Survey of demand and supply forecasts for the coal industry
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For the Australian Coal Industry Council Study of the Queensland and New South Wales Black Coal Industry

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Lindsay Jolly, Donald Muir and Roger Stuart
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COAL FORECASTS

Summary and conclusions

This study contains a review of the short, medium and longer term supply and demand forecasts for world thermal and coking coal trade which have been released recently by leading analysts, and ABARE's judgment of these forecasts. A consensus view of the short and medium term outlooks is provided. Major factors driving the forecast changes in supply and demand are identified and the areas of major uncertainty which analysts have recognised in their forecasts are highlighted. Views on the future path of coal prices are also collated and compared with ABARE's judgment.

Analysts reporting their views on the short term prospects for the world coal market in trade journals and recent conference papers point to the considerable strengthening in the spot prices for both thermal and metallurgical coal since the annual Australia-Japan benchmark price negotiations earlier in 1994. Those negotiations led to falls of 8 per cent in metallurgical coal prices and 5.5 per cent in thermal coal prices, in US dollar terms. Spot prices for coal have been recovering strongly over recent months due to a considerable tightening of available supplies of both thermal and metallurgical coals in the major exporting countries. However, analysts' opinions differ on the extent to which spot prices will continue to rise during the remainder of 1994 and the impact of such price rises on next year's contract price negotiations.

ABARE's assessment is that higher spot prices for thermal coal are likely to be maintained during 1994. This situation would be likely to benefit thermal coal suppliers during the 1995 price negotiations with power utilities in Japan. Similarly, higher spot settlements during June 1994 for metallurgical coal by the Steel Authority India Ltd (SAIL) and only a marginal fall in contract prices between Australian exporters and Brazilian steel mills demonstrate tightness in the metallurgical coal market. This together with recently upgraded forecasts for Japanese steel production for JFY 1994 point to the likelihood of upward price pressure on the next round of contract price negotiations between Australia and Japan.

Fifteen separate medium to longer term coal trade projection studies were selected in order to provide a range of analysts, regional country groupings, commodity coverage, projection periods and projection methods. The studies include those issued by key international public organisations including the International Energy Agency (IEA), the Energy Information Administration (EIA) of the US Department of Energy, the World Bank, and more recently,
COAL FORECASTS

APEC. Projections by Wharton Econometric Forecasting Associates (WEFA) are also reviewed, as they represent a large private forecasting agency. Studies of the outlook for coal by individual analysts, such as those by Barlow Jonker, have also been included. Projections issued by large trading companies and private consultancies have not been included in this review as they are not as widely available and usually must be purchased at considerable cost.

While the assumptions, projection method and regional coverage differ between the selected studies, a consensus view can be formed of the outlook for world coal trade during the medium term. There is general agreement between analysts that total hard coal trade will rise significantly by the year 2000. The volume of thermal coal trade is expected to increase substantially. It is projected to rise from its present estimated level of 200 million tonnes seaborne (1993) to an average level of 340 million tonnes (325-365 million tonnes) in the year 2000, due mainly to the increased demand for electricity in Asia and reduced indigenous coal production in Europe.

An important finding also is that projections of European thermal coal trade vary more than those for Asia (a range of 60 million tonnes for Europe compared with a range of 40 million tonnes for Asia). The difference reflects uncertainty about changes to indigenous coal output cuts resulting from national coal policies that influence the levels of subsidies to domestic production in European countries and consequent changes in domestic coal production.

The consensus view is also for metallurgical coal trade to remain stagnant or decline slightly as little or no growth is expected in blast furnace steel production in coal importing countries and as PCI technology is more widely employed. Asia will remain the main coking coal importing region due to the demand from blast furnace steel producers in Japan and newly industrialised Asian countries. Imports in the Asian region in 2000 are projected to range between 60 and 115 million tonnes, compared with imports of around 97 million tonnes in 1993.

A projected decline in blast furnace steel production as a result of competition from other steel suppliers using different steelmaking technologies, is expected to restrict European coking coal imports to an average projected level of around 60 million tonnes in 2000.

ABARE's assessment of prospects for coal demand during the medium term readily reflect the consensus view. There is also a consensus that metallurgical coal prices will not rise significantly in real terms.
COAL FORECASTS

For the medium term, analysts generally agree that coal exports from Indonesian and South American suppliers will rise and that some recovery will occur in export volumes from the CIS and Poland. There is also general agreement that Australia, the United States and South Africa will remain the major exporters in the medium term. Canadian exports are projected to expand slightly, while the level of coal shipments from China remains uncertain. Reflecting Australia’s strong comparative advantage in exports to the Asian market, all analysts project that Australia will remain the overall major supplier of coal to the world market in the medium term.

Analysts generally agree that Australia, the United States and Canada will be the major coking coal suppliers in the medium term, with China a minor supplier to Asian markets, and the former Soviet Union and Poland minor suppliers to Europe. In the medium term Australia and South Africa are projected to be the major suppliers of PCI coal to blast furnace steel producers.

However, while there is consensus on the above issues there is also a considerable range in projected export volumes and market shares of the major exporters in world coal trade. Market shares not only reflect the supply costs of exporters, but are also influenced by coal quality issues and port capacity constraints, as well as the supply diversification policies of the major importing countries. A feature of the projection studies is that frequently insufficient information is presented to ascertain the precise cost factors (such as mine costs, internal transport costs, port handling costs, comparative ocean freight rates) leading to the relative position of major exporters in key markets.

In ABARE’s assessment Australia’s dominant position in the Asian thermal coal market is the result of a comparative advantage arising from, among other things: its proximity and resulting freight advantage over many other world suppliers; the quality of the thermal coal supplied (low sulphur, low ash, low moisture); and the exporters’ ability to supply a product consistent with specifications and on a regular basis. The growth in Australia’s capacity to supply thermal coal will result from increased production from incremental expansions at existing mines, new mine development and productivity gains.

However, the low mining costs of Indonesian coal, together with its close proximity to the Asian market, make Indonesia a strong competitor with Australia.

To a significant degree, differences between projected coal trade patterns reflect the different assumptions made by analysts about the key factors influencing coal supply and demand. However, some of the difference could also be attributed to differences in projection methods, or due to the
availability of more up-to-date information to some analysts (the studies under review were released over a period of four years).

Key variables for which analysts make conditional assumptions are:

- rates of economic growth;
- the level of alternative energy prices during the projection period;
- the extent of interfuel competition, particularly in the electricity generation sector; and
- the level of indigenous coal supply (policy driven).

That is, changes in assumptions on these and other factors including technological changes would cause revisions to the projected growth in demand for coal in the major end use sectors. Most often, however, analysts do not present the key assumptions underlying their projections. Across the selected studies, however, there appears to be two main areas of consistency in underlying assumptions. First, most analysts appear to have assumed strong economic growth in Asia as reflected in the general view that growth in thermal coal demand will be strong in Asia. Second, there appears to be consensus that there will be little change in the relative fuel prices to the year 2000, and consequently little fuel switching caused by changes in fuel prices.

There is less agreement about the extent to which interfuel competition will arise during the medium term. However, there appears to be a consensus among those analysts who present their assumptions on interfuel competition, that such competition will come mainly from natural gas.

Many analysts argue that, in Asia, the continued price competitiveness of coal over LNG and the fact that most utility plans already incorporate substantially diversified fuel supply suggest that further interfuel substitution will not have a dramatic impact on anticipated coal use up to 2000.

Several analysts identify the level of indigenous coal production, particularly in Europe, as a major uncertainty for their medium term projections. This is because the pace and extent of withdrawal of coal subsidies is uncertain as is the consequence of subsidy withdrawal on the wider energy market.

The relative importance of assumptions on key market variables differs between Asia and Europe. For steam coal, the uncertainties would appear to be greater in Northern Europe than in Asia. A large range of outcomes for European import demand is possible from the interaction of uncertainties about electricity demand growth, potential for interfuel competition as well as the level of indigenous coal supply, particularly in Germany and the United
In short, the outcome will be based as much on political as on economic considerations. Such a difference in the level of uncertainty between Asia and Europe is corroborated by considering the clear disparity in the range of projected demand levels for thermal coal by the year 2000 between Europe and Asia.

This would also appear to be the case for the metallurgical coal trade. Although projected import demand for metallurgical coal in both Asia and Europe would be conditional on assumptions about PCI injection rates, variations between studies concerning the volume of metallurgical coal imported by European countries reflect uncertainties over the extent and pace of falls in indigenous coal production as well as differing expectations about EU steel production capacity and the rate of increase in use of PCI.

In addition to making assumptions on the key fundamental variables influencing the outlook for coal demand and supply, analysts also identify significant ‘cross-cutting’ issues that inherently have a high degree of uncertainty and which could have a marked impact on the longer term outlook. Key uncertainties most often identified in the studies are:

- environmental factors and government policy, especially concerning climate change policy responses;
- coal technology development;
- possible difficulties in raising funds for power sector investment; and
- energy market liberalisation in the developing countries of Asia.

Most analysts recognise environmental pressures and possible policy responses, particularly concerning greenhouse gas emissions, as substantial threats to their coal demand outlook. At the same time there appears to be a tendency for analysts to assume that policies on greenhouse gas emissions will not be implemented or take effect before 2000. Alternatively those analysts who do suggest the possibility of the implementation of policies before 2000, such as carbon or energy taxes in OECD countries, do no more than to note that this would lower coal use in some countries from the projected levels.

Most analysts assume for Asian economies that governments will not alter their plans for future coal use because of concern about coal’s contribution to greenhouse gas emissions, because in most cases there are no alternatives to coal. For Europe, environmental pressures are already causing revisions to coal fired power station programs and the threatened implementation of carbon taxes or direct legislative constraints has already persuaded coal users to switch from coal use to natural gas or multifiring in planned capacity.
ABARE also explicitly recognises that the major uncertainty affecting the demand for coal in the longer term is the extent to which policies are adopted (both at national and global levels) to implement environmental regulations related to the discharge of airborne pollutants and solid wastes from power plants. ABARE has investigated the potential impacts of environmental policies on coal demand and growth in coal trade by considering the Clean Air Act in the United States. And ABARE is currently investigating possible coal trade impacts of greenhouse gas emission reduction targets under the Framework Convention on Climate Change.

When considering technical change, all analysts acknowledge the impact of PCI technology for blast furnaces on projected metallurgical coal demand and trade patterns and, to varying degrees, analysts acknowledge the role of improving efficiencies in coal fired power generation plant in determining future thermal coal demand. However, the lack of explicit discussion and detailing of underlying assumptions, meant that the sensitivity of medium term projections to different rates of technical change could not be gauged.

The impact of the development of advanced clean coal technologies such as integrated coal gasification combined cycle (IGCC) and pressurised fluidised bed combustion (PFBC) was also considered by ABARE. ABARE's assessment is that presently the potential for and net effects of these complex developments are difficult to read and are unlikely to have significant demand effects for Australian coal until into the next century. However, ABARE considers them to be potentially important and is devoting significant research resources to understanding them better.

ABARE has identified another key uncertainty likely to have an impact on the medium and longer term outlook for world coal trade as energy market liberalisation in the developing countries of Asia. In particular, important considerations are whether China will be a large net exporter or importer, whether import demand from India will rise, and what the implications for coal trade will be from private power developments in developing Asian countries.

The key supply side uncertainty would appear to be the price level required to bring on sufficient coal production in the major coal exporting countries to meet projected demand. Differences in this assessment would seem to be a function of assumptions about future productivity gains in coal mining.

Across the selected studies, no analyst is projecting large increases in real coal prices. Most price projections to the year 2000 fall into a general consensus of continued downward pressure on real prices until the mid-1990s due to
excess coal supplies. However, by 2000, strong growth in coal demand, particularly for thermal coal, is projected to lead to some upward pressure on coal prices to encourage major coal exporting countries to invest in new mines and, to the extent required, new infrastructure (additional transport and port infrastructure will be needed in most exporting countries to meet international coal demand). At the same time, because of likely improved technology and mining efficiency, real prices are unlikely to increase significantly.

ABARE's assessment is that because of likely improved technology and mining efficiency (which lowers industry supply costs for a given production level), real prices for thermal coal in the medium term are unlikely to increase above the 1993-94 level. In contrast, metallurgical coal export prices are projected to continue falling gradually in real terms during the medium term due to prospects of a continuing oversupply.

Only five analysts covered in this survey provide projections for the longer term to 2010. Because there is little consistency in regional breakdown and coverage across those studies, a consensus view could not be formed.
COAL FORECASTS

1. Introduction

As part of the current Australian Coal Industry Council (ACIC) study of the Queensland and New South Wales coal industry, ABARE has undertaken a survey of selected projection studies of world coal demand and supply (including the demand for and supply of Australian coals) which have been prepared by leading industry analysts.

The terms of reference for the survey were to:

- review and report on the short, medium and longer term supply and demand forecasts for world thermal and coking coal trade which have been released recently by leading analysts
  - ABARE's point of view on these forecasts should be given and this view should include the projected demand and supply for Australian coal and the expected price where available;
- identify the major factors driving the forecast changes in supply and demand and the areas where the forecasts are similar or different;
- identify the areas of major uncertainty which analysts have recognised in their forecasts.

This report is structured in the following way. First the selected coal trade projection studies are reviewed in the next section, including the organisations/analysts making the projections, the coverage of the regional grouping, the projection period and the coal types projected. A consensus view of the outlook and key uncertainties are then highlighted for the short and medium term (year 2000), but not for the longer term as there is little consistency in regional breakdown and coverage across those studies. To the extent possible, reasons are identified for any large variations between the projected outcomes among the selected studies. In the final section, views on the future path of coal prices are collated.
2. Coal trade projection studies

Fifteen separate coal trade projection studies were selected in order to provide a range between analysts, regional country groupings, commodity coverage, projection periods and projection methods. The projection period of each selected projection study is presented in table 1. The commodity coverage, year published, projection year, regional country coverage and trade status for each study are provided in table 2.

The selected projections include those issued by key international public organisations including the International Energy Agency (IEA), the Energy Information Administration (EIA) of the US Department of Energy, the World Bank, and more recently, Asia-Pacific Economic Cooperation (APEC) members. Projections by Wharton Econometric Forecasting Associates (WEFA) are also reviewed, as they represent a large private forecasting agency.

Studies of the outlook for coal by individual analysts have also been included, such as those by Barlow Jonker (who also provide assessments on a private basis) and Chimura (the only study included which generates supply and demand projections from a Japanese perspective). Several other studies conducted by Japanese analysts and organisations (for example, Ministry of International Trade and Industry – MITI, and the New Energy and Industrial Technology Development Organisation – NEDO) were initially considered for inclusion, but were discounted on the basis that the projections were presented at too high a level of aggregation.

Projections issued by large trading companies and private consultancies have not been included in this review as they are not as widely available and must usually be purchased at considerable cost.

While the commodity coverage, projection year, and the regional country coverage differ between the selected studies, so do the methods and the assumptions. In some cases the methods and assumptions are not presented in detail. A variety of different types of projection methods may be used by analysts to assist them in developing coal trade forecasts. The projection method used in each study is presented in appendix A.

In their simplest form the projection methods may consist merely of a single equation estimate of the relationship between a 'dependent' variable (such as
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## COAL FORECASTS

### Projection coverage, by forecasting agency

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<td>EIA</td>
<td>S</td>
<td>1994</td>
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</table>

*a S - steam (thermal), C - coking, T - total.*
coal consumption) and a set of 'explanatory' variables (such as coal price, price of substitutes and some measure of income such as the rate of economic growth).

Other more complex models include spreadsheets of a commodity market and large, detailed econometric or spatial equilibrium models of an industry. Models used by ABARE, Wharton Econometric Forecasting Associates and the Energy Information Administration (EIA) of the US Department of Energy fall into this category. This type of model determines optimal coal trading patterns between specified demand and supply regions by maximising total consumer and producer surplus for coal, subject to specific constraints concerning transport costs, port capacity and import restrictions placed on particular countries.

The IEA uses the IEA World Energy Model as the basic analytical tool for constructing the scenarios that comprise its long term global energy outlook (IEA 1994). As coal is not the focus of this projection study and most often coal is not separately identified in the broader aggregate of 'solids', this study has not been included in our review (however, this is one of the few studies available which takes a broader global energy market outlook and for this reason would be of interest to the ACIC).

Differences in projection methods would appear to some extent to influence projected outcomes, as illustrated in appendix A.

A comparison of coal forecasts and projection studies is useful as major differences in forecast values could also be an indication that some important factor influencing the market has been overlooked in one or more of the studies. Alternatively, differences in forecast values may be a function of different underlying assumptions and differing views between analysts on the key uncertainties to the outlook, or may reflect the availability of more up-to-date information to some analysts.

**Differing information sets across studies**

In addition to differences in underlying assumptions, treatment of key uncertainties and projection methods, forecasts/projections can also differ because different information sets were used. In particular, the studies under review were made during the period 1991–94. Therefore significant developments in the world coal industry that might not have been incorporated into the earlier projections include:
COAL FORECASTS

- the sharp increase in world seaborne trade in the early 1990s;
- economic and social changes in Eastern Europe and the former Soviet Union;
- the lifting of sanctions on South African coal;
- the privatisation of coal powered electrical generation in the United Kingdom;
- the UK coal mine plan;
- developments related to the Clean Air Act in the United States; and
- rapid upward revisions of the quantity of coal available for export from Indonesia and Colombia/Venezuela.
COAL FORECASTS

3. Coal trade outlook: short term

Analysts' assessments of the short term (6–12 months) outlook for coal trade and prices are usually based on their perceptions and analysis of current information on key market variables in both the domestic and international marketplace. Most forecasts, and certainly those produced at ABARE, are 'conditional'. That is, they are conditional on a basic set of assumptions about a range of factors not directly part of the coal market. These include such things as world and regional economic growth, exchange rate movements, interest and inflation rates, and the continuance or otherwise of domestic and international policies which may have a bearing on future production, consumption and trade in coal.

Because analysts often have different information sets and the interpretation of market information varies, they can disagree on the magnitude of change for particular market variables. However, analysts usually agree on the general direction of the market in the short term.

While a variety of short term outlook papers are prepared for various national and international coal conferences, these quickly become dated. On the other hand, information contained in trade journals mainly centres on details of recent events such as particular coal tenders, contract settlements and so on, rather than presenting market outlook assessments. ABARE therefore continues to report short term outlook assessments on a quarterly basis.

Estimated world seaborne coal trade in 1993 is given in table 3.

Consensus view

All analysts of the short term prospects for the world coal market point to the considerable strengthening in the spot prices for coal since the annual Australia–Japan benchmark price negotiations earlier in 1994 which lead to falls of 8 per cent in metallurgical coal prices and 5.5 per cent in thermal coal prices in US dollar terms. Spot prices for coal have been recovering strongly over recent months due to a considerable tightening of available supplies of both thermal and metallurgical coals in the major exporting countries. However, analysts' opinions differ over the extent to which spot prices will continue to rise during the remainder of 1994 and the impact of such price rises on next year's contract price negotiations.
COAL FORECASTS

McCloskey (May 1994) gave an optimistic short term outlook for the international thermal coal market.

For the European market McCloskey argued that rapidly rising spot prices for coal, as evidenced by South African spot prices rising from around US$19.20/t fob in July 1993 to US$27.00/t fob in May 1994, would continue during 1994. He forecast that by the time contracts come up for renewal in late 1994 the spot market would be at a higher level than the 1994 contract price, the first time that spot prices were above contract prices since the mid-1980s. However, he acknowledged a possible threat to rising prices should both Poland and Russia be able to increase export volumes to Europe. A possibility he also described as unlikely.

For the Asian market, McCloskey forecast a steady recovery in spot prices, due to accelerating Indian demand, recovery in Japanese activity and power demand, and the strong likelihood of significant import demand from China, mostly from Pearl River power stations.

ABARE's assessment is also for a recovery in spot market prices, with positive implications for the next Australia–Japan benchmark price negotiations, as discussed in the following section.

### World seaborne coal trade in 1993

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<tr>
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<td></td>
<td>Mt</td>
<td>Mt</td>
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<tr>
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<td>12.1</td>
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<td>52.2</td>
<td>16.8</td>
<td>106.0</td>
<td>366.1</td>
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</tbody>
</table>

*Others* includes France, Czechoslovakia, New Zealand, North Korea, Venezuela, Vietnam and all Others.

Source: SS and Y Research Services Ltd.
COAL FORECASTS

ABARE's assessment

Spot prices for coal rising

The world thermal coal supply-demand balance tightened considerably during the first quarter of 1994 and spot prices increased.

The tighter market situation reflected reduced production in Australia, South Africa and the United States, leading to a lowering of exporters’ stocks. For example, by April 1994, Australia’s export stocks had fallen to their lowest level since August 1989. In addition, there was no major expansion in Indonesian exportable supplies over the level in the previous quarter, Colombian output was threatened by a possible strike at El Cerrejon, and Poland and the former Soviet Union continued to have difficulties meeting supply commitments in Europe.

Recent internationally quoted thermal coal spot prices of around US$28–29/t are significantly higher than the US$21/t for similar quality product quoted during the last half of 1993.

Higher spot prices for thermal coal are likely to be maintained during 1994. Spot purchases of thermal coal by the industrial sector in Asia are expected to remain firm and production increases from brownfield expansions and productivity gains in Australia and other suppliers may take six months to eventuate. A narrowing of the margin between power sector contract prices and industrial sector spot prices can therefore be expected. This situation, if maintained, would be likely to benefit thermal coal suppliers during the 1995 price negotiations with utilities. The South American thermal coal market is also expected to remain tight during much of 1994. The reduction in South American exportable supplies follow increased sales to Western Europe as a consequence of rising prices.

Spot settlements during June 1994 for metallurgical coal by SAIL (Steel Authority of India) and in contract prices between Australian exporters and Brazilian steel mills reflect a tightness in the metallurgical coal market. Higher bids by suppliers of around $2.00/t for SAIL’s June spot tender were accepted by SAIL. They also called for optional tonnages (set at 15 per cent of awarded tonnage). Negotiated prices between the Brazilian steel mills and Australian suppliers were settled in late June with only marginal price falls rather than the full flow on of the Australia–Japan benchmark prices typical of previous negotiations.
COAL FORECASTS

Coal base price negotiations

The rise in spot prices has occurred despite negotiated lower benchmark prices for coal for the 1994 Japanese fiscal year (JFY), commencing 1 April 1994, announced between Australian suppliers and Japanese buyers earlier in 1994. A fall in negotiated metallurgical coal prices of around 8 per cent was announced on 24 January 1994. Individual metallurgical coal prices in JFY 1994 were reduced by US$3.85/t for hard coals, US$3.50/t for soft coals and US$3.30/t for semisoft coals. The lower prices were caused by expectations of a significant decline in Japanese steel production during JFY 1994, the world oversupply of metallurgical coal and aggressive bidding by Canadian suppliers.

Just before the Australian settlements, Canadian suppliers of equivalent quality hard metallurgical coal (Fording River, Elkview, Luscan) negotiated similar price cuts.

In addition to price cuts, BHP Australia Coal contract tonnages of coal to Japanese steel mills were reduced by 0.9 million tonnes to 7.0 million tonnes in JFY 1994. Settlement between Japanese steel mills and other Australian metallurgical coal suppliers indicated cuts in contract tonnages of 10-20 per cent for JFY 1994.

Key thermal coal price negotiations between Chubu Electric Power Company of Japan and a team of Australian thermal coal exporters were completed on 31 March 1994. The negotiations, which had begun at the end of January, resulted in a US$2.00/t price cut to a new average price of US$34.35/t (fobt for 6700 kcal/kg) for JFY 1994. This 5.5 per cent reduction represented the fourth decline in thermal coal price in as many years. Since JFY 1990, the thermal coal base price has fallen by 16 per cent (US$6.40/t) compared with 14 per cent (US$6.35/t) for hard metallurgical coal.

Almost all of the thermal coal price and tonnage agreements settled between Japan’s major utilities and international suppliers reflected the price outcome between Australia and Japan. The notable exception was the China-Japan settlement, which preceded the Australian negotiations. Chubu and the China Coal Import Export Corporation agreed on a price cut for thermal coal of US$3.30/t, with Chinese suppliers gaining an additional 0.8-1.0 million tonnes of contracted thermal coal during JFY 1994.

While the 8 per cent reduction in negotiated metallurgical coal prices for JFY 1994 reflected the depressed conditions in the Japanese steel sector, a smaller decline was negotiated in the thermal coal price, reflecting tighter...
COAL FORECASTS

supply-demand conditions. Notably, increases in spot sale prices emerged during the negotiation period. The different reductions in coal prices have narrowed the gap between semisoft metallurgical and thermal coal to its lowest level (US$1.95/t) since JFY 1988 and, significantly, have broken the nexus, for this year at least, between thermal and metallurgical coal price outcomes.

Expectations of Japanese steel production improve

Forecasts for Japanese steel production for JFY 1994 have been markedly upgraded since the price negotiations. This reflects the prospects of recovering domestic steel demand in conjunction with stronger growth in the Japanese economy, as well as some growth in steel exports to China.

At the time of the metallurgical coal price negotiations earlier this year, the Japanese steel industry was expecting steel production to fall from 97 million tonnes in JFY 1993 to 90–92 million tonnes in JFY 1994. Instead, steel production is now expected to remain around 97 million tonnes, the third consecutive year of production under 100 million tonnes.

Australian supplies tighten

Australian coal production has not recovered strongly from setbacks early in 1994 arising from industrial unrest during February, flooding at several opencut mines in Queensland, as well as technical mining difficulties and longwall changes at mines in Queensland and New South Wales.

To meet commitments, suppliers reduced stockpiles by 14 per cent during the first quarter of 1994 to 7.5 million tonnes and to 6.9 million tonnes at the end of April, the lowest recorded since August 1989. During May, however, stocks were rebuilt slightly to 7.3 million tonnes, due mainly to a small rise in thermal coal stocks in Queensland. Stocks of medium-vol and low-vol metallurgical coals also increased slightly, whereas stocks of high-vol coals continued to fall.

As a consequence of these supply constraints, Australian exports fell by 8 per cent from February to March 1994 and total coal exports during the March quarter declined by 12 per cent from their level during the December 1993 quarter.
COAL FORECASTS

**Australian exports to rise in 1994-95**

Total Australian coal exports are forecast to rise by around 5 per cent in 1994-95 to nearly 138 million tonnes. Australian metallurgical coal exports are forecast to fall by nearly 2 per cent to just over 69 million tonnes in 1994-95, while thermal coal exports are forecast to rise to 68 million tonnes, almost 13 per cent above the estimated level in 1993-94.

The main growth in thermal coal imports will be in the Asian market, particularly Japan, in response to strong demand from coal fired electrical power stations. Indonesia, South Africa and China will continue to be Australia’s main competitors in the Asian market. South Africa, Colombia and, to a lesser extent, Poland, will be significant competitors in the smaller but important European thermal coal market.

**Australian production and consumption to rise**

Australian production is forecast to rise to nearly 192 million tonnes in 1994-95. Australian domestic black coal consumption is expected to rise only slightly, to 54 million tonnes in 1994-95, 1 million tonnes above the level in the previous year (table 4). The forecast rise reflects the increased consumption of black coal in coal fired electrical power plants.

### Australian black coal outlook

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<td>2 983</td>
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<td>2 956</td>
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</table>

COAL FORECASTS

Export earnings to decline

Despite the expected increased export volumes in 1994-95, Australia’s export revenue from coal is forecast to fall to around $6.9 billion from an estimated $7.2 billion in 1993-94. The Australian–US average exchange rate is assumed to be higher in 1994-95 than in 1993-94, reinforcing the impact of the lower contract prices for Australian coal.
COAL FORECASTS

4. Coal trade outlook: medium term

Consensus view: coal import demand

While the assumptions, projection methods and regional coverage differ between the selected studies (see table 2), a consensus view can be formed of the outlook for world coal trade during the medium term (to the year 2000).

There is general agreement between analysts that total and seaborne hard coal trade will rise significantly by the year 2000. This will be totally driven by the increased volumes of thermal coal trade resulting mainly from the forecast increased demand for coal fired electrical power in Asia and reduced indigenous coal production in Europe. At the same time coking coal trade is projected to remain stagnant or decline slightly as little or no growth is expected in blast furnace steel production in coal importing countries and as PCI technology is more widely employed. There is also a consensus that coal prices will not rise significantly in real terms.

Based on the selected studies, total world trade in black coal is expected to rise at an average annual rate of around 4.5 per cent. As a result world imports in the medium term are projected to range between 470 million tonnes (WEFA 1993) and 530 million tonnes (EIA 1993) (table 5).

Although ABARE's coal trade projections appear to be conservative compared with those of other analysts, it should be noted that these projections relate to seaborne trade and not total world trade, the measure most frequently projected by other analysts. For the period 1990–93, the ratio of seaborne trade to total world trade has been 0.9. On this basis, ABARE's projection of world seaborne trade of 480 million tonnes would equate to total world trade of around 533 million tonnes.

It is also generally accepted that Asia will be the major coal importing region, with Japan the major single importing country. Asian coal imports are projected to rise from around 200 million tonnes in 1993 to 210–270 million tonnes, compared with European imports of 190–250 million tonnes (130 million tonnes in 1993). The difference in growth is due, in part, to different trends in demand for thermal and coking coal in the two regions as discussed below.
COAL FORECASTS

Thermal coal

All analysts agree that, over the medium term, growth in world trade will be driven by thermal coal trade, while metallurgical coal trade will at best be stagnant or slowly declining. Imports of thermal coal are projected to rise from their present estimated level of 200 million tonnes (1993) to a projected

5 Projections of total coal trade to the year 2000

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a Seaborne trade. b Coal equivalent. c Current and potential supply capacity. d To Asian destinations.
COAL FORECASTS

average of 340 million tonnes (320–366 million tonnes) in the year 2000 (table 6). This represents an average annual growth of 9–12 per cent.

The expected strong growth in Asia reflects this region’s projected high growth in demand for electrical power together with an increase in demand for coal from industrial sectors. While the development of additional coal fired

6 Projections of thermal coal trade to the year 2000

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<td>EIA 1994</td>
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<td>142.0</td>
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</tbody>
</table>

- a Seaborne trade. b Coal equivalent. c Current and potential supply capacity. d To Asian destinations.
COAL FORECASTS

electricity capacity in Asia (notably in Japan and the newly industrialised coal importing countries) over the medium term is well documented, the projections of Asian thermal coal imports still vary between 145 million tonnes (EIA 1991) and 185 million tonnes (APEC 1992). The variation in projected trade reflects in part the use of different economic growth rates, different expectations in various studies about the development of coal fired power capacity and the degree of competition between various sources of energy. The projections also vary because of the different assumptions on the effect and timing of environmental policies and regulations.

In Europe, where thermal coal imports are projected to range between 140 and 200 million tonnes in the year 2000 (around 80 million tonnes in 1993), additional new electricity capacity will only account for a small increase in the import demand for thermal coal. European coal output is expected to decline in response to regulations constraining the burning of fossil fuels and because most domestic production is of high cost relative to current and expected international coal prices and consequently is uncompetitive compared with imported coal.

European coal imports are expected to rise but not to the same extent as the falls in indigenous coal output. While analysts agree on the general outlook for European thermal coal trade, their projections of import volumes vary more than those for Asia (a range of 60 million tonnes for Europe compared with a range of 40 million tonnes for Asia). The greater range of projections for Europe reflect uncertainty about the timing and extent of changes to subsidies and other aspects of national coal policies and consequent changes in domestic production.

Metallurgical coal

Overall, little change is projected in the world coking coal supply-demand situation in the medium term. Analysts are expecting world coking coal imports to decline because of the expected stagnant level of blast furnace steel production in coal importing countries and the increasing use of PCI technology (table 7).

Despite its growing importance in the medium term, only one analyst (Barlow Jonker) has made separate projections of import demand for PCI coal and coal for coke making. However, according to all analysts Asia will remain the main coking coal importing region due to the level of demand from blast furnace steel producers in Japan and newly industrialised countries. Imports in the region are projected to range between 60 million tonnes and 115 million
COAL FORECASTS

tonnes, compared with imports of around 97 million tonnes in 1993. A
projected decline in blast furnace steel production as a result of competition
from other steel producing technologies is expected to restrict European
coking coal imports to an average projected level of around 50 million tonnes.

ABARE's assessment of prospects for coal demand during the medium term
readily reflect the consensus view. Key extracts from the most recently
released ABARE assessment of the medium term coal trade outlook are
provided in appendix B.

7 Projections of coking coal trade to the year 2000

<table>
<thead>
<tr>
<th>Year published</th>
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<td>155.5</td>
</tr>
</tbody>
</table>

a Seaborne trade. b Coal equivalent. c Current and potential supply capacity. d To Asian destinations.
COAL FORECASTS

Coal supply and exports

Analysts generally agree that over the medium term exports from Indonesian and South American suppliers will rise and that some recovery will occur in export volumes from the former Soviet Union and Poland during the medium term. There is also general agreement that Australia, the United States and South Africa will remain the major exporters in the medium term. Canadian exporters are projected to expand slightly while the level of coal shipments from China remains uncertain.

Reflecting Australia's strong comparative advantage in exports to the Asian market, all analysts project that Australia will remain the overall major supplier of coal to the world market in the medium term. Specifically for metallurgical coal, analysts generally agree that Australia, the United States and Canada will be the major coking coal suppliers in the medium term, with China a minor supplier to Asian markets and the former Soviet Union and Poland minor suppliers to Europe. In the medium term Australia and South Africa are projected to be the major suppliers of PCI coal to blast furnace steel producers.

While there is consensus on the above issues there is also a considerable range in projected export volumes and market shares of the major exporters in world coal trade (tables 4–6). Market shares not only reflect the supply costs of exporters, but are also influenced by coal quality issues and port capacity constraints, as well as the supply diversification policies of the major importing countries.

The range of projected market shares for major exporters in the thermal and metallurgical coal markets are presented in figures A and B respectively. A feature of the projection studies is that frequently insufficient information is presented to ascertain the precise cost factors (such as mine costs, internal transport costs, port handling costs, comparative ocean freight rates) leading to the relative position of major exporters in key markets.

The EIA studies for 1991 and 1993 would be the exception, where considerable information is presented on the supply costs of competing exporters to the European and Asian markets. For instance, the EIA in 1991 expected US coal to be the most expensive in both European and Asian markets, that Australia was a low cost supplier to Asia, but that in the European market, Australia's cost advantage over other European suppliers was so thin that major investments in port capacity dedicated to European markets were judged too risky. That is, even though significant detail on supply costs was included in the International Coal Trade Model (ICTM), projected trade
COAL FORECASTS

Patterns appeared to be more determined by the impact of a binding port capacity constraint for Australia and South Africa, with the United States gaining the remainder of world trade, despite its higher supply costs.

This pattern seems to remain true in the most recently available projections from the EIA (1994), although a new coal trade model was used to generate these forecasts. Far less information is presented on the results and assumptions underlying the new coal market linear program model (see discussion in appendix A).

---

A. Projected market shares in the world steam coal market in the year 2000

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>United States</th>
<th>South Africa</th>
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<td>Chimura</td>
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</tr>
<tr>
<td>1993 actual</td>
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B. Projected market shares in the world metallurgical coal market in the year 2000

<table>
<thead>
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<th>Australia</th>
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<td>1993 actual</td>
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<td>5%</td>
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</tbody>
</table>
COAL FORECASTS

ABARE, in its modelling framework (the World Coal Trade Expert System—WOCTES), also incorporates a description of the supply costs of major world exporters of thermal coal (fob costs are represented by a linear mining cost function, plus estimates of transport costs and port charges). However, the specific parameters have not been explicitly identified in published output—rather, general statements have been made on the relative competitiveness of the major exporting countries.

For instance, in ABARE's most recent medium term outlook presented at the OUTLOOK 94 conference, Australia's dominant position in the Asian thermal coal market is argued to be the result of a comparative advantage, arising among other things from: its proximity and resulting freight advantage over many other world suppliers; the quality of the thermal coal supplied (low sulphur, low ash, low moisture); the competitively priced product; and the exporters' ability to supply a product consistent with specifications and on a regular basis. The growth in Australia's capacity to supply thermal coal will result from increased production from incremental expansions at existing mines, new mine development and productivity gains.

At the same time, ABARE argues that the low mining costs of Indonesian coal, together with its close proximity to the Asian market, make Indonesia a strong competitor with Australia in thermal coal trade. This is despite a number of coal quality characteristics, notably a high moisture content and a low Hardgrove grindability index, which currently make Indonesia's thermal coal less desirable in the higher premium power utility market. In the longer term, however, Indonesian coal is expected to become more competitive as most Asian countries adopt new boiler technology in coal fired power generation which allows for the use of coal with a wider range of quality characteristics.

ABARE's assessment

Thermal coal trade

ABARE has projected Australian medium term thermal coal exports at 110 million tonnes (58 million tonnes in 1993) compared with the United States 36 million tonnes (20 million tonnes), South Africa 57 million tonnes (46 million tonnes), Indonesia 31 million tonnes (12 million tonnes) and 'others' 90 million tonnes (67 million tonnes). Underlying reasons for these projections include the projected ability of the Australian industry to supply much larger volumes of high quality, competitively priced, coal to the Asian market.
COAL FORECASTS

ABARE’s assessment is that there is large scope for new production capacity in Australia, with existing and potential thermal coal producers already committed to projects which have the potential to increase output by around 17.5 million tonnes (Roarty et al. 1994). Also, an additional 7 million tonnes of thermal coal production capacity, mainly in New South Wales, is ‘near commitment’. Prospects for an additional 40 million tonnes of new thermal coal development exist, but the ultimate decision to undertake full scale development depends on expected market conditions and often on the ability to secure contracts to cover the majority of mine production.

Planned expansions in Australia’s transport and port infrastructure by the end of the decade will be adequate to handle the projected increase in coal exports (see appendix B for details). At the same time Australia is expected to be a residual supplier to the European market, with market share unlikely to increase, reflecting our freight disadvantage relative to higher cost, but geographically closer, producers such as the United States.

ABARE projects a declining market share for the United States in thermal coal trade. This reflects the assumption of relatively higher fob supply costs for US coal. However, although a relatively high cost producer, the United States has a freight advantage over many other suppliers to the European market, and if prices rise, the US coal industry can increase exports quickly by employing excess capacity at mines, rail lines, river barge routes and at ports. Prospects for the United States in the Asian market depend on the success or otherwise of the port of Los Angeles Export Terminal project. If fully developed, this port facility would allow the export of up to 6 million tonnes of coal a year to Asia.

For South Africa, ABARE’s assessment, consistent with many other analysts, is that port capacity constraints will be an issue in the medium term which will restrict total exports from South Africa to around 60 million tonnes. The proposed 12 million tonne a year capacity expansion at the Richard’s Bay Coal Terminal is unlikely to be commissioned before 2000 at current prices for coal.

Among the new suppliers, Indonesia is expected to increase its export volumes of thermal coal significantly over the medium term, due to its low mining costs and close proximity to the Asian market. However, the level of Indonesian coal exports will depend on additional investments in mine expansions and port infrastructure. Growth in domestic demand for coal to fuel the power generation sector could constrain the exportable coal surplus. Indonesia’s potential coal exports volume is seen by ABARE as a key uncertainty for the longer term outlook and will be discussed in more detail later in the paper.
COAL FORECASTS

China's potential net coal trade is also viewed as a key uncertainty and will be discussed later. Colombia and Venezuela are expected to increase their European exports of high volatile, low sulphur coals due to the high level of public and private investment in expansion of the mining and, particularly, port infrastructure. The former Soviet Union and Poland are expected to remain minor suppliers of coal, reflecting structural problems in their coal producing sectors.

Metallurgical coal trade

ABARE's assessment is that Australia (with a share of 40 per cent), the United States (32 per cent) and Canada (16 per cent) will remain the major metallurgical coal exporters to all world destinations in the medium term. These exporters, and to a lesser extent China, will be the major suppliers of metallurgical coal to Asian importers. Although world trade is projected to decline in the future, Australia has the potential to significantly increase its exportable supplies of metallurgical coal, with increased production from existing mines and development of new mines, such as Gordonstone and North Goonyella. In Asia, Australia is expected to gain some market share from Canada because Canada currently has a relatively weak marketing position as a result of high coal export costs and the long term effects of recent uncharacteristic industrial disturbances.

The cost disadvantages of some Canadian producers are caused by the geological conditions of the coalfields, the long rail transport distances to export ports, and the expected slow decline in demand for high quality coking coals. The latter is related to the shift to a larger percentage of cheaper soft coking coals and PCI in steelmaking, which has reduced the premiums for high quality coking coals.

However, Canada will continue to be an important supplier of metallurgical coal to the Japanese market in the medium term because of its substantial reserves, modern infrastructure, stable supplies, Japanese investment in the industry and the Japanese steel mills' supply diversification policy.

In the European metallurgical coal trade ABARE projects that the United States and Australia will continue to be the major suppliers of hard quality metallurgical coal. Poland and the former Soviet Union will continue as small suppliers. Although total US exports are projected to decline slightly, the United States is not projected to lose market share because of the availability of suitable export quality coals and its proximity to the market.
COAL FORECASTS

Despite significant transport costs due to the long shipping route to the European market, Australia will be able to maintain its supplies of hard metallurgical coal to Europe in the medium term through the development of new mines, such as Gordonstone and North Goonyella.

Poland and the former Soviet Union will remain small suppliers of metallurgical coal to the European market but are unlikely to expand market share in the medium term. In Poland, the closing of uneconomic mines, increasing labour costs and difficulties in operating deep mines, will result in limited exportable supplies. Metallurgical coal exports from the former Soviet Union to Europe in the medium term will also be limited, due to the likely slow recovery from recent political and industrial turmoil, poor mining productivity and inadequate rail and port facilities.

Also, Australia and South Africa are projected to be the main suppliers of PCI coals in Europe in the medium term.
COAL FORECASTS

5. Major assumptions and uncertainties in the medium term outlook

Demand side uncertainties

Major uncertainties can be conveniently grouped into two broad categories. The first is uncertainty about the key factors influencing coal demand, for which analysts make conditional assumptions in preparing their projections. The second group includes those issues which could have a marked impact on the outlook, such as climate change and coal technology. Analysts choose particular scenarios and provide an assessment of the implications for their outlook.

Major assumptions

To a significant degree, differences between projected coal trade patterns are caused by different assumptions made by analysts about the key factors influencing coal demand. Key variables for which analysts make conditional assumptions are:

- rates of economic growth;
- the level of alternative energy prices during the projection period; and
- the extent of interfuel competition, particularly in the electricity generation sector.

Changes in assumptions about these factors cause revisions to the projected growth in demand for coal in the major end use sectors. Most often, however, analysts do not present the key assumptions underlying their projections. Across the selected studies there appear to be two main areas of consistency in underlying assumptions. First, most analysts appear to have assumed strong economic growth in Asia as reflected in the general view that growth in thermal coal demand will be strong in Asia. The second area is an apparent consensus about there being little change in the relative fuel prices to the year 2000, with little consequent fuel switching attributable to relative price movements.

IEA Coal Research (1993) projects a substantial increase in natural gas’s share of electricity production in the European Union by 2000 (180 per cent of the 1990 level). They argue that environmental, technological and cost advantages
COAL FORECASTS

(natural gas is presently competitive against coal in planned new plants) have been important factors in gas firing being preferred over coal use in new power stations in Europe, as well as the expansion and integration of the natural gas pipeline network. However, in the view of IEA Coal Research (1993), natural gas prices are likely to rise relative to coal prices over the medium to longer term, reflecting differences in the availability and cost of new resources.

For Asia, many analysts argue that there will be limited substitution from coal to gas in those countries where governments have policies to promote the use of thermal coal for electricity generation because of large domestic reserves (China and India in particular). Natural gas will, however, compete to some extent with coal in Japan, Korea, Thailand and Indonesia.

Key uncertainties

Key uncertainties most often identified in the studies are:
- the level of indigenous coal supply (policy driven);
- environmental factors and government policy, especially concerning climate change policy responses;
- coal technology development;
- possible difficulties in raising funds for power sector investment;
- energy market liberalisation in the developing countries of Asia; and
- the potential of the new coal exporters, particularly Indonesia.

Indigenous coal supply

Several analysts identify the level of indigenous coal production, particularly in Europe, as a major uncertainty for their medium term projections. This is because the pace and extent of withdrawal of coal subsidies are uncertain as is the consequence of subsidy withdrawal on the wider energy market.

The relative importance of assumptions on key market variables differs across Asia and Europe. For thermal coal, the uncertainties appear to be greater in Europe than in Asia. A large range of outcomes for European import demand is possible from the interaction of uncertainties about electricity demand growth, potential for interfuel competition as well as the level of indigenous coal supply, particularly in Germany and the United Kingdom. In short, the outcome will be based as much on political as on economic considerations. Such a difference in the level of uncertainty between Asia and Europe is corroborated by considering the clear disparity in the range of projected demand levels for thermal coal by the year 2000 between Europe and Asia.
This would also appear to be the case for metallurgical coal trade. Although projected import demand for metallurgical coal in both Asia and Europe would be conditional on assumptions about PCI injection rates, variations between studies on the volume of metallurgical coal imported by European countries reflect uncertainties over the extent and pace of falls in indigenous coal production as well as differing expectations about EU steel production capacity and the rate of increase in use of PCI.

Environmental factors
Most analysts recognise environmental pressures and possible policy responses, particularly on greenhouse gas emissions, as substantial threats to their coal demand outlook. However, there would appear to be a tendency for analysts to assume that policies on greenhouse gas emissions will not be implemented before 2000. Those analysts who do suggest the possibility of the implementation of policies before 2000, such as carbon or energy taxes in OECD countries, do no more than note this would constrain coal use in some countries as against the projections provided.

Most analysts assume that Asian governments will not alter their plans for future coal use because of concern about coal's contribution to greenhouse gas emissions, as in most cases there are no alternatives to coal. However, the East-West Center (1994) notes that all Asian economies would substantially reduce those emissions that are controllable with existing technologies (particularly, $\text{SO}_2$ and $\text{NO}_x$), but that only Japan had plans to significantly reduce $\text{CO}_2$ emissions.

For Europe, IEA Coal Research (1993) notes that environmental pressures are already causing revisions to coal fired power station programs. Siting of new coal fired power stations has become highly contentious. Planned installations have been cancelled or switched to other fuels in a number of countries, including Belgium, Germany, Italy and the Netherlands. IEA Coal Research (1993) also notes that the threatened implementation of carbon taxes or direct legislative constraints has already persuaded coal users to switch from coal use to natural gas or multifiring in planned capacity.

EIA (1991) noted that their base case projections were developed prior to the development of some of the initiatives on greenhouse emissions and other emissions from coal burning. Therefore, no account was taken of the potential reduction in coal demand that could result from a full implementation of such measures.

In their more recent study, EIA (1994) explicitly incorporates constraints to the US coal market on $\text{SO}_2$ emissions, given the application of the US Clean
COAL FORECASTS

Air Act. In particular, an electricity market submodel determines the most economical electricity power generation technology and fuel for the United States from the entire range of fossil, nuclear and renewable fuel technologies. The model also determines the optimal mix of coals of different sulphur contents based on regulatory and technological costs. The SO2 content of imported coal is also incorporated into the solution.

ABARE also explicitly recognises that the major uncertainty affecting the demand for coal in the longer term is the extent to which policies are adopted (both national and global) to implement environmental regulations related to the discharge of airborne pollutants and solid wastes from power plants. Of particular concern to coal fired plants are the levels of emission of oxides of sulphur (SOx) and nitrogen (NOx), which are precursors to acid rain, and of carbon dioxide (CO2), which is the principal greenhouse gas. In addition, the disposal from power plants of ash containing hazardous elements and of the residual products from SOx and NOx control equipment have also become environmental issues for coal fired plants.

ABARE has attempted to partially illustrate the potential impacts of environmental policies on coal demand and growth in coal trade by considering the Clean Air Act in the United States and, more importantly, ABARE is currently investigating possible coal trade impacts of greenhouse gas emission reduction targets under the Framework Convention on Climate Change, which arose out of the United Nations Conference on the Environment and Development held in Rio de Janeiro in mid-1992.

The US Clean Air Act: ABARE's assessment
This Act, as amended in 1990, requires utilities in the United States to reduce sulphur dioxide (SO2) emissions by the year 2000 to half of the 1980 level. The policy was implemented to reduce acid rain. Key options available to electricity utilities to reduce emissions include: flue gas desulphurisation units (which chemically capture SO2 emissions after combustion); switching to coal with lower sulphur content; installing plants which use natural gas (which emit less SO2 per unit of energy); introducing advanced clean coal technologies (these technologies are at present only in the early stages of development); or transferring or purchasing excess SO2 emission allowances.

ABARE research (Thorpe, Hogan and Beil 1992) using a programming model of coal fired electricity generation and coal supply in the United States indicated that switching to low sulphur coal was likely to be an important method by which electricity utilities reduce SO2 emissions during the 1990s. However, this option is expected to become less important as electricity utilities invest progressively more in plant with flue gas desulphurisation units.
COAL FORECASTS

post-2000. With increased demand for low sulphur coal during the 1990s the price of US low sulphur coal is likely to increase relative to high sulphur coal. Imports of low sulphur coal are also likely to increase. These two factors together would have a positive impact on Australian coal exports and exports by other suppliers of low sulphur coal. However, the magnitude of any price premium would be constrained by the possibility of utilities switching into alternative energy sources and increased exports of low sulphur coal from the United States. The EIA (1994) projects increased demand for (and production of) low sulphur coal in the United States during the medium and longer terms.

The effects of technological change: ABARE's assessment
ABARE also takes technological change in coal use explicitly into account in preparing its demand forecasts. The following exposition explains the basis on which this is accomplished and provides some examples of the more important changes.

Because of the multiple influences on coal demand and the uncertainties inherent in forecasting, the relatively small demand effects arising from ongoing incremental technological change are not explicitly taken into account. For example, the coal demand effects of progressive efficiency improvements in conventional pulverised coal fired (PCF) power generation technology over the medium term (through retro-fitting of existing power stations and construction of new plants with state-of-the-art PCF technology) are not explicitly factored into ABARE's projection method at this stage. However, the projection method explicitly takes into account technological change which results in large structural changes in demand. Some examples are provided below.

- **The coking coal market**
The adoption of pulverised coal injection (PCI) technology in blast furnaces has led, and is continuing to lead, to major changes in both the quantity and the quality of coking coal demand. This development has been researched by ABARE (Dwyer and Muir 1992; Labson et al. 1994) and incorporated into our projection method for coking coal.

PCI technology allows for the substitution of relatively low cost and abundant semisoft coals for higher cost hard coking coals in the production of blast furnace pig iron. More importantly, the use of PCI decreases the demand for coal in aggregate, since PCI represents a more efficient use of coal (by volume) in the blast furnace. Depending on the installed blast furnace and its management, the replacement ratio of injected coal to coking coal can be as high as 0.8 to 1.0. However, 1 kg of coke, and so 1.4 kg of coking coal, can
**COAL FORECASTS**

be replaced by 1 kg of PCI coal when it is injected with hot air into the base of the blast furnace.

As steelmakers increase coal injection rates to a practical working level of around 150–200 kg per tonne of hot metal output, the demand for lower quality coking coal will rise at the expense of high quality coking coal. Australia has large supplies of both semisoft and higher quality coking coals, and is well placed to accommodate the changing demand for coking coals in major importing countries, especially in North Asia.

PCI presently represents only a small proportion of world blast furnace consumption of coal (14 million tonnes of PCI coal as against 400 million tonnes of coking coal consumed in steelmaking worldwide) because the technology has only recently been adopted on a large scale commercial basis.

Of significance to Australia, the Japanese steel industry is a world leader in PCI technology and by the end of 1994 all of the 28 operational blast furnaces in Japan will be fitted with PCI technology, although most plants had PCI technology fitted by 1991. On average, the Japanese steel industry injected pulverised coal at a rate of 87.5 kg per tonne of hot metal. This injection rate compares to a maximum possible rate of 150 kg per tonne of hot metal given present technology. This rate is likely to be reached on average in Japanese steel mills by 2000, although the actual rate will be sensitive to the relative prices of coke to PCI coal.

The electric arc method of steelmaking has become an increasingly important means of bypassing the blast furnace altogether over the past three decades. Electric arc furnaces melt scrap steel into usable metal. ABARE research (Labson et al. 1994) using a statistical model of technological adoption, suggests that continued growth in electric arc furnace production will result in this sector accounting for roughly 31 per cent of total steel production by the year 2000, compared with 28.8 per cent in 1992. This relatively minor growth on its own is not likely to have a large impact on demand for coming coal during this period. However, new developments in steel casting techniques, if proved commercially viable, coupled with electric arc furnaces, may significantly increase the share of electric arc furnaces in steelmaking.

New, direct reduction iron smelting methods are being researched and could have a large impact on demand for coking and PCI coals in the long term (Labson et al. 1994). Such new steelmaking technology can operate at a smaller scale than blast furnaces and can also reduce or eliminate the need for raw materials, including coking coal (although the demand for an energy source remains). However, the commercial viability of such technology
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remains uncertain and, accordingly, it is not expected to have a significant impact on the steel and coal industries until late next decade, beyond our forecasting period.

- Thermal coal market
An important example of technological change affecting thermal coal demand is the aircraft industry-driven development of gas turbine technology, which has facilitated fuel switching in the power sector. Since the mid-1980s this technology, together with high efficiency combined cycle (gas cycle combined with steam turbine use of gas turbine exhaust heat) arrangements, has made possible the introduction of large increments of base-load gas fired power generation capacity in Asian and European markets at the expense of thermal coal and other fuels. Previously, gas turbines had been used only for peak load capacity.

However, there are major constraints on the extensive penetration of this technology. These include the uneven distribution of natural gas reserves, the high capital cost of transporting natural gas (by pipeline or as LNG) over long distances and the prospect of gas prices increasing substantially in response to increased demand. ABARE takes these factors and countries’ power station construction plans into account in developing its estimates of future changes in coal demand from the power sector.

The only efficiency oriented technological change of a structural kind in prospect in the thermal coal market is the commercialisation of the emerging advanced clean coal technologies such as integrated coal gasification combined cycle (IGCC) and pressurised fluidised bed combustion (PFBC). These will be the first coal fired technologies to transcend the thermal efficiency limits of the steam cycle, which has been used since the advent of electricity generation (Bharucha and Singh 1993; IEA 1992).

The market entry of the advanced technologies will be a development of considerable significance for coal suppliers. Experts anticipate that these advanced technologies will reduce coal requirements for a given power output by about 15–20 per cent relative to PCF with flue gas desulphurisation. They will also provide more cost-effective means for pollutant removal and may thus reduce the comparative advantage enjoyed by low sulphur coals. Moreover, they are likely to have other coal quality sensitivities which are different from those of PCF boilers, which would have further implications for coal suppliers. For example, IGCC is likely to be better able to accept low volatile coals, which are widespread in Australia.
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Finally, the approaching prospect of IGCC commercialisation may encourage utilities to install gas fired combined cycle rather than PCF in advance of their commercialisation, as gas fired combined cycle units could in principle be converted to IGCC plants subsequently — that is, the same technology could produce opposite effects on coal demand in different timeframes.

However, IGCC and PFBC are not expected to be commercially demonstrated until beyond the end of the century, and are therefore unlikely to start entering the market (in Japan, the United States and Europe) at a significant rate before the middle of the next decade. (These technologies have been forecast to achieve a market share not exceeding 3 per cent of the approximately 120 GW of new coal based world capacity coming on stream by the year 2000 (APEC 1992). This penetration will, however, essentially be achieved through demonstration/precommercial plants rather than the first wave of commercial technology). ABARE is keeping a watching brief on technical and commercial developments and their effects will be incorporated into ABARE projections once that becomes appropriate.

Another technological development of potential significance for traded coal in the medium to longer term is improvement in the thermal efficiency of the power generation capital stock in developing countries, particularly in the Asia Pacific region. This is likely to be part of a complex dynamic process with contradictory effects on traded coal. It is possible, for example, that the market liberalisation process currently under way in many of these economies could simultaneously:

- open these markets to international coal trade (both imports and exports);
- allow the accelerated transfer of more efficient PCF technology, thus reducing coal demand per unit of end use energy demand;
- introduce pricing regimes which increase the value of these technologies (as well as producing demand moderating effects); and
- increase coal demand through an increased rate of economic development.

At the moment the potential for, and net effects of these developments, which are likely to be driven in part by strengthened environmental considerations, are difficult to read and are unlikely to have significant market demand effects for Australian coal until into the next century. However ABARE judges them to be potentially important and is devoting significant research resources to understanding them better.
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Energy market liberalisation: ABARE’s assessment
ABARE’s judgment is that there is considerable uncertainty about possible consequences for coal markets arising from energy market liberalisation in the developing countries of Asia. China and India account for the overwhelming proportion of coal consumption in the developing countries of Asia and also account for the bulk of the planned additions to coal fired power generating capacity. However, these two countries and most ASEAN countries have historically attached great importance to self-reliance in energy supplies, in part for balance of payments reasons. This has effectively ensured that indigenous supplies of coal and other fuels are used and coal imports have consequently been minimised or prohibited.

The requirements of rapid economic development in recent years have created major pressures for liberalisation of energy markets to allow competition and undistorted (chiefly higher) energy prices. In such a price environment, resources, especially private capital, are more likely to be attracted to the energy sector to raise output and to fund transport and power generation infrastructure. Higher energy prices would also provide disincentives to the inefficient consumption of energy. Price reform may also help governments attain environmental goals by encouraging energy conservation.

The prospects of accelerated liberalisation of the energy sectors in developing Asian countries can be illustrated, first, by an analysis of the implications of the extension to Asian countries of a worldwide trend toward private financing of power stations and, second, by examining the deregulation of China’s large coal economy, which has already started. The outcome in China may well be important in itself and foreshadow a trend to liberalisation elsewhere in Asia.

• Private power
The World Bank has estimated the capital requirement to fund planned power generation expansions in developing countries during the 1990s at US$1 trillion (Malhotra 1991). However, government owned utilities in developing Asian countries are experiencing difficulties in financing their substantial power generation projects through traditional means. There is a shortage of government funds and the availability of concessionary loans from the major bilateral and multilateral lending institutions, such as the World Bank and the Asian Development Bank, can only meet a small proportion of total requirements.

Resolving this power sector financing shortfall has therefore become crucial to the maintenance of the economic development momentum in the rapidly developing countries. Because of this imperative, many of the governments in the region are seeking to mobilise the only other possible source of finance.
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— private capital. However, this will not in general be possible without sector reform because of pricing, investment and regulatory policies, and inefficient operating and maintenance practices characteristic of the power sector (Churchill 1992; Glen 1992; Malhotra 1991). This has led to a rate of return in the power generation sector which has not been sufficient to attract private debt or equity investment.

The most common method for mobilising capital is to invite private companies to form consortiums to invest in Build–Own–Operate/Transfer (BOO/T) power stations. Private companies are invited to construct, finance and run power plant and, possibly, to transfer the plant to the government after a specified time. The private plants would be linked directly to the national grid in each country and the government utilities would purchase electricity on the basis of long term contracts which provide an adequate rate of return on capital, including compensation for risk. An attraction of the BOO/T approach is that it ensures the economically and technically efficient management of a station and its relative insulation from political pressures.

Very few private power projects have yet been established. This is because of the novelty of the concept, the substantial contractual complexities in establishing a BOO/T station, and the political sensitivities created by the significantly higher electricity prices required to generate an economic rate of return. A large part of the contractual complexity arises from differences in legal systems and coverage of sovereign risk. These difficulties can be illustrated by the case of the 1200 MW coal fired Paiton BOO/T project in Indonesia, where negotiations have taken around three years (Millsteed, Jolly and Stuart 1993). Final settlement of the power purchase agreement with the government occurred in February 1994.

Asian private power stations are likely to create an important new demand for traded coal. To ensure an adequate rate of return and because the price for electricity will also depend on the size of the initial capital investment, private power investors will tend to favour stations fuelled by natural gas, as gas fired stations have the lowest capital costs and the shortest construction time. However, natural gas reserves are limited in Asia and there is not a well developed infrastructure for gas supply and transmission. Consequently, around 45 GW of private coal power stations are presently proposed for commissioning in Asia between 1993 and 2000, compared with only 15 GW of gas fired stations (Doyle 1993).

More importantly, however, many consortiums intending to use coal are likely to import coal in preference to using indigenous coal in order to reduce fuel supply risks. If local suppliers cannot absolutely guarantee both supply and
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quality, then coal will be imported instead, most probably under long term contract. However, coal suppliers are likely to have to develop new types of relationships with the customer to capture these opportunities (Churchill 1992; Hellicar 1992).

In particular, coal producers may have to enter consortiums with private power joint venturers. For example, the Australian producer Coal and Allied Industries Ltd is negotiating to become the coal supplier to a BOO/T consortium in Sri Lanka for a fifteen year period, with potential sales amounting to 11 million tonnes. This strategy would effectively create a market for coal that otherwise might not have developed.

The bulk of private power proposals are in China and India as these two very large economies have the largest planned increase in power generating capacity (private power capacity of 35 GW and 19.5 GW respectively are planned by the year 2000) and large coal reserves.

In India, the bulk of private power generators are expected to enter into long term coal supply contracts with Coal India Limited, the main coal producer. Importing coal is only likely to be an option for private power projects in the south of the country, where coal must be transported long distances from mines (over 1000 km) and where problems with unreliable supply and quality are most acute. Indian state governments have been arguing for a reduction in the import duty on coal to ensure that the private power projects proceed (Doyle 1993).

China has the largest planned reliance on private power stations. It was the first country to successfully commission such a power station (the Shajiao B – 700 MW) in 1989 and a second (Shajiao C) is under construction. The planned heavy reliance on private power, together with the reform of support to its coal mining sector, creates a high probability of some coal imports during the longer term.

Elsewhere in Asia, countries such as Pakistan, Thailand, Malaysia and the Philippines are either considering or implementing the use of imported coal for power generation.

These markets will be small relative to others in Asia, but may provide important opportunities for Australian coal companies. ABARE is continuing its research into the consequences of private power projects for world coal trade.
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- Coal market liberalisation in China

China is liberalising its enormous coal industry in a bid to increase production and improve the efficiency of the sector, in part to meet ambitious long term electricity generation plans. The government plans for an additional 70 GW of coal fired power generating capacity to be installed by the end of the decade, accounting for around half of the growth in Asian coal fired capacity (Doyle 1993).

The plan, implemented in January 1992, is intended to facilitate a rise in coal production from 1.1 billion tonnes in 1992 to 1.4 billion tonnes by 2000. Key elements of the plan are the deregulation of coal prices and the elimination of coal subsidies. Liberalisation will therefore substantially increase China's domestic coal prices to world levels (Peng 1992). Higher prices would encourage expansion by low cost producers. The productive capacity of the industry is to be boosted by the government establishing 100 new, highly productive, low cost mines to replace inefficient, high cost mines. Surplus labour will be transferred to coal processing and service industries.

At the same time, higher prices will create pressures to economise on coal consumption. The government also places emphasis on a more concentrated use of coal. Presently about two-thirds of coal is consumed among millions of small scale users. Even so, demand is likely to continue to increase and there remains significant uncertainty about whether liberalisation of the coal sector will ensure that production is increased sufficiently to meet domestic demand. A substantial injection of funds is required in the coal mining and transport sector to meet the production and supply targets.

Resolving the transport constraint will be critical. Coal must be transported long distances by rail (and by sea) from the central north to the areas of biggest demand in South and East China. Meeting the considerable growth in coal demand implies large investment in both port and railroad developments. Some analysts expect that there is little chance of the Chinese government meeting its production and infrastructure goals (Marcum 1993).

Consequently, power stations and users in the industrial sector of the coastal regions in the southern ‘special’ zones are likely to have to import coal to meet part of their needs. Guangdong province, in particular, is likely to import significant quantities of coal due to this export oriented region’s high valuation of supply security and quality control. However, given the vast scale of coal production and consumption in China, a small percentage difference in the extent to which local production falls short of demand can result in a large import volume. Conceivably, coal imports by China could increase to as high as 50 million tonnes by the year 2000.
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Supply side uncertainties

As discussed earlier in this paper, differences in the market shares of the key coal exporters reflect different descriptions of coal supply costs for each exporter, possible port constraints, as well as differing assumptions regarding the supply diversification goals of the major importing countries. A key uncertainty therefore is the relative competitiveness of the major exporters.

A related uncertainty is that of the price level needed to bring on sufficient coal production in Australia (and other major coal exporters) to meet the rapidly growing demand for imported thermal coal during the medium term. Several of the selected studies explicitly address this question; however, there is considerable disagreement, as discussed below.

Differences in the selected studies seem to be a function of assumptions made on the potential for future productivity gains in coal mining to lower fob supply costs for the major exporters.

Barnett (1994) argues that contract prices need to be restored to their 1993 levels to achieve an Australian coal export level of 170 million tonnes (implying that many prospective mines cannot cover full fob costs at 1994 prices).

IEA Coal Research argues that the consistent oversupply of thermal coal evident in the 1980s seems likely to continue during the 1990s, with many prospective mines easily covering costs at fob prices maintained at 1992 levels (although cif prices could rise steadily due to rising real sea freight rates).

Barlow Jonker (1992) identify supply capacity around the world well in excess of projected coal demand and therefore argue that the proportion of the potential capacity brought on stream in each exporting country will depend on the relative competitiveness of the major international suppliers. They note that some countries are more constrained than others in bringing on production unless prices rise. For Australia, they argue that exporters can only win significant additional tonnage by improving their productive performance.

Johnson (1994) argues there is no convincing evidence for sustained shortages of coal supplies and high prices over the 1994–2010 period, due to a diversity of low cost coal suppliers and the competitive nature of the industry.

ABARE’s assessment is that sufficient additional production can come on stream to meet projected demand growth with only a small rise in coal prices from real 1993 levels, because of expected significant further gains in mine productivity.
Reflecting the high degree of uncertainty associated with long term projections, only five analysts covered in this survey made an assessment of the longer term outlook for coal trade to the year 2010. The available projections are given in table 8. Overall, there is far less consistency in regional breakdown and coverage across the available studies than is the case for the medium term. Consequently, a consensus view of the longer term outlook could not be developed. Clearly, though, continued growth is expected in both Asia and Europe, and the key uncertainties identified in the medium term outlook remain relevant to the longer term outlook — in particular, issues surrounding technological change and environmental factors.

Of the longer term projection studies only that of the EIA (1991) gives a comprehensive analysis covering the supply, demand and trade outlook for both thermal and coking coals. A feature of the EIA projections is that trade flows and patterns differ markedly from those presented for the medium term. This result reflects changes in key underlying assumptions between the two periods on costs of export coal, port capacity, oil prices, economic growth, regional import demand for different coal types and technological and environmental factors.

The EIA (1994) study presents projections on a less disaggregated basis and reflects a change in projection method from the large International Coal Trade Model (ICTM) to the smaller Coal Export Submodule (as discussed in appendix B). Compared with the EIA 1991 study, the 1994 study projects much larger shipments of coal to Asia by the year 2010 and a significant lowering in shipments of coal to Europe (driven by an assumed increased level of natural gas use). In addition, the more recent study projects a more conservative rate of increase in US coal exports.

The IEA Coal Research (1993) study presents projections to the year 2010 for thermal and coking coal for Europe only. The projections were generated on the assumption of a continuation of current trends and policies. The author does acknowledge that uncertainties exist about the restructuring of various country coal sectors, trade in electricity, interfuel competition, coal demand prospects and environmental pressures. However, major conclusions for the longer term outlook were arrived at including: increased imports will partly offset a projected continuing fall in indigenous coal production in Europe; coal demand will increasingly be concentrated in the power generation sector; and,
**COAL FORECASTS**

by 2010, the solid fuels share of European electricity production will decline; but that Europe will remain a key market for coal.

### Projection of coal trade to the year 2010

<table>
<thead>
<tr>
<th></th>
<th>Asia</th>
<th>Europe</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Japan</td>
</tr>
<tr>
<td></td>
<td>Mt</td>
<td>Mt</td>
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<tr>
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<tr>
<td>Total</td>
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<td><strong>IEA(CR) (1993)</strong></td>
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</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>E-W Center (1994)</strong></td>
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</tr>
<tr>
<td>Total</td>
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<td>154.0</td>
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<tr>
<td><strong>APEC (1992)</strong></td>
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<tr>
<td>Total</td>
<td>350.0</td>
<td>150.0</td>
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<tr>
<td>Coking</td>
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<td>Thermal</td>
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<td>Mt</td>
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<td>Mt</td>
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<td><strong>EIA (1991)</strong></td>
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<tr>
<td>Total</td>
<td>208.0</td>
<td>227.0</td>
<td>90.0</td>
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<td>175.0</td>
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<td>534.0</td>
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<tr>
<td><strong>E-W Center (1994)</strong></td>
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<tr>
<td>Total</td>
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</tr>
<tr>
<td>Total</td>
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<tr>
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<tr>
<td><strong>EIA (1994)</strong></td>
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<tr>
<td>Total</td>
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<td>Coking</td>
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<td>Thermal</td>
<td>131.0</td>
<td>88.5</td>
<td>80.6</td>
<td>na</td>
<td>189.1</td>
<td>489.2</td>
</tr>
</tbody>
</table>
COAL FORECASTS

7. Coal price projections

Analysts draw conclusions about the future trends in coal prices by considering the ability of major world exporters to increase production to match the projected growth in coal consumption at current prices. For those analysts using a formal modelling approach to generating projections, a coal price path can be explicitly generated. Two key variables for which analysts either explicitly or implicitly make assumptions are: the required long run rate of return on capital investment in coal mining (sometimes termed 'full cost pricing'); and the scope for continued productivity and efficiency gains in coal mining. Each of these factors is critical to determining the absolute level of coal prices during the remainder of this decade and into the next.

In particular, assuming that the excess capacity evident in the thermal coal market during the early 1990s is gradually reduced as import demand increases, then coal prices will be determined more by the long run marginal costs of coal production in the major exporting countries. As a consequence, the export costs in the longer term will be higher than the short run variable costs of production for existing mines, where capital investment is viewed as a sunk cost and is not factored into the decision of whether to continue producing. The higher the assumed rate of capital return and the lower the assumed decline in overall cost structures due to productivity gains, the higher will be the projected coal price by the year 2000.

Analysts tend not to project any increases in cost structures resulting from the depletion of coal resources over the longer term as reserves remain large in major exporting countries. Note also that analysts tend to use fob export prices, as cif prices projections need to account for projected trends in sea transport rates.

Because those few analysts that publish detailed price projections have not used a common benchmark price and have expressed prices in different ‘real’ terms, a table comparing projected prices has not been prepared for this study. However, most analysts present explicit statements on the general trend in coal prices over the medium and longer terms.

Across the selected studies, some salient points emerge. First, no analyst is projecting large increases in real coal prices. Second, most price projections to the year 2000 fall into a general consensus of continued downward pressure on prices until the mid-1990s due to excess coal supplies. However, by 2000,
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strong growth in coal demand, particularly for thermal coal, is expected to lead to some upward pressure on coal prices to encourage major coal exporting countries to invest in new mines and, to the extent required, new infrastructure (additional transport and port infrastructure will be needed in most exporting countries to meet international coal demand). At the same time, because of likely improved technology and mining efficiency, real prices are unlikely to need to increase much in order to encourage new production.

Analysts sometimes explicitly refer to the link between coking and thermal coal prices — for example, ABARE (1994b), Carlaco (1993), McIntosh Baring (1993) — arguing that within the overall coal price trend, the premium between thermal and coking coals will narrow during the longer term. This is because the projected stagnant demand for metallurgical coals, together with a devaluation of the traditional coke making properties of coking coal with the increasing use of PCI technology (see Low et al. 1993), will lead to metallurgical coal prices gradually moving downwards toward thermal coal prices.

Price outlook review, by analyst

The major conclusions drawn about price by analysts are summarised below.

McIntosh Baring (1993)

This study presented the ‘conventional wisdom’ of the time. Ample coal supplies would be available in the short-medium term to meet expected demand increases. Consequently, contract prices were projected to fall further in real terms over the next two years (financial years 1994 and 1995). Fundamental market conditions were expected to improve steadily after the middle of the decade and especially toward the end of the century. During this period prices were projected to rise to justify the new production projects required to meet expected demand.

Thermal coal contract prices were projected to rise to around US$52/t in 2000, a rise of about US$5/t in real terms on the 1993 price and similar in real terms to 1991 prices.

Given the weak demand for hard coking coal in coming years as a result of sluggish blast furnace steel output and increased use of PCI coals, the premium between thermal and coking coals was projected to diminish over time. This premium in 1993 was estimated at US$12.90/t. The premium was expected
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to fall to US$12.50/t in nominal terms by the end of the decade, a drop of more than US$2.50/t or 25 per cent in real terms from the mid-1993 premium. As a result coking coal prices were expected to reach almost US$65/t in 2000.

Barclays de Zoete Webb (1994)

In the mid-term, according to their study, increasing demand for thermal coal will dominate the market and prices for both thermal and coking coals will strengthen. However, the risks of thermal coal supply far outstripping demand and prices being depressed throughout the decade were seen to be very real by the analyst. Steaming coal price growth struggling to match inflation was seen as the most likely long term outcome beyond 1996. Actual price projections are reported in table 9.

Table 9: Barclays projected coal prices

<table>
<thead>
<tr>
<th>Coal Type</th>
<th>1993</th>
<th>1994e</th>
<th>1995t</th>
<th>1996t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$/t</td>
<td>US$/t</td>
<td>US$/t</td>
<td>US$/t</td>
</tr>
<tr>
<td>Coking coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- hard</td>
<td>49.22</td>
<td>45.82</td>
<td>45.62</td>
<td>47.00</td>
</tr>
<tr>
<td>- soft</td>
<td>45.73</td>
<td>42.63</td>
<td>42.55</td>
<td>43.93</td>
</tr>
<tr>
<td>- semisoft</td>
<td>39.83</td>
<td>36.73</td>
<td>36.65</td>
<td>38.03</td>
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<tr>
<td>Steaming</td>
<td>37.79</td>
<td>35.28</td>
<td>35.40</td>
<td>36.78</td>
</tr>
</tbody>
</table>

*Estimated. f Forecast.

World Bank (1992)

Although a little dated, the price conclusions of this study remain relevant. The major conclusion of this study was that there would be no increase in real prices during the medium term, and only small increase during the long term. Over the period to 1995, thermal coal prices were expected to increase somewhat in nominal terms as the industrialised economies were projected to recover from recession and marginal coal capacities were expected to be removed from the market.

At 1991 prices the World Bank characterised the world coal industry as facing consolidation and restructuring; while investments for capacity expansion were also being restrained. The Bank argued that this was likely to relieve some of the excess supply pressure during the medium term, but not by enough to result in prices increases in real terms. Nevertheless, new export coal...
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projects were expected to come on stream over the 1991–95 period, amounting to 50 million tonnes or about 16 per cent of world exports. Given that world import demand was expected to increase by 14 per cent over the period, the market balance was not expected to improve significantly over the medium term.

In the longer term, thermal coal prices were forecast to match the projected fob costs of the major coal exporters. The price for the US benchmark thermal coal was forecast at US$43.69–44.70/t (in constant 1990 dollars) for the year 2000, with little change projected by 2005. Australia prices were projected at US$42.16/t for the year 2000 and US$41.20/t for the year 2005. The long term price forecasts implied small increases for thermal coal export prices in real terms. These forecast increases were justified by the Bank on several grounds.

First, relatively low prices during the first half of the 1990s were thought to discourage investments in coal capacity expansion and hence result in a more balanced market towards the year 2000.

Second, petroleum prices were expected to rise in real terms in the second half of the 1990s, and this expectation would keep coal as a viable energy option.

Finally, production costs of coal were expected to rise moderately over the longer term as production moved to more difficult locations and opportunities for efficiency improvements become harder to find.

EIA (1991)

According to this study, thermal coal prices were expected to remain near 1990 levels through to 1995 (in real terms) due to a large worldwide resource base, excess production capacity, and interfuel competition. Between 1994 and 2010, the real price of thermal coal imported by Europe and Asia was expected to rise at a 2.3 per cent annualised rate. The assumption underlying the forecast was that coal would be traded at a price that would allow mining companies to earn a 15 per cent return on mining investment. At the time this projection was made, many coal producers were not earning any return on mining investment.

Using the same assumption about an adequate rate of return on mining investment, metallurgical coal prices (measured as the Western Europe import price) were projected to rise at a 2.5 per cent annualised rate through to 2010.
The assumption that coal prices by 2000 should cover the actual cost of mining and transporting coal was justified on the basis of the expected strong growth in coal demand, particularly due to the anticipated elimination of inefficient coal production in Poland, Germany and the United Kingdom, and growing electricity demand in Asia.

Given that observed prices for traded coal have declined considerably since this study was released, the assumption of prices returning to a level to allow the coal mining industry to earn a 15 per cent rate of return implies a significant real increase in prices from their 1994 level.

**EIA (1994)**

The EIA only published projections for US minemouth prices, rather than an international benchmark price for coal. However, in ABARE's assessment, trends in US prices will have a direct impact on international coal prices. The EIA expected average minemouth prices to rise by an average of 1.4 per cent a year (in constant 1992 dollars) to the year 2010. This rate was characterised as low due to gains in coal mining productivity, an abundant coal reserve base, and additional production of low cost western coal.

However, the EIA also argued that a considerable amount of uncertainty surrounded the key factors determining its coal price forecasts for the US coal industry. The extent to which reserve depletion affects future coal prices depends on the rate at which existing capacity in the United States is retired, growth in domestic and foreign demand, and the availability and geological characteristics of coal reserves in new mines. The EIA argued that labour productivity would continue to increase over the longer term, but at a slower pace than during recent periods. This had the effect of altering production costs and therefore minemouth prices for US coal.

**Calarco (1993)**

Calarco shares the view of others that prices will need to eventually rise in the longer term to encourage investment in new mines. In particular, he argues that new mines will have to be added in the later part of the decade if the demand for seaborne thermal coal is to be met by the start of the 21st century. For this to happen, prices would have to rise between 1995 and 1997. However, the strength of any price rise may be impeded by conditions in markets for metallurgical coal, which will remain in excess supply throughout the decade. In this market, prices will remain low, leading to the elimination of higher cost
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operations. In terms of implications for thermal coals, mines previously meeting metallurgical coal markets will switch to thermal coal markets by ceasing to operating coal washing plants. As in the past, the magnitude of the price rise needed to bring about the appropriate production response will be dictated by the likely changes in the cost of production, in particular, due to continuing scope for efficiency improvements.

Overall, Calarco argues that prices will have to increase for growth in demand for thermal coal to be met in the longer term. The continuing improvement in the costs of production suggests that the magnitude of the price rise will be modest. If the real improvement in price does not occur in a timely fashion, the magnitude of change will be greater as the instability created by tight supplies forces the market to overrespond.

East-West Center (1994)

This study saw no convincing evidence that the underlying causes of low coal prices would change during the long term to 2010. The main reasons for low coal prices were identified as: large coal reserves located in stable economies; coal capacity additions exceeding the growth in demand; new coal suppliers; and continued advances in mine productivity. However, the potential for a significant price premium for coals having superior environmental performance (very low sulphur and ash contents) could develop. In particular, over the next decade low sulphur coal would be a preferred option for meeting environmental regulations in many areas of Asia. However, competition among coal suppliers was seen as likely to limit the premium for low sulphur coal to a few dollars per tonne.

McCloskey (1994)

In a general discussion of the outlook for world coal trade, McCloskey argues that 'mine development has reached a watershed’ (p. A3) with a dearth of new coal export projects coming on stream during the next few years. He notes the only new mines as the South African greenfield mine of Anglovaal’s Forzando, two greenfields in Australia — Shell’s Dartbrook and the Idemitsu/Lucky Goldstar Ensham mine — and two brand new Colombian developments of Drummond’s La Loma and Prodeco’s Calenturitas mine. He also argues that many of the proposed new mines in Australia look doubtful at 1994 prices.
COAL FORECASTS

In light of this, McCloskey supports the argument offered by some other analysts in recent months that a spike in prices will bring on new capacity, but that prices at the end of the decade will be similar in real terms to 1994 levels. The idea of a price spike rather than sustained higher prices appears to be the product of an expectation that investment in new mine capacity will ‘overshoot’ that required to meet demand growth, thereby ensuring the eventual return to oversupply in the longer term.

ABARE (1994b)

Overall, as suggested in the earlier review of supply uncertainties to the outlook, the major point of contention among analysts is the potential for further reductions in cost structures due to efficiency gains and the required rate of return for coal mines over the longer term, and the consequent implications for coal prices. ABARE’s assessment on this matter is as follows.

Additional exportable supplies of thermal coal can be expected from low cost producing countries, notably Australia and Indonesia, during the short term. However, toward the end of the medium term and during the longer term, growth in demand for coal will lead to increased production from new mines and associated infrastructure in the major coal exporting countries. Because of likely improved technology and mining efficiency (which lowers industry supply costs for a given production level), medium to long term real prices are unlikely to need to increase above the 1993-94 level in order to achieve a market equilibrium.

In contrast, metallurgical coal demand is projected to fall slightly in the medium term, exacerbating an already oversupplied market. The newly industrialised coal importing countries of Asia are projected to be the only markets with increasing import demand. However, this will be more than offset by stagnant or falling demand elsewhere for Australian and world seaborne exports. Metallurgical coal export prices are therefore projected to continue to fall gradually in real terms to 1998-99.
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Appendix A: Projection methods

Barlow Jonker (1992)

The comprehensive projections produced by Barlow Jonker are the most detailed in the survey, with the report compiled from country by country data. Both thermal and coking coal consumers in individual countries were contacted about their present and future levels of coal consumption and forecasts. The availability and competitiveness of alternative fuels were also investigated. Demand for pulverised coal injection (PCI) coals and coal for coke in each country were estimated. In the case of coal exporters, coal producing capacity was established based on current and projected capital investment, plus rail and port infrastructure. Detailed supply and cost competitiveness estimates were made for Australia and competitive suppliers. However, no price projections were made and no trade flows between suppliers and consumers were estimated.

Chimura (1994)

Chimura employed a similar approach to Barlow Jonker, but restricted the scope of the study to the supply and demand for thermal coal in the Asian region. Chimura presented two sets of supply projections, one based on current country mining plans and infrastructure development and the other with additional supplies becoming available from Australia and the United States, due to their assumed ability to ‘take extraordinary action to boost their exports’.

East-West Center (1994)

The method of analysis used in the East-West Center study is not explained in detail. However, for those countries included in the analysis assumptions are made about coal resources and energy alternatives, government policies, environmental factors, economic and electricity growth rates, competition and prices, and strategic factors. The price assumption made in the study states that there is no convincing evidence that the underlying causes of low coal prices will change during the period 1994–2010. In addition it is assumed that competition among coal suppliers is likely to limit the premium for low sulphur coals to a few dollars (US) per tonne.
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The International Energy Agency collates forecasts for IEA countries obtained through annual submissions to the IEA Standing Group on Long-Term Cooperation (SLT). These country submissions include national projections of energy trends and descriptions of energy policies. Elements of the projections are in some cases IEA Secretariat projections. Forecasts of the main elements in an overall energy balance are supplied by member countries. Projections are also given for electricity generation capacity by fuel type and for production and trade of different types of coal and fuels derived from coal.

*IEA Coal Research (1992, 1993)*

The IEA Coal Research study on seaborne steaming coal trade does not attempt to match supply and demand or to estimate future prices. The demand projections reflect future coal consumption by electrical power stations plus an assessment of future requirements by other coal consuming sectors. The second IEA Coal Research analysis of European coal prospects is based on an assessment of the most likely outcomes given a continuation of countries' current production and consumption trends and policies. This is a bold assumption given the rapid and fundamental changes which may occur.

*Energy Information Administration (1991, 1993)*

The comprehensive EIA world coal trade analysis is based on a linear programming model which estimates trade flows between twenty supply and nine destination regions worldwide. In the model, freight rates are assumed to provide a competitive rate of return to the owner/operator in the long term. To undertake the study a detailed assessment of supply, demand and transport factors must occur. In the EIA analysis the two general assumptions are that the world price of oil will rise to US$34 a barrel (in 1990 US$ terms) by 2010 and that in market economy countries, gross domestic product will increase by 2.4 per cent a year.

*Energy Information Administration (1994)*

Projections are derived using a different modelling framework to the earlier studies. The Coal Export Submodule (CES) has replaced the much larger International Coal Trade Model. This submodule estimates the quantities of coal imported and exported from the United States. The quantities are
COAL FORECASTS

estimated within a world trade context, based on user provided characteristics of foreign coal supply and demand. The submodule disaggregates coal into sixteen coal export regions and twenty import regions.

The CES is a small linear program that estimates world coal trade distribution by minimising overall costs for coal, subject to US coal supply prices and a number of constraints. Coal suppliers compete in two demand sectors (coking and steaming). It also takes into account limits on sulphur dioxide emissions and concerns about diversity of coal sources. Coal export demand projections from the CES are passed to the National Energy Modelling System (NEMS) coal distribution submodule.

ABARE (1994b)

In ABARE's world coal trade projection study, the World Coal Trade Expert System (WOCTES) was employed. In WOCTES, a spatial equilibrium modelling structure is used to solve for trade patterns and prices. The structure of international coal trade is defined in terms of three components: supply, demand and transport. Sets of information or assumptions for each of these components are required to specify the model. A particular set of figures for these three components, together with assumptions about market structure and conduct, can be thought of as a 'market description'. Once the market description has been defined, WOCTES calculates the equilibrium set of prices and trade flows.

The model can accommodate up to twenty supply regions, twenty demand regions, four coal types and ten time periods. WOCTES has also been used by Wharton Econometric Forecasting Associates (WEFA).

The results from the WOCTES model are adjusted by the commodity analysts based on specific knowledge that cannot be incorporated into the structure of the model. ABARE also makes assumptions about future economic growth rates and exchange rates.

Impact of differences in projection method on medium term outlook

An idea of the way in which the choice of method can influence projected outcomes can be gleaned by considering a change in the method and modelling approach used by Energy Information Administration (EIA) in the United States over the past two years.
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In particular the EIA has developed a National Energy Modelling System (NEMS) in which the Coal Export Submodel (CES) has replaced the former International Coal Trade Model (ICTM) which was used for several years to generate projections.

As a result of the change in projection method, together with changes in underlying assumptions in response to significant events in the world coal market over the period (such as the demise of the Soviet Union and its associated trading bloc, the lifting of sanctions on South African coal and a general decline in coal prices), the projected trade patterns from NEMS vary significantly from those generated using ICTM. A comparison of the two sets of projections is instructive because some appreciation can be gained of the relative importance of the overall projection approach is to the actual projections.

Key differences include the following. Projected European coal imports in the year 2000 in the most recent study have been reduced by 60 million tonnes and Europe’s share of trade has been reduced from 56 per cent to 41 per cent. Such a reduction appears to reflect revised expectations about the pace of decline in European indigenous coal production and the potential for other fuels (particularly gas) to substitute for coal in the European electricity generation sector. At the same time, the volume of Australia’s exports to Europe has also been reduced between the two studies, from 21 million tonnes (10 per cent) to zero. Projected US thermal coal exports to Europe in the year 2000 were reduced from 78 million tonnes to 46 million tonnes and South American volumes were reduced from 34 million tonnes to 4 million tonnes.

The more recent study by the EIA projects an increased volume of thermal coal trade in Asia, up 38 million tonnes to 177 million tonnes. Australia’s thermal coal exports to Asia increase accordingly between the two studies by 17 million tonnes to 85 million tonnes, but in terms of market share remain constant at around 48 per cent. Exports from South America to Asia are projected at 36 million tonnes (20 per cent of the market), representing a dramatic revision from the projected level of only 1 million tonne in the 1991 study (and also explaining the low export figure for South America to Europe). At the same time, South African shipments to Asia have been reduced in the year 2000 to zero, from 12 million tonnes in the 1991 study.
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Appendix B: Extracts from ABARE’s outlook for world coal trade

- World seaborne thermal coal trade is projected to rise to 300 million tonnes in 1998-99 compared with an estimated level of around 215 million tonnes in 1993-94. World seaborne metallurgical coal trade is projected to decline by around 5 million tonnes to 160 million tonnes over the same period.

- Total Australian coal exports are projected to increase by 24 per cent from the estimated level of 132 million tonnes in 1993-94 to 164 million tonnes in 1998-99, due mainly to an expected rise of 35 million tonnes in thermal coal exports to 99 million tonnes.

- Export prices for Australian coal are forecast to fall in real terms in 1994-95 and to recover only slightly by 1998-99. The real value of Australian coal exports is forecast to decline in 1994-95 and to fall slightly further in the following years but to recover to around $7.7 billion (in 1993-94 dollars) in 1998-99.

- The European Union’s continuing program of reduction in state aid to coal producers in member countries, which will produce significant benefits for Australia, has been formalised and reinforced in a GATT-linked bilateral coal agreement between Australia and the European Union. However, GATT will not produce significant import tariff related benefits because of the low levels of import tariffs in most coal importing countries.

World seaborne trade in coal is projected to rise to around 460 million tonnes in 1998-99, almost 80 million tonnes above the forecast of 380 million tonnes in 1993-94. This growth mainly reflects projected increases in thermal coal trade. Metallurgical coal trade is projected to decline slightly during the outlook period.

Outlook for thermal coal trade

World seaborne thermal coal trade is projected to increase by around 40 per cent to 300 million tonnes over the next five years (table 10). This projected sharp rise in trade mainly reflects expected dramatic increases in demand for coal fired electrical power in Asia. European demand for imported thermal coal is also expected to grow substantially.
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Asian thermal coal demand

Seaborne imports of thermal coal into Asia are projected to rise from an estimated 104 million tonnes in 1993-94 to around 150 million tonnes in 1998-99, despite a projected slowing in the rate of Asian economic growth during the 1990s from the level recorded in the previous decade.

The projected increased level of thermal coal trade in Asia is due to: coal’s reputation as a low cost and secure source of energy; the rise in demand for electrical power from coal fired power stations, including those in the newly industrialised and rapidly developing coal importing countries; an increasing

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World

Seaborne trade 362.4 369.5 381.5 397.0 412.6 428.1 443.7 459.2
- metallurgical 167.4 165.2 165.7 164.6 163.6 162.5 161.5 160.4
- thermal 195.0 204.3 215.8 232.4 249.0 265.6 282.2 298.8

Thermal coal imports

Asia 89.1 96.9 104.2 113.8 123.4 133.0 142.6 152.2
- Japan 46.4 50.2 52.5 56.6 60.7 64.7 68.9 73.0
- Other Asia 42.7 46.7 51.7 57.2 62.7 68.2 73.7 79.2
Europe 94.7 96.9 93.1 100.2 107.3 114.4 121.5 128.6
- European Union 85.7 86.5 84.3 90.0 95.7 101.4 107.1 112.8
- Other Europe 9.0 10.4 8.8 10.2 11.6 13.0 14.4 15.8
Others 11.2 10.5 18.5 18.4 18.3 18.2 18.1 18.0

Thermal coal exports

Australia 58.2 59.6 64.1 71.1 78.1 85.1 92.1 99.1
United States 34.3 26.4 21.7 23.9 26.1 28.3 30.5 32.7
South Africa 44.9 47.0 50.5 51.5 52.5 53.5 54.5 55.5
Indonesia 7.3 17.1 21.4 22.9 24.4 25.9 27.4 28.9
Colombia/Venezuela 17.2 20.3 21.0 24.1 27.2 30.3 33.4 36.5
China 12.8 13.3 17.4 18.1 18.8 19.5 20.2 20.9
Others 20.3 20.6 19.7 20.8 21.9 23.0 24.1 25.2

Australia

Production a 176.6 178.3 185.0 192.4 199.6 206.8 215.4 224.3
Domestic consumption 51.1 51.5 53.0 54.0 54.7 55.4 57.5 60.5
Exports 123.3 129.1 132.0 136.4 144.9 151.4 157.9 163.8
- thermal 58.2 59.6 64.1 71.1 78.1 85.1 92.1 99.1
- metallurgical 65.1 69.5 67.9 67.3 66.8 66.3 65.8 64.7

a Salable coal. f ABARE forecast. z ABARE projection.
Sources: Australian Bureau of Statistics; ABARE.
COAL FORECASTS

perception in some countries, particularly where local energy markets are liberalised, of the overall economic benefits of using high quality, reliable imported coal relative to some indigenous coals; and the continuing rise in the use of coal in industries outside the electrical power generation sector.

On the other hand, the increasing use of imported coal as a source of power is expected to be lessened to some extent by: the higher capital costs and longer construction lead times of coal fired power units relative to combined cycle gas turbine units; the operational complexity of coal fired power stations relative to gas fired plants; storage and handling problems of coal; environmental concerns; and fuel mix and supply security policies in some countries.

Japan, South Korea and Taiwan are projected to remain the key import markets for thermal coal in Asia during the period to 1998-99.

Japan
With projected thermal coal imports in 1998-99 of around 73 million tonnes, almost 40 per cent above the estimated level in 1993-94, Japan will continue to be the major importer in the world. Almost all of this increase will result from increased demand in the power sector. Coal fired electrical power capacity is projected to rise by around 62 per cent to 28 GW by 1998-99 or almost 13 per cent of total projected electricity generation capacity from all fuel sources. Such an output would require the consumption of around 53 million tonnes of thermal coal. The demand for thermal coal by the general industrial sector, including cement manufacture, is projected to increase only slightly, rising by 2 million tonnes to just over 20 million tonnes by 1998-99. The small increase in the medium term reflects the flat outlook for cement output.

South Korea
Thermal coal imports by South Korea are projected to rise to around 39 million tonnes in 1998-99, almost double the level estimated for 1993-94. The overall electricity generation policy of South Korea assumes that during the period to the year 2010 approximately 50 per cent of electricity demand will be produced by nuclear powered plants.

Oil consumption for power generation will be phased down and coal and LNG will take a larger share of the market. However, due to growing public resistance to the construction of nuclear power plants and the disposal of waste products, the government's nuclear power program may have to be scaled down over the longer term.
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Coal fired power station capacity in South Korea is projected to rise by 5 GW by 1997 and a further 3.1 GW by the end of the decade. As a result, thermal coal imports for coal fired power generation are projected to rise to around 23 million tonnes in 1998-99, from around a forecast 11 million tonnes in 1993-94.

Thermal coal imports by other industrial sectors are projected to rise to around 16 million tonnes, mainly due to an expansion in the cement manufacturing industry.

Taiwan
In Taiwan, which imports most of its energy requirements, coal fired power capacity is expected to rise to around 6.7 GW by 1997, an increase of 2.8 GW from the level recorded at the beginning of 1993. Reflecting this more than 40 per cent increase in coal fired power capacity, imports of thermal coal are projected to rise to around 27 million tonnes in the medium term, compared with a forecast 19 million tonnes in 1993-94.

European thermal coal demand

European seaborne thermal coal trade is projected to rise to almost 129 million tonnes in 1998-99, 36 million tonnes above the forecast for 1993-94. The major rise will occur in the EU, where seaborne thermal coal trade is expected to increase from 84 million tonnes in 1993-94 to 113 million tonnes in the medium term.

By 1997 European coal importing countries are expected to add an additional 14.5 GW of coal fired power station capacity to the 156 GW of capacity existing at the beginning of 1993. European Union countries are expected to increase their capacity by 11 GW by 1997 and a further 6 GW by the end of the decade.

Of European seaborne thermal coal imports in 1998-99, less than 30 per cent will be consumed by non-electrical power generating sectors.

While the level of thermal coal imports will be determined in part by the demand for coal fired electrical power, it will also reflect the degree of interfuel competition between coal, natural gas and nuclear power, and the projected displacement of indigenous coal supplies in the European Union as subsidy supports are reduced.
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The program of reducing coal subsidies in the European Union, already underway, has been formalised and reinforced by a bilateral agreement between Australia and the European Union which was formally linked to the GATT outcome of 15 December 1993. ABARE has estimated that this subsidy reduction program will produce benefits to Australia of around $300–500 million (1994 dollars) a year by the year 2000. Tariffs on imported coal are generally low in the European Union and elsewhere, and their removal is not expected to lead to a substantial increase in demand for imported coal.

Thermal coal imports into the United Kingdom are projected to increase once the large stocks presently held by the two major generators and British Coal are consumed and industry rationalisation, involving the closure of a large number of mines, is complete. Indigenous coal production capacity will decline by around 32 million tonnes a year under the government’s rationalisation plan.

However, it is expected that most of this coal will be replaced by natural gas rather than imported coal. The share of coal in the United Kingdom’s electricity generation fuel mix has recently fallen, and is expected to decline further, because of the installation of additional gas fired combined cycle gas turbine units. The prospect of returning to coal fired units in the future is limited, as no new coal fired plants are expected to be built over the period 1995–2010.

In Germany, future thermal coal imports will depend on the construction of new import dependent power stations and the reduction of indigenous lignite coal production in the eastern sector of the United country, the removal of assistance to indigenous coal production in the western sector, the overall level of competition from natural gas and any change in the anticipated 12 per cent increase in electricity imports projected between 1992 and 2000.

The German thermal coal subsidy agreement (the Jahrhundertvertrag) and associated ‘Kohlepfennig’ levy arrangement will expire in 1995. The German government is proposing that beyond that point German producers will no longer have a guaranteed market share and power utilities will be free to buy their coal from the most competitive supplier, domestic or overseas.

However, a subsidy will be available to domestic coal producers to bridge the gap between prices and production costs. Future indigenous output will therefore depend primarily on the level of subsidy that Germany is prepared to support and the EU Commission is willing to approve. Preliminary evidence indicates that the total subsidy available will be reduced from DM 7.5 billion in 1996 to DM 7.0 billion in the year 2000.
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In 1992, subsidies to the coal industry amounted to around DM 8 billion. Indigenous production is therefore not expected to fall rapidly, but the loss to coal producers of the guaranteed annual uptake of thermal coal by the power utility sector represents a fundamental change to the German coal sector.

Suppliers of thermal coal to Asia

Australia

Australian thermal coal exports to Asia are projected to rise to around 86 million tonnes in 1998-99, 35 million tonnes or almost 70 per cent above the forecast level in 1993-94. In the medium term such exports are projected to represent around 87 per cent of Australia's total thermal coal exports to all destinations and 57 per cent of Asia's total seaborn thermal coal imports.

Australian thermal coal exports to Japan are projected to rise from a forecast 35 million tonnes in 1993-94 to almost 43 million tonnes in 1998-99. Australian exports to 'other' Asian destinations in the same period are projected to rise at a much faster rate in both percentage and absolute terms, increasing by almost 28 million tonnes to 44 million tonnes.

Australia's dominant position in the Asian thermal coal market is the result of a number of comparative advantages, including: its proximity and resulting freight advantage over many other world suppliers; the quality of the thermal coal supplied (low sulphur, low ash, low moisture); the competitively priced product; and the exporters' ability to supply a product consistent with specifications and on a regular basis.

The growth in Australia's capacity to supply thermal coal will result from increased production from incremental expansions at existing mines, new mine development and productivity gains. Australian thermal coal producers are already committed to projects which have the potential to increase output by around 17.5 million tonnes. These projects, which have start-up dates during the first half of the current decade, are almost exclusively underground mines in New South Wales. Also, an additional 7 million tonnes of thermal coal production capacity — mainly in New South Wales — is 'near commitment'.

Proposals for an additional 40 million tonnes of new thermal coal mine development exist, but the ultimate decision to undertake full scale development depends on expected market conditions and often on the ability to secure contracts to cover the majority of mine production.
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Planned expansions in Australia's transport and port infrastructure by the end of the decade will be adequate to handle the projected increase in coal exports. In New South Wales a total of 16.3 million tonnes a year of extra export capacity is expected to be available by 1997, with most of the development occurring by 1995. The bulk of the additional export capacity will be thermal coal. In Queensland 13.5 million tonnes a year of additional export capacity is projected to be available by 1997. In New South Wales the authorities are expected to increase the track and rolling stock capacity of both the Port Kembla and Newcastle rail routes, while Queensland Rail is expected to spend $A1.1 billion between 1993-94 and 1997-98 on tracks, signalling equipment and rolling stock, to meet the increased coal transport requirements in the next five years.

Indonesia

While Australia is expected to remain the dominant supplier of thermal coal to the Asian market over the medium term, Indonesia's coal exporting sector is expanding rapidly. The sector is dominated by contract mines, whereby mostly foreign companies work under contractual agreement to the Indonesian government. Australia's presence in this sector is strong.

Indonesia's thermal coal exports to Asia are projected to rise to 26 million tonnes in 1998-99, 50 per cent above the forecast level in 1993-94. Total thermal coal exports from Indonesia to all destinations are expected to increase to almost 30 million tonnes in 1998-99, from a forecast level of 21 million tonnes in 1993-94. Of Indonesian exports to Asian destinations in 1998-99, 11.2 million tonnes are projected to be imported by Japan. The remaining 14.9 million tonnes will be directed to 'other' Asian destinations. In 1998-99 it is projected that 90 per cent of Indonesia's thermal coal exports will be to Asian markets compared with a forecast 80 per cent in 1993-94.

The low mining costs of Indonesian coal, together with its close proximity to the Asian market, make Indonesia a strong competitor with Australia. This is despite a number of coal quality characteristics, notably a high moisture content and a low Hardgrove grindability index, which currently make Indonesia's thermal coal less desirable in the higher premium power utility market. However, in the longer term, Indonesian coal is expected to become more competitive as most Asian countries adopt new boiler technology in coal fired power generation which allows for the use of coal with a wider range of quality characteristics.

The level of Indonesian thermal coal exports to Asian destinations in the medium term will depend on two important factors. First, Indonesian exporters will need to increase production through additional investments in
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mine expansion and export infrastructure development. Second, the government’s expansion plan for coal fired power generation capacity, which is expected to provide the major domestic demand for coal, might constrain growth in Indonesia’s exportable coal surplus.

During the medium term, both Australia and Indonesia are projected to increase their market share in the Asian thermal coal market.

Other suppliers
Despite huge resources and a high level of production, exports of thermal coal from China to Asian destinations are projected to rise by only around 4 million tonnes to just over 17 million tonnes between 1993-94 and 1998-99. Such exports will represent 83 per cent of China’s total thermal coal exports in 1998-99 and 11 per cent of Asia’s imports. Of China’s thermal coal exports to Asian destinations in 1998-99, 37 per cent are projected to be directed to Japanese consumers.

While South Africa is a major supplier of thermal coal to the European market, significant quantities are also exported to the Asian market. Exports to Asia are projected to fall slightly from 12 million tonnes in 1993-94 to 11 million tonnes in 1998-99. The decline is mainly due to South Africa’s concentration on the European market where it has a freight advantage over Australia and Indonesia. In the medium term South Africa’s total coal exports to all destinations will be restricted by the capacity of its port facilities.

Exports from the United States to Japan may increase after 1996 when the first phase of the Los Angeles Export Terminal is planned for completion. A joint United States–Japanese operating company was established in April 1993, to develop the modern coal shipping terminal to replace the Kaisen coal terminal. The first stage of the project is planned to load 9 million tonnes of bulk cargo, including around 6 million tonnes of coal. This would represent a 3 million tonne increase in shipping capacity, and much larger bulk carriers will be accommodated. The proposed terminal would handle mainly coals from Utah and Colorado. However, implementation of the first phase of the project could be delayed by a law suit filed by the Long Beach Municipal Authority, based on violations of the California Environment Quality Act and the Public Resource Code.

Suppliers of thermal coal to Europe
South Africa (with 30 per cent of the market), the United States (22 per cent) and Colombia/Venezuela (22 per cent) are projected to be the major suppliers
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of seaborne thermal coal to the European market in 1998-99. While South African thermal coal exports to Europe are projected to rise to around 39 million tonnes, 24 per cent above the forecast level in 1993-94, the United States, Colombia and Venezuela are expected to be the only major suppliers to gain market share over the medium term.

The combined market share of the minor suppliers is projected to fall from 28 per cent in 1993-94 to 22 per cent in 1998-99. The traditional suppliers, the former Soviet Union and Poland, are not expected to increase their exports significantly due to likely ongoing political and economic difficulties disrupting supplies in the medium term.

Because of South Africa’s freight advantage to Europe and the expected increased accessibility of world markets, South African total thermal coal exports to all destinations are projected to rise to around 55 million tonnes (39 million tonnes to Europe) in 1998-99, compared with a forecast level of 50 million tonnes (32 million tonnes to Europe) in 1993-94. At this projected level of thermal coal exports and given small exports of metallurgical coal (3 million tonnes), South Africa’s present export infrastructure would be near full capacity. An upgrading of the Maputo terminal will increase its capacity from just over 1 million tonnes to 5 million tonnes by 1998. Given expected depressed real coal prices over the medium term, the development of the proposed 12 million tonne capacity South Dunes Coal Terminal at Richards Bay is unlikely to be commissioned by 1998.

US exports are projected to recover from the low level estimated for 1993-94 due in part to a reduction in labour disputes. Although a relatively high cost producer, the United States has a freight advantage over many other suppliers to the European market. In addition, US producers can increase exports relatively quickly, if necessary, by employing excess capacity at mines, rail lines, river barge routes, ports and handling and storage facilities, particularly when prices are favourable.

Colombia and Venezuela are expected to increase their exports of high volatile, low sulphur thermal coal to Europe to a projected 29 million tonnes in 1998-99, compared with a forecast level of 18 million tonnes in 1993-94. This expansion reflects the high level of public and private investment in expansion of the mining and, particularly, port infrastructure.

During the medium term, Australian thermal coal shipments to Europe are projected to rise from a forecast level of 10.3 million tonnes in 1993-94 to 14 million tonnes in 1998-99. The gain reflects the projected declining indigenous production in the European Union. However, Australia’s share of
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the European market is not likely to increase over the medium term due to projected increased competition in the European market from the major suppliers to this region. Australia’s focus is expected to remain the Asian region where it has established markets and a greater comparative advantage.

Outlook for metallurgical coal

World seaborne metallurgical trade in 1998-99 is projected to decline by 5 million tonnes from the level estimated for 1993-94, to around 160.4 million tonnes. The slight decline in world metallurgical trade over the medium term reflects the stagnant level of blast furnace steel production in coal importing countries and the increasing use of pulverised coal injection (PCI) technology.

Asian metallurgical coal demand

In the medium term Asian seaborne imports of metallurgical coal are projected to decline from a forecast 92 million tonnes in 1993-94 to a projected 90 million tonnes in 1998-99. While Japanese imports are projected to decline from 64 million tonnes to 60 million tonnes over the medium term, metallurgical coal imports by ‘other’ Asian countries are projected to rise by 1 million tonnes to 29 million tonnes.

The slight decline in Asian imports of metallurgical coal into Asia and the increasing use of PCI reflect the high cost of replacing aging coke oven capacity, the opportunity to use less expensive coal for injection, the desire for more efficient blast furnace operation and the availability of greater flexibility in input supply with PCI compared with the relatively inflexible coke plant output.

By the end of 1994, all 28 Japanese blast furnaces will be fitted with PCI equipment. Over the medium term it is expected that the average injection rate will rise, thereby requiring a greater use of PCI coals. While Japanese metallurgical coal imports are projected to fall by around 4 million tonnes to 60 million tonnes in 1998-99, PCI coal use is expected to rise to around 10 million tonnes, compared with a forecast 7 million tonnes in 1993-94.

The slight increase in metallurgical coal imports into ‘other’ Asian coal importing countries (1 million tonnes) over the medium term reflects increased demand for steel from the construction, automobile and shipbuilding sectors.
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Steel production in South Korea is projected to rise in the medium term, due mainly to the increased capacity introduced at the Posco steel mill. Further expansion in steel production is expected through smaller electric arc furnaces using scrap metal as feedstock. In Taiwan, additional steel output is also expected to come from additional capacity at China Steel and new electric arc furnaces.

While India's steel industry is expected to expand slightly during the medium term, it will continue to be a small importer of high quality metallurgical coal for mixing with lower quality domestically produced coals.

With an increased level of blast furnace steel production expected in South Korea, India and Taiwan, PCI coal demand is projected to rise to 4 million tonnes in 1998-99, around 1.5 million tonnes above the forecast level in 1993-94.

European metallurgical coal demand

Seaborne metallurgical coal trade to Europe is projected to decline to around 53 million tonnes in 1998-99, 2 per cent below the forecast for 1993-94. Of the imports to Europe in 1998-99, 81 per cent will be to the European Union.

The privatisation of the steel industries in the United Kingdom, Italy, Spain, France, Belgium and the Netherlands, is expected to result in declining imports of metallurgical coal are expected to decline, due to a reduction in blast furnace steel production and an increasing use of PCI coal.

On the other hand steel producers in Germany must purchase highly subsidised domestically produced metallurgical coal instead of readily available, cheaper internationally traded coal.

Under the current plans, the maximum level of German metallurgical coal production which the government is prepared to assist financially through subsidies will decline from 18 million tonnes to 15 million tonnes a year by the year 2005.

Suppliers of metallurgical coal to Asia

Australia (with a share of 40 per cent), the United States (32 per cent) and Canada (16 per cent) are projected to remain the major metallurgical coal exporters to all world destinations in the medium term. These exporters, and
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to a lesser extent China, will be the major suppliers of metallurgical coal to Asian importers.

Although world trade is projected to decline in the future, Australia has the potential to significantly increase its exportable supplies of metallurgical coal, with increased production from existing mines and development of new mines, such as Gordonstone and North Goonyella.

In the medium term, Australia is expected to gain some market share from Canada. Canada currently has a relatively weak marketing position as a result of high coal export costs and the long term effects of prolonged industrial disturbances.

The cost disadvantages of some Canadian producers are caused by the geological conditions of the coal fields, the long rail transport distances to export ports, and the expected slow decline in demand for high quality coking coals. The latter is related to the shift to a larger percentage of cheaper soft coking coals and PCI in steelmaking, which has reduced the premiums for high quality coking coals.

On the other hand, Canada will continue to be an important supplier of metallurgical coal to the Japanese market in the medium term because of its substantial reserves, modern infrastructure, stable supplies, Japanese investment in the industry and the Japanese steel mills’ supply diversification policy.

Suppliers of metallurgical coal to Europe

In the medium term the United States and Australia will continue to be the major suppliers of quality hard metallurgical coal to Europe. Poland and the CIS will continue as small suppliers. Total European seaborne metallurgical coal imports are projected to decline slightly to 53 million tonnes in 1998-99.

The United States will remain the largest supplier of metallurgical coal to the European market, despite the projected depressed real prices in the medium term. Although US exports are projected to decline slightly, the United States is not projected to lose market share. In the medium term the United States is expected to maintain its position in European trade because of the availability of suitable export quality coals and its proximity to the market.

The demand for Australian metallurgical coal in Europe is projected to remain strong despite the slight overall decline in total demand. Although transport costs to the European market are high because of the long shipping route,
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Australia is expected to be able to maintain its supplies of hard metallurgical coal to Europe in the medium term through the development of new mines, such as Gordonstone and North Goonyella.

Poland and the former Soviet Union will remain small suppliers of metallurgical coal to the European market but are unlikely to expand market share in the medium term. In Poland, the closing of uneconomic mines, increasing labour costs and difficulties in operating deep mines, will result in limited exportable supplies. Metallurgical coal exports from the former Soviet Union to Europe in the medium term will also be limited because of the likely slow recovery from recent political and industrial turmoil, poor mining productivity and inadequate rail and port facilities.

In the medium term Australia and South Africa are projected to be the main suppliers of PCI coals in Europe.
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