

**CENTRAL ELECTRICITY REGULATORY COMMISSION
New Delhi**

Petition No.125/MP/2021

Coram:

Shri Jishnu Barua, Chairperson

Shri I.S. Jha, Member

Shri Arun Goyal, Member

Shri P.K. Singh, Member

Date of Order: 10th December, 2023

In the matter of

Petition under Sections 62 and 79 (1) of the Electricity Act, 2003 read with related provisions of Regulations 48 (1)(a), 48 (1)(b), 54 and 55 under Chapter-10 (Miscellaneous Provisions), of the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations,2014 and Regulations 66 (1), 66 (2), 76 and 77 under Chapter-15 (Miscellaneous Provisions) of the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations , 2019 for approval of Determination of Normative Plant Availability Factor (NAPAF) and Relaxation of Norms for Auxiliary Energy Consumption (AEC) in respect of 60 MW Turrial Hydro Electric Plant.

And

In the matter of

North Eastern Electric Power Corporation Limited

Corporate Office: Brookland Compound

Lower New Colony, Shillong 793003, Meghalaya

..... **Petitioner**

Vs

**1. The Engineer-in-Chief,
Power & Electricity Department,
Government of Mizoram,
New Secretariat Complex, Kawlphetha
Aizwal- 796 001.**

**2. Member Secretary,
North Eastern Regional Power Committee,**



NERPC Complex, Dong Parmaw
Lapalang, Shillong-793 006, Meghalaya.

**3. Executive Director,
North Eastern Regional Load Dispatch Centre,
Dongtiah, Lower Nongrah,
Lapalang, Shillong -793 006, Meghalaya.**

4. The Superintending Engineer,
Mizoram State Load Despatch Centre,
SLDC Circle, Power & Electricity Department,
New Secretariat Complex, Kawlphetha
Aizawl – 796 001.

.....Respondent

Parties Present:

Shri Ripunjoy Bhuyan, NEEPCO

ORDER

The Petitioner, NEEPCO. (hereinafter referred to as NEEPCO) has filed this petition seeking the following relief:

- a) *Approve the relaxation of Normative Plant Availability Factor (NAPAF) to 72 % for the 60 MW (2 X 30`MW) Tuirial Hydro Electric Plant for the recovery of full capacity charges with effect from COD till completion of the useful life of the plant.*
- b) *Approve the relaxation of norms allowing Auxiliary Energy Consumption (AEC) @ 4.30 % in respect of 60 MW (2 X 30 MW) Tuirial Hydro Electric Plant with effect from from COD till completion of the useful life of the plant.*
- c) *Allow recovery of arrears from the beneficiaries, if any, on account of the above relaxations.*
- d) *Allow additions/ alterations/ changes/ modifications to the Petition at a future date.*
- e) *Pass such order as this Hon'ble Commission deems fit and appropriate in the facts*
- f) *and circumstances of the case in the interest of justice.*
- g) *Condone any inadvertent omissions/errors/differences/shortcomings.*



Background

1. The North Eastern Electric Power Corporation Limited (hereinafter referred to as NEEPCO), a Government of India Undertaking established under the Companies Act, 1956, came into existence on 2nd April 1976, with its Headquarters in Shillong, Meghalaya.
2. The Tuirial Hydro Electric Power Plant (hereafter referred to as “TrHEP”) owned and operated by NEEPCO, is a medium head storage scheme on the river Tuirial/Sonai, a tributary of river Barak in the Kolasib district of Mizoram. The installed capacity of the Tuirial Hydro Electric Project is 60 MW (2 X 30 MW).
3. The plant consists of a 75 m high Zoned Earth Fill Dam, 2 nos. of Diversion Tunnels of diameter 8.0 m and length 787.8 m each, an Open Chute Spillway and Surface Power House with 2 nos. of Vertical Francis Turbines with an installed capacity of 2x30 MW and an annual Design Energy 250.63 MU.

Submission of the Petitioner

4. The dates of commercial operation of individual units and the corresponding unit capacities are indicated in the table below:

Plant	Unit No.	Date of Commercial Operation	Unit Capacity
Tuirial Hydro Electric Plant (2X 30 MW)	U# I	29.10.2017	30 MW
	U# II	29.01.2018	30 MW
	Generating Station	29.01.2018	60 MW



5. The Annual Design Energy of the Tuirial Hydro Electric Power Plant is 250.63 Million units (MU).

6. It is submitted that the electricity generated from the Tuirial Hydro Electric Power Plant is being supplied to the Govt. of Mizoram.

7. The generated power from the Tuirial HEP is evacuated through a 132KV Single Circuit Transmission Line up to Kolasib Sub-Station of Govt. of Mizoram.

8. The Commission determined the tariff of Tuirial Hydro Electric Power Plant for the period 29.01.2018 (Station COD) to 31.03.2019 and approved the Annual Fixed Charges (AFC) for the control period 2014-19 vide their order dated 9.10.2018 in Petition No. 15/GT/2018 and revised the same based on truing up exercise vide order dated 10.3.2021 in Petition No. 329/GT/2019 in accordance with the Central Electricity Regulatory Commission (Terms and Condition of Tariff) Regulations, 2014. The Commission determined the tariff and approved the AFCs of the Plant for the period 01.04.2019 to 31.03.2024 vide order dated 16.04.2021 in Petition No. 390/GT/2020.

9. It is humbly submitted that vide the orders aforementioned in paragraph 8 the Commission has allowed the Operational norms as follows:

- A. Normative Annual Plant Availability Factor (NAPAF): **85%.**
- B. Auxiliary Energy Consumption (2014-2019 control period): **1%.**
- C. Auxiliary Energy Consumption (2019-2024 control period): **1.2 %**

(A). Normative Plant Availability Factor (NAPAF)



10. The Petitioner has submitted that in its aforementioned Petition Nos. 15/GT/2018, 329/GT/2019 and 390/GT/2020 had pleaded for relaxation of norms on NAPAF as 82% on the following grounds:

a. Salient features of the Tuirial Project are as follows:

FRL - 90.5 m, MDDL - 68.0 m, Normal TWL at Full load - 30.7 m, TWL with 1 unit running - 29.3 m.

b. From the above parameters, it was observed that head variation between FRL and MDDL is more than 8%, and accordingly month, month-wise peaking capability shall form the basis of fixation of NAPAF. However, monthly peaking capability was considered in DPR based on the net head. The net head has been further reduced by another 2 m considering the existing TWL as the Tail water level gets raised by approximately 2.0 m due to the raising of the river bed level downstream.

c. From the calculated monthly peaking capability, the NAPAF is obtained as 96%. Based on this, and considering all applicable allowances (10 % for outage and 5 % for N. E. Region), the final NAPAF stands at $96\% \times 0.85 = 82\%$, which was submitted to the Commission vide affidavit dated 13.07.2018 for consideration of NAPAF of 60 MW Tuirial Hydro Electric Project.

d. It was submitted by the Petitioner that the matter was pending before CEA for a final opinion.

11. The Commission vide orders dated 10th March 2021 and 16th April 2021 in Petition Nos. 329/GT/2019 and 390/GT/2020, respectively had granted liberty to the Petitioner to



file an appropriate petition for revision of NAPAF after obtaining approval of CEA on the matter.

12. In continuation of the above, the Petitioner has submitted for the kind perusal of the Hon'ble Commission:

- (i) The Tuirial Hydro Electric Plant is operated in a wide variation of reservoir level with full reservoir level at El. 90.5m and minimum draw-down level at El. 68.0m. Maximum reservoir level (MRL) and Normal Maximum Operating Level (Full Supply Level, FSL) are El. 95.2m and El. 90.5m respectively. Here FSL is considered as full reservoir level. This variation of 22.5m is 42.4% of the rated net head of 53.0m. This significant variation has put certain limitations in the design and subsequent operation of machines. The machines of the plant have been designed for 53m design head and thus, the demonstration of a rated installed capacity of 30 MW per machine is possible only when the reservoir level is El. 84.38m or above. Below El. 84.38m, the machine rating gets reduced gradually commensurate to the available head and it reduces even up to 17MW against the rated nameplate capacity of 30MW.
- (ii) This characteristic has become evident during the operation of the plant for the last three years. The turbine model study carried out before the manufacturing of the machine also clearly shows this reduction in MW capability. This issue covered in the model study was submitted to CEA for examination. CEA vide letter dated 30.9.2020, agreed to the outcome of the study. The study, inter alia, shows MW limitations as given below:

Sl. No.	Head (m)	Max. permissible MW per machine
1	59.7	31.05



2	56.7	31.05
3	53	31.05
4	44.7	25.30
5	34.2	17.00

(iii) As the reservoir level is directly related to the Plant Availability Factor (PAF) of the plant, additional letup is due for the Normative Annual Plant Availability Factor (NAPAF).

Regulation 50(A) (1) (b) of the Tariff Regulations, 2019 and Regulation 37

(1) (b) of the Tariff Regulations, 2014 reads as :

“In case of storage and pondage type of plants with head variation between full reservoir level and minimum draw down level is more than 8% and when plant availability is not affected by silt, the month wise peaking capability as provided by the project authorities in the DPR (approved by CEA or the State Government) shall form basis of fixation of NAPAF”

(iv) DPR for the plant prepared by CEA/CWC was very old (1991), and the discussed characteristic was not covered in month-wise peaking capability; nonetheless, the plant’s head variation between full reservoir level and minimum draw-down level is more than 8% and plant availability has not been affected by silt. Because of the inadequacy of DPR, the Corporation has not been able to get the benefit of lower NAPAF under the above provision.

Regulation 50(A) (2) of the Tariff Regulations, 2019 and Regulation 37 (2)

of the Tariff Regulations, 2014 reads as :

“A further allowance may be made by the Commission in NAPAF determination under special circumstances, e.g. abnormal silt problem or other operating conditions, and known plant limitations.”

The reduction in MW output, as discussed above, is a known and established plant limitation in operating conditions. Therefore, the plant deserves lower NAPAF by virtue of the above-referenced regulation.



Further, Regulation 50 (3) of the Tariff Regulations, 2019 and Regulation 37 (3) of the Tariff Regulations, 2014 states:

“A further allowance of 5% may be allowed for difficulties in North East Region.”

(v) Reduced NAPAF is calculated based on model study output vetted by CEA and actual reservoir level for the last three years since the commissioning of the plant. Month-wise maximum MW capability is calculated corresponding to the average monthly reservoir level based on model study output.

PAF, without considering the discussed limitation, is 85% for the plant, and therefore, the proposed reduced **NAPAF is 70%** with a 15% reduction (10 % for outage + 5 % for N. E. Region) from the calculated value of 85 %.

13. In view of the facts and circumstances mentioned above, it is humbly submitted that the Commission may be pleased to revise the NAPAF of the 60 MW Tuirial Hydro Electric Power Plant in accordance with the opinion of CEA with effect from the Date of Commercial Operation of the Plant invoking the powers vested in it under Regulations 54 (Power to Relax) and 55 (Power to Remove Difficulties) of the Tariff Regulations, 2014, and Regulations 76 (Power to Relax) and 77 (Power to Remove Difficulties) of the Tariff Regulations, 2019.

(B) Auxiliary Energy consumption (AEC)

14. It is humbly submitted that vide the orders aforementioned in paragraph 8 the Commission has allowed Auxiliary Energy Consumption (AEC) @ 1% for the period 2014-19 and @ 1.2 % for the 2019-24 control period.

15. However, it has been observed from the actual operational data that the auxiliary energy consumption is in excess of the normative of 1.0 % and 1.2 % and stands at 3.03



% in 2017-18 (1 unit running -3 months and 2 units running- 2 months), 4.48 % in 2018-19, 4.04 % in the year 2019-20 and 4.65 % in 2020-21 (up to Aug'2020). The above mentioned auxiliary consumption is tabulated as follows with respect to the gross generation of the plant:

Parameter	30.10.20 17 to 31.03.20 18	01.4.201 8 to 31.03.20 19	01.4.201 9 to 31.03.20 20	01.04.2020 to 31.08.2020 (5 months only)	Average Weighted AEC considering w.e.f.01.4.20 18.
Gross Energy generation (MU)	79.1057	168.435	177.0114	46.05	4.304 %
Total ex-bus energy generation (MU)	76.8697	160.7812	169.6915	43.9198	
Auxiliary Energy Consumption (MU)	2.3989	7.5529	7.1563	2.1421	
Auxiliary Energy Consumption (%)	3.03252	4.48416	4.04285	4.65168	

16. Petitioner has submitted that the reasons for the auxiliary energy consumption in Tuirial Hydro Electric Plant exceeding the normative rates may be attributed to the following causes:

- (i) Power consumption by Electrical drives utilized for generation of power. A substantial quantum of power is required to maintain various auxiliary equipment and systems both when the units are running and when the units are not running
- (ii) The station is operated in isolation, not being connected with ISTS through 220 KV or 400 KV lines, but connected with 132 KV and 66 KV lines of STU



viz. Power & Electricity Department of Mizoram. Sufficient load is not available in the area to absorb the entire available capacity of the Plant.

- (iii) Operation of units in partial load due to frequent under-requisitioning of capacity by the sole beneficiary of the Plant, viz. Mizoram.
- (iv) Lighting of the project area.
- (v) Dam Auxiliaries.
- (vi) It is further mentioned that during the winters, load availability (demand) is there but generation is less as per availability of water; therefore, actual auxiliary consumption will be higher in terms of percentage (approx.4 - 5%).

17. In the context of the matter, the Petitioner has submitted the following for the kind consideration of the Commission:

- i. The Commission had approved Auxiliary Energy Consumption @ 6% for NHPC Limited's 45 MW (3 X 15 MW) Nimoo Bazgo Hydro Electric Project, Leh, Union Territory of Ladakh, in their special petition No.229/GT/2014 dated.22.09.2016 for the period of 01.04.2014 to 31.03.2019. The operative part of the approval order i.e. paragraph No.38 is reproduced below:

*"We have examined the matter. Considering the location of plant, the extreme weather condition and the data submitted by the petitioner, we, in exercise of the power under Regulation 54 of the 2009 Tariff Regulations, and as a special case relax the provisions of Clause (6) sub-clause (a)(ii) of Regulation 37 of the 2014 Tariff Regulations and **allow the auxiliary consumption of up to 6% based on average actual auxiliary consumption** for the period 2012-16 as against the claim of the petitioner for 9%. The relaxation granted for this generating station cannot be cited as precedent in future".*

- ii. The Commission had also allowed Auxiliary Energy Consumption @ 5% for NHPC Limited's 44 MW (4 X 11 MW) Chutak Hydro Electric Project, Jammu &



Kashmir, for the year 2012-13 to 2015-16 in the petition No. 252/GT/2014, dated.29.03.2017. Paragraph NO. 44 of the order is reproduced below:

*“We have examined the matter. Considering the location of plant, the extreme weather condition and the data submitted by the petitioner, we, in exercise of the power under Regulation 54 of the 2009 Tariff Regulations, and as a special case relax the provisions of Clause (6) sub-clause (a)(ii) of Regulation 37 of the 2014 **Tariff Regulations allow the auxiliary consumption of up to 5% based on average actual auxiliary consumption for the period 2013-16 as against the claim of the petitioner for 6%.**”*

- iii. It is further submitted that recovery of auxiliary energy consumption in excess of the normative 2.5 % has also been allowed in thermal power stations in the tariff order in petition no 129/GT/2015, dated.30.03.2017, in respect of the Palatana Combined Cycle Gas-based Project (726.6 MW) of OTPC, Tripura for the period from 01.04.2014 to 31.03.2019, the auxiliary energy consumption of 3.50 % has been allowed under Regulation 54 of the 2014 Tariff Regulations, in the exercise of the Power to Relax.
- iv. In the verdict of the Appellate Tribunal of Electricity in reference to Appeal No. 41 of 2012 dated 21st November 2012 between Puducherry Power Corporation Limited vs Joint Electricity Regulatory Commission, Govt. of Haryana, Gurgaon, Haryana, the Appellate Tribunal allowed Auxiliary Power Consumption of 5.5% of gross power generation for the FY 2011-12.

In view of the peculiar facts and circumstances mentioned above, Petitioner has submitted that the Commission may relax the norms as a special case for the 60 MW Turrial Hydro Electric Power Plant and allow Auxiliary Energy Consumption @ 4.3 %, which is the actual average consumption with effect from the Date of Commercial Operation of the Plant invoking the powers vested in it under Regulations 54 (Power to Relax) and 55 (Power to Remove Difficulties) of the Tariff



Regulations, 2014, and Regulations 76 (Power to Relax) and 77 (Power to Remove Difficulties) of the Tariff Regulations, 2019.

Reply and Rejoinder

18. No reply has been filed to the petition by the Respondent.

Hearing dated 14.10.2021

19. The matter was heard on 14.10.2021, and the Commission directed the Petitioner to submit the following information:

- (a) Status of approval of CEA for reduction of NAPAF to 82% for the instant generating station submitted by the Petitioner in Petition No. 329/GT/2019 (true-up petition for 2014-19) and Petition No. 390/GT/2020 (tariff petition for 2019-24);
- (b) The Petitioner in its prayer, has requested for relaxed NAPAF norms for 72%, whereas in the submissions, it has indicated 70%. The same may be clarified;
- (c) Calculation for relaxed NAPAF claimed (in M S Excel) correlating with the model study as approved by CEA;
- (d) Calculation of Design Energy (in M S Excel) approved by CEA;
- (e) Actual PAF achieved till date (duly certified);
- (f) Status of load provided by the beneficiary State and steps taken by the Petitioner to improve the same;
- (g) Impact on PAF and auxiliary consumption once full load is being scheduled from the instant generating station;
- (h) Complete model study report approved by CEA.

20. The Petitioner vide affidavit dated 27.10.2021 in reply to the above ROP of the hearing dated 14.10.2021 has submitted as under:



- a. The Petitioner submitted the proposal of NAPAF to CEA vide letter no. NEEPCO/GHY/D&E/T58/2019-20/696 dated 20-08-2019. CEA examined the model study report and the Report was found to be generally in agreement with the specifications & relevant IEC Codes.
- b. Regarding the Petitioner, in its prayer, has requested for relaxed NAPAF norms for 72% was inadvertently mentioned instead of “70%” in the petition and prayer and begs pardon for the inconvenience thus caused.
- c. The revised calculation of relaxed NAPAF correlating with the model study. Based on the revised calculation, the Petitioner has requested approval of the relaxation of the Normative Plant Availability Factor (NAPAF) to 70 % for the 60 MW (2 X 30`MW) Tuirial Hydro Electric Plant for the recovery of full capacity charges with effect from COD till completion of the useful life of the plant.
- d. Annual Plant Availability Factor of Tuirial Hydro Electric Plant since Commercial operations of the Plant are as follows :

SL No.	Y E A R	ANNUAL PAF
1	2018 19	50.916
2	2019-20	75.011
3	2020-21	74.259
4	2021-22 (Up to Sept 21)	60.666

- e. Status of load provided by the beneficiary State and step taken by the Petitioner to improve the same.

The following Table reflects the Schedule made by SLDC, Mizoram against Declared Capacity in MU of 60 MW Tuirial HEP



SL No.	Y E A R	DECLARED CAPACITY (MU)	SCHEDULED ENERGY (MU)
1	2018 19	183.772	165.41
2	2019-20	230.533	172.098
3	2020-21	215.754	150.476
4	2021-22 (Up to Sept 21)	72.568	37.381

From the above data, it is seen that the scheduling is less than the declaration. SLDC Mizoram is persuaded to draw power as per DC on a regular basis. It is worth mentioning here that, although the schedule made by SLDC, Mizoram is less than Declared Capacity, there had been no Spillage of Water from the Reservoir during 2019-20, 2020-21 and 2021-22 (up to September). The lean season had already started.

It is further seen that because of the rainfall pattern in Mizoram, which generally occurs from August to Nov, the RWL increases and then starts decreasing. In the remaining period, the generation is maintained by utilizing the reservoir water with available minimum water flow in the reservoir. In order to ensure optimum utilization of reservoir water, the generation from the plant is declared accordingly so that reservoir water can be maintained near MDDL with some margin.

f. Regarding the Impact on PAF and Auxiliary consumption once a full load is scheduled from the instant Generating Station, the Petitioner has submitted the following facts for perusal:

(A) Impact of full loading on PAF:

(i) The rainfall pattern during the last 3 ½ years at the catchment areas of Tuirial Reservoir was such that full loading of Tuirial Power Station was possible during the months of August, September, October and November



only. In the remaining months, due to the depletion of the Reservoir Water level, plant had to be run on part load.

(ii) The PAF achieved during the last 3 ½ years has been as follows:

From the table, it may be observed that the maximum Annual PAF achieved in respect of Tuirial HEP during the previous 3 ½ years was **75.011** and the average Annual PAF during the same period has been **66.605 (up to Sept 2021)**.

PAF of TrHEP From 2018-19 to 2021-22

Month	PLANT AVAILABILITY FACTORS				Average PAF
	2018-19	2019-20	2020-21	2021-22	
April	29.798	64.327	61.516	43.860	49.875
May	37.254	58.770	60.728	28.677	46.357
June	63.244	68.601	61.966	47.627	60.360
July	71.304	72.156	53.655	63.776	65.223
August	30.303	91.528	74.061	84.128	70.005
September	30.303	96.829	83.446	95.929	76.627
October	50.722	89.951	95.011		78.561
November	60.157	76.389	96.042		77.529
December	53.438	84.345	89.787		75.857
January	53.220	79.339	82.822		71.794
February	63.913	71.315	71.453		68.894
March	67.340	46.580	60.620		58.180
Annual PAF	50.916	75.011	74.259	60.666	66.605

As PAF depends on Declared Capacity (3 Hrs. Maximum Capability of the Plant) and Declared Capacity depends on Available Reservoir Water level and Machine availability, full loading (when Reservoir Water level permits full loading) or Part loading of the plant by SLDC shall have no impact on PAF.



PAF has a direct relationship with Machine availability and Reservoir water level. Since our Machine availability during 2018-19, 2019-20, 2020-21 and 2021-22 (Up to September 2021) were 72.50%, 94.68%, 98.20% and 92.01% (Up to Sept 2021) respectively, the only factor that restricted in the achievement of NPAF of Tuirial HEP is Reservoir Water Level that depends on Rainfall in the Catchment Area of the Reservoir.

(B) Impact of full loading on auxiliary consumption:

The percentage of auxiliary consumption reduces with an increase in generation. The average auxiliary consumption observed is as follows:

Year 2018-19 =4.84%

Year 2019-20 =4.50%

Year 2020-21 =4.32%

Hearing dated 13.6.2023

21. The matter was heard on 13.6.2023 and Commission directed the Petitioner to submit the following information:

(a) Actual PAF for the period 2021-22 and 2022-23.

(b) Status of revision of design energy by CEA.

(c) The month wise 10 daily discharge data as per design and as per actual for the period 2014-19 and 2019-24.

(d) Calculations in support of relaxation sought for Auxiliary Energy Consumption giving a breakup of design auxiliary load with actual auxiliary load and reason for the difference, if any.

22. The Petitioner vide affidavit dated 13.7.2023 in reply to the above ROP of the hearing dated 13.6.203 has submitted as under:

A. The actual PAF for period 2021-22 and 2022-23 are mentioned below:



MONTHLY PAF (IN PERCENTAGE)				
2021-2022			2022-2023	
Month	PAF (%)		Month	PAF (%)
Apr-21	43.86		Apr-22	50.49
May-21	28.68		May-22	34.06
Jun-21	47.63		Jun-23	66.75
Jul-21	63.78		Apr-22	78.63
Aug-21	84.13		May-22	97.24
Sep-21	95.93		Jun-23	90.87
Oct-21	97.51		Apr-22	97.62
Nov-21	97.84		May-22	96.55
Dec-21	93.71		Jun-23	93.05
Jan-22	82.82		Apr-22	87.23
Feb-22	77.60		May-22	77.00
Mar-22	65.14		Jun-23	69.22
YEARLY (21-22)	73.217869		YEARLY (22-23)	78.2259983

B. The Status of revision of design energy by CEA as mentioned below:

- i. In the DPR of Tuirial HP Station of NEEPCO, a long term runoff series from 1956 to 1984 was developed by CWC using observed discharge data at Baghkhal, Checkersham, Monierkhal, Tuirial GD site on Tuirial/Sonai River and Lakhipur site on Barak river. To update the hydrological series, daily discharge data of Fulertal G& D Site of CWC was collected and an updated Hydrological Study Note was submitted to Hydrology Directorate (NE), CWC vide letter No. CA/63/406 dated 26.10.2021.
- ii. Hydrology (NE) Directorate, CWC vide letter no. File No. T-11034/1/2022-HYD(NE) dated 13.01.2022 made some observations like exploring the possibility of using the discharge data available at any other G&D site of comparable area located in the vicinity of the project.



- iii. Chief Engineer, BOBO, CWC Shillong office was contacted for recent hydrological Data of Tuirial/Sonai River, and an online application was submitted on 8.6.2023.
 - iv. Chief Engineer, BOBO, CWC Shillong called for a PPT presentation on the purpose of utilization of the hydrological data of Barak River vide File No.T-36055(11)/2/2023/BBBO-SHILLONG dated 23.6.2023. A Power Point Presentation was delivered to the Chief Engineer and his team, BOBO, CWC, Shillong on 4.7.2023. The Chief Engineer agreed to recommend to the Committee to provide 10 daily discharge data of the Monierkhal G & D site and Tuirial G&D site to NEEPCO. Accordingly, re-application for the above-mentioned G&D Sites has been submitted on 10.7.2023.
 - v. Once 10 daily discharge data of Monierkhal and Tuirial GD sites of CWC over Tuirial/ Sonai River is available, the Updated Water availability study will be submitted to the Hydrology Directorate of CWC for their approval.
- C. Regarding the month-wise 10 daily discharge data as per design and as per actual for the period 2014-19 and 2019-24, Petitioner placed before the following points for kind perusal:
- i. In the DPR of Tuirial HP Station of NEEPCO, a long term runoff series from 1956 to 1984 was developed by CWC using observed discharge data at Baghkhal, Checkersham, Monierkhal, Tuirial GD site on Tuirial/Sonai River and Lakhipur site on Barak river. These data are on monthly format.
 - ii. G & D Site established by the Project Authority at the Dam site has collected data up to 14th Nov. 2016 and shut down the G & D Site on account of Reservoir



Impounding for the commissioning of the Project. These data are in 10 daily formats.

D. The connected load while the unit is operating is itself 2.93%. Further, the Auxiliary consumption in the hydro Power stations also occurs when the Plant is non-operating/shut down. These loads that consume power when the plant is non-operating/shut down are Generator Heaters, Ventilation and air-conditioning System, drainage and dewatering system, Compressed Air System, OPU, lighting loads, Transformation loss in the Station Service Transformer, etc. In winter months, plants operate hardly for 3 hours, and during the rest of the 21 hours in a day, the above loads consume energy, shooting up the overall percentage of auxiliary consumption. Further, to sort out the excess auxiliary energy consumption issue, the petitioner also engaged Central Power Research Institute, Bangalore.

The Actual Auxiliary consumption for the year 2021-22 & 2022-23 is mentioned below:

MONTHLY APC (IN PERCENTAGE)				
2021-2022			2022-2023	
Month	APC (%)		Month	APC (%)
Apr-21	7.18504662		Apr-22	6.897530179
May-21	9.23062204		May-22	7.046142383
Jun-21	7.92392577		Jun-23	4.810981806
Jul-21	5.97477742		Apr-22	3.772093418
Aug-21	4.44041824		May-22	4.052512015
Sep-21	4.43371364		Jun-23	4.130365761
Oct-21	3.93247372		Apr-22	3.866079918
Nov-21	4.36869271		May-22	4.157003653
Dec-21	4.06374471		Jun-23	4.306008396
Jan-22	4.09281979		Apr-22	4.076584503
Feb-22	4.40366204		May-22	4.201059133
Mar-22	4.42791683		Jun-23	4.602812000
YEARLY (21-22)	5.37315113		YEARLY (22-23)	4.659931097



23. Based on the above submissions and documents on record, we now proceed to deal with the prayer of the Petitioner in the following paragraphs.

Analysis and Decision

24. We have considered the submissions.. The Petitioner has prayed for relaxation of NAPAF and relaxation of Auxiliary consumption w.r.t. to Tuirial Hydro Electric Plant in the given peculiar facts and circumstances:

(A). Normative Plant Availability Factor (NAPAF)

25. The Commission, vide order dated 9.10.2018 in petition no. 15/GT/2018 and vide order dated 10.3.2021 in petition no. 329/GT/2019 had allowed NAPAF of 85% for the 2014-19 tariff period for the instant generating station. Similarly, for the 2019-24 tariff period, the Commission vide order dated 16.4.2021 in petition no. 390/GT/20220 had allowed NAPAF of 85%. The Petitioner in the above petitions had requested for relaxation of NAPAF for the instant generating station and claimed NAPAF of 82% for both the tariff periods i.e., 2014-19 and 2019-24. However, the Commission, in above stated orders, had not considered the prayer of the Petitioner for relaxation of NAPAF, The Commission in its order dated 9.10.2018 in Petition No.15/GT/2018 had allowed NAPAF of the generating station as under:

“80. The petitioner vide Form-2 has claimed NAPAF of 85%. Subsequently vide affidavit dated 13.7.2018 the petitioner has claimed NAPAF as 82% based on the following justification.



Calculation of Normative Annual Plant Availability Factor (NAPAF)

81. The Salient features for Tr HEP are as follows:

FRL:	90.5m
MDDL:	68.0m
Normal TWL at Full Load:	30.7m
TWL at 1 unit running:	29.3m

82. From the above it has been observed that the Head Variation between FRL and MDDL is more than 8% for the instant case. Hence month wise peaking capability shall form the basis of fixation of NAPAF. However, as confirmed by the model studies carried out by the E&M Contractor, the load generation (MW) is reduced with lowering of reservoir level/ head. The aforesaid machine characteristic was not considered by CWC while carrying out the Power Potential Study for the DPR.

83. However, while determining monthly peaking capability, the net head calculated in the DPR has been considered. The net head has further been reduced by another 2.0m considering existing TWL. Tail water Level gets raised by approximately 2.0m due to raising of river bed level in downstream of the project which is beyond the control of NEEPCO. From the calculated Monthly Peaking Capability, the obtained NAPAF is 96%. Considering 10% allowance for outage & 5% for North- eastern region, the final NAPAF is $0.85 \times 96\% = 82\%$

84. Regulation 37 (1) (b) of the 2014 Tariff Regulations provides that in case of storage and pondage type plants with head variation between full reservoir level and minimum draw down level is more than 8% and when plant availability is not affected by silt, the month wise peaking capability as provided by the project authorities in the DPR (approved by CEA or the State Government) shall form basis of fixation of NAPAF. The submission of petitioner for consideration of NAPAF of 82% cannot be accepted at this stage. The monthly peaking capability based on which NAPAF of 85% has been furnished in Form-2 of original tariff petition is based on the net head furnished in the DPR. If there is any reduction in the net head subsequently due to rise in water level in the tail raise then the petitioner should approach the authority / government body which has approved the DPR.

85. In view of the above, NAPAF of 85% is allowed for the year 2018-19. However the petitioner is granted liberty to approach the Commission at the time of truing up along with revision, if any, in the net head duly approved by the competent authority as the same will be in accordance with the law.”

26. Similarly, the Commission, in an order dated 16.4.2021 in petition no. 390/GT/20220 with regard to NAPAF observed as under:



*“42. As against the claim of the Petitioner for NAPAF of 82%, the Commission vide its Orders dated 9.10.2018 in Petition No. 15/GT/2018 and dated 10.3.2021 in Petition No.329/GT/2019 had allowed NAPAF of 85% subject to revision if any, based on approval of CEA on the request of the Petitioner. Considering the fact that the request of the Petitioner for NAPAF of 82% is still pending before CEA, we consider the NAPAF of 85% in this order. **The Petitioner is, however, granted liberty to approach the Commission after obtaining approval of CEA with regard to revision of NAPAF.**”*

27. In view of the above backdrop, the Petitioner, in the instant petition, has submitted that:

- (i) The Tuirial Hydro Electric Plant is operated in a wide variation of reservoir level with full reservoir level at El. 90.5m and minimum draw-down level at El. 68.0 m. Maximum reservoir level (MRL) and Normal Maximum Operating Level (FSL) are El. 95.2m and El. 90.5m respectively. Here FSL is considered as full reservoir level. This variation of 22.5m is 42.4% of the rated net head of 53.0m. This significant variation has put certain limitations in the design and subsequent operation of machines. The machines of the plant have been designed for a 53m design head, and thus, the demonstration of a rated installed capacity of 30 MW per machine is possible only when the reservoir level is El. 84.38m or above. Below El. 84.38m, the machine rating gets reduced gradually commensurate to the available head and it reduces even up to 17MW against the rated nameplate capacity of 30MW.



(ii) This characteristic has become evident during the operation of the plant for the last three years. The turbine model study carried out before the manufacturing of the machine also clearly shows this reduction in MW capability. This issue covered in the model study was submitted to CEA for examination. CEA, vide letter dated 30.9.2020, agreed to the outcome of the study. The study, inter alia, shows MW limitations as given below:

Sl. No.	Head (m)	Max. permissible MW per machine
1	59.7	31.05
2	56.7	31.05
3	53.0	31.05
4	44.7	25.30
5	34.2	17.00

(iii) As the reservoir level is directly related to the Plant Availability Factor (PAF) of the plant, additional letup is due for the Normative Annual Plant Availability Factor (NAPAF).

(iv) DPR for the plant prepared by CEA/CWC was very old (1991), and the discussed characteristic was not covered in month-wise peaking capability nonetheless the plant's head variation between full reservoir level and minimum draw down level is more than 8% and plant availability has not been affected by silt. Because of the inadequacy of DPR, the Corporation has not been able to get the benefit of lower NAPAF under the above provision.

(v) The reduction in MW output, as discussed above, is a known and established plant limitation in operating conditions. Therefore, the plant deserves lower NAPAF by virtue of the above-referenced regulation.



(vi) Reduced NAPAF is calculated based on model study output vetted by CEA and actual reservoir level for the last three years since commissioning of the plant. Month wise maximum MW capability is calculated corresponding to the average monthly reservoir level based on model study output. PAF, without considering the discussed limitation is 85% for the plant and therefore proposed reduced NAPAF is 70% with a 15% reduction (10 % for outage + 5 % for N. E. Region) from the calculated value of 85 %.

(vii) In view of the facts and circumstances mentioned above, Commission may be pleased to revise the NAPAF of the 60 MW Tuirial Hydro Electric Power Plant in accordance with the opinion of CEA with effect from the Date of Commercial Operation of the Plant by invoking the powers vested in it under Regulations 54 (Power to Relax) and 55 (Power to Remove Difficulties) of the Tariff Regulations, 2014, and Regulations 76 (Power to Relax) and 77 (Power to Remove Difficulties) of the Tariff Regulations, 2019.

28. With regard to NAPAF of the instant generating station, CEA vide its letter dated 20.10.2020 had conveyed its observation on the Model Study submitted by the Petitioner to CEA. The following is the average PAF submitted by the petitioner from January 2018 to October, 2020:

Year	Month	Average Reservoir Level (m)	Net Head (m)	Maximum MW capability (As per Model Study)	Installed Capacity (MW)	PAF	Average Annual PAF	Average Weighted PAF
2017-18	Jan-18	83.56	50.22	59.50	60	99%	89%	85%



	Feb-18	78.67	45.57	52.64	60	88%	
	Mar-18	76.25	43.28	48.72	60	81%	
2018-19	Apr-18	74.33	41.45	45.53	60	76%	85%
	May-18	72.05	39.29	41.78	60	70%	
	Jun-18	74.48	41.59	45.77	60	76%	
	Jul-18	77.80	44.75	51.26	60	85%	
	Aug-18	83.17	49.85	59.03	60	98%	
	Sep-18	87.58	54.04	62.10	60	104%	
	Oct-18	86.15	52.68	62.11	60	104%	
	Nov-18	83.08	49.76	58.92	60	98%	
	Dec-18	78.18	45.10	51.86	60	86%	
	Jan-19	74.74	41.84	46.21	60	77%	
	Feb-19	74.18	41.30	45.27	60	75%	
	Mar-19	73.11	40.29	43.50	60	73%	
	2019-20	Apr-19	72.21	39.44	42.04	60	
May-19		71.58	38.84	41.02	60	68%	
Jun-19		73.18	40.35	43.61	60	73%	
Jul-19		77.78	44.73	51.23	60	85%	
Aug-19		83.74	50.39	59.70	60	100%	
Sep-19		88.18	54.61	62.10	60	104%	
Oct-19		88.76	55.16	62.10	60	104%	
Nov-19		86.23	52.76	62.17	60	104%	
Dec-19		81.46	48.22	56.79	60	95%	
Jan-20		78.07	45.00	51.69	60	86%	
Feb-20		75.97	43.01	48.26	60	80%	
Mar-20		74.00	41.13	44.97	60	75%	
2020-21		Apr-20	71.86	39.10	41.47	60	69%
	May-20	70.85	38.14	39.87	60	66%	
	Jun-20	72.25	39.48	42.11	60	70%	
	Jul-20	74.33	41.44	45.52	60	76%	
	Aug-20	79.34	46.21	53.69	60	89%	
	Sep-20	81.77	48.51	57.22	60	95%	



	Oct-20	86.14	52.67	62.10	60	104%		
Annual Average Weighted PAF = 85%								
Considering another 15% allowance								
NAPAF for the plant= 85% - 15%= 70%								

29. Further, the Petitioner in the main petition and in reply to ROP dated 13.6.2023 has submitted the following actual PAF for the period from 2018-19 to 2022-23:

2018-19	2019-20	2020-21	2021-22	2022-23	Average
50.92	75.01	74.26	73.22	78.22	70.33

30. We have anxiously considered the matter. It is noticed that the actual PAF of the generating station is less than the NAPAF of 85% allowed for the generating station. The Petitioner has submitted that the Machine availability during 2018-19, 2019-20, 2020-21 and 2021-22 (Up to September 2021) were 72.50%, 94.68%, 98.20% and 92.01% (Up to Sept 2021), respectively. Further, it is also noticed that the DPR for the plant prepared by CEA/CWC was very old (1991) and the head variation between full reservoir level and minimum draw-down level of more than 8%. With regard to the relaxation of NAPAF, the Petitioner was granted liberty to approach the Commission after obtaining approval of competent authority/ CEA. The same was also allowed by the Commission for the instant generating station in tariff orders for the period 2014-19 and 2019-24 with liberty to approach the Commission. The petitioner has filed the instant petition based on the letter of CEA in this regard.

31. On perusal of the letter dated 30.9.2020 from CEA, it is noticed that CEA has not categorically provided a revised NAPAF. Accordingly, in the absence of the same, we



hereby consider the average actual PAF achieved by the generating station from the period 2019-20 to 2022-23, which comes out to 75%.

32. In view of the above, we are of the view that it is a fit case to invoke our power to relax. Accordingly, we hereby relax the NAPAF to 75% based on of actual PAF achieved by the generating station from the period 2019-20 to 2022-23 invoking the powers vested under Regulations 54 of the Tariff Regulations, 2014, and Regulations 76 of the Tariff Regulations, 2019 from the Date of Commercial Operation of the Plant the instant generating station i.e. for the 2014-19 tariff period and 2019-24 tariff period. This is to further clarify that the above relaxed NAPAF of 75% is for the purpose of recovery of capacity charges for the generating station. However, the calculation of incentive on capacity charges shall be considered for NAPAF above 85% on an annual basis. The relaxed norms for the 2019-24 period are subject to the final recommendation of CEA, which will be considered at the time of true-up.

(B) Auxiliary Energy consumption (AEC)

33. Commission vide order dated 9.10.2018 in petition no. 15/GT/2018 and vide order dated 10.3.2021 in petition no. 329/GT/2019 had allowed a normative AEC of 1% for the 2014-19 tariff period for the instant generating station. Similarly, for the 2019-24 tariff period, the Commission, vide order dated 16.4.2021 in petition no. 390/GT/20220 had allowed a normative AEC of 1.2%.

34. The Petitioner has submitted as per the actual operational data the auxiliary energy consumption is in excess of the normative of 1.0 % and 1.2 % and stands at 3.03 % in 2017-18 (1 unit running -3 months and 2 units running- 2 months), 4.48 % in 2018-19, 4.04 % in the year 2019-20 and 4.65 % in 2020-21 (up to Aug'2020). This above-



mentioned auxiliary consumption is tabulated as follows with respect to the gross generation of the plant:

Parameter	30.10.2017 to 31.03.2018	01.4.2018 to 31.03.2019	01.4.2019 to 31.03.2020	01.04.2020 to 31.08.2020 (5 months only)	Average Weighted AEC considering w.e.f.01.4.2018.
Gross Energy generation (MU)	79.1057	168.435	177.0114	46.05	4.304 %
Total ex-bus energy generation (MU)	76.8697	160.7812	169.6915	43.9198	
Auxiliary Energy Consumption (MU)	2.3989	7.5529	7.1563	2.1421	
Auxiliary Energy Consumption (%)	3.03252	4.48416	4.04285	4.65168	

35. Petitioner has stated that the auxiliary energy consumption in Tuirial Hydro Electric Plant exceeding the normative rates may be attributed to the following causes:

- (i) Power consumption by Electrical drives utilized for generation of power. A substantial quantum of power is required to maintain various auxiliary equipment and systems both when the units are running and when units are not running
- (ii) The station is operating in isolation, not being connected with ISTS through 220 KV or 400 KV lines, but connected with 132 KV and 66 KV lines of STU viz. Power & Electricity Department of Mizoram. Sufficient load is not available in the area to absorb the entire available capacity of the Plant.



- (iii) Operation of units in partial load due to frequent under-requisitioning of capacity by the sole beneficiary of the Plant, viz. Mizoram.
- (iv) Lighting of the project area.
- (v) Dam Auxiliaries.
- (vi) It is further mentioned that during the winters, load availability (demand) is there, but generation is less as per availability of water therefore, actual auxiliary consumption will be higher in terms of percentage (approx.4 - 5%).

36. With regard to AEC, Commission, vide ROP of the hearing dated 13.6.2023 directed the Petitioner to submit '*Calculations in support of relaxation sought for Auxiliary Energy Consumption giving breakup of design auxiliary load with actual auxiliary load and reason for the difference, if any*'. The Petitioner, in reply to the above has submitted that the connected load while the unit is operating is 2.93%. Further, the Auxiliary consumption in the hydro Power station also occurs when the Plant is non - operating/shutdown. These loads that consume power when the plant is non-operating/shut down are Generator Heaters, Ventilation & Air-conditioning System, drainage and dewatering system, Compressed Air System, OPU, lighting loads, Transformation loss in the Station Service Transformer, etc. In winter months, plants operate hardly for 3 hours, and during the rest of 21 hours in a day the above loads consume energy, shooting up the overall percentage of auxiliary consumption. Further, to sort out the excess auxiliary energy consumption issue the Central Power Research Institute, Bangalore has been engaged. The Petitioner has also submitted that the Actual Auxiliary consumption for the year 2021-22 & 2022-23 is 5.37% and 4.66%, respectively.

37. We have examined the matter. It is noticed that the AEC is much more than the normative AEC allowed to the instant generating station. In support of the same, the



Petitioner has submitted the energy audit report of Central Power Research Institute, Bangalore. The following are the observations in the report:

(i) As per the scheme of the complete energy generation and distribution system, the incoming 132 kV from local grid is stepped down to 33 KV by a 5 MVA station service transformer (SST) and then stepped down to 433 V by two 1000 kVA station auxiliary transformers (SAT) and distributed to various loads. The 415 V supply from 2 x 500 kVA DG sets is fed to various loads during grid power supply failure. The generated power from Units at 11 kV is fed to GT, UAT & excitation transformer. When units are under generation, UAT caters to unit auxiliary loads through the UAB bus. Grid supply is used for station loads in the power house and colony.

(ii) Power is measured at the generator output and at the generator transformer output to get the total unit auxiliary power consumption. Difference of these two measurements includes power consumption by excitation system and unit auxiliaries. Generator transformer loss is found by further deducting power consumption by the excitation system and unit auxiliaries. Transformer loss, thus estimated, is within a measurement accuracy of 1 %, and it may vary depending on test conditions.

(iii) The typical auxiliary power usage in the plant at various test loads is computed considering the two units in operation. It is seen that the station auxiliary power including common loads is 1.51 % to 1.92 % at various test loads when Unit#1 alone is in operation whereas auxiliary power consumption when Unit#2 alone is operating is 2.94 % to 3.99 % at various test loads. There is a common station load (Imported energy from the grid for plant operation) of 117.6 kW which will get distributed for two units when both are in operation. When two units are in operation, effective auxiliary consumption varies from 2.01 to 2.64 % at different loads. However, when entire year operation of Units and auxiliaries are considered, this value may be different. Auxiliary power consumptions (APC) on monthly basis for the plant from the past data which is



higher than the APC observed during the audit time. This is due to change in the operational duration of units based on variation in the seasonal availability of water and demand by the grid. APC can vary even if the plant is operated at a particular generation depending on the pattern in which both the units operates. This happens due to high APC observed in the Unit #2.

(iv) It is found that difference between measured power at generator output and generator transformer secondary side varies from 622 kW to 760 kW at different loads. Consumption by unit auxiliaries is nearly 120 kW and by excitation system is 55 kW — 65 kW during different loads. Taking consumption by excitation system and unit auxiliaries into account, rest of the difference cannot be attributed to transformer loss without completely ruling out the possibilities for measurement error. Since there are no abnormalities observed in the transformer such as unusual temperature rises of GT cooling water, noise etc., this difference can be due to improper instrumentation for metering. This leads to further scope of work to converge on the exact cause for the loss which is an implementation measure. Further, higher loss of Generator transformer # 2 is prevailing since commissioning. Hence, this need to be studied by competent agency or OEM to curtail the existing high loss for identifying whether the issue is with GT or with the measurement system, transformer bank of Unit #1 and Unit #2 can be swapped and the energy meter readings is to be observed for both the units. By this way, exact cause of the issue can be identified.

38. The conclusion of above report is as under:

- (i) The operating net head and water flow to turbines are at par with design.
- (ii) The efficiencies of all the turbines and generators are good.
- (iii) Primary and secondary cooling water flow to various purposes needs to be reduced to ensure the optimum temperature rise. The use of an AC variable frequency drive with motors of secondary CWP will save 153.1 MWh/year, which is equivalent to Rs.9.03 Lakhs/year. As the head available is sufficient to circulate



the primary CW water, primary pumps in the line may be bypassed to save 217 MW/year (Rs.12.8 Lakhs/year).

- (iv) Reduction of contract demand with Electricity Department to optimum level will lead to considerable savings in Energy bill which saves Rs.34.56 Lakhs/year.
- (v) It is found that the difference between measured power at generator output and generator transformer secondary side for Unit #2 varies from 622 kW to 760 KW at different loads which is very high. Auxiliary power consumption was found on par with Unit #1. It is either due to GT loss or due to an error in the measurement system. For identifying whether the issue is with GT or with the measurement system, the transformer bank of Unit # 1 and Unit # 2 can be swapped, and the energy meter readings are to be observed for both the units.
- (vi) As the energy loss is identified on the GT # 2 or due to metering system, this leads to further scope of work to converge on the exact cause for the loss, which is an implementation measure. Further, higher loss of Generator transformer # 2 is prevailing since commissioning. Hence, this needs to be studied by a competent agency or OEM to curtail the existing high loss.

39. The petitioner has submitted that the connected load while the unit is in operation is around 2.93%. The above report also observed that when two units are in operation, effective auxiliary consumption varies from 2.01 to 2.64 % at different loads. On perusal of the above report, it is noticed that AEC is more than the normative AEC of 1% for the period 2014-19 and 1.2% for the 2019-24 tariff period. Further, with regard to high APC observed in Unit # 2, the above report opined that *'this need to be studied by competent agency or OEM to curtail the existing high loss for identifying whether the issue is with GT or with the measurement system, transformer bank of Unit # 1 and Unit # 2 can be swapped and the energy meter readings is to be observed for both the units. By this way, exact cause of the issue can be identified'*.



40. The Petitioner has also submitted that a review of design energy is under consideration before the CEA. Accordingly, as per the recommendation in the above energy audit report of CPRI, the Petitioner is directed to approach the CEA with regard to fixing AEC. However, considering the fact that the connected load is more than the normative AEC, we allow an AEC of 4.304% of for the 2014-19 period based on the average weighted AEC data (para 34 above) as submitted by the petitioner by invoking the powers vested in it under Regulations 54 of the Tariff Regulations, 2014 from the Date of Commercial Operation of the Plant the instant generating station i.e. for the 2014-19 tariff period. For the 2019-24 tariff period, AEC will be decided based on the recommendation by the CEA.

41. Petition No. 125/MP/2021 is disposed of in terms of the above.

Sd/-	Sd/-	Sd/-	Sd/-
(P. K. Singh) Member	(Arun Goyal) Member	(I. S. Jha) Member	(Jishnu Barua) Chairperson

