

COAL

*John Knight
Harworth Mining Consultancy*

The World Energy Outlook 2002 (WEO 2002), published by the International Energy Agency (IEA), forecasts a 1.7% annual increase in energy demand in the period 2000-2030. Demand for energy worldwide is predicted to have increased by 65% during the period 1995-2020 and fossil fuels are expected to meet over 90% of this additional energy demand. Fossil fuels will remain the primary sources of energy well beyond 2030.

Currently, coal's share of total global primary energy consumption is around 24% and WEO 2002 projections are for this level to be maintained through to 2010 and to remain essentially stable through to 2030. This is reflected in the forecast that global primary coal consumption will rise at an average annual rate of 1.4% up to 2030.

Coal use is forecast to become increasingly concentrated in power generation, which will account for almost 90% of the forecast increase in demand between 2000 and 2030. The strongest growth in electricity demand will be in developing countries, where demand will climb by over 4% per year, tripling by 2030.

While coal's share of total generation is expected to decline from the 2000 level of 39%, it will remain the largest source of electricity generation beyond 2030. Coal-based electricity generation is expected to more than triple by 2030 in developing countries and most of this increase will be in India and China.

Steel production remains a significant market for coal, and international trade in metallurgical and coking coal accounts for some 29% of the total world hard coal trade, running at 182.5 Mt in 2001. It is estimated that approximately 15% of total hard coal production is utilised by the steel industry and almost 70% of total global steel production is dependent on coal. Steel production continues to increase and initial figures indicate that crude steel production in 2002 exceeded 900 Mt for the first time ever.

China is by a significant margin the largest producer of steel in the world and production increased in 2002, although against this background China remained a net exporter of coking coal.

Regrettably, the coal industry continued to make headlines by virtue of the large number of accidents associated with underground mining. In China over 5,230 fatalities occurred in the first 10 months of the year, running at some 4.7 fatalities per million tonnes of production. In Ukraine over 230 miners were killed, representing some 3.0 fatalities per million tonnes. Other major accidents with multiple fatalities occurred in Mexico, Poland, Romania and the Russian Federation.

World coal production

Detailed returns for annual world coal production are available from the latter half of the following year and a full reference list can be accessed from the BP Statistical Review of World Energy. A modest increase in growth of world production, from the 4,563.7 Mt recorded for 2001, can be anticipated on the basis of the returns of the major producing nations, amongst which China, India and Australia have indicated substantial increases in production (Table 1).

Regional Summaries

Asia Pacific Region

On a regional basis, Asia Pacific is by far the most important in terms of production, export trade and consumption. Nearly 45% of world coal production is sourced in the region, which includes three of the top four coal-producing nations, China, India and Australia having the top, third and fourth national production levels respectively.

Of these, Australia and China are respectively the largest and second most important coal-exporting countries. The region also includes the most important coal-importing countries, of which Japan is the largest, followed by South Korea and Chinese Taipei.

China

China is the world's largest coal producer and coal consumer and is also one of the economies most reliant on coal for its primary energy needs. Consistent growth in the Chinese economy has driven steadily increasing demand for power generation and corresponding increase in demand for steam coal, coupled with increased production of steel and corresponding demand for coking coal. It is expected that China's national economy will grow at an annual rate of 8% in 2003.

In 2002, power generation increased by 10% on the previous year, in what is seen as a pattern of consistent annual growth. The national annual electricity production for 2003 is planned to reach 1.72×10^{12} kWh, of which over 80% will be coal-based thermal power. This is estimated to represent an annual increase in coal burn of 35 Mt, with predictions that the annual coal burn for power generation in 2003 will be 560 Mt. Changes in the structure of the power sector at the end of 2002 reflect the changing commercial climate. The State Power Corp., which owned some 46% of the national electricity generation assets and 90% of the electricity supply assets, has been split into 11 separate companies. Of these, five are power generation companies, each with generating capacity between 30 – 38 GW, representing a total of 161.6 GW.

National steel production in 2002 also witnessed a spectacular increase estimated at around 20% on the 2001 figure, representing an annual production of over 180 Mt. Coal consumption by the metallurgical sector in 2002 has been quoted at around 200 Mt and this is expected to grow to 220 Mt in 2003.

Peak annual coal production of 1,397 Mt was reached in 1997, including hard coal and around 55 Mt of lignite. However, an oversupply in that year of 40 Mt prompted severe cut-backs in 1998. Production fell in the following years to 2000 and since then has progressively increased to 1,326 Mt in 2002. It should be noted that some confusion has surrounded figures quoted for China's annual coal production, and in recent years the IEA has revised upwards the officially released figures as, for example, presented in the widely-referenced BP Statistical Review of World Energy; the re-stated figure for production in 2001 was 1,294 Mt.

The structure of the Chinese coal industry has been complicated, with different categories of mines under administration and management at national, provincial or township level. At national level, the past two decades have seen frequent structural changes in the administration of the coal and energy industries and, according to *China Coal News*, there is now serious consideration of re-establishing the State Energy Commission to provide a comprehensive administrative and management framework. According to Zhang Baoming, former Coal Minister and Vice Minister of the State Development Planning Commission, considerable changes in administrative structure have been introduced, but there is also a need for significant state investment in order to allow China to respond to the level of competition it will face in joining the World Trade Organisation.

Zhang Baoming has quoted the original ratio of production between major state-owned mines, local or provincial mines and township coal mines as having been set at 40%:20%:40%. This ratio has changed in recent years and currently stands at 60%:20%:20%, representing a major move to modern, large-to medium-sized mine complexes, while reducing production from small, low- technology mining operations. He also indicated plans for the creation of large coal business enterprises on the international corporate model, with vertical integration with consumer processes, specifying coal-power, coal-chemical and coal-coke businesses. At least three such corporations would have coal production capacity in excess of 100 Mt/y.

China Coal News, reporting a forum held at Chengdu in September 2002, indicates that there are some 100 high-efficiency mines, including both underground and surface mines, and that these mines produce over a quarter of national production (238.0 Mt in 2001). These large and medium-sized mines are primarily under management at national level but also include 16 under provincial management. National policy for coal-sector development foresees the construction of new large or medium-size mine complexes, particularly in the western part of Shanxi Province, the western part of Shaanxi Province and the western part of the Inner Mongolia Autonomous Region, where the new projects will be integrated with power-generation capacity.

Already a number of mining groups have operated as Western-style corporations since the mid 1990s and are acknowledged to be the most modern and efficient operations. According to statistics published by

Chinamonitors, during the middle part of 2002, production from national government-owned coal mines was in the region of 50%-55% of national production. However, within this component, over a quarter was produced from just five companies, which represent the major coal producing corporations. These companies, which are among the "key state-owned companies and mining bureaus", comprise Shenhua Group, the largest, Yanzhou Coal Corp., second in size, and then three groups based in Shanxi Province: Datong Coal Mine Corp., Xishan Coal and Electricity Group and Pingshuo Coal Industry Corp.

Shenhua Group Corp. is reported to have produced some 60 Mt of coal in 2002. Established in 1995, Shenhua Group has 31 subsidiary companies and holding companies. Its commercial base is the operation and management of the enormous Shenfu Dongshen Coalfield, located in adjoining areas of Shaanxi Province and the Inner Mongolia Autonomous Region, with quoted proven reserves of 224,000 Mt.

Within the Shenhua Group, Shendong Co. is the largest coal-production unit in China. Started in 1987 with first production in 1996, the principal mines of the coalfield, Da Liu Ta and Huo Ji Tu have independent surface and underground installations but share a high-speed mine-to-surface conveyor system, coal washery and transport infrastructure. This complex has undergone recent upgrade during 2000-2002, with advanced conveyor controlled-start-transmission technology and then a complete automation system upgrade supplied by Rockwell Automation. As a measure of the success of the upgrade, production at Da Liu Ta (with a design throughput of 3.5 Mt/y), climbed to 9.2 Mt/y in 2000. The commitment to high production is indicated by the recent sale by Joy Mining Machinery of the most powerful shearer built to date by Joy, the 7LS6 model with 1,860 kW installed power. At Da Liu Ta mine a world record has been established of producing 8 Mt/y from a single long-wall. Annual production from the Shendong operations in 2001 was 37 Mt, and is anticipated to have reached 50 Mt/y for 2002.

Development of the Shenfu Dongshen Coalfield is the biggest coal project in the world, with an overall design capacity of 70 Mt/y and a dedicated new rail link of over 1,000 km to new port facilities at Huanghau (Hebei Province), just north of the delta of the Huang He (Yellow River). The first foreign vessel berthed at Huanghua in July 2002 and during the first half of 2002 the port had achieved a throughput of 5.2 Mt. Some concerns have been expressed as to the capacity of Huanhua Port and the need for dredging to allow access for panamax vessels.

Although coal production and an export business are core elements of the business plan, Shenhua has embarked on a programme to become an energy and chemicals conglomerate. Its operations include mine mouth power generation. In 2002, Shenhua signed a contract with the US group Headwaters Inc. to provide the technology, process design and technical services for a direct coal liquefaction plant, aimed to produce 50,000 barrels per day of low-sulphur diesel and gasoline from 13,000 t of coal. Project management will be performed by ABB Lummus Global and the plant at Majiata, Inner Mongolia, is

planned to come on-stream in 2005. Three additional similar plants are also planned, which together will consume 15 Mt/y of coal for the direct liquefaction process.

Yanzhou Coal Mining Co. is currently the second largest of the coal production companies and is traded on the Hong Kong and New York Stock Exchanges, although some 58% ownership remains in state hands. Based in Shandong Province the company produced 38.4 Mt in 2002 and sold 35.05 Mt, of which 60% was sold overseas, through the port of Rizhao. The company operates five modern mines by longwall systems in thick seams (3.38 – 5.74 m) producing low sulphur coal, primarily for power generation but with an important percentage of coking coal. The company claims to be China's most profitable coal producer and the unit cost of coal in 2002 is reported as Yu94.5/t or approximately US\$ 11.4/t. Although 2002 net profits were somewhat lower than expected the company proposes to raise production in 2003 to 40 Mt and proposes to develop a new coal terminal on the Jing-Hang River in Jiangsu Province, so that it can expand sales in northern China and the Yangtze River Delta. It is also reported that the company is considering the purchase or development of new mines outside its home base, including in Inner Mongolia, Shanxi and Guizhao provinces.

Datong Coal Mine Group Co. Ltd is based in the traditional coal mining area of northern Shanxi Province. The group included a number of older mines, some of which were closed in 2000 due to exhaustion of reserves. The company developed as the major producer of export coal via the Qinhuangdao export terminal. Reported coal exports from the company in 2002 were 8.2 Mt, an apparent increase of 91%. In the competitive export market there has been pressure on the company to improve consistency of coal quality. In response to this the Datong Group has entered a joint agreement with China National Coal Import Export Corp. (CNCIEC) and an Australian group to process up to 3.6 Mt/y of Datong product using high technology coal preparation technology. Recent reports of shipments of Datong washed coal fines to Japan indicate that they meet specifications set for Australian product.

Pingshuo Coal Industry Corp. is a recent development based on the Nigwu Coalfield in northern Shanxi Province, near Shuozhou City. The Jurassic coals were only explored and initial development undertaken in the late 1980s. Pingshuo Corp. is now the largest surface-mining operation in China with three opencast operations which together have a production capacity of over 45 Mt/y. The first operation, the An Tai Bo opencast mine, started in 1987 and was a Sino-US joint venture, with a production capacity of 15 Mt/y. The An Jia Ling mine was more recently commenced using only Chinese technology and is scheduled to produce at 15 Mt/y. The Pingshuo operations are geared primarily to the export market and the 2002 target was for sales of 20 Mt.

Xishan Coal and Electricity (Group) Corp. (XCEGC) is the second-largest coal production company in Shanxi Province, based in the Taiyuan region of the central part of the province. The company operates nine underground coal

mines and six preparation plants and was on target to produce over 24 Mt of raw coal in 2002. Coking coal is reported to comprise some 60% of production. The company primarily supplies major steelworks in Shanxi and also operates other industrial units including a cement plant, chemical plant and coal gas manufacturing plant. It has committed to grow as an integrated coal production and electricity generating company and is the developer of the major Gujiao Power Project. The markets of XCEGC are primarily domestic.

Shanxi Province is by a large margin the largest coal-producing province, producing nearly 30% of all national production, which is three times greater than each of the two next largest provinces (Shandong, Inner Mongolia). Shanxi has been characterised by a mixture of production from large state-owned mines, including operations of the Datong, Xishan and Pingshuo corporations, and also important large mines owned by the provincial administration, mines owned by individual county and city administrations, in addition to numerous smaller township mines. After major accidents in late 2001, in small poorly-managed mines, all 4,685 township mines in the province were ordered to stop production until safety measures had been introduced and approved. Only at the end of 2002 were 3,771 of these mines authorised to restart production. Plans are that by the end of 2005, the number of township mines in the province will be cut to around 3,000 and no mines with production of less than 60,000 t/y will be operating.

Shanxi Province is also the largest province for production of export coal and is the largest in terms of exports of anthracite, coking coal and steam coal. The greater part of Shanxi exports pass through Qinhuangdao port. In Shanxi Province only Shanxi Coal Import Export Group Corp. has a licence to export coal produced in the province, but as reported in *China Coal Report Monthly*, this is being strenuously challenged by the Datong Corp.

Qinhuangdao Port has traditionally been seen as the barometer of the national coal market. However, the ports of Rizhao, Tianjin and Qingdao have become increasingly important as also will be the new port of Huanghua. Overall, China exported 85.75 Mt of coal in 2002 (*McCloskey's Coal Report*), of which 43.26 Mt passed through Qinhuangdao.

Although the State Economic and Trade Commission (SETC) has targeted increased coal exports, the 2002 figures represent no increase on the 2001 figure of 86 Mt, and targets for 2003 of 90 Mt may be optimistic and will be sensitive to the regional market price structure.

For steam coal, the pattern of exports in 2002 to some degree reflects the domestic market. Internal demand was high during mid-2002 as extremely hot weather gave rise to heavy power consumption. Supply shortages were reported at power plants in Shandong Province and a shortage of better quality blending coal for power plants in Guangdong and Zhejiang provinces was met by imports. There was also a shortage of supply of Shanxi coal to Qinhuangdao Port attributed to insufficient rail transport capacity, which was reflected in falling stocks at the port. As the year progressed, coal exports picked up but at the end of the year last quarter sales were some 15% down

on the same quarter in the previous year. The Australian Government's commodity forecasting arm, ABARE, suggests that the low thermal coal prices in the Asian thermal coal spot market (around US\$22/t in mid-2002) was the main reason for the decline in Chinese exports. Increased internal demand gave rise to higher domestic prices and when export prices were low there appears to have been a redirection of supplies to the domestic market. Anticipated increases in thermal coal spot prices in 2003 are expected to stimulate increased exports from China.

Exports of coking coal increased in 2002 to 13.3 Mt, of which the biggest component was 8.6 Mt to Japan, which marked up a 20% rise in purchase of semi-soft coking coal. Export sales of coke showed an overall fall on the year of 9%, down to 13.6 Mt; largest purchasers were Japan and Brazil. Anthracite exports fell by some 20%.

A markedly increased level of coal imports in the first half of the year reflected the high demand by power generators in the southern provinces, which could not be met by domestic suppliers. Overall, the 2002 figure for steam coal imports was around 7.5 Mt, compared to some 1.5 Mt in 2001. Of the 2002 total, 5.68 Mt was imported in the first six months of the year. Principal suppliers were Australia, Indonesia and Russia, with smaller quantities from South Africa. Anthracite imports also saw a dramatic rise, running at around 2.8 Mt for 2002 in comparison with 400,000 t in 2001. Principal suppliers were Vietnam and North Korea. Coking-coal imports were, in contrast, essentially stable at around 250,000 t, showing a modest rise of some 15%. Principal suppliers were New Zealand and Australia.

India

India is the second production giant of the Asia Pacific region and third-largest coal producer in the world. In the calendar year 2002, hard-coal production (raw coal) was 335 Mt and lignite production was on target for a production of just over 24 Mt. The total coal product shows an annual growth of over 4%.

India is highly dependent on coal, which supplies some 63% of the national primary energy requirements. Coal resources, reported as of January 1, 2003, to a depth of 1,200 m are in excess of 240,000 Mt, of which over 35% are in the proven category. Hard-coal deposits are largely confined to the east and south central regions of the country. Lignite resources, quoted at around 34,600 Mt are primarily located in the southern state of Tamil Nadu, with 90% of quoted reserves, although significant lignite production is also obtained in the northwest of the country from Gujarat and to a lesser extent Rajasthan.

The structure of the coal industry still essentially reflects that of a command economy, dominated by the state-owned coal producer Coal India Ltd (CIL), the subsidiaries of which produce over 85% of national hard coal production. The greater part of the balance is produced in Andhra Pradesh by Singareni Collieries Co. Ltd (SCCL), a joint venture between the Government of India and the state government.

After speculation in the late 1990s on privatisation of the coal industry, this has been definitively excluded in recently proposed legislation. The Coal Mines (Nationalisation) Amendment Bill, originally proposed in 1997, has faced fierce opposition from trades unions, and after failing to obtain assent in the last Government, is again in 2002 before the Houses of Parliament at a consultative stage. The policy clearly envisages that coal mining remains a public sector activity but aims to increase the scope of private participation, by allowing private mining of non-captive blocks of coal and by allowing joint venture project development with increased investment levels for international participation.

Since 1996, legislation has been in place which prevents direct budget support of CIL from government funds. In the last full financial year, ended March 2002, CIL and its wholly-owned subsidiaries made a pre-tax profit of Rs17,545 million, turning around a pre-tax loss in the 2000-2001 exercise of Rs14,145 million. CIL operates through eight coal-production subsidiaries and an engineering, design and exploration consultancy. The relative performance of the coal-production subsidiaries and also SCCL is summarised in table 2.

There is significant variation in the profile and performance of the various CIL subsidiaries and SCCL, reflecting the structural complexity of the coal sector. Chronically loss-making companies are Bharat Coking Coal Ltd (BCCL), Eastern Coalfields Ltd (ECL) and SCCL, which are the companies with the highest percentages of underground mine production. They are characterised by numerous small underground mines and low productivity levels. In contrast, high profitability is characteristic of Northern Coalfields Ltd (NCL), operating only eight large surface mines. During 2002, 17% of all CIL production was from underground mining as was 40% of SCCL production.

The Working Group on Coal and Lignite for the government's 10th Five Year Plan 2002 – 2007 reported during the year and identified that resources available for surface mining are limited and plans for growth in production must focus on the large volume of resources suitable for underground mining. The report foresees an increase in coal production of some 77 Mt, representing an annual growth of 4.5%.

The report also identifies that costs of production of Indian coal remain relatively high. These are quoted for underground production as being around US\$5.47 per billion calories, compared with costs in Australia, South Africa and US in the range US\$2.42 - US\$3.43. Costs for surface-mined coal in India are around US\$2.18 per billion calories, which are correspondingly high, and relative productivity is very low in international terms. (Table 1).

A focus on increased underground production will require considerable capital outlay. A model which has been promoted primarily by South Eastern Coalfields Ltd (SECL) and Western Coalfields Ltd (WCL) is for risk-sharing with suppliers of new production equipment. In principle there is a substantial down-payment and then deferred payment of the balance, recovered over a five-year period in which responsibility for operation, training and maintenance remains with the supplier; the cost of services, spares and the balance of the

price is recovered against production to agreed targets. In 2002, Joy Mining Machinery supplied the first complete continuous miner system in India to SECL at Chirimiri mine, apparently on this financing basis, and a similar system is awaiting installation in early 2003 in Tandsi mine for WCL. The impact of this mechanisation can be expected to be dramatic. Since commencement of operation by the continuous miner at Chirimiri, 440,000 t has been mined in the first 11 months. However, the delay from initial invitations to tender to delivery for these contracts has been of the order of seven years. ECL is endeavouring to use a similar approach for financing new long-wall equipment at its Jhanjra mine, but in view of the indebted position of the company, clearance from the Ministry of Coal is first necessary to close off existing projects.

Lignite mining in India is dominated by production from Neyveli Lignite Corp. (NLC) in the southern state of Tamil Nadu, with a production in calendar 2002 of around 18 Mt. Smaller operations in Gujarat and Rajasthan together contributed a further 6 Mt. The report of the Working Group on Coal and Lignite for the 10th Five Year Plan foresees expansion of lignite production within the plan period increasing to 56 Mt by 2007. Of this, some 88% will be destined for the power generation industry. Investment for significant expansion in production is proposed to be directed both to NLC and also to the Gujarat operations.

Since the 8th Five Year Plan, there has been recognition of a need to increase thermal power generation capacity, and at the same time recognition of a significant gap between demand and domestic supply of hard coal. Since 1993 the private sector has been able to apply to mine coal for captive consumption for thermal power generation. Currently, 16 mines in the hands of six separate commercial enterprises mine coal under this legislation, and in 2002 they produced together 9.4 Mt.

The supply gap over the capacity to deliver domestic coal has driven the opening up of coal production and processing to the private sector and also the policy of allowing unrestricted imports of coal by commercial consumers. In 2002, 78% of all hard-coal production went to only three industrial sectors, power generation, steel-making and cement production. Power generation consumed over 250 Mt of mostly run-of-mine product. The steel industry consumed some 5 Mt of coking coal, representing virtually all washed-coal product, from BCCL, CCL and WCL, with admixture of good quality run-of-mine product. The cement industry consumed some 12 Mt.

The year 2002 may be seen as the threshold of significant change in the pattern of coal supply to the power-generation industry. Regulations drafted in the late 1990s were designed to prohibit the transport of low calorific value coal over long distances to the point of consumption, in order to reduce uneconomic transport costs, to reduce the environmental impact of burning low-quality coal and disposal of ash and to rationalise rail transport capacity. After a legal challenge the Supreme Court has ruled, after a five-year period of deliberation, that regulations shall apply which prohibit power plants from burning any coal with an ash content in excess of 34% which has been

transported over a distance in excess of 1,000 km. Since June 2002, it is reported that this ruling has been enforced. CIL has maintained that the business of washing coal is not part of its remit and there has been a period of speculation as to a private-sector business opportunity for undertaking coal preparation and delivery. To date this appears not to have developed. Also during 2002, CIL waived rules which prevent the various subsidiaries from competing with each other for domestic supply contracts. It is therefore anticipated that some of the State Electricity Boards (SEBs) will seek to source cheaper product than that from their traditional tied supplier.

India exports a small tonnage (some 16,000 t) to its land-locked neighbours to the north. It is also becoming an important coal importer in the Asia Pacific Region. In the financial year 2001-2002 India imported a total of 22.8 Mt, comprising 11.1 Mt of coking coal, 2.88 Mt of coke and 9.44 Mt of thermal coal. Coking coal is primarily imported by the Steel Authority of India Ltd, in order to blend with indigenous coal product. Coke is imported mainly by manufacturers of pig-iron and steel producers using mini-blast furnace technology. Thermal coal is being supplied to a large number of individual consumers for steam-raising. During 2002, Gujarat SEB was a significant importer of coal (about 1 Mt/y) and tenders have been let by Maharashtra SEB for the early part of 2003. Coal exporters report that they expect that Rajasthan, Tamil Nadu and Karnataka SEBs will also come onto the market during 2003. *McCloskey's Coal Report* has indicated that in mid-2002 Indian buyers were seeking fob supply prices of close to US\$20.00/t for standard 6,000 kc (NAR) coal from South Africa.

Australia

Australia is the fourth largest coal producer in the world, producing 341.7 Mt of coal and lignite in 2002, and is the largest coal exporter, despatching 203.8 Mt in 2002. The Australian economy is heavily dependent on the performance of its coal export trade, which accounts for nearly 25% of national export earnings. Australia accounts for nearly one-third of coal supplies to the world market and also supplies almost 60% of the imports to the world's largest importing nation, Japan. On the international stage, Australia has a high profile by virtue of its exports of coking coal and thermal coal, but the economy is also reliant on coal-fired and lignite-fired power generation as the major contributor to the total national electricity supply. For example, in New South Wales (NSW), approximately 90% of electricity is generated from coal, and in Victoria 85% of the state's electricity is from lignite-fired plant.

Reflecting national concerns on dependency on coal-fired domestic power generation and the value of coal exports, the Howard government made the decision in June 2002 not to ratify the Kyoto Protocol.

In 2002, Australia produced 275 Mt of hard coal (ABARE forecast), primarily from Queensland (~148.4 Mt for 2001/02) and NSW (~114.3 Mt for 2001/02) with much smaller amounts produced in South Australia, Tasmania and Western Australia. Of this total for 2002, *McCloskey's Coal Report* records Group reports 203.8 Mt as exports, the balance being largely consumed for domestic power generation. In Victoria, 66.7 Mt of brown coal was mined in

the Latrobe Valley, and virtually all of the coal was consumed for power generation.

Queensland and NSW both produce coking coal and thermal coal qualities. Of Queensland production, coking coal comprises around 60% of coal production in the state and 75% of all coking coal produced nationally. Of NSW production, thermal coal comprises around 75% of coal production in the state and around 56% of all thermal coal produced nationally.

Coal production in both Queensland and NSW has experienced a consistent growth over the past decade, showing average annual growth of 5.8% and 3.2% respectively over the period 1992-2001. In Queensland, underground production has always been the minor component (only 10% in 1992) but the level of production has almost quadrupled over the period and now comprises almost 22% of annual production. In NSW, the contribution of underground and opencast mining was approximately equal throughout the first half of the 1990s, but from 1996, opencast production has shown a dramatic growth and now comprises nearly 60% of annual production. Overall, in the export coal states of Queensland and NSW, approximately 70% of production is now from surface mining.

The Australian coal industry, as represented by the export-led operations in Queensland and NSW, continued to undergo a period of dynamic consolidation during 2002. The most high-profile restructuring was the sale in mid-2002 of the coal assets of the Glencore group to Xstrata plc, which in Australia saw the operations of Enx Resources incorporated into Xstrata. At the end of 2002 the export coal operations of Queensland and NSW were dominated by five groups: Rio Tinto, BHP Billiton, Xstrata, Anglo Coal and MIM Holdings. These five companies produce some 50% of all Australian hard-coal production.

Rio Tinto Plc operates in the Australian coal industry through its subsidiaries Pacific Coal, which is wholly-owned, and Coal & Allied Industries, approximately 70%-owned. In 2002, a production of 35 Mt was attributable to Rio Tinto group from its various holdings in Australia, making it the largest single production group.

In 2001, Coal & Allied Industries acquired the Australian assets of Peabody Resources, which gave rise to a doubling of the production capacity of Coal & Allied in the Hunter Valley, NSW, to over 36 Mt in 2001/02, to the extent that the company now manages roughly one-third of all coal exports from the Hunter valley. During calendar year 2002, some of the recently acquired Peabody assets were sold, including the Ravensworth East and Narama mines and interest in Moura mine. As a result of this, annual production managed by Coal & Allied fell to 32.3 Mt, of which the tonnage attributable to the company was 22 Mt. Key projects in 2002 involved the continuing pre-production studies of the Mount Pleasant project and integration of the Warkworth and Mount Thorley operations to create a single unit with capacity of some 11 Mt/y.

Pacific Coal manages the Queensland interests of the Rio Tinto group and operates three mines, including Blair Athol, Australia's largest exporting mine, which produced some 11.8 Mt of thermal coal. Pacific Coal managed a 2002 production of some 21.6 Mt, of which tonnage attributable to the company was 17.4 Mt. The principal project is development of the Hail Creek mine in the Bowen Basin, designed to produce 5.5 Mt/y of prime hard coking coal, for which contracts have been let for construction of a coal-preparation plant, a 52 km railway spur and erection of a 80 m³ bucket dragline.

In the financial year 2001-02, BHP Billiton produced 28.4 Mt attributable coal from the metallurgical coal operations managed by the company in the Bowen Basin of Queensland. The company manages nine surface mines and one underground mine and an export port facility in Queensland. However, for these operations BHP Billiton is the majority equity partner in two joint ventures with Japanese partners: in the BHP Billiton Mitsubishi Alliance (BMA) in which it has a 50% stake and in BHP Mitsui Coal (Australia) in which it has an 80% stake. The balance of metallurgical coal produced by BHP Billiton was 7.1 Mt from its wholly owned Illawarra operations comprising six underground mines in NSW. In addition it produced 4.6 Mt of thermal coal from wholly-owned operations in the Hunter Valley of NSW.

In 2002, BHP Billiton further integrated its management structure with the consolidation of BMA, involving some selling down of its joint venture stake in Central Queensland Coal Associates and in the Gregory Joint Venture (Gregory and Crinum mines). Construction has commenced on the Dendrobium underground mine project in NSW, planned with a capacity of 5.2 Mt/y of metallurgical coal, to come on-stream in 2005, and progress continued on the integration of the Blackwater and South Blackwater surface mines in the Bowen Basin. The development of the Mt Arthur North mine project (Hunter Valley, NSW) continues on schedule for operation in late 2003, when it will become the largest hard coal open-cut mine in Australia, with a design capacity of 12.1 Mt/y of thermal coal.

Xstrata is a new entry among the major Australian coal-producing companies. Following the restructuring which gave rise to Xstrata as the operating company, and some further acquisitions, at the end of 2002 the company had achieved an annual attributable production of 27.6 Mt. This was primarily from NSW, from the Hunter Valley, and the company's products are thermal coal or semi-soft coking coal. The company indicates that it has 12 Mt/y of new capacity in the pipeline over the next ten years and it aims to increase its annual production by 2005 to around 32 Mt/y. The new projects include the new 4 Mt/y Beltana underground mine, owned 87.5% by Oakbridge itself a 78% subsidiary of Xstrata, which will come on-stream in 2004, and the 3 Mt/y Glendell surface mine, a satellite to Mount Owen, also due on-stream in 2004.

Anglo Coal Australia became one of the leading coal producers after acquiring the assets of Shell Coal in 2001, and in 2002 its attributable production places it in fourth place nationally. The company has continued to acquire interests in a number of joint ventures and in May 2002 entered into a joint venture with Mitsui, acquiring 51% of the Moura thermal/coking coal mine in Queensland

and divesting to Mitsui part of its interests in German Creek mine and other operations in Queensland. A fall in annual operating profits in 2002 was attributed to technical difficulties at two of the major underground mines: Moranbah North in Queensland and Dartbrook in NSW. In early 2003, Anglo Coal acquired a 70% interest in the Girrah coal deposit in Central Queensland, adjacent to German Creek, with the balance acquired by Mitsui. Active development continues at two new projects, Grasstree and Kayuga, the latter due to come into full production in 2004. In 2002, Anglo Coal produced 25.0 Mt of attributable saleable coal (24.3 Mt in 2001).

MIM Holdings produced just under 20 Mt in 2002, from three mines, Oaky Creek and the Newlands-Collinsville complex, in the Bowen Basin of Queensland. Currently, MIM holds a 75% ownership of these assets, which together have a nominal capacity of 21 Mt/y. Oaky Creek is a major coking-coal operation, while the Newlands-Collinsville complex produces both thermal and coking coal. MIM has publicised plans to achieve 38 Mt/y production over the next five years, including raising production from the Newlands thermal coal operation to 16.5 Mt/y and through development of the new Rolleston mine scheduled to produce 6 Mt/y by 2006. At the end of 2002 there was wide speculation on the acquisition of MIM Holdings by Xstrata. Irrespective of the implications for the metals operations of each company, this consolidation would give rise to a significant re-adjustment of the status of the major players in coal production.

Amongst other companies endeavouring to develop a significant share of the lucrative export market for Australian coal production, RAG Coal International, operates North Goonyella and Burton mines in Queensland, achieving a production of some 6 Mt in 2001. Full ownership of North Goonyella by RAG was consolidated at the beginning of 2003. Austral Coal is also expanding its Tahmoor longwall operation in NSW, anticipating placing an order for a new longwall face and increasing output to over 3 Mt/y by the end of 2003.

Brown-coal production is devoted almost exclusively to power generation. The state of Victoria claims to have the thickest and most extensive brown coal seams in the world. Production is dominated by the electricity generating companies in the Latrobe Valley. The Loy Yang mine is the largest open-cut mine in Australia, operating four bucket-wheel-excavators to mine 31 Mt in 2001/02, fed directly to the 4 x 500 MW power station of Loy Yang Power. The two other major mining and power generation companies are Hazelwood Power Corp. and Yallourn Energy Ltd, extracting 15.7 Mt and 19.0 Mt of lignite respectively in 2001/02. The other major brown-coal miner is Alcoa of Australia Ltd, which extracted 1.07 Mt of brown coal at Anglesea to generate power for its Point Henry aluminium smelter. In 2002, proposals were tabled for a major combined power generation and gas-to-liquids project, to produce low-sulphur diesel fuel, based on extracting 26 Mt/y of lignite from the Flynn lignite field east of the Loy Yang project area.

Indonesia

Indonesia is the world's third largest exporter of thermal coal, after Australia and China. Exports of 64 Mt in 2001 are expected to have increased in 2002,

although Indonesia is also characterised by a steadily increasing domestic market for power generation. There are abundant identified coal reserves, of which the majority (68%) are located in Sumatra, primarily in the south of the island, and the remainder are in Kalimantan. The greater part of the reserve base is brown coal (59%) and sub-bituminous coal (27%) with lesser amounts of higher rank coals.

Indications are that coal production in Indonesia continued the rapid growth of recent years and in 2002 would reach 100 Mt, compared with over 92 Mt in 2001. However, two items have dominated reports on the Indonesian coal industry. The previously state-owned company PT Tambang Batubaru Bukit Asam (PTBA) was finally privatised, with the release of 15% of the equity for listing on the Jakarta and Surabaya Stock Exchanges in late 2002. The second item is the on-going saga of the divestment of the 51% stake in Kaltim Prima Coal (KPC), now overdue, to be purchased by Indonesian enterprises.

After a lengthy wrangle and hard political pressure by the provincial government of East Kalimantan, agreement was reached with the Government of Indonesia to purchase the 51% stake, to be sold on to Indonesian interests, including 20% to PTBA. However, by the end of January 2003 the purchasers had not completed their due diligence and some reports suggested they were struggling to raise the required finance; so the saga continues.

The largest coal producer is PT Adaro Indonesia (Adaro), with a large surface mine operation in South Kalimantan, producing over 18 Mty. Adaro mines thick seams, up to 50 m thick, of exceptionally good quality coal, marketed with 0.1% sulphur and 1% ash. The company supplies both the domestic (approximately 35% of its sales) and export markets. In contrast, the second largest producer, KPC, based in East Kalimantan, is focussed almost exclusively to the export market and is the largest coal exporter. KPC produced 17 Mt in 2002 (2001: 15 Mt) and is targeting 18.5 Mt for 2003.

PTBA, now operating as a private corporation, is planning to offer 20% of its total shares on a Canadian stock exchange during 2003. The company is based in South Sumatra and is ranked the third-largest coal producer in the country with production of approximately 11 Mt/y from four surface mine operations, only one of which it operates directly, the others being worked under contract. The company is the largest single supplier to the domestic market, supplying over 8 Mt/y to power generators and to the cement industry. The company aspires to acquiring part of the government stake in KPC and has revealed plans to acquire other operations and enter partnerships for the construction and management of power plants.

The position as third-ranked producer is disputed with the consolidated Indonesian holdings of the Thai energy group Banpu, which operates the Indominco (65% owned), Jorong and Kitadin mines, producing a total of 11.4 Mt from their Indonesian operations. The company holds reserve blocks in Kalimantan and Sumatra with plans for expansion based on three further coal blocks currently under exploration. Of comparable size, the next largest

operation is the South Korean-owned Kideco Jaya Agaung company, which operates the Pasir open-pit mine in East Kalimantan, producing 10.3 Mt/y (2001) by truck-and- shovel mining.

Other leading coal operations in Indonesia have seen changes in ownership, accompanied by plans for expansion. At the end of 2001, BHP Billiton sold its 80% stake in the Arutmin operation to PT Bumi Resources; the balance is held by PT Bakrie and Brothers Tbk. Arutmin is producing over 10 Mt/y from two mining complexes, Senakin and Satui, in South Kalimantan, linked to the port facility of North Pulau Laut Coal Terminal. The Arutmin product is primarily for export and BHP Billiton continues to provide market services for 75% of the product. Ownership of Berau Coal also changed in 2002, when the 60% holding of PT United Tractors Tbk was sold to PT Intra Karsa Corp. Production of Berau Coal in 2002 is reported to be slightly down on the 6.6 Mt produced in 2001. Expansion plans are to some extent limited by the crushing plant and equipment and the supply chain to Suaran port. Currently some 71.5% of production is exported.

Smaller producers, particularly from Kalimantan and including co-operatives, made their appearance on the export market during 2002. There are also a significant number of smaller illegal mining operations in Kalimantan and government initiatives to crack down on these have been announced.

Other Asia Pacific

Bangladesh is progressing to become a coal producer when the first coal face at its Barapukuria mine comes into production, currently scheduled for October 2003. Development of the Barapukuria mine is being undertaken by China National Machinery Import and Export Corp. (CMC). Construction was delayed by a major inrush of water in 1998 requiring redesign and causing a two-year delay in the project schedule. A second face is scheduled to come on-stream in 2004, with hand-over of the mine to Bangladeshi management in late 2004. The mine will supply a 125 MW mine-mouth power plant. It is reported that CMC is now in negotiation to undertake a second coal mine project in the country.

Iran maintains annual production at around 1.5 Mt, under the management of the National Iranian Steel Corp. (NISCO) from relatively small underground mines in the Kerman Coalfield and from even smaller operations in the Alborz coalfields. Virtually all production is from underground, from relatively thin, locally steeply- dipping seams, and is destined for the steel industry. NISCO remains however a consistent purchaser of coking coal from the international market and has a policy to increase indigenous coal production. A major investment project is development of the Tabas Coalfield. There is some limited production from semi-mechanised underground mining from pilot mines and in 2002 there was continuing progress in the design and engineering of the main Tabas project, which is being undertaken by the UK-based Cementation Skanska, for construction of a 1.5 Mt/y longwall operation.

In **Japan**, the beginning of 2002 saw the closure of the last operating colliery, the Taiheiyo mine which worked under-sea resources in Hokkaido. A longer,

phased closure had been planned but withdrawal of subsidies precipitated closure in January 2002. This marks closure of an industry which at its peak produced over 37 Mt/y during the Second World War. Production of the mine in 2001 was 2.9 Mt which was supplied to domestic power generators. Those generating units in near-coastal locations are anticipated to turn to imported coal while a number of inland coal-fired generating units will close.

The coal industry in **New Zealand** is dominated by the state-owned Solid Energy. After failed attempts to sell the business to the private sector, there are now no longer plans to privatise the industry. The company achieved a production 3.35 Mt in the 2001/02 financial year, of which it exported 1.8 Mt. A number of smaller producers contribute to an estimated national production of 4 Mt in calendar year 2002, with corresponding exports of 2 Mt. Solid Energy achieved a 13% annual increase in production (2000-01: 2.97 Mt), attributed mainly to increased output from its Stockton open-pit mine, in the northwestern part of South Island, where a new aerial ropeway configuration was introduced. Solid Energy achieved an 8% growth in exports between 2000/01 (1.66 Mt) and 2001/02, and aims for 15% annual growth to achieve 2.1 Mt for 2002/03. The increase in export coal is scheduled from the re-opening of the Spring Creek underground mine, near Greymouth, South Island, after acquiring ownership from the private sector. Only 5% of New Zealand's electricity is generated from coal, and sales to the power-generation industry were only 0.7 Mt, primarily to the Huntly Power Station (North Island). Projections are that this will increase to 2.5 Mt/y by 2010, requiring increased investment to develop the coal resources of the Waikato Basin in North Island, which currently produces 1.4 Mt/y. Over 80% of coal produced by Solid Energy is high-quality metallurgical coal for the steel sector in New Zealand and overseas. This has generated strong profits, but concerns are voiced regarding the level of investment required to prove and develop future reserves, of which the majority currently identified are thermal coal quality.

Pakistan has a small coal industry based on low technology underground mining operations in Baluchistan, Punjab and Sindh. Markets are the cement industry and small industrial applications such as brick kilns, with the exception of a number of small mines in the Lakhra Coalfield in Sindh, which supply the Kanot Power Plant. The Kanot Power Plant, built in the early 1990s by the Chinese company CMC, comprises 3 x 50 MW units, of which only one is intermittently functional. The role of coal in Pakistan's power generation mix is only around 1%. Only in Sindh have deposits of wide extent been identified, with the potential that modern mining systems may be applicable in future.

These are lignite fields locally classifiable as sub-bituminous coal. These comprise two coalfield areas, the Lakhra-Sonda-Thatta area, to the west of Hyderabad, and the Thar Coalfield in the Thar Desert in the southeast of the province. In the former area, despite frequently reported interest by Chinese groups to collaborate in the development of new mining and power-generation projects, there has been no movement. However, in the Thar area, a large coal block has been licensed to Shenua Corp. of China, which is currently undertaking drilling and feasibility evaluation for coal mining and a captive

power plant. Also in 2002, the greater part of the Thar coal blocks, surrounding the one licensed to Shenua Corp., was the subject of international tender for feasibility appraisal, which was awarded to Rheinbraun Engineering und Wasser. In 2002, Pakistan had substantially increased imports for the cement industry, in response to government rulings that this sector should reduce its dependence on hydrocarbons, in favour of coal.

The **Philippines** has very limited coal resources, quoted as 300 Mt of recoverable reserves, but these are dispersed and mostly of lignite or sub-bituminous coal. Through the 1990s, coal production declined and currently the bituminous coal open-pit mine on Semirara Island, Province of Antique, is the only operation of significance. This operation produces 2.4 Mt/y of coal with corresponding overburden production of 23 M bcm. Semirara Coal Corp. invested significantly in late 2001 and early 2002 in the purchase of two Terex RH-120-E backhoes, with 16 m³ buckets, and five TR 100 trucks, with a 91 t payload. Coal is transported by barge from the site to local power plants and cement works.

The country does rely on a significant amount of coal-fired power generation and during 2002, the National Power Corp. (Napocor) indicated that it would seek to meet national clean air and emissions legislation by increasing the burn of imported low sulphur clean coal. Napocor signed a long-term supply agreement for an additional 3 Mt/y of coal from Indonesia but this commitment has been modified to only a short-term contract as long-standing plans for the privatisation of Napocor are planned to be implemented in 2003.

A small open-pit operation is reported to be planned by Philippine National Oil to utilise some 28 Mt of lignite reserves in Isabela Province, feeding a planned 150 MW power plant scheduled to come on-stream in 2005.

South Korea has a small national coal industry producing under 4 Mt/y of anthracite for power generation and domestic use.

Thailand is a significant producer of brown coal which is used almost exclusively for power generation. The 2,400 MW lignite-fired Mae Moh power plant is the largest source of electricity generation in the country and also one of the largest point sources of atmospheric pollution in Southeast Asia, generating around 13% of Thailand's electric power production. The Mae Moh mine produces around 18.3 Mt/y, feeding directly to the power plant. A number of smaller producers supply the balance of the total national lignite production, which was 21.6 Mt in 2001. The smaller producers supply the cement industry and industrial steam-raising requirements. The country currently imports also some 5 – 6 Mt/y of bituminous coal and some coke for industrial use. Banpu plc is Thailand's largest private coal production company, producing 2.7 Mt/y of lignite and sub-bituminous coal in Thailand in 2002, but with attributed production of around 13.7 Mt, of which the balance is from company-owned operations in Indonesia.

Vietnam produced 15 Mt of coal in 2002, an increase of around 2.5 Mt over 2001. Exports of coal, mainly anthracite, were 5.5 Mt, and the balance was

consumed in power generation and domestic use. Since 2000 there has been a 65% growth in production but predictions are for production in 2003 to be static or to show limited growth.

North America

US

According to preliminary data from the US Energy Information Administration, coal production in the US, in the calendar year 2002, fell by 3% from the 2001 level and was recorded as 1,093.8 million short tons (992.2 Mt). Nationally, overall exports continued the fall from the plateau of 1999-2000 (53.1 Mt) and in 2002 were 35.9 Mt, comprising 16.4 Mt of steam coal and 19.5 Mt of metallurgical coal. Imported coal totalled 15.3 Mt, a decline on the 2001 figure of 15%.

The returns of the Department of the Interior Office of Surface Mining, for the fiscal year to October 2001 – September 2002, show that of the total annual production, 67.5% was produced by surface mining and the balance from underground extraction. The surface-mined total included some 73.5 Mt of lignite, produced primarily from just two states, Texas (40 Mt) and North Dakota (27.8 Mt), with much smaller quantities from Louisiana, Mississippi and Montana. The total of hard-coal production was split 65% surface-mined and 35% underground.

The pattern of coal supply and demand in 2002 was complex. The early part of the year was characterised by slow economic performance and a mild winter, which held down demand for coal, although a generally hot summer contributed to increased demand for coal to meet higher power generation requirements later in the year. Against this pattern, there was a continued decline in coal production, reflecting periods of low demand, while overall coal consumption increased.

On a regional basis, production from the Appalachian Region fell sharply, with a decrease of 8%, while the Interior and Western Regions remained essentially constant. Wyoming in the Western Region was, by a large margin, the state with highest coal production of coal and registered an annual record of 338.8 Mt, an increase of 1.3% over the previous year. This was 34% of all national coal production and almost equal to the sum of the next three largest coal-producing states (West Virginia, Kentucky and Pennsylvania). Around 56% of national coal production was produced by just six major coal companies.

Peabody Energy is the world's largest private-sector coal company, and operates in nine US states. The company sold 179.6 Mt in 2002, representing close to 20% of national hard-coal production. Coal sales fuelled more than 9% of US electricity generation. The company owns coal reserves stated as 9.1 billion short tons, which are more than double those of the next largest reserve base owned by CONSOL Energy. In its annual report Peabody indicates that in the past five years it has opened mines with more than 22.5 Mt/y capacity, which includes capacity of nearly 11 Mt/y in 2002. In early

2002, Peabody reopened its Rawhide mine in the Powder River Basin (PRB) of Wyoming, to produce some 2.7 Mt in the year and maintains its position as the largest single producer in PRB. The company's North Antelope-Rochelle surface mine is the largest single operation in the PRB, producing almost 68 Mt in 2002.

In mid-2002 the new Willow Lake surface mine in Southern Illinois came into production with a capacity of 3.2 Mt/y. Construction of the new Big Run mine in Western Kentucky, and the Vermilion Grove mine in Central Illinois, both with capacity of 900,000 t/y was completed in the year, the latter mine to be operated by the Black Beauty affiliate company. Scheduled for opening in 2003 are the Highland No. 9 mine in Western Kentucky, with 3.6 Mt/y capacity, and the Federal East underground operation in northwest Virginia, with 4.5 Mt/y capacity. The Lee Ranch surface mine in New Mexico was also expanded. Peabody highlights its focus on efficiency and cost-reduction, in particular related to improved mining methods which include double-sided digging and dozer-assisted overburden removal, allowing the moth-balling of a significant fleet of truck and shovel equipment. The company continues to develop its highwall mining capability and to develop high productivity continuous miner operations in its underground mines.

Arch Coal Inc. claims to be the second-largest coal producer nation-wide, with a strategy to concentrate on production of low-sulphur, clean-burning thermal coal. Coal sales in 2002 were 104.7 Mt, from three regions, Central Appalachia (29.1 Mt), PRB (61 Mt) and the Western Bituminous Region (14.6 Mt) which covers Colorado, Utah and southern Wyoming. The PRB production is all attributable to the Black Thunder surface mine, using four large draglines, one of the largest mines in the US. It is claimed to be the world's biggest coal producer, having achieved a production total of 750 million short tons (680 Mt) since it commenced in 1977. However, one of the most significant increases in production in 2002 in the Western Region generally, is attributable to Arch's highly productive West Elk mine in Colorado. This is an underground longwall operation which is reported to have increased output by some 1.36 Mt in 2002, in which targeted production was 5.4 Mt.

Also in the west, Arch has a 65% interest in Canyon Fuel Co., operating three underground mines in Utah. In the central Appalachians, Arch operates surface and underground mines in West Virginia, Kentucky and Virginia. In this area, Arch's largest mine is the Samples operation, rated at nearly 7Mt/y, but which was suffering from geological problems in the early part of 2002. The controversy on permitting of valley-fill disposal of spoil from mining became acute in mid-2002 through the ruling of US District Court Judge Haden, and potentially serious impacts are anticipated in Central Appalachia, where Arch is one of the leading operators of large surface mines.

Kennecott Energy, part of the Rio Tinto Group, produced 105.3 Mt of thermal coal from six operations in Wyoming, Montana and Colorado, placing it on a par with Arch as the second-largest producer. The company operates three major surface mines in the PRB of Wyoming, Cordero Rojo (2002: 34.7 Mt),

Jacobs Ranch (2002: 28.8 Mt) and Antelope (2002: 24.3 Mt), respectively the third, fourth and eighth largest operations in PRB. Also in the PRB, there are two smaller operations in Montana, one of which is 50%-owned, so that attributable production from these two was 12.6 Mt. Kennecott also operates the Colowyo surface mine in Colorado, in which the company has a 50% stake.

RAG Coal International has grown since 1999 to be one of the major coal producers in the US. In 2002, it produced 64.5 Mt from ten operations spread between Wyoming, Colorado, Illinois, West Virginia and Pennsylvania. The company produced 38.5 Mt from two large open-pit, truck-and-shovel operations in the PRB, Eagle Butte and Belle Ayr, respectively the seventh and tenth largest mines in Wyoming. In Colorado, the company operates the Twentymile underground longwall mine, which produced 6.9 Mt in 2002, making it among the three or four largest underground coal mines in the US. Twentymile is claimed to be the most productive underground coal mine in the world in terms of output per man-year, with a workforce of little over 300. It operates on the basis of a single longwall of over 300 m length plus continuous miner development units. Two other large longwall mines are in operation in Pennsylvania, Cumberland and Emerald mines, each of which produced 6 Mt in 2002. The remainder of operations are smaller underground room-and-pillar operations in Illinois and West Virginia, and a small surface mine operation also in West Virginia. The majority of production is sub-bituminous thermal coal from PRB and bituminous thermal coal from the other operations, although a small quantity of metallurgical coal is obtained from the West Virginia mines.

Consol Energy mines more high calorific bituminous coal in the US than any other producer and is the largest exporter of US coal. It is the largest producer of underground coal and also one of the leading producers of coal bed methane. In 2002 the company produced 58.8 Mt from its US operations, a reduction of around 12% on the previous year. At the beginning of 2002 the company had some interests also in Canada and Australia. The metallurgical coal interests in western Canada were disposed of at the beginning of 2003 as part of the amalgamation of the Fording Trust. The 27 mining operations in the ownership of Consol at the end of 2001 had fallen to 22 at the end of 2002, of which 17 were in active production at the end of the year.

All the operations in the US are underground mines, with the exception of the Mahoning Valley surface mine in the northern Appalachians, although this had been put on care-and-maintenance from June 2002. Consol faced reserves exhaustion during the year at a number of its northern Appalachian mines. Nevertheless, it operates three of the largest underground mines in the US, all of which are longwall operations supported by continuous miners, in the northern Appalachians (Pennsylvania and West Virginia); Enlow Fork, producing at just under 9.0 Mt/y, Bailey at around 7.5 Mt/y and McElroy at over 6.0 Mt in 2002. A major new coal preparation plant at McElroy mine, which became operational in late 2002, will support expansion of McElroy, planned to increase to around 10.9 Mt/y by 2004.

A new name appearing in 2002 was Horizon Natural Resources, which emerged from the Chapter 11 restructuring of AEI Resources. Production in 2002 was approximately 42 Mt from 27 surface mines and 15 underground mines in the central Appalachians, the Illinois Basin and the Rocky Mountains. Approximately 64% of production came from the central Appalachian operations and 36% from six surface and underground mines in Colorado, Illinois and Indiana. During 2002, the company acquired the remaining coal assets of Pittston Coal Co., which has definitively withdrawn from the coal business. Horizon therefore acquired further low-sulphur, high-calorific coal reserves in West Virginia including the Kanawha River operations. However, by the end of the year, reduced demand, high levels of stocks held by customers and an uncompetitive capital structure required a new petition for reorganisation under Chapter 11 of the US Bankruptcy Code. Commentators speculate as to the continued high level of debt incurred through acquisitions in the 1990s. At the time of the end-2002 petition, it was expected that coal operations would continue uninterrupted. During early 2003 the company has closed, or technically idled, four operations in West Virginia, which produced around 3.5 Mt in 2002, and a surface mine and coal preparation plant in Indiana which produced 600,000 t in 2002.

Canada

Hard-coal production in Canada has resumed its pattern of general decline. The annual total of coal production in 2002 of 66.6 Mt (2001: 70.5 Mt) shows a 5.5% decline overall. However, the totals include lignite production in Saskatchewan, which remained essentially constant in 2002 at over 11.3 Mt, and was consumed in the domestic market for power generation.

The bulk of coal production in Canada comprises primarily metallurgical coal from British Columbia and primarily thermal coal from Alberta. Production from Alberta was 30.5 Mt in 2002, down marginally from the previous year, and comprising 90% thermal coal and the balance of metallurgical quality. In British Columbia, coal production fell by 10% to 24.4 Mt in 2002 (2001: 27.0 Mt), comprising 95% metallurgical coal and the balance of thermal quality. Production in Alberta and British Columbia is predominantly from surface mining, although the Coal Association of Canada records one underground mine in British Columbia. Coal production in the east of the country, in New Brunswick and Nova Scotia, has now virtually ceased and currently comprises some small surface mines and a highwall mining operation, together producing less than 1% of national production.

Canada remains a significant export coal producer, although exports fell by 11% to 26.8 Mt in 2002 (2001: 30.1 Mt), of which 90% was coking coal, primarily from British Columbia. The primary export destinations were Japan, Korea, UK, US and Germany, in that order, for coking coal. Korea also received the greater part of thermal coal exports.

Luscar Ltd is Canada's largest coal company, mining lignite in Saskatchewan and bituminous thermal coal in Alberta. During 2002 the company operated ten mines, including seven that were wholly-owned, with an attributable production of approximately 37 Mt/y (36.7 Mt in 2001). At the end of 2002 and

early 2003, the consolidation of Fording Canadian Coal Trust, involved the transfer of the Luscar metallurgical coal operations, reserves and assets to the trust, including its 50% interests in Line Creek mine, British Columbia, Luscar mine, Alberta and the adjacent Cheviot mine project. Luscar now holds a 6.8% in the trust and at the same time has undertaken not to participate in the metallurgical coal business for a five-year period. The company will now concentrate on nine operations which supply thermal coal and lignite under long-term agreements to adjacent power stations.

The most significant regrouping of coal production in Canada started in the latter half of 2002 when Fording Coal became the object of unwelcome take-over attention from Sherritt Group. After complex manoeuvring, the outcome has been a consolidation of metallurgical coal operations, primarily in the Elk Valley coalfield of British Columbia and in western Alberta. The resulting partnership has become the world's second largest exporter of metallurgical coal. In a series of transactions Fording Inc. converted into Fording Canadian Coal Trust ('Fording Trust') in February 2003, which holds a 65% interest in a partnership (the Fording Coal Partnership) comprising the metallurgical coal assets of Fording and Teck Cominco, to which will be added the metallurgical coal interests of Luscar and Consol Energy. Teck Cominco will initially own 35% of the Fording Coal Partnership and will be the managing partner.

The Fording Coal Partnership, as of early 2003, holds six mines with combined sales in 2002 of 22.6 Mt. The core assets of the partnership are the five surface mines in the Elk Valley area of southeast British Columbia: Fording River (2002: 7.5Mt), Greenhills (2002: 2.8 Mt), Line Creek (2002: 2.1 Mt), Elkview (2002: 5.5 Mt) and Coal Mountain (2002: 2.0 Mt). In early 2003, after creation of the partnership, it announced the decision to close the Luscar mine in Alberta, which it inherited as part of transferred assets. In a related decision, Teck Cominco announced the closure of the Bullmoose open-pit metallurgical coal mine (65%-owned) in northeastern British Columbia, with completion of coal production in early 2003 owing to increasingly uneconomic strip ratio.

Canada holds a position as a 'swing' supplier of metallurgical coal, and to maintain this, supply capacity must be kept close to near-term demand. Replacement production capacity will be a significant element for longer-term viability, but reported reserves suggest that the current level of production and exports can be maintained in the longer term.

Mexico

Coal provides only about 4% of Mexico's total energy and coal-fired plants supply roughly 10% of electricity generation, although this is programmed to fall in the face of preferred use of natural gas. Production levels have been recorded as approximately 13 Mt/y since the late 1990s. Almost all production and resources are in the state of Coahuila in the northeast of the country bordering the US, although a very small production is also recorded in the state of Sonora. Mexico imports around 2-3 Mt/y of both metallurgical coal and high quality thermal coal, mostly from the US.

The principal producer is Minera Carbonífera Rio Escondido (Micare), a subsidiary of Altos Hornos de Mexico (AHMSA), which operates a complex of three underground mines and two surface mines, all feeding to a single blending and washing plant. The mines produce a sub-bituminous, relatively low sulphur thermal coal primarily to supply two adjacent thermal power generation plants (Carbón I and II), of 1,200 MW and 1,400 MW capacity respectively, which also need to import some low sulphur coal from the US as a blend to help meet environmental constraints. The Micare operations have a production capacity of approximately 7.0 Mt/y, approximately 50% of which is from the surface mines, operated as a large dragline operation. Two of the underground mines (No. 4 and No.5) are in full production and a third, No.6, is in development. The No.5 mine, opened in 1997, is the most modern operation comprising one longwall of 200 – 250 m length and four continuous miners.

Also owned by AHMSA, the second important mining complex is Minerales Monclova SA (Mimosa) which operates five underground mines in the Sabinas area, also in Coahuila State. These extract a coking coal which after washing is largely consumed as metallurgical product by AHMSA although a portion is classified as thermal coal. There are also a number of smaller, privately-owned operations, which include the Espuelita mine, near the Texas border where 13 miners died in January 2002 as a result of an inrush.

South America

The northern part of South America has become an important source of thermal coal exports, primarily supplied to Europe and the US. Together in 2002 Colombia and Venezuela exported 43 Mt of low-sulphur thermal coal. Colombia also sustains a significant level of domestic utilisation but in general coal utilisation in South America is very limited. The exception is Brazil, which is the largest coal consumer in the continent but, despite extensive reserves, domestic production has fallen to a very limited level and the country is now a significant importer of metallurgical coal, with smaller demand for thermal coal imports. Argentina, Chile and Peru have all had small domestic coal or lignite operations and are now net importers of relatively small amounts of coal.

Colombia

Colombia continues to weather difficult political and economic conditions, despite which the economy continued its modest growth, increasing 1.5% in 2002. Coal remains the second most valuable export commodity after oil and above coffee. Colombia is an important coal exporter on the world scale, being the fourth -largest exporter of thermal coal and overall fifth-largest exporter of coal after Australia, China, Indonesia and US. In 2002, Colombia exported 35.4 Mt, a decrease of some 5% from 2001, and some 7 – 8 Mt less than forecast at the beginning of 2002.

National coal production is expected to show a fall from the 43.5 Mt of 2001, and is estimated to be around 39.5 Mt for 2002. A relatively small proportion (approximately 10%) of national production is consumed internally (2001: 4.1 Mt), primarily for power generation, with smaller quantities for metallurgical and other industrial use. Coal accounts for only 10% of national energy

consumption, and typically 70% of electricity generation is hydroelectric. However, in the longer term, national plans are to increase export coal production and also to increase the coal-fired share of electricity generation.

All coal production in Colombia is in private hands. Major export operations are limited to the two northern states of Guajira and Cesar. However, coal deposits are widely scattered through the northern and western sectors of the country. There are widespread small and medium-scale coal operations, particularly in the states of Norte de Santander, Córdoba, Santander, Antioquia, Cundinamarca, Boyacá, Valle del Cauca and Cauca. These small operations are largely underground mines and together represent less than 5 Mt/y, sometimes using relatively primitive mining methods although there are records of a number of semi-mechanised longwalls. Metallurgical coal in Colombia is produced only in the states of Boyacá, Cundinamarca and Norte de Santander. The greater part of production from these interior regions is for local industrial use, although exports of 1.3 Mt were recorded in 2001, of which 0.75 Mt was metallurgical coal. Much of the export tonnage attributed to the interior regions is from the Norte de Santander area, from which the export route is across the border to Venezuela, from where it contributes to coal shipped from the port of Palmarejo on Lake Maracaibo.

Two major companies, Cerrejón Coal Co. and Drummond Coal, are responsible for more than 85% of all export coal production. The balance is covered by two other well-established exporters, Prodeco and Carbones del Caribe, plus one or two other smaller producers. Fundamental to the performance of these companies is their access and transport routes to ports with adequate coal-handling capacity on the Caribbean coast.

Cerrejón Coal Co. (CCC) became established as an operational organisation only in March 2002. This was the culmination of an amalgamation process which commenced in 2000 with the privatisation of Carbocol, the state-owned coal production and management company. The largest operational asset of Carbocol was its 50% holding in the Cerrejón Norte mine, operated and managed by the other 50%-owner, Intercor, a wholly-owned subsidiary of ExxonMobil Corp. The Carbocol holding was transferred to a new entity, Cerrejón Zona Norte SA (CZN) which was purchased by a three-partner consortium comprising Glencore, BHP Billiton and Anglo American. These three companies were already the owners of Carbones del Cerrejón (CdC), operating in the contiguous coal zone to the south of CZN and have also acquired control of the southern block Cerrejón Sur. In early 2002, the three-partner consortium bought out the Intercor holding, so that ownership of the Cerrejón resources, operations and transport and port infrastructure was amalgamated entirely in the hands of the consortium, who promptly announced the creation of CCC as a single unified management structure. In 2001, the combination of the CZN and CdC operations, now amalgamated in CCC, exported 20.8 Mt through Puerto Bolivar.

2002 was not an easy year for CCC, as it was faced with falling export demand from the early part of the year, and, as stocks rose to maximum levels, production was cut back and the export sales fell to 18.5 Mt compared

with a target of 22 Mt at the beginning of the year. Export sales in 2002 were 76% to Europe, 18% to North America, 3% to Central America and 3% to South America. CCC is planning to increase its production capacity through development of the Patilla resource area, to the west of Cerrejón, with capacity to contribute an additional 3 Mt/y from 2003.

Drummond Coal operates the second largest mine in Colombia, La Loma open-pit, in Cesar state. Drummond's exports from this operation in 2002 were 12.8 Mt, an increase of 5% over 2001, although this is in fact a reduction from the 14 Mt target at the beginning of 2002. La Loma production is transported by rail to the dedicated port facilities of Puerto Drummond at Ciénaga, on the Caribbean coast. This 200 km rail route has been susceptible to guerrilla attacks, which cumulatively represent significant losses, although to date each attack represents only a few days loss of transport capacity. Drummond is now in the process of permitting for development of the major El Descanso deposit adjacent to la Loma. El Descanso reserves are quoted as 800 Mt proven, plus the potential for an additional 500 Mt of reserves for eventual underground mining. Planned operation of El Descanso in conjunction with La Loma, is aimed to achieve an export production approaching 25 Mt/y within the next five years, requiring an investment injection of US\$1 billion.

Among the smaller exporters, Prodeco managed an export level of 1.56 Mt in 2002, a 25% increase on 2001. This comprises tonnage from relatively small underground and surface mines in the La Jagua area of Cesar State, which is trucked to its port facilities near Ciénaga, a distance comparable to that of the Drummond rail link. Carbones del Caribe also ships coal from small surface and underground operations in the La Jagua area, and specifically from the Carboandes operations, shipping just under 1 Mt in 2002. At the end of the year, port facilities were compromised by closure of the Carbosan port at Santa Marta by local authorities on the grounds of environmental pollution. However, Carbones del Caribe is currently constructing a dedicated port facility at Rio Córdoba, near Puerto Drummond, due to be operational in late 2003.

Venezuela

Venezuela is the second largest coal producer in Latin America, with a production in 2002 of 8.1 Mt, of which exports were 7.7 Mt of low-sulphur thermal coal. There are only two large-scale mining operations in the country, both of which are truck-and-shovel surface mines in adjacent blocks in the Guajira Peninsula, Zulia State. Carbones del Guasare, operating the Paso Diablo mine produced 6.4 Mt in 2002, while Carbones de la Guajira, operating Mina Norte, produced 1.4 Mt in 2002. Both operations are joint ventures with important minority participation held by Carbozulia, a subsidiary of the state-owned petroleum company PDVSA. From December 2002, both of these operations were severely affected by the national strike which was focussed strongly towards PDVSA operations, giving rise to effective shut-down for much of December 2002 and January 2003, with suspension of their export shipments. Repercussions of the strike are more likely to be shown in figures for 2003, as export levels for 2002 were only 5% down on 2001.

Development of further coal blocks in the Zulia region is largely dependent on a solution of access to export port facilities. The Paso Diablo and Mina Norte operations each truck production over 100 km to independent port facilities on Lake Maracaibo, in each case requiring barge transfer and floating cranes for loading in the main shipping channel of the lake. A new mining operation in the Guajira coal area of Zulia, west of Maracaibo, now completing permitting and expected to become operational in 2003, is Las Carmelitas. This will be operated by Cosila (Complejo Siderúrgico del Lago CA), a subsidiary of Tomen America, which already owns the coal export port of Palmarejo on Lake Maracaibo. At start-up, the investment is expected to total some US\$60 million and the initial production target for the first twelve months in 1 Mt/y, expected to double in the following year. Economically recoverable reserves are quoted as 28.8 Mt, to support a 14 year life, with stripping ratio indicated as 4:1. The low ash thermal coal (0.51% sulphur, 2% ash, 5.8% moisture) will be transported 123 km by truck to Palmarejo port.

A recurrent concept, aired again in 2002 by the government of Zulia state, is the development of a deep-water terminal in the Gulf of Venezuela, north of the entrance to Lake Maracaibo. This development, with rail link to the coal developments through western Zulia, would unlock large resources, for which development is currently constrained by poor infrastructure and available outlet routes only through Lake Maracaibo.

Other than in Zulia State, there is a small level of production from the Andes region (2002: 150,000 t), generally comprising small underground mines producing coking coal for local consumption, and also in the northeastern region (2002: 80,000 t). In the latter region, a bid process was staged in late 2002 to develop concessions in Anzoátegui State, in the Naricual basin, previously the site of ambitious underground mine development, now aborted. A very limited level of surface mine operation has since been maintained in the region. A further tender process is imminently expected for development of concessions in Falcón State, in the west of the country adjacent to Zulia.

Other South America

In **Argentina** coal is a minimal component of the country's fuel mix. There is a wide expanse of Patagonia in which brown coal deposits are known and historically a number of small mines have operated, although the remote location and indifferent coal quality have inhibited any more significant development. The only significant coal mine is at Rio Turbio in Santa Cruz Province, close to the border with Chile. Latest recorded production figures are 300,000 t in 2000 produced by underground mining. Through 2002 the mine has continued to be subject to labour unrest and political agitation. Transferred to private ownership in recent years, the company is apparently heavily indebted and requested state subsidies to allow it to pay the workforce. Survival of mining here apparently rests upon continued state support and investment in a mine-site power generation unit. Production in 2002 was interrupted by a lengthy underground lock-in at the mine.

Brazil maintains a small private-sector coal industry with a production capacity of around 5.5 Mt/y. The country is, however, a major consumer

(2000: 21 Mt), for which imports are primarily for metallurgical coal with much smaller demand for thermal product. Coal provides around 2% of the total national energy requirement and currently operating coal-fired thermal plants comprise three units in Rio Grande do Sul, of which two are very small, and the Jorge Lacerda plant (1 x 482 MW, 1 x 350 MW) in Santa Catarina. Coal consumption for these plants is around 4.5 Mt/y. The leading coal producer is Copelmi Mineração, in which Rio Tinto Brasil has an interest, which operates the Recreio mine in Rio Grande do Sul, producing 1.9 Mt/y. During 2002 the state government of Rio Grande do Sul leased Mina Leão II to the company Carbonífera Criciúma and production will supply the Jacui coal-fired power station.

Chile currently has minimal production capacity, having closed the bituminous coal mines near Concepción in VIII Region and having seen the suspension of the Pecket mine, mining brown coal near Punta Arenas in XII Region. Total production in 2000 was some 400,000 t/y. Chile, however, continues to utilise a number of older coal-fired power generating plants, and 9% of national primary energy requirements in 2001 were met by coal. The country is therefore a regionally significant importer of thermal coal. It is reported that a new tendering process has been let in 2002 for exploitation of the brown coal deposits in the south of the country in the Punta Arenas area. A number of very small private underground mines reportedly continue to operate in this area.

A very small production of coal is reported in **Peru**, of some 30,000 t in 2002, from underground exploitation of anthracite-grade coal for local industrial use. Peru has imported over 500,000 t of Colombian thermal coal in 2002.

Africa

The regional production of coal is dominated by South Africa, which obtains virtually all its production from the Karoo sediments of Permian age. The widely scattered coal deposits elsewhere in southern and eastern Africa (Botswana, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe) are part of the same depositional sequence but owing to local conditions and development strategies, no other national coal industry approaches the significance of the South African operations. Isolated coal-bearing sequences in Niger (Carboniferous), Nigeria (Cretaceous), Morocco (Upper Carboniferous) and Egypt (Jurassic) represent only regionally significant coal-bearing potential.

South Africa

For South Africa, saw the continuation of two related themes, being the progress to black empowerment targets and the realignment of ownership of the major assets to meet the objectives of the new Mineral Resources and Petroleum Development Act and its Mining Charter, issued in October 2002. Policy is that the 'old order' of mineral ownership will be converted over five years into 'new order' mining rights. In conjunction with this the Mining Charter requires the transfer of 15% of the assets of the mining industry to 'historically disadvantaged South Africans' within a five-year period, with the ultimate objective that this shall be 26%. Early in 2003, a long-awaited 'scorecard' was

published which will provide the basis of evaluation of progress to a wide range of empowerment targets. After prolonged uncertainty during 2002, the expressed position of the major mining companies at the end of the year was relief that a clear road-map was in place for the future.

Overall coal production showed a small decline against the previous year (2001: 224.2 Mt) and on the basis of statistical returns was close to 220.7 Mt. Exports in 2002 totalled 69.16 Mt, primarily from Richards Bay (66.0 Mt) but with smaller quantities handled through Durban (2.10 Mt) and Matola in Maputo (1.06 Mt). At the end of 2002, stocks held at Richards Bay were 2.2 Mt. Capacity through Richards Bay is largely to the benefit of the three major shareholders, Anglo Coal, Ingwe (a BHP Billiton subsidiary) and Xstrata, which together hold 86% of the equity. Smaller shareholders include Eyesizwe, Total and Kangra. Agreements are reported to have been reached to ship some 1 Mt/y through the Richards Bay site from smaller black empowerment companies, although whether this will be effective is put in doubt by the capacity of the national rail operator, Spoornet.

Completion of the Phase V expansion at Richards Bay, scheduled for 2007, will increase export capacity to 82 Mt/y. This expansion will open up significant export tonnages to a number of new exporters, including potentially Eskom, the national power generation company. Commitments have been made to upgrade the rail link from South Africa to Mozambique, aiming to increase rail capacity to Matola to 2 Mt/y in 2003 and to 4 Mt/y by 2005.

However, the future performance of exports through Durban and Matola is also highly dependent on rail freight rates. *McCloskey Coal Report* indicates that the rail transport cost per tonne between Witbank and Matola is set to increase by 40% in early 2003 and between Witbank and Durban by 68%, Spoornet claiming these rises are essential to maintain its economic viability. Richards Bay is not affected as it is protected by a long-term cost-based contract.

The realignment of assets culminated in 2002 for the three leading coal producers and exporters; Anglo Coal, Ingwe and Xstrata. Anglo Coal and Ingwe have in recent years sold significant assets to emerging black empowerment companies although these sales are primarily related to production for the domestic power-generation market. The leading producers supplying the domestic power generation and industrial markets are Sasol Mining, which supplies Sasol's synthetic fuels and chemicals industry, Eyesizwe Coal, the largest black empowerment coal mining company and Kumba Resources, the now independent, former mining division of the steel group Iscor.

The relationship between underground and surface mine production is approximately 50:50, and underground annual production is quoted as 120 Mt/y. However, in contrast to many other major coal-producing nations, longwall mining contributes only some 10% of underground production, which is dominated by continuous miner technology. In 2002 there were only four longwalls in operation. Another significant technological development is the

growth of highwall mining, which is making an impact in sustaining the otherwise declining northern KwaZulu-Natal mining region.

Ingwe is the largest coal producer in South Africa, reporting production managed by the company as 55.7 Mt for the year 2001/2002. This was somewhat lower than previous years, reflecting in part the sale of Matla Colliery to Eyesizwe Mining. Sales in the period were 27.5 Mt despatched to the export market, 29.4 Mt sold to Eskom for power generation and 4.3 Mt sold to the domestic industrial market. Largest operations managed by the company are the Middleburg surface mine (84%-owned), producing some 16.8 Mt, Khutala mine complex (100% owned) which produced 12.5 Mt from underground and 800,000 t from surface operations and the Optimum surface mine (100%-owned), producing 12.4 Mt. Overall, some 64% of Ingwe-managed production was from surface mines and 36% from underground. During 2002, Ingwe closed Rietspruit Colliery (50%- owned) and sold the Delmas Colliery (100%-owned) to Kuyasa Mining. Delmas is relatively isolated from the other core operations and located in Ingwe's largely untouched Leandra resource area, the development of which would require partnership with a black empowerment company; this sale could be seen as preparing a strategic position to plan future development of the Leandra block.

Anglo Coal posted total attributable coal sales in South Africa in 2002 of 48.8 Mt, an increase of 5% over 2001. Domestic volumes were essentially constant at 30.6 Mt, volume growth being achieved in export sales. Eskom is the principal consumer of Anglo's domestic production, consuming 28.6 Mt in 2002. Anglo Coal highlighted exceptional production performances in two of its collieries in 2002. At the 6.1 Mt/y capacity New Denmark Colliery the longwall achieved 406,000 t in the month of October 2002, from a 2 m seam section, representing world-standard performance. The other high-producing unit was the Goedehoop Colliery which produced some 7.5 Mt/y run-of-mine coal from eight continuous miner sections. Anglo Coal holds an 11% share of Eyesizwe Coal, which Anglo helped create. During 2002 it acquired a significant holding in Kumba Resources, in part related to the acquisition of iron-ore production but with an important coal capacity.

Xstrata appeared as a major coal operator and exporter in early 2002, when the company took over the coal assets of Glencore, which retains a 40% ownership stake in Xstrata. In South Africa, the Duiker operations were incorporated within Xstrata, comprising seven surface and underground mines. Consolidated sales in 2002 were 16.8 Mt, of which 12.5 Mt was exported, making the company the third-largest exporter and the sixth-largest producer. Increased export sales will be dependent upon the planned increase in capacity at Richards Bay scheduled for 2007.

Eyesizwe is the fourth-largest coal company and produced 23 Mt in 2002. The company operates five coal-production units, Matla, Arnot, New Clydesdale, Glisa and Strathrae. Of these, the largest is the underground Matla Colliery, working one longwall and thirteen continuous miner sections, with production capacity of up to 15 Mt/y run-of-mine coal primarily for the power generation market. Matla has almost five years' experience of operating a longwall in the

No. 4 Seam, and during 2002 a new face was set up in the No. 2 Seam in which the average seam section is over 5 m thick. The configuration of the new face, installed by DBT of Germany, is a shortwall of only 130 m face length, reflecting economic analysis of gate road development rates and the optimum shearer cycle. Currently, Eyesizwe has only a minimal export capacity through Richards Bay. However, it is actively pursuing a strategy to develop the Kalbasfontein resource near Witbank in joint venture with Kumba Resources, aimed to bring thermal coal production on-stream for export in conjunction with the introduction of the Phase V, South Dunes Coal Terminal, at Richards Bay.

Sasol Mining supplies coal for the Sasol synthetic fuels and the chemicals business, and in 2001 sold 49.3 Mt, primarily to its parent company but with a small but significant export component. Sasol Mining holds a 5% stake in Richards Bay Coal Terminal. There are two regional operations, one based around Sigma Colliery near Sasolburg, now comprising only surface extraction, and the Secunda Collieries complex consisting of five underground operations at Secunda and the Syferfontein surface and underground operation near Trichardt. The Secunda Collieries complex is claimed to form the world's largest underground coal-mining complex, currently producing around 37 Mt/y. During 2002 a major infrastructure expansion project for the Secunda complex progressed to its objective of sinking nine new ventilation shafts in a two-year period. RUC, part of Thyssen Mining, reports its completion of three 7.1 m ventilation shafts at the Middelbult and Bosjesspruit mines using raise-boring, representing the largest diameter shafts completed using this technology.

Kumba Resources, now separated from Iscor, produced about 18.2 Mt in 2002. It operates three mines of which by far the most important is the large Grootegeluk surface mine near Ellisras in the Northwest Province, which is a multi-product operation with 14.5 Mt/y production capacity for coking and thermal coal, of which 12 Mt/y of thermal coal is sold to the adjacent Eskom Matimba power plant and 1 Mt/y of coking coal is sold to Iscor. Kumba Resources is constrained in its export aspirations by lack of access to Richards Bay. Of the Grootegeluk production a small tonnage of thermal coal, around 300,000 t, is exported via Matola and some 600,000 t of coking coal is exported through Durban.

Among the black empowerment companies, Kuyasa was founded in 1995 by ex-Ingwe middle managers, initially working the Ikhwezi surface mine, but has now purchased the Delmas colliery from Ingwe, bringing annual saleable capacity to 2.5 – 3.0 Mt/y. Kuyasa is noteworthy as the company which has purchased the moribund Maamba Colliery operations in Zambia.

Eskom, the electricity power generator is a critical component of the South African coal industry. In 2001 the annual coal burn was 94 Mt and the company holds stocks estimated to be around 20 Mt. Currently the proportion of electricity generated from coal is around 88%, but Eskom is pledged to reduce this to around 70% by 2025. However, reality suggests that the coal burn will continue to grow at existing generation plants, given the low cost of

production and delivery, compared to the cost of other generation options. Nevertheless, the construction of new coal-fired plant is now considered unlikely. Historically Eskom has assisted with financing mine development to secure supply contracts, but has not itself entered directly in mining. This position may change as it is reported that the company has interests in some new mining ventures and will acquire a participation in the Phase V expansion at Richards Bay.

Other Africa

Botswana has only one coal mine, Morupule, supplying Botswana's only coal-fired power station as well as the mining operations at Selebi Phikwe and the Sua Pan soda ash plant. The reported level of production is around 1.06 Mt/y and the Morupule power station, of net capacity 118 MW, supplies almost half of the national electricity demand. Although there are reportedly extensive coal resources in the eastern part of the country, in the Morupule and Mamabula deposits, this is only of thermal coal quality and there are no apparent plans to expand production.

Egypt has one small coal mine, the Maghara underground mine in the Sinai Peninsula. Production is reported to be around 360,000 t/y, and this contributes to a national demand for hard coal of around 2 Mt/y, which is primarily for the Helwan steel works. Maghara production, which is non-coking, contributes to a blend with imported metallurgical coal.

Malawi had only one operational coal mine in 2002, Mchenga in the northern district of Rumphi, with low-technology underground operations and some limited surface extraction. Heavy rains and flooding at the beginning of 2003 reduced production from 300 t/d to 100 t/d. Malawi has a number of identified, relatively small coal deposits and there is considerable interest to develop these to meet local industrial demand for kilns, steam-raising and drying, and also, perhaps optimistically, as an option for thermal power generation. A small mining operation in the southern district of Nsanje started production in 2003; Mwabvi coal mine announced plans to increase its annual production from 60,000 t to 200,000 t in 2003. Current national demand is only some 100,000 t for industrial use, and sales of additional production will be focussed to export sales to adjacent countries. Mchenga has a ready market in neighbouring Tanzania and this was not being met during the early part of 2003.

Morocco had an active coal industry based on underground anthracite mines at Jerada, in the Middle Atlas near the eastern border of the country. Significant production ceased in 2000 but very small quantities of anthracite are reported to continue to be produced. However, the country has committed to the building of coal-fired power generation plants on the Atlantic coast. The Jorf Lasfar 1,356 MW power plant has been constructed as a private sector independent power facility and the fourth unit came on stream at the end of 2001. Imported coal consumption in 2000, imported primarily from South Africa, is reported as 4 Mt.

Mozambique continues to explore means to revive coal production from its Moatize Coalfield, in which formal production ceased during the civil war. Small amounts of coal are trucked into Malawi, but there are no other routes to potential markets since destruction of the Sena-Beira railway. Rehabilitation of the mining industry is proposed on the basis of construction of an on-site thermal power plant and reinstatement of the railway to allow exports of coking coal via the port of Beira. Current estimates of the cost of the rehabilitation project are US\$1.3 billion. Serious interest in development of the project has been expressed by the Brazilian mining and energy group CVRD and South African industrial and financial institutions. Coal consumption in 2002 was estimated at 80,000 t.

Coal production in **Niger** takes place at the Tefereyre mine, 75 km north-west of Agadez, operated by Sonichar, which runs one of the two thermal power stations in the country. The on-site power plant comprises two 18.8 MW units and in 2001 consumed 160,000 t of coal from the surface mine. The corresponding over-burden removal suggests a stripping ratio of 9.5:1 (bench m³:t).

Nigeria has a small coal industry in the east of the country, comprising small underground operations near Enugu and some surface mining at sites in the lower Benue Trough. Annual production is estimated to be around 100,000 t. Efforts have been made in recent years to develop the Lafia-Obi deposit, southeast of Abuja, in order to contribute to a coking coal blend which will be required by the long-delayed Ajaokuta steel works project. It is reported that exploratory shafts for bulk sampling have been undertaken during 2002.

The only operating coal mine in **Swaziland** is the Maloma colliery, which in 2002 produced 310,000 t of anthracite, a fourfold increase on 2001. The mine is operated by Xstrata of South Africa and the product is exported to South Africa. It has been proposed at national level that the Mpaka Colliery should be re-opened in 2003, after years of suspension, but the financing of this has not been clarified.

Tanzania has a number of coalfields, but formal mine development has only taken place in the Songwe-Kiwira coalfield, south of Mbeya. The Kiwira underground mine appears no longer to be able to supply other than to its own small 6 MW on-site power plant. Potential local industrial customers, such as Mbeya Cement, have in recent years sourced their requirements from Malawi.

The only coal-mining operation in **Zambia** is Maamba Collieries in the Southern Province. The operation consists of two open pits with a production capacity of up to 800,000 t/y, but production has been greatly reduced in recent years. The company was part of the privatisation exercise which in 2002 put on offer a 70% stake. The reported purchaser is Kuyasa Mining of South Africa.

Zimbabwe has one coal producer, Wankie Colliery Co, which operates near Hwange in the Zambezi Valley in the northwest of the country. The company

produced 3.4 Mt of coal in 2002, down 8% from 2001, and has been operating greatly under capacity in recent years. Some 90% of production comes from the open pit, in which the prime earth-mover is the dragline which has suffered from poor availability and lack of spare parts. It has been reported that in early 2003 the company secured a financing facility of US\$5.3 million and a return to increased production is planned, including investment in increased underground mine capacity.

Former Soviet Union

The countries of the Former Soviet Union (FSU) have traditionally been highly dependent on coal as a primary energy source. With the break-up of the FSU a number of countries were able to configure their energy utilisation to local resources, such as for example, Turkmenistan with hydrocarbons and Tajikistan with hydro-electric resources. For most of the others, coal remains an important element of the energy mix and there is an important cross-border coal trade across much of the region. Three countries dominate coal production based on the historic coal production areas of the FSU: Russian Federation, Ukraine and Kazakhstan.

Russia

According to Rosinformugol, Russia's coal output fell by 6.3% in 2002 to 253 Mt (hard coal and lignite). Companies based in Eastern Siberia, saw the sharpest decline in coal output, although companies based in Western Siberia, and also in the Far East, exceeded 2001 production levels. Coal exports from Russia rose to 51 Mt (2001: 42 Mt), coal imports fell to 20.5 Mt (2001: 26.3 Mt) and supply to the domestic market fell to 203 Mt (2001: 237 Mt).

During 2002, the privatisation process of the Russian coal industry has continued, with the specific blessing of President Putin, who, speaking to miners in the Kemerovo Region in August 2002, made clear the objective of producing the quantity of coal as actually required by the national economy. Auctions for federal government stakes in various coal operations have continued, but in a number of cases the tender process has been a failure owing to lack of interest, specifically for a stake in Kuznetskugol in July and most recently for Intaugol in the Komi Republic. The net result of the auction process has been complex shareholdings and frequent litigation to establish controlling interests, both in mining operations and export port facilities.

The Kuznetsk Basin (Kuzbass) accounted for almost 52% of all production, with a production of 130 Mt in 2002 from 48 deep mines and 33 surface mines. Kuzbassrazrezugol controls about one-third of the output from the Kuzbass and mined 39.2 Mt, of which 5.3 Mt was coking coal. Over 20% of production is for export and this has been despatched principally through ports in the Baltic States. At the end of 2002, Kuzbassrazrezugol purchased from the Sokolovskaya company its 45% stake in Rosterminalugol at the Ust Luga port in Leningrad Region, which will now be the outlet for exports. This facility can currently only take vessels of 5,000 t, but dredging is aimed to allow vessels of 20,000 t in 2003 and ultimately panamax size.

Kuzbassugol was privatised only in late 2001, through the merging of coal companies in the Kemerovo region, and had a stormy ride in 2002 as shareholding groups struggled to assert control. Production was cut back by some 8%, to 14.7 Mt and a number of mines were spun off in 2002, so that at the end of the year the company was operating 12 mines. Company plans are to increase production of coking coal for national steel companies and also to aim for steam coal exports of 7 Mt in 2003, shipping through Vostochniy port, which is operated by shareholders of the company

Other significant developments in the Kuzbass include the record-breaking performance of Rapsadskaya mine, a stand-alone operation which is rated one of Russia's most productive underground mines. A new face equipped with a complete Joy Mining longwall installation, with 3.3 kV high voltage supply unique in Russia, achieved a 2002 production total of 3.1 Mt from one face. Increased productivity is anticipated in 2003 when a new panel is undertaken with an increased face length of 300 m. In 2002, Rapsadskaya reported a total production of 7.1 Mt. Also in the region, the Sokolovskaya company, which produced 3.5 Mt in the year, disappointed against targets of twice this level and suffered a drop in production of over 23%, attributed to face changes in its three underground mines. These include Tadinskaya mine, equipped with a DBT longwall in a 4.2 m seam, and a Joy Mining longwall, originally installed in a 4.7 m seam in Sokolovskaya No. 7 mine but undergoing transfer. The three surface mines of the company maintained continuity of production. In October 2002, Yuzhkuzbassugol, formerly known as Kuznetskugol, opened its new Ulyanovskaya mine with a capacity of 3 Mt/y.

The largest corporate coal company is SUEK Baikal-Ugol, which produces nearly 30% of all Russian coal, some 65 Mt in 2002, owning and operating coal companies in Siberia and the Russian Far East. In Siberia, the group includes Krasugol (formerly Krasnoyarskugol) which produced 28.6 Mt from three large strip mines, and the two companies Vostsibugol (2002: 15.5 Mt) and Chita Coal Co. (2002: 6.4 Mt). In the Far East the company also owns Sakhalin Coal Corp., Sakhalinugol and other operations. The company owns and manages the east coast port of Posyet, from which it is targeting exports to Japan and Taiwan.

Critical to the competitiveness of Russian exports, in particular, are the rail freight charges which apply over the huge haulage distances. According to *McCloskey's Coal Report*, the federal rail authorities have imposed increases on rail haulage charges of 12.5% for all destinations from the beginning of 2003. It has been calculated that average haulage costs to Pacific ports and to the Baltic/Murmansk outlets will be US\$13.5/t and US\$14.0/t, confirming Russian coal as the highest marginal cost tonnage in world markets.

Ukraine

Ukraine produced approximately 71 Mt of hard coal in 2002, estimated from the reported 11-month figures to November 2002, of 65.4 Mt. This represents a significant drop from targets of 82 Mt. In recent years there has been considerable confusion regarding reliable production figures as opposed to

targets which have been around 80 Mt. Of the total hard coal production, 56% was thermal coal for the power generation industry, which was some 3.5% down on 2001, and the balance was coking coal, which was essentially consistent with 2001. In mid 2002, it was announced that imports would be reduced to 3.7 Mt in the year, of which 1.8 Mt was to be coking coal.

The year has been marked by a number of strikes and a large number of accidents. The government is proceeding cautiously towards privatisation. The coal industry restructuring has seen a fall in number of operating mines from 276 in 1996 to 173 in 2001. Of these only four are currently deemed to be profitable and able to survive without financial assistance. The majority, some 155, are characterised as potentially profitable and 14 are earmarked for closure before 2005. Government policy is now to group the mines into seven production associations for mining coal and to establish 21 open joint-stock companies in the coal sector which will then be privatised.

Coal remains central to the national economy in terms of the employment it creates and its contribution to primary energy needs, which is around 30%. The principal coal-fired power generation plants are in the east of the country adjacent to the mines in the Donetsk Basin. In contrast, lignite and peat play a very minor role in overall coal production and easily accessible lignite reserves are more or less exhausted. Over 95% of coal production is from underground mines and plans for investment in modern mechanised systems are critical to plans for economic viability of the industry.

Kazakhstan

Kazakhstan includes some of the major coal-producing regions of the FSU and is the third-largest producer. In 2002, estimated production, based upon 11-month figures, comprised a total of 73.2 Mt, of which some 2.6 Mt was lignite and 70.6 Mt bituminous coal. Lignite production linked to internal power generation appears to have remained essentially constant but bituminous coal production suffered a fall of some 9% against 2001 levels, reflecting a decline in export sales to Russia. Some 60% of national energy consumption is derived from coal and overall national coal consumption is around 55 Mt/y (2001).

There are a number of significant coal basins, and 86% of the quoted reserves are from six coal basins. However, the greater part of Kazakh coal production is centred upon the Karaganda and Ekibastuz coal basins. The Ekibastuz basin in the Pavlodar administrative region produces thermal coal from thick seams which support large-scale, low-cost surface mines. The largest production company is Bogatyr Access Komir (BAK), a Kazakh-US joint venture, with production in 2002 of around 30 Mt from its two large surface mines, Bogatyr with capacity in excess of 24 Mt/y, and Severny with capacity of some 12 Mt/y. BAK supplies some 70% of the coal for national power generation. In the same basin, the Vostochny surface mine owned by Eurasian Energy Corp. produced around 15 Mt.

The Karaganda basin is characterised by underground mines producing high-quality coking coal and thermal coal. The greater part of production capacity in this basin is under the ownership of Ispat Karmet, which purchased the

mines in conjunction with the local steel industry. Production in 2002 was 10.6 Mt, of which over half was consumed by Ispat Karmet, although significant export sales of coking coal were despatched to Russia, with smaller amounts to Romania.

Coal exports are primarily thermal coal and by far the largest export customers are the Russian power utilities Sverdlovskenergo and Chelyabenergo, taking product from the Ekibastuz basin. During 2002, coal exports were also sold to Kyrgyzstan, but overall this destination represented only some 3% of export sales.

Other Former Soviet Union

Belarus, Georgia and Tajikistan all reportedly have some identified resources of coal or lignite. However, in none of these countries is there any significant production. Belarus has a hydrocarbons industry which reduces reliance on coal, and Tajikistan has significant hydro-electric resources. By contrast, Georgia is more reliant on coal imports from other FSU countries.

Kyrgyzstan has a small coal industry and virtually all production is from the Kara-Kechen surface mine in Naryn Region. Mine capacity is reported to be in excess of 1.5 Mt/y, although national production in 2002 is reported as 500,000 t. The main market is for district heating schemes in the capital Bishkek. Operation of the mine since 2000 has been through a joint-venture private sector management contract. Plans for expansion are subject to the participation of investment partners and reserves for surface mining have been quoted as 192 Mt. In addition, development continued during 2002, with an underground operation and construction of shafts and infrastructure at the Besh-Burkhan mine.

Uzbekistan has extensive proven reserves of coal and lignite of some 3,000 Mt, of which 1,000 Mt are bituminous coal. National production is undertaken by the state monopoly AO Ugol, which in 2002 produced some 2.7 Mt of lignite and 80,000 t of bituminous coal. Lignite production is based on the Angren coal deposit, which in 2002 produced just over 2.0 Mt by surface mining. The Angren surface mine is the site of a major investment contract with Thyssen Krupp Fördertechnik, currently in planning and design, but expected to introduce bucket-wheel technology; conveyor systems have already been supplied. This investment will increase production capacity to 7.8 Mt/y by 2010, with an annual stripping task of 62.7 Mm³. Also in the Angren deposit, it is reported that there are small underground operations, in 2002 producing less than 30,000 t, and also a project to develop underground coal gasification. Bituminous coal deposits at Shargun and Baisun contributed the small amount of hard-coal production. The national coal requirement in 2002 was estimated at around 4 Mt, but planned increases in production will return the country to self-sufficiency in the near future.

Europe (including Turkey)

While Western Europe, in particular, has suffered the inexorable decline of the traditional hard-coal mining industry, based predominantly on underground mining, much of the region, particularly Eastern Europe, remains heavily

dependent upon utilisation of indigenous lignite and brown coal for a significant component of primary energy supply. The region includes the world's largest lignite producer, Germany, and a number of the principal lignite producers and consumers, including Greece, Poland and Turkey. The largest hard-coal producer in the region is Poland, which is the world's seventh-largest hard-coal producer. Reflecting the former importance of hard-coal production, Western Europe continues to be a major importer of steam coal for power generation.

Germany

Germany produced a total of 207.9 Mt of coal and lignite in 2002, an almost 3% increase on 2001, and attributable to increased lignite production for power generation. Germany is the world's largest producer of lignite. The country is also a net importer of coal, totalling approximately 37 Mt in 2002, the greater part of which contributes to thermal power generation but includes 3.7 Mt of coking coal and 3.2 Mt of coke.

German lignite production surged in 2002 as new power generation plant was introduced in the year, specifically the 970 MW Niederaussem plant, while older plant due for replacement have not yet closed. Total lignite production was 181.8 Mt, up 3.7% on 2001, according to the national lignite association Debriv. Total lignite deliveries to power stations were 167.4 Mt, representing 93% of lignite production, and corresponding to some 28% of national electricity generation. The largest lignite production company is RWE Rheinbraun, which produced 99.4 Mt from four lignite mines in the Rhenish mining area of western Germany using bucket-wheel technology; this was an increase of 5.3% over 2001. In the east of the country, in the Lusatian mining area, the Laubag company produced 59.3 Mt, and in the Central German mining area the Mibrag company produced 20 Mt. While bucket-wheel technology predominates, smaller operations in the east of the country use surface miners and trucks.

The hard-coal sector continued its gradual decline. After mine closures in 2001, production from Deutsche Steinkohle (DSK) was obtained from just ten underground collieries and totalled 26.1 Mt (2001: 27.1 Mt). There are now just two mines producing a total of 3.0 Mt of coking coal, Lohburg and Ost (formerly Heinrich Robert), the future of both of which seems secure in the long term due to demand from the steel industry. DSK commissioned a new 1.4 km shaft at Ost mine in 2002, creating access to more than 30 Mt of high-quality coking coal reserves, and permitting procedures have sought to assure operations for a further 15 years through to 2019. The hard-coal mining industry continues to be heavily subsidised and the terms of the subsidies, set through to 2005, envisage production remaining at the 26 Mt/y level through to 2005, but thereafter there must be a reduction of 3 – 4 Mt capacity before the end of 2007. Two mines are therefore anticipated to close by 2007 although there are no obvious candidates. In 2002, applications for authorisation of working through to 2019 were lodged for the Walsum mine and the West mine (formed in 2001 by amalgamation of Niederberg and the Friedrich Heinrich/Rheinland mines).

Poland

Poland is one of the most coal-dependent countries in the world. Coal represents over 66% of primary energy supplies (1998) and accounts for over 97% of all electric power (2001), the balance being from hydroelectric generation. The greater part (55%) of coal-fuelled power generation is based on hard coal and the remainder is from lignite-fired capacity at mine-mouth captive power plants.

There are substantial lignite resources, mainly of Miocene age, located in the central and western parts of Poland, with quoted reserves of 14,000 Mt. Four large mines are in operation, Adamów, Belchatów, Konin and Turów, which together contributed some 60.0 Mt of product directly for power generation. The Patnów-Adamów-Konin power complex controls over 10% of Poland's generating capacity and has been offered for minority private investor participation. The current level of lignite production and its contribution to power generation can be expected to be maintained in the foreseeable future, although the Belchatów plant is aging and scheduled for replacement.

The hard coal mining industry remains politically sensitive to reform because of the large number of employees, over 140,000, the overwhelming economic significance of the industry in the mining areas and the need for extensive subsidies to maintain current levels of production. Production in 2002 was 102.1 Mt, only marginally lower than the 103.0 Mt of 2001. During 2002 the government announced plans for sector restructuring, accepted in an amended version in January 2003 by the Council of Ministers.

The reforms envisage that operations will be concentrated in a small number of mining groups. Independent operating companies will include the Katowicki Holding Co. (KHW), Jastrzebska Coal Corp. (JSW), specialised in coking coal production, the Bogdanka Mine Co., operating in the Lublin Basin, the Budryk Mine Co. and the Sobieski-Jaworzno III mine and power plant complex. The bulk of mines in the Upper Silesian Basin will be incorporated in the new company Kompania Weglowa, requiring that five existing mining companies are subsumed in the new company: Rudzka Coal Corp. with four mines, Bytomska Coal Corp. with five mines, Gliwicka Coal Corp. with eight mines, Nadwislanska Coal Corp. with six mines and Rybnicka Coal Corp. with six mines. The reform programme specifies that during 2003 seven of the worst-performing mines will be closed, comprising five mines from Kompania Weglowa, one from KHW and one from JSW. This is envisaged as a reduction in production of 12.7 Mt in 2003, with a net reduction of personnel employed in the industry of some 27,000 by 2006. Management of closure of the designated seven mines will be implemented by their transfer to the Mine Restructuring Co.

The proposed changes can be expected to deliver an industry in which high cost, subsidised elements have been reduced with a production of around 90 Mt/y in 2006. This should eliminate the traditional surplus, which was some 3 Mt in 2001 and was certainly predicted from mid-2002. Exports for 2002 remained consistent with those of 2001, comprising 19.0 Mt of steam coal and 3.0 Mt of coking coal. The principal customer for steam coal was Germany, which absorbed some 7 Mt.

Turkey

Coal, and in particular lignite, continue to make a significant contribution to the energy mix in Turkey although there is an explicit focus on increased natural gas use for electricity production. Coal and lignite, together, account for some 25% of national electricity generation. In 2001, Turkey suffered a severe economic crisis and economic contraction of 9.4%, which was largely overcome in 2002, where growth was restored at above 4%. This sharp fluctuation is reflected in a slump in lignite and coal production in 2002. During the first seven months of 2002, lignite production was down 15.4% against 2001 and estimated annual production was around 55 Mt (2001: 63.5 Mt), while hard coal in the same period was down some 9%, with expected annual production of 2.1 Mt.

The government is pursuing a policy of privatisation with specific reference to the power sector. In May 2002, the Energy Ministry transferred six power plants to the national privatisation authority, which included the Orhanlı and Soma A/B lignite-fired plants in addition to the Çatalgazi hard-coal-fired plant in the Zonguldak region on the Black Sea coast.

Lignite deposits are found widely spread across the country and, although generally of low calorific value (<3,000 kcal/kg), economically mineable reserves are quoted as 8,000 Mt, representing the seventh-largest lignite reserve base in the world. Some 40% of these reserves are located in the Afsin-Elbistan basin in south-central Turkey. However the greatest concentration of lignite mines is in the northwest region around the towns of Soma, Seyitömer and Çan. Approximately 90% of all lignite production is from surface mines. A number of underground mines operate longwall systems, with significant operations at Tunçbilek and Soma, both worked in conjunction with surface mines, and at the privately-owned Cayirhan mine operated by Park Holdings. Surface mining is performed using a variety of methods, including bucket-wheels at the large Afsin-Elbistan mine, with capacity in excess of 18 Mt/y, and draglines at smaller operations such as the 3.5 Mt/y Kangal mine. Although over 40 private mines extract lignite, the major operations are owned either by state-owned Turkish Coal Enterprises (TKİ), responsible for approximately 55% of national lignite production, or by state-owned electricity company TEAS. The large lignite mines are directly linked to captive power stations, and under government plans for privatisation of the power industry, the mines will be sold as part of power generation packages.

Production of hard coal is centred on the Black Sea region of Zonguldak, where the Hard Coal Enterprise (TTK) operates five underground mines. Despite plans for increased production in 2002, production in the first half of the year was down by 8.8% against 2001, and estimated production for 2002 was around 2.1 Mt. The washed product comprises coking coal and high ash, thermal coal supplied to the Çatalgazi power complex. In addition, a number of small private mines in the area are also seeking to supply low-quality coal to this power complex. Coking coal production in 2001 was around 600,000 t from the Zonguldak mines, and was supplied to the national steel industry. While significant, this is, however, a small component of national coking coal demand. The two major steel works, Erdemir, based at Ereğli in the north, and

Isdemir, based at Iskenderun on the south coast, together, have an annual demand for coking coal of some 3.5 Mt.

Reflecting the economic fluctuation between 2001 – 2002, imports saw a major jump compared with 2001. Imports were on target for around 12 Mt, almost three times that of 2001, reflecting demand for coking coal, cement works and domestic fuel. The new 1,300 MW Iskenderun power station in southern Turkey was completed at the end of 2002, to be fired entirely by imported coal; first coal deliveries were received in November 2002. This will create a significant rise in imports of thermal coal.

Czech Republic

The Czech Republic is heavily dependent on coal for its energy needs and is able to count on extensive reserves of brown coal or lignite in north Bohemia, in the northwest of the country, and of hard coal in the east of the country, where the Upper Silesian Basin falls within Czech territory. In 2001, 70% of installed power generation capacity was based on coal-fired plant. Total coal and lignite production was around 66 Mt, remaining essentially constant from 2001, and the country imported some 1.1 Mt and exported 5.7 Mt.

In early 2002, the first public tender for privatisation of the Czech energy sector was cancelled. The offer comprised a 67.6% stake in the state-owned utility CEZ, which owns some 65% of installed generation capacity. However, the tender required commitment to take deliveries of domestic brown coal over a 15-year period and this proved unpalatable to prospective purchasers. Also in early 2002 the government drew up plans for the sale of the state's 45.9% interest in the hard coal company OKD, based in Ostrava. The sale strategy became complex, with potential purchasers considering share swaps for stakes in the other partly- privatised coal and energy companies.

There are three Czech producers of sub-bituminous brown coal, the already privatised MUS Most, SD Chomutov and SU Sokolov, with annual production capacities of 17 Mt, 20 Mt and 10 Mt respectively. In conjunction with the power companies CEZ and Carbunion Bohemia, they have founded a company, Coal Energy, specifically for trading electricity generated from brown coal, with the objective of developing export sales of electricity. Croatia has been unofficially identified as a sales target.

OKD produces both coking coal and thermal coal, in almost equal proportions, from underground operations, with a production capacity of some 11 Mt/y. In 2002, six mines remained open and two coking plants. Plans announced in 2002 were for reduction of the current workforce of 19,000 to 11,000 by 2007. Two other smaller hard-coal producers operate four underground mines in the Silesian Basin.

Greece

Lignite has the biggest share of primary energy production (1999: over 80%) and satisfies over 67% of national demand for electric power. Over 95% of lignite production is from mines operated by the state-owned Public Power Corp. (PPC), producing 66.2 Mt for electricity generation. A small tonnage of

lignite, less than 4 Mt, is also produced from privately-owned operations which supply PPC and also produce briquettes or supply lignite for direct use in industry or domestic heating in areas adjacent to the mines. Annual production for 2002 is estimated at 70 Mt. The principal lignite production areas comprise the Ptolemais-Amyntes and Florina lignite fields in the north, which contribute 80% of production, and the Megalopolis area in the Peloponnese. Lignite production has been increasing steadily since the 1990s and the new Florina lignite-fired power plant is now ready to commence operation, requiring the introduction of an additional 2.5 Mt/y production of lignite to support this. A further four lignite-fired power stations are in the planning process, reflecting the need to satisfy the estimated national annual increase in electricity demand of 2.7%. A small amount of imported coal, of some 2 Mt/y, is used to enhance lignite feed quality.

Other European

Bulgaria relies upon coal for nearly 45% of its production of energy as opposed to nearly 44% from nuclear power. The environmental performance of older coal-fired power stations and the safety of the nuclear plants present a dilemma for long-term energy planning. In conjunction with a programme of improved emissions technology there is no doubt that indigenous lignite will remain a significant component of energy production for decades to come. There are large deposits of low-quality lignite (reserves 2,500 Mt), lesser amounts of sub-bituminous brown coal (reserves around 230 Mt) and there are also small amounts of currently uneconomic resources of hard coal and anthracite. Total coal production is around 30 Mt/y. The greatest production is from the Maritsa lignite field, in which the three main surface mines use bucket-wheel excavators to produce over 80% of total coal production. Sub-bituminous coal is largely produced in the Bobov Dol area, where there are a number of underground and surface mines. With the exception of the Babino underground mine, underground mining technology is only semi-mechanised. A recent major investment has been committed to undertake the US\$242 million modernisation and upgrade of the Maritsa East 2 power plant, which has been signed with Mitsui Corp. of Japan to commence in 2003. Bulgaria imports several million tonnes of coking coal annually.

France is now in the final stages of phasing out its coal industry. Production for 2002 was around 1.2 Mt, with a workforce of about 2,400. All production by Charbonnages de France is scheduled to cease by 2005.

Hungary maintains a small hard-coal industry, comprising one underground mine and two surface mines, and a more significant lignite industry, supporting over 20% of national power generation. The lignite mines are both surface mines and underground. In 2002, the order was placed for a new DBT shearer for the Markushegy underground mine of the state-owned Vértess Co., for working lignite thicknesses up to 3.5 m. Overall, production of hard coal and lignite is expected to remain around the 14 Mt/y level of recent years.

Italy produces almost no coal domestically although some 20 Mt of imported coal are consumed for power generation and coke production for the steel industry. Investigation and engineering work has continued with the aim to

bring the Carbosulcis underground mine in Sardinia back into production. This will produce sub-bituminous coal from longwall operations. Production is linked to construction of a thermal power station, for which part of the feed will be imported coal.

Norway has one coal producer, Store Norske Spitsbergen Kulkompani (SNSK), which operates on the Arctic island of Svalbard. SNSK has been mining on Svalbard since 1916, but since the late 1990s has been developing the new Svea Nord mine which has reserves quoted as 32 Mt in a coal seam of thickness 3.0 – 5.5 m. The new mine had a planned production of 1.2 Mt/y, although capacity was quoted as 2.5 Mt/y, based on a complete new longwall system supplied by Joy Mining Machinery. Production commenced in August 2001 and a run-of-mine output of 1 Mt was achieved in the first four months of operation.

The coal industry in **Romania** continues to have a high profile owing to the regional impact of the industry, although coal contributes only approximately 30% of power generation. Two state-owned companies are responsible for lignite and brown coal production, National Lignite Co. Oltenia (CNL Oltenia) and National Coal Co. Ploiesti (SNC Ploiesti), and one company is responsible for hard coal production, National Hard Coal Co. Petrosani (CNH Petrosani). CNL Oltenia produced around 27 Mt of lignite from 17 surface mines and seven underground mines, representing 78% and 22% respectively of production. Surface mine technology is predominantly bucket-wheel-based, while the underground mines operated ten modern longwalls. SNC Ploiesti is a smaller company producing approximately 2.3 Mt from open pits. Of the total lignite and brown coal production of approximately 29.3 Mt, virtually all production was despatched for power generation. Hard coal is produced primarily from underground mines in the Jiu Valley, of which only four out of eleven mines are considered to be modernised. Serious explosions in mid-2001 and early 2002, in total with 24 deaths, led to suspension of operations at the Vulcan Colliery. Production of hard coal is estimated at approximately 2.8 Mt, virtually all for power generation. A production total for the country of some 32 Mt represents a minor decrease of around 4% against 2001.

The **Republics of the Former Yugoslavia** reflect the heavy dependence upon lignite-fired power generation of the former federal republic. Only **Croatia** has no significant indigenous coal or lignite production although there are measured resources in the country. Since 1999 the two coal-fired power plants have been supplied exclusively by imported bituminous coal. **Slovenia** produced 3.8 Mt of lignite from the underground Velenje mine and around 750,000 t of sub-bituminous coal from the underground Trbovlje-Hrastnik mine, all of which production was destined for electricity generation. **Serbia, including Kosovo, and Montenegro** has extensive reserves of lignite, of around 15,000 Mt, and much smaller resources of sub-bituminous and hard coal. Production of lignite is around 36 Mt/y (2001: 35.8 Mt) of which over 80% is for power generation, supplying some 50% of primary energy needs.

Kosovo formerly produced over 20% of power generated in Serbia and Montenegro, and work continues on rehabilitating the two lignite open pits which supply the Kosovo A and B power plants. **Bosnia Herzegovina** has numerous, relatively small lignite and bituminous coal mines throughout its territory from which the greater part of production is destined for two thermal power plants. In 2002, lignite production was 5.5 Mt and bituminous coal production around 3.6 Mt. In **Macedonia**, some 75% of electricity generation is from lignite-fired power plants, primarily the Bitola power plant which is supplied from the two lignite mines in the Suvudol area. National lignite production in 2001 was 7.5 Mt and is likely to have been unchanged in 2002.

Spain reduced coal production in 2002 to 13.5 Mt, in line with its commitments to EU policy on restructuring and elimination of subsidies. This total includes some 1.7 Mt (saleable) of bituminous coal from the nine underground mines of Hunosa, in the traditional mining heartland of Asturias, a further 2.5 Mt of bituminous coal from primarily underground mines in other northern provinces and over 1.2 Mt of bituminous coal from two surface mines and one underground operation in the southern provinces of Córdoba and Ciudad Real. Spain also produced some 4.5 Mt of anthracite, mostly from small underground mines in Asturias, León and Palencia in the north of the country. Sub-bituminous brown coal is produced primarily in the northeast of the country for power generation, mostly from Teruel, producing some 3 Mt, but with smaller amounts from adjacent provinces. Lignite is produced from two operations in Galicia in the northwest of the country, both supplying adjacent power stations. However, the 8.7 Mt produced in 2001 is set to fall substantially when one of these operations, Lignitos de Meirama, reaches the end of its planned life in 2003. The adjacent power plant is planned to be converted to run on imported coal. Coal remains an important component of energy consumption and some 21.7 Mt of coal was imported in 2001, of which 80% was for power generation. However, in 2002 the high levels of hydro-electric generation are expected to have reduced demand for imported coal.

The **UK** saw further closures of underground mines in 2002, including Longannet, the only remaining deep mine in Scotland, and Prince of Wales in the Yorkshire Coalfield. Also, during the year the closure was announced of Clipstone colliery in Nottinghamshire, to close in April 2003, and of the Selby Complex, to close before spring 2004. In 2002, coal produced 32% of the total of UK power generation (2001: 34%) and UK power stations consumed some 47.5 Mt (2001: 50.8 Mt). In the twelve-month period to March 2003, the UK coal industry produced some 28.8 Mt from 25 underground mines and 48 surface mines. The principal coal producer, UK Coal, produced 19.5 Mt from 13 underground mines (78% of total tonnage) and 13 small surface mines, and sold 18.9 Mt to the power generation industry. Coal imports to UK for power generation were 22.1 Mt, a drop of 18% from 2001, as power generators reduced their stockpiles.

Table 1: The major coal producers and exporters (Mt)

	2000	2001	2002	Exports 2002	Imports 2002
China (total) <i>all qualities</i>	1,171.0	1,294.0	1,326.0	85.8	
US (total)	974.0	1,021.3	992.2	35.9	15.3
<i>lignite</i>	77.6	76.1	73.5		
<i>hard coal</i>	896.4	945.2	918.7		
India (total)	334.8	343.5	359.3		22.8
<i>lignite</i>	22.9	22.3	24.3		
<i>hard coal</i>	311.9	321.2	335.0		
Australia (total)	291.0	315.0	341.7	203.8	
<i>lignite</i>	67.4	66.4	66.7		
<i>hard coal</i>	223.6	248.6	275.0		
Russian Federation (total) <i>coal + lignite</i>	258.0	269.0	253.0	51.0	20.5
South Africa (total) <i>hard coal</i>	224.1	224.7	^e 220.4	69.2	
Germany (total)	201.0	202.4	207.9		^e 37.0
<i>lignite</i>	167.7	175.3	181.8		
<i>hard coal</i>	33.3	27.1	26.1		
Poland (total)	162.8	163.4	^e 162.1	22.0	
<i>lignite</i>	59.5	60.4	^e 60.0		
<i>hard coal</i>	103.3	103.0	102.1		
Indonesia (total) <i>all qualities</i>	77.0	92.6	^e 100.0	^e 64.0	
Ukraine (total)	81.3	83.9	^e 71.0		^e 3.7
<i>Lignite</i>	1.1	1.0			
<i>hard coal</i>	80.2	82.9			
Kazakhstan (total)	74.9	79.0	73.2	^e 23.4	
<i>Lignite</i>	2.4	2.5	2.6		
<i>hard coal</i>	72.5	76.5	70.6		
Canada (total)	69.2	70.5	66.6	26.8	22.1
<i>Lignite</i>	11.2	11.4	11.3		
<i>hard coal</i>	58.0	59.1	55.3		
Turkey (total)	63.1	65.8	^e 57.1		^e 12.0
<i>Lignite</i>	60.9	63.5	^e 55.0		
<i>hard coal</i>	2.2	2.3	^e 2.1		
Czech Republic (total)	65.2	66.1	^e 66.0	^e 5.7	^e 1.1
<i>Lignite</i>	50.3				
<i>hard coal</i>	14.9				
Greece (total) <i>lignite</i>	63.3	67.3	^e 70.0		^e 2.0
Colombia (total) <i>hard coal</i>	38.1	42.4	^e 39.5	35.4	

Figures for 2000 and 2001 primarily from BP Statistical Review of World Energy; 2002 figures compiled from various sources, primarily international and national data releases:

^e indicates estimated figures. Lignite includes brown (sub-bituminous) coal.

Table 2: Coal Mines India

Company	Production 01/02 (Mt)	No. of mines u- underground o/p- surface	U/g production %	Profit/ loss Rs million
Bharat Coking Coal Co. Ltd - BCCL (Jharkand)	25.26	87	32.2	-7,550.0
South Eastern Coalfields - SECL (Madhya Pradesh)	64.12	97	23.8	+7,688.7
Western Coalfields - WCL (Maharashtra/ Madhya Pradesh)	37.01	81	24.7	+3,102.0
Eastern Coalfields - ECL (West Bengal/ Jharkand)	28.55	111	43.7	-2,778.4
Central Coalfields - CCL (Jharkand)	33.81	64 (35 o/p; 22 u; 7comb)	8.1	-1,083.2
Northern Coalfields - NCL (M. Pradesh - Uttar Pradesh)	42.46	8 o/p	0	+13,873.4
Mahanadi Coalfields - MCL (Orissa)	47.80	22	3.1	+7,196.0
North-Eastern Coalfields - NEC (Assam)	0.64	5 (2 o/p; 3 u)	25.5	+5,618.0
Singareni Coalfields Co. Ltd - SCCL (Andhra Pradesh)	30.81	67	39.8	Loss-making
Totals (CIL + SCCL)	310.47	544	19.6	