

## **Establishing the *right price* for electricity in South Africa**

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This exercise is designed to answer the essential question of relevance for consumers of electricity in South Africa. The question is – what charge per KWH would justify the investment by Eskom in a new efficiently sized Power Station in South Africa? Having provided an answer to this question we consider the appropriate lowest cost way of financing the expansion of Eskom’s generating capacity. We apply a model of Power Station economics and finances to help us provide concrete answers to these questions. We provide to readers the spread sheet we have developed to this purpose to undertake simulation exercises.

### *Defining the right price*

The *right price* or charge for electricity in South Africa is the price that would generate sufficient revenue to recover all the direct costs of producing electricity by a new power station (fuel, operations and maintenance, management overhead) and also cover the costs of additional financial capital invested in the newly constructed power station. Or in other words would be sufficient to cover the direct costs of operating the station and also provide a satisfactory return on the capital employed.

### *Establishing the cost of capital – that is the required return for additional investments in electricity generation in SA*

The first step in the exercise is to establish the cost of capital, that is the required return on capital to be invested in electricity generation in SA. The return required to justify any investment has to be consistent with the risks of business failure. The greater the risk the higher must be the expected returns. Electric

utilities are properly considered to be low risk enterprises and therefore are able to attract capital when offering a well below average risk premium to investors in its shares.

*Why electricity generation and Eskom attracts a well below average cost of capital*

The production technologies used by electric utilities are well understood and the demand for electricity is highly predictable, much more so than almost any other good or service. Eskom has further advantages as a utility – it enjoys a statutory monopoly – and is subject to regulation of its prices that will take account of any unforeseen increases in direct costs e.g. fuel costs that are not controllable by Eskom itself. Prices approved by the regulator are very likely to adjust to such unforeseen pressures on costs. This further reduces the business risks to which Eskom is exposed.

Eskom therefore is a SA business in an industry with well below average business risks. The cost of capital for the average South African business would be about 4- 5 per cent per annum above the risk free rate. That is to say the average cost of capital would be the after tax returns provided by a long term government bond plus an expected extra four or five per cent return, known as the equity risk premium.

The risk premium we would attach to Eskom would be no more than an extra one per cent per annum. Or in other words in our judgment an investment in additional electricity capacity by Eskom would be justified if it could be expected to return one or two per cent per annum over the yield currently available from and therefore expected from a long dated RSA bond. That is to say a return of approximately 10% - 11% per annum

*Other estimates of Eskom's cost of capital are highly exaggerated.*

Most discussions we have seen of Eskom's cost of capital, as suggested by Eskom itself, or as calculated by Nersa, the regulator, appear to attach much higher costs of capital to Eskom. These higher estimates, we would suggest, have greatly exaggerated Eskom's cost of capital. That is we are of the view that the risk premium attached to Eskom's cost of capital and also by Nersa appears to greatly overestimate the average cost of capital, that is to say the required returns from an investment in SA business in general and so for low risk electricity generation in particular.

*Past equity returns are not necessarily a good guide to expected returns and therefore to the cost of capital properly understood*

It should be understood by Nersa in this regard that past historic or realised returns achieved by investors on the JSE do not necessarily reveal the current cost of capital. The cost of capital is a forward looking notion – it attempts to measure the expected returns that would justify a particular investment or capital formation decision made today- made in competition with other alternative investment decisions that could be undertaken made at the same moment. For the average SA business, the expected returns on capital in present circumstances to justify an investment in an averagely risky share on the JSE would be no more than four or five per cent above the returns expected from and currently available in the government bond market. These are currently of the order of eight to nine per cent per annum.

Past returns may have proved much higher than expected returns if equity valuations had compensated for much higher risks than in fact materialised. Exceptional equity returns are realised

when economic outcomes, that is to say the growth in profits, turned out to have been much more favourable than was expected when the decisions to buy an equity was made. Exceptionally good after inflation returns were provided by the JSE over the past ten or more years precisely because the SA economy and the companies listed on the JSE performed unexpectedly well. Much less favourable expectations had informed the value attached to SA equities in the past. As these expectations were proved too pessimistic the value of JSE listed shares were revised upwards – so providing exceptionally good returns to investors.

Such high returns realised in what turned out to be unexpectedly favourable circumstances should not be regarded as the returns needed to justify capital formation in South Africa today. If equivalently high returns were expected they would be very hard to achieve and would lead to well below optimal volumes of capital formation. The danger of overestimating the returns required of additional capital invested in power generation in SA is subject to the same danger- that too little will be invested in meeting the demands for electricity at prices that make good economic sense.

*The investment decision must be separated from the financial structure selected.*

Having established as accurately as possible the “right price” that will meet this objective of covering all costs including the costs of capital, the investment in additional capacity should be made. Investors need also to be confident that demand for the additional capacity at the “right price” will be forthcoming to allow the station to realise its available economies of scale.

One of the key theorems of modern financial economics is the importance of separating the investment decision from decisions about how such investments are best financed. The financial decisions are regarded in principle as secondary to the

investment decision. Of course in practice investment decisions will be often constrained by a lack of finance. The balance sheets – that is to say the borrowing capacity of the intending investor – may be insufficient to the purpose. If so the investment will prove impossible to make irrespective of the investment case.

Moreover if the business contemplating such investment is subject to competition in its markets, the ability to charge more for current and future production, to help fund the investment programme independently of new bond or equity issues, will be severely constrained by competitive forces.

*Internally generated finance is convenient- but does not mean less costly capital*

It is very convenient for expanding firms to be able to finance their intended capital formation and growth plans from internally generated cash flows. This allows the company to escape the constraints sometimes imposed by unappreciative financial markets. No doubt it would be as convenient for the management of Eskom, or for the RSA Treasury to avoid heavy reliance on financial markets. The alternative to drawing on the financial markets as sources of finance for expanding generating capacity is to fund Eskom's expansion with the cash flow generated from much higher charges.

That Eskom enjoys a high degree of monopoly power allows it unusual freedom to charge more without much affecting demand for the power generated in the short run. However the price elasticity of demand is very likely to be much higher when potential consumers are given time enough to substitute away from established more expensive suppliers. Eskom however would do very well not to underestimate the long term elasticity of demand for coal derived electricity.

*Using taxes to fund capital expenditure is not good economics*

However the grave problem with such an approach that substitutes current cash flow for newly subscribed debt or equity capital, is that it will make for very expensive electricity. Energy a key ingredient in the production process of SA firms and the consumption spending of SA households. Overcharging for electricity is a burden that should not be imposed on the SA producer. It would represent a process of taxing current consumers to finance future consumers – this may be financially convenient but can make for grave economic inefficiencies.

The economically efficient solution is to find the *right price* for electricity in SA, as indicated before, that is the price that makes good economic sense rather than one that makes it easier to fund Eskom's investment programme. This would be to allow financial considerations to dominate and pervert the investment decision. Good economic sense is to establish a price for electricity that would provide a return to investors in Eskom – especially the SA tax payer that is consistent with the risks involved. We argue that a return of ten to eleven per cent on new investments in electricity generation in SA would be consistent with the risks involved in current financial market conditions.

*What to do with apparently insufficient balance sheet strength to fund Eskom's expansion.*

Clearly Eskom's own balance sheet as it now stands appears inadequate to fund an expansion programme of the order of magnitude intended without a RSA government guarantee. Eskom is a wholly owned subsidiary of the RSA and so the relevant balance sheet is that of the RSA. We are of the view that the RSA could surely guarantee Eskom's planned borrowings without damaging its own debt rating. Its debt rating

in our view would be unlikely to be damaged given that the funds so raised were being used to fund capital formation that makes economic sense. Economic sense means that the investments so funded would pay for themselves, provided the *right price* were charged for the output.

*The logic of a wholly owned subsidiary of the RSA*

It might make even better *financial* sense for the RSA to raise all the funds on its own balance sheet funds and provide Eskom with the finance it needs as additional equity capital. Eskom, even with a government guarantee, might have to pay a higher interest rate to raise debt capital than would the RSA, when borrowing directly from the debt markets.

Given that the operating profits and cash flows from Eskom's operations are unaffected by such financial structures, and given that the RSA is the only shareholder in Eskom, it will make no difference if the cash flows to the shareholder are labelled interest, dividends or taxes. In the case of the government as the only shareholder such distinctions would have no economic significance – they only influence the accounting for cash flow.

Issues of how much depreciation is allowed as a taxable expense or how interest paid may reduce the weighted average cost of capital has no relevance to a wholly owned subsidiary of the RSA. Lower taxes or less interest paid would simply mean higher dividend payments or vice versa. It would in fact make every sense to consolidate the financial accounts of the Eskom with those of the RSA.

*Selling off established power plants is a further financing option*

Unfortunately it appears the RSA is reluctant to assume the responsibility for funding Eskom and is pursuing alternative funding strategies. In our view the inability to accept the logic of the integration of Eskom into the financial operations of the

Republic itself is to deny the RSA the one strategic advantage it does have as the owner of Eskom and that is a lower cost of finance than would be available to potential outside partners in Eskom.

It is perhaps necessary at this point to emphasise again the difference between the cost of capital and the cost of finance. The cost of capital is the required return on capital invested in a project. It incorporates a risk premium consistent with the nature of the project- the higher the risk the higher the expected return and is independent of the financial options used to fund the project- that is whether the capital raised is debt or equity capital.

The cost of debt finance will be a function of the strength of the balance sheet that helps secure finance. A strong balance sheet that secures lenders against the risks of default does not mean a lower cost of capital- it means a lower cost of finance- for any given project risk. It is this financial advantage provided by a strong balance sheet that the RSA appears willing to give up when funding operations for Eskom are being considered.

These financial advantages apparently being forsaken by the RSA for fear of what it might do to its own credit rating- fears we would say are greatly exaggerated - does not mean that introducing private partners into Eskom would not have other benefits. Private generators of electricity either independently of Eskom or in partnership with it might well encourage operational efficiencies that Eskom is unable to realise. They would help reduce the operational risks that are associated with electricity generation and distribution in SA that is now the responsibility of a single management team. However such partnerships would bring with them higher costs of finance.

However if the RSA judges (incorrectly we would say) that it lacks the financial capacity to fund Eskom, even though the



investment made economic sense there would still be no good reason to overcharge for electricity to realise more abundant cash flows as a financial alternative to raising debt.

One solution to the perceived financial constraints on Eskom's expansion would be to raise the necessary funds for additional capital formation by selling off power stations on the Eskom balance sheet. The power stations sold off would command a value proportionate to the prices these new owners would expect to receive for electricity generated and the operating profits they would consequently earn. A similar valuation exercise would determine the value of any equity stake in an individual power station or in Eskom as a whole.

This expected price would largely determine the value of all existing capacity (assuming the direct costs of operations were similar) It would also make every sense to improve the look of Eskom's balance sheet by revaluing the assets on its books in line with these improved market values.

However given the uncertainties inevitably associated with such a process and the novelty of bringing in equity or other partners into its business it is very likely that the return on capital expected by any potential outside partner for Eskom would have to command a risk premium significantly higher than the 10-11 per cent return we regard as appropriate for Eskom itself or for the RSA as the provider of finance to it.

It appears that outside investors would be looking for returns of at least 14% per annum. If so selling off a share in Eskom at the right price for electricity – one designed to produce an expected return of 10-11 per cent - would prove an expensive option for the RSA as the shareholder. That is to say either Eskom would receive less for the generating capacity it sold off- or consumers would have to be overcharged to provide equity or other partners with the higher required returns.

There is however a further alternative that would combine the advantages of low costs of finance potentially available to the RSA as the source of funds for Eskom – or as guarantor of funds raised by Eskom on its own account - with the operational efficiencies to be gained from introducing other independent managers into the system.

We consider these alternatives below after we report on our simulation exercise that was designed to reveal the right price for electricity in SA – one that would be consistent with a 10- 11 per cent return on capital invested in a new power plant. With this exercise we are able to estimate the return on capital as well as the financial implication of a range of charges.

*The assumptions and results of the simulation exercise summarised*

Critical to any calculation of the *right price* for electricity is the estimate of the direct cost of producing electricity in South Africa. The key assumptions are made clear by the spread sheet and can be altered by way of a sensitivity analysis. We also provide an idea in the spread sheet of the cash flows that would be generated by the Power Station over its life for different prices, interest rates and debt ratios

We have assumed a direct cost of R240 per megawatt hour MWH of electricity generated (charges are made for fuel, O&M and management overhead). After a full investigation and after consultation with expert engineering opinion and with regard to costs incurred in the US by coal fired utilities, we are confident that this is a conservative estimate of the direct costs. For revenue generating purposes we have assumed the station runs at an 85% capacity utilisation rate. We have assumed the 4800MW plant has a capital cost, including interest capitalised during construction, that takes five years of R156b in money of

the day. All calculations are conducted in money of the day rather than real after inflation terms.

The exercise undertaken in the spread sheet is to simulate for different possible prices per KWH to establish the prices that would make economic sense. The *right price* for electricity in our judgment is the price that would yield a Net Present Value of about zero for a new power station given a cost of capital or discount rate of 10-11 per cent per annum. Or alternatively the price that would provide an internal rate of return of about 11% per annum from the project .

The present value of the plant with a current cost of R156b and an economic life of 40 years is established by discounting operating profits or Earnings before interest, depreciation and taxation at 10% per annum. The 10% is judged to be the opportunity cost of capital employed for reasons indicated above. Revenues and direct costs are escalated in the base case at the rate of 6 per cent per annum.

This 6% pa escalation rate is in line with the inflation compensation currently available in the RSA bond market. Six per cent is approximately the difference between RSA inflation linked bond yields- around 2% real and the equivalent long dated vanilla bonds that offer about 8% per annum.

The internal rate of return is the rate of discount applied to the operating cash flow that would provide a zero NPV given the R156b cost of the plant and equipment. As may be seen from the spread sheet the right price would be a current price per KWH of about 45 cents per KWH. A price of 50c escalating at 6 per cent per annum per KWH generates a more than satisfactory IRR of over 11%

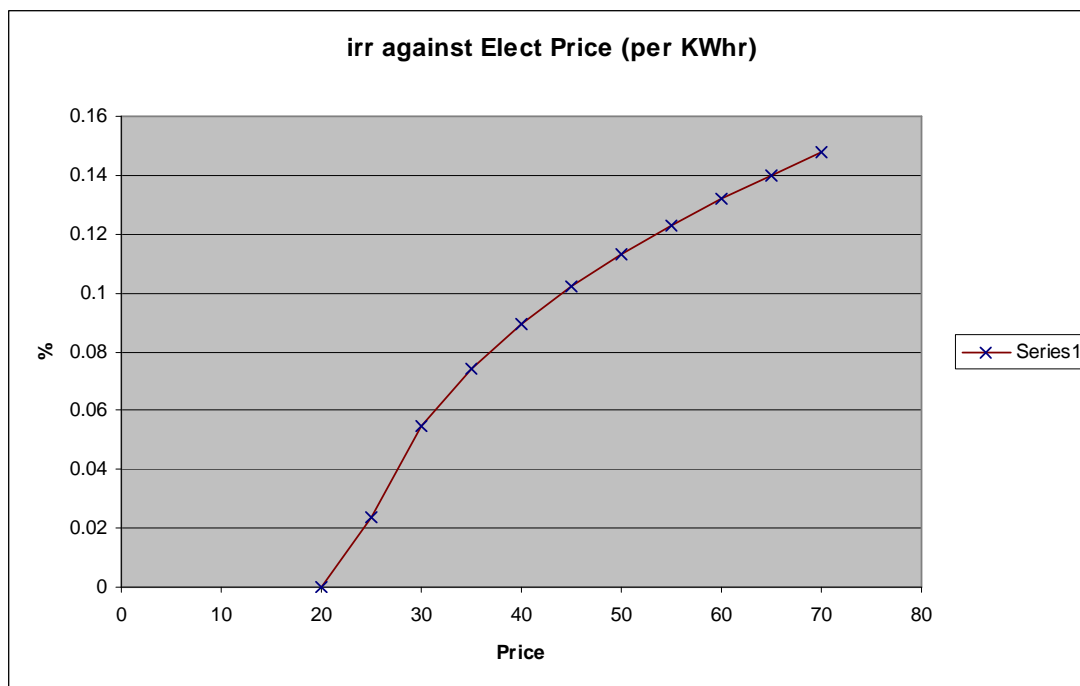
The results of the simulation exercise for an investment in new generating capacity of R156b are summarised below

Price per KWhr	Present Value
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20 c	-R 4.22 bn.
25 c	R 29.16 bn.
30 c	R 62.54 bn.
35 c	R 95.92 bn.
40 c	R 129.30 bn.
45 c	R 162.68 bn.
50 c	R 196.06 bn.
55 c	R 229.44 bn.
60 c	R 262.82 bn.
65 c	R 296.20 bn.
70 c	R 329.58 bn.

Price per KWhr	Irr%
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20 c	0.0%
25 c	2.4%
30 c	5.5%
35 c	7.4%
40 c	9.0%
45 c	10.2%
50 c	11.3%
55 c	12.3%
60 c	13.2%
65 c	14.0%
70 c	14.8%



**Are Eskom’s latest proposals sensible? Applying the model.**

Eskom has indicated more recently that it will be applying for a 35% increase in its tariff with further increases of 35% per annum in 2011 and 2012. This would take the charge from the current 33 cents to approximately 45c per kilowatt hour (KWH) in 2010 with further large increases to follow.

This 45c per KWH charge in 2010 may be seen to be in line with our own estimation of the price that would justify investing in a new power station. Allowing for price and direct cost escalations of 6% pa before and after the plant was commissioned we indicate that a 45c per KWH charge would deliver an internal rate of return on the project of about 11% pa—a return that we would regard as more than satisfactory for an investor in a low risk electric utility.

Eskom has also indicated that it is looking for a 30 per cent equity partner to help it fund its Kusile project, estimated to cost R142b. The question is then how much would an equity partner be prepared to pay for a 30% stake in a new power generating

plant in SA? The answer of course would depend on the price expected to be charged for electricity as well as the required rate of return. We have therefore applied our model to estimate how much an outside investor would pay for a share in the operating profits delivered by a new power station.

Our calculations indicate that in year six, when the new R156b power station would start generating power and revenues, the operating profits, that is to say cash flows before interest depreciation taxation and amortisation, would be of the order of R11b. That is given a current KWH charge of 45c rising by 6% per annum to about 63 cents by year six. Operating costs are also assumed to escalate at 6% per annum. And so the question reduces to the following one. What would be the market value of a 30 per cent share of R10.6b per annum available in six years time that would rise with inflation for 40 years?

We have suggested that the required rate of return or cost of capital (after taxes) on a new power station for some outside investor would have to be of the order of 14% per annum. If so at an assumed 45c per KWH with charges and costs escalating at 6% per annum, a 4800MW station on line in six years time would have a present value to the outside investor of about 100b.

Thus if we are on the right lines about the price to be charged here an outside investor would pay about R33b today for 30% of the R10-R11 to be generated in year 6. Eskom apparently is looking for 40 billion for this 30 per cent stake.

An alternative way of looking at the issue is to estimate the price per KWH that would cover the costs of a new power station of R156b using a discount rate of 14%. The answer is a price of 65 cents per KWH today, also escalating at 6% per annum. Thus if the price were regulated to 45c per KWH on the basis of a 10% return on capital Eskom shareholders- that is the RSA would receive but R33b in exchange for 30% of a new station. If consumers were to be charged enough (65c) to provide a 14%

return on capital for investors, the new plant would command a value of R156b and a third share would then command approximately R50b or R17b more. The consumer's loss becomes the taxpayers gain on the sale of a stake in Eskom.

*The right way to value operating profits from Eskom.*

But this perhaps is not the right way to think about the issue. The better way would be to ask what institutional investors would pay for direct access to the inflation linked cash flows generated by Eskom. That is instead of inviting an equity partner in a new station, Eskom (back ranked by the RSA) would issue a contract (bond) guaranteeing institutional investors a share of the inflation linked cash flow, expected to be generated by the new power station.

Such a contract would then presumably be valued completely in line with other inflation linked RSA bonds. These, as indicated currently trade in the bond market, at about a real 3% yield. In very broad brush terms, for every inflation linked R10b of cash flow expected to be realised by Eskom operations and guaranteed by the SA government, could be worth, in the right financial package, 33 times as much or R330b at a 3% real rate of discount or return.

Institutional investors in SA and abroad have proved to have a very healthy appetite for inflation linked income- especially inflation linked income guaranteed by the tax base, which could be used to back up Eskom's own income statements. Another way of understanding this option is to think of it as a toll on Eskom's future income that is capitalised and sold off to the market

Eskom and its only shareholder the RSA would be doing the SA taxpayer a grave disservice if they do not think thoroughly and creatively about how best to put the RSA balance sheet

combined with the income to be generated by Eskom to best use.

*Conclusion- the rewards of consistent thought about economics and finance*

The financial differences between putting the RSA balance sheet behind Eskom and to leaving Eskom to its own financial devices is a very large one as we have illustrated. Furthermore attempting to close this financial gap with higher charges, rather than debt finance on the best possible terms, means unnecessarily expensive electricity to the great disadvantage of not only SA households but its mines and industries that should be able to look to economically sensible, but still comparatively low energy costs as among its advantages.

Moreover this financial difference of the large order large one – more than wide enough to hire the best utility management in the world – or to contract out for an attractive fee, the management of any new power station to management they could have every confidence in.

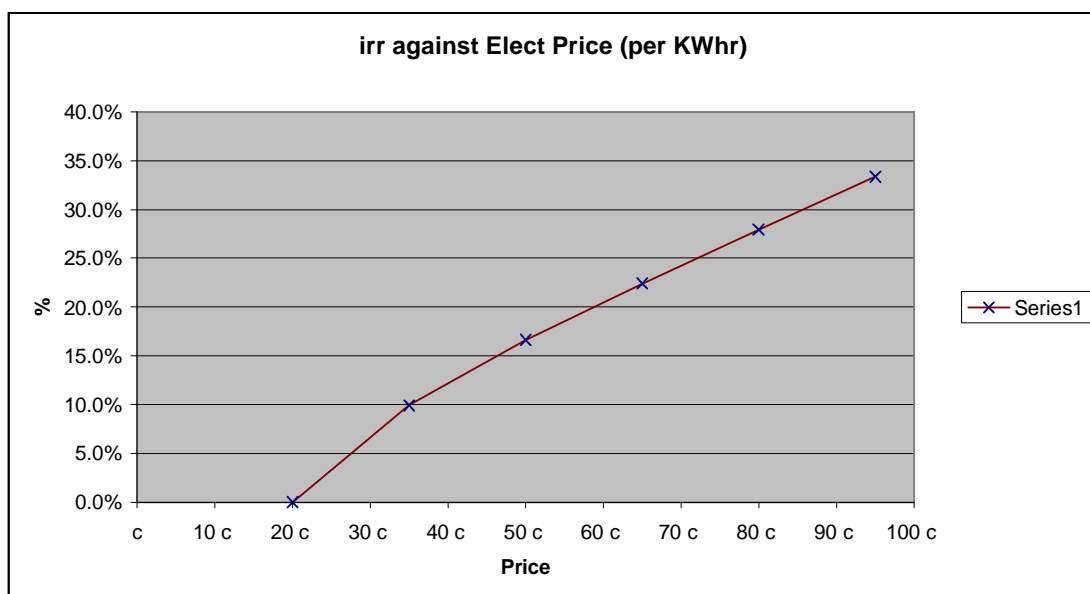
A further point should be made about the financial capacity and balance sheet strength of Eskom. The KWH charge applies not only to new power stations in SA- it applies equally to all the established capacity. This apparently runs at about 40,000MHW or about 10 times the capacity added by a new power plant of the kind contemplated. In very broad brush terms we can therefore present value, not only of a mere R10b of extra inflation linked operating profits or cash flow to be generated by a new power station, applying a 45cents KWH charge, but about 10 times as much operating profit earned by Eskom's total generating capacity.

In other words if Eskom were to be treated in accounting terms, as are property companies and was to revalue its generating capacity and operating profits at a 10% capitalisation rate, we



would observe a company with assets of perhaps well over a trillion rand. If so it would present low rather than high debt ratios.

The point to be taken is that narrowly based accounting notions, especially the historic book value of Eskom's assets, or an artificial separation of the Eskom balance sheet from that of the Republic of South Africa – should not be allowed to influence either Eskom's tariff. Nor should a lack of understanding of financial economics be allowed to inform how Eskom's additional capacity is best financed. What is required is a full realisation of the true cost of generating additional electricity in SA and a full appreciation of the opportunity to finance such an expansion of generating capacity on the best possible terms. This means putting the RSA behind Eskom in a sensible way to take advantage of its low costs of finance and to establish a price for electricity that provides cost of capital returns.



**Table of internal-rate-of return wrt Price and First-ten-year-price-escalation**

		Escalation in price for FIRST 10 years (then 6%)				
		4%	5%	6%	7%	8%
Price per KWhr	20 c	Neg return	Neg return	Neg return	Neg return	4.0%
Price per KWhr	35 c	4.7%	7.5%	9.9%	12.1%	14.2%
Price per KWhr	50 c	12.1%	14.4%	16.6%	18.9%	21.1%
Price per KWhr	65 c	17.5%	20.0%	22.4%	24.9%	27.4%
Price per KWhr	80 c	22.5%	25.2%	27.9%	30.7%	33.6%
Price per KWhr	95 c	27.4%	30.3%	33.4%	36.5%	39.6%