



# **Bhutan Electricity Authority**

## **DGPC Tariff Review Report 2022 to 2025**

**December 2022**

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## **Executive Summary**

The Druk Green Power Corporation Limited (DGPC) submitted a revision of the generation tariff from Nu.1.42/kWh to Nu.1.54/kWh for the tariff period from 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025. The Bhutan Electricity Authority (BEA), after reviewing the DGPC tariff application, approved the generation tariff of DGPC as Nu. 1.34/kWh for the tariff period from 1<sup>st</sup> September 2022 to 30<sup>th</sup> June 2025 based on the pre-tax weighted average cost of capital (WACC) of 13.06%, cost of equity (CoE) of 13.59% (after-tax), cost of debt (CoD) of 8.83% and gearing ratio of 60%.

The return on assets, depreciation, operation and maintenance cost and return on working capital have been determined according to the provisions of the Tariff Determination Regulation, 2022. The proposed investments for the tariff period largely include the installation and up-gradation of power house facilities, replacement of equipment, maintenance of dam structures, construction of buildings and refurbishment of embedded generation assets.

While calculating the tariff, the annual energy generation has been considered based on mean annual energy generation of the past three years with 98% water utilization factor after deduction of 15% royalty energy.

# 1 Background

DGPC submitted their proposal for revision of the domestic generation tariff vide letter no. 08/DGPC/BEA/MD/2022/19 dated 28<sup>th</sup> February 2022 for the tariff period 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025.

DGPC stated that the tariff revision proposal was prepared in line with the provision of Domestic Electricity Tariff Policy 2016 (DETP), the Tariff Determination Regulation 2016 (TDR) and the Guideline for Determination of Regulatory Asset Base 2021 (RAB).

DGPC proposed to increase the generation tariff from Nu. 1.42/kWh to Nu. 1.54/kWh, which is weighted average generation tariff of the four existing power plants of DGPC including the embedded generation assets, which will be transferred from the Bhutan Power Corporation Limited (BPC) to DGPC by the end of June 2022.

As part of the tariff review process, a public hearing was conducted virtually on 3<sup>rd</sup> May 2022 during which DGPC presented the rationale for their tariff proposal while the Association of Bhutanese Industries (ABI) presented their findings and comments on the tariff proposal. The public consultation was attended by the Department of Hydropower and Power System (DHPS), High Voltage (HV) customers, Medium Voltage (MV) customers, the Licensees and BEA Commissioners.

ABI and DGPC were provided three (3) weeks after the public hearing to submit their written comments on the tariff revision proposal to BEA. ABI submitted their written comments on DGPC tariff application on 23<sup>rd</sup> May 2022 and DGPC submitted their response on 23<sup>rd</sup> May 2022.

## 2 Regulatory parameters

### 2.1 Tariff period

DGPC has proposed a three-year tariff period from 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025 in accordance to the Clause 7.19 of DETP with reference year as 2021.

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 22<sup>nd</sup> August 2022, BEA approved two (2) years and ten (10) months tariff period, starting from 1<sup>st</sup> September 2022 to 30<sup>th</sup> June 2025.

### 2.2 WACC Parameters

The pre-tax weighted average cost of capital (WACC) is 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 the 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 the 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.

#### 2.2.1 DGPC Proposal

DGPC has proposed a pre-tax WACC of 14.07%, based on a gearing ratio of 60%, CoE of 13.56%, CoD of 10.53% and a tax rate of 30%. The details of WACC parameters are discussed in the subsection below.

##### 2.2.1.1 Gearing Ratio

DGPC has proposed a gearing ratio of 60% for the purpose of tariff determination. DGPC stated that while the Tala Hydropower Plant (THP) and Kurichhu Hydropower Plant (KHP) do not

have any loan, the loan for Basochhu Hydropower Plant (BHP) will be liquidated soon, resulting to average gearing ratio of 0.66% for the tariff period 2022-2025. However, the proposed loans of DGPC for the new investments during the tariff period will increase the average gearing ratio to 9.72% for the tariff period 2022-2025.

2.2.1.2 *Cost of Equity (CoE)*

In accordance to the provisions of the DETP 2016, DGPC has proposed a post-tax CoE of 13.56% based on the average lending rates of 11.06% of the domestic financial institutions and taking maximum premium of 250 basis points. An average lending rate of 11.06% of the domestic financial institutions has been calculated by DGPC as provided below in the Table 1.

**Table1: Proposed Average Long Term Lending Rate**

<b>Sl. No.</b>	<b>Banks</b>	<b>Interest Rate</b>
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 of Bhutan Limited (RICBL)	12.20%
8	Tashi Bank Limited (T Bank Ltd.)	10.69%
	<b>Average Rate</b>	<b>11.06%</b>

2.2.1.3 *Cost of Debt (CoD)*

DGPC has proposed CoD of 10.53% and stated that the proposed CoD was calculated as a weighted average of the interest rates of the remaining loan of existing DGPC power plants and the additional future loans of the tariff period, 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025. DGPC has proposed the future loan worth of Nu. 8.69 billion at an interest rate of 11.06% to finance the new investments during the tariff period 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025.

2.2.2 *Inputs from Stakeholders*

2.2.2.1 *Gearing Ratio*

In the written comments to BEA, ABI explained that during the two tariff periods, that is, 2010-2013 and 2013-2016, BEA had approved a gearing ratio of 40% for DGPC. Similarly, during

the subsequent two tariff periods, that is, 2016-2019 and 2019-2022, BEA approved gearing ratio of 60% for DGPC. Therefore, ABI submitted that the gearing ratio of DGPC during the next tariff period, 2022-2025, should be considered at 65%, and not 60%, to reach to an optimal gearing ratio of 70%.

*2.2.2.2 Cost of Equity*

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. Consequently, growth in credit was around 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 during the decade. Therefore, ABI stated that the interest rates could be reduced from the current level, possibly to 10.5 % at least for the next 2-3 years, to encourage investments for enabling bounce-back of the national economy. 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 DGPC was allowed a premium of 200 basis points 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.

DGPC responded that with the consideration of proposed gearing of 60% from the actual gearing of 0.66%, the applicability of maximum premium of 250 basis point for determining CoE appears to be reasonable, since CoE is applicable for only 40% equity, although the actual equity comprises of 99.34% of DGPC's net assets.

*2.2.2.3 Cost of Debt*

ABI submitted that an annual interest rate for new loans of DGPC should be considered at 10% by BEA, similar to that of 2019-2022 tariff period and also stated that DGPC has been allowed higher CoD than actual as DGPC didn't take any loans during the 2019-2022 tariff period. Since the DGPC was allowed higher CoD than actual despite not taking any loans during the tariff period 2019 -2022, ABI further objected that DGPC has proposed to utilise 100% loans to finance the new investments which is not in accordance to the Clause 7.1 of DETP and requested BEA to allow DGPC to finance their new investments with 70% of loans as per DETP.

In response, DGPC submitted that the loans involved in the investments of hydropower projects are for long-term purpose, which are normally are not available in the domestic market. DGPC

clarified that loans from the State Bank of India (SBI) are being availed at a floating interest rate of 9.5% or at 11.65% fixed rate.

**2.2.3 BEA Review**

The pre-tax WACC parameters are determined as per the Schedule C of TDR, 2022 and the details are discussed in the subsections below.

**2.2.3.1 Tax**

BEA has verified that the proposed tax rate of 30% is in accordance with the rate prescribed in the Income Tax Act of the Kingdom of Bhutan 2001. Therefore, a tax rate of 30% is used for the determination of pre-tax WACC.

**2.2.3.2 Gearing Ratio**

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.”

BEA verified the actual average gearing ratio of DGPC as 9.72% for the tariff period 2022-2025 considering the proposed loans for new investments. The existing hydropower plants of DGPC have been developed with huge amounts of grants to RGoB and only around 40% of the investments are financed through loans as shown in the Table 2 below.

**Table 2: Financing Structure of DGPC**

<b>Loan Particulars</b>	<b>BHP - Upper Stage</b>	<b>BHP - Lower Stage</b>	<b>CHP</b>	<b>KHP</b>	<b>THP</b>	<b>Overall</b>
Project Cost	1,441	1,749	2,465	5,600	41,283	52,538
RGoB Contribution	197	90				287
Grant	537	48	1,479	3,360	24,770	30,194
Loan	706	1,611	986	2,240	16,513	22,056
<b>Debt Equity ratio (%)</b>	<b>49:51</b>	<b>92:8</b>	<b>40:60</b>	<b>40:60</b>	<b>40:60</b>	<b>42:58</b>

The Table 3 below shows the comparison between the actual gearing ratio of DGPC and gearing ratio approved by BEA in previous tariff periods.



**Table 3: Gearing Ratio Trend**

Tariff Period	Actual	BEA Approved
2010-2013	41%	40%
2013-2016	35%	40%
2016-2019	9.36%	60%
2019-2022	8.56%	60%

BEA approved a gearing ratio of 40% during the tariff period 2010-2013 and 2013-2016, which was later on increased to 60% during the tariff period 2016-2019. During 2019-2022 tariff review period, actual gearing ratio of DGPC was 1.73% with the completion of the loan repayment of THP and KHP. While DGPC had proposed for new loans during the last tariff period 2019-2022 and envisaged to increase their average gearing ratio to 8.56%, in actuality, DGPC did not avail any new loans during the last tariff period 2019-2022; therefore, resulting to their actual gearing ratio of 0.66%.

As per DETP, the gearing ratio is required to gradually increase to a maximum of 70%. However, as seen from Table 3 above, DGPC's actual gearing ratio is witnessed to be decreasing to value less than 10% in the last two tariff periods, 2016-2019 and 2019-2022. During the tariff period 2022-2025, DGPC's actual gearing ratio is 9.72%, which is still less than 10%. Considering that the actual gearing ratio of DGPC is much lower than the initial financing structure of DGPC power plants (with gearing ratio of 40%), BEA has approved in maintaining DGPC's gearing ratio at 60% for the tariff period 2022-2025.

### 2.2.3.3 Cost of Debt

CoD of 10.53% proposed by DGPC has been calculated as the weighted average interest rates of their existing loan and future loan for the tariff period 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025. DGPC has proposed their future loan worth of Nu. 8.69 billion at interest rate of 11.06% for the tariff period 1<sup>st</sup> July 2022 to 30<sup>th</sup> June 2025. The interest rates of loans of DGPC are presented in Table 4 below.

**Table 4: Interest Rates of Loans of DGPC**

Sl. No.	Loan Details	Loan Disbursements	Principal Amt (Mill. Nu.)	Interest Rate (%)	Repayment Period (Years)	Loan balance as on 31.12.22 (Mill. Nu.)	Loan balance as on 31.12.23 (Mill. Nu.)	Loan balance as on 31.12.24 (Mill. Nu.)
1	BHP Lower Stage	2 April 2002 to 17 June 2005	1,648.87	6.00	15	219.849	109.924	-

2	BHP Upper Stage	30Dec. 1997 to 14 Oct. 2007	708.00	6.00	20	141.600	106.200	70.800
3	Proposed loan	2022	1,193.73	11.06	10	1,193.73	1,122.54	1,043.47
4	Proposed loan	2023	3,286.65	11.06	10	-	2,092.92	1,968.10
5	Proposed loan	2024	4,556.98	11.06	10	-	-	1,270.34
	<b>Total</b>		<b>11,394.24</b>			<b>1,555.18</b>	<b>3,431.58</b>	<b>4,352.72</b>

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 BHP are found to be proposed correctly.

DGPC has proposed new investments for the period 2022 to 2024 with new loans at the lending rate of 11.06%, calculated based on the long-term average lending rates of the domestic financial institutions. While the proposed lending rate of DGPC is 11.06% for the individual loan, BEA assumed that the actual lending rate for DGPC will be lower at the time of availing the loan. Since BPC availed loan at an interest rate of 9% from NPPF, MHP at loan interest rate of 10% from the Government of India (GoI) and THyE at an interest rate of 11.55% from SBI, the average lending rate of DGPC's new loans was considered at 10% by BEA. BEA considered only those loan for new investments that will be capitalized before 1<sup>st</sup> July 2025. Based on the above consideration, BEA approved DGPC's CoD as 8.83%, which is the weighted average interest rate of existing loans and new loans using the loan balance at the end of the year 2022 to 2024 as shown below in Table 5.

**Table 5: Approved Cost of Debt**

<b>Loan particulars</b>	<b>Principal Amt (Mill Nu.)</b>	<b>Interest Rate (%)</b>	<b>Loan balance as on 31.12.21 (Mill Nu.)</b>	<b>Loan balance as on 31.12.22 (Mill Nu.)</b>	<b>Loan balance as on 31.12.24 (Mill Nu.)</b>
BHP Lower Stage	1,648.87	6.00	219.849	109.924	-
BHP Upper Stage	708.00	6.00	141.600	106.200	70.800
New Loans	2,017.47	10.00	259.40	618.40	1,959.74
<b>Total</b>	<b>4,374.34</b>		<b>620.85</b>	<b>834.52</b>	<b>2,030.54</b>
<b>Annual CoD</b>			<b>7.67%</b>	<b>8.96%</b>	<b>9.86%</b>
<b>Average CoD</b>			<b>8.83 %</b>		

#### 2.2.3.4 Cost of Equity

DGPC has proposed CoE of 13.56%, based on the average lending rates of 11.06% of the domestic financial institutions and maximum allowable premium of 250 basis points as per the DETP. BEA calculated the average long-term lending rate of the domestic financial institutions and non-banking institutions as shown in Table 6 below.

**Table 6: Average Long Term Average Lending Rate of Financial Institutions in Bhutan**

Sl. No	Banks	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 %
	<b>Average Rate</b>	<b>11.09%</b>

The Clause 7.2 of DETP states, “BEA may allow a reasonable premium up to a maximum of 250 basis points on the average lending rates of the financial institutes depending on the domestic market situation and gearing ratio applied”. BEA approved a premium of 250 basis points for DGPC considering its hugely adjusted gearing ratio 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 DGPC has been approved as 13.59%.

2.2.3.5 *The WACC*

Based on the approved gearing ratio of 60%, CoE of 13.59%, CoD of 8.83% and tax rate of 30%, BEA approved WACC of 13.06% for DGPC as shown in Table 7 below.

**Table 7: Proposed and Reviewed WACC**

	DGPC	BEA
<b>Gearing:</b>	60 %	60 %
<b>CoE:</b>	13.56 %	13.59 %
<b>CoD:</b>	10.53 %	8.83 %
<b>Tax:</b>	30 %	30 %
<b>WACC:</b>	<b>14.07 %</b>	<b>13.06 %</b>

**2.3 Inflation**

Normally, historical average inflation rate is used to escalate the historical operation and maintenance (O&M) costs to 2021 price level and to inflate O&M allowance over the tariff period. As per Clause 7.4 of DETP, inflation for O&M expenses should be based on historical average inflation rates published by the National Statistics Bureau (NSB).

*2.3.1 DGPC Proposal*

DGPC has used the historical inflation figures for the year 2019, 2020 and 2021 from the Consumer Price Index (CPI) Bulletin of NSB for non-food items as shown in the Table 8 below.

**Table 8: Proposed Historical Inflation Rates**

<b>Year</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Average</b>
<b>Inflation figures</b>	1.35 %	2.02 %	6.82 %	3.40 %

DGPC has proposed an average annual inflation rate of 3.40% to calculate the historical O&M average cost and to escalate the yearly O&M allowance over the tariff period.

*2.3.2 Inputs from Stakeholders*

In the written comments submitted by ABI, the inflation rates of 2.28%, 7.66% and 6.87% for the years 2019, 2020 and 2021 were recommended which have been obtained based on the Consumer Price Index (CPI) for food and non-food data maintained on a quarterly basis by RMA.

*2.3.3 BEA Review*

BEA observed that ABI has calculated the average inflation rate considering quarterly inflation rates for both food and non-food items of the years 2018, 2019, 2020 and 2021. Upon examination of DGPC’s proposal, BEA noted that the historical inflation rates for the years 2019 to 2021 were considered, which is correctly calculated. The average historical inflation rate calculation of 3.40% for the years 2019 to 2021 is shown in the Table 9 below.

**Table 9: Reviewed Historical Inflation Rates**

<b>Inflation</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Average</b>
<b>Year on year inflation</b>	1.35 %	2.02 %	6.82 %	3.40 %

BEA approved average historical inflation rate of 3.40% for this tariff period 2022-2025.

## 2.4 Other Regulatory Parameters

O&M benchmark and O&M efficiency gain parameters are discussed in Section 3.2 of this review report. Other amendments to the regulatory parameters that have not been proposed by DGPC has not discussed in this review report.

## 3 Allowances, Cost of Supply and Energy Volumes

The total cost of supply for DGPC in any tariff year to be determined in accordance with TDR, 2022.

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

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”, 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.

### 3.1 Allowances for Depreciations (DEP) and Return on Fixed Assets (RoA)

As per TDR, 2022, asset values are to be based on historical asset values and licensees are allowed to include the interest during construction (IDC) and associated labour costs to be capitalized. The regulation also allows the allowance for asset additions and asset disposals and other asset value adjustments over the course of the tariff period.

The Clause 9 of the Guideline for Determination of Regulatory Asset Base, 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, in accordance with the Schedule B of TDR, 2022. The allowance for depreciation allows taking asset 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 asset values.

### 3.1.1 DGPC Proposal

#### 3.1.1.1 Assets Schedule at the end of 2021

DGPC has proposed the asset schedule as per the Guideline for determination of RAB which states that for existing Licensees, the historical cost of assets to be considered based on audited accounts as of 31<sup>st</sup> December 2021. Accordingly, DGPC stated that to establish the initial RAB, the asset schedule of DGPC and embedded generation asset schedule as of 31<sup>st</sup> December 2021 is derived as per the depreciation rates given in Schedule B of TDR. DGPC further submitted that the embedded generation assets will be transferred to DGPC at cost on the net asset values as per the books of account of BPC and the total book value of Nu. 411.45 million with grant of Nu. 152.7 million is considered in the tariff proposal. The asset schedule submitted by DGPC is shown in

Table 10 below.

**Table 10: Proposed Asset Schedule**

Fixed assets (Mill. Nu.)	Gross value	Acc. Dep.	Net value	Depreciation
Land	3.91	-	3.91	-
Buildings	2,564.46	1,018.52	1,545.95	84.51
Civil structures	3,328.10	1,292.05	2,036.05	110.66
Dam complex	12,147.66	5,869.06	6,278.60	403.95
Water conductor	23,565.56	10,222.26	13,343.30	784.73
Power house	21,318.16	11,769.40	9,548.76	752.19
Transmission equipment	351.08	204.35	146.72	12.32
Equipment	1,089.71	841.03	248.67	36.07
Office equipment	702.15	567.49	134.66	67.56
<b>Total DGPC</b>	<b>65,070.78</b>	<b>31,784.17</b>	<b>33,286.63</b>	<b>2,251.99</b>
Mini/Micro Plants (EG)	411.45	-	411.45	50.94
<b>Total (DGPC &amp; EG)</b>	<b>65,482.24</b>	<b>31,784.17</b>	<b>33,698.07</b>	<b>2,302.93</b>

### 3.1.1.2 Investments – Asset additions 2022 - 2025

DGPC stated that the investment schedule has been prepared using the 2021 approved DGPC Investment Plan 2022 to 2025. It was further submitted that the proposed Investment Plan included only the investments pertaining to the existing power plants. DGPC stated that the proposed investment schedule for the years 2022 to 2025 has been prepared as per the year of capitalization as provided in the

Table 11 below. Further, DGPC stated that the investment plan for Embedded Generation is considered based on assessment study and reports prepared by BPC.

**Table 11 : Proposed Investment Capitalization Schedule**

Fixed assets (Mill. Nu.)	2022	2023	2024	2025	Total
Land	-	-	-	-	-
Buildings	5.00	486.63	5.00	120.46	<b>617.09</b>
Civil structures	26.02	22.50	14.00	14.00	<b>76.52</b>
Dam complex	539.47	3.78	142.21	-	<b>685.46</b>
Water conductor	-	-	-	-	-
Power house	238.70	1,088.41	587.35	356.50	<b>2,270.96</b>
Transmission equipment	-	8.00	13.75	4.00	<b>25.57</b>
Equipment	159.76	167.74	176.13	184.94	<b>688.57</b>
Office equipment	84.99	60.57	94.75	58.03	<b>298.34</b>
<b>Total (DGPC)</b>	<b>1,053.94</b>	<b>1,837.63</b>	<b>1,033.19</b>	<b>737.93</b>	<b>4,664.69</b>
Mini/Micro (EG)	139.79	255.29	237.15	-	<b>632.23</b>
<b>Total (DGPC &amp; EG)</b>	<b>1,193.73</b>	<b>2,092.92</b>	<b>1,270.34</b>	<b>737.93</b>	<b>5,294.92</b>

### 3.1.1.3 Return on Assets and Depreciations

The proposed return on asset is calculated as the product of the proposed WACC (14.07%) and the proposed net asset value at the end of each year. DGPC has stated that the depreciation allowance calculated in Table 12 below are as per the depreciation rates in Schedule B of TDR.

**Table 12: Proposed Allowances for Return on Assets and Depreciations**

RoA and DEP (Mill. Nu.)	July 2022	July 2023	July 2024
	- June 2023	- June 2024	-June 2025
Gross asset values	66,079	67,722	69,404
Accumulated depreciations	32,955	35,358	37,888
Net asset value	33,124	32,382	31,551
<b>Return on asset (RoA)</b>	<b>4,659</b>	<b>4,555</b>	<b>4,438</b>

<b>Depreciation (DEP)</b>	<b>2,403</b>	<b>2,531</b>	<b>2,629</b>
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### 3.1.2 *Inputs from Stakeholders*

#### 3.1.2.1 *Assets Schedule at the end of 2021*

ABI submitted that the approved gross asset value for DGPC in the tariff period 2019-2022 was Nu. 62,088.49 million and with additional capital investment during the tariff period, the gross assets value should not have exceeded Nu. 63,825 million. Therefore, ABI submitted that the gross asset value as of end of the year 2021 has been over-estimated by Nu. 1,657 million which is evident that the return on assets as well as depreciation will be much higher than allowable values resulting in a higher tariff than actually allowable. Thus, ABI recommended the gross assets value as of end of the year 2021 be corrected and adjusted so that only allowable assets are included determining the generation cost.

In response, DGPC submitted that DGPC has proposed the gross assets value as per the provision of RAB guidelines 2021 where it states that, for the existing licensees the historical cost of assets to be based on audited accounts as of 31<sup>st</sup> December 2021. DGPC further submitted that the proposed gross assets value includes embedded generation assets which will be transferred to DGPC from BPC at the end of June 2022.

#### 3.1.2.2 *Investments – Asset additions 2022 to 2025*

ABI submitted that DGPC has not been able to achieve its planned capital investments based on the historical trends of DGPC and accordingly, DGPC has been benefited by higher return on investment although the investment allowed by BEA has not been achieved for the past tariff periods. Therefore, ABI recommended the consideration of 50% of the proposed investments of Nu. 4,329 million which was submitted by DGPC in October 2021 for the tariff period 2022-2025.

In response, DGPC submitted that the capital investments could not be made due to COVID-19 pandemic in the past three years and for this tariff period (2022-2025) DGPC has placed the work order for over Nu. 1.77 billion where most of the investments are for the renovation and modernization of the power plants. Further, DGPC submitted that the majority of the proposed investments are for the implementation of SCADA and upgradation of governor and excitation system in the power plants which will help in minimizing the generating equipment downtime and bring about O&M efficiency gain.

### 3.1.3 *BEA Review*



### 3.1.3.1 Assets Schedule at the end of 2021

The Clause 9 of RAB Guideline, 2021 states that the Authority has to establish the initial RAB of the existing Licensees based on the historical cost of assets as per audited accounts as of 31<sup>st</sup> December 2021. Accordingly, BEA has verified the proposed gross assets values, accumulated depreciation and net assets values of DGPC with the audited financial statement of 2021 and found that it has been reported correctly.

DGPC has also proposed the Embedded Generation (EG) assets worth of Nu. 411.45 million to be included in DGPC Asset Schedule which will be transferred to DGPC from BPC at the end of June 2022 as per the agreement signed between BPC and DGPC. Considering that the EG assets are not transferred yet and the value of these assets have not been reflected in DGPC audited financial statement of 2021, BEA has deducted the EG assets worth of Nu. 411.45 million from asset schedule and considered these assets as investments which will be capitalized in July 2022.

DGPC has stated that BEA has allocated only 80% of the Corporate Office (CO) assets and depreciations to the existing power plants in the last tariff review, in this tariff period DGPC proposed to allow the entire asset of CO. BEA after review deducted 20% of CO assets since it was found that 1/5<sup>th</sup> of employees under CO are working for future projects, costs for which would be capitalized along with the commissioning of these projects. Considering the above deductions, BEA reviewed asset schedule is as shown in Table 13 below.

**Table 13: Reviewed Asset Schedule (Nu. mill.)**

<b>Fixed assets (Mill. Nu.)</b>	<b>Gross value</b>	<b>Acc. Dep.</b>	<b>Net value</b>	<b>Depreciation</b>
Land	3.91	-	3.91	-
Buildings	2,563.97	1,018.30	1,545.67	84.49
Civil structures	3,327.64	1,291.91	2,035.73	110.55
Dam complex	12,147.66	5,869.06	6,278.60	403.95
Water conductor	23,565.56	10,222.26	13,343.30	784.71
Power house	21,318.00	11,769.35	9,548.65	752.19
Transmission equipment	351.08	204.35	146.72	12.05
Equipment	1005.25	780.89	224.37	30.17
Office equipment	657.75	532.47	125.28	65.47
<b>Total</b>	<b>64,940.83</b>	<b>31,688.60</b>	<b>33,252.24</b>	<b>2,243.57</b>

### 3.1.3.2 Investments – Asset additions 2022 to 2025

BEA has reviewed the proposed investment plan (2022 to 2025) which has been submitted based on the year of capitalization. A detailed review of DGPC Investment Plan Proposal was carried out as per the Tariff Review Guidelines, the RAB Guideline and in consultation with DGPC tariff team and other relevant officials of DGPC.

While the site visits to the existing hydropower plants were planned in January 2022 to verify the proposed investments, however, due to lockdown in the capital and other Dzongkhags, site visit could not be made. Nevertheless, the relevant officials from four hydropower plants and CO were contacted through email and phone calls to get the details and updates on the proposed investments. However, the site visit to the construction of corporate office building was made in December 2021 to ascertain the current status of the investment as the construction of corporate office building was started since 2017 and the investment proposal for this project was proposed from 2016-2019 tariff period onwards.

The investments review was carried out by assessing the need for the proposed investment, source of funding, cost benefit analysis, current status of the proposed investment, risk associated with the proposed investment and expected capitalization of the proposed investment. The investment plan was further scrutinized by considering the approved budget of 2022 and based on which the realistic cost for 2022 investments was estimated. The investments which are crucial for the operation and maintenance of the existing power plants, renovation and modernization of the embedded generation assets and which will have a direct implication on the energy generation are considered in the tariff determination.

Further, in order to assess the past performance, BEA has compared the actual DGPC investment capitalization for the past three years 2019, 2020 and 2021 against DGPC proposal and BEA approved figures for the period 2019-2022 which is as shown in the Table 14 below.

**Table 14: Historical Investment Capitalization (Mill. Nu.)**

<b>Year</b>	<b>DGPC Proposed (2019-2022)</b>	<b>BEA Approved (2019-2022)</b>	<b>Capitalization from Audited Accounts</b>
2019	1,114.24	513.81	529.61
2020	1,766.37	809.54	620.88
2021	1,074.68	421.75	219.56
<b>Total</b>	<b>3,955.29</b>	<b>1,745.10</b>	<b>1,370.05</b>
<b>% Achieved/ Capitalized</b>	<b>35%</b>	<b>79%</b>	

From the table, it can be seen that during the tariff period 2019-2022, DGPC has capitalized 79% of BEA approved amount and 35% of DGPC proposed Investment. In the tariff cycle 2019-2022, BEA had allowed total investment of 45% of total investments proposed by DGPC. Unlike in the last tariff periods, BEA has allocated 100% of CO investments to the existing hydropower plants since CO investments for this tariff period are directly linked to the existing hydropower plants of DGPC.

Considering the detailed review of the proposed investment plan of Nu. 5,294.92 million from 2022 to 2025, BEA allowed 61% of DGPC proposed investment plans including the embedded

generation asset worth of Nu. 411.45 million which is considered as capitalized in the year 2022. The breakup of BEA allowed DGPC Investment Plan for the tariff period 2022-2025 is as shown in the Table 15 below.

**Table 15: Reviewed Investment Schedule (Mill. Nu.)**

<b>Fixed assets</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>Total</b>
Land	-	-	-	-	-
Buildings	5.00	5.00	16.50	-	26.50
Civil structures	4.15	15.52	19.00	5.00	43.67
Dam complex	-	1.94	543.83	-	545.77
Water conductor	-	-	-	-	-
Power house	49.00	197.95	586.27	426.82	1260.04
Transmission equipment	411.45	0	55.24	237.53	704.22
Office equipment	201.25	154.86	161.96	151.35	669.42
<b>Total</b>	<b>670.85</b>	<b>375.27</b>	<b>1,382.80</b>	<b>820.70</b>	<b>3249.62</b>

#### 3.1.4 Summary on Depreciations and Return on Assets

80% of the Corporate Office asset, accumulated depreciations and depreciations of the year 2021 have been included in the reviewed DGPC asset schedule.

100% of the Corporate Office investments are included in the reviewed investment schedule for the tariff period 2022 to 2025.

A total investment outlay of Nu. 3.249 billion has been considered for the tariff period 2022-2025 against investment of Nu. 5.294 billion proposed by DGPC.

Based on the review of the asset schedule of 2021, the planned investments for the tariff period 2022-2025 and the approved pre-tax WACC of 13.06%, BEA has approved the allowances for return on assets and depreciations as shown in the Table 16 below.

**Table 16: Approved Allowances for Return on Assets and Depreciations**

<b>RoA and DEP (Mill. Nu.)</b>	<b>July 2022 - June 2023</b>	<b>July 2023 - June 2024</b>	<b>July 2024 - June 2025</b>
Gross asset values	65,481.98	65,799.32	66,678.35
Accumulated depreciations	32,825.50	35,108.90	37,453.05
Net asset value	32,656.48	30,690.42	29,225.30
<b>Return on Asset (RoA)</b>	<b>4,266.53</b>	<b>4,009.67</b>	<b>3,818.25</b>
<b>Depreciation (DEP)</b>	<b>2,286.83</b>	<b>2,344.15</b>	<b>2,422.46</b>

## 3.2 O&M allowances

The determination of O&M costs is described in 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 deduction of 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 investment schedule using benchmarks as set out in the Schedule A of TDR. An annual regulatory fee and system operator charges are added to O&M costs.

### 3.2.1 DGPC Proposal

#### 3.2.1.1 Historical O&M Cost

The proposed historical O&M allowance figures for the year 2019 to 2021 are given in the Table 17 below.

**Table 17: Proposed Total O&M Allowances (Mill. Nu.)**

<b>Total Expenses</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
O&M Costs	498.31	479.12	498.62
Employee Costs	932.36	961.96	988.20
Other Expenses	285.80	901.13	315.51
Embedded Generation	16.75	17.25	22.76
<b>Total</b>	<b>1,733.21</b>	<b>2,359.47</b>	<b>1,825.53</b>

DGPC has stated that the proposed O&M allowances of Nu. 1,935.16 million comprises of O&M costs, employee costs, other expenses and cost of embedded generation which is based on the historical average O&M costs for the past three years adjusted for inflation. DGPC has further stated 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 18 below.

**Table 18: Proposed Deductions from O&M Allowances (Mill. Nu.)**

<b>Expenses</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
Corporate Social Responsibility (CSR)	16.10	13.35	22.27
Foreign Exchange Loss	38.18	71.05	54.60
House Rent Income	14.63	15.88	15.70
License Fee	14.80	14.80	14.80
<b>Total</b>	<b>83.71</b>	<b>115.08</b>	<b>107.37</b>

### 3.2.1.2 O&M Efficiency Gain

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% and also considering the under recovery of Nu. 763.05 million for the last tariff period. Further, DGPC has stated that there is an average increase of 6.15% in the historical O&M costs over the past three years from 2019 to 2021 which is higher than the proposed inflation rate of 3.40% of O&M escalation from 2022 to 2025 as shown in Table 19 below.

**Table 19 : Proposed Historical O&M Costs**

Year	2018	2019	2020	2021	Average Increase
O&M Costs (Mill. Nu.)	1,558.57	1,649.50	2,244.39	1,718.16	
% Increase		5.83 %	36.06 %	-23.45%	<b>6.15 %</b>
Inflation		1.35 %	2.02 %	6.82 %	<b>3.40 %</b>

DGPC has further stated that the proposed annual O&M cost escalation of 3.40% is reasonable compared to the 2019 Indian Central Electricity Regulatory Commission (CERC) norms, which allows an annual O&M cost escalation of 4.77%.

### 3.2.1.3 Benchmark O&M Cost

DGPC has proposed O&M cost allowance of 1% for new investments to be capitalized during the tariff period. DGPC has stated that O&M benchmark of 1% is much lower compared to benchmarks set by the Indian CERC, which allows O&M allowance of 5% for projects with installed capacity of less than 200 MW and 3.5% for projects with installed capacity of more than 200 MW. DGPC has further stated that the proposed O&M benchmark of 1% is as per DETP which states that O&M benchmarks for the new investments shall be maintained lower than that of older assets where the proposed average O&M allowance of Nu. 1,935.16 million is 1.33% of the total current replacement value of DGPC assets.

DGPC has stated that the revalued assets costs of DGPC power plants were valued by Mack Insurance Surveyors and Loss Assessors Pvt. Ltd. for the years 2019 to 2021 and the revalued assets costs during the tariff period is Nu 145,122.16 million as shown in Table 20 below.

**Table 20: Proposed Replacement Cost (2021)**

Plants	New Replacement Value (Mill. Nu)
Basochhu Hydropower Plant	7,325.52
Chhukha Hydropower Plant	37,330.04
Tala Hydropower Plant	13,518.50
Kurichhu Hydropower Plant	86,948.10

<b>Total Assets (Replacement Cost)</b>	<b>145,122.16</b>
Proposed O&M Allowance	1,935.16
O&M Cost/Replacement Cost	1.33 %

### 3.2.1.4 Fees and Charges

DGPC has stated that the regulatory fees of Nu.14.80 million per year for the tariff period has been added separately in the tariff model and the System Operator Charges to be paid to the Bhutan Power System Operator (BPSO) which has been calculated as per the System Operator Charges Regulation, 2022 as shown in Table 21 below has been considered in the tariff model.

**Table 21: Proposed Fees and Charges (Mill. Nu)**

Sl. No.	Parameters	2022 – 2023	2023 – 2024	2024 - 2025
1	Regulatory Fees	14.80	14.80	14.80
2	SO Charges allocated to DGPC	63.21	104.21	40.17
	<b>Total fees and charges</b>	<b>78.01</b>	<b>119.01</b>	<b>54.97</b>

### 3.2.2 Inputs from Stakeholders

#### 3.2.2.1 Historical O&M Cost

ABI submitted that BEA has approved O&M allowance of Nu. 1,561 million (base year 2018) in 2019-2022 tariff period. Accordingly, ABI has submitted that the O&M allowance of Nu. 1,837.04 million for the base year of 2021 has been determined considering the actual inflation for the years 2019, 2020 and 2021 to be used for tariff determination.

DGPC in response submitted that, as per TDR, the determination of the O&M allowance shall take into consideration historical costs, as adjusted for inflation incurred by the Licensee. DGPC further submitted that O&M cost for the last three years to be considered for the upcoming tariff period in keeping with the provision of TDR.

#### 3.2.2.2 O&M Efficiency Gain

ABI submitted that DGPC has proposed O&M efficiency gain of 0% and ABI has proposed to consider O&M efficiency gain of 2% which was approved by BEA in 2019-2022 tariff period.

In response, DGPC submitted that the proposed reduction in O&M efficiency gains was proposed considering the under recovery of O&M allowances which would impact the overall operation and maintenance of the power plants.

### 3.2.2.3 Fees and Charges

ABI submitted that the regulatory fees of Nu. 10,000 per MW is as per regulation and recommended SO charges to be used as provided in Table 212 below.

**Table 22: ABI Recommended SO Charges (Mill. Nu.)**

Parameters	2022 - 2023	2023 - 2024	2024 - 2025
SO Charges allocated to DGPC	13.79	17.06	31.60

### 3.2.3 BEA Review

#### 3.2.3.1 Historical O&M Cost

BEA has verified that the historical O&M costs for the past years 2019 to 2021 from the audited annual accounts submitted by DGPC and found the historical O&M is reported correctly.

#### 1. Deduction of Corporate Social Responsibility (CSR)

BEA has found that DGPC has proposed the deduction of Nu. 13.35 million in 2020 on account of CSR while the actual CSR reflected in audited accounts is Nu. 563.35 million. DGPC submitted that Nu. 550 million was contributed as COVID relief fund to MoF. As per TDR, 2022, O&M allowance shall not include CSR expenses. Therefore, BEA has deducted CSR of Nu. 563.35 million from the historical O&M expenses.

#### 2. Deduction of Corporate Office (CO) Expenses

BEA has verified O&M expenses of DGPC and found that remuneration, benefits and other expenses for employees working in deputations for the new projects are met from the budget of the new projects. However, the remuneration, benefits and other expenses for the employees working under Druk Green Consultancy, Hydropower Research and Development Centre, Planning & Design Division, Project Implementation & Monitoring Division and Project Departments of CO are met from DGPC. BEA also found that above Divisions of CO mainly work on future projects and also provide services to other agencies upon review of their activities during the past three years. Therefore, BEA has deducted 20% of CO O&M expenses.

#### 3. Deduction of Embedded Generation O&M cost

DGPC has proposed the historical O&M cost of embedded generation to be included in O&M cost of DGPC. BEA viewed that since the embedded generation assets are included as new investment, O&M cost of embedded generation is added to O&M cost allowance for year 2022 considering O&M benchmark of 2.5% as per the Schedule A of TDR and escalated by inflation thereon.

Based on the above review, BEA approved O&M allowance of Nu. 1,587.40 million as shown in Table 23 below.

**Table 23: Reviewed Historical O&M Costs (Mill. Nu.)**

O&M costs	2019	2020	2021
O&M Costs	498.31	479.12	498.43
Employee Costs	932.36	961.96	987.17
Other Expenses	285.80	901.13	317.17
<b>Total O&amp;M</b>	<b>1,716.46</b>	<b>2,342.21</b>	<b>1,802.78</b>
Corporate Social Responsibility	(16.10)	(563.35)	(22.27)
Foreign Exchange Gain/Loss	(38.18)	(71.05)	(54.60)
License Fee	(14.63)	(15.88)	(15.70)
20% of CO O&M Cost	(79.12)	(203.95)	(89.58)
<b>Total Deductions</b>	<b>(148.20)</b>	<b>(853.15)</b>	<b>(181.25)</b>
<b>Allowable O&amp;M Expenses</b>	<b>1,568.26</b>	<b>1,489.06</b>	<b>1,621.53</b>
<b>O&amp;M allowance</b>	<b>1,587.40</b>		

### 3.2.3.2 Non-Tariff Revenue (NTR)

As per TDR, 2022, NTR is the estimated Non-Tariff Revenue of the Generation Licensee in million Ngultrum. BEA has found out that DGPC has proposed house rent income to be deducted from O&M cost. BEA has considered NTR separately and deducted it from the total cost of supply of DGPC as per TDR. The list of NTR to be deducted from the total cost of DGPC is as shown in the Table 25 below.

**Table 24: Reviewed NTR**

Sl. No.	Particulars	2019	2020	2021	Average
1	House rent income	14.63	15.88	15.70	15.40
2	Profit on sale/discard of assets	2.49	4.93	6.66	4.69
3	Lease rental income	1.26	2.19		1.73
	<b>Total</b>	<b>18.38</b>	<b>23.00</b>	<b>22.36</b>	<b>21.82</b>

Based on the above review, annual average NTR of Nu. 21.82 million is deducted from the Total Cost of Supply of DGPC annually from 2022 onwards.

### 3.2.3.3 O&M Efficiency Gains

DGPC has proposed 0% O&M efficiency gains to be used during the tariff period considering at least to recover O&M cost increase at inflation rate of 3.40% and also to recover the under



recovered O&M cost of Nu. 763.05 million for the last tariff period 2019-2022 as shown in the Table 23 below.

**Table 25: DGPC Proposed Comparison of Actual O&M Cost and BEA Allowed**

<b>Total Expenses</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Total</b>
<b>Actual Expenses (A)</b>	1,649.50	2,244.39	1,718.19	<b>5,612.05</b>
<b>Allowed Expenses (B)</b>	1,597.90	1,614.90	1,636.20	<b>4,849.00</b>
<b>Difference (A-B)</b>	51.60	629.49	81.99	<b>763.05</b>

BEA found that the under recovery of O&M cost of Nu. 763.05 million was mainly on account of unallowed expenses such as CSR of Nu. 550 million in 2020 and a lower inflation rate considered by BEA in line with the Tariff Policy in 2019-2022 tariff period.

BEA also learned that O&M efficiency gain of DGPC is being achieved through maintaining plant availability, minimizing the auxiliary consumption and with aging plants, it will be challenging for DGPC to gain further O&M efficiencies. Therefore, BEA has decided to use an annual O&M efficiency gain of 1% to provide some signals to the Licensee on the expectations on O&M efficiency.

#### 3.2.3.4 O&M Benchmarks

DGPC has proposed the re-valued assets cost of BHP, CHP, KHP and THP to be Nu. 145,122.16 million based on the valuation conducted by Mack Insurance Surveyors and Loss Assessors Pvt. Ltd. for the years 2019 to 2021. The methodology of valuation was based on the fixed asset register and reinstatement value where depreciation was not adjusted and the settlement of insurance claims were considered on “New for Old” basis which reflects the cost of replacing the existing assets by a new asset of similar type, capacity and utility. From the fixed assets register, assets as per the commodities in different sections were categorised and applied the indices generated by the government sites and updated on regular basis. DGPC submitted that physical verification of the assets was done in July 2017 and virtual inspection was done in January 2022.

DGPC has further submitted that the proposed average O&M allowance of Nu. 1,935.16 million is 1.33% of the capital cost (replacement value) of Nu. 145,122.16 million and proposed O&M benchmark of 1.00% considering the provision of TDR and DETP. Accordingly, BEA approved O&M benchmark of 1.00% to be used in this tariff cycle considering that it is lower than O&M allowance of the existing assets. BEA reviewed O&M allowance of Nu. 1,587.40 million is 1.09% of the capital cost of the assets which is higher than the approved O&M benchmark of 1.00%.

### 3.2.3.5 Fees and Charges

As per TDR, 2022, Fees is the allowance for regulatory fees and levies of the Generation Licensee in million Ngultrum.

As per the System Operator Charges Regulation 2021, the System Operator Charges is to be recovered from Generation, Transmission and Distribution, and any other users as system operator charges for the service rendered by System Operator and accordingly 50% of SO cost is allocated to Generation Licensees and 50% to Transmission and Distribution Licensee.

The System Operator cost allocated to generation is to be further allocated to individual Generation Licensee based on the installed capacity (MW).

BEA reviewed that the License fee has been proposed correctly and the System Operator charges as approved by BEA has been allocated to DGPC as provided in the Table 23 below.

**Table 26: Reviewed Fees and Charges (Mill. Nu.)**

Sl. No.	Parameters	July 2022 - June 2023	July 2023 - June 2024	July 2024 - June 2025
1	SO Charges allocated to DGPC	14.04	37.43	117.32
2	Regulatory Fees	14.80	14.80	14.80
	<b>Total Fees and Charges</b>	<b>28.84</b>	<b>52.23</b>	<b>132</b>

### 3.2.4 Conclusions on O&M Allowances

DGPC has deducted the other incomes such as CSR, foreign exchange gain/loss and license fees. BEA further deducted 20% of Corporate Office O&M cost and O&M cost of embedded generation from the historical O&M Costs.

BEA has decided to use the amount of Nu. 1,587.40 million, which is the average of O&M costs in the years 2019 to 2021 after deductions and to use O&M benchmark of 1% for new investments and an annual O&M efficiency gain target of 1% in this tariff period.

## 3.3 CoWC Allowances

CoWC is the cost of working capital for Generation Licensee “g”, in million Ngultrum. The cost of working capital shall cover the allowance for arrears and inventories, and shall be determined in accordance with TDR, 2022 as follows;

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

Where:

- 1) I is the interest rate for working capital as determined in TDR 2022;
- 2)  $REV_g = OM_g + DEP_g + RoA_g$  where DEP, RoA and OM is as described in Section 3.1 and 3.2 in this review;
- 3)  $ARREARS_g$  is the allowed days receivables for the Generation Licensee “g”, in days; and
- 4)  $INVENTORIES_g$  is the allowance for inventories for the Generation Licensee “g”, in million Ngultrum.

The purpose of CoWC allowances is to compensate for the loss of revenues caused by the lag between the time, the costs occurs and the time of receivables from the customers.

### 3.3.1 DGPC Proposal

#### 3.3.1.1 Cost of Working Capital

DGPC has proposed allowances for CoWC per year as shown in Table 27 below.

**Table 27: Proposed Allowances for CoWC**

	2022 - 2023	2023 -2024	2024 -2025
CoWC (Mill. Nu.)	184	188	268

The proposal is based on arrears of 50 days, inventories of Nu. 455.16 million which is average inventories for the past three years of 2019, 2020 and 2021 including the inventories of embedded generation assets, interest on working capital of 9.97% and DEP, RoA and OM allowances as described under DGPC proposals in Section 3.1 and 3.2 and of this review report.

#### 3.3.1.2 Arrears

DGPC has proposed arrears of 50 days. According to DGPC, the proposal is based on the agreement signed between DGPC and BPC for the sale and purchase of electrical energy which was signed on 12<sup>th</sup> May 2017. DGPC has added the number of days of average energy consumption duration, bill preparation and delivery duration and bill payment due date to arrive at the arrears of 50 days as shown in Table 27 below.

**Table 28: Proposed Arrears**

Arrears	No. of days
Average energy consumption duration	15
Bill preparation and delivery duration	5
Bill payment due date	30
<b>Total Arrears</b>	<b>50</b>

### *3.3.1.3 Inventories*

DGPC has proposed total inventories of Nu. 455.16 million which is the average inventories for the past three years of 2019, 2020 and 2021 including the inventories of Nu. 6.34 million of embedded generation assets.

### *3.3.2 Input from Stakeholders*

#### *3.3.2.1 Interest on Working Capital*

ABI submitted that the interest on working capital of 8% be considered based on the current lowest short term lending rate of 8% offered by BoB for Manufacturing- Hydro power term loan.

In response, DGPC submitted that the prevailing interest rate (1year tenure) of working capital is 9.97% offered by BoB is the lowest amongst the Financial Institutions which is also keeping with the tariff review report of the last tariff cycle published by BEA. DGPC further submitted that the interest rate of 8% proposed by ABI is the floating interest rate of hydropower term loan of 20 years offered by BoB and that interest rate is unpredictable.

#### *3.3.2.2 Arrears*

ABI submitted that DGPC has proposed arrears of 50 days for collection of outstanding bills and ABI has requested to consider an arrear of 40 days which was approved by BEA in 2019-2022 tariff period.

In response DGPC submitted that during the import of power from the Indian Energy Exchange in January, February and March 2022, the payments of power purchase had to be made upfront before the actual delivery of the power and that was facilitated by the Indian trader which had to be settled within 5 days of receipt of invoice. DGPC further submitted that since industries consume more than 70% of the electricity that is being sold to BPC by DGPC, the payment period by the industries to BPC may need to be considered for a shorter time period which could be appropriately required of DGPC for the component of the electricity consumed by the industries.

### *3.3.3 BEA Review*

#### *3.3.3.1 Interest on Working Capital*

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 viewed that the 8% lending rate proposed by ABI is a long-term loan offered by BoB for Manufacturing – “Hydro Power’. Upon review, it was found that the lowest working capital interest rate was 9.23 % offered by BoB. Accordingly, BEA considered interest on working capital of 9.23 %.

### 3.3.3.2 Arrears

DGPC has proposed arrears of 50 days. According to DGPC, the proposal is based on the agreement signed between DGPC and BPC for the sale and purchase of electrical energy which was signed on 12<sup>th</sup> May 2017.

BEA has viewed that bill preparation and delivery duration of 10 days for its four plants not reasonable considering the availability of upgraded billing 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 and maintained the same number of days for average energy consumption duration. Therefore, BEA approved arrears of 40 days in 2019-2022 tariff period as shown in the Table 27 below.

**Table 29: Reviewed Arrears**

<b>Arrears</b>	<b>No. of days</b>
Average energy consumption duration	15
Bill preparation and delivery duration	5
Bill payment due date	20
<b>Total Arrears</b>	<b>40</b>

Based on the above, BEA has approved arrears of 40 days to be used to calculate the cost of working capital of DGPC.

### 3.3.3.3 Inventories

DGPC has proposed total inventories of Nu. 455.16 million which is the average inventories for the past three years of 2019, 2020 and 2021 including the inventories of Nu. 6.34 million of embedded generation assets. BEA verified the inventories of DGPC and embedded generation assets and found that the proposed inventories are reported correctly.

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 further reviewed the inventories of DGPC for the past three years and found that average inventory of past three years is 0.31% of current replacement cost and 0.69% of capital cost of DGPC assets which seems reasonable. Therefore, BEA decided to use the inventories as proposed by DGPC to calculate the cost of working capital.

3.3.3.4 Cost of Working Capital (CoWC)

DGPC has calculated the proposed CoWC as the product of interest of working capital and the amount of working capital in line with TDR, 2022. Clause 7.7 of DETP states that the interest on working capital to 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 seven (7) financial institutions of Bhutan and found that the lowest working capital interest rate of 9.23% is offered by BoB. Accordingly, BEA applied the lowest prevailing short term lending rate of 9.23% to calculate the cost of working capital. The reviewed allowances for CoWC per year is as shown in Table 27 below.

**Table 30: Reviewed CoWC Allowances**

	2022 - 2023	2023 - 2024	2024 - 2025
CoWC (Mill. Nu.)	126.30	126.19	127.13

3.3.4 Conclusions on the Cost of Working Capital

BEA has decided to reduce the arrears from 50 days to 40 days, to use inventories of Nu. 455.16 million and to apply the lowest prevailing short-term working capital interest rate of 9.23% when calculating the cost of working capital. Table 31 below shows the proposed and approved arrears, inventories and rates used to calculate CoWC allowances.

**Table 31: Proposed and Reviewed Arrears, Inventories and Rates**

	DGPC	BEA
Arrears (days)	50	40
Inventories (Mill. Nu.)	455.16	455.16
WACC/Interest Rate	9.97 %	9.23 %

3.4 Energy Volumes

As per TDR 2022, 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 deduction of royalty energy adjusted for auxiliary consumption as:

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

Where:

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

### 3.4.1 DGPC Proposal

#### 3.4.1.1 Forecasted Generation

DGPC proposed the forecast generation of 7,289 GWh per annum which is based on the average of the past three years from four plants (BHP, CHP, KHP and THP) and 22.63 GWh per annum which is based on the average of the past three years from Embedded Generation including 0.26 GWh from solar plant as shown in Table 32 below.

**Table 32: Proposed Historical Generation (GWh)**

Plants	2019	2020	2021	Average
BHP	306.47	348.56	339.11	<b>331.38</b>
CHP	1,687.71	1,858.07	1,966.31	<b>1,837.36</b>
KHP	395.46	391.59	386.29	<b>391.11</b>
THP	4,536.58	5,031.82	4,619.77	<b>4,729.39</b>
<b>Total Generation</b>	<b>6,926.22</b>	<b>7,630.04</b>	<b>7,311.47</b>	<b>7,289.24</b>
Embedded Generation	20.24	25.44	21.41	<b>22.36</b>
Solar Plant			0.26	0.26

DGPC has proposed the forecasted generation of each plant based on the average of the past three years as shown in the Table 32 below.

**Table 33: Proposed Forecast Generation (GWh) for the Years 2022 to 2025**

Plants	BHP	CHP	KHP	THP	Total
Energy Generation	331.38	1,837.36	391.11	4,729.39	<b>7,289.24</b>

#### 3.4.1.2 Annual Energy Volumes

DGPC has stated that as per the provision of TDR and DETP an average annual generation of 6,149 GWh has been used to calculate the energy volumes after netting off auxiliary losses of 1.12% and 15% royalty energy volumes from the four power plants. However, energy volume of 22.63 GWh from embedded generation has been added directly to DGPC net energy volume without netting off auxiliary losses and royalty energy. DGPC further stated that 15% of royalty energy from energy generation of four power plants corresponds to an energy volume of 1,081 GWh and 1.12% of auxiliary losses corresponds to an energy volume of 82 GWh annually during the tariff period. The proposed energy volume to be considered for tariff determination is as shown in Table 34 below.

**Table 34: Proposed Energy Volumes (GWh)**

Year	2022 - 2023	2023 - 2024	2024 - 2025
Energy (GWh)	6149	6149	6149

*3.4.2 Inputs from Stakeholders*

ABI submitted that DGPC has proposed generation volume of 6,149 GWh based on the historical values for the last three years (2019,2020 and 2021) after adjusting for auxiliary consumption of 1.12% and royalty of 15% of the total generation and adding the energy from embedded generation plants. ABI requested to consider the auxiliary consumption of 1% which was approved by BEA in 2019-2022 tariff period and use the energy generation of 6,157 GWh for the tariff determination.

*3.4.3 BEA Review*

Since TDR 2022 states that 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 deduction of royalty energy adjusted for auxiliary consumption, BEA reviewed the proposed calculation of 98% of water utilization factor of all plants and found that the water utilization factor for all plants for last three years are above 98%. Therefore, BEA viewed that the proposed annual energy generation forecast of 7,289.24 GWh for existing hydropower plants as proposed by DGPC is in line with TDR.

Upon detailed review of actual auxiliary consumption of the power plants for the past three years of 2019 to 2021, BEA found that average auxiliary consumption of all the plants for the past three years is 0.89%. Therefore, 0.90% of auxiliary losses is used for the tariff period 2022-2025.



As per the Clause 7.18 of DETP, all existing generation plants (BHP, CHP, KHP and THP) fully owned by RGoB have to provide 15% of an annual generation as Royalty Energy to RGoB.

Accordingly, BEA calculated an annual energy volume as the mean annual energy generation of the past three years based on 98% water utilization factor to the extent of generation capacity after deduction of 15% royalty energy adjusted for reviewed auxiliary consumption of 0.90% as shown in the Table 35 below.

**Table 35: Reviewed Energy Volume (GWh)**

Year	2022 - 2023	2023 - 2024	2024 - 2025
Forecast Generation (A)	7289.24	7289.24	7289.24
Auxiliary Losses (B)	65.60	65.60	65.60
Royalty Energy (C)	1083.55	1083.55	1083.55
<b>Energy Volume (A-B-C)</b>	<b>6140.09</b>	<b>6140.09</b>	<b>6140.09</b>
Add: Average of past three years Generation from EG (including 0.26 GWh from solar plant)	22.62	22.62	22.62
Add: Additional Energy from EG (after rehabilitation and upgradation of Mini Hydropower Plants)			1.55
<b>Reviewed Energy Volume</b>	<b>6162.71</b>	<b>6162.71</b>	<b>6164.26</b>

#### 4 Tariff determination

As per TDR 2022, the average cost of supply to 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<sub>n</sub> is the energy volume in year “n” in GWh, as determined in accordance with Clause 71 of TDR, 2022; and
- 5) WACC<sub>g</sub> is the weighted average cost of capital for the Generation Licensee “g”, as determined in Clause 69(1) of TDR, 2022.

The review of BEA has resulted in the allowances for this tariff period as shown in Table 36.

**Table 36: Reviewed Allowances (Mill. Nu.)**

Allowances	2022 - 2023	2023 - 2024	2024 - 2025
OM	1,638.33	1,681.34	1,736.30
DEP	2,286.83	2,344.15	2,422.46
RoA	4,266.53	4,009.67	3,818.25
CoWC	126.30	126.19	127.13
Annual License Fees	14.80	14.80	14.80
System Operator Charges	14.04	37.43	117.32
Less NTR	(21.82)	(21.82)	(21.82)
<b>Total Cost</b>	<b>8,325.00</b>	<b>8,191.76</b>	<b>8,214.43</b>
<b>Energy</b>	<b>6,163</b>	<b>6,163</b>	<b>6,164</b>

By discounting the Total Cost of Supply (TC) and the Energy using a pre-tax WACC of 13.06%, BEA has determined DGPC generation tariff to be Nu.1.34/kWh.