Tariff Structures for Sustainable Electrification in Africa

By order of European Copper Institute (ECI)

74101247-MOC/MAR 12-00402
Arnhem, 17 April 2012
KEMA Nederland B.V.
Authors: Viren Ajodhia, Wiebe Mulder, Thijs Slot

74101247-MOC/MAR 12-00402

Tariff structures for Sustainable Electrification in Africa

Arnhem, 17 April 2012

Author: Viren Ajodhia, Wiebe Mulder, Thijs Slot

By order of European Copper Institute (ECI)

author	: W. Mulder		2012-03-16	reviewed	: T. Slot	2012-03-16
A	56 blz.	0 bijl.	WB/TBT	approved	: E. de Corte	2012-03-16

KEMA Nederland B.V. Utrechtseweg 310, 6812 AR Arnhem P.O. Box 9035, 6800 ET Arnhem The Netherlands
T +31 26 3 56 91 11 F +31 26 3 89 24 77 contact@kema.com www.kema.com Registered Arnhem 09080262

CONTENTS

page

1 INTRODUCTION

1.1 Background and Objectives

In the context of its *Africa* and *Energy Advocacy* initiatives, the European Copper Institute (ECI) wants to develop an understanding of the electricity tariff structures in Sub-Saharan Africa. In particular, ECI is concerned about the extent to which tariff structures are adequate to attract private capital to develop and maintain the national electricity infrastructure. The purpose of this study is to:

1 Review the tariff structures in representative countries in Africa;
2 Assess these tariffs in terms of the long-term financial viability for the electricity sector and their ability to attract capital;
3 Offer suggestions regarding how to evolve to a healthier and more attractive tariff structure.

Based on these requirements, KEMA has undertaken a series of country studies investigating these issues. The list of countries was discussed and agreed with ECI also taking into account data constraints. The final list of countries of be reviewed includes Kenya, Cape Verde, Ghana, Tanzania, and Senegal.

1.2 Report Outline

The remainder of this report is set out as follows:

- Section 2 sets out the methodological aspects adopted for carrying out the analysis. Here the definition of customer groups and the main parameters adopted are presented. The financial indicators used are also defined and the underlying methodology for the financial analysis is explained;
- Section 3 presents the country studies. Each study starts with an overview of the power sector and the principal industry actors and power sector statistics. The applicable tariff structure is described and average prices computed based on standardized load profiles. The financial performance of the particular power sector is then highlighted and an analysis is carried out with respect to the necessary adjustment in tariff levels to achieve adequate financial performance;
- Section 4 presents the final conclusions of the study through a comparative analysis of the five country studies. Based on the analysis results, the main impediments for investments in the transmission and distribution sectors, and possible ways to remove these impediments, are discussed.

2 METHODOLOGICAL BACKGROUND

2.1 Tariff Analysis

2.1.1 Customer Groups and Load Profile

International comparisons of tariffs face a number of methodological obstacles and have to take into account numerous factors that influence their relative level. The structure of electricity tariffs tends to vary considerably across different countries and companies. Many utilities use a combination of multiple tariff elements, including e.g. standing charges, capacity and energy fees, and a number of other elements as well. To ensure that the analysis is based on a common measure that can be compared across countries, all prices have been converted into annual payments per kWh of electricity consumed.

In order to provide a basis upon which reasonable comparisons can be made, it is necessary to define standard load profiles for a given set of customer classes. KEMA defined four customer categories based on a review of national load profiles. This review is shown in the following Table.

Table 1 Typical capacity per consumer group (source: KEMA)

Customer Category	Voltage	Consumption (kWh/year)	Connected Capacity (kVA)
Domestic	LV	1,100	n/a
Small commercial	LV	13,800	3
Large commercial	MV	590,000	115
Industrial	HV	23,000,000	3,500

2.1.2 Focus on Main Tariff Elements

Tariff elements represent a subset of the final price and are intended to compensate for different services, such as the use of the system, metering services, and the provision of reactive power. Some of these payments are based on rather specific criteria and complex pricing schemes, but represent only a minor share of total grid charges.

Most network companies split grid charges into several sub-tariffs (multi-part). In order to limit the number of additional assumptions and to reduce the level of complexity, the main network tariff elements have been considered first:

- **Fixed:** This fee is typically charged per month or per year and is intended to cover the fixed cost of the connection. In some instances, the fee is charged on a daily or weekly basis. A year is defined as consisting of a standard (non-leap) 52 weeks or 365 days;
- **Energy:** The energy fee is charged per kWh of electricity consumed. A large number of variations may exist here. The energy charge can either be fixed, i.e. constant over all units of kWh consumed, or can vary as a function of the customer's consumption. In addition, rates may also vary over time, i.e. between peak, off peak, and night hours, or by season. With respect to peak/off-peak consumption, we have used a 50/50 allocation. In instances where the energy fee varies according to the season, we have assumed a uniform consumption of electricity throughout the year;
- **Capacity:** The capacity fee is charged to larger customers and is a fee to be paid per kW or kVA of contracted capacity. In instances where the charge is per kVA, we have assumed a power factor of 0.8, i.e. 1 kW = 0.8 kVA;
- **Metering:** The metering fee should cover the costs of the meter provided to the customer, as well as the costs associated with meter reading. In some cases, metering costs are not explicitly mentioned but included in the fixed fee. In other cases, meter reading costs are stripped out of the tariff and covered separately, generally due to subcontracting arrangements that can be incorporated into overheads;
- **Connection—periodic:** In some rare instances, the fixed fee can be split between a normal fixed fee and a periodic connection fee. In these cases, the periodic connection fee has been treated as a fixed fee component.

There is another group of tariff elements which are less relevant to this project, and which have been excluded when computing the charges. These excluded items are:

- **Connection—initial:** When applying for a new network connection, customers need to pay a connection fee. This fee usually depends on the size of the connection as well as the location of the customer, i.e. the distance from the network (this is related to the issue of deep or shallow connection costs).
- **Excess capacity:** Some companies charge customers an additional fee (penalty) in the event that their peak exceeds the level of contracted kW capacity. We ignore this fee in our analysis as we assume that the contracted capacity is sufficient to cover the customer's normal electricity demand.
- **Reactive power:** Fees for reactive power compensation are typically dependent on a predefined threshold in kVAR consumption during a given period (usually one month). Alternatively, fees are dependent on measured deviations from a benchmark co-sin (φ) established by the utility. This fee has been ignored since we assume that either reactive energy consumption remains below normally acceptable levels or the payments for reactive power are minimal when compared to the total electricity bill.

The following table provides a summary of the different types of fees that have been included in, or excluded from, the analysis.

Table 2 Overview of tariff elements that have been included in or excluded from the analysis (source: KEMA)

Type of charge	Basis	Included	Excluded
Fixed	Per day, month, or year	•	
Energy	per kWh	•	
Capacity	per kW	•	
Metering	Per day, month, or year	•	
Connection—periodic	Per day, month, or year	•	
Connection—initial	One-off		•
Excess capacity	per kW per month or year		•
Reactive power	Per kVARh or cos (φ)		•

2.1.3 Exchange Rates

When comparing the level of prices in different countries, it is necessary to use a common currency; therefore all prices have been converted to Euros using average nominal exchanges rates from the year 2011. The exchange rates used are presented in the following table.

Table 3 Exchange Rates used, 2011 average rates (source: www.xe.com)

Country	Currency	Exchange Rate [1 EUR = X Local]
Kenya	KES	120
Cape Verde	CVE	110
Ghana	GHS	2.16
Tanzania	TZS	2,150
Senegal	XOF	656

2.1.4 Taxes/VAT

The analysis includes the costs of all government fees such as environmental taxes, et cetera but excludes costs of Value Added Taxes (VAT).

2.1.5 Bundled versus Unbundled Tariffs

In principle, a comparison of electricity prices would need to be performed at the level of the different functions within the supply chain, i.e. generation, transmission, distribution, and supply. However, it is important to note that this is typically not possible due to the relatively limited degree of market liberalization in the countries investigated here. The comparisons are therefore made at the level of the end-user tariff, i.e. the aggregation of all the various tariff components to be paid by the user.

2.2 Financial Analysis

The objective of the financial analysis is to study and assess a company's financial position and its evolution based on their annual corporate results. The basic information for the analysis is extracted from the company's financial statements. These summarize and report the company's results in standardized and comparable formats, using generally accepted accounting standards and subject to external scrutiny. The analysis is carried out on the basis of financial ratios that are used as performance indicators. These financial ratios are calculated using data from the common financial statements: the balance sheet, the profit and loss statements, and the cash flow statements. Financial ratios are important because they serve to combine information from different statements and enable the comparison of the financial results of different companies. For the purpose of the present analysis, several key financial indicators (ratios) were selected to assess performance in the following four different financial areas, which are recognized as of fundamental importance to measure the financial condition of any business. These are described in the following sections.

2.2.1 Gearing

Most firms use both debt and equity to fund their business and the relationship between these two sources of funds provides the firm's capital structure ratios or gearing ratios or leverage ratios. The analysis of a firm's capital structure is essential to evaluate its long-term risk and return prospects. Since debt carries fixed-interest and repayment commitments, a highly geared firm (i.e. a firm with large fraction of debt in its invested capital) has greater chances of failing on its financial commitments and being forced into bankruptcy. Consequently, highly leveraged firms are more vulnerable to business downturns than those with lower debt to worth positions. Also, for the same reason, the returns for equity shareholders (who are the residual claimants in the company) become more volatile and risky as gearing increases. Finally, a high level of gearing may also have implications for the extent to which a company may have access to additional capital.

One indicator of the amount of leverage used by a business is the Gearing Ratio. This ratio indicates the level of debt in proportion to total capital (debt + equity). A high gearing indicates an extensive use of leverage, i.e. a large proportion of financing provided by creditors. A low gearing, on the other hand, indicates that the business is making little use of leverage. Generally, a gearing of not more than 66% is considered to be appropriate, i.e. two-thirds funded by debt and one-third by equity.

2.2.2 **Interest Coverage Ratio**

The Interest Coverage Ratio (ICR) measures the company's ability to pay interest on outstanding debt from its operational profit. It is calculated by dividing the earnings before interest and taxes (EBIT) by the interest expenses, and represents the number of times interest payments are covered by earnings. An interest-coverage ratio below 1 is an immediate indication that the company does not generate sufficient profit to cover its interest payments. An interest-coverage ratio of 1.5 is generally considered the minimum level for any company taking into account revenue uncertainty. For companies with good business positions as power utilities with stable earnings, an ICR of 2 to 2.5 is an acceptable standard.

2.2.3 **Debt Coverage Ratio**

Another indicator for the ability to borrow is the Debt Service Coverage Ratio (DSCR). The DSCR gives an indication of an organization's excess revenues over debt obligations. The higher the ratio, the more funds the company has available to finance its debt obligations (interest and principal payments). Consequently, the better the company is able to attract new debt.

It is computed as (net income + depreciation + interest)/(repayments + interest). Target values are typically a minimum of 1.5 while the desirable level is above 2.0. A lower level implies that there is a risk that an excessive level of debt (and consequently high interest and principal payments) can quickly consume any excess revenues.

2.2.4 **Current Ratio**

Liquidity is the ability of a company to satisfy its short-term obligations with current assets. In contrast to viability, liquidity is a short-term element of financial health. The fact that a company has substantial resources to operate over the long-term (viability) may be irrelevant if it does not have the cash or other resources easily convertible to cash to pay its bills in the coming twelve months.

The Current Ratio is typically used to measure liquidity. This indicator is computed by dividing total current assets by total current liabilities. This ratio provides a measure of a business's current assets in proportion to its current liabilities and indicates whether the organization has sufficient cash or other easily convertible assets to cover its obligations due in the next twelve months. The more current assets the company has, the more liquid and safer it is. Current assets can also be viewed as the liquid resources needed to meet a firm's current liabilities (i.e. liabilities due within one year). The current ratio measures a firm's margin of safety for meeting its short-term obligations. If the current ratio for a company is falling over time, the presumption is that the risk is increasing and vice versa.

A ratio of less than 1.0 suggests that the firm's liquid resources are insufficient to cover its short-term payments. Moreover a ratio less than 1.0 indicates that fixed assets are being financed partially with short-term debt. This is not considered to be a good financial management practice. Short-term debt typically becomes due more quickly than long-term debt, so there is greater risk of non-payment. In practice, a current ratio of 1.2 is generally considered to be desirable.

2.2.5 Summary Financial Targets

It should be emphasized that financial ratios are functionally intertwined, reflecting the logical relationships among the components of a balance sheet and income and cash flow statements. For instance, the earnings generated by a company's operations are reflected in the profit margin, return on assets, and cash flows, which in turn reveal liquidity and solvency. Therefore, those ratios can be considered as indicative of the financial position of the company.

Table 4 shows a summary of the indicators and expected performance levels to be classified as financially adequate.

Table 4 Summary expected range of financial indicators (source: KEMA)

Financial Indicator	Expected Range
Return on Capital (pre-tax nominal)	10%
Gearing	< 66%
Interest Coverage Ratio (ICR)	> 1.5
Debt Service Ratio (DSR)	> 1.5
Current Ratio	> 1.2

2.3 Tariff Analysis

In conducting the financial analysis, the current level of performance is assessed, as established from the current financial status. Two scenarios have been investigated based on this approach.

Firstly, the necessary tariff adjustment has been computed in order to achieve a break-even outcome, i.e. a net profit of zero. We should stress that operating at the break-even level does not in any way imply a financially healthy state of affairs and is only used here as a reference case. Nevertheless computation of the necessary tariff increase to achieve break-even provides useful insight into the level of the tariffs versus financial performance. Secondly, the necessary tariff increase is computed based on the requirements of a rate of return of 10%. The 10% adopted here acts as a starting point; in practice the true economic rate of return will be dependent upon the specific conditions of the country and company. It should also be noted that the computation of the tariffs providing a 10% return assumes that any underlying efficiency potential is not exploited.

3 COUNTRY STUDIES

This section presents the results of the country studies for Kenya, Cape Verde, Ghana, Tanzania, and Senegal. Each section starts with an overview of the power sector and the principal industry actors. The tariffs in use are then presented after which the average price for the four customer categories are computed based on the standard load profiles. The financial performance of the main utility (typically the distribution company) is reviewed on the basis of the financial indicators defined in Section 2.2. The sustainability of the existing tariffs is evaluated by reviewing the necessary adjustment in tariffs in order to assure a break-even outcome and an economic rate of return of 10%. Finally, some conclusions are drawn.

3.1 Kenya

3.1.1 Power sector overview

The Republic of Kenya has a rapidly growing population of 41 million[1] (July 2011) and a GDP of USD 32 billion in 2010, with an estimated growth of 5%. The country has experienced an increase in energy demand which is linked to the rising population and expanding economy.

Figure 1 Map of Kenya (source: The World Factbook, CIA)

[1] The World Factbook Kenya, CIA (July, 2011)

Roughly 16-18% of the Kenyan population has access to electricity. The present level of network losses is around 19%.

Over the last 6 years, electricity demand has increased by an average of 7% per annum. In 2008, 6.79 TWh was produced and 5.74 TWh was consumed. In that same year, 41 GWh was exported and 16 GWh was imported. According to the national *Least Cost Power Development Plan*[2] (LCPDP) from March 2010, the energy demand forecast for 2010-2030 is rising from 7.4 TWh in 2009 to 92 TWh in 2030. This corresponds to an annual increase of 12.8%. In 2011, Kenya had a total of around 1.8 million connections to the grid of which 17% were accomplished through rural electrification programmes.

The installed capacity as of June 2008 was 1,197 MW, and comprised of i) 677.3 MW of hydroelectric generation, ii) 389.3 MW of thermal generation, iii) 128 MW of geothermal generation, iv) 2 MW of cogeneration, and v) 0.4 MW of wind generation. Figure 2 gives an overview of the shares in generating capacity.

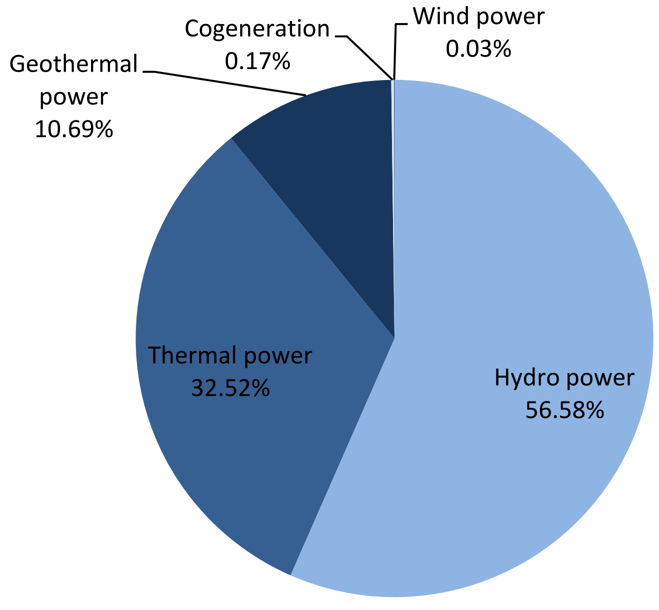


Figure 2 Installed generating capacity in Kenya in 2008 (source: LCPDP[2])

Electricity generation is heavily reliant on hydroelectric power stations. As a result, the system is highly weather dependent. The contribution of thermal power generation is higher during long periods of drought. In addition, issues such as heavy rainfall, leading to landslides as well as flooding, often lead to a disruption in electricity supply due to the destruction of power lines.

[2] www.erc.go.ke/erc/lcpdp.pdf

Governing institutions

The Ministry of Energy[3] is responsible for electricity policy in Kenya and has an oversight role over service delivery by statutory bodies such as the Energy Regulatory Commission, Kenya Electricity Generating Company Limited, Kenya Power and Lighting Company Limited, Rural Electrification Authority, the Geothermal Development Company, and the Kenya Electricity Transmitting Company.

The Energy Regulatory Commission (ERC)[4] was established as the energy sector regulator under the *Energy Act in July 2007*. The ERC is a regulatory agency with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors, including tariff setting and review, licensing, enforcement, dispute settlement, and approval of power purchase and network service contracts.

Generation

Kenya Electricity Generating Company Limited[5], (KenGen) is the leading electric power generation company in Kenya, producing about 80% of the electricity consumed in the country. The company utilizes various sources to generate electricity including hydroelectric, geothermal, thermal, and wind. Hydroelectric is the leading source, with an installed capacity of 767 MW in 2011, which is 64.9 % of the company's installed capacity.

Independent Power Producers (IPPs) supply the remaining 20% of Kenya's electricity.

Geothermal Development Company (GDC). This is a public company formed in December 2008 to explore and produce geothermal steam through government budget and/or concessionary funding from development partners. The company in turn will sell the steam to other companies, such as KenGen or independent power producers, who develop future geothermal power stations. Current activities are focused in the Rift Valley area.

Transmission, distribution, and supply

The Kenya Power & Lighting Company Limited (Kenya Power)[6] is a limited liability company which transmits, distributes, and retails electricity to customers throughout Kenya. Kenya Power is a public company and is listed on the Nairobi Stock Exchange (NSE).

[3] http://www.energy.go.ke/
[4] http://www.erc.go.ke/erc/index.php
[5] http://www.kengen.co.ke/
[6] http://www.kplc.co.ke/

Kenya Power is responsible for ensuring that there is adequate capacity to maintain supply and quality of electricity across the country. The interconnected network of transmission and distribution lines covers 41,486 kilometres. The national grid is operated as an integral network linked by a 220 kV and 132 kV transmission network. There is a limited length of 66 kV transmission lines. Kenya Power also supplies the electricity to consumers and applies the electricity tariffs set by the ERC.

Kenya Electricity Transmission Company (KETRACO) is a public company formed in December 2008 to build new transmission lines and substations with government budget and/or concessionary funding from development partners. These new lines include 132kV, 220kV, 400kV, and 500kV High Voltage Direct Current (HVDC). The transmission and distribution grid developed by Kenya Power prior to formation of the company will remain in possession of Kenya Power.

The Rural Electrification Authority (REA) is a public authority formed in July 2007 to develop and build the rural electricity grid with government budget and/or concessionary funding from development partners. Once the lines and/or substations are complete, they are handed over to Kenya Power for operations and maintenance.

3.1.2 Tariff analysis

The electricity tariff in Kenya consists of several components, which are shown in Table 5. A number of charges are related to payments to other industry stakeholders. However these are collected from customers directly by Kenya Power.

Table 5 Tariff components in Kenya

Item	Payable to	
Fixed Charge	Kenya Power	The Fixed Charge is a fee that is used by Kenya Power to provide for fixed costs such as meter reading, billing, printing, postage for bills, and customer care.
Consumption Charge	Kenya Power	The Consumption Charge applies to the customer's electricity consumption within the billing period. Kenya Power uses 70-75% of this charge to purchase bulk power from electricity generating companies which in turn is retailed to its customers. The remaining share is used for Kenya Power operations and profits
Fuel Cost Adjustment	KenGen and IPPs	Fuel Cost Adjustment is used to recover the cost of fuel that is used to generate part of the power that is

		consumed each month and remit the same in total to thermal generators who generate the power. The amount is published monthly in the *Kenya Gazette*[7]. The most recent amount for January 2012 was 5.48 KES per kWh (0.046 EUR/kWh).
Foreign Exchange (Forex) adjustment	Government	The Foreign Exchange Fluctuation Adjustment (FEFA) is related to the fluctuation of foreign currencies against the Kenya Shilling for foreign currency based payments in the power sub-sector related to, e.g. electricity project loan repayments. The FEFA was 1.38 KES per kWh (0.0115 EUR/kWh) in January 2012.
Value Added Tax	Government	Value Added Tax (VAT) is collected on the sold electricity for the government. The VAT of 16% is charged to the fixed charge, demand charge, FEFA, fuel costs, and a taxable value of electrical energy consumed in a manner required by the government.
ERC levy	Energy Regulatory Commission	The ERC levy is a statutory levy for the Energy Regulatory Commission and is 0.03 KES per kWh (0.00025 EUR/kWh).
Rural Electrification Programme	Rural Electrification Authority	The Rural Electrification Programme (REP) receives a levy to develop and build the rural electricity grid. Once the lines and/or substations are completed, they are handed over to Kenya Power for operations and maintenance. The amount is 5% of the revenue of unit sales and includes the fixed and consumption charge, fuel cost adjustment, and the FERFA.
Inflation adjustment	Kenya Power	Inflation adjustment (INFA) is set every six months. It is 0.22 KES per kWh (0.0018 EUR/kWh) for the first half-year of 2012.

To determine the Fixed Charge and Consumption Charge, tariff categories and rates have been set by the ERC. Table 6 provides an overview of these tariff categories and rates applied in Kenya.

[7] Issues of Kenya Gazette available on:
http://books.google.nl/books?id=wjV5yOadoOsC&source=gbs_all_issues_r&cad=1

Table 6 Relevant electricity tariff categories for this study in Kenya (source: Kenya Power[8])

Category in this study	Tariff category	Connection type	Max consumption/ billing period (kWh/month)	Fixed Charge (KES)	Demand Charge/ kVA (KES)	Energy Charge (KES)	
						Consumption	Tariff
Domestic	DC	240-415V	15,000	120	n/a	0-50 51-1,500 >1,500	2.00 8.10 18.57
Small commercial	SC	240-415V	15,000	120	n/a	8.96	
Large commercial	CI1	415V, 3 phase, four-wire	15,000	800	600	5.75	
	CI2	11 kV	n/a	2,500	400	4.73	
	CI3	33 kV	n/a	2,900	200	4.49	
Industrial	CI4	66 kV	n/a	4,200	170	4.25	
	CI5	132 kV	n/a	11,000	170	4.10	

The typical consumption and capacity per consumer group, which were determined in Section 2 are used to calculate the yearly costs of the Fixed Charge and the Consumption Charge. The total costs per typical consumer are given in Table 7.

Table 7 Electricity costs per typical consumer for each consumer group, excluding 16% VAT (source: KEMA)

Item	Domestic	Commercial Small	Commercial Large	Industrial
Fixed Charge [KES/year]	1,440	1,440	11,910	93,240
Consumption Charge [KES/year]	5,250	123,648	3,147,114	97,364,935
Fuel Cost Adjustment [KES/year]	6,028	75,624	3,233,200	126,040,000
Foreign Exchange adjustment (FERFA) [KES/year]	1,518	19,044	814,200	31,740,000
Inflation (INFA) [KES/year]	242	3,036	129,800	5,060,000
ERC levy [KES/year]	33	414	17,700	690,000
Rural Electrification Programme [KES/year]	712	10,988	360,321	12,761,909
Total costs [KES/year]	15,223	234,194	7,714,244	273,750,084
KES/kWh	13.84	16.97	13.07	11.90
EUR/kWh	**0.12**	**0.14**	**0.11**	**0.10**

[8] Source: http://www.kplc.co.ke/index.php?id=45

3.1.3 Financial analysis

Kenya Power is the company that supplies the electricity and collects all electricity related charges. The financial analysis therefore focuses on Kenya Power. Information from the *2010 Annual Report* has been used to compute the various financial indicators as shown below.

Table 8 Financial indicators (source: KEMA)

Financial Indicator	Expected Range	Actual
Return on Capital (pre-tax nominal)	10%	8.5%
Gearing	< 66%	57%
Interest Coverage Ratio (ICR)	> 1.5	7.09
Debt Service Ratio (DSR)	> 1.5	3.84
Current Ratio	> 1.2	1.16

The current ROC is a solid 8.5%. For the utility to just break-even it would be possible to decrease the average tariffs by 6.2%. However if one would like to achieve an economic return on capital of 10%, the average tariffs would have to increase by 1.8%. The gearing level of 57.4% is an appropriate balance between debt and equity. The DSCR of 3.84 is well above the desired level of 2.0 and indicates that the risk of high interest and principal payments is at an acceptable level.

The current ratio (1.16) is above 1; this suggests that the firm's liquid resources are sufficient to finance short-term debt. Since a current ratio above 1.2 is desired, there is still room for some improvement. The high interest coverage rate of 7.09 indicates relatively low interest expenses in relation to the operating income.

Figure 3 gives the average tariff for different customer categories. It also indicates what the projected tariff would have been under two scenarios namely (1) to achieve a break-even situation where net profits are zero and (2) to achieve a ROC of 10%.

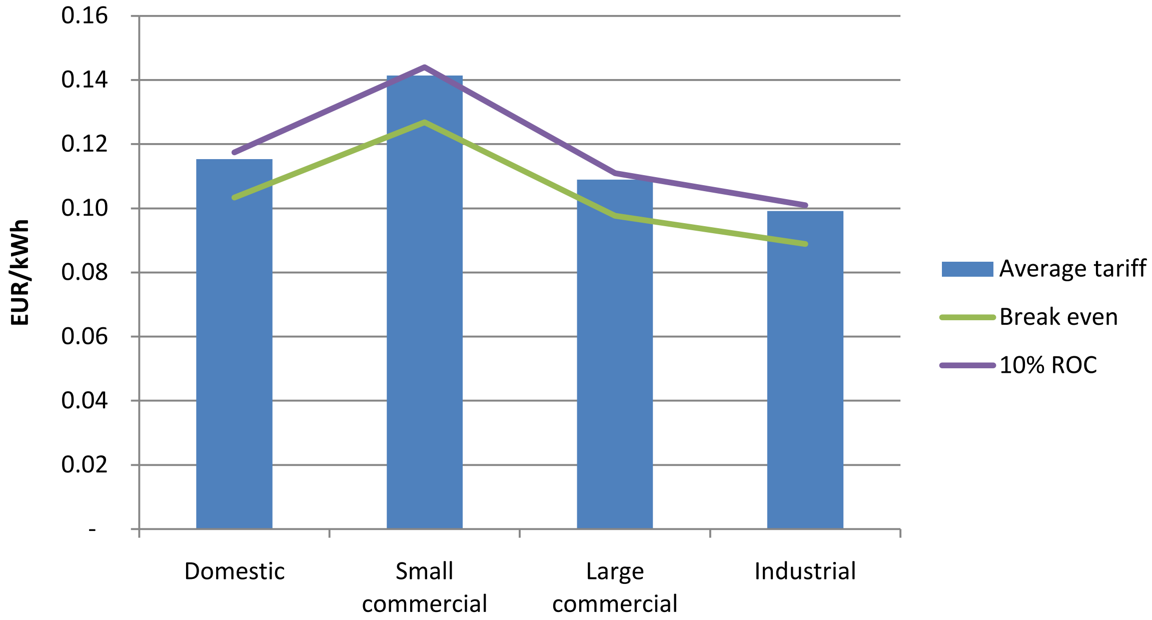


Figure 3 Tariffs per category and average tariffs during 2010/2011 in Kenya (source: KEMA)

As can be observed, Kenya Power achieves relatively healthy results with current tariffs well above the break-even level and with a return on capital of 8.5% in 2010/2011. If a return on capital of 10% were to be reached, the tariffs would have to increase with 1.8%.

As can be seen from Figure 3, the electricity tariff is not equal between all consumer groups. Regarding the differences between consumer groups, it is justifiable that consumers that are connected at higher voltage levels pay a lower tariff since they do not make use of the lower voltage grids. In general the trend can be observed that larger customers pay substantially lower prices. The notable exception is the small commercial consumer group that pays a relatively high price for their electricity compared to the other consumer groups. This suggests some degree of cross-subsidy from these customers to others.

3.1.4 **Conclusions**

Demand growth in Kenya at 7% is high while the level of electrification is currently still below 20%. This indicates substantial scope for expansion in system capacity. At the same time, the Kenya power sector seems to be well organized with a favourable structure for attracting investment. Tariffs seem to be set in a relative independent manner with automatic adjustments for fuel, inflation, and exchange rates.

Tariffs in Kenya are around 0.12 EUR/kWh, which is moderate. This can be explained by the considerable hydroelectric capacity. This also helps to dampen the effect of oil price variability. The favourable situation seems to be reflected in the financial performance of Kenya Power. Financial indicators are well within the expected range except for the rate of return, which nevertheless is at a high 8.5%. The level of electricity losses currently stands at 19%. Hence, even with tariffs unchanged, there is potential for higher returns through reduction of losses.

3.2 Cape Verde

3.2.1 Power sector overview

Cape Verde, a small archipelago consisting of ten volcanic islands, is located in the Atlantic Ocean about 500 km off the coast of Senegal. Cape Verde has a total population of approximately 516,000[9] (July 2011 estimation). In 2010 its GDP was 1.65 billion USD. The country boasted a remarkable average annual GDP growth rate of 6.0% from 2000 through 2010, with inflation averaging 2% and declining debt until 2009[10].

Figure 4 Map of Cape Verde (source: The World Factbook, CIA)

[9] The World Factbook Cape Verde, CIA (July 2011)
[10] Project Appraisal Document on a proposed loan in the amount of Euros 40.2 million to the Republic of Cape Verde for a recovery and reform of the Electricity sector project (report no. 58218-CV), The World Bank, December 2011.

In 2010, Cape Verde had 116,000 electricity consumers, excluding public lighting, and a total electricity demand of 204 GWh. The electrification coverage in rural areas is more than 95%, however the dispersed character of the islands and the inherently small power stations have resulted in high electricity costs. Demand is growing at a rate of around 8% per annum.[11] The level of network losses is 26%.

The maximum technically possible amount of renewable energy sources has currently been integrated into the system. The total installed capacity is approximately 116 MW, including 25 MW of wind power and 7.5 MW of solar power. The remaining share of electricity is generated by 18 diesel power stations spread over the islands.

Governing institution

The Economic Regulatory Agency[12] (Agência de Regulação Económica, ARE) was established in 2003 and started its activities on 12 February 2004. ARE regulates various sectors such as: water, electricity, and the fuel and transport sector. Among the tasks of the regulator are the protection of rights and interests of the consumers, particularly in terms of prices, tariffs, and service quality. ARE is the institution that sets the tariffs in the electricity sector.

Generation, transmission, distribution, and supply

Electra[13] is the electricity generator, the transmission and distribution network operator, and the electricity supplier for Cape Verde. In addition, Electra produces and distributes drinking water in São Vicente, Sal, Praia, and Santiago Vila Sal Rei on Boa Vista, with a coverage rate of 50%. Electra is responsible for the collection, treatment, and reuse of wastewater in the city of Praia. From 1999 to 2006, 51% of the shares were in the hands of the Portuguese consortium EdP/AdP. However due to discussions on tariffs and postponed investments, EdP/AdP pulled back and the government of Cape Verde once again currently owns all shares.

3.2.2 Tariff analysis

The electricity tariff in Cape Verde consists of only a few components, which are shown in

---

[11] http://www.jica.go.jp/english/operations/evaluation/oda_loan/economic_cooperation/2007/pdf/capeverde01.pdf

[12] http://www.are.cv

[13] http://www.electra.cv

Table 9. These components include costs that in some other countries are mentioned separately, such as a fuel charge.

The most recent update of the applied tariffs dates from 12 April 2011, when a tariff increase close to 20% was applied. Initially the government decided not to pass on the impact of higher fuel prices to consumers and to compensate Electra for the loss of revenues[14], but it became necessary to change their position and in the end they indexed the tariff to fuel prices. ARE concluded that the frequency of indexing fuel costs should be increased to once every four months due to the volatility of the oil prices.

A new tariff structure, with a proposal for a tariff indexing formula for the period 2012-2016 is expected to be issued anytime now. However there is no reason to expect that the application of this formula will result in major adjustments of the existing tariffs.

Table 9 Tariff components in Cape Verde (source: ARE[15])

Item	
Electricity consumption charge	The Electricity Consumption Charge is the charge for the customer's electricity consumption for one month. Other aspects such as the fuel charge are included in this component as well. The consumption charge is regulated in the tariff groups.
Capacity charge	The Capacity Charge is charged to the all consumer groups except the domestic consumers. The charge is dependent on the capacity of the connection that is contracted and is issued monthly.
Fixed Charge meter rental	A Fixed Charge for meter rental is a monthly fee, dependent upon the capacity of the electricity connection.
Value Added Tax	All charges are taxed with 4.5% VAT.

To determine the Fixed Charge and Consumption Charge, tariff categories and rates have been set by ARE. Table 10 provides the monthly meter rental charge and Table 11 provides an overview of the tariff categories and rates applied in Cape Verde.

[14] Project Appraisal Document on a proposed loan in the amount of Euros 40.2 million to the Republic of Cape Verde for a recovery and reform of the Electricity sector project (report no. 58218-CV), The World Bank, Dec 2011.
[15] http://www.are.cv/index.php?option=com_content&task=view&id=77&Itemid=54

Table 10 Calculation of Monthly Fixed Charge for meter rental (source: ARE[16])

Capacity [kW]	Fixed Monthly Charge, excl. VAT [CVE]
0-2.2	41.41
3.3-6.6	100.56
6.6-9.9	265.07
> 9.9	369.89

Table 11 Relevant electricity tariff categories (sources: ARE[17] and Electra[18])

Category in this study	Tariff category	Connection type	Monthly meter rental [CVE]	Demand Charge/ kVA [CVE]	Energy Charge, excl. VAT [CVE]	
					Consumption	Tariff
Domestic	Baixa Tensão Domestica	low voltage	41.41	n/a	0 - 60 > 60	26.52 33.83
Small commercial	Baixa Tensão Especial/Industrial	low voltage	100.56	379.94	29.54 x k (multiplier)	
Large commercial	Media Tensão	medium voltage	369.89	349.94	25.21 x k (multiplier)	
Industrial	n/a					

The typical consumption and capacity per consumer group are used to calculate the yearly costs of the Fixed Charge and the Consumption Charge. The total costs per typical consumer are given in Table 12. Note that the tariff for industrial customers does not apply to Cape Verde.

[16] http://www.are.cv/index.php?option=com_content&task=view&id=77&Itemid=54
[17] http://www.are.cv/index.php?option=com_content&task=view&id=77&Itemid=54
[18] http://www.electra.cv/index.php/Contratacao/tarifas.html

Table 12 Tariffs for typical consumer groups Cape Verde (source: KEMA)

	Domestic	Small commercial	Large commercial
Energy charge [CVE/year]	31,779	407,652	14,873,900
Capacity charge [CVE/year]	n/a	13,678	482,917
Meter rental [CVE/year]	497	1,207	4,439
Total [CVE/year]	32,276	422,537	5,361,256
CVE/kWh	29.34	30.62	26.04
EUR/kWh	**0.27**	**0.28**	**0.24**

3.2.3 Financial analysis

Electra is the company that supplies the electricity and collects all electricity related charges. The financial analysis therefore focuses on Electra. Information from the *2010 Annual Report* has been used to compute the various financial indicators as shown below.

Table 13 Financial indicators Electra (source: KEMA)

Financial Indicator	Expected Range	Actual
Return on Capital (pre-tax nominal)	10%	-10.5%
Gearing	< 66%	87%
Interest Coverage Ratio (ICR)	> 1.5	-1.82
Debt Service Ratio (DSR)	> 1.5	0.09
Current Ratio	> 1.2	0.99

With a ROC of minus 10.5%, the financial prospects of Electra are precarious. Besides the fact that electricity generation is relatively expensive on the dispersed islands, there is a high level of distribution losses: above 26% in 2010. These losses are largely driven by the poor level of revenue collection. Improving these aspects will help increase operating income.

The high gearing level indicates that Electra is mostly financed with debt. This high leverage increases the sensitivity to volatile business results and in the case of a bad performance worsens the situation for the equity holders. Although the current ratio (0.99) is just under 1, it still indicates that Electra has potential difficulties in meeting its short-term obligations. It seems that the main cause of the negative working capital is a shortage of cash flows into the company, caused by a poor level of revenue collection[19]. With a negative operating income, the interest coverage ratio indicates a negative result, which is financially unsustainable. Finally, the low DSCR gives a strong signal that the company has difficulties in meeting annual interest and principal payments on debt, and has a negative cash flow.

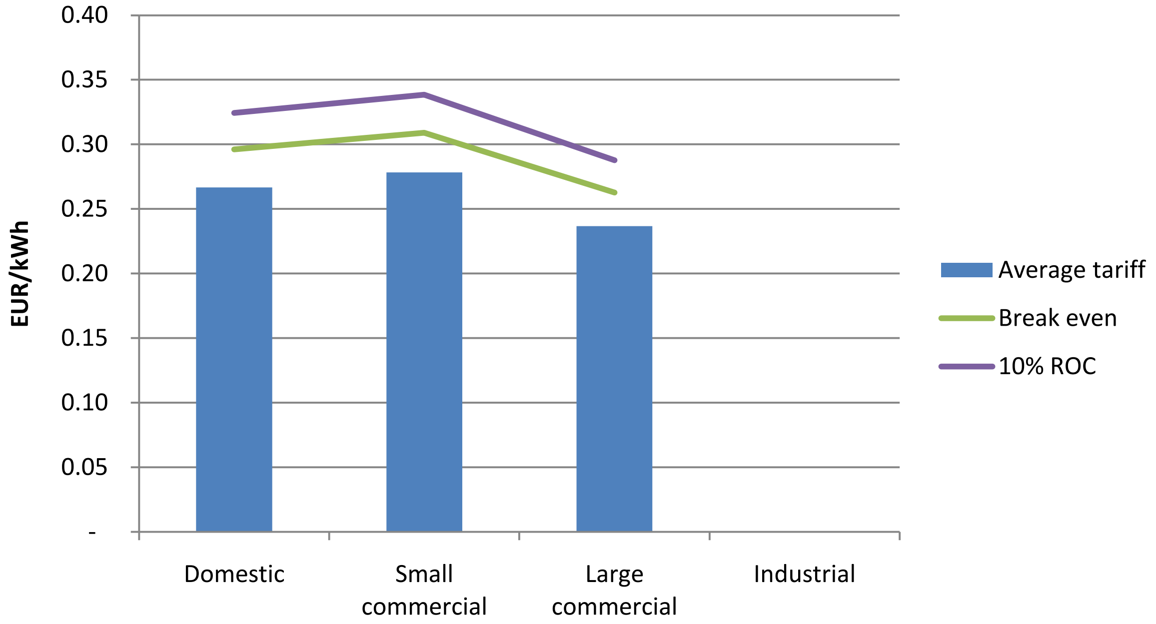


Figure 5 Tariffs per category and average tariffs in 2010 excluding VAT in Cape Verde (source: KEMA)

Figure 5 shows the average tariff for different customer categories. It indicates what the projected tariff would have been under two scenarios namely (1) to achieve a break-even situation where net profits are zero and (2) to achieve a ROC of 10%. Since there is no high voltage grid in Cape Verde, according to our grouping of consumers there are no industrial consumers in Cape Verde.

[19] Project Appraisal Document on a proposed loan in the amount of Euros 40.2 million to the Republic of Cape Verde for a recovery and reform of the Electricity sector project (report no. 58218-CV), p. 7, The World Bank, Dec 2011.

The current tariffs are well below the tariff that would result in a healthy ROC of 10% or even a break-even situation. To be able to present a break-even result, the tariffs would have to be increased by 11.0% and even by 21.6% to achieve a ROC of 10%.

In addition, Figure 6 shows that the difference between the consumer groups is moderate, but that the Large Commercial group obtains their electricity at a lower tariff. This can partly be explained by the higher voltage level to which this consumer group is connected. Since it does not use the lower voltage grid, the costs do not necessarily have to be paid by this group. Furthermore it can be seen that on the low voltage grid, the small commercial group pays relatively more per kWh than the domestic users, which might be caused by the relatively cheap first 60 kWh/month for domestic consumers

3.2.4 Conclusions

Although electrification rates in Cape Verde are already high at 95% the demand is still growing steadily at the rate of around 8%. This indicates that growth is coming from an increase in consumption due to higher economic wellbeing. At the same time, the power sector seems to be suffering from lack of funds. Even though tariffs are already high at an average of 0.26 EUR /kWh, they do not seem to cover costs. Production costs in Cape Verde are very high due to lack of local energy resources. This results in the use of diesel power, which is generally more expensive. Although the tariffs are high, Electra has substandard financial performance and seems to be financially distressed. The fact that losses are very high (above 26%) and revenue collection is poor contributes to this situation.

3.3 Ghana

3.3.1 Power sector overview

Ghana, a country in the west of Africa, has an estimated population of 24.8 million (July 2011) and a GDP of 38.6 billion USD in 2011, with an impressive real growth rate of 13.5% in that same year. Electricity demand growth is around 11% per annum.[20]

[20] Source: Discussions with ECG

Figure 6 Map of Ghana (source: The World Factbook, CIA)

The Ministry of Energy instituted the *National Electrification Scheme* (NES) in 1989 to extend electricity to all parts of Ghana over a 30-year period from 1990-2020. At the end of 2010 the electricity distribution infrastructure provided access to about 72%[21] of the population. However, it is old and obsolete, leading to frequent interruptions in power supply and relatively high system losses. While national access is about 72%, access in the three northern regions is about 30%[22].

The level of network losses in Ghana is 27%[23], with an estimated half of this share being commercial losses, i.e. illegal hook-ups and bypasses.

Installed power capacity in Ghana was 2,186 MW at the end of 2010 and consisted of hydroelectric power (1,180 MW) and thermal power (1,006 MW). Figure 7 gives an overview of the share of hydroelectric and thermal power in Ghana. The total electricity generated was 10,232 GWh, comprised of 6,994 GWh of hydroelectric power, 3,134 GWh of thermal power, and 95 GWh of electricity imports[24].

[21] Annual report 2010, Electricity Company Ghana
[22] Ministry of Energy, Sectorial overview, http://energymin.gov.gh/
[23] Annual report 2010, Electricity Company Ghana
[24] 2011 Energy (supply and demand) outlook for Ghana, April, 2011. Energy Commission Ghana

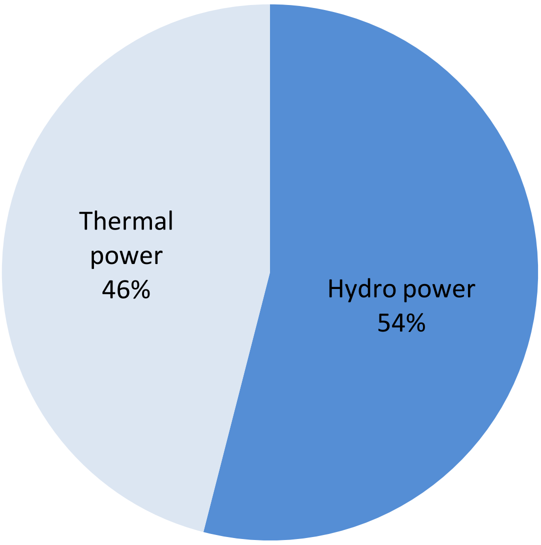


Figure 7 Installed generating capacity in Ghana in 2010 (source: ECG)

The power market in Ghana is divided into two: regulated and deregulated markets. The regulated market is made up of all customers who are not bulk customers of electricity. The Public Utilities Regulatory Commission (PURC) regulates prices in this market. The deregulated market is made up of bulk customers who can negotiate power prices directly with power producers without the intervention of the PURC[25].

Governing institutions

The Ministry of Energy[26] is responsible (among other matters) for the policies regarding electricity. In Ghana, the electricity sector is unbundled with separate jurisdictions controlling electricity generation, transmission, and distribution activities.

The Energy Commission is required by law to regulate, manage, and develop the utilization of energy resources in Ghana and to provide the legal, regulatory, and supervisory framework for all providers of energy in the country.

The Public Utilities Regulatory Commission[27] (PURC) is an independent body set up to regulate and oversee the provision of electricity and water services to consumers. Under the *Energy Commission Act 1997 (Act 541),* PURC is also required to approve charges for the

[25] Energy Commission, http://new.energycom.gov.gh/pgs/faqdetails.php?recordID=28
[26] http://energymin.gov.gh/
[27] http://www.purc.com.gh

supply, transportation, and distribution of electricity. Other tasks include providing guidelines for water and electricity sector tariffs, monitoring performance standards, promoting and enforcing competition among public utilities, receiving and investigating complaints, and settling disputes.

Generation

Volta River Authority[28] (VRA) was established on April 26, 1961 under the *Volta River Development Act, Act 46 of the Republic of Ghana*, as a corporate body with the mandate to operate mainly as a power generation, transmission, and distribution utility. In 2005, following the promulgation of a major amendment to the *VRA Act* in the context of the *Ghana Government Power Sector Reforms*, the VRA's mandate has now been largely restricted to generation of electricity. The transmission function has been separated into Ghana Grid Company (GRIDCo). The distribution activities have been placed under the Northern Electricity Department (NED), a subsidiary company of VRA, which will eventually be integrated with the Electricity Company of Ghana.

Enclave Power Company[29] generates, distributes, and supplies electricity in the Tema Free Zones Enclave.

Transmission

Ghana Grid Company[30] (GRIDCo) was established in accordance with the *Energy Commission Act, 1997 (Act 541)* and the *Volta River Development (Amendment) Act, 2005 Act 692*. These acts provide for the establishment and exclusive operation of the National Interconnected Transmission System by an independent utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities. GRIDCo provides metering and billing services to bulk customers, in addition to its transmission responsibilities.

Distribution and supply

The Electricity Company of Ghana[31] (ECG) is the largest electricity distributor and supplier in Ghana with 2,120,564 customers in 2010 and total energy sales of 4,972 GWh. Total electricity purchased from VRA was 6,771 GWh.

The Northern Electricity Department (NED) is the sole distributor and supplier of electricity in the Brong-Ahafo, Northern, Upper East, Upper West, and parts of the Ashanti and Volta

[28] http://www.vra.com/
[29] http://lmi-ghana.com/enclave.php
[30] http://www.gridcogh.com
[31] http://www.ecgonline.info/ecgweb/

Regions of Ghana. The NED is currently still a subsidiary of VRA, but will eventually merge with ECG. NED has a customer population close to 300,000 and a load demand of about 120 MW.

3.3.2 Tariff analysis

There are two electricity tariff structures in Ghana; the general tariff system is applied by ECG and NED, and the second tariff structure is applied directly by VRA to bulk customers. The general tariff system applied by ECG and NED is used in this study. Data from ECG, the main electricity supplier in Ghana, is used in the tariff analysis and the financial analysis section 0.

The tariff structure consists of several components, which are shown in Table 14. These components include costs that in some other countries are mentioned separately, such as the fuel charge.

Table 14 Tariff components in Ghana (source: ECG)

Item	
Service Charge	The Service Charge is a monthly fee, dependent upon the consumer group and electricity consumption.
Consumption Charge	The Electricity Consumption Charge is the charge for the customer's electricity consumption for one month. Other aspects such as the fuel charge are included in this component as well. The consumption charge is regulated in the tariff groups.
Capacity Charge	The Capacity Charge is charged to the Special Load Tariff consumer groups. Those groups include part of the small commercial group and the large commercial and industrial consumer groups. The charge is dependent upon the capacity of the connection that is contracted.
Value Added Tax	All charges are taxed with 15% VAT.
National Electrification Levy	A surcharge for the promotion of rural electrification.
Public Lightning Levy	A surcharge for the costs of public lighting.

Table 15 provides an overview of the tariff categories and rates applied in Ghana. The charges for National Electrification Levy and Public Lighting Levy are very small and for computation purposes assumed to be included in the current tariffs.[32]

[32] The total revenue from these levies is less than 100,000 USD on an annual basis.

Table 15 Relevant electricity tariff categories excluding VAT, dated December 2011 regarding Ghana (source: ECG)

Category in this study	Tariff category	Connection type	Service Charge (GHS)	Demand Charge/ kVA (GHS)	Energy Charge (GHS)	
					Consumption	Tariff
Domestic	Residential	Low voltage	1.6532	n/a	1-50 1-300 301-600 600+	0.095 0.175785 0.228135 0.253483
Small commercial	Non-residential	Low voltage	2.7553	n/a	1-300 301-600 600+	0.252712 0.268912 0.424309
	SLT-LV	Low voltage	1.10221	15.4294	0.263402	
Large commercial	SLT-MV	Medium voltage	1.54294	13.2252	0.203889	
Industrial	SLT-HV	High voltage	1.54294	13.2252	0.187357	

The typical consumption and capacity per consumer group, as determined in Section 2.1.1, are used to calculate the yearly costs of the Fixed Charge and the Consumption Charge. The total costs per typical consumer are given in Table 16.

Table 16 Electricity costs per typical consumer for each consumer group, excluding 15% VAT (source: KEMA)

Yearly rate	Domestic	Small commercial	Large commercial	Industrial
Service charge	20	83	185	185
Energy charge	193	4,745	120,295	4,309,211
Capacity charge	n/a	278	18,251	555,458
Total	213	5,106	138,730	4,864,855
GHS/kWh	0.19	0.37	0.24	0.21
EUR/kWh	**0.09**	**0.17**	**0.11**	**0.10**

3.3.3 Financial analysis

ECG is the company that supplies the electricity and collects all electricity related charges. The financial analysis therefore focuses on ECG. Information from the *2010 Annual Report* has been used to compute the various financial indicators as shown below.

Table 17 Financial indicators ECG (source: KEMA)

Financial Indicator	Expected Range	Actual
Return on Capital (pre-tax nominal)	10%	2.4%
Gearing	< 66%	47%
Interest Coverage Ratio (ICR)	> 1.5	8.21
Debt Service Ratio (DSR)	> 1.5	26.4
Current Ratio	> 1.2	0.59

With a ROC of 2.4%, returns are relatively low and by itself not sufficient to finance the demand expansion plans. According to ECG, only around half of the investments are currently in fact undertaken. The gearing level of 47% indicates a moderately leveraged company but it should be taken into account that this figure is affected by the fact that most of the debt is from donor agencies.

Because finance costs are relatively low, the ICR and DSR are high, which suggests that the risk of capital costs consuming all income and cash flows is low. However, it should be taken into account that most of the loans are from donors with low interest rates and soft repayment requirements. Hence the ICR and DSR provide a distorted picture as these do not reflect interest and repayment conditions based on true market rates. Since the current ratio is below 1, the firm's liquid resources are most likely insufficient to cover its short-term payments. In that case, fixed assets are being financed partially with short-term debt. As short-term debt obviously comes due sooner than long-term debt, there is a greater risk of non-payment.

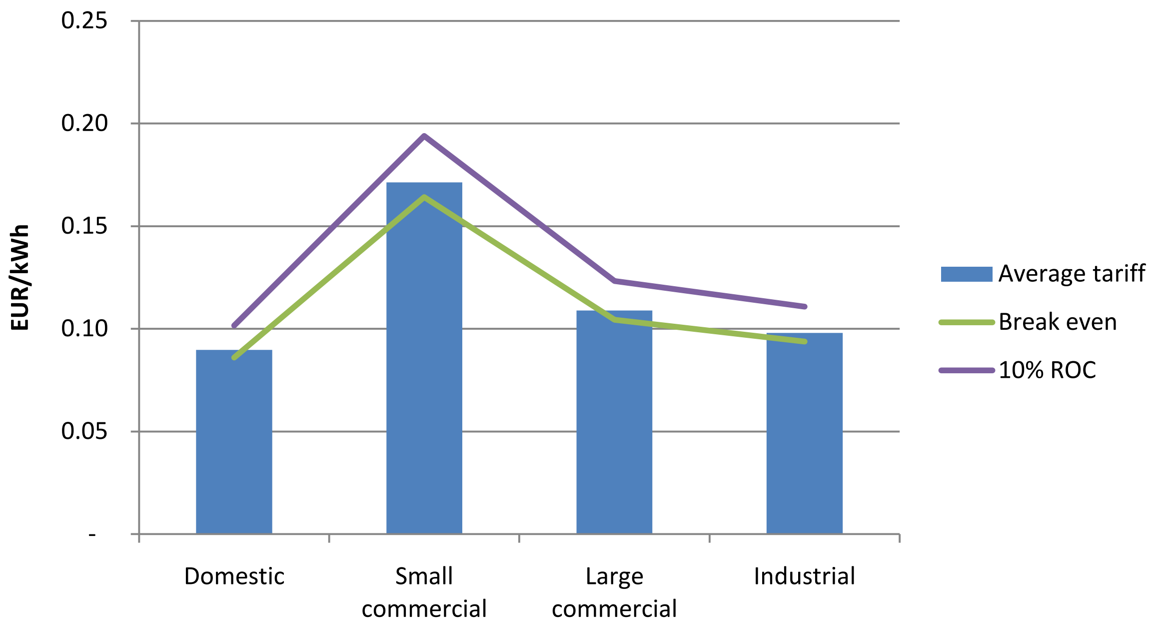


Figure 8 Tariffs per category and average tariffs in 2010 in Ghana (source: KEMA)

Figure 8 shows the average tariff for different customer categories. It also indicates what the projected tariff would have been under two scenarios namely (1) to achieve a break-even situation where net profits are zero, and (2) to achieve a ROC of 10%.

The most notable aspect is the very high tariff for the small commercial group. This suggests that some degree of cross-subsidy from these customers is in force to other consumer groups. The domestic consumers pay a relatively low tariff, especially when taking into account that they are connected to the low voltage grid and make use of the higher voltage grids as well. Consumer groups that are connected at high or medium voltage grids do not use the lower voltage grids, which would justify lower electricity price for those consumer groups.

Tariffs are currently above the break-even level. The figure shows that tariffs would have to increase by 13% to reach a ROC of 10%.

3.3.4 Conclusions

Ghana is experiencing accelerated economic development and this is reflected in the high growth in demand of more than 10% per year. Electricity access is currently at 72% and increasing, suggesting a continued growth in demand for the coming years. The power sector has been reformed with a proper regulatory structure and some degree of market liberalization. Tariffs are moderate at a level of 0.12 EUR/kWh, which is roughly comparable to Kenya. The fuel mix in Ghana and Kenya is also similar, with a high contribution from hydroelectric. However, the financial performance of the main utility ECG is considerably lower. This seems to be explained by the higher level of losses in Ghana (27% versus 19% in Kenya). Although ECG seems to be performing relatively well currently, most of the investments are from multilateral sources. Improvement in ECG's performance would seem achievable through a reduction in the level of losses rather than through a tariff adjustment.

3.4 Tanzania

3.4.1 Power sector overview

Tanzania has a population of 42.7 million (July 2011). About 14% of the population has access to electricity[33]. Electricity demand is growing steadily at a rate of 10% per year.[34] The level of network losses in Tanzania is 24.3%[35].

Figure 9 Map of Tanzania (source: The World Factbook, CIA)

---

33 http://www.mem.go.tz/modules/documents/index.php?action=downloadfile&filename=OVERVIEW%20OF%20ENERGY%20SECTOR%202010.pdf&directory=Energy%20Sector&

34 http://www.usea.org/Programs/EUPP/gee/presentations/TANESCO08March2010_USEA.pdf

35 Tanzania Ministry of Finance and Economic Affairs, Electricity loss reduction study, June 2011

The electricity sector in Tanzania is dominated by the Tanzania Electric Supply Company Limited (TANESCO) in a vertically integrated structure carrying out generation, transmission, distribution, and supply. TANESCO operates the grid system and isolated supply systems in Kagera, Kigoma, Rukwa, Ruvuma, Mtwara, and Lindi. Due to slow development in the sector and the general global trend in the electricity supply industry, the government in 1992 through its *National Energy Policy*, lifted the monopoly by the public utility to allow involvement of the private sector in the electricity industry. This major policy reform enabled Independent Power Producers (IPPs) to operate in the generation segment.

Electricity generation, transmission, and distribution activities are governed by the *Electricity Act, Cap 131*[36]. In addition to Cap 131, the electricity sector is governed by the *National Energy Policy, 2003*[37]. The Ministry of Energy and Minerals is drafting the Electricity Bill to reflect the requirements of the National Energy Policy and other reforms in the sector.

Power generation

The power generation system of Tanzania's national utility TANESCO consists mainly of hydroelectric and thermal based generation. Hydroelectric contributes the largest share of power generation capacity in the country; it contributed 73% of total power generated from October 2009 up to September 2010. Thermal capacity contributed the remaining amount.

In 2010, Tanzania had an installed electricity generation capacity of 887 MW, but only 660 MW of this capacity was available to the grid due to droughts that impacted heavily upon the available hydroelectric power capacity. Much of Tanzania's electricity is generated from four hydroelectric-powered stations. However, the increased occurrence and intensity of droughts has significantly reduced Tanzania's generating capacity; between 25 and 45% during severe droughts[38]. With a peak electricity demand of 879 MW, peak demand exceeded available capacity by over 30%.

---

[36] The Electricity Act (Cap. 131); Document available on: http://www.ewura.com/pdf/SPPT/PROPOSED%20RULES/The%20Electricity%20(Development%20of%20Small%20Power%20Project)%20Rules-2010.pdf

[37] See: http://www.tanzania.go.tz/policiesf.html - National energy policy (only available in Swahili)

[38] Source: *'The Tanzanian Electricity Industry',* V. Maposa (Frost & Sullivan), 6 September 2011

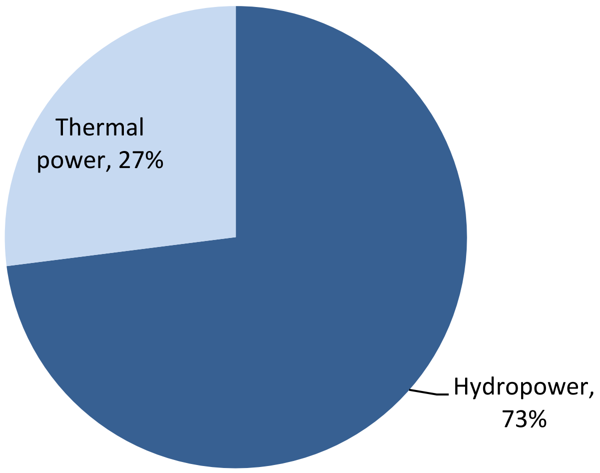


Figure 10 Power generation in Tanzania in 2010 (source: Frost & Sullivan[37])

Because of the heavy impact of droughts upon available generation capacity, Tanzania has been aiming to diversify its electricity fuel mix and expand it with additional thermal capacity. This aim did not have the desired effect; The Songas gas fired power station, with an installed capacity of 190 MW, is the only thermal power station that supplies sizable capacity to the national grid. Furthermore, about 260 MW of emergency power generation contracts have been signed with suppliers of emergency power such as Aggreko, since May 2011.This was undertaken to prevent the power crisis from getting further out of hand.

Governing institutions

The Ministry of Energy and Minerals[39] is responsible for the electricity market in Tanzania. It is the full owner of TANESCO, the generation, transmission, distribution, and supply company in Tanzania. Other state owned or run bodies under the Ministry are the regulator Energy and Water Utilities Regulatory Authority (EWURA)[40].

EWURA is responsible for carrying out technical and economic regulation in the electricity sector. Technical regulation includes benchmarking standards, code of practice, levels of investments, planning and procurements for major projects, and heath, safety and environmental issues. Economic regulations include but are not limited to reviewing and setting rates and charges. Licensable activities in this sector include electricity generation, transmission, distribution, supply, system operation, import and export of electricity, and electrical installation. Major players are TANESCO, Songas, IPTL, Artumas Group & Partners, Aggreko, Dowans and Alstom.

39 http://www.mem.go.tz/
40 http://www.ewura.com/

Utilities

Tanzania Electric Supply Company Limited (TANESCO)[41] is an organization under the Ministry of Energy and Minerals. The Company generates, transmits, distributes, and sells electricity on mainland Tanzania and sells bulk power to the Zanzibar Electricity Corporation (ZECO). TANESCO owns most of the electricity generating, transmitting, and distributing facilities on mainland Tanzania.

Rural Energy Agency (REA)[42] is an autonomous body under the Ministry of Energy and Minerals. Its primary role is to promote access to modern energy services in rural areas of Mainland Tanzania.

3.4.2 Tariff analysis

The electricity tariffs in Tanzania are divided into four categories, which are presented in the table below. This information is available on the website of TANESCO[43]. Along with the four tariff categories, there are special tariffs for power supply to the Zanzibar utility company which is excluded from this analysis. The tariff categories are shown in Table 18.

Table 18 Tariff categories Tanzania (source: TANESCO)

Tariff category	
Domestic Low Usage Tariff (D1)	This category covers domestic customers who on average consume 50 kWh. This 50 kWh is subsidized by the company and are not subjected to service charge. In this category any unit exceeding 50 kWh is charged a higher rate up to 283.4 kWh. In this tariff category, power is supplied at a low voltage, single phase (230 V).
General usage Tariff (T1)	This segment is applicable for customers who use power for general purposes: including residential, small commercial and light industrial use, public lighting, and billboards. The average consumption in this category is more than 283.4 kWh per meter reading period. Power is delivered at low voltage single phase (230), as well as three phase (400V).
Low voltage maximum Demand (MD) usage tariff (T2)	Applicable for general use where power is metered at 400V and average consumption is more than 7,500kWh per meter reading period and demand doesn't exceed 500KVA per meter reading period.
High Voltage Maximum Demand (MD) usage tariff (T3)	Applicable for general use where power is metered at 11KV and above.

[41] http://www.tanesco.co.tz/
[42] http://www.rea.go.tz/
[43] http://www.tanesco.co.tz/index.php?option=com_content&view=article&id=63&Itemid=205

Table 19 presents the current tariff structure applicable to each category. The three columns on the right side of this table show the proposed tariffs as of 1 January 2012. The average proposed increase is 155%. TANESCO argues that this 'emergency tariff increase' is required to meet additional high operational costs from emergency rentals and owned thermal power plants. It also necessary, they argue, to demonstrate and maintain its bankability to financers and Development Partners offering financing and concessionary loans in order to meet power demand[44]. KEMA did not find evidence that this renewed tariff has actually been adopted.

Table 19 Current and proposed tariff structure as per 1 January 2012 (source: TANESCO[45])

Category in this study	Tariff category	Current tariffs				Proposed tariffs			
		Basic Charge (TZS)	Demand Charge/ kVA (TZS)	Energy Charge (TZS)		Basic Charge (TZS)	Demand Charge/ kVA (TZS)	Energy Charge (TZS)	
				Consumption	Tariff			Consumption	Tariff
Domestic	Domestic Low Usage	0	n/a	0-50 >50	60 195	0	n/a	0-50 >50	153 497
Small commercial	General Use	2,738	n/a	157		3,106	n/a	400	
Large commercial	Low Voltage Supply	10,146	12,078	94		25,875	30,802	240	
Industrial	High Voltage Supply	10,146	10,350	84		25,875	26,395	212	

The typical consumption and capacity per consumer group, which were determined in Section 2.1.1, are used to calculate the yearly costs of the Fixed Charge and the Consumption Charge. The total costs per typical consumer are given below for two cases namely (1) for current tariffs and (2) for the proposed new tariffs.

[44] Source: *'An application for emergency tariff by TANESCO'*, TANESCO, 9 November 2011
[45] Source: *'Notice of inquiry – Call for public meeting to collect stakeholders' views on TANESCO's application for emergency tariff adjustment'*, EWURA

Table 20 Tariffs for typical consumer groups in Tanzania based on current tariffs (source: KEMA)

	Domestic	Small commercial	Large commercial	Industrial
Basic charge [TZS/year]	n/a	32,856	121,752	121,752
Energy Charge [TZS/year]	214,500	2,166,600	55,460,000	1,932,000,000
Demand charge [TZS/year]	n/a	n/a	16,667,640	434,700,000
Total [TZS/year]	214,500	2,199,456	72,249,392	2,366,821,752
TSH/kWh	195	159	122	103
EUR/kWh	**0.09**	**0.07**	**0.06**	**0.05**

Table 21 Tariffs for typical consumer groups in Tanzania based on proposed tariffs (source: KEMA)

	Domestic	Small commercial	Large commercial	Industrial
Basic charge [TZS/year]	n/a	37,272	310,500	310,500
Energy Charge [TZS/year]	546,700	5,520,000	141,600,000	4,876,000,000
Demand charge [TZS/year]	n/a	n/a	42,506,760	1,108,590,000
Total [TZS/year]	546,700	5,557,272	184,417,260	5,984,900,500
TSH/kWh	497	403	313	260
EUR/kWh	**0.23**	**0.19**	**0.15**	**0.12**

3.4.3 **Financial analysis**

TANESCO supplies the electricity and collects all electricity related charges. The financial analysis therefore focuses on TANESCO. The financial analysis of Tanzania is based upon a balance sheet, income and cash flow statements, and a demand and energy forecast containing TANESCO budget figures for 2007. These statements were taken from the *TANESCO Tariff Application January 2008*, which was composed in August of 2007. This is the most recent and complete source of financial information that is publicly available for this project.

In spite of the fact that the available financial information describes a situation of that is almost 5 years old, the situation based on the budget figures for that year already illustrate the worrying financial position of TANESCO.

Table 22 Financial indicators TANESCO (source: KEMA)

Financial Indicator	Expected Range	Actual
Return on Capital (pre-tax nominal)	10%	-7.2%
Gearing	< 66%	28%
Interest Coverage Ratio (ICR)	> 1.5	-3.05
Debt Service Ratio (DSR)	> 1.5	-0.19
Current Ratio	> 1.2	0.20

Due to the negative EBIT in the budget for 2007, the ROC is a negative 7.2%. This shows that expected costs were higher than expected revenues in 2007, which is not a healthy situation. If this trend persists, there will be no capital available for required capacity expansion. This illustrates why Tanzania and TANESCO are looking for external sources of financing[46] and an application of emergency tariffs[47]. The gearing ratio of 28% indicates the relatively low leverage used by TANESCO.

Because of the negative EBIT budgeted for 2007, the interest coverage ratio (ICR) is negative as well. The debt service coverage ratio (DSR) also suffers from the negative EBIT. Also important with respect to the DSR calculation is the fact that the repayment of loans was budgeted to be particularly large in 2007, which causes an unusually large denominator in the calculation of the DSR for this year.

As the current ratio is far below 1, the firm's liquid resources are most likely insufficient to cover its short-term payments. In that event, fixed assets are being financed partially with short-term debt. As short-term debt obviously comes due sooner than long-term debt, there is a greater risk of non-payment. This is reflected by the high figure for repayment of loans in 2007.

[46] Source: *' Tanzania Seeks $257 Million Loan From Citibank, Other Lenders',* Bloomberg Business week, 19 January 2012
[47] Source: *'An application for emergency tariff by TANESCO'*, TANESCO, 9 November 2011

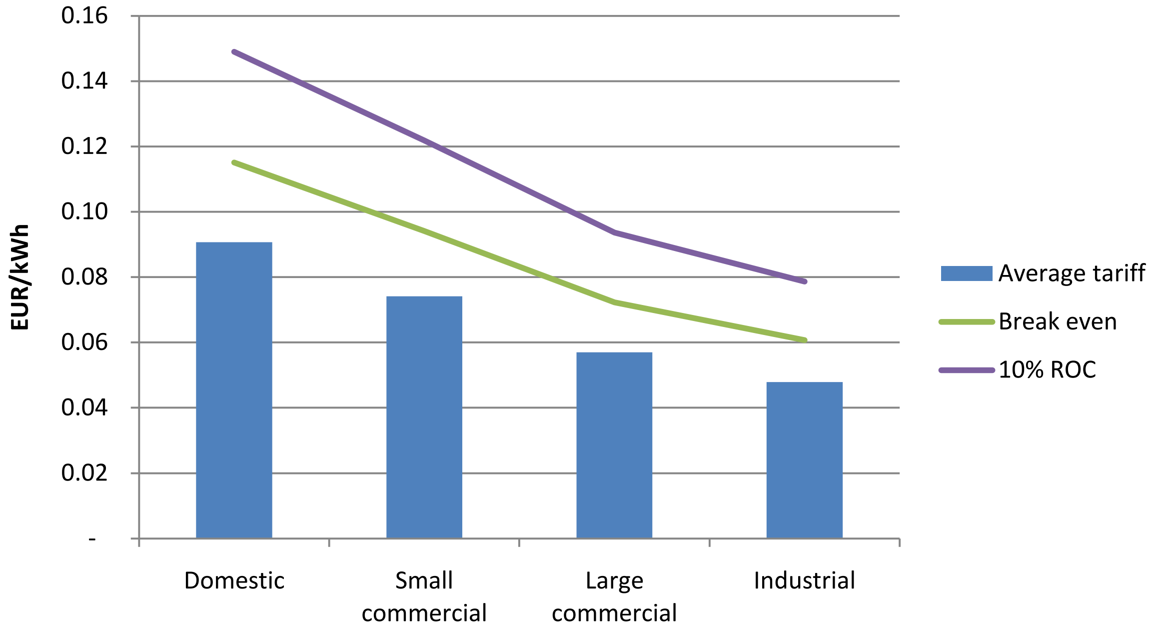


Figure 11 Tariffs per category and average tariffs in 2011 in Tanzania (source: KEMA)

Figure 11 shows the average tariff for different customer categories. Furthermore, it indicates what the projected tariff would have been under two scenarios namely (1) to achieve a break-even situation where net profits are zero and (2) to achieve a ROC of 10%.

The most notable aspect is the fact that domestic consumers pay a relatively high price, almost double that of industrial consumers. More important is the price difference between small commercial and domestic consumers. Both of these groups are connected to the same voltage levels (LV), but there is a price difference of almost 0.02 EUR/kWh. Consumer groups that are connected at high or medium voltage grids do not use the lower voltage grids, which would justify a slightly lower electricity price for those consumer groups. This justifies to some extent the lower tariffs for large commercial and industrial consumers. The high consumption by the industrial consumers relative to the other groups (industrial consumed about 12 times more kWhs than the other three groups combined in the budgeted figures for 2007) suggests that a slight increase in the tariffs for this category could also have a huge impact upon TANESCO's overall income.

Furthermore, the figure shows that overall the tariffs would have to increase by 27% to achieve a break-even situation and by 64% to achieve a ROC of 10%.

3.4.4 Conclusions

Tanzania has a very low level of electricity access at 14%. Demand is growing at 10% but the true demand potential seems to be much higher. The organizational structure of the Tanzania power sector is still traditional with TANESCO being the vertically integrated monopoly. Tariff levels are very low at around 0.07 EUR /kWh. Although the amount of hydroelectric in the system is high, in practice there are capacity shortages due to droughts. A significant portion of power is therefore still from thermal sources, suggesting a large gap between cost and tariffs. This is confirmed by the poor financial performance of TANESCO. The proposed tariff increase will improve financial performance but so far, it has not been implemented. Further scope for improvement is in the losses which are currently at a very high 24%.

3.5 Senegal

3.5.1 Power sector overview

Senegal, a country in the west of Africa, has an estimated population of 13.0 million (July 2012) and a GDP of 25.4 billion USD in 2011. Its real growth rate was approximately 4% in 2010 and 2011. Around 42%[48] of the population has access to the electricity grid. Demand growth is around 10%[49] and the level of network losses in the country is 22%.

Figure 12 Map of Senegal (source: The World Factbook, CIA)

[48] International Energy Agency, World Energy Outlook 2010
[49] Sanoh, Aly et al., Local and National Electricity Planning in Senegal: Scenarios and Policies, Energy Policy (forthcoming)

Governing institutions

The Ministry of Energy prepares and implements Senegal's energy policy and supervises the public energy companies. The priorities of the energy policy are set out in the *Energy Sector Development Policy Letter* (LPDSE) 2008. Those priorities are to develop national energy sources (biofuels and renewable energies in particular), diversify and secure the energy supply, rehabilitate and modernize energy infrastructures, establish household access to modern energy (particularly in rural areas), improve energy efficiency, increase the electrification rate, restructure the electricity sector (in particular the privatization of Senelec), and to exploit forestry resources sustainably.

The Electricity Regulatory Commission (CRSE) was established in 1998 and regulates the electricity and power sector, including the approval of electricity tariffs.

The Senegalese Agency for Rural Electrification (ASER) has the mission to increase the rural electrification rate.

Power generation

In 2010, Senegal had a total installed power generation capacity of 700 MW. Due to ageing facilities, operational incidents, fuel supply constraints, and maintenance programmes, the available capacity is only around 85% of total capacity. Approximately 10% (66 MW) of total capacity comes from the Manantali hydroelectric power plant. The remaining capacity is from diesel generators and gas turbines.

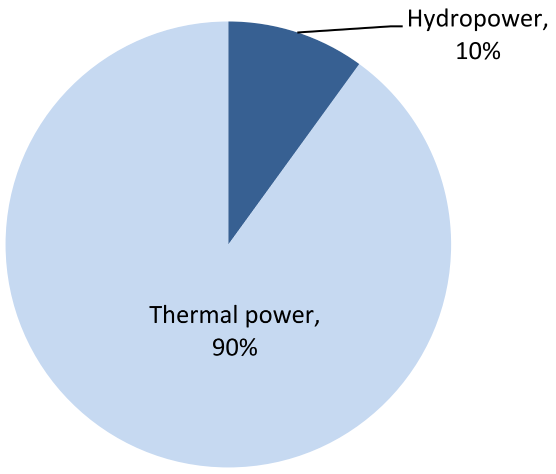


Figure 13 Installed generating capacity in Senegal in 2011 (source: Senelec)

Senegal does not have any indigenous energy sources other than some limited natural gas production south of the capital city of Dakar. As a result, Senegal relies on oil imports as a source of fuel for electricity generation to satisfy its electricity demand.

Senelec, the state-owned utility, is the major producer and accounts for 73% of the electricity production. Private sector investors licensed as Independent Power Producers (IPPs) currently have a combined capacity of 114 MW.

Mainly because of soaring oil prices and their consequent impact upon power production prices, Senegal has committed itself to shifting from a mainly diesel-based power generation to cheaper energy sources. The fuel alternative currently in focus is coal technology. As a result, the Swedish Nykomb Synergetics have been awarded a contract to build, own, and operate a 125 MW coal-fired power station at Sendou[50]. In addition, Senegal recently signed a half-billion dollar energy deal with Korea Electric Power Corp (KEPCO), for KEPCO to supply Senegal with a 250-megawatts coal-fired power station at a cost of US$600 million, which will be operational from 2015. The plant will be built with funding from the Korea Development Bank (KDB)[51].

Utilities

Senelec (Société Nationale dElectricité) is the national electricity production, transport, and distribution company. There have been two failed attempts to privatise the company in response to the continuous financial difficulties the company has suffered since 2006[52]. In addition to Senelec, the following IPPs are active in Senegal: DTI Dakar, Eskom-Manantali, Kounoune Power, and Aggreko (operating 40 MW of temporary capacity). Senelec represents 70% of the production, GTI Dakar and Kounoune 17%, and Eskom-Manantali (operating the Manantali hydroelectric power plant) 10%[53].

3.5.2 **Tariff analysis**

The regulation of electricity tariffs in Senegal is the responsibility of CRSE. The structure and actual tariffs are designed to minimize the rates charged to consumers while respecting the financial viability of Senelec and the quality of supply. The categorization applied by Senelec is presented in Table 23.

---

50 Source: *'Sendou 125 MW Coal Power Plant',* African Development Bank (AFDB), August 2009

51 Source: *"Senegal, KEPCO sign $600 million coal-fired power station deal"*, The Korean Times, 29 January 2012

52 Source: *"Senegal energy report' (update June 2011)'*, Enerdata, 2011

53 Source: *"Senegal energy report' (update June 2011)'*, Enerdata, 2011

Table 23 Tariff categories in Senegal explained (source: Senelec)

Tariff Category	Definition
General domestic use (UDG)	Clients that use low voltage power for their general domestic needs.
Special domestic use (UDS)	Clients that use low voltage power for exclusive lighting needs.
Professional use without fixed premium (UP1)	Clients that use low voltage power for professional purposes with a power demand less than 34 kW.
Public lighting (EP)	Clients that use low voltage power for the purpose of public street lighting.
Usage UP2	Customers who use electricity in low voltage with a subscribed power greater than 34 kW.
Medium voltage short use (MTUC)	Customers who use electricity in medium voltage with an annual consumption less than 1,000 hours of use of the subscribed power.
Medium voltage general use (MTUG)	Customers who use electricity in medium voltage with an annual consumption greater than 1,000 hours of use of the subscribed power and less than 4,000 hours of use of the subscribed power.
Medium voltage long use (MTUL)	Customers who use electricity in medium voltage with an annual consumption of more than 4,000 hours of use of the subscribed power.
High voltage use (UHT)	Customers who use high voltage electricity.
Emergency high voltage use (UHTS)	Customers who use high voltage electricity in case of emergency.

The regulation of rates is based on the method of price ceilings (price cap). The conditions for determining of those ceilings are fixed over a period of five years.

The structure presented in Table 24 applies to the 1999-2004 period. Although this appears to be out-of-date, a more recent overview of the tariffs applicable to each category was not found.

Table 24 Tariff structure in Senegal (period 1999-2004) (source: CRSE[54])

<table>
<tr><th>Category in this study</th><th>Tariff category</th><th colspan="2">Demand Charge/ kVA (TZS)</th><th colspan="4">Energy Charge (TZS)</th></tr>
<tr><td>Domestic</td><td>Abonnés Domestiques BT, Régime Général UDG</td><td colspan="2">n/a</td><td colspan="2">0 – 75
75 -125
>125</td><td colspan="2">120.28
87.07
62</td></tr>
<tr><td>Small commercial</td><td>Abonnés Professionnels BT < 32 kW, UP1</td><td colspan="2">n/a</td><td colspan="2">0 – 75
75 -125
>125</td><td colspan="2">125.16
112.26
76.56</td></tr>
<tr><td>Large commercial</td><td>Moyenne Tension, Tariff Général</td><td colspan="2">1,852.63</td><td colspan="2">Peak
Off-peak</td><td colspan="2">84.45
58.53</td></tr>
<tr><td rowspan="2">Industrial</td><td rowspan="2">Haute Tension</td><td>TAIBA and SOCOCIM</td><td>ICS</td><td colspan="2">TAIBA and SOCOCIM</td><td colspan="2">ICS</td></tr>
<tr><td>6491.76</td><td>2886.01</td><td>Peak
Off-peak</td><td>48.76
38.21</td><td>Peak
Off-peak</td><td>61.06
50.88</td></tr>
</table>

There is a new tariff methodology available for the 2011-2013 period[55]. However the exact impact of this document upon the charges per consumer group is unclear.

Table 25 Electricity costs per typical consumer for each consumer group (source: KEMA)

Yearly rate	Domestic	Small commercial	Large commercial	Industrial
Energy charge	125,666	1,121,688	42,179,100	1,095,777,615
Demand charge	-	-	3,656,724	222,223,900
Total	125,666	1,121,688	45,835,824	1,318,001,515
XOF/kWh	114	81	78	57
EUR/kWh	**0.174**	**0.124**	**0.118**	**0.087**

[54] Source: CRSE on http://www.crse.sn/crse.php?pg=4tarification
[55] "Decision No. 2011-4 Relative aux conditions tarifaires de Senelec pour la periode 2011-2013", CRSE, 21 July 2011

3.5.3 Financial analysis

The financial analysis of power supply in Senegal is based upon the *Senelec 2008 Annual Report*. Senelec is the company that supplies the electricity and collects all electricity related charges. A more recent version of this document was not available to KEMA.

Due to the negative EBIT, the ROC is negative at 0.09%. This shows that costs were higher than revenues in 2007, which is not a healthy situation. If this trend persists through, there will be no capital available for required investments. The gearing ratio of about 20% indicates the relatively low leverage used by Senelec. The interest coverage ratio (ICR) also suffers from the negative EBIT, resulting in a negative value of 0.02. This indicates that in 2008 Senelec was unable to generate sufficient revenues to satisfy their interest expenses. The negative debt service coverage ratio (DSR) shows that there is insufficient operating income to cover annual debt payments. The current ratio of 0.7 suggests that Senelec would be unable to pay off its obligations when they come due, which is another bad sign regarding the financial strengths and capabilities of the company.

Table 26 Financial indicators Senelec, 2008 (source: KEMA)

Financial Indicator	Expected Range	Actual
Return on Capital (pre-tax nominal)	10%	-0.09%
Gearing	< 66%	19.8%
Interest Coverage Ratio (ICR)	> 1.5	-0.02
Debt Service Ratio (DSR)	> 1.5	-0.19
Current Ratio	> 1.2	0.70

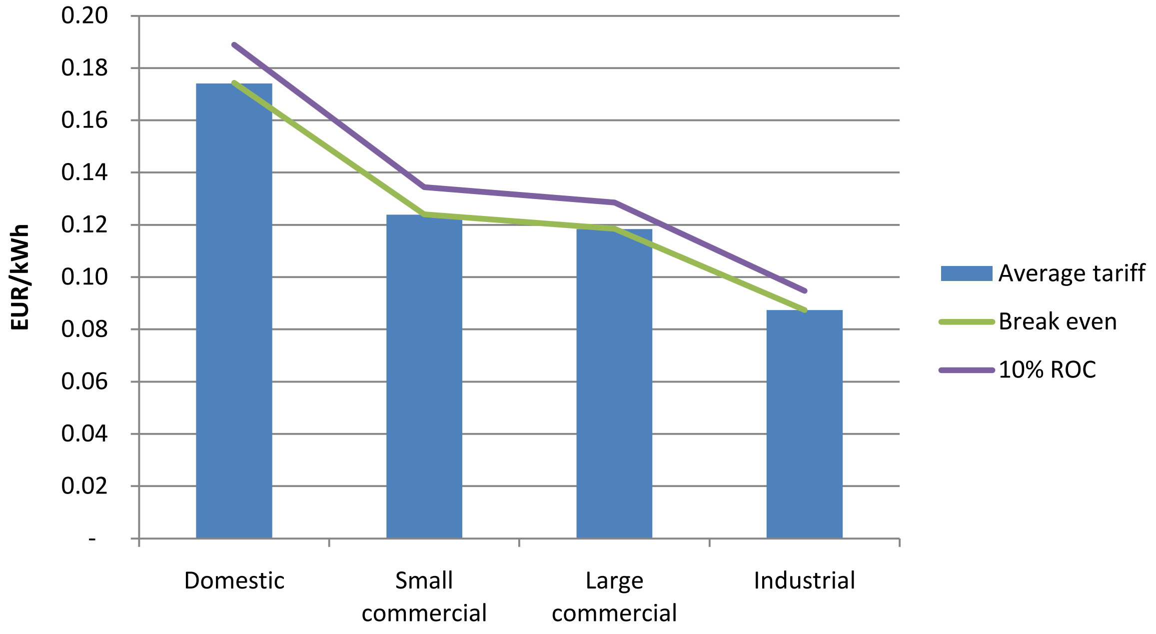


Figure 14 Average tariff per consumer group in Senegal (source: KEMA)

The lower tariffs for large commercial and the industrial consumer groups can be explained by the fact that these two are connected to the medium (large commercial) and high (industrial) voltage grids and do not use the lower voltage grids.

Furthermore, Figure 14 shows that these tariffs are almost sufficient for Senelec to break-even. Depending on the consumer group, the tariffs need to increase by 8.5% to reach a ROC of 10%.

3.5.4 Conclusions

Compared to the other cases reviewed, electricity access in Senegal is moderate at 42% while demand is growing at a high rate of 10% per year. The industry is dominated by Senelec, which is a vertically integrated utility. Senegal's tariff structure seems to be more cost reflective than others showing a clear reduction in prices for larger customers. Financial performance is low however with all financial indicators lower than expected. The level of losses is high at 22% suggesting that considerable returns could be reached by reducing these losses.

4 CONCLUSIONS

4.1 Overall Conclusions

The purpose of this study was to perform a review of the tariff structures in the Sub-Saharan African region in order to identify the extent to which these tariffs are adequate to attract private capital and to develop and maintain the national electricity infrastructure. This was done by reviewing five countries, namely Kenya, Cape Verde, Ghana, Tanzania, and Senegal. The country reviews identified a number of commonalities which seem to be characteristic for the Sub-Saharan countries in general. These characteristics are as follows.

There is a strong growth in electricity demand

All countries investigated showed a significant increase in demand with growth levels of more than 10% in Tanzania, Senegal and Ghana. In Kenya and Cape Verde levels of respectively 7% and 8% are also substantial, especially when compared to the levels normally witnessed in more developed countries.

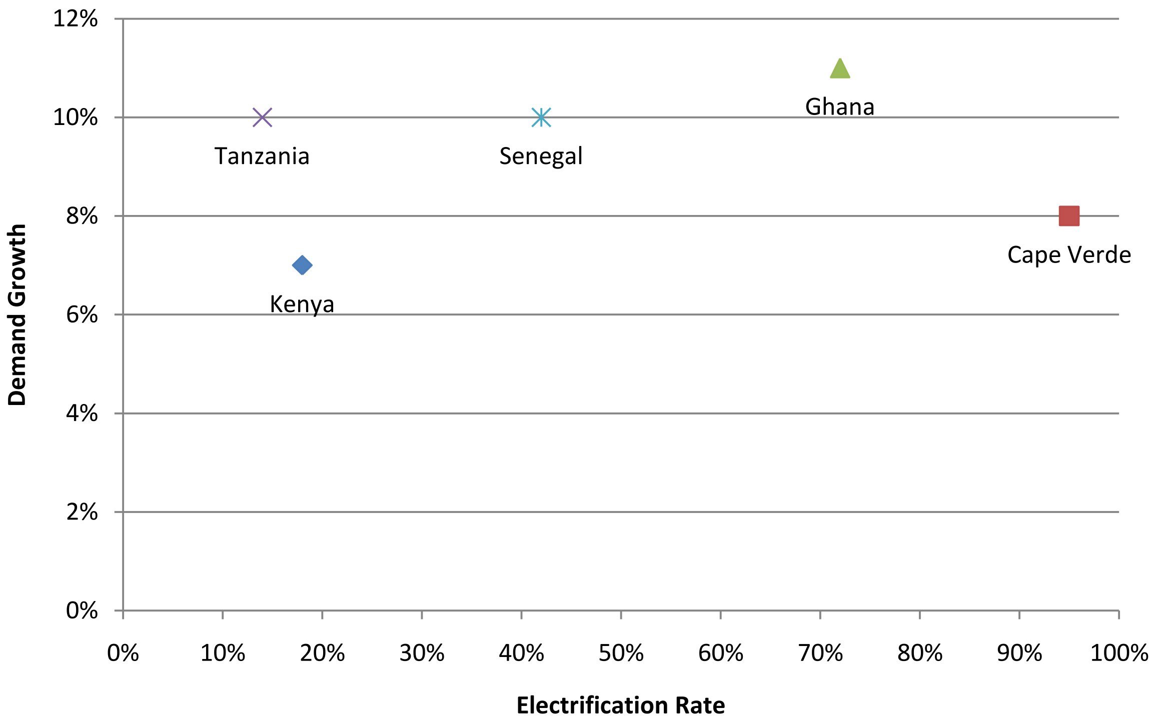


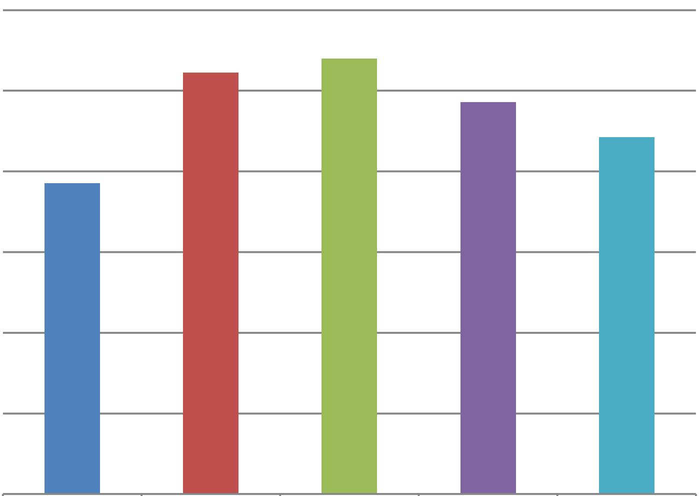
Figure 15 Demand growth and current electrification rates in countries reviewed (source: KEMA)

The high demand growth seemed to be fuelled by two factors. First, the level of electrification generally is still low hence providing for a large portion of new demand due to providing connections to communities previously electrically isolated. Second, there is autonomous demand growth as a direct result of strong economic growth in these countries and hence higher living standards with increased penetration of electrical apparatus.

Overall there seems to be a significant prospect of growing electricity demand. There is a significant level of suppressed demand, which can currently not be met. Given the relative poor financial state of the companies (with the exception of Kenya) the main challenge seems to be the ability to finance the necessary investments in system capacity to accommodate growth.

The level of network losses is very high

The level of network losses is very high for all countries reviewed. Kenya, which has the lowest losses at 19%, still exhibits a high level of losses. It would not be fair to compare the level of losses to those observed in Europe (around 7%) due to differences in demand conditions. However, it does seem that a performance of 10% is a realistic goal given experiences in reducing losses from +20% to below 10% after power sector reform in Latin America[56].



	Kenya	Cape Verde	Ghana	Tanzania	Senegal
Network Losses	19%	26%	27%	24%	22%

Figure 16 Network losses in countries reviewed (source: KEMA)

56 In Chile for example losses for Chilectra were reduced from 19.8% in 1987 to 8.3% in 1997 after sector reform.

Network losses can be divided into two main categories; those which are technical and those which are commercial. Technical losses are the heat loss caused by passing current through the network, circuit charging currents, and transformer magnetizing losses. Commercial losses include electricity theft, meter bypassing, meter errors, un-metered customers, billing errors, et cetera.

Any reduction in network losses automatically improves financial performance. In the countries investigated, a significant portion of the losses (around half) seems to be commercial in nature. These losses generally require moderate investment to reduce compared to technical losses, especially when initial levels are very high as is the case here. Of course commercial losses are related to various socio-economic factors which would also need to be considered. From a strictly rational point of view, however, it seems that significant financial improvement can be achieved by reducing the commercial losses.

Financial performance is low

There is a significant variation in the average tariff level in the countries investigated. In Cape Verde tariffs are considerably higher, which is due to the use of expensive diesel power. In Kenya, Ghana, Tanzania, and to some extent in Senegal, the production costs are lower due to presence of hydroelectric power. Kenya in particular seems to be enjoying low production costs considering the low tariff combined with the good financial performance of Kenya Power. When comparing the tariffs against the EU average, it can be observed that they are in general moderately lower (except for Cape Verde, which is a special case).

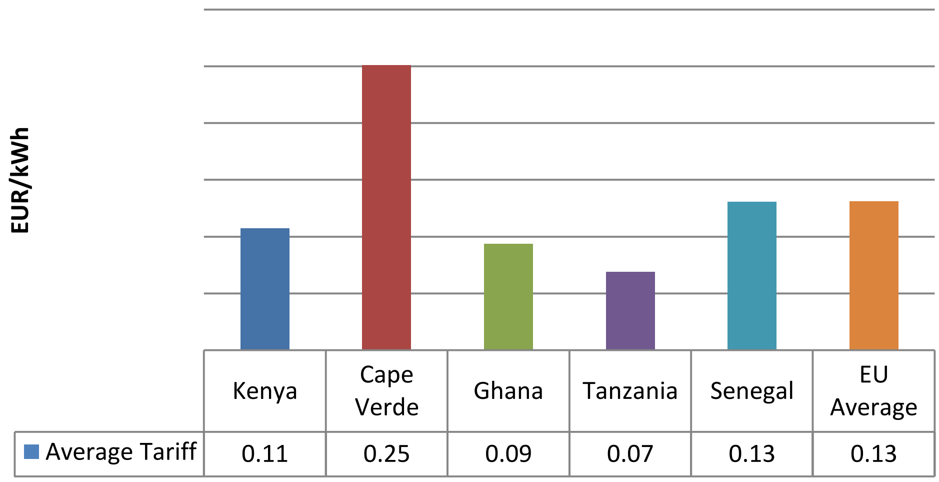


Figure 17 Comparison of average tariff for domestic and industry versus EU average, excluding VAT but including levies (Source for EU tariffs: Eurostat)

Kenya has relatively moderate tariffs but good financial performance. In Ghana tariffs are somewhat lower than Kenya but returns are much lower. This is explained by the high level of commercial losses in Ghana (27%) versus Kenya (19%). In Senegal losses are lower than in Ghana at 22% and tariffs higher. But this does not seem to result in better financial performance, probably due to the absence of large hydroelectric capacity. Tanzania and Cape Verde both perform very badly financially. In Tanzania this seems to be driven by the combination of low tariffs and high losses. In Cape Verde the high production costs and high losses seem to be the drivers.

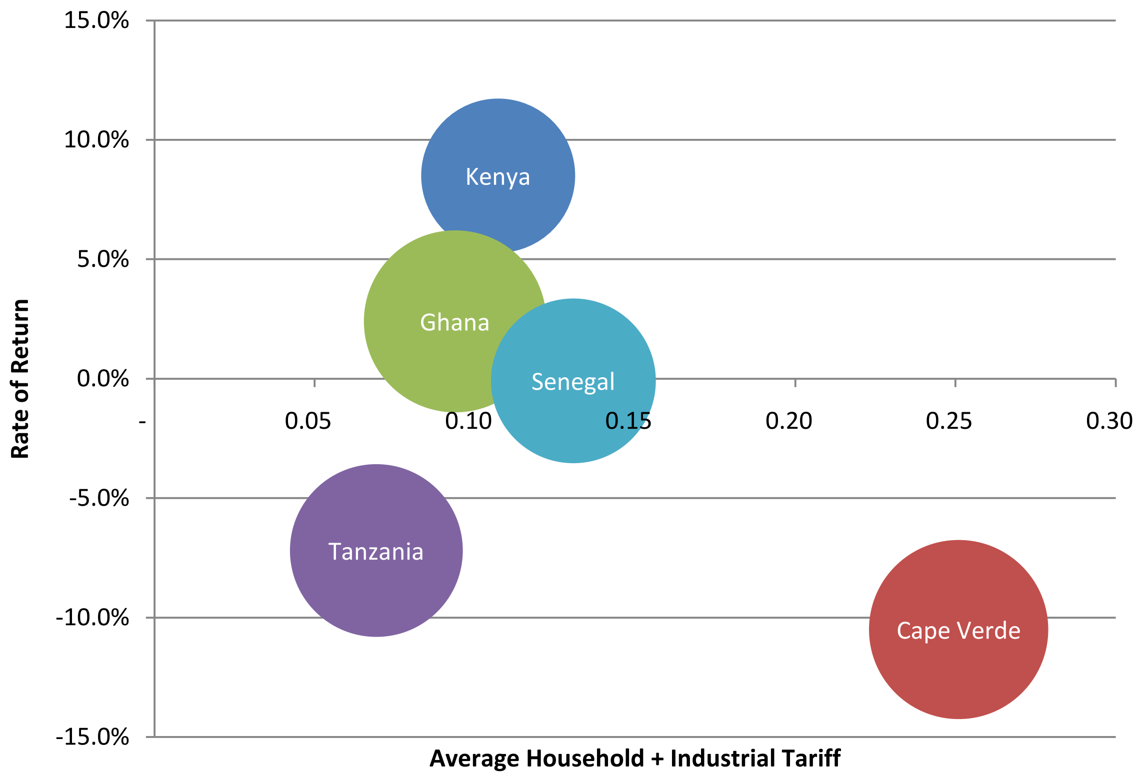


Figure 18 Comparison of average tariff for domestic and industry versus realized rate of return. The size of the bubble represents the level of network losses (source: KEMA)

Loss reduction is an important means of achieving sustainability

It is obvious from the discussion above that the high level of losses is an important impediment in achieving sustainability in the electricity supply. To illustrate this point the following Table shows the change in financial performance under two scenarios namely (1) the current situation, and (2) if losses were reduced to a benchmark value of 12%[57].

Table 27 Financial performance and required tariff increase to achieve 10% ROC under current losses and benchmark losses scenarios (source: KEMA)

	Kenya	Cape Verde	Ghana	Tanzania	Senegal
Scenario 1: Current Network Losses					
Network losses	19.3%	26.1%	27.0%	24.3%	22.1%
Return on Capital (ROC)	8.5%	-10.5%	2.4%	-7.2%	-0.1%
Tariff Increase for 10% ROC	**1.8%**	**21.6%**	**13.2%**	**64.3%**	**8.5%**
Scenario 2: Benchmark Network Losses					
Network losses	12.0%	12.0%	12.0%	12.0%	12.0%
Return on Capital (ROC)	14.5%	2.9%	11.0%	-3.9%	11.9%
Tariff Increase for 10% ROC	**-5.4%**	**7.5%**	**-1.8%**	**52.0%**	**-1.6%**

Reduction of network losses directly improves the bottom line of the company. In the simulated results under Scenario 2 it can be seen that for Kenya, Ghana, and Senegal the existing tariffs would be sufficient to assure a 10% return if losses were reduced to 12%. In fact there would even be scope for a slight reduction in tariffs.

In Cape Verde and Tanzania even after reducing losses a tariff increase would still be needed although to a lesser extent. In Cape Verde the necessary increase would only be 7.5% instead of 21.6%. In Tanzania the increase would need to be 52%, which is still high, but this is driven by the fact that tariffs here are currently far too low. Overall however it is clear that focusing on losses can bring about a significant improvement in the performance and hence sustainability of the power sectors.

[57] The chosen benchmark of 12% would seem quite challenging considering the current level of losses but at the same time it should be taken into account that significant improvements in losses have in fact been achieved elsewhere (also refer to footnote 56).

4.2 Recommendations

From the previous analysis it seems that the main impediment for investments in the transmission and distribution sectors is the poor financial performance of the utilities. This is to a large extent driven by the high level of network losses. Increasing tariffs alone will therefore not likely solve the fundamental underlying problems. Rather the path towards sustainability would be achieved through a mix of effective tariff policies and efficiency improvement programmes.

An important consideration is the issue of affordability. The general economic level of development is lower than in the EU in the countries reviewed. A tariff increase has a proportionally greater impact on customers and is more likely to result in an increase in commercial losses. This leads to a negative feedback loop where higher tariffs lead to higher commercial losses, which in turn dampens the improvement in financial performance, triggering another round of tariff increase, et cetera.

A proper balance between tariff policy and losses reduction strategies is required for achieving a sustainable investment in electricity networks. Tariffs should be set at economic levels but incorporate a reasonable level of losses. Utilities should dedicate significant efforts towards the reduction of losses. Regulatory policies can help provide utilities with incentive frameworks to achieve such improvements. Possible strategies that could be followed by utilities include:

- Technical loss reductions aimed at the reduction of system loading by installing capacity and high-quality equipment, voltage level choice and control, increasing network maintenance, monitoring of the network, and continuously analyzing opportunities to improve;
- Commercial loss reduction by assuring metering accuracy and coverage, improving revenue collection, and enforcement of the rule of law, customer education, and applying targeted tariff schemes.

In conclusion, demand for electricity is growing rapidly. This presents clear opportunities. Considerable investment in the power system will be needed to serve this new demand. The main challenge will be to assure that investments brought about by the new demand also result in sustainable economic returns.