



NEDCo
NORTHERN ELECTRICITY DISTRIBUTION COMPANY

TARIFF PROPOSAL FOR 2022

NORTHERN ELECTRICITY DISTRIBUTION COMPANY LTD (NEDCO)

April, 2022

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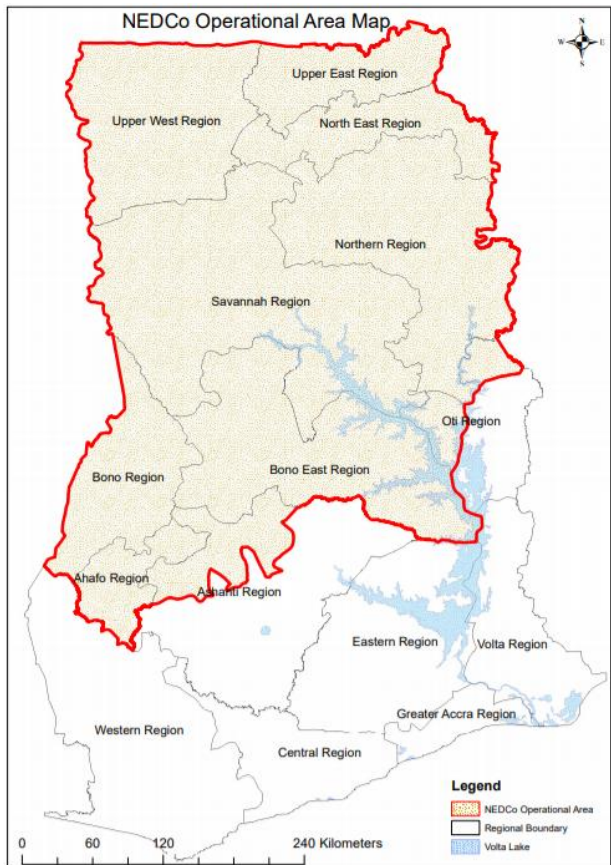
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1.0 INTRODUCTION

In pursuance of the Government of Ghana's Power Sector Reform Programme (PSRP) initiated in the late 1990s, Management of the Volta River Authority (VRA), in 1997, registered the Northern Electricity Distribution Company (NEDCo) as a wholly owned VRA subsidiary, with a Board of Directors, to take over the operations of the then Northern Electricity Department of VRA, (NED). NEDCos' mandate, according to its Operating License and Instrument of Incorporation is to procure electricity from Bulk Suppliers and distribute same to customers in a commercially viable and reliable manner.

In May 2012, VRA Management operationalized NEDCo as a wholly VRA owned subsidiary, to focus on electric power distribution in its operational area, with the expectation that sustained distribution of safe and reliable electric power would help to promote economic growth and job creation in the Middle and Northern Sectors of Ghana.

In addition to the northern parts of Western, Ashanti and the Volta Regions, NEDCo operates in eight administrative regions in Ghana namely Northern, Upper East, Upper West, Bono, Bono East, North-East, Savanna and Ahafo Regions. On behalf of its parent company VRA, NEDCo also supplies electricity to some parts of Togo and Burkina Faso. Although this is based on an internal arrangement with VRA, which should be earning NEDCo some revenue, this component of the agreement is yet to be operationalized. Whereas NEDCos' utility territory covers about 64% of the geographical Area of Ghana, its

customer density at the end of 2021 was approximately 7 customers per sq. km, which is relatively very low and its customer profile is also dominated by residential category including- lifeline customers, whose consumption is very low with low revenue.

NEDCo has been experiencing both operational and financial challenges since its establishment. The electricity supply challenges can be attributed to a number of factors, including a high level of losses in the distribution system, which is mainly due to the obsolete nature of distribution equipment, power theft as well as non-payment of bills by Government Ministries, Departments and Agencies and other public and private sector organizations including individual consumers.

1.1 Brief Description of the Current Status of the Ghanaian Electricity Supply Industry (ESI)

The entire Ghanaian electricity supply industry (ESI) has over the recent past few decades not lived up to expectations of its cherished customers of the various categories, namely domestic, commercial, industrial and other bulk customers. This situation has largely resulted from two main supply side challenges, including weak, obsolete, undersized and overloaded distribution infrastructure. The issue of inadequate generation capacity has been resolved since the last half decade, and the power generation mix now has over 35% excess capacity. The situation in NEDCos' utility territory has not been different. Cost of capital available to the main Ghanaian market for public electric utilities comprising VRA, GRIDCo, ECG and NEDCo for timely investments in capacity upgrading, scheduled maintenance, system refurbishing and expansion are relatively high.

Consumer practices such as inadequate adherence to energy conservation principles, concentration of power usage during peak hours, failure and or inability to pay energy bills timely enough, coupled with high numbers of power thefts from the demand side, have also contributed to the persistence of poor quality of electricity supply.

The economically infertile geographical location of NEDCo, in comparison with ECG's operational area, has aggravated the financial situation of NEDCo resulting in its inability to deliver quality service at the level desired by Management to its cherished customers. Additional challenges peculiar to NEDCos' operational area include high cost of supply of every kWh of electricity and cost per customer care due to the sparse nature of dwellings, low population density, low numbers of economic customers/consumers as well as network vulnerability to seasonal bush fires and other adverse weather conditions including lightning strikes.

2.0 LEGISLATIVE PROVISIONS IN SUPPORT OF THE TARIFF APPLICATION

This tariff application is in compliance with NEDCos' statutory obligation under Sections 18 and 21 of the Public Utilities Regulatory Commission Act, Act 538 (1997). Section 18 (1) of Act 538 provides that "A public utility shall not demand a rate for the service it provides unless the rate chargeable for the service has been approved by the Board" of the Public Utilities Regulatory Commission. Section 21 (1) provides that "A public utility shall, within the time determined by the Board" of the Public Utilities Regulatory Commission, file with the Commission in the form specified by the Board, tariffs showing the rates charged by it for the service it provides".

3.0 BRIEF BACKGROUND OF NEDCo AND ITS POWER SUPPLY OPERATIONS

As part of the Government of Ghana's on-going nation-wide electrification drive under SHEP and GEDAP, NEDCo has, over the recent years undertaken power extensions to new towns and communities that were hitherto not served from the grid. According to the 2021 annual customer classification, the Residential customers constitute 84.96% of total customer

population, they consume about 67.76% of total energy sales and contribute to only 51.40% of total revenue. The Non-Residential customers mostly shops, agricultural and public institutions, including the security agencies, hospitals, educational institutions constitute 15.03% of total customer population, consumed about 24.00% of total energy sales and contributed 38.94% of revenue. Special Load Tariff (SLT) customers who constitute only 0.01% of the customer population consumed about 8.24% of total energy sales, and contributed 9.66% of total revenue.

In addition to the sale of electricity at Residential including lifeline rates to the bulk of our customers, the sparse nature of settlements means that the cost of supplying each kWh of electricity comprising meter reading, bill delivery, revenue collection, disconnection of defaulting customers and reconnection of paid-up disconnected customers, resolution of faults is relatively higher than the average in more economically fertile utility territories, such as in the middle and southern parts of Ghana.

In 2020 NEDCo consumed only 8% of total energy consumed by the Distribution Utilities in Ghana.

4.0 RATIONALE/ OBJECTIVES UNDERPINNING TARIFF SUBMISSION

Since the last tariff proposal approved by PURC in 2019, the total and aggregate cost of supply of a kWh of electricity to the customers in NEDCos' utility territory has increased significantly due to the reasons below:

- The sparse nature of habitation in many of the rural communities within NEDCos' utility territory, which continues to worsen with each square kilometres' increase of our distribution network, arising out of NEDCos' own annual

expansion plan and Government of Ghana's on-going nation-wide electrification programmes such as SHEP and GEDAP.

- Increasing US Dollar to Ghana Cedi Exchange Rate of 7.89% as at March 2022
- Increasing costs of vital materials and equipment relevant to provision of service, that is, fuel and maintenance components of transportation, power and distribution transformers, transformer fuses, drop-out fuses, conductors, poles, insulators, energy meters, charges of contractors for network maintenance, vegetation control, network extension and upgrading.
- Uneconomic existing tariff
- Inflation 19.4% as at March 2022
- High proportion of Residential customers (approximately 84.96%) and about 46% lifeline customers in NEDCos' customer demography.

5.0 HIGHLIGHTS OF MAJOR ISSUES WHICH DESCRIBE STRUCTURE OF TARIFF

SUBMISSION:

- Ghanaian Electricity End-User Tariff consists of the following:
 - a. Bulk Generation Charge (BGC), which is an average of the unit cost of electricity of all the power generation plants in the Ghanaian energy mix.
 - b. Transmission Service Charge (TSC)
 - c. Distribution Service Charge (DSC)

The last DSC tariff of GH¢0.315307 approved by PURC was inadequate to meet the total cost of service delivery to customers. The BGC and TSC invoiced to NEDCo in the tariff build up are always high ie about 70%, thus increasing NEDCos' operational costs. As a result, NEDCo has been incurring financial losses as it is not able to recover its cost of service delivery, as a result of the high BGC and TSC and unfavourable customer profile. It is worth noting that when hydroelectricity represented a higher percentage of previous BGCs approved for NEDCo, the BGC reduced in the year 2016 and NEDCo came close to making profit. NEDCo is therefore better off with a higher percentage of hydroelectricity in its energy mix. In the light of this, it is being proposed that PURC through EMOP (Electricity Market Oversight Panel) should allocate more hydro power to NEDCo in the energy mix during the tariff period. A hydro component of 626GWh is being proposed to be considered for 2022 tariff approval.

- Increasing distribution system losses in NEDCo, which was about 27.29% as at the end of 2021. This constitutes about 9.2% technical losses and 18.09% commercial losses. NEDCo has therefore identified the need to install meters at critical nodes of the distribution network to ensure proper energy auditing, replacement of faulty meters, customer audit and also undertake initiatives to reduce the system losses.
- High cost of investment in NEDCos' operations to improve upon service delivery to customers.

6.0 INITIATIVES UNDERTAKEN SINCE JULY 2019 TARIFF APPROVAL

The following projects were undertaken since the last tariff review:

6.1. Procurement and installation of 25,000No. Smart Type PPMs and Accessories (Oct. 2019)

6.1.1 Project Objective

NEDCo initiated procurement processes to purchase prepayment meters in line with its drive to enhance revenue collection and protection. The smart-type prepayment meters was considered in this procurement, particularly, because of its features that makes energy theft and tampering of meters difficult. With this type of meter, the customer is given Customer Interface Unit (CIU) to keep in his/her premises. The CIU is used to load credit and access all necessary information from the meter and therefore the customer has no business getting closer to the meter.

The initial design was to install the meters on walls at the customer's premises, however after further consideration it was agreed by stakeholders that installation on poles will serve a better purpose. Pole installation was thus endorsed and implemented.

6.1.2 Scope of Work

The scope of work is as follows

- Supply and installation of 25,000 No. single phase and 150No. three (3) phase multi-part prepayment energy meters and associated materials
- Supply and installation of vending system with its associated accessories
- Testing and commissioning of the installed meters
- Supply of tools
- Training of NEDCo staff

6.1.3 Project Benefits

The benefits of the project are as follows

- Reduced commercial losses by 0.3%
- Contributed to increase in revenue collection from 73% in 2018 to 79% in 2019
- Improved customer service

6.1.4 Project Cost

The total cost of the project is estimated at GHS 38,680,069.35

6.1.5 Completion Date:

This project was completed in October, 2020

6.2 Automatic Meter Reading (AMR) and Boundary Metering

6.2.1 Project Objective

NEDCo has since 2014 been piloting the AMR system with twenty (20) customers and has expanded the system to cover about 254 of its Special Load Tariff (SLT) customers, Tee-off feeders (Boundaries) and Incomer feeders (Check meters) at primary Bulk Supply Points (BSP). The project is part of efforts to identify areas in the distribution system where commercial losses are high and to take the necessary steps to minimize them.

6.2.2 Scope of Work

The scope of work is as follows

- Supply and installation of 432no. smart energy meters
- Supply and installation of 432no. communication modules
- Supply and installation of 104 pieces of 34.5kV combined CTs/VTs,
- Supply and installation of 55 pieces of 11.5 kV combined CTs/VTs
- Testing and Commissioning of install system
- Training of NEDCo Staff

6.2.3 Project Benefits

The benefits of the project are as follows

- Energy Audit- NEDCO is able to identify areas where losses are high
- Improved customer service

6.2.4 Project Cost

The total cost of the project is estimated at GHS12,890,016.09

6.2.5 Completion Date:

This project was completed in September 2020

6.3 Techiman-Abofour Line Construction

6.3.1 Project Objective

A greater percentage of NEDCos' customers along the Techiman-Abofour stretch were served from 30kV and 20kV shield wire networks, which was not able to serve their purpose. It became necessary to transfer these customers from the shield wire network to a conventional 34.5kV voltage network. NEDCo therefore constructed a new 34.5kV conventional line and upgraded portions of the existing shield wire line to make the transfer possible. Some 11.5kV networks were also to be upgraded to 34.5kV as part of the project.

6.3.2 Scope of Work

- Construction of 70km of 34.5kV steel pole line from GRIDCo/NEDCo BSP at Techiman to Abofour
- Upgrade 30kV Shield wire (SHW) network with 1No. Transformer to 34.5kV conventional network at Kuntunso Township
- Upgrade 30kV SHW network with 12No. Transformer to 34.5kV conventional network at Afrancho/Akomadam Township
- Upgrade 30kV SHW network with 18No. Transformer to 34.5kV conventional network at Nkenkensu Township
- Upgrade 30kV SHW network with 18No. Transformer to 34.5kV conventional network at Abofour Township
- Upgrade 11.5kV conventional network with 7No. Transformer to 34.5kV conventional network at various towns
- Upgrade 5 km of 1-phase 2 wire and 2-phase 3 wire existing LV line to 3-phase, 4 wire

6.3.3 Project Benefits

The benefits of the project include

- Reduce technical losses
- Improve reliability
- Increase installed capacity (over 300% increase in line capacity)

6.3.4 Project Cost

The total cost of the project is GHS12,352,748.40

6.3.5 Completion Date:

This project was completed in March 2021

6.4 Hexing System Upgrade

6.4.1 Project Objective

NEDCo currently operates a multiplicity of prepayment metering systems sourced from different manufacturers. Each of these manufacturers has its own vending software making data transfer from one system to another practically impossible. This means that multiple vending stations had to be created at the same venue to cater for all the meter manufacturers. This undoubtedly increases the cost of operating prepayment metering systems from different manufacturers. To solve this challenge, NEDCo contracted Hexing Electrical Company Limited to supply and install a Standard Transfer System (STS) compliant system that will be a platform to harmonize all the vending and integrated billing software. In other words, the Hexing System will provide a common vending platform for all prepayment and postpaid meters. This means that NEDCo could procure prepayment meters from any STS compliant manufacturer without worrying about the introduction of a new vending software to add to the already numerous vending software in NEDCo.

6.4.2 Scope of Work

The scope of work is as follows

- Supply, installation, testing and commissioning of an Integrated Billing and Vending System with a license limitation for 1,000,000 meters.
- Supply, installation, testing and commissioning of a Head End System (HES) with a license limitation for 1,000,000 meters
- Supply, installation, testing and commissioning of Third-Party quota system
- Supply, installation, testing and commissioning of IT hardware and related software
- Supply, installation, testing and commission of desktop & mobile POSs, GPRS modems, and Data concentrators.
- Provision of OJT and Remote Technical support and Maintenance Service for one year.

6.4.3 Project Benefits

The benefits of the project are as follows

- Reduce receivables
- Improve revenue collection
- Improve customer service

6.4.4 Project Cost

The total cost of the project is USD 2,425,953.66

6.4.5 Completion Date:

The project was completed in December 2020.

6.5 Supply and Installation of 100,000 Smart Prepaid Meters

6.5.1 Project Objective

NEDCo initiated procurement processes to purchase 100,000 smart prepayment meters in line with its drive to enhance revenue collection and reduce energy losses. The smart prepaid meters procured are in two types; monobloc and split-type prepayment meters. The split-type was also considered in this procurement, particularly, because of its features that makes energy theft and tampering of meters difficult.

The split-type meters are being installed on poles to minimize energy theft.

6.5.2 Scope of Work

The scope of work is as follows

- a. Supply and installation of 100,000no. single and three phase smart meters and associated materials
- b. Supply and installation of vending system with its associated accessories
- c. Testing and commissioning of the installed meters
- d. Supply of tools

Training of NEDCo staff

6.5.3 Project Benefits

The benefits of the project are as follows

- Reduce commercial losses (2018:30.1%, 2019:27.5%, 2020:27% and 2021: 27.29%)
- Improve revenue collection from 2018:76%, 2019:79%, 2020: 82%.

- Improved customer service

6.5.4 Project Cost

The total cost of the project is estimated at USD 16,021,440.19

6.5.5 Completion Date:

The expected completion date of the project is 30th April 2021

7 PROJECTS TO BE UNDERTAKEN

To be able to surmount the challenges facing NEDCo, various projects have been planned for future implementation when money becomes available. Among some of the projects are the following:

7.1 Construction of Lamashegu Primary Substation

Due to the expanding client base, the 11.5 kV distribution networks in the Tamale metropolis and its immediate environs are currently loaded to maximum capacity, thereby creating no allowance for additional customer connections. Also, the rapid expansion of the metropolis has resulted in the growth of the networks beyond their technically acceptable lengths. This has led to power quality problems like serious voltage drops at some portions of the networks. The residents in Tamale are dissatisfied with the quality of supply as some customers have resorted to the use of generators sometimes. Another problem faced by these long 11.5kV lines is the introduction of high technical losses in the distribution network. It is in the light of this that this project is being proposed to correct the anomalies.

7.1.1 Project Cost:

The total cost of the project is USD 9 million

Anticipated Project Outcomes/Impact

Constructing the Lamashegu substation will result in the following outcomes:

- Increased installed capacity by 40MVA: There will be adequate capacity of in the Tamale metropolis to make provision for additional load growth.
- Increased reliability (SAIFI): There will be increased reliability as the construction of the substation will introduce an acceptable degree of redundancy in the network. The new substation will receive its power supply from the new GRIDCo BSP (Tamale #2) to augment the existing network that is currently receiving power from the old BSP (Tamale #1)
- Improved voltage quality: The voltage profile in the Tamale metropolis will be improved when the length of the 11kV distribution lines are shortened. The Feeder end voltage from 90% to > 95%
- Increased revenue: The above-mentioned benefits will result in increased revenue as energy will be available for customers to use at all times.

The failure to construct the proposed Lamashegu substation will result in the following:

- Load shedding: The distribution infrastructure will exceed their technical loading capacity which will force NEDCo to shed load at peak seasons.

- Increase Technical losses: In principle, the technical losses are expected to increase exponentially with increase in load over time if the infrastructure remains the same. The cumulative energy loss by 2047 is estimated to be 305,280,987.40 kWh compared to 76,329,489.32 kWh after the implementation of the project over the same period. This represents an estimated cumulative financial loss of GH¢ 269,030,325.31 by year 2047 if nothing is done.
- Poor voltage profile: Voltage supply to customers in the targeted project area will worsen without the implementation of the project. This will lead to customer dissatisfaction. NEDCo is expected to maintain a voltage range of $\pm 10\%$ of rate voltage. This however has been exceeded in the targeted network Area and needs to be corrected.
- Poor supply reliability: As equipment gets overloaded thermally, they begin to fail, resulting in total or partial loss of power supply to customers. The frequency of failure is expected to increase if no action is taken immediately

7.2 100km Conductor upgrade:

Due to the increase load growth, the 50sqmm 11.5kV Aluminium overhead lines in NEDCo's operational Areas are currently loaded to maximum capacity, thereby increasing the technical loss on the 11.5kV distribution network. The aging of these conductors has also led to power quality problems like voltage drops at some portions of the network. NEDCo's customers are dissatisfied with the quality of supply as they are not able to use their equipment and would have to resort to the use of generators at some points.

7.2.1 Project Cost:

The total cost of the project is USD 1,287,000

Anticipated Project Outcomes/Impact

The upgrade of the 100km undersized conductors will result in the following outcomes:

- Increased installed capacity (increase installed capacity by 75%): There would be adequate capacity to accommodate additional load growth.
- Loss reduction: There would be loss reduction on the 11kV network of about 1.5%.
- Improved voltage quality (Improve feeder end voltage to >90%): The voltage profile in NEDCo would be improved as a result of shortening of the lengths of the 11kV distribution lines.
- Increased revenue: The above-mentioned benefits will result in increased revenue as energy would be available for customers to use.
-

The failure to upgrade the 11kV overhead lines will result in the following:

- Load shedding: The distribution infrastructure will exceed their technical loading capacity thereby forcing NEDCo to shed load.
- Increase Technical losses: In principle, the technical losses are expected to increase exponentially with increase in load over time if the infrastructure remains the same. The cumulative energy loss by year 2046 is estimated to be 1,705,918,845.86 kWh compared to 1,293,878,931.00 kWh after the implementation of the project over the same period. This represents a cumulative financial loss of GH¢ 957,470,408.94 by 2046 if the project is not implemented.
- Poor voltage profile: Voltage supply to customers in the targeted project area will worsen without the implementation of the project. This will lead to customer dissatisfaction and sanctions by regulatory agencies. NEDCo is expected to maintain a voltage range of $\pm 10\%$ of rate voltage. This however is exceeded in the targeted network areas and needs to be corrected.

7.3 THE KEXIM PROJECT

This project is the 'Northern Ghana Rural Electricity Infrastructure and Access Project'. It is to improve the aging distribution system in northern Ghana. The project would be funded by the Government of the Republic of Korea which would be loaned to the Government of Ghana using the Economic Development Cooperation Fund (EDCF). Major project items include the construction of six distribution substations, two switching stations, one Distribution Network Management System (DNMS), and a number of capacitor banks. If this project is implemented, the following would be the expected project outcome/impact.

7.3.1 Project Cost:

The total cost of the project is USD112.6 million

7.3.2 BENEFITS OF THE PROJECT

- Reduction of power supply cost which may arise as a result of reduction of distribution power loss. A Reduction in technical losses by 1.05%.
- Improve feeder voltage from 87.7% to 95%
- increased power supply capacity
- Reducing the emission of environmental substances
- Reduction of unserved energy cost by reducing the power supply interruption

7.4 Procurement of Distribution Materials:

NEDCo as a distribution company need distribution materials to carryout maintenance as well as extension of the network. Maintenance of the network becomes necessary due to aging of equipment as a result of usage and vagaries of the weather. NEDCo also losses equipment as a result of accidental contacts of animals and vehicles on the distribution network. In situation where the distribution network is weak or faulty, NEDCo will have to replace them with similar materials to make the network functional. This therefore calls for the stocking of enough distribution materials to cater for the unforeseen circumstances. Without adequate spare materials, outages caused by some of the above enumerated reasons could be prolonged leading to agitation by customers and loss of revenue. It is in the light of this, that NEDCo is procuring distribution materials to carry out maintenance as well as expansion of the distribution network. Among some of the distribution materials earmarked for purchased are transformers, wood and steel poles, fuses, energy meters, conductors and cables etc.

7.4.1 Project Cost:

The total cost of the project is USD 1.438 million

7.4.2 Anticipated Project Outcomes/Impact

Availability of the required spare materials will result in the following outcomes:

- Increased service availability: This leads to availability of power supply to customers and avoidance of possible sanctions by regulators.
- Improved customer perceptions: customer perceptions about reliability of power would improve thereby influencing their willingness to pay electricity bills.

- Increased installed capacity: There will be adequate capacity to make provision for additional load growth.
- Increased energy sales/revenue: The above-mentioned benefits will result in increased revenue, as it will improve energy delivery to customers.

The failure to procure the distribution materials will result in the following:

- Poor supply reliability: As equipment gets overloaded thermally, they begin to fail, resulting in total or partial loss of power supply to customers. The frequency of failure is expected to increase significantly if no action is taken immediately.
- Loss of potential revenue from existing customers who usually are unwilling to pay their bills as a result of poor quality of service
- Potential sanctions by regulators.

7.5 Construction of NEDCo Head Office Complex:

The Head office of the Northern Electricity Distribution Company is located in Tamale. The administrative structure has six departments. These departments however operate from six distinct buildings with the farthest being about three kilometers (Protection and Control Section, at GRIDCo office, Choggu) away from the NORRIP building. This over the years has posed a challenge, as the routine activities of each department is not entirely independent of the others. This in one way or another causes delay in expected deliverables in the entire business processes of the organization. The construction of the building will bring together all the departments of NEDCo in Tamale under one roof for easy workflow.

7.5.1 Project Cost:

The total cost of the project is USD 7.883million

The main objective of this project is to provide a suitable office accommodation to house all Head office staff of NEDCo in Tamale with the intention of achieving the following:

- Cost saving by avoiding expensive rentals of office space.
- Increase productivity by having all NEDCo Staff in the same building
- Reduction of operational cost by sharing resources like printers.
- Improved VRA/ NEDCo image
- Avoid threat of ejections by Landlords.
- Improve Security to NEDCo's equipment and tool

Failure to build the Head Office Complex to house all the departments of NEDCo will continue to impact on the overall output and efficiency of the company. The impacts include the following;

- Delays in processing of documents: With the departments located in different buildings, movement of documents from one department to another takes time.
- Loss of man-hours/reduced productivity
- Overcrowded offices
- Increased costs as some cost such as internet connection and security cannot be shared
- Risk of being ejected at any time by property owners.

- Lack of good working environment

7.6 Proposed Tamale Metropolis Split Smart PPM Project

The project consists of the procurement and installation of pole-mounted smart & split prepaid meters for LV customers in the Tamale metropolis, where non-technical losses are predominant. In the intervention areas (Tamale Metropolis and immediate surroundings), 33,800 customers are on post-paid or flat rate billing. Also, it is estimated that, about 51,000 customers out of the total 77,000 PPM customers in the Tamale Metropolis is engaged in energy theft in the form of meter bypass. This project intends to replace 53,200 (69%) of the existing monobloc PPM in Tamale to stem the rampant power theft situation in Tamale. 87,000 split meters have been earmarked for the execution of the project.

7.6.1 Project Cost:

The total cost of the project is USD 26.131million

7.6.2 Expected Results and Benefits

- Reduction of non-technical losses (NT): A sharp reduction of non-technical losses - from 28% to 12% over a 3-year period is expected in the intervention areas due to the split and anti-tampering features of the meters. The pole-mounted split system is assumed to eliminate the most common fraudulent practices, i.e. meter tampering or bypassing, in the target population.

- Increased collection efficiency: Through the shift from post-paid and flat rate to prepaid billing, the project will increase the collection efficiency to 100% within the target population.

7.7 NEDCO STREETLIGHTS METERING PROJECT

This Project is intended to meter all street light installations (including street light installations on major road networks in NEDCo's Operational Area.

The scope will involve the installation of transformers dedicated to the metering of street light installations. It will also involve the installation of switch wires and LV switches. Additionally, some high consuming street light lamps will be replaced with more-energy efficient types.

7.7.1 Project Cost

The estimated cost of the project is twenty-five million United States dollars (USD25million).

7.7.2 Anticipated Project Outcomes/Impact

By metering all street lights and making provision for future ones, NEDCo will be able to correctly estimate street light consumptions and impress on government to make payments for them.

8 HIGHLIGHTS OF MAJOR ISSUES WHICH DESCRIBES STRUCTURE OF TARIFF SUBMISSION:

- Ghanaian Electricity End-User Tariff consists of the following:

- d. Bulk Generation Charge (BGC), which is an average of the unit cost of electricity of all the power generation plants in the Ghanaian energy mix.
- e. Transmission Service Charge (TSC)
- f. Distribution Service Charge (DSC)

The last DSC tariff of GH¢0.315307 approved by PURC was inadequate to meet the total cost of service delivery to customers. The BGC and TSC invoiced to NEDCo in the tariff built up are always high, thus increasing NEDCos' operational Cost. As a result, NEDCo has been incurring financial losses as we are not able to cover our cost- of- service delivery, as a result of the high BGC and TSC. It is worth noting that when hydroelectricity was more in the BGC, the CBGC reduced in the year 2016 and NEDCo came close to making profit. NEDCo is therefore better off with a higher percentage of hydroelectricity in its energy mix. In the light of this, it is being proposed that PURC through EMOP (Electricity Market Oversight Panel) should allocate more hydro power to NEDCo in the energy mix during the tariff period. A hydro component of 626GWh has been proposed for 2022.

- Increasing distribution system loss in NEDCo, which was about 27.29% as at the end of 2021. This constitutes about 9.2% technical losses and 18.09% commercial losses. NEDCo has therefore identified the need to install meters at critical nodes of the distribution network to energy auditing and to undertake initiatives to reduce the system losses.
- High cost of investment to improve upon service delivery during the five-year period.

Table 1: Service Delivery and Efficiency Targets for the Tariff Period

STRATEGIC OBJECTIVE	MEASURES/ KPI	TARGETS				
		2021	2022	2023	2024	2025
Increase Revenues	Collection Rate (%)	81.66	90	91	92	95
	Receivable lag (days)	980	750	600	550	350
Increase Customer Satisfaction	Customer Satisfaction Index (%)	72	85	86	87	88
Enhance Customer/stakeholder Engagements	Stakeholder satisfaction index	85	87	88	89	90
Improve network automation	% of network automated	10	20	30	40	50
Improve IT System Reliability and Quality	Average IT System availability (%)	97	98	99	99.5	99.8
Improve power supply quality and reliability	Average System Availability Index (%)	99.27	99.45	99.51	99.55	99.6
	System Average Interruption Duration Index (Hrs)	63.6	48.2	43.3	39	35.1
	System Availability Interruption Frequency Index (No.)	40.9	39.5	30.3	25.3	20.7
	Planned maintenance executed (%)	95	96	97	98	98
STRATEGIC OBJECTIVE	MEASURES/ KPI	TARGETS				
		2021	2022	2023	2024	2025
Reduce Distribution losses	% reduction in distribution loss	27.29	26.09	24.89	23.69	22.49
	Human Capital Readiness Index	75	80	85	90	100

Improve Employee Knowledge and Skills	% of employees trained as per Scheme of Service	100	100	100	100	100
	% of employees trained in network maintenance and management	100	100	100	100	100
Improve suitable work environment	Number of modern Service Centre offices constructed	5	7	10	8	10
Improve IT Infrastructure and access to Tools	IT system infrastructure coverage (%)	60	70	80	90	95
	34.5/11.5kV Primary Substations and (No.) 34.5kV Switching Stations constructed	0	1	0	0	8
	Distribution Transformer Injected (No.)	143	173	215	218	234
	Available transformer capacity (MVA)	2,048.50	2,137	2,165	2,202	2,221
	HV /MV Line Upgrades/extension (Km)	317.3	681.7	605.4	605.5	605.5
	Lv Line upgrades/extension (Km)	91.1	164	148.4	168	164.4
	Network maintenance undertaken (%)	95	96	97	98	98

8.1 Technical / Operating Performance Indicators/Indices

Table 2: Statistics on Technical/Operating Performance Indicators/Indices

STATISTICS	2016	2017	2018	2019	2020	2021
34.5kV Overhead (km)	10,213	10,545.4	10,839.8	11,105.8	11,544.3	12,847.6
34.5kV Underground (km)	75.2	75.2	75.2	75.2	75.2	75.2
30kV line length (km)	386.9	386.9	391.3	391.3	466.5	467.5
20kV line length (km)	201.4	201.4	201.4	201.4	201.4	163.0
11.5kV Overhead (km)	2,225	2,320.2	2,337.9	2,410.0	3,500.8	3,589.3
11.5kV Underground (km)	51.3	51.3	51.9	53.7	60.8	64.7
Total Length of MV Line	13,153	13,580.3	13,897.3	14,237.3	15,849	17,141.8
No. of Bulk Supply Points serving NEDCo	12	12	12	16	16	16
No. of 34.5/11KV Primary Substations	10	10	11	11	11	11
No. of Secondary Substations	5,610	5,901	6,066	6,353	6983	7,465
415V line length (km)	16,861	17,403.6	17,621.5	18,401.8	27,576.1	28,481.5
Peak load (MW) -Non-Coincidental	221	240	246.7	328.5	335.6	348.3

8.2 Financial Performance Indicators/Indices

NEDCo has been making losses over the years. In 2017, GH¢278.22 million loss was recorded. This loss rose to GH¢315.4 million in 2018. Loss levels for 2019 was GH¢343.31, 2020 and 2021 were GH¢367.86 and 163.92million respectively. NEDCo's losses are mainly attributable to high amount paid for Bulk Generation charge and transmission service charge.

The two constitute about 70% of NEDCo's operational cost aside salaries and related cost which is also about 21% of operational cost. Other factors accounting for the loss are inadequate revenue from approved tariffs especially for residential customers and the lack of adequate economic customers (Residential and Special Load Tariff) to cross subsidize the consumption of the residential customers within the NEDCo areas.

Table 3: Financial Performance of NEDCo from 2017 to 2021

Indicator	Unit	2017	2018	2019	2020	2021
Revenue (Sales)	GH¢m	598.98	529.25	574.66	688.98	883.49
Other Income	GH¢m	37.51	16.37	49.61	62.84	69.46
Net Profit	GH¢m	- 278.22	- 315.40	- 343.31	- 367.86	- 163.92
Total Assets	GH¢m	2,036.94	2,156.83	2,085.27	2,174.39	2,521.53
Current Assets	GH¢m	1,023.64	1,150.83	1,344.10	1,454.43	1,701.18
Current Liabilities	GH¢m	255.82	331.29	483.36	615.05	742.46
Total Liabilities	GH¢m	794.85	1,116.38	1,548.87	1,966.08	2,418.06
Equity	GH¢m	1,242.10	1,040.44	536.40	208.31	103.47
Ratios:						
Net Profit Margin	%	-46.45	-59.59	-53	-46	-18
Return on Equity	%	-0.022	-0.0303	-0.064	-0.177	-0.158
Current Ratio	No.	1.29	1.03	0.87	0.74	0.70
Gearing	No.	-	-	-	-	-
Return on Capital Employed	%	-0.022	-0.03	-0.064	-0.177	-0.158

9 Key Challenges Likely to Impact Service Delivery

NEDCo as a utility company faces many challenges, some of which are inherent in the geographical location of NEDCo and socio-economic circumstances of customers within the NEDCo operational area. The cost of providing electricity in NEDCo's operational area is very high due to factors such as the sparse nature of dwellings, low population density, low numbers of economic customers/consumers, low ability of customers to pay, as well as network vulnerability due to seasonal bush fires and other adverse weather conditions including lightning strikes. High cost of capital for timely investments in capacity upgrading, scheduled maintenance, system refurbishing and expansion has hindered NEDCo's expansion projects.

9.1 Inadequate Revenue from Tariff

Insufficient revenue from regulated tariffs especially for residential customers has resulted in a recurring gap between the operating costs and revenue, leading to perennial operating losses. See customer category breakdown in Section 3.0 above.

9.2 Low Numbers of SLT Customers

The PURC tariff structure has an in-built cross-subsidization mechanism whereby the commercial/large users subsidize the lifeline and other residential customers. However, inadequate industrialization in NEDCo's operational area has largely deprived it of the benefits of the cross-subsidization policy embedded in the PURC tariff.

NEDCo does not enjoy much benefits of the policy since there are only a few commercial/large users and SLT (0.01% of total customer population) in its catchment area.

9.3 Large Operational Area with Low Customer Density

NEDCo's coverage area is 152,665 sq. km (64%) of Ghana's land area, with customer population of 1,136,050, representing about 7 customers per square kilometer, while the Electricity Company of Ghana (ECG) covers the remaining 36% of the land area of Ghana with a customer population of about 3,400,000, representing about 49.0 customers per square kilometer.

9.4 Perennial Ministries, Departments & Agencies (MDAs) & Sensitive Customers Indebtedness

The debts of MDAs and other sensitive customers (hospitals, military, police, prisons, GBC, GWCL, etc.) constitute about GH¢ 1,069,528,995.31 including subsidies and streetlighting shortfall as at December 2021. Due to the sensitive nature of the services rendered by these institutions coupled with the special protection they enjoy under the GOG's Clearing House Policy, the traditional means of recovering these debts through disconnection cannot be easily applied.

9.5 Metering Including prepayment metering

NEDCo's metering mix is made up of both postpaid and prepayment meters. The ratio of postpaid meters to prepayment meters as at the end of 2021 was about 51:49. Most of the postpaid meters are found in the rural areas whereas the prepayment meters are predominant in urban communities. There are some Current Transformer (CT) meters installed for the few Special Load Tariff (SLT) customers in NEDCo Areas. NEDCo also has installed net-meters for customers who have installed solar PV systems. There are also some flat rate customers still on NEDCo's billing system. NEDCo is however unable to meet its metering requirements for both customers and for public lighting infrastructure due to the scanty cash flows and numerous projects which are all competing for the rather insufficient funds available for projects.

9.6 Energy Audit

The distribution system loss in NEDCo was about 27.29% as at the end of 2021. This constitutes about 9.2% technical losses and 18.09% commercial losses. NEDCo has therefore identified the need to install meters at critical nodes to enable the auditing of the energy flow and to undertake initiatives to reduce the losses.

The intention of metering the critical nodes will allow NEDCo to identify and monitor the locations where technical and commercial losses are occurring. These critical nodes are the bulk supply point incoming feeders, primary substation outgoing feeders and distribution transformers that serve more than one customer.

This project when implemented together with other systems such as the Customer Information Systems (CIS) and Geographic Information System (GIS) will help provide the foundation for an electrical model of the system to calculate technical losses. The project also aims at installing meters with communication capability to enhance the collection of information at all the critical nodes and also to monitor consumption of customers in real time. This will enable NEDCo account for all the energy recorded by the meters and then compute the losses in each network segment

9.7 Theft of power, cables and Equipment

Power theft has been one of the major problems of NEDCo. Customers have devised various means of by-passing energy meters or connecting and using power without paying. Total number of power theft cases recorded in 2021 was 4,747.

This is mostly attributable to the tendency of some to consume electricity without paying for it. Although NEDCo has procured ten vehicles to resource its standing Loss Reduction Team to enable them do constant monitoring of the network to identify people engaged in power theft, their impact has not yielded the desired result due to large geographical area coverage. The issue of cable theft was also rampant in the past but has started reducing when NEDCo started replacing its

copper service cables with aluminum. The issue of equipment theft is not rampant in the NEDCo Areas. However, NEDCo experiences reported cases of energy meter theft sometimes. Power theft and cable theft impacts negatively on NEDCo's ability to supply quality electricity to its customers.

9.8 Loss Control - Technical and Commercial

Over the past five years, NEDCo has undertaken key activities aimed at reducing both technical and non-technical distribution losses. The following initiatives were deployed to target losses:

- Intensification of monitoring and control teams: Ten vehicles were procured for the monitoring unit in order to intensify controls and reduce energy theft.
- Replacement of faulty meters : The billing teams in the operational areas as part of their work identify and replace faulty meters on monthly basis to reduce commercial losses.
- Procurement and installation of prepaid meters (monobloc type): 428,399 monobloc prepaid meters with anti-tampering features have been procured since 2011 with the aim of reducing losses and improving collection efficiency. The procurement of 125,000, 187,000 and 395,000 meters were procured for 2019 and 2020. Additional 395,000 were planned for 2021 and are being procured in piece meal due to non-availability of funds. These PPM meters have contributed to increase the collection efficiency but do not offer a long-term solution against energy theft, as they can still be tampered with or bypassed with relative ease.
- Procurement and installation of 25,000 split and smart prepaid meters in Sunyani (15,000 meters) and Techiman (10,000 meters). This pilot project aims at both, reducing energy theft and improving collection efficiency and serves as the reference point for the roll-out of split-smart prepaid meter solution in NEDCo.

- Metering of streetlights: Plans are far advanced to meter all street lights starting with ceremonial streets to be able to account accurately for streetlighting energy consumption.
- Reduce operational complexity and respond promptly to customers in need of new service
- Improve management of reward system for reporting illegal connections and meter tampering

On technical losses, the following projects are being undertaken or earmarked to be undertaken;

- Metering all substations and tying customers to the substation audit meters to aid in tracing places where losses occur in the system,
- Undertake planned system rehabilitation to upgrade lines and transformers
- Carryout technical loss reduction projects

9.9 Availability/Reliability of Supply/Quality of Service

Power supply in the NEDCo Area is relatively stable. The indicators below show

NEDCos’ availability and reliability indices over the years.

Table 4: NEDCos’ System availability and Reliability Indices

Indicator	Base Year	2016	2017	2018	2019	2020	2021
Average Feeder Reliability (%)		98.3	98.7	98.68	99.31	99.32	99.27
Quality of supply (SAIFI)		160	116.5	77.9	48.8	69.1	40.9
Quality of supply (SAIDI)		147	132.4	115.4	60.1	59.4	63.6

9.10 Suppressed Demand

NEDCos' power purchase from the grid has increased from 1,124GWh in 2016 to 1,761GWh in 2021 mainly due to expansion of the network and government-initiated programs such as the SHEP and GEDAP. NEDCos' customers are mostly low consuming customers who are mostly residential with a few non-residential and Special Load Tariff (SLT) customers. However, due to long distribution lines and overloaded transformers, NEDCo is unable to supply its customer with the quality of power required to meet their needs at some areas within the operational area.

9.11 Management information system including E-payment

NEDCo started with stand-alone billing and vending systems which were separated from each other. The two systems never communicated with each other making it difficult for reporting, as separate reports had to be run to be able to get a required information. To be able to cure this challenge, NEDCo set out to consolidate the billing and vending systems in order to make it more efficient and effective in providing services to the customers and for easy access to common reports. The integration of these systems made it possible to bring on board other systems such as digital payments and electronic billing. The digital payment solution is currently being piloted. The payment solutions in the piloted channels are;

- USSD channel (*914#)
- Android mobile application
- IOS (Apple) mobile application
- Web application
- POS based payments using major bank cards, mobile money and Near Field Communication (NFC)

Another key component of digitalization of NEDCos' operations is the electronic billing. We are in the process of developing this platform to cater for all aspects of our billing processes, that is, from meter reading through to bill delivery via multiple channels such as physical, SMS or email. This will ultimately culminate into a self-service portal where customers can manage their accounts from any web-enabled device. A key component of this is to build a resilient Customer Relationship Management (CRM) that has accurate and up-to-date data of our customers. We are making use of the enterprise GIS system deployed to gather this information.

9.12 Billing and Collection

NEDCo had five decentralized servers for billing in each of its five operational Areas until August, 2019 when the Hexing System Upgrade Project, with a centralized billing system was introduced. Each operational area has a number of service stations under it depending on the size. NEDCo operates a monthly billing cycle for both postpaid and prepaid customers. Meter readers go around the premises of customers to read their post-paid meters manually each month after which they submit the readings to the office for data inputting. In order to ensure that customers are billed accurately, consumption proof (audit) is carried out on the data inputted into the billing system and all errors identified corrected after which the bills are produced and distributed to customers.

NEDCo also has collection points located all over the operational Areas. We have just launched a mobile payment platform to enable customers to pay their bills via their mobile phones.

NEDCo was able to account for about 72.71% of its energy purchase from the grid for 2021. The rest of 27.29% represents the system losses. NEDCos' billed energy has increased from GWh683 in 2016 to GWh1,060 in 2021 with a corresponding monetary value of GH¢600million and GH¢ 883.49million.

Collection on the other hand was GH¢373million in 2016, GH¢417million in 2017, GH¢408million in 2018, GH¢513million in 2019, and GH¢667million and GH¢744million in 2020 and 2021 respectively. The corresponding collection rates were 61%,

69%, 76%, 79%, 81.72% and 81.66% respectively. (See table below table showing the relationship between billed revenue and power purchased cost.)

It would be seen that power sales in 2016 was GH¢600m. This dipped to GH¢599m in 2017, GH¢529M in 2018, GH¢575M in 2019 before increasing to GH¢687m in 2020 and then to GH¢692.35million in 2021. The power purchase cost also consistently increased between 2016 to 2021 from GH¢309m to GH¢743.73m. The increases are mainly accounted for by the surge in TSC and BGC. Also in 2021, the power purchase cost outstripped the power sales by GH¢51.38m (GH¢743.73- GH¢692.35).

Table 5: The relationship between billed Revenue and Power Purchase Cost

KPI	2016	2017	2018	2019	2020	2021
Power Purchase (GWh)	1,124	1,224	1,312	1,413	1,575	1,761
Power Purchase (GH¢'M)	309	331	432	544	697	743.73
Billed Energy (GWh)	683	702	754	844	948	1,060
Power Sales (GH¢'M)	600	599	529	575	687	692.35
Collected Revenue (GH¢'M)	373	417	408	513	667	744
Collection rate (%)	61	69	76	79	81.72	81.66

9.13 Organizational reforms and restructuring

In order to ensure efficiency in the business, NEDCo has been rotating its Directors and key officers. A new Department, Corporate Strategy and Business Development was created to handle NEDCos' strategic issues. This Department replaces the Special Duties Directorate.

9.14 Customer Complaints & Dispute Resolution

NEDCo as a utility company has customer satisfaction as one of its core values. As a result, NEDCo is committed to the effective and timely resolution of customer complaints and disputes. To achieve this goal, NEDCo has engaged the services of trained professionals who handle customer complaints at each of its five operational Areas and some service centres. Most NEDCo staff have received training in customer service. NEDCo still operates in old fashioned customer service; without a call centre where customers make their complaints in writing, in person (face-to-face) or by telephone. The complaints are recorded and works order issued to scheduled officers for them to attend to the complaints. When the work is done, the work order is returned to the office to indicate the completion of work.

Where there is a dispute between NEDCo and the customer, it is handled by the Customer Service Officer at the Area Offices of NEDCo. Where the Customer Service Officer is not able to handle the dispute, it is referred to the Area Manager.

The challenge for NEDCo is that of the large number of customer complaints from a geographically dispersed communities and the high cost of attending to them.

9.15 Resolution of Court Cases

Typically, NEDCo initiates legal action against customers who engage in power theft or default in paying their electricity bills. NEDCo is however guided by the fact that it has to treat its customers leniently, as a result, this option is adopted hesitantly. Occasionally however, customers drag NEDCo to Court when they are dissatisfied with the services we render

to them or when there is a damage to their equipment or property due to electrical voltage surge. In most cases, NEDCo's Legal Team and Customer Service Team handles legal cases between the customer and NEDCo.

9.16 Government and Public Sector Debts

The government of Ghana is one of the major customers of NEDCo. NEDCo supply electricity to the government through state institutions including Ministries, Departments and Agencies (MDAs) who are connected. Whiles prepaid meters are being installed for customers in the private sector, those in the government sector are still on credit meters resulting in the accumulation of huge debt. Unfortunately, however, government has not been paying the MDA debt as expected. As at December 2021, the Government of Ghana owed NEDCo about GH¢ GH¢1,069,406,304.04 with subsidies and streetlighting in bills. These debts have made it difficult for NEDCo to meet its debt obligations to suppliers of electricity

9.17 Bad & Doubtful Debts

NEDCo has a policy in place for the management of bad and doubtful debt. A Board memo was submitted to write off an amount of GHC4.14million for 6,226 accounts due to inability to trace the account owners.

Surcharge & Subsidies

As a responsible publicly owned and regulated electric utility, NEDCo has always made serious efforts at complying with all regulations that govern the supply of electricity to consumers. These include all Legislative Instruments, Rules and Laws set out by the power sector regulators, such as the Energy Commission, PURC and MoEn. So far, these efforts have paid off, and NEDCo has never been surcharged for any offence by any regulatory body. As part of the tariff structure, PURC instituted the lifeline tariff for low-income consumers at tariffs below the cost of providing electricity to the end-user. Government also extended the subsidies enjoyed by the lifeline customers to all consumers and promised to pay the difference to the Utilities. Unfortunately, the government is yet to honour its part of the bargain. As at December 31, 2021

the Government of Ghana owed NEDCo an amount of about GH¢75,083,739.43 in subsidies. The amount owed NEDCo by the government in subsidies makes it difficult for NEDCo to undertake projects to improve on its operations. Restructuring the tariff regime to ensure that subsidies are directed to only the poor in the society would go a long way to help save the utility companies and for that matter NEDCo from financial difficulties.

9.18 Government Grants

NEDCo, through the Government of Ghana has received a loan facility of US\$ 2 million from the World Bank under the Ghana Energy Sector Transformation Initiative Project (GESTIP). This project will assist NEDCo to improve its operational efficiency. This project will update NEDCos' distribution system master plan, update distribution standards and produce documented design and construction standards that will guide future expansion and network improvements and develop the geographic information system (GIS) for NEDCos' Techiman Operational Area and parts of Sunyani Area.

The project will also finance the purchase of small tools and equipment for NEDCos' business operations and provide training to NEDCo staff across functional departments.

The Government of Ghana has secured a loan facility of US\$68 million from the Korean Export-Import Bank (KEXIM) to undertake the Northern Ghana Rural Electrification Infrastructure and Access Project (NGREIA) across NEDCos' Operational Areas.

The NGREIA Project comprises the construction of Six (6) 34.5/11kV primary substations, two (2) 34.5kV switching substations and one (1) Supervisory Control and Data Acquisition (SCADA) system, Distribution Network Management System (DNMS) made up of 42km sub-transmission lines and about 29km distribution/offloading feeders.

9.19 Access to Finance and Repayment of Financing Costs

PURC's Tariff Review for 2022 is aimed at setting a multi-year tariff, expected to cover the total cost incurred by the Ghanaian DISCOs to supply electricity to the end-user; this is a kind of Long Run Marginal Cost (LRMC). In this regard, if a DISCO identifies a genuine need for capital, equipment, material and services injections into its network or operational procedures to improve on quality of service, and the DISCOs' own IGFs are not adequate to finance these injections, one of the obvious options is to go for commercial loans.

Management of NEDCo has identified the need for such injections, and gaps in associated funding. Management has therefore initiated the process of procuring a commercial loan to the tune of GHS 100,000,000, from GT Bank limited.

The table below provides details of the commercial facility:

Table 6: Details of Commercial Loan Procured by NEDCo for Injection of Materials, Equipment and Services during the Validity of the Proposed Tariff:

Item No.	Identified Gap	Estimated Cost of Materials, Equipment, Services GHS	Loan Procured GHS	Component of Interest Relating to the Five- Year Duration of Proposed Loan GHS
1.	Net Cashflow Deficit	219,244,000.00	100,000,000.00	63,990,000.00
Grand-Total		219,244,000.00	100,000,000.00	63,990,000.00

9.20 Tariff Structure and Rates Design

While Management of NEDCo understands and appreciates the wisdom in PURC's decision to set affordable tariff for lifeline customers, it is worth stating that this arrangement has a measurable negative impact on the revenue of NEDCo. As mentioned earlier, the geography and demography of NEDCos' utility territory makes the electricity distribution business inherently infertile economically. While settlements are sparse in nature, as much as 84.96% of NEDCos' customer population belong to the residential tariff category, including about 46% lifeline customers, where the PURC approved electricity rates are amongst the lowest. Customers in the Non-residential and SLT tariff categories constitute 15.03% and 0.01% respectively.

While the residential customers consume about 67.76% of total energy sales, they contribute only 51.40% of total revenue. The Non-Residential customers, comprising mostly businesses, agricultural and public institutions, including the security agencies, hospitals and educational institutions constitute 15.03% of the customer population, consumed about 24.00% of total energy sales and contributed 38.94% of revenue. SLT customers who constitute 0.01% of the customer population consumed about 8.24% of total energy sales, and contributed 9.66% of revenue as at December 2021.

In addition to the sale of electricity at domestic and lifeline rates to the bulk of our customers the sparse nature of settlements means that the cost of supplying each kWh of electricity comprising meter reading, bill delivery, revenue collection, disconnection of defaulting customers and reconnection of paid-up disconnected customers, is relatively higher than the average in more economically fertile utility territories, such as in the middle and southern parts of Ghana.

In sum, the PURC tariff structure as described above does not adequately support the financial operations of NEDCo.

9.21 Introduction of Wholesale Electricity Market

The Wholesale Electricity Market (WEM) consists of the regulated and deregulated components. The customers under the regulated market purchase electricity at tariffs set or approved by the regulator, while wholesale customers are allowed to negotiate their own tariff and other supply arrangements, such as time-of-use tariffs etc directly generators and, or the transmission company.

In September, 2019, The Government of Ghana declared its intention to launch the first ever WEM in Africa by the year 2022; the process is on-going. The introduction of a WEM moves electricity as a commodity away from centralized trading under fully regulated tariffs and supply arrangements, and allows the determination of electricity prices by market forces, thereby introducing more competition into the industry, which in turn exerts downward pressure on the cost of electricity to end-users, especially for bulk purchasers.

Management of NEDCo has no issues with this policy, and supports the implementation as a contribution to ensure a more efficient and vibrant electricity supply industry (ESI) in Ghana.

9.22 Wholesale Market Bulk Customers Embedded in Distribution Network

SONABEL and SAVANA Cement (SAVACEM) are the only Wholesale Market Bulk Customers embedded in NEDCos' distribution network. Whereas on the basis of an internal agreement with VRA, NEDCo wheels power to SONABEL on behalf of the former, of which NEDCo is a subsidiary, SAVACEM has direct arrangement with VRA, which sells power to the former through GRIDCos' transmission network.

This market arrangement poses no threats or challenges to NEDCos' operations.

9.23 Embedded Generators and Interconnection

There are two embedded generation facilities in the NEDCo operational area, a 2.5MWp at Navrongo and 6.5MWp at Lawra in the Upper East and Upper West region respectively. The Navrongo solar plant was commissioned on June 2013 with an annual generation of 3,843MWh. The solar plant connects to NEDCos' grid at a distance of 10km via a medium voltage of 34.5kV from a 2.5MVA power transformer. The Lawra solar plant is also connected to the grid via a medium voltage line of 34.5kV. The Lawra solar plant was commissioned in October 2020. The plant recorded a grid feed-in energy of about 6,088MWh from January 2021 to December, 2021, respectively. Aside these embedded generations, NEDCo has customers spread across its operational areas with rooftop solar PVs also tied to the grid via a net-meter for billing. The capacity of these customers combined is 1MWp as at 2021.

9.24 Power Procurement from Independent Power Producers and Renewable Energy Generators.

As a result of the absence of economic customers within the NEDCo operational area to consume high amount of electricity, VRA is able to supply the power requirement of NEDCo. Apart from the 2.5MWp solar generator at Navrongo and 6.5MWp solar generator at Lawra which are embedded in the network, NEDCo does not procure power from any independent power producers or renewable energy generator.

9.25 Human Resource-Skilled Manpower

NEDCo is endowed with rich human resource with varied professional backgrounds at all levels of our operations. It is however deficient in the required staffing to man its operational service centres due to the vast geographical land mass that it covers arising out of NEDCos' own annual expansion plan and Government of Ghana's on-going nation-wide electrification programmes such as SHEP and GEDAP. The expansion of the network calls for commensurate number of skilled workforce to handle issues. NEDCo is unable to recruit staff to match up with the expanded network due to

insufficient cash flows to support the recruitment of staff. As a result of this, the existing staff are ever burdened with workload.

10 Strategies to Address Key Challenges

AS part of the strategies to reduce NEDCos' distribution losses and improve upon its collection rate, a number of interventions or strategies have been employed by NEDCo to address these challenges and key among them are those discussed below.

NEDCo is deploying Split smart prepaid metering system (din rail type) for all customers currently on post-paid or flat rate billing. The deployment of the meters would be first targeted at the 25 most urban stations, where non-technical losses are identified to be predominant. Pilot project started in Sunyani and Techiman where 25,000 smart and split prepaid meters have been deployed with the associated vending systems. To implement this pilot project, NEDCo launched a competitive tendering process in 2018 and selected a contractor, who is pre-financing the installation. The contract was signed, the meters procured and the deployment of the meters is ongoing.

Additionally, as part of an Access Project in the Tamale market area, which the MCC is funding, the U.S. Army Corps of Engineers, proposed the installation of pole-mounted prepaid split meters aimed at improving the electricity supply of commercial customers in the market areas of Tamale that are accessible to vendors via short messaging services (SMS, or text messaging) over mobile telephones. This project will provide meters for about 4,830 customers in the market and economic enclave areas in Tamale.

There is also a project to tackle the high energy losses in the Tamale metropolis dubbed the 'Tamale Strategy', The project consists of the procurement and installation of pole-mounted smart and split prepaid meters for LV customers in the Tamale

metropolis, where non-technical losses are predominant. In the intervention areas (Tamale Metropolis and immediate surroundings), 33,800 customers are on post-paid or flat rate billing. Also, it is estimated that, about 51,000 customers out of the total 77,000 PPM customers in the Tamale Metropolis are engaged in energy theft in the form of meter bypass. This accounts for the high energy loss of about 43% in the Area. This project intends to replace 53,200 (69%) of the existing monobloc PPM in Tamale that are prone to bypassing by customers. This brings the total Split PPM requirement of Tamale to 87,000. The scope of the split metering project comprises the following:

- Procurement and installation of 87,000 din rail, split and smart (two-way communication) prepaid meters over two years.
- Installation of computer servers and meter vending software;
- Installation of all required hardware to facilitate a two-way communication. The communication shall be by General Packet Radio Service (cellular) or Power Line Carrier communications.
- Creation of an additional 20 vending points in the intervention area to avoid bottlenecks in the sale of prepaid credit. Currently NEDCo uses a network of 220 vending points (third party and own offices).
- Supply and installation of Transformer LV metering for 200 transformer points

A sharp reduction of non-technical losses is expected in the intervention areas due to the split and anti-tampering features of the meters. The pole-mounted split system is assumed to eliminate the most common fraudulent practices, i.e. meter tampering or bypassing, in the target population. However, the installation of the split system cannot be used against more sophisticated frauds, such as a direct connection to overhead line. This practice however is unlikely to be common within the LV customer population. Hence, we assume that the intervention will reduce theft by 90%. To detect the remaining

frauds and better monitor losses, NEDCo proposes to deploy a loss monitoring team to immediately patrol the area to identify connection that are unauthorized.

The project will increase the collection efficiency to about 100% within the target population through the shift from post-paid and flat rate to prepaid billing. The collection efficiency in the intervention areas currently amounts to 50% and the average payment lag of arrears is 980 days, ie. 2.7years.

Another key initiative undertaken by NEDCo to retrieve debts is the deployment of E-Payment platforms which makes it easy for customers on post-paid meters to pay for their bills at the comfort of their homes and those on smart prepaid meters to also buy power with their phones. This intervention makes it convenient for customers to transact business with NEDCo easily without the intervention of third parties.

Government is the biggest debtors of NEDCo. NEDCo provides electricity to the government through the Ministries, Departments and Agencies (MDAs) and other sensitive customers like the hospitals, military, police, prisons, GBC, GWCL, etc. Government however, have not been honouring its debt obligation to NEDCo as expected. Due to the sensitive nature of the services rendered by these institutions, coupled with the special protection they enjoy under the GoG's Clearing House Policy, the traditional means of recovering these debts through disconnection cannot be applied. As at December 2021 Government debt to NEDCo stood at approximately GH¢1,069,528,995.31. We have been following up with the Ministry of Finance to settle the Government debt but not much have been achieved in this regard. That notwithstanding, we shall continue to engage the Ministry until the outstanding debts are paid.

Disconnection has been one of the tools used by NEDCo to retrieve its unpaid bills from customers. NEDCo will normally disconnect customers who fail to pay their bills over a certain period of time. We shall continue to deploy this tool whenever customers default in paying their electricity bills.

In order to improve upon the liquidity of the company, we wish to propose that PURC and other regulators approve an interest rate for NEDCO to be applied on overdue debts. This will go a long way to compel customers to promptly pay for the electricity bills when they become due.

We shall also respond promptly to customers in need of new service to avert the possibility of self-connection and its associated energy loss.

Our legal unit is also up and doing in prosecuting illegal connection customers. We shall intensify the prosecution to deter customers from power theft.

NEDCo understands that, for a distribution utility company to be able to supply quality and reliable power, it will thrive on the shoulders of a robust distribution Network. In view of that, NEDCo has been carrying out regular rehabilitation of the distribution network, upgrading the distribution lines, and injecting transformers in areas where the transformers have reached their peak. Plans are also underway to automate the network to ensure efficient network management and speedy identification and resolution of faults in order to reduce fault turnaround time. The projects identified for execution are part of the strategies to address some of the challenges confronting NEDCo.

11 Total Distribution Utility System Load at Peak

The total distribution utility system load at peak is as indicated in the table below

Table 7: Distribution Utility System Load at Peak Demand

INDICATOR	2016	2017	2018	2019	2020	2021
Peak load (MW) -Non-Coincidental	221	240	246.7	328.5	335.6	348.3

The table shows the total distribution system load at peak. The data shows that the figure have been increasing steadily from 2016 through to 2021. In NEDCo Areas the peak periods are always at night between 7pm and 10pm. NEDCo is able to meet the power requirement during peak period.

12 Regulated Market-Non-Special Load Tariff Customers

The composition of NEDCos' customer population makes it difficult for NEDCo to generate enough revenue for its operations. Though Energy consumption has grown from as low as 60.03GWh in 1990 to 1,761.37 GWh in 2021 (84.96%) of NEDCos' customers who are in the Residential category consumed 67.76% of the total billed energy of 1,060GWh out of the 1,761.37GWh, which represents total power purchased but contributed only 51.40% to the total revenue. Non-Residential customers constituted 15.03% who consumed 24.00% of the total energy sales and have contributed 38.94% to the total revenue. SLT customers represent approximately 0.01% of the customer population, consumed about 8.24% of energy sold with an associated revenue of 9.66%.

13 Regulated Market-Energy Commission Licensed Bulk Customers Embedded in Disco Network

SONABEL and SAVANA Cement (SAVACEM) are the only Wholesale Market Bulk Customers embedded in NEDCos' distribution network. Whereas on the basis of an internal agreement with VRA, NEDCo wheels power to SONABEL on behalf of the former, of which NEDCo is a subsidiary, SAVACEM has direct arrangement with VRA, which sells power to the former through GRIDCos' transmission network.

This market arrangement poses no threats or challenges to NEDCos' operations.

14 Base Load

Table 8: Base Load Statistics

INDICATOR	2016	2017	2018	2019	2020	2021
Base load (MW) -Non-Coincidental	114.92	124.8	128.28	169.26	174.51	350.2

15 Forecast of Energy to be Purchased

Table 9: Energy Purchase Forecasts

ITEM	2021	2022	2023	2024	2025	2026
Power Purchase (GWh)	1,761	1,891.3	2,031.3	2,181.6	2,343.0	2,516.4

16 Non-Conventional Energy - Renewable Energy

With the enactment of the Ghana Renewable Energy Law, Act 538 of 2011, Ghanaian publicly owned and regulated electric utilities are required to procure ten percent of their energy requirements from renewable energy sources by the year 2021. NEDCo as a publicly owned and regulated electricity distribution company is therefore under a statutory obligation to comply with the above legal provision.

Table 10: Statistics of Current and Projected Renewable Energy Purchases

Renewable Energy	2021	2022	2023	2024	2025	2026
Hydro<100MW	8.9GWh	503.36GWh	553.69GWh	609.06GWh	669.97GWh	736.96GWh
Waste to Energy	No purchases, due to technology immaturity and uncompetitive Levelized Cost of Energy (LCoE)	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff
Biomass	No purchases, due to technology immaturity and uncompetitive Levelized Cost of Energy (LCoE)	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff

Renewable Energy	2021	2022	2023	2024	2025	2026
Wind	No purchases, due to technology immaturity and uncompetitive Levelized Cost of Energy (LCoE)	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff
Solar	No purchases, due to uncompetitive Levelized Cost of Energy (LCoE)	To be determined by improvement in competitiveness of Levelized cost of Energy (LCoE)	To be determined by improvement in competitiveness of Levelized cost of Energy (LCoE)	To be determined by improvement in competitiveness of Levelized cost of Energy (LCoE)	To be determined by improvement in competitiveness of Levelized cost of Energy (LCoE)	To be determined by improvement in competitiveness of Levelized cost of Energy (LCoE)
Wave	No purchases, due to technology immaturity and uncompetitive Levelized Cost of Energy (LCoE)	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff	To be determined by the availability of technology at economically competitive tariff
TOTAL	457.6GWh	N/A	N/A	N/A	N/A	N/A

17 Distribution System Losses at Various Voltage Levels

Table 11: Distribution System Loses at Various Voltage Levels

Voltage Levels	2021	2022	2023	2024	2025	2026
34.5kV-11.5Kv	3.39	3.39	3.39	3.39	2.69	2.69
33kV-11kV	-	-	-	-	-	-
415V-240V	5.81	5.81	5.64	5.64	4.80	4.80

18 Customer Population by Classification at Characteristics

Table 12: Customer Population by Classification

Category	2021	2022	2023	2024	2025	2026
Active Customers	1,136,050	1,220,118	1,310,406	1,407,376	1,511,522	1,623,375
Inactive Customers						
Total	1,136,050	1,220,118	1,310,406	1,407,376	1,511,522	1,623,375

19 Regulated Market- Non-Special Load Tariff Customers

19.1 Residential Customers

Table 13: Residential Customer Classification by Voltage Distribution

Category	2021	2022	2023	2024	2025	2026
Lifeline	516,547	554,742	595,792	639,881	687,233	738,088
Medium	443,143	475,909	511,126	548,949	589,572	633,200
High	5,550	5,961	6,402	6,876	7,384	7,931
Total	965,240	1,036,612	1,113,320	1,195,706	1,284,189	1,379,219

These are active customer numbers

19.2 Non-Residential Customers

Table 14: Non-Residential Customer Population Projections

Category	2021	2022	2023	2024	2025	2026
Non-Residential	170,728	183,422	197,002	211,582	227,243	244,063

These are active customer numbers

19.3 Special Load Tariff Customers

Table 15: Current and Projected SLT Customer Distribution by Voltage Levels

Category	2021	2022	2023	2024	2025	2026
SLT-LV	43	44	44	45	46	46
SLT-MV	17	18	18	19	20	20
SLT-HV	22	22	22	24	24	27
Total	82	84	84	88	90	93

These are active customer numbers

19.4 De-regulated Market-Energy Commission Licensed Bulk Customers Embedded in Disco Network

Table 16: Statistics of De-regulated Market-Energy Commission Licensed Bulk Customers Embedded in Disco Network

Category	2021	2022	2023	2024	2025	2026
Bulk (MV)	4	-	-	-	-	-
Bulk (HV)						
Total	4					

20 Energy Allocated to Public Lighting (GWh)

Table 17: Energy Allocated to Public Lighting (GWh)

Category	2021	2022	2023	2024	2025	2026
Streetlight Consumption (GWh)	211	226	243	261.3	280.73	301.51

21 Distribution Company's System Load Data

Table 18: Disco System Load Data 2021-2026

Parameter	2021	2022	2023	2024	2025	2026
Total System Load @ Peak	348.3	353.8	371.6	402.1	424.0	440.9
Regulated Market (Non-SLT Customers)	893.23	939.05	1016	1,072.51	1,127.94	1,184.27
Regulated Market (SLT including Bulk Customers)	47.53	48.45	50.00	55.56	55.56	55.56
Regulated Market (Energy Commission Licensed Bulk Customers Embedded in Disco Network)						
Projected Base Load	174.4	184.0	193.2	209.1	220.5	229.3

22 Summary of Capital Investment Plan (Million GHS) 2021-2026

Table 19. Summary of Capital Investment Plan (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Capital Cost	181.48	422.43	296.72	284.18	725.96	412.09
Initial Spares						
Additional Capitalisation						
Renovation & Modernisation (R&M)						
Rehabilitation & Resettlement (R & R)						

22.1 Capital Expenditure Financing Plan

Table 19: Summary of Capital Expenditure Financing Plan (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Accumulated Depreciation	2,811.09	2,920.82	3,039.36	3,165.96	3,300.29	3,442.67
Retained Earnings	-204.9	-97.87	-92.61	-106.92	-106.91	-90.67
Commercial Borrowings:						
Domestic	60					
Foreign						
Additional Equity Contribution By Shareholder(s)	100	95.5	100	100	100	100
Grants:						
Domestic						
Foreign						
Tariff Revenue (Revenue from Projected Capacity Charge)						

23 Operation and Maintenance Costs

Table 20: Operation and Maintenance Costs (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Fixed O & M Costs	79.6	85.99	91.84	97.44	103.29	113.62
Variable O & M Cost	21.16	22.86	24.41	25,90	27.46	30.2

24 Administration and General Costs

Table 21: Administration and General Costs (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Fixed O & M Costs	44.36	47.92	51.18	54.30	57.56	61.66
Variable O & M Cost	12.87	13.90	14.85	15.75	16.70	17.89

25 Human Resource Costs- Employee Costs

Table 22: Human Resource Costs (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Fixed O & M Costs	167.93	193.12	222.09	255.40	280.94	309.03
Variable O & M Cost	47.05	54.11	62.23	71.56	78.72	86.59

26 Public Education

Table 23: Summary of Public Education Costs (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Stakeholder Communication & Sensitisation (Public Education)	0.095727	0.103414	0.110746	0.117183	0.124214	0.133071

27 Financing and Interest Costs:

Table 24: Financing and Interest Costs (Million GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Interest on Foreign Loans						
Interest on Local Loans		10.63	9.21	7.55	5.88	4.22
Interest on Working Capital Loan						

28 Return on Equity

Table 25: Equity Financing Costs (GHS) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Rate of Return	-327.83	-456.13	-325.10	-384.75	-418.82	-413.92

29 Depreciation

Table 26: Equity Financing Costs (%) 2021-2026

Item	2021	2022	2023	2024	2025	2026
Rate of Return	-0.1584%	0.0258%	-0.0149%	-0.0154%	-0.0151%	-0.0141%

30 Projected Electricity Distribution Revenue Requirement:

Table 27: Summary of Distribution Company's Revenue Requirement (Million GHS) 2021-2026

ITEM	2021	2022	2023	2024	2025	2026
A. Capital Recovery Component (CRC)	181.48	422.43	296.72	284.18	725.96	412.09
B. Fixed O & M Component (FOMC)	384.17	438.36	485.75	502.76	545.38	621.50
C. Revenue from Energy Charge	883.49	966.00	1,039.35	1,074.37	1,115.65	1,227.20
D. Reactive Power Charge						
E. Revenue from Open Access- Wheeling						
F. Fixed Charges						
F1. Service Connection Charge	28.00	32.26	37.09	42.66	49.06	56.42
F2. Reconnection Charges	1.84	1.84	2.12	2.44	2.80	1.84
F3. Interconnection Charges	16.00	16.00	17.60	19.36	21.30	16.00
F4. Separate Metering Charges	25.00	25.00	27.50	30.25	33.38	25.00
F5. Penalties-Illegal Connection	65.00	80.00	88.00	96.80	106.48	117.13
F6. Revenue from Rural Electrification Levy	11.14	14.76	15.59	16.12	16.73	18.41

31 Proposed Tariff and Rates Structure

NEDCo's cost of sales continue to increase over the years; of which power purchase and transmission service charge dominates its total recurrent expenses, representing about 70% of its total operating expenses.

The operations of NEDCo are very sparse with long distribution network with very limited number of SLT customers (0.01%). The quality of customers within the jurisdiction of NEDCo do not provide NEDCo the needed revenue to cover at least its fixed and direct variable cost.

Again, procurement of Capital Expenditure items for distribution network expansion, consumer connections, meters and information technology infrastructure are mostly denominated in forex. Variable cost per unit in 2022 is expected to be GHp49.14 and Fixed cost per unit for the same period is also projected to be GHp18.03, totaling GHp67.17. To enable NEDCo recover at least its cost of service and fixed cost, NEDCo proposes **GHp67.1650/kwh** for Distribution Service Charge for the year 2022, representing **113.0%** of the prevailing distribution service charge. Total variable cost includes the benchmark distribution loss of 22.6% in Ghana cedi, forming part of the variable cost per kWh. The proposed rate assumes that Transmission Service Charge and Bulk Generation Tariff remain the same. However, where BGC and TSC goes up, we recommend that PURC factor in the rate of increase of the two direct cost elements to enable NEDCo recover its direct fixed and variable costs.

In addition, NEDCO recorded a total customer population of 1,136,050 as at 2021. This comprises 84.96% of residential customers, 15.03% non-residential customers and 0.01% of SLT customers. Additionally, about 46% of the total customer population, (516,547) are lifeline customers who consume power at GHp32.6060/kwh which is far below the total of the current approved DSC rate of GHp31.5307/kwh, TSC GHp7.9846/kwh and BGT tariff of GHp33.7957/kwh, which is GHp73.311/kwh. This means that NEDCO is making losses of GHp 40.705/kwh for power sold to lifeline customers. We

therefore wish to suggest the lifeline tariff band should be scrapped or reduced from 50kwh to 30kwh/month due to availability of more efficient energy gadgets.

Furthermore, due to the amendment of the energy sector levies ACT 899, 2015 as ACT 941, 2017, the 5% rate for public lighting levy was reduced to 3%. This has resulted in shortfalls in revenue for the provision of public lighting especially due to the proliferation of public lighting as a result of the creation of new regional capitals and district capitals in NEDCO operational Areas. For NEDCO to be able to recover these shortfalls, there is the need for PURC to approve a tariff rate for public lighting which should be applied in costing the shortfalls.

Table 28: Details of NEDCo's Operating Costs

Description	Actual	Actual	Actual	Projection	Projection	Projection	Projection	Projection
	2019	2020	2021	2022	2023	2024	2025	2026
Average exchange rate (cedis)	5.15	5.78	6.03	7.89	8.39	8.91	9.37	9.88
Power Sales (GWh)	845.00	950.00	1,060.05	1,172.09	1,219.54	1,260.63	1,309.07	1,439.98
Salaries and related expenses	139,592	150,555	214,842	248,335	284,314	326,961	359,657	395,623
Material expenses	43,896	23,131	60,456	65,311	69,752	74,007	78,447	56,59986,292
Repairs and maintenance	4,344	13,189	40,304	43,540	47,011	50,254	53,395	
Transportation and Travelling	20,136	22,149	13,106	23,710	25,600	27,366	29,049	30,792
Other working costs	34,301	23,909	43,005	34,821	37,596	40,190	42,662	45,222
Regulatory Benchmark Value GH¢'000	46,170	150,957	168,713	160,238	172,211	172,499	179,127	197,040
Total Variable Cost	288,439	383,889	540,425	575,955	636,484	691,277	742,337	811,567

CAPACITY COST (GH¢'000)								
Average Net Fixed Assets (ANFA)	1,119,514	964,324	797,103	820,800	945,917	1,040,485	979,572	918,667
Total Depreciation	173,219	166,559	64,021	145,613	275,609	133,504	127,914	127,241
Return on ANFA (8%)	89,561	77,146	63,768	65,664	75,673	83,239	78,366	73,493
Total Capacity Cost	262,780	243,705	127,790	211,277	351,282	216,743	206,280	200,734
Variable Unit Cost (¢/KWh)	0.3413	0.4041	0.5098	0.4914	0.5219	0.5484	0.5671	0.5636
Fixed Unit Cost (¢/KWh)	0.3110	0.2565	0.1206	0.1803	0.2880	0.1719	0.1576	0.1394
Variable Unit Cost (\$/KWh)	0.0663	0.0699	0.0845	0.0623	0.0622	0.0616	0.0605	0.0571
Fixed Unit Cost (\$/KWh)	0.0604	0.0444	0.0200	0.0228	0.0343	0.0193	0.0168	0.0141
Total Cost (¢/KWh)	0.6523	0.6606	0.6304	0.6717	0.8099	0.7203	0.7246	0.7030
Total Cost (\$/kWh)	0.13	0.11	0.10	0.09	0.10	0.08	0.08	0.07
Average Exchange Rates (¢/\$)	5.15	5.78	6.03	7.89	8.39	8.91	9.37	9.88
PROPOSED DSC (GHC)	0.652330	0.660625	0.630362	0.671650	0.809949	0.720290	0.724650	0.702998
<i>PURC APPROVED/EXISTING DSC</i>			0.315307	0.315307	0.315307	0.315307	0.315307	0.315307
Proposed Percentage Increase	113.0%							

32 Appendices

- F-1D Distribution Sub-Transmission Data
- F-2D Distribution Network Capacity Parameters Data
- F-3D Distribution Substations Data
- F-4D Distribution System Capital Outlay Data
- F-5D Distribution Fixed Assets Schedule
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- F-7D Distribution Project Cost Data (Foreign Costs)
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- F-9D Capital Expenditure Funding/Financing Plan
- F-10D Operation and Maintenance Cost Data
- F-11D Administration and General Cost Data
- F-12D Human Resource Cost Data
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- F-14D Working Capital Requirement Data
- F-15D Summary of Distribution Costs
- F-16D Relevant Documentation In Respect of Distribution Tariff Proposal