



# **Tangsibji Hydro Energy Limited Tariff Review Report 2024 to 2025**

**Electricity Regulatory Authority  
Ministry of Energy and Natural Resources  
Royal Government of Bhutan**

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## **Executive Summary**

The Druk Green Power Corporation Limited (DGPC) submitted the domestic generation tariff proposal for 118 MW Tangsibji Hydro Energy Limited (THyE), a 100% subsidiary company of DGPC set to be commissioned by late January 2024. The DGPC has proposed THyE tariff of Nu 6.54/kWh for the tariff period from January 2024 to June 2025 considering the project cost of Nu 14,921.31 million, cost of equity (CoE) of 13.72%, cost of debt (CoD) of 10.07%, gearing ratio of 55% and mean annual energy generation of 427 GWh.

The Electricity Regulatory Authority (ERA), after reviewing the THyE tariff petition, approved the generation tariff as Nu 3.89/kWh for the tariff period with effect from the Commercial Operation Date (COD) till 30<sup>th</sup> June 2025 based on the pre-tax weighted average cost of capital (WACC) as 11.93%, CoE of 11.36% (after-tax), CoD of 10.08%, gearing ratio of 70% and mean annual energy generation of 427.35GWh.

The cost allowances such as return on assets, depreciation, operation and maintenance cost and return on working capital have been set according to the provisions of the Tariff Determination Regulation (TDR) 2022.

# 1 Background

DGPC submitted the proposal for the domestic generation tariff application of THyE for the period January 2024 to June 2025 vide letter no. 08/DGPC/ERA/MD/2023/227 dated 27<sup>th</sup> November 2023 with THyE set to be commissioned by January 2024. The tariff application is proposed till June 2025 in order to align the next tariff review of THyE with the tariff revision cycle of other power plants. DGPC stated that since the project is yet to be fully commissioned, the project completion cost is assumed based on the anticipated completion cost and may differ from actual completion cost post commissioning.

DGPC stated that the proposal of domestic generation tariff has been prepared as per the provisions of the TDR and Domestic Electricity Tariff Policy (DETP) considering the following principles for tariff determination:

1. Fairness to both service customers and service providers;
2. No unjust discrimination against service providers or those who wish to use the services;
3. Reflect the actual cost of efficient business operation;
4. Conducive to efficiency improvement in business operation;
5. Enhance efficient and adequate supply to satisfy the domestic demand; and
6. Transparency in the determination and presentation of tariffs.

THyE tariff application was publicly announced in the media on 8<sup>th</sup> December 2023 for comments from consumers and stakeholders. However, ERA did not receive any comments on the tariff application. Further a consultation meeting was held on 5<sup>th</sup> January 2024 with DGPC and THyE.

## 2 Regulatory parameters

### 2.1 Tariff period

DGPC had proposed one and half year's tariff period from January 2024 to June 2025. The total cost and the total energy are discounted over the tariff period using the Weighted Average Cost of Capital (WACC).

ERA also approved one and half year's tariff period effective from Commercial Operation Date (COD).

### 2.2 WACC Parameters

The pre-tax WACC is calculated in accordance with 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<sub>g</sub> is the weighted average cost of capital for the Generation Licensee "g", as a percentage;
2. CoE<sub>g</sub> 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<sub>g</sub> 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<sub>g</sub> 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 had proposed a pre-tax WACC of 14.36%, based on a gearing ratio of 55%, CoE of 13.72%, CoD of 10.07% and a tax rate of 30%. The details of WACC parameters are discussed in the subsection below.

##### 2.2.1.1 Gearing Ratio

It was stated that the proposed gearing ratio of 55% has been calculated as per the TDR and provision of DETP which states that the gearing ratio for the computation of WACC shall be higher than the actual gearing ratio and up to maximum of 70:30.

##### 2.2.1.2 Cost of Equity (CoE)

In accordance to the provisions of the DETP 2016, DGPC had proposed a post-tax CoE of 13.72% based on the average lending rates of the domestic financial institution plus a premium of 250 basis points depending on the domestic market situation and gearing ratio applied. An average lending rate of 11.22% of the domestic financial institutions is proposed by DGPC as shown in the Table 1 below.

**Table 1: Proposed average lending rate**

SL.No	Financial Institutions	Average Interest Rate
1	Bhutan Development Bank Limited	11.24%
2	Bank of Bhutan Limited	11.30%
3	Bhutan National Bank Limited	11.92%
4	Tashi Bank Limited	10.69%
5	Druk PNB Limited	10.73%
6	Royal Insurance Corporation Limited	12.17%
7	Bhutan Insurance Limited	12.25%
8	National Pension and Provident Fund (NPPF)	9.50%
	<b>Average Interest Rate</b>	<b>11.22%</b>

Accordingly, DGPC had proposed a post-tax CoE of 13.72% for THyE based on the average lending rates of 11.22% and the maximum premium of 250 basis points.

### 2.2.1.3 Cost of Debt (CoD)

DGPC had proposed CoD of 10.07% for THyE based on the provisions of the DETP which states that the actual cost of debt for the tariff period should be considered. THyE has ICB loan of Nu 2,884.61 million at interest rate of 12% for tenure of 10 years and ADB OCR loan of Nu 5216.63 million at interest rate of 5.25% for tenure of 24.5 year. DGPC has further added 3.83% (five-year average) as the foreign exchange fluctuation rate on the ADB OCR loan since the loan repayment has to be paid in USD denomination. The loan for THyE is as shown in Table 2 below.

**Table 2: Proposed Cost of Debt**

Loan Details	Loan Disbursements	Principal Amount (MNu.)	Interest Rate (%)	Repayment period (years)	Loan balance 31.12.2023 (MNu.)	Loan balance 31.12.2024 (MNu.)	Loan balance 31.12.2025 (MNu.)
ICB Loan	2016-2023	2,884.61	12.00%	10	2,672.81	2,508.67	2,309.22
ADB OCR Loan	2016-2023	5,216.63	9.08% (5.25 + 3.83)	24.5	5,130.42	4,886.11	4,641.81
<b>Total</b>		8,101.02			7,803.23	7,394.78	6,951.03
<b>Weighted Average</b>			10.07%				

## 2.2.2 DGPC Comments

### 2.2.2.1 Cost of Equity

During the meeting held on 5<sup>th</sup> January 2024 with DGPC and THyE, DGPC informed that the proposed premium of 250 basis point is in accordance with the DETP. In addition, taking full premium on the average lending rates was mainly to attract future investments in hydropower

projects, power sale arrangements and the quick recovery of investments through loan repayment.

For the consideration of allowing the same approved CoE for DGPC of the current tariff cycle, DGPC emphasized the necessity for a particular policy that could provide a standardized framework for determining the tariff of plants commissioning in between tariff cycles, ensuring consistency across the board.

#### *2.2.2.2 Cost of Debt*

During the meeting, THyE informed that the foreign exchange loss of 3.83% considered in interest rate and loan conversion is to recover the fluctuation of exchange rates in coming years.

DGPC informed that the interest rate for ICB loan has been recalibrated to 12.05% effective from December 2023, comprising an MCLR (Marginal cost of Funds based on Lending Rate) of 8.45% in addition to a premium of 3.6%. It was also informed that the ICB loan gets revised every six months.

#### *2.2.3 ERA Review*

The WACC parameters are determined as per the Schedule C of TDR and may be updated by the ERA from time to time in accordance with Clause 7 of the TDR. The reviewed parameters are discussed in the subsections below.

##### *2.2.3.1 Tax*

The ERA 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*

As per the Clause 69 of TDR 2022, Gearing is the ratio of debt to total net fixed assets, as determined by the Authority for the Generation Licensee.

The Clause 7.1 of DETP states that the gearing ratio for the computation of WACC shall be higher than actual gearing ratio and up to maximum of 70%.

The DGPC had proposed THyE gearing ratio of 55% which is the actual gearing ratio of THyE.

ERA had approved gearing ratio of 70% for Mangdechu Hydropower Project (MHP) in 2019 when the project initially commissioned and for the current tariff period ERA had approved gearing ratio of 70% for MHP and 60% for existing DGPC plants. The loan of existing DGPC plants which have been running since 1986 are much lower than the approved gearing ratio of 60% and it is expected that the gearing ratio for THyE should be higher than DGPC being a new plant.

As per the provision of DETP, ERA has approved a gearing ratio of 70% for the tariff period 2024-2025 considering efficient financing structure of newer plants such as MHP.

##### *2.2.3.3 Cost of Equity (CoE)*

ERA calculated the average lending rates of the domestic financial banks and non-bank institutions for all sectors as shown in the Table 3 below.

**Table 3: Average Long Term Average Lending Rate of Financial Institutions in Bhutan**

Sl.No	Financial Institutions	Average Interest Rate
1	Bhutan Development Bank Limited	11.24%
2	Bank of Bhutan Limited	11.58%
3	Bhutan National Bank Limited	12.10%
4	Tashi Bank Limited	10.69%
5	Druk PNB Limited	11.17%
6	Royal Insurance Corporation Limited	12.14%
7	Bhutan Insurance Limited	12.33%
8	National Pension and Provident Fund (NPPF)	9.63%
	<b>Average Lending Rate</b>	<b>11.36%</b>

The Clause 7.2 of DETP states, “ERA 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”. In this regard, ERA approved CoE of 11.36%, average lending rate in line with the provision of DETP with no premium. The decision to provide no premium was based on the average lending rate of 11.36% itself being higher than most of the global return on equity of 10%, risks such as currency exchange taken into consideration in determination of the cost of debt and the export tariff of THyE.

Based on the long-term average lending rate of 11.36% with no premium, CoE of THyE has been approved at 11.36%.

#### 2.2.3.4 Cost of Debt (CoD)

ERA had verified the principal loan amount, interest rate, repayment period and the loan balance as of 31.12.2023, 31.12.2024 and 31.12.2025 of ICB as per the loan agreement and found it to be reported correctly.

For ADB OCR, it was found that the interest rate of 5.25% excluding the foreign exchange appreciation is found to be reported correctly and DGPC has included average USD appreciation of last five years which is around 3.83% resulting in an interest rate of 9.08%. Further, DGPC has considered USD exchange rate as on 31/10/2023 for conversion for the remaining loan balance.

ERA considered the USD rate as on 6<sup>th</sup> December 2023 at the time of the tariff review for the calculation of USD appreciation of last five years which works out to be 3.85%. Therefore, ERA has considered the USD appreciation of 3.85% on the interest rate of 5.25% for ADB OCR loan for accounting of foreign exchange fluctuation loss over the tariff period. The ICB loan interest rate of 12% was considered as per the loan agreement.

Therefore, the loan interest rate of 10.08% has been approved for determination of THyE domestic generation tariff.



### 2.2.3.5 WACC

Based on the considered gearing ratio of 70%, CoE of 11.36%, CoD of 10.08% and tax rate of 30%, ERA approved WACC of 11.93% for THyE as shown in Table 4 below.

**Table 4: Reviewed WACC**

<b>WACC Parameters</b>	<b>Proposed</b>	<b>ERA</b>
<b>Gearing</b>	55%	70%
<b>CoE</b>	13.72%	11.36%
<b>CoD</b>	10.07%	10.08%
<b>Tax</b>	30%	30%
<b>WACC</b>	<b>14.36%</b>	<b>11.93%</b>

## 2.3 Inflation

Normally, historical average inflation rate of past three years is used to escalate the historical operation and maintenance (O&M) costs to 2023 price level and to escalate the 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

#### 2.3.1.1 Inflation

DGPC had proposed an average annual inflation rate of 5.28% for THyE to be used to calculate the historical O&M average cost and to escalate the yearly O&M allowance over the tariff period as shown in the Table 5 below.

**Table 5: Year on Year historical Inflation on Non-Food Item**

<b>Year</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>Average</b>
<b>Inflation Figures</b>	2.02%	6.82%	7.01%	5.28%

### 2.3.2 ERA Review

#### 2.3.2.1 Inflation

ERA verified the proposed historical inflation rates for the years 2020 until 2022 and found that the proposed average historical inflation rates of 5.28% is reported correctly.

Therefore, ERA approved average historical inflation rate of 5.28% for the tariff period.

## 2.4 Other Regulatory Parameters

The O&M benchmark and O&M efficiency gain parameters are discussed in Section 3.2 in this review report.

## 3 Allowances, Cost of Supply and Energy Volumes

The total cost of supply for DGPC in any tariff year is to be determined in accordance with Clause 70 of TDR, 2022.

$$TCg = OMg + DEPg + RoAg + CoWCg + SOg + FEESg - NTRg$$

Where:

1. TCg is the total cost of supply of the Generation Licensee “g” in million Ngultrum;
2. OMg is the allowance for operating and maintenance costs of the Generation Licensee “g” in million Ngultrum;
3. DEPg is the allowance for depreciation of assets for the Generation Licensee “g” in million Ngultrum;
4. RoAg is the return on fixed assets of the Generation Licensee “g” in million Ngultrum, determined as,

$$RoAg = WACCg \times NA_g,$$

Where:

- a. WACCg is the weighted average cost of capital for the Generation Licensee “g”, and
  - b. NA<sub>g</sub> is the net value of all fixed assets at the start of the year for the Generation Licensee “g”, in million Ngultrum.
5. CoWCg 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 Clause 42 to 50 of 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.

Further, 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 Schedule B of the TDR, which may be updated by ERA 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 the WACC and the net assets values.

#### 3.1.1 DGPC Proposal

##### 3.1.1.1 Fixed Assets

The DGPC has proposed a gross asset value of Nu 14,921.31million, net value of Nu 14,921million and depreciation of Nu 523.77million at the end of the year 2023 for THyE as

shown in the Table 6 below. It was stated that the gross value of Nu 14,921.31million is the estimated cost of completion excluding the cost of transmission line of Nu 363.92 million and the accumulated interest of Nu 281.46 million. Further, it was submitted that the assets schedule proposed is as per the depreciation rates given in Scheule B of TDR.

**Table 6: Asset schedule of THyE (Nu Mill)**

<b>Fixed assets</b>	<b>Gross value</b>	<b>Acc. Dep.</b>	<b>Net Value</b>	<b>Depreciation</b>
Land	-	-	-	-
Buildings	65.58	-	65.58	2.19
Civil Structures	78.30	-	78.30	2.61
Dam Complex	1,237.91	-	1,237.91	141.26
Water Conductor	3,658.34	-	3,658.34	121.94
Power House	6,829.86	-	6,829.86	250.25
Transmission	18.26	-	18.26	0.61
Equipment				
Equipment	30.60	-	30.60	4.52
Office equipment	2.40	-	2.40	0.39
<b>Total</b>	<b>14,921.31</b>	<b>-</b>	<b>14,921.31</b>	<b>523.77</b>

### 3.1.1.2 Investments

DGPC had proposed investments of Nu 15 million in the year 2025 for the reclamation of runner and Nu. 46.73 million in the year 2026 for the purchase of one new spare runner and reclamation of one runner. The proposed investment schedule is as shown in the Table 7 below.

**Table 7: Proposed Investment Schedule for THyE (Nu Mill)**

<b>Asset</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>Total</b>
Land				
Buildings				
Civil Structures				
Dam Complex				
Water Conductor				
Power House		15	46.73	61.73
Transmission Equipment				
Equipment				
Office equipment				
<b>Total</b>		<b>15</b>	<b>46.73</b>	<b>61.73</b>

### 3.1.2 ERA Review

#### 3.1.2.1 Fixed Assets

As per the Audited report 2022 of THyE, the gross asset value as of 31<sup>st</sup> December 2022 is Nu 14,133.73 million with accumulated depreciation of Nu 106.65million resulting in a net asset value of Nu 14,027.08million.

Further, as per the additional information sought from THyE, it was informed that advance amount to supplier/contractor of Nu 1,974.43 million was paid due to fund shortage which will be refunded to THyE and is deducted from the total gross value of 2022. By excluding the advance amount to supplier/contractor of Nu 1,974.43 million, the gross asset value at the end of the year 2022 is Nu 12,052.65 million.

THyE submitted the actual expenditure as of 31<sup>st</sup> December 2023 amounting to Nu 13,289.89 million excluding the transmission line cost of Nu 640.63million on 13<sup>th</sup> January 2024. THyE also informed ERA that the expected completion cost is Nu 14,921.31 million and the balance amount is expected to be incurred from January to June 2024.

Based on the above, ERA approved the asset value as of December 2023 amounting to Nu 13,289.89 million and the balance amount of Nu 1,631.42 million could be reviewed in the next tariff review. The approved assets schedule for THyE is as shown in Table 8 below.

**Table 8: Reviewed Asset (Nu million)**

<b>Fixed assets</b>	<b>Gross value</b>	<b>Acc. Dep.</b>	<b>Net Value</b>	<b>Depreciation</b>
Land				
Buildings	65.58		65.58	2.19
Civil Structures	78.30		78.30	2.61
Dam Complex	4,237.94		4,237.94	141.26
Water Conductor	2,842.63		2,842.63	94.75
Power House	6,014.15		6,014.15	223.06
Transmission Equipment	18.28		18.28	0.61
Equipment	30.60		30.60	4.52
Office equipment	2.40		2.40	0.39
<b>Total</b>	<b>13,289.89</b>		<b>13,289.89</b>	<b>469.39</b>

#### 3.1.2.2 Investment

- a) Nu 15 million for Reclamation of runner in the year 2025

As per DGPC Runner Purchase and Reclamation Guideline 2017, “*It is recommended that runner must be sent for reclamation before the material loss reaches 20% of original thickness.*”

It was found that during the inspection of runner of MHP in the year 2022, the thickness of runner buckets was reduced by around 20% from its original thickness at 11,000 operating hours which is around 1 year 3 months where MHP would have to do runner reclamation in the year 2021. However, MHP had carried out runner reclamation in the year 2022 after three years of operation.

DGPC send runner reclamation to Bhutan Hydropower Services Ltd (BHSL) and BHSL has a capacity to repair or reclaim about ten (10) runners in a year and reclamation of each runner takes about 6 months.

Considering the runner reclamation duration and operating hours of THyE runners, reclamation of runners is expected to be completed within the tariff cycle. Therefore, the proposed investment is approved for the tariff period.

b) Purchase of one new spare runner and reclamation of one runner

DGPC had proposed Nu 46.73 million for purchase of one new spare runner and reclamation of one runner in the year 2026. Since the current tariff cycle is only till June 2025, the proposed investment shall be deferred to next tariff review.

### **3.2 O&M Allowances**

The determination of O&M costs is described in 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 2023 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 O&M Allowances*

The DGPC had proposed O&M allowance of Nu 148.21 million for THyE which is 1% of the total project cost. It was stated that the proposed O&M cost is based on approved O&M cost for the existing hydropower plant in the last tariff review 2022-2025. O&M efficiency gains of 1% is proposed as new power plant experiences teething problem at the start of operation.

##### *3.2.1.2 O&M Efficiency Gain*

The DGPC had proposed 1% efficiency gains on O&M costs for THyE during the tariff period 2024-2025 as new power plant experiences teething problem at the start of operation.

##### *3.2.1.3 Regulatory Fees*

The DGPC had proposed annual regulatory fee of Nu 1.2 million (Nu. 10,000 per MW) and annual system operator charges of Nu 6.49 million as per the System Operator Charges Regulation and order no. 02/BPSO/Admin/vol-2/2023/137 dated October 09, 2023 issued by BPSO for the revised system operator charges for the period of 2023-2024.

#### *3.2.2 ERA Review*

##### *3.2.2.1 O&M Allowances*

The Clause 38 of the TDR states that the determination of the operation and maintenance allowance shall take into consideration the historical costs for the power plants that are older than five years, as adjusted for inflation, while for the recently commissioned projects, it shall

be determined based on the industry’s best practices, as set out in Schedule A of TDR, opportunities for efficiency improvements and may include comparison with benchmarks from comparable utilities in the region.

As per Schedule A of the TDR, the O&M benchmark for large hydropower plant is 1 to 1.5% of the capital cost. The O&M cost of existing DGPC plants is 3% of the asset value in the year 2022 and 0.62% of the asset value for MHP.

In line with the TDR and the O&M cost of existing plants, 1% of the capital cost (Nu 132.90 million) has been approved as O&M cost since THyE, being a new plant, is expected to have higher efficiency than the existing DGPC plants.

### 3.2.2.2 O&M efficiency Gain

Considering the teething problems with electro mechanical equipment failures during the initial stages in MHP during the tariff review 2022-2025, 1% efficiency gains on O&M costs has been approved for THyE.

### 3.2.2.3 Regulatory Fees

In line with the Regulatory Fees Regulation 2006, ERA approved annual regulatory fees of Nu 1.18 million (Nu. 10,000 per MW).

ERA had approved total cost of Nu 255.26 million as system operator charges for the period 2023-2024 where 50% of the cost amounting to Nu 127.63 million has to be borne by Generation Licensees which was further allocated to each hydro plant based on the installed capacity as shown in Table 9 below and 50% of the cost by Transmission and Distribution Licensee as per Clause 39 of the System Operator charges Regulation 2022.

**Table 9: Approved System Operator charges to Generation companies**

<b>Plants</b>	<b>Amount (Nu Mill)</b>
DGPC	81.37
MHP	39.37
DHPC	6.89
<b>Total</b>	<b>127.63</b>

With THyE coming online from January 2024, as per Clause 17 of the System Operator Charges the allocation of System Operator cost to THyE is estimated as Nu 6.14 million as shown in table 10 below. The excess collection from DGPC, MHP, and DHPC on account of this new allocation shall be adjusted in the subsequent tariff period.

**Table 10: Reviewed System operator charges to Generation companies**

<b>Plants</b>	<b>Amount (Nu Mill)</b>
DGPC (1488 MW)	77.45
MHP (720 MW)	37.48
DHPC (126 MW)	6.56
THyE (118 MW)	6.14
<b>Total</b>	<b>127.63</b>

## 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 Clause 70(5) of 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 OM is as described in Section 3.2 in this review;
3. ARREARS<sub>g</sub> is the allowed days receivables for the Generation Licensee “g”, in days; and
4. INVENTORIES<sub>g</sub> 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 occurred and the time of receivables from the customers.

### 3.3.1 DGPC Proposal

#### 3.3.1.1 Interest on Working Capital

DGPC had proposed 9.97% as interest on working capital.

#### 3.3.1.2 Inventories

DGPC had proposed inventory of 1.84% (in the ratio of  $MW=118/64=1.84\%$ ) of BHP inventory level amounting to Nu 86.14 million.

#### 3.3.1.3 Arrear

DGPC had proposed an arrear of 30 days for THyE.

### 3.3.2 DGPC Comments

#### 3.3.2.1 Inventories

During the meeting held on 5<sup>th</sup> January 2024, DGPC clarified that their rationale behind comparing the inventories of THyE with BHP was due to similarities in its technology. After discussion, DGPC suggested benchmarking with Dagachu Hydropower Plant (DHP) in relation to its technology and capacity.

### 3.3.3 ERA Review

#### 3.3.3.1 Interest on Working Capital

As per Clause 7.7 of DETP, the interest on working capital shall be determined based on the prevailing lowest short-term lending rate of financial institution of Bhutan. In line with DETP, it was found that the lowest working capital interest rate is 9.37% as offered by Bank of Bhutan.

Therefore, ERA approved interest on working capital of 9.37% for determination of CoWC.

### 3.3.3.2 Arrear

ERA approved an arrear of 40 days at par with DGPC and MHP for the tariff period 2022-2025 as shown in table 11 below.

**Table 11: Reviewed Arrear**

<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>

### 3.3.3.3 Inventories

The inventories of BHP is Nu 43.33 million and Nu 50.11 million respectively for the year 2021 and 2022 which amounts to Nu 86.14 million at the ratio of 1.84%. ERA verified that the proposed inventories of Nu 86.14 million is 0.58% of THyE's proposed completion cost of Nu 14,921.31 million.

Clause 16 of Guidelines for Determination of Regulatory Asset Base 2021 states that *“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”*.

As per the audited report of THyE, the inventories for the year 2021 and 2022 is Nu 5.02 million and Nu 3.99 million respectively which is not a true representation since the projects is under construction phase.

In the year 2022, the inventories of existing DGPC plants are 1.57% of the assets value and 26% of O&M cost. For MHP, the inventories are 0.02% of the assets value and 4% of O&M cost. Similarly, 0.45% of asset value and 20% of O&M cost for DHP.

Considering 15% of O&M cost in comparison to other power plants inventory allowance and being a new plant, the inventory for THyE works out to be Nu 19.93 million considering the allowed O&M cost of Nu 132.90 million.

Since THyE is a new plant and would require much lower inventory than older plants, ERA approved inventory of Nu. 19.93 million.

## 3.4 Energy Volume

As per the Clause 71 of 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, 2016, 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

DGPC had proposed generation forecast of THyE as 491.49 MU for the year 2024, 2025 and 2026. DGPC has also proposed an auxiliary consumption of 1.12% and Royalty energy of 12% resulting in annual energy of 427 MU as shown in the Table 12 below.

**Table 12: Proposed Annual Energy Volumes (GWh)**

Year	2024	2025	2026
Mean Annual Energy	491.49	491.49	491.49
Less: Auxiliary Losses (1.12%)	5.5	5.5	5.5
Less: Royalty (12%)	58.98	58.98	58.98
<b>Energy Used for Tariff Determination</b>	<b>427</b>	<b>427</b>	<b>427</b>

### 3.4.2 DGPC Comments

During the meeting held on 5<sup>th</sup> January 2024, ERA sought clarifications on the proposed energy volume. DGPC had submitted 491.52 MU in the operation licence application to ERA as per the salient features and also in the Power Purchase Agreement (PPA), the design energy volume considered is 491.52 MU while in the tariff application it is 491.49 MU.

DGPC agreed to consider the annual design energy of 491.52 MU as per PPA. Further, DGPC informed that as per the PPA, auxiliary loss considered is 1.2% and in relation to energy accounting for royalty energy payment, DGPC requested to consider 1.2% loss similar to how it is done for Dagachu Hydropower Plant.

### 3.4.3 ERA review

It was found that in the year 2022, the auxiliary loss for BHP was 0.18%, 0.27% for CHP, 0.58% for KHP, 0.20% for THP and 1.09% for DHP resulting in an average auxiliary loss of 0.46% for these plants. However, as per the PPA with Power Trading Company (PTC), India, the auxiliary loss considered is 1.2%. Therefore, ERA approved auxiliary loss of 1.2% as per PPA.

As per Clause 7.18 of DETP, all generation plants fully owned by the RGoB have to provide 15% of an annual generation as Royalty Energy to RGoB. However, as per the PPA between THyE and PTC, India, the royalty energy is 12% for the first 12 years and 18% thereafter. Therefore, ERA approved 12% royalty energy as shown below.

**Table 13: Reviewed Energy Volumes for THyE (GWh)**

Year	2024	2025	2026
<b>Mean Annual Energy</b>	<b>491.52</b>	<b>491.52</b>	<b>491.52</b>

<b>Less: Auxiliary Losses (1.2%)</b>	5.90	5.90	5.90
<b>Less: Royalty (12%)</b>	58.27	58.27	58.27
<b>Energy Used for Tariff Determination</b>	<b>427.35</b>	<b>427.35</b>	<b>427.35</b>

## 4 Tariff Determination

As per Clause 72 of the TDR, 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 the  $WACC_g$ , 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:

- $AC_g$  is the average cost of supply for the Generation Licensee “g”, in Ngultrum per kWh;
- TP is the number of years in the Tariff Period;
- $TC_{g,n}$  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, 2016;
- $ENERGY_n$  is the energy volume in year “n” in GWh, as determined in accordance with Clause 71 of TDR, 2016; and
- $WACC_g$  is the weighted average cost of capital for the Generation Licensee “g”, as determined in Clause 69 of TDR, 2016.

With commissioning of THyE, there will be an additional energy generation of 324 MU at MHP. On 17<sup>th</sup> January 2024, DGPC submitted that the additional generation to MHP will result in a revenue of Nu 460.40 million from the sale of energy to domestic market at MHP domestic tariff of Nu 3.64/kWh and Nu 544.36 million revenues from the sale of energy to India during the peak seasons at the MHP export tariff of Nu 4.12/kWh, after adjusting for auxiliary and transmission loss of 1.2% and Royalty energy of 15%. The total revenue generated from the sale to domestic market and India is Nu 1,004.76 million. DGPC submitted that the total revenue generated will be shared equally between THyE and MHP.

However, with ERA considering MHP’s approved auxiliary loss of 1.12%, transmission loss of 1.14% and Royalty energy of 15%, the total revenue amounts to Nu 993.98 million. With equal distribution of the revenue generated, THyE will receive an additional annual revenue of Nu 496.99 million from MHP.

Since 324 MU energy is generated at MHP, the revenue received from MHP shall be deducted from THyE cost as non-tariff review in line with Clause 70 of TDR.

**Table 14:Reviewed Allowances**

<b>Allowances</b>	<b>2024</b>	<b>2025</b>
O&M (Nu Mill)	145.91	152
DEP (Nu Mill)	470	470

RoA (Nu Mill)	1,529	1,502
CoWC (Nu Mill)	24	24
Less NTR (Nu Mill)	497	497
<b>Total cost (Nu Mill)</b>	<b>1,671</b>	<b>1,650</b>
<b>Energy (GWh)</b>	<b>427.35</b>	<b>427.35</b>

By discounting the Total Cost of Supply and the Energy using a pre-tax WACC of 11.93%, ERA has determined THyE generation tariff as **Nu 3.89/kWh**.

## 5 Infirm Power

The THyE project synchronized its Unit 2 on 17<sup>th</sup> January 2024 with the domestic grid, thereby, injecting infirm power into the grid. The COD for Unit 2 of THyE was set on 25<sup>th</sup> January at 00:00 hours.

In May 2019, during the testing and commissioning of MHP's generating units, the ERA granted an infirm power tariff rate to BPC of Nu 1.59/kWh equivalent to the average domestic generation tariff of DGPC.

Therefore, ERA has approved a tariff of Nu 1.60/kWh for the infirm power injected into the domestic grid from THyE equivalent to the average domestic generation tariff of DGPC and MHP. The infirm power tariff rate will only be applicable until the COD and the tariff for domestic sale thereafter shall be as determined by ERA.