

**TARIFF DETERMINATION IN THE UGANDA
ELECTRICITY SECTOR**

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Preamble

Economic regulation is dynamic and forms of regulation change from time to time depending on the structure of the industry, size of the firms and overall policy objectives. This paper provides the process and methodology of tariff setting in the electricity sector as at October 2006. The paper does not envisage changes to tariff setting that may arise in the period ahead.

This paper is the first version and the Electricity Regulatory Authority will try to update it whenever changes arise. This, however, does not imply that there will not be lags between the time changes in tariff setting are effected and the time a new version becomes available.

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ABBREVIATIONS AND ACRONYMS

BST	Bulk Supply Tariff
ERA	Electricity Regulatory Authority
GoU	Government of Uganda
kWH	Kilo Watt Hour
kVA	Kilo Volt Ampere
LV	Low voltage (Below 11 KV)
MEMD	Ministry of Energy and Mineral Development
MV	Medium Voltage (11 and 33 KV)
MW	Megawatts
O&M	Operating and Maintenance Costs
PPA	Power Purchase Agreement
ROR	Rate of Return Regulation
TOU	Time of use Meters
UEB	Uganda Electricity Board
UEDCL	Uganda Electricity Distribution Company Limited
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited.
V	Volts
VAT	Value Added Tax

EXECUTIVE SUMMARY

The Electricity Regulatory Authority (ERA) was established in 2000 under section 4(1) of the Electricity Act (1999) to regulate the electricity industry in Uganda. The Act empowers ERA to issue Licenses for Generation, Transmission, Distribution or Sale of Electricity; establish a tariff structure and investigate charges, whether or not a specific complaint has been made for a tariff adjustment; approve the rates of charges and terms and conditions of electricity services provided by transmission and distribution companies, and develop and enforce performance standards for the generation, transmission and distribution of electricity, among others.

In accordance with Section 75 of the Act, ERA developed **the Electricity (Tariff Code) Regulations (2003)**. The Code provides for tariff objectives, principles of tariff calculations, regulation of costs and investments.

Under the current price setting structure, the ERA determines the revenue requirement of each of the companies and applies a Rate of Return (ROR) regulation. The determination of the revenue requirement using the rate of return method is enhanced by elements of performance-based ratemaking such as a benchmarked level of losses, operating and maintenance costs and bad debts in case of distribution companies. The companies provide ERA with an application for a revenue requirement each year based on a specified tariff methodology, which exists in the licenses. The information include cost breakdown so that ERA can assess the proposed rate. ERA invites the public to make comments on the submissions of the companies. ERA conducts public consultations after receiving comments from the public where necessary in order to enhance transparency and accountability.

This paper outlines the process and methodology for tariff setting in the Ugandan electricity sector. This is meant to enhance the public understanding of the tariff setting process in Uganda. The sensitisation programs carried out by ERA revealed that the public has limited knowledge on the objectives and procedures for setting electricity tariffs.

1. Introduction

In mid 1990's, Uganda initiated measures aimed at reforming the electricity sector. The sector was suffering from a number of fundamental problems which included (i) very poor supply reliability characterised by extensive and increasing load shedding, (ii) inadequate investment in all parts of the sector and an inability to finance future required investment, (iii) very poor commercial performance by the Uganda Electricity Board (UEB) characterised by collections being received for less than 50% of the electricity generated, (iii) high technical and non-technical losses exceeding 30%, (iv) high accounts receivable, which in early 1999 were equivalent to about nine months billings but with around 50% being due for more than one year, (v) low productivity, and (vi) poor rate of connection of new customers. In 1997, the Government of Uganda formulated a comprehensive and detailed Strategic Plan for transforming the Uganda power sector into a financially viable electricity industry, in order to enable it to supply reasonably priced and reliable power, and to make its full contribution to further economic and social development of Uganda.

The plan was updated in 1999 as more information became available on power sector reform around the world. The New Strategic Plan was formulated to address the key problems in the power sector, and in particular those of very poor financial and commercial performance by the UEB and the need to finance a relatively large investment programme. The New Strategic Plan placed particular emphasis on the role of competition in promoting efficiency within the power sector and on private sector participation as being a key driver to enhance the power sector's performance.

A new Electricity Act was passed on November 1, 1999 and this enabled private participation in the power sector; paved the way for the establishment of the Electricity Regulatory Authority (ERA) in 2000, and provided the legal basis for the privatisation of UEB formally a vertically integrated monopoly. The ERA was established with the responsibility to regulate the electricity industry in Uganda.

The restructuring of the power sector in Uganda called for unbundling of the vertically integrated, composite functions performed historically by the UEB into

separate business functions of generation, transmission and distribution business. The successor companies were registered in accordance with the Companies Act under the following names:

- Uganda Electricity Distribution Company Limited (UEDCL)
- Uganda Electricity Transmission Company Limited (UETCL)
- Uganda Electricity Generation Company Limited (UEGCL)

The objectives of unbundling UEB were:

- i. Permit greater transparency in electricity pricing, and in monitoring the efficiency of the three business segments, thereby assisting the ERA in the task of regulation
- ii. Improve corporate governance in the power sector
- iii. To liberalise and introduce competition in the sector
- iv. Provide a basis for the privatisation of the generation and distribution businesses via long-term concessions.

After unbundling, Government proceeded with the process of privatisation. The generation concession license was competed for and won by Eskom (U) Ltd, which took over in April 2003. Umeme Ltd won the distribution concession and took over in March 2005.

This paper outlines the process and methodology for tariff setting in the Ugandan electricity sector. This is meant to enhance the public understanding of the tariff setting process in Uganda. The sensitisation programs carried out by ERA revealed that the public has limited knowledge on the objectives and procedures for setting electricity tariffs.

2. Legal Framework for Setting and Approving Tariffs

The functions of ERA are spelt out under section 10 of The Electricity Act (Act 6, 1999) CAP 145 Laws of Uganda 2000 edition. These include, among other things:

- i. To issue Licenses for Generation, Transmission, Distribution or Sale of Electricity;
- ii. Establish a tariff structure and investigate charges, whether or not a specific complaint has been made for a tariff adjustment;
- iii. Approve the rates of charges and terms and conditions of electricity services provided by transmission and distribution companies.
- iv. To develop and enforce performance standards for the generation, transmission and distribution of electricity.

Under Section 75 of the Act, the tariff structure and terms of supply shall be in accordance with the principles of tariff calculation prescribed by the Authority taking into account the licensees total revenues from tariffs covering all reasonable costs and a reasonable rate of return. ERA has issued Regulations prescribing the principles of tariff calculations and terms of supply as required by section 75 of the Act referred to as **The Electricity (Tariff Code) Regulations, 2003**.

The Code provides for tariff objectives; principles of tariff calculations; regulation of costs and investments and components in tariff computation.

3. The Tariff Setting Process

ERA regulates both the levels and structures of the electricity tariffs and is in the process of issuing guidelines for tariff setting that must be followed by all operators.

Under the current price setting structure, the ERA determines the revenue requirement of each of the companies and applies a Rate of Return (ROR) regulation. The determination of the revenue requirement using the rate of return method is enhanced by elements of performance-based ratemaking such as a benchmarked level of losses, operating and maintenance costs and bad debts in case of distribution companies. The ROR or Cost of Service regulation is an internationally accepted cost plus based method of regulating utilities revenue and is defined so that the “revenue to be earned should be equal to the cost to supply electricity plus a fair return on the rate base”.

The ROR reviews of all the companies are done on an annual basis. On a quarterly basis, the tariffs are adjusted to allow for a pass-through of the changes in fuel prices, inflation and exchange rates. The companies provide ERA with an application for a revenue requirement each year based on a specified tariff methodology, which exists in the licenses. The information include cost breakdown so that ERA can assess the proposed rate. ERA invites the public to make comments on the submissions of the companies. ERA conducts public consultations after receiving comments from the public where necessary. Making public the information provided to ERA by the licensees enhances transparency and accountability.

The views expressed at the public consultations do not have necessarily to be reflected in the eventual tariff. Because of this, the public may not be satisfied with the final tariff if it does not reflect their views. However, the public may wish to know that in setting the tariffs, ERA is guided by two main considerations;

- i] Whether the revenue requirements as applied for by operators are fair and reasonable in light of the objective of continuity of supply and affordability; and
- ii] Whether the proposed tariff regimes balance the interest of all the stakeholders, which include, current and potential consumers, government, and licensees.

4. Tariff Objectives

Tariff setting is guided by the following objectives¹:

- i. To provide consumers with fair and reasonable price structures consistent with maintenance of a financially and operationally secure electricity supply system;
- ii. Encourage consumers to make efficient use of energy based on price signal;
- iii. Encourage operators to make efficient use of plant (Assets) and operational efficiency based on financial benefits and penalties;
- iv. Provide Operating Companies reasonable return/profit to give confidence to current investors and attract new investors;
- v. Provide a tariff structure for cost reflective tariff for each customer group; and
- vi. Provide for future progress towards a commercially competitive system.

Another aspect of tariff setting, though not explicitly spelt out in the Electricity Tariff Code, is price stability. Sharp fluctuations in prices are detrimental to commercial functioning. They can result in deviant consumer behaviour and increase the level of theft. Sharp price hikes can also damage the public credibility of reform in terms of their consumer welfare enhancing impact.

5. Tariff Structure

In the case of grid connected consumers, electricity prices are set at three points in the industry:

- At the interface between generation and transmission;
- At the interface between transmission and distribution; and
- At the interface between distribution and end-user consumers.

¹ These are provided in the Electricity (Tariff Code) Regulations, S1 No. 23/2003.

The Transmission Company acts as a single buyer of electricity supplied to the transmission network in Uganda and the sole exporter and importer of power. The prices between generation and Transmission Company are negotiated between themselves in a form of a Power Purchase Agreement, which is subject to oversight, and approval by ERA. The Transmission Company sells power to any distribution company (buyer) that is connected to the transmission network at a Bulk Supply Tariff. The Bulk power supply tariff reflects the costs of power acquisition and transmission costs.

The Transmission Company can export power at specially negotiated prices, but not below either the average or marginal cost of power purchase. The Distribution Company purchases power at the Bulk Supply Tariff and sells it to end users following an approved tariff schedule. These end-user tariffs reflect the costs of power purchase as well as the costs of distribution and retail supply.

The elements of the end user tariffs in Uganda include:

- i. Fixed standing charges (Shs per month);
- ii. Capacity (demand) charges (Shs per KVA); and
- iii. Energy or usage charge (Shs/KWh)

The fixed customer charges (per customer per month) are charges that are not a function of the customer usage during the billing period and are often used to recover costs that vary with the number of customers being served. They cover costs incurred by the licensee for providing power supply to the consumers such as metering and meter services, customer billing and customer information plus service expenses.

The energy charge is a charge per KWh of energy consumed. It is a usage charge, which is related to the amount of electricity consumed. The energy charge has a life

line rate intended to make electricity services affordable to the poor or those who would otherwise be able to afford the services only with great sacrifice or not at all. Lifeline rates are lower than the true costs of supply, and are subsidised. Therefore in order to ensure that only those in need gain the benefits of the subsidy, consumption above a certain maximum level per month is priced at the cost of supply plus a small percentage required to subsidise the life line consumers. The lifeline rate is currently for the first 15kWh.

The maximum demand charging i.e. charging customer on the basis of their maximum demand in any given billing period, is used to recover capacity costs. The idea behind these charges is that the maximum usage of a customer in a billing period is a proxy for that customer's contribution to the need to invest in capacity to cover peak demand.

The number of end-user customers is categorised into five, namely; domestic, commercial, medium scale industries, large industries and street lighting.

- Domestic consumers (Code 10.1). These are customers who are metered at low voltage supply single phase and supplied at 240 volts. They include residential houses, small shops and kiosks. These customers have no time of use tariffs.
- Commercial consumers (Code 10.2/10.3). These are small commercial consumers. Electricity is supplied at three-phase voltage, with a load not exceeding 100 Amperes. They mainly include small industries such as maize mills, water pumps metered with connected load at low voltage (415 volts). These customers have time of use tariffs.
- Medium Scale Industries (Code 20). These are medium scale industries that take power at low voltage (415 volts) with a maximum demand of up to 500 kVA. This category of customers has time of use meters.

- Large Scale Industries (Code 30). They include large-scale industries taking power at a high voltage (11,000 V or 33,000 V) with a maximum demand exceeding 500 kVA but up to 10,000kVA.
- Street Lighting (Code 50). This includes electricity supply for street lighting in cities, municipalities, towns, trading centres and community centres.

6. Time Differentiation (Time of Use)

Flat rate pricing system, regardless of the time of use create over consumption, discourage energy efficiency and lead to leakage to other uses or consumers. To ensure efficiency in consumption, the end user tariffs are time differentiated i.e. apply different charges to usage in different time periods to reflect underlying cost differences, for those customers with time of use meters. Marginal costs of generation, transmission and high voltage distribution vary by time of day. Costs are higher in hours when load growth is likely to require additional capacity, or when high cost generators must be dispatched to meet load.

Time of use (TOU) charging improves the efficiency of price signals because the charges vary for consumption in predefined period within the billing period. However, the requirement for such complex metering if premised on the assumption that implementation of TOU charging to customers who lack the necessary metres is only cost effective if savings from load shifts from peak to off-peak periods (or reduction in peak period use) are sufficient to cover the added metering costs.

Consumption is divided into 3 periods of time; Peak, Shoulder and Off-peak.

Load pattern	Time
Peak	18:00 – 24:00 hrs
Shoulder	6:00 – 18:00 hrs
Off-peak	24:00 – 6:00 hrs

Time of use meters is currently available for code 30 (large industrial consumers); code 20 (medium industrial consumers) and some customers in code 10.2 (Commercial consumers). The strategy is to extend these to all consumers including domestic in the medium term. The limiting factor at the moment is that the cost of these meters is rather high.

7. Tariff Determination Methodology

This section presents the discussion of the tariff methodology for those utilities that are interconnected to the main grid. The tariff methodology for the utilities, which are not interconnected to grid, is not discussed in this paper.

7.1 Generation Tariffs

The price paid to the generation companies by UETCL for bulk energy purchases depends on whether the transmission company is paying for capacity or energy. In the case of the large hydro plants such as Kiira and Nalubaale and Bujagali if it is commissioned, UETCL pays a capacity price.

The generation capacity price is the price paid for a kW per hour. In most instances, the generation capacity price is determined annually and adjusted quarterly for changes in tested capacity, inflation and exchange rate.

The revenue requirement is made up of the following cost components, where applicable²:

² Note that the components of the revenue requirement for generation companies differ from company to company depending mainly on its financing structure. For some companies, the revenue requirement include concession fees depending on whether the generation assets are leased while others include debt service payments (both principal and interest).

- The investment component;
- The operating and maintenance (O&M) component;
- The concession fee or lease component.
- Other costs such as regulatory fees and royalties.

The investment component is made up of depreciation, return on the company's capital investments and income tax.³ The investment component is determined in US dollars and converted to shillings at the prevailing exchange rate.

The O&M component is a sum of local currency denominated element and foreign currency denominated component. The foreign currency element of O&M is converted to shillings using the prevailing exchange rate on a quarterly basis. The local element is adjusted for Uganda inflation. The O&M allowance is determined from the USD amount set in the licence, and is adjusted on a quarterly basis for (a) Uganda price inflation, and (b) changes in the USD exchange rate and further adjusted by an efficiency factor to provide an incentive for increased productivity. The concession fee component includes the lease fees paid to UEGCL by Eskom (U) Ltd under the Concession Agreement. It includes mainly debt service (both principal and interest) and administrative expenses of UEGCL.

The capacity price is adjusted quarterly for inflation, exchange rate and available capacity. The following cost elements are adjusted in response to inflation:

- The local currency component of operating and maintenance costs

The following cost elements are adjusted in response to exchange rate:

- The foreign currency component of operating and maintenance costs;
- The investment component, comprising capital recovery charges (i.e. depreciation); Return on Investment; and Income Taxes Payable.

In the case of the thermal generation only projects that sell power to the grid, such as Aggreko (U) Ltd, UETCL pays a capacity price meant to recover the capital costs of the project and an energy charge. The energy charge has two elements: the O&M

³ Note that VAT is not included as part of revenue requirement.

component and the fuel component. The fuel component covers the cost of fuel logistics as well as the means of plants. The fuel price is escalated periodically for changes in the international prices for fuel.

The small generation projects of less than 20 MW are supposed to be paid a feed-in tariff to be determined by UETCL based on the avoided cost principle. Currently, these projects are paid a fixed price as negotiated between them and UETCL in their power purchase agreements (PPA) and approved by ERA.

7.2 Bulk Supply Tariffs

The Bulk Supply Tariff (BST) is the tariff charged by the Transmission Company to the distribution companies. The BST is a per unit energy charge separated for peak, shoulder and off-peak. It is based on the revenue requirement of Transmission Company, which includes the operating and maintenance expenses (O&M), the net power purchase costs, and allowance for debt service costs. Net power purchase costs are the total cost of power purchase from generators and imports less export revenues.

To arrive at the BST, the revenue requirement of the transmission company is divided by bulk energy sales of the transmission company. This yields the shoulder tariff, which is adjusted for a peak-weighting factor to derive the peak price. The off-peak tariff is therefore derived using the residual revenue requirement.

The BST is adjusted quarterly for changes in (i) purchases from generators and imports; (ii) export revenues and volumes; and (iii) sales volumes to distributors.

The following cost elements are adjusted in response to purchases from generators and exports, and sales volumes to Ugandan distributors:

- The net power purchase costs are updated quarterly to reflect the actual net costs – being the cost of purchases less the revenues from exports.

- The volumes used to calculate tariffs from costs are updated quarterly to reflect actual sales volumes (these are calculated as purchases less exports less transmission losses).

7.3 End-User Prices

Uganda has one large distribution company (Umeme Ltd) which leased the assets of the formerly government owned distribution company (Uganda Electricity Distribution Company Ltd). There some mini-grid distribution systems and one off-grid generation and distribution company (West Nile Rural Electrification Company Ltd). Tariff setting follow similar principles and actual method of tariff setting differ across the different distribution systems.

In the case of **Umeme Ltd**, Tariff rates for customers in each tariff category are computed to reflect the cost of electricity supply to that category. This approach is in line with modern principles of tariff determination internationally as well as the Act which calls for cost reflective tariffs. Implementation of this principle eliminates cross-subsidization of any category of customers by other categories and therefore promotes greater efficiency.

As a result, the tariff for domestic consumers is often higher than the tariff for industrial consumers. Domestic consumers who take supply at the low voltage impose higher investment and operational costs on the system than industrial consumers who are supplied at the high voltage or medium voltage. At the higher voltage, the utility is spared the investment cost in transformers and secondary lines, and operational and maintenance costs will also be reduced. In addition, the unavoidable technical losses are also lower since the current flows through a smaller number of transformers and shorter line lengths on its way from generators to the customers. The consumer supplied at low voltage (secondary voltage) imposes additional investment costs, for transformers and secondary lines and the utility experiences greater technical losses.

The end-user prices are computed by implementing the following steps:

- Calculating the revenue requirement of the distribution company
- Allocating this revenue requirement to the different customer categories; and
- Converting this revenue requirement into fixed, energy and capacity tariff as appropriate for each tariff category.

The revenue requirement of the distribution company is made up of:

- Operating and maintenance costs. A portion of this is indexed to foreign exchange and the remainder is indexed to local inflation.
- Depreciation
- Return on assets
- Return on working capital
- An allowance for bad debts and losses. The benchmark on these is set in the contracts in order to create an incentive for the distribution company to reduce them. Therefore, they are not fully passed over to the consumer
- Income tax.

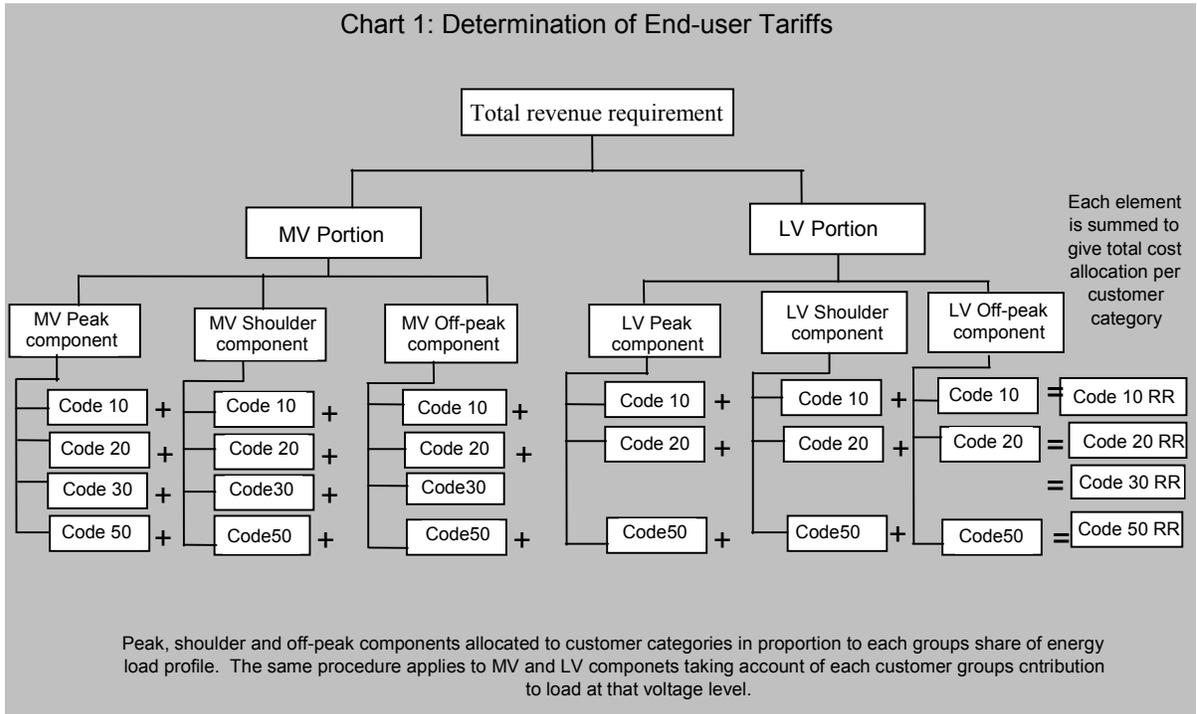
The next step is to allocate the revenue requirement to customer categories. This is done in the following manner:

- Firstly, the total revenue requirement is split into two portions: the MV portion and the LV portion.
- Secondly, both the MV and the LV portions are then split into peak, shoulder and off-peak components.

The MV components are then allocated to customers who make use of the MV network. This allocation is done on the basis of a customer group's share of energy delivery at the MV level in each load period. The LV components are allocated in the same way.

The final step is to convert this total cost allocation into a tariff for each tariff category. The energy charge may be split into different TOU charges.

All these steps are illustrated in chart 1:



The end-user tariffs are adjusted quarterly to reflect changes in (i) the BST; (ii) the inflation rate and (iii) the exchange rate.

The following cost elements are adjusted in response to changes in the BST:

- The power supply elements of end-user tariffs are amended to reflect any changes in the BST.

The following cost elements are adjusted in response to inflation:

- The local currency component of operating and maintenance costs.

The following cost elements are adjusted in response to exchange rate:

- The foreign currency component of operating and maintenance costs;
- Return on working capital.

In the case of West Nile Rural Electrification Company, the tariffs are fixed in United States Dollar for a period of time and adjusted on a quarterly basis for changes in inflation, exchange rate and fuel prices. This is similar to a price cap regulation.

7.4 Sensitivity Factors

The revenue requirement of the companies is sensitive to changes in: i) inflation, ii) Exchange rate, and iii) increase in fuel prices.

- Exchange rate: A number of costs are denominated in foreign currency and therefore sensitive to exchange rate movements. A significant depreciation of the Uganda shilling would cause tariffs to increase sharply even when everything else is stable.
- Fuel prices: Given the increasing share of thermal power in total energy mix, tariffs are highly sensitive to changes in fuel prices. An increase in fuel prices has a significant upward effect on energy purchase costs of the Transmission Company. These are passed through to the consumers on a quarterly basis.
- Inflation: Some of the costs that make up the revenue requirement of the companies are adjusted on a quarterly basis for changes in inflation. Therefore, increase in inflation in any given period would cause an upward movement in tariffs.

8. Conclusion

This paper documents the methodology for determining tariffs in the Uganda electricity sector. The objective is to present the tariff methodology in a simplified framework for the easy understanding by the stakeholders.

It is quite evident that with the introduction of incentive enhancing aspects in the economic regulation of the utilities, most costs are fixed for a period of time. The companies are only allowed to adjust the tariffs quarterly for those factors beyond the control of the companies.

The main factors driving the tariffs are therefore those costs that are beyond the control of the companies such as variations in energy purchase costs due to changes in capacity and fuel prices. Fuel prices are now an important factor as far as affecting electricity tariffs is concerned.

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