PUBLIC UTILITIES REGULATORY COMMISSION

TEMPLATE FOR FILING OF INFORMATION AND DATA

FOR

REVIEW OF ELECTRICITY GENERATION REVENUE REQUIREMENT AND TARIFF

BY

VOLTA RIVER AUTHORITY

APRIL 2022

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This template is issued by the Public Utilities Regulatory Commission (PURC) under section 24 of the Public Utilities Regulatory Commission Act, 1997 (Act 1997) for completion by the Volta River Authority (VRA). It is intended to capture in detail qualitative data on VRA's electricity generation operations to complement quantitative data captured in the PURC Info Data Model –VRA Generation Tariff Data. The data provided is to enable PURC undertake a comprehensive analysis of VRA's electricity generation operations as part PURC's 5-Year Multi-Year Tariff Review covering 2022-2027. VRA is expected to provide a detailed write-up on each of the following sections, as applicable. Data presented in this write-up should be in consonance with the results presented in the attached excel spreadsheet.

The sections in this template are not exhaustive. VRA may provide additional sections to capture other relevant aspects of its operations.

1 INTRODUCTION

In accordance with the Public Utilities Regulatory Commission (PURC) Act, 1997 (Act 538) (Sections 16, 17 and 18) and the PURC Electricity Rate Setting Guidelines (Section 4.0), this tariff proposal seeks to request the PURC to approve power tariffs for Electricity Distribution Companies (DISCOs).

1.1 Brief Background of VRA's Electricity Generation Operations

The Volta River Authority (VRA) was established under the Volta River Development Act,1961 (Act 46), as a body corporate with the mandate to operate mainly as a power generation and transmission utility. In 2005, following the promulgation of the Volta River Development (Amendment) Act, 2005 (Act 692) in the context of the Ghana Government Power Sector Reforms, the VRA's mandate has now been largely restricted to the generation of electricity to both domestic and foreign customers.

The domestic customers include both bulk customers and distribution companies who are licensed to distribute and sell electricity without discrimination to customers in an area or zone designated by the Board of the Energy Commission (EC).

The VRA currently operates a total installed electricity generation capacity of 2539MW. This is made up of two hydroelectric generating stations, i.e., the Akosombo and Kpong Generating Stations with installed capacities of 1,020MW and 160MW respectively. The hydro generation is complemented by 330MW Combined Cycle Thermal Plant (Takoradi 1), 340MW Takoradi International Company (Takoradi 2), which is a joint venture between VRA and TAQA from Abu Dhabi, and 250MW (Ameri Power Plant) all at Aboadze, near Takoradi. Additionally, VRA has developed a number of thermal plants at Tema, including 110MW Tema Thermal 1 Power Station (Tema 1), 87MW Thermal 2 Power Station (Tema 2), and 220MW Kpone Thermal Power Plant (KTPS). A further 2.5MW, 6.5MW and 13.0MW Solar Power Plant has also been installed at Navrongo, Lawra and Kaleo (phase 1) respectively.

1.2 Rationale/Objectives Underpinning Tariff Submission

The major objectives underpinning this tariff proposal are:

1. To recover the cost of power supply to the DISCOs and ensure the sustainability of VRA.
2. To recover the cost of transmission losses.
3. To recover the net cost of inadvertent power imports.
4. To recover the cost of ancillary services to the National Interconnected Transmission System.
5. To recover any additional cost borne by VRA to ensure grid stability and uninterrupted power supply in the nation.

1.3 Legislative Provision(s) in support of Tariff Application

In accordance with Sections 17 of the Public Utilities Regulatory Commission, 1997 Act 538, the VRA hereby requests the PURC to approve power tariffs to be charged by the VRA to

Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo) and Enclave Power Company Limited (EPCL).

1.4 Highlights of Major Issues Underpinning Tariff Submission

- Cost recovery tariffs on electricity supply to DISCOs:
  In line with the PURC Rate Setting Guidelines, VRA used the Revenue Requirement Approach to determine the cost recovery tariffs. This is based on the required revenue that allows VRA to recover the cost of operation and at the same time earn a return on Average Net Fixed Assets.
- Cost of Inadvertent energy imports for system stability:
  The required revenue should also take account of unplanned power imports from CIE to support grid stability which come at a cost higher than the PURC approved tariff.
- Reactive Power Compensation:
  Institute a framework for compensation/reimbursement for provision of ancillary services provided in line with regulations.
- Allocation of Hydro Generation to Electricity Consumers:
  Projected hydro generation of 6,500GWh has been allocated to DISCOs, VALCO, GWCL, Bulk Customers and Export Customers.
- Composite Gas Price:
  The WACOG of US$6.08/MMBtu was used in the computation cost of supply from our thermal power plants. However, the N-Gas price is relatively higher than the WACOG.

2 INITIATIVES UNDERTAKEN SINCE 2020 TARIFF REVIEW

Since 2020, VRA has undertaken a number of initiatives and projects aimed at enhancing reliability and affordability while ensuring the sustainability of the company.

2.1 Projects Executed and Impact

2020

THERMAL PROJECTS	2020 Expenditure Total Annual (GH¢M)
TTPS-T1 - Refencing Of Takoradi Thermal Power Station	0.20
Rust Control Works	1.48
Supply Of Unit Power Transformer for Tema Thermal Power Complex – Station 2 (TT1PS)	0.19
TTPS-T1 Unit 2 Overhaul	22.2
Gas Infrastructure Facility Upgrade in Tema	8.14
TOTAL	**34.60**

2021

THERMAL PROJECTS	2021 Expenditure Total Annual (GH¢M)
Kpone Thermal Power Project (KTPP) Outstanding Works	1.35
TTPS Gas Interconnection Upgrade	7.40
Power Connection from GRIDCo to VRA's Gas Regulating and Metering Station In Tema	3.20
Relocation of AMERI Power Plant to Kumasi	1.29
Asset Valuation for T3	0.61
Weather Protection enclosure for T1 Plant	5.79
TOTAL	**12.76**

2.2 Compliance with Directives of the Commission

VRA has been complying with all the directives of the PURC. Tariffs charged to ECG, NEDCo and EPCL are based on the approved tariffs by the PURC. Also, in compliance with the directives of the PURC, the following quarterly reports are submitted as scheduled:

- Quality of Service
- Key Performance Indices

3 KEY POLICY ISSUES FOR TARIFF CONSIDERATION

3.1 Foreign Exchange Losses Resulting from Tariff

Reference to contractual agreements between its fuel suppliers and power plant partners, VRA is required to honour its obligations, particularly payment for natural gas and operational spares in foreign currency while the receivables from the regulated market are paid in local currency (Ghana Cedis). The average actual exchange rate for 2020 was GHS 5.596/USD while the PURC FX rate was GHS 5.3767/USD. The exchange rate for the 1st Quarter 2022 was GHS 6.4892 /USD. The table below indicate VRA's Exchange Losses for the period 2019 to 2021.

KEY ISSUES-FOREX LOSSES			
	2019	**2020**	**2021**
Exchange Losses on Transactions (GHS'Millions)	237,368	300,438	306,546
Exchange Losses on Loans (GHS'Millions)	367,678	169,248	25,957

3.2 Payment for Power Supply by Discos

Payment for power bills by ECG and NEDCo continues to be a challenge. Despite the introduction of the cash waterfall mechanism, the absence of a balancing fund to cater for unpaid portion of power bills poses a challenge to the sustainability of VRA's operations. There is also no penalty or interest charged on delayed payments for the DISCOs.

3.3 Billing Challenges on Weighted Average Cost of Natural Gas (WACOG)

As indicated in the details of the WACOG, the N-Gas price is relatively higher than the WACOG. The PURC had indicated that a Natural Gas Clearing House (NGCH) would be instituted to cater for the price difference between the N-Gas price and the WACOG. Even though a pilot version of the NGCH was being implemented under the Energy Sector Recovery Program (ESRP), the current mechanism does not resolve the "over-billing" related to gas supplied by N-Gas. The other gas suppliers (GNPC & GNGC), on the other hand, continue to bill VRA at the WACOG.

3.4 Dispatch of Power Plants / Supply to ECG

Actual dispatch by GRIDCo in every given period has an impact on VRA's planned revenues and must therefore be well coordinated with the tariff determination.

It is necessary for the dispatch regime to respect PURC's energy allocation.

3.5 Generation on Liquid Fuel

Occasionally, VRA has been called upon by the grid operator, over the past years, to generate power from liquid fuel to prevent disruptions in power supply and contribute to grid stability. The PURC-approved tariff does not cater for such instances since the tariff has been solely based on generation from natural gas. Over the past years, the Kpone Thermal Power Station (KTPS) has operated under emergency circumstances to support the grid whenever there is a shortfall. The shortfalls as usually as a result of inadequate gas supplies due to forced and planned outages from the suppliers, i.e. natural gas supply interruptions. The following table

highlights the amount of liquid fuel used and the corresponding energy generated over the period:

	KTPS		TICO		
Year	**DFO (m^3)**	**MWh**	**DFO (m^3)**	**LCO (m^3)**	**MWh From Liquid Fuel**
2020	24,890.12	75,466.00	10.51	6,806.46	20,490.00
2021	4,738.44	15,204.16	30,764.48	109.10	128,936.63
2022	8,976.02	26,535.67	-	-	-
Total	**38,604.58**	**117,205.83**	**30,774.99**	**6,915.56**	**149,426.63**

In 2020, VRA spent US$13.26 million on DFO to generate 75.3GWh. In 2021, KTPS used about US$3 million to generate 15.2 GWh of energy

Moreover, operating on liquid fuel results in lower efficiency for the turbines. As compared to a heat rate of 11,895 Btu/kWh, the KTPS heat rates increases to as high as 12,689 Btu/kWh on peaking mode, representing a 6% increase in heat rate.

Lastly, VRA also keeps strategic fuel stock as well as maintain a service contract for the Single Point Mooring (SPM) facility in Aboadze. The SPM facilitates the safe receiving and transfer of LCO from vessels to the tanks in the plants. This maintenance of the SPM costs VRA USD 900,000/annum. In addition, the estimated opportunity cost of keeping the liquid fuel stock is USD 550,000 for 2020.

To enable VRA to continue to provide this strategic service to the power sector, the tariff structure should make provision to cater for these costs which are incurred by VRA for the purpose of ensuring reliable power supply to the nation.

3.6 Inadvertent Power Exchanges

The interconnection between Ghana and Cote d'Ivoire also results in inadvertent power exchanges which help to sustain the reliability of the grid in both countries. This sometimes results in unplanned power imports which come at a cost higher than the PURC approved tariff. It will be necessary for the tariff to make provision for the US$0.12/kWh cost.

3.7 Ancillary Services

VRA provides additional services to ensure grid stability and continuity of supply which results to increasing the overall cost of power. These services include black start, provision of reactive power, spinning reserve and voltage/frequency regulation. VRA currently makes provision from its existing power plants as reserve margin; in this respect it will be imperative to define a tariff for the reserve margin. At present, there is no clear framework or provision for reimbursement or payment for the ancillary services provided.

3.8 Mini-Grid Maintenance

VRA is currently responsible for operation and maintenance of mini-grids installed on 5 island communities. Furthermore, 3 installations are in the offering as the Ministry of Energy and VRA are discussing terms for the operation and maintenance before handing-over is finalised. Clearing and fencing of the sites have been completed. However, electrical, and mechanical installations are yet to begin. Additional mini-grids are being constructed which are at different stages of completion and they will be handed-over to VRA as and when commissioned by the Ministry of Energy & Partners. PURC will need to develop a tariff purposely for the maintenance and operation of the mini – grid plants.

3.9 Payment for Unutilized Capacity

VRA has at least 200MW of unutilized capacity in the Tema enclave which contribute to the nation's reserve capacity. PPAs usually cater for unutilized capacity by making provisions via capacity payments when they are not dispatched. However, there is no such provision for VRA in the tariff structure. The estimated cost of keeping the plants in an operable state to VRA is USD 22 Million a year.

4 Proposed Service Delivery and Efficiency Improvements during Tariff Period

It is expected that the 220MW KTPS simple cycle plant will be converted to a combined cycle plant by the year 2025.

The TAPCO (T1) Plant has been in existence for about 20 years but its utilization has been around 50%. Furthermore, major components of the plant have either been replaced with new parts or refurbished. The study to assess the state of the plant for a major retrofit, which would extend the life of the plant for another 15-20 years has been completed.

The table below highlights the run hours of the units at T1 as at the end of 2021:

	T1 Run Hours as at 31-Dec-21		
Run Hours	**Run Hours (FH)**	**FH in Calendar Years**	**FH in Calendar Years At 90% Availability**
32G1	118,035.9	13.5	15.0
32G2	100,063.8	11.4	12.7
32G3	87,847.0	10.0	11.1

The T3 Plant has been shut down for the past 6 years due to technical issues which required GoG resolution with the contractor. However, plans are underway to repower the plant to start operations by 2023.

4.1 Service Delivery and Efficiency Targets

Refer to Section 4.2

4.2 Technical / Operating Performance Indicators/Indices

Plant	Availability (%)	Capacity Utilization (%)
Akosombo GS	94	55
Kpong GS	94	55

Plant	Availability (%)	Capacity Utilization (%)
TAPCO (T1)	80	85
TT1PS	90	30
KTPS	90	85
Ameri	90	85
VRA Solar Plant	90	18

NB: These availability factors are based on assumption that there are no major projects that will require extended outages outside of the normal outages taken to carry out planned maintenance works.

4.3 Financial Performance Indicators/Indices

With the objective of improving financial performance and business sustainability, VRA intends to achieve an annual equity return of 11.3%.

5 KEY CHALLENGES LIKELY TO IMPACT SERVICE DELIVERY

5.1 Generation Plant Availability

Grid Induced Challenges:

Grid disturbances result in tripping of various power plants which consequently reduce plant performance. The trips result in more simple cycle run, numerous starts and stops, more part-loading and higher heat rates. These disturbances also pose risks of failure to the machines and increases the frequency of maintenance with resultant increased maintenance cost.

Switchyard Challenges:

Snapping of cables at the switchyard and breaker failures renders turbines unavailable for longer hours. In some instances, breaker failures resulted in the motoring of generator rotors causing failures, longer outage durations and unbudgeted cost.

Dispatch Challenges:

Dispatch challenges such as part loading, improper application of merit order dispatch and frequent constraints imposed by the grid operator results in inefficiencies in the operation of plants.

5.2 Fuel Availability

VRA has gas sales agreements with Ghana National Gas Company (GNGC), Ghana National Petroleum Company (GNPC) and N-Gas Limited (through West Africa Gas Pipeline Company (WAPCo)). Future sources may include regasified Liquefied Natural Gas from GNPC via the Tema LNG Terminal Company Ltd facilities.

There have been instances of supply challenges and quality of gas supplied which require pre-heating of the natural gas before it can be used by the gas turbine.

VRA also procures Light Crude Oil (LCO) and Distillate Fuel Oil (DFO) from the spot market as and when required to cater for gas supply disruptions or during emergencies.

VRA already has some LCO and DFO in stock. However, it is worth noting that due to changes in its chemical properties, the liquid fuel has to be retreated after protracted storage.

5.3 Fuel Price

The price of N-Gas is determined by the contractual arrangements in place while the price of local gas is determined by the PURC. The PURC-determined WACOG is expected to reflect the composite gas price from the various supply sources, but this was not achieved in 2020. Furthermore, the fuel is priced and billed in USD, but the tariff is in GHS.

5.4 Expansion of Generation Capacity

Over the next five (5) years, VRA has plans of expanding its generation asset base and also undertaking a number of generation efficiency projects to increase its power supply capacity and supply reliability.

The planned generation projects are:

T1 Life Extension Project: The Takoradi Thermal Power Plant (T1), at the Aboadze enclave has been in operation for a period of 25 years (since 1997) and it is almost at the end of its planned economic life of 25 years. It is intended that a comprehensive Rehabilitation, Modernization and Life Extension Project (RMLEP) would be undertaken. A Consultant was engaged to undertake a technical assessment study of the T1 power plant and advise on improvements, not only with regard to the physical conditions of the plant's equipment but also with regard to the efficient and reliable operational performance of the power plant. The recommendation was to undertake retrofitting of some equipment in order to extend the economic life of the plant by a further 10 years. This Life Extension project would cost USD 60 Million and is expected to commence in 2022 till end of 2023.

KTPS Conversion to Combined Cycle: We also intend to convert the existing 220 MW simple cycle KTPS power plant into a 315 MW combined cycle power plant. This project will improve the efficiency of the power plant, increase generation output and reduce cost of power generation from the power plant. The project is currently at developmental stage. The target is to have the project completed by 2025. The estimated cost of the project is US$ 250 Million.

T3 Retrofit Project: The 132 MW T3 Power plant is currently out of service because of damage to some of the machines. A 'No Objection' is to be obtained from the Government through the Ministry of Energy to enable VRA rehabilitate the power plant into a 132 MW combined cycle power plant. The estimated cost of the project is US$ 100 Million. It is projected that the project will commence by end of 2022.

5.5 Reactive Power Generation and Compensation Issues

VRA provides additional services to ensure grid stability and continuity of supply which results in increasing the overall cost of power. These services include black start, provision of reactive power, spinning reserve and voltage/frequency regulation. VRA currently makes provision from its existing power plants as reserve margin; in this respect it will be imperative to define a tariff for the reserve margin. At present the tariff does not explicitly or indirectly make provision for reimbursement or payment of the ancillary services provided. VRA estimates that cost of providing spinning reserve, standby reserve and other ancillary services from the Akosombo Generating Station is about USD 48 Million per year.

5.6 Auxiliary Energy Consumption

Apart from VRA's hydro power plants (Akosombo G.S. and Kpong G.S), all other power plants in Ghana currently consume energy from the grid at some point or the other. Both Akosombo GS & Kpong GS have black start capability.

By the current tariff structure, VRA supplies all the auxiliary power used by the IPPs who supply energy to ECG. The cost of supplying the auxiliary power is significantly higher than the PURC-approved BGC.

5.7 Organisational Reform and Restructuring

As part of efforts to turnaround VRA's fortunes and improve its competitiveness, VRA in collaboration with Government, has started a process to restructure the Authority into a holding company with multiple businesses, that operates on sound commercial basis. Work is ongoing to define an optimal structure for the holding company as well as the best path in the restructuring process. It is expected that the final structure will include Hydro, Renewables, Thermal and Non-Power Subsidiaries, with some subsidiaries having private sector participation.

5.8 Payments by Government in Respect of VRA's Debts

The Government has since 2017 paid an amount of GHS3,810,137,000 to Creditors of VRA comprising Financial Institutions, Fuel Suppliers and Energy Generators. These amounts have been treated as additional contribution by Government in the operations of VRA

5.9 Embedded Generation Facility

Embedded Generation Facility owners have undue competitive advantage over VRA because their bulk customers do not pay transmission service capacity charge, regulatory levies and the Energy Sector Levies. This has incentivised some bulk customers to switch from grid power to embedded generation facilities with the resultant effect of stranded transmission and generation assets.

To encourage competitive wholesale electricity market, it is important for the PURC to ensure that all bulk customers (grid connected or embedded) to pay transmission service capacity charge and the levies.

6 STRATEGIES TO ADDRESS KEY CHALLENGES

6.1 Merit Order Dispatch

Currently the mode of implementation of Merit Order by the grid operator is at variance with the LI 1937 that established a wholesale electricity market comprising a Bilateral Market and a Spot Market. This mode of application distorts the pricing arrangement of PURC and also distorts energy accounting. We are in continuous discussion with EMOP, the market regulator, to address the issue.

Addressing the issue will reduce the incidence of partial dispatching and non-dispatch of plants which leads to high cost of operation and low asset utilisation.

6.2 Gas Fuel Price:

It is recommended that PURC should review the WACOG price to reflect the contractual obligations as per the Gas Sales Agreement signed between the parties prior to the introduction WACOG as well as the actual gas volumes consumed by off-takers. Where the WACOG price excludes provisions of a legally binding agreement, a mechanism should be introduced to absorb any liabilities that will affect the bottom line of VRA.

6.3 Auxiliary Service:

It will be imperative for PURC to develop a regulation for auxiliary service as well as define a tariff for the various categories of auxiliary services.

6.4 Generation & Plant Availability

Upgrade of Hydraulic to Spring Operated Breakers: One major problem affecting generation and availabilities is unstable frequency and equipment failures such as cable snapping, breaker hydraulic oil leakages and mechanism failure. To help reduce the impact of these failures on the generating stations, VRA has pre-financing the replacement of all hydraulic operated breakers at TAPCO switchyard to a Spring-Operated type. The replacement will make the tie breakers more reliable and dependable. The cost of replacement will be passed on to GRIDCo.

Procurement and installation of synchronizing Breakers: As a measure to reduce the impact of Switch yard related failures (e.g generator motoring), VRA has initiated processes to procure and install synchronizing breakers at the LV side of the transformer. This mitigates the possibility of generators motoring due to failure of tie breakers to open.

Fuel Redundancy Provision:

To ensure high availabilities and reliabilities, VRA continues to invest in getting back-up for all the fuel being used for generation. LCO and DFO are stored in readiness for usage during gas supply cuts. VRA has engaged Smit Terminals for a quarterly servicing and maintenance of the fuel receiving facility at cost of $900,000.00 every year. Gas contract arrangement with N-Gas/ WAPCO is also being maintained as a back-up to that of GNGC.

7 AKOSOMBO HYDRO GENERATION

7.1 Projected Generation Data

Table 1 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	1020	1020	1020	1020	1020	1020
Name Plate Power Factor	0.95	0.95	0.95	0.95	0.95	0.95
Net Effective / Dependable Generation Capacity	900	900	900	900	900	900
Projected Energy Generated	5,513	5,300	4,850	4,415	4,415	4,415
Target Availability of Power Plant	89	94	94	94	94	94

7.2 Capital Expenditure

For purposes of tariff application, the Generating Company must provide generation augmentation plan based on Load Growth Forecast during the tariff review period, which in this case is 2021-2026. The same is required for computation of Revenue Requirement (RR), indicating projected amount of electricity to be generated taking into consideration, estimated growth plan of its customers and any plans of new generation facilities.

The capital investment plan to be submitted by the generating company must contain details of ongoing projects as well as new projects beyond the tariff period.

The generating company must submit Renovation and Modernisation (R&M) **plans** for purposes of extension of asset life beyond its useful life. Detailed project reports indicating scope, justification, cost– benefit analysis, estimated life extension from a reference date, financial package, phasing of expenditure and schedule of completion.

With respect to Annual Performance Review, the generating company must submit capital expenditure incurred and capitalisation during the year under review alongside Annual Performance Review.

Outline of the Capital Investment Plan must include but not limited to the following:

- Purpose of Capital Investment Plan
- Replacement of existing assets with a view to meeting load growth, transformation losses, reactive power generation, improvement in quality and reliability of supply
- Capital Structure
- Capitalisation Schedule
- Financing Plan
- Cost – benefit analysis
- Performance improvement envisaged during tariff period

Table 2 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)	3.76	3.91	4.01	4.05	4.05	4.05
Additional Capitalisation (b)	51.05	18.44	10.99	11.02	11.02	11.02
Renovation & Modernisation (R&M) (c)	57.95	79.20	85.62	169.70	5.72	15.87
Rehabilitation & Resettlement (R & R) (d)	51.45	26.53	1.70	1.72	1.72	1.72
Capital Cost (a+b+c+d)	**164.22**	**128.08**	**102.32**	**186.48**	**22.50**	**32.65**

7.3 Capital Expenditure Financing Plan

Table 3 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	6,233.01	6,385.75	6,541.89	6,702.39	6,865.54	7,031.49
Net Asset Value	3,880.20	4,008.13	4,110.71	4,298.19	4,321.79	4,355.67
Retained Earnings	(155.20)	(198.74)	(545.89)	(911.65)	(1,187.10)	(1,511.39)
Commercial Borrowings:						
Domestic						
Foreign	131.47	117.43	98.96	183.52	18.96	19.61
Additional Equity Contribution By Shareholder(s)	32.75	10.65	3.36	2.96	3.54	13.04
Grants:						
Domestic	-	-	-	-	-	-
Foreign	-	-	-	-	-	-
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	-

7.4 Operation & Maintenance Costs

Table 4 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	19.86	22.25	24.69	27.28	29.23	32.16
Variable O & M Cost	3.51	3.93	4.36	4.81	5.16	5.67

7.5 Administration & General Costs

Table 5 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	42.98	48.13	53.43	59.57	60.48	66.53
Variable O & M Cost	1.33	1.49	1.65	1.84	1.87	2.06

7.6 Human Resource Costs (Employee Costs)

Table 6 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	286.91	344.29	389.05	487.26	462.81	555.37
Variable O & M Cost	-	-	-	-	-	-

7.7 Public Education

Table 7 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	1.21	1.35	1.50	1.65	1.79	1.97

7.8 Financing and Interest Costs:

Table 8 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	14.63	23.53	30.84	44.19	41.88	44.84
Interest on Domestic Loans	-	-	-	-	-	-
Interest on Working Capital Loan	11.87	15.23	17.08	19.66	46.14	50.69

7.9 Return on Equity

Table 9 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

7.10 Depreciation

Table 10 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	149.14	152.74	156.13	160.51	163.15	165.95

7.11 Projected Electricity Generation Revenue Requirement:

Table 11 Summary of Akosombo Hydro Generating Station Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	491.38	506.26	518.70	539.61	544.33	550.12
Fixed O & M Component (FOMC)	*350.96*	*416.02*	*468.67*	*575.77*	*554.32*	*656.03*
Non-Fuel Variable Operating Component (NFVOC)	*4.83*	*5.41*	*6.01*	*6.66*	*7.03*	*7.73*
Fuel Cost Recovery Component (FCRC)	-	-	-	-	-	
Reactive Power Compensation Component (RPCC)	*308.44*	*399.69*	*404.51*	*418.32*	*343.73*	*404.47*

8 KPONG HYDRO GENERATION

8.1 Projected Generation Data

Table 12 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	160	160	160	160	160	160
Name Plate Power Factor	0.90	0.90	0.90	0.90	0.90	0.90
Net Effective / Dependable Generation Capacity	140	140	140	140	140	140
Projected Energy Generated	987	1,000	950	885	885	885
Target Availability of Power Plant	94	94	94	94	94	94

8.2 Capital Expenditure

Table 13 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)	1.50	1.56	1.60	1.62	1.62	1.62
Additional Capitalisation (b)	89.66	71.49	72.36	13.88	13.88	13.88
Renovation & Modernisation (R&M) (c)	1.29	0.78	0.21	0.81	0.81	0.81
Rehabilitation & Resettlement (R & R) (d)	8.07	4.16	0.27	0.27	0.27	0.27
Capital Cost (a+b+c+d)	**100.53**	**77.99**	**74.45**	**16.57**	**16.57**	**16.57**

8.3 Capital Expenditure Financing Plan

Table 14 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	20226	2027
Accumulated Depreciation	2,190.87	2,286.88	2,385.01	2,484.76	2,586.16	2,689.22
Net Asset Value	1,887.66	1,931.57	1,971.85	1,953.84	1,935.40	1,916.53
Retained Earnings	(24.35)	(31.17)	(85.63)	(143.00)	(186.21)	(237.08)
Commercial Borrowings:						
Domestic						
Foreign	94.76	76.03	73.93	16.11	16.11	16.11
Additional Equity Contribution By Shareholder(s)	5.77	1.97	0.52	0.46	0.46	0.46
Grants:						
Domestic	-	-	-	-	-	-

Foreign	-	-	-	-	-	-
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	-

8.4 Operation & Maintenance Costs

Table 15 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	3.12	3.49	3.87	4.28	4.59	5.04
Variable O & M Cost	0.55	0.62	0.68	0.76	0.81	0.89

8.5 Administration & General Costs

Table 16 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	18.77	21.02	23.33	25.79	27.57	30.33
Variable O & M Cost	0.58	0.65	0.72	0.80	0.85	0.94

8.6 Human Resource Costs (Employee Costs)

Table 17 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	45.01	54.01	61.03	76.43	72.60	87.12
Variable O & M Cost	-	-	-	-	-	-

8.7 Public Education

Table 18 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	0.19	0.21	0.24	0.26	0.28	0.31

8.8 Financing and Interest Costs:

Table 19 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	12.72	18.58	24.00	25.76	23.41	22.64
Interest on Domestic Loans	-	-	-	-	-	-
Interest on Working Capital Loan	1.86	2.39	2.68	3.08	7.24	7.95

8.9 Return on Equity

Table 20 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

8.10 Depreciation

Table 21 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	93.90	96.01	98.13	99.75	101.39	103.06

8.11 Projected Electricity Generation Revenue Requirement:

Table 22 Summary of Kpong Hydro Generating Station Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	260.39	266.38	272.05	272.08	272.10	272.10
Fixed O & M Component (FOMC)	*67.08*	*78.73*	*88.47*	*106.76*	*105.04*	*122.80*
Non-Fuel Variable Operating Component (NFVOC)	*1.13*	*1.27*	*1.40*	*1.55*	*1.66*	*1.83*
Fuel Cost Recovery Component (FCRC)	-	-	-	-	-	
Reactive Power Compensation Component (RPCC)	*0.50*	*0.58*	*0.61*	*0.61*	*0.55*	*0.61*

9 TAPCo THERMAL GENERATION

9.1 Projected Generation Data

Table 23 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	330	330	330	330	330	330
Name Plate Power Factor	0.85	0.85	0.85	0.85	0.85	0.85
Net Effective / Dependable Generation Capacity	300	300	300	300	300	300
Projected Energy Generated	1,916	1,124	1,124	2,283	2,283	2,283
Target Availability of Power Plant	80	80	85	85	85	85

9.2 Capital Expenditure

Table 24 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)						
Additional Capitalisation (b)	1,179.09	784.91	-	-	-	-
Renovation & Modernisation (R&M) (c)	131.60	64.60	111.07	5.23	5.23	5.23
Rehabilitation & Resettlement (R & R) (d)						
Capital Cost (a+b+c+d)	**1,310.68**	**849.50**	**111.07**	**5.23**	**5.23**	**5.23**

9.3 Capital Expenditure Financing Plan

Table 25 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	1,838.76	1,986.94	2,145.27	2,306.37	2,470.29	2,637.14
Net Asset Value	1,552.99	2,317.50	2,336.03	2,247.01	2,156.23	2,063.63
Retained Earnings	(50.21)	(64.30)	(176.61)	(294.95)	(384.06)	(488.98)
Commercial Borrowings:						
Domestic						
Foreign	1,310.52	848.96	110.36	4.37	4.37	4.37
Additional Equity Contribution By Shareholder(s)	0.16	0.54	0.71	0.86	0.86	0.86
Grants:						
Domestic	-	-	-	-	-	-
Foreign	-	-	-	-	-	-

Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	-

9.4 Operation & Maintenance Costs

Table 26 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	18.08	20.25	22.47	24.72	27.19	29.91
Variable O & M Cost	3.19	3.57	3.97	4.36	4.80	5.28

9.5 Administration & General Costs

Table 27 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	20.04	22.45	24.92	27.41	30.15	33.16
Variable O & M Cost	0.62	0.69	0.77	0.85	0.93	1.03

9.6 Human Resource Costs (Employee Costs)

Table 28 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	102.23	122.68	138.63	166.35	187.98	225.57
Variable O & M Cost	-	-	-	-	-	-

9.7 Public Education

Table 29 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	0.40	0.45	0.50	0.55	0.60	0.66

9.8 Financing and Interest Costs:

Table 30 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	83.81	146.21	158.68	163.89	171.78	98.98
Interest on Domestic Loans	-	-	-	-	-	-

Interest on Working Capital Loan	3.84	4.93	5.53	6.36	14.93	16.40

9.9 Return on Equity

Table 31 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

9.10 Depreciation

Table 32 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	174.56	148.19	158.33	161.09	163.93	166.84

9.11 Projected Electricity Generation Revenue Requirement:

Table 33 Summary of TAPCo Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	311.53	352.59	364.37	359.28	354.11	348.86
Fixed O & M Component (FOMC)	*140.75*	*165.82*	*186.51*	*219.03*	*245.92*	*289.31*
Non-Fuel Variable Operating Component (NFVOC)	*3.81*	*4.27*	*4.74*	*5.21*	*5.73*	*6.30*
Fuel Cost Recovery Component (FCRC)	*724.28*	*754.09*	*923.85*	*936.56*	*938.90*	*941.25*
Reactive Power Compensation Component (RPCC)	-	-	-	-	-	

FCRC based on natural gas price of 6.08 through all the years

10 TT1PP THERMAL GENERATION

10.1 Projected Generation Data

Table 34 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	126	126	126	126	126	126
Name Plate Power Factor	0.8	0.8	0.8	0.8	0.8	0.8
Net Effective / Dependable Generation Capacity	105	105	105	105	105	105
Projected Energy Generated	353	335	335	335	335	335
Target Availability of Power Plant	90	90	80	90	90	90

10.2 Capital Expenditure

Table 35 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)						
Additional Capitalisation (b)	33.46	-	-	-	-	-
Renovation & Modernisation (R&M) (c)	3.76	2.94	2.31	1.74	1.74	1.74
Rehabilitation & Resettlement (R & R) (d)						
Capital Cost (a+b+c+d)	**37.22**	**2.94**	**2.31**	**1.74**	**1.74**	**1.74**

10.3 Capital Expenditure Financing Plan

Table 36 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	609.24	786.16	965.95	1,148.61	1,334.21	1,522.83
Net Asset Value	65.97	(97.90)	(265.09)	(435.54)	(608.75)	(784.78)
Retained Earnings	(16.74)	(21.43)	(58.87)	(98.32)	(128.02)	(162.99)
Commercial Borrowings:						
Domestic						
Foreign	36.00	2.76	2.08	1.46	1.46	1.46
Additional Equity Contribution By Shareholder(s)	1.22	0.18	0.24	0.29	0.29	0.29
Grants:						
Domestic	-	-	-	-	-	-
Foreign	-	-	-	-	-	-
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	-

10.4 Operation and Maintenance Costs

Table 37 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	6.03	6.75	7.49	8.24	9.06	9.97
Variable O & M Cost	1.06	1.19	1.32	1.45	1.60	1.76

10.5 Administration and General Costs

Table 38 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	6.68	7.48	8.31	9.14	10.05	11.05
Variable O & M Cost	0.21	0.23	0.26	0.28	0.31	0.34

10.6 Human Resource Costs (Employee Costs)

Table 39 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	34.08	40.89	46.21	55.45	62.66	75.19
Variable O & M Cost	-	-	-	-	-	-

10.7 Public Education

Table 40 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	0.13	0.15	0.17	0.18	0.20	0.22

10.8 Financing and Interest Costs:

Table 41 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	4.57	5.13	5.42	5.66	4.17	1.82
Interest on Domestic Loans	-	-	-	-	-	-
Interest on Working Capital Loan	1.28	1.64	1.84	2.12	4.98	5.47

10.9 Return on Equity

Table 42 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

10.10 Depreciation

Table 43 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	174.06	176.92	179.79	182.66	185.60	188.62

10.11 Projected Electricity Generation Revenue Requirement:

Table 44 Summary of TT1PP Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	179.88	168.29	156.41	144.25	131.91	119.40
Fixed O & M Component (FOMC)	*46.92*	*55.27*	*62.17*	*73.01*	*81.97*	*96.44*
Non-Fuel Variable Operating Component (NFVOC)	*1.27*	*1.42*	*1.58*	*1.74*	*1.91*	*2.10*
Fuel Cost Recovery Component (FCRC)	*433.75*	*451.61*	*464.33*	*470.72*	*471.90*	*473.08*
Reactive Power Compensation Component (RPCC)	-	-	-	-	-	

FCRC based on natural gas price of 6.08 through all the years

11 TT2PP THERMAL GENERATION

11.1 Projected Generation Data

Table 45 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	n/a	n/a	n/a	n/a	n/a	n/a
Name Plate Power Factor	n/a	n/a	n/a	n/a	n/a	n/a
Net Effective / Dependable Generation Capacity	n/a	n/a	n/a	n/a	n/a	n/a
Projected Energy Generated	n/a	n/a	n/a	n/a	n/a	n/a
Target Availability of Power Plant	n/a	n/a	n/a	n/a	n/a	n/a

11.2 Capital Expenditure

Table 46 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)	n/a	n/a	n/a	n/a	n/a	n/a
Additional Capitalisation (b)	n/a	n/a	n/a	n/a	n/a	n/a
Renovation & Modernisation (R&M) (c)	n/a	n/a	n/a	n/a	n/a	n/a
Rehabilitation & Resettlement (R & R) (d)	n/a	n/a	n/a	n/a	n/a	n/a
Capital Cost (a+b+c+d)	n/a	n/a	n/a	n/a	n/a	n/a

11.3 Capital Expenditure Financing Plan

Table 47 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	n/a	n/a	n/a	n/a	n/a	n/a
Net Asset Value	n/a	n/a	n/a	n/a	n/a	n/a
Retained Earnings	n/a	n/a	n/a	n/a	n/a	n/a
Commercial Borrowings:	n/a	n/a	n/a	n/a	n/a	n/a
Domestic	n/a	n/a	n/a	n/a	n/a	n/a
Foreign	n/a	n/a	n/a	n/a	n/a	n/a
Additional Equity Contribution By Shareholder(s)	n/a	n/a	n/a	n/a	n/a	n/a
Grants:	n/a	n/a	n/a	n/a	n/a	n/a
Domestic	n/a	n/a	n/a	n/a	n/a	n/a
Foreign	n/a	n/a	n/a	n/a	n/a	n/a
Tariff Revenue (Revenue from Projected Capacity Charge)	n/a	n/a	n/a	n/a	n/a	n/a

11.4 Operation & Maintenance Costs

Table 48 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a
Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

11.5 Administration and General Costs

Table 49 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a
Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

11.6 Human Resource Costs (Employee Costs)

Table 50 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a
Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

11.7 Public Education

Table 51 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	n/a	n/a	n/a	n/a	n/a	n/a

11.8 Financing and Interest Costs:

Table 52 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	n/a	n/a	n/a	n/a	n/a	n/a
Interest on Domestic Loans	n/a	n/a	n/a	n/a	n/a	n/a
Interest on Working Capital Loan	n/a	n/a	n/a	n/a	n/a	n/a

11.9 Return on Equity

Table 53 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	n/a	n/a	n/a	n/a	n/a	n/a

11.10 Depreciation

Table 54 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	n/a	n/a	n/a	n/a	n/a	n/a

11.11 Projected Electricity Generation Revenue Requirement:

Table 55 Summary of TT2PP Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	n/a	n/a	n/a	n/a	n/a	n/a
Fixed O & M Component (FOMC)	n/a	n/a	n/a	n/a	n/a	n/a

Non-Fuel Variable Operating Component (NFVOC)	n/a	n/a	n/a	n/a	n/a	n/a
Fuel Cost Recovery Component (FCRC)	n/a	n/a	n/a	n/a	n/a	n/a
Reactive Power Compensation Component (RPCC)	n/a	n/a	n/a	n/a	n/a	n/a

FCRC based on natural gas price of 6.08 through all the years

12 T3 THERMAL GENERATION

12.1 Projected Generation Data

Table 56 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	132	132	132	132	132	132
Name Plate Power Factor	0.8	0.8	0.8	0.8	0.8	0.8
Net Effective / Dependable Generation Capacity	127	127	127	127	127	127
Projected Energy Generated	-	*810*	*834*	*834*	*834*	*834*
Target Availability of Power Plant	-	85	85	85	85	85

12.2 Capital Expenditure

Table 57 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)						
Additional Capitalisation (b)	451.20	-	-	-	-	-
Renovation & Modernisation (R&M) (c)	-	-	-	-	-	-
Rehabilitation & Resettlement (R & R) (d)						
Capital Cost (a+b+c+d)	**451.20**	**-**	**-**	**-**	**-**	**-**

12.3 Capital Expenditure Financing Plan

Table 58 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	-	-	-	-	-	
Net Asset Value	-	-	-	-	-	
Retained Earnings	-	-	-	-	-	
Commercial Borrowings:	-	-	-	-	-	
Domestic	-	-	-	-	-	
Foreign	451.20	-	-	-	-	
Additional Equity Contribution By Shareholder(s)	-	-	-	-	-	
Grants:	-	-	-	-	-	
Domestic	-	-	-	-	-	
Foreign	-	-	-	-	-	
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	

12.4 Operation & Maintenance Costs

Table 59 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	12.05	13.50	14.98	16.48	18.13	19.94
Variable O & M Cost	2.13	2.38	2.64	2.91	3.20	3.52

12.5 Administration & General Costs

Table 60 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	13.36	14.96	16.61	18.27	20.10	22.11
Variable O & M Cost	0.41	0.46	0.51	0.57	0.62	0.68

12.6 Human Resource Costs (Employee Costs)

Table 61 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	68.16	81.79	92.42	110.90	125.32	150.38
Variable O & M Cost	-	-	-	-	-	-

12.7 Public Education

Table 62 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	0.27	0.30	0.33	0.37	0.40	0.44

12.8 Financing and Interest Costs:

Table 63 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	55.63	60.59	62.48	64.16	42.13	8.29
Interest on Domestic Loans	-	-	-	-	-	-
Interest on Working Capital Loan	2.56	3.29	3.68	4.24	9.95	10.93

12.9 Return on Equity

Table 64 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

12.10 Depreciation

Table 65 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	-	-	-	-	-	

12.11 Projected Electricity Generation Revenue Requirement:

Table 66 Summary of T3 Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	72.91	72.91	72.91	72.91	72.91	72.91
Fixed O & M Component (FOMC)	*93.83*	*110.55*	*124.34*	*146.02*	*163.95*	*192.87*
Non-Fuel Variable Operating Component (NFVOC)	*2.54*	*2.84*	*3.16*	*3.47*	*3.82*	*4.20*
Fuel Cost Recovery Component (FCRC)	*311.51*	*332.97*	*342.35*	*347.06*	*347.93*	*348.80*
Reactive Power Compensation Component (RPCC)	-	-	-	-	-	

FCRC based on natural gas price of 6.08 through all the years

13 KTPS THERMAL GENERATION

13.1 Projected Generation Data

Table 67 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	220	220	220	220	220	220
Name Plate Power Factor	0.85	0.85	0.85	0.85	0.85	0.85
Net Effective / Dependable Generation Capacity	205	205	205	205	205	205
Projected Energy Generated	249	708	1421	1287	1692	1692
Target Availability of Power Plant	80	80	90	90	80	80

13.2 Capital Expenditure

Table 68 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)						
Additional Capitalisation (b)	376.00	585.75	901.13	911.25	99.50	13.00
Renovation & Modernisation (R&M) (c)	89.33	37.13	4.62	3.48	896.23	934.13
Rehabilitation & Resettlement (R & R) (d)						
Capital Cost (a+b+c+d)	**465.33**	**622.88**	**905.75**	**914.73**	**995.73**	**947.13**

13.3 Capital Expenditure Financing Plan

Table 69 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	232.33	325.30	471.40	675.12	946.12	1,286.48
Net Asset Value	1,085.02	1,643.85	2,446.33	3,214.44	4,011.97	4,706.74
Retained Earnings	(33.47)	(42.86)	(117.74)	(196.63)	(256.04)	(325.99)
Commercial Borrowings:						
Domestic						
Foreign	465.29	622.52	905.28	914.16	995.16	946.56
Additional Equity Contribution By Shareholder(s)	0.04	0.36	0.47	0.57	0.57	0.57
Grants:						
Domestic	-	-	-	-	-	-

Foreign	-	-	-	-	-	-
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	-

13.4 Operation & Maintenance Costs

Table 70 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	12.05	13.50	14.98	16.48	18.13	19.94
Variable O & M Cost	2.13	2.38	2.64	2.91	3.20	3.52

13.5 Administration & General Costs

Table 71 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	13.36	14.96	16.61	18.27	20.10	22.11
Variable O & M Cost	0.41	0.46	0.51	0.57	0.62	0.68

13.6 Human Resource Costs (Employee Costs)

Table 72 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	68.16	81.79	92.42	110.90	125.32	150.38
Variable O & M Cost	-	-	-	-	-	-

13.7 Public Education

Table 73 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	0.27	0.30	0.33	0.37	0.40	0.44

13.8 Financing and Interest Costs:

Table 74 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	87.86	130.24	192.15	258.08	351.96	501.47
Interest on Domestic Loans	-	-	-	-	-	-
Interest on Working Capital Loan	2.56	3.29	3.68	4.24	9.95	10.93

13.9 Return on Equity

Table 75 Equity Financing Costs (%) 2022-2027

Item	2021	2022	2023	2024	2026	2027
Rate of Return	11.30	11.30	11.30	11.30	11.30	11.30

13.10 Depreciation

Table 76 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	58.42	92.96	146.11	203.72	271.00	340.35

13.11 Projected Electricity Generation Revenue Requirement:

Table 77 Summary of KTPP Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	154.12	237.95	361.87	487.24	624.85	755.49
Fixed O & M Component (FOMC)	93.83	110.55	124.34	146.02	163.95	192.87
Non-Fuel Variable Operating Component (NFVOC)	2.54	2.84	3.16	3.47	3.82	4.20
Fuel Cost Recovery Component (FCRC)	809.27	842.57	604.91	920.59	922.89	925.20
Reactive Power Compensation Component (RPCC)						

FCRC based on natural gas price of 6.08 through all the years

14 AMERI THERMAL GENERATION

14.1 Projected Generation Data

Table 78 Summary of Generating Station Data 2022-2027

Parameter	2022	2023	2024	2025	2026	2027
Gross Generation Capacity	250	250	250	250	250	250
Name Plate Power Factor						
Net Effective / Dependable Generation Capacity	250	250	250	250	250	250
Projected Energy Generated	*857*	*1,150*	*1,150*	*967*	*967*	*967*
Target Availability of Power Plant	75	90	90	90	90	90

14.2 Capital Expenditure

Table 79 Capital Investment Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Initial Spares (a)						
Additional Capitalisation (b)	268.31					
Renovation & Modernisation (R&M) (c)						
Rehabilitation & Resettlement (R & R) (d)						
Capital Cost (a+b+c+d)	268.31					

14.3 Capital Expenditure Financing Plan

Table 80 Capital Expenditure Financing Plan (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Accumulated Depreciation	n/a	n/a	n/a	n/a	n/a	n/a
Net Asset Value	n/a	n/a	n/a	n/a	n/a	n/a
Retained Earnings	n/a	n/a	n/a	n/a	n/a	n/a
Commercial Borrowings:	n/a	n/a	n/a	n/a	n/a	n/a
Domestic	n/a	n/a	n/a	n/a	n/a	n/a
Foreign	n/a	n/a	n/a	n/a	n/a	n/a
Additional Equity Contribution By Shareholder(s)	n/a	n/a	n/a	n/a	n/a	n/a
Grants:	n/a	n/a	n/a	n/a	n/a	n/a
Domestic	n/a	n/a	n/a	n/a	n/a	n/a
Foreign	n/a	n/a	n/a	n/a	n/a	n/a
Tariff Revenue (Revenue from Projected Capacity Charge)	-	-	-	-	-	

14.4 Operation & Maintenance Costs

Table 81 Operation and Maintenance Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a

Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

14.5 Administration & General Costs

Table 82 Administration and General Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a
Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

14.6 Human Resource Costs (Employee Costs)

Table 83 Human Resource Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Fixed O & M Costs	n/a	n/a	n/a	n/a	n/a	n/a
Variable O & M Cost	n/a	n/a	n/a	n/a	n/a	n/a

14.7 Public Education

Table 84 Summary of Public Education Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Stakeholder Communication & Sensitisation (Public Education)	n/a	n/a	n/a	n/a	n/a	n/a

14.8 Financing and Interest Costs:

Table 85 Financing and Interest Costs (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Interest on Foreign Loans	n/a	n/a	n/a	n/a	n/a	n/a
Interest on Domestic Loans	n/a	n/a	n/a	n/a	n/a	n/a
Interest on Working Capital Loan	n/a	n/a	n/a	n/a	n/a	n/a

14.9 Return on Equity

Table 86 Equity Financing Costs (%) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Rate of Return	n/a	n/a	n/a	n/a	n/a	n/a

14.10 Depreciation

Table 87 Depreciation (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Depreciation	n/a	n/a	n/a	n/a	n/a	n/a

14.11 Projected Electricity Generation Revenue Requirement:

Table 88 Summary of AMERI Revenue Requirement (Million GHS) 2022-2027

Item	2022	2023	2024	2025	2026	2027
Capital Recovery Component (CRC)	108.54	112.72	115.61	116.91	116.91	116.91
Fixed O & M Component (FOMC)	90.24	94.87	98.50	100.83	102.07	103.33
Non-Fuel Variable Operating Component (NFVOC)	13.31	41.49	62.58	69.36	29.84	31.88
Fuel Cost Recovery Component (FCRC)	184.97	577.94	874.01	971.09	418.85	448.63
Reactive Power Compensation Component (RPCC)	-	-	-	-		

FCRC based on natural gas price of 6.08 through all the years

15 Summary of Projected Energy Generation By Power Plant

Table 89 Projected Electricity Generation 2021-2026

Generating Station/Plant	Gross Generation Capacity	Name Plate Power / Capacity Factor	Net Effective / Dependable Generation Capacity	Projected Energy Generated
Hydro:				
Akosombo Generating Station	1020	0.95	900	28,908
Kpong Generating Station	160	0.9	140	5,5592
Sub-Total	1180	1.85	1040	34,300
Thermal:				
TAPCo	330	0.85	300	8,728
TICo				
TT1PP	126	0.8	105	1,693
TT2PP	86	0.8	65	
MRP				
T3	126		115	
KTPP	220	0.85	205	5,357
AMERI	250	0.85	250	4,533
Sub-Total	1138			20311
Renewable:				
Navrongo	2.5MWp	1	0	14.94
Lawra	19.58MWp	0.9	0	157
Kaleo 2 Solar	15MWp		0	94.61
Bongo Solar	60MWp		0	157.68
Kpong Floating Solar	10MWp		0	15.77
Wind Power Generation	150MWp		0	331.68
Sub-Total	257.08			
Grand Total	2575.08			35603

16 Reactive Power Parameters

16.1 Name Plate Information

Table 90 Name Plate Information (Akosombo Generating Station)

Item	Total No of Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Generator Data							
Name Plate Capacity	6	179.5MVA	179.5MVA	179.5MVA	179.5MVA	179.5MVA	179.5MVA
Rated Power Factor	6	0.95	0.95	0.95	0.95	0.95	0.95
Exciter Data							
Name Plate Rating	6	0.915 MVA	0.915 MVA	0.915 MVA	0.915 MVA	0.915 MVA	0.915 MVA

Name Plate Information (Kpong Generating Station)

Item	Total No of Units	Unit 1	Unit 2	Unit 3	Unit 4
Generator Data					
Name Plate Capacity	4	44.44MVA	44.44MVA	44.44MVA	44.44MVA
Rated Power Factor	4	0.90	0.90	0.90	0.90
Exciter Data					
Name Plate Rating	4	1 MVA	1 MVA	1 MVA	1 MVA