oaky North	Peak Downs	Peak Downs East	Pentland	Washed	Poitrel	Poitrel	Red Hill
TYPE	Thermal	Thermal	Coking	Coking	Coking	Coking	Coking	Coking	Coking	Thermal	Thermal	Coking	Thermal	Coking
ANALYSIS OF ASH (%)														
SiO_2	60	47.2	56.9	55.4	51.5	48.3	51.6	64.9		58.8			48.4	56.2
Al_2O_3	32	36.5	29.3	28.9	36.4	38.4	37	25.4		34			32.7	30.8
Fe_2O_3	1.8	4.8	5.5	6.4	4.4	4.2	3.53	2.9		2.1			6.43	4.2
TiO_2	1.8	1.34	1.6	1.6	1.67	1.52	1.81	1.4		1.9			1.53	1.7
Mn_3O_4	0.05	0.033	<0.10	0.1	0.033	0.01	0.01	<0.10		0.1			0.07	0.05
CaO	0.7	4	1.8	2.4	2.01	2.43	2.1	1.2		0.6			5.66	2
MgO	1.3	1.08	0.7	0.7	0.73	0.6	0.43	0.5		0.3			1.11	0.8
Na_2O	0.6	0.36	0.5	0.5	0.25	0.63	0.56	0.4		0.1			0.12	0.4
K_2O	0.75	0.65	1	0.9	0.76	0.99	0.83	0.9		0.7			0.75	0.9
P_2O_5	0.2	1.85	0.9	1.1	1.33	1.64	0.74	0.8		0.3			1.25	0.7
SO_3	0.3	1.13	0.5	0.7	0.34	0.63	1.15	0.4		0.3			1.59	1.2
Loss on ignition or undetermined	0.5	1.06			0.53	0.65	0.24			0.8			0.39	1.05
Total	100	100			100	100	100			100			100	100
MINOR CONSTITUENTS (db)														
Phosphorus (%)	0.01	0.074	0.04	0.06	0.050–0.055	0.06	0.05	0.035		0.01		0.006	0.06	0.03
Chlorine (%)	0.01	0.02			n/a	0.01		0.05		0.02		0.07		
Fluorine (%)	10	100			n/a					20				
Arsenic (ug/g)	1.5	1.3			n/a	0.3				1.15			1	
Boron (ug/g)	11	17			20					54				
Cadmium (ug/g)	0.01	0.05			n/a					0.01				
Mercury (ug/g)	0.015	0.09			n/a					0.012				
CAKING & COKING PROPERTIES														
Crucible swelling number (CSN)	1.5		9	8.5	8 to 9	8	9	8.5	8.5			7	1	8.5
Gray-King coke type			G6		G7–G9	G9	G9	G7				G7	D	
Roga index					72	87								
GIESELER PLASTOMETER VALUES														
Initial Softening Temperature (ºC)			445	450	415	390	395	425				413		452
Maximum Fluidity (dd/min)			100	20	900	>5000	>2000	350				1300		55
Maximum fluidity temperature (ºC)			480	485	465	450	465	470				451		479
Resolidification temperature (ºC)			510	510	505	495	500	505				486		494
Temp. range soften to resolidification (ºC)			65	60	90	105	105	80				73		42
DILATOMETER VALUES														
Initial softening temperature (ºC)			425	435	395	359	394	405						433
Temperature of max. contraction (ºC)			455	460	430	409	431	435						479
Temperature of max. dilatation (ºC)			490	465	470	475	486	480						490
Maximum contraction (%)			21	20	25	30	23	22						19
Maximum dilatation (%)			55	20	>100	240	180	80						6
COKE PROPERTIES														
Micum M_{40} index			82		82	78	83.2	84						
Micum M_{10} index			7.5		7	8.5	6.9	7						
IRSID I_{20} index			76		77	75.8	76.1	78						
IRSID I_{10} index			23		21	22	22.5	20						
ASTM coke strength - stability factor			58		63	58.3	59.6	62						
ASTM coke strength - hardness factor			62		68	63.7	63.1	67						
Coke reactivity index (CRI)			21		19 - 24	22.7	18.5	17						
Coke strength after reaction (CSR)			67		68–70	57.4	69	74						

COLLIERY / DEPOSIT	RIVERSIDE	ROLLESTON	RUGBY	RYWUNG	SARAJI	SEFTON PARK		SOUTH WALKER CREEK		SUTTOR CREEK	TAROBORAH	TAROOM		THEODORE	
BASIN	Bowen	Bowen	Bowen	Surat	Bowen	Surat		Bowen		Bowen	Bowen	Surat		Bowen	
OPERATOR / OWNER	BMC	XCQ	QCO	CHA	BMA	CHA		BMC		XCQ	NRM	ANG		ANG	
PROJECT STATUS	Mine - Operating	Deposit	Deposit	Deposit	Mine - Operating	Deposit		Mine - Operating		Deposit	Deposit	Deposit		Deposit	
BRAND NAME	Riverside	Rolleston	Washed	Rywung Raw	Saraji	Washed	Raw	PCI	Sth Walker	Suttor Creek	Washed	Washed	Raw	Raw	Washed
MARKET	Export				Export			Export	Export						
TYPE	Coking	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	PCI	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)															
Moisture	1.1	9.5	1.5	8.1	1	6	7.1	1.1	1.2	2.6	7	7	8.1	4.5	4.5
Ash	9.8	7.5	12.5	26.2	9.7	14	28.9	8.5	13.5	14	5.5	10	21	12	10
Volatile Matter	22	30	26.5	32.3	19	40.5	33.6	13.7	13.7	26.7	36	44.8	37.9	31	31.6
Fixed Carbon	67.1	53	59.5	33.4	70.3	39.5	30.4	76.7	71.6	56.7	51.5	38.2	33	53.9	53.9
TOTAL MOISTURE (% as)	10	16			10			9	8.8						11
EQUILIBRIUM MOISTURE (% as)										4.5				6.3	
SPECIFIC ENERGY															
Gross (MJ/kg, ad)	32.3	26.9	30.0	21.5	32.4	26.4	20.9	32.6	30.0	28.7	28.5	26.4	22.5	28.0	28.8
Gross (MJ/kg, daf)	36.2	30.9	34.9	32.7	36.3	33.0	32.6	36.0	35.2	34.4	32.6	31.8	31.7	33.6	33.7
Gross (kCal/kg, ad)	7705	6425	7170	5140	7740	6300	4980	7775	7175	6850	6810	6300	5370	6700	6880
ULTIMATE ANALYSIS (% daf)															
Carbon	88.3	80.1			89.7	77.9	78.1	90.6	90.1	84.8		78	78.3	81.2	82
Hydrogen	5	5.0			4.7	6.2	6.2	4.2	4.1	4.8		6.3	5.7	5.2	5.2
Nitrogen	1.9	2.1			1.9	1.2	1.1	1.6	1.6	1.7		1.1	1.1	1.8	1.8
Sulphur	0.7	0.6			0.7	0.5	0.5	0.4	0.6	0.4		0.4	0.4	0.6	0.5
Oxygen	4.1	12.2			3	14.2	14.1	3.2	3.6	8.2		14.2	14.5	11.2	10.5
Total						100									
SULPHUR (% ad)															
Pyritic	<0.05				0.07			0.2				0.08	0.12	0.12	
Sulphate	<0.02				<0.02			0.02						0.02	
Organic	0.51				0.52			0.23				0.25	0.19	0.4	
Total	0.55	0.55	1.7	0.4	0.62	0.41	0.4	0.45	0.55	0.37	1	0.33	0.31	0.54	0.45
RELATIVE DENSITY (ad)				1.5			1.5			1.6		1.38	1.5	1.4	1.4
HARDGROVE GRINDABILITY INDEX	85	53	50		95	35	40	84	84	65		35	40	53	50
ABRASION INDEX (mg/kg)															
ASH FUSION TEMPERATURE Reducing atmosphere (°C)															
Deformation	1580	1210			1450	1280	1260	1440	1345	1500		1450	1450	1230	1470
Sphere	>1600	1280			>1600			1480	1400	1600				1350	1520
Hemisphere	>1600	1320			>1600	1520	1600	1500	1415	1600		1510	1500	1370	1530
Flow	>1600	1380			>1600	>1560	1600	1520	1440	1600		>1520	>1550	1430	1550
PETROGRAPHIC ANALYSIS															
Vitrinite (% by volume)	58	70			70			41		34		75		62	70
Liptinite (% by volume)	1	4			0			0		4		16		3	3
Inertinite (% by volume)	36	19			27			56		57		2		26	23
Coke (% by volume)															
Mineral (% by volume)	5	7			3			3		5		7		9	4
Mean max Vitrinite Reflectance ($R_{V,max}$)	1.2	0.58			1.55	0.47		1.85		0.96		0.47		0.67	0.67
Semi-inertinite (low reflecting inertinite)	24	18			19			45				1			

COLLIERY / DEPOSIT	RIVERSIDE	ROLLESTON	RUGBY	RYWUNG	SARAJI	SEFTON PARK		SOUTH WALKER CREEK		SUTTOR CREEK	TAROBORAH	TAROOM		THEODORE	
BRAND NAME	Riverside	Rolleston	Washed	Rywung Raw	Saraji	Washed	Raw	PCI	Sth Walker	Suttor Creek	Washed	Washed	Raw	Raw	Washed
TYPE	Coking	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	PCI	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal
ANALYSIS OF ASH (%)															
SiO_2	65.4	56.00			57.3	59.5	59.8	39.2	43.1	57.2		47.4	48.4	53.7	58
Al_2O_3	27	21.36			30.4	31.8	31	37.1	31.6	36.2		33.2	32.9	24.8	27
Fe_2O_3	2.4	10.96			4.3	1.92	2.1	7.5	7.3	1.9		3.1	2.8	9.7	6.6
TiO_2	1.7	0.95			1.6	1.91	1.8	2	1.6	1.7		1.6	1.5	1.1	1.5
Mn_3O_4	<0.10	0.06			<0.10	0.11	0.1	0.1	0.1	0.01		0.03	0.1	0.1	0.05
CaO	0.2	4.55			1.7	1.6	1.6	4.9	6.7	0.7		7.2	7.8	3.1	2.2
MgO	0.4	1.57			0.6	0.98	1	1.5	1.6	0.3		0.9	0.8	1.6	1.1
Na_2O	0.4	0.92			0.6	0.7	0.7	0.3	0.6	0.2		1.1	0.9	0.3	0.4
K_2O	0.9	0.49			1.1	0.6	0.6	0.9	0.9	0.7		0.4	0.4	1.6	1.1
P_2O_5	0.2	1.17			0.7	0.06	0.7	2.1	2.5	0.6		0.6	0.5	0.6	0.8
SO_3	0.1	1.45			0.6	0.72	0.7	2.7	2.8	0.1		3.4	3	0.1	0.7
Loss on ignition or undetermined		0.52				0.1	0			0.39		1.07	0.9	3.3	0.55
Total		100				100	100.1			100		100	100	100	100
MINOR CONSTITUENTS (db)															
Phosphorus (%)	0.007	0.045			0.03	0.004		0.08		0.04		0.02	0.02	0.03	0.03
Chlorine (%)	0.04	0.01			0.04					0.05		0.01	0.01	0.02	0.02
Fluorine (%)		91				50	50						10		0.001
Arsenic (ug/g)		0.80					2			1			2	4	2
Boron (ug/g)		100				47				96			47		53
Cadmium (ug/g)		0.01								0.04			0.02		0.11
Mercury (ug/g)		0.04				0.02							0.02		0.11
CAKING & COKING PROPERTIES															
Crucible swelling number (CSN)	7.5	1			8.5			1		1.5		1	0.5	1	1.5
Gray-King coke type	G5				G7										
Roga index															
GIESELER PLASTOMETER VALUES															
Initial Softening Temperature (ºC)	415				435									347	
Maximum Fluidity (dd/min)	500				200									1	
Maximum fluidity temperature (ºC)	460				480									383	
Resolidification temperature (ºC)	500				505									420	
Temp. range soften to resolidification (ºC)	85				70									73	
DILATOMETER VALUES															
Initial softening temperature (ºC)	395				420										
Temperature of max. contraction (ºC)	435				445										
Temperature of max. dilatation (ºC)	470				485										
Maximum contraction (%)	21				21										
Maximum dilatation (%)	65				75										
COKE PROPERTIES															
Micum M_{40} index	81				84										
Micum M_{10} index	7				7										
IRSID I_{20} index	77				78										
IRSID I_{10} index	21				20										
ASTM coke strength - stability factor	60				62										
ASTM coke strength - hardness factor	67				67										
Coke reactivity index (CRI)	21				17										
Coke strength after reaction (CSR)	72				74										

COLLIERY / DEPOSIT	TOGARA NORTH	TOGARA SOUTH	VALERIA	VERMONT		WANDOAN DEPOSITS		WARDS WELL	WINCHESTER SOUTH	WILKIE CREEK		YARRABEE	
BASIN	Bowen	Bowen	Bowen	Bowen		Surat		Bowen	Bowen	Surat		Bowen	
OPERATOR / OWNER	XCA	BHP	PAC	QCM		XCQ		BMC	PAC	PWC		YAR	
PROJECT STATUS	Deposit	Deposit	Deposit	Deposit		Deposit		Deposit	Deposit	Mine - Operating		Mine - Operating	
BRAND NAME	Togara North	Washed	Valeria	Washed	Semi-Soft	Washed	Raw	Wards Well	Winchester South	Domestic	Surat Premium	MPA	MPB
MARKET										Domestic	Export	Export	Export
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal
PROXIMATE ANALYSIS (% ad)													
Moisture	5	4	5.0	1.5	1.5	9.7	7.9	1.1	2.0	8	7.5	1.5	1.5
Ash	11	8.4	9.0	13	9	8.0	23.9	8.4	14.0	14	11.5	10.5	14.5
Volatile Matter	27	29.9	33.5	19.5	20.5	41.5	36.1	22.2	21.0	40	41.5	10.5	10.5
Fixed Carbon	55	57.7	52.5	65.5	69	40.8	32.1	68.3	63.0	38	39.5	77.5	73.5
TOTAL MOISTURE (% as)			12.0			15	12.8			12	12	8.5	8.5
EQUILIBRIUM MOISTURE (% as)													
SPECIFIC ENERGY													
Gross (MJ/kg, ad)	28.5	29.4	29.3	30.4	31.8	26.6	21.6	32.7	29.3	25.8	26.8	31.0	29.1
Gross (MJ/kg, daf)	33.9	33.6	34.1	35.5	35.5	32.3	31.7	36.1	34.9	33.1	33.1	35.2	34.7
Gross (kCal/kg, ad)	6810	7020	7000	7250	7590	6350	5160	7800	7000	6190	6400	7400	6960
ULTIMATE ANALYSIS (% daf)													
Carbon	83.5	83.1	82.3	88	88.4	77.4	75.9	88.7	87.0	81.8	78.3	90.76	90.76
Hydrogen	4.8	4.99	5.3	5.2	4.7	6.0	6.2	4.9	4.6	6.7	6	3.76	3.76
Nitrogen	1.8	1.98	2.00	1.8	1.8	0.9	1.1	1.9	1.70	1.1	1.1	1.85	1.85
Sulphur	0.5	0.36	0.80	0.5	0.4	0.4	0.4	0.5	0.40	0.5	0.4	0.81	0.81
Oxygen	9.6	9.64	9.50	4.5	4.7	15.3	16.3	4	6.30	9.9	14.2	2.82	2.82
Total										100	100		
SULPHUR (% ad)													
Pyritic		0.1	0.18			0.08	0.08		0.04	0.07	0.07		
Sulphate		0.02	0.03			0.01	0.01		0.01	0.02	0.02		
Organic		0.21	0.49			0.19	0.23		0.30	0.3	0.3		
Total	0.3	0.31	0.70	0.45	0.36	0.28	0.32	0.5	0.35	0.39	0.37	0.65	0.65
RELATIVE DENSITY (ad)	1.4	1.36	1.4		1.4	1.3	1.5		1.5	1.5	1.3		
HARDGROVE GRINDABILITY INDEX	55	56	40	80	80	35	40		75	35	35	70	80
ABRASION INDEX (mg/kg)		7				15	23			15	15		
ASH FUSION TEMPERATURE Reducing atmosphere (°C)													
Deformation	1270	1270	1540	1350	1310	1340	1250	1470	1350	1500	1320	1200	1200
Sphere	1300	1360	1580	1450	1430	1360	1430	1530		>1600	1550		
Hemisphere	1310	1380	>1600	1500	1470	1370	1450	1540	1470	>1600	1570	1300	1300
Flow	1340	1400	>1600	>1600	>1600	1380	1480	1550	1500	>1600	>1600	1400	1400
PETROGRAPHIC ANALYSIS													
Vitrinite (% by volume)	30	52	45			72		58	30		71	39	39
Liptinite (% by volume)	4	3	11			14		0	2		13		
Inertinite (% by volume)	60	42	42			9		37	60		9	56	56
Coke (% by volume)													
Mineral (% by volume)	6	3	2			5		5	8		7	5	5
Mean max Vitrinite Reflectance ($R_{V,max}$)	0.72	0.73	0.68		1.22			1.25	1.15	0.4	0.4	2.59	2.59
Semi-inertinite (low reflecting inertinite)			30			8		25				53	53

COLLIERY / DEPOSIT	TOGARA NORTH	TOGARA SOUTH	VALERIA	VERMONT		WANDOAN DEPOSITS		WARDS WELL	WINCHESTER SOUTH	WILKIE CREEK		YARRABEE	
BRAND NAME	Togara North	Washed	Valeria	Washed	Semi-Soft	Washed	Raw	Wards Well	Winchester South	Domestic	Surat Premium	MPA	MPB
TYPE	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Thermal	Coking	Thermal	Thermal	Thermal	Thermal	Thermal
ANALYSIS OF ASH (%)													
SiO_2	43	49.3	61.5	57	54.6	48.00	59.36	53.2	52	63.5	58.5	53.17	53.17
Al_2O_3	26	23.5	30.2	30	30.3	28.90	26.6	33.8	30	27.5	33.7	23.7	23.7
Fe_2O_3	14	9.26	4.21	3	6.64	3.15	2.84	5.7	8	1.75	1.55	8.38	8.38
TiO_2	1	1.03	1.42	0.9	0.92	1.61	0.81	1.6	1.5	1.7	1.48	1.12	1.12
Mn_3O_4	0.1	0.09	0.04			0.03	0.04	0.07	0.1	0.01	0.01	0.08	0.08
CaO	7.5	8.26	0.8	4.5	2.9	7.50	3.79	1.7	3.5	1.75	1.49	6.52	6.52
MgO	1.7	1.58	0.55	0.9	1.11	2.03	1.38	0.8	0.5	1.4	1	1.41	1.41
Na_2O	0.2	0.4	0.19	0.3	0.15	2.96	1.8	0.3	0.5	0.8	0.51	1.42	1.42
K2O	0.6	0.44	0.51	1.2	1.05	0.47	1	0.6	1	0.4	0.21	1.21	1.21
P_2O_5	1.3	2.46	0.29	2.1	2.21	0.05	0.06	1	1.5	0.05	0.04	2.02	2.02
SO_3	2.4	3.24	0.12	<0.10	<0.01	3.98	1.5	0.6	1.4	0.6	0.6		
Loss on ignition or undetermined	2.2	0.44	0.17			0.87	0.82	0.63		0.54	0.91		
Total	100	100	100			100	100	100	100	100	100		
MINOR CONSTITUENTS (db)													
Phosphorus (%)		0.091	0.011			0.017		0.04	0.09	0.005	0.005	0.08	0.08
Chlorine (%)			0.04			0.17	0.04		0.05	0.03	0.03	0.09	0.09
Fluorine (%)						50					10	6	6
Arsenic (ug/g)		0.38	1.5			1.09	1.5		1	1		1	1
Boron (ug/g)		38	68			33					40	25	25
Cadmium (ug/g)		0.06	0.011			0.08					0.7	0.07	0.07
Mercury (ug/g)		0.06	0.015			0.02					0.017	0.01	0.01
CAKING & COKING PROPERTIES													
Crucible swelling number (CSN)		1.5	1	1	1.0–2.0			7					
Gray-King coke type								G6					
Roga index													
GIESELER PLASTOMETER VALUES													
Initial Softening Temperature (ºC)								420					
Maximum Fluidity (dd/min)								400					
Maximum fluidity temperature (ºC)								465					
Resolidification temperature (ºC)								490					
Temp. range soften to resolidification (ºC)								70					
DILATOMETER VALUES													
Initial softening temperature (ºC)								410					
Temperature of max. contraction (ºC)								455					
Temperature of max. dilatation (ºC)								480					
Maximum contraction (%)								27					
Maximum dilatation (%)								42					
COKE PROPERTIES													
Micum M_{40} index													
Micum M_{10} index													
IRSID I_{20} index													
IRSID I_{10} index													
ASTM coke strength - stability factor													
ASTM coke strength - hardness factor													
Coke reactivity index (CRI)													
Coke strength after reaction (CSR)													

Appendix C
Company Information —
Contact Details and Project Ownership

The information presented here includes contact details and project ownership information for companies that operate or have majority ownership in Queensland's operating mines and identified coal deposits, as noted in previous sections of this publication. Potential investors in the development and mining of Queensland's coal resources, or organizations wishing to purchase coal from Queensland, are encouraged to contact the owners or project operators directly.

The information presented includes:

Operator/Owner Contact Details: for the operator or proprietor of the listed mines and deposits, a contact address and phone number (international code) is given, and where available an email contact and web site address from which to obtain further information as required. In some cases, details for just the principal (or majority) owner are given.

Mine/deposit, status, coal type, deposit type: list of each mine or deposit, operating status and type, under the management or control of the operator/owner.

Ownership Details: this information identifies the individual company ownership of each mine or deposit. The details are valid as at July 2003. Major changes in ownership of some of the mine operators and projects have occurred since the publication of the last edition of Queensland Coals. These changes are included in the information in this section. Changes occurring since July 2003 have generally not been included.

Note that some abbreviation of full company names has been necessary in this section.

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
Anglo Coal Australia Pty Ltd GPO Box 1410 Brisbane QLD 2001 Phone: +61 7 3834 1333 Web site: www.anglocoal.com.au	BOUNDARY HILL	Mine-Operating	TH	OC	Anglo Coal Aust. Pty Ltd 100%
	CALLIDE	Mine-Operating	TH	OC	Anglo Coal Aust. Pty Ltd 100%
	Callide — other	Deposit	TH	OC/ UG	Anglo Coal Aust. Pty Ltd 100%
	Dawson	Deposit	TH	OC/ UG	Anglo Coal Aust. Pty Ltd 51% Mitsui Moura Investment Pty Ltd 49%
	GERMAN CREEK	Mine-Operating	CO	OC/ UG	Anglo Coal Aust. Pty Ltd 70% Mitsui & Co. Ltd 30%
	GERMAN CREEK EAST	Mine-Operating	CO	OC	Anglo Coal Aust. Pty Ltd 86.36% Marubeni Coal Pty Ltd 13.64%
	Grosvenor	Deposit	CO	OC/ UG	Anglo Coal Aust. Pty Ltd 100%
	Lake Lindsay	Deposit	CO/ TH	OC/ UG	Anglo Coal Aust. Pty Ltd 70% Mitsui & Co. Ltd 30%
	MORANBAH NORTH	Mine-Operating	CO	UG	Anglo Coal Aust. Pty Ltd 88% Nippon Steel Aust. Pty Ltd 5% Tomen Coal Resources Pty Ltd 3.75% NS Resources Aust. 1.25% Sumikin Bussan Coal Aust. Pty Ltd 1% Shinsho Aust. Pty Ltd 0.5% Kokan Kogyo (Aust.) Pty Ltd 0.5%
	MOURA	Mine-Operating	CO/ TH	OC	Anglo Coal Aust. Pty Ltd 51% Mitsui & Co. Ltd 49%
	Taroom	Deposit	TH	OC	Anglo Coal Aust. Pty Ltd 51% Mitsui Moura Investment Pty Ltd 49%
	Theodore	Deposit	TH	OC	Anglo Coal Aust. Pty Ltd 51% Mitsui Moura Investment Pty Ltd 49%
Australian Premium Coals Pty Ltd PO Box 7057 Riverside Centre QLD 4001 Phone: +61 7 3239 7666 Web site: www.macarthurcoal.com.au	COPPABELLA	Mine-Operating	TH	OC/ UG	Macarthur Coal Ltd. 50% AMCI Aust. Pty Ltd 30% CITIC Aust. Pty Ltd 5% Marubeni Corp. 5% Nissho Iwai Corp. 5% Kawasho Corp. 3% Nippon Steel Trading Co Ltd 2%.
	MOORVALE	Mine-Operating	TH	OC	Macarthur Coal Ltd. 77% AMCI Aust. Pty Ltd 13.8% CITIC Aust. Pty Ltd 2.3% Marubeni Corp. 2.3% Nissho Iwai Corp. 2.3% Kawasho Corp. 1.38% Nippon Steel Trading Co Ltd 0.92%.
Aquila Resources Limited PO Box 1038 South Perth WA 6951 Phone: +61 8 9474 3311 www.aquilaresources.com.au	Moura West	Deposit	CO	UG	Aquila Coal Pty Ltd 100%
Baralaba Coal Pty Ltd c/- Peabody Coaltrade Pty Ltd PO Box 47 Hunter Region MC NSW 2310 Phone: +61 2 4968 8699	Baralaba (Dawson Valley)	Deposit	TH	OC/ UG	Peabody Baralaba Investments Aust. Pty Ltd 62.5% Republic Coal Pty Ltd 37.5%
Coal Mines Australia Limited c/- BHP Billiton GPO Box 1389 Brisbane QLD 4001 Phone: +61 7 3226 0600 Web site: www.bhpbilliton.com	Togarah South	Deposit	TH	UG	BHP Billiton Ltd 100%

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
BHP Billiton Mitsubishi Alliance GPO Box 1389 Brisbane QLD 4001 Phone: +61 7 3226 0600 Web site: www.bmacoal.com	BLACKWATER	Mine-Operating	CO	OC	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	CRINUM	Mine-Operating	CO	UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	Daunia	Deposit	CO	OC	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	GOONYELLA	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	GREGORY - CRINUM	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	Liskeard	Deposit	CO	OC	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	NORWICH PARK	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	PEAK DOWNS	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	Peak Downs East	Deposit	CO	UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	Red Hill	Deposit	CO	UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	SARAJI	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	Sirius Creek	Deposit	CO	UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
	SOUTH BLACKWATER	Mine-Operating	CO	OC/ UG	BHP Billiton Ltd. 50% Mitsubishi Development Pty Ltd 50%
BHP Mitsui Coal Pty Ltd c/- BHP Billiton Mitsubishi Alliance GPO Box 1389 Brisbane QLD 4001 Phone: +61 7 3226 0600 Web site: www.bmacoal.com	Bee Creek	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Kemmis - Walker	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Lancewood	Deposit	CO	UG	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Mavis Downs	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Morambah	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Nebo West	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Poitrel	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	RIVERSIDE	Mine-Operating	CO	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	SOUTH WALKER CK	Mine-Operating	TH	OC/ UG	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Wards Well	Deposit	CO	UG	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Winchester	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
	Wotonga	Deposit	TH	OC	BHP Billiton Ltd. 80% Mitsui & Co Ltd 20%
Chandail Pty Ltd c/- Chinchilla Coal Pty Ltd 23 Corona St Hamilton NSW 2303 Phone: +61 2 4961 3630	Rywung	Deposit	TH	OC	Chandail Pty Ltd 50% Ecarlate Pty Ltd 50%
	Sefton Park	Deposit	TH	OC	Chandail Pty Ltd 50% Ecarlate Pty Ltd 50%
Curragh Queensland Mining Pty Ltd c/- Wesfarmers Curragh Pty Ltd GPO Box 51 Brisbane QLD 4001 Phone: +61 7 3031 7777 Web site: www1.wesfarmers.com.au	CURRAGH	Mine-Operating	CO/ TH	OC/ UG	Wesfarmers Ltd. 100%
	Curragh East	Deposit	CO/ TH	OC/ UG	Wesfarmers Ltd. 100%
	Curragh North	Deposit	TH	OC/ UG	Wesfarmers Ltd. 100%
	Curragh North (Pisces)	Deposit	TH	OC/ UG	Stanwell Corp. Ltd 100%

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
Cook Resource Mining Pty Ltd PO Box 119 Blackwater QLD 4717 Phone: +61 7 4986 1600 Web site: www.centennialcoal.com.au	COOK	Mine-Operating	CO	UG	Xstrata Coal Aust. Ltd. 50% Centennial Coal Company Ltd 45% Tokyo Boeki Aust. Pty Ltd 5%
CS Energy Pty Ltd GPO Box 769 Brisbane QLD 4001 Phone: +61 7 3222 9333 Web site: www.csenergy.com.au	Kogan Creek	Deposit	TH	OC	CS Energy Pty Ltd 100%
Cuba Mining Pty Ltd PO Box 7146 Riverside Centre QLD 4001 Phone: +61 7 3221 7210	Hillalong	Deposit	TH	OC/ UG	Cuba Mining Pty Ltd 30% Qld Coal Exploration Pty Ltd 25% Qld Coal Resources Pty Ltd 24% Happyclam Pty Ltd 21%
Ebenezer Mining Company Pty Ltd 350 Coopers Road Willowbank QLD 4306 Tel: +61 7 5467 3355	Bremer View East	Deposit	TH	OC	Idemitsu Kosan Co Ltd 100%
	Bremer View West	Deposit	TH	OC	Idemitsu Kosan Co Ltd 100%
	EBENEZER	Mine-Closed	TH	OC	Idemitsu Kosan Co Ltd 100%
	Mount Mort	Deposit	TH	OC	Idemitsu Kosan Co Ltd 100%
Ensham Resources Pty Limited GPO Box 814 Brisbane QLD 4001 Phone: +61 7 3221 1201 Web site: www.ensham.com.au	ENSHAM	Mine-Operating	TH	OC/ UG	Idemitsu Kosan Co Ltd 85% EPDC (Aust.) Pty Ltd 10% LG International (Aust.) Pty Ltd. 5%
Foxleigh Mining Pty Ltd GPO Box 843 Brisbane QLD 4001 Phone: +61 7 3220 0800 Fax: +61 7 3220 0449 Email: info@foxleigh.com.au	FOXLEIGH	Mine-Operating	TH	OC	CAML Resources Pty Ltd 63% ICRA Foxleigh Pty Ltd 20.6% Bowen Basin Investments Pty Ltd 16.4%
	Foxleigh South	Deposit	TH	OC	CAML Resources Pty Ltd 63% ICRA Foxleigh Pty Ltd 20.6% Bowen Basin Investments Pty Ltd 16.4%
Hancock Prospecting Pty Ltd Post Office Locked Bag No.2 West Perth WA 6005 Phone +61 8 9429 8222	Alpha	Deposit	TH	OC/ UG	Hancock Prospecting Pty Ltd 100%
	Kevins Corner	Deposit	TH	OC	Hancock Prospecting Pty Ltd 100%
Kumba Australia Pty Ltd Level 1, 1 Havelock Street West Perth WA 6005 Phone +61 8 9321 7211	Moranbah South	Deposit	CO	UG	Kumba Resources Ltd 100%
Macarthur Coal Limited PO Box 7146 Riverside Centre QLD 4001 Phone: +61 7 3221 7210 Web site: www.macarthurcoal.com.au	Codrilla	Deposit	TH	OC/ UG	Macarthur Coal Ltd. 100%
	Monto	Deposit	TH	OC	Macarthur Coal Ltd. 51% Sanrus Pty Ltd 39.2% Edge Developments Pty Ltd 4.9% H&J Enterprises (Qld) Pty Ltd 4.9%
	Olive Downs	Deposit	TH	OC/ UG	Macarthur Coal Ltd. 100%

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
Megajoule Mining Pty Ltd c/- Tenement Administration Services GPO Box 3081 Brisbane QLD 4001 Phone: +61 7 3229 5611	Gattonvale	Deposit	TH	OC/ UG	Megajoule Mining Pty Ltd 100%
Millennium Coal Pty Ltd PO Box 3109 Singleton DC NSW 2330 Phone: +61 2 6571 4781	Millennium	Deposit	CO/ TH	OC/ UG	Millennium Coal Pty Ltd 100%
Millmerran Operating Company Pty Ltd PO Box 5743 Brisbane QLD 4001 Phone: +61 7 3001 7138 Web site: www.intergen.com/australia.html	Bringalily North	Deposit	TH	OC	InterGen (Aust.) 53.69% Marubeni Corp. 30% GEC 6.31% EIF Group 5% Tohoku Electric Power Co. Inc. 5%
	COMMODORE	Mine-Operating	TH	OC	InterGen (Aust.) 53.69% Marubeni Corp. 30% GEC 6.31% EIF Group 5% Tohoku Electric Power Co. Inc. 5%
Mt. Robert Coal Pty Ltd Level 20, 141 Queen Street Brisbane QLD 4000 Phone: +61 7 3220 0800	Mt Fort Cooper/ Carinyah	Deposit	TH	OC	Mt. Robert Coal Pty Ltd 57% Itochu Coal Resource Aust. Pty Ltd 26.6% IBA Coal Investments Pty Ltd 16.4%
	Wonbindi (Baralaba)	Deposit	TH	OC	Mt. Robert Coal Pty Ltd 57% Itochu Coal Resource Aust. Pty Ltd 26.6% IBA Coal Investments Pty Ltd 16.4%
New Hope Corporation Limited PO Box 47 Ipswich QLD 4305 Phone: +61 7 3810 0500 Web site: www.newhopecoal.com.au	JEEBROPILLY	Mine-Operating	TH	OC	New Hope Corp. Ltd 100% (comprising Washington H Soul Pattinson & Co 69.337% and various minority owners)
	Minerva	Deposit	TH	OC/ UG	New Hope Corp. Ltd 70% Winnin Pty Ltd 30%
	NEW ACLAND	Mine-Operating	TH	OC	New Hope Corp. Ltd. 100%
	NEW OAKLEIGH	Mine-Operating	TH	OC	New Hope Corp. Ltd. 100%
	Rosewood	Mine-Operating	TH	OC	New Hope Corp. Ltd. 100%
	Sabine	Deposit	TH	OC	New Hope Corp. Ltd. 100%
	Smithfield	Mine-Operating	TH	OC	New Hope Corp. Ltd. 100%
	Spring Mountain	Deposit	TH	UG	New Hope Corp. Ltd. 100%
	SWANBANK	Mine - closed	TH	OC/ UG	New Hope Corp. Ltd. 100%
	Thagoona	Mine-Operating	TH	OC	New Hope Corp. Ltd. 100%
Newmont Pacific Energy Pty Ltd 100 Hutt Street Adelaide SA 5000 Phone: +61 8 8303 1722	Bringalily South*	Deposit	TH	OC	Newmont Mining Corp. 100%
	Felton	Deposit	TH	OC	Newmont Mining Corp. 100%
	Lochbar	Deposit	TH	OC	Newmont Mining Corp. 100%
Qld. Dept. of Natural Resources and Mines GPO Box 2454 Brisbane QLD 4001 Phone: +61 7 3237 1480	Cullin-la-Ringo	Deposit	TH	UG	Held under Departmental Restricted Area (RA) 279
	Taroborah	Deposit	TH	OC/ UG	Held under Departmental Restricted Area (RA) 290

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
Pacific Coal Pty Limited GPO Box 391 Brisbane QLD 4001 Phone: +61 7 3361 4200 Web site: www.pacificcoal.com.au www.riotinto.com	BLAIR ATHOL	Mine-Operating	TH	OC	Rio Tinto Ltd. 71.2380% UniSuper Ltd. 15.3940% EPDC (Aust.) Pty Ltd 9.9513% JCD Aust. Pty Ltd 3.4167%
	Clermont	Deposit	TH	OC	Rio Tinto Ltd. 55% Mitsubishi Development Pty Ltd 45%
	HAIL CREEK	Mine-Operating	CO	OC/ UG	Rio Tinto Ltd. 92% Marubeni Aust. Ltd 5.33% Sumitomo Corp. 2.67%
	KESTREL	Mine-Operating	CO	UG	Rio Tinto Ltd. 80% Mitsui & Co Ltd 20%
	Kunioon	Deposit	TH	OC	Rio Tinto Ltd. 100%
	Lake Elphinstone	Deposit	TH	OC/ UG	Rio Tinto Ltd. 92% Marubeni Aust. Ltd 5.33% Sumitomo Corp. 2.67%
	MEANDU	Mine-Operating	TH	OC	Rio Tinto Ltd. 100%
	SW Yarraman	Deposit	TH	OC	Rio Tinto Ltd. 100%
	Valeria	Deposit	TH	OC	Rio Tinto Ltd. 71.238% UniSuper Ltd. 15.394% EPDC (Aust.) Pty Ltd 9.9513% JCD Aust. Pty Ltd 3.4167%
	Winchester South	Deposit	TH	OC	Rio Tinto Ltd. 75% Westfield Ltd. 25%
Peabody (Wilkie Creek) Pty Ltd PO Box 260 Dalby QLD 4405 Phone: +61 7 4663 5555 Email: wilkiecreek@peabodywilkiecreek.com	Horse Creek	Deposit	TH	OC	Peabody Surat Pty Ltd 100%
	WILKIE CREEK	Mine-Operating	TH	OC	Peabody Surat Pty Ltd 100%
Queensland Coal Mine Management Pty Ltd c/- Jellinbah Mining Pty Ltd GPO Box 374 Brisbane QLD 4001 Phone: +61 7 3877 6700 Web site: www.jellinbah.com.au	JELLINBAH EAST	Mine-Operating	TH	OC/ UG	Qld. Coal Mine Management Pty Ltd 70% Marubeni Corp. 15% Nissho Iwai Corp. 15%
	Vermont	Deposit	TH	OC/ UG	Qld. Coal Mine Management Pty Ltd 70% AMCI Metal & Kohle AG 10% Marubeni Coal Pty Ltd 10% Winning Pty Ltd 10%
QCOAL Pty Ltd 1095 Waterworks Road The Gap QLD 4061 Phone +61 7 3300 1111	Bowen River	Deposit	CO/ TH	OC	QCOAL Pty Ltd 100%
	Minyango	Deposit	CO/ TH	OC/ UG	QCOAL Pty Ltd 100%
	Rugby	Deposit	CO/ TH	OC/ UG	QCOAL Pty Ltd 100%
RAG Australia Coal Pty Ltd Level 27, AMP Place 10 Eagle Street Brisbane, QLD 4000 Phone: +61 7 3225 5500 Web site: www.rag-coalinter.de/profil/eprofil101b.htm	Broadmeadow	Deposit	CO/ TH	OC	RAG Aust. Coal Pty Ltd 95% Thiess Investments Pty Ltd 5%
	BURTON	Mine-Operating	CO/ TH	OC/ UG	RAG Aust. Coal Pty Ltd 95% Thiess Investments Pty Ltd 5%
	Eaglefield	Deposit	CO/ TH	OC	RAG Aust. Coal Pty Ltd 100%
	NORTH GOONYELLA	Mine-Operating	CO	OC/ UG	RAG Aust. Coal Pty Ltd 100%
	Plumtree	Deposit	CO/ TH	OC	RAG Aust. Coal Pty Ltd 95% Thiess Investments Pty Ltd 5%
Ribfield Pty Ltd 3 Lyons Avenue Devonport TAS 7310 Phone: +61 4 2865 4077	Collingwood	Deposit	TH	OC	Ribfield Pty Ltd 100%
	Middlemount	Deposit	CO/ TH	OC/ UG	Ribfield Pty Ltd 99% Ellrock Pty Ltd 1%
	Ownaview	Deposit	TH	OC	Ribfield Pty Ltd 99% Ellrock Pty Ltd 1%

Operator/Owner Contact Details	MINE/Deposit	Status	Coal Type	Deposit Type	Ownership Details (as at July 2003)
Surat Coal NL Level 8, 261 George Street Sydney NSW 2000 Phone: +61 2 9247 5577	Guluguba	Deposit	TH	OC	Surat Coal NL 100%
Syntech Resources Pty Ltd PO Box 205 Robina QLD 4226 Phone: +61 7 5531 6968	Cameby Downs	Deposit	TH	OC	Syntech Resources Pty Ltd 100%
Tarong Energy Corporation Limited GPO Box 800 Brisbane QLD 4001 Phone: +61 7 3228 4333 Web site: www.tarongenergy.com.au	Glen Wilga Haystack Road	Deposit Deposit	TH TH	OC OC	Tarong Energy Corp. Ltd. 100% Tarong Energy Corp. Ltd. 100%
Taroom Coal NL PO Box 7109 Riverside Centre QLD 4001 Phone: +61 7 3839 4766	Elimatta	Deposit	TH	OC	Taroom Coal NL 100%
Christopher Wallin 1095 Waterworks Road The Gap QLD 4061 Phone +61 7 3300 1111	Bluff	Deposit	TH	UG	Christopher Wallin 100%
Xstrata Coal Australia Pty Ltd PO Box R1543 Royal Exchange Sydney NSW 1225 Tel: +61 2 9253 6732 Web site: www.xstrata.com/prod_coal.php	Togara North	Deposit	TH	UG	Xstrata Coal Aust. Pty Ltd 33.33% Mitsui Mining 33.33% Hyosung Corp. 8.33% SK Corp. 8.33% Korea Resources Corp. 8.33% Dongbu Corp. 8.33%
Xstrata Coal Queensland Pty Ltd GPO Box 1433 Brisbane QLD 4001 Tel: +61 7 3833 8000 Web site: www.mim.com.au/coal.html	COLLINSVILLE NEWLANDS OAKY CREEK Pentland PIPELINE Rolleston Suttor Creek Wandoan area deposits	Mine-Operating Mine-Operating Mine-Operating Deposit Mine-Operating Deposit Deposit Deposit	CO/TH TH CO TH CO/TH TH TH TH	OC/UG OC/UG OC/UG OC OC OC OC OC	Xstrata Qld. Ltd. 75% Itochu Corp. 25% Xstrata Qld. Ltd. 75% Itochu Corp. 25% Xstrata Qld. Ltd. 75% Sumisho Coal Aust. Pty Ltd 15% Itochu Corp. 10% Xstrata Qld. Ltd. 100% Xstrata Qld. Ltd. 75% Itochu Corp. 25% Xstrata Qld. Ltd. 100% Xstrata Qld. Ltd. 75% Itochu Corp. 25% Xstrata Qld. Ltd. 100%
Yarrabee Coal Company Pty Ltd PO Box 431 BLACKWATER QLD 4717 Phone: +61 7 4982 7730 Email: yarrabeecoal@yarrabeecoal.com.au	YARRABEE	Mine-Operating	TH	OC	Resource Management and Mining Pty Ltd 100%

Appendix D

Queensland Coal Industry

Rail, Port, Power and Services Contacts

RAILWAYS

QR
General Manager Coal, Coal & Freight Services
Level 10 Rail Centre 1
305 Edward Street
Brisbane Q 4000 Australia
Phone: +61 7 3235 1470
Email: qr.coal@qr.com.au
Web site: www.qr.com.au

PORTS

Abbot Point Bulk Coal Pty Ltd
PO Box 207 Bowen Qld 4805
Phone: +61 7 4786 0300
Web sites: www.pcq.com.au/html/02p_abbot.htm
www.mim.com.au/nca.html#abbotpoint

Hay Point Services Pty Ltd
Mail Service 283
Mackay Qld 4740
Phone: +61 7 4943 8222
Web site: www.pcq.com.au/html/02p_hay.htm

Dalrymple Bay Coal Terminal Pty Ltd
Mail Service F 283
Mackay Qld 4740
Phone: +61 7 4943 8444
Web sites: www.pcq.com.au/html/02p_hay.htm
www.primeinfrastructure.com.au/pages/home.php

Gladstone Port Authority
(RG Tanna and Barney Point terminals)
PO Box 259
Gladstone Qld 4680
Phone: +61 (07) 4976 1333
Web site: www.gpa.org.au

Queensland Bulk Handling Pty Ltd
(Fisherman Islands terminal)
PO Box 348
Wynnum Central Qld 4178
Phone: +61 7 3895 1166
Web site: www.portbris.com.au

COAL TESTING LABORATORIES

ACIRL Ltd
1 Acirl Street
Riverview Qld 4303
Phone: +61 7 3282 2011
Email: ipswich@acirl.com.au

Foundry Road
Emerald Qld 4702
Phone: +61 7 4982 4066

9 Acacia Street
Moranbah Qld 4744
Phone: +61 7 4941 8302

CASCO Australia Pty Ltd
7 Chain Street
Mackay Qld 4740
Phone: +61 7 4951 3977

104 Hanson Road
Gladstone Qld 4680
Phone: +61 7 4972 6591
Web site: www.casco.com.au

CCI Australia Pty Ltd
102 Hanson Road
Gladstone Qld 4680
Phone: +61 7 4972 4966
Web site: www.ccipl.com.au

Preplab Testing Services Pty Ltd
13 Bush Crescent
Parkhurst Industrial Estate
North Rockhampton Qld 4701
Phone: +61 7 4936 2977
Email: admin@preplab.com.au

SGS Australia
27 Wallace Street
Albion Qld 4010
Phone: +61 7 3262 7500
Email: sgs_australasia@sgs.com
Web site: www.sgs.com

POWER GENERATION UTILITIES

CS Energy Ltd
Level 21, Central Plaza Two 66 Eagle Street
Brisbane Qld 4000
Phone: +61 7 3222 9333
Email: energyinfo@csenergy.com.au
Web site: www.csenergy.com.au

Callide Power Station
PO Box 392
Biloela Qld 4715
Phone: +61 7 4992 9329

Swanbank Power Station
Mail Service 460
Ipswich Qld 4306
Phone: +61 7 3810 8800

Enertrade
Level 10, Comalco Place
12 Creek Street
Brisbane Qld 4000
Phone: +61 7 3331 9900
Email: contracts@enertrade.com.au
Web site: www.enertrade.com.au/glad.html

Gladstone Power Station
NRG Gladstone Operating Services Pty Ltd
PO Box 5046
Gladstone Qld 4680
Phone: +61 7 4976 5312

InterGen (Australia) Pty Ltd
Level 18, Comalco Place
12 Creek Street
Brisbane Qld 4000
Phone: +61 7 3001 7177
Email: energyinfo@csenergy.com.au
Web site: www.intergen.com

Millmerran Power Station
Millmerran Operating Company Pty Ltd
Rocky Creek Rd
Millmerran Qld 4357
Phone: +61 7 4612 0800

Stanwell Corporation Limited
GPO Box 773
Brisbane Qld 4001
Phone: +61 7 3335 7444
Web site: www.stanwell.com

Stanwell Power Station
PO Box 5895
Central Queensland Mail Centre Qld 4702
Phone: +61 7 4930 3444

Tarong Energy Corporation Ltd
GPO Box 800
Brisbane Qld 4001
Phone: +61 7 3228 4333
Web site: www.tarongenergy.com.au

Tarong Power Station
Tarong Rd
Tarong Qld 4615
Phone: +61 7 4160 9444

Transfield Services
GPO Box 5344
Sydney NSW 2001
Phone: +61 2 9475 5600
Email: power@transfieldservices.com
Web site: www.transfieldservices.com.au/power.asp

Collinsville Power Station
Power House Rd
Collinsville Qld 4804
Phone: +61 7 4785 8200

Appendix E: Conversion factors.

Length			
1 in	= 25.4 mm	**1 cm**	= 0.394 in
1 ft	= 304.8 mm	**1 m**	= 3.28 ft
1 yd	= 914 mm	**1 m**	= 1.09 yd
1 fur	= 201 m	**1 km**	= 4.97 fur
1 mile	= 1.609 km	**1 km**	= 0.621 mile
Area			
1 in^2	= 645.16 mm^2	**1 cm^2**	= 0.155 in^2
1 ft^2	= 0.093 m^2	**1 m^2**	= 10.8 ft^2
1 yd^2	= 0.836m^2	**1 m^2**	= 1.2 yd^2
1 perch	= 25.3 m^2	**1 m^2**	= 0.0395 perch
1 rood	= 0.101 ha	**1 ha**	= 9.88 rood
1 acre	= 0.405 ha	**1 ha**	= 2.47 acre
1 $mile^2$	= 2.59 km^2	**1 km^2**	= 0.386 $mile^2$
Volume			
1 in^3	= 16.387 cm^3	**1 cm^3**	= 0.061 in^3
1 ft^3	= 0.0283 m^3	**1 m^3**	= 35.3ft^3
1 yd^3	= 0.765 m^3	**1 m^3**	= 1.31 yd^3
1 fl oz	= 28.4 ml	**1 ml**	= 0.0352 fl oz
1 pt	= 568 ml	**1 litre**	= 1.76 pt
1 gal	= 4.546 litre	**1 m^3**	= 220 gal
Mass			
1 oz	= 28.35 g	**1 g**	= 0.03527 oz
1 lb	= 453.6 g	**1 kg**	= 2.2046 lb
1 ton	= 1.016 tonne	**1 tonne**	= 0.984 ton
Force			
1 lbf	= 4.45 N	**1 N**	= 0.225 lbf
1 tonf	= 9.96 kN	**1 kN**	= 0.1 tonf
Pressure			
1 psi	= 6.89476 kPa	**1 kPa**	= 0.145 psi
1 atmosphere	= 101.325 kPa	**1 Mpa**	= 9.87 atm.
1 ton/ in^2	= 15.4 Mpa	**1 Mpa**	= 0.647 ton/ in^2
1 inch Hg	=3.38639kPa	**1 kPa**	=29.5 inch Hg
1 inch water	=0.24908 kPa	**1 atm.**	=14.696 psi

Density	
1 lb/ in^3	= 27.7 t/ m^3
1 ton/ yd^3	= 1.33t/ m^3
Power	
1 horsepower	= 0.7457 kW
Energy	
1 Btu	= 1.05506 kJ
	= 0.2519 kcal
1 kilowatt/hour	= 3.6 MJ
1 cal	= 4.187 J
1 Btu/ lb	= 0.002326 MJ/ kg
1 kcal/ kg	= 0.0041868 MJ/ kg
1 tonne oil equiv.	= 41.868 GJ
1 tonne of coal equivalent (tce)	= 29.3 GJ
1 tonne oil	= 1.43 tce
1 tonne gas (liquid)	= 1.57 tce
1 tonne orimulsion	= 0.94 tce
1 tonne steam coal	= 0.91 tce
Calorific Values	
1 Btu/ lb	= 0.002326 MJ/ kg
	= 0.5556 kcal/ kg
1 Btu/ ft^3	= 37.26 kJ/ m^3
Net Specific Energy	
SE Net (as)	= SE gross (as, MJ/ kg) – 0.0245 x (M(as) + 9xH(as))
where M(as) % = total moisture as fired	
and H(as) % = hydrogen content as fired	

Appendix F: Comparative fuel heating values (indicative).

Queensland Coking Coals	30 - 33 MJ/ kg
Queensland Thermal Coals (export)	26 - 30 MJ/ kg
Queensland Thermal Coals (domestic)	18 - 29 MJ/ kg
LPG - Propane	49.6 MJ/ kg (25.3 MJ/ l)
LPG - Butane	49.1 MJ/ kg (27.7 MJ/ l)
Fuel Oil - low sulphur	44.1 MJ/ kg (39.7 MJ/ l)
Fuel Oil - high sulphur	42.9 MJ/ kg (40.8 MJ/ l)
Queensland Natural Gas	39.6 MJ/ m^3
Coke Oven Gas	18.1 MJ/ m^3
Blast Furnace Gas	4.0 MJ/ m^3

Appendix G: Specific Energy (calorific value) conversion table.

MJ/ kg	kcal/ kg	Btu/ lb		MJ/ kg	kcal/ kg	Btu/ lb
20.10	4800	8640		26.38	6300	11340
20.31	4850	8730		26.59	6350	11430
20.52	4900	8820		26.80	6400	11520
20.72	4950	8910		27.00	6450	11610
20.93	5000	9000		27.21	6500	11700
21.14	5050	9090		27.42	6550	11790
21.35	5100	9180		27.63	6600	11880
21.56	5150	9270		27.84	6650	11970
21.77	5200	9360		28.05	6700	12060
21.98	5250	9450		28.26	6750	12150
22.19	5300	9540		28.47	6800	12240
22.40	5350	9630		28.68	6850	12330
22.61	5400	9720		28.89	6900	12420
22.82	5450	9810		29.10	6950	12510
23.03	5500	9900		29.31	7000	12600
23.24	5550	9990		29.52	7050	12690
23.45	5600	10080		29.73	7100	12780
23.66	5650	10170		29.94	7150	12870
23.86	5700	10260		30.14	7200	12960
24.07	5750	10350		30.35	7250	13050
24.28	5800	10440		30.56	7300	13140
24.49	5850	10530		30.77	7350	13230
24.70	5900	10620		30.98	7400	13320
24.91	5950	10710		31.19	7450	13410
25.12	6000	10800		31.40	7500	13500
25.33	6050	10890		31.61	7550	13590
25.54	6100	10980		31.82	7600	13680
25.75	6150	11070		32.03	7650	13770
25.96	6200	11160		32.24	7700	13860
26.17	6250	11250		32.45	7750	13950

Appendix H: Factors for calculating coal analyses to different bases.

Given Basis	Desired Basis				
	Air-dried (ad)	As sampled (as) (as despatched) (as fired) or (as received)	Dry	Dry, ash-free (daf)	Dry, mineral matter free (dmmf)
Air-dried (ad)	—	$\frac{100 - M_{as}}{100 - M_{ad}}$	$\frac{100}{100 - M_{ad}}$	$\frac{100}{100 - (M_{ad} + A_{ad})}$	$\frac{100}{100 - (M_{ad} + MM_{ad})}$
As sampled (as) (as received) (as despatched) (as fired)	$\frac{100 - M_{ad}}{100 - M_{as}}$	—	$\frac{100}{100 - M_{as}}$	$\frac{100}{100 - (M_{as} + A_{as})}$	$\frac{100}{100 - (M_{as} + MM_{as})}$
Dry	$\frac{100 - M_{ad}}{100}$	$\frac{100 - M_{as}}{100}$	—	$\frac{100}{100 - A_d}$	$\frac{100}{100 - MM_d}$
Dry, ash-free (daf)	$\frac{100 - (M_{ad} + A_{ad})}{100}$	$\frac{100 - (M_{as} + A_{as})}{100}$	$\frac{100 - A_d}{100}$	—	$\frac{100 - A_d}{100 - MM_d}$
Dry, mineral matter-free (dmmf)	$\frac{100 - (M_{ad} + MM_{ad})}{100}$	$\frac{100 - (M_{as} + MM_{as})}{100}$	$\frac{100 - MM_d}{100}$	$\frac{100 - MM_d}{100 - A_d}$	—

Source: Australian Standard AS 1038.16 - 1996 (Standards Australia)

Index of Operating Collieries and Mines, and Undeveloped Coal Deposits

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