



Bhutan Electricity Authority

MHP Tariff Review Report 2022 to 2025

December 2022

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Executive Summary

The Druk Green Power Corporation Limited (DGPC) submitted the revision of the 720 MW Mangdechhu Hydropower Plant (MHP) generation tariff on behalf of MHP since the Mangdechhu Hydroelectric Project Authority (MHPA) has the mandate for construction of the project only and DGPC will be responsible for operation and maintenance of the project. DGPC proposed the revision of MHP domestic generation tariff from Nu. 3.77/kWh to Nu. 3.85/kWh for the tariff period from 1st July 2022 to 30th June 2025. The Bhutan Electricity Authority (BEA) has reviewed MHP tariff application and approved a pre-tax weighted average cost of capital (WACC) of 12.82% based on 13.59% after-tax cost of equity (CoE), 10% cost of debt (CoD) and 70% gearing ratio.

The cost allowances and MHP tariff has been set in line with the Domestic Electricity Tariff Policy (DETP) and according to the provisions of the Tariff Determination Regulation (TDR) 2022. The major Investment Plan of MHP during the tariff period 2022-2025 includes the purchase and reclamation of runners and construction of additional residential colonies for the operation and maintenance employees.

BEA has calculated the mean annual energy generation of the past three years based on 98% water utilization factor after deduction of 15% royalty energy. After considering the approved regulatory parameters, cost allowances and annual energy volume, MHP generation tariff was determined to Nu. 3.64/kWh for the tariff period 2022-2025.

1 Background

The Druk Green Power Corporation Limited (DGPC) submitted the proposal for the revision of the 720 MW Mangdechhu Hydropower Plant (MHP) domestic generation tariff for the tariff period 1st July 2022 to 30th June 2025 vide letter no. 08/DGPC/BEA/MD/2022/33 dated 23rd March 2022. The submission of the tariff application was delayed by over three (3) weeks.

DGPC stated that the 720 MW MHP domestic tariff proposal was prepared in line with the Domestic Electricity Tariff Policy (DETP) and the provision of the Tariff Determination Regulation (TDR) 2016. DGPC stated that the increase of MHP generation tariff from Nu. 3.77/kWh to Nu. 3.85/kWh is to recover their cost of generation through efficient cost of business operation.

As part of the tariff review process, a public hearing was conducted virtually on 3rd May 2022 to present MHP tariff proposal. The Association of Bhutanese Industries (ABI) presented its findings on MHP tariff proposal submitted by DGPC. The public hearing was also attended by the officials of the Department of Hydropower and Power Systems (DHPS), High Voltage (HV) and Medium Voltage (MV) consumers, the Licensees and BEA Commissioners. ABI submitted their written comments on MHPA tariff application on 23rd May 2022.

BEA has sought clarifications and conducted consultations with DGPC, MHP, DHPS and Bhutan Power Corporation Limited (BPC) on the various information required to conduct the tariff review. Based on the detailed review of the tariff application, BEA has approved the cost allowances and tariff of MHP as provided below.

2 Regulatory parameters

2.1 Tariff Period

2.1.1 DGPC Proposal

DGPC has proposed a three years tariff period for MHP from 1st July 2022 to 30th June 2025 in line with DETP, with the year 2021 as the reference year.

2.1.2 BEA Review

As per the Clause 7.19 of DETP, the tariff revision cycle will be normally three years unless there is a substantial and significant difference in the business environment and generation scenario.

Based on the approval of subsidy allocation for domestic electricity tariff provided by DHPS, the Ministry of Economic Affairs (MoEA) vide letter no. 24/DHPS/HQ/Tariff/2022-23/75 dated 22nd August 2022, BEA has approved two (2) years and ten (10) months tariff period for MHP, starting from 1st September 2022 to 30th June 2025.

2.2 Gearing Ratio

2.2.1 DGPC Proposal

DGPC stated that the actual Gearing ratio of MHP is 70.84% for the tariff period 2022-2025 and DGPC has proposed a Gearing ratio of 70% in line with DETP.

2.2.2 BEA Review

The Clause 7.1 of DETP states *“To ensure competitive and efficient pricing through an optimal capital structure, the gearing ratio for the computation of WACC shall be higher than actual gearing ratio and up to maximum of 70:30.”*

In the 2019-2022 tariff period, BEA had approved the gearing ratio of 70% for MHP considering their project financing structure of 70 % debt and 30% grant. Since DETP recommends a maximum gearing of 70%, BEA has approved a gearing ratio of 70% for MHP.

2.3 Cost of Equity

2.3.1 DGPC Proposal

In accordance to the provision of DETP 2016, DGPC has proposed a post-tax Cost of Equity (CoE) of 13.56% for MHP based on the average lending rates of 11.06% of the domestic financial institutions and the maximum premium of 250 basis points. The proposed average lending rate is as provided in Table 1 below.

Table 1: Proposed Average Lending Rate

Sl.	Institutions	Interest Rate
1	Bhutan Development Bank Limited (BDBL)	11.24 %
2	Bhutan Insurance Limited (BIL)	12.40 %
3	Bhutan National Bank Limited (BNBL)	10.83 %
4	Bank of Bhutan Limited (BOBL)	11.66%
5	Druk Punjab National Bank (Druk PNB)	9.94%
6	National Pension & Provident Fund (NPPF)	9.50%
7	Royal Insurance Corporation Limited (RICBL)	12.20%
8	Tashi Bank Limited (T Bank Ltd)	10.69%
Average lending Rate		11.06%

2.3.2 Input from Stakeholders

ABI submitted that with the current situation of excess liquidity with the financial institutions in Bhutan which has been exacerbated by the slow growth in credit compounded with the fact that COVID-19 pandemic has detrimentally impacted businesses, it is envisaged that the Royal Monetary Authority (RMA) will lower the interest rates for all types of loans before the expiry of the Phase III monetary measures in June 2022. ABI stated that deposits in the financial institutions grew by 29.6 % in 2020 as compared to 12.5% in 2019 and 6.7% in 2018. Growth in credit was only 6.9% in 2021 and 7.4% in 2020 compared to 16.7% in 2019 and 15.4% in 2018. This is the lowest growth in credit in a decade. Therefore, ABI submitted that the interest rates have to be brought down from the current level to encourage investments and to enable the economy to bounce back from pandemic. ABI anticipates that the average interest rates may drop to about 10.5% at least in the next 2-3 years.

Therefore, ABI requested BEA to consult with RMA and financial institutions prior to finalizing the average lending rates for the determination of CoE. ABI also stated that similar to the tariff period 2019-2022, where 200 basis points was allowed over the average lending rates for computation of CoE, BEA should allow only 200 basis points during the tariff period 2022-2025, instead of 250 basis points as proposed by DGPC for MHP.

2.3.3 BEA Review

The Clause 7.2 of DETP states, “...the CoE shall be based on the average lending rates of the domestic financial institutions and BEA may allow a reasonable premium up to a maximum of 250 basis points on the above rates depending on the domestic market situation and gearing ratio applied...”

BEA has considered the long-term average lending rates of the domestic financial institutions as per the provision of DETP.

Considering the recommendations of ABI to have consultation with RMA and financial institutions for the lending rates, BEA enquired with the banks on their plans to reduce loan

interest rates but the majority of the banks informed that they did not have any plans of decreasing the loan interest rates at the moment.

Based on the above, BEA has reviewed the average lending rates of the domestic financial institutions as of 3rd June 2022 as shown in Table 2 below.

Table 2: Average Long Term Lending Rate of Financial Institutions in Bhutan

Sl.	Financial Institutions	Interest Rate
1	Bhutan Development Bank Limited (BDBL)	11.24 %
2	Bhutan Insurance Limited (BIL)	12.00 %
3	Bhutan National Bank Limited (BNBL)	10.60%
4	Bank of Bhutan Limited (BoBL)	11.66 %
5	Druk Punjab National Bank (Druk PNB)	11.17 %
6	National Pension & Provident Fund (NPPF)	9.27 %
7	Royal Insurance Corporation of Bhutan Limited (RICBL)	12.08 %
8	Tashi Bank Limited (T Bank Ltd)	10.75 %
	Average Rate	11.09%

In line with DETP, BEA has allowed a premium of 250 basis points at par with DGPC and to encourage investments in the generation sector. Based on the long-term average lending rate of 11.09% and 250 basis points, CoE of MHP has been approved as 13.59%.

2.4 Cost of Debt

2.4.1 DGPC Proposal

DGPC has proposed CoD of 10% for MHP and stated that the proposed CoD is the actual interest rate of MHP loan as per the Inter Government (IG) agreement for MHP loan. DGPC also stated that the proposed CoD of MHP has been proposed as per the provisions of DETP.

2.4.2 BEA Review

BEA has reviewed the IG loan agreement signed between the Government of India (GoI) and the Royal Government of Bhutan (RGoB) on 30th April 2010 and noted that Article 3 (b) which states “...The loan shall carry an interest rate of 10% per annum and be repayable in thirty equated semi-annual instalments, the first repayment commencing one year from the mean date of commercial operation...”. The details of loan of MHP is provided in Table 3 below.

Table 3: MHPA Loan Detail (Mill. Nu.)

Loan Disbursement	Principle amount	Interest rate (%)	Repayment period (years)	Loan balance (31.12.2022)	Loan balance (31.12.2023)	Loan balance (31.12.2024)
2020-2036	35,088.41	10.0	17	30,960.36	28,896.34	26,832.31

The principal loan amount, interest rate, repayment period and the loan balance as of 31.12.2022, 31.12.2023 and 31.12.2024 of MHP are found to be proposed correctly. Therefore, CoD of 10% for MHP has been approved.

2.5 Weighted Average Cost of Capital (WACC)

The pre-tax weighted average cost of capital (WACC) for the Generation Licensee to be calculated in accordance with the Clause 69 of TDR, 2022 as follows:

$$WACC_g = \frac{CoE_g(1 - Gearing_g)}{1 - Tax} + (CoD_g \times Gearing_g)$$

Where,

- 1) $WACC_g$ is the weighted average cost of capital for the Generation Licensee “g”, as a percentage;
- 2) CoE_g is the cost of equity, as set out in Schedule C of TDR 2022, as a percentage for the Generation Licensee “g”;
- 3) $Gearing_g$ is the ratio of debt to total net fixed assets, as set out in Schedule C of TDR 2022 for the Generation Licensee “g”;
- 4) CoD_g is the actual cost of debt for the tariff period for the Generation Licensee “g”, as a percentage, being the weighted average interest rate of the Licensee’s loans with suitable allowance made for currency risk of any loans not made in local currency, provided that the cost of debt should not exceed reasonable benchmarks; and
- 5) Tax is the prevailing rate of company taxation, as a percentage.

2.5.1 DGPC Proposal

DGPC has proposed a pre-tax WACC of 12.81% based on a gearing ratio of 70%, CoE of 13.56%, CoD of 10% and a tax rate of 30% for MHP.

2.5.2 Input from Stakeholders

ABI has recommended BEA to use the WACC of 12.60% based on a Gearing ratio of 70%, CoD of 10%, CoE of 13.06% and a tax rate of 30%.

2.5.3 BEA Review

Based on the approved Gearing ratio of 70%, CoE of 13.59%, CoD of 10% and tax rate of 30%, WACC of 12.82% for MHP has been approved as shown in Table 4 below.

Table 4: Proposed and Approved WACC

	MHP	BEA
Gearing	70 %	70 %
Cost of Equity	13.56 %	13.59 %
Cost of Debt	10 %	10 %
Tax	30 %	30 %
WACC	12.81 %	12.82%

2.6 Inflation

2.6.1 DGPC Proposal

DGPC has proposed an average annual inflation rate of 3.40% for MHP to be used to calculate the average historical Operation and Maintenance (O&M) cost and to escalate the yearly O&M allowance. DGPC stated that the historical inflation figures are used from the Consumer Price Index (CPI) bulletin of National Statistics Bureau (NSB) for non-food items and calculated as the arithmetic average of the year-on-year inflation rates as in shown in Table 5 below.

Table 5: Proposed Historical Inflation Rates

Year	2019	2020	2021	Average
Inflation figures	1.35%	2.02 %	6.82 %	3.40 %

2.6.2 Input from Stakeholders

ABI submitted that the inflation rates of 2.28%, 7.66% and 6.87% for the years 2019, 2020 and 2021 are recommended to be used by BEA which have been obtained based on CPI for food and non-food data maintained on a quarterly basis by RMA.

2.6.3 BEA Review

As per Clause 7.4 of DETP, “...Inflation to be used for the O&M expenses shall be based on historical average inflation rates published by the National Statistics Bureau (NSB)”. The historical average inflation rate is used to escalate the historical O&M costs to 2022 price levels and to escalate O&M allowance over the tariff period.

BEA has found that ABI calculated the average inflation rate considering quarterly inflation rates for both food and non-food items of the years 2018, 2019, 2020 and 2021.

BEA has also verified the historical inflation rates proposed by DGPC for the years 2019 to 2021 and found that the inflation rate has been proposed correctly by DGPC. Therefore, inflation rate of 3.40% has been approved for the tariff period 2022-2025.

2.7 Asset Schedule at the end of 2021

The total cost of supply for a Generation Licensee in any year to be determined in accordance with TDR, 2022 is as follows:

$$TC_g = OM_g + DEP_g + RoA_g + CoWC_g + SO_g + Fees_g - NTR_g$$

Where,

1. TC_g is the total cost of supply of the Generation Licensee “g”, in million Ngultrum;
2. OM_g is the allowance for operating and maintenance costs of the Generation Licensee “g”, in million Ngultrum;
3. DEP_g is the allowance for depreciation of assets for the Generation Licensee “g”, in million Ngultrum;
4. RoA_g is the return on fixed assets of the Generation Licensee “g”, in million Ngultrum, determined as:

$$RoA_g = WACC_g \times NA_g$$

Where,

- a) $WACC_g$ is the weighted average cost of capital for the Generation Licensee “g”, as determined in accordance with Clause 69 of TDR 2022; and
 - b) NA_g is the net value of all fixed assets at the start of the year for the Generation Licensee “g”, in million Ngultrum.
5. $CoWC_g$ is the cost of working capital for the Generation Licensee “g”, in million Ngultrum. The cost of working capital shall cover the allowance for arrears and inventories, and shall be calculated as follows:

$$CoWC_g = I * [REV_g \times \frac{ARREARS_g}{365} + INVENTORIES_g]$$

Where,

- a) I is the interest rate for working capital as determined in Clause 59 of TDR 2022;
- b) $REV_g = OM_g + DEP_g + RoA_g$
- c) $ARREARS_g$ is the allowed days receivables for the Generation Licensee “g”, in days; and

d) INVENTORIES_g is the allowance for inventories for the Generation Licensee “g”, in million Ngultrum.

6. SO_g is the System Operator charges payable by the Generation Licensee “g”, in million Ngultrum.
7. FEES_g is the allowance for regulatory fees and levies of the Generation Licensee “g”, in million Ngultrum.
8. NTR is the estimated Non-Tariff Revenue of the Generation Licensee “g”, in million Ngultrum

2.7.1 DGPC Proposal

DGPC has proposed the gross assets value of Nu. 56,451.41 million, net assets value of Nu. 55,545.34 million, and depreciation of Nu. 2,034.47 million at the end of the year 2021 for MHP as shown in Table 6 below.

Table 6: Proposed Assets Schedule (Mill. Nu.)

Fixed assets	Gross value	Acc. Dep.	Net value	Depreciation
Land	11.18	-	11.18	-
Buildings	1,298.06	481.25	816.80	34.11
Civil structures	666.92	166.71	500.21	22.23
Dam complex	16,409.72	-	16,409.72	546.99
Water conductor	9,530.02	-	9,530.82	317.67
Power house	28,094.56	63.74	28,030.82	1,038.28
Transmission equipment	-	-	-	-
Equipment	176.37	82.76	93.61	24.87
Office equipment	264.58	111.60	152.98	50.31
Total	56,451.41	906.06	55,545.34	2,034.47

DGPC stated that the gross assets value of Nu. 56,451.41 million as shown in Table 7 is including interest during construction (IDC) of Nu. 12,118.70 million and operational cost of Nu. 83.89 million as of 31st December 2021. DGPC also stated that the final Revised Cost Estimate (RCE) of the project as submitted by MHPA to GoI for approval was Nu. 51,441 million including the cost of construction of additional residential buildings for the O&M employees but excluding IDC and Associated Transmission System (ATS).

Table 7: Final RCE Cost Breakup

Asset Description	Acquisition cost (Mill. Nu.)
Asset Capitalized till 31 st March 2021	2,784.80
Add: CWIP including TL/ATS	41,216.73

Value of Asset as per SAP	44,001.61
Add: pre-operating Expenses	6,573.34
Add: Balance cost to completion as per proposed final RCE	535.05
Total Projected Completion Cost (Proposed final RCE under approval)	51,110.00
Add: prorated IDC for MHEP (86.66% of the IDC considered for export tariff)	12,118.70
Less: MHEP TL/ATS handed over to BPC	(6,716.98)
Less: Yurmo Substation handed over to BPC	(144.21)
Project MHEP Cost excluding the Assets handed over to BPC	56,367.51
Add: Operational Asset (as on 31.12.2021)*	83.89
Gross Asset Capitalization	56,451.41

*Nu 83.892 million worth of asset under the operation accounts is capitalized as of 31st December 2021.

DGPC Further stated that the depreciation has been calculated as per the depreciation rates given in the Schedule B of TDR 2022.

2.7.2 Input from Stakeholders

ABI submitted that the approved gross asset value for MHP was Nu. 53,331 million for the tariff period 2019-2022 and since no new investments were proposed by MHP and approved by BEA for the same period, the opening gross asset value for the tariff period 2022-2025 at the end of the year 2021 should remain the same at Nu. 53,331 million. However, ABI stated that the gross asset value for MHP has reflected as Nu. 56,451 million as of 2021 which has been over-estimated by Nu. 3,120 million which is also evident that the return on assets as well as depreciation will be much higher than allowable values resulting in a higher tariff than actually allowed. Therefore, ABI recommended the gross asset value at the of end of the year 2021 to be corrected and adjusted so that only allowable and admissible assets are included for the purpose of determination of MHP tariff.

DGPC submitted that even though the project was fully commissioned in the year 2019 and all units were commercially operationalized since then, the approval of the cost to completion of the project is yet to be accorded by GoI and the project is also not yet handed over to RGoB. The final completion cost of project of Nu. 51,110.61 million as vetted by the Central Electricity Authority (CEA) is under approval process of GoI. Therefore, DGPC has requested BEA to consider the gross asset value of Nu 56,451 million as the project cost to completion for MHP tariff computation.

2.7.3 BEA Review

As per the Clause 42 to 50 of TDR 2022, assets values are to be based on historical assets values and Licensees are allowed to include IDC and associated labour costs to be capitalized. The regulation also allows the allowance for asset additions and asset disposals and other assets value adjustments over the course of the tariff period.

Further, the Clause 9 of the Guideline for Determination of Regulatory Asset Base (RAB), 2021, states “The Authority shall establish the initial Regulatory Asset Base of each Licensee based on the following criterion:

- a) For existing Licensees, the historical cost of assets based on audited accounts as of 31st December 2021 shall be considered; and
- b) For new Licensees, which come into existence after the commencement of this guidelines, all assets approved by the Royal Government of Bhutan shall be considered.”

The allowance for depreciation is based on the economic lifetime of the assets as per the Schedule B of TDR 2022, which may be updated by BEA from time to time. The allowance for depreciation allows taking assets additions and removals over the tariff period into consideration. The return on assets is to be determined as the product of WACC and the net assets values.

BEA has verified the proposed total gross asset value, accumulated depreciation and net asset values with Audited Annual Accounts for 2020-2021 of MHP and noted asset worth of Nu. 2,776.34 has been capitalized and Nu. 41,216.20 million is still under capital work in progress (CWIP) as of 31st March 2021. This is because the project is considered still under construction and is yet to be handed over to RGoB/DGPC by GoI/MHPA.

BEA also received a copy of the letter submitted by MHPA to GoI vide letter No. MHPA/MD/RCE/2020/90 dated 1st October 2020 and noted that estimated completion cost of Nu. 51,441 has been proposed for approval. DGPC submitted that Nu. 51,441 million is including the cost of construction of additional residential buildings for the O&M employees. However, DGPC stated that the cost of residential buildings has not been considered by GoI and the final revised cost estimate of Nu. 51,110 million is being considered for approval.

After verification of the final project completion cost, IDC, ATS handed over to BPC, pre-operating expenses and operational assets as of 31st December 2022, BEA has approved the gross asset value, accumulated depreciation and net asset value of MHP as shown in Table 8 below.

Table 8: Approved Assets Schedule (Mill. Nu.)

Fixed assets	Gross value	Acc. Dep.	Net value	Depreciation
Land	11.18	-	11.18	-
Buildings	1,298.06	481.25	816.80	34.11
Civil structures	666.92	166.71	500.21	22.23
Dam complex	16,409.72	-	16,409.72	546.99
Water conductor	9,530.02	-	9,530.82	317.67
Power house	28,094.56	63.74	28,030.82	1,038.28

Transmission equipment	-	-	-	-
Equipment	176.37	82.76	93.61	24.87
Office equipment	264.58	111.60	152.98	50.31
Total	56,451.41	906,06	55,545.34	2,034.47

2.8 Investment Plan 2022-2025

2.8.1 DGPC Proposal

DGPC has submitted that the investment of MHP has been proposed as per the capitalization schedule for the determination of MHP tariff. An investment worth of Nu. 1,472.3 million has been proposed to be considered for the tariff period 2022-2025 as shown in Table 9 below.

Table 9: MHP Proposed Investment Plan 2022-2025 (Mill. Nu.)

Fixed assets	2022	2023	2024	2025	Total
Land	-	-	-	-	
Buildings	2.00	-	95.87	191.73	289.60
Civil structures	0.52	-	35.45	-	35.97
Dam complex	-	-	-	-	-
Water conductor	-	-	-	-	-
Power house	526.02	150.97	100.97	25	802.96
Transmission equipment	-	-	-	-	-
Equipment	63.55	64.82	66.12	67.44	261.92
Office equipment	19.86	20.26	20.66	21.07	81.85
Total	611.95	236.04	319.06	305.25	1472.32

2.8.2 Input from Stakeholders

ABI has submitted that the targets made on the capital investments have never been fulfilled or achieved based on the historical experiences. Therefore, ABI stated that it is unknown and uncertain if this level of expenses will be incurred. Accordingly, ABI recommended to consider only 80% of the proposed investments for MHP.

2.8.3 BEA Review

BEA has scrutinized the proposed investments of MHP as per the RAB Guidelines and the Generation Tariff Review Guidelines 2018. The review was carried out considering the need for the investment, source of funding, cost benefit analysis, current status, risk associated and expected capitalization of each investment.

BEA has considered the investment which are crucial for O&M of the power plant and which will have a direct implication on the energy generation.

Considering the detailed review of the proposed investment plan, BEA has approved an investment worth of Nu. 1,143.34 million, which is 78% of the proposed investment plan for the tariff period 2022-2025 as shown in Table 10 below.

Table 10: Approved Investment Schedule (Mill. Nu.)

Investments	2022	2023	2024	2025	Total
E&M equipment	54.36	150.96	100.96	25.00	331.28
Civil Works	2.44	506.81	-	143.8	653.03
Other Assets	28.57	79.53	25.20	25.70	159.01
Total	85.37	737.30	126.16	194.50	1,143.34

2.9 Depreciation and Return on Assets

2.9.1 DGPC proposed Return on Assets and Depreciations

The proposed return on assets is calculated as the product of the proposed WACC (12.81%) and the net asset value at the end of each year. DGPC submitted that the depreciation allowance calculated in Table 11 below are as per the depreciation rates in the Schedule B of TDR 2022.

Table 11: Proposed Allowances for Return on Assets and Depreciations (Mill. Nu.)

RoA and Depreciations	2022	2023	2024	2025	Total
Gross asset values	56,757	57,181	57,459	57,771	229,168
Accumulated depreciations	1,993	4,005	6,117	8,263	20,378
Net asset value	54,825	53,180	51,348	49,518	208,871
Return on asset	7,023	6,812	6,578	6,343	26,756
Depreciation	2,073	2,112	2,146	2,169	8,500

2.9.2 BEA Review

The total investment outlay of Nu. 1,143.34 million has been considered for the tariff period 2022-2025. Based on the approved asset schedule and the approved pre-tax WACC of 13.59% for MHP, BEA has approved the allowances for return on assets, accumulated depreciation and depreciations as shown in the Table 12 below.

Table 12: Approved Allowances for Return on Assets and Depreciations (Mil Nu)

RoA and Depreciations	2022	2023	2024	2025	Total
Gross asset values	56,494	56,905	57,337	57,498	228,234
Accumulated depreciations	1,927	3,987	6,086	8,215	20,215
Net asset value	54,568	52,922	51,256	49,292	208,038
Return on Asset	6,998	6,787	6,573	6,321	26,679
Depreciation	2,060	2,099	2,129	2,143	8,431

2.10 O&M Cost

The determination of O&M costs is described in the Clause 35 to 41 of TDR 2022. The allowance for O&M costs is calculated each tariff year. O&M allowance is determined for the reference year 2021 which will be increased by inflation after deducting the efficiency gain targets through the tariff period. For each year in the tariff period, an additional O&M allowance is added for new assets as per the investments schedule using the benchmarks as set out in the Schedule A of TDR 2022. The annual regulatory fees are added to the O&M costs.

2.10.1 DGPC Proposal

The proposed historical O&M allowance figures for the years 2019 to 2021 are given in the Table 13 below.

Table 13: Proposed Total O&M Allowances (Mill. Nu.)

Total Expenses	2019	2020	2021
O&M Costs	-	83.57	183.30
Employee Costs	-	219.79	331.15
Other Expenses	-	2.36	25.71
Total	-	305.72	540.16

DGPC submitted that, as per the provisions of DETP, the costs related to the Corporate Social Responsibility (CSR), foreign exchange loss and income from rental and hire charges are deducted from O&M allowances as shown in the

Table 14 below.

Table 14: Proposed Deductions from O&M Allowances (Mill. Nu.)

Expenses	2019	2020	2021
Total Historical O&M cost	-	305.72	540.16
Less: CSR	-	-	0.858
Less: Rental Income	-	1.410	8.518
Less: License Fee	-	7.20	7.20
O&M less deductions		297.12	523.586

DGPC further submitted that the historical average O&M cost reflected in the accounts for the years 2020-2021 for MHP is not the true representation for the basis of projection of O&M cost for the upcoming tariff period. This is mainly on the account that the project was not handed over to the O&M entity and majority of the components were under defect liability period (DLP), wherein contractors were liable for repair cost incurred in attending to any other defects that might appear in the equipment. MHP envisages that O&M cost would increase with the increase of O&M personnel after the project is handed over to RGoB or DGPC by GoI or MHPA.

As per TDR, for large hydropower generation, the benchmark cost of 1.0% to 1.5% of capital cost is allowed. Based on TDR, DGPC has proposed consideration of benchmark O&M of 1% of capital cost which is Nu. 564.51 million for the upcoming tariff period.

2.10.2 Input from Stakeholders

ABI in its written comment submitted that, BEA has approved O&M allowance of Nu. 530 million in 2019-2022 tariff period which was 1% of admissible gross asset value and therefore, ABI recommended Nu. 530 million as O&M allowance to be used for this tariff period 2022-2025 as well.

DGPC submitted that, as per TDR, for large hydropower generation, the benchmark cost of 1.0% to 1.5% of capital cost is allowed. ABI has proposed O&M of Nu. 530 million as approved by BEA during 2019-2022 tariff period is not adjusted for inflation. As per TDR, the determination of O&M allowance shall take into consideration the historical costs, as adjusted for inflation incurred by the Licensee. If inflation is adjusted, which is as per the provisions of TDR, O&M allowance works out to be Nu. 585.86 million which is higher than what has been proposed. Therefore, DGPC submitted that the benchmark cost of 1% (Nu. 564.51 million) is proposed as O&M cost for the upcoming tariff period. DGPC has submitted that the project is not handed over to DGPC but O&M will be fully functional from the upcoming tariff period.

2.10.3 BEA Review

BEA has verified the historical O&M costs for the past years of 2019 to 2021 from the audited annual accounts submitted by DGPC and found that it has been reported correctly as provided in Table 15 below.

Table 15: Historical O&M Cost of MHPA (Mill. Nu.)

Total Expenses	2020	2021
O&M Costs	83.57	183.30
Employee Costs	219.79	331.15
Other Expenses	2.36	25.71
Total O&M	305.72	540.16
Less: Corporate Social responsibility	-	0.858
Less: Rental Income	1.410	8.518
Less: License fee	7.2	7.2
Historical O&M	297.12	523.58
Average O&M	410.35	

BEA has reviewed the historical O&M cost of MHP for the years 2020 and 2021 and found that the average O&M cost is Nu. 410.35 million which is only 0.73% of total gross asset value.

As per the Schedule A of TDR, O&M benchmark for large hydropower plant is 1% to 1.5% of the capital cost. Considering MHP being in operation for less than 5 years and with inadequate historical data, BEA has approved O&M allowance of 1% (Nu. 564.51 million) of gross asset value as per the Schedule A of TDR.

2.11 Fees and Charges

2.11.1 DGPC Proposal

DGPC proposed the regulatory fee of Nu. 7.20 million and the System Operator (SO) Charges for MHP for the upcoming tariff period as given in Table 16 below.

Table 16: Proposed Fees and Charges (Mill. Nu.)

Sl. No	Fees	July 2022 – June 2023	July 2023 – June 2024	July 2024 – June 2025
1	Regulatory Fees	7.2	7.2	7.2
2	SO Charges allocated to MHP	30.80	50.70	19.50
	Total	38	58	26.7

2.11.2 Inputs from Stakeholders

ABI stated that they have considered the regulatory fees of Nu. 10,000 per MW and SO charges as provided in Table 17 below.

Table 17: ABI Recommended Fees and Charges (Mill. Nu.)

Sl. No	Fees	July 2022 - June 2023	July 2023 - June 2024	July 2024 – June 2025
1	Regulatory Fees	7.2	7.2	7.2
2	SO Charges allocated to MHP	6.70	8.30	15.37
	Total fees and charges	13.9	15.5	22.57

2.11.3 BEA Review

Considering the fees prescribed in the Regulatory Fees Regulation and SO Charges approved by BEA for allocation to MHP, the total fees and charges is provided in Table 18 below.

Table 18: Approved Fees and Charges (Mill. Nu.)

Sl. No.	Fees	July 2022 - June 2023	July 2023 - June 2024	July 2024 – June 2025
1	Regulatory Fees	7.2	7.2	7.2
2	SO Charges allocated to MHP	6.79	18.11	56.77

	Total fees and charges	13.99	25.31	63.97
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2.12 O&M Efficiency Gain

2.12.1 DGPC Proposal

DGPC has proposed 0% efficiency gains on O&M costs during the tariff period 2022-2025 and stated that it is to recover O&M cost increased at proposed inflation rate of 3.40%.

2.12.2 BEA Review

Considering that MHP is currently experiencing the teething problems with electro-mechanical equipment failures and would require some time to stabilize the situation, BEA approved the O&M efficiency of 0% as proposed.

2.13 Benchmark O&M Cost

2.13.1 DGPC Proposal

DGPC has proposed O&M cost allowance of 1% of capital cost for MHP for the upcoming tariff period. DGPC stated that O&M benchmark of 1% of capital cost as of the commercial operation date (COD) is reasonable compared to benchmarks set by the Central Electricity Regulatory Commission (CERC), India, which allows an O&M allowance of 4% of capital cost as of COD for projects with installed capacity of less than 200 MW and 3.5% of capital cost as of COD for projects with installed capacity of more than 200 MW. Therefore, DGPC submitted that the proposed O&M benchmark of 1% is as per TDR for large hydropower generation, where the benchmark of 1.0% to 1.5% of the capital cost is allowed. The breakup of the proposed O&M allowances is as shown in Table 19 below.

Table 19: Proposed Break up of O&M Allowances (Mill. Nu.)

O&M allowances	2021	2022	2023	2024	2025
O&M 2022 allowance	564.51	583.70	603.55	624.07	645.29
O&M additions 2022 investments	-	6.12	6.18	6.24	6.31
O&M additions 2023 investments	-	-	2.36	2.38	2.41
O&M additions 2024 investments	-	-	-	3.19	3.22
O&M additions 2025 investments		-	-	-	3.05
O&M allowances		589.82	612.09	635.89	660.27

2.13.2 BEA Review

As per O&M benchmarks set by CERC, India, O&M allowance is fixed at 2.5% of capital cost (excluding IDC, rehabilitation cost, resettlement cost) for the first year. Since O&M benchmark of 1% to 1.5% of the capital cost is allowed by TDR including IDC, rehabilitation and resettlement cost, 1% O&M benchmark has been approved for MHP.

2.14 Arrears

2.14.1 DGPC Proposal

According to DGPC, the proposed arrears of 50 days as shown in Table 20 below is based on the agreement signed between DGPC and BPC for the sale and purchase of electrical energy which was signed on 12th May, 2017.

Table 20: Proposed Arrears

Particulars	Days
Average energy consumption duration	15
Bill preparation and delivery duration	5
Bill payment due date	30
Total Arrears	50

2.14.2 Input from Stakeholders

ABI has submitted that BEA had approved an arrear of 40 days in 2019-2022 tariff period and accordingly, 40 days has been recommended by ABI to be used for the tariff period 2022-2025.

2.14.3 BEA Review

In the tariff period 2019-2022, BEA was of the view that bill preparation and delivery duration of 10 days for the four plants of DGPC were not justifiable especially considering the availability of upgraded SAP/ERP software system.

Therefore, in order to avoid passing on of such inefficiencies to the customers, BEA in consultation with BPC and DGPC in 2019 reduced the bill preparation and delivery duration to five (5) days and bill payment duration to twenty (20) days. Therefore, BEA approved arrears of 40 days as shown in the Table 21 below.

Table 21: Approved Arrears

Particulars	Days
Average energy consumption duration	15
Bill preparation and delivery duration	5
Bill payment due date	20
Total Arrears	40

Based on the above, BEA has approved the arrears of 40 days to be maintained for MHP which is same for DGPC plants.

2.15 Inventories

2.15.1 DGPC Proposal

DGPC submitted that, during the previous tariff period, all the project components/equipment were under DLP where the suppliers/contractors were obligated to carry out repair of the defects appearing in the equipment supplied/component constructed by them during the period. Therefore, DGPC stated that a very minimal inventory was maintained by MHP. However, as DLP is over, the plant will have to build up the required level of inventory of spares as per the Inventory Management Guideline to ensure smooth operation of the plant for ensuring steady revenue streams. Therefore, DGPC has considered the benchmark inventory level of DGPC which is 0.314% of the current capital cost and works out to be Nu. 177 million. DGPC stated that the proposed inventory of Nu. 177 million is reasonable when compared with DGPC power plants of equivalent capacity.

2.15.2 BEA Review

BEA verified that the proposed inventories of Nu. 177 million is 0.314% of MHP proposed capital cost of Nu. 56,451.41 million.

Clause 16 of RAB Guidelines states *“The allowance for inventories shall be as a percentage (%) of the operation and maintenance expenses or capital cost based on industry practice or applicable benchmark”*.

BEA has reviewed the inventories of MHP and noted that inventory for the years 2020 and 2021 is Nu. 14.22 million and Nu. 7.38 million respectively. Considering CERC norms of 15% of O&M cost for the inventory allowance for hydropower projects, the inventory for MHP works out to be Nu. 84.68 million. Since MHP is a new plant and would require much lower inventory than older plants, BEA has approved the inventory of Nu. 84.68 million as per CERC norms which is much higher than the current inventory level.

2.16 Interest on Working Capital

2.16.1 DGPC Proposal

DGPC has proposed the interest on working capital of 9.97% for MHP for the computation of generation tariff.

2.16.2 Input from Stakeholders

ABI stated that the interest on working capital of 8% be considered based on the current lowest short term lending rate of 8% per annum for Manufacturing - Hydro power term loan at a floating rate from BoB.

2.16.3 BEA Review

Clause 7.7 of DETP states “The interest on working capital shall be determined based on the prevailing lowest short-term lending rate of financial institution of Bhutan”. BEA reviewed the working capital interest rates offered by the financial institutions in Bhutan and found that the lowest interest rate is 9.23 % which is the interest rate for the working capital for businesses loan offered by BoB. Accordingly, BEA approved the interest on the working capital of 9.23%.

2.17 Energy Volumes

The annual energy volumes to be determined as the mean annual energy generation of the past three years based on 98% water utilization factor to the extent of generation capacity after deducting royalty energy adjusted for auxiliary consumption, determined as follows:

$$ENERGY = \sum_i ENERGY_i \times (1 - AUX_i) \times (1 - ROYALTY_i)$$

Where,

- 1) ENERGY is the annual energy volume in any year, in GWh;
- 2) ENERGY_i is the average historical mean annual energy generation of the past three years for plant “i”, in GWh;
- 3) AUX_i is the allowance for auxiliary consumption at plant “i”, as set out in Schedule D of TDR 2022, as a percentage; and
- 4) ROYALTY_i is the free energy which is made available to RGoB by plant “i”, as a percentage.

2.17.1 DGPC Proposal

DGPC has proposed generation forecast of MHP as 3008 GWh for the years 2022, 2023 and 2024. DGPC has also proposed an auxiliary consumption of 1.12% and Royalty energy of 15% resulting in annual energy of 2,528 GWh for 2022, 2023 and 2024 as shown in Table 22 below.

Table 22: Proposed Annual Energy Volume (GWh)

Year	2019	2020	2021
Mean annual energy	3008	3008	3008
Auxiliary Losses (1.12%)	34	34	34
Royalty (15%)	446	446	446
Annual Energy Volume	2528	2528	2528

2.17.2 Input from Stakeholders

ABI stated that BEA had approved an annual energy generation volume of 2,531 GWh after deducting auxiliary losses of 1% and 15% royalty in 2019-2022 tariff period. ABI further stated that an average energy generation has been calculated from 2019-2022 (excluding the

generation from June to September 2019 as the plant was under testing and all turbines were not operational) as 3,128 GWh. ABI accordingly recommended energy generation of 2,632 GWh after deducting auxiliary consumption of 1% and royalty of 15%.

2.17.3 BEA Review

The historical energy generation of MHP for the years 2019, 2020 and 2021 are 1320.32 MU, 3218.39 MU and 2987.89 MU respectively as shown in Table 23. The average historical energy generation is 2508.87 MU which is lower than the energy proposed (3008 MU) by DGPC for MHP.

Table 23: Historical MHP Energy Generation (GWh)

Month	Annual Generation		
	2019	2020	2021
January	-	77.59	84.5
Feb	-	63.95	65.49
Mar	-	83.20	95.51
Apr	-	139.93	110.38
May	-	317.52	256.12
June	23.11	440.63	398.38
July	193.50	538.42	430.77
Aug	278.15	547.72	492.44
Sep	343.16	477.46	488.16
Oct	257.50	285.16	298.26
Nov	128.35	143.44	158.73
Dec	96.52	103.32	109.10
Total	1320.32	3218.39	2987.89

DGPC has also stated that the energy generation for the years 2020 and 2021 are not the true representation as the generation was contributed due to good hydrology even with frequent failure of unit III of MHP. BEA has verified the generation of other existing plants of DGPC in the years 2020 and 2021 and noted that the generation in other DGPC plants were also high as compared to previous year and therefore, it was concluded that the high generation was due to good hydrology.

BEA also verified the water utilization of MHP and found the average water utilization factor was 96.40% for 2020 and 95.32% for 2021.

The Clause 71 of TDR 2022 states, “*The annual energy volumes shall be determined as the mean annual energy generation of the past three years based on 98% water utilization factor to the extent of generation capacity less royalty energy adjusted for auxiliary consumption*”.

Therefore, BEA approved the mean energy generation as 3,151 GWh by adjusting the historical average energy volume with 96.5% water utilization for the first year, 97.5% for the second year and 98% water utilization for the third year.

As per Schedule D of TDR, the maximum auxiliary and transformation losses is 1.2%. The actual average auxiliary loss of MHP was 0.37% for the years 2019-2021. Considering problems with automation and frequent breakdown of Unit III at MHP, BEA approved the auxiliary loss of 1.12% as proposed.

As per Clause 7.18 of DETP, all generation plants fully owned by RGoB have to provide 15% of an annual generation as Royalty Energy to RGoB.

Accordingly, BEA approved the annual energy volumes as the mean annual energy generation of MHP after deducting the royalty energy of 15% adjusted for reviewed auxiliary consumption of 1.12% as shown in the Table 24 below.

Table 24: Approved Energy Volume (GWh)

Year	2019	2020	2021
Reviewed Generation	3,151	3,151	3,151
Less 1.12% Auxiliary	35.29	35.29	35.29
Less 15% Royalty Energy	467	467	467
Annual Energy Volume (GWh)	2,648	2,648	2,648

2.18 Non-Tariff Revenue

2.18.1 DGPC Proposal

DGPC has not proposed any Non-Tariff Revenue (NTR) for the upcoming-tariff period 2022-2025.

2.18.2 BEA Review

As per the Clause 70 of TDR 2022, the estimated NTR has to be deducted from the total cost.

Accordingly, BEA reviewed NTR and found that MHP received a total NTR of Nu. 7.10 million as of 31st December 2021 as per Audited Financial Statement of MHP. Therefore, BEA approved NTR of Nu. 7.10 million to be deducted from the total cost as per TDR.

3 Generation Tariff

As per the Clause 72 of TDR 2022, the average cost of supply shall be taken as the ratio of the discounted annual costs of supply to the discounted energy volumes, with discounting applied over the Tariff Period using $WACC_g$, as follows:

$$AC_g = \frac{\sum_{n=1}^{TP} TC_{g,n} / (1+WACC_g)^n}{\sum_{n=1}^{TP} ENERGY_n / (1+WACC_g)^n}$$

Where,

- 1) AC_g is the average cost of supply for the Generation Licensee “g”, in Ngultrum per kWh;
- 2) TP is the number of years in the Tariff Period;
- 3) $TC_{g,n}$ is the total cost of supply of Generation Licensee “g” in year “n” in million Ngultrum, as determined in accordance with Clause 70 of TDR, 2022;
- 4) $ENERGY_n$ is the energy volume in year “n” in GWh, as determined in accordance with Clause 71 of TDR, 2022; and
- 5) $WACC_g$ is the weighted average cost of capital for the Generation Licensee “g”, as determined in Clause 69 of TDR, 2022.

3.1 DGPC Proposal

DGPC proposed the generation tariff of MHP of Nu. 3.85 per kWh for tariff period 2022-2025 based on the proposed cost and energy volume as shown in Table 25 below.

Table 25: Proposed MHPA Tariff

	2022	2023	2024	2025
OM	630	672	663	688
DEP	2,073	2,112	2,146	2,169
RoA	7,023	6,812	6,578	6,343
CoWC	151	150	190	187
Total Cost	9,876	9,744	9,576	9,387
Energy Volume (GWh)	2,528	2,528	2,528	2,528
Proposed Tariff	3.85 Nu/kWh			

3.2 Input from Stakeholders

ABI has also computed the generation tariff as Nu. 3.61 per kWh based on the proposed cost and energy.

3.3 BEA Review

The approved cost allowances and energy volume for this tariff period (2022-2025) is as shown in Table 26 below.

Table 26: Approved Cost Allowances (Mill. Nu.)

	2022-2023	2023-2024	2024-2025
OM	600	637	698
DEP	2,060	2,099	2,129

RoA	6,998	6,787	6,573
CoWC	106	105	104
Total Cost	9,757	9,620	9,497
Energy Volume (GWh)	2,648	2,648	2,648
Reviewed tariff	Nu. 3.64/kWh		

By discounting the Total Cost of Supply and the Energy Volume using a pre-tax WACC of 12.82%, MHP generation tariff of Nu. 3.64 per kWh has been approved for the tariff period 2022-2025 starting from 1st September 2022 to 30th June 2025.