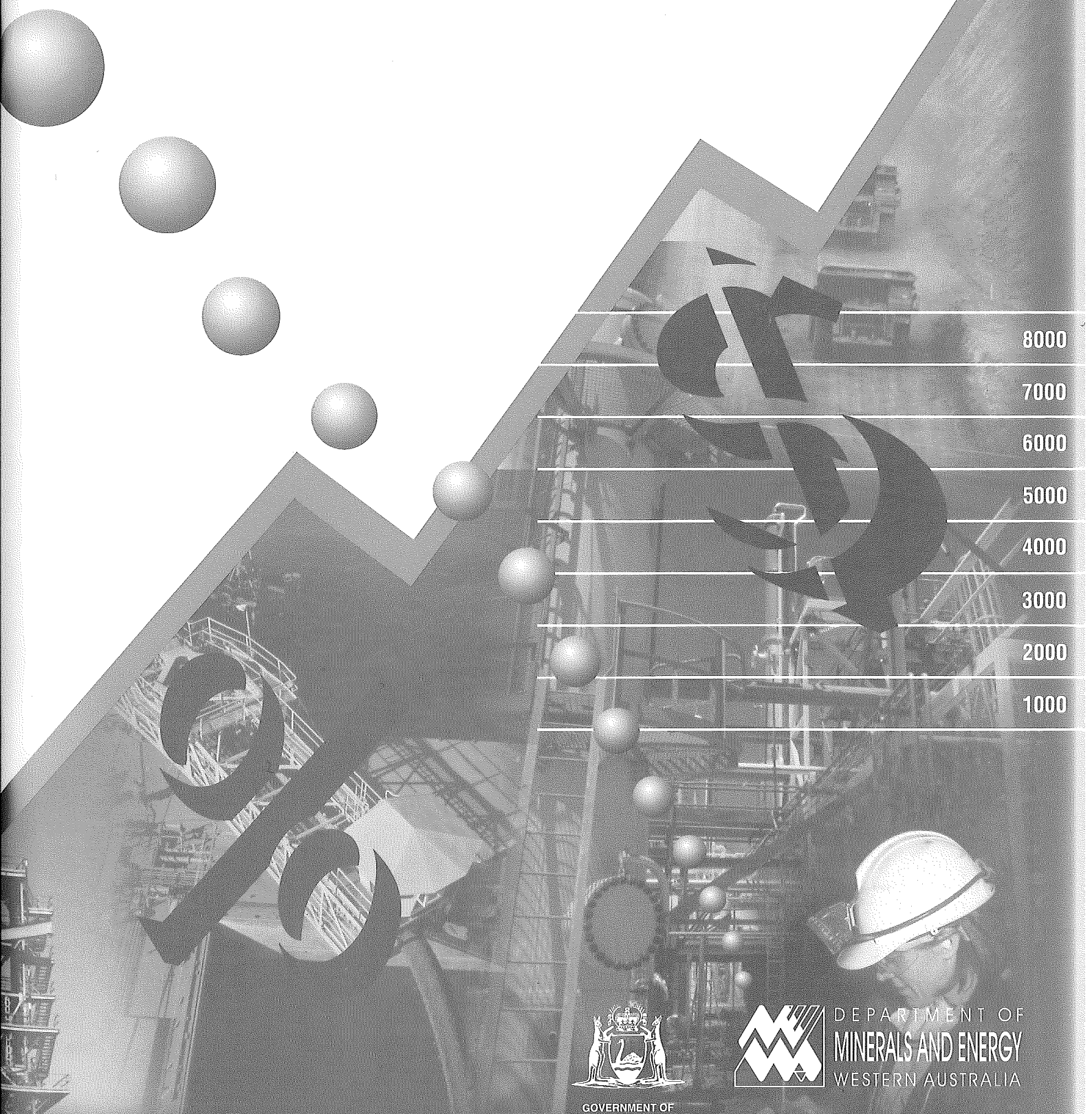


1996-97

# STATISTICS DIGEST

MINERAL AND PETROLEUM PRODUCTION



8000  
7000  
6000  
5000  
4000  
3000  
2000  
1000



GOVERNMENT OF  
WESTERN AUSTRALIA



DEPARTMENT OF  
MINERALS AND ENERGY  
WESTERN AUSTRALIA

Policy and Planning Division

J A S O N D J F M A M J

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Resource Centre  
Policy Branch  
Dept. of Minerals & Energy

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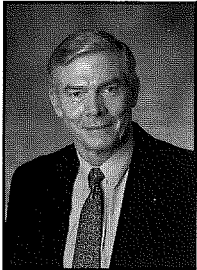
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## FOREWORD



L C Ranford  
DIRECTOR GENERAL

A handwritten signature in cursive script that reads "Lee Ranford".

It is remarkable that over the last 30 years the value of production of the State's resource industry has grown by an average rate of around 17% per annum. Growth since that time has been highlighted by the start of iron ore and nickel production in the late 1960s; the continued development of the alumina industry in the 1970s; the dramatic increase in gold production in the 1980s; and petroleum emerging as an important resource sector from the mid 1980s.

With the State's resource industry performing strongly, year after year, it is easy to become complacent and to overlook the magnitude of its contribution to our economy. In 1996/97 the resources sector continued to underpin the State's economy, accounting for around 30%, directly and indirectly, of State Gross Product; more than 70% of its exports and around 50% of private capital investment. A 1995/96 study also indicated that the resources sector accounted for around one fifth, both direct and indirect, of the State's employment.

The State's economy is dependent on the continued growth of its resources sector and the economy is therefore very susceptible to international developments in commodity markets. However given the healthy diversity of the State's resources sector, and the potential for increased downstream processing, only a major downturn in world economic activity would significantly impact on the State.

In 1996/97 Western Australia's resources sector again demonstrated its phenomenal strength. The value of production rose by 7% in 1996/97 to more than A\$16,400 million. The rise was mainly attributable to the strong increase in the value and production of the petroleum and iron ore sector.

The growing importance of petroleum was again highlighted in 1996/97, with new production records set for oil, gas and condensate. The continued surge in the petroleum sector has made it the State's first industry to produce more than A\$5,000 million of product in a year. The sector now represents more than 30% of the State's value of mineral and energy production. Not surprisingly, Western Australia has retained its status as Australia's largest oil producing State for the second successive year.

Significantly, growth in the State's petroleum sector is taking place at a time when the Government's long held goal to enhance downstream processing of the State's resources is coming to fruition. While a number of downstream processing developments are currently occurring in the State's iron ore sector, growing supplies of gas and oil, plus, continuing deregulation of the energy market augur well for the alumina, gold, and nickel industries.

The Native Title Act (NTA) procedures continued to impact adversely on the mining and petroleum sectors. At the end of June 1997 there were 259 native title claims covering more than 80% of Western Australia, including most areas of known mineralisation.

In September 1997 the Federal Government introduced the Native Title Bill 1997 into the Federal Parliament. The Bill incorporates a number of amendments which are designed to streamline the native title process to make it more workable. The outcome of the Native Title Bill is crucial to the long term future of the industry in Western Australia. Unless we can achieve more workable procedures there will be an inevitable decline in exploration with adverse consequences for future mineral and petroleum production in this State.

The matters referred to above are described in some detail within this Digest. The information and statistics were assembled by the Department with assistance from the Australian Bureau of Statistics, Australian Bureau of Agricultural and Resource Economics and resource companies. I thank these organisations for their cooperation and help; it would be impossible to present such a comprehensive publication without their assistance.



Lee Ranford  
DIRECTOR GENERAL

# 1. ECONOMIC AND SOCIAL ENVIRONMENT

## 1.1 World Economy Review

*State's trade surplus at A\$12,500 million.*

In 1996/97 foreign exports accounted for 35% of Western Australia's economy as compared to around 15% for Australia. The State's future growth prospects are, therefore, more reliant on world economic conditions than for Australia generally.

In 1996/97 the State exported A\$19,250 million worth of product, and given it imported significantly less, the State's merchandise trade surplus stood at around A\$12,500 million.

The State's mineral and energy exports continue to account for more than 70% of total exports. Asia remains the State's predominant export market taking more than two thirds of the State's mineral and energy exports.

*Favourable growth prospects for the USA.*

Economic indicators suggest that the US economy continues to perform strongly, with growth being driven primarily by buoyant domestic demand conditions. The economy is expected to grow by 3.5% in 1997. This exceeds long-run average growth of 2.6% per annum.

Despite such strong economic growth inflationary pressures in the US have remained subdued with underlying inflation at 2.4% in 1996/97. Nonetheless, there is some evidence that the labour market is tightening and this is likely to flow through to an increase in labour costs in 1997/98. This will place upward pressure on interest rates, and as a result, economic growth is expected to ease to more sustainable levels. Economic growth is forecast at 2.1% in 1998.

*The economic outlook for Japan is uncertain.*

The economic outlook for Japan, the State's largest export market, has deteriorated with the release of the June quarter 1997 economic growth data. The GDP outcome of minus 2.9% was the worst quarterly growth figure since the first quarter of 1974, following the world's first oil shock. The outcome was largely due to a fall in business and housing investment and private consumption. The increase in the consumption tax from 3% to 5% in April 1997 has been blamed for the fall in private consumption. Despite the poor June GDP 1997 quarter outcome, GDP grew by 2.1% in 1996/97.

The Government's tight fiscal policy settings as well as its continued moves to deregulation are adversely impacting business sentiment. While a Bank of Japan survey (September 1997) has concluded that Japan will soon reap the rewards of the Government's current economic policy settings the Tankan index of business sentiment indicates that big manufacturing companies expect business conditions to remain subdued in the first half of 1997/98.

The International Monetary Fund believes the Japanese economy will, on the back of strong private consumption, improve in the first half of 1997/98. It, nonetheless, has revised downwards its 1997 growth forecast from 2.2% to 1.1%.

It is expected that private consumption will strengthen over 1997/98. Growth is forecast at around 2% to 2.5% in 1998.

*Economic conditions in Europe are favourable.*

Economic conditions in Western Europe continue to improve. Nonetheless, governments are restraining their fiscal expenditures in order to meet the

Maastricht criteria for monetary union. In pursuing monetary union a number of European Central Banks have been diversifying their investment portfolios away from gold. Their actions have placed considerable uncertainty on the gold price over the latter half of 1996/97.

Economic growth in Western Europe is expected to rise from 1.4% in 1996 to 2.2% in 1997. In 1998 growth is estimated at 2.5%.

Germany's economy recorded moderate growth of 1.4% in 1996. GDP growth data for the first half of 1997 suggests the economy is picking up. Business investment and exports remain the main sources of growth but consumer spending remains weak. The German economy is expected to grow by 2.2% in 1997 rising to 2.8% in 1998.

The United Kingdom, now in its sixth year of economic expansion, is experiencing higher than average economic growth. Growth of 3.2% is expected for 1997, up from 2.1% in 1996. Consumer spending remains high on the basis of strong employment and rising incomes. Although inflation remained subdued over the first three quarters of 1996/97 the Bank of England increased UK interest rates in response to early signs of accelerating price growth in the June 1997 quarter. Growth of 2.7% is estimated in 1998.

In Eastern Europe, three major emerging market economies - Poland, Czech Republic and Hungary - continued to benefit from market reforms, privatisation programs, trade with Western Europe and foreign investment. Average annual growth across these three countries continued in 1997 at around 4% to 4.5%. Growth of this magnitude can be expected to continue in the near future.

Russia's economic downturn which commenced in the early 1990s is expected to bottom out in 1997. The economy is expected to grow by around 2% in 1998.

*South East Asia currency problems create uncertainty in regional growth.*

Economic activity continues to be dominated by export growth, underpinned by increased global economic activity. Nonetheless, there is considerable uncertainty about the short term outlook for some Asian economies. There has been a sharp depreciation in the value of South East Asian currencies in the September 1997 quarter and this is creating some problems in the region. The IMF is currently reassessing its role in the Asian region. It has indicated that it will step up its financial monitoring role to avoid further currency turmoil in the region.

Asian governments are having to adjust their economic policies in order to reduce current account imbalances and inflationary pressures.

On the whole, however, Asian growth has been quite strong. It is forecast at around 7% in 1997 and 1998, somewhat lower than the 7.8% recorded in 1996.

China's growth for 1997 and 1998 is expected to remain at around its 1996 level of 9.7%. Taiwan and Singapore are also estimated to grow by between 6% and 7% in both 1997 and 1998. Hong Kong's growth rate is estimated to stay around its 1996 level of 5% for both 1998 and 1999.

While South Korea's competitiveness is expected to improve as a result of its currency depreciation in the short term, its growth is expected to fall from 7.1% in 1996 to 5.3% in 1997. As its improved competitive position filters into increased export growth it is expected that the economy will strengthen in 1998 with growth forecast at 6.1%.

Asian currency problems have had a particularly severe impact on Thailand. Thailand's growth is expected to be between 2.5% and 3% in both 1997 and 1998, down from the 6.7% recorded in 1996. In order to stabilise the economy, the International Monetary Fund has organised a rescue fund totalling US\$16 billion. Japan is contributing US\$4 billion, four more times than any other country. Australia's contribution of US\$1 billion equals that of Singapore and Malaysia.

In late October 1997 the IMF and World Bank were also considering a rescue fund for Indonesia. If proceeded with it is likely Australia's contribution will be around US\$1 billion.

*On the whole economic conditions in the State's major trading partners are favourable.*

Economic conditions in Western Australia's major 12 trading partners (MTPs), which accounted for around three-quarters of the State's 1996/97 exports, continue to be favourable. Economic growth in the State's MTPs is forecast at 4.0% to 5% in both 1997 and 1998.

The International Monetary Fund (September 1997) has forecast world growth of 4.3% in 1998. This is despite the currency and asset market turmoil in some South East Asian countries and lower than anticipated growth for Japan. Its medium term forecast of world growth is 4.5% p.a to 2002.



## 1.2 Review of the Western Australian and Australian Economy

*Australia's and Western Australia's growth moderated in 1996/97.*

The Australian national economy's growth moderated to 2.8% in 1996/97. This was lower than the 3.25% growth rate estimated in the 1997/98 Commonwealth Budget, delivered in May 1997. Nonetheless, the 1996/97 GDP outcome represents the sixth sustained year of Australia's economic recovery. Despite this, the average unemployment rate has been stuck at an unacceptably high level. Indeed, it rose marginally in 1996/97 to 8.7%.

*State business investment down, but, expected to rebound in 1997/98.*

Following the strong rates of economic growth of the past 3 years, Western Australia's growth moderated to 3.1% in 1996/97. This outcome was weaker than the 5% forecast in the 1997/98 State Budget, delivered in April 1997. The main causes for the State's lower than expected 1996/97 growth were the sluggish growth in the State's retail sales, lower than expected business investment and higher imports.

Surprisingly, business investment fell by a modest 2.1% in 1996/97. This fall was largely the result of the 7.5% decrease in business investment in the June 1997 quarter. The main reason for the fall was the timing of investment. Strong growth in imports of investment goods in the June 1997 quarter are consistent with a substantial pickup in investment spending in the first half of 1997/98. This suggests the original investment profile underlying the 1997/98 State Budget investment profile remains accurate but has been moved back one quarter. This is likely to have been the result of unexpected delays in the construction of some of the State's large resource projects.

On a positive note there are tentative signs that housing activity, which has been falling over the last two years, is beginning to recover. Despite falling by 0.1% in 1996/97 dwelling investment activity increased in the latter half of 1996/97 to reach its highest level since March 1995.

Western Australia's employment growth increased from 1.8% in 1995/96 to 2.3% in 1996/97. Western Australia's average unemployment rate in 1996/97 remained at around its 1995/96 level of 7.5%, still the lowest rate in Australia.

*Inflation under control. Lower official interest rates.*

In 1996/97 Australia's headline inflation rate increased by 1.3%. Australian average weekly earnings for full time employees also rose by 3.9%. Growth in Western Australia's headline inflation rate and average weekly earnings for full time employees eased over the second half of 1996/97 with the final outcomes being 1.4% and 2.3% respectively.

On the back of a low inflationary environment, favourable wages growth and concerns over Australia's high level of unemployment, the Reserve Bank of Australia initiated four cuts in official interest rates in 1996/97. Official interest rates were cut by another 0.55 percentage points in July 1997. Reflecting the official interest rate cuts the yield on 90-day bank bills has fallen from around 7.6% in June 1996 to 4.9% in August 1997.

*Continued improvement in Australia's balance of payments and Budget deficit positions.*

In 1996/97 there has been a substantial improvement in Australia's balance of payments as well as in the Commonwealth Government's budget deficit position. In 1996/97 Australia's current account deficit totalled A\$16,500 million, down A\$4,000 million on 1995/96. Whilst this accounted for 3.2% of Australia's GDP in 1996/97, significantly lower than the 5.8% figure recorded

in 1994/95, this outcome is considered still too high but at least it is moving in the right direction. Importantly, this is first time in over two decades, that Australia has recorded a surplus on both its net services and its merchandise trade accounts. In terms of the latter this was achieved largely by the Reserve Bank's decision to sell 167 tonnes of gold in April 1997. The bulk of this was delivered and paid for in June 1997. The remainder is expected to be delivered in the September 1997 quarter.

In 1996/97 the underlying Commonwealth budget deficit was around A\$6,800 million. This represented 1.3% of Australia's GDP, and was significantly lower than the 4.2% peak of 1992/93. The 1997/98 Budget continued the Government's fiscal strategy initiated in 1996/97 to bring the Budget back into an underlying surplus in 1998/99.

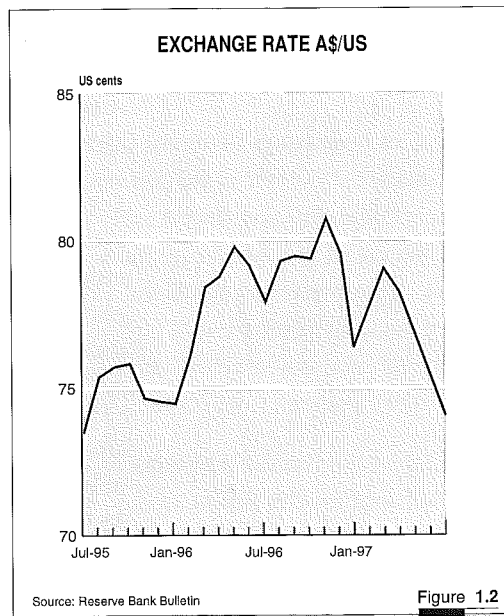
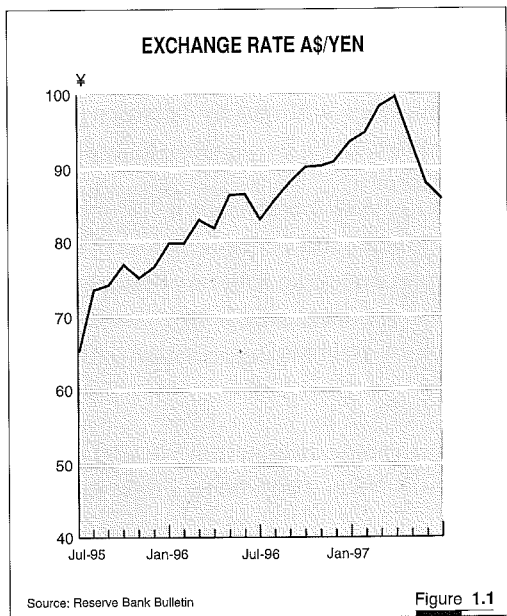
*Australian dollar appreciates.*

The A\$ appreciated significantly against the US\$ in the first half of 1996/97. The higher A\$ came primarily from strong Japanese capital flows into the Australian bond market. The A\$ reached a peak of US\$0.8214 in early December 1996, its highest level since October 1990. The A\$ also gained significant ground on the Japanese Yen, rising from Y83.05 in July 1996 to Y99.16 in April 1997. Since April 1997 the A\$ has depreciated significantly closing in June at US\$0.7455 and Y85.20. The fall in the A\$ to a more realistic level is largely attributed to the lagged impact of the official cuts in Australian interest rates on international money markets. Overall, in 1996/97 the A\$ appreciated against the Yen and US\$ by 16.7% and 3.3% respectively (Figures 1.1 and 1.2).

The Australian dollar performed similarly against other major currencies. While the Trade Weighted Index rose by 7.1% in 1996/97 it closed at 2.4% below its June 1996 level in June 1997.

*Favourable State growth.*

The State's economic growth outlook is positive with growth expected to pick up in 1997/98. State growth is expected to range between 5% and 6% per annum from 1997/98 to 2000/01. Similarly the growth prospects for Australia are encouraging with growth expected to be 3.75% in 1997/98.



*Commodity prices mixed, gold and nickel down, petroleum and iron ore up.*

### **1.3 Economic Factors Affecting the Mining Industry**

A major factor affecting the economics of mining and petroleum extraction are the demand prices received for the resources extracted. While demand for most mineral and energy commodities was strong in 1996/97, in terms of commodity prices received, producers' fortunes in 1996/97 depended on which market they were in.

Gold, for example, performed poorly. While the average gold price fell to US\$364 per ounce in 1996/97, down from US\$390 per ounce in 1995/96, continued market concerns over gold stocks held and speculative gold sales by Central Banks, saw the gold price fall to US\$317 per ounce on July 9, 1997, its lowest level in four years.

After US\$ nickel prices rose over the previous two years, the price fell by around 12% in 1996/97. This fall in price was the result of lacklustre nickel demand by stainless steel producers generated by a drawdown in world stainless steel stocks and the increased availability of stainless steel scrap (a substitute for nickel).

Petroleum products on the other hand were the best performing commodity in 1996/97, with oil prices reaching a six-year high in December and January 1997, trading above US\$26/barrel. This outcome was primarily the result of cold weather concerns in Europe and low inventories. By end June 1997, however, petroleum product prices fell to around US\$21. Overall petroleum product prices rose by 18% in 1996/97.

Australian negotiated iron ore prices also recorded a 6% increase in 1996/97.

Aluminium prices are showing signs of recovery. While they fell by 9% in 1996/97 aluminium prices recovered in the first half of 1997. In 1997/98 they are expected to be 6% higher than the 1995/96 level.

With strong growth expected to continue in most of Asia and major OECD countries the outlook for commodity prices is favourable. On the back of continuing rising demand and the supply of a number of minerals constrained in the shorter term by capacity, ABARE predicts average prices for most Australian minerals and energy commodities will rise by between 3% and 13% in calendar year 1998.

For the 1997/98 financial year, however, ABARE has forecast a 2.4% rise in A\$ average prices received by Australian mineral and energy exporters. Stronger average 1997/98 A\$ mineral and metal export prices (up 6.8%) are offset by lower energy export prices (down 3.7%). The subdued overall 1997/98 outcome, therefore, comes from the anticipated 3.8% 1997/98 depreciation in the US\$/A\$.

On the back of a 5.4% rise in Australian mine production, ABARE expects mineral and energy exports to grow by 5.7% in 1997/98 to a new record of A\$38,550 million.

A positive development emerging for mineral commodity markets is that Soviet stockpiles appear to be depleted and there are early signs that pressure on

*Favourable 1998 commodity price outlook.*

prices from Soviet dumping has ended. Over recent years the collapse of the USSR triggered frenetic dumping of all types of commodities in search of foreign exchange.

*Major trading partners  
provide positive outlook.*

For Western Australian miners, in particular, major trading partners (MTPs) continue to provide substantial demand. The positive economic outlook for most Asian economies should continue to benefit the State's mining industry. The region currently takes more than two thirds of the State's mineral and energy exports and will remain the main target of exporters. The spill-over effects for the rest of the State's economy of favourable economic conditions in the State's MTPs are significant. For example, it has been estimated that a 1.0 percentage point increase in Japan's economic growth would add 1.4 percentage points to Western Australia's economic growth.

As so many export contracts are written in US\$, the exchange rate between the A\$ and US\$ is a very significant economic determinant affecting the Australian mineral industry. For example, a 1% appreciation in the value of the A\$ against the US\$ equates to a decrease in sales value of around A\$29 million a year for the iron ore industry and A\$26 million a year for the petroleum sector. In this respect, the currency movements over the first half of 1996/97 were not favourable to Australian mineral and energy producers. 1996/97 saw the Australian dollar appreciate against the US currency and trade particularly strongly over the final quarter of 1996, reaching a peak of US\$0.8214 in early December 1996, the highest level since October 1990. Four official interest rate cuts over 1996/97 provided the catalyst for a fall in the A\$ to US\$0.7455 in June 1997. Official interest rates were again cut by 0.55 percentage points in July 1997. Given the potential of another interest rate cut, assuming Australian wages growth remains at acceptable levels, the exchange rate is likely to remain at below its June 1997 level (US\$0.7455) for most of 1997/98. In late October 1997 the exchange rate dipped below US\$0.70.

A number of measures taken by either the State or Commonwealth Governments have the potential to impact on the competitiveness of Western Australia's mineral and energy sector.

*WA competitiveness  
boosted by energy  
deregulation.*

Western Australia's mining industry competitiveness continued to improve with the further deregulation of the energy market in 1996/97. This included the completion of the Goldfields Gas Pipeline which was officially opened in October 1996 and continuation of the program of phasing in access to the Dampier to Bunbury natural gas pipeline for large gas customers. From 1 January 1997 gas customers taking at least 500 TJ per annum through a single connection have been able to contract directly with the gas supplier of their choice. This threshold will be reduced to 250 TJ from 1 January 1998.

Since gas suppliers have been allowed to contract directly with major gas customers, it has been estimated that gas prices in the Pilbara have fallen by over 50%. This will further assist the development of the State's mining industry by significantly improving the viability of potential secondary mineral processing projects in the region.

In addition to the developments in the gas market, the State Government is phasing in access for large electricity producers and consumers to Western Power's high voltage electricity transmission and distribution systems. Open access is to be provided to large electricity consumers according to a schedule which commenced from 1 January 1997. Deregulation of access to Western Power's systems is expected to create competitive pressures between electricity generators which should ultimately lead to the supply of cheaper electricity, providing in turn a further boost to economic development.

*Hilmer reforms provide benefits.*

More generally, the market framework within which the mining industry operates had its competitiveness enhanced with all States and Territories enacting legislation which subjected their public enterprises to the provisions of the Trade Practices Act (TPA) from 21 July 1996. This was a major step in National Competition Policy resulting from the Commonwealth, State and Territory governments endorsing the 1993 Commonwealth Independent Committee of Inquiry into National Competition Policy (the Hilmer Report") and subsequent signing of agreements in April 1995 to put into effect various microeconomic reforms.

*Commonwealth Government targets the Diesel Fuel Rebate Scheme (DFRS) for revenue savings.*

As a means to address DFRS's rising revenue cost, in October 1996 the Commonwealth Government proposed a number of amendments to the Scheme. The amendments, amongst others, will make diesel used in all vehicles under 3.5 tonnes which are suitable/capable for use on public roads ineligible for the rebate. The Bill is being debated in the Commonwealth Parliament.

Western Australia is already the State most affected by the proposed October 1996 legislative changes to DFRS as its mining industry relies more on diesel fuel than in other States. Any additional changes to DFRS, such as capping its future cost, would further impact on the international competitiveness of the State's resources sector.

*Section 23 (pa) exemption from income tax for prospectors removed.*

On August 25 1997 the Commonwealth Parliament passed an amendment which removed the exemption previously provided under paragraph 23 (pa) of the Income Tax Assessment Act 1936 to income derived by bona fide prospectors from the sale, transfer or assignment of rights to mine for gold or any other prescribed metal or mineral. Removal of the exemption is being phased in over the period 19 August 1996 to 19 August 2001. Over this period only the increase in value of mining rights is taxable. The value accrued to 19 August 1996 remains exempt until 19 August 2001. After this date the exemption will be completely removed and total value taxable.

*1997/98 Commonwealth Budget.*

The 1997/98 Commonwealth Budget brought down in May 1997 was essentially a "steady as you go - hands off" approach which, unlike the 1996/97 Budget, inflicted minimal additional pain on business and the community in general. The massive 1996/97 Budget cuts to Government expenditure and industry incentive schemes, such as the reduction in the premium rate of deduction for research and development expenditures from 150% to 125%, are now having full effect. The resultant increased revenue growth is the key factor to the Commonwealth's expected budgetary improvement for 1997/98 and return to surplus in 1998/99.

*Commonwealth budget reductions in grants to State.*

Since handing down the Budget it appears likely that the Commonwealth will derive a significant windfall from the 1/3 sale of Telstra with the total sales price expected to exceed the A\$8,000 million budgeted for. The Commonwealth Government has indicated that the windfall will be used largely for Commonwealth debt reduction purposes.

The 1997/98 Commonwealth Budget confirms the State's view that the Commonwealth is balancing its books by shifting its debt onto the States and Territories. The Budget incorporated the outcome of the 1997 Premiers Conference of a 0.4% real cut in Commonwealth grants to the States and Territories for 1997/98. This follows a real cut of 0.9% in 1996/97.

In addition, under a 1996 agreement with the Commonwealth the States' and Territories are required to contribute A\$1,559 million in total over three years towards the Commonwealth's debt reduction program. Western Australia's share is A\$151 million. If the Commonwealth continues its policy of shifting its deficit to Western Australia, the State may not have the infrastructure funds necessary to foster the continued growth of the State's resources sector or raising its revenue from a smaller base.

*High Court rules States' business franchise fees unconstitutional.*

On 5 August 1997 the High Court ruled in NSW vs Hammond and Ha that the NSW business franchise fees (BFFs) on tobacco were unconstitutional. The High Court essentially ruled that the tobacco BFFs was an excise and therefore as Section 90 of the Constitution only allows the Commonwealth to levy an excise they were invalid. The High Court's decision impacted on all States and Territories. Solicitors General subsequently advised that the decision also meant that the validity of BFFs on fuel and liquor was doubtful. Consequently, all States agreed that there was little point in still trying to collect them.

The High Court's decision effectively created a A\$600 million shortfall in Western Australia's budget. The revenue loss for all States totalled around A\$5,000 million. To protect the States' income a safety net arrangement which had been agreed with the Commonwealth in case of an adverse finding by the High Court was triggered.

The Federal Government is to collect BFFs on behalf of the States. The major objective of the safety net arrangements is to leave each State in a revenue neutral position while keeping any price increases, particularly for fuel, at a minimum. This position arises because the Commonwealth must implement BFFs at a uniform national rate. Prior to the High Court's decision BFF rates varied amongst the States.

The High Court's decision could have had wide ranging ramifications for Western Australia's mining industry. Under the new arrangements Western Australia would have received a significant windfall from the extra monies generated because the Commonwealth's 8.1 cents per litre surcharge on diesel was higher than the State's old diesel BFF rates. However, Western Australia will give back all extra revenue to the fuel companies and therefore the price of diesel should not be affected by the new arrangements.

To help protect the States from potential claims of billions of dollars in refund of past BFF collections, the Commonwealth Government will introduce a 100%

Windfall Tax to apply on any refunds of past BFFs paid by companies to the States. This would prevent companies from undertaking court action to recover past BFF payments.

*Commonwealth  
Government foreshadows  
major tax reform.*

On a positive note the High Court's decision has provided the Commonwealth Government with a catalyst for a wide ranging inquiry into tax reform. The inquiry will develop tax reform options that the Government can take to the Federal election, due at the latest, in March 1999. The Prime Minister has indicated that the guiding principles for reform are to include consideration of a broad based indirect tax; reform of Commonwealth/State relations; reductions in personal income tax; and no increase in the overall tax burden.

A priority outcome for the States from the reform of Commonwealth/State financial will be to reduce the States' dependence on Commonwealth grants for their funding. This dependence was further exacerbated by the High Court's decision.

From a State perspective the optimal outcome of the tax inquiry would be the adoption of a more efficient and effective tax system, one that does not unduly penalise Australia's export sector, as is the case with current tax system. It has been estimated that Australia's existing indirect tax system (ie. wholesale sales tax, diesel fuel excise etc) imposes an additional cost of 5% (i.e. about A\$3,800 million) on exporters.

*State Government  
introduces a gold royalty.*

In the 1997/98 State Budget, brought down in April 1997, the Government's challenge was to meet the State's revenue shortfall resulting from the continued cuts in Commonwealth grants to Western Australia. The State Government faced difficult fiscal decisions and this has led to the gradual removal of the exemption from royalty payments on gold production.

The 1997/98 State Budget indicated that a gold royalty option was being examined but the final makeup of the royalty was still subject to industry consultation.

After consulting with industry groups the final makeup of the royalty was decided by Cabinet and announced on 28 July 1997.

The royalty will now commence from 1 July 1998 at a rate of 1.25%. The full royalty of 2.5% has also been delayed until 1 July 2000 and will be conditional on the gold price exceeding an average A\$450 for the quarter. The royalty will be unconditional from 2005. These concessions are worth about A\$56 million over the next three years, and up to A\$160 million over the next seven years.

The State's gold royalty is also deductible for Federal company tax purposes. At 1.25% and 2.5% the effective rate of gold royalty translates to 0.8% and 1.6% respectively.

*The calls for a new  
Australian industry  
policy.*

Over the last five years the consensus among industry is that Commonwealth governments have lacked an industry policy direction. Industry believes that the lack of a coordinated industry policy will impact on Australia's international competitiveness in the near future.

Against this background the Commonwealth Government commissioned a number of reports in 1996/97.

The Mortimer Report's (June 1997) overriding goal is to provide Government with a strategy for doubling Australia's average per annum economic growth per capita rate from 1.7% per annum over the last 10 years to 3.4% for the next 10 years. The Report's principal focus is to provide a framework for assessing and developing business assistance programs (BAP) consistent with the Report's goal. If all the Report's recommendations were implemented a net A\$850 million increase, over the current forward estimates, in BAP would result over the five years 1998/99 to 2002/03.

The Goldsworthy Report (August 1997) provides Government with a strategy to improve Australia's rate of innovation in information technology. It recommends major tax concessions to achieve this objective, including a proposal for a 200% tax concession on research and development of information technology.

The Commonwealth Government is currently considering these reports in its framing of a coherent and effective industry policy.

*South East Asian  
currencies in turmoil.*

The dramatic collapse of South East Asian currencies could significantly impact on Australia's export industries. The currency crisis in Asian markets has been attributed to a general slowdown in Asian economic activity; some countries having deteriorating external accounts; and markets driving down the value of the currencies.

From July 1997 to August 1997 the Thailand Baht has fallen by 33%; the Indonesian rupiah by 17%; The Malaysian ringgit by 11% and the Philippines peso by 15%.

There are some international concerns that the fall in South East Asian currencies could have a domino effect throughout Asia. If this were the case then imports to Asia could be affected as their costs would increase significantly. In addition a prolonged depreciation of Asian currencies would lead to both stock exchange and asset price deflation in the region. This ultimately would impact on Asian investment and hence their demand for imports. With more than 70% of the State's mineral and energy exports taken up by Asia, Asia's currency turmoil could adversely spillover into the State's economy. However, given the diversified nature of the State's resources sector, including the takeup of downstream processing opportunities, some of these adverse affects would be ameliorated.

In September 1997 Japan was leading a concerted push for the creation of an US\$100 billion Asian Monetary Fund. The aim of the fund was to avoid further currency turmoil in the region. The proposal was subsequently rejected by the International Monetary Fund (IMF). In its place the IMF intends to step up its regional surveillance of capital markets in the region. The IMF strategy is to have a mechanism which allows the earlier identification of problems within the region and where applicable, make speedy arrangements for financial support to stabilise currencies. The latter was the case with the recent US\$16 billion currency rescue fund for Thailand.



*Mining outlook is favourable.*

According to Australian Bureau of Statistics (ABS) data mining profits growth fell from 27% in 1995/96 to 2.5% in 1996/97. Profitability levels in the mining industry are expected to improve in 1998.

The ABS's Australian Business Expectations Survey suggests that mining profits are expected to be around 35% higher in the September quarter 1998 compared with the September quarter 1997. This suggests that most mining companies responding to the survey expect a more favourable international economic climate and commodity price outlook in 1998. It is also expected that Australia's new mining investment will rise by 19% in 1997/98.

#### 1.4 Social and Political Factors Affecting the Mining Industry

*Native title delays remain a concern.*

The major issue during 1996/97 was again native title and its impact on the mining and petroleum sectors. At the end of June 1997 there were 259 native title claims covering over 80% of Western Australia including most areas of known mineralisation. In 1996/97 there were 81 new claims lodged.

The Western Australian Government has had procedures consistent with the Federal Government's Native Title Act (NTA) since the High Court decision of 16 March 1995. To 12 August 1997 the Department had referred some 8,769 exploration and mining titles to the NTA processes. All title applications are advertised by the Department of Minerals and Energy (DME) and relevant parties notified. If the area is not subject to a registered native claim at the end of the two-month notification period the tenement is granted.

*The grant of an Exploration and Prospecting licence under the "expedited procedures" of the NTA is delayed by 3-4 months.*

In the case of prospecting, exploration and certain miscellaneous licences, the State seeks the "expedited procedure" which applies to acts which do not have a significant impact on native title interests. Experience to date has been that about 92% of exploration and prospecting licences have been granted following this procedure. However, this process has meant a delay of some three to four months on top of the usual six to seven months to grant exploration licences.

If an objection to the expedited procedure is made by a registered native title claimant and the objection is upheld by the National Native Title Tribunal (NNTT), then the matter must proceed in accordance with the right to negotiate procedure.

In the case of mining leases and general purpose leases, all applications over areas that are the subject of a registered native title claim must undergo the right to negotiate procedure.

The right to negotiate procedure involves meetings of the various parties involved in negotiations related to the grant of tenements. These negotiations must be carried out in accordance with NTA procedures which require that negotiations carried out on behalf of the State be in "good faith" with a view to achieving an agreement with the tenement applicants and native title parties. Where no agreement results from negotiations within the prescribed six-month time frame, any of the parties may apply for a determination by the NNTT.

*Mining lease applications held up by right to negotiate procedures.*

The delays experienced with mining leases have been much greater compared to exploration licences. Approximately 80% of mining lease applications have been subject to the right to negotiate procedure. Of the 1,950 titles that have been submitted to the process in the period 16 March 1995 to 30 September 1997, only 146 have been granted as a result of successful negotiations. Another ten have been recommended for grant by the NNTT following determinations. However, these determinations were the subject of Federal Court appeals and have been returned to the NNTT.

*Three NTA ruling in 1996/97 will further impact on the number of tenements the State can grant.*

During 1996/97 there were three significant decisions which had a detrimental impact on the number of tenements which could be granted under the State's Mining Act 1978.

First, in August 1996 the NNTT found that the Western Australian Government had not fulfilled its obligations to negotiate in "good faith" and as a result over 900 mining lease applications subject to the NNTT's right to negotiate at the time of the ruling have had to restart their progress through the negotiation process.

Secondly, on 23 December 1996 the High Court provided its long awaited ruling (Wik decision) on the key issue for Western Australia of whether pastoral leases extinguish native title. Despite the Court's ruling this remains largely unresolved. The High Court ruled that pastoral leases in Cape York in northern Queensland did not necessarily extinguish the native title claimed by the Wik people. It concluded that, because the nature of the Wik people's native title claim had not yet been determined and because the pastoral lease in question was a limited grant of rights, there was potential for native and pastoral rights to co-exist. Therefore, the lease may not have extinguished native title. It also ruled that where the rights under a pastoral lease were inconsistent with those of native title, the rights of pastoral leases would prevail.

Thirdly, on 8 May 1997 the Federal Court (the Dann decision) upheld that the NNTT should consider the rights bestowed by the grant of a tenement, rather than the intended use of the tenement by the applicant, when making a decision as to whether the expedited procedure (or fast tracking) should apply. As a result of this, if a native title party objects to the expedited procedure applying to any exploration title then the full right to negotiate process will apply.

Western Australian officials have been working with the Commonwealth and other States in an attempt to identify amendments to the NTA which would make the system more workable.

*Commonwealth Government moves to amend the NTA.*

In October 1996 the Prime Minister announced a number of proposed amendments to the Native Title Act 1993. Those amendments aimed to streamline the NTA so as to make it more workable by, amongst others, making all native title claims subject to a threshold test so as to determine their legitimacy; allowing once-only right to negotiate for mining companies and developers; and excluding exploration companies and prospectors from right to negotiate obligations.

On 28 April 1997 the Prime Minister announced a 10 point Wik plan strategy. While the strategy does not extinguish native title on pastoral leases it attempts to define those pastoral activities which are viewed as being inconsistent with native title rights.

In September 1997 the Federal Government introduced the Native Title Bill 1997 into the Federal Parliament. The Bill incorporates the proposed October 1996 NTA amendments and the so called Wik 10 point strategy.

Western Australia broadly supports the 1997 amendments to the NTA currently before the Commonwealth Parliament. They offer some possibility that a more workable system of dealing with native title claims related to mineral titles will be developed in future years.

Nonetheless, given that the passage of the Commonwealth Government's native title legislation requires the support of the minor parties and/or two independent Senators it could be some time before the NTA amendments are passed (or rejected). Until then the industry will need to continue to negotiate with claimants under the current NTA.

*State election returns  
Liberal/National  
coalition in December  
1996.*

Western Australian State elections were held on 14 December 1996 and the State Coalition returned to power for a second term. In general, the Coalition's election platform in terms of the mining industry was a reiteration of existing policies and a commitment to extend those policies into a second term. The Coalition's major new mining initiative is its goal to have a petrochemical industry located in the Pilbara. The Government has invited expressions of interest for the development of the A\$1 billion to A\$1.5 billion petrochemical plant.

Reflecting the outcome of the 1996 State Election the Coalition lost control of the Upper House for the first time in its history. This took effect on 21 May 1997, when the new members elected to the Upper House, were able to take their seats.

*Commonwealth relaxes  
mining controls.*

Since coming to power in March 1996 the new Commonwealth Government has been attempting to re-balance environmental and development objectives. Implicit in the present Government's approach is its belief that the previous government skewed debates on important issues, such as greenhouse, towards environmental protection rather than development considerations.

Consistent with this change in the Commonwealth Government perspective it has abolished the former government's uranium three mines policy as well as removing price controls on coal, bauxite and mineral sands. This should see increased opportunities in the mining industry in Western Australia and in particular could lead to the development of the Kintyre uranium deposit.

*International  
greenhouse gas  
pressures.*

In July 1996, the Commonwealth Government also stated its views on the need to balance environmental and development considerations at the Climate Change Convention in Geneva. The Federal Government has adopted a stance of not signing any convention on climate change and greenhouse gas emissions which "unfairly" harmed Australia's economic welfare. The proposed convention on greenhouse gas emissions is due to be signed in Kyoto, Japan at the end of 1997. In its formal submission to the UN lodged on the 15 January 1997 deadline, the Commonwealth has remained steadfast in its insistence that those developed countries that would be hardest hit by reduction measures should be allowed to emit higher levels of greenhouse gases. Whilst the stance has garnered some support from the likes of Norway, Poland and France, it has also generated unofficial threats of trade sanctions from the US. In October 1997 Australia's

position was dealt a major blow when Japan, which had been previously receptive to Australia's position, called for a 5% reduction in greenhouse gases below 1990 levels. It therefore remains to be seen what the outcome of further negotiation will be.

*1992 National  
Greenhouse Response  
Strategy to be revamped.*

Australia has, in the past, attempted to contribute in a fair and equitable way to the international response on greenhouse. In 1992 a National Greenhouse Response Strategy (NGRS) was adopted by Australian governments. Following a 1996 review of the strategy it was concluded that governments, stakeholders groups and the community need to do more to reduce Australia's greenhouse gas emissions and to prepare for the potential impacts of climate change.

In 1997 a discussion paper - Future Directions for Australia's Greenhouse Strategy - was released for public comment by the Intergovernmental Committee on Ecologically Sustainable Development. The paper provides possible actions across a range of industry sectors and sets out potential measures on community information and education with the aim of reducing greenhouse gas emissions.

Nonetheless, as of September 1997, the suggestions contained in the paper have not been formally considered by Australian governments. The NGRS is expected to be finalised later this year but it may need to be modified to incorporate Kyoto outcomes.

*WA Government gives  
legislative backing to its  
Marine Parks policy.*

The State Government has continued its policy of balancing environmental and development objectives.

In November 1994 the State Government outlined its new policy for managing the marine environment in a policy document titled "New Horizons in Marine Management". As part of the process of framing the policy the Government announced that year that future drilling exploration in the Ningaloo Marine Park was prohibited.

Key elements of the marine management strategy include: the provision of clear access guidelines for petroleum explorers and developers in marine conservation reserves; a three-tiered approach to marine conservation reserve categories; and the establishment of a Marine Parks Authority in which marine conservation reserves will be vested under the Conservation and Land Management Act.

A key aspect of the policy was that the Minister for the Environment would obtain the consent of the Minister for Mines before creating any marine reserve or management zone within a reserve that would preclude petroleum exploration and development activities.

The November 1994 policy has been given legislative backing by amendments to the Conservation and Land (CALM) Act and the Western Australian Petroleum Acts. These amendments, applying both to petroleum and mineral exploration and development, were proclaimed on 29 August 1997. Drilling and sea floor sampling is now prohibited in Marine Nature Reserves and Recreation and some special purpose zones of Marine Parks.

*Management Agreement  
adopted for the Shark  
Bay World Heritage Area.*

The Commonwealth/State Management Agreement for the Shark Bay World Heritage Area (SBWHA) was signed on 12 September 1997. As a result, before any petroleum exploration proposals can be considered within the SBWHA, the EPA has to undertake a review of the environmental implications of such activities for consideration by the Federal Minister for the Environment and the World Heritage Area Ministerial Council.

*WA joins the National  
Environmental  
Protection Council.*

Related to State/Commonwealth environmental matters, Western Australia joined the National Environment Protection Council (NEPC) in September 1996, making it a truly national body. The NEPC consists of Federal, State and Territory environment ministers working together to provide a consistent framework for environmental legislation. A meeting of the NEPC in November 1996 agreed to develop a national environment protection measure (NEPM) for a national pollutant inventory. The council also initiated a new NEPM on assessment of contaminated sites and approved protocols for community and business consultations on national measures and on guidelines for the environmental, social and economic assessment of future NEPMs. This followed strong pressure from industry, including the mining industry, for better consultation by the NEPC. Industry had complained that the NEPC was consulting after, rather than before, it drew up guidelines.

Figure 1.3

## LOCAL GOVERNMENT BOUNDARIES

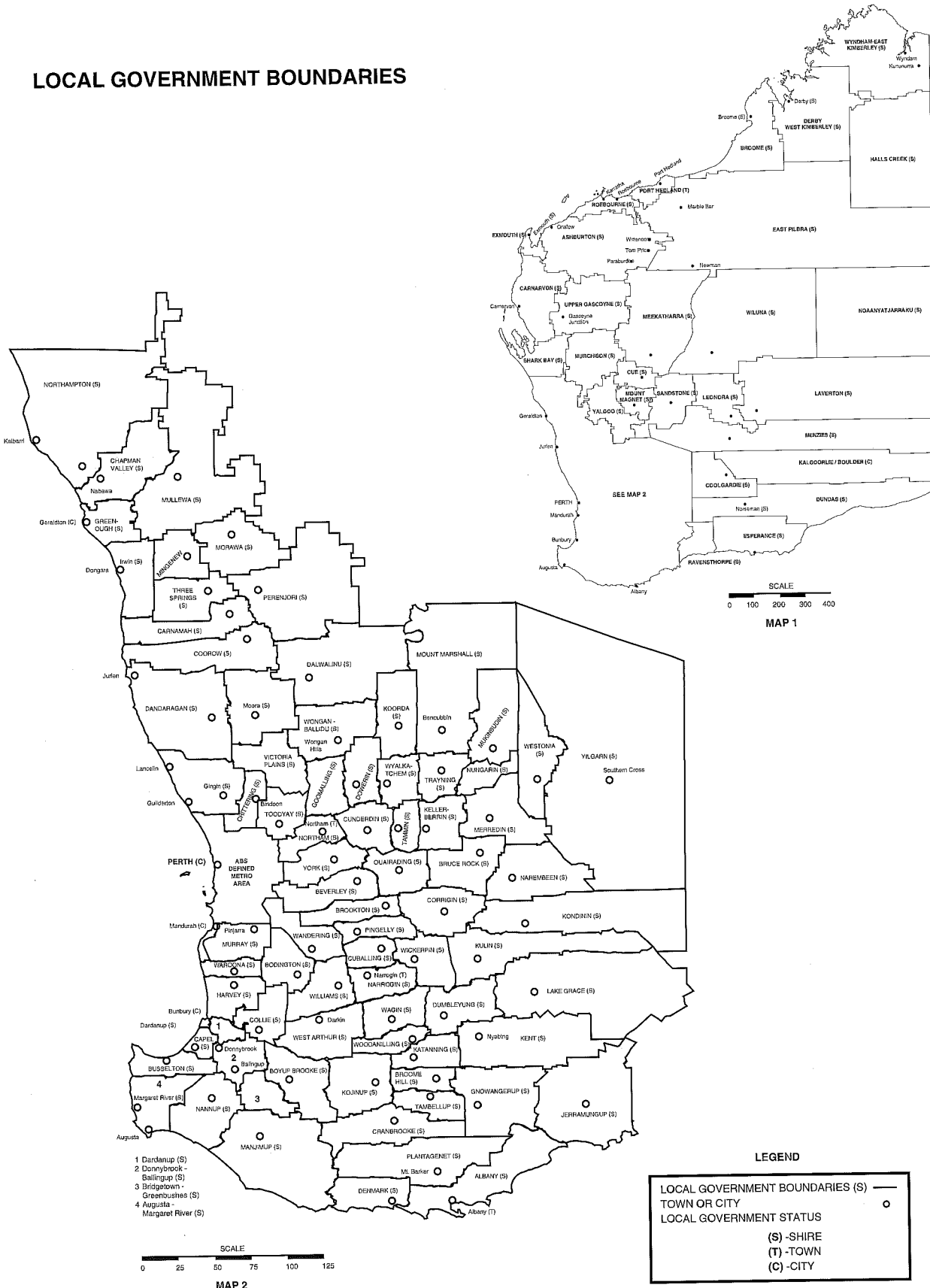
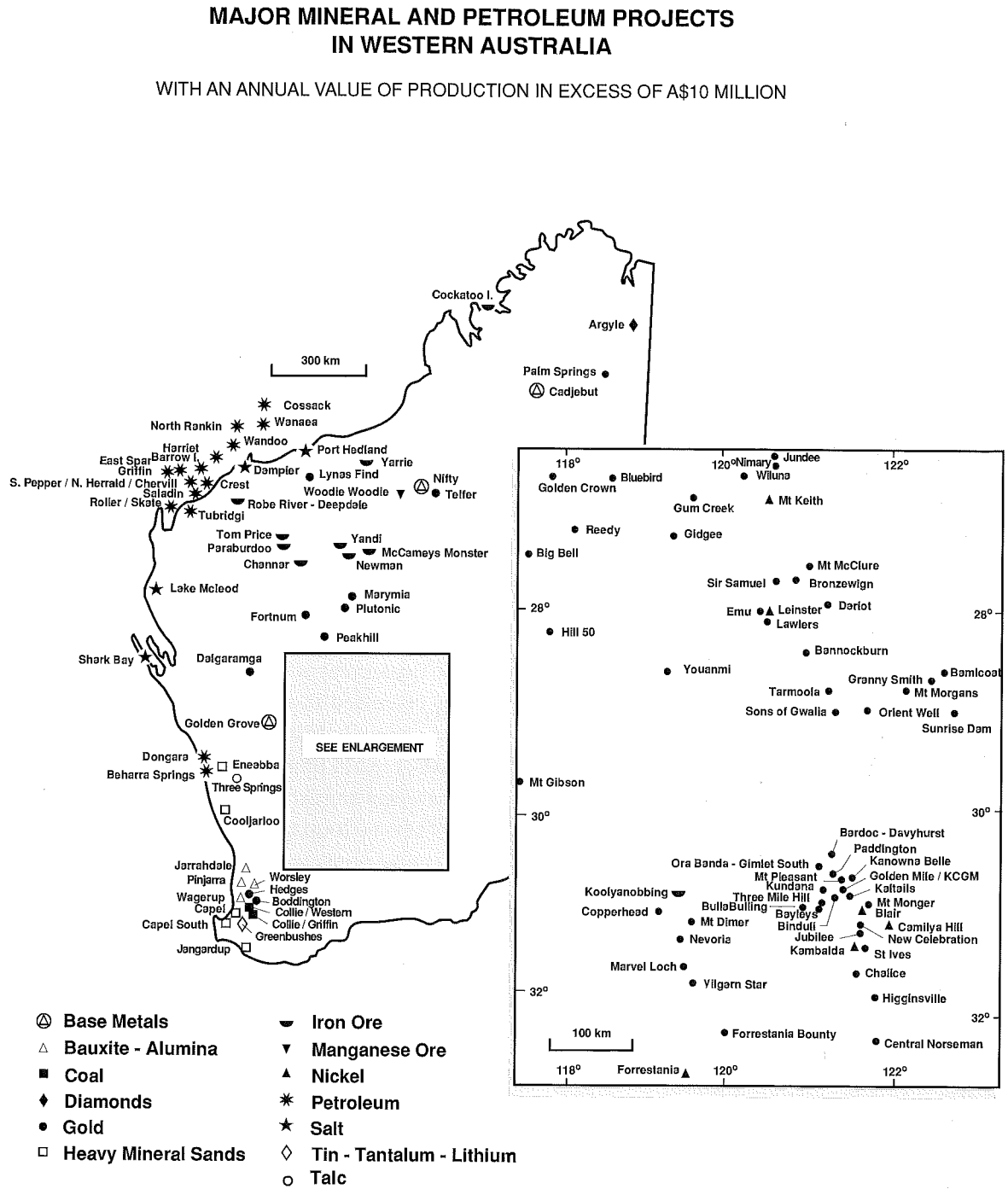


Figure 1.4





## 2. REVIEW OF MAJOR MINERALS AND PETROLEUM IN WA

### 2.1 Overview and Outlook

The value of mining and petroleum production increased by 7.0% in 1996/97 to A\$16.4 billion.

The key sector contributing to this growth was petroleum (up A\$965 million) and iron ore (up A\$235 million). Commodity prices were mixed in their movements over 1996/1997, but the appreciation in the A\$ over the year uniformly eroded the returns for most of the State's mineral and energy producers.

Undoubtedly the highlight of 1996/97 was the continued surge in the petroleum sector, making it the State's first industry to produce more than A\$5,000 million of product in a year. The petroleum industry has entrenched its position as the State's leading resource industry and it now produces more than 30% of the State's total value of mineral and petroleum production. Against this background it is not surprising that Western Australia has maintained its position for the second consecutive year as Australia's largest oil producer.

Conditions in world iron markets improved in the latter half of 1996/97 and this was reflected in a 8.1% rise in the value of iron ore. The gathering pace of downstream processing and increasing prominence of new Asian markets augur well for an exciting future.

After alumina spot prices fell by 34% in 1996 prices have firmed over the first half of 1997. Ironically the State's alumina sector was protected from the events in world spot alumina markets because of higher contract prices settled prior to the 1996 drop in spot prices. As a result the value of the State's alumina production increased by 2% in 1996/97, due largely to a 1.4% increase in production. The State's gold industry also increased its value of production by 1%, but this was achieved through higher output to counteract a year of lower prices and a higher A\$.

Other sectors were mixed. The nickel industry suffered from lower prices, while buoyant markets helped mineral sands to increase its value by 3.3% despite mineral sands production falling.

Deregulation of the gas market, commencement of gas deliveries via the Goldfields Gas Pipeline coupled with, in general, a favourable outlook for Asian growth

and commodity prices all suggest that the outlook for Western Australia's mineral and petroleum sectors is bright.

Western Australia is expected to continue to be a significant world player on many international commodity markets. In 1996/97, Western Australia supplied (by quantity) around 14% of the world's iron ore production, 10% of its gold production, 7% to 10% of its LNG production, 18% of its alumina production, 12% of its nickel production; 32% of its zircon production and 30% to 40% of its diamond production (Figure 2.26).

The State's prominence on the international minerals scene is expected to be maintained well into the 21st century.

As of the June quarter 1997 the value of State mining and petroleum projects under construction was more than A\$5,000 million. In addition, as of June 1997, more than A\$30,000 million worth of resource projects were either under consideration or listed as a possibility for Western Australia.

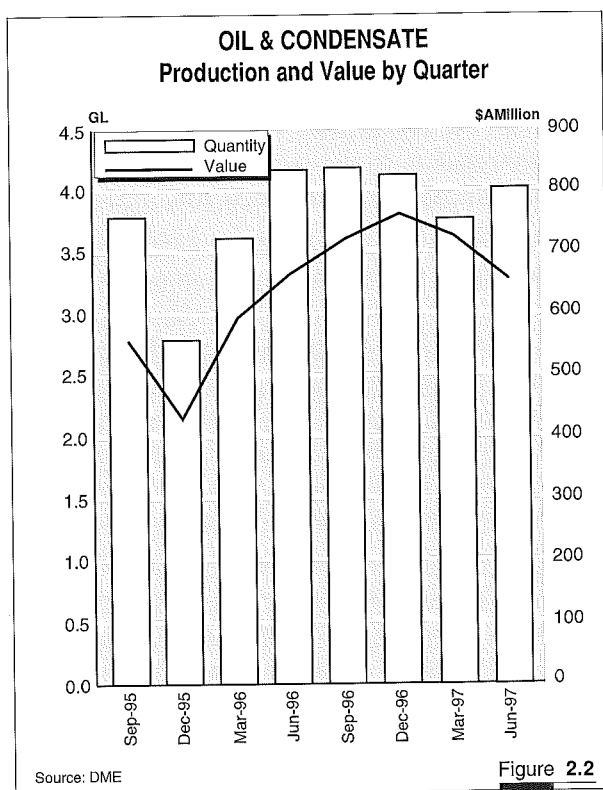
The Department of Minerals and Energy (February 1997) has estimated that the value of the State's mineral and energy industry is estimated to be in the range of A\$21 - A\$24 billion in 2000/01. This translates into an average annual rate of growth in production from 1995/96 to 2000/01 of 7% to 9%. These forecasts are of course predicated on particular price assumptions and most importantly, on the likelihood of new projects advancing. For example, the value of alumina production in a low growth scenario is estimated to increase at an average annual rate of 6% based on current facilities and production levels. However, in a high growth scenario, where it is assumed that all new expansion plans reach fruition, the average annual growth rate to 2000/01 for the value of alumina output could be around 13% (Figure 2.27).

## 2.2 Petroleum

For the third year running petroleum has been the State's most valuable resource sector. New annual production rate records were set for oil, gas and condensate with the value of output in 1996/97 rising by 24% to reach A\$5,035 million. This represented 31% of Western Australia's value of mineral and petroleum production.

In 1996/97, the State exported A\$3,151 million worth of petroleum products with the major destinations being Japan (60%) and Taiwan (9%) (Figure 2.1).

### 1996/97 Petroleum Industry Highlights

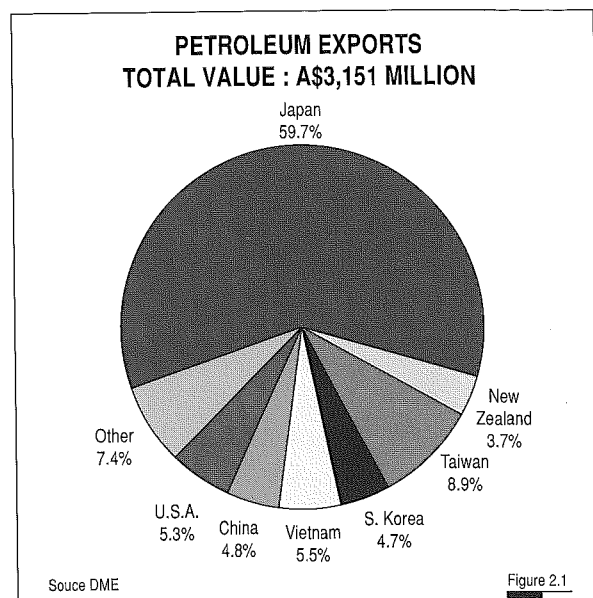


Source: DME

Figure 2.2

Highlights of the Western Australian petroleum industry over 1996/97 included:

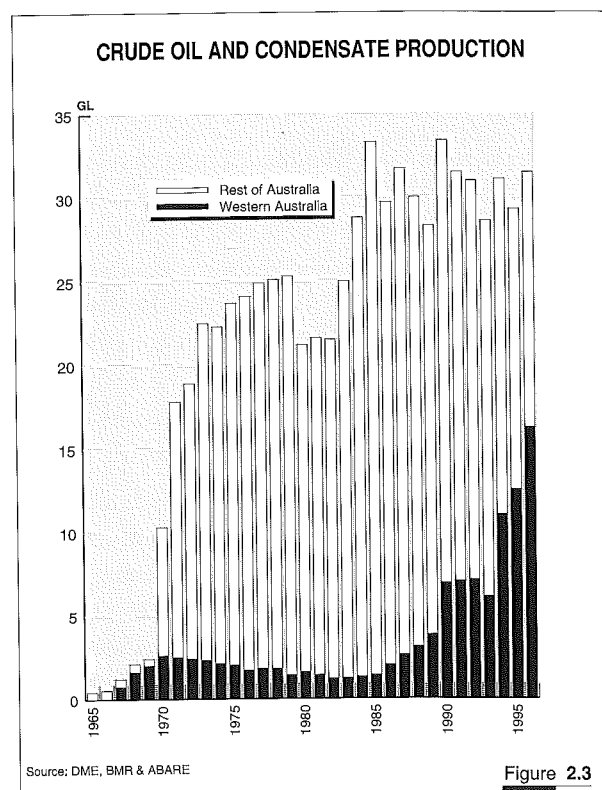
- Western Australia has retained its status for the second successive year as Australia's premier petroleum producer. In 1996/97 the State accounted for approximately 52% of Australia's total crude oil and condensate production. December 1996 data suggests the State also produces around 50% of Australia's gas production (Figure 2.2 & 2.3).
- Crude oil production, worth an estimated A\$1,913 million, was the most significant product. Its value of output was up around 25%. This large increase



Source DME

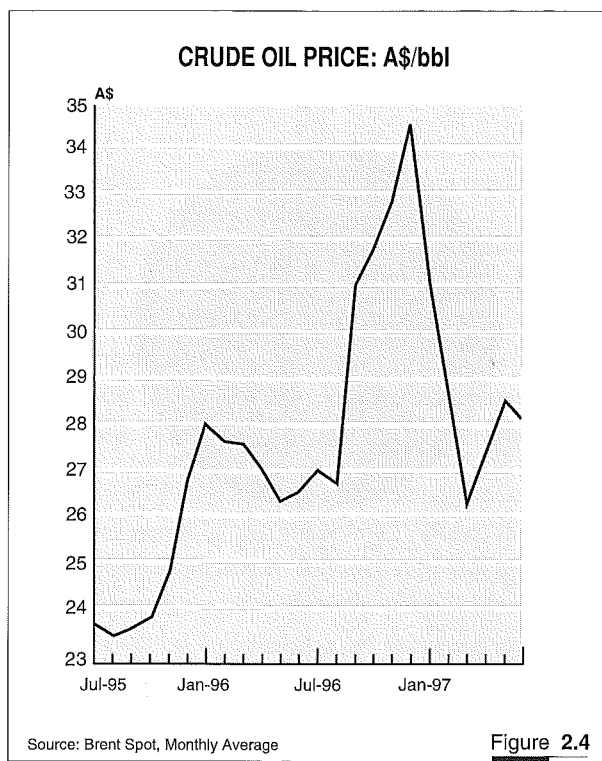
Figure 2.1

was partly attributable to the first full year's production from the North West Shelf Project's Wanaea and Cossack oilfields. Importantly though, Western Australian producers also received significantly higher average oil prices in 1996-97 as world oil markets reached their highest prices in six years (Figure 2.4). This played an important role in also raising the value of LNG production to more than A\$1.5 billion.



Source: DME, BMR & ABARE

Figure 2.3



- Higher oil prices, in conjunction with greater output from the North West Shelf Project, also boosted the value of condensate production by a significant 38% to reach A\$943 million.
- The value of natural gas production increased 18% in 1996-97 to A\$535 million.
- Also in 1996-97 was the first full year's production from Woodside Petroleum's liquefied petroleum gas (LPG) plant. In 1996-97 the plant produced 395,000 tonnes of LPG worth A\$115 million.
- The A\$610 million Wandoo oil field development was completed. The Wandoo A platform is currently producing 13,600 bbl/d while oil from the newly commissioned platform Wandoo B first flowed in March 1997. A concrete gravity structure, constructed at Bunbury, capable of holding 400,000 bbls of oil is located on the seabed and supports the topsides. The field has estimated recoverable reserves of 40 million bbls.
- The A\$450 million Goldfields Gas Pipeline Project was completed. Gas deliveries to Mt Keith, Leinster, and Kalgoorlie commenced in October 1996. Deliveries to Mt Newman commenced in July 1996. A number of gas fired power stations are under construction or have been commissioned along the pipeline's route. For example Western Mining Corporation commissioned four 40MW gas turbine power stations, one each at the Mt Keith nickel

mine, Leinster, Kalgoorlie nickel smelter and Kambalda. The 1380 km pipeline has a capacity of 100TJ/d compressible to 160TJ/d.

- The East Spar field using Australia's first fully automated subsea gathering system was commissioned in November 1996. The A\$250 million project is expected to be capable of producing at rates in excess of 100TJ/d, mainly for supply into the Goldfields Gas Pipeline, and around 7,000 bbl/d of condensate.
- The exploration programs of petroleum companies for the Timor Gap area in the far north west of the State are finally coming to fruition. The Bayu/Undan oil and gas field has been earmarked for development at a cost of between A\$800 million to A\$900 million. In addition development of the North West Shelf Joint Venture (NWS) Laminaria oil and gas field is proceeding. The field will cost A\$900 million to develop. Local content in the Laminaria project could reach 50%.
- In December 1996 a significant oil discovery was made in the Cornea field, located in the Browse Basin 400 Km north of Derby. Oil estimates for the field range from 500 Mmmbbl to 2,665 Mmmbbl. Future production tests will determine the likely recovery rates of the field and are awaited with extreme interest.

*World Petroleum Outlook*

After peaking in January 1997 world oil prices have trended downwards over the latter half of 1996/97 (Figure 2.4). Reflecting this LNG export values fell by around 14% in the second half of 1996/97. According to ABARE world crude oil prices are forecast to firm slightly in 1998 as both production and consumption expand. Of particular interest is the expected return to economic growth in Russia, following six years of decline, and the positive impact this will have on world oil consumption.

While production in OPEC countries is expected to increase, 80% of the forecast 2,300 Mbd increase in oil production in 1998 will come from Non-OPEC countries.

ABARE has forecast a 5% increase in Australian crude oil and condensate production in 1997/98.

*State Outlook*

The outlook for the State's petroleum industry is extremely positive with many oil, gas delivery and gas processing projects expected to come on stream

either in 1997/98 or in subsequent years. These include:

- The A\$900 million Laminaria oil project to come onstream in 1999. The field contains an estimated 200 million bbls of oil. Project approval was received in February 1997.
- Continued deregulation of the energy market, in addition to the take-up of downstream processing opportunities and a favourable international economic environment, will see a continuance in the trend to prove up gas reserves. Demand for natural gas, which at 278 petajoules represented 43% of the State's primary energy use in 1995/96, has increased by 9 fold since 1973/74. Natural gas demand is forecast to more than double by 2009/10. Gas demand is expected to be driven by the resource processing and power generation sector.
- Whilst growth in LNG production in 1996/97 was subdued, the longer term outlook is exciting. New LNG markets are opening up in Asia, the Japanese LNG market is expanding and potential new projects are being examined. These include WAPET's plans for a possible stand-alone \$10 billion LNG development based on the Gorgon field and the NWS Partners' proposal to a \$6 billion expansion of the NWS facilities in anticipation of increased gas sales. The NWS Partners' proposal consists of constructing a second trunkline to the Burrup Peninsula and two extra processing trains. In addition, the NWS participants are in the process of proving up gas reserves from their Perseus field and in conjunction with WAPET are also considering an integrated LNG project using gas from the Gorgon and Rankin gas fields. A decision on the next State LNG project is expected in December 1997.
- Oil production from the Stag oil field is expected to commence in the second quarter of 1997/98. Reserves are estimated at 44 million bbls of oil and field life is anticipated at 10-15 years.
- Hopes for a A\$1.5 petrochemical plant project, producing A\$1 billion worth of product per year, in the Pilbara have increased. The North West Shelf Participants have indicated that there will be sufficient ethane for the project after the year 2000. The State Government has received 33 expressions of interest from companies wanting to participate in various parts of the project and associated operations. The value of natural gas increases seven-fold if transformed to petrochemical products as against three-fold for LNG.

### 2.3 Gold

Gold output continued to grow, increasing by a strong 12% to reach 230 tonnes in 1997/98. Despite tonnage increases, the value of production, at A\$3.4 billion, was barely up 1% (Figure 2.5). This was chiefly due to low world gold prices which averaged US\$364/oz over 1996-97, about 7% down on the previous year.

In 1996/97 gold prices were weighed down due to ongoing enormous supplies and speculative activity relating to central bank sales. For Australian producers, weak global prices were exacerbated by an average appreciation in the Australian currency which translated to an Australian dollar denominated gold price being on average 10% down on the previous year.

Western Australia continues to account for more than three quarters of Australia's total gold production (Figure 2.6).

In 1996/97 gold exports amounted to A\$3,187 million. South Korea (54%), Singapore (23%) and Hong Kong (8%) were the State's predominant gold export markets (Figure 2.7).

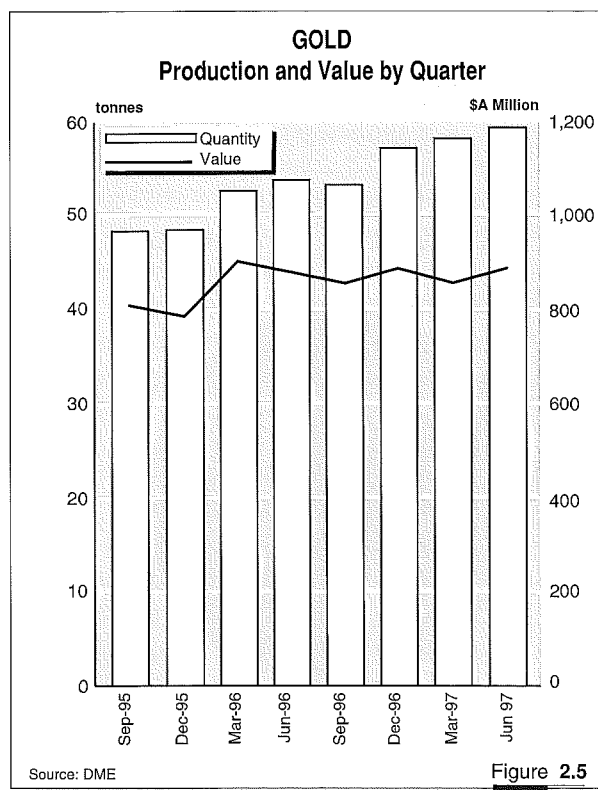
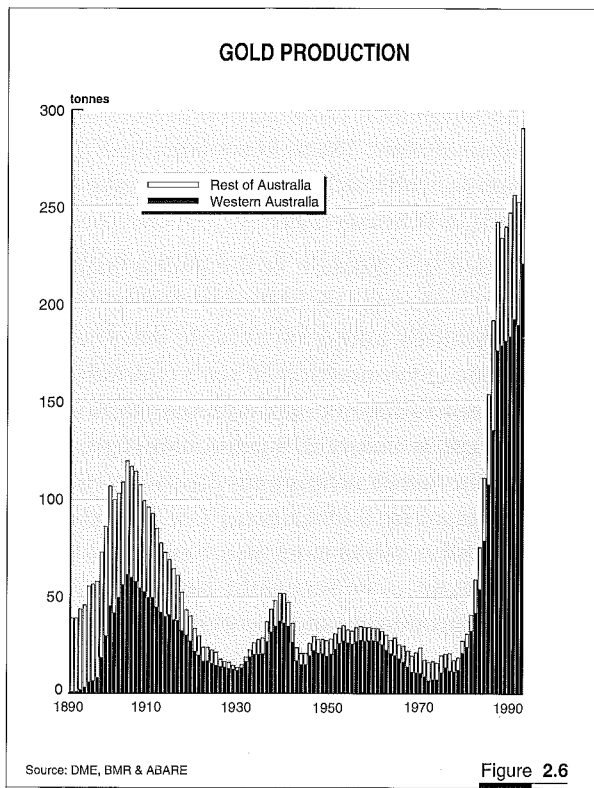


Figure 2.5

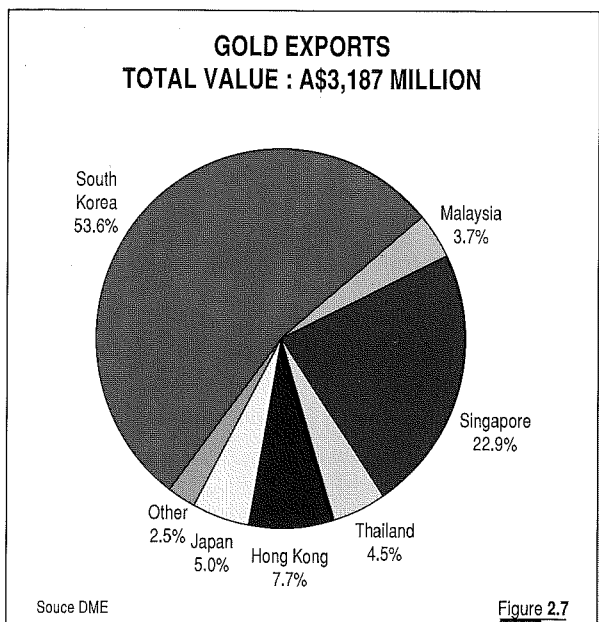
## 1996/97 Gold Industry Highlight

- The 12% increase in gold production was attributed to large increases from existing producers, such as Golden Mile, Plutonic and Granny Smith, and from the first full year's output from the Nimary and Jundee operations. The year also saw production start from the new Dalgaranga and Sunrise Dam projects.
- Full production from the Sunrise Dam project, previously estimated at 100,000 ounces per year, is almost certain to rise following a doubling in the project's resource to 2.5 million ounces in September 1997.
- The 13 biggest producing projects in Western Australia accounted for 51% of the State's gold production in 1996/97 (figure 2.9). The largest projects, with gold production worth over A\$100 million in 1996/97 were:
  - Golden Mile - Kalgoorlie - 26.6 tonnes;
  - Kambalda - St Ives - 13.5 tonnes;
  - Granny Smith - 10.7 tonnes;
  - Telfer - 10.3 tonnes;
  - Boddington - 10.3 tonnes;
  - Plutonic - 7.8 tonnes; and
  - Bronzewing - 7.1 tonnes
- The gold industry has recently been affected by falls in price (Figure 2.8). The gold price has fallen from US\$380 per ounce in December 1996 to US\$317 per ounce on July 9, 1997, its lowest level in four years.



The gold price recovered marginally thereafter to average US\$323.66 per ounce in the September 1997 quarter.

- The Reserve Bank's sale of 167 tonnes, which equated to around 4.4% of the world's 1996/97 gold supply, surprised international gold markets and contributed to the downward pressure on prices. However there have been a number of more important contributors which have adversely impacted on gold prices. The most notable of these have been gold sales by European Central Banks and the gold market's perception that these will continue. With European Monetary Union about to commence European Banks are aiming to divest themselves of these gold stocks and invest in other assets (i.e. bonds, futures etc) offering higher returns.
- In December 1996 above-ground world gold stock held by the banking sector totalled 32,800 tonnes. Of this 39% (or 12,792 tonnes) are held by banks in the European Union while another 23% (7,544 tonnes) are held by USA banks. Adding the gold stocks (i.e. coin and gold bullion) held by private investors (24,100 tonnes in 1996) the amount of gold that can be supplied from stock was around 57,000 tonnes in December 1996. At the 1996/97 fabrication consumption rate of 3,520 tonnes, gold stocks held equate to about 16 years supply.



- Recent price falls have underlined the importance to Australian producers of extensive hedging positions. Over half of Australia's 1997 and 1998 gold production is under hedging contracts with the prices received being between US\$360/oz and US\$400/oz.
- Although no major gold discoveries (on the scale of Bronzewing for example) have been made since the flurry of finds in the early 1990s, remaining reserves still stand at ten years of production with companies expanding resource bases for existing operations. Western Australia's strong gold reserve situation is being supported by the trend towards underground development of sulphide ores.
- In 1996/97 State gold exploration activity increased by 44% to \$531 million.

*Gold Outlook*

Western Australia's gold industry is highly capital intensive and cost competitive compared with the rest of the world. A study by Surbiton Associates Pty Ltd has found the gold industry to be fundamentally sound. Some 80% of Australian gold miners are producing at cash costs of less than A\$450 per ounce and up to 50% are producing at less than A\$350 per ounce.

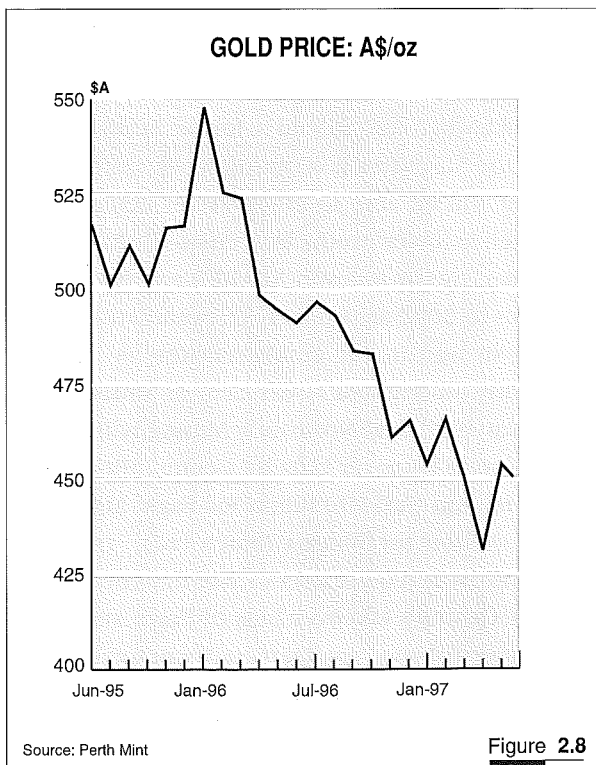


Figure 2.8

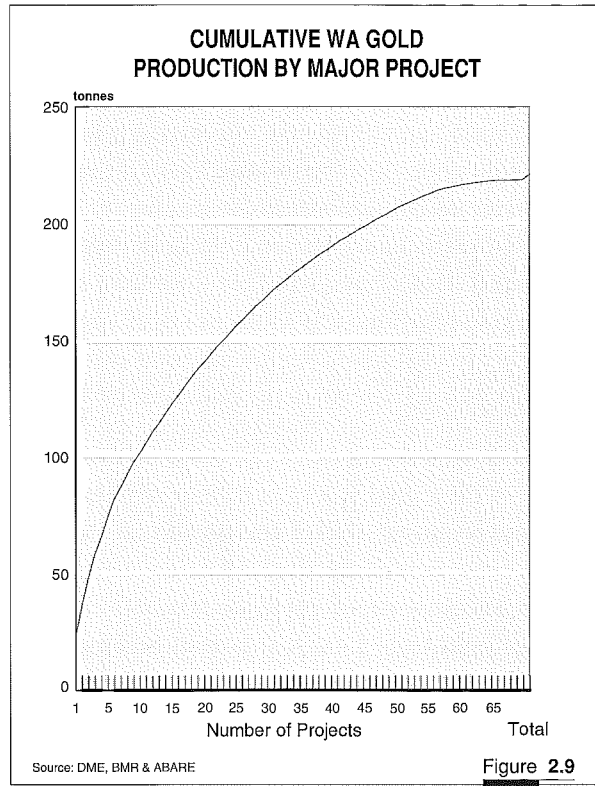


Figure 2.9

Analysts suggest that gold is beginning to lose its allure as a speculative investment commodity and is increasingly viewed as a normal commodity subject to regular supply and demand forces. With a low inflationary world outlook in addition to the potential for higher returns in equity markets Central Banks and speculative investors are likely to continue to sell their gold stocks on international markets. This over-hang in supply is unique to gold in the commodity market and is increasingly being questioned.

The manner in which European Banks manage the sale of their gold stocks will have significant repercussions on the gold price in the forthcoming years. There is some speculation that they have formed a 'pseudo' cartel and therefore will manage stock sales in a manner that does not significantly impact on the gold price.

Adding to the uncertainty is the view of some market analysts that the USA's Central Bank may also begin to lower its gold stocks. Countering this is the perception that Asian Central Banks may begin to stock gold. Nonetheless, if the current currency crisis in South East Asian economies continues, Asian gold demand will be adversely affected.

Reaction to the sale of gold by the Reserve Bank of Australia should ensure that any future sale of gold by

major Central Banks will be done in coordinated manner so as to reduce the current volatility in world gold prices. It is not in the interests of Central Banks to dump gold haphazardly on international markets as this could open them up to huge losses if the price of gold were to fall significantly from current levels. World gold market analysts are uniting in their view that Central Banks have fixed an unofficial ceiling price on gold of around US\$330 per ounce. Australian producers are cushioned somewhat from this lower gold price through the A\$ depreciation in 1997/98.

The likelihood of European Central Banks' managing the sale of their gold stocks is further strengthened by the international market reaction to an October 1997 report commissioned by Switzerland's Financial Ministry. The Report recommended the sale of 1,400 tonnes of gold over a 10 year period commencing 1999. While it is only a recommendation, which is yet to be formally considered by the Swiss Government and its Central Bank, the Report triggered a fall in the gold price to US\$307/oz in late October 1997, its lowest level in 12 years.

With international markets already concerned over the impact on Australia's growth of Asia's currency crisis, the Report contributed to the A\$ falling below US\$0.70. As a result the A\$ gold price remained relatively unchanged with gold trading at around A\$450/oz in late October 1997.

According to ABARE in 1998 world gold production is expected to rise by 3.8% to 2,502 tonnes. Demand is forecast to rise by 5.2% to 3,701 tonnes. The supply/demand imbalance will be made up from the sale of stocks. The price of gold is expected to increase by 2.7% to US\$345 per ounce in 1998. Nonetheless, ABARE's forecasts were done prior to the release of the Report by the Swiss Financial Ministry.

Despite a low gold price Australian gold production is forecast by ABARE to rise by 5.2% to 314.4 tonnes in 1997/98. A 3.8% depreciation in the US\$/A\$ will in part recoup some of the gold price losses recorded in the second half of 1996/97.

Growth over the next three years will be primarily derived from existing gold projects and committed new projects. This expected production growth is the result of several historical factors. Most important was the rapid increase in exploration expenditure, which to a large extent brought about the

development of a number of newly discovered deposits such as Bronzewing (WA), Jundee (WA), Nimary (WA) and Cadia Hill (NSW).

The high levels of exploration expenditure, largely driven by excellent cash margins, resulted in Australia's demonstrated resources of gold expanding from 2,129 tonnes in 1990 to more than 4,200 tonnes in 1996 - resources on which production growth in the next three years will be principally based.

Despite the positive short term production outlook, the Australian gold industry seems to have entered a period of rising costs. This is a reversal of the early 1990s experience where production costs were falling. Factors contributing to increasing costs include:

- a greater proportion of production being drawn from underground and deeper open cut operations;
- increasing depth of operations result in increased proportion of sulphide ore processed which raises processing costs; and
- likely increase in depth of new discoveries, raising exploration and mine development costs.

These factors, together with a lower real gold price, are expected to result in a margin squeeze. ABARE forecasts suggest real cash margins for the Australian gold industry will fall by A\$40 from A\$131 in 1996 to A\$91 in 2002.

The changing world market trading environment for gold is likely, in future, to lead to further amalgamations within the Australian gold industry. By doing so the industry will be able to enjoy better economies of scale, hence lower production costs. If this strategy is pursued by the industry ABARE's real cash margin forecasts to 2002 are unlikely to eventuate. To date, the most significant amalgamation is between Normandy Mining and Great Central Mines. Under an August 1997 deal Normandy Mining will bankroll two separate takeover bids by Central Mines worth A\$350 million (A\$240 million for Eagle Mining and A\$110 million for Wiluna Mines Ltd). In return, Normandy will acquire a 25% stake in Central Mines. If Great Central's takeover bids of Eagle and Wiluna are successful the "amalgamated" company would become one of the world's largest gold producers. As of 31 October 1997 the deal was as yet to be completed.

**2.4 Iron Ore**

Iron ore output of 141 million tonnes worth A\$3.2 billion in 1996-97 represented an increase in both quantity and value compared to the previous year. Output was up 6% despite a lacklustre Japanese economy and Japanese steel manufacturers being buffeted by a strong yen. Value of production was up by 8% thanks to higher prices (Figure 2.10 & 2.11).

Total world iron ore production increased by 2.6% in 1996/97 to around 1,035 million tonnes. Australia was the world's third biggest producer with around 152 million tonnes of which Western Australia accounted for 93% (Figure 2.12). Exports from Western Australia totalled A\$3,020 million in 1996/97. The major export destinations were Japan (46%), China (21%) and South Korea (13%) (Figure 2.13).

*1996/97 Iron Ore Industry Highlights*

In 1996/97 world steel production increased by 3.7% to 779 million tonnes. The vigour of steel industries in China, South Korea and Taiwan, now taking an increasingly important share of State export markets, has provided steady growth for the State's iron ore industry.

In 1996/97 Western Australian exports accounted for around 30% of the world's iron ore trade. 86% of our

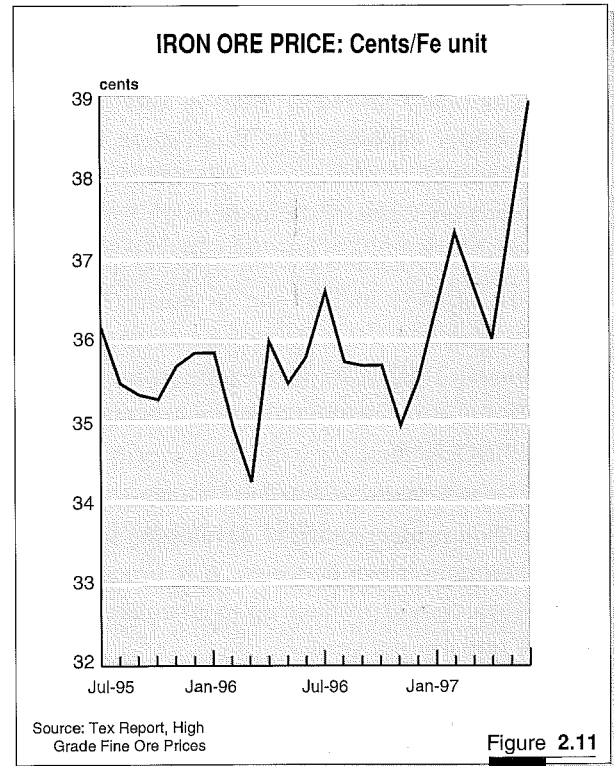


Figure 2.11

exports are destined for Asia while the remainder goes to Europe. With a burgeoning steel market forecast for the next five years, particularly for Asia, the outlook for the State's iron ore industry is extremely favourable.

Against this background in September 1997 Hamersley Iron announced that it would develop the Yandicoogina iron ore mine in the Pilbara. The A\$705 million project producing 15 million tonne per annum of iron ore is expected to come on stream in 1999. The main component of the project cost will be the mine itself plus a 147km extension of the existing railway network from the present Murrumbidgee mine to the port of Dampier, where expansion of ore stockpiling and loading capacity is also required.

A number of iron ore projects are currently committed or under consideration in Western Australia. These include:

- the development of the West Angelas deposit, at a cost of A\$1,000 million, by Robe River which could produce up to 15 million tonnes per annum. AA\$20 million pre-feasibility study commenced in early 1997.
- BHP is considering developing its Area C deposits, near its existing Newman operations. Area C has a major resource and BHP has previously indicated that development would

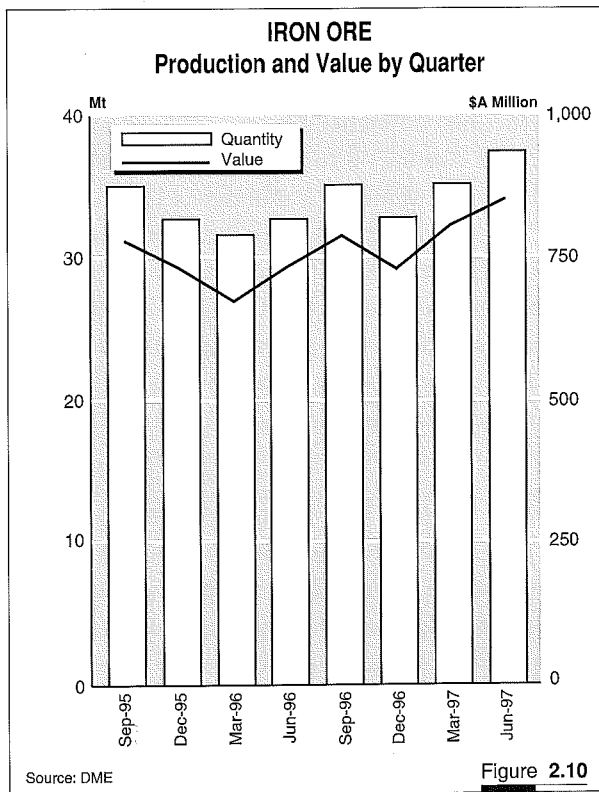


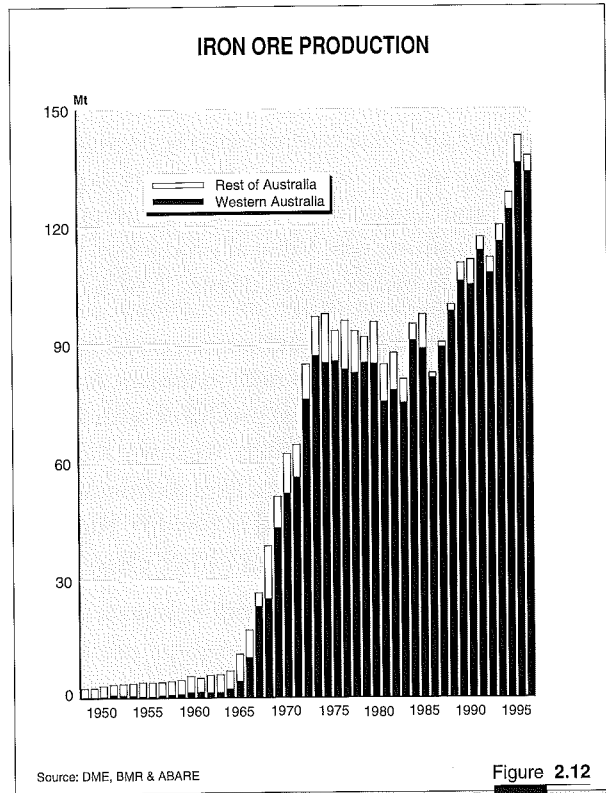
Figure 2.10



be in the realm of a 4-5 million tonne a year operation, increasing to about 20 million tonnes as demand allowed. BHP is also likely to consider expanding its Yandi mine from its present 15 million tonnes to 35 million tonnes if iron ore demand strengthens.

- BHP has committed itself to developing, at a cost of A\$50 million, the Newman (Orebody 18) deposit. Construction commenced in August 1997 with the 5 million tonnes per annum mine expected to be operational in January 1998.
- Hancock Resources is also studying a A\$450 million project aimed at developing the Hope Downs iron ore deposits. If it proceeds the project could produce up to 30 million tonnes of iron ore per year.

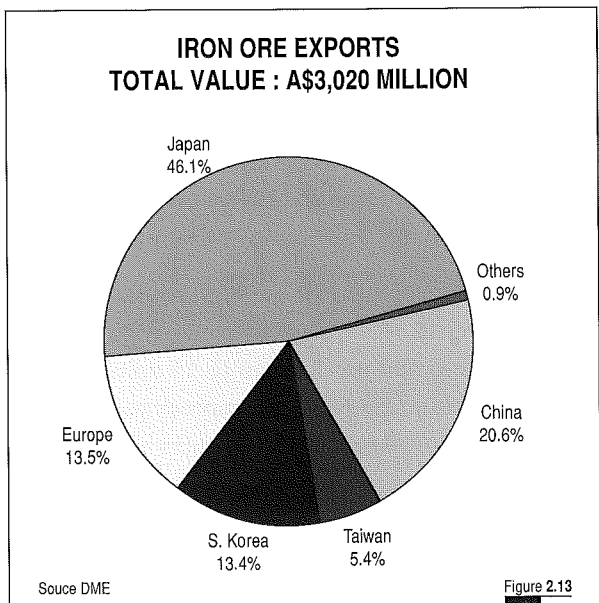
The range of new projects in the Pilbara either committed or under consideration raises the need to seriously consider options such as stand alone, sharing or paralleling of rail facilities in this region. At a cost of around A\$1 million per line-km, rail makes up a significant part of capital costs for these projects. Linkages by existing producers are already planned to spread east and south. Hamersley's Iron's spur line to Marandoo for example, is to be extended to the east using the infrastructure corridor across Karijini National Park, whilst further extensions of BHP's spur line from the existing Yandi mine to Mining Area C are being planned. The progressive development of these infrastructure networks could potentially



improve the viability of a number of orebodies in the region.

The growth in iron ore production is also underpinned by a number of iron ore processing projects. Of these only BHP's 2.5 million tonnes per annum DRI project, Australia's first downstream iron ore processing facility, has been committed. When completed the project would export around A\$400 million p.a. of product. Construction commenced in late 1995 with a view to the project coming on stream in mid 1997. Since that time it has encountered a number of difficulties. In particular the project cost has escalated upwards by A\$1 billion to around A\$2.5 billion. The project start up has also been delayed to August 1998. While prospects for the further processing of the State's iron ore resources are bright this outcome is likely to lead to investors trading cautiously when examining the feasibility of the host of iron ore processing projects currently under consideration. These include:

- The A\$1.8 billion Mineralogy Project which will produce up to 4 million tonnes per annum of DRI. It also includes a separate 6 million tonne per annum export pellet plant.
- The A\$1.8 billion Australian United Steel Industry (AUSI) project consisting of a beneficiation, pellet plant and DRI plant to be



established south of Cape Lambert capable of producing almost 4 million tonnes per annum of DRI.

- The A\$2,400 million An Feng Kingstream Resources project involving a 2.4 million tonnes per annum steel mill located at Oakajee near Geraldton.
- The A\$900 million Mt Gibson DRI project. It is planned that iron ore would be mined at Mt Gibson and fed into a 2 million tonne per annum DRI facility located at either Moonyoonooka or Oakajee near Geraldton.
- The A\$1.49 billion Steel/DRI Compact Steel Project located at East Rockingham. The first stage will produce 1.37 million tonnes per annum of hot rolled coil and 0.12 million tonnes of DRI for export.
- Robe River's proposed re-opening of its 5 million tonnes per annum pellet plant at Cape Lambert. The project cost is A\$250 million.

In September 1996 the Australian Government was stunned by BHP's announcement that it would close its loss-making stainless steel reprocessing plant near Port Kembla. It also announced job cuts at its Newcastle steel works, and foreshadowed its closure, in 1999. In September 1997 the Prime Minister announced a A\$30 million regional assistance package and a A\$1 million tourism development strategy for the Newcastle area. The Prime Minister also indicated that he had discussed a proposal for a Chinese Government steel project to replace the BHP steel works. It is understood the proposed Chinese steel project would use direct reduced iron processed in Western Australia for electric arc furnaces in Newcastle instead of exporting the DRI for use in arc furnaces in China.

The January 1997 round of iron ore price negotiations by Australian iron ore producers and Japanese steel manufacturers saw a favourable outcome for the year and are effective from April 1997 to March 1998. BHP and Hamersley Iron obtained a rise of 1.1% for fine ore, a rollover in the JFY 1996 price for lump ore and Robe River secured a 1.4% increase for its fine ore. With strong iron ore demand growth expected to continue in China, Taiwan and Korea in 1998 and 1999 the outlook for firmer State iron ore prices is favourable. As always the variations in the US\$/A\$

exchange rate plays an important part in the returns to Western Australian producers.

#### *Outlook*

Given that major growth in steel consumption is expected in Asia over the next decade, particularly in China, Taiwan and Korea, the outlook for the State's iron ore industry is excellent.

With world steel production forecast to rise by 2.3% in 1998, ABARE has forecast Australian iron ore exports to rise by 5.6% in 1998. On the back of a 1.1% rise in iron ore prices, combined with a lower A\$, the value of iron ore exports is expected to increase by 12.1% to A\$3,539 million in 1998.

The world demand for direct reduced iron (DRI) will be governed, in future, by technological shifts in steel making, particularly shifts to electric arc furnace steel making processes. Approximately 30% of Asian steel making processes by 2010 are forecast to be electric arc based, thus creating a strong demand for metallics, such as DRI and pig iron.

Western Australia is also well poised to supply the Asian market with its steel making inputs, including DRI. Deregulation of the State's gas market, technology improvements in the use of fine ore and a transport advantage over South American producers mean that the Pilbara is now well placed as a DRI producer for the Asian region.

### 2.5 Alumina

The State's alumina output increased by around 1.5% to reach 8.3 million tonnes. Average contract prices received by Australian producers in 1996-97 were up by 3% on the previous year. Total value of production was therefore higher by 2% to reach A\$2 billion (Figure 2.14). Again, this value could have been greater had it not been for the offsetting effect of an appreciated Australian currency in 1996-97.

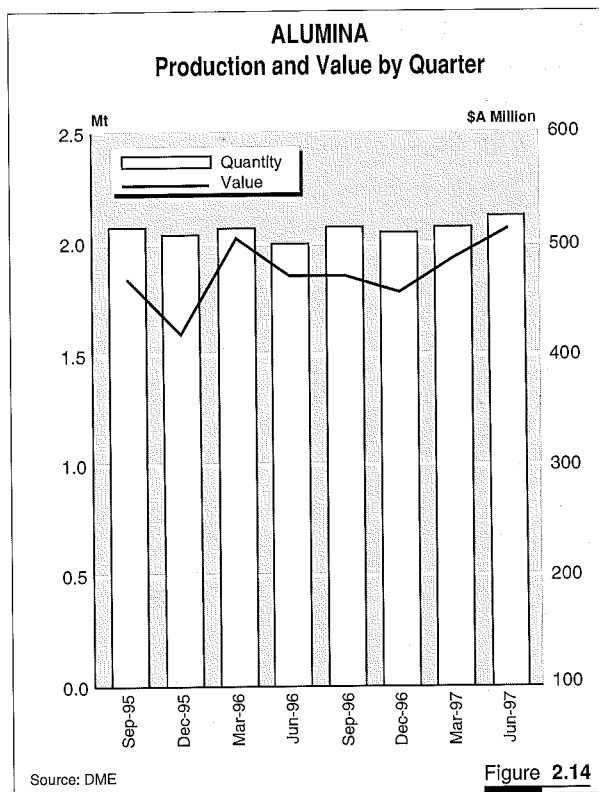
Western Australia produced 63% of Australia's alumina in 1996/97 (Figure 2.15).

Around 90% of the State's production was exported overseas. The USA (29%), South Africa (17%), Canada (16%) and Bahrain (9%) were the State's predominant alumina export markets (Figure 2.16).

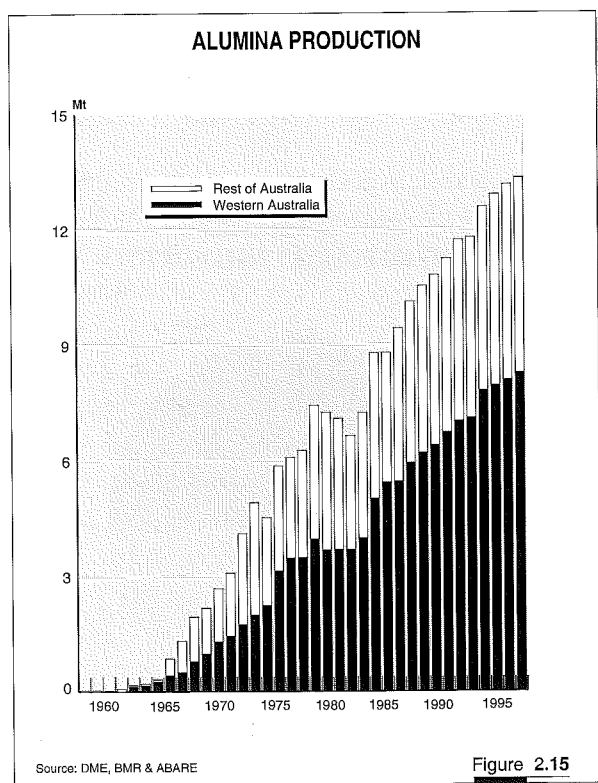
#### 1996/97 Alumina Industry Highlights

In 1996/97 world aluminium markets were buoyant. Production and consumption increased by 3.0% and 4.3% respectively but more importantly aluminium stocks have been falling. Stocks are expected to fall to around 6.5 weeks of consumption by the end of 1997, down from 7.9 weeks in 1996. Nonetheless, there is still some speculation in the market that not all aluminium stocks are accounted for.

With a number of capacity expansions the aluminium price fell by 9% to average US\$1,513 per tonne in



1996/97. However the underlying demand strength in the aluminium market, largely driven by OECD and USA consumption growth, has resulted in substantial price increases in the September 1997 quarter, with the aluminium price closing above US\$1,600 per tonne.



In the first half of 1996/97, the alumina market was also highlighted by downward pressure on the world spot price which emanated from increased capacity as producers began to restart projects which were mothballed by the memorandum of understanding reached between aluminium world producers over two and a half years ago. With rising demand and capacity constraints emerging in the second half of 1996/97, world alumina spot prices began to rise markedly (Figure 2.17). Over 1997 ABARE has forecast alumina prices to rise by 27% to US\$221 per tonne in 1997.

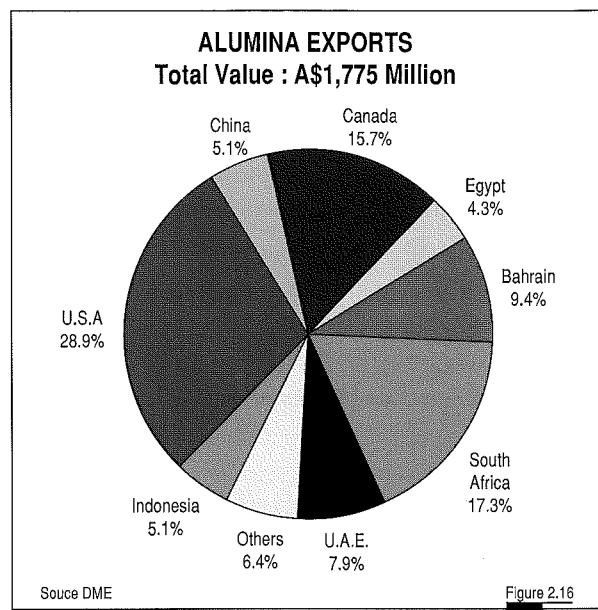
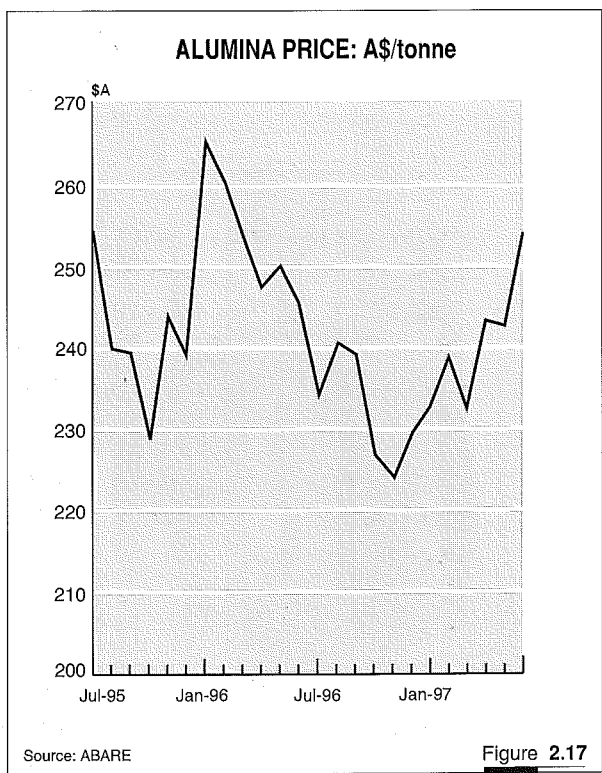
In a nutshell, the consensus of forecasters is that in 1997/98 both LME and producer aluminium inventories should decline further as world economic growth translates into increased orders for aluminium products by manufacturers.

Manufacturers are also expected to rebuild stocks to ensure they can meet rising demand. This translates into a positive 1997/98 market outlook for alumina.

On the local scene, in September 1997 Worsley announced a A\$800 million expansion of its refinery. The expansion will almost double the refinery's capacity to 3.1 million tonnes per year, up from 1.75 million tonnes per annum now. Construction is expected to start in October 1997 with completion targeted for the year 2000. The peak construction workforce is 1,000 persons with 150 employed once the project is operational. The Worsley expansion is the largest resource development project in the State's South West region for more than a decade.

The State's other alumina producer, Alcoa, is considering a proposed two-stage A\$970 million expansion of its Wagerup alumina refinery. The A\$620 million first stage expansion would add 850,000 tonnes of output to its 25% share of the world alumina production capacity. If the expansion were to include the second stage this would almost double its current alumina output to 3.3 million tonnes per annum.

In another development, Alichem is working towards establishing an aluminium fluoride plant in Kwinana. A pre-feasibility study for processing alumina hydrate to produce 20,000 tonnes per annum of aluminium fluoride has been completed. It is expected that 75% of the final product will be sold on the domestic market. All environmental and statutory approvals have been granted.



**Outlook**

With world aluminium consumption forecast to rise by 3.7% to 22,150kt in 1997/98 the price is expected to average US\$1,761 per tonne, up 16% on 1996/97. Correspondingly production is expected to rise by 3.2% to 22,100kt.

Further major capacity restarts are not expected to occur in 1997/98. As a result aluminium stocks are forecast to fall to 6.1 weeks of consumption by the end of 1998.

With the aluminium market continuing to rise in 1997/98, world spot alumina prices are forecast by ABARE to rise by 5.4% to US\$233 per tonne in 1998.

With stronger alumina prices forecast for 1997 and 1998 ABARE predicts a 2.4% rise to 13,570kt in Australian alumina production in 1997/98. As a result of increased alumina sales to Australian aluminium producers, by volume, alumina exports are forecast to fall by 4.4% in 1997/98. Nevertheless, given the depreciation in the A\$, and the potential for higher alumina contract prices, ABARE has forecast a 10.2% rise to A\$2,867 million in the value of alumina exports. With Western Australia producing 63% of Australia's alumina production the outlook for the State's alumina industry is positive.

Nonetheless, this 1997/98 assessment needs to be tempered by a number of threats to the aluminium market. The strength of demand is uncertain in some major markets, particularly Japan where economic

growth forecasts have been wound down. The situation surrounding Russia is also unclear, specifically, no one is sure of the country's indigenous demand situation and hence, Russian metal available for export. Foremost is the question regarding how quickly the amount of idle capacity will be returned to production. Currently around 800,000 tonnes of worldwide smelter capacity remains idle. The high cost nature of some of this may prevent it from being restarted, but considerable potential still exists for additional production to come on stream relatively quickly.

The longer term outlook is that high prices will certainly encourage at least some new production and rising stocks, especially after 1999. This will put renewed downward pressure on prices depending on the extent to which current smelter expansions go ahead.

## 2.6 Nickel

Despite nickel output climbing 10.5% to 114 thousand tonnes in matte, metal and concentrate products, the value of production fell by 4.2% to A\$1,051 million in 1996/97. This reflected a year of weaker prices compounded by the rise in the Australian dollar when compared with 1995/96 (Figure 2.18 and 2.19).

Western Australia accounted for around 99% of Australia's nickel production (Figure 2.20)

Almost all nickel in 1996/97 was exported overseas, with the significant destinations being Europe (53%) and Japan (20%) (Figure 2.21).

### 1996/97 Nickel Industry Highlights

Higher output from Western Mining Corporation's Leinster operations and expanded Mt Keith project, together with improvements at the Kwinana nickel refinery, were the most significant contributors to the increase in nickel production.

The development of Mt Keith has elevated WMC to the status of the western world's third largest producer after Canada's Falconbridge and Inco. It has also contributed to positioning Australia as the world's second largest producer behind Canada, excluding the CIS (i.e. the former Soviet Union).

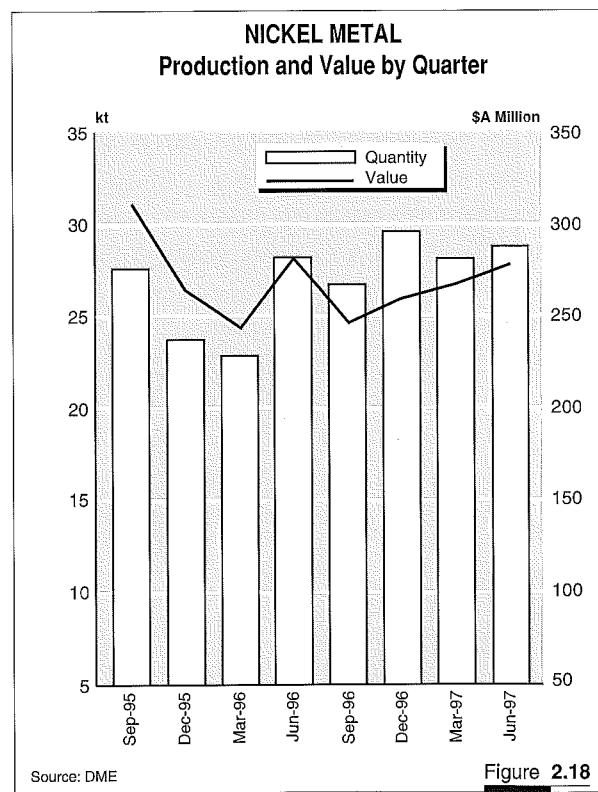
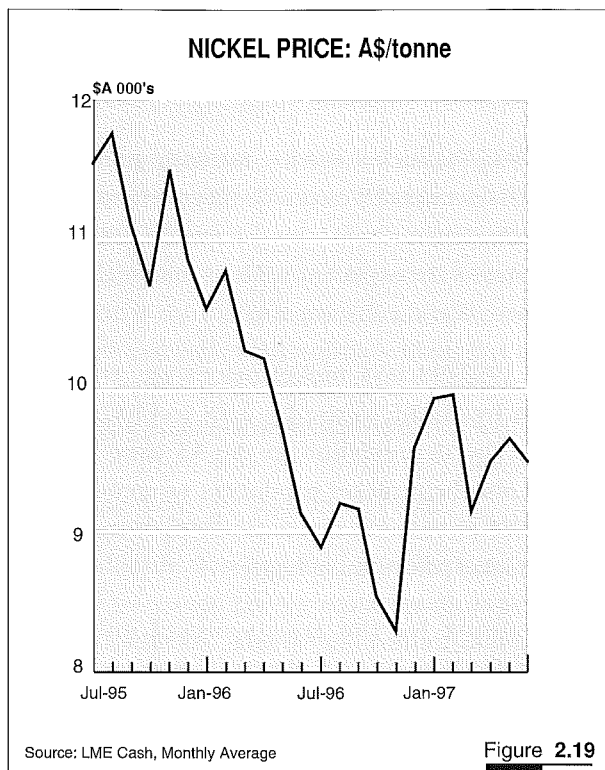


Figure 2.18



Unfortunately WMC's production in 1996/97 was set back because a section of its flash furnace roof collapsed at its Kalgoorlie smelter in April 1997. WMC has estimated a production loss of between 7,000 and 8,000 tonnes of nickel in matte form. The smelter was shut down for about a month, with the production loss expected to be made up towards the end of 1997.

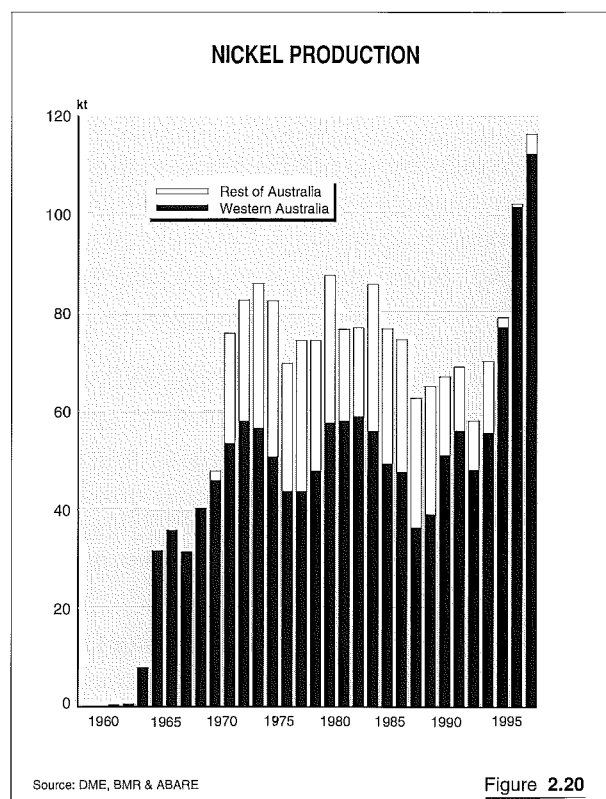
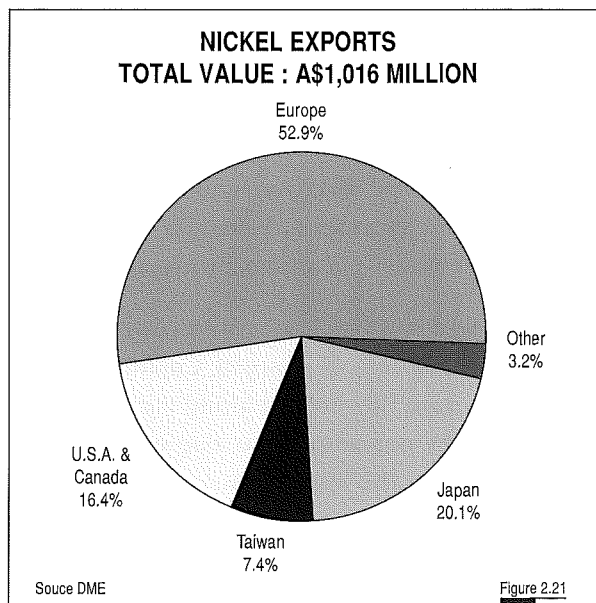
After US\$ nickel prices rose over the previous two years, it fell by around 12% to average US\$7,224 per tonne in 1996/97. This fall in price was the result of lacklustre nickel demand by stainless steel producers

generated by a drawdown in world stainless steel stocks and the increased availability of stainless steel scrap (a substitute for nickel). In addition there was also an increase in Russian nickel supply. As a result of these factors nickel prices remained subdued in the first quarter of 1997/98.

A number of nickel projects are currently committed in Western Australia.

In April 1997 Anaconda Nickel announced that it would proceed with development of its A\$900 million Murrin Murrin nickel project near Leonora after reaching a historic agreement with key Aboriginal groups in the region. Murrin Murrin is currently the biggest Western Australian nickel project on the drawing boards, with an estimated output of 45,000 tonnes per annum of contained nickel.

In September 1996 Resolute Ltd committed itself to the development of the Bulong nickel/cobalt deposit. Phase One of the project is expected to cost A\$200 million and produce 9,000 tonnes per annum of nickel metal and 700 tonnes per annum of cobalt. Construction of Phase One commenced in April 1997 with commissioning expected in May 1998. The project could be expanded to 22,000 tonnes per annum of nickel metal (Phase Two). Phase Two, if and when proceeded with, will cost around A\$320 million.



The A\$220 million Cawse nickel/cobalt project is expected to be commissioned in August 1998. The project will produce 8,700 tonnes per annum of nickel and 2,000 tonnes per annum of cobalt (as sulphide).

Significantly, Bulong, Murrin Murrin and Cawse, are based on laterite ores. These have been previously shunned by Australian producers in favour of more easily treated sulphide deposits. The processing method proposed for these new laterite nickel projects in Western Australia has the potential to alter significantly the State's nickel supply picture.

Some market analysts suggest that because of the improved processing method, the unit costs of these laterite deposits will be around US\$1/lb less than those of Western Mining's Kambalda operations, which have been estimated at US\$2.18/lb in 1997/98.

Long term price uncertainty threatens the world nickel market because a number of projects are coming on stream, the most important of which is Canada's Voisey Bay project (discussed below).

The low unit cost of the Bulong, Murrin Murrin and Cawse projects will shelter them from a substantial fall in the world nickel price which in June 1997 was around US\$3.25/lb.

It should be noted that unit costs at Western Mining's operations have been falling. In the September 1997 quarter the Company indicated that overall unit costs for all its nickel operations were around A\$2.00/lb.

Mining Project Investor's (MPI) new A\$46 Silver Swan mine development came on stream in late 1996/97. First deliveries to Outokumpu's smelter commenced in May 1997. Nickel output of around 10,000 tonnes per annum is expected from this project.

Other State nickel projects currently under consideration include:

- Carr Boyd (Defiance Mining);
- Honeymoon Well (CRA-Outokumpu);
- Lake Johnston/Maggie Hayes (Forrestania Gold-Gencor Ltd); and
- Yakabindie (Dominion Mining-North Ltd).

#### *Outlook*

In 1997/98 world supplies of stainless steel scrap are expected to tighten. In addition world economic

conditions are expected to improve resulting in increased stainless steel production and associated nickel demand.

Over 1997/98, nickel stocks, currently estimated at around 8.6 weeks of Western World consumption, will be slowly drawn down. By the end of 1998 world nickel stocks are expected to be around eight weeks of Western World consumption.

World 1997/98 US\$ nickel prices are, therefore, forecast by ABARE to rise by 2.4% to US\$7,395 per tonne. The depreciation in the A\$ over 1997/98 should also help nickel producers to recover some of the US\$ price losses derived in 1996/97 from lower world nickel prices and a higher A\$.

The outlook for the State's nickel industry is favourable. With Murrin Murrin, Cawse and Bulong expected to come on stream in 1998 the resulting increased State nickel output should maintain the industry's current position as the State's fifth largest minerals and energy sector.

In the longer term the consensus is that prices will decline to some lower base level. Western world production is already at a record and a number of new projects, not including those in Western Australia, are expected to come on stream before the year 2002. In 1998 production is expected to commence at Falconbridge's 20,000 tonne a year Raglan concentrate operation in Canada and Mineracao Corumbaense's 10,000 tonne a year Fortalesza de Minas refinery in Brazil.

In analysing the effects of increased production on prices, it needs at least to be balanced by the buoyant outlook for demand for nickel in stainless steel production. ABARE data suggests world nickel production has increased by around 4.7% per annum since 1992/93 which means demand is increasing by about 40,000 tonnes per annum on average.

The most significant of new projects is Inco's giant Voisey Bay deposit in eastern Canada. Initial production from this project alone is estimated at 60,000 tonnes per annum, to rise eventually to 122,500 tonnes. This suggests Voisey Bay could be producing around 10% of the world's nickel by the year 2000. Not only its size, but also its proximity to

the surface and the large amounts of copper and cobalt by-products suggest that its production costs will be amongst the lowest in the industry.

This development will reinforce Canada's position as the largest and most important influence in the nickel industry, exerting downward pressure on prices. This could be exacerbated if the CIS were to resume full production in the medium term. It has been suggested by analysts that Voisey Bay will have the ability to drive out producers with operating costs over US\$3.00/lb. If Voisey Bay proceeds on schedule, it may well impact upon the decisions of companies looking at developing nickel projects in this State.

The Goldfields Gas Pipeline, nonetheless, has the potential to reduce energy costs significantly in the Eastern Goldfields. This would further improve the highly competitive cost position of the State's nickel industry. With lower energy prices the State's nickel industry should be cushioned, somewhat, from falling nickel prices.

## 2.7 Heavy Mineral Sands

In 1996/97 the value of the State's mineral sands production increased by 3% to A\$605 million. With production volumes decreasing for ilmenite, zircon and rutile, the 1996/97 outcome was largely attributed to the favourable contract prices received by Australia's mineral sands producers.

The value of heavy mineral sands exported overseas was A\$523 million. The USA (31%), the Netherlands (14%) and Japan (12%) were the State's largest mineral sands export markets (Figure 2.22).

The 1996/97 outcome was achieved despite an average 23% fall in world titanium dioxide prices. The nature of the Australian mineral sands market, which is dominated by long term contracts, meant the lower 1996/97 titanium dioxide price did not flow through to mineral sands prices during that year (Figure 2.23).

### *1996/97 Mineral Sands Industry Highlights*

Western Australia is one of the world's most important producers of feedstocks for titanium dioxide pigments. The most significant of these are ilmenite, rutile and upgraded ilmenite (or synthetic rutile). In 1996/97 the State accounted for approximately 60% of Australia's titanium feedstock.

In 1996/97 ilmenite sales remained at the 1995/96 level of 1.1 million tonnes. Thanks to higher prices which have been growing strongly since 1994/95, the value of production was up by 5.5% to \$117 million (Figure 2.24 & 2.25). ABARE has suggested that a factor behind strengthening ilmenite prices is the progressive global run down in supply of quality ilmenite available for external sale - as opposed to ilmenite particularly dedicated to slag or upgraded ilmenite/synthetic rutile plants.

In 1997/98 and 1998/99 the State's ilmenite production is expected to increase dramatically. In March 1997 BHP's A\$200 Beenup minerals sands project came into production. With a projected output of 600,000 tonnes per annum of ilmenite, it is destined to be one of Western Australia's biggest producers of heavy mineral sands. About half of the ilmenite output will be exported in a joint venture with Tinfos Titan and Iron KS to Norway, where it will be smelted to chloride grade feedstock for titanium pigment manufacture. The balance of exports is destined mainly for European sulphate-route pigment plants.



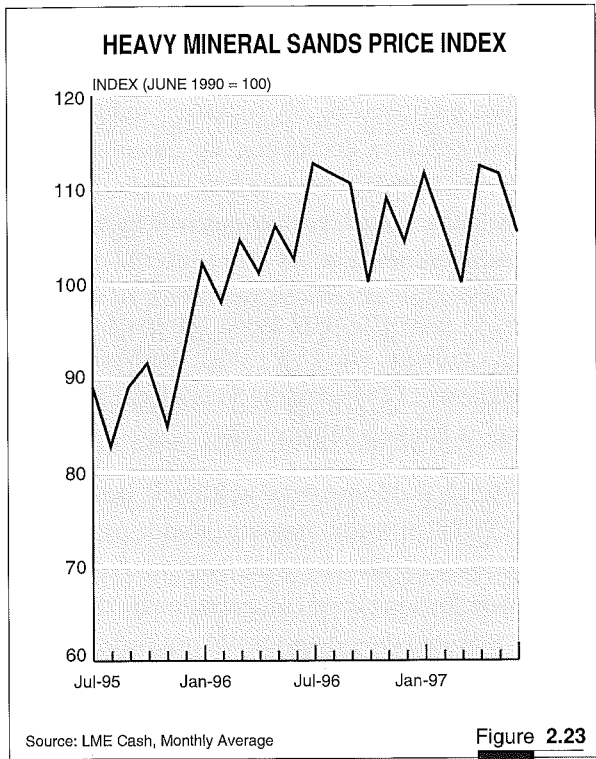


Figure 2.23

The State's ilmenite production will also be boosted with the commissioning in July 1997 of Cable Sands Yarloop project.

The value of sales of upgraded ilmenite increased by 2.8% to A\$205 million in 1996/97. Western Australia produced 413,457 tonnes of upgraded ilmenite during 1996/97, a 1.2% increase on the previous year. This represented more than 40% of the world's estimated upgraded ilmenite output in 1996/97.

The State's upgraded ilmenite industry will continue to play an important role in the world market as output is expected to increase in 1997/98. Westralian Sands commissioned its A\$134 million expansion of its ilmenite processing plant at Capel in the September 1997 quarter. This will increase upgraded ilmenite production capacity to 230,000 - 250,000 tonnes per annum. Tiwest also completed its program of minor capacity increases at its Chandala plant in 1996/97 by removing bottlenecks from existing processes. The capacity of the Chandala plant has increased from 130,000tpa to 185,000tpa.

World rutile prices on average strengthened considerably over 1996/97. Reflecting this, the value of the State's rutile production increased by 3.6% to A\$78 million, despite a 6.9% drop in sales quantity due to lower grades.

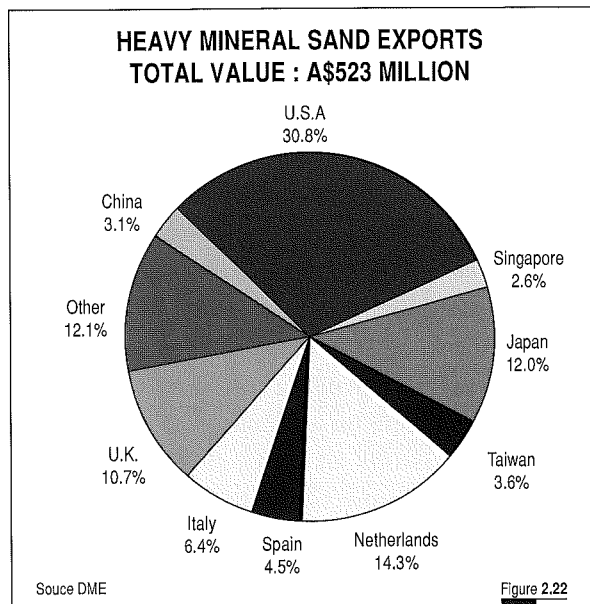


Figure 2.22

In the early part of 1997 there was considerable market uncertainty over the impact on world rutile prices of the recommencement of operations, scheduled for early 1998, of the world's largest rutile producer, Sierra Rutile. Due to political uncertainty in Sierra Leone the mine has been closed since 1995. This has been the most significant factor in the firming of world rutile prices since 1995. Following another military coup in May 1997 it seems that the mine's reopening has been indefinitely deferred.

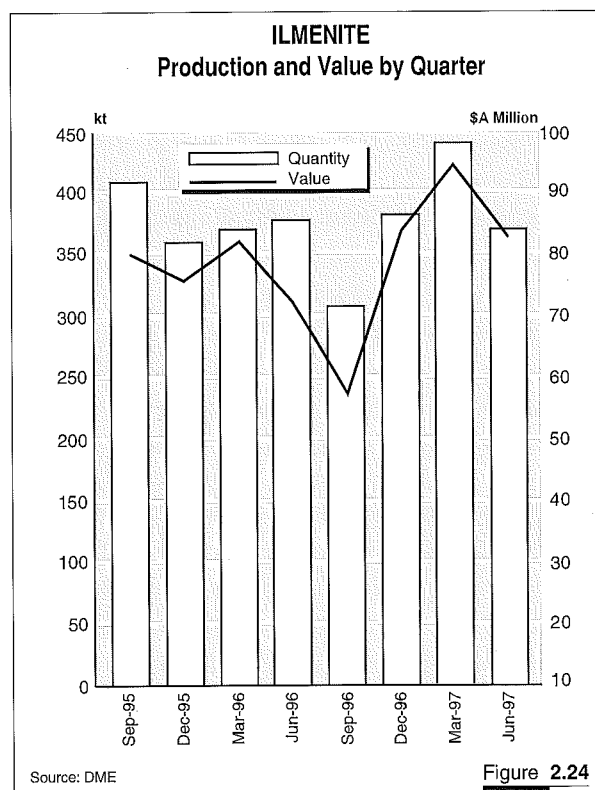


Figure 2.24

On the back of a favourable titaniferous feedstocks market the value of the State's leucoxene production increased by 44% to A\$15.2 million. The increase in value was largely attributed to a 41% increase in production.

1996/97 saw zircon prices continuing their strong upswing from 1994/95. In 1996/97, the average A\$ export price obtained by Australia's bulk zircon producers increased by 21% to A\$601. Nonetheless, given a 21% drop in sales quantities the value of the State's zircon production fell by 1.8% to A\$178 million in 1996/97. A major contributory cause of the reduction in sales quantity was a decline in grades from RGC's Eneabba North deposit. Zircon output will be boosted by BHP's new Beenup mineral sands project which is expected to produce 20,000 tonnes of zircon per annum.

### Outlook

Analysts suggest that favourable economic conditions in most major consumer markets should contribute to a recovery in pigment demand as excess stocks are cleared. As pigment prices firm, associated feedstock prices are also expected to rise, especially for ilmenite and upgraded ilmenite.

DuPont's acquisition of ICI's non American pigment production assets has increased its share of world capacity from around 25% to 40%. With DuPont becoming the titanium market's price leader it could be in a position to consolidate the price gains made since January 1997 and it could support further price increases in 1997/98.

When all these factors are combined the 1997/98 outlook for the titanium dioxide pigment market, and hence feedstocks, is positive. Overall ABARE has forecasted a 11% increase in pigment prices for 1997/98. With the price of rutile, synthetic rutile and ilmenite rising in 1996/97, despite the 23% fall in the pigment price over the corresponding period, moderate price rises, ranging from 3 to 5% are forecast for these commodities in 1997/98.

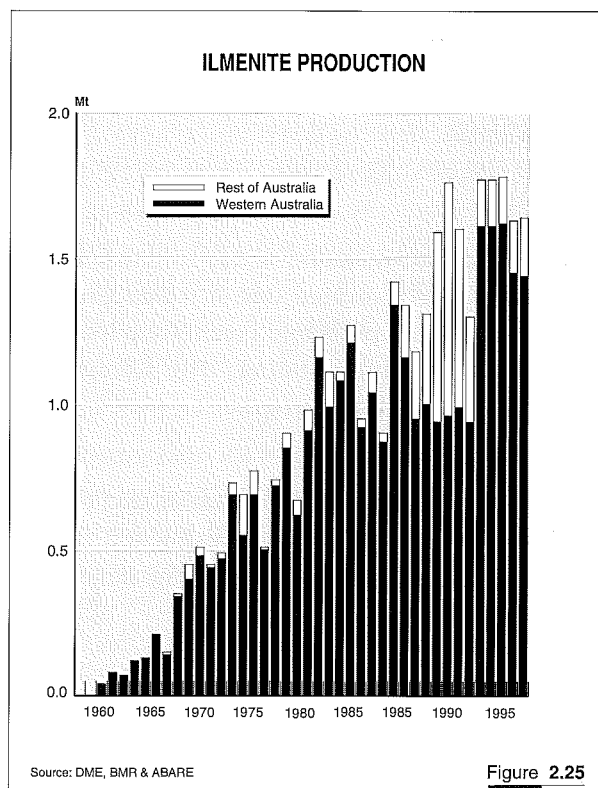
With the European ceramic market in a state of flux due to a run down of stocks zircon prices are forecast to rise by only 1.5% in 1997/98. However, market conditions for zircon are expected to strengthen in

the latter half of 1998 due to a recovery in European demand.

The 1997/98 outlook for the State's mineral sands industry is positive. The value of State mineral sands projects currently under consideration or committed to is around A\$700 million to A\$800 million.

Unfortunately the biggest of these, the SCM Chemicals', now called Millennium Inorganic Chemicals, A\$470 million expansion of its titanium dioxide plant at Kemerton, was put on hold in 1996 due to conditions in the titanium dioxide market. The expansion would have increased its production from 80,000 tonnes to 190,000 tonnes.

Construction of Rhone Poulenc Chimie Australia's proposed rare earth plant near Pinjarra is expected to commence in 1998 with commissioning planned for 1999. The project will process up to 12,000 tonnes per annum of monazite and 15,000 tonnes per annum of solid rare earth nitrates. The Environmental Protection Authority has assessed the proposal and recommended approval.



## 2.8 Diamonds

At 53 million carats, the volume of diamonds sold from Western Australian was up a significant 57% in 1996/97. But because of lower prices, the value of sales was down 25% to \$396 million. All production emanated solely from the Argyle operation.

The increase in sales volume was due to the purchase of Argyle's deferred stocks by the Central Selling Organisation (CSO), in addition to Argyle Diamond Mines' aggressive marketing strategy in its first year of selling diamonds directly to the market. The market has continued to support the Argyle product and Argyle hopes that sales will further expand.

Overall CSO purchases of Argyles diamonds totalled 28 million carats, valued at A\$253 million, in 1996/97.

### 1996/97 Diamond Industry Highlights

Production from the Argyle mine reached 37.1 million carats in 1996/97. While this was down 5 million carats on the 1995/96 figures the 1996/97 production outcome was on budget.

According to Argyle the fall in production was the result of a decision by the mine owners to produce larger stones, leaving a large volume of the smaller low grade stones, primarily industrial stones, in the waste stream. While Argyle is the world's biggest diamond producer by volume, only about 5% to 10% of its diamonds are gem quality.

In addition to a change in the production focus of Argyle to larger stones, production was also affected by heavy rain and some mining problems in the second half of 1996/97.

Argyle's open pit operation is due to finish around 2002. Argyle has indicated that it would prefer to deepen its existing pit before committing itself to a move to underground mining. The Company is undertaking a drilling program as part of a pit expansion feasibility study.

A study into the underground mining of AK-1 ore was completed in early 1997. It is estimated that an underground development would extend mine life by at least 5 to 7 years.

The move to direct marketing by the Argyle joint venture, from 1 July 1997, has tested the cohesiveness of one of the oldest cartels in existence. It has been suggested that the world diamond marketing cartel

controlled by De Beers was on the brink of dissolving until Russia signed a memorandum of understanding (MOU) with the CSO in February 1996.

The MOU was to be replaced with a comprehensive CSO/Russian agreement. The three-year agreement that will give Russia over one-quarter of global sales through the CSO is still clouded with uncertainty. While it was scheduled to be signed in December 1996 it now seems the Agreement will not be signed until late 1997. The major question still is whether Russia could control diamond sales outside the CSO. Notably, Russia contributed about 26% to CSO sales value compared with Argyle's 6% during its membership.

The CSO must also contend with the potential flood of additional gems from South Africa and Canada.

In August 1997, BHP indicated that it was likely to sell a proportion of its gem quality diamonds from its A\$750 million Lac de Dras diamond project, located in Canada, outside the CSO. BHP indicated that if it was to sell all its diamonds through the CSO, USA regulators would object because of concerns that the CSO was a cartel. The project, scheduled to commence production in 1998, has an initial 17 year mine life.

A further long term threat to CSO market control is development of CRA - RTZ's Diavik diamond project in Canada. Interestingly CRA-RTZ also have a 60% stake in Argyle.

If both BHP and CRA - RTZ opt out of the CSO, up to 20% of the world's gem diamond sales could be traded outside the CSO.

State diamond exploration activity has been relatively strong over the last few years. Some prospective deposits have had encouraging results. In particular, Striker Resources announced in September 1997 that it had discovered a 2.45 carat diamond at its Beta Creek project in the Northern Kimberley. Striker also indicated that results from its other drill cores around the area were positive and as a result it would initiate a program of comprehensive bulk sampling to determine diamond grades and the quality of these deposits. If the results are encouraging a pre-feasibility study would be undertaken.

### Outlook

The outlook for the State's diamond industry remains uncertain. Argyle diamond sales over the second half of 1996/97 have been sluggish. This has mainly

reflected slack demand in the Japanese market and lower demand in Hong Kong and other parts of the Asian region. Argyle has indicated that these conditions will persist for the remainder of 1997.

State diamond exploration activity is becoming increasingly dependent on a significant commercial discovery being made.

Internationally, diamond markets remain in a significant state of flux following the withdrawal of Argyle and increased threats of sales by new producers outside the CSO. Despite De Beers' difficulties it managed record gem sales of around US\$5 billion in 1996. With economic uncertainty hanging over South East Asia and lower than expected Japanese growth, diamond market analysts expect diamond sales to be sluggish in 1997/98. Growth in diamond sales, which over the preceding three years had been relatively strong, is therefore forecast to moderate over 1997/98.

## 2.9 Other Minerals

### Base Metals

The combined value of the State's copper, lead and zinc production fell by 5% in 1996/97 to A\$146 million.

Zinc prices strongly rebounded in the second half of 1996/97, rising by around 25%, to average US\$1,300 per tonne in the June 1997 quarter. Despite a 8% fall in production the value of the State's zinc production increased by 6% to A\$80 million.

The 1997/98 outlook for zinc is positive. World stocks of zinc metal continue to fall and with consumption expected to exceed mine production in both 1997 and 1998, zinc prices are forecast to rise by around 35% and 5% in 1997 and 1998 respectively.

The outlook for Western Australia's zinc output is also healthy. Western Metals A\$50 million development of its Kapok lead-zinc deposit was completed in 1997. This has added to the company's Cadjebut and Goongewa mines. In addition, Western Metals is also developing its A\$100 million Pillara (formerly Blendevale) project with commissioning anticipated in June 1998.

In 1996/97 copper prices fell by 17% to \$US2,265 per tonne. Despite the State's copper production rising by 17% to 27,825 tonnes, on the back of an appreciation in the A\$, the value of copper production fell by 8.3% to \$60 million.

According to ABARE, supply and demand conditions in copper markets will remain uncertain throughout 1997/98. As a result estimating copper prices is problematic. As a best guess copper prices are expected to fall in the first half of 1997/98 before rising in the second half of the year, thanks to increased demand in copper consuming countries. Overall, ABARE has forecast a 1.1% fall in world copper prices in 1997/98.

In the latter half of 1996/97 weaker than expected demand for lead has resulted in world lead prices falling by more than 10%. This wiped out all the price gains made in the first half of 1996/97. Overall in 1996/97 average lead prices, after recording significant rises over the previous three years, fell by 2% to average \$US707 per tonne. This is significantly higher than the average June quarter 1997 price of US\$625. On the back of a 38% fall in the State's lead production to 13,272 tonnes its

value fell by 53% to A\$5.9 million in 1996/97. With a number of lead mines coming on stream in 1997/98, such as Cannington in Queensland, it is expected that world lead production will outstrip consumption. As a result ABARE has forecast a 10% fall in the average 1997/98 lead price.

#### *Coal*

Coal output eased by 6% in 1996/97 to result in a 5% drop in the value of production to A\$257 million. In November 1996, production commenced from Griffin Coal Mining's A\$60 million Ewington II open cut project. This will assist in providing feedstock for the new 300 megawatt coal-fired power station being constructed at Collie and expected to be operational in 1999. Development of the Western Collieries Premier open cut mine for dedicated supply to the new power station also commenced with the Premier Pit 1 now producing coal.

#### *Manganese*

The value of the State's manganese production fell by 14% to A\$35 million in 1996/97. This was primarily the result of a 12% fall in production to 304,000 tonnes.

#### *Salt*

Salt production increased by 1.3% to 7.5 million tonnes in 1996/97, but lower prices and the A\$ appreciation saw the value of output dropping 0.4%. The State's biggest salt producer, Dampier Salt Ltd, is to diversify into gypsum production at its Lake MacLeod operation. Initial contracts have been signed for commitment to developing a gypsum output capacity of up to 2 million tonnes per annum.

In addition, Onslow Salt is expected to develop a new salt field at Onslow with capacity of up to 2.5 million tonnes per annum. The project cost is A\$80 million.

#### *Other*

Tantalite production fell 15% to 379 tonnes worth A\$31 million. This product is chiefly produced by Gwalia from its Greenbushes operation, as is spodumene. Despite a 6% fall in spodumene production its value increased by 20% to A\$16 million. More than 50% of the world's spodumene is mined at Greenbushes and changes in production levels closely reflect world demand.

The first shipment from Gwalia Consolidated's Kemerton Silica Sand Mine was made in July 1997. The mine is on target for annual output of 400,000 tonnes next year. Capacity is forecast to rise to 1 million tonnes per annum.

#### *Uranium*

Western Australia does not produce any uranium but this situation may change.

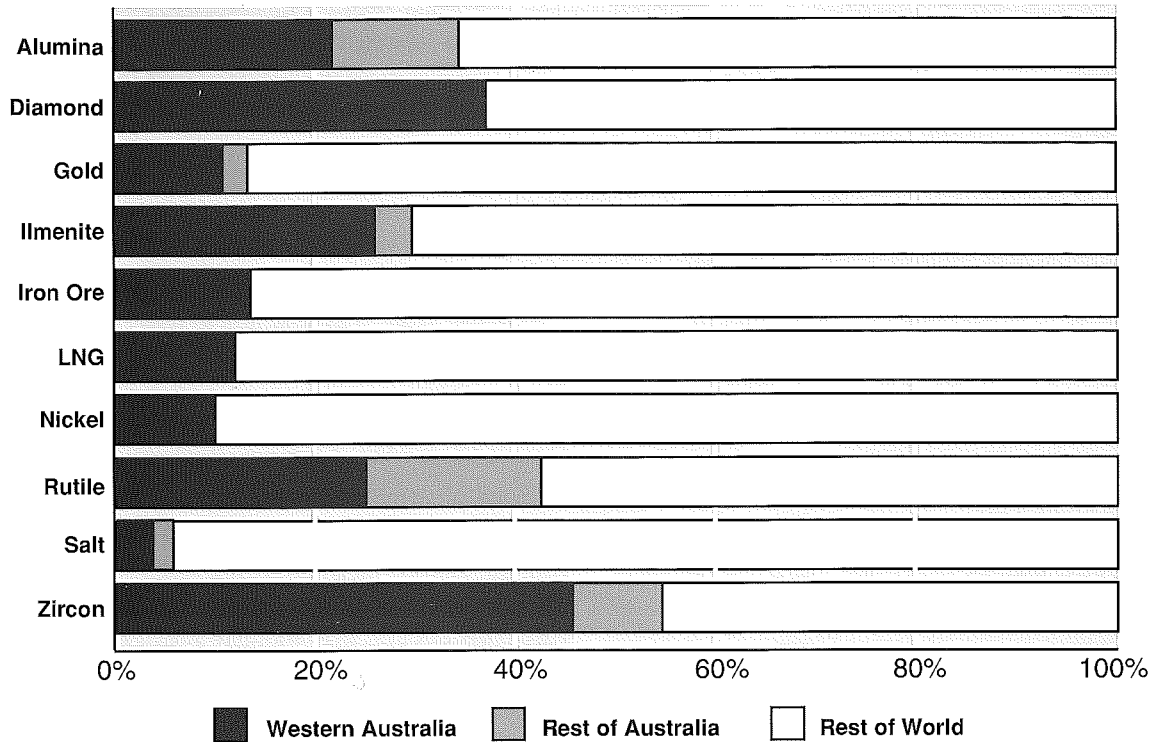
In 1996 the new Commonwealth Government abandoned the previous government's 'three mines policy', therefore enabling uranium projects to be considered for development. In addition and during May 1997, the Senate Select Committee on Uranium Mining and Milling supported the principal findings of the 1977 Fox Inquiry that there should be no unreasonable impediment to developing Australia's uranium mining industry.

Consistent with this was the Commonwealth's approval for mining at Jabiluka (Northern Territory), held by Energy Resources of Australia Ltd. The mine, expected to commence production in 1999, will be the first established since the abolition of the former government's three mines policy.

Although 1996/97 world demand for uranium far exceeded production, spot prices for uranium declined sharply from about US\$15.50 per pound in 1996 to a forecast of US\$11.50 per pound in 1997. As a result, there are few signs at present of renewed exploration for uranium in West Australia, and exploration expenditure for uranium remains at historically low levels of \$2-3 million per year.

Of the likely State mine developments, the large Kintyre deposit, in the Rudall River area, is the most advanced. However, although exploration continues, a decision by Rio Tinto on whether to develop has been put on hold until the uranium market improves. A go-ahead by WMC for the deposit at Yeelirrie, 110 km northwest of Leinster, is unlikely following WMC's commitment to the expansion of Olympic Dam in South Australia.

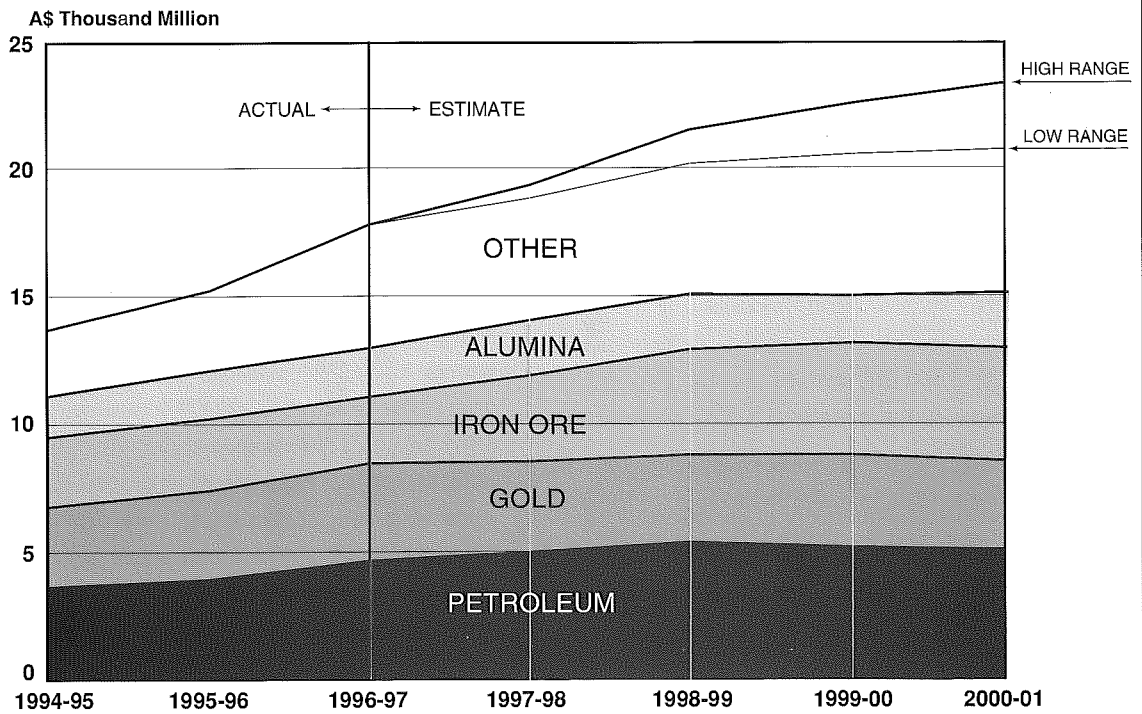
SELECTED WA COMMODITIES RELATIVE TO WORLD PRODUCTION



Source: ABARE, 1995 Australian Commodity Statistics

Figure 2.26

ESTIMATES OF MINERAL AND PETROLEUM VALUE OF PRODUCTION  
Value of Production to the Year 2000-01



Source: DME

Figure 2.27

### 3. EXPLORATION, CAPITAL EXPENDITURE AND EMPLOYMENT

#### Mineral Exploration

Mineral exploration in Western Australia expanded significantly despite uncertainties caused by the native title debate. In 1996/97, mineral exploration expenditure reached A\$690 million, 33% higher than the previous year, indicating a substantial increase in activity.

Western Australia attracted 59.6% of the total Australian mineral exploration budget, the highest level reached since 1986/87. This compared with 54.1% in 1995/96.

In 1996/97 State gold exploration activity increased by 44% to A\$531 million. The State now accounts for 73% of Australia's gold exploration expenditures, up about 6 percentage points on 1995/96. Gold accounted for 77% of the State's exploration effort, also up 6 percentage points on 1995/96.

This occurred despite a significant fall in the gold price in the June 1997 quarter, in part, triggered by the Reserve Bank of Australia's disclosure that it had sold 167 tonnes of its gold stocks. This action apparently had no impact on State gold exploration activity in the June 1997 quarter. Continued uncertainty on international gold markets, through the potential of additional gold sales by, in particular, European Central Banks, will most likely impact, if at all, on State gold exploration activity during 1997/98.

In 1996, gold discoveries and resource category upgrades contributed, in net terms, more than 300 tonnes of contained in-ground gold resources to the measured and indicated inventory. This translates to a discovery cost of around A\$26/oz, providing very good value for exploration investment. A large proportion of the resource increase is in 'brownfield' areas around existing mines. True greenfield discoveries most likely cost 2 to 3 times the above-mentioned figure.

Numerous gold discoveries were made during 1996-97 and from diverse geological settings, including the Pilbara, the Ashburton Basin and along the Northern Territory border (southeast of Halls Creek).

The Yilgarn Craton continues to be a major focus of activity. However, more explorers are focusing on the less traditional areas along its south-eastern and eastern margins.

Aggressive exploration in the Yandal area has been successful in upgrading measured and indicated resources. Exploration has concentrated around the Jundee, Nimary, Bronzewing, Mt McClure and Darlot gold mines.

Many of the long-established open pit operations of the Goldfields region have been delineating longer term resources below existing pit limits. This is being carried out to allow production to move progressively underground.

Base metals (including nickel) exploration fell by around 1% to A\$88.1 million. With gold exploration surging this has meant that its share of State exploration fell by four percentage points to 13%. This share is around the 1994/95 outcome. As several nickel - cobalt projects are apparently advancing well, this decline may indicate greater weakness in the exploration for zinc, copper and lead. International copper and lead markets were relatively weak in 1996/97 with their prices falling.

Base-metal activity was concentrated in the Pilbara and Kimberley regions.

Regular announcements of good drill intersections have come from project areas that have been explored over the past few years, including Panorama in the Pilbara, Koongie Park in the East Kimberley, and Pillara Range in the West Kimberley.

Nickel exploration has continued to surge even with a decreasing nickel price. The focus is on upgrading known deposits for 'fast-tracking' development prior to 1999 when Voisey Bay in Canada is expected to be commissioned. The most notable impact of the nickel search and evaluation in W.A. is the emergence of laterite nickel deposits as the front runners for the next phase of development (i.e. Bulong, Murrin Murrin and Cawse). This owes a lot to the application and adaptation of high-pressure acid-leach process technology (in conjunction with Solvent Extraction Electrowinners) and cheaper power from the Goldfields Gas Transmission Line. Laterite nickel projects are potentially very cost competitive with sulphide operations.

In addition to the major laterite nickel deposits, a significant amount of regional exploration is being conducted throughout the known nickel provinces

and at other known occurrences, including Siberia (Ora Banda greenstone belt), Pinnacles (Mulgabbie district), Eucalyptus and Yundamindra (Edjudina greenstone belt), Laverton Downs (Margaret greenstone belt), Waite Kaure and Mertondale (Murrin Murrin greenstone belt), Weld Range and Ravensthorpe.

In 1996/97, diamond exploration expenditure increased by 13% to A\$38.6 million. The increase mostly represents a greater appreciation of the diamond potential of the Yilgarn Craton, with keen activity by numerous companies, both large and small, and the emergence of the Leonora-Menzies region as a potentially new kimberlite province.

The Kimberley region, nonetheless, both onshore and offshore, continues to be the main focus of activity at a number of defined target areas, with broader regional reconnaissance work being undertaken in the Yilgarn, Bangemall, Gascoyne and Pilbara areas.

Some prospective diamond explorers have had encouraging results. In particular, Striker Resources announced in September 1997 that it had discovered a 2.45 carat diamond at its Beta Creek project in the Northern Kimberley. Striker also indicated that results from its other drill cores around the area were positive and as a result it would initiate a program of comprehensive bulk sampling to determine diamond grades and the quality of these deposits. If the results are encouraging a pre-feasibility study would be undertaken.

The iron-ore sector is continuing to experience a very high level of interest with numerous projects at the feasibility study stage and with considerable public promotion of developments connected with downstream processing (magnetite processing, direct-reduced ironmaking, hot briquetted iron and steelmaking). The reported level of iron-ore exploration in Western Australia for 1996-97 rose sharply to A\$25.5 million for the year - an increase of A\$12 million or 87% from the previous year. This sharp increase also reinforces the view previously held by the State's Department of Minerals and Energy that the ABS figures for iron-ore exploration had been significantly underestimated for the previous two years.

Exploration effort has concentrated in the State's Hamersley Basin resources, the area where most of

the current iron production is from. Exploration results from the Basin suggest that the State has sufficient iron ore resources for the foreseeable future. However without a major technological breakthrough which allows steel makers to be able to produce steel from high phosphorous or high alumina iron ore resources, the Basin's higher grade iron ore resources - referred to as the Brockman Iron Formation - are in relatively short supply. Nonetheless, if the high grade resources of the Robe Pisolite Iron Formation and those of various sites within the Marra Mamba Iron Formation are included, at this stage it seems the State has sufficient high grade iron ore resources for at least 60 years at current production rates.

At a cost of A\$7.9 million in 1996/97, Western Australia retains the top share of the nation's heavy mineral sands exploration expenditure. Exploration for heavy-mineral sands has a low public acceptance and is constantly competing with other land uses. Since 1992, the industry has gained access to enough land to retain the State's resource base of more than 100 million tonnes of contained heavy minerals. The most recent significant new discovery was made in 1996 at Metricup, south-west of Busselton. In 1996/97 appraisal continued at Jangardup South, Yoganup, Yarloop and north of Brunswick Junction as replacements of nearby mines.

### Petroleum Exploration

ABS data suggests that in 1996/97 the State's petroleum exploration effort increased by 39% to A\$444 million. The 1996/97 outcome lifts the State's petroleum exploration expenditure above average 1990s levels, and raised the State's share of Australia's petroleum exploration expenditure from 44% in 1995/96 to 51% in 1996/97.

Again in 1996/97, petroleum exploration activity was concentrated on the North West Shelf area, with some interest in the Bonaparte Basin.

Total Australian petroleum exploration expenditure in 1996/97 increased by 20% to A\$871.7 million. Of this total about 16% was spent on production lease areas while the remaining 84% was spent, amongst others, on exploration permit areas. Compared to 1995/96, these figures represent a swing towards exploration expenditure on production leases. In 1995/96 exploration expenditure on production leases was 11%.

ABS data shows that offshore exploration, Australia wide, is taking place at record levels. In 1996/97



offshore exploration worth A\$617.1 million accounted for 71% of all petroleum exploration and was up by 12% on 1995/96. Onshore petroleum exploration in Australia increased by 46% in 1996/97 to A\$254.5 million.

In December 1996 a significant oil discovery was made in the Cornea field, located in the Browse Basin 400km north of Derby. Oil estimates for the field range from 500 Mm bbl to 2,665 Mm bbl. Results of future production tests are awaited with much anticipation.

### Mining Investment

The ABS mining capital investment statistics are published for each financial year and show that in 1996/97 the State's investment fell by 4% to A\$4,115 million. The main reason for the fall was the timing of mining investment. Strong growth in imports of investment goods in the June quarter 1997 are consistent with a pickup in mining investment spending in the first half of 1997/98. The 1996/97 outcome follows strong mining investment growth in the early 1990s and is more than double the level in 1991/92. With Australian mining investment activity rising by 16% to A\$8,716 million Western Australia's share of the national total fell 10 percentage points to 47% in 1996/97. As a result of the forecast pickup in the State's mining investment activity in 1997/98 it is expected that the State's share of Australian mining investment will rise in 1997/98.

ABS mining investment figures need to be treated cautiously as they do not capture all mining investments. Investment in downstream processing is regarded by the ABS as manufacturing investment. A breakdown of the manufacturing figures into resource processing and other categories is not available.

The Delta Electricity and Access Economics Investment Monitor indicates that there is currently over A\$30,000 million worth of mining projects in Western Australia either under construction, committed or under consideration. Western Australia accounts for more than half of Australia's investment in proposed mining and downstream processing projects.

The Australia wide trend in mining investment is not based on a speculative rush of exploration expenditure or high commodity prices, but on solid capital

expenditure that will generate a growing mineral production profile leading into the next century. The seeds of this expansion were set in the late 1980s and early 1990s when large discoveries were made. New technology, improved infrastructure and microeconomic reforms have all contributed to encouraging companies to develop these large finds. In terms of the latter a recent Industry Commission Report (September 1997) has indicated that Australian 1990s productivity growth is 50% higher than the OECD average and is comparable to the high growth rates of the 1960s and early 1970s. Over the period 1970 to 1989 Australia's productivity growth had significantly lagged behind the OECD average.

These anticipated resource developments do not only provide a foundation for the long term viability of the State's resource sector but also through its associated multiplier effects provides a significant impetus to State economic and employment growth. These benefits are enhanced when projects have a significant degree of local content. Excellent levels of local content have been obtained in several of the State's big recent mining developments. For example local content was 94% in the A\$200 million Beenup mineral sands project; 75% in the A\$200 million East Spar petroleum project; and 65% in the A\$450 million Goldfields Gas Pipeline project. In addition it has been estimated that Australian content in the A\$11,200 million spent to financial year 1995/96 on the North West Shelf Gas Project was 74%.

### Mining Employment

The Department of Minerals and Energy's official employment statistics are compiled from industry returns and include contracted mining labour working on the mine sites.

Due to production problems these figures were not available when this publication went to print.

## 4. STATE VALUE OF MINERAL AND ENERGY EXPORTS

Since the 1993/94 issue of the Statistics Digest, information has been presented on export values and destinations for the State's major mineral and petroleum commodities. DME collects export information on approximately 25 resource commodities, the value of that totalled A\$13,428 million in 1996/97.

As downstream processing becomes an increasingly important feature of the State's resource sector, recognition of mineral and petroleum commodities that have undergone further processing and their appropriate classification will require greater consideration. Therefore, as a special exercise, DME's export statistics were recalculated using additional data from the ABS. This chiefly consisted of adding A\$525 million worth of mineral and petroleum commodities which had undergone further processing - namely titanium dioxide, silicon, heavy petroleum/bituminous oils and worked diamonds.

DME's export figures were also supplemented with ABS export data on over 35 minor mineral and petroleum commodities. These were worth approximately A\$105 million in 1996/97.

Including DME's export data with the above information showed that total mineral and petroleum exports were worth \$14,059 million in 1996/97. Figure 4.1 illustrates the relative value of the various commodity sectors.

Export data was also compiled for the agriculture, forestry, fishing and manufacturing. Combining these with the above results showed that minerals and energy represented a significant 73%, or almost three-quarters of the State's total value of goods exports in 1996/97 (Figure 4.2).

The data also showed that the major destinations for the State's <sup>merchandise</sup> mineral and petroleum exports are Japan and South Korea (Figure 4.3).

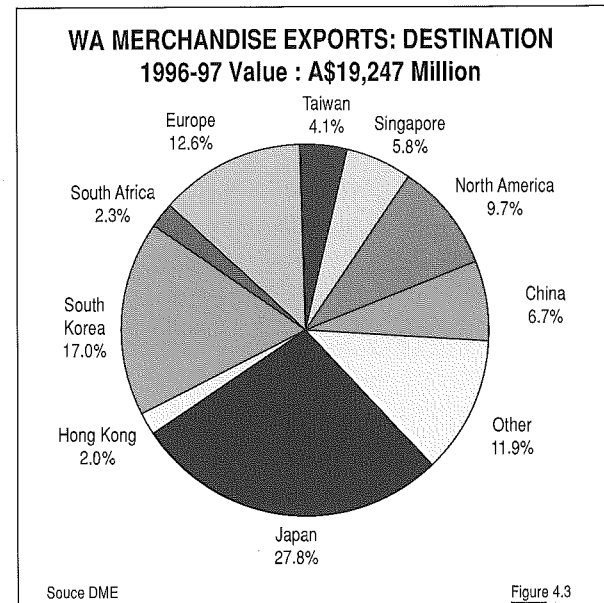
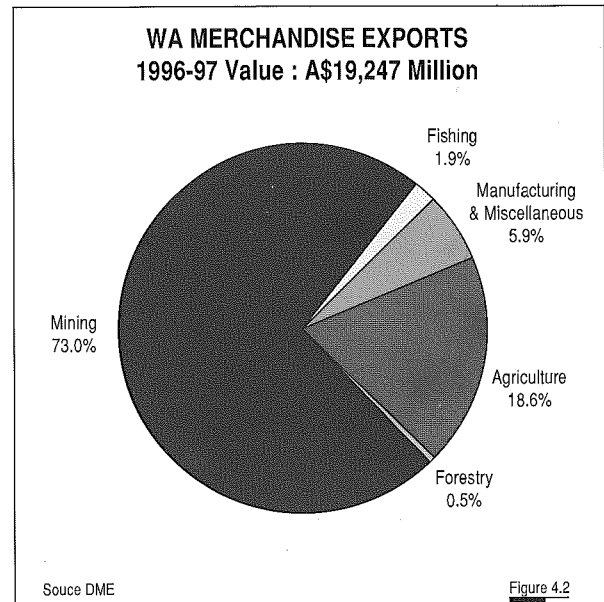
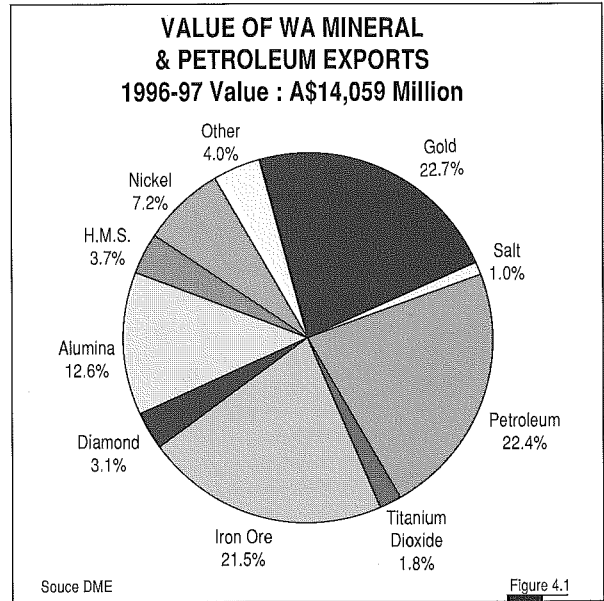


TABLE 1 QUANTITY & VALUE OF MINERALS & PETROLEUM

COMMODITY \ Mineral	UNIT	1995-96		1996-97	
		QUANTITY	VALUE (A\$)	QUANTITY	VALUE (A\$)
<b>BASE METALS</b>					
Copper Metal	t	23,685 (r)	65,420,387 (r)	27,825	59,985,982
Lead Metal	t	21,277 (r)	12,644,200 (r)	13,272	5,923,179
Zinc Metal	t	113,492 (r)	75,322,576 (r)	104,446	79,846,311
<b>TOTAL BASE METALS</b>			<b>153,387,163 (r)</b>		<b>145,755,472</b>
<b>BAUXITE-ALUMINA</b>					
Alumina	t	8,232,135	1,918,337,128 (r)	8,347,933	1,955,770,170
Gallium	kg	5,388 (r)	2,118,702 (r)	25,221	9,570,910
<b>TOTAL BAUXITE - ALUMINA</b>			<b>1,920,455,830 (r)</b>		<b>1,965,341,080</b>
<b>CLAYS</b>					
Attapulgite	t	19,753	4,096,240	20,473	4,073,620
Clay Shale	t	21,175	259,212	16,689	212,081
Fire Clay	t	127,813	258,976	54,861	65,833
Kaolin	t	3,363	173,565	3,307	211,973
White Clay	t	10,885	108,850	13,003	130,030
<b>TOTAL CLAYS</b>			<b>4,896,843</b>		<b>4,693,537</b>
<b>COAL</b>	t	<b>5,897,443</b>	<b>270,359,539</b>	<b>5,556,644</b>	<b>257,303,044</b>
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	t	556,743	3,487,810	405,993	2,635,481
Gravel	t	177,597	1,019,434	234,063	1,326,354
Rock	t	261,652	1,711,061	404,438	2,525,448
Sand	t	1,353,346	5,968,708	1,621,532	7,585,651
<b>TOTAL CONSTRUCTION MATERIALS</b>			<b>12,187,013</b>		<b>14,072,934</b>
<b>DIAMOND</b>	ct	<b>33,522,991 (r)</b>	<b>525,213,116 (r)</b>	<b>52,521,276</b>	<b>395,793,806</b>
<b>DIMENSION STONE</b>					
Black Granite	t	0	0	946	283,695
Granite	t	40	12,000	220	11,000
Jasper	t	25	9,016	0	0
<b>TOTAL DIMENSION STONE</b>			<b>21,016</b>		<b>294,695</b>
<b>GEM &amp; SEMI-PRECIOUS STONE</b>					
Agate	kg	0	0	5	3,089
Chalcedony	kg	2,053	20,020	41	20,680
Chrysoprase	kg	39,220	47,136	20	4,000
Jasper	kg	0	0	1,193	23,798
Variscite	kg	25,700	33,314	29	17,238
<b>TOTAL GEM &amp; SEMI-PRECIOUS STONE</b>			<b>100,470</b>		<b>68,805</b>
<b>GOLD</b>	kg	<b>205,889 (r)</b>	<b>3,404,646,735 (r)</b>	<b>229,982 (e)</b>	<b>3,438,121,985 (e)</b>
<b>GYPSUM</b>	t	<b>252,910</b>	<b>2,451,768</b>	<b>251,909</b>	<b>2,642,427</b>
<b>HEAVY MINERAL SANDS</b>					
Garnet	t	83,655	7,948,288	98,456	11,323,354
Ilmenite	t	1,101,515	111,179,482	1,100,919	117,284,071
Upgraded Ilmenite (a)	t	408,521	199,569,466	413,457	205,199,238
Leucoxene	t	21,776	10,556,319	30,723	15,187,711
Rutile	t	119,140	75,058,683	110,962	77,743,262
Zircon	t	410,025	181,210,326	324,087	177,986,602
<b>TOTAL HEAVY MINERAL SANDS</b>			<b>585,522,564</b>		<b>604,724,238</b>

TABLE 1 (Cont.)

QUANTITY & VALUE OF MINERALS & PETROLEUM

COMMODITY\Mineral	UNIT	1995-96		1996-97	
		QUANTITY	VALUE (A\$)	QUANTITY	VALUE (A\$)
<b>INDUSTRIAL PEGMATITE MINERALS</b>					
Felspar	t	61,445 (r)	2,265,550 (r)	63,066	2,725,219
<b>IRON ORE</b>					
Domestic	t	6,328,119	149,565,656	5,938,893	139,776,550
Exported	t	126,571,650	2,774,492,764	135,349,473	3,019,870,527
<b>TOTAL IRON ORE</b>		<b>132,899,769</b>	<b>2,924,058,420</b>	<b>141,288,366</b>	<b>3,159,647,077</b>
<b>LIMESAND-LIMESTONE-DOLOMITE</b>					
Dolomite	t	7,342	62,040	4,387	126,045
Limesand-Limestone	t	2,612,334	17,508,415	2,353,431	15,744,780
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>			<b>17,570,455</b>		<b>15,870,825</b>
<b>MANGANESE ORE</b>	t	<b>347,038 (r)</b>	<b>41,335,413 (r)</b>	<b>304,053</b>	<b>35,471,281</b>
<b>NICKEL INDUSTRY</b>					
Cobalt by-product	t	870	66,688,908	878	50,853,771
Nickel Concentrate	t	761,919	1,097,301,395 (r)	776,490	1,051,111,897
Palladium by-product	kg	558	2,703,172	433	2,238,476
Platinum by-product	kg	87	1,995,309	255	1,582,314
<b>TOTAL NICKEL INDUSTRY</b>			<b>1,168,688,784 (r)</b>		<b>1,105,786,458</b>
<b>PEAT</b>	t	<b>547</b>	<b>40,748</b>	<b>0</b>	<b>0</b>
<b>PETROLEUM</b>					
Condensate	kl	4,648,827	685,743,146	5,734,946	943,153,536
Crude Oil	kl	9,646,943	1,535,670,541 (r)	10,465,729	1,913,449,953
LNG	Btu 10 <sup>6</sup>	379,788,312	1,350,915,501	370,498,578	1,528,770,813
LPG - Butane	t	100,241	22,708,772	209,685	59,668,659
LPG - Propane	t	87,016	19,732,974	185,737	55,658,974
Natural Gas	000m <sup>3</sup>	6,309,564	454,763,779	6,892,912	534,648,055
<b>TOTAL PETROLEUM</b>			<b>4,069,534,713 (r)</b>		<b>5,035,349,990</b>
<b>PIGMENTS</b>					
Red Oxide	t	6,000	164,250	0	0
<b>SALT</b>	t	<b>7,451,699 (r)</b>	<b>154,217,940</b>	<b>7,546,294</b>	<b>153,616,036</b>
<b>SILICA-SILICA SAND</b>					
Silica	t	81,479	814,785	74,866	748,664
Silica Sand	t	660,373	6,439,983	625,338	6,306,388
<b>TOTAL SILICA-SILICA SAND</b>			<b>7,254,768</b>		<b>7,055,052</b>
<b>SILVER</b>	kg	<b>42,621 (r)</b>	<b>9,267,484 (r)</b>	<b>48,200</b>	<b>8,089,451</b>
<b>TALC</b>	t	<b>161,412</b>	<b>13,029,931</b>	<b>177,540</b>	<b>14,077,712</b>
<b>TIN-TANTALUM-LITHIUM</b>					
Spodumene	t	105,324	13,445,325	99,409	16,168,027
Tantalite	t	447	33,018,287	379	31,229,683
Tin Metal	t	403	3,227,809	523	3,360,540
<b>TOTAL TIN-TANTALUM-LITHIUM</b>			<b>49,691,421 (r)</b>		<b>50,758,250</b>
<b>TOTAL VALUE</b>			<b>15,336,361,934 (r)</b>		<b>16,417,259,374(e)</b>

Note: Quantities used in this table only apply to Minerals and Petroleum covered by the Mining Act 1978, the Petroleum Act 1967, the Petroleum (Submerged Lands) Act 1982 and relevant State Agreement Acts.

- (a) Also known as synthetic rutile
- (e) Estimate
- (r) Revised from previous edition

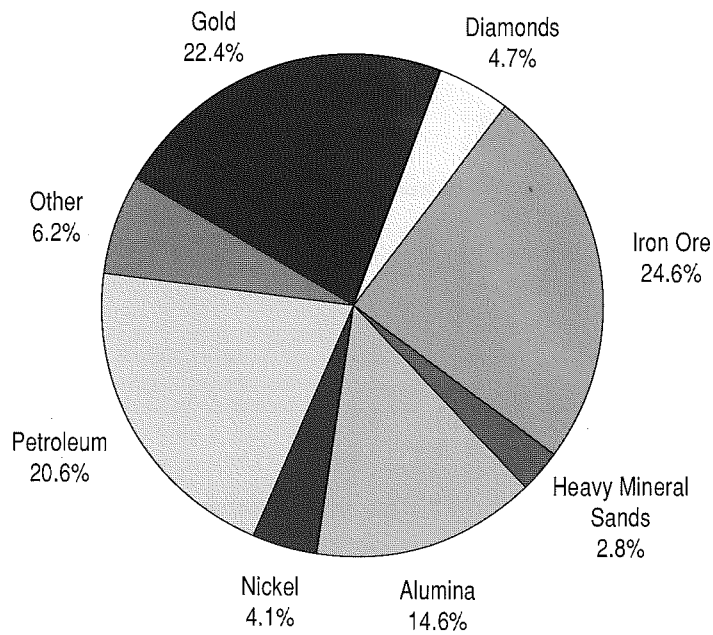
**TABLE 2 QUANTITY AND VALUE OF SELECTED MAJOR COMMODITIES**

	Unit	1987-88		1988-89		1989-90		1990-91	
		Quantity	Value\$M	Quantity	Value\$M	Quantity	Value\$M	Quantity	Value\$M
ALUMINA	Mt	6.06	1,183.00	6.17	1,619.23	6.65	2,335.70	6.80	2,099.13
BASE METALS									
copper	kt	2.70	5.94	13.08	31.37	14.98	23.92	12.00	20.35
lead	kt	0.00	0.00	2.43	0.92	13.17	7.61	12.48	5.99
zinc	kt	4.06	2.81	28.80	26.79	45.88	59.76	75.20	76.39
COAL	Mt	3.70	150.97	3.80	161.24	4.16	183.70	5.22	232.92
DIAMOND	M ct	30.22	248.20	36.47	354.75	33.85	413.58	29.96	435.73
GOLD	tonnes	90.55	1,843.77	130.57	2,072.69	161.79	2,596.45	181.17	2,762.82
HEAVY MINERAL SANDS									
ilmenite	Mt	0.95	63.93	0.87	67.18	1.07	89.61	0.97	85.48
synthetic rutile	kt	195.50	70.00	227.98	95.47	284.11	131.11	263.41	131.71
rutile	kt	85.08	51.17	100.48	62.49	82.23	58.54	65.45	49.60
zircon	kt	366.05	97.15	340.14	151.61	300.26	175.19	208.42	100.80
IRON ORE	Mt	95.18	1,867.17	100.42	1,790.45	106.27	2,246.03	107.67	2,648.69
NICKEL	kt	43.01	391.75	38.26	633.84	47.83	585.97	54.49	595.88
PETROLEUM PRODUCTS									
condensate	Gl	1.14	169.91	1.15	141.80	1.60	235.65	1.87	370.95
crude oil	Gl	1.93	304.36	2.20	269.86	3.96	601.47	5.14	1,054.06
lng	btu 10 <sup>12</sup>	0.00	0.00	0.00	0.00	104.17	336.09	184.93	836.40
lpg - butane	kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
lpg - propane	kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
natural gas	Gm <sup>3</sup>	3.63	320.50	3.64	284.64	3.85	356.85	3.61	379.23
SALT	Mt	5.53	107.17	6.02	106.71	5.93	124.11	6.41	136.97
OTHER			67.85		87.77		101.60		129.86
<b>TOTAL</b>			<b>6,945.64</b>		<b>7,958.81</b>		<b>10,662.93</b>		<b>12,152.93</b>

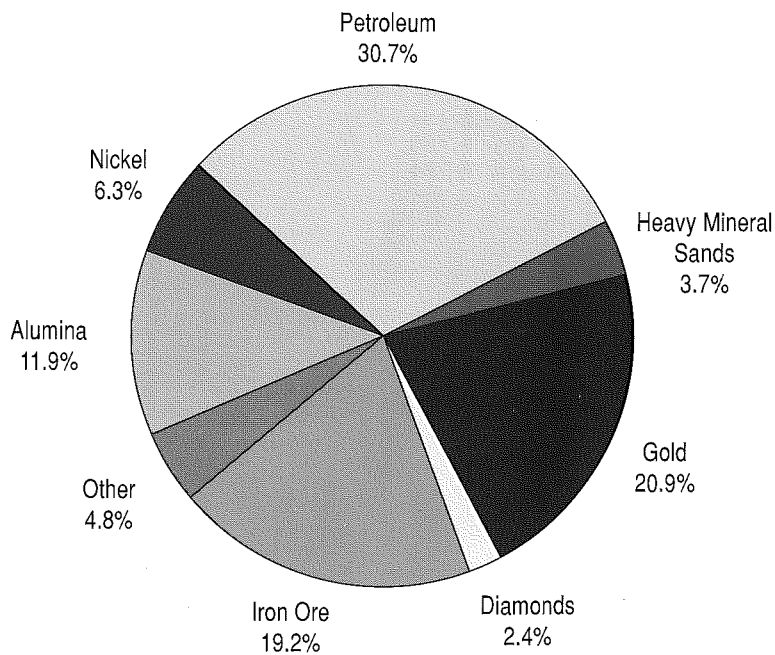
# 1996 - 97 STATISTICS DIGEST

1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
Quantity	ValueA\$M	Quantity	ValueA\$M	Quantity	ValueA\$M	Quantity	ValueA\$M	Quantity	ValueA\$M	Quantity	Value\$M
7.13	1,758.15	7.55	1,818.12	7.83	1,784.32	7.91	1,684.60	8.23	1,918.34	8.35	1,955.77
12.02	17.44	22.92	27.44	32.46	40.26	29.20	76.54	23.69	65.42	27.83	59.99
21.68	7.30	22.30	6.65	21.11	4.98	21.10	9.20	21.28	12.64	13.27	5.92
142.92	125.58	127.96	104.11	136.39	79.54	132.85	95.84	113.49	75.32	104.45	79.85
5.49	243.54	5.43	244.77	5.15	236.29	5.86	274.75	5.90	270.36	5.56	257.30
47.49	564.77	24.83	519.98	28.86	476.75	23.93	480.03	33.52	525.21	52.52	395.79
182.04	2,689.92	179.80	2,834.19	193.89	3,420.06	187.85	3,132.87	205.89	3,404.65	229.98	3,438.12
0.97	83.15	0.99	81.66	1.07	92.32	0.99	89.65	1.10	111.18	1.10	117.28
305.12	153.12	361.42	168.55	332.99	153.94	396.28	184.63	408.52	199.57	413.46	205.20
47.47	26.88	75.93	42.14	68.93	35.76	107.78	56.13	119.14	75.06	110.96	77.74
226.93	61.11	302.46	49.19	349.13	63.10	477.05	129.77	410.03	181.21	324.09	177.99
111.64	2,953.27	111.73	2,991.14	119.69	2,865.16	133.13	2,794.31	132.90	2,924.06	141.29	3,159.65
50.17	489.51	53.27	472.17	61.11	458.62	92.99	897.12	103.30	1,097.30	114.10	1,051.11
2.00	338.98	2.00	363.04	2.35	348.71	2.64	398.34	4.65	685.74	5.73	943.15
5.43	941.29	4.54	855.69	5.33	815.33	9.90	1,559.65	9.65	1,535.67	10.47	1,913.45
219.70	846.33	254.47	1,025.06	296.36	1,015.68	356.11	1,262.51	379.79	1,350.92	370.50	1,528.77
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.24	22.71	209.69	59.67
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	87.02	19.73	185.74	55.66
3.77	349.26	3.96	407.02	4.46	413.37	5.37	445.71	6.31	454.76	6.89	534.65
6.93	153.14	6.63	158.38	6.25	151.31	7.18	155.14	7.45	154.22	7.55	153.62
	206.44		162.34		175.61		187.93		252.29		246.58
<b>12,009.19</b>		<b>12,331.62</b>		<b>12,631.11</b>		<b>13,914.71</b>		<b>15,336.36</b>		<b>16,417.26</b>	

**COMPARATIVE VALUE OF PRODUCTION**  
**1991-92 Total : A\$12,009 Million**



**1996-97 Total : A\$16,417 Million**



Source: DME

**Figure 0.1**

**TABLE 3 QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA**

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>BASE METALS</b>					
			Cu Tonnes		
Copper By-Product	Coolgardie		4,216,452	6,039,730	(a),(b)
			Cu %		
Copper Concentrates	East Pilbara	4,878	15.90	1,517,153	
	Yalgoo	62,230	20.09	22,150,478	
		67,108		23,667,631	(a)
			Cu Tonnes		
Copper Cathode	East Pilbara		10,330,096	30,278,621	(a)
Total Copper				59,985,982	
			Pb %		
Lead	Derby-West Kimberley	17,634	75.26	5,923,179	(a)
			Zn %		
Zinc	Derby-West Kimberley	102,514	55.09	44,350,002	
	Yalgoo	114,084	42.05	35,496,309	
		216,598		79,846,311	(a)
<b>TOTAL BASE METALS</b>				<b>145,755,472</b>	
<b>BAUXITE - ALUMINA</b>					
Alumina	Boddington	1,739,219		428,494,272	
	Murray	3,106,450		717,787,445	
	Serpentine-Jarrahdale	1,761,439		407,156,831	
	Warooka	1,740,825		402,331,622	
		8,347,933		1,955,770,170	(c)
			Ga kg		
Gallium	Murray		25,221.3	9,570,910	
<b>TOTAL BAUXITE - ALUMINA</b>				<b>1,965,341,080</b>	(j)
<b>CLAYS</b>					
Attapulgitite	Mullewa	20,473		4,073,620	(a)
Clay Shale	Collie	16,689		212,081	(a)
Fire Clay	Chittering	54,861		65,833	(d)
Kaolin	Bridegetown-Greenbushes	3,307		211,973	(d)
White Clay	Swan	13,003		130,030	(d)
<b>TOTAL CLAYS</b>		108,333		4,693,537	
<b>COAL</b>	Collie	5,556,644		257,303,044	(e)
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	Broome	18,874		289,101	
	Collie	270		18,000	
	Exmouth	2,851		17,112	
	Nannup	520		10,400	
	Port Hedland Town	310,784		1,864,704	
	Roebourne	19,328		115,968	
	Wyndham-East Kimberley	53,366		320,196	
		405,993		2,635,481	



TABLE 3 (cont.) QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>CONSTRUCTION MATERIALS Cont.</b>					
Gravel	Broome	23,808		115,066	
	Coolgardie	47,078		280,691	
	Kalamunda	135,257		811,542	
	Port Hedland Town	22,000		110,000	
	Shark Bay	50		250	
	Wyndham-East Kimberley	5,870		8,805	
		234,063		1,326,354	
Rock	Broome	2,792		81,275	
	Derby-West Kimberley	177		1,058	
	East Pilbara	24,990		174,930	
	Kalgoorlie-Boulder	94,807		568,842	
	Port Hedland Town	281,672		1,699,343	
		404,438		2,525,448	
Sand	Ashburton	2,102		44,984	
	Broome	24,809		146,541	
	Carnarvon	8		280	
	Cockburn	14,659		58,276	
	Collie	32,338		194,023	
	Coolgardie	189,755		1,124,843	
	Coorow	2,586		12,931	
	Dandaragan	4,147		24,882	
	Derby-West Kimberley	1,442		10,099	
	Gingin	3,937		23,624	
	Kalgoorlie-Boulder	8,399		50,393	
	Leonora	5,492		27,460	
	Meekatharra	34,450		206,700	
	Menzies	697		3,485	
	Northam	478		1,434	
	Port Hedland Town	139,297		734,182	
	Roebourne	74,298		583,242	
	Shark Bay	300		1,500	
	Wanneroo	1,074,915		4,299,660	
	Wyndham-East Kimberley	4,000		20,000	
Yllgarn	3,423		17,112		
		1,621,532		7,585,651	
<b>TOTAL CONSTRUCTION MATERIALS</b>				<b>14,072,934</b>	(d)
Carats					
<b>DIAMOND</b>	Wyndham-East Kimberley	52,521,276		395,793,806	(a)
<b>DIMENSION STONE</b>					
Black Granite	Dundas	946		283,695	
Granite	Roebourne	220		11,000	
<b>TOTAL DIMENSION STONE</b>				<b>294,695</b>	(d)

TABLE 3 (cont.)

QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>GEM &amp; SEMI-PRECIOUS STONE</b>		kg			
Agate	East Pilbara	5		3,089	
Chalcedony	Carnarvon	41		20,680	
Chrysoprase	Menzies	20		4,000	
Jasper	Ashburton	38		22,585	
	Port Hedland	1,155		1,213	
		1,193		23,798	
Variscite	Upper Gascoyne	29		17,238	
<b>TOTAL GEM &amp; SEMI-PRECIOUS STONE</b>				<b>68,805</b>	
			Au kg		
<b>GOLD</b>	Boddington	13,775.193		205,679,231	
	Coolgardie	32,898.683		491,624,195	
	Cue	8,040.243		120,850,197	
	Dundas	4,333.222		64,898,512	
	East Pilbara	11,982.400		180,092,262	
	Halls Creek	1,115.119		16,853,504	
	Kalgoorlie - Boulder	48,635.417		726,896,067	
	Katanning	451.248		6,790,741	
	Laverton	11,849.551		175,452,960	
	Leonora	35,795.925		534,331,069	
	Meekatharra	17,417.943		260,667,214	
	Menzies	3,185.716		47,639,153	
	Mt Magnet	4,403.373		65,406,769	
	Sandstone	4,436.420		66,573,486	
	Wiluna	13,855.626		207,925,909	
	Yalgoo	1,836.500		27,437,078	
	Yilgarn	15,969.690		239,003,638	
<b>TOTAL GOLD</b>		<b>229,982.269</b>		<b>3,438,121,985</b>	(f)
<b>GYPSUM</b>	Bruce Rock	960		9,600	(e)
	Dalwallinu	56,802		1,181,209	(d)(e)
	Dandaragan	29,431		294,278	(e)
	Dundas	5,778		34,670	(e)
	Koorda	250		2,500	(e)
	Lake Grace	56,481		436,078	(e)
	Merredin	1,775		16,800	(d)(e)
	Mt Marshall	587		4,696	(e)
	Nungarin	23,662		141,972	(e)
	Ravensthorpe	11,843		71,058	(e)
	Wyalkatchem	59,681		410,424	(e)
	Yilgarn	4,659		39,142	(e)
<b>TOTAL GYPSUM</b>		<b>251,909</b>		<b>2,642,427</b>	

TABLE 3 (cont.) QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>HEAVY MINERAL SANDS</b>					
Garnet Sand	Bunbury City	48		5,760	(g)
	Northampton	98,408		11,317,594	(e)
		98,456		11,323,354	
Ilmenite			TiO <sub>2</sub> %		
	Bunbury City	436,460	56.24	50,580,841	
	Capel	358,727	54.89	39,190,383	
	Carnamah	305,732	58.33	27,512,847	
		1,100,919		117,284,071	(a)
Upgraded Ilmenite			TiO <sub>2</sub> %		
	Capel	181,736	92.30	92,104,645	
	Carnamah	151,567	93.21	75,053,843	
	Dandaragan	80,154	91.20	38,040,750	
		413,457		205,199,238	(a)
Leucoxene			TiO <sub>2</sub> Tonnes		
	Bunbury City	6,436	4,929	5,752,883	
	Capel	8,313	6,234	6,292,485	
	Dandaragan	15,974	12,785	3,142,343	
		30,723	23,948	15,187,711	(a)
Rutile			TiO <sub>2</sub> Tonnes		
	Bunbury City	8,446	7,877	7,948,592	
	Carnamah	85,485	80,596	57,296,084	
	Dandaragan	17,031	11,915	12,498,586	
		110,962	100,388	77,743,262	(a)
Zircon			ZrO <sub>2</sub> Tonnes		
	Bunbury City	39,177	25,460	23,167,586	
	Capel	50,205	35,629	28,308,763	
	Carnamah	192,609	125,576	101,538,403	
	Dandaragan	42,096	30,378	24,971,850	
		324,087	217,043	177,986,602	(a)
<b>TOTAL HEAVY MINERAL SANDS</b>				<b>604,724,238</b>	
<b>INDUSTRIAL PEGMATITE MINERALS</b>					
Felspar	Port Hedland Town	57,808		2,185,982	
	Mukinbudin	5,258		539,237	
		63,066		2,725,219	(h)
<b>IRON ORE</b>					
Domestic Ore			Fe%		
	East Pilbara	5,938,893	62.68	139,776,550	
Exported Ore			Fe%		
	Ashburton	78,246,734	61.30	1,682,088,369	
	Derby-West Kimberley	567,274	66.14	12,857,515	
	East Pilbara	55,487,330	62.36	1,303,411,648	
	Yilgarn	1,048,135	64.17	21,512,995	
		135,349,473		3,019,870,527	
<b>TOTAL IRON ORE</b>		<b>141,288,366</b>		<b>3,159,647,077</b>	(a)

TABLE 3 (cont.)

QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA

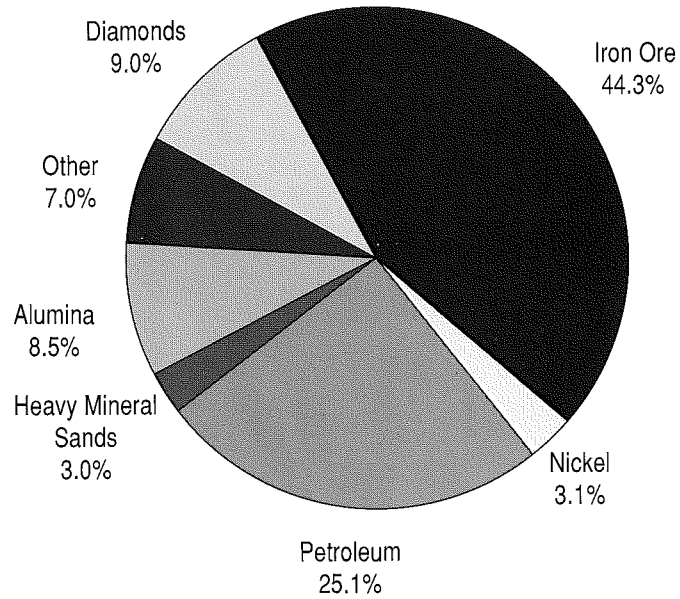
MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>LIMESAND - LIMESTONE-DOLOMITE</b>					
Dolomite	Lake Grace	4,069		122,070	
	Yilgarn	318		3,975	
		4,387		126,045	
Limesand - Limestone	Cockburn	1,822,900		9,490,300	
	Dandaragan	21,162		182,993	
	Dundas	83,282		1,249,223	
	Exmouth	200		2,000	
	Gingin	108,471		1,242,067	
	Irwin	30,191		120,764	
	Kwinana	32,504		325,040	
	Shark Bay	949		118,572	
	Wanneroo	253,772		3,013,821	
		2,353,431		15,744,780	
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>		<b>2,357,818</b>		<b>15,870,825</b>	(d)
<b>MANGANESE ORE</b>					
	East Pilbara	304,053	Mn % 49.12	35,471,281	(a)
<b>NICKEL INDUSTRY</b>					
Cobalt By-Product	Coolgardie	Co Tonnes		50,853,771	(a),(b)
		878.001			
Nickel Concentrates	Coolgardie	Ni %		267,722,423	
		214,267	13.54		
		29,026	12.32		
		299,057	12.54		
		167,166	21.57		
66,974	11.86	69,181,650			
		776,490		1,051,111,897	(i)
Palladium By-Product	Coolgardie		Pd kg 433.215	2,238,476	(a),(b)
Platinum By-Product	Coolgardie		Pt kg 254.560	1,582,314	(a),(b)
<b>PETROLEUM</b>					
Condensate	Ashburton	Kilolitres		10,408,971	(d)
		60,175			
		190			
		2,906			
		5,671,675			
		5,734,946		932,345,103	(a)
				943,153,536	
Crude Oil	Ashburton	Kilolitres		921,626,638	
		4,927,734			
		7,770			
		17,187			
		5,513,038			
		10,465,729		1,913,449,953	(a)
Liquified Natural Gas	Roebourne	Btu 10 <sup>6</sup>		1,528,770,813	(j)
		370,498,578			
L.P.G. - Butane	Roebourne	Tonnes		59,668,659	(j)
		209,685			
L.P.G. - Propane	Roebourne	Tonnes		55,658,974	(j)
		185,737			

TABLE 3 (cont.)

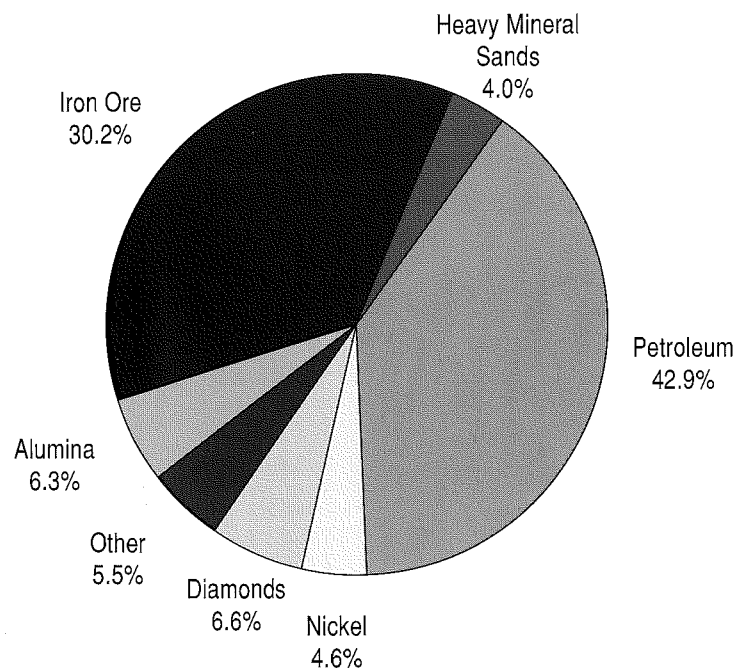
QUANTITY & VALUE OF MINERALS & PETROLEUM BY LOCAL GOVERNMENT AREA

MINERAL	LOCAL GOVERNMENT AREA	QUANTITY TONNES	METALLIC CONTENT	VALUE A\$	Ref.
<b>PETROLEUM Cont.</b>		'000 m <sup>3</sup>			
Natural Gas	Ashburton	475,157		40,236,456	(d)(j)
	Carnamah	38,492		6,324,461	(j)
	Irwin	357,363		46,694,282	(j)
	Roebourne	6,021,900		441,392,856	(d)(j)
		6,892,912		534,648,055	
<b>TOTAL PETROLEUM</b>				<b>5,035,349,990</b>	
<b>SALT</b>	Carnarvon	1,026,995		21,191,398	
	Dalwallinu	1		39	
	Esperance	15,105		505,124	
	Port Hedland Town	2,395,727		49,178,002	
	Roebourne	3,092,869		63,743,626	
	Shark Bay	907,307		14,255,028	
	Wyalkatchem	364		27,953	
	Yilgarn	107,925		4,714,866	
		<b>7,546,294</b>		<b>153,616,036</b>	(a)
<b>SILICA - SILICA SAND</b>					
Silica	Moora	74,866		748,664	(a)
Silica Sand	Albany	73,889		1,108,335	(a)
	Canning	504		5,544	(a)
	Cockburn	191,111		2,102,221	(a)
	Coolgardie	89,288		218,752	(a)
	Swan	245,049		2,695,539	(a)
	Wanneroo	25,497		175,997	(a)
<b>TOTAL SILICA - SILICA SAND</b>		<b>700,204</b>		<b>7,055,052</b>	
<b>SILVER: BY-PRODUCT</b>					
		Ag kg			
	Coolgardie	182,059		36,094	(a),(b)
	Derby-West Kimberley	5,343,929		785,765	(a),(l)
	East Pilbara	104,383		21,281	(a),(l)
	State-Wide	28,776,350		4,777,696	
	Yalgoo	13,793,107		2,468,615	(a),(l)
		<b>48,199,828</b>		<b>8,089,451</b>	
<b>TALC</b>	Meekatharra	16,174		1,132,180	
	Three Springs	161,366		12,945,532	
		<b>177,540</b>		<b>14,077,712</b>	(e)
<b>TIN - TANTALUM - LITHIUM</b>					
<b>Spodumene</b>			Li <sub>2</sub> O, %		
	Bridegetown-Greenbushes	99,409	5.77	16,168,027	(a)
<b>Tantalite</b>			Ta <sub>2</sub> O <sub>5</sub> , kg		
	Bridegetown-Greenbushes	265	156,100	26,031,974	
	East Pilbara	94	49,350	3,320,069	
	Yalgoo	20	10,500	1,877,640	
		379	215,950	31,229,683	(a)
<b>Tin</b>			Sn Tonnes		
	Bridegetown-Greenbushes	0	520	3,326,093	
	East Pilbara	n.ap.	3	34,447	
		0	523	3,360,540	(a)
<b>TOTAL TIN - TANTALUM - LITHIUM</b>				<b>50,758,250</b>	
<b>VALUE OF MINERALS</b>				<b>7,943,787,399</b>	
<b>VALUE OF PETROLEUM</b>				<b>5,035,349,990</b>	
<b>VALUE OF GOLD</b>				<b>3,438,121,985</b>	
<b>TOTAL VALUE</b>				<b>16,417,259,374</b>	

**COMPARATIVE ROYALTY RECEIPTS**  
**1991-92 TOTAL : A\$344.9 MILLION**



**1996-97 TOTAL : A\$535.9 MILLION**



Source: DME

Figure 0.2

TABLE 4

ROYALTY RECEIPTS

Mineral	1995-96	1996-97	1996-97 GROWTH	
	A\$	A\$	A\$	%
<b>BASE METALS</b>				
Copper	3,463,455.98	1,830,921.67	(1,632,534.31)	(47)
Lead	493,943.34	643,726.37	149,783.03	30
Zinc	4,782,128.66	4,763,749.24	(18,379.42)	0
<b>TOTAL BASE METALS</b>	<b>8,739,527.98</b>	<b>7,238,397.28</b>	<b>(1,501,130.70)</b>	<b>(17)</b>
<b>BAUXITE-ALUMINA</b>				
Alumina	30,194,089.45	33,622,839.76	3,428,750.31	11
Gallium	0.00	116,896.40	116,896.40	n.ap.
<b>TOTAL BAUXITE-ALUMINA</b>	<b>30,194,089.45</b>	<b>33,739,736.16</b>	<b>3,545,646.71</b>	<b>12</b>
<b>CLAYS</b>	<b>257,328.05</b>	<b>227,902.93</b>	<b>(29,425.12)</b>	<b>(11)</b>
<b>COAL</b>	<b>13,511,198.52</b>	<b>12,962,184.17</b>	<b>(549,014.35)</b>	<b>(4)</b>
<b>CONSTRUCTION MATERIALS</b>				
Aggregate	198,515.16	115,336.33	(83,178.83)	(42)
Gravel	53,084.25	54,142.38	1,058.13	2
Rock	70,415.90	133,424.96	63,009.06	89
Sand	434,362.40	458,546.40	24,184.00	6
Sandstone	46.18	0.00	(46.18)	(100)
<b>TOTAL CONSTRUCTION MATERIALS</b>	<b>756,423.89</b>	<b>761,450.07</b>	<b>5,026.18</b>	<b>1</b>
<b>DIAMOND</b>	<b>37,972,556.70</b>	<b>35,266,731.00</b>	<b>(2,705,825.70)</b>	<b>(7)</b>
<b>DIATOMITE</b>	<b>107.56</b>	<b>0.00</b>	<b>(107.56)</b>	<b>(100)</b>
<b>DIMENSION STONE</b>	<b>32.50</b>	<b>1,173.09</b>	<b>1,140.59</b>	<b>3,510</b>
<b>GEM, SEMI-PRECIOUS &amp; ORNAMENTAL STONE</b>	<b>49,842.84</b>	<b>8,304.69</b>	<b>(41,538.15)</b>	<b>(83)</b>
<b>GOLD</b>	<b>366,367.69</b>	<b>464,066.41</b>	<b>97,698.72</b>	<b>27</b>
<b>GYPSUM</b>	<b>66,663.02</b>	<b>91,450.01</b>	<b>24,786.99</b>	<b>37</b>
<b>HEAVY MINERAL SANDS</b>				
Garnet	439,343.02	511,070.46	71,727.44	16
Ilmenite	8,048,706.83	6,863,886.88	(1,184,819.95)	(15)
Leucoxene	472,720.26	598,433.38	125,713.12	27
Rutile	4,252,401.87	4,172,120.41	(80,281.46)	(2)
Zircon	9,521,232.21	9,302,270.20	(218,962.01)	(2)
<b>TOTAL HEAVY MINERAL SANDS</b>	<b>22,734,404.19</b>	<b>21,447,781.33</b>	<b>(1,286,622.86)</b>	<b>(6)</b>
<b>INDUSTRIAL PEGMATITE MINERALS</b>				
Feldspar	102,669.84	129,837.71	27,167.87	26
<b>IRON ORE</b>	<b>156,284,784.27</b>	<b>161,908,466.49</b>	<b>5,623,682.22</b>	<b>4</b>
<b>LIMESAND-LIMESTONE-DOLOMITE</b>				
Dolomite	3,387.60	1,220.70	(2,166.90)	(64)
Limesand-Limestone	279,597.60	273,256.44	(6,341.16)	(2)
<b>TOTAL LIMESAND-LIMESTONE-DOLOMITE</b>	<b>282,985.20</b>	<b>274,477.14</b>	<b>(8,508.06)</b>	<b>(3)</b>
<b>MANGANESE</b>	<b>1,091,637.78</b>	<b>1,417,212.95</b>	<b>325,575.17</b>	<b>30</b>

TABLE 4 (cont.)

ROYALTY RECEIPTS

Mineral	1995-96 A\$	1996-97 A\$	1996-97 GROWTH	
			A\$	%
<b>NICKEL</b>				
Cobalt by-product	1,507,524.26	1,218,420.35	(289,103.91)	(19)
Nickel	23,648,999.13	24,659,213.24	1,010,214.11	4
Palladium by-product	71,393.02	59,028.95	(12,364.07)	(17)
Platinum by-product	68,149.04	73,187.34	5,038.30	7
<b>TOTAL NICKEL INDUSTRY</b>	<b>25,296,065.45</b>	<b>26,009,849.88</b>	<b>713,784.43</b>	<b>3</b>
<b>PEAT</b>	<b>1,706.21</b>	<b>0.00</b>	<b>(1,706.21)</b>	<b>(100)</b>
<b>PETROLEUM</b>				
Condensate	22,827,106.48	36,076,076.68	13,248,970.20	58
Liquefied Natural Gas	63,245,146.82	77,065,721.50	13,820,574.68	22
LPG - Butane	377,287.55	2,543,797.22	2,166,509.67	574
LPG - Propane	358,106.18	2,567,199.01	2,209,092.83	617
Natural gas	21,790,765.54	26,561,753.05	4,770,987.51	22
Oil	50,806,813.45	84,932,223.71	34,125,410.26	67
<b>TOTAL PETROLEUM</b>	<b>159,405,226.02</b>	<b>229,746,771.17</b>	<b>70,341,545.15</b>	<b>44</b>
<b>PIGMENTS</b>				
Red Oxide	8,212.50	0.00	(8,212.50)	(100)
<b>SALT</b>	<b>1,655,125.38</b>	<b>1,878,311.32</b>	<b>223,185.94</b>	<b>13</b>
<b>SILICA SAND</b>	<b>311,927.28</b>	<b>341,519.45</b>	<b>29,592.17</b>	<b>9</b>
<b>SILVER</b>	<b>228,259.47</b>	<b>254,331.93</b>	<b>26,072.46</b>	<b>11</b>
<b>TALC</b>	<b>78,826.00</b>	<b>88,058.50</b>	<b>9,232.50</b>	<b>12</b>
<b>TIN-TANTALUM-LITHIUM</b>				
Spodumene	704,631.40	830,253.49	125,622.	18
Tantalite	949,972.44	741,954.38	(208,018.06)	(22)
Tin	94,792.90	79,881.76	(14,911.14)	(16)
<b>TOTAL TIN-TANTALUM-LITHIUM</b>	<b>1,749,396.74</b>	<b>1,652,089.63</b>	<b>(97,307.11)</b>	<b>(6)</b>
<b>TOTAL ROYALTY RECEIPTS</b>	<b>461,145,364.53</b>	<b>535,910,103.31</b>	<b>74,764,738.78</b>	<b>16</b>
<b>IRON ORE ADDITIONAL RENTAL</b>	<b>24,817,325.80</b>	<b>24,910,937.11</b>	<b>(1,524,436.21)</b>	<b>(6)</b>
<b>TOTAL REVENUE</b>	<b>485,962,690.33</b>	<b>560,821,040.42</b>	<b>73,240,302.57</b>	<b>15</b>



TABLE 5

## PRINCIPAL MINERAL &amp; PETROLEUM PRODUCERS 1996 - 97

**BASE METALS****Copper**

Murchison Zinc Co. Pty Ltd, 100 Hutt Street, Adelaide SA 5000, (08) 8303 1700: Golden Grove.

Newcrest Mining Ltd, 600 St Kilda Road, Melbourne Vic, 3004, (03) 9522 5333: Telfer.

WMC Ltd, 168 Greenhill Road, Parkside SA 5063, (08) 8372 7200: Nifty.

**Lead - Zinc**

Murchison Zinc Co. Pty Ltd, 100 Hutt Street, Adelaide SA 5000, (08) 8303 1700: Golden Grove.

Westmet Metals Zinc NL, 263 Adelaide Terrace, Perth WA 6000, (08) 9221 2555: Cadjebut.

**BAUXITE - ALUMINA****Alumina**

Alcoa of Australia (WA) Ltd, cnr Davey & Marmion Streets, Booragoon WA 6154, (08) 9316 5111: Del Park, Jarrahdale, Willowdale.

Worsley Alumina Pty Ltd, PO Box 344, Boddington WA 6225, (08) 9734 8311: Boddington.

**CLAY****Attapulgite**

Hudson Resources Ltd, James St Narngulu, Geraldton WA 6530, (08) 9923 3604: Lake Nerramyne.

**Clay Shale**

Wesfarmers Coal Ltd, 276 Leach Highway, Myaree WA 6153, (08) 9333 0391: Collie.

**Fire Clay**

Midland Brick Co Pty Ltd, Bassett Rd, Middle Swan WA 6056, (08) 9273 5522: Muchea

**Kaolin**

Gwalia Consolidated Ltd, PMB 16, West Perth WA 6872, (08) 9481 1988: Greenbushes.

**White Clay**

Metro Brick, Locked Bag 100, Midland WA 6056, (08) 9250 2111: Middle Swan.

**COAL**

Griffin Coal Mining Co. Ltd, 28 The Esplanade, Perth WA 6000, (08) 9325 8155: Collie.

Wesfarmers Coal Ltd, 276 Leach Highway, Myaree WA 6153, (08) 9333 0391: Collie.

**CONSTRUCTION MATERIALS****Aggregate**

The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Boodarrie, Boulder, Burrup-Dampier.

**Gravel**

Boral Resources (WA) Ltd, 63 Abernethy Rd, Belmont WA 6104, (08) 9333 3400: Gnangarra, Grosmont.

**Rock**

Boral Resources (WA) Ltd, 63 Abernethy Rd, Belmont WA 6104, (08) 9333 3400: Gnangarra, Grosmont.

**Sand**

Amatek Ltd, 1 Newburn Road, Kewdale WA 6104, (08) 9353 3030: Gnangarra, Jandakot.

The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Comet Vale, Pinnacles, Sandy Hill, Sullivan's Creek, Turner River, Warrawanda, Widgiemooltha.

**DIAMOND**

Argyle Diamond Mines, 2 Kings Park Road, West Perth WA 6005, (08) 9482 1166: Argyle.

TABLE 5 (CONT.)

## PRINCIPAL MINERAL &amp; PETROLEUM PRODUCERS 1996 - 97

## DIMENSION STONE

**Black Granite**

Fraser Range Granite NL, 164 Burswood Road, Victoria Park WA 6010, (08) 9470 4487: Mt Malcolm.

## GOLD

- Acacia Resources Ltd, 3 Richardson St, West Perth WA 6005, (08) 9480 1666: Sunrise Dam.  
 Amalg Resources NL, 11 Keogh Way, Kalgoorlie WA 6430, (08) 9091 1422: Burbanks-Lady Robinson.  
 Australasian Gold Mines NL, 47-79 Stirling Highway, Nedlands WA 6009, (08) 9386 7211: Red White & Blue.  
 Australian Gold Fields NL, 8 The Esplanade, Perth WA 6000, (08) 9221 7300: Bannockburn.  
 Australian Resources Ltd, 5 Mill Street, Perth WA 6000, (08) 9481 1654: Gidgee, Mt McClure.  
 Camelot Resources Ltd, 46-50 Kings Park Road, West Perth WA 6005, (08) 9321 0616: Mt Gibson, Tarmoola.  
 Centaur Mining & Exploration Ltd, 580 St Kilda Rd, Melbourne Vic 3004, (03) 9276 7870: Mt Pleasant-Golden-Kilometre, Ora Banda.  
 Central Norseman Gold Corp. NL, PO Box 56, Norseman WA 6443, (08) 9039 1101: Central Norseman.  
 Consolidated Gold NL, 10 Richardson St, West Perth WA 6005, (08) 9481 5870: Davyhurst. Kookynie-Orient Well.  
 Croesus Mining NL, 39 Porter Street, Kalgoorlie WA 6430, (08) 9091 2222: Binduli.  
 Eagle Mining Corporation NL, 1 Sleat Road, Applecross WA 6153, (08) 9316 3611: Nimary.  
 Equigold NL, 7 Sleat St, Applecross WA 6153, (08) 9316 3661: Dalgaranga.  
 Forrestania Gold NL, 15 Ord St, West Perth WA 6005, (08) 9481 5656: Bounty-Forrestania.  
 Gindalbie Gold NL, 124 Hannan St, Kalgoorlie WA 6430, (08) 9021 1877: Two Boys.  
 Gold Mines of Australia Ltd, 161 Great Eastern Highway, Belmont WA 6104, (08) 9277 9500: Reedy, Youanmi.  
 Great Central Mines NL, 46 Kings Park Road, West Perth WA 6005, (08) 9322 2044: Bronzewing, Jundee.  
 Hedges Gold Pty Ltd, Williams Road, Boddington WA 6390, (08) 9538 4500: Hedges.  
 Herald Resources Ltd, 40 Kings Park Road, West Perth WA 6005, (08) 9322 2788: Bayley's Reward-Greenfields, Hancocks, Gum Creek-Montague, Sandstone, Three Mile Hill.  
 Kalgoorlie Consolidated Gold Mines Pty Ltd, Private Bag 27, Kalgoorlie WA 6430, (08) 9022 1100: Golden Mile.  
 Lynas Gold NL, 50 Colin St, West Perth WA 6005, (08) 9481 3400: Lynas Find.  
 New Hampton Goldfields NL, 9 Havelock St, West Perth WA 6005, (08) 9321 0611: Jubilee, Mt Martin.  
 Newcrest Mining Ltd, 30 Terrace Road, East Perth WA 6004, (08) 9270 7070: New Celebration, Telfer.  
 Normandy Mining Ltd, 100 Hutt Street, Adelaide SA 5000, (08) 8303 1700: Big Bell, Golden Crown, Kaltails.  
 North Ltd, 12 St George's Terrace, Perth WA 6000, (08) 9268 3900: Kanowna Belle.  
 Pancontinental Mining Ltd, 1 Alfred St, Sydney NSW 2000, (02) 9934 8888: Kundana, Paddington.  
 Perilya Mines NL, 278 Stirling Highway, Claremont WA 6010, (08) 9385 2400: Fortnum.  
 Placer Pacific Ltd, 1 Alfred Street, Sydney Cove NSW 2000 (02) 9256 3800: Granny Smith.  
 Plutonic Resources Ltd, 221 St George's Terrace, Perth WA 6000, (08) 9324 1699: Darlot, Lawlers, Mt Morgans, Peak Hill, Plutonic, Sir Samuel-Bellevue.  
 Precious Metals Australia Ltd, 37 St George's Terrace, Perth WA 6000, (08) 9221 3711: Palm Springs.  
 Ramsgate Resources Ltd, 229 Stirling Highway, Claremont WA 6010, (08) 9383 4321: Mt Monger-Randalls.  
 Resolute Ltd, 28 The Esplanade, Perth WA 6000, (08) 9261 6100: Bullabulling, Chalice, Higginsville, Marymia Hill.  
 Sons of Gwalia NL, 16 Parliament Place, West Perth WA 6005, (08) 9263 5555: Bullfinch, Laverton, Marvel Loch-Southern Cross, Nevoria, Sons of Gwalia, Yilgarn Star.  
 St Barbara Mines Ltd, 28 The Esplanade, Perth WA 6000, (08) 9324 6350: Bluebird.  
 Tectonic Resources Ltd, 100 Hay Street, Subiaco WA 6008, (08) 9388 3872: Mt Dimer.  
 Westgold Resources NL, 40 The Esplanade, Perth WA 6000, (08) 9324 2877: Tuckabianna.  
 WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Emu-Leinster, Hill 50-Mt Magnet, Kambalda-St Ives.  
 Wiluna Mines Ltd, 10 Ord Street West Perth WA 6005, (08) 9481 2050: Wiluna.  
 Worsley Alumina Pty Ltd, PO Box 48, Boddington WA 6390, (08) 9883 8260: Boddington.

TABLE 5 (CONT.)

## PRINCIPAL MINERAL &amp; PETROLEUM PRODUCERS 1996 - 97

**GYPSUM**

H.B. Brady & Co. Pty Ltd, PO Box 42, Bayswater WA 6053, (08) 9279 4422: Lake Brown.  
 Quantum Holdings Pty Ltd, 17 Hawkstone St, Cottlesloe WA 6011, (08) 9481 4101: Jurien Bay.  
 Swan Portland Cement Ltd, Burswood Road, Rivervale WA 6103, (08) 9361 8822: Lake Hillman.  
 Westdeen Holdings Pty Ltd, 7 Armstrong Road, Applecross WA 6153, (08) 9364 4951: Lake Cowcowing.

**HEAVY MINERAL SANDS****Garnet Sand**

GMA Garnet Pty Ltd, PO Box 188, Geraldton WA 6530, (08) 9923 3644: Port Gregory.

**Ilmenite, Leucoxene, Rutile & Zircon**

BHP Titanium Minerals Pty Ltd, PO Box 22, Karridale WA 6288, (08) 97582500: Beenup.  
 Cable Sands (WA) Pty Ltd, PO Box 133, Bunbury WA 6230, (08) 9721 4111: Busselton, Jangardup, Waroona.  
 RGC Mineral Sands, PO Box 62, Geraldton WA 6530, (08) 99568 822: Capel, Encabba North, Eneabba West, Narngulu.  
 TiWest Pty Ltd, 1 Brodie Hall Drive, Bentley WA 6102, (08) 9365 1390: Cooljarloo, Chandala.  
 Westralian Sands Ltd, PO Box 96, Capel WA 6271, (08) 9727 2002: Yoganup, Yoganup Extended.

**INDUSTRIAL PEGMATITE MINERALS****Feldspar**

Commercial Minerals Ltd, 26-28 Tomlinson Road, Welshpool WA 6106, (08) 9362 1411: Mukinbudin, Pippingarra.

**IRON ORE**

BHP Iron Ore (Goldsworthy) Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Nimingarra, Yarrie.  
 BHP Iron Ore (Jimblebar) Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Jimblebar.  
 BHP Iron Ore Ltd, 200 St George's Terrace, Perth WA 6000, (08) 9320 4444: Newman, Yandicoogina.  
 Channar Mining Pty Ltd, 152 George's Terrace, Perth WA 6000, (08) 9327 2327: Channar.  
 Hamersley Iron Pty Ltd, 152 George's Terrace, Perth WA 6000, (08) 9327 2327: Brockman, Marandoo, Tom Price, Paraburdoe.  
 Koolyanobbing Iron Pty Ltd, 1 William St, Perth WA 6000, (08) 426 3388: Cockatoo Island, Koolyanobbing.  
 Robe River Iron Associates, 12 St George's Terrace, Perth WA 6000, (08) 9421 4747: Pannawonica.

**LIMESAND - LIMESTONE**

Cockburn Cement Ltd, Russell Road, East Munster WA 6166, (08) 9411 1000: Cockburn Sound, Coogee.  
 Swan Portland Cement Ltd, Burswood Road, Rivervale WA 6103, (08) 9361 8822: Wanneroo.

**MANGANESE**

Valiant Consolidated Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9321 3797: Mt Sydney, Pearana.

**NICKEL**

Mining Project Investors Pty Ltd, 600 Bourke Street, Melbourne Vic 3000, (03) 9672 3222: Black Swan  
 Outokumpu Australia Pty Ltd, 141 Burswood Road., Burswood WA 6100, (08) 9472 3144: Forrestania  
 WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Blair, Carnilya Hill, Kambalda, Leinster, Mt Keith.

**PETROLEUM**

Apache Energy Ltd, 256 St George's Terrace, Perth WA 6000, (08) 9422 7222: Campbell, Harriet, Rosette, Sinbad, Tanami.  
 BHP Petroleum Pty Ltd, 152-158 St George's Terrace, Perth WA 6000, (08) 9278 4800: Griffin  
 Boral Energy Resources Ltd, 60 Hindmarsh Square, Adelaide SA 5000, (08) 8235 3737: Beharra Springs, Tubridgi.  
 CMS Transmission of Australia Pty Ltd, 8 Marchesi St, Kewdale WA 6105, (08) 9353 7555: Dongara, Mondara.

TABLE 5 (CONT.)

## PRINCIPAL MINERAL &amp; PETROLEUM PRODUCERS 1996 - 97

**PETROLEUM Cont.**

Mobil Exploration & Producing Australia Pty Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9429 3200: Wandoo  
 Novus West Australia Pty Ltd, 76 Kings Park Road, West Perth WA 6005, (08) 9486 7700: Chervil, North  
 Herald, South Pepper, Airlie Island.

Phoenix Energy Pty Ltd, 28 The Esplanade, Perth WA 6000, (08) 9261 2800: Woodada.

Premier Oil Australia Pty Ltd, 31 Ventnor Avenue, West Perth WA, 6005, (08) 9480 4100: Mt Horner.

Santos Ltd, 39 Grenfell Street, Adelaide SA 5001, (08) 8224 7162: Blina, Boundary, Lloyd, Sundown, West  
 Terrace.

West Aust. Petroleum Pty Ltd (WAPET), QV1, 250 St George's Terrace, Perth WA 6000, (08) 9263 6000:

Barrow Island, Cowle, Crest, Roller-Skate, Saladin, Yammaderry.

Woodside Offshore Pet. Pty Ltd, 1 Adelaide Terrace, Perth WA 6000, (08) 9224 4111: Cossak/Wanaca,  
 Goodwyn, North Rankin.

**SALT**

Cargill Australia Ltd, PO Box 420, Port Hedland WA 6721, (08) 9140 1255: Port Hedland.

Dampier Salt (Operations) Pty Ltd, 152-158 St George's Terrace, Perth WA 6000, (08) 9327 2299: Dampier,  
 Lake Macleod.

Shark Bay Salt Joint Venture, 22 Mount Street, Perth WA 6000, (08) 9322 4811: Useless Loop.

WA Salt Koolyanobbing Pty Ltd, Cockburn Road, Hamilton Hill WA 6163, (08) 9430 5495: Lake Deborah  
 East, Pink Lake.

**SILICA - SILICA SAND****Silica**

Simcoa Operations Pty Ltd, PO Box 1389, Bunbury WA 6231, (08) 97912 588: Dalaroo.

**Silica Sand**

Amatek Ltd, 1 Newburn Road, Kewdale WA 6104, (08) 9353 3030: Jandakot, Gnangara.

Boral Resources WA Ltd, 136-138 Gt Eastern Highway, South Guildford WA 6055, (08) 9279 0000: Jandakot.

The Readymix Group (WA), 75 Canning Highway, Victoria Park WA 6100, (08) 9472 2000: Jandakot.

WMC Ltd, 250 St George's Terrace, Perth WA 6000, (08) 9442 2000: Mt Burgess.

**TALC**

Gwalia Minerals NL, PMB 16, West Perth WA 6872, (08) 9481 1988: Mt Seabrook.

WMC Ltd, PO Box 116, Three Springs WA 6519, (08) 9954 5047: Three Springs.

**TIN - TANTALUM - LITHIUM****Spodumene**

Gwalia Consolidated Ltd, PMB 16, West Perth WA 6872, (08) 9481 1988: Greenbushes.

**Tantalite - Tin**

Gwalia Consolidated Ltd, PMB 16, West Perth WA 6872, (08) 9481 1988: Greenbushes, Wodgina.

## ABBREVIATIONS, REFERENCES, UNITS AND CONVERSION FACTORS

As the document makes use of abbreviations and references, an explanation of each has been included below. A conversion table, relating the units by which various commodities are measured, has also been provided.

### ABBREVIATIONS

cons	concentrates	n.ap.	not applicable
f.o.t.	free on truck	f.o.b.	free on board
f.o.r.	free on rail	¥	Japanese Yen
A\$	Australian Dollar	US\$	United States Dollar
ABS	Australian Bureau of Statistics	GDP	Gross Domestic Product
AFR	<i>Australian Financial Review</i>	BMR	Bureau of Mineral Resources
CSO	Central Selling Organisation	HBI	Hot Briquetted Iron
DRI	Direct Reduced Iron	IMF	International Monetary Fund
RBA	Reserve Bank of Australia		
ABARE	Australian Bureau of Agricultural and Resource Economics		

### REFERENCES

- (a) Estimated f.o.b. value.
- (b) Metallic by-product of nickel mining.
- (c) Value based on the average Australian Value of Alumina as published by the ABS.
- (d) Value at works.
- (e) Estimated ex-mine value.
- (f) Value based on monthly production and average gold price of that month as supplied by GoldCorp.
- (g) Estimated f.o.t. value.
- (h) Estimated f.o.r. value.
- (i) Estimated f.o.b. value based on the current price of nickel containing products.
- (j) Delivered value.
- (k) Metallic by-product of copper mining.
- (r) Revised from previous edition.

### UNITS AND CONVERSION FACTORS

	Metric Unit	Symbol	Imperial Unit
<b>Mass</b>	1 gram	(g)	= 0.032151 troy (fine) ounce (oz)
	1 kilogram	(kg)	= 2.204624 pounds (lbs)
	1 tonne	(t)	= 1.10231 United States short ton [1 US short ton = 2,000 lbs]
	1 tonne	(t)	= 0.98421 United Kingdom long ton [1 UK long ton = 2,240 lbs]
<b>Volume</b>	1 kilolitre	(kl)	= 6.28981 barrels (bbls)
	1 cubic metre	(m <sup>3</sup> )	= 35.3147 cubic feet (ft <sup>3</sup> ) [1 kilolitre (kl) = 1 cubic metre (m <sup>3</sup> )]
<b>Energy</b>	1 kilojoule	(kj)	= 0.94781 British Thermal Units (Btu)

#### Energy Content

Coal	19.7 GJ/t
Condensate	32.0 MJ/L
Crude oil	37.0 MJ/L
LNG	25.0 MJ/L
Natural gas	38.2 MJ/m <sup>3</sup>

#### Prefix

kilo (k)	10 <sup>3</sup>
mega (M)	10 <sup>6</sup>
giga (G)	10 <sup>9</sup>
tera (T)	10 <sup>12</sup>
peta (P)	10 <sup>15</sup>