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## Introduction

**M**ining, as defined in the 1993 edition of the *Australian and New Zealand Standard Industrial Classification (ANZSIC)* (1292.0), broadly relates to the extraction of minerals occurring naturally as solids such as coal and ores; liquids such as crude petroleum; or gases such as natural gas.

The mining industry contributed \$16,889m or 4% of Australia's Gross Domestic Product (GDP) in 1994–95.

First stage processing of minerals and mineral extracts, while closely related to the mining industry, is included as part of the manufacturing industry. See *Chapter 18, Manufacturing* for details.

## Main features of 1994–95

Table 16.1 provides a summary of the operations of mining industries in 1994–95. Turnover in the mining industry sector remained relatively unchanged at \$28,936m (down less than 1% from 1993–94) while employment in the sector dropped by 2% to 55,348 persons between June 1994 to June 1995.

The mining industries which recorded the largest rises in turnover were Silver-lead-zinc, up \$129m to \$1,064m; and Mineral sands, up \$110m to \$631m. Other industries to show increases in turnover were Other metal ores, up \$389m to \$1,070m; Bauxite, up \$56m to \$856m; and Copper ore, up \$53m to \$1,019m.

Industries that declined in turnover were Coal, down \$531m to \$9,342m; Oil and gas, down \$124m to \$7,681m; Iron ore, down \$99m to \$3,103m; and Gold ore, down \$68m to \$4,169m.

Table 16.2 contains a summary of the operations of mining industries in 1994–95, by State and Territory.

**16.1 MINING, Summary of Operations by Industry — 1994–95**

	Employment(a) no.	Wages and salaries(b) \$m	Turnover(c) \$m	Stocks		Purchases and selected expenses \$m	Value added \$m	Net capital expenditure \$m
				Open \$m	Close \$m			
Coal mining	25 295	1 830	9 342	720	741	4 226	5 137	1 026
Oil and gas extraction	4 310	330	7 681	213	239	716	6 992	1 227
Metal ore mining								
Iron ore mining	6 090	402	3 103	327	280	1 102	1 954	438
Bauxite mining	1 713	92	856	55	40	288	554	56
Copper ore mining	2 236	133	1 019	140	150	351	678	65
Gold ore mining	8 238	413	4 169	513	571	2 147	2 080	1 005
Mineral sand mining	1 888	81	631	152	142	311	310	70
Silver-lead-zinc ore mining	3 366	185	1 064	146	114	472	561	130
Other(d)	2 212	125	1 070	255	284	451	648	680
Total metal ore mining	25 743	1 431	11 913	1 589	1 582	5 121	6 784	2 445
<b>Total mining 1994–95</b>	<b>55 348</b>	<b>3 590</b>	<b>28 936</b>	<b>2 522</b>	<b>2 562</b>	<b>10 063</b>	<b>18 914</b>	<b>4 698</b>
Total mining 1993–94	56 465	3 626	29 024	2 614	2 517	9 995	18 933	4 186

(a) Includes working proprietors. (b) Excludes amounts drawn by working proprietors. (c) Includes transfers out to other establishments of the same management unit where appropriate. (d) Includes nickel ores, tin ores, uranium ores and non-ferrous metal ores n.e.c.

Source: *Australian Mining Industry (8414.0)*.

**16.2 MINING, Summary of Operations by State/Territory — 1994–95**

	Employment(a) no.	Wages and salaries(b) \$m	Turnover(c) \$m	Stocks		Purchases and selected expenses \$m	Value added \$m	Net capital expenditure \$m
				Open \$m	Close \$m			
NSW	14 869	1 059	4 589	380	350	1 979	2 580	620
Vic.	2 036	140	3 435	41	52	267	3 179	566
Qld	14 756	964	6 669	707	716	3 124	3 554	677
SA	2 123	107	940	77	89	187	765	68
WA	18 736	1 140	11 817	1 045	1 077	3 982	7 867	2 613
Tas.	1 086	77	371	61	49	149	210	45
NT	1 742	104	1 115	210	229	376	758	110
<b>Aust.</b>	<b>55 348</b>	<b>3 590</b>	<b>28 936</b>	<b>2 522</b>	<b>2 562</b>	<b>10 063</b>	<b>18 913</b>	<b>4 698</b>

(a) Includes working proprietors. (b) Excludes amounts drawn by working proprietors. (c) Includes transfer out to other establishments of the same management unit where appropriate.

Source: Australian Mining Industry (8414.0).

## Mineral production

Australian production in the Metallic minerals, Coal, and Oil and gas industries for 1994–95 was valued at \$26,741m, an increase of 4% over the previous year (table 16.3). Metallic minerals production was the largest proportion with 44% of the total, while Oil and gas was 29% of the total and Coal 27%.

The increase in the value of mineral production in 1994–95 was primarily due to growth in Metallic minerals, which rose 8% to \$11,719m.

All States recorded rises in the value of Metallic minerals production, increases in both production and prices of most minerals contributing to that rise.

By value, the two largest components of Metallic minerals production were Gold and Iron ore which accounted for \$4,246m and \$3,020m respectively, for a combined share of 62%.

Western Australia accounted for both the largest share of Metallic minerals production with \$7,908m (67%), and the largest share of total mineral production with \$11,835m (44% of the total).

The value of production of the Oil and gas industry rose to \$7,683m from \$7,423m in 1993–94. This represented an increase of \$260m or 3.5%, primarily due to increased production despite falls in prices for some commodities.

The value of coal production fell 1%, primarily due to lower prices. The total value of the coal industry (excluding Tasmania) was \$7,339m in 1994–95. Queensland and New South Wales are the major coal producing States, with 45% and 44% of production respectively.

In 1994 Australia remained the world's largest producer of bauxite (39% of total world production); diamonds (37%); lead (19%); and zircon, a mineral sands concentrate (56%).

**16.3 MINERAL PRODUCTION, Selected Minerals — Australia**

	Units	1990-91	1991-92	1992-93	1993-94	1994-95
<b>Metallic minerals</b>						
Bauxite	kt	41 831	34 788	40 946	43 306	45 384
Copper concentrate(a)	kt	1 004	915	1 254	1 322	1 114
Copper precipitate(b)	t	4 384	6 203	8 174	16 192	18 888
Gold bullion (dore)(c)	kg	264 993	259 656	275 331	274 687	298 697
Iron ore(d)	kt	111 475	114 781	115 703	123 631	137 525
Lead concentrate	kt	870	858	856	873	766
Manganese ore(e)	kt	724	375	597	815	n.p.
Mineral sands(f)	kt	1 878	1 954	2 118	2 252	2 375
Uranium concentrate (U <sub>3</sub> O <sub>8</sub> )(a)	t	2 913	2 901	1 342	1 457	n.a.
Zinc concentrate(g)	kt	1 810	1 927	2 011	1 890	1 699
Total value of metallic minerals(h)	\$m	10 910	10 957	10 920	10 861	11 741
<b>Coal</b>						
Black coal	kt	166 505	176 570	177 970	177 874	191 903
Brown coal	kt	48 169	50 731	47 912	49 684	50 679
Total value of coal(i)	\$m	6 754	7 216	(j)7 585	(j)7 418	(j)7 340
<b>Oil and gas</b>						
Crude oil(k)	ML	29 189	31 984	30 592	29 583	31 301
Natural gas(l)	GL	15 589	16 289	16 631	15 959	17 486
Ethane	GL	175	182	187	202	208
Propane(m)	ML	2 013	2 064	2 078	2 115	1 999
Butane(m)	ML	1 504	1 574	1 651	1 622	1 480
Liquefied natural gas	kt	3 577	4 250	4 922	5 732	6 888
Total value of oil and gas	\$m	8 629	7 812	8 216	7 423	7 683
<b>Total value of metallic minerals, coal, oil and gas</b>	<b>\$m</b>	<b>26 293</b>	<b>25 985</b>	<b>26 721</b>	<b>25 702</b>	<b>26 741</b>

(a) Excludes South Australia. (b) Includes copper concentrate in other forms. (c) Includes alluvial gold. (d) Includes iron ore pellets. (e) Metallurgical grade. (f) Includes ilmenite, beneficiated ilmenite, leucoxene, monazite, rutile and zircon. (g) Includes zinc-lead concentrate. (h) Includes Tasmanian coal production. (i) Excludes Tasmania. (j) Excludes briquettes. (k) Stabilised. Includes condensate. (l) Includes field and plant usage. (m) Excludes refinery production.

Source: Australian Mining Industry (8414.0).

## Exports

Australia is the world's largest exporter of black coal, iron ore, alumina, lead, diamonds and mineral sands products, the second largest exporter of zinc and the third largest exporter of aluminium and gold.

Exports of mining products rose in value by 2% in 1994-95 to \$14,904m or 22% of total merchandise exports. This followed a fall of 8% in 1993-94.

The percentage contributions of the major mineral products to total exports have remained stable over the period 1990-91 to 1994-95. Black coal remains the largest single export item and the main mineral exported, with a value of \$6,792m in 1994-95, 10% of total exports. Other major exports were iron ore (\$2,771m, 4% of total exports), crude oil (\$1,726m, 3%), zinc ores (\$404m, 1%) and uranium (\$188m, less than 1%).

Exports of mining products together with basic manufactures of mineral origin rose by 2% in 1994-95. However, as a proportion of total exports they declined slightly from 36% in 1993-94 to 35% in 1994-95.

A significant increase in nickel and aluminium export earnings offset the decline in export earnings from most other mineral resources. The value of nickel exports rose \$340m (58%) to \$925m following increased export volumes and higher world nickel prices. Although aluminium export volumes were reduced as Australian producers maintained production cuts introduced in the first half of 1994, sharply higher aluminium prices in 1994-95 resulted in Australian export earnings rising \$346m (19%) to \$2,169m.

The main minerals with declines in export earnings were gold and coal. The value of gold exports fell \$467m (9%) to \$4,819m, following lower bullion production in Australia and overseas. The value of coal exports fell \$374m (5%) to \$6,792m, despite increased export volumes, because of lower negotiated contract prices with Japanese steel mills and electricity utilities.

## Imports

In 1994-95, mining imports were \$2,804m, a rise of 9% on the 1993-94 total of \$2,573m.

With the inclusion of basic manufactures of mineral origin, imports of mineral resources were valued at \$6,141m in 1994-95, a rise of \$350m (6%) on 1993-94. The major contributors to the increase were: crude oil, other refinery feedstock and petroleum refinery products, up \$233m (6.8%) to \$3,678m; and iron ore, ingot steel and ferro alloys, up \$198m (21%) to \$1,023m. The major offsetting fall occurred for imports of refined gold, down \$271m (28%) to \$708m.

## Review of selected commodities

### Gold

Gold production (content of all minerals) in Australia during 1994-95 was 243,213 kg. Western Australia accounted for most production with 77%, followed by Queensland with 11%, the Northern Territory (7%) and New South Wales (4%).

Gold is Australia's second biggest export earning commodity, having overtaken wool in 1990-91. In 1994-95 it accounted for 7% of total exports at a value of \$4,820m. The main markets were Singapore (\$1,573m), Japan (\$1,310m) and Republic of Korea (\$1,004m).

The gold mining industry employed 8,238 people at June 1995, 15% of total employment in the metallic minerals, coal, oil and gas industries, making it the second highest employer in the mining sector behind coal.

Australia accounts for about 11% of estimated world gold production. South Africa is the world's biggest gold producer with 24%.

### Iron ore

Iron ore production in 1994-95 was 136.8 million tonnes, of which 94% or 128.7 million tonnes were exported. Iron ore mining employed 6,090 people at the end of June 1995.

Almost 97% of production takes place in Western Australia's Pilbara region. Iron ore is also mined in South Australia and Tasmania.

Iron ore accounted for \$2,771m or 4% of total exports in 1994-95. Japan is Australia's largest market, taking nearly half of its exports (in dollar terms). Other important markets are China (18%), Republic of Korea (15%), Taiwan (5%), the United Kingdom (4%), and Germany (4%).

### Bauxite and alumina

Australia is the world's largest bauxite and alumina producer, and the fourth largest aluminium producer.

Bauxite mining employed 1,713 people nationally at June 1995, with mines in Western Australia south of Perth, in the Northern Territory on the Gove Peninsula and in Queensland at Weipa. Generally the bauxite ore is not sold but is processed to alumina for sale or for conversion to aluminium. Alumina production reached 12.9 million tonnes in 1994-95, while refined aluminium production was 1.3 million tonnes.

In 1994-95, alumina ranked fifth in value among major commodity exports with 3% of total exports, 10.3 million tonnes valued at \$2,237m; aluminium ranked sixth with 3% of exports, 0.9 million tonnes valued at \$2,169m.

Japan was the major market for aluminium, taking 34%; Northeast and Southeast Asia together (which includes Japan) accounted for over 92% of Australia's exports.

### Mineral sands

Mineral sands are a group of minerals comprising ilmenite, leucocoxene, rutile, monazite and zircon, which are produced from deposits on the east and west coasts of Australia. Australia was the world's largest producer of zircon (56%) in 1994.

The value of production increased by 4% to \$470.9m in 1994-95. For the same period, exports were valued at \$302.4m, a rise of 28% from the 1993-94 value.

Ilmenite, leucoxene and rutile are sources of titanium metal and are used in the manufacture of paint and other pigments and as a coating on welding-rod electrodes. Zircon is the major source of zirconium, which is a corrosion resistant metal used in nuclear reactors and chemical processing equipment. Monazite contains certain rare-earth elements and thorium, which is used in incandescent gas mantles and as a fuel in nuclear reactors.

Thorium is a radioactive mineral that is about three times as abundant as uranium, but occurs in fewer geological environments and in lower grade accumulation. Most of the world's resources of thorium occur in monazite, which is produced in Australia from titanium-bearing mineral sands. Australia presently supplies about 65% of the world's traded monazite. Exports from Australia of thorium and thorium-containing ores require the approval of the Minister for Primary Industries and Energy under the *Customs (Prohibited Exports) Regulations*.

## Diamonds

Diamonds were first extracted in 1982 in Western Australia.

Australia is now the world's largest producer of diamonds (gem and industrial) with 37% of world production in 1994. Most of this is from the Argyle diamond mine in the Kimberley region of Western Australia. This mine commenced operations in December 1985 and is the world's biggest single producer of diamonds.

In 1994–95, 34.7 mega carats of diamonds (sorted and unsorted) were exported, with a value of \$570m.

## Uranium

Australia has about 40% of the world's low-cost uranium reserves (excluding the current and former centrally planned economies). Deposits occur in the Northern Territory, Western Australia, South Australia and Queensland.

Australia's reasonably assured uranium resources, at December 1994, totalled 630,000 tonnes of uranium recoverable at less than \$US80 per kg of uranium.

The Australian Government no longer maintains its three mines policy with regard to uranium mining. However, restrictions on the export of uranium still apply.

The Ranger deposit was discovered in 1969, 250 km east of Darwin, and mining commenced in 1981. There was no uranium production at this mine during 1994–95.

The Olympic Dam deposits were discovered in 1975 and mining commenced in 1988.

Sales of uranium (contained in uranium oxide) for 1994–95 were 2,232 tonnes, with 1,313 tonnes from Ranger and 918 tonnes from Olympic Dam.

Uranium oxide exports in 1994–95 were 4,069 tonnes, valued at \$188m.

All Australian uranium production is exported, in the form of yellow cake, principally for use as fuel for nuclear power stations. Minor quantities are used in medical, industrial and scientific applications.

All exports of Australian uranium are subject to the most stringent safeguards which provide assurance that none of the material is diverted from peaceful uses.

The *Nuclear Non-Proliferation (Safeguards) Act 1987* gives domestic effect to Australia's international nuclear non-proliferation obligations which require domestic legislation. The legislation establishes a system of permits for the possession and transport of nuclear material (defined to cover uranium, thorium and plutonium), and other physical items such as equipment and material used in nuclear reactors. The permit and related provisions also deal with the possession and communication of sensitive information about nuclear technology, in circumstances where that information is not already a matter of public record. The legislation is administered by the Australian Safeguards Office.

Australia has no nuclear power stations.

In 1994 Australia produced 10% of the world's uranium (excluding the current and former centrally planned economies).

## Coal

Black coal is currently the largest source of primary energy in Australia. By world standards, in relation to present population and consumption, Australia has ready availability of easily worked deposits of coal. The main black coal fields are located in New South Wales and Queensland, not far from the coast and the main centres of population.

Of Australia's identified resources of black coal, currently estimated at 76 gigatonnes, about 54 gigatonnes are considered to be economically recoverable. They are located largely in the Sydney Basin in New South Wales and the Bowen Basin in Queensland. There are other coal-bearing basins in New South Wales and Queensland, while small deposits are being worked in Western Australia, South Australia and Tasmania.

Black coal production in 1994-95 was 192 million tonnes, most of it from Queensland (94.5 million tonnes) and New South Wales (88.6 million tonnes). The coal industry was the single largest employer in the mining sector at June 1995, employing 25,295 people.

More than 45% of New South Wales coal production is from underground mines, whereas over 86% of Queensland coal production is from open-cut mines.

Black coal produced in South Australia and Western Australia is used for electricity generation, while coal mined in Tasmania is used for industrial purposes such as steam generation.

Black coal is Australia's biggest export earning commodity at \$6,792m, accounting for 10% of the total value of exports in 1994-95. In 1993-94, it was \$7,166m (11% of total exports). The biggest market for Australian coal in 1994-95 was Japan which bought 65.1 million tonnes for \$3,326m (47% of total sales). The Republic of Korea bought 17.3 million tonnes for \$880m (13%), and Taiwan 8.4 million tonnes for \$399m (6%).

Two-thirds of black coal production, consisting of steaming coal and hard and soft coking coal, is exported.

Australia's Economic Demonstrated Resources (EDR) of brown coal were estimated to be around 41 gigatonnes at December 1994. The main deposits are located in Victoria's Latrobe

Valley (over 39 gigatonnes). Small deposits exist in other areas of south Gippsland, in south-eastern Victoria at Gelliondale and in the south-central region at Angelsea, Bacchus Marsh and Altona. Deposits are also known to exist at many places along the southern margin of the continent, and as far north as central Queensland. Large deposits are being tested in the Kingston area of South Australia, the Esperance area of Western Australia and at Rosevale in the north-east of Tasmania.

Because brown coal has a relatively low specific energy value and high water content, its utilisation depends on large-scale, low-cost mining and negligible transportation costs in its raw state. In Victoria, the brown coal industry has reached a high degree of sophistication in mining, in on-site development of power generation, and in briquette and char manufacture.

## Crude oil and condensate

Indigenous production of crude oil and condensate in 1994-95, at 31,301 megalitres (539 thousand barrels per day), was slightly higher than production in 1993-94 of 29,583 megalitres. In 1994-95, the Bonaparte Basin produced 1,588 megalitres of crude oil, nearly 6% of the total indigenous oil production. Production of crude oil from the Gippsland Basin accounted for 51% of total indigenous crude oil production. The North West Shelf was the major producer of condensate during 1994-95 with 63% of indigenous production sourced in that region.

Export volumes of crude oil and condensate increased by 16% to 11,434 megalitres in 1994-95 compared with 1993-94. The main markets were Japan, Indonesia and Singapore. Imports of crude oil and condensate increased by 2% to 20,641 megalitres.

## Liquefied petroleum gas

Liquefied petroleum gas (LPG) is a valuable co-product of oil and gas production and petroleum refining. The major constituents of LPG are propane and iso- and normal-butane, which are gaseous at normal temperatures and pressures and are easily liquefied at moderate pressures or reduced temperatures. Operations involving LPG are expensive in relation to other liquid fuels because LPG has to be refrigerated or pressurised when transported and stored.



LPG is an alternative transport fuel for high mileage vehicles in urban areas as well as a petrochemical feedstock and domestic fuel.

Identified economically recoverable resources of LPG at December 1994 of 135,000 megalitres were concentrated in Bass Strait, the North West Shelf and the Cooper Basin.

Production of naturally occurring LPG in Australia in 1994–95 was 3,479 megalitres. The major contributors were the Bass Strait fields (2,558 megalitres or 71% of total production) and the Cooper Basin (936 megalitres or 26% of total production). About 33% of domestic LPG production is exported (1,189 megalitres in 1994–95), mainly to Japan.

## Natural gas

During 1994–95, 28,176 million cubic metres of natural gas (including liquefied natural gas (LNG)) were produced for domestic consumption and export, an increase of 13% from 1993–94 production. In 1994–95, 10,690 million cubic metres of natural gas from the export phase of the North West Shelf Project were liquefied for shipment. This export earned \$1,201m and was 32% of total Australian natural gas production.

It is estimated that exports of LNG to Japan will continue to expand, rising to a peak of about 7 million tonnes per year by 1995–96.

### 16.4 OIL AND GAS RESOURCES(a) — December 1994

Basin	Crude oil GL	Gas condensate GL	LPG GL	Sales of gas TL
<b>Demonstrated economic resources(b)</b>				
Gippsland (Vic.)	114	20	36	206
Carnarvon (WA)	123	123	105	958
Cooper/Eromanga (SA/Qld)	10	7	12	83
Amadeus and Bonaparte (WA/NT)	45	4	—	24
Perth (WA)	2	—	—	4
Bowen/Surat (Qld)	—	—	—	5
Canning (WA)	—	—	—	—
Bass (Tas.)	2	1	1	3
Otway (Vic.)	—	—	—	9
<b>Total</b>	<b>297</b>	<b>156</b>	<b>154</b>	<b>1 292</b>
<b>Demonstrated sub-economic resources(c)</b>				
Gippsland (Vic.)	18	3	—	36
Bonaparte (WA/NT)	4	4	4	161
Carnarvon (WA)	6	—	—	373
Cooper/Eromanga (SA/Qld)	—	3	4	34
Browse (WA)	—	49	74	625
Perth (WA)	—	—	—	—
Amadeus (NT)	—	—	—	7
Bowen/Surat/Adavale (Qld)	—	—	—	1
Bass (Tas.)	1	5	7	7
Otway (Vic.)	—	—	—	4
<b>Total</b>	<b>29</b>	<b>65</b>	<b>90</b>	<b>1 249</b>

(a) Based on the McKelvey classification which subdivides resources in terms of the economic feasibility of extraction and their certainty of occurrence. (b) Demonstrated economic resources are resources judged to be economically extractable and for which the quantity and quality are computed from specific measurements and extrapolations on geological evidence. (c) Demonstrated sub-economic resources are similar to demonstrated economic resources in terms of certainty of occurrence, but are judged to be sub-economic at present.

Source: Department of Primary Industries and Energy.

## Oil and gas resources

The prospects of further discoveries of petroleum in Australia are considered to be only modest, the most prospective area being the sedimentary basins off the north-west coast. Consistent with the existing pattern of discoveries, undiscovered oil is likely to be of the light, low sulphur type, and more gas fields than oil fields are considered likely to be found. Assessments by the Bureau of Resource Sciences indicate that there is an average probability of finding at least another 380 giga litres (2,400 million barrels) of crude oil in Australia. This compares with demonstrated economically recoverable resources of 297 giga litres (1,866 million barrels) and

demonstrated sub-economically recoverable resources of 29 giga litres (186 million barrels) as at December 1994.

## Minerals processing and treatment

As few minerals can be directly used in the form in which they are mined, most minerals undergo processing and treatment before utilisation.

Table 16.5 shows the production of the main manufactured products of mineral origin during recent years.

**16.5 PRODUCTION(a) OF PRINCIPAL MANUFACTURED PRODUCTS OF MINERAL ORIGIN**

	Units	1992-93	1993-94	1994-95p
<b>METALS(b)</b>				
Non-ferrous				
Alumina	'000 t	12 221	12 761	12 940
Refined aluminium	'000 t	1 306	1 384	1 285
Refined copper	'000 t	312	351	281
Lead bullion (for export)(c)	'000 t	234	208	176
Refined lead	'000 t	225	220	206
Refined zinc	'000 t	332	316	312
Refined tin	t	258	190	455
Ferrous				
Pig iron	'000 t	6 445	7 209	7 425
Precious				
Refined gold(d)	kg	288 188	307 336	296 626
Refined silver	t	355	379	349
<b>FUELS</b>				
Petroleum products				
Diesel-automotive oil	ML	10 603	11 063	11 365
Industrial and marine fuel	ML	87	95	129
Fuel oil	ML	2 498	2 263	2 431
Petrol	ML	17 728	17 724	17 911
<b>BUILDING MATERIALS</b>				
Clay bricks	mill.	1 722	1 814	1 860
Portland cement	'000 t	6 225	6 733	7 124
<b>CHEMICALS</b>				
Sulphuric acid	'000 t	868	833	n.a.
Superphosphate(e)	'000 t	1 440	1 344	1 590

(a) Some products exclude production of single establishment manufacturing businesses employing less than four persons and production of establishments predominantly engaged in non-manufacturing activities but which may carry on, in a minor way, some manufacturing.

(b) Excludes secondary metal with the exception of basic iron. (c) Metallic content. (d) Newly won gold of Australian origin. (e) Double and triple superphosphate expressed in terms of single phosphate, that is 9% P equivalent.

Source: Australian Bureau of Agricultural and Resource Economics (non-ferrous, precious metals and petroleum products only).

## Mineral resources and geology

Australia has the world's largest economically recoverable resources of lead, mineral sands (ilmenite, rutile and zircon), silver, uranium, zinc and gem/near gem diamonds. In addition, Australia's economic demonstrated resources are within the top six world-wide for bauxite, black coal, cobalt, copper, gold, iron ore, lithium, manganese ore, nickel, rare earths, tantalum and industrial diamonds. Australia has almost all of the world's opal resources, and a significant share of the world's sapphire resources.

The diversity of Australian geology provides the basis for its wide range of economically important minerals and variety of deposit types. Its classified geological settings range from major Precambrian Shields composed of Archaean (older than 2.5 billion years) granite greenstone terrains, through to extensive Proterozoic (2.5 to 0.5 billion years) basins and metamorphic belts, to the younger Palaeozoic fold belts (0.5 to 0.25 billion years). Despite more than a hundred years of exploration, mineralisation is still being discovered in outcrops. However, most significant mineral deposits discovered in the past two decades were hidden beneath cover and this is likely to be the pattern in the future, because prospective rocks in some 80% of the continent are concealed by veneers of deeply weathered rocks or sedimentary strata. The weathering occurred particularly during the Mesozoic and Cainozoic periods (0.25 billion years to the present).

The Archaean and Proterozoic basement rocks, underlying most of the western two thirds of Australia, have been the source of much of the country's mineral wealth to date. Large deposits such as the gold mines of the Kalgoorlie region and the iron ore deposits of the Pilbara region (Western Australia); the base metal deposits at Broken Hill (New South Wales), Mount Isa (Queensland), McArthur River (Northern Territory); the copper-uranium-gold deposit at Olympic Dam (South Australia); and the uranium deposits of the Alligator Rivers area of the Northern Territory, all occur in the Precambrian rock. In eastern Australia, the major deposits are of Palaeozoic age and include the base metal deposits at Elura, Cobar, Woodlawn (New South Wales), Hellyer and Rosebery, the Mount Lyell copper-gold deposit,

and the Renison tin deposit (Tasmania); and Kidston, Mount Leyshon (Queensland) and most other gold deposits. The large black coal deposits in New South Wales and Queensland are of upper Palaeozoic and Mesozoic age. Deposits formed in Tertiary times include the brown coal of Victoria; the oil shales of eastern Queensland; the bauxite of Weipa (Queensland), Gove (Northern Territory) and the Darling Ranges (Western Australia); the lateritic nickel deposits of Queensland and Western Australia; and the mineral sands deposits of the Murray Basin (Victoria).

The continuing discovery of world class deposits in both the established and new mineral provinces confirms Australia's high mineral potential. Major discoveries since 1990 include the Century (zinc), Cannington (lead, zinc, silver) and Ernest Henry (copper-gold) deposits in the major Carpentaria-Mount Isa base metal province, the Cadia (gold-copper) deposit in central western New South Wales, and the Bronzewing (gold) deposit in the Eastern Goldfields of Western Australia.

Australia's most important petroleum basins are under Bass Strait and off north-western Australia. Petroleum has been identified in Australian sediments as old as middle Proterozoic, but the main onshore petroleum accumulations are in sedimentary strata of middle Palaeozoic and younger ages and include the Bowen/Surat, Cooper/Eromanga, Otway and Perth Basins.

## Mineral exploration

Exploration consists of the search for new ore occurrences and undiscovered oil or gas, and/or appraisal intended to delineate or extend the limits of known deposits of minerals and oil or gas reservoirs by geological, geophysical, geochemical and other methods. This includes drilling, but excludes activities of a developmental or production nature. Exploration for water is excluded.

## Mineral exploration expenditure

Table 16.6 shows expenditure on private mineral exploration other than for petroleum in Australia during the last five years.

### 16.6 PRIVATE MINERAL EXPLORATION EXPENDITURE (Other than for Petroleum)

State	1990-91 \$m	1991-92 \$m	1992-93 \$m	1993-94 \$m	1994-95 \$m
New South Wales	60.6	63.3	60.9	73.6	79.2
Victoria	12.7	12.6	12.2	20.7	31.2
Queensland	124.1	109.9	117.9	140.2	176.0
South Australia	15.5	19.7	21.3	24.7	20.9
Western Australia	324.8	332.8	348.1	453.7	495.5
Tasmania	9.9	7.9	7.8	10.2	14.9
Northern Territory	53.9	57.8	63.5	69.5	75.8
<b>Australia</b>	<b>601.7</b>	<b>604.0</b>	<b>631.8</b>	<b>792.6</b>	<b>893.3</b>

Source: Actual and Expected Private Mineral Exploration, Australia (8412.0).

### Drilling methods used in Australia

In 1995, the ABS collected information on methods used for exploration drilling for minerals in Australia.

Private sector companies spent \$322m in direct drilling costs exploring for minerals in Australia in 1994-95. This represents 36% of the total Australian mineral exploration expenditure of \$893m.

Tables 16.7 and 16.8 show metres drilled and expenditure by drilling methods for all areas (including production leases and other areas) by State/Territory.

### 16.7 TOTAL METRES DRILLED, By State/Territory — 1994-95

Drilling method	NSW '000 metres	Vic. '000 metres	Qld '000 metres	SA '000 metres	WA '000 metres	Tas. '000 metres	NT '000 metres	Aust. '000 metres
Diamond	213.4	44.1	220.9	12.8	791.5	38.2	83.4	1 404.2
Reverse circulation	165.9	49.7	402.7	n.p.	2 992.5	n.p.	193.0	3 845.9
Percussion	42.4	14.3	187.7	n.p.	55.0	n.p.	n.p.	313.3
Rotary air blast	53.7	n.p.	313.0	9.0	2 956.3	n.p.	192.2	3 537.3
Other	28.7	n.p.	27.0	12.6	460.8	—	n.p.	609.3
<b>Total</b>	<b>504.1</b>	<b>119.1</b>	<b>1 151.3</b>	<b>64.9</b>	<b>7 256.2</b>	<b>57.7</b>	<b>556.8</b>	<b>9 710.1</b>

Source: Actual and Expected Private Mineral Exploration, Australia (8412.0).

### 16.8 TOTAL DRILLING EXPENDITURE, By State/Territory — 1994-95

Drilling method	NSW \$m	Vic. \$m	Qld \$m	SA \$m	WA \$m	Tas. \$m	NT \$m	Aust. \$m
Diamond	17.9	3.8	34.3	n.p.	80.4	n.p.	9.4	151.8
Reverse circulation	4.5	1.5	14.3	n.p.	86.9	n.p.	6.3	114.6
Percussion	1.5	0.3	6.3	n.p.	1.4	—	n.p.	10.0
Rotary air blast	0.7	0.1	5.3	0.1	28.3	—	2.5	37.0
Other	0.3	n.p.	0.7	n.p.	6.7	—	n.p.	8.6
<b>Total</b>	<b>24.8</b>	<b>5.7</b>	<b>61.0</b>	<b>3.2</b>	<b>203.7</b>	<b>4.6</b>	<b>19.2</b>	<b>322.2</b>

Source: Actual and Expected Private Mineral Exploration, Australia (8412.0).

## Petroleum exploration expenditure

Petroleum exploration expenditure for all States and Territories for 1994–95 was \$688.8m, an increase of 36% compared to 1993–94. Expenditure on exploration in production leases increased 49%, while exploration in all other areas increased 34%.

Offshore exploration expenditure increased by 44% to \$519.8m and onshore exploration expenditure increased 17% to \$169m in 1994–95 compared to 1993–94.

Table 16.9 shows expenditure on private petroleum exploration in Australia during the last six years.

**16.9 PRIVATE PETROLEUM EXPLORATION EXPENDITURE**

	1989-90 \$m	1990-91 \$m	1991-92 \$m	1992-93 \$m	1993-94 \$m	1994-95 \$m
Onshore	143.2	217.1	135.3	115.2	144.5	169.0
Offshore	439.4	365.4	338.8	496.7	362.2	519.8
<b>Total</b>	<b>582.6</b>	<b>582.6</b>	<b>473.9</b>	<b>611.9</b>	<b>506.7</b>	<b>688.8</b>

Source: Actual and Expected Private Mineral Exploration, Australia (8412.0).

## Overseas exploration

Overseas exploration expenditure, by Australian resident companies which are also involved in mineral or petroleum exploration in Australia, increased by 69% from \$255.5m in 1993–94 to \$430.8m in 1994–95.

(\$325.2m). This represented 75% of total overseas exploration expenditure by Australian resident companies.

Table 16.10 shows overseas exploration expenditure for 1994–95.

The largest portion of total overseas exploration expenditure was on petroleum exploration

**16.10 OVERSEAS EXPLORATION EXPENDITURE, Of Australian Resident Companies(a) — 1994–95**

	North America(b)	Latin America(c)	Papua New Guinea	Indonesia	China	Other Asia	Africa	Other	Total
	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m
Petroleum	72.0	57.2	26.8	n.p.	21.2	31.5	n.p.	67.3	325.2
Copper, lead, zinc, silver, nickel and cobalt	n.p.	n.p.	n.p.	n.p.	n.p.	3.9	n.p.	n.p.	21.2
Gold	9.0	6.9	n.p.	10.0	n.p.	11.5	8.1	7.0	64.8
Iron ore	..	..	..	..	..	..	..	..	..
Mineral sands	n.p.	—	..	..	..	n.p.	..	n.p.	1.5
Tin, tungsten, scheelite and wolfram	..	..	..	..	..	..	..	..	..
Uranium	..	..	..	..	..	..	..	..	..
Coal	..	..	..	..	..	n.p.	..	..	n.p.
Construction materials	..	..	..	..	..	n.p.	..	..	n.p.
Bauxite	..	..	..	..	..	n.p.	..	..	n.p.
Diamonds	n.p.	n.p.	..	n.p.	..	n.p.	3.4	4.4	17.7
Other(d)	..	..	..	..	n.p.	..	..	..	n.p.
<b>Total</b>	<b>89.2</b>	<b>70.8</b>	<b>40.6</b>	<b>20.1</b>	<b>23.5</b>	<b>48.4</b>	<b>56.7</b>	<b>81.7</b>	<b>430.8</b>

(a) Excludes overseas subsidiaries of Australian resident companies. (b) Includes Canada. (c) Comprises Mexico, South America, Central America and the Caribbean. (d) Preliminary exploration where the commodity is not yet known.

Source: Actual and Expected Private Mineral Exploration, Australia (8412.0).

## Administrative and financial arrangements

### Mineral rights

Mineral rights in Australia are held by the State and Territory Governments, and the granting of exploration and mining titles is administered by them under the respective State or Territory legislation. The Commonwealth Government holds rights to minerals on Australia's continental shelf beyond coastal waters of the States and the Northern Territory, and certain prescribed substances in the Northern Territory, within the meaning of the *Atomic Energy Act* (principally uranium). The Commonwealth Government is also able to influence overall development and production activity in the mineral industry by virtue of its constitutional powers with respect to international trade, customs and excise, taxation and foreign investment, through established consultative mechanisms such as the Australian and New Zealand Minerals Energy Council (ANZMEC), the Council of Australian Governments (COAG) and through initiatives for the enhancement of mineral provinces.

### Mining and exploration for other than petroleum — legislation

#### Onshore

Each State and Territory has its own Mining Act and Regulations governing the prospecting for and working of mineral deposits. These Acts and Regulations, although similar in principle, are different in detail.

Rights to explore for minerals are awarded by granting prospecting licences and (for larger areas) exploration licences or exploration permits. Each tenement is granted subject to conditions such as minimum exploration expenditure each year, methods of prospecting and the requirement for progressive relinquishment of area held. The tenure is usually limited. Most States and Territories make provision for a Miner's Right which permits an individual to prospect or fossick for minerals on Crown Land.

Following the 3 June 1992 decision by the High Court of Australia which held that the common law of Australia recognised a form of native land title, the Commonwealth enacted the *Native Title Act 1993*. The Act recognises and protects

native title rights and establishes procedures to determine those rights and to ensure that those rights, where they continue to exist, are taken into account in future land management administration.

Existing rights held by non-Indigenous people are also protected by the Act. While the Act does not provide a veto over activities on Aboriginal land, it does enable Aboriginal people to negotiate in relation to proposed activities. Amendments to the Act to make it more effective were introduced into the Parliament in June 1996.

#### Offshore

Following the enactment of the *Seas and Submerged Lands Act 1973*, the High Court confirmed that the Commonwealth has sovereignty over the territorial sea and sovereign rights over the resources of the whole of Australia's continental shelf. However, in the Offshore Constitutional Settlement between the Commonwealth and the States reached in June 1979, it was agreed that responsibility for mining of the seabed of coastal waters (i.e., the area landward of three nautical miles from the baseline of the territorial sea) should lie with the States and the Northern Territory and should be governed by their legislation, while the Commonwealth should have responsibility for areas beyond. The *Offshore Minerals Act 1994*, which replaced the *Minerals (Submerged Lands) Act 1981*, provides for the granting and administration of exploration and mining licences in those areas of sea covered by Commonwealth legislation.

### Petroleum mining and exploration — legislation

#### Onshore

In Australia, full control of petroleum mining rights is vested with the relevant State or Territory Government. Any organisation or individual proposing to undertake petroleum exploration or development must first satisfy the relevant government that it has access to the necessary financial and technical resources to undertake the proposed operations.

## Offshore

The situation is the same as detailed above for mining exploration and development, with the Commonwealth having sovereignty but administrative responsibility shared between the Commonwealth and the States; in the case of petroleum, under the *Petroleum (Submerged Lands) Act 1967*.

The offshore mining and exploration legislation provides for:

- exploration permits, providing exclusive exploration rights over a specific area; and
- production licences to authorise development and commercial production from discovered fields; and retention leases to allow security of tenure over discoveries not currently regarded as economic to develop.

Offshore projects, except in the area around the North West Shelf Gas Project, are subject to Petroleum Resource Rent Taxation (PRRT) see discussion under *Secondary tax arrangements in the petroleum industry*, below.

The Timor Gap Zone of Co-operation Treaty designates an area of the Continental Shelf between Australia and Indonesia subject to control by a Joint Administration. Revenue collected from petroleum production taxation is

shared between the two nations. The Treaty has provisions to prevent double taxation.

## Mineral royalties

Mineral resources are owned by the Crown in Australia, either by the State and Territory Governments, within their borders (and up to three nautical miles offshore), or by the Commonwealth Government in offshore areas outside the three nautical mile limit. Accordingly, royalties are collected by State and Territory Governments for mining onshore and up to three nautical miles offshore and by the Commonwealth outside that limit.

State royalties regulations vary in regard to types of royalties, rates levied and those commodities subject to royalties.

In recent years some State Governments have negotiated special royalty arrangements with companies which are seeking mineral leases for large-scale developments. These royalty rates may vary, depending on whether production is for export or for domestic processing. Examples of this type of royalty agreement are the Argyle Project in Western Australia and the Olympic Dam mine in South Australia. Mineral royalties received by governments in recent years are shown in table 16.11.

**16.11 MINERAL ROYALTY RECEIPTS BY GOVERNMENTS(a)**

	1989-90 \$m	1990-91 \$m	1991-92 \$m	1992-93 \$m	1993-94 \$m	1994-95 \$m
New South Wales	128 966	155 006	141 819	150 380	158 008	158 202
Victoria(a)	60 146	53 359	62 600	57 527	48 564	49 586
Queensland	207 152	226 689	263 406	303 194	301 731	301 669
South Australia	44 004	80 570	71 767	71 344	61 114	52 509
Western Australia(b)	244 330	284 842	308 257	310 582	285 200	287 659
Tasmania	6 394	5 350	4 729	5 795	3 938	8 653
Northern Territory	24 079	28 350	28 265	14 942	28 715	25 848
Commonwealth Government	273 077	361 791	102 459	78 436	100 327	133 390
<b>Total</b>	<b>988 148</b>	<b>1 195 957</b>	<b>983 302</b>	<b>992 200</b>	<b>987 597</b>	<b>1 017 518</b>

(a) Includes royalties on sand and gravel from Crown lands. (b) Includes royalties on brown coal paid by State Electricity Commission. (c) Includes prepaid royalty of \$50m in respect of diamond royalty agreement.

Source: Federal, State and Territory departments responsible for mining.

## **Crude oil marketing and pricing arrangements**

Refiners and producers are free to negotiate the quantities and prices of crude oil they buy and sell. Crude oil producers can export crude oil as an alternative to selling on the domestic market.

Decisions on major refinery investment associated with changes in domestic crude availability have led to a significant program of investment in upgraded plant and equipment.

The price of crude oil used for the purposes of excise tax assessment is the monthly volume-weighted average of realised prices of sales of oil from the area subject to excise.

## **Pricing of liquefied petroleum gas**

As from January 1991 the pricing of LPG became subject to market forces alone. The Australian Competition Consumer Commission (ACCC) ceased to have responsibility for determining the maximum wholesale price of LPG in each capital city, although it maintains a monitoring role.

## **Pricing and export approval system for liquefied natural gas**

The Commonwealth government removed volume controls on LNG exports in November 1991, but a price approval and monitoring system has been maintained to ensure that community returns are safeguarded. The Department of Primary Industries and Energy has responsibility for price monitoring.

## **Secondary tax arrangements in the petroleum industry**

In addition to general taxation arrangements applying to companies in Australia, petroleum production projects are subject to secondary taxes. The type and rate of secondary taxation (resource rent tax, resource rent royalty, or excise and royalties) depends on the location of the petroleum resource, the date of discovery of the petroleum reservoir and the date upon which production commenced.

A profit based Petroleum Resource Rent Tax (PRRT) applies to petroleum projects in the majority of Australia's offshore areas beyond the State's territorial seas. The PRRT is levied at a rate of 40% of net revenues from successful projects which have recovered outlays, plus a threshold rate of return. The North West Shelf

production licence areas and associated exploration permits are excluded. Where RRT applies, it replaces excise and royalties which would otherwise have been levied.

A Resource Rent Royalty (RRR) may be applied to onshore petroleum projects by State Governments. Where RRR is applied the legislation provides for the Commonwealth to waive its crude oil excise whenever the relevant State Government negotiates an acceptable RRR agreement with the project producers and agrees to a satisfactory revenue sharing formula with the Commonwealth.

Excise applies to crude oil production from the North West Shelf projects offshore and all onshore areas (except Barrow Island where a RRR applies).

Crude oil excise is based on the annual level of crude oil sales from individual production areas and is levied as a percentage of the realised price received by producers.

Different excise scales are applicable to oil production depending upon the date of discovery of the production area and the date when the area was first developed. In the case of new offshore and onshore fields the first 30 million barrels of crude oil production are exempt from excise. Production beyond this level is subject to the appropriate excise rate.

Oil discovered before 18 September 1975 (old oil) attracts a higher rate of excise than oil discovered on or after this date (new oil). An intermediate scale also applies to oil produced from old oil fields that were not developed as at 23 October 1984. However, in the case of all onshore fields that commenced production after 1 July 1987, production in excess of 30 million barrels is subject to new oil excise.

A Commonwealth Royalty is also levied on offshore petroleum production from the North West Shelf project area. Proceeds are shared by the Commonwealth with Western Australia. Onshore petroleum rights are vested in the State and Northern Territory Governments and the Commonwealth does not, in general, receive a share of this royalty.



## Incentives to encourage petroleum exploration and development

Australia remains under-explored and its full petroleum potential is yet to be determined. Through both macro-economic policies and micro-economic reform, the Commonwealth Government has introduced measures to encourage investment to ensure that Australia's potential is realised.

Key government initiatives specific to the petroleum industry include:

- the offshore exploration strategy, which includes a program of regularly releasing exploration areas on which companies can bid;
- the Petroleum Resource Rent Tax (PRRT) reforms (see *Secondary tax arrangements in the petroleum industry*, above);
- development of a national gas strategy, which aims to free up domestic gas markets;
- deregulation of the crude oil and LPG markets, which removed controls on prices and restrictions on sale of these commodities within and outside Australia; and
- accelerated depreciation and investment allowance arrangements under company tax.

In the 1995 Budget the Commonwealth Government set the rate of company tax in Australia at 36%. This rate of taxation is significantly lower than the peak rate of 49% which applied during the 1987 and 1988 financial years.

## Research

Research into exploration, mining, ore-dressing and metallurgy is conducted by government bodies, universities, private enterprise, and by the combined efforts of all these. A summary of the main organisations and their functions follows.

### Australian Geological Survey Organisation (AGSO)

The Australian Geological Survey Organisation (AGSO), formerly called the Bureau of Mineral Resources, Geology and Geophysics, is Australia's national geoscientific agency.

The primary mission of AGSO is to build a national geoscientific mapping effort to

encourage economically and environmentally sustainable management of Australia's minerals, energy, soil and water resources.

Its role is to improve the quality, extent and accessibility of the geoscience knowledge base to underpin the development of a more competitive and diversified Australian mineral and petroleum exploration industry. It also aims to improve the management of Australia's natural resources consistent with the principles of ecologically sustainable development, while at the same time developing effective strategies to mitigate the effects of natural geological hazards.

AGSO provides expert professional geoscientific advice on minerals, petroleum, ground water, coastal and marine issues and seismological and geological hazard analysis to support the development of management principles and land use strategies. AGSO also contributes to Commonwealth Government involvement in international geoscientific activities and development assistance programs, and actively pursues commercial geoscientific projects in collaboration with Australian industry and other organisations.

AGSO's activities include regional mapping and analysis of major mineral provinces and petroleum basins, regional environmental mapping (including land resources such as soils and ground water), airborne magnetic and radiometric surveying, onshore and offshore seismic surveying, the operation of geophysical observatories and the development of an accessible National Geoscience Information System.

### Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Research and development activities of CSIRO are designed to play a major contributing role in the development of sustainable and competitive minerals and energy industries in Australia.

This is achieved by the provision of research, development and service capabilities to support existing and emerging industries as well as providing for the next generation of technology, products and processes. At the same time

CSIRO endeavours to bring about safe and ecologically sustainable development through research and advice on environmental issues related to client industries. In addition, by working closely with industry, government and other organisations, CSIRO helps transform research outcomes into new or improved business opportunities including, where appropriate, the championing of individual projects.

Minerals research by the CSIRO is primarily undertaken within the Minerals and Energy Alliance, and involves a number of elements of the work program of the research sectors of this alliance.

See *Chapter 24, Science and technology* for more information on the CSIRO.

### **Australian Mineral Industries Research Association Limited**

The Association provides high quality development and management of jointly funded research projects for the benefit of the Association's members. Membership includes all the largest Australian mineral and coal companies, smaller exploration companies, and suppliers of services to the industry. It sustains an active involvement in four Co-operative Research Centres and was appointed in 1992 to manage the Australian Coal Association Research Program.

### **Australian Bureau of Agriculture and Resource Economics**

Established 51 years ago, the Australian Bureau of Agricultural and Resource Economics (ABARE) is the largest research agency in Australia undertaking applied economic research into commodities.

ABARE undertakes specific research projects on behalf of a wide range of clients and deals directly with a variety of industry groups, Australian and international agencies and research organisations, and Commonwealth and State Government departments.

ABARE assists clients by:

- deriving supply and demand projections;
- assessing the outlook for commodity prices;
- examining patterns of national and world production and consumption;
- analysing the impact of economic policies;

- developing analytical computer programs and economic policies;
- undertaking regional and environmental economic assessments; and
- providing economic assessments of factors affecting the competitiveness of the economic sector.

The organisation is based on two research groups, Agriculture and Natural Resources and Minerals and Energy, where staff are involved in economic research on issues affecting the full range of major minerals, energy, agricultural and natural resources industries, as well as on climate change, and including macroeconomic, microeconomic and trade issues relating to these industries.

### **Bureau of Resource Sciences (BRS)**

BRS provides scientific analysis and advice to support the sustainable competitive growth of Australia's resource based industries.

BRS's Mineral Resources and Energy Branch provides expert scientific analyses and technical advice on identified mineral resources, mineral resource potential, exploration, mining activity and technologies, and the sustainable development of mineral resources. It undertakes a range of activities including: mineral resource assessments; exploration analyses; appraisals of mineral resource potential; integrated analyses of diverse mineral, mining and environmental information; mineral resource audits; financial modelling of mineral projects; and assignments to advise on mineral resource developments in emerging nations.

The Branch also maintains two large databases which are accessed by Commonwealth and State government departments, the mining industry and the wider community. The mineral occurrence location database (MINLOC) contains information on more than 47,000 Australian mineral occurrences, and MINRES, a mineral resources database, contains comprehensive information on the mineral resources of over 1,500 of Australia's mineral deposits. The organisation is based on two research groups, Agriculture and Natural Resources, and Minerals and Energy, where staff are involved in economic research on issues affecting the full range of major minerals, energy, agricultural and natural resources industries, as well as on climate change, and including macroeconomic, microeconomic and trade issues relating to these industries.

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### Other publications

Other organisations which produce statistics in this field include the Australian Bureau of Agricultural and Resource Economics, the Department of Primary Industries and Energy, the Joint Coal Board and the Australian Institute of Petroleum. State government departments and instrumentalities also are important sources of energy data, particularly at the regional level, while a number of private corporations and other entities operating within the mining and energy fields also publish or make available a significant amount of information.

