Memo 36/01

Bulk Supply Tariff in Uganda

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Commissioned by Electricity Regulatory Authority and
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1 Introduction

The Ugandan power sector is in the process of being restructured, and private participation introduced into the industry. Simultaneously, a new regulatory institution, the Electricity Regulatory Authority (ERA) has been established, and is in the process of developing and applying a new regulatory framework for the industry.

The ERA has a co-operation agreement with the Norwegian Energy and Water Resources Directorate (NVE). Under this co-operation, ECON Centre for Economic Analysis has been contracted to assist with special pricing studies for the Ugandan electricity sector. An initial report, *Cost Structure and Tariff Study for Uganda*, was submitted in February 2001. ECON was subsequently requested to extend this work in a number of areas. One such area was further analysis of an alternative bulk supply pricing mechanism for Uganda to allow gradual introduction of higher prices related to the Bujagali power station. This report presents the results of this analysis.

2 Problem statement

Costs of supplying electricity in Uganda will increase dramatically in 2005. At the moment almost all electricity supplied in Uganda is sourced from the two power stations at the mouth of the Nile River – Kiira and Nalubaale power stations. The unit costs of electricity from these stations is low – in the order of 50 Ush/kWh, or 2.8 USc/kWh.

Despite the recent and planned extension of capacity at these plants, Uganda will remain capacity constrained, and the problem will only exacerbate as demand continues to grow. The planned station at Bujagali Falls will be commissioned in 2005, introducing an additional 200 MW of capacity - almost doubling supply capacity. While this will relieve capacity constrains for several years to come, the costs of supply will increase significantly. The power sales agreement with Bujagali implies payments of around $100 million per annum, effectively on a take-or-pay basis. Even without taking into account currency devaluation, this will more than triple overall costs of power generation (total costs at Kiira and Nalubaale amount to approximately $36 million per annum).

Since costs are transferred to end-users in prices, the effect on tariffs will be dramatic. The price effect is accentuated by the likely presence of surplus capacity in the years following the commissioning of Bujagali in 2005. As this surplus capacity is eroded by demand growth, so unit costs can be expected to decline somewhat.

The ERA has an interest to improve price stability. One way of achieving this is to gradually increase the price increase attributable to the additional costs of Bujagali prior to 2005. This will mean that a surplus will be made over the period 2002 to 2004 and this can be used to buy down the cost of power during the period of

surplus capacity. From 2008 onwards, prices can then be set at their cost-reflective level.

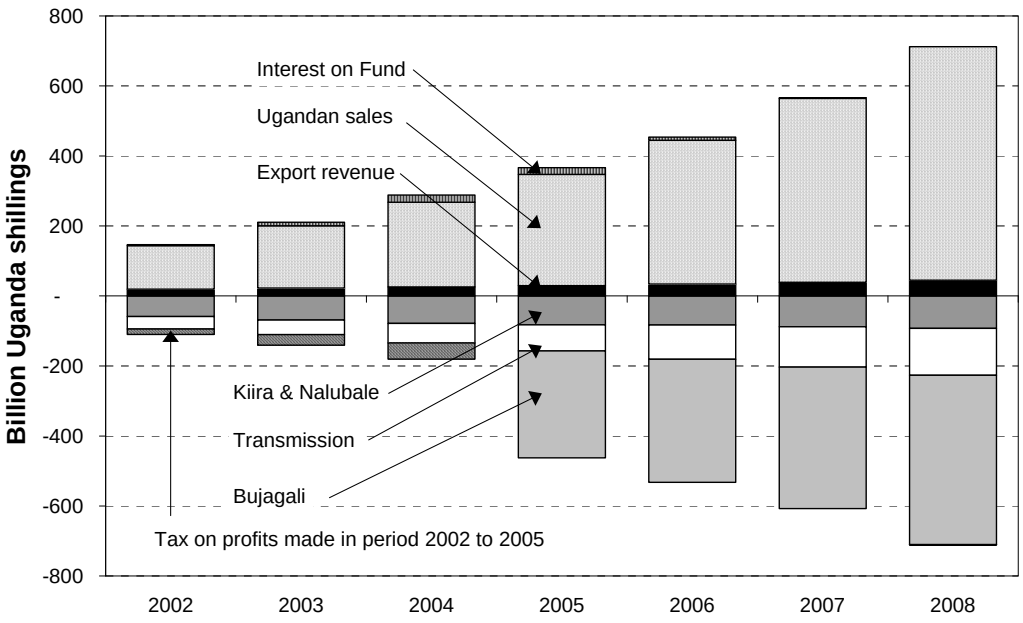
3 Proposed pricing mechanism

We propose using the design of the Bulk Supply Tariff charged by the Transmission Company to implement this price adjustment mechanism. The concept is that:

- Price increases commence in 2002 and gradually increase to cost-reflective levels by 2008
- Surpluses made in the period 2002 to 2004 are placed in a Fund operated by the Transmission Company and used to buy-down the costs of supply in the period 2005 to 2007.

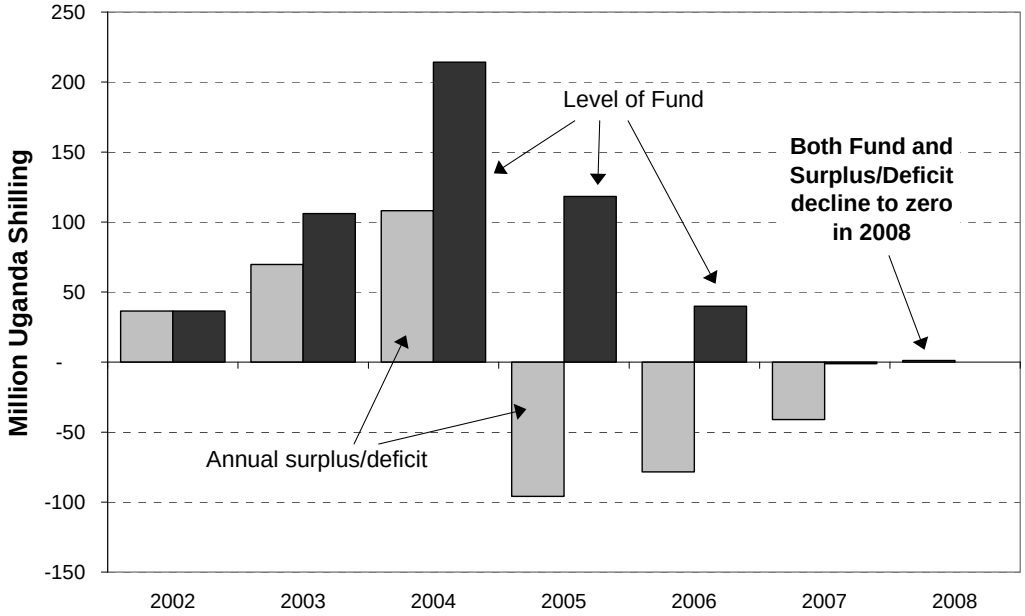
The pricing mechanism can be balanced so that the Fund is fully utilised by 2008. This mechanism is illustrated in the figure below which shows costs and revenue. In this illustration, prices are set so that revenue from Ugandan sales in 2008 and exports equals the costs of supply in that year.

Figure 3.1 Costs and revenue of bulk supply



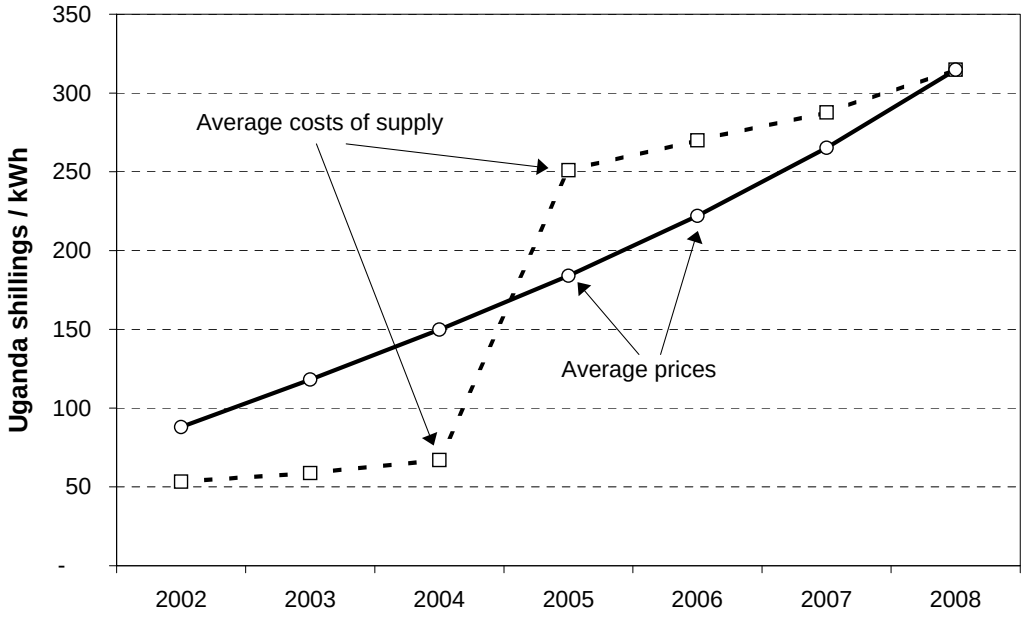
Surplus revenues are made in the period 2002 to 2004, and these are used to build up a Fund, which is then used to finance deficits in the years 2005 to 2007. The annual surpluses and the level of the Fund in the example illustrated above are shown in the figure below. The pricing mechanism is designed so that both annual surplus/deficit and the Fund decline to zero in 2008. At this point prices are set to cost reflective levels and no surpluses or deficits are realised.

Figure 3.2 Annual surpluses and accumulation in Fund



As this method implies, prices will be above costs in the period 2002 to 2004, and below costs in the period 2005 to 2007. In 2008, prices will reflect costs. The figure below illustrates this effect, and shows how the mechanism smoothes in price increases over time. In this illustration, prices increase quite steeply each year, and this is because an annual 15% devaluation in the currency is assumed each year. Since the Bujagali contract, and many elements of the costs at Kiira and Nalubaale, are in US dollars, this devaluation has a fairly dramatic effect on prices, leading to prices in 2008 that are more than five times their level in 2001 (58 shillings/kWh). Nevertheless, as can be seen the proposed mechanism leads to smoother prices than would otherwise be obtained.

Figure 3.3 Comparison of average costs of supply and average prices



4 Implementing the method

The objective of the method is to result in prices in 2008 that are cost reflective. However, at this stage we can only estimate costs in 2008 and this estimate may not be very accurate. Costs of supply in 2008 will depend on several factors:

- Foreign exchange rates
- Inflation
- Investment in transmission as well as Kiira and Nalubaale
- Efficiency targets set by ERA at the next price review in 2005

Costs are especially sensitive to changes in foreign exchange rates, which is also the most uncertain of the above variables. Consequently, it is not possible to set prices now for the full period until 2008. Instead, prices can be set on an annual basis, based on updated cost projections.

4.1 The spreadsheet pricing model

ECON has designed a spreadsheet to implement this proposed method, which allows the ERA to update variables on an annual basis, perform the price setting calculations and obtain updated Bulk Supply Tariffs. The same spreadsheet tool can be used to update prices on a quarterly or regular basis in response to exchange rate variations.

The data that should be updated on an annual basis comprises:

- Exchange rate for previous year and exchange rate projections
- Interest rate for previous year and interest rate projections
- Power purchases for previous year and projections of power purchases
- Exports for previous year and export projections
- Average export price for previous year and price projections
- Load profile of sale to Disco (% in peak, shoulder and off-peak)
- Costs of transmission and generation for previous year and projections
- Previous year's Bulk Supply Tariff if different from that in the model

The spreadsheet is provided together with this report.

4.2 Export revenue

The model as implemented assumes that all export revenue is used to off-set prices in Uganda. At present, the regulatory framework allows the Transmission Company to retain export profits.

Should the ERA determine that export revenues should not be used to subsidise local prices, then this will mean higher prices in Uganda. An adjustment to the pricing model would be required to effect this policy.

4.3 Taxation

The spreadsheet model assumes that annual trading profits, together with interest on the Fund, will be taxed at 30%. This naturally implies higher prices than would otherwise result. Should the Ministry of Finance provide a waiver on taxation of profits accrued to the Fund, then this can easily be implemented in the model by setting the tax level to zero percent. This will result is approximately 20% lower prices over the period.

4.4 Price structure

The model implements a price structure as proposed for 2001, that is the Bulk Supply Tariff is a time-or-use energy charge, with peak, shoulder and off-peak prices. The ratio between prices in each period is kept constant at 120:100:74. Alternative price structures include the option of a maximum demand charge as well as different price ratios between price periods.

The option of a maximum demand charge may be attractive, particularly given the capacity constraints until 2005 and once demand has grown to absorb the additional capacity at Bujagali. We have not investigated the options for this, although if such a decision is made it is a fairly simple exercise to implement it in the pricing model.

The price ratios between periods as proposed by UEB for 2001 prices are fairly arbitrary. Again, stronger price signals can be provided by increased the ratio of peak to off-peak prices. It is possible to calculate a suitable price structure based on the cost structure, which would in all likelihood result in much higher peak prices (since both transmission network costs and hydropower generation costs are dependent more on peak demand than energy supplied). However, it has not been part of our scope of work to investigate this. However, should a different price structure be required by ERA, it would again be a simple exercise to build this into the price model.

5 Conclusions

We have proposed here a method for phasing in the price increases associated with the introduction of Bujagali in 2005. In addition, we have developed a simple spreadsheet tool to implement this method.

The method involves charging prices above cost in the period 2002 to 2004, and prices below cost from 2005 to 2007. In 2008 prices are set equal to the costs of supply. The surpluses generated in the first period are used to cover deficits incurred in the second period. A special Fund should be established by Transco to implement this method.

The main advantage of this approach is that prices will be more stable over the time period, avoiding a large price increase in 2005. We have implemented the method using the same price structure as proposed by UEB for 2001. Should ERA wish to change the price structure, small modifications would have to be made to the pricing model.

To implement these proposals, ERA should further explore the institutional and taxation arrangements that may be put in place. Further, the method should be incorporated into the quarterly updates of tariffs.