



# Minerals and Energy

Mining continues to play an important role in the national economy. Provisional figures for 2001 indicate that mining contributed R66,8 billion to gross domestic product (GDP) compared with R59,1 billion in 2000, which is a 13% increase. This constitutes 7,5% of GDP in 2001. There is still a lot of potential for growth in the exploitation of minerals in the country, especially where the country is ranked number one in terms of reserves. For example, in manganese, chrome and the platinum-group metals (PGMs), South Africa has 80%, 76% and 56% of world reserves respectively.

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, Ms Phumzile Mlambo-Ngcuka, who in consultation with Cabinet, takes final responsibility for policy.

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

## Policy

The Minerals Development Bill was published for public comment in December 2000. After extensive consultation, the Bill, now called the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002), has been modified slightly. Its principles and core objectives have, however, not changed.

The essential objectives of the Act are to:

- recognise that mineral resources are the common heritage of all South Africans and collectively belong to all the peoples of South Africa
- promote the beneficiation of minerals
- guarantee security of tenure for existing prospecting and mining operations
- ensure that mining contributes to rural development and supports those communities affected by mining operations
- redress the effects of past racial discrimination by ensuring that historically disadvantaged persons participate more meaningfully in the mining industry
- ensure that a proactive social plan is implemented by all mining companies
- provide simple and competitive services for use by local and foreign investors
- promote junior and small-scale mining
- uphold good environmental practices and sustainable development

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◀ Mining continues to play an important role in the national economy. Provisional figures for 2001 indicate that mining contributed R66,8 billion to gross domestic product (GDP) compared with R59,1 billion in 2000, which is a 13% increase. This constitutes 7,5% of GDP in 2001.

- ensure increased access to geological and mining information.

The following concerns have been addressed:

- government's commitment to guarantee security of tenure is visible in all clauses of the Act
- the Act ensures that new order rights are registrable, transferable, tradable and bondable
- existing operators are guaranteed security of tenure
- prospecting rights will be valid for a maximum period of five years and renewable for a further maximum period of three years
- mining rights are valid for a maximum period of 30 years and renewable for a further period of 30 years.

The cancellation of new rights will only take place if there is a breach of the terms and conditions of the right of tenure by the holder

### Information

The Department of Minerals and Energy played a leading role in the establishment of the Kimberley Process, which aims to prevent conflict diamonds from getting into the global diamond-market industry and to protect legitimate trade.

The Kimberley Process was initiated by a Working Group of representatives from 39 African diamond-producing and trading countries in 2000, after non-governmental organisations (NGOs), supported by some governments, threatened to boycott diamonds from conflict-ridden areas.

Minister Phumzile Mlambo-Ngcuka chaired the Ministerial Session of the Kimberley Process in Gaborone, Botswana in November 2001.

The meeting, attended by Ministers and representatives of the world's leading diamond exporting, processing and importing States, the World Diamond Council and NGOs, developed a proposal for a workable international certification scheme for rough diamonds.

Agreement was reached on the nature of the Kimberley Process Certificate, internal controls to support the certification scheme, rules governing international trade and sharing of information on the trade in rough diamonds.

In terms of the proposed document, a forgery-proof certificate should accompany the exporting and importing of diamonds.

The Kimberley Process Certification Scheme was launched in Interlaken, Switzerland in November 2002.

and only after the holder had been given enough notice to rectify such a breach.

The Broad-based Socio-economic Empowerment Charter for the South African Mining Industry, which has the support of the mining houses and labour unions concerned, was approved by Cabinet in October 2002.

The objectives of this Charter are to:

- promote equitable access to the nation's mineral resources for all South Africans
- substantially and meaningfully expand opportunities for historically disadvantaged South Africans including women, to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources
- utilise the existing skills base for the empowerment of historically disadvantaged South Africans
- expand the skills base of historically disadvantaged South Africans to serve the community
- promote employment and advance the social and economic welfare of mining communities and the major labour-sending areas
- promote beneficiation of South Africa's mineral commodities.

### 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, the South African Institute of Mining and Metallurgy, the Water Institute of South Africa, the departments of Water Affairs and Forestry, Environmental Affairs and Tourism, and Agriculture and the National Nuclear Regulator (NNR).



The EMEM Award System aims to:

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

## 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 had been spent on the rehabilitation of 53 derelict and/or ownerless asbestos mines in the Northern Cape, Limpopo (formerly the 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 2001, the mining industry directly contributed 7,5% to GDP and an estimated 10,3% through associated multiplier effects. The declining trend in mining's contribution to GDP in recent years was reversed from 2001 with the highest levels recorded since 1996, mainly as a consequence of the strong performance in the PGMs sector.

Mining contributed 10% to South Africa's gross fixed capital formation during 2001, while sales of primary mineral products accounted for 29,3% of total exports. The inclusion of various processed mineral products such as ferro alloys and aluminium increased this contribution to 35,5% in 2001.

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
- 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 to attract investment
- a mineral-beneficiation strategy to 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 impact of mine downscaling when this does occur
- a co-ordinated 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 to ensure that skills develop-

ment becomes a priority in the industry.

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

The Government is the only shareholder of Alexkor, a diamond-mine situated on the west coast in Namaqualand. The Alexkor Limited Amendment Act, 2001 (Act 29 of 2001), was promulgated in November 2001.

The Act will provide for the sale or disposal of shares held by the State.

In his Budget Vote on 16 May 2002, the Minister of Public Enterprises, Mr Jeff Radebe, said the community would directly benefit from restructuring plans for the Alexkor mine. According to the Minister, lengthy discussions between the Northern Cape Government, the Namaqualand community, employees from Alexkor and stakeholders would ensure that all involved have a defined role to play and would benefit from an envisaged 10% equity transfer to the community.

On offer is a 51% share to a Strategic Equity Partner to provide the necessary investment for exploration and sound management direction.

## Mineworkers

During 2001, the mining industry employed 408 894 people. The gold-mining industry still remained the largest employer at 49,9%. 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 employers. 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 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

The Mine Health and Safety Inspectorate (MHSI), as an integral part of the Department of Minerals and Energy, was established to protect the health and safety of employees and others persons at mines.

Current capacity enables the MHSI to conduct 3 000 accident investigations, 14 000 inspections and 3 500 audits annually. These activities are apportioned to various mines according to their risk profiles.

The MHSI employs 194 inspectors who are responsible for auditing and inspecting mines. Mines are inspected on a regular basis to check physical conditions and machinery. Audits on all mines are conducted on an annual basis.

Since the introduction of the Mine Health and Safety Act, 1996 [Act 29 of 1996], the rate at which workers lose their lives in mine accidents has been steadily decreasing, from 1,02 deaths per 1 000 employees per annum in 1995 to 0,78 deaths per 1 000 employees per annum at the end of 2001. Similarly, reportable injury rates decreased from 14,76 in 1995 per 1 000 employees per annum to 12,33 in 2001.

The injury and fatality rates for the industry overall are largely determined by trends in gold-mining. Although 49,9% of the mining



work-force is employed on gold-mines, these mines accounted for 65% of all industry deaths, 64% of all casualties and 67% of the days lost to injury. The gold-mining industry has some of the deepest underground mines in the world, and are much deeper than the other mines in South Africa.

The number of fatal accidents and reportable injuries increases during times of uncertainty, e.g. during retrenchments and when mines are expanding production capacity.

Analyses of annual medical reports during the year showed that five times more medical compensation cases were settled during 2001 than in previous years, with claims totalling R121 million. Asbestosis, silicosis I and silicosis II accounted for more than 60% of total compensation payments and 52% of the cases. Tuberculosis accounted for 23% of cases but only 9% of total compensation. These cases related to past exposures as diseases develop over time, often many years.

The challenge for the industry remains to achieve significant and consistent improvements in safety and health.

## Human resource development

The overall aim of the Mine Qualifications Authority (MQA) is to facilitate the development of appropriate knowledge and skills in the mining, minerals and jewellery sectors to:

- enable the development and transformation of the sector
- contribute to the health, safety and competitiveness of the sector
- improve access to quality education and training for all
- redress past inequalities in education and training.

The MQA has been established as a Sector Education and Training Authority under the aegis of the Department of Labour. Staff of the MHSI head the board and all the major committees of the MQA.

Inspectors are involved in the development of unit standards, qualifications and learnerships.

The responsibilities of the MQA are to:

- develop and monitor the implementation of a sector skill plan
- register skills-development facilitators at workplaces within the sector
- approve work skills plans and annual training reports of companies in the sector
- develop unit standards and qualifications
- maintain the quality of standards, qualifications and learning provision in the sector
- establish, register, administer and promote learnerships
- administer existing apprenticeship systems
- administer and disburse skills development levies.

The MQA has applied surplus funds arising from the 10% allocation to the Department of Labour for administration costs for the following priority areas, namely, apprenticeships (R15,2 million), quality management system accreditation of training service-providers (R5 million), developing and piloting learning material (R10 million) and bursaries for scarce skills (R14,4 million). A small-scale mining project is being fasttracked through the Standards Generating Body.

Important projects include:

- adult basic education and training: a total sum of R25 million is being sought from the National Skills Fund to be spent over a three-year period (2002 – 2004).
- small business development: the MQA will facilitate projects to support small-scale miners and small jewellery manufacturers with skills development. The projects are *Nami Ngiyafuna* and 'A Cut Above the Rest'.
- HIV/AIDS is a significant challenge for the mining sector. The Tripartite HIV/AIDS Coordinating Committee was established in 2001.

## Chamber of Mines

Established in 1889, the Chamber of Mines consists of independent mining finance cor-

porations, individual mines and mining companies. 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
- the Nuclear Fuels Corporation (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
- the Council for Scientific and Industrial Research's (CSIR) Mining Technology Division (Miningtek).

## Junior and small-scale mining

The economic impact of small-scale mining is difficult to measure as most of this mining is illegal and the criteria that can be used to monitor these operations have not yet been

developed. One of the most crucial tasks facing government is to legalise small-scale mining by assisting in the upgrading of these operations into economically viable business units. This task is ongoing and for the period April 2001 to March 2002, the National Steering Committee of Service-providers to the Small-scale Mining Sector (NSC) received over 100 applications of which 12 pilot projects were approved.

The NSC is focusing on identifying small-scale mining operations in recognised poverty nodes to enhance economic development in these mainly rural areas. A number of such areas have been singled out for attention.

The NSC has also played a pivotal role in the regeneration of economic activity in former mining and labour-sending areas currently in a state of economic decline, e.g. in Namaqualand in the Northern Cape, Ndedwe in KwaZulu-Natal and Taung in the North West.

The NSC has also established good working relations with organisations such as the Zenzele Technical Demonstration Centre. This organisation aims to train small-scale miners in practical mining methods, while Mintek, a partner in the NSC, will provide training in the processing and beneficiation of the products mined. Mintek is also establishing a school for small-scale miners, where miners will be introduced to the basic principles governing the running of a mining enterprise. With these endeavours to streamline the services available for small-scale mining activities, service delivery looks set to be more efficient and further-reaching than has been the case in the past.

### **Bakubung Initiative**

In her 2002 Budget Vote, the Minister of Minerals and Energy said the Initiative aimed to establish a fund that would support junior companies was well under way. In this regard, the Industrial Development Corporation (IDC) has indicated their commitment towards investing money in the fund – thus becoming one of the founding investors. On mining and beneficiation projects, the IDC's Strategic



Business Unit has made investments totalling R1 billion, which generated R2,5 billion worth of exports and created some 2 500 jobs.

## Mineral wealth

South Africa's mineral wealth is found in diverse geological formations, some of which are unique and extensive by world standards. Some of the country's minerals include:

- gold – the unique and wide-spread Witwatersrand basin yields some 98% of South Africa's gold output.
- diamonds (in kimberlites, alluvial and marine) – the country is ranked fifth in terms of production.
- titanium – heavy mineral-sand occurrences containing titanium minerals are found

along the coasts.

- manganese – enormous reserves of manganese are found in the ancient sediments of the Northern Cape.
- PGMs and chrome – these minerals occur in the Bushveld Complex in Mpumalanga, Limpopo and North West. More than half of the global reserves of chrome and platinum are found in this deposit.
- coal and anthracite beds occur in the Karoo Basin in the northern and north-eastern (Mpumalanga) parts of the country.
- copper phosphate, titanium, iron, vermiculite and zirconium occur in the Phalaborwa Igneous Complex in Limpopo.

South Africa's reserves of seven commodities rank highest in the world. These are:

- manganese, 80% of world reserves
- chromium, 76%
- PGMs, 56%
- gold, 52%
- vanadium, 44%
- alumino-silicates, 37%
- vermiculite, 40%.

South Africa's large reserve base and important position as a world producer means that the country's mineral industry is export-orientated: for vermiculite it contributes 97% of world exports, vanadium 76%, alumino-silicates 50%, ferrochromium 53%, PGMs 47%, chrome ore 41%, and manganese ore and ferromanganese a total of 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, 2001

Commodity	Unit	Reserves	%	World ranking
Alumino-silicates	Mt	50,8	37,4	1
Antimony	kt	250	7,8	4
Asbestos	Mt	8,2	na	na
Chrome ore	Mt	3 100	76,1	1
Coal	Mt	55 333	10,9	5
Copper	Mt	13	2,0	13
Diamonds	k car	na		
Fluorspar	Mt	36	9,5	3
Gold	t	36 000	51,9	1
Iron ore	Mt	1 500	0,9	9
Lead	Mt	3	2,3	5
Manganese ore	Mt	4 000	80,0	1
Phosphate rock	Mt	2 500	7,0	3
Platinum-group metals	t	63 000	55,7	1
Silver	kt	10	na	na
Titanium minerals	Mt	146	19,8	2
Uranium	kt	284,4	9,1	4
Vanadium	kt	12 000	44,4	1
Vermiculite	Mt	80	40,0	2
Zinc	Mt	15	3,5	5
Zirconium minerals	Mt	14,3	22,1	2

na = not available, Mt = megaton, kt = kiloton, t = ton, car = carats

Source: Minerals Bureau

The more notable imports into South Africa in 2001 were diamonds, alumina, certain ferro-alloys, 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 15,8% to R113,9 billion in 2001.

Additionally, total processed mineral sales increased by 8,7% in 2001, to some R24,6 billion.

The combined total for primary and processed mineral sales is estimated to have increased by 14,6% in 2001, to R138,5 billion.

These Rand revenue gains in 2001 were

partly insufficient to compensate for the 24% weakening of the average Rand exchange rate against the United States of America (US) Dollar. In 2001, the major developed countries moved into recession and this was reflected in weakened industrial production, reduced demand and lower prices. Few commodities escaped this trend, but notable South African exceptions were coal and iron ore exports.

Domestic primary mineral sales revenue increased in 2001 by 14,5% to R25,3 billion. This was a decline of 7,7% in current Dollar terms, suggesting a corresponding decline in domestic demand or activity. The value of exports of primary minerals in 2001 increased by 16,2% to R88,7 billion. In current Dollar terms, this decline of 6,3% represented both reduced demand and lower prices in most export markets.

Export revenue was 77,8% of primary minerals revenue, and 77,5% by value of all primary and processed minerals sales in 2001.

In 2001, the PGMs, gold, processed minerals and coal accounted for 85,3% of all mineral exports, 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 supply and demand for gold decreased by a further 2,5% to 3 868 t in 2001. Accordingly, the average gold price traded at a recent medium-term low of \$271/oz.

World mine supply increased by 20 t to 2 604 t, but South African gold production, with cost-pressures from deep, hard-rock mining,

South Africa's mineral production, 2001\*

Commodity	Unit	Production	World	
			%	Rank
Aluminium	kt	662	2,8	8
Alumino-silicates	kt	198	35,9	1
Antimony	t	4 827	3,1	4
Asbestos	kt	13	0,9	11
Chrome ore	kt	5 502	44,8	1
Coal	Mt	224	6,2	6
Copper	kt	142	1,0	13
Diamonds	k car	11 163	9,7	5
Ferrochromium	kt	2 141	47,5	1
Ferromanganese	kt	783	11,4	3
Ferrosilicon	kt	108	2,9	6
Fluorspar	kt	286	4,8	3
Gold	t	395	16,6	1
Iron ore	Mt	35	3,6	8
Lead	kt	51	2,5	9
Manganese ore	kt	3 266	19,5	1
Nickel	kt	36	3,1	9
Phosphate rock	kt	2 420	2,0	9
Platinum-group metals	kg	229	46,2	1
Silicon metal	kt	39	4,4	7
Silver	t	110	0,8	18
Titanium minerals	kt	2 406	22,8	2
Uranium	t	1 065	2,5	9
Vanadium	kt	18	57,2	1
Vermiculite	kt	157	44,7	1
Zinc in minerals	kt	61	0,8	18
Zirconium minerals	kt	377	28,1	2

na = not available, Mt = megaton, kt = kiloton, t = ton, car = carats  
\*Preliminary data

Source: Minerals Bureau



### South Africa's primary and processed mineral sales, 2001\*

Commodity or sector	Unit	Local sales (FOR)**		Export sales (FOB) ***		Total sales	
		Mass	Value	Mass	Value	Mass	Value
			(R' million)		(R' million)		(R' million)
Gold	t	4,8	358	365,6	27 328	370,4	27 686
Coal	Mt	152,2	9 568	66,8	16 315	219,0	25 883
PGMs	t		3 991	193,4	29 381		33 372
Base minerals	Mt	2,1	2 981	0,7	3 726	2,8	6 707
Ferrous minerals	Mt	17,7	1 733	26,0	4 700	43,7	6 433
Industrial minerals	~		3 466		1 544		5 010
Other minerals	~		3 160		5 697		8 857
Sub-total primary	~		25 256		88 692		113 948
Processed minerals	Mt	1,4	5 955	4,9	18 611	6,3	24 566
Total	~		31 211		107 303		138 514

\*Preliminary

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

\*\* FOR – Free on rail values

\*\*\* FOB – Free on board values

Source: Minerals Bureau

continued to slide. Gold output in 2001 fell by 8% to 395t, and gold revenue decreased by a corresponding 11,7% to \$3,22 billion according to provisional 2001 data.

### South Africa's 'heavy-weight' mineral exports, 2001\*

Commodity	Export mass in kt
Aluminium	476
Alumino-silicates	133
Chrome ore	931
Chrome alloys	1 853
Coal	66 752
Dimension stone	762
Fluorspar	259
Iron ore	23 519
Manganese ore	1 528
Manganese products	616
Phosphate products	981
Silicon products	89
Special pig-iron	491
Titanium products	1 059
Vermiculite	154
Zirconium products	428
Sub-total 'heavy-weights'	100 031

\*Preliminary data

Source: Minerals Bureau

Rationalisation of regional ownership and operations moved forward in 2001, especially in the southern Free State gold-fields, where the process is nearly completed. Harmony Gold-mining and the empowerment-controlled African Rainbow Minerals made a successful joint bid for AngloGold's Freegold assets. Continuing new investments into deeper extensions at Moab, Target and South Deeps have commenced output contributions.

### Coal

Revenue from coal increased by \$163 million, or 5,7%, in 2001 to regain the \$3 billion level that was last exceeded in the 1995 – 1998 period. World coal prices strengthened considerably towards mid-year, but sales volumes were relatively unchanged. Just over 30% of the sales volume was exported, accounting for 63% of the sales revenue.

Investments in new coal-mining and transport infrastructural developments are still awaiting prospects of sustained strong activity and firm prices.

### Platinum-group metals

A noteworthy feature has been the dramatic

increase in domestic sales revenue over five years, from almost zero to \$464 million in 2001, largely to supply a developing manufacturing business providing automotive exhaust catalysis systems for world markets.

PGM mining investments in progress, committed, and proposed, involving new mines, extensions, mineral processing plants, and smelters will be substantial over the next five years. New entrants, often representing previously disadvantaged community interests, are mostly participating through joint ventures with established major operators.

### 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. About 44% of total revenue is local sales for further added-value operations.

World prices for base minerals collapsed in 2001, typified by heavy declines in the London Metal Exchange-priced metals aluminium, copper, nickel, lead and zinc. Demand was also weak. First signs of a recovery were evident by the end of 2001.

Provisional statistics indicate that the South African base mineral sales fell by \$100 million, or 11,4%, to \$780 million in 2001.

### Ferrous minerals

This sector consists of the ores of iron, manganese and chrome, dominated by iron ore. It has been a leading performer in the primary minerals industry over the last 16 years, with revenue in Dollar terms growing at almost 3% annually. Demand depends on the fortunes of the world steel and stainless steel industries.

Recessionary economic conditions in the developed world during 2001 impacted negatively on ferrous minerals demand and prices. Improved iron ore sales were insufficient to off-set this trend. Overall ferrous min-

eral sales fell by \$28 million, or 3,5%, below the 2000 revenue.

### Industrial minerals

This sector comprises a wide variety of mineral products, from which 69% of revenue is local sales. It has encountered declining trends in domestic activity and total revenue, in Dollar terms, over the last 10 years. Sector sales revenue fell by \$27 million, or 4,4%, to \$582 million in 2001.

Four commodity groups have accounted for four-fifths of local sales, namely aggregate and sand (24,5%), limestone and dolomite (25,9%), phosphate rock (data withheld) and sulphur (5,2%).

Five commodity groups have contributed some nine-tenths to industrial minerals export revenue of \$180 million: granite dimension stone (44,2%), phosphate rock (data withheld), fluorspar (14,3%), andalusite and vermiculite (8,4% each).

### 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 16 years, with revenue in Dollar terms growing at 6% annually.

Weakening demand and prices in the recessionary world economic climate of 2001 resulted in processed mineral sales falling by \$400 million, or 12,3% below the 2000 revenue.

New investments for ferrochrome, phosphoric acid and titanium products were in process during 2001. Several further investments in aluminium-refining capacity were being contemplated.

### Other minerals

This sector is dominated by diamonds, with



support from hydrocarbon fuels, uranium oxide, silver and semi-precious stones. Sales revenue was boosted enormously in 2000 by diamond sales that were held back from the previous year and by a strategy to amortise commercial diamond inventories.

In 2001, the sector sales returned to a more typical recent level of just over \$1 billion. Almost two-thirds of sales were exports, and a strong share of the local sales arose from products of the domestic hydro-carbon wells, which are not directly exported.

New investment potential remains strong in this sector, which has recovered enormously by new investments in operations since 1994, compensating for the rapid demise of uranium oxide demand in nuclear applications from the late 1980s.

## Energy

### Energy in the economy

Energy comprises approximately 15% of GDP, creating employment for about 250 000 people. The total electricity sales in 2001 grew by 1,8% to 181 511 GWh. Total liquid fuels sales in 2001 grew by 0,3% to 20 934 million litres. These figures demonstrate the growth of the South African economy and the importance of energy as a key driver of the country's economy.

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.

Government has been persistently engaging members of the Organisation of

Petroleum Exporting Countries 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 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 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 mineral and metal 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.

The total volume of liquid fuels sold during 2001 in South Africa was 20 934 Ml in comparison to 20 868 Ml sold in 2000. Of the sales in 2001, petrol and diesel accounted for 10 340 Ml.

The demand for petrol and diesel has remained relatively static over the last five years. The demand for jet fuel has, however, grown steadily since 1994 as a result of increased business and tourism activities.

Government has accepted a process of managed liberalisation for the liquid fuels industry.

The Petroleum Products Act, 1977 (Act 120 of 1977), will be amended to institute a licensing dispensation for participants in the liquid fuels industry.

A regulatory regime for the petroleum pipeline industry will be established.

## Energy and rural development

Energy is an essential, but insufficient and often overlooked, element of all rural dev-

elopment 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 sixth-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 t to one Mt per month. With mergers and purchases, operating collieries remained at 62 in 2000. Of these, a relatively small number of large-scale producers supply coal primarily to the electricity and synthetic fuel producers.

About 43% of South African coal-mining is done underground. Of the underground production volume, some 0,9% was produced by long walling, 11% by pillar recovery and 31% by board-and-pillar mining. About 57% is produced by open-cast methods.

The coal-mining industry is highly concen-

### Information

The Department of Minerals and Energy officially launched the Women in Oil and Energy South Africa (WOESA) in March 2002 at the International Convention Centre in Durban. The objective of WOESA is to represent the interests of women in the oil and energy industry.

This will be done by empowering women to understand the business and management of the industry, and lobbying government to use State assets and government business opportunities to promote women empowerment.



trated, with three companies, Ingwe (Billiton), Anglo Coal and Sasol, accounting for 81% of local production. Production is concentrated in large mines, with 12 mines accounting for 73% of production.

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 percent 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 marketable and therefore discarded. Total discards could reach 2 300 Mt by the year 2020, should none of this material be utilised. As a result, ways are being investigated to make use of the discards.

## Nuclear power

Nuclear science employs approximately 3 000 skilled people in diverse areas such as electricity generation, isotope production and non-destructive material studies for industry.

It positions South Africa at the forefront of medical applications of radioisotopes such as cancer diagnostics and therapy and enables it to absorb and apply new nuclear technologies developed elsewhere in the world. It also gives South Africa the competitive advantage to play a leading role in Africa in the application of nuclear techniques in health, food, agriculture and environmental management.

South Africa has 34 nuclear medicine-imaging centres, of which 75% are privately-owned. These centres together perform between 25 000 and 30 000 diagnostic procedures per annum. In addition, 30 oncology clinics and hospitals are equipped with teletherapy and accelerator equipment used in nuclear therapy to treat life-threatening diseases.

The South African nuclear industry is mainly governed by the Nuclear Energy Act, 1999 (Act 46 of 1999), and the NNR Act, 1999 (Act 47 of 1999). The legislation has established the South African Nuclear Energy Corporation

Ltd (NECSA), previously called the Atomic Energy Corporation, responsible for nuclear technology and the NNR, previously called the Council for Nuclear Safety.

Other relevant legislation that also play a regulatory role in the nuclear industry are the Hazardous Substances Act, 1993 (Act 131 of 1993), the Mine Health and Safety Act, 1996, the Minerals Act, 1989 (Act 30 of 1989), the National Environmental Management Act, 1998 (Act 107 of 1998), the Water Act, 1998 (Act 36 of 1998), and the Dumping at Sea Act, 1980 (Act 73 of 1980).

The Minister of Minerals and Energy is responsible for the governance of the nuclear industry and related matters. NECSA and the NNR report to the Minister who appoints the boards of these organisations. Apart from the Minister's authority over radioactive waste and irradiated nuclear fuel, the Minister also regulates matters regarding nuclear non-proliferation.

Nuclear energy policy was formulated as part of the *White Paper on Energy Policy*, approved by government at the end of 1998. In terms of this policy, government will investigate what long-term contribution nuclear power can make to the country's energy economy and, secondly, how the existing nuclear industrial infrastructure can be optimised. Some of the main policy objectives relate to discussions regarding possible new nuclear power stations, the management of radioactive waste, safety monitoring of the nuclear industry, effectiveness and adequacy of regulatory oversight, and a review of bodies associated with the nuclear industry.

## NECSA

NECSA was established as a public company in terms of the Nuclear Energy Act, 1999 and is wholly-owned by the State. Apart from several ancillary functions, the main functions of NECSA are to undertake and promote research and development in the field of nuclear energy and radiation sciences and technology; to process source material, special nuclear material and restricted material;

and to co-operate with persons in matters falling within these functions. Apart from its main operations at Pelindaba, NECSA also operates the Vaalputs radioactive waste-disposal facility.

NECSA employs some 1 400 people in diverse areas such as physics engineering, chemistry and electronics. The research reactor at Pelindaba, SAFARI-1, is now the most commercialised such reactor in the world with ISO 9001 accreditation and is earning South Africa millions of Rands' worth of foreign revenue.

NECSA develops and utilises nuclear technology as part of the National System of Innovation. The Corporation also serves the State's nuclear institutional obligations. Its growth strategy, Vision 2010, is aimed at contributing to national and regional socio-economic development, in line with the New Partnership for Africa's Development.

In addition, NECSA is actively involved in training the health-care sector in the safe and optimal use of nuclear material and technology. It also provides a 24-hour emergency service for nuclear-related accidents throughout Africa.

It is used (among other things) to produce radioisotopes that are used to fight diseases and to accurately measure critical process parameters such as levels, mass, density and quality and thus help keeps the wheels of industry turning.

NECSA houses and operates the first gamma-irradiation facility in Africa. The facility, which was commissioned in 1971, is used to sterilise a range of products such as peat moss used as growth medium in the seed industry.

NECSA is accredited by the International Atomic Energy Agency as a regional designated centre, servicing the rest of Africa in radioactive waste management. The Corporation has been given the responsibility of developing a low-cost radioactive waste-disposal facility – known as the Borehole Nuclear Waste Disposal System – to be used for the disposal of radioactive waste from hospitals on the continent.

Annually, NECSA dispatches top nuclear scientists to help condition and store spent radium sources in countries such as Zimbabwe, Madagascar, Tunisia, Sudan and Mauritius. Other projects include dam leakage detection and the auditing of radiotherapy and nuclear medicine facilities in countries that include Libya, Nigeria and Ethiopia.

Radiation techniques are benefiting farmers across the continent – its use in agriculture increases crop quality and improves cattle production, thus raising income potential.

Other projects undertaken by NECSA include helping authorities curb the growing illegal trade in elephant and rhino horns by using radiation techniques to identify the origins of the ivory. The dating of archaeological artifacts is yet another example of the useful and peaceful application of nuclear technology.

NECSA currently comprises two entities, Pelindaba Nuclear Institute and the commercially driven Pelindaba Technology.

### **Eskom Koeberg Nuclear Power Station**

Construction of Koeberg's two reactors commenced in 1976 under a turn-key contract and have operated safely since their commissioning in 1984 and 1985 respectively. Koeberg supplies 1 800 MW to the national grid when both reactors are operating at full power, contributing 7% of South Africa's electricity. Koeberg meets the full electricity demand of the Western Cape and was built mainly for economic reasons. It would be approximately 6% more costly to supply electricity to the Western Cape from the power stations in the northern part of the country due to losses during transmission. With most of South Africa's electricity-generating stations situated on the Highveld coal fields, Koeberg provides a necessary 'anchor' for the supply network.

### **Uranium mining**

NUFCOR is the uranium sales organisation in South Africa. In 1980, South Africa produced



approximately 7 000 t from 18 uranium plants but as a result of the low price of uranium, this has declined to only two plants still in operation.

### **Nuclear safety regulation**

The NNR is the prime safety regulator and is responsible for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices. It exercises regulatory control related to safety over the siting, design, construction and operation of nuclear installations and other actions.

### **Possible expansion**

Nuclear power has not been excluded as a possible energy supply option for the future. However, the energy policy requires that decisions to construct future nuclear power stations will be taken within the context of an integrated energy planning process and subject to consultation with all stakeholders. This integrated energy planning process has been initiated by the Department of Minerals and Energy.

Eskom is conducting a feasibility study of the pebble-bed modular reactor (PBMR) with the objective of establishing whether such technology could form part of Eskom's expansion planning, and what advantages/disadvantages it would have compared to other options.

### **Liquid fuels**

South Africa consumed 20 934 Ml of liquid fuel products in 2001. Thirty-six percent of the demand is met by synthetic fuels (synfuels) 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 linked to the price of petrol in US Dollar in certain international markets for petrol. This means that the domestic price is influenced by supply and demand for petroleum products in the

international markets, combined with the Rand/Dollar exchange rate.

During 2001/02, there were various petrol price increases as a result of increased prices for petroleum products in relevant international markets and the deterioration in the Rand/Dollar exchange rate.

### **Sasol**

The Sasol group of companies comprises diversified fuel, chemical and related manufacturing and marketing operations, complemented by interests in technology development, oil and gas exploration and production.

Its principal feedstocks are obtained from coal, which the company converts into value-added hydrocarbons through Fischer-Tropsch process technologies.

The company supplies 41% of South Africa's liquid fuel needs. It also provides 200 000 direct and indirect jobs, contributes R34 billion annually to South Africa's GDP and produces 23% of the country's required coal.

Furthermore, Sasol is ranked as South Africa's largest single industrial investor, with capital investment amounting to R12 billion over the previous five financial years.

Sasol has grown into a global enterprise, producing more than 200 fuel and chemical products and exporting to 90 countries worldwide.

The two plants in South Africa, at Sasolburg and Secunda, are estimated to contribute 50% and 12% respectively to the GGP of the Free State and Mpumalanga.

In addition, Sasol has production operations in Germany, the Netherlands, China, Canada, Italy, the Czech Republic, Dubai and the US, as well as marketing offices in the United Kingdom (UK), US, Venezuela, Australia, China, Singapore, Malaysia and the United Arab Emirates.

Through Sasol Petroleum International and Sasol Synfuels International, the Group also has interests in Mozambique, the Congo, Equatorial Guinea, Gabon, Nigeria and Qatar.

Among its recent international developments is an agreement signed with the Mozambican Government for the development of natural gas fields in the country and the construction of a pipeline to South Africa. It is expected that the first gas from this source will be available in South Africa by 2004.

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

The Petroleum Agency of South Africa (PASA), the Department of Minerals and Energy's agency responsible for the promotion of oil and gas exploration, has been successful in further encouraging international exploration companies to evaluate the country's oil and gas opportunities.

Nine exploration subleases are active, involving 11 international companies. During 2000/01, excluding the activities of the former Mosgas (now part of PetroSA), these companies spent in excess of R450 million on exploration activities, which included the drilling of four exploration/appraisal wells and the acquisition of 2 435 km<sup>2</sup> of 3D seismic survey data and 6 980 km of 2D seismic survey data.

The most significant activities being carried out are the appraisal of the Ibhubesi Gas Field on the west coast and the acquisition, for the first time, of deep-water seismic data over the east and west coasts.

As a result of increased exploration activities, a better understanding of the potential for commercial oil and gas is being developed. PASA is following this up with a detailed possible resource study.

Natural gas and associated condensate production is currently limited to the FA and EM gas fields off Mossel Bay.

The core of this is the world's largest commercial scale gas-to-liquids (GTL) plant, owned by the State-owned petroleum company, PetroSA, which converts 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 PetroSA to

maintain current liquid fuel production levels at 36 000 barrels (bbls) of petroleum products a day until 2009.

During 2001, 1 550 056 t (66 512 Mmscf) of gas and 294 574 t (389 308 m<sup>3</sup>) of condensate were brought ashore. Together with 226 917 t of imported condensate, this was converted to 12,05 million bbls of finished products. Total PetroSA production to date since going into full production in 1993 amounts to 89 million bbls.

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

PetroSA's GTL plant 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.

PetroSA also produces anhydrous alcohols and speciality fuels that are exported and earn the company more than R500 million per year. In 2001,

- oil production from Oribi Oilfield was 2,74 million bbls
- oil production from Oryx Oilfield was 3,2 million bbls
- total oil production was 5,94 million bbls

Total combined oil production since the start of production in May 1997 to the end of 2001 was 28,36 million bbls.

### **Procurement and crude refining**

Sasol and PetroSA's Mossel Bay plant are situated in close proximity to their feedstock sources, which they own. However, the crude refineries rely on imported crude oil. 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 Central Energy Fund (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 the handling of supertankers.

Proceeds of sales were paid to the fiscus from the SFF. Almost all crude oil is currently procured directly by refiners.

The target strategic stock level for the end of December 2002 was 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 generally granted, provided that both South Africa's and other Southern African Customs Union members' requirements are met.

#### Information

The National Petroleum, Gas and Oil Corporation of South Africa (PetroSA) was officially launched in Cape Town in October 2002.

The formation of the company was the result of a merger between Mossgas, Soekor and other assets managed by the Strategic Fuel Fund.

The work on the merger began in 1998 with the adoption of the *White Paper on Energy Policy*.

As the national petroleum company in South Africa, PetroSA is responsible for the exploration and exploitation of oil and natural gas, as well as the production and marketing of synthetic fuels produced from offshore gas at the world's largest commercial gas-to-liquids plant in Mossel Bay.

PetroSA's commitment to the safety and health of its workers led to the company winning the National Association of Clean Air Award, for clean air and environmental care at its Mossel Bay refinery operation.

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.

### 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 PetroSA's 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 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 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. These customers are mostly in the greater Johannesburg-Pretoria region, as well as the industrial areas of Witbank-Middelburg and Durban. Its pipeline network consists of about 1 500 km of underground pipelines.

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 joint venture company owned by Cinergy Global Power Inc. 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 synthesised 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.

PASA markets offshore gas exploration and exploitation.

The Gas Act, 2001 (Act 48 of 2001), aims 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.

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.

Cabinet approved the establishment of a national gas development company, iGas, within the CEF Group in 2000. The task of this company is 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 percent of South African electricity is produced from coal. Generation is currently dominated by Eskom, which also owns and operates the national electricity grid. Eskom cur-

rently supplies more than 95% of South Africa's electricity and more than 60% of electricity consumed throughout Africa. In global terms, the utility is among the top seven in generating capacity, among the the top nine in terms of sales, and has the world's biggest dry-cooling power station.

Eskom was incorporated as a public company on 1 July 2002 as it is financed by net financial market liabilities and assets as well as reserves. It currently runs on business principles for the benefit of its customers.

While Eskom does not currently 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 beneficiators and other large industries. In addition, it supplies directly to commercial farmers and, through the Integrated National Electrification Programme (INEP), to a large number of residential consumers. It sells in bulk to municipalities, which distribute to consumers within their boundaries.

A massive electrification programme is under way.

## Restructuring of the electricity supply industry (ESI)

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

- to meet government's developmental and social objectives, Eskom retains no less than 70% of the existing electricity-generating market sector.
- that the introduction of private-sector participation in the generation sector be increased to 30% of the existing electricity-generating market sector.
- that the involvement of black economic empowerment (BEE) within the generation sector be about 10% of the existing generation capacity by no later than 2003.



- to ensure a meaningful participation of the private sector in electricity in the medium term, Eskom not be allowed to invest in new generation capacity in the domestic market, other than in existing capacity.
- to ensure non-discriminatory and open access to the transmission lines and taking into consideration the financial stability of Eskom, government, in the medium term, establishes a separate State-owned transmission company that will be independent of generation and retail businesses, with a ring-fenced transmission system operation and market operation functions. Initially, this transmission company will be a subsidiary of Eskom Holdings and will be established as a separate State-owned company before any investments are made in current or new generation capacity.
- over time, a multimarket model electricity market framework will ensure that transactions between electricity generators, traders and power purchasers take place on a variety of platforms, including bilateral deals, future and day-ahead markets.
- a regulatory framework is in place that will ensure the participation of independent power producers and that diversified primary energy sources be developed within the electricity sector without hindrance.
- the planning and development of transmission systems be undertaken by the transmission company subject to government policy guidelines.
- over time, and taking cognisance of the strategic objectives of the region, the Southern African Power Pool (SAPP) must develop into an independent system operator for the southern African regional grid system, where public and private generating companies can participate in the Pool.
- adapting the role of the regulatory system, which will include the reform of the legal framework defining the role of the NER, the development of a new framework for licensing, the adaptation of price-setting and the creation of the capacity to monitor

the effectiveness of the reformed ESI and to ensure the security of supply.

## 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 EDI restructuring in such a manner that the ESI and the EDI restructuring process are inter-linked.

The EDI Holdings Company is being established and will be responsible for the next phase, which is transformation 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:

- endorsing the thrust of the revised EDI *Restructuring Blueprint Report*
- the number of six REDs as both the Government's policy direction and the end-state model for the restructured EDI
- the EDI restructuring implementation plan, especially the time frames, establishment of the EDI Holdings Company and the transition will ensure that Eskom and stronger municipalities support the weaker municipal distributors and that RED 3 and RED 6 receive transitional financial support from the EDI Holdings Company

- ongoing consultations with stakeholders such as new municipalities, the NER, Eskom, organised labour, customers, provincial and local governments
- that the Minister for Provincial and Local Government convenes a meeting of relevant Ministers to deal with the issue of debt owed by local authorities to Eskom.

### **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 ESI. During 2001, the NER approved a general price increase of 6,2% for 2002, which was anticipated to be marginally above the expected rate of inflation for 2002 and the actual consumer price index (CPI) of 5,7% for 2001.

The EDI is still operating with temporary licences, pending the restructuring of the industry, which will result in six REDS being responsible for electricity supply throughout South Africa. Amalgamating the municipal electricity distribution assets with that of Eskom will form these distributors. The first RED is expected to be operational from 2004.

There will be a need for investment in new generating capacity some time during the second half of the present decade. This will depend on economic growth and the associated growth in electricity demand and effectiveness in the current system. 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 genera-

tion sector. Demand management options include the use of renewable energy resources to reduce environmental impact (although these will be done at a premium) and to use electricity more efficiently to avoid building new generation plants sooner than necessary.

The way in which these options are exercised will be informed by a national energy policy with input from the public and private sectors. An Integrated Energy Plan was expected to be presented to the Portfolio Committee on Minerals and Energy in July 2002. 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 poor households connected to the national grid be issued with 50kWh/month free of charge, followed by normal tariffs. The possibility of funding free basic electricity services from the equitable share is being investigated. Initial results indicate a need for additional fiscus allocation to enable municipalities to supply free basic electricity to the poor. Households connected to non-grid systems will be provided with a maintenance and operation subsidy to a maximum of R40 per installation. The Department of Minerals and Energy is also investigating the impact of efficiency lighting as a component of providing relief to poor households. These proposals will be subject to Cabinet approval, followed by a phased implementation of the programme.

### **Electricity prices**

Over the period 1995 to 2000, Eskom reduced the real price of electricity, using the CPI as criterion, by 14,1%. The average price of electricity to end-users was at the following levels during 2000 as shown in the table.

A large number of electricity tariffs apply in South Africa because in addition to Eskom's national tariffs, each local distributor applies



Customer percentage of total consumption	Price (c/kWh)	
Domestic	16,7	25,3
Agriculture	2,5	23,9
Commerce	7,3	23,9
Transport	2,4	16,8
Industry	37,7	13,1
Mining	18,7	12,6
<b>Total</b>	<b>100,0</b>	<b>16,6</b>

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its own set of tariffs within its area of supply. The restructuring of the EDI will see the formation of six financially-independent REDs, each with one set of tariffs applicable to its supply area. These rationalised cost-reflective tariffs will achieve a more rational and equitable industry and facilitate the achievement of the goals of the INEP.

### National and regional co-operation in regulation

The NER is a founder member of the South African Utility Regulators' Association, a body formed for regulators in different economic sectors to interact on matters of mutual concern and interest. In addition, the NER is the deputy chair of the South African Regulators' Forum, which is an organisation of all regulators in South Africa and chaired by the Competition Commission.

Electricity regulators in the Southern African Development Community (SADC) region, together with Kenya and Uganda, have also formed the Regional Electricity Regulators' Association (RERA) to co-operate in the regulation of cross-border electricity supply issues. The NER is a founder member of RERA. It is also a founder member of the African Forum for Utility Regulators.

### Integrated National Electrification Programme

This Programme remains the flagship of the Department of Minerals and Energy.

In 2001/02, responsibility for the funding of the INEP was transferred to the Department from Eskom, after Eskom's tax-exempt status was revoked.

Funding for electrification has therefore been allocated to the Department from 2001/02 to facilitate the continued expansion of access to electricity. The Department is responsible for the strategic and financial management of the Programme while Eskom and the licensed municipalities are responsible for its execution.

In 2001, the South African EDI spent R909 million on the INEP. The total number of connections in 2001 were 336 858, of which 141 707 were installed in rural areas and 195 151 in urban areas. The connections were spread in all nine provinces.

The Programme has been delivering above target. In 2001/02, there were 336 858 connections against a target of 300 000. Real costs per connection have been coming down at a rate of about 2,5% per annum, but are expected to increase slowly as the Programme proceeds to the more remote and sparsely populated rural areas, where the larger backlog exists.

During 2002/03, a further 200 000 households, 1 050 schools and 100 clinics will be electrified at a cost of R950 million. With more emphasis placed on integration with other infrastructure and service-providers, this pace will continue, until universal access is reached, which is targeted for 2012.

### Mini-grid hybrid systems

The Minister of Minerals and Energy said in a media briefing in February 2002 that during 2001 most of the attention was focused on developing a project implementation plan of a mini-grid for the Hluleka Nature Reserve. The main role-players are the NER, CSIR, Shell, the Department of Minerals and Energy and the Eastern Cape Provincial Government. An integrated approach resulted in a design consisting of an energy system, a water purification system and a telecommunications sys-

tem. The energy system will make use of renewable energy, solar water heaters and liquid petroleum gas.

Additionally, two villages adjacent to Hluleka Nature Reserve have been identified as sites for pilot hybrid mini-grid systems. Emphasis has been placed on the linking of these mini-grids to new economic activities in collaboration with the Agricultural Research Council. High-value crops have been planted in a number of demonstration plants in co-operation with entrepreneurial farmers. The plan is to evaluate the mini-grid systems with a view to exporting the value-added crops out of the region, hence generating income.

After starting with the identified sites next to Hluleka Nature Reserve, additional sites for hybrid mini-grid systems will be attended to in the Eastern Cape, KwaZulu-Natal and Limpopo.

An integrated framework for a national strategy to roll out hybrid mini-grids will be developed as part of the analysis of the pilot study.

## Regional Electricity Regulatory Association

RERA is a voluntary association of regional electricity regulators within the SADC.

The objective of RERA is to facilitate the harmonisation of regulatory regimes of member states to facilitate the trading of electricity in the region.

The constitution for the establishment of RERA has been finalised and will become functional if 50% or more of member states approve. By mid-2002, the following countries had signed: South Africa, Zambia, Malawi, Namibia and Zimbabwe. It was expected that the remaining countries would sign during 2002 to enable the functioning of RERA.

## Southern African Power Pool

The SAPP was formally established following the signature of an Intergovernmental

Memorandum of Understanding (MoU) by the Ministers of Energy of the SADC Summit on 28 August 1995 and the subsequent signature of an Interutility MoU in December.

All SADC countries, including the Democratic Republic of the Congo (but excluding Mauritius because it is an island), signed the intergovernmental MoU.

Eskom has continued to play a pivotal role in the SAPP, particularly with regard to the repositioning of the Pool in line with global trends of liberalising and introducing competition into electricity markets.

In 2002/03, the SAPP will have a fully-established and operational Regional Power Exchange. Long-term bilateral contracts will also be traded in this market.

The SAPP is envisaged as a two-tier structure where all the SADC utilities can participate in joint planning activities, exchange of information and technical co-operation, while those physically interconnected can engage in electricity trading. To lay the rules governing electricity exchange between countries, the SAPP Agreement was drafted. It has been signed by nine of the national utilities: BPC of Botswana, EDM of Mozambique, Eskom of South Africa, SNEL of Zaire, ZESA of Zimbabwe, NamPower of Namibia, ZESCO of Zambia, SEB of Swaziland and LEC of Lesotho.

The following are developments in the SAPP:

- Pool Plan: the initial Pool Plan was completed in November 2001 and will be updated as and when required. The wheeling study was completed and presented to the SAPP Management Committee meeting.
- Short-term Energy Market (STEM): as of the end of March 2002, the following four utilities are participating in STEM: BPC (Botswana), Eskom (South Africa), NamPower (Namibia) and ZESA (Zimbabwe). Three additional utilities have signed the necessary documentation and will soon be participating. These are EDM (Mozambique), HCB (Mozambique-Cahora Basa) and LEC (Lesotho).



- Joint hydropower development on the Cunene River: the updating of previous feasibility studies has been completed. Funding is being sought for detailed studies and project implementation. It is funded by the Portuguese Government.
- The Angolan and Namibian Power grids: a joint task force involving the national utilities ENE (Angola), NamPower (Namibia) and relevant government departments from both countries has been established to commence preparations for the project.

## 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.

The *Draft White Paper on the Promotion of Renewable Energy and Clean Energy Development* was released in August 2002. The White Paper addresses four key strategic areas, namely:

- financial instruments to promote the implementation of sustainable renewable energy through the establishment of appropriate financial instruments
- legal instruments to develop, implement, maintain and continuously improve an effective legislative system to promote the implementation of renewable energy
- technology development to promote, enhance and develop technologies for the implementation of sustainable renewable energy
- raising awareness, building capacity and educating to develop mechanisms to raise awareness on the benefits and opportunities renewable energy offers.

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 – which is 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 UK, 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 non-grid technologies into the INEP 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); com-

merce 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 will have a major beneficial impact on 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 can ameliorate the situation substantially.

Switching from electrical to solar water-heating can, therefore, have significant eco-



nomic and environmental benefits. There are economic benefits for home-owners in reducing their energy bills.

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 (GHG) releases and the release of scarce capital for other pressing needs.

### **Wind**

Wind as an energy source is only practical in strong and steady wind areas. 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 has limited potential for large-scale hydro-electric power due to its limited water resources. Although the country's total hydro potential is estimated at 3 500 MW, the economically feasible potential is much lower.

The current total installed large-scale hydropower generation capacity (larger than 10 MW), is 2 061 MW. The installed capacity of plants smaller than 10 MW totals some 65 MW.

River flows in South Africa are not constant, varying between floods and very low flows. For this reason, the running of river schemes is generally not a feasible option. Relatively large and expensive storage dams are normally required, even for small hydro stations.

South Africa has two conventional hydro-electric power stations and two pumped storage schemes. Pumped storage generation

involves the construction of two adjacent reservoirs, or dams, one at a significantly higher elevation than the other. During periods of low demand on the Eskom grid, normally at night and over weekends, excess energy is used to pump water from the lower reservoir to the higher reservoir via underground tunnels. During peak demand periods, such as early mornings and evenings, the process is reversed. The stored water is allowed to flow back via the tunnels to the lower reservoir through hydraulic turbines driving generators. Apart from a small quantity of water lost to evaporation, pumped storage schemes, like conventional hydro stations, do not consume water. Once one of the reservoirs is filled, the same active volume is used over and over again.

## **Energy and the environment**

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

On a global scale, South Africa's contribution to GHG 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 tonne 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 GHG 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 and wind energy. In addition, 57% of the coal-mining methane emissions can be attributed to these two uses of coal.

### **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 ( $180 \text{ mg.m}^{-3}$ ) by factors of six to seven during winter, and two to three in 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 participates in a National Housing Interdepartmental Task Team and has contributed towards the development of norms and standards for solar passive and thermally efficient design housing.

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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