
# On the Real Exchange Rate Effects of Higher Electricity Prices in South Africa

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# On the Real Exchange Rate Effects of Higher Electricity Prices in South Africa*

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**Abstract**

The paper uses a static Computable General Equilibrium (CGE) model of South Africa and simulates various shocks to the price of electricity. We attempt different closures to the model and compare their respective effects on the Consumer Price Index. In a CGE model, this is measuring the real appreciation of the exchange rate, or international trade competitiveness. In general, we conclude that electricity prices *per se* does not significantly influence the real exchange rate, regardless of which closure is used.

JEL codes: D5, E3,H2

## 1 Introduction

Few would deny the importance of electricity as an essential input to production and to economic activity in general. Since changes in electricity prices impact every person in South Africa, it is important to determine the effect on the real exchange rate in South Africa. Salvatore (2004) defines the real exchange rate as the nominal exchange rate multiplied by the foreign Consumer Price Index (CPI) divided by the local CPI. In our model, both the nominal exchange rate and foreign prices are exogenous (and therefore constant, unless shocks occur), so that movements in the domestic CPI show exactly the inverse of the movements in the real exchange rate. The paper starts with an overview of electricity prices in South Africa, and concludes with an empirical analysis using a Computable General Equilibrium (CGE) model.

## 2 Overview of electricity prices

### 2.1 International comparisons

Relative to international electricity prices, electricity in South Africa is sold at the second cheapest rates, beaten only by New Zealand (Doppegieter *et al.*, 1999). This is shown by the fact that the cost of electricity as a percentage of total cost to company is very low, in most cases less than 5 per cent, while electricity's contribution to Gross Domestic Product (GDP) is only approximately 3,5 per cent. It is therefore not surprising that the demand for electricity is relatively insensitive to changes

*The paper originated from a brief study for the National Electricity Regulator (NER) (later, the National Energy Regulator of South Africa (NERSA)). The findings of the study showed that higher electricity prices caused very small inflationary effects. We would hereby like to thank the NER for their financial support and stress that the contents of the paper do not, in any way, reflect the views of the NER, but only those of the authors. We would also like to thank Mark Horridge at the Centre of Policy Studies in Melbourne for valuable comments.

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in price, as measured by the elasticity of demand. The implicit financial subsidy on electricity prices is clearly shown in Table 1, which gives an international perspective on electric power prices. South Africa's US$0.01/kWh price on electricity for industry is matched by no other country and only India (US$0.04/kWh) comes close to the retail prices of electricity for households of US$0.03/kWh charged in South Africa. The average international price of electricity for industrial use in 2004 was $0.10/kWh for upper-income countries and $0.06/kWh for developing countries. For household use, the average international price of electricity for upper-income countries was $0.14/kWh, and $0.09/kWh for developing countries.

INSERT TABLE 1 HERE

## 2.2 Trends in electricity prices

One can clearly see from Table 2 the large differences in electricity prices among different users in South Africa. In 2004, Households (38.7 c/kWh) and Agriculture (30.8 c/kWh) paid the highest rates for electricity, whereas Manufacturing and Mining continued to pay much lower prices (13.97 c/kWh and 15.36 c/kWh respectively) - less than half of what domestic users paid. One reason for this is that the number of clients serviced in the Residential sector is much larger than the number of clients serviced in the Manufacturing and Mining sectors, who consume about 65 per cent of total electricity. This indicates that Manufacturing and Mining receive bulk sales at lower prices.

INSERT TABLE 2 HERE

In general, electricity prices in South Africa have declined in real terms since 1991, when Eskom announced its *price compact* with the conviction that cheap electricity was essential for rapid economic growth (Van Horen, 1996). Under the *price compact,* Eskom undertook to decrease the real price of electricity substantially. Table 3 shows that the real price of electricity for all sectors declined by 11 per cent, whereas the real price for the industrial sector decreased by 25 per cent over the period 1970 to 2005. Since 1990, the price of electricity for all sectors declined by 43 per cent, while for Manufacturing, the price dropped by 53 per cent.

INSERT TABLE 3 HERE

The relatively low electricity prices could be attributed to a number of factors. Eskom enjoyed relatively low production costs in terms of the value of its key inputs (coal), and hence a low marginal cost of production – only operations (estimated to be between 4 c/kWh and 5c/kWh). This allowed Eskom fairly high average profit margins.

Figure 1 illustrates Eskom's announced and effective price adjustments since 1995. The announced price increases are the increases approved by the National Energy Regulator of South Africa (NERSA). The effective price increases illustrate the actual increase that occurred during a year, as reflected in Eskom's balance sheet for the relevant year. The difference between announced and effective increases is due to the difference between projected and actual sales, as well as structural changes to prices. In 1995, 2000, 2002 and 2006 the effective price increase experienced was above the price increase granted.

INSERT FIGURE 1 HERE

Table 4 shows the percentage change in Eskom's average prices per customer category after each annual price adjustment during the period 1994 to 2002.

INSERT TABLE 4 HERE

As shown in Table 4, in nominal terms, prices in general had an upward trend. However, if this is compared with the effective annual price increase, it is evident that these increases did not necessarily follow a general upward trend, except for the last couple of years. As stated before, these price changes originated from a fairly low base and, as such, represented marginal changes with a fairly high level of volatility.

#### 2.2.1 2.3 Electricity consumption

The sectoral distribution of electricity consumption in South Africa provides some insight into the relative importance of each sector in terms of consumption. Figure 2 illustrates the relative consumption for the following sectors: Residential, Commerce, Agriculture, Transport and Industry, using the Department of Minerals and Energy price report data set.

INSERT FIGURE 2 HERE

From Figure 2, it is evident that the bulk supply of electricity to municipalities (which include Residential, Industrial and Commercial demand for electricity) comprises the largest component of electricity consumption, followed by the Agriculture and Transport sectors. It is important to note that these sales reflect the direct sales of Eskom to these sectors.

INSERT FIGURE 3 HERE

Figure 3 shows that there is a relationship between electricity prices and the two most studied price indices, namely the CPI and the Producer Price Index (PPI). However, the CGE model is not well-suited to comment on the causality of these relationships, since it is a relative price model. The important point to note from Figure 3 and Table 5 is that electricity prices have generally increased by less than the inflation rate in most time periods, while Eskom would have preferred that they could increase prices to stay in sink with inflation.

INSERT TABLE 5 HERE

To enable a more detailed analysis of the impact of a change in electricity prices on the real exchange rate of South Africa, different scenarios are analysed using a CGE model. Since a CGE model takes into account all inter-industry adjustments, including a decline in demand, before it arrives at an equilibrium price level, the results are different from those of partial equilibrium models that simply multiply a change in price with the CPI weight associated with electricity. Partial analysis models usually assume that demand remains constant irrespective of changes in the level of the price and is clearly inconsistent with economic theory. In such models, the effects of price increases will be over-estimated.

# 3 Data and Model

The data used in the paper are the official 1998 Social Accounting Matrix (SAM) of South Africa, developed by Statistics SA (StatsSA, 2001). The SAM divides households into 12 income groups and 4 ethnic groups, and distinguishes between 27 sectors. The elasticities used for the Constant Elasticity of Substitution (CES) functions in the model have been taken from De Wet (2003), who estimated the elasticities using time-series data.

The model is the static CGE model of the Department of Economics at the University of Pretoria, called UPGEM. It is similar to the ORANI-G-model of the Australian economy, and is written and solved using GEMPACK, a flexible software system for solving CGE models (Harrison and Pearson, 1996). In general, the model allows for limited substitution on the production side while it focuses on substitution in consumption. It is a static model with an overall Leontief production structure and CES sub-structures for (i) the choice between labour, capital and land; (ii) the choice between the different labour types in the model; and (iii) the choice between imported and domestic inputs into the production process. Household demand is modelled as a linear expenditure system that differentiates between necessities and luxury goods, while households' choices between imported and domestic goods are modelled using the CES structure.

## 3.1 Assumptions

We model both the short-run and long-run effects of an increase in the price of electricity. The standard closures[1] are described here, but in the scenarios that we model, we make slight adjustments

[1] We use the word "closure" to indicate which variables in the model are exogenous.

to the closures in our quest to understand the impact of electricity price increases. In the short-run, the capital stock is assumed to be fixed, while the rate of return on capital is allowed to change. The labour market is modelled in the typical ORANI way, which assumes fixed real wages in the short-run, and an infinite supply of labour at the given real wage. This is a fairly realistic assumption of the South African labour market with its large unemployment of unskilled labour. The supply of land is also assumed inelastic. In the long-run, the real rate of return on capital is fixed, with capital being allowed to adjust, while employment is fixed, with adjusting real wages.

With reference to the macroeconomic variables, it is assumed that aggregate investment, government consumption and inventories are exogenous, while consumption and the trade balance are endogenous in the short-run. It differs slightly from the ORANI assumptions of fixed real household consumption in the short-run, because this specification allows us insight into the effect of the suggested policies on South Africa's consumption and competitiveness. In the long-run, we follow the usual ORANI closure with C, I and G[2] endogenous, and the Balance of Trade exogenous[3]. All technological change variables and all tax rates are exogenous in the closure. Finally, the nominal exchange rate is set to be the numeraire in each of the simulations.

The focus of the paper is the impact of electricity prices on the real exchange rate, as measured by the CPI variable in our model. To shed light on this question, various shocks to the model are implemented, while altering some key assumptions about employment and consumer behaviour.

# 4 The Scenarios

Eleven simulations are run to determine what the influence of the following variations in the assumptions would be on the results:

1. the difference between being able to set the price of electricity and raising a tax on electricity;
2. the difference between a tax on households only, versus a tax on intermediate and final use of electricity;
3. the difference between fixed real consumption and the standard closures;
4. the difference between fixed real wages and fixed nominal wages in the short-run; and
5. the effect of electricity price increases in the long-run.

In variation (i), we compare the situation where the government levies an additional tax of 10 per cent on the price of electricity with the one where the electricity industry increases its own price by 10 per cent. A CGE model has endogenous prices, i.e., they are determined by the model and could in general not be "set" by anyone. Usually prices can only be affected through some exogenous shock to the model, or in other words, through a manual change to some variable that is not endogenous. Therefore, to be able to set the price of electricity, we need to change the closure of the model by making the price of electricity exogenous and another variable endogenous. The only possible way to do this is to endogenise the amount of production taxes paid by electricity, or some cost variable. The (neo-classical) model does not allow excess profits to any industry, so the only way that they can actually do this is by either paying more taxes or experiencing higher costs. Therefore, in principle, it does not matter who increases the price of electricity – the government or the electricity industry – the effects will be similar.

In variation (ii), we isolate the effect of a tax on only household consumption of electricity. In general, industries pay much less for electricity than households, and some industries would often be exempted from price increases. Hence, it is necessary to isolate the effect of a price increase on

[2] From the well-known macroeconomic equation Y = C + G + I + X – M.

[3] No country should have continued trade deficits or surpluses in the long-run.

households. In this scenario, we model the extreme case where all industries receive a special deal from the electricity industry, while only households are targeted to pay more for electricity.

Variation (iii) is a comparison between the ORANI standard short-run closure and the closure we use in the paper, described above. In ORANI, household consumption expenditure is held fixed in real terms in the short-run, alongside G and I. Only the trade balance is allowed to vary. We compare two ways of modelling household behaviour. Do households try to keep their real consumption levels constant in the short-run, or would they allow nominal consumption expenditure to vary with nominal wage income? The former means that they keep total real spending on consumption constant, while the latter means they react to the price increase in electricity by altering the quantities consumed of all commodities, while also adjusting total expenditure. We study the effects of the two scenarios and comment on the results below.

A key assumption of many CGE models for the short-run is fixed real wages. In variation (iv) from the standard closure, we compare the situation where real wages are held fixed with the one where nominal wages are held fixed. If something bad happens in the economy, such as a new tax, and real wages are fixed, then firms will be inclined to lay off workers. By keeping nominal wages fixed in the variation, we assume that firms would rather lower real wages than lay off workers. Firms cannot continue to pay the same real wages and simultaneously employ the same number of workers when their costs increase. They must reduce either real wages or employment, or a combination thereof. By allowing real wages to change, we allow a price effect. If they are kept constant, we expect to see a quantity (number of workers) effect.

The final "variation" is actually the standard long-run closure. We are interested to know what the effects of a rise in the electricity price would be in the longer run. In our modelling terms, we allow the capital stocks of all industries in the economy to vary, while keeping employment constant. In this way, we are able to compare the effects that labour and capital have on the economy in general.

# 5 The Results

## 5.1 Increase in administered prices versus an increase in taxes

The highest increase in the real exchange rate was found when both the households and firms are paying more for electricity, and when we hold real household spending and real wages fixed at the same time. The results of the first variation are presented in Table 6 for thirteen variables, of which the CPI is the focus of the paper[4]. However, we are convinced that the influence of electricity prices extends far beyond relative prices, and therefore also comment on the effects of electricity prices on other variables. We list the relevant scenarios in the columns, and report on the macroeconomic outcomes of significant variables in the rows.

In Table 6, zeros appear in the first three rows of all the short-run simulations, which indicates the initial assumption about domestic absorption on the macroeconomic level. The exceptions are the scenarios where nominal household spending is a function of wage income. The whole third last row is also filled with zeros, because import prices (PIMP) are assumed exogenous – South Africa being a small open economy that cannot influence world prices.

INSERT TABLE 6 HERE

Comparing the simulations that start with "f0" to the "p1's" (see the notes below Table 6), provides interesting but intuitive results. Levying a tax of 10 per cent on electricity is like shifting one of the curves in a two dimensional graph of supply and demand: the new equilibrium price of electricity will be less than 10 per cent higher due to the elasticities of demand and supply (it turns out to be 7 per cent higher). However, with the price-simulations, we force the new equilibrium

[4] In a CGE model with nominal exchange rate fixed, the CPI is measuring real appreciation, or international trade competitiveness.

price of electricity to be 10 per cent higher, despite the values of elasticities. Hence, we find from Table 6 that the changes in CPI are larger in absolute value for all the price-simulations than for the tax-simulations. The initial impacts on electricity prices are forced to be larger, and this effect works through the price system and influences all the price indices in the economy (see PINV, PGOV, etc., in Table 6).

## 5.2 Increase in household consumption only versus an increase in intermediate use as well

The second pair of scenarios to be compared concerns the taxpayers. The results are presented in Table 7, and the effect on CPI depends not only on the subject of the taxpayer, but also on the assumption about consumer behaviour. If real consumption is held fixed (zeros in row one of Table 7), then a tax on both industries and households leads to a higher increase in CPI. However, if nominal consumption follows nominal wage income, a tax on only households leads to a higher increase in CPI.

INSERT TABLE 7 HERE

## 5.3 Fixed real household consumption versus nominal consumption as a function of nominal wages

With all pairs of simulations, the CPI is higher when real consumption is forced to stay constant. Real consumption (CONS) always decreases if it is endogenous, no matter who pays the taxes. So, if we force real consumption to stay constant, it is higher than otherwise, with upward pressure on prices. With real consumption fixed; we are forcing households to keep their total spending constant in real terms. However, this does not mean they have to consume the same amount of electricity. Their demand for electricity decreases, but the demand for other commodities increases, since other commodities have become relatively cheaper than electricity. This increase in demand puts upward pressure on the CPI, between 0.204 and 0.29 per cent (columns 7 and 8 in Table 7). However, if firms also pay the tax, their costs increase and they will increase the prices of all commodities, which will increase the CPI variable by between 0.24 and 0.34 per cent (columns 3 and 4).

With household consumption adjustable, it is clear from the first row in Table 7 that real consumption decreases with a tax on electricity. It decreases more if industries also have to pay the tax, because then the prices of all commodities will be inclined to rise. In fact, we see that the first two columns on the left show a slight decrease in CPI, since consumer demand has fallen enough to contract prices in the economy. If only households pay the tax, the higher price of electricity has a positive effect on the CPI. Only the price of electricity increases and consumers therefore only slightly decrease their total demand.

## 5.4 Fixed real wages versus fixed nominal wages

With all pairs of simulations, keeping the real wage fixed leads to larger movements in the CPI (compare n-simulations with r-simulations in Table 8).

INSERT TABLE 8 HERE

Fixed real wages imply that firms have to increase nominal wages at the same rate as the CPI, whenever they experience a cost increase. They will react to this by laying off workers. This is clear from the last row in Table 8 in all the columns that show increases in CPI – employment decreases more with real wages fixed than otherwise. Production of commodities in the short-run depends on the amounts of capital, land and labour employed, as well as technology. Only labour can change in the short-run, so GDP will also decrease more if real wages are fixed (see the fourth row in Table 8). A decrease in supply, given a certain demand, puts upward pressure on prices. Hence, with real

wages fixed, labour is laid off, which decreases supply and puts upward pressure on prices. The reverse of the argument would be true when the CPI decreases; this is confirmed in Table 8 as well.

### 5.5 Long-run effects

The final set of simulations to be discussed is the effects of tax or price increases in the long-run. The long-run is characterised by a flexible capital stock, endogenous domestic demand, and an exogenous balance of trade. The results of three simulations are presented in Table 9. The last and third last rows contain zeros to indicate the assumptions of given world prices and exogenous employment growth respectively. The three columns to the right (copied from Table 8) are the short-run equivalent scenarios of the three long-run scenarios to the left of Table 9.

INSERT TABLE 9 HERE

Once again the results are interesting, and they confirm some of the short-run conclusions outlined above. The highest increases in CPI would be experienced when a tax is levied on households only, while an increase in the administered price would have a smaller effect than a tax on intermediate and household consumption. In the majority of scenarios depicted in Table 9, we see increases in CPI together with decreases in GDP. In a simple supply and demand diagram, this would only be possible if supply shifts to the left and demand does not change enough to offset the fall in supply – positive or negative.

In the long-run, real wages are flexible, as well as household consumption, so that we only need to explain three pairs of comparisons: (i) why we do have increases in CPI in the long-run, while similar assumptions in the short-run lead to lower prices; (ii) why a tax on only households leads to larger increases in CPI, and (ii) why using an administered price leads to lower increases in CPI than a tax.

Firstly, the values for CPI are higher in the left three columns than for the similar short-run situations on the right. Our assumptions about the macroeconomic variables on the demand side mainly drive the results. In the short run, the changeable variables are consumption expenditure and the trade balance, while in the long-run, the trade balance is fixed, and C, I and G are allowed to change. Investment decreases as firms demand less capital in the long-run. Government consumption moves with household consumption by assumption (the percentage changes are the same in Table 9); the movement is one that decreases, due to the rise in commodity prices. In both the short-run and the long–run, GDP decreases due to a decrease in employment of labour. Total demand must follow, and in the short-run, there is a large decrease in household consumption, the only component of Gross National Product (GNP) that can change and which has an influence on the CPI. In the long-run, all three components of GNP can change, so that we find much smaller decreases in demand by households, and less downward pressure on CPI. In terms of our virtual graph of supply and demand, household demand changes less in the long-run, and has a smaller offsetting effect on the increase in prices that are experienced due to a fall in supply.

Secondly, the increase in CPI is higher in both the long- and short-run if only households are taxed, given that household consumption and real wages are also flexible. A tax on firms increases their costs and forces them to employ less labour than before. They employ less capital and decrease production. From Table 9, it is clear that GDP decreases when firms are included in the tax, while it almost does not change when only households are taxed. This results in a large decrease in total demand in the long-run, with downward pressure on prices. Moreover, if we look at the fourth row in Table 9, we see that exports differ markedly between the two scenarios. When firms are included in the tax on electricity, they increase the prices of their goods (actually the market does, since prices are determined by marginal cost in the model), including the prices of exported goods. The result is that export demand also falls to strengthen the demand effect. If only households pay more for electricity, a decrease in demand leads to lower prices of some commodities, which stimulates export demand to counteract the falling demand effect of the tax, and hence counteracts the decrease in CPI as well.

Thirdly, in both the long- and the short-run, CPI ends up lower if an administered price is used to model the change in the price of electricity, than with a tax. If we compare the values of macro demand quantities in the first four rows of Table 8 the administered price leads to larger decreases in demand because the initial shock to electricity prices is larger. The same argument holds as in the previous discussion, namely that the larger decrease in total demand leads to lower increases in CPI than would be the case if the decrease in total demand had been smaller.

# 6 Conclusion

The main conclusions from the modelling exercises are:

- Electricity price increases have mostly negative effects on the economy. All industry production decreases in the short-run (GDP declines as well), while many industries are also worse off in the long-run.
- Poorer groups are affected in a worse manner than other groups; price increases should be carefully chosen. The most efficient policy is not necessarily the most equitable policy.
- While some industries enjoy the benefits of exemptions, the consumers and industries who are not exempt have to bear the costs of those exemptions, i.e., if some industries face lower increases in prices, other industries and final consumers that face higher increases in prices would obviously be worse off. The latter industries would then face a greater negative effect, than in instances where all industries pay the same price increase.
- When foreign consumers of electricity pay less than domestic consumers, there is cross-subsidisation from the domestic consumers to the foreigners. In general, exports and the foreign markets determine what the industry results would be if electricity prices increased. The effect on the terms of trade and balance of payments is important – export-driven sectors are particularly vulnerable to an electricity price hike.
- Some sectors, such as the Iron and Steel industry, are sensitive to a change in electricity prices. Electricity makes up a large proportion of their input cost, with the result that any increase in the price influences their cost significantly. Moreover, these industries are export-driven, thus higher costs adversely affect their competitiveness in the world market.
- In the model, the effect on the CPI, and therefore on the real exchange rate is generally very small. The South African Reserve Bank warned against inflationary effects of higher electricity prices, but we did not find significant effects in this regard.

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# TABLES AND FIGURES

*Table 1: Retail electricity prices: International comparisons, 2004*

| Upper-income countries | | | Developing countries | | |
|---|---|---|---|---|---|
| | **Electricity for industry** | **Electricity for households** | | **Electricity for industry** | **Electricity for households** |
| | **US$/kWh** | **US$/kWh** | | **US$/kWh** | **US$/kWh** |
| Australia | 0.36 | 0.06 | Czech Republic | 0.06 | 0.09 |
| Belgium | - | - | Greece | 0.06 | 0.11 |
| France | 0.05 | 0.14 | Hungary | 0.09 | 0.13 |
| Germany | 0.05 | 0.14 | India | - | 0.04 |
| Italy | 0.15 | 0.20 | Korea | 0.05 | 0.07 |
| Japan | 0.12 | 0.17 | Mexico | 0.06 | 0.10 |
| Netherlands | - | 0.22 | Poland | 0.06 | 0.10 |
| New Zealand | 0.05 | 0.12 | Slovak Republic | 0.08 | 0.12 |
| Spain | 0.05 | 0.11 | **South Africa** | **0.01** | **0.03** |
| United Kingdom | 0.06 | 0.13 | Taipei | 0.05 | 0.07 |
| United States | 0.05 | 0.08 | Turkey | 0.09 | 0.10 |
| **Average** | **0.10** | **0.14** | **Average** | **0.06** | **0.09** |

*Source: International Environmental Agency (2004).*

*Table 2: Overview of electricity prices & sales in South Africa, 1992-2004*

| | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **Electricity consumption in GWh** | | | | | | |
| Manufacturing | 42,122 | 43,681 | 43,014 | 47,481 | 55,073 | 61,070 | 72,663 | 70,796 | 70,665 | 74,778 | 83,581 | 78,796 | 101,556 |
| Mining | 33,962 | 32,026 | 32,668 | 33,176 | 34,831 | 30,390 | 29,204 | 28,877 | 29,038 | 31,691 | 32,204 | 30,793 | 32,828 |
| Transport | 4,629 | 4,017 | 4,389 | 4,297 | 4,274 | 4,563 | 4,639 | 4,429 | 5,411 | 5,562 | 6,246 | 5,565 | 6,302 |
| Agriculture | 4,038 | 3,108 | 4,880 | 5,301 | 5,103 | 5,640 | 5,627 | 5,755 | 3,954 | 4,175 | 4,644 | 5,142 | 6,158 |
| Commerce | 17,484 | 13,586 | 14,058 | 17,307 | 19,768 | 22,170 | 13,974 | 17,709 | 17,164 | 18,301 | 18,227 | 21,071 | 24,990 |
| Residential | 24,253 | 21,542 | 22,115 | 24,369 | 29,552 | 30,722 | 30,163 | 29,511 | 28,680 | 34,623 | 30,418 | 34,074 | 36,231 |
| **Total** | **126,488** | **117,960** | **121,124** | **131,931** | **148,601** | **154,555** | **156,270** | **157,077** | **154,912** | **169,130** | **175,320** | **175,441** | **208,065** |
| **Eskom revenue in c.kWh** | | | | | | | | | | | | | |
| Manufacturing | 8.17 | 8.35 | 8.91 | 10.4 | 10.1 | 10.78 | 11.02 | 10.56 | 11.94 | 11.56 | 12.88 | 14.16 | 13.97 |
| Mining | 8.79 | 9.52 | 10.11 | 10.62 | 11.02 | 11.66 | 12.22 | 12.61 | 12.91 | 13.35 | 14.14 | 15.07 | 15.36 |
| Transport | 12.44 | 13.7 | 14.31 | 14.65 | 15.31 | 15.04 | 14.9 | 15.19 | 15.35 | 15.69 | 17.15 | 18.98 | 19.37 |
| Agriculture | 17.14 | 19.84 | 21.13 | 21.99 | 23.39 | 24.66 | 26.42 | 26.58 | 28.88 | 26.85 | 26.47 | 29.14 | 30.83 |
| Commerce | 15.57 | 16.46 | 17.43 | 18.65 | 19.49 | 20.23 | 18.85 | 22.27 | 22.64 | 17.95 | 19.51 | 20.62 | 21.88 |
| Residential | 15.27 | 12.68 | 16.76 | 18.15 | 19.45 | 21.33 | 22.74 | 25.36 | 27.7 | 30.9 | 33.43 | 36.58 | 38.7 |
| **Average** | **9.16** | **10.14** | **10.26** | **11.15** | **11.3** | **11.95** | **12.29** | **12.44** | **13.23** | **13.76** | **14.98** | **16.05** | **16.04** |

*Sources: DME (2006); DME (2005).*

*Table 3: Real electricity prices in South Africa, 1970-2004/5 (2000=100) (c/kWh)*

| | Ave: all sectors | | Industrial | | | Ave: all sectors | | Industrial | |
|---|---|---|---|---|---|---|---|---|---|
| | **Real price** | **% change** | **Real price** | **% change** | | **Real price** | **% change** | **Real price** | **% change** |
| **1970** | 14.36 | | 14.1 | | **1988** | 19.44 | -3.1% | 18.18 | -4.9% |
| **1971** | 13.94 | -3.0% | 13.7 | -2.9% | **1989** | 18.6 | -4.5% | 17.44 | -4.2% |
| **1972** | 13.8 | -1.0% | 13.57 | -1.0% | **1990** | 18.56 | -0.2% | 17.27 | -1.0% |
| **1973** | 13.43 | -2.8% | 13.22 | -2.6% | **1991** | 17.31 | -7.2% | 15.9 | -8.6% |
| **1974** | 12.62 | -6.4% | 13.17 | -0.4% | **1992** | 16.43 | -5.4% | 14.66 | -8.5% |
| **1975** | 13.09 | 3.6% | 13.42 | 1.9% | **1993** | 15.58 | -5.5% | 13.65 | -7.4% |
| **1976** | 15.32 | 14.6% | 15.61 | 14.0% | **1994** | 15.4 | -1.2% | 13.37 | -2.1% |
| **1977** | 20.4 | 24.9% | 20.66 | 24.4% | **1995** | 15.4 | 0.0% | 14.36 | 6.9% |
| **1978** | 21.28 | 4.1% | 21.41 | 3.5% | **1996** | 14.54 | -5.9% | 12.99 | -10.5% |
| **1979** | 19.98 | -6.5% | 19.87 | -7.8% | **1997** | 14.04 | -3.6% | 12.77 | -1.7% |
| **1980** | 18.65 | -7.1% | 18.74 | -6.0% | **1998** | 13.62 | -3.1% | 12.21 | -4.6% |
| **1981** | 18.27 | -2.1% | 18.27 | -2.6% | **1999** | 13.11 | -3.9% | 11.13 | -9.7% |
| **1982** | 19.58 | 6.7% | 19.79 | 7.7% | **2000** | 13.23 | 0.9% | 11.94 | 6.8% |
| **1983** | 20.93 | 6.5% | 21.05 | 6.0% | **2001** | 13.02 | -1.6% | 10.94 | -9.1% |
| **1984** | 19.99 | -4.7% | 20.1 | -4.7% | **2002** | 13.01 | -0.1% | 11.19 | 2.2% |
| **1985** | 19.77 | -1.1% | 19.77 | -1.7% | **2003** | 13.14 | 1.0% | 11.6 | 3.5% |
| **1986** | 20.16 | 1.9% | 20.36 | 2.9% | **2004/05** | 12.96 | -1.4% | 11.28 | -2.8% |
| **1987** | 20.04 | -0.6% | 19.07 | -6.8% | **Ave. over period** | 16.37 | -10.8% | 15.62 | -25.0% |

*Source: DME (2005).*

*Table 4: Percentage change in Eskom average prices per customer category (nominal rand), 1994 to 2002*

| | Eskom average price increase % | Domestic | Agriculture | Commercial | Traction | Mining | Industrial | Redistributors | Effective price increase %* |
|---|---|---|---|---|---|---|---|---|---|
| 1994 | | | | | | | | | |
| 1995 | 4.0% | 8.38 | 4.05 | 7.42 | 2.38 | 4.96 | 16.74 | 5.84 | 8.03 |
| 1996 | 4.0% | 7.10 | 6.27 | 4.11 | 4.61 | 3.81 | -2.87 | 3.38 | 1.38 |
| 1997 | 5.0% | 9.73 | 5.52 | 4.15 | -1.92 | 5.81 | 6.68 | 2.49 | 4.87 |
| 1998 | 5.0% | 6.61 | 7.11 | -6.79 | -0.96 | 4.77 | 2.21 | 1.86 | 3.71 |
| 1999 | 4.5% | 11.51 | 0.62 | 18.11 | 2.02 | 3.20 | -4.16 | 1.73 | 1.20 |
| 2000 | 5.5% | 9.24 | 8.64 | 1.70 | 1.03 | 2.37 | 13.05 | 3.17 | 6.35 |
| 2001 | 5.2% | 11.54 | -7.04 | -20.66 | 2.40 | 3.42 | -3.18 | 5.87 | 4.06 |
| 2002 | 6.2% | 8.19 | -1.42 | 8.62 | 9.16 | 5.97 | 10.75 | 9.05 | 8.9 |
| 2003 | 8.43% | | | | | | | | 7.21 |
| 2004 | 2.50% | | | | | | | | |
| 2005 | 4.10% | | | | | | | | -0.26 |
| 2006 | 5.10% | | | | | | | | 6.26 |
| 2007 | 5.90% | | | | | | | | 5.93 |

*Source: NERSA (2004); Eskom Annual Reports (various issues).*

*Note: *Effective increase refers to the actual increase that occurred in a year.*

*Table 5: Comparison of the average Eskom price increase to consumer inflation, 1987-2007*

| Year | Eskom average price increase (%) | Inflation rate (%) |
|---|---|---|
| **1987** | 12.00 | 16.20 |
| **1988** | 10.00 | 12.90 |
| **1989** | 10.00 | 14.50 |
| **1990** | 14.00 | 14.30 |
| **1991** | 8.00 | 15.60 |
| **1992** | 9.00 | 13.70 |
| **1993** | 8.00 | 9.90 |
| **1994** | 7.00 | 8.80 |
| **1995** | 4.00 | 8.70 |
| **1996** | 4.00 | 7.30 |
| **1997** | 5.00 | 8.60 |
| **1998** | 5.00 | 6.90 |
| **1999** | 4.50 | 5.20 |
| **2000** | 5.50 | 5.40 |
| **2001** | 5.20 | 5.70 |
| **2002** | 6.20 | 9.20 |
| **2003** | 8.43 | 5.80 |
| **2004** | 2.50 | 1.40 |
| **2005** | 4.10 | 3.42 |
| **2006** | 5.10 | 4.70 |
| **2007** (projected) | 5.90 | 7.10 |

*Source: Eskom yearbook (various editions); StatsSA (various editions).*

*Table 6: Comparison between a tax on electricity and an increase in its administered price – percentage changes*

| | f0wn | f0wr | f0xn | f0xr | p1wn | p1wr | p1xn | p1xr |
|---|---|---|---|---|---|---|---|---|
| CONS | -0.312 | -0.312 | 0 | 0 | -0.492 | -0.504 | 0 | 0 |
| INV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GOV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EXP | -0.098 | -0.096 | -0.482 | -0.818 | -0.239 | -0.169 | -0.808 | -1.26 |
| IMP | -0.186 | -0.186 | -0.035 | -0.06 | -0.291 | -0.293 | -0.051 | -0.084 |
| GDP | -0.177 | -0.177 | -0.11 | -0.186 | -0.3 | -0.29 | -0.186 | -0.289 |
| CPI | -0.001 | -0.002 | 0.24 | 0.34 | -0.032 | -0.057 | 0.334 | 0.469 |
| PINV | -0.006 | -0.006 | 0.059 | 0.167 | -0.008 | -0.028 | 0.091 | 0.238 |
| PGOV | 0.004 | 0.002 | 0.03 | 0.319 | 0.002 | -0.047 | 0.042 | 0.44 |
| PEXP | 0.02 | 0.019 | 0.097 | 0.164 | 0.048 | 0.034 | 0.162 | 0.254 |
| PIMP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PGDP | 0.012 | 0.011 | 0.194 | 0.352 | -0.029 | -0.062 | 0.248 | 0.464 |
| EMPL | -0.31 | -0.31 | -0.208 | -0.351 | -0.52 | -0.5 | -0.344 | -0.537 |

*Note: "f0": industries and households pay a 10% tax on electricity; "p1": prices are directly increased by 10%; "w": nominal household spending is a function of wage income; "x": real household spending is constant; "n": nominal wages are held fixed; "r": real wages are held fixed.*

*Table 7: Comparison between a tax on households with a tax on both households and firms – percentage changes*

| | f0wn | f0wr | f0xn | f0xr | f3wn | f3wr | f3xn | f3xr |
|---|---|---|---|---|---|---|---|---|
| CONS | -0.312 | -0.312 | 0 | 0 | -0.132 | -0.097 | 0 | 0 |
| EXP | -0.098 | -0.096 | -0.482 | -0.818 | 0.253 | 0.027 | 0.091 | -0.196 |
| IMP | -0.186 | -0.186 | -0.035 | -0.06 | 0 | 0.003 | 0.064 | 0.043 |
| GDP | -0.177 | -0.177 | -0.11 | -0.186 | -0.021 | -0.055 | 0.008 | -0.058 |
| CPI | -0.001 | -0.002 | 0.24 | 0.34 | 0.103 | 0.185 | 0.204 | 0.29 |
| PINV | -0.006 | -0.006 | 0.059 | 0.167 | -0.028 | 0.038 | -0.001 | 0.09 |
| PGOV | 0.004 | 0.002 | 0.03 | 0.319 | -0.012 | 0.148 | -0.001 | 0.245 |
| PEXP | 0.02 | 0.019 | 0.097 | 0.164 | -0.051 | -0.005 | -0.018 | 0.039 |
| PGDP | 0.012 | 0.011 | 0.194 | 0.352 | 0.05 | 0.157 | 0.126 | 0.261 |
| EMPL | -0.31 | -0.31 | -0.208 | -0.351 | -0.031 | -0.098 | 0.012 | -0.11 |

*Note: "f0": industries and households pay a 10% tax on electricity; "f3": only households pay a 10% tax on electricity; "w": nominal household spending is a function of wage income; "x": real household spending is constant; "n": nominal wages are held fixed; "r": real wages are held fixed.*

*Table 8: A Comparison between fixed real and fixed nominal wages – percentage changes*

| | f0wn | f0wr | f0xn | f0xr | f3wn | f3wr | f3xn | f3xr | p1wn | p1wr | p1xn | p1xr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONS | -0.31 | -0.31 | 0.00 | 0.00 | -0.13 | -0.10 | 0.00 | 0.00 | -0.49 | -0.50 | 0.00 | 0.00 |
| EXP | -0.10 | -0.10 | -0.48 | -0.82 | 0.25 | 0.03 | 0.09 | -0.20 | -0.24 | -0.17 | -0.81 | -1.26 |
| IMP | -0.19 | -0.19 | -0.04 | -0.06 | 0.00 | 0.00 | 0.06 | 0.04 | -0.29 | -0.29 | -0.05 | -0.08 |
| GDP | -0.18 | -0.18 | -0.11 | -0.19 | -0.02 | -0.06 | 0.01 | -0.06 | -0.30 | -0.29 | -0.19 | -0.29 |
| CPI | -0.001 | -0.002 | 0.24 | 0.34 | 0.10 | 0.19 | 0.20 | 0.29 | -0.03 | -0.06 | 0.33 | 0.47 |
| PINV | -0.01 | -0.01 | 0.06 | 0.17 | -0.03 | 0.04 | 0.00 | 0.09 | -0.01 | -0.03 | 0.09 | 0.24 |
| PGOV | 0.00 | 0.00 | 0.03 | 0.32 | -0.01 | 0.15 | 0.00 | 0.25 | 0.00 | -0.05 | 0.04 | 0.44 |
| PEXP | 0.02 | 0.02 | 0.10 | 0.16 | -0.05 | -0.01 | -0.02 | 0.04 | 0.05 | 0.03 | 0.16 | 0.25 |
| PGDP | 0.01 | 0.01 | 0.19 | 0.35 | 0.05 | 0.16 | 0.13 | 0.26 | -0.03 | -0.06 | 0.25 | 0.46 |
| EMPL | -0.31 | -0.31 | -0.21 | -0.35 | -0.03 | -0.10 | 0.01 | -0.11 | -0.52 | -0.50 | -0.34 | -0.54 |

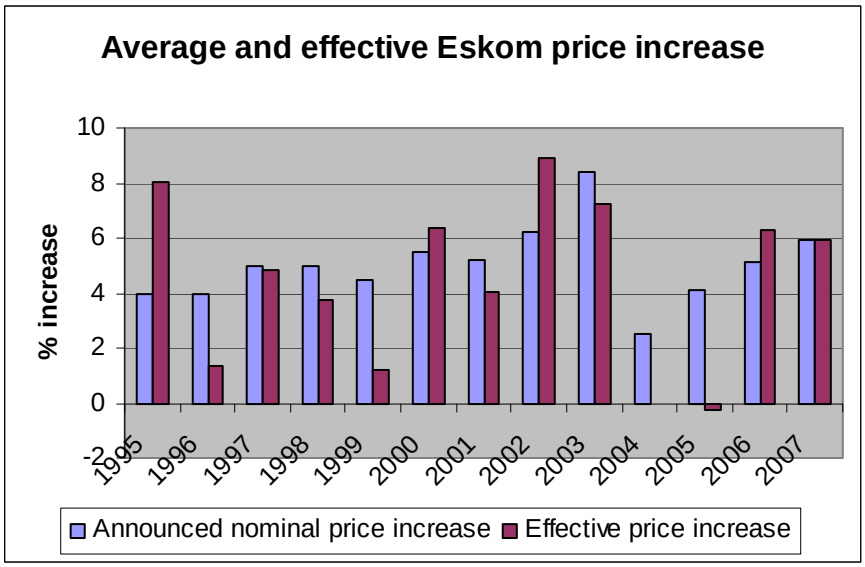
*Note: "f0": industries and households pay a 10% tax on electricity; "f3": only households pay a 10% tax on electricity; "w": nominal household spending is a function of wage income; "x": real household spending is constant; "n": nominal wages are held fixed; "r": real wages are held fixed.*

*Table 9: Long run effects*

| | lrf0 | lrf3 | lrp1 | f0wn | f3wn | p1wn |
|---|---|---|---|---|---|---|
| CONS | -0.087 | -0.012 | -0.097 | -0.312 | -0.132 | -0.492 |
| INV | -0.365 | -0.027 | -0.4 | 0 | 0 | 0 |
| GOV | -0.087 | -0.012 | -0.097 | 0 | 0 | 0 |
| EXP | -0.369 | 0.051 | -0.388 | -0.098 | 0.253 | -0.239 |
| IMP | -0.299 | 0.036 | -0.311 | -0.186 | 0 | -0.291 |
| GDP | -0.155 | -0.01 | -0.171 | -0.177 | -0.021 | -0.3 |
| CPI | 0.049 | 0.193 | 0.031 | -0.001 | 0.103 | -0.032 |
| PINV | -0.14 | -0.013 | -0.157 | -0.006 | -0.028 | -0.008 |
| PGOV | -0.545 | 0.005 | -0.583 | 0.004 | -0.012 | 0.002 |
| PEXP | 0.074 | -0.01 | 0.078 | 0.02 | -0.051 | 0.048 |
| PIMP | 0 | 0 | 0 | 0 | 0 | 0 |
| PGDP | -0.088 | 0.116 | -0.132 | 0.012 | 0.05 | -0.029 |
| EMPL | 0 | 0 | 0 | -0.31 | -0.031 | -0.52 |

*Note: "f0": industries and households pay a 10% tax on electricity; "f3": only households pay a 10% tax on electricity; "w": nominal household spending is a function of wage income; "n": nominal wages are held fixed; "r": real wages are held fixed.*

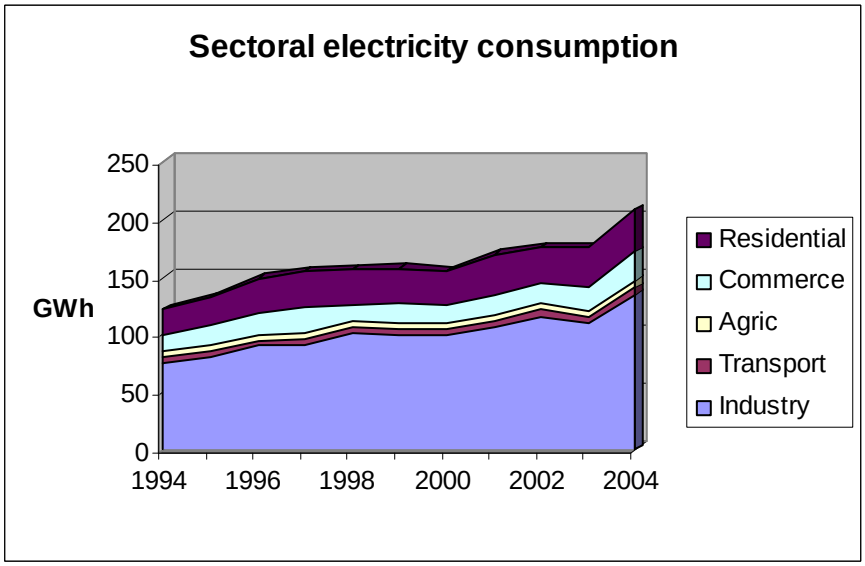
*Figure 1: Average announced and effective Eskom price increases*




*Source: Eskom yearbook (various editions).*

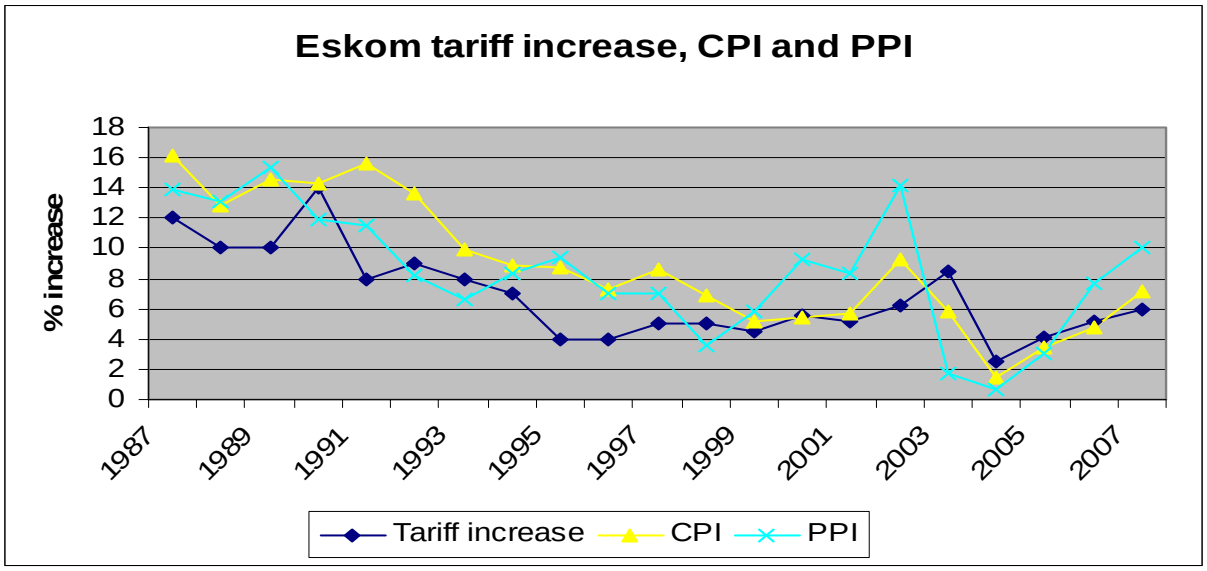
*Note: No data were available for the effective price increase in 2004. In 2005, the effective price increase was actually negative.*

*Figure 2: Sectoral electricity consumption in South Africa: Eskom sales, 1994-2004*




*Source: DME (2006).*

*Figure 3: CPI, PPI and average Eskom price increase*




*Source: StatsSA and NERSA approvals (various editions).*