**CENTRAL ELECTRICITY REGULATORY COMMISSION**
**NEW DELHI**

**Petition No. 15/MP/2014**

**Coram:**
**Shri Gireesh B. Pradhan, Chairperson**
**Shri A.K. Singhal, Member**
**Shri A.S. Bakshi, Member**

**Date of Hearing: 30.9.2014**
**Date of Order 05.2.2016**

**In the matter of**
Relaxation of Heat Rate Norms of Assam Gas Based Power Station (AGBPP) and Agartala Gas Turbine Power Station (AGTPP) of NEEPCO as per provisions of Regulation 44 (Power to Relax) of the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009.

**And**
**In the matter of**

North Eastern Electric Power Corporation Limited
Brookland Compound, Lower New Colony,
Shillong-793 003
Meghalaya **….Petitioner**

**Vs**

1. Assam Power Distribution Company Ltd.
Bijulee Bhawan, Paltan Bazar,
Guwahati – 781001

2. Meghalaya Energy Corporation Ltd.
Short Round Road, Lumjingshai,
Shillong – 793001

3. Tripura State Electricity Corporation Ltd
Agartala Banamalipur,
Agartala – 799001

4. Power and Electricity Department
Government of Mizoram,
Power House Complex,
Electric Veng, Aizawl – 796001

5. Electricity Department, Government of Manipur
Imphal Government of Manipur Keishampet,

Imphal – 795001

6. Department of Power, Government of Arunachal Pradesh
Government of Arunachal Pradesh,
Bidyut Bhawan, Itanagar – 791111

7. Department of Power, Government of Nagaland
Kohima – 797001

8. North Eastern Regional Power Committee
NERPC Complex, Dong Parmaw, Lapalang,
Shillong – 793006

9. North Eastern Regional Load Despatch Centre
Dongtieh, Lower Nongrah, Lapalang,
Shillong – 793006 **…Respondents**

**Following were present**:

Shri M.G. Ramachandran, Advocate, NEEPCO
Ms. Anushree Bardhan, Advocate, NEEPCO
Ms. Poorva Saigal, Advocate, NEEPCO

**ORDER**

The petitioner, North Eastern Electric Power Corporation Limited, has filed the present petition seeking relaxation of the heat rate norms fixed by the Commission for the Assam Gas Based Power Plant and the Agartala Gas Turbine Plant under Regulation 44 of the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009 (hereinafter referred to as "the 2009 Tariff Regulations").

**Background of the case:**

2. Assam Gas Based Power Project (291MW) and Agartala Gas Turbine Project (4x21 MW) (hereinafter referred to as 'the generating stations") are owned by the petitioner and the said generating stations have been commissioned on 1.4.1999 and 1.8.1998 respectively. The tariff of the generating stations are

determined by the Commission in terms of Section 79(1)(a) read with Section 62(1)(a) of the Electricity Act, 2003.

3. On 26.3.2009, the Commission notified the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009 ('the 2009 Tariff Regulations') applicable for the period 2009-14 and in terms of Regulation 26(ii)(e) of the 2009 Tariff Regulations, the normative Gross Station Heat Rate (GSHR) in respect of the generating stations are as under :

| Name of the generating station | Heat Rate (kCal/kWh) | |
|---|---|---|
| | Combined Cycle | Open Cycle |
| Assam GPS | 2400 | 3440 |
| Agartala GPS | - | 3500 |

4. Based on the 2009 Tariff Regulations, the Commission vide orders dated 6.9.2011 and 11.3.2011 in Petition Nos. 295/2009 and 299/2009 respectively approved the tariff for the generating stations considering the following Gross Station Heat Rate norms:

| Name of the generating station | Heat Rate (kCal/kWh) | |
|---|---|---|
| | Combined Cycle | Open Cycle |
| Assam GPS | 2400 | 3440 |
| Agartala GPS | - | 3500 |

5. Subsequently, based on the petition filed by the petitioner to revise the heat rate norms specified in 2009 Tariff Regulations, the Commission vide order dated 7.6.2012 in Petition No. 133/MP/2011 revised the Heat Rate norms with observation that GSHR specified in 2009 Tariff Regulations for generating stations were based on Net Calorific Value of fuel furnished by the petitioner inadvertently during the finalisation of 2009 Tariff Regulations and same is required to be recomputed and reviewed on the Gross Calorific Value of fuel. Relevant portion of said order dated 7.6.2012 is extracted as under:

> "19..On analysis, it is noticed that the actual energy rate recovered during the period 2004-05 to 2007-08 was lower than the energy rate recoverable based on actual

consumption of fuel and the actual price of fuel. Thus, it is evident that the petitioner had suffered due to higher actual Heat Rate in comparison to the Heat Rate norms specified under the 2004 Tariff Regulations, on account of mistake attributable to it. Based on the above discussions, and facts on record, we are of the view that the mistake in the data pertaining to Gross Station Heat Rate in respect of this generating station submitted by the petitioner during the finalization of operational norms for 2009-14 which had resulted in the notification of the 2009 Tariff Regulations, appears to be genuine for which necessary correction is required to be undertaken, in the interest of justice. Accordingly, in exercise of 'Power to relax' under Regulation 44 of the 2009 Tariff Regulations, we relax the normative Gross Station Heat Rate in respect of AGBPP (combined cycle mode) specified under Regulation 26(e)(ii) of the 2009 tariff Regulations. The actual average Heat Rate on NCV of fuel for the period 2003-04 to 2007-08 for the generating station is 2369 kCal/kWh, based on which the normative Heat Rate of 2400 kCal/kWh has been specified under Regulation 26(e)(ii) of the 2009 Tariff Regulations. After conversion of the Heat Rate based on NCV of fuel to GCV of fuel, the said Heat Rate (combined cycle) for the generating station would be 2511 kCal/kWh (2369x1.06). It is noticed that the actual gross Heat Rate of GT machines of similar frame size, of Indraprashtha Power Generation Company Limited (IPGCL), New Delhi is found to be in the range of 2504 kCal/kWh and 2557 kCal/kWh during 2007-08 to 2010-11. In terms of the above discussions, the normative Gross Heat Rate of 2400 kCal/kWh specified in respect of AGBPP (combined cycle mode) under Regulation 26(e)(ii) of the 2009 Tariff Regulations, is revised to 2500 kCal/kWh.

21. Based on the above decision, the prayer of the petitioner in paragraph 1(a) is disposed of by revision of Heat Rate norms for the generating stations as under:

| Name of the generating station | Heat Rate (kCal/kWh) | |
|---|---|---|
| | Combined Cycle | Open Cycle |
| Assam GPS | 2400 | 3440 |
| Agartala GPS | - | 3700 |

6. Gist of the submission of the petitioner in the present petition is as under:

(a) The fuel gas to Assam Gas Based Power Project (AGBPP) and Agartala Gas Turbine Power Plant (AGTPP) is being supplied by M/s Oil India Ltd and M/s GAIL respectively. The landed cost of fuel gas comprising price of fuel gas and transportation charge is recoverable from the beneficiaries based on the normative Gross Station Heat Rate (GSHR) and the normative Station Auxiliary Consumption (SAC) as specified under the 2009 Tariff Regulations.

(b) Subsequently, the petitioner observed that there was an inadvertent problem in the operational data, more specifically in the normative Gross Station Heat Rates prescribed by the Commission in the 2009 Tariff

Regulations, because of an inadvertent mistake on the part of the petitioner, while submitting the operational data to the Commission. In the said submission, the 'Weighted Average Net Calorific Value of fuel' was furnished as the 'Weighted Average Gross Calorific Value of fuel' by mistake. Accordingly, the petitioner approached the Commission to relax the Heat Rate norms.

(c) Even after relaxation of the Heat Rate norms by the Commission vide order dated 7.6.2012 in Petition No. 133/MP/2011, NEEPCO continues to suffer from under recovery of cost of fuel gas. The landed cost of gas and the actual recovery thereof in respect of the generating stations during the current tariff period are as under:

**Assam Gas Based Power Project (AGBPP):**

| Year | Landed Cost of Fuel Gas (Rs. Crore) | Landed Cost of Fuel Gas Actually Recovered (Rs. Crore) | Under Recovery of Landed Cost of Fuel Gas (Rs. Crore) |
|---|---|---|---|
| 2009-10 | 141.55 | 134.09 | 7.46 |
| 2010-11 | 267.95 | 246.93 | 21.02 |
| 2011-12 | 287.87 | 267.19 | 20.68 |
| 2012-13 | 319.43 | 294.17 | 25.26 |
| 2013-14 (up to September 2013) | 190.20 | 167.37 | 22.83 |

**Agartala GasTrubine Power Project (AGTPP):**

| Year | Landed Cost of Fuel Gas (Rs. Crore) | Landed Cost of Fuel Gas Actually Recovered (Rs. Crore) | Under Recovery of Landed Cost of Fuel Gas (Rs. Crore) |
|---|---|---|---|
| 2009-10 | 66.14 | 60.82 | 5.32 |
| 2010-11 | 118.90 | 109.81 | 9.09 |
| 2011-12 | 141.43 | 136.66 | 4.77 |
| 2012-13 | 146.75 | 140.09 | 6.66 |
| 2013-14 (upto September 2013) | 79.12 | 75.98 | 3.14 |

(d) On investigation into the matter, it was found that the under recovery is attributable to the fact that it is not practically possible for the generating

stations to achieve the Normative GSHR prescribed by the Commission in the 2009 Tariff Regulations despite all efforts and measures taken by it. Work has been taken up for renovation/up-gradation/replacement of the Gas Booster Station and control systems of the generating units of AGBPP. There was some inherent problem with the gas based generating station which resulted in frequent tripping of the station leading to increase of the station heat rate. The Commission vide order dated 6.9.2011 in Petition No. 295/2009 allowed the additional capital expenditure of ₹ 82.00 crore for these works during the tariff period 2009-14. The heat rate is expected to be improved and the same may be considered as the base for fixing the normative GSHR for the next period.

(e) The actual heat rates achieved by the generating stations during the period 2003-04 to 2007-08 as well as during the current tariff period are as under:

**2003-04 to 2007-08**

| | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | **Average** |
|---|---|---|---|---|---|---|
| **AGBP** (Kcal/KwH) | 2583 | 2683 | 2573 | 2637 | 2661 | **2627** |
| **AGTP** (Kcal/KWh) | 4011 | 3950 | 3789 | 3715 | 3703 | **3834** |

**2008-09 to 2012-13**

| | 2008-19 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | **Average** |
|---|---|---|---|---|---|---|
| **AGBP** (Kcal/KwH) | 2665 | 2565 | 2666 | 2733 | 2817 | **2689** |
| **AGTP** (Kcal/KWh) | 3748 | 3757 | 3754 | 3781 | 3813 | **3771** |

(f) In view of the above fact, since it is not practically feasible for the generating stations to achieve the heat rate norms specified by the Commission in Regulation 26 (ii) (e) of the 2009 Tariff Regulations, the Commission may take cognizance of the average actual achieved heat rates

during the period 2003-04 to 2007-08 and exercise its power conferred under Regulation 44 (Power to Relax) of the 2009 Tariff Regulations to relax the heat rate norms for the generating stations for the Tariff Period 2009-14 to enable the petitioner to fully recover the landed cost of fuel.

7. Against the above background, the petitioner has made the following prayers:

> "(a) Review the Heat Rate norms prescribed by it for the Assam Gas Based Power Plant and the Agartala Gas Trubine Plant of NEEPCO for the period 2009-14 and fix it at least at 2620 Kcal/KWh and 3830 KWh respectively.
>
> (b) Relax the Heat Rate norms as mentioned above with retrospective effect from 1.4.2009 to enable full recovery of the landed cost of fuel incurred during the current tariff period from the beneficiaries; and
>
> (c ) Allow recovery of the landed cost of fuel from the beneficiaries based on the relaxed Heat Rate norms with retrospective effect from the beginning of the current tariff period i.e. 1.4.2009
>
> or
>
> (iv) Pass any such further order or orders as the Commission may deem just and proper in the circumstances of the case."

8. The petitioner was directed to furnish the detailed investigation report elaborating the causes of such higher heat rate than the normative. The petitioner, vide its affidavit dated 7.3.2014, has submitted the investigation report based on past operational data which is summarised as under:

**(A) Assam Gas Based Power Plant (AGBP)- Investigation Report on reasons for actual heat rate being higher than the normative value:** As per the Commission's order dated 7.6.2012, the Normative Gross Station Heat Rates for the Assam GPS are 3440 kCal/kWhr for open cycle operation and 2500 kCal/kWhr for combined cycle operation (w.e.f 26.5.2011). Assam

GPS is operated in the combined cycle mode. However, due to various reasons, the heat rate achieved by the Assam GPS is higher than the normative values. The increase in the heat rate is attributable to various reasons viz. operation of gas turbines on either FSNL mode (no load) or part load which is summarised as under:

(a) Operation of gas turbines on either FSNL mode (no load) or part load**:** The committed quantity of gas to be supplied by Oil India Limited (OIL) as per the Agreement is 1.4 MMSCMD (Million Metric Standard Cubic Meter per Day) which is not adequate to run all the 6(six) gas turbines on full load and NEEPCO are compelled to run only 5(five) gas turbines. Two steam turbines are operated with respective steam generating WHRBs of 4 nos. gas turbines and the remaining Steam turbine is operated with only 1(one) WHRB in service. It is observed that any steam turbine with only one WHRB in operation does not generate 50% output, thereby leading to increase in heat rate. In order to run all 6(six) gas turbine on full load, around 1.75 MMSCMD of gas is required even the Commission allowed heat rate. It is noted that OIL is generally unable to supply the committed quantity of gas either in various hours of a day or in various months of a year. Further, the supply of gas is often erratic over the day and seen to increase and decrease at times. Decrease in supply of gas necessitates the operation of gas turbines of FSNL (no load) or part load. This results in increase of heat rate as gas is consumed by the gas turbine with little or no generation. The petitioner has submitted

the details of the average gas consumption for the period from 1.4.2009 to 31.3.2014 as under:

Financial Year **2009 to 2010**: Gas Consumption= 483.464238 MMSCM i.e. average of **1.32 MMSCMD**
Financial Year **2010 to 2011**: Gas Consumption= 524.127700 MMSCM i.e. average of **1.44 MMSCMD**
Financial Year **2011 to 2012**: Gas consumption= 505.883698 MMSCM i.e. average of 1**.39 MMSCMD**
Financial Year **2012 to 2013**: Gas consumption= 502.582022 MMSCM i.e. average of **1.38 MMSCMD**
Financial Year **2013 to 2014**: Gas consumption= 394.415216 MMSCM i.e. average of **1.43 MMSCMD** (up to 31.12.2013)

When inadequate quantum of gas is received from the supplier continuously for a few hours, gas turbines are not stopped, as it is not advisable to do so because frequent starts and stops lead to thermal stresses on the gas turbines. Therefore, it is required to operate the gas turbines of FSNL (Full Speed No Load) mode or part load. This result in increase in heat rate as gas is consumed by the gas turbines with very low or no generation output and steam turbines cannot operate as the minimum inlet steam temperature and pressure parameters cannot be achieved with low exhaust gas temperature.

(b) Reduction in gas turbine output due to high ambient temperature: Since the gas turbine is an air-breathing engine, its performance is changed by anything with the density and/or mass flow of the air intake to the compressor. Ambient weather conditions, in particular, the ambient temperature affects the heat consumption in

the turbine-the exhaust flow- the output and hence the heat rate. The increase in the ambient temperature results in decrease in the power output of the gas turbines which leads to the increase of the heat rate. The gas turbines in AGBPP are designed to operate at the rated output at an ambient temperature of $23^{o}$ C. It is noted that in the summer months when the ambient temperature is far above than $23^{o}$ C, the power output of a gas turbine falls to 28MW instead of rated output of 33.5 MW. The generation records reveal that the rated output of 33.5MW from the gas turbines is achieved only in the cold winter months of December and January. This is also one of major factors for non-achievement of the desired heat rate.

(c) Reduction in gas turbine output due to high humidity**:** Humid air, which is less dense than dry air, also affects power output and heat rate. As the power plant is located in a heavy rainfall and high humidity area, decrease in output for high humidity cannot be neglected. However, there is no metering system or any equipment to ascertain the loss due to change of humidity. The petitioner has placed on record the copy of GE gas turbine performance characteristic with its submission.

**(B) Agartala Gas Based Power Plant (AGTPP): Investigation report on reasons for actual heat rate being higher than the normative value**

(a) The details of GHR pertaining to AGTPP since 2007-08 are as under:

| Year | Gas Consumption MMSCM | Generation | Heat Rate (GCV Basis) kcal/kWh |
|---|---|---|---|
| 2006-07 | 267258380 | 653.818 | 3715.308 |
| 2007-08 | 268825737 | 659.809 | 3702.862 |

| | | | |
|---|---|---|---|
| 2008-09 | 270187712 | 660.507 | 3748.312 |
| 2009-10 | 271627172 | 662.56 | 3757.116 |
| 2010-11 | 263876529 | 643.988 | 3754.044 |
| 2011-12 | 273729988 | 666.106 | 3780.52 |
| 2012-13 | 263708711 | 632.700 | 3813.10 |
| 2013-14 Upto Jan 2014 | 224393068 | 536.56 | 3830.114 |

(b) AGTPP has an allotment of gas of 0.75 MMSCMD (Million Metric Standard Cubic Meter per Day) and with this quantity full load operation i.e. 84 MW is not possible even as the heat rate allowed by the Commission. The guaranteed (design) GHR of an individual gas turbine unit based on NCV (Net Calorific Value) stands at 3337 Kcal/kWh. Design GHR on GCV basis is not provided by the OEM. Therefore, as per empirical formula, the design/guaranteed GHR (GCV basis) of unit stands at 1.1x3370=3670 kcal/kWh.

(c) There were outages due to grid disturbances which are mainly attributable for being in the 132 kV pocket in very short spells and the units were to be kept on FSNL. The units are also in operation since last 15 years and the aging factor needs to be considered.

**(**d) In the months of December to February, dense foggy conditions persist in this region. As humid air is less dense than dry air, this also affects power output and hence, the heat rate. In the year 2012-13, the following major shutdowns were taken place:

| | | |
|---|---|---|
| Unit #1 | Major inspection and installation of Mark VIe panel | 16/11/2012 to 13/12/2012 for a period of 27 days |
| Unit #2 | Major inspection and installation of Mark VIe Panel and generator overhauling | 20/08/2012 to 30/09/2012 for a period of 41 days |

The shutdown taken for units#1 and 2 as depicted above called for frequent starting and stopping of the units during the commissioning process of MARK VIe panels also contributed appreciably for high heat rate.

(e) Since the gas turbine is an air-breathing engine, its performance is changed by anything with the density and/or mass flow of the air intake to the compressor. Ambient weather conditions, in particular, the ambient temperature affects the heat consumption in the turbine-the exhaust flow- the output. The increase in the ambient temperature results in decrease in the power output of the gas turbines which leads to the increase of the heat rate. During the peak summer, operating conditions also apply temperature limit preventing full load operation and rejection of load occurs. It is noted that in the summer months, NEEPCO is unable to generate up to rated capacity of 21 MW which is also one of the major factors for non-achievement of the desired heat rate.

9. Assam Power Distribution Company Limited (APDCL), vide its affidavit dated 29.8.2014, has submitted as under:

(a) The supply and transportation of gas for AGBPP and AGTPP are governed by bilateral agreements entered into between the petitioner and M/s Oil India Limited (OIL) and the Assam Gas Company Limited (AGCL) and M/s Gas Authority of India Limited (GAIL) respectively. APDCL is not party to these agreements. APDCL is sharing the fuel cost i.e. energy charge as per 2009 Tariff Regulations applicable from time to time, on the basis of

landed cost of fuel comprising price of gas with transportation charge, heat rate and calorific value of fuel.

(b) The petitioner should be directed to submit copies of gas supply and transportation agreements for examination of the Commission. Such agreements contain some standardized information like daily volume of gas to be made available/Minimum gas off-take, Calorific value and quality of gas to be maintained, etc. If there is any deviation of quality and quantity of gas supplied then the same should have been taken up with the supplier/transporter of gas and ultimate consumers should not be penalized.

(c) The petitioner has contended that even after the revision of heat rate norms, it still continues to suffer under recovery of its fuel cost. The reason of under recovery of cost of fuel is due to leakage/misuse/theft of fuel gas and/or poor quality of gas. Therefore, under recovery of cost of fuel should be investigated. If the under recovery of cost of fuel is due to the said reasons then it would be attributable to either the petitioner or to the fuel gas supplier/transporter and the burden should not shift to the respondents or the ultimate consumers.

(d) The generating stations have already completed its more than half useful life. In case of AGBPP, despite allowing additional capital expenditure of ₹ 82.00 crore during tariff period 2009-14, the petitioner has not yet been able to detect the alleged inherent problems of the machines and has failed to utilize the funds to rectify the problems faced by the generating stations

and continue to blame inadequate supply of gas both in terms of quality and quantity.

(e) Without any investigation for detection of causes of under recovery of fuel cost, heat rate norms of the petitioner`s generating stations should not be relaxed. As the higher heat rates result in higher fuel price, the matter has serious commercial implication on the ultimate consumers. The Commission should either engage CEA or any other expert agency to examine the problems of the generating stations to find out the reasons of under recovery of fuel cost. The Commission should arrange funds, if necessary for this purpose from the PSDF in the interest of ultimate consumers.

9. The matter was heard on 30.9.2014 on admission. The petitioner was directed vide ROP dated 30.9.2014 to file the following information:

(a) Unit-wise availability (%), planned outage (days), forced outage (days), generation at Generator terminals (MUs) and PLF (%) from FY 2004-05 to FY 2013-14;

(b) Year-wise quantum of gas received and the quantum of gas contracted for the period 2004-05 to 2013-14;

(c) Number of Hot Gas Path Inspection (HGPI) and Major inspection undertaken since the inception of the project till 2013-14; and

(d) Performance Characteristics curves of the OEM of gas turbines of AGBP and AGTP for part load operation."

10. The petitioner, vide affidavit dated 28.11.2014, has submitted the requisite information.

**Analysis and Decision:**

11. We have considered the submissions of the petitioner and the respondent and perused documents available on record. The petitioner, in this petition has sought the relaxation of Gross Station Heat Rate norms specified by the Commission in Regulation 26 (e) (ii) of the 2009 Tariff Regulations for these generating stations, on the ground that even after relaxation of the GSHR by the Commission vide order dated 7.6.2012 in Petition No. 133/MP/2011, the petitioner continues to suffer from under recovery of cost of fuel gas**.**

12. Regulation 26 (ii) (e) of the 2009 Tariff Regulations provides the normative GSHR in respect of the generating stations as under:

| Name of the generating station | Heat Rate (kCal/kWh) | |
|---|---|---|
| | Combined Cycle | Open Cycle |
| Assam GPS | 2400 | 3440 |
| Agartala GPS | - | 3500 |

13. The petitioner has submitted that there was some inherent problem in the operational data submitted by it, more specifically in the normative GSHR prescribed by the Commission in the 2009 Tariff Regulations, because of an inadvertent mistake on the part of petitioner, while submitting the operational data to the Commission. While submitting the operational data, 'weighted Average net Calorific Value of fuel' was furnished as the 'weighted Average Gross Calorific Value of fuel' by mistake. Subsequently, the petitioner filed the petition for review the heat rate norms with retrospective effect from 1.4.2009 for the generating stations on the basis of the correct operational data so that the landed cost of gas could be fully recovered from the beneficiaries. The Commission vide order dated 7.6.2012 in Petition No. 133/MP/2011 re-fixed the Heat Rate norms with effect from 26.5.2011 i.e. from the date of filing of Petition No. 133/MP/2011as under:

| Name of the generating station | Heat Rate (kCal/kWh) | |
|---|---|---|
| | Combined Cycle | Open Cycle |
| Assam GPS | 2500 | 3440 |
| Agartala GPS | - | 3700 |

14. The petitioner has submitted even after relaxation of norms of the heat rate, it continues to suffer from under recovery of cost of fuel gas.

16. It needs to be examined as to whether there exist sufficient grounds and reasonable justification for relaxation of the heat rate norms specified in the case of the generating stations by the Commission to exercise its power of relaxation.

**Assam Gas Based Power Project (AGBPP).**

17. The petitioner has submitted that owing to operation of gas turbines on FSNL mode or part load, reduction in gas turbine output due to high ambient temperature and reduction in gas turbine output due to high humidity heat rate of the generating station has been increased. The average design heat rates of AGBPP on LCV basis works out as 2135 kCal/kWh and 2164 kCal/kWh at 100% and 80% respectively loading and site ambient conditions. The deterioration in heat rate at 80% loading is of the order of 2164-2135= 29 kCal/kWh, which works out to 1.36% of the heat rate corresponding to 100% loading. It is noted that the Commission vide order dated 7.6.2012 in the Petition No.133/2011 allowed heat rate of 2500 kCal/kWh as against gross designed heat rate of 2263.1 kCal/kWh (on GCV basis) at 100% loading. Therefore, the operational norm of 2500 kCal/kWh has a margin of 10.47% over the designed heat rate (on GCV basis) at 100% loading. The generating station requires about 1.78MSCUM of gas/day to run it at 100% load based on Gross Station Heat Rate of 2500 kCal/kWh. On the contrary, the petitioner has submitted that the actual gas supply for the period 2009-14 is of the order of

1.32 mmscmd to 1.436 mmscmd, which corresponds to unit loading of 74.43% to 80.67%. However, the margin of 10.47% in the norm of Gross Station Heat Rate is sufficient to cover any further deterioration in loading and GCV of fuel. The petitioner has contended that there is variation in heat rate due to site ambient conditions of temperature and humidity. However, it is evidently clear that the guaranteed Station Heat Rate is specified corresponding to site ambient conditions. Therefore, the justifications given by the petitioner cannot be accepted. Accordingly, the petitioner`s prayer to relax the Gross Station Heat Rate in respect of AGBPP is rejected.

**Agartala Gas Turbine Power Project (AGTPP)**

18. The petitioner has submitted that due to (i) operation of gas turbines on either FSNL mode or part load, (ii) units are in operation since last 15 years and the aging factor needs to be considered, (iii) reduction in gas turbine output due to high ambient temperature, and (iv) reduction in gas turbine output due to high humidity, heat rate of AGTPP has been increased. The petitioner has submitted the data for the period 2009-14 in respect of AGTPP as under:

| Year | Energy Generated (MU) | Gas Consumption (SCUM) | Gas Consumption per day (MMSCUMD) | Contracted gas (SCUM) | Gross Heat Rate (kCal/kWh) |
|---|---|---|---|---|---|
| **2009-10** | 662.56 | 271627172 | 0.74418 | 273750000 | 3757.116 |
| **2010-11** | 643.988 | 263876529 | 0.72295 | 273750000 | 3754.044 |
| **2011-12** | 666.106 | 273729988 | 0.74995 | 273750000 | 3780.520 |
| **2012-13** | 632.700 | 263708711 | 0.72249 | 273750000 | 3813.100 |
| **2013-14 (Upto Jan)** | 536.56 | 224393068 | 0.73814 | 273750000 | 3830.114 |

| Year | Machine Availability Ranges from (%) | Forced Outage ranges from (days) | PLF (%) |
|---|---|---|---|
| **2009-10** | 98.11 - 99.07 | 0.55 - 6.77 | 89.09 |
| **2010-11** | 90.41 - 99.79 | 0.56 - 5.95 | 87.52 |
| **2011-12** | 95.94 - 99.37 | 0.00 - 2.29 | 90.30 |
| **2012-13** | 86.81 - 99.38 | 1.36 - 3.74 | 86.13 |
| **2013-14** | 95 - 99.48 | 0.52 - 2.18 | 86.01 |

19. The average design heat rate of AGTPP on LCV basis works out as 3337 kCal/kWh at 100% loading and site ambient conditions. The Commission vide order dated 7.6.2012 in the Petition No.133/2011 allowed heat rate of 3700 kCal/kWh as against gross designed heat rate of 3537.22 kCal/kWh (on GCV basis) at 100% loading. Therefore, the operational norm of 3700 kCal/kWh has margin of 4.47% over the designed heat rate (on GCV basis) at 100% loading. Based on Gross Station Heat Rate of 3700 kCal/kWh, the generating station requires about 0.77MSCUM of gas/day to run it at 100% load. As against this, the actual gas supply for the period 2009-14 as submitted by the petitioner is of the order of 0.72249 mmscmd to 0.74995 mmscmd, which corresponds to unit loading of 92.98% to 96.51%. Taking into account the above facts, operation of gas turbine on either FSNL mode or part load cannot be made out.

20. The petitioner has submitted that as the units of the generating station are in operation since last 15 years, heat rate of the generating station has been increased. It is clarified that in the 2009 Tariff Regulations, the petitioner has been allowed reasonable O&M expenses to maintain the generating station to sustain the efficiency and performance by undertaking regular inspection of hot gas path components and major overhaul from time to time at regular intervals. The petitioner also has the option to undertake comprehensive R&M for gas turbines to improve the performance and life extension. Therefore, the petitioner`s contention in this regard is not sustainable.

21. The petitioner has submitted that there is reduction in gas turbine output due to high humidity/foggy conditions in the months of December to February. The petitioner has contended that the increase in the ambient temperature results in

decrease in the power output of the gas turbines which leads to the increase of the heat rate of the generating station. It is clarified that the guaranteed Station Heat Rate is specified corresponding to site ambient conditions. Therefore, the contention of the petitioner in this regard is not tenable.

22. In view of the above, we do not find any reason to relax the heat rate norms for the generating stations for the period 2009-14.

23. Respondent No. 1, Assam Power Distribution Company Ltd., has submitted that in case of AGBP, the petitioner has not been able to detect the alleged inherent problems of the machines despite long running period of these machines. The Respondent No. 1 has requested that the Commission may direct thorough investigation into high heat rate to identify the actual problem/reason. In our view, the reasons for persistent failure of the petitioner to recover the cost of fuel needs to be investigated including any fault in the gas turbines and gas booster station. We direct CEA to investigate into the reasons of high heat rate of AGBP in consultation with the OEM i.e. BHEL and MHI and submit a report within three months from the date of this order.

24. The petition is disposed of in terms of the above.

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|---|---|---|
| **Sd/-** | **sd/-** | **sd/-** |
| **(A.S. Bakshi)** | **(A. K. Singhal)** | **(Gireesh B. Pradhan)** |
| **Member** | **Member** | **Chairperson** |