



SAFETY FIRST EXCELLENCE THE KEY

ELIMINATE RISK

Photograph by Graeme Williams/South Photographs

## Chapter 17

# Minerals and Energy

South Africa is the world's biggest producer of gold and platinum and one of the leading producers of base metals and coal. It is one of the few countries in the world that has a system of dual State and private ownership of mineral rights.

The Department of Minerals and Energy is the primary Government institution responsible for formulating and implementing policy. It reports to and advises the Minister of Minerals and Energy, who, in consultation with the Cabinet, takes final responsibility for policy.

Within the Department, the Energy Branch takes responsibility for energy affairs, while the Minerals Development Branch manages, among other things, mineral prospecting and mining rights.

An independent study, commissioned by the Chamber of Mines of South Africa, found that mining remained vital to the national economy and that it was growing in importance. It stated that the industry remained the single most important foreign exchange earner, providing more than a quarter of all income earned by black workers.

The study was conducted under the auspices of the Cape Town University Graduate School of Business. Its finding was that declining gold output had masked significant growth in other mining sectors. Coal, platinum-group metals (PGMs), chrome and iron ore industries doubled in size since 1980. Between 1990 and 1996, employment in the non-gold mining sector increased by 10%, creating 217 000 jobs by 1996. The study was presented to the Government in September 2000.

## Policy

The Minerals Development Bill was published for public comment in December 2000. The fundamental principles underpinning the Bill include the following:

- mineral resources are the common heritage of all South Africans, and belong collectively to all South Africans
- it is a universally recognised right of the State to exercise full and permanent sovereignty over all its natural resources
- the State, as the representative of the people, is the custodian of the nation's mineral resources
- the results of past racial discrimination are to be addressed, and historically disadvantaged persons are to participate in the mineral and mining industry and benefit from the exploitation of the nation's mineral resources

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◀ In 2000, some 750 mines and quarries employed about 412 000 people, many from neighbouring countries, representing about 3,5% of the economically active population. Taking into account the multiplier effect of the supply and consumer industries, including dependants, many millions rely on the mining industry for their livelihood.

- security of tenure in respect of prospecting and mining operations is to be secured.

The Bill will usher in a new dispensation in minerals and mining law in South Africa. In accordance with international norms and principles, prospecting and mining rights will be granted on the basis of public ownership and State custodianship of mineral resources.

International law recognises that states have the right to exercise full and permanent sovereignty over their natural resources. The principle of public ownership of mineral resources is recognised and accepted in all major mining countries.

Notwithstanding the proposed changes, the Government undertakes and commits itself to guaranteeing security of tenure in respect of prospecting and mining operations.

Following a *lekgotla* between government and mining in June 2001, an agreement was reached on the following key issues:

- policy principles underlying the draft Bill
- a need to attract investment in the mining and minerals industry
- security of tenure
- discretionary powers of the Minister and good administrative law
- the mineral rights regime should be brought in line with the internationally-accepted norms and standards, which recognise the State's custodianship of the nation's mineral resources
- the appeal process to the courts
- mechanisms to implement the transitional measures with a view to phasing in the new legislative framework with minimum disruption to the mining industry.

According to the World Bank Report entitled *Strategy for African Mining in 1992*, ex-

ploration rights are normally for a period of three years with one or two possible renewals for the same period, whereas mining rights are usually for 20 to 30 years with similar renewal periods. The draft Bill proposes prospecting rights of five years renewable for three years, and mining operations of 25 years renewable for 25 years.

Compared with other countries, South Africa's proposed regime is highly competitive. In Namibia, prospecting rights are granted for three years, renewable for two years, and mining operations for 25 years, renewable for 15 years.

In Tanzania, prospecting rights are granted for three years, renewable for two, and mining operations are renewable for 25 years. In Australia, prospecting rights are renewable for five years and mining operations for 21 years, renewable for 21 years.

In Canada, mining rights are renewable for 21 years and in Botswana prospecting rights are granted for three years, renewable for two years, while mining rights are renewable for 25 years.

### **Excellence in Mining Environmental Management (EMEM) Award System**

The EMEM Award System was launched in March 2000. Although the Department of Minerals and Energy administers the System, other government departments have endorsed it and three professional organisations accepted joint patronship for the Award.

They are the International Association of Impact Assessment, South African Institute of Mining and Metallurgy, Water Institute of South Africa, the Department of Water Affairs and Forestry, the Department of Environmental Affairs and Tourism, the Department of Agriculture, and the National Nuclear Regulator (NNR).

The EMEM Award System serves various objectives, namely to:

- motivate the industry to excel in environmental management
- recognise publicly those mining companies which have excelled in their environmental management endeavours

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Former Anglo American and De Beers Chairman, Harry Oppenheimer, died on 19 August 2000 at the age of 91 after a short illness. President Thabo Mbeki said that Mr Oppenheimer played a seminal role in the industrialisation of South Africa over a period spanning most of the 20th century. President Mbeki also said that he was one of the pioneers of reconciliation in this country, and that his life served as an inspiring example to all South Africans.



- improve the image of the mining industry
- evaluate and establish the status and effectiveness of the environmental management requirements of mines
- highlight examples of excellence in environmental management in the mining industry so that others can take note of techniques and technologies which have been developed successfully
- promote awareness
- strive for continual improvement.

The award categories are:

- large open-cast mining operations (moving more than 500 000 t per annum)
- small open-cast mining operations (moving less than 500 000 t per annum)
- underground mining operations
- offshore mining operations.

Awards are made on both a regional and national level, and are presented on a biennial basis.

## Rehabilitation of mines

The rehabilitation of derelict and/or ownerless mines that pose environmental hazards and health implications to communities has been a prominent activity of the Department since 1986.

By May 2001, approximately R50 million has been spent on the rehabilitation of 53 derelict and/or ownerless asbestos mines in the Northern Cape, Northern Province and Mpumalanga. It is expected that another R150 million would be required to rehabilitate the remaining 68 derelict and/or ownerless asbestos mines. Although the rehabilitation of derelict and/or ownerless mines will remain a priority for years to come, attention is also being focused on the rehabilitation of derelict and/or ownerless coal mines and gold residue deposits.

## Mining industry

During 2000, the mining industry directly contributed 6,5% to gross domestic product (GDP) and an estimated 14% through associated multiplier effects. The declining trend in mining's contribution to GDP in recent years

was reversed in 2000 with the highest level recorded since 1996, mainly as a consequence of the strong performance in the PGMs sector.

Mining contributed more than 8% to South Africa's gross fixed capital formation during 2000, while sales of primary mineral products accounted for 35% of foreign exchange earnings. The inclusion of various processed mineral products such as ferro alloys and aluminium increased this contribution to 43,1% in 2000.

A Mining Sector Summit was held in February 2000. The objective was to develop

- a sector strategy for the mining industry in terms of job creation and job quality
- a national vision that brings about positive changes for the whole industry in all its commodity sectors.

The outcome of the Summit was consensus on five sector strategies to achieve the following stated objectives:

- an industry promotion strategy in order to disseminate reliable information about the industry that attracts appropriate investment
- a mineral beneficiation strategy to both add value to exports and increase employment levels in the process
- an employment and human resources development strategy for sustaining and enhancing existing jobs and protecting vulnerable workers
- a strategy to manage the impact of cyclical volatility in the mining industry to reduce job losses and to alleviate the social impacts of mine downscaling when this does occur
- a coordinated rural development strategy to enhance the potential for alternative forms of employment, particularly in labour-sending areas.

Employers and trade unions in the mining industry also agreed to establish various measures that will help create jobs and alleviate poverty. The parties committed themselves to co-operate in order to ensure that skills development becomes a priority in the industry.

Over the last two years, South African mining houses transformed into large focused mining companies that include Anglo Platinum, AngloGold, De Beers, Implats and Iscor.

The Government is the only shareholder of Alexkor, a diamond mine situated on the west coast in Namaqualand. In March 2001, Cabinet approved the Alexkor Limited Amendment Bill for submission to Parliament.

The Bill will help facilitate the restructuring of the mine by allowing government to bring in an equity partner.

### Mineworkers

In 2000, some 750 mines and quarries employed about 412 000 people, many from neighbouring countries, representing about 3,5% of the economically active population. Taking into account the multiplier effect of the supply and consumer industries, including dependants, many millions rely on the mining industry for their livelihood. More than R24 billion was paid out in wages.

Over the past five years, South Africa's gold mines have been plagued by diminishing economic reserves and consequent cost controls. Since 1990, more than 200 000 workers have lost their jobs through retrenchments in the gold-mining industry alone.

The Government has put into motion an extensive discussion process between itself, organised labour and industrialists. It aims to formulate an official policy, making gold-mining an important contributor to the reconstruction of South Africa's post-apartheid economy.

The Gold Crisis Committee (GCC), representing the Government, the National Union of Mineworkers (NUM) and the Chamber of

Mines, was established to manage the industry's restructuring.

Since the formation of the GCC, thousands of jobs in the gold-mining industry have been saved through extended leave arrangements, transfers and replacement of contractors.

Other measures such as early retirement, voluntary separation, natural attrition and medical repatriation have, although not saving jobs, avoided the further compulsory retrenchment of employees.

### Mine health and safety

Improved safety performance is evident in the South African mining industry. At the end of 2000, the fatality and reportable injury rates were below 1999 levels, continuing a 16-year long downward trend.

Since the introduction of the Mine Health and Safety Act, 1996 (Act 29 of 1996), the fatality rate in 1995 of 1,02 employees killed in mine accidents per 1 000 employees has steadily declined to 0,69 per 1 000 employees (provisional).

These rates correspond to 533 deaths in 1995 and 281 in 2000. Similarly, reportable injuries decreased from 7 717 to 4 729, corresponding to rates per 1 000 of 14,76 to 11,57 respectively.

The Mine Health and Safety Council, its permanent committees, and their subcommittees and working groups are supported and administered by the Mine Health and Safety Inspectorate. The permanent committees include the Mining Regulations Advisory Committee (MRAC), Mine Occupational Health Advisory Committee, and Safety in Mines Research Advisory Committee. The Mining Qualifications Authority (MQA) is the final statutory tripartite institution in which the Inspectorate participates.

A new award scheme was implemented on 1 January 2000. The Inspectorate administers the scheme on behalf of the Mine Health and Safety Council.

The South African Mines Occupational Disease Database was launched, and the mine equipment database upgraded.

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TEBA Bank was launched in October 2000 and will expand its products and services to markets beyond the mining industry. TEBA Bank, an exercise by the TEBA Fund Trust, is jointly controlled by NUM and mining employers. The Bank will focus on the underbanked areas in rural South Africa. It operated as TEBA Savings Fund for the past 25 years, until it received its banking licence in July 2000.



The Inspectorate identified the need to educate employees in respect of the Mine Health and Safety Act, 1996. Some 100 000 pocket-sized copies of the Act were provided to employees to make them aware of their obligations, duties and rights to health and safety.

### **Policy and legislation**

The Mine Health and Safety Inspectorate embarked on a project plan of developing legislation relating to mining and the use of equipment. Fall-of-ground, underground transport, equipment and flammable gas explosions are a few of the topics being dealt with. It is intended that the legislation will enable and speed up the already improving health and safety performances.

The Mine Health and Safety Council recommended that the following legislation be promulgated:

- a guideline for trackless mobile machinery
- a guideline for mine residue deposits
- regulations for the reporting of mine accidents and dangerous occurrences
- minimum standards of fitness.

The MRAC appointed and trained Tripartite Task Groups to draft legislation on topics such as accident, injuries and investigations; coal dust and flammable gas explosions; track-bound machinery; electricity; explosives; lifting equipment; and occupational hygiene regulations.

### **Training and research**

The Council approved the annual Health and Safety Research Programme of R38,6 million for the period April 2000 to April 2001.

The education and training of employees remain a high priority. The MQA has made significant progress in generating unit standards and qualifications relevant to the mining industry.

It is intended that all persons working in the mining industry receive training to acquire the skills required to operate as competent persons, and that such competencies in the form of unit standards are registered on the National Qualifications Framework. The na-

tional recognition of these unit standards will assist employees wishing to move from one sector to another.

The MQA has been registered by the Department of Labour as a Skills and Education Training Authority for the mining and minerals sector.

The MQA has been registered to perform the functions of an Education and Training Qualifications Authority by the South African Qualifications Authority.

The MQA has appointed a number of standard-generating groups to generate unit standards for the mining and minerals sector.

A language policy for the mining industry has been developed and published for comment. The policy is in the process of being considered by the national language policy committee as well as by the various stakeholders of the MQA.

### **HIV/AIDS**

The terms of reference for an industry Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) committee have been developed, and by May 2001 representatives were being nominated by stakeholders.

The Department of Minerals and Energy, together with Anglo Coal, Sasol, Ingwe Coal Corporation, Duiker Mining, the Council for Scientific and Industrial Research (CSIR), Mintek and Eskom, launched the Powerbelt Project in Mpumalanga on 1 December 2000 in the fight against HIV/AIDS.

The aims are:

- minimising the prevalence of HIV/AIDS in the coal and power-generating industries and their communities
- employing proven and effective scientific methodologies
- maximising exploitation of financial and human resources within the industry and communities.

### **Chamber of Mines**

Established in 1889, the Chamber of Mines consists of independent mining finance corporations, individual mines and mining com-

panies. The members account for over 85% of South Africa's mineral output.

The Chamber of Mines provides an extensive advisory and service function for its members and for the industry on a co-operative basis, in areas such as industrial relations, education and training, security and health care, technical, legal and communication services, and the provision of statistical data.

The following services to the South African mining industry and, in some instances, also to customers outside the mining industry are provided by subsidiary companies: training; examination administration; visits to operational gold mines; the monthly newspaper *Mining News*; mine rescue services; environmental management services; and centres for human development.

Other areas of industry networking include The Employment Bureau of Africa (TEBA); TEBA-Bank, providing efficient and cost-effective banking services for mineworkers; Rand Mutual Assurance, providing workers' compensation benefits for accidental injury or death arising out of and in the course of employment; Rand Refinery Ltd, the world's largest gold refinery; NUFCOR, one of the world's largest continuous producers of uranium oxide; Colliery Technical Services, which includes the Colliery Training College; Rescue Drilling Unit; Collieries Environmental Control Services; and the CSIR's Mining Technology Division (Miningtek).

In November 1999, the Chamber of Mines allocated R10 million towards the funding of rural economic development initiatives.

### **Small-scale mining**

The economic impact of small-scale mining is far from small. The small-scale mining sector makes a significant contribution to job creation in the mining sector.

It is estimated that about 1 000 jobs can be created for every seven to 10 sustainable small-scale mining projects. By February 2001, the National Steering Committee of Service-providers to the Small-scale Mining Sector

(NSC) had received 60 applications for assistance, and eight pilot projects had been approved.

Identifying joint ventures and technical partners for small-scale miners is one of the tasks undertaken by the NSC to assist miners in overcoming some of the obstacles they face. Access to finance remains a major issue for small and aspiring miners. Programmes assisting illegal miners to become legal continued during 2000, and attempts to promote entry for those who were not taking part in the sector also continued.

The compilation of a business plan for the Osizweni brick-making project was a major exercise and achievement for the NSC. The entire exercise involved the signing of the Trust Deed Agreement and the registration of a Trust.

The Trust then negotiated a Prospecting and Option Agreement with Anglocoal who own the mineral rights on the identified alternative site. The necessary evaluation and sample analysis was conducted, design of the mining layout and management structure specifications done, a market survey conducted, and the business plan compiled.

The assistance agreement between the Industrial Development Corporation and the Kimberley Miners Forum Trust was signed, and letters of appointment given to service-providers, who promptly started geological evaluation on the site. Initial sample results were submitted, and the feasibility study was expected to be completed in 2001.

In Steinkopf, the small-scale miners signed a Memorandum of Agreement to co-operate in their mining activities. They have since formed a commercial company, and the NSC has identified a big pegmatite deposit that will form the backbone of the central processing facility.

The assistance agreement and the project plan have been compiled.

### **Mineral wealth**

South Africa's mineral wealth is found in diverse geological formations, some of which are unique and very extensive by world standards. Doubtless, the best known geo-



logical formation is the remarkably unique and extensive Witwatersrand Basin, hosting a considerable portion of the world's gold reserves, as well as uranium, silver, pyrite and osmiridium.

It yields some 98% of South Africa's gold output. Another is the Bushveld Complex, a sill-like geological feature occupying about 50 000 km<sup>2</sup>, mainly in the North-West and Mpumalanga provinces.

It contains more than half of the world's chrome ore and PGMs. It also encloses ores of vanadium, iron, titanium, copper, nickel and fluorspar.

South Africa's importance in the global minerals industry is centred around its large and diversified mineral reserve base:

- the Transvaal System, which contains more than 80% of the world's manganese reserves, also hosts appreciable amounts of iron ore

- the coal and anthracite beds of Mpumalanga and KwaZulu-Natal
- the Phalaborwa Igneous Complex, which hosts extensive deposits of copper, phosphate, titanium, iron, vermiculite and zirconium
- diamond (kimberlites, alluvials and marine) and heavy mineral sand occurrences containing titanium, iron and zircon
- voluminous deposits of lead and zinc ores in the Northern Cape, as well as copper and silver ores.

South Africa holds the world's largest reserves of ores of manganese (possessing 80% of the total world reserves), chromium (68%), PGMs (56%), vanadium (45%), gold (35%) and alumino-silicates (37%).

It is also the leading holder of reserves of ores of vermiculite, andalusite, zirconium, titanium, antimony, fluorspar and phosphate rock.

The domestic market for most of the mineral commodities is relatively small.

South Africa's large reserve base and important position as a world producer necessarily means that the country's mineral industry is export-orientated: for vermiculite it contributes 97% of world exports, for vanadium 76%, for alumino-silicates 50%, for ferrochromium 53%, for PGMs 47%, for chrome ore 41%, and for manganese ore and ferromanganese 27%.

For these commodities, as well as for gold and PGMs, it is also the world's largest exporter.

Other important export commodities include zirconium minerals, coal and fluorspar.

Because of this vast mineral resource base, South Africa is, to a large degree, self-sufficient with respect to the usage of minerals.

However, some minerals and mineral products need to be imported owing to an insufficiency of local resources or the fact that their deposits in South Africa cannot be economically exploited.

Another factor is that certain specialised grades and products are not produced in South Africa.

**South Africa's mineral reserves, 2000**

Commodity	Unit	Reserves	%	World ranking
Alumino-silicates	Mt	50,8	37,4	1
Antimony	kt	250	5,3	4
Asbestos	Mt	8,2	na	na
Chrome ore	Mt	3 100	68,3	1
Coal	Mt	55 333	10,6	5
Copper	Mt	13	2,1	13
Diamonds	k car	na	na	5
Fluorspar	Mt	36	9,6	3
Gold	t	35 877	35,0	1
Iron ore	Mt	1 500	0,9	9
Lead	Mt	3	2,1	5
Manganese ore	Mt	4 000	80,0	1
Phosphate rock	Mt	2 500	7,2	3
Platinum-group metals	t	62 816	55,7	1
Silver	kt	10	2,4	na
Titanium minerals	Mt	146	21,0	1
Uranium	kt	284,4	9,3	4
Vanadium	kt	12 000	44,5	1
Vermiculite	Mt	80	40,0	2
Zinc	Mt	15	3,4	6
Zirconium minerals	Mt	14,3	22,1	2

na = not available

Source: Minerals Bureau



The more notable imports into South Africa in 2000 were diamonds, alumina, certain ferro-alloys, nickel, coking coal, phosphate rock, sulphur, magnesite and magnesia.

Based on preliminary data, South Africa's total primary mineral sales are estimated to have increased by 28,7% from R76 billion in 1999 to R97,8 billion in 2000.

Additionally, total processed mineral sales increased by 24,4% in 2000, from R18,2 billion to some R22,7 billion.

The combined total for primary and processed mineral sales is estimated to have increased by 27,9% in 2000, from R94,2 billion to R120,5 billion.

#### South Africa's mineral production, 1999

Commodity	Unit	Production	World	
			%	Rank
Aluminium	kt	689	3,0	6
Alumino-silicates	kt	137	46,1	1
Antimony	t	4 400	3,1	4
Asbestos	kt	19	1,0	9
Chrome ore	kt	6 817	50,9	1
Coal	Mt	226	7,1	4
Copper	kt	144	1,1	13
Diamonds	k car	10 015	9,0	5
Ferrochromium	kt	2 155	44,5	1
Ferromanganese	kt	3 122	17,3	2
Ferrosilicon	kt	82	3,2	6
Fluorspar	kt	218	5,2	3
Gold	t	451	17,5	1
Iron ore	Mt	29,5	3,3	8
Lead	kt	80	2,7	8
Manganese ore	kt	3 122	17,3	2
Nickel	kt	36,2	3,4	9
Phosphate rock	kt	2 957	2,1	9
Platinum-group metals	kg	216 479	49,0	1
Silicon metal	kt	36	4,2	7
Silver	t	152	0,9	14
Titanium minerals	kt	1 951	19,9	3
Uranium	t	2 501	3,7	8
Vanadium	kt	17,6	60,9	1
Vermiculite	kt	218	75,0	1
Zinc	kt	70	0,9	18
Zirconium minerals	kt	219	24,0	2

Source: Minerals Bureau

These large Rand revenue gains in 2000 were partly caused by the weakening of the United States (US) Dollar exchange rate, but were also attributable to a world recovery from the Asian financial crisis that commenced progressively from early 1999, consequently improving international prices for most mineral commodities.

A particular highlight was the exceptional price increases for PGMs, which resulted in their sales revenue exceeding that of gold for the first time.

Domestic primary mineral sales revenue increased in 2000 by 21,7% to R21,7 billion. This was an improvement of only 7,3% in current Dollar terms, and does not reflect a corresponding improvement in domestic demand or activity. The value of exports of primary minerals in 2000 increased by 30,8% from R58,1 billion to R76 billion. In current Dollar terms, this improvement of 15,3% represented both increased demand and prices in the export markets.

Export revenue was 77,7% of primary minerals revenue, and 78,2% by value of all primary and processed minerals sales in 2000.

The PGMs, gold, processed minerals and coal accounted for 83,5% of all mineral exports in 2000, which were shipped to more than 85 countries.

The Directorate: Mineral Economics (Minerals Bureau) of the Department of Minerals and Energy monitors and analyses all mineral commodities with regard to South African and world supply and demand, marketing and market trends.

Full details of South Africa's mineral industry (including the individual commodities) and its recent performance are given in the Directorate's annual review.

The recent performance of the more important individual commodities and of the different mineral sectors are summarised below.

#### Gold

World demand for gold decreased by about 4% in 2000 compared with 1999.

The gold price was disappointing, trading at an average price of \$279/oz.



### South Africa's primary mineral production and sales, 2000\*

Commodity or sector		Local sales (FOR)**		Export sales (FOB) ***		Total sales	
		Mass	Value (R' million)	Mass	Value (R' million)	Mass	Value (R' million)
Gold	t	3,6	217,5	403,9	25 055	407,6	25 272
Coal	Mt	153,9	8 707	67,7	10 813	221,5	19 520
PGMs	t	16,1	2 465	198,9	24 646	215,0	27 111
Base minerals	Mt	2,1	2 931	0,8	3 147	2,9	6 077
Ferrous minerals	Mt	17,6	1 654	24,3	3 693	41,9	5 347
Industrial minerals	Mt	55,1	2 937	2,2	1 369	57,4	4 296
Other minerals	~		3 149		7 417		10 567
Total primary	~		21 743		76 052		97 795
Processed minerals	Mt	1,1	4 473	5,4	18 199	6,6	22 672
<b>Total</b>	~		26 216		94 251		120 467

\*Preliminary

~ Various mass and volume measurements (e.g carats, barrels and tonnes)

\*\* FOR – Free on rail

\*\*\* FOB – Free on board

Source: Minerals Bureau

Mine supply decreased by 2 t to 2 568 t during the year. Net sales of bullion by central banks grew by 16,9% to 491 t. Total supply fell by 4% compared to 1999. South African gold production continued to slide in 2000, with output falling 6,4% to 422 t, while total revenue increased to R25,2 billion.

Owing to the accelerated weakening of the Rand, the average Rand price of gold improved by 5,5% from R1 702,7/oz in 1999 to R1 932,5/oz in 2000.

A new jewellery sector cluster manufacturing initiative, the Rand Refinery Jewellery Manufacturing Complex, was launched late in 2000. Called the African Gold Zone, it is the product of a partnership between the Government and the gold industry. The initiative seeks to establish a platform for the competitive repositioning and the accelerated expansion of the South African jewellery industry.

Rand Refinery, the principal gold refiner in the country, made its unutilised land available to the South African jewellery industry for the project.

With the recent decline in the market price of gold, jobs have been significantly depleted, resulting in the real threat of mines closing down. However, this decline takes place with-

in the context of a significant growth in the physical demand for gold for fabrication into jewellery.

In 2000, overall demand in the 27 markets covered in the World Gold Council's gold demand trends was essentially unchanged from 1999 levels.

#### Coal

Revenue from coal has increased by 10,6% since 1999. About 30% of the sales volume is exported, but exports account for about 56% of the revenue. Coal output decreased by 7,8 Mt or 3,5% in 2000 to 215,7 Mt.

Total sales volumes increased by 2,5%, with local sales decreasing 1,1 Mt or 0,7%.

Rand revenue increased to R19,8 billion, but in Dollar terms the revenue declined by 9,9% owing to weaker world prices.

The realised export price in Dollar terms fell by 16,1%, indicating oversupply and the weakness in world demand in 1999. New mine developments are still awaiting stronger and higher world prices.

#### Platinum-group metals (PGMs)

Export sales volumes of PGMs decreased by 3,5% during 2000 to 192 t. Total Rand earn-

## South Africa's mineral exports, 1999

Commodity	Unit	Exports	%	World Ranking
Alumino-silicates	kt	109	40,7	1
Antimony	t	2 584	4,5	5
Asbestos	kt	21,5	2,0	8
Chrome ore	kt	1 897	50,6	1
Coal	Mt	66,2	12,7	2
Copper	kt	77,0	0,7	15
Ferrochromium	kt	2 155	44,5	1
Ferromanganese	kt	1 569	24,1	2
Ferrosilicon	kt	36	3,0	6
Fluorspar	kt	218	5,2	3
Iron ore	Mt	21,1	4,8	6
Lead	kt	67,0	2,6	9
Manganese ore	kt	1 569	24,1	2
Phosphate rock	kt	994	1,7	7
Silicon metal	kt	33	6,1	5
Vanadium	kt	15,9	66,3	1
Vermiculite	kt	187,0	94,9	1
Zirconium minerals	kt	276,0	34,3	2

Source: Minerals Bureau

ings were boosted by a hefty 74% to R25,9 billion, as a combined result of accelerated depreciation of the Rand and a strong increase in the average dollar price of metals in the group.

The average rhodium price rose by 119,8% in 2000 to \$1 993, 66/oz, and the average price of palladium climbed by 89% to \$678,4/oz. The average price for platinum also increased by 44,2% from \$377,2/oz to \$544,1/oz.

The price of palladium climbed to a high of \$958 in December 2000, and the price of platinum rose to \$625, the highest since August 1987.

Early in 2000, Impala Platinum revealed its intention to reopen the Crocodile River Mine, which was mothballed in 1991. The company is also going to develop a new mine at Winnaarshoek at a cost of R1,2 billion.

In the first quarter of 2000, Aquarius Platinum announced its decision to develop the Marikana project. Mining started in 2001, at an annual production rate of some 5 000 kg of PGMs.

The world's largest platinum producer, Anglo Plat, reached a landmark deal with the Government about the future of several farms in the Northern Province in December 2000.

This means that Anglo Plat will continue its mining operations on about 12 of the farms, where it has already been mining. The Government will grant the company 25-year leases on these farms, renewable for a further 25-year period. Anglo Plat will pay royalties of about R3,5 million a year on the farms.

### Base minerals

Refined copper, nickel and cobalt, and titanium and zirconium concentrates dominate this sector, with support from zinc, lead and arsenic concentrates. The sector contributes some 12% and 4% respectively to total primary local sales and total primary export sales. Overall sector revenues improved in Dollar terms over the year (1999 compared with 2000) by about 15,8%. About 48% of total revenue is local sales for further added-value operations.

Provisional statistics show that South Africa's production of base minerals (1999 compared with 2000) decreased by about 7%.

Local sales mass decreased by about 10%, while export sales mass increased by 5%. World prices collapsed in 1998, typified by a decline in the London Metal Exchange-priced metals copper, lead, zinc, aluminium, nickel and cobalt. Recovery commenced from 1999 and generally firmer prices were achieved in 2000.

### Ferrous minerals

This sector consists of the ores of iron, manganese and chrome, dominated by iron ore. It has been the leading performer in the primary minerals industry over the last 15 years, with revenue in dollar terms growing at 3% annually. Demand depends on the fortunes of the world steel and stainless steel industries.

A good economic recovery commenced in 1999. Crude steel output improved by 1,4% from 1998, and then a further 7% in 2000. Iron ore prices recovered from the very low levels of 1999, but price pressure remained, especially on chrome ores.



In 2000, real revenue from ferrous minerals showed good recovery from the weak levels of 1999.

### Industrial minerals

This sector contains a wide range of mineral products, and 68,4% of sales are local revenue.

The sector has achieved revenue growth in Dollar terms of 2% annually over the last 15 years. Sector sales revenue in 2000 decreased marginally to R4,3 billion. This represented an 8% decrease in Dollar terms.

Local sales revenue remained constant in 2000 at R2,9 billion. Industrial minerals' local earnings now constitute 13,5% of all local primary minerals earnings.

Four commodity groups accounted for more than 79% of local sales, namely aggregate and sand (27%), limestone and dolomite (26,5%), phosphate rock (data withheld) and sulphur (5,4%).

Five commodities contributed considerably more than 90% to export revenue of R1,4 billion: granite (46,8%), phosphate rock (data withheld), fluorspar (7,4%), andalusite (8,7%) and vermiculite (9,8%). Rand export earnings increased by 27,5% in Dollar terms.

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On 1 December 2000, the General Assembly of the United Nations (UN) adopted a resolution initiated by South Africa on 'The role of diamonds in fuelling conflict' by consensus, thereby expressing a strong, clear and unambiguous statement that the UN is determined to act decisively in breaking the link between illicit transactions of rough diamonds and armed conflict. The resolution was co-sponsored by more than 40 states, including all major diamond exporting, processing and importing countries.

At a Ministerial Conference in September 2000, the creation and implementation of an international certification scheme for rough diamonds, the Global Certification System, was accepted. This scheme will inform national certification schemes that are functional and have legal enforcement capacities to monitor, regulate and control diamond transactions. However, conflict diamonds consist of about only 4% of the total world diamond markets, and 96% of the world's diamonds are in fact 'prosperity diamonds'.

As part of the campaign to clean up the trade in conflict diamonds, the world's largest traders, including South African giant De Beers, have formed the World Diamond Council.

### Processed minerals

Ferro-alloys and aluminium dominate this sector, with solid support from titanium slag, phosphoric acid, vanadium, zinc metal and low-manganese pig-iron. Through investment in beneficiation, it has been the outstanding performer in the minerals industry over the last 15 years, with revenue in Dollar terms growing at 6% annually.

Prices were generally weak in 1999 and demand was flat, resulting in constrained production output and weakening Rand revenue growth.

Improved performance was achieved in 2000, with output improvements and small average price gains, resulting in 10% higher Dollar revenues.

New investments for ferro-chrome were announced in 2000.

However, further investments in this mineral beneficiation sector will be required to sustain the growth performance that has been achieved in recent years.

### Other minerals

This sector is dominated by diamonds, with support from hydrocarbon fuels, uranium oxide, silver and semi-precious stones. Its performance over 12 years has been flat, in spite of a recent boost from new investments in the leading diamond producer at Venetia and in hydrocarbon fuels, especially crude oil production.

The revenue in Dollar terms increased enormously, mainly as a result of the phenomenal increase in the oil price during 1999 and 2000.

## Energy

### Energy in the economy

South Africa's GDP is the 26th-highest in the world, but its primary energy consumption ranks 16th.

The energy sector is critical to the South African economy, contributing about 15% of GDP and employing about 250 000 people. Its energy intensity is above average, with only 10 other countries having

higher commercial primary energy intensities. This high energy intensity is largely a result of the economy's structure, with large-scale, energy-intensive primary minerals beneficiation industries and mining industries dominating.

In addition, there is a heavy reliance on coal for generation of most of the electricity and a significant proportion of the liquid fuels consumed in the country. Furthermore, South Africa's industry has not generally used the latest in energy-efficient technologies, mainly as a result of relatively low energy costs.

The Government has been persistently engaging members of the Organisation of Petroleum Exporting Countries (OPEC) through diplomatic channels to increase production.

### Energy demand by the economic subsector

Industry is the largest energy consumer, accounting for nearly half of total consumption. Households and transport make up most of the other half, while agriculture accounts for only 3% of consumption.

#### Households

Energy consumed by households represents some 22% of the country's net use. Most household energy is obtained from fuelwood (65% of net energy), primarily in rural areas, with the remainder coming from coal (9%), illuminating paraffin (8%) and a small amount from liquid petroleum gas.

Rural households comprise the majority of poor homes and are characterised by severe poverty. In terms of basic energy services,

their energy 'poverty' is exacerbated by increasingly widespread scarcity of fuelwood resources. Wood and paraffin are their main energy sources, with few having access to electricity.

#### Productive sectors

Industry and mining are the most important subsectors in terms of energy consumption. Electricity and coal provide about three-quarters of the energy consumed by these subsectors.

The balance comes largely from coke and blast-furnace gases, and small amounts of heating oils.

The mining industry depends heavily on electricity, with 87% of its energy use coming from this source. Mineral and metal processing uses large amounts of both electricity and coal, mostly in large-scale minerals beneficiation processes. Base metals, the largest single industrial energy-consuming subsector, is also by far the most energy-intensive one.

The food sector shows both a high total use and relatively high intensity, although, in terms of value added, its energy requirements are very modest in comparison with the basic minerals and metals industries. The chemicals and paper and pulp industries also consume large amounts of energy at high intensities.

#### Transport

Liquid fuels such as petrol and diesel account for 92% of energy used for transport. Rail transport accounts for less than 5% of total national electricity consumption. Petrol sales account for more than half of the total sales of local petroleum products. Petrol sales decreased by 3% to 2 761 Ml during the fourth quarter of 1999, compared to the same period in 1998.

Sales of diesel, an important agricultural and industrial fuel, were 1% lower in the fourth quarter of 1999 compared with the same period in 1998.

The availability of liquid fuels is good, and prices are competitive by international stand-

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A Charter to promote black economic empowerment in the petroleum and liquid fuels industry was drawn up and signed by industry players and the Government in November 2000.

According to the *White Paper on Energy Policy*, there should be a 25% equity stake in the South African operating assets of oil companies. This sale and transfer of the 25% equity stake should be completed within 10 years.



ards. The total local demand for petrol in 1999 was 10 832 Ml and for diesel 5 946 Ml. This represents an average annual market growth of 2,8% for petrol and 3,3% for diesel since 1993.

The demand for diesel has remained relatively low since the beginning of the eighties. This is to be expected, as diesel is largely used in the commercial transport sector and by industry and agriculture. The demand in these sectors is less price-elastic than that of the demand for petrol used primarily by private motorists.

Jet fuel demand is affected by a complex group of factors ranging from tourist travel to business confidence. With most economic indicators in South Africa having improved considerably since the democratic election in 1994, and an increase in tourism, it is likely that jet fuel demand will continue to show a strong upward trend.

The *White Paper on Energy Policy* directs that the liquid fuels industry be deregulated when certain milestones have been achieved.

The fuel tax contributed about R14 billion to the national revenue during 1999.

## Energy and rural development

Energy is an essential, but insufficient and often overlooked, element of all rural development activities. Rural energy provision has some features requiring special attention in development planning:

- as energy is an essential factor for all rural activities, it should be integrated into all developmental projects
- energy use in the rural economy is still not well understood in South Africa
- new rural energy supply systems often require large capital expenditure and special skills, and have longer lead times than many other rural infrastructural projects and investments.

Within the above context, the provision of essential electricity services for health care, education and other important services in rural areas has been identified as a priority.

## Coal

South Africa's indigenous energy resource base is dominated by coal. Many of the deposits can be exploited at extremely favourable costs and, as a result, a large coal-mining industry has developed.

The country ranks as the world's fourth-largest coal producer. In addition to the extensive use of coal in the domestic economy, large amounts are exported mainly through the Richards Bay Coal Terminal. South Africa is ranked the second-largest exporter of steam coal.

South Africa's coal comes from collieries ranging from among the largest in the world to small-scale producers with output in the range of 5 000 to one million t per month. With mergers and purchases, operating collieries remained at 55 in 1999. Of these, a relatively small number of large-scale producers supply coal primarily to the electricity and synthetic fuel producers. About 55% of South African coal-mining is done underground. Of the underground production volume, some 0,9% was produced by long walling, 10,1% by pillar recovery, and 44% by board-and-pillar mining. About 45% is produced by open-cast methods.

The coal-mining industry is highly concentrated, with three companies, namely Ingwe, Anglo Coal and Sasol, accounting for 76% of local production. Production is concentrated in large mines, with 15 mines accounting for 80% of production.

Mining rights will in future be regulated by the Minerals Development Bill, and all mineral rights will be vested in the State. According to the Bill, the principle of 'use it and keep it' will be applicable to all existing mineral rights holders.

South African coal for local electricity production is among the cheapest in the world. The beneficiation of coal, particularly for export, results in more than 60 Mt of coal discards being produced annually.

Thirty per cent of raw coal mined for the export market, and between 15% and 25% of the raw coal mined for local demand (excluding power-station coal), is not mar-

ketable and therefore discarded. Total discards could reach 2 300 Mt by the year 2020. As a result, ways are being investigated to make use of them.

### **Nuclear power**

Nuclear power remains one of the possible options once low-cost coal reserves become depleted.

The Council for Nuclear Safety, which reports to the Minister of Minerals and Energy, is responsible for the licensing and safety monitoring of all nuclear installations in South Africa.

South Africa has one nuclear power station in operation. The Eskom nuclear power station, called Koeberg, is located in the Western Cape and operates two PWR reactors of 1 840 MW.

Eskom is developing a fail-safe and highly efficient nuclear technology called the pebble bed modular reactor (PBMR). This technology is exceptionally safe and cost-effective, and promises to have a significant positive impact on the national economy.

The Government gave Eskom permission to continue and complete the feasibility study on the PBMR. The project involves building a demonstration model reactor at the Koeberg nuclear power station. Technologically, the project is more advanced than current nuclear-type designs and operating experience.

The demonstration model will allow Eskom to assess the 'techno-economic' viability of the project. Eskom hopes that the project will attract major buyers. A draft copy of an environmental report was released for comment in February 2001.

Under contract from Eskom, the Nuclear Energy Corporation of South Africa (NECSA) is involved with planning and process development activities aimed at the future establishment of a fuel-manufacturing plant for the PBMR.

NECSA was established in accordance with the Nuclear Energy Act, 1999 (Act 46 of 1999). It operates the SAFARI-1 Research Reactor at Pelindaba, Gauteng, and the facil-

ity for the disposal of radioactive waste at Vaalputs, some 100 km south-east of Springbok in the Northern Cape.

This facility disposes of low and intermediate-level waste from Koeberg. The 100-m long trenches have been compartmentalised, and capping of the filled section has commenced.

NECSA has also commissioned an interim retrievable dry store at Thabana, a waste facility on site, for spent fuel from the Safari-1 Research Reactor. In keeping with the commercialisation strategy of NECSA, nuclear and industrial products, as well as services and technology, are put at the disposal of industry on a competitive basis.

The technology development programmes of NECSA, based on selected nuclear core competencies of fluorination and radiation processes, are conducted to support the increasing competitiveness of the local industry in certain fields such as mineral beneficiation, radio-isotopes, chemical products and nuclear services.

A focused industrial product portfolio, aimed at local and foreign market niches, has since been developed and marketed in 22 countries worldwide. It is housed in the Pelindaba Technology Division of NECSA.

NECSA boasted sales of nuclear and industrial products and services of more than R300 million in 2000. Of this amount, 52% was earned on the export market.

In terms of the National Nuclear Regulator Act, 1999 (Act 47 of 1999), the functions of nuclear safety fall within the ambit of the NNR which regulates and controls the nuclear industry through nuclear licences.

South Africa serves on the Board of Governors of the International Atomic Energy Agency (IAEA) and is the most advanced African country in the field of nuclear expertise. It was selected as a Radiological Emergency Centre in February 1998.

The Centre acts as coordinating body in the event of any nuclear emergency in all of the 23 co-operating African countries. A squad of South African radiation experts can be deployed to combat all nuclear disasters in Africa.



NECSA participates in the African Regional Agreement for Research initiative of the IAEA, an African regional co-operative agreement, according to which many research, development and training projects in the field of nuclear science and technology are undertaken in African countries.

In 1996, South Africa signed the Nuclear Test-ban Treaty, also known as the Pelindaba Treaty, which declared the African continent a nuclear weapons-free zone. The ratification of the Treaty was approved by Parliament in March 1999.

### Liquid fuels

South Africa consumed some 21,1 billion litre of liquid fuels in 1999. Thirty-six per cent of the demand is met by synthetic fuels (syn-fuels) produced locally, largely from coal and a small amount from natural gas. The rest is met by products refined locally from imported crude oil. The petrol price in South Africa is directly linked to the price of petrol in US Dollars in certain international markets for petrol. The specific markets referred to are those 'East of Suez', including *inter alia* the Arabian/Persian Gulf, the Pacific Rim countries and Australasia.

This means that the domestic price is influenced by supply and demand for petroleum products in the international (East of Suez) markets, combined with the Rand/Dollar exchange rate.

Despite an increase in the production of crude oil at the beginning of September 2000, crude oil was still trading at the high price of between \$28 and \$34 per barrel in October 2000.

During 2000/01, there were various petrol price increases as a result of

- developments in the Middle East, which resulted in negative responses from the market
- low stock levels in the main consuming markets in the northern hemisphere of certain petroleum products, especially paraffin, jet fuel and diesel
- the deterioration in the Rand/Dollar exchange rate.

The Central Energy Fund (CEF), through its subsidiaries, operates offshore oil and gas exploration and production, synfuels production, handles State imports and the strategic oil stockpile, and administers the liquid fuels pricing controls and State subsidies for synfuels production.

The South Africa Petroleum Agency has achieved a lot of success over the past few years. Despite the general uncertainty in the international oil market, the fall of the Rand and the turmoil in the global economy, the Agency's Petroleum Licensing Unit has managed to attract investment worth over R200 million to South Africa through the sub-leasing of concession blocks off the coastline.

The Agency manages offshore projects such as the Oribi oilfield, which meets 6% of South Africa's petroleum needs.

### Sasol

Sasol is South Africa's largest petrochemical and explosives corporation, and operates a number of collieries to provide the raw materials for its synfuel and petrochemical plants.

By February 1999, seven of the eight new Sasol Advanced Synthol reactors were in operation, replacing the 16 old reactors at its Secunda plant.

The new-generation technology will cut the cost of producing synthetic crude oil by about one Dollar per barrel. The reactors are the biggest of their kind ever built. The cost of the project amounts to R1,01 billion, and the aim is not to expand production, but to save costs.

Sasol won its bid to acquire Condea, the chemicals subsidiary of Germany's largest power utility, RWE-DEA in December 2000. Sasol is to pay Euro1,3 billion in cash for

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South Africa and Algeria signed an agreement in November 2000, which gives both countries the right to pursue projects in each other's territory and to explore further opportunities on the continent. The agreement was signed by the CEF and the Algerian national oil company, Sonatrach.



Condea. The acquisition will substantially increase Sasol's foreign income from 10% to about 35%.

In October 2000, Sasol signed three agreements with the Mozambican Government, covering the joint development of the Pande and Temane natural gas fields and piping the gas to customers in both countries.

A petroleum production agreement provides for the unification of the Pande and Temane gas reservoirs, and a production sharing agreement grants Sasol the sole right to explore for hydrocarbons in the remaining acreage around the two reservoirs.

Subsidiaries of *Empresa Nacional de Hidrocarbonetos de Mocambique* (ENH), the State oil company of Mozambique, will partner Sasol with 30% of the equity in the company that will develop the Pande and Temane fields.

In terms of the pipeline agreement, Sasol and a subsidiary company of ENH will jointly own and build a pipeline stretching from Temane to Ressano Garcia on the border between Mozambique and South Africa, to take gas with an energy potential of 120 million gigajoules a year to South African customers.

Construction of the 895-km pipeline and development of field facilities in Temane and Pande were scheduled to start in June 2001. As part of a diversification and globalisation initiative, Sasol has been involved with the industry in Qatar in a feasibility study for the application of its synthetic fuels technology to convert remote natural gas reserves into high-quality liquid fuels. Apart from limited gas and oil reserves in the Mossel Bay area, South Africa does not have significant commercially exploitable gas or crude oil reserves.

### **Indigenous oil and gas resources and production**

Natural gas and associated condensate production is currently limited to the FA and EM gas fields off Mossel Bay, for the Mossgas project at Mossel Bay.

The core of this is the world's largest commercial scale gas-to-liquids plant, which con-

verts the gas and condensate to liquid fuel.

The EM gas field complex was brought into production in the third quarter of 2000, and will ensure sufficient feedstock to Mossgas to maintain current liquid fuel production levels at 30 200 barrels (bbls) of petroleum products a day until 2009.

During 2000, 1 513 431 t of gas and 271 787 t of condensate were brought ashore. This was converted into 9,96 million bbls of finished products. Total Mossgas production to date since going into full production in 1993 amounts to 77 million bbls. This equates to 110 million bbls of crude oil refined.

Parallel exploration is being carried out in various other sections of the Bredasdorp Basin off the coast of Mossel Bay to find reserves for Mossgas beyond 2009.

Mossgas supplies about 7% of South Africa's liquid fuel needs. The products are supplied to oil companies that market them under their own brand names.

Mossgas also produces anhydrous alcohols and speciality fuels that are exported and earn the company more than R250 million per year.

During the same period, the total volume of crude oil produced from the Oribi Field off the Cape south coast was 5 455 599 bbls.

### **Procurement and crude refining**

Sasol and Mossgas are situated in close proximity to their feedstock sources, which they own. However, the crude refineries rely totally on imported crude. During the oil embargo years, South Africa built up a considerable stockpile of crude oil, owned and managed by the Strategic Fuel Fund (SFF), a subsidiary of the CEF. This strategic stock was stored in disused coal mines at Ogies (Mpumalanga), in conventional steel tanks in Cape Town, and in inground concrete containers at Saldanha on the Cape west coast. The mine storage has a capacity of 118 million bbls and has proven very efficient. Each of the six tanks at Saldanha has a capacity of 7,5 million bbls, while the capacity in Cape Town is only about 1,5 million bbls.



The SFF storage facilities at Saldanha, with a capacity of 45 million bbls, are conveniently situated at the port of Saldanha, with facilities for handling supertankers.

However, by 1998 the Government had sold off the bulk of the strategic oil reserves to an undisclosed buyer, with the first option of buying it back again.

The proceeds of R800 million from the sale were paid to the fiscus from the SFF. Almost all crude is currently procured directly by refiners. The 1988 SFF crude stock levels of 158,5 million bbls (about one and a half years' supply) were drawn down to 45 million bbls in February 1996.

The target strategic stock level for the end of December 2002 is that 35 days of national crude import requirements should be physically held in crude oil at Saldanha Bay.

The value of crude imports is closely related not only to import volumes, but also to the volatile price of the commodity.

### Import and export of fuel products

The import of refined products is restricted to special cases where local producers cannot meet demand. It is subject to State control with a view to promoting local refinery utilisation.

When overproduction occurs, export permits are required and are generally granted, provided that both South Africa's and other South African Customs Union members' requirements are met. For 1998, petrol and diesel exports amounted to 25 Ml and 35 Ml.

More diesel than petrol is exported, owing to the balance of supply and demand of petrol and diesel relative to refinery configurations. Although petrol and diesel make up 55% of total liquid fuel exports, South Africa is also the main supplier of all other liquid fuels to Botswana, Namibia, Lesotho and Swaziland.

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The Department of Minerals and Energy announced in October 2001 that Soekor, Mossgas and the CEF would merge in an effort to consolidate a number of commercial activities and make its operations more sustainable.

## Gas

In addition to coal gas and liquid petroleum gas, South Africa produced 1 513 431 t of natural gas and 271 787 t of associated condensate in 2000.

The entire gas and condensate output is dedicated to the State-owned Mossgas liquid fuels synthesis plant, and accounts for about 1,5% of total primary energy supply. Gas manufactured from coal accounts for 1,2% of net energy consumption, and liquid petroleum gas accounts for about 0,5%.

Natural and coal gas play separate roles in the energy system, with natural gas being used solely as a feedstock for production of synthetic fuels, and coal gas as an industrial and domestic fuel.

However, current development of regional gas fields will most probably lead to natural gas becoming a more important fuel in South Africa.

South Africa's gas infrastructure stretches from Sasolburg in the northern Free State, through the industrial areas of Vereeniging, Johannesburg and the East Rand, from Secunda to Witbank and Middelburg to Newcastle, Richards Bay and to Durban.

Through the Sasol Gas Division, Sasol Oil markets industrial pipeline gas produced by Sasol Synthetic Fuels and Sasol Chemical Industries to about 700 industrial customers. Its pipeline network consists of about 1 500 km of underground pipelines. These customers are mostly in the greater Johannesburg-Pretoria region, as well as the industrial areas of Witbank-Middelburg and Durban.

Most of the remaining 10% of gas sales in South Africa is on-selling of Sasol gas by Metro Gas in Johannesburg, which owns 1 300 km of distribution pipe and supplies 12 000 domestic and 3 000 industrial customers.

The privatisation of Metro Gas was completed in 2000. It is now owned by Egoli Gas (Pty) Ltd, a newly-established joint venture company owned by Cinergy Global Power Inc, the international development arm of Cinergy Corp and a consortium of local

empowerment partners, Egoli Empowerment Holdings. Egoli Gas intends to invest R276 million in Metro Gas.

Industrial customers use 87% of the gas, and domestic consumers the rest. The supply of cost-competitive pipeline gas is complemented by the fuel oils department's range of low-sulphur residual and distillate fuel oils derived from coal and other synthesized forms, as well as crude oil. A privately-owned company in Port Elizabeth distributes a small amount of liquid petroleum gas/air blend by pipe.

The South Africa Petroleum Agency markets offshore gas exploration and exploitation.

A draft Gas Bill was tabled in Parliament during the second quarter of 2001. The aim of the Bill is to

- promote the orderly development of the piped gas industry
- establish a national regulatory framework
- establish a National Gas Regulator as the custodian and enforcer of the national regulatory framework.

In order to facilitate the movement of gas across international borders, a cross-border gas trade agreement with Mozambique has been signed, and a similar agreement with Namibia is under negotiation.

The first delivery of natural gas across South African borders is expected within the next five years.

The Cabinet approved the establishment of a national gas development company within the CEF Group in 2000. The task of this company will be to enter into joint ventures for gas transmission pipeline projects.

## Electricity

South Africa, which supplies two-thirds of Africa's electricity, is one of the four cheapest electricity producers in the world. Ninety-two per cent of South African electricity is produced from coal. Generation is dominated by the utility Eskom which also owns and operates the national electricity grid. Eskom supplies more than 95% of South Africa's electricity and more than 60% of electricity consumed throughout Africa. In global

terms, the utility is the seventh-largest in generating capacity, the seventh-largest in sales, and has the world's biggest dry cooling power station.

A massive electrification programme is under way in which some 256 023 electrical connections were made in 2000.

Although Eskom is a public corporation, it is financed by net financial market liabilities and investments as well as reserves. It is run on business principles for the benefit of its customers.

While Eskom does not have exclusive generation rights, it has a practical monopoly on bulk electricity sales. It also operates the integrated national high-voltage transmission system, and supplies directly to large consumers such as mines, mineral beneficiaries and other large industries. In addition, it supplies directly to commercial farmers and, through the National Electrification Programme (NEP), to a large number of residential consumers. It sells in bulk to municipalities, which distribute to consumers within their boundaries.

A rural electrification and transformation workshop entitled 'Peoples' Power Workshop' was organised by the Department of Minerals and Energy in collaboration with the World Bank in September 2000.

The objectives of the workshop were to develop

- a 10-year strategic plan aimed at addressing the backlog in rural electrification
- an implementation strategy for the energisation of rural areas to socially and economically promote rural development
- an advanced implementation strategy for renewable energy in South Africa.

Government is proposing that six regional electricity distributors be created to take over the distribution of power from Eskom and the municipalities. Government would have golden shares in the distributors.

## Restructuring of the electricity distribution industry (EDI)

The EDI restructuring process differs from most of the other State restructuring activities, as it addresses a number of diverse



stakeholders, of which the most important are:

- Eskom (60% of sales, 40% customers)
- electricity departments of municipalities (40% of sales, 60% customers)
- provinces (related to their governance of municipalities)
- consumers, ranging from very large and electricity-intensive to small
- labour
- a number of government departments.

The normal State restructuring process needs to be modified at the entry level for the EDI restructuring, in such a manner that the Eskom and the EDI restructuring process are interlinked.

The proposal phase was nearly completed by June 2001. The next will be the transformation phase to move from the current fragmented EDI structure to the implementation of regional electricity distributors (REDs).

The recommendations approved by Cabinet and which represent government's position on the EDI are the following:

- The consolidation of the EDI into the maximum number of financially viable and independent REDs. This means that the distribution sections of Eskom and licenced municipalities will be combined into a small number of REDs. The number of regional distributors still has to be determined.
- The introduction of cost-reflective tariffs, an electrification fund and a capped tax for the part-funding of municipal services. The tariffs, any subsidies and tax will be fully transparent. The electrification fund will be administered nationally.
- Consultation by the Ministers of Minerals and Energy, Finance, Public Enterprises, Labour, Trade and Industry, and Provincial and Local Government with major stakeholders.
- The appointment of a full-time restructuring team to investigate detailed issues, involving major stakeholders in the planning of the transformation process.

### **National Electricity Regulator (NER)**

Established in 1995, the NER is a statutory

body funded from a small levy imposed on the generators of electricity.

Legislation requires anybody wishing to generate, transmit or supply electricity to apply to the NER for a licence. This is issued on the basis of criteria which aim to promote and maintain a viable electricity supply industry.

The NER approved a 5,2% average increase in electricity tariffs for Eskom in 2001. This is substantially lower than the 6,2% increase Eskom had initially applied for. The NER said that the tariff increase was benchmarked against a predicted consumer price inflation rate of 6,2% in 2001.

There will be a need for investment in new generating capacity at some time during the second half of the present decade. This will depend on economic growth and the associated growth in electricity demand. The options that will be exercised to meet this need will determine the efficiency of electricity supply in South Africa in the future.

Some of the options can be used to influence the demand for electricity, and others to supplement the supply of electricity.

The supply options include the use of new primary energy sources such as natural gas and the entry of new players into the generation sector. Demand management options include the use of renewable energy resources in order to reduce environmental impacts (although these will be done at a premium) and to use electricity more efficiently in order to avoid building new generation plants.

The way in which these options are exercised will be informed by a national energy policy with input from the public and private sectors. It was expected that a process to establish an integrated energy plan would commence in 2001. Electricity supply and demand investment decisions will be based on the framework provided by such a plan.

The Department of Minerals and Energy has been tasked to develop a National Electricity Basic Services support tariff to facilitate the alleviation of poverty through the provision of basic electricity.

It is proposed that all households connected to the national grid be issued with 50kWh/month free of charge, followed by Support Tariffs. There is also a possibility of funding free electricity services from the equitable share. Households connected to non-grid systems will be provided with maintenance and operation expenses to a maximum of R40 per installation. These proposals are subject to Cabinet approval in 2002.

### The National Electrification Programme

The Government regards an accelerated and sustainable electrification programme as being of the utmost importance. Communities have to be involved in the planning and execution of this Programme. Micro, small and medium-sized enterprises must be given support and shown preference in the tendering process.

Through the Reconstruction and Development Programme (RDP), a total of 2,74 million households have been connected and have exceeded the set target of 2,5 million connections for the period 1994 to 1999. The Programme was concluded in 2000.

This brings the national level of electrification to about 70%, consisting of 50% and 80% rural and urban connections respectively for the year ending December 2000. The status of household electrification on 31 December 2000 was 89,9% urban and 50,3% rural. These figures include non-grid connections done by Solar-Shell.

There are still over 2,8 million unelectrified households, of which two million are in rural areas. Electrification statistics are based on records by Statistics South Africa, indicating that the households that were not electrified

in 1999 were approximately 3,2 million. This didn't make provision for growth in the number of households. These figures suggest a focus on rural electrification if the goal of universal access is to be attained.

According to the *White Paper on Energy Policy*, the Government will take responsibility for driving and integrating the electrification programme with other infrastructure initiatives.

To that end, the National Electrification Coordinating Committee (NECC) has been established to advise the Minister on issues relating to the transition towards an Integrated National Electrification Programme. Key issues under consideration by the NECC relate to the development of strategies for electrification planning, technologies, funding, implementation, monitoring and evaluation, and the integration of these into the processes of local government.

The work of the NECC came to an end by December 2001, due to the establishment of the new National Electrification Fund (NEF). From 2002 onwards, the management and operational functions of the NER and Eskom will be taken over by the NEF structures.

In pursuance of the goal of universal access, and where grid electrification costs are prohibitive, non-grid technologies are being implemented.

To that end, the Government will facilitate the establishment of non-grid electrification service-providers to provide electricity services in target areas.

The target for the year 2001 is about 400 000 connections, and will also include non-grid installations.

Unelectrified schools and clinics are incorporated in the NEP and will be funded through the NEF from 2002. About 411 schools and 26 clinics were connected to grid electricity, and 499 schools and 31 clinics were connected to non-grid electricity in 2000.

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In a survey of 14 countries conducted by international utility cost analyst group NUS, South Africa retained its position as the lowest-cost producer of electricity in 2000. The survey showed that South Africa's power prices came in at 2,74 US cents compared with Italy, which had the highest electricity prices of the countries surveyed at 8,06 US cents.

### Electricity prices

In accordance with its 1994 commitment, Eskom undertook to reduce the real price of electricity by 15% between 1 January 1995



and the end of 2000 for the benefit of its consumers. Over the period 1995 to 2000, Eskom reduced the real price of electricity, using the consumer price index (CPI) as criterion, by 14,1%.

However, during this period an NER-approved electrification incentive discount of R300 million per annum was introduced, effective from 1997, increasing in line with the tariff increases. This incentive discount, if expressed in percentage points, reduced the real price over the period by another 1,58 percentage points, bringing the total real reduction to 15,68%. The real reduction is a major achievement for Eskom, and has contributed significantly to reducing the average rate of inflation of the country.

The 2000 general price increase, as approved by the NER, was 5,5% (4,5% in 1999) compared with the rate of inflation as measured by the average CPI of 5,3% (5,2% in 1999).

Because of the fragmentation of the EDI, more than 2 000 tariffs apply in the country. A move to implement rationalised cost-reflective tariffs has been proposed as part of the EDI restructuring process in order to achieve a more rational and equitable industry and to facilitate the achievement of the goals of the NEP.

### **Southern African Power Pool**

The Southern African Power Pool was formally started in 1996 when the 12 member states of the Southern African Development Community (SADC) signed an enabling memorandum for the formation of the pool.

The southern African region has good hydroelectric generation potential, all of which is outside South Africa, with an estimated total of 125 GW in the SADC.

It is therefore believed that the least-cost supply of future growth in electricity demand in the region will be achieved by a regional grid, coordinated use of regional generating capacity, and the development of hydroelectric resources.

Five interconnectors, with a transfer capacity of 1,66 GW, are already operational

between SADC states. An additional three, with a transfer capacity of 2,2 GW, have been approved or are under construction.

In October 1998, Parliament passed and ratified two SADC protocols on mining and energy, which speak of greater co-operation in policy development and information and research in the energy and mining sectors. They strive for the alleviation of poverty and the improvement of quality of life throughout the region.

In August 1999, the first phase of a 400-MW power line linking South Africa and Namibia was inaugurated by President Mbeki and Namibian President Sam Nujoma. Initiated by Eskom and Namibia's Nampower, the line will supply power to Namibia and possibly Angola in future.

### **Biomass**

Fuelwood, which comes mainly from natural woodlands, is the primary source of energy used by households in most rural areas for the purposes of cooking and heating. In some areas, this is already almost completely depleted and in others it is under heavy pressure.

The total annual sustainable supply of wood from natural woodlands in communal rural areas is estimated at about 12 Mt. However, probably no more than half of it is usable as fuelwood. In addition to these sources, residues from commercial forestry total about 4,2 Mt per year. Much of this, as well as wood from bush clearing on commercial farmland, is being used increasingly as fuel.

To be effective, planning for a sustainable fuelwood supply thus requires decentralisation, understanding of local conditions, and flexibility.

Supply-side interventions focus on satisfying a range of local needs and the realisation that community forestry does not involve only the planting of trees but that community participation is central to all activities.

Planning must ensure their integration into broader rural development, land use, natural

resources management, and agricultural and energy planning. Interventions should build on the best indigenous practices identified. (See chapter: *Water Affairs and Forestry*.)

## Renewables

Renewable energy sources, other than biomass, have not yet been exploited to the full in South Africa. There are a number of initiatives to expand their use.

### Renewable energy technologies – resource assessment and feasibility studies

Technological feasibility studies will be conducted for possible implementation in the medium to longer term. These include:

- grid-connected wind farms.
- wind farm/pumped storage as a means of addressing peak loads on the national electricity grid.
- the local production and commercial dissemination of solar cookers. This is a collaborative project between the German development agency GTZ and the Department of Minerals and Energy.
- solar thermal power generation, a collaborative programme with Eskom, also involving the SolarPACES programme of the International Energy Agency.
- small-scale hydropower; a scoping study aimed at developing an implementation strategy.
- landfill gas exploitation.
- rural water supply and sanitation.

### Solar

Most areas in South Africa average more than 2 500 hours of sunshine per year, and average daily solar radiation levels range between 4,5 and 6,5 kWh/m<sup>2</sup> in one day.

The southern African region, and in fact the whole of Africa, is well endowed with sunshine all year round. The annual 24-hour global solar radiation average is about 220 W/m<sup>2</sup> for South Africa, compared to about 150 W/m<sup>2</sup> for parts of the US and about 100 W/m<sup>2</sup> for Europe and the United

Kingdom, making the local resource one of the highest in the world. The solar resource is by far the most readily accessible in South Africa. It lends itself to a number of potential uses.

The country's solar equipment industry is developing. Annual photovoltaic (PV) panel assembly capacity totals 5 MW, and a number of companies in South Africa manufacture solar water-heaters.

The *White Paper on Energy Policy* identifies universal access to electricity as one of the primary goals of South Africa's energy policy.

To achieve this goal, it was decided to integrate the non-grid technologies into the NEP as complementary supply technologies to grid extension.

A pilot programme has been launched to establish a limited number of public-private sector institutions in conjunction with the relevant municipalities to provide electricity services on such an integrated basis. The service-provider will own and maintain the systems, allowing longer-term financing to ameliorate monthly payments. It will provide the service against a fee, payable as a monthly tariff.

Once the underlying managerial and funding issues have been resolved, the process will be expanded to cover all the rural areas.

Solar power is increasingly being used for water-pumping through the rural water provision and sanitation programme of the Department of Water Affairs and Forestry.

Solar water-heating is used to a certain extent. Current capacity installed includes domestic 330 000 m<sup>2</sup> and swimming pools 327 000 m<sup>2</sup> (middle to high income); commerce and industry 45 000 m<sup>2</sup>, and agriculture 4 000 m<sup>2</sup>.

### Solar passive building design

Houses and buildings in South Africa are seldom designed from an energy consumption or energy efficiency perspective. The energy characteristics of low-cost housing are particularly bad, resulting in high levels of energy consumption for space heating in winter. The net result is dangerously high levels of indoor and outdoor air-pollution in the townships, due mainly to coal burning.



Research has shown that low-cost housing could be rendered 'energy smart' through the utilisation of elementary 'solar passive building design' practice. This can result in fuel savings of as high as 65%. Such savings on energy expenditure would have a major beneficial impact on the household cash-flow situation. Energy-efficient homes may be constructed at the same direct cost (and lower life-cycle cost) as energy wasteful houses. The challenge is to develop awareness and to ensure implementation of basic energy efficiency principles.

### **National solar water heating programme**

Water heating accounts for a third to a half of the energy consumption in the average household. In South Africa, this derives mainly from electricity, it being the most common energy carrier employed. Avoidance of this expenditure on household budgets could lead to significant improvements in disposable incomes of the lower-income sector.

Furthermore, the equivalent of a large coal-fired power station (2 000 MW +) is employed to provide hot water on tap to the domestic sector alone. Since the inception of the accelerated domestic electrification programme through grid extension, a major distortion of the national load curve has emerged, with the early evening load peak growing significantly.

Modeling indicates that the introduction of solar water heating could ameliorate the situation substantially.

Switching from electrical to solar water heating could, therefore, have significant economic and environmental benefits. There are economic benefits for the home-owner in reducing his/her energy bill.

Expensive generation capacity to address load peaks will be obviated, and the introduction of new base-load capacity will be postponed. Benefits for the country include reducing greenhouse gas releases and the release of scarce capital for other pressing needs.

### **Wind**

Wind as an energy source is only practical in areas that have strong wind areas and steady

winds. South Africa has fair wind potential, especially along the coastal areas. At present, however, wind is not used to generate electricity in this country. For the future it presents itself as a competitive energy source.

Wind power is primarily used for water-pumping, with about 300 000 windmills being used for watering livestock and supplying communities with water. About 400 kW of small wind turbines for power generation have been installed. The implementation of hybrid systems that make use of wind power is being investigated by the Department.

### **Hydro**

South Africa is classified as a generally dry country and thus has very little perennial hydropower potential.

The current total installed large-scale hydropower generation capacity (larger than 10 MW), including pumped storage schemes, is 2 222 MW. The installed capacity of plants smaller than 10 MW totals some 65 MW.

Hydroelectricity comes from falling water. Sometimes the water is stored in dams or behind dam walls, thus creating a waterfall. When the pipes are opened, the water rushes past the turbines and then starts spinning generators. The more water pressure, the faster the turbines spin and the more electricity is produced.

South Africa has two hydroelectricity stations and two pumped water storage schemes. In a pumped water storage scheme water is pumped up to a dam. Pumping the water uses some electricity, but it's done in off-peak periods. During peak hours, when extra electricity is needed, the water is released through a turbine, which drives an electric generator. Peak hours are usually between six and eight o'clock in the mornings and evenings.

## **Energy and the environment**

### **Energy and the global environment**

On a global scale, South Africa's contribution to greenhouse gas (GHGs) emissions is small.



On a per capita basis, however, they are well above global averages and those of other middle-income developing countries. Furthermore, the economy is carbon-intensive, producing only US\$259 per ton of carbon dioxide emitted as compared with US\$1 131 for South Korea, US\$484 for Mexico and US\$418 for Brazil.

### **Sources of greenhouse gas emissions**

The energy sector is a major source of GHGs because of the heavy reliance on coal for electricity generation, the Sasol oil-from-coal process, and a dearth of other indigenous energy resources, such as hydro. In addition, 57% of the coal-mining methane emissions can be attributed to these two uses of coal.

Mining operations also contribute to global climate change through methane emission.

### **Energy and the national environment**

There is some contention regarding the polluting effects of the energy sector, particularly in the Mpumalanga Highveld – the location of most of Eskom's coal-powered stations and the largest Sasol plants.

As is the case internationally, there is ongoing debate about the desirability of nuclear energy.

The long-term disposal and storage of high-level nuclear waste are being addressed as part of a policy on nuclear waste management.

### **Energy and the household environment**

Coal is used by about 950 000 households country-wide. This brings with it indoor air

pollution problems which have a serious health impact. It has been found that some people's exposure, especially to particulate matter, can exceed World Health Organisation (WHO) standards (180 mg.m<sup>-3</sup>) by factors of six to seven during winter, and two to three in the summer. A national programme has been established with the objective of introducing low-smoke alternatives into the townships.

Fuelwood is used by three million rural households as their primary energy source. Studies have shown that fuelwood users are exposed to even higher levels of particulate emissions than coal users. In one study, exposure levels were found to exceed the WHO lowest-observed-effect level by 26 times.

The Department is investigating the introduction of improved woodstoves and other alternatives, such as solar cookers and biogas, in an attempt to address these pollution problems. More widespread is the use of paraffin by low-income households, rural as well as urban. Paraffin has, however, associated health and safety problems. The distribution of child-proof caps and the dissemination of information on the safe storage and use of paraffin are some of the measures taken by the Department and other role-players to address the problem.

### **Institutions involved**

Apart from the Department of Minerals and Energy, the departments of Health, Environmental Affairs and Tourism, and Water Affairs and Forestry are involved to greater or lesser degrees in the monitoring of and legislation on pollution.



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