The Challenges Facing Energy and Climate Change Policy in South Africa

For South Africa, the country with the highest energy consumption and greenhouse-gas emissions in Africa, the ratification of the Framework Convention on Climate Change in late August 1997 represents a major challenge. The prime aim of the young democracy, alongside stimulating investment activity and thus growth and employment, is currently that of improving the living conditions of the mass of the population, among other things by means of a housing construction and electrification campaign. In addition, the legislative framework for the energy supply sector is to undergo fundamental reform. Given the expected growth of the South African economy, a further rise in the demand for energy is to be expected. Under the prevailing conditions it therefore appears that the conflict between the goals of a cheap, widely available and at the same time liberalised electricity supply on the one hand and intensified measures to save energy and reduce emissions of greenhouse gases on the other can only be solved in political terms if clear priorities are set.

Economy on a flat but stable growth path

South Africa has embarked on democracy and integration into the international economic community under difficult initial conditions. Following decades of Apartheid and a largely autarkic economic orientation, associated with the exclusion and underinvestment in the skills of the majority of the population, with trade sanctions and a strategy of import substitution, it could not be expected that the economic situation would rapidly improve following the first free general elections in April 1994. Yet the liberal market economic programme adopted by the government in 1996, entitled "Growth, Employment and Redistribution" (GEAR), the consolidation of government finances, favourable legal conditions for investors and the gradual opening of the country for regional and global trade and capital movements have clearly served to reinforce the confidence of both foreign and domestic investors in South Africa's potential.

This has been due not least to the restrictive monetary policy. The inflation rate declined from 15.3% in 1991 to 7.4% in 1996. The overall budget deficit (borrowing requirement) fell from 8% of GDP in 1994 to 5.3% in 1996, this despite the enormous economic policy responsibilities taken on by government. The extent of the deficit is estimated to remain broadly unchanged in the current year. South Africa's outstanding government debt is, at 56% of GDP (1996), not unusually high in international comparative terms, nor is its foreign debt, at 24% in 1995 (cf. table 1).

A look at the structure of today's South African economy reveals that the traditional sectors, mining and agriculture, account for around 14% of GDP; the secondary sector (industry, energy and construction) represents 32% and public and private services 53%. Exports consist largely of primary goods, gold and metal products, an export structure more typical of a developing country. The dichotomy in the South African economy between a comparatively modern industry and a developed service sector, on the one hand, and a large, unproductive sector relying on barter and subsistence production on the other is unlikely to be overcome in the short to medium term.

According to government plans a longer-term growth trajectory of 6% p.a. is to be achieved by the year 2000, and indeed a high rate of growth will be necessary if the goal of substantial income redistribution is to be achieved with as little friction as possible and if the high level of unemployment (30 to 40%) is to be reduced. Seen against the background of past developments, this is an ambitious target. Following a period of several years in which GDP contracted in real terms, a turnaround was achieved in 1993; in 1995 and 1996 annual growth rates in excess of 3% were achieved. Yet this is still a good way off the target set.

Due not least to international sanctions, between 1985 and 1993 South Africa experienced a net capital outflow; this was associated with a net decline in its foreign debts. Since then the country has imported more capital than it has exported. In 1996 domestic investment as a share of output was, at 17%, significantly higher than the trough of 15.5% in 1993. Since 1994 investment in machinery and equipment has been increasing at a two-digit annual rate, manifesting the growing confidence in the South African economy. Yet the pace of investment growth must be raised still further if the planned growth dynamic is to materialise: in the successful South-East Asian "tiger" economies, for example, investment accounts for double the share of output. Overall, the process of equalising living conditions is likely to take longer than hoped. Even so the South African economy is currently on a steady, albeit rather flat, growth path.

Table 1

The South African Economy – Selected Indicators

	1990	1991	1992	1993	1994	1995	1996
Population mill. persons[1)]	37.1	38.0	38.9	39.7	40.6	41.4	42.3
Employment,[2)] 1990 = 100	100.0	98.3	96.3	94.3	93.7	94.4	93.3
GDP[3)] in bill. Rand at 1990 prices	276	273	267	271	278	288	297
Real GDP, % change on previous year	–0.3	–1.0	–2.2	1.3	2.7	3.4	3.1
Real GDP per capita, in Rand[1)]	7 434	7 192	6 879	6 816	6 854	6 938	7 007
Inflation (consumer prices), % change on previous year	14.4	15.3	13.9	9.7	9.0	8.7	7.4
Gross domestic fixed investment, as a % of GDP	19.6	17.8	16.6	15.5	16.0	16.9	17.0
Gross investment, % change on previous year	–2.3	–7.4	–5.3	–2.8	8.7	10.3	6.8
Investment in machinery and equipment, % change on previous year	–4.6	–11.8	7.7	3.2	18.4	20.4	10.3
Total debt, as a % of GDP	38.6	37.2	39.5	44.5	48.6	54.6	56.0
Foreign debt, as a % of GDP	24.5	22.8	22.7	21.6	22.9	24.0	k.A.
Borrowing, as a % of GDP	1.5	2.7	4.9	7.9	6.4	5.6	5.3
Balance of payments, in bill. Rand at 1990 prices							
Trade balance	–0.7	–2.4	–2.2	–2.4	–7.3	–9.9	–9.5
Services balance	–12.4	–9.6	–9.1	–9.4	–8.9	–9.6	–9.3
Revenue from gold exports and transfers	18.4	17.4	15.2	16.0	15.4	13.4	14.2
Current account balance	5.3	5.4	3.8	4.2	–0.8	–6.0	–4.6
Current account balance as a % of GDP	1.9	2.0	1.4	1.6	–0.3	–2.1	–1.6
Capital account balance, in bill. Rand at current prices	–1.8	–2.2	–4.7	–15.2	4.3	19.2	3.9
Sectoral contributions to GDP, in %[4)]							
Agriculture and mining	15.0	15.2	14.2	15.2	15.1	13.6	14.3
of which: Mining	9.7	9.6	10.0	10.1	9.6	9.0	8.6
Agriculture	5.3	5.6	4.2	5.1	5.5	4.6	5.6
Industry[5)]	33.3	32.5	32.2	31.8	31.8	32.9	32.3
of which: Manufacturing	25.5	24.6	24.4	24.0	24.1	25.2	24.5
Private and public services	51.7	52.3	53.6	53.1	53.1	53.5	53.5
DM exchange rate (DM 1 = Rand X)	1.60	1.67	1.83	1.98	2.19	2.53	2.85
Dollar exchange rate (US-$ 1 = Rand X)	2.59	2.76	2.85	3.27	3.55	3.63	4.30

1) The provisional result of the most recent census (October 1996) puts the population substantially lower (at 37.9 million); given that final figures are not available, however, the previous official figures were used. — 2) Excluding employment in the informal sector and agriculture. — 3) GDP at market prices. — 4) Contributions to GDP at factor cost. — 5) Energy sectors (excl. mining), construction and manufacturing.
Sources: Central Statistical Service; South African Reserve Bank; DIW calculations.

Cheap energy resources

One of South Africa's comparative advantages lies in its huge reserves of easily accessible coal, half of which can be mined cheaply in open-cast mines, and, consequently, the very low cost of electricity generation in international comparative terms. At both the generation and transmission level, the electricity industry is dominated by the state-owned Eskom company. In 1996 Eskom produced around 179 TWh, almost 98% of South Africa's electricity output (cf. table 2). This is equivalent to about 75% of the total amount of electricity generated in sub-Saharan Africa.[1]

[1] In terms of installed generating capacity Eskom is in fourth place in the world behind the French EdF, Italy's ENEL and the Tokyo Electric Power Company; on the basis of electrical power sold it cedes this fourth position to Hydro-Quebec and is the fifth-largest energy supply company in the world.

Table 2

Eskom: Key Electricity Generation Data

	1985	1990	1991	1992	1993	1994	1995	1996
				Installed generation capacity, in MW				
Total power station net maximum capacity	24 359	33 843	36 228	36 846	37 636	35 926	35 951	36 563
Heat power stations	20 979	30 063	32 448	33 066	33 856	32 086	32 111	32 723
Coal-fired power stations	20 637	29 673	32 058	32 698	33 488	31 744	31 769	32 381
Gas turbine power stations	342	390	390	368	368	342	342	342
Hydroelectric power stations	540	540	540	540	540	600	600	600
Nuclear power stations	1 840	1 840	1 840	1 840	1 840	1 840	1 840	1 840
Pumped storage stations	1 000	1 400	1 400	1 400	1 400	1 400	1 400	1 400
				Electricity generated GWh				
Coal-fired power stations	113 941	135 743	135 743	136 834	145 514	148 005	151 730	163 541
Hydroelectric power stations	624	1 980	1 980	752	146	1 074	529	1 319
Nuclear power stations	5 315	9 144	9 144	9 288	7 255	9 697	11 301	11 775
Pumped storage stations	2 107	1 804	1 804	1 333	1 345	1 517	1 274	2 220
Total	121 987	148 671	148 671	148 207	154 260	160 293	164 834	178 855
% share of electricity generation in South Africa	94.5	97.5	98.0	97.9	97.9	97.4	97.4	97.9
				Contribution of power station types to generation, in %				
Coal-fired power stations	93.4	91.3	91.3	92.3	94.3	92.3	92.1	91.4
Hydroelectric power stations	0.5	1.3	1.3	0.5	0.1	0.7	0.3	0.7
Nuclear power stations	4.4	6.2	6.2	6.3	4.7	6.0	6.9	6.6
Pumped storage stations	1.7	1.2	1.2	0.9	0.9	0.9	0.8	1.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Eskom Annual Report, different years.

In 1996 Eskom had at its disposal an installed maximum net capacity of 36.6 GW; of this more than 4.5 GW or 15% of the capacity of the coal-fired power stations are still kept in reserve. By 1996 the maximum power demand had risen to just under 28 GW. The high capacities result from the expansionary phase during the 1970s when exaggerated demand prognoses led to over-investment. In 1987 this finally led to the restructuring of and a new legal framework for Eskom, requiring it to take account of profitability considerations. Since then significant efficiency gains have been realised. In real terms electricity prices in 1996 were around one third lower than the 1985 level, this against the background of rising profitability. The energy supply company intends to maintain its course of forcing down costs. It is likely to be successful in this, not least because, following the regional cooperation adopted within the framework of the South African Power Pool (SAPP) in 1995, it has

Table 3
Energy in South Africa: Selected Data, 1993

	Coal	Petroleum	Gases	Biomass	Electricity[1)]	Total
Primary energy consumption, in PJ	2 956	695	75	419	2	4 148
Contribution by energy sources, in %	71.3	16.8	1.8	10.1	0.1	100.0
			Final energy consumption (FEC) by sector, in PJ			
Industry and trade	439	49	25	124	274	910
of which: Metal-producing branches	214	0	0	0	0	214
Households	42	36	1	295	77	452
Agriculture	6	41	0	0	13	59
Mining	13	14	0	0	135	162
Transport[2)]	4	473	0	0	24	501
Total	503	613	26	419	522	2 083
			Energy-source structure of final energy consumption, in %			
Industry and trade	48.2	5.4	2.7	13.6	30.1	100.0
Households	9.3	8.0	0.2	65.4	17.1	100.0
Agriculture	9.8	68.8	0.0	0.0	21.4	100.0
Mining	7.7	8.8	0.0	0.0	83.5	100.0
Transport[2)]	0.8	94.5	0.0	0.0	4.7	100.0
Total	24.2	29.4	1.2	20.1	25.0	100.0
			Sectoral structure of final energy consumption, in %			
Industry and trade	87.2	8.0	96.2	29.6	52.4	43.7
Households	8.4	5.9	3.8	70.4	14.8	21.7
Agriculture	1.1	6.6	0.0	0.0	2.4	2.8
Mining	2.5	2.3	0.0	0.0	25.9	7.8
Transport[2)]	0.8	77.2	0.0	0.0	4.5	24.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

1) The sum of electricity generated by nuclear power (26.1 PJ) and hydroelectric power (0.5 PJ) minus net exports (-24.3 PJ). — 2) Including statistical discrepancies.
Sources: Department of Minerals and Energy 1995; Energy & Development Research Centre 1996.

gained access to cheap hydro-electric power potential to the North (Zaire, Angola, Tanzania and Zambia). By the end of this year the power stations at the Cahora Bassa dam that had been partially destroyed in the Mozambique civil war will once again be linked up to the grid. These power stations will largely be used to supply South Africa with electricity which is supposedly cheaper than Eskom's own- generated electricity.

The large coal-fired power generators, most of them with six power blocks ("sixpacks") run by Eskom are located in direct proximity to the coal-mining areas of the highveld in Mpumalanga, reducing transport costs to an absolute minimum. The Department of Minerals and Energy (DME) put the available reserves of the 18 leading coal mines at 55 billion tonnes (1996); this constitutes around 5½% of the world's coal accessible reserves. A total of around 121 billion tonnes of the "black gold" is thought to lie on South African territory. Coal accounts for at least 71% of primary energy consumption; the precise figure depends on the amount of biomass estimated to be consumed to cover household fuel requirements (cf. table 3).

There has been scarcely any significant change in the sectoral structure of energy demand in South Africa since the start of the 1980s. Industry accounts for around 44% of final energy consumption, just under

22% is consumed by private households and 24% by transport. The most important source of energy for industry is coal (48%), and further 30% is supplied in form of electricity. Overall, industry accounts for more than half of the electricity sold in South Africa, followed by mining, at 26%, of which almost two thirds is accounted for by the energy-intensive gold-mining sector alone. Less than 15% of electricity is consumed by private households; outside urban agglomerations they meet their energy needs primarily with biomass (firewood, waste wood). As in other countries, the transport sector is the largest consumer of petroleum products.

Of all the sources of final energy, electricity is expected to record the fastest rates of growth in the coming years. The International Energy Agency (IEA) expects, in its base scenario (1993-2010), an annual rate of growth of electricity sales of 5%, whereas sales of petroleum products (4%) and especially coal (1.4%) are expected to grow more moderately. Overall, final energy consumption is forecast to expand by more than 3% p.a.[2]

Table 4
Comparison of Energy Intensities, 1993
in tonnes oil equivalent per 1000 US-$ GDP

	South Africa	OECD
On the basis of exchange rates:		
Primary energy consumption	0.996	0.299
Final energy consumption	0.487	0.212
On the basis of purchasing power parities:		
Primary energy consumption	0.666	0.344
Final energy consumption	0.336	0.244

Source: IEA 1996.

High energy consumption and emissions levels

Traditionally the South African economy is very energy-intensive. Compared with the OECD average the country requires three times the volume of primary energy to produce one unit of GDP - calculated on the basis of exchange rates - and twice the energy input calculated on the basis of purchasing power parities (cf. table 4). Comparison of final energy demand also reveals that South Africa is markedly above the OECD average.

The causes of the high energy intensity lie to some extent in the low cost and ready availability of coal, which in the past offered only a marginal incentive for the electricity generation sector to raise the technical efficiency of its plants or substitute fuel types. In 1996 91% of electricity were generated in coal-fired power stations, in which a total of 85.4 million tonnes of coal were consumed.[3] The extremely energy-intensive coal-based synthetic oil production programme begun back in the 1950s also exerts a negative impact in this regard.

Consequently, South Africa emits large quantities of the greenhouse gas CO_2. A preliminary systematic survey put the annual emissions for 1988 at 350 million tonnes of CO_2.[4] More recent data are not available. If this value is extrapolated proportionally to energy consumption, we obtain an arithmetic value of around 400 million tonnes of CO_2 in 1996. Unless effective counter measures are taken, this figure must be expected to increase in the future by at least 3% p.a. A comparison of per capita emissions in the OECD countries reveals that South Africa, with emissions of the order of 9 to 10 tonnes occupies a position in the middle ground. Measured per unit of GDP, however, emissions are very high, amounting to several times the values typical of the OECD countries.

On 15 June 1993 South Africa signed the Framework Convention on Climate Change; however, its ratification took only place by the end of August 1997. The delay is due not least to fears that commitments entered into might come into conflict with domestic political problems and goals that are seen as more urgent. South Africa now faces up to the task of drawing up an inventory of the sources of emissions of greenhouse gases and of the carbon sinks and of developing a national policy on climate change. In addition it may participate in the

[2] Cf. IEA, Energy Policies in South Africa, Paris 1996. According to a scenario based on a higher rate of economic growth, one that comes closer to the plans of the South African government (from 2000 almost 6% p.a.), the IEA forecasts annual growth of energy consumption amounting to 4%, whereby electricity consumption is expected to increase by more than 6%.

[3] Most of this coal is low-quality coal with a low calorific value (19.8 MJ/kg) and with a low sulphur, but a high ash content. High-quality coal is exported. The average efficiency rate of the power stations is, however, at 34.4%, relatively high for a country of this stage of development.

[4] Cf. R.J. Scholes and M.R. van der Merwe, South African Greenhouse Gas Inventory, CSIR, Pretoria 1995. On top of this come methane emissions amounting to at least 2.8 million tonnes, primarily from the coal mining industry.

international pilot phase consisting of Activities Implemented Jointly (AIJ).[5]

A reduction in carbon dioxide emissions can be achieved by reducing emissions directly or by expanding the carbon dioxide sinks, for example via reafforestation. Given that virtually all emissions of greenhouse gases are caused by energy consumption, raising energy efficiency constitutes a strategy particularly well-suited to an energy-intensive economy such as South Africa.

Potential for reducing energy consumption

Above-average energy intensities at the final consumption level are not surprising given persistently low energy prices; there is little incentive to save energy. Not least for this reason, only vague estimates have so far been made of the technical and economic scope for saving energy in South Africa. A substantial potential could be tapped at the conversion stage, however, by refraining from synthesising oil from coal. The IEA estimates that this would reduce South Africa's energy intensity by around 10%. According to official statistics, around 25 million tonnes of coal and 1.8 billion m^3 of natural gas and condensate are converted into synthetic oil each year; this covers 27% (1995) of domestic demand for petroleum products for heating and transport. The total energy input into the production of petroleum products amounts to 1 468 PJ, consisting of crude oil (47%), gas and condensate (5%) and coal (48%), in order to obtain an output of petroleum products with an energy value of 613 PJ. More than half (58%) of the input is lost in the course of this process, primarily when the coal is liquidified.[6] However, for political reasons it is unlikely that this costly – in energy terms – conversion technique will be abandoned in the near future, however rational this might be in terms of saving energy.

Studies of final energy consumption in the South African industry come to the conclusion that the economic scope for energy savings amounts to between 9% and 12% of energy costs by the year 2005, and between 14% and 16% by 2015.[7] The potential is even greater in the field of space heating, particularly in low-income households. Most of the simple brick houses being constructed under the government housing programme to replace temporary wooden and corrugated iron huts are being built without internal ceilings and insulation. It has been estimated that in the heavily populated winter-frost areas in the Province of Gauteng, the centre of the South African economy around Johannesburg, up to 90% of the energy required to heat these simple houses could be saved.[8] Yet given the limited resources available for the housing programme, the focus is on quantity rather than quality: energy-saving measures are not implemented although the additional initial costs would be more than offset by subsequent cost savings.

Eskom, too, has discovered "energy saving", although less in terms of reducing emissions than with regard to costs against the background of the perceptible increase in the extent to which electricity demand fluctuates. This is largely due to private households which, despite their subordinate overall importance as consumers, account for at least one third of the fluctuations in peak demand. Eskom has responded by announcing a *demand-side management* programme for the next 5 to 10 years. Through demand management and energy-saving measures around 7 000 MW of the additional capacity that would otherwise have to be constructed to the year 2015 is to be avoided, at a lower cost than that of building new power stations. The prime aim of Eskom's demand-side management is to improve the economic efficiency of electricity provision; Eskom's programme will only serve to reduce emissions if at the same time the overall level of energy consumption can be reduced.

The renewable energy sources wind and solar energy have so far barely stood a chance in the face of cheap energy from coal-fired power stations, except in remote areas located far away from established grids. The large hydroelectric power stations in the northern neighbouring countries are expected, as mentioned earlier, to play a more important role in the future.

Other priorities for energy policy

Although protection against climate change and energy saving are explicitly mentioned in the government's programme and, following ratification of the

[5] *Activities Implemented Jointly* or *Joint Implementation* aim to realise greenhouse gas (GHG) emission reduction at minimum cost while taking advantage of cost differentials between countries. Countries with high marginal costs realise GHG reduction projects in other countries and in return are granted an "emission credit" that is taken into account in their reduction aim; this is subject to the condition that binding targets have been set. Projects conducted in the current pilot phase cannot be credited in this way.

[6] Cf. Department of Minerals and Energy, South African Energy Statistics, no. 2, Pretoria 1994.

[7] Cf. M.G. de Villiers and R.K. Dutkiewicz, The potential benefits of improved energy effectiveness in manufacturing and mining in South Africa, Cape Town 1994.

[8] Cf. S.L. van Wyk and E.H. Mathews, The effect of ceilings and insulation integrated ceilings on the energy efficiency of formal low-cost housing in the Gauteng area, Cape Town 1995.

Framework Convention on Climate Change, South Africa commits itself to paying greater attention to these matters, the list of priorities for economic, distributional and even energy policy is headed by other issues, and in particular by short-term challenges. In this, cheap energy is seen as a precondition for international competitiveness. Centre-pieces of the programme of redistribution are an ambitious house-building and a comprehensive electrification programme. Under the former at least one million new housing units are to have been built by the end of the decade; under the latter the proportion of households linked up to the electricity grid is to double from 35% (1992) to 72%. So far Eskom has linked up around 300 000 housing units a year, whereby this usually involves the installation of a link to the grid and a so-called *ready board,* i.e. one plug, one bulbholder and an electricity meter. Even so, by the end of 1996 only 54% of the households had been hooked up to the electricity network.[9] In urban areas almost 79% of households have electricity, whereas the figure in rural areas is less than 27%. The electrification goal requires that 400 000 housing units be linked up every year until the start of the new millennium, many of them in remote areas or on local authority land which Eskom is not authorised to supply. Yet in most cases the local electricity supply authority is not up to this task for organisational, financial and/or technical reasons.

At heart this is why a reform of the legislative framework for electricity supply to final consumers is currently seen as the most urgent task for South Africa's electricity supply sector. Also under consideration are the opening of the various generation levels to competition, and the vertical disintegration and – in the medium-term – privatisation of Eskom. So far Eskom has exerted monopoly control over generation and the high-tension grid and supplying, in particular, large-scale industrial consumers. The remaining distribution is in the hands of just under 400 largely municipal supply units, most of which do not have power stations of their own, but purchase electricity from Eskom, re-selling it under more than 2 000, often arbitrarily set tariff structures exhibiting price differentials of up to 360%. Local authorities use the resources generated by the re-sale of electricity to finance other public tasks. Under the Apartheid regime, local authorities were divided up on the basis of skin colour. Although since the reform of local authority borders this division has been gradually replaced and larger areas formed, the number of electricity customers and their structure tends – outside the few large cities – to be relatively small and unfavourable respectively. There is, moreover, a lack of the economic and technical know-how required to ensure a qualitatively satisfactory supply and electrification.

In 1995 a nation-wide regulatory institution – the National Electricity Regulator (NER) – was set up for the first time in South African history. Its primary tool for making its influence felt is that of issuing licences for the three stages of electricity supply: generation, transport and distribution. The NER is supposed to refuse to grant licences to unsuitable supply units. However, given the large number of municipalities that do not meet the criteria for a licence and the fact that most local authorities are dependent on revenue from the re-sale of electricity, it is currently unable to perform its task resolutely without taking a political risk. Since as long ago as 1992 numerous specialist bodies including representatives of the social groups and institutions involved have sought to resolve this conflict. At the end of the day a model based on a small number of regional electricity distributors is likely to prevail, whereby local authorities are to be given the right of imposing a mark-up on electricity sales in their area in order to ensure that local authority tasks can be financed. It is to be expected that the regional distributors will be under the influence of Eskom, at least provisionally. The introduction of elements of competition into the generation and distribution of electricity and the vertical disintegration and privatisation of Eskom will not be realised until a later date, probably only after the electrification programme has been completed.

Conclusion

In the context of a political situation characterised by a large number of demands from different spheres, it must be doubted whether the South African government will commit its limited financial and institutional resources to develop and implement programmes to raise energy efficiency and reduce emissions of greenhouse gases to the extent required. For this reason it is important in the political debate to underline the point that energy-saving measures not only help avoid climate change, but also hold out the prospect of economic advantages. Higher energy efficiency is often associated with higher productivity due to the link between the deployment of modern technology and energy-cost savings. The DME has calculated that nation-wide energy savings of between 10 and 20% could lead to a 1.5 to 3% higher level of GDP.

Energy efficiency and climate protection have been adopted, at least as a principle, in a number of statutes and regulations, but the concretisation and implementation of support programmes and minimum standards

[9] NER, Lighting up South Africa, Electrification Progress Report, Sandton 1996.

are being hampered by the lack of political and administrative capacities. Yet delays in implementing such measures are likely to raise the costs of climate-protection measures in the future. For instance, it is more costly to put in insulation and ceilings after a house has been built than to incorporate the requirements of heat insulation into housing construction programmes. If expensive negative developments in the future are to be avoided, among other things the scope for international cooperation in this areas should be exploited.

Barbara Praetorius