1693

NORTHERN POWER GENERATION COMPANY LIMITED

(GENCO – III)

LPM

TO ALIGN THE AUXILIARY CONSUMPTION ALLOWED IN GENERATION LICENSE AND TARIFF DETERMINATION

GHC

NORTHERN POWER GENERATION COMPANYLIMITED

MEHMOOD KOT ROAD
TPS MUZAFFAR GARH
Phone# 066-9200165
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Chief Executive Officer

No: CEO/MZG/Dir (Tech)/5296 Dated: 15/02/2018

The Registrar,
National Electric Power Regulatory Authority
NEPRA Tower, Ataturk Avenue (East), G-5/1,
Islamabad

Subject: **Application for Licensee Proposed Modification from Northern Power Generation Company Limited GENCO-III**

I, Ali Asghar, CEO, NPGCL, being the duly authorized representative of Northern Power Generation Company Limited (NPGCL) hereby apply to the National Electric Power Regulatory Authority (NEPRA) for the approval of Licensee Proposed Modification (LPM) in the Generation License of NPGCL No. GL/03 dated 1st July, 2002 pursuant to Regulation 10(2) of NEPRA (Application & Modification Procedure) Regulations, 1999 (AMPR).

I certify that the documents-in-support attached with this Application are prepared and submitted in conformity with the provisions of the AMPR, and undertake to abide by the terms and provisions of the above-said regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of my knowledge and belief.

A Bank Draft No. 126C3514 dated 15/02/2018 Rs. 703,469/- (Rupees - Seven Hundred Three Thousand Four Hundred Sixty Nine only) being the Licensee Proposed Modification fee calculated in accordance with Schedule II to the AMPR, is also attached herewith.

(Ali Asghar)
Chief Executive Officer

GHC

NORTHERN POWER GENERATION COMPANYLIMITED
MEHMOOD KOT ROAD
TPS MUZAFFAR GARH
Phone # 066-9200171
066-9200173
Fax # 066-9200172

Company Secretary

COPY OF THE RESOLUTION PASSED BY THE BOARD OF DRIECTORS OF NORTHREN POWER GENERATION COMPANY LIMITED IN THEIR MEETING HELD ON 06/01/2018 AT 1300 HRS IN COMMITTEE ROOM OF 425-MW, CCPP, NANDIPUR, DISTRICT GUJRANWALA

"Resolved that petition for Licensee Proposed Modification (**the LPM)** be filed by and on behalf of Northern Power Generation Company Limited (the **"Company")** with the National Electric Power Regulatory Authority **("NEPRA")** to align/ match the auxiliary consumption provided in Generation License with the auxiliary allowed Tariff Determination.

Further resolved that the Chief Executive Officer and Chief Engineer/ Technical Director be and are hereby jointly and individually authorized to sign all documentation, pay filing fees, appear before NEPRA and provide any information required by NEPRA in respect of the LPM and do all acts and things necessary for processing, completion and finalization of the LPM".

Company Secretary

NORTHERN POWER GENERATION COMPANY LIMITED

TeleNo. 066-9200293

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Office Of The
Chief Executive Officer
Genco-III, NPGCL, TPS,
Muzaffargarh

LICENSEE PROPOSED MODIFICATION IN THE GENERATION LICENSE NO. GAL/03/2002 DATED JULY, 01, 2002 OF NPGCL/GENCO-III

The LPM is being submitted as per National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999 clause (10.2) a~ c, as below,

10.2 (a) The Proposed Modification

In order to discharge its contractual obligations under the bilateral agreements with the companies, the Company is required to obtain and maintain a Generation License from NEPRA, which remains valid for the remaining life of the project. The Generation License of NPGCL (GENCO-III) has been granted by NEPRA vide No. GL/03/2002 (issued on July 01, 2002) is valid for 25 years i.e. up to 2027 and subsequently, vide Modification-II dated 31.10.2014, the Authority has re-fixed the term of Generation License up to the year 2044 with the addition of Nandipur CCPP Block.

NEPRA had provisionally mentioned the ***Operational Auxiliary Limits*** in the Generation License issued on 01.07.2002 (Page 2 of Schedule-II ***Annex-A***). As these values were provisional and had to be revised as per Dependable Capacity Tests, but could not be revised in the latest Generation License Modification issued by NEPRA on 31.10.2014. Therefore these values need to be revised. The Operational Auxiliary figures as used by NEPRA in its Tariff determination dated 22.01.2016, should be used as bench mark parameter for TPS Muzaffargarh and Tariff determination issued on 02.05.2006 for GTPS Faisalabad, SPS Faisalabad and NGPS Multan.

In view of the above explanation, the Company requires revision in:

1. **Percentage Auxiliary being consumed by different plants of NPGCL GENCO-III as per latest Tariff Determination/Dependable Capacity Tests.**

2. **Provision of %age Auxiliary Consumption for operation of the machines on part load.**

The Latest Auxiliary Consumption (%age) is as below,

Power Station	Unit No	Installed Capacity (MW)	Derated Capacity (100 % MCR) (MW)	50 % MCR (MW)	%age Aux Cons On 100 % MCR	%age Aux Cons On 50 % MCR	Final %age Aux Cons On 100 % MCR after Trans.	Final %age Aux Cons On 50 % MCR after Trans.
TPS Muzaffargarh	1	210.00	190.00	111.5	7.47	11.48	**7.93**	**11.93**
	2	210.00	182.50	107.0	7.34	11.12	**7.80**	**11.57**
	3	210.00	183.50	110.0	6.62	9.68	**7.09**	**10.13**
	4	320.00	272.20	162.0	9.18	10.31	**9.64**	**10.75**
	5	200.00	181.44	107.7	7.36	9.92	**7.82**	**10.37**
	6	200.00	173.88	109.6	8.63	10.83	**9.08**	**11.27**
	Sub Total	**1,350.00**	**1,183.52**	**707.9**	-	-	-	-
GTPS Faisalabad	Units 1-4	100.0	75.00	-	**1.50**	-	-	-
	Units 5-9	144.0	117.00	-	**2.15**	-	-	-
	Sub Total	**244.0**	**192.00**	-	-	-	-	-
SPS Faisalabad	1	66.0	48.50	-	**8.00**	-	-	-
	2	66.0	48.50	-	**8.00**	-	-	-
	Sub Total	**132.0**	**97.00**	-	-	-	-	-
Grand Total		**1,726.00**	**1,472.52**	-	-			

Provision of %age Auxiliary Consumption for operation of the machines on part load may also be allowed as %age figures vary with load as also evident from Heat Rate Test Report submitted by Independent Engineer and Test Results approved by the Authority for the sake of Tariff Determination.

10.2 (b) Statement of the reasons in support of the modification

NPGCL GENCO-III was granted Generation License by the Authority, vide No. LAG-03/3589-90 dated 01.07.2002 for its Power Plants located at different locations in Province of Punjab. The Auxiliary consumption mentioned in the Original License in 2002 was in "Percentage of Installed Capacity" of all the units of NPGCL GENCO-III. This percentage of Auxiliary at rated load, as mentioned in Generation License in 2002, has been used by NEPRA for the sake of comparison of the actual Auxiliary Consumption of the units. NEPRA had provisionally mentioned the Operational Auxiliary Limits in the Generation License issued on 01.07.2002 (Page 2 of Schedule-II). As these values were provisional and had to be revised as per Dependable Capacity Tests ***(as has been mentioned in the***

Page 2 of Schedule-II itself), but could not be revised in the latest Generation License Modification issued by NEPRA on 31.10.2014.

Moreover in 2013-14 as per the directions of the Authority, Heat Rate tests were conducted by Independent Engineer, Pakistan Engineering Services (PES), for block 1, 2 and 3 of Muzaffargarh Plant under USAID Energy Power Policy after the rehabilitation of the plant. The same tests were witnessed by the representatives of NEPRA and the tariff petition was filed according to the Heat Rate Tests conducted by PES. ***NEPRA has already agreed with the PES report and has granted tariff accordingly on 22.01.2016*** to be effective w.e.f 01.07.2014. As per report submitted by PES, the actual Auxiliary Consumption of the units of TPS Muzaffargarh is outlined as below please. The test report pages are being hereby attached for ready reference **(Annex-B).**

At 100 % MCR of Thermal Power Station Muzaffargarh

Unit No.	Annex of Test Report	Gross Output (KWh) As per Report	Net Output (KWh) As per Report	Auxiliary Cons. (KWh) As per Report	%age Auxiliary Cons. Excluding transformer and switchyard losses (%)
	1	2	3	4	5
1	D (3)	190000.00	175810.02	14190.00	7.47
2	E (3)	182500.00	169108.60	13391.40	7.34
3	F (3)	183500.00	171352.25	12147.75	6.62
4	G (3)	272200.00	247200.00	25000.00	9.18
5	H (3)	181440.00	168091.85	13348.15	7.36
6	I (3)	173880.00	158878.10	15001.90	8.63

At 50 % MCR of Thermal Power Station Muzaffargarh

Unit No.	Annex of Test Report	Gross Output (KWh) As per Report	Net Output (KWh) As per Report	Auxiliary Cons. (KWh) As per Report	%age Auxiliary Cons. Excluding transformer and switchyard losses (%)
	1	2	3	4	5
1	D (3)	111500.00	98696.00	12804.00	11.48
2	E (3)	107000.00	95100.20	11899.80	11.12
3	F (3)	110000.00	99350.10	10649.90	9.68
4	G (3)	162050.00	145350.00	16700.00	10.31
5	H (3)	107730.00	97040.36	10689.64	9.92
6	I (3)	109620.00	97749.11	11870.89	10.83

However, despite approved test Methodology by NEPRA and applicable codes ASME PTC-46, PES did not count for Transformation Auxiliary Consumption in its test report which was pursued in the tariff petition filed with NEPRA in 2014. NEPRA being kind enough allowed the 0.50% losses ***in lieu of Transformer Auxiliary Consumption*** in its determination on dated 19.10.2016 ***(Annex-C)***. So taking into the effect of transformation losses, the total auxiliary consumption will be as tabularized below,

At 100 % MCR of Thermal Power Station Muzaffargarh

Unit No.	Annex of Test Report	Gross Output (KWh) As per Report	Net Output (KWh) As per Report	Auxiliary Cons. (KWh) As per Report	Aux. Consumption with 0.5% Transformer Losses (KWh)	%age Auxiliary Cons. including transforme r losses (%)
	1	2	3	4	6	7
1	D (3)	190000.00	175810.02	14190.00	15,069.05	**7.93**
2	E (3)	182500.00	169108.60	13391.40	14,236.94	**7.80**
3	F (3)	183500.00	171352.25	12147.75	13,004.51	**7.09**
4	G (3)	272200.00	247200.00	25000.00	26,236.00	**9.64**
5	H (3)	181440.00	168091.85	13348.15	14,188.61	**7.82**
6	I (3)	173880.00	158878.10	15001.90	15,796.29	**9.08**

At 50 % MCR of Thermal Power Station Muzaffargarh

Unit No.	Annex of Test Report	Gross Output (KWh) As per Report	Net Output (KWh) As per Report	Auxiliary Cons. (KWh) As per Report	Aux. Consumption with 0.5% Transformer Losses (KWh)	%age Auxiliary Cons. including transforme r losses (%)
	1	2	3	4	6	7
1	D (3)	111500.00	98696.00	12804.00	13,297.48	**11.93**
2	E (3)	107000.00	95100.20	11899.80	12,375.30	**11.57**
3	F (3)	110000.00	99350.10	10649.90	11,146.65	**10.13**
4	G (3)	162050.00	145350.00	16700.00	17,426.75	**10.75**
5	H (3)	107730.00	97040.36	10689.64	11,174.84	**10.37**
6	I (3)	109620.00	97749.11	11870.89	12,359.64	**11.27**

The Tariff has already been determined by the Authority based on results of Dependable Capacity Tests. Therefore these values need to be revised. It is therefore stated that the Reference Auxiliary Consumption being used by Authority for the sake of comparison may please be taken as per table above.

PROVISION OF %AGE AUXILIARY CONSUMPTION FOR OPERATION OF THE MACHINES ON PART LOAD:

The determination of NEPRA is silent about use of Auxiliary consumption during different phases of the plants like Part load; Operational, Standby, Shutdown etc, which must be differentiated as shown in the above table also that %age Auxiliary Consumption increases abruptly with operation of the plant on Part Load. Even if the plant is on standby mode, there is a minimum auxiliary which is being used for the safety of the plant.

The conventional steam plant is primarily designed for base load operation wherein the load variation is kept at minimum. This gives the best efficiency and minimum %age Auxiliary Consumption of the plant. The system operator tends to frequently vary the load thereby affecting %age Auxiliary Consumption of the plant. The provision of Part Load Correction Factor for Heat Rate (BTU/kWh) has already been allowed by the Authority in case of TPS Muzaffargarh vide Tariff Determination issued on 22.01.2016 ***(Annex-D)***.

The part load correction factor as already allowed by NEPRA is tabularized as below please;

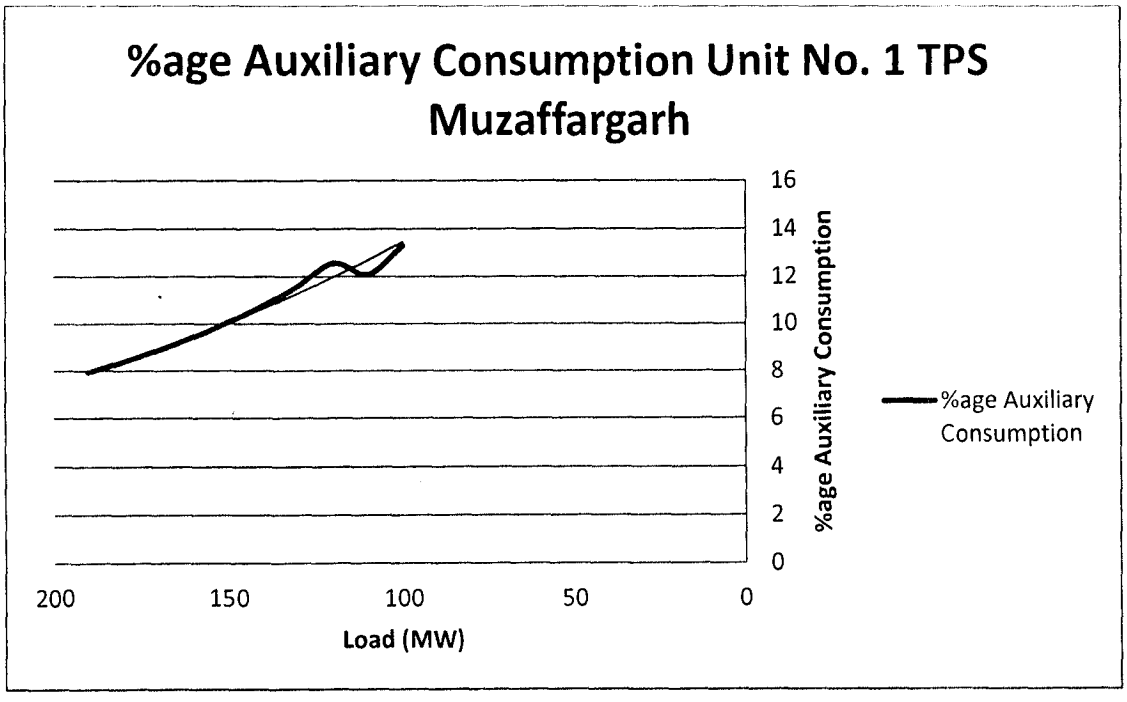
Thermal Power Station Muzaffargarh					
Unit No.1,2 &3		Unit No.4		Unit No.5,6	
%age load	Correction Factor	%age load	Correction Factor	%age load	Correction Factor
100	1.0000	100	1.0000	100	1.0000
				95	1.0093
90	1.0002			90	1.0188
				85	1.0283
80	1.0068			80	1.0380
		75	1.0003	75	1.0477
70	1.02	70	1.0057	70	1.0575
		65	1.0129	65	1.0675
60	1.0397	60	1.0219	60	1.0776
		55	1.0326	55	1.0877
50	1.0659	50	1.0451	50	1.098

The ***Percentage*** Auxiliary Consumption of a Steam Power Plant is minimum when the plant is operating at its Maximum Continuous Rating (MCR). However on part

load operation of the unit till the Minimum load, the Auxiliary required is equal to that of Full Load Auxiliary Consumption. The entire auxiliary equipments required for Full Load Operation of unit remain in service till the minimum or 50% load on the unit is achieved, leaving hike is ***Percentage*** Auxiliary Consumption of the unit. This has been illustrated by case of Unit No. 1 TPS Muzaffargarh as below based upon the Tariff determination on dated 22.01.2016, 19.10.2016 and HR Test carried out by M/s PES;

Plant Load (MW)	Auxiliary Consumption (MW)	%age Auxiliary Consumption
190	15.06905	**7.93**
180	15.06905	8.37
170	15.06905	8.86
160	15.06905	9.42
150	15.06905	10.05
140	15.06905	10.76
130	15.06905	11.59
120	15.06905	12.56
110	13.29748	**12.09**
100	13.29748	13.30

The same is illustrated in Graphical format as under;



From the above explanation, it is clear that impact of change in Percentage Auxiliary Consumption w.r.t varying load is critical. It is therefore requested that impact of change in Percentage Auxiliary Consumption with varying load as per demand of System Operator may please be allowed to NPGCL regarding its steam units.

10.2 (c) Statement of the impact on the tariff, quality of service and the performance by the licensee of its obligations under the license.

The proposed change is as per actual test carried out for the sake of tariff determinations and approved by the Authority. It is rather rectification of previous provisional figures.

Impact of the Proposed Modification

a) Impact on Tariff

It is pertinent to mention that the proposed amendments do not impact the tariff determination in any manner.

b) Impact on Quality of Service

The Company certifies that the quality of service and performance of the company under the license shall not be affected on acceptance by NEPRA of this LPM.

INSTALLED CAPACITY (GROSS) & NET CAPACITY

(Northern Power Generation Company Limited)

Power Station	Installed Capacity MW		Derated Capacity (MW)		Net Capacity after *Aux. Consumption (MW)	
Thermal Power Station (TPS) Muzaffargarh	Unit # 1	210	Unit # 1	200	Unit # 1	188
	Unit # 2	210	Unit # 2	200	Unit # 2	188
	Unit # 3	210	Unit # 3	200	Unit # 3	188
	Unit # 4	320	Unit # 4	300	Unit # 4	276
	Unit # 5	200	Unit # 5	200	Unit # 5	182
	Unit # 6	200	Unit # 6	200	Unit # 6	182
		1350		**1300**		**1204**
Natural Gas Power Station (NGPS) Multan	Unit # 1	65	Unit # 1	50	Unit # 1	45
	Unit # 3	65	Unit # 3	50	Unit # 3	45
	Unit # 4	65	Unit # 4	50	Unit # 4	45
		195		**150**		**135**
Gas Turbine Power Station GTPS) (Faisalabad)	Unit # 1-7		Unit 1-7		Unit # 1-7	136.67
	(25 x 7)	175	(19 x 7)	**133**	Unit # 8	18.81
	Unit # 8	25	Unit # 8	19	Unit # 9	35.72
	Unit # 9	44	Unit # 9	38		**186.20**
		244		**190**		
Steam Power Station (SPS) Faisalabad	Unit # 1	66	Unit # 1	50	Unit # 1	49.83
	Unit # 2	66	Unit # 2	50	Unit # 2	49.83
		132		**100**		**99.66**
TOTAL		**1921**		**1740**		**1624.86**

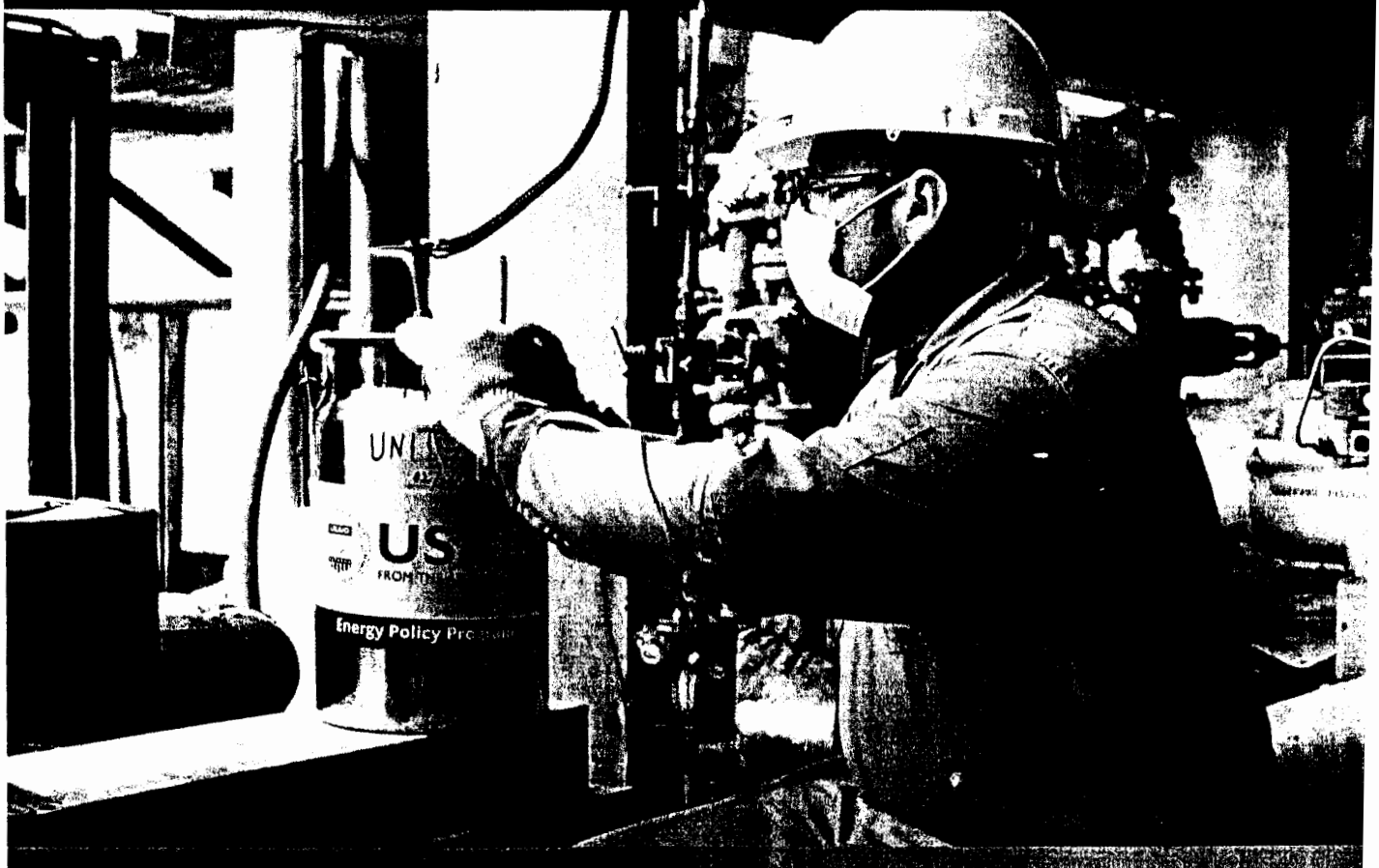
* **Indicative Figures only**: These figures have been based on historic average auxiliary consumption provided by the licensee. The net capacity available to NGC Licensee for dispatch and other purchasers will be determined through procedures contained in the Grid Code, applicable documents or the bilateral contracts.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR

USAID
FROM THE AMERICAN PEOPLE

ENERGY POLICY PROGRAM

CURRENT DEPENDABLE CAPACITY AND HEAT RATE TESTS OF MUZAFFARGARH THERMAL POWER STATION



April 2014

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ANNEX D (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 1TPS MUZAFFARGARH ON 11-1-2014(LHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) SIDE A		UNIT AUXILIARY CONSUMPTION (kWh) SIDE B		Total Auxiliary After Taleri Share	FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	CV Btu/kg	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh		Meter reading Tons	Difference Tons	(LHV)	(LHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC																	
1	11:00	137398000	x	47820960	x	[illegible]	x		7677.812	x							
2	11:30	137494000	96000	47824128	3168	[illegible]	[illegible]		7702.843	25.031	[illegible]	[illegible]	[illegible]	96000.00	89400	9937.60	10671.25
3	12:00	137586000	94000	47827824	3696	[illegible]	[illegible]		7726.471	23.628	[illegible]	[illegible]	[illegible]	94000.00	85816	9580.18	10493.81
4	12:30	137683000	95000	47831256	3432	[illegible]	[illegible]		7750.396	23.925	[illegible]	[illegible]	[illegible]	95000.00	88400	9598.49	10315.12
5	1:00	137778000	95000	47834688	3432	[illegible]	[illegible]		7774.358	23.962	[illegible]	[illegible]	[illegible]	95000.00	87080	9613.33	10487.67
6	Steam Turbine at CDC - Total based on 2 hours readings		380000		13728		[illegible]			96.546	[illegible]	[illegible]	[illegible]	380000.00	350696	9683.34	10492.48
7	Hourly Average at CDC		190000.00		6864.00		7788.00	14190.00		48.27	[illegible]	[illegible]	18398834873.47	190000.00	175810.00	9683.34	10464.90
AT 50 % MCR																	
8	03:00	138048000	x	47847096	x	[illegible]	x		7843.813	x							
9	03:30	138104600	56000	47850000	2904	[illegible]	[illegible]		7858.744	14.931	[illegible]	[illegible]	[illegible]	56000.00	49136	10161.91	11581.47
10	04:00	138160000	56000	47853168	3168	[illegible]	[illegible]		7872.53	13.786	[illegible]	[illegible]	[illegible]	56000.00	49400	9382.63	10636.18
11	04:30	138216000	56000	47856072	2904	[illegible]	[illegible]		7887.262	14.732	[illegible]	[illegible]	[illegible]	56000.00	49400	10026.47	11366.04
12	05:00	138271000	55000	47858976	2904	[illegible]	[illegible]		7902.482	15.22	[illegible]	[illegible]	[illegible]	55000.00	48136	10546.94	12050.89
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		223000		11680		[illegible]			58.669	[illegible]	[illegible]	[illegible]	223000.00	196072	10027.17	11404.27
14	Hourly Average at 50% MCR		111500.00		5940.00		7824.00	13884.00		29.33	[illegible]	[illegible]	[illegible]	111500.00	98696.00	10027.17	11328.01

Note.

For MCR Auxillries Side A and Side B to be added Taleri Tube well total Consumption to be subtracted [illegible] added for calculation of net gereration

For 50 % MCR Auxillries Side A and Side B to be added Taleri Tube well total Consumption to be subtracted [illegible] be added for calculation of net gereration

ANNEX E (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 2 TPS MUZAFFARGARH ON 30-12-2013 (LHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) SIDE A		UNIT AUXILIARY CONSUMPTION (kWh) SIDE B		Total Auxiliary After tellen Share	FUEL OIL CONSUMPTION (Tons)		CV Btu/lb (LHV)	CV Btu/kg (LHV)	Fuel Input Btu	Gross Output kWh	Net Output kWh	Heat Rate on Gross Output Btu/kWh	Heat Rate on Net Output Btu/kWh
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh		Meter reading Tons	Difference Tons							
AT CDC																	
1	**11:00**	8122367000	x	63723000	x	28074856	x		2996.693	x	x						
2	**11:30**	8122459000	92000	63726168	3168	28077984	3128		3019.723	23.03	17367.00	38276.87	881756247.25	92000.00	85664	9584.31	10293.19
3	**12:00**	8122550000	91000	63729336	3168	28081152	3168		3043.829	24.106	17367.00	38276.87	922953369.35	91000.00	84664	10142.34	10901.37
4	**12:30**	8122641000	91000	63732504	3168	28084848	3696		3066.955	23.126	17367.00	38276.87	885431826.91	91000.00	84136	9730.02	10523.82
5	**1:00**	8122732000	91000	63735672	3168	28088016	3168		3090.389	23.434	17367.00	38276.87	897224311.68	91000.00	84664	9859.61	10597.47
6	**Steam Turbine at CDC - Total based on 2 hours readings**		365000		12672		13200			93.696	17367.00	38276.87	3587365755.19	365000.00	339128	9828.40	10578.21
7	**Hourly Average at CDC**		**182500.00**		**6336.00**		**6600.00**	13391.40		**46.85**	17367.00	38276.87	**1793682877.59**	**182500.00**	**169108.60**	**9828.40**	**10606.69**
AT 50 % MCR																	
8	**03:00**	8123000000	x	63742320	x	28100160	x		3161.722	x	x						
9	**03:30**	8123053000	53000	63750720	2904	28102800	2640		3176.261	14.539	17367.00	38276.87	556658883.14	53000.00	47456	10503.00	11730.00
10	**04:00**	8123107000	54000	63753624	2904	28105968	3168		3191.193	14.932	17367.00	38276.87	571705787.40	54000.00	47928	10587.14	11928.43
11	**04:30**	8123161000	54000	63756792	3168	28108608	2640		3205.754	14.561	17367.00	38276.87	557501203.48	54000.00	48192	10324.10	11568.34
12	**05:00**	8123214000	53000	63759432	2640	28111512	2904		3220.52	14.766	17367.00	38276.87	565350097.56	53000.00	47456	10666.98	11913.14
13	**Steam Turbine at 50% MCR - Total based on 2 hours readings**		214000		11616		11352			58.798	17367.00	38276.87	2251215971.58	214000.00	191032	10519.70	11784.50
14	**Hourly Average at 50% MCR**		**107000.00**		**5808.00**		**5676.00**	11899.80		**29.40**	17367.00	38276.87	1125607986	**107000.00**	**95100.20**	**10519.70**	**11836.02**

Note Taleri share in Auxilliries is added for calculation

ANNEX E (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 2 TPS MUZAFFARGARH ON 30-12-2013 (HHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) SIDE A		UNIT AUXILIARY CONSUMPTION (kWh) SIDE B		Total Auxiliary After tellen Share	FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	CV Btu/kg	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh		Meter reading Tons	Difference Tons	(HHV)	(HHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC																	
1	11:00	8122367000	x	63723000	x	[illegible]	x		2996.693	x	x						
2	11:30	8122459000	92000	63726168	3168	[illegible]	[illegible]		3019.723	23.03	18147.00	[illegible]	[illegible]	92000.00	85664	10014.76	10755.49
3	12:00	8122550000	91000	63729336	3168	[illegible]	[illegible]		3043.829	24.106	18147.00	[illegible]	[illegible]	91000.00	84664	10597.87	11390.98
4	12:30	8122641000	91000	63732504	3168	[illegible]	[illegible]		3066.955	23.126	18147.00	[illegible]	[illegible]	91000.00	84136	10167.02	10996.47
5	1:00	8122732000	91000	63735672	3168	[illegible]	[illegible]		3090.389	23.434	18147.00	[illegible]	[illegible]	91000.00	84664	10302.43	11073.43
6	Steam Turbine at CDC - Total based on 2 hours readings		365000		12672		[illegible]			93.696	18147.00	[illegible]	[illegible]	365000.00	339128	10269.82	11053.30
7	Hourly Average (A) at CDC		182500.00		6336.00		6668.00	11491.40		46.85	18147.00	[illegible]	1874242136.22	182500.00	169108.60	10269.82	11083.07
AT 50 % MCR																	
8	03:00	8123000000	x	63747816	x	[illegible]	x		[illegible]722	x	x						
9	03:30	8123053000	53000	63750720	2904	[illegible]	[illegible]		3176.261	14.539	18147.00	[illegible]	581659673.67	53000.00	47456	10974.72	12256.83
10	04:00	8123107000	54000	63753624	2904	[illegible]	[illegible]		3191.193	14.932	18147.00	[illegible]	597382675.42	54000.00	47928	11062.64	12464.17
11	04:30	8123161000	54000	63756792	3168	[illegible]	[illegible]		3205.754	14.561	18147.00	[illegible]	582540124.35	54000.00	48192	10787.78	12087.90
12	05:00	8123214000	53000	63759432	2640	[illegible]	[illegible]		3220.52	14.766	18147.00	[illegible]	590741533.97	53000.00	47456	11146.07	12448.19
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		214000		11616		[illegible]			58.798	18147.00	[illegible]	2352324306.81	214000.00	191032	10992.17	12313.77
14	Hourly Average at 50% MCR		107000.00		5808.00		[illegible]	11491.80		29.40	18147.00	[illegible]	1176162153	107000.00	95100.20	10992.17	12367.61

ANNEX F (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 3 TPS MUZAFFARGARH ON 01-01-2014 (LHV)

S. No.	Time	GROSS GENERAT ION (kWh)		UNIT AUXILIARY CONSUMPT ION (kWh) SIDE A		UNIT AUXILIARY CONSUMPT ION (kWh) SIDE B		Tellen Tube well Share	Total Auxiliary After telleri Share	FUEL OIL CONSUMPT ION (Tons)		CV Btu/lb	CV Btu/lb	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh			Meter reading Tons	Difference Tons	(LHV)	(LHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC																		
1	10:00	8801195000	x	90812040	x	[illegible]	x			13711.95	x	x						
2	10:30	8801287000	92000	90814944	2904	[illegible]	[illegible]			13734.96	23.01	17302.00	38133.61	877693191.49	92000.00	86192	9540.14	10183.00
3	11:00	8801379000	92000	90817848	2904	[illegible]	[illegible]			13757.96	23	17302.00	38133.61	877311751.60	92000.00	85928	9536.00	10209.85
4	11:30	8801471000	92000	90820752	2904	[illegible]	[illegible]			13780.91	22.95	17302.00	38133.61	875404552.14	92000.00	86192	9515.27	10156.45
5	12:00	8801562000	91000	90823656	2904	[illegible]	[illegible]			13803.95	23.04	17302.00	38133.61	878837511.17	91000.00	85192	9657.56	10315.96
6	Steam Turbine at CDC - Total based on 2 hours readings		367000		11616		11880				92	17302.00	38133.61	3509247006.40	367000.00	343504	9561.98	10216.03
7	Hourly Average at CDC		**183500.00**		**5808.00**		**5940.00**	399.75	12147.75		**46.00**	17302.00	38133.61	**1754623503.20**	**183500.00**	**171352.25**	**9561.98**	**10239.86**
AT 50 % MCR																		
8	02:00	8801818000	x	90833952	x	77356752	x			13869.63	x	x						
9	02:30	8801874000	56000	90836592	2640	77359656	2904			13884.2	14.57	17302.00	38133.61	555757922.64	56000.00	50456	9924.25	11014.70
10	03:00	8801927000	53000	90838176	1584	77362560	2904			13897.93	13.73	17302.00	38133.61	523716971.72	53000.00	48512	9881.45	10795.62
11	03:30	8801983000	56000	90840816	2640	77365560	3000			13912.26	14.33	17302.00	38133.61	546603365.24	56000.00	50720	9760.77	10776.88
12	04:00	8802038000	55000	90843456	2640	77367840	2640			13927.03	14.77	17302.00	38133.61	563386720.16	55000.00	49720	10243.39	11331.19
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		220000		9504		11088				57.4	17302.00	38133.61	2189464980.08	220000.00	199408	9952.11	10979.83
14	Hourly Average at 50% MCR		**110000.00**		**4752.00**		**5544.00**	353.90	10649.90		**28.70**	17302.00	38133.61	**1094732490**	**110000.00**	**99350.10**	**9952.11**	**11018.94**

Note aleri share in Auxilliries is added for calculation

ANNEX F (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 3 TPS MUZAFFARGARH ON 01-01-2014 (HHV)

S. No.	Time	GRDSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) SIDE A		UNIT AUXILIARY CONSUMPTION (kWh) SIDE B		Total Auxiliary After Iellen Share	FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	CV Btu/kg	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh		Meter reading Tons	Difference Tons	(HHV)	(HHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC																	
1	10:00	8801195000	x	90812040	x	[illegible]	x		13711.95	x	x						
2	10:30	8801287000	92000	90814944	2904	[illegible]	[illegible]		13734.96	23.01	18057.00	[illegible]	[illegible]	92000.00	86192	9956.44	10627.35
3	11:00	8801379000	92000	90817848	2904	[illegible]	[illegible]		13757.96	23	18057.00	[illegible]	[illegible]	92000.00	85928	9952.12	10655.37
4	11:30	8801471000	92000	90820752	2904	[illegible]	[illegible]		13780.91	22.95	18057.00	[illegible]	[illegible]	92000.00	86192	9930.48	10599.64
5	12:00	8801562000	91000	90823656	2904	[illegible]	[illegible]		13803.95	23.04	18057.00	[illegible]	[illegible]	91000.00	85192	10078.98	10766.12
6	Steam Turbine at CDC - Total based on 2 hours readings		367000		11616		[illegible]			92	18057.00	[illegible]	[illegible]	367000.00	343504	9979.23	10661.82
7	Hourly Average at CDC		183500.00		5808.00		5440.00	12147.75		46.00	18057.00	[illegible]	1831189261.20	183500.00	171352.25	9979.23	10686.70
AT 50 % MCR																	
8	02:00	8801818000	x	90833952	x	[illegible]	x		13869.63	x	x						
9	02:30	8801874000	56000	90836592	2640	[illegible]	[illegible]		13884.2	14.57	18057.00	[illegible]	580009204.25	56000.00	50456	10357.31	[illegible]
10	03:00	8801927000	53000	90838176	1584	[illegible]	[illegible]		13897.93	13.73	18057.00	[illegible]	546570186.01	53000.00	48512	10312.65	11266.70
11	03:30	8801983000	56000	90840816	2640	[illegible]	[illegible]		13912.26	14.33	18057.00	[illegible]	576455263.33	56000.00	50720	10158.70	11247.15
12	04:00	8802038000	55000	90843456	2640	[illegible]	[illegible]		13927.03	14.77	18057.00	[illegible]	587970986.69	55000.00	49720	10690.38	11825.64
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		220000		9504		[illegible]			57.4	18057.00	[illegible]	2295805730.28	220000.00	199408	10386.39	11458.95
14	Hourly Average at 50% MCR		110000.00		4752.00		5544.00	10649.90		28.70	18057.00	[illegible]	1142502865	110000.00	99350.10	10386.39	11499.77

ANNEX G (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 4 TPS MUZAFFARGARH ON 02-01-2014 AND 03-01-2014 (LHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh)		FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	CV Btu/kg	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading Tons	Difference Tons	(LHV)	(LHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC														
1	10:00	842894400	x	75182500	x	[illegible]	x	x						
2	10:30	843030000	135600	75195400	[illegible]	[illegible]	33.228	17290.00	38107.16	1266660419.75	135600.00	123100	9340.48	10288.95
3	11:00	843165100	135100	75207100	[illegible]	[illegible]	32.69	17290.00	38107.16	1246062186.46	135100.00	123400	9223.26	10097.75
4	11:30	843300600	135500	75220300	[illegible]	[illegible]	33.505	17290.00	38107.16	1277166094.20	135500.00	122300	9425.58	10442.90
5	12:00	843438800	138200	75232900	[illegible]	[illegible]	33.194	17290.00	38107.16	1265273423.60	138200.00	125600	9155.38	10073.83
6	Steam Turbine at CDC - Total based on 2 hours readings		544400		[illegible]		132.618	17290.00	38107.16	5055071124.01	544400.00	494400	9285.58	10224.66
7	Hourly Average at CDC		272200.00		25000.00		66.31	17290.00	38107.16	2527535562.01	272200.00	247200.00	9285.58	10224.66
AT 50 % MCR														
8	02:00	845903600	x	75465100	x	[illegible]	x	x						
9	02:30	845984000	80400	75473500	8400	[illegible]	21.72	17290.00	38107.16	827912838.48	80400.00	72000	10297.42	11498.79
10	03:00	846065700	81700	75482000	8500	[illegible]	22.22	17290.00	38107.16	846971605.48	81700.00	73200	10366.85	11570.65
11	03:30	846146500	80800	75490300	8300	[illegible]	21.47	17290.00	38107.16	818383454.98	80800.00	72500	10128.51	11288.05
12	04:00	846227700	81200	75498500	8200	[illegible]	21.82	17290.00	38107.16	831724591.88	81200.00	73000	10242.91	11393.49
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		324100		33400		[illegible]	17290.00	38107.16	3324992490.82	324100.00	290700	10259.16	11437.88
14	Hourly Average at 50% MCR		162050.00		16700.00		43.61	17290.00	38107.16	1662496245	162050.00	145350.00	10259.16	11437.88

ANNEX G (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 4 TPS MUZAFFARGARH ON 02-01-2014 AND 03-01-2014 (HHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh)		FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	CV Btu/kg	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	Meter reading Tons	Difference Tons	(HHV)	(HHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC														
1	10:00	842894400	x	[illegible]	x	[illegible]	x	x						
2	10:30	843030000	135600	[illegible]	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	135600.00	123100	9746.19	10735.85
3	11:00	843165100	135100	[illegible]	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	135100.00	123400	9623.88	10536.35
4	11:30	843300600	135500	[illegible]	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	135500.00	122300	9834.98	10896.49
5	12:00	843438800	138200	[illegible]	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	138200.00	125600	9553.05	10511.40
6	Steam Turbine at CDC - Total based on 2 hours readings		544400		[illegible]		[illegible]	18041.00	[illegible]	[illegible]	544400.00	494400	9688.91	10668.77
7	Hourly Average at CDC		272200.00		25000.00		66.31	18041.00	[illegible]	2637320362.88	272200.00	[illegible]7200.00	9688.91	10668.77
AT 50 % MCR														
8	02:00	845903600	x	75465100	x	[illegible]	x	x						
9	02:30	845984000	80400	75473500	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	80400.00	72000	10744.70	11998.25
10	03:00	846065700	81700	75482000	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	81700.00	73200	10817.14	12073.23
11	03:30	846146500	80800	75490300	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	80800.00	72500	10568.45	11778.35
12	04:00	846227700	81200	75498500	[illegible]	[illegible]	[illegible]	18041.00	[illegible]	[illegible]	81200.00	73000	10687.82	11888.37
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		324100		[illegible]		[illegible]	18041.00	[illegible]	[illegible]	324100.00	290700	10704.77	11934.69
14	Hourly Average at 50% MCR		162050.00		16700.00		43.61	18041.00	[illegible]	1734707621	162050.00	145350.00	10704.77	11934.69

ANNEX H (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 3 TPS MOUTAI JANDJARH ON 13-01-2013 (LHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) Starting Transformer	TOTAL AUXILIARY kWh	FUEL OIL CONSUMPTION (Tons)		CV Btu/lb	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Efficiency on Gross Output	Heat Rate on Net Output	Efficiency on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	kWh		Meter reading Tons	Difference Tons	(LHV)	Btu	kWh	kWh	Btu/kWh	%	Btu/kWh	%
AT CDC																	
1	14.00	3218601960	x	1030349093	x	x			x	x							
2	14.30	3218696460	94500	1030356706	[illegible]	[illegible]		[illegible]	23.89	17274.00	[illegible]			[illegible]	35.44	10352.00	32.96
3	15.00	3218787180	90720	1030362323	[illegible]	5.47		[illegible]	23.98	17274.00	[illegible]			[illegible]	33.90	10858.01	31.43
4	15.30	3218874120	86940	1030368405	[illegible]	[illegible]		[illegible]	23.99	17274.00	[illegible]			[illegible]	32.47	11307.20	30.18
5	16.00	3218964840	90720	1030375081	[illegible]	[illegible]		[illegible]	24.25	17274.00	[illegible]			[illegible]	33.52	10980.26	31.08
6	Steam Turbine at CDC - Total based on 2 hours readings		362880		[illegible]				96.11	17274.00	[illegible]			[illegible]	33.83	10864.26	31.41
7	Hourly Average at CDC		181440.00		12993.75	354.4	13348.15		48.05	17274.00	1830043823.52	181440.00	168994.85	10086.22	33.83	10887.16	31.34
AT 50 % MCR																	
8	17.00	3219093360	x	1030387305	x	x			x	x							
9	17.30	3219146280	52920	1030392563	[illegible]	[illegible]		[illegible]	15.73	17274.00	[illegible]			[illegible]	30.14	12552.44	27.18
10	18.00	3219199200	52920	1030397760	[illegible]	[illegible]		[illegible]	15.6	17274.00	[illegible]			[illegible]	30.39	12448.70	27.41
11	18.30	3219252120	52920	1030402958	[illegible]	[illegible]		[illegible]	15.68	17274.00	[illegible]			[illegible]	30.24	12512.54	27.27
12	19.00	3219308820	56700	1030408155	[illegible]	[illegible]		[illegible]	15.89	17274.00	[illegible]			[illegible]	31.97	11749.47	29.04
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		215460		[illegible]				[illegible]	17274.00	[illegible]			[illegible]	30.69	12304.79	27.73
14	Hourly Average at 50% MCR		107730.00		10395.00	294.64	10689.64		31.45	17274.00	1197687090	107730.00	97040.36	11117.49	30.69	12342.15	27.65

NOTE

Hourly values could not be taken for Starting Transformer meter The measurement scale of these meters was not [illegible] and the difference in kWh . Average readings of this meter is [illegible] that is equal to 0.09 MWh. Therefore this reading after applying multiplication (264000) comes out to 0.09x264000 kWh during [illegible] kWH. After deduction of colony the net figure [illegible] 294.64 kWh for 50% MCR

ANNEX H (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 5 TPS MUZAFFARGARH ON 13-01-2013 (HHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh) Starting Transformer	TOTAL AUXILLIARY	FUEL OIL CONSUMPTION (Tons)					Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	kWh	kWh	Meter reading Tons	Difference Tons				kWh	Btu/kWh	Btu/kWh
AT CDC															
1	14.00	3218601960	x					15796.44	x						
2	14.30	3218696460	94500					15820.33	23.89				87885	10042.57	10798.46
3	15.00	3218787180	90720					15844.31	23.98				84105	10500.42	11326.29
4	15.30	3218874120	86940					15868.3	23.99				80798	10961.53	11794.86
5	16.00	3218964840	90720					15892.55	24.25				84105	10618.65	11453.82
6	Steam Turbine at CDC - Total based on 2 hours readings		362880						96.11				336893	10521.22	11332.81
7	Hourly Average at CDC		**181440.00**		12993.75	354.4	13348.15		**48.05**		190836.9853.01	181440.00	**168091.85**	**10521.22**	**11356.71**
AT 50 % MCR															
8	17.00	3219093360	x					15928.31	x						
9	17.30	3219146280	52920					15944.04	15.73				47722	11807.81	13093.81
10	18.00	3219199200	52920					15959.64	15.6				47723	11710.23	12985.60
11	18.30	3219252120	52920					15975.32	15.68				47723	11770.28	13052.19
12	19.00	3219308820	56700					15991.21	15.89				51502	11132.72	12256.21
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		215460						62.9				194670	11596.97	12835.48
14	Hourly Average at 50% MCR		**107730.00**		10395.60	294.64	10690.24		**31.45**		1249341419	107730.00	**97040.36**	**11596.97**	**12874.45**

ANNEX I (3)

CDC/HEAT RATE TEST OF STEAM TURBINE UNIT # 4, TPS MUGHAL KOT ON 16-01-2013 (HHV)

S. No.	Time	GROSS GENERATION (kWh)		UNIT AUXILIARY CONSUMPTION (kWh)		NET AUXILIARY CONSUMPTION (kWh) Station Transformer	TOTAL AUXILLIARY	FUEL OIL CONSUMPTION (Tons)		Net CV Btu/lb	Fuel Input	Gross Output	Net Output	Heat Rate on Gross Output	Heat Rate on Net Output
		Meter reading kWh	Difference kWh	Meter reading kWh	Difference kWh	kWh	kWh	Meter reading Tons	Difference Tons	(HHV)	Btu	kWh	kWh	Btu/kWh	Btu/kWh
AT CDC															
1	14.00	2352199500	x	[illegible]	[illegible]	[illegible]		7500.784	x	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	14.30	2352286440	86940	[illegible]	[illegible]	[illegible]		7524.073	23.289	[illegible]	[illegible]	[illegible]	79380	10723.31	11744.58
3	15.00	2352373380	86940	[illegible]	[illegible]	[illegible]		7547.234	23.161	[illegible]	[illegible]	[illegible]	79853	10664.38	11610.92
4	15.30	2352460320	86940	[illegible]	[illegible]	[illegible]		7570.363	23.129	[illegible]	[illegible]	[illegible]	79380	10649.64	11663.89
5	16.00	2352547260	86940	[illegible]	[illegible]	[illegible]		7593.574	23.211	[illegible]	[illegible]	[illegible]	79853	10687.40	11635.98
6	Steam Turbine at CDC - Total based on 2 hours readings		347760		[illegible]				92.79	18158.00	[illegible]	[illegible]	318465	10681.18	11663.73
7	Hourly Average at CDC		173880.00		14647.50	154.4	15001.90		46.40	18158.00	1857244127.89	173880.00	158878.10	10681.18	11689.74
AT 50 % MCR															
8	17.00	2352842100	x	914358179	[illegible]	[illegible]		7676.36	x	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	17.30	2352895020	52920	914364047	[illegible]	[illegible]		7692.075	15.715	18158.00	[illegible]	[illegible]	47250	11887.55	13314.06
10	18.00	2352951720	56700	914369715	[illegible]	[illegible]		7707.636	15.561	18158.00	[illegible]	[illegible]	51030	10986.32	12207.02
11	18.30	2353004640	52920	914375858	[illegible]	[illegible]		7722.833	15.197	18158.00	[illegible]	[illegible]	46778	11495.71	13005.25
12	19.00	2353061340	56700	914381528	[illegible]	[illegible]		7738.376	15.543	18158.00	[illegible]	[illegible]	51030	10973.61	12192.90
13	Steam Turbine at 50% MCR - Total based on 2 hours readings		219240		[illegible]				62.016	18158.00	[illegible]	[illegible]	196087	11323.53	12660.52
14	Hourly Average at 50% MCR		109620.00		11576.25	294.64	11870.89		31.01	18158.00	1241285180	109620.00	97749.11	11323.53	12698.69

National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

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No. NEPRA/TRF-304/NPGCL-2015/14377-14379
October 19, 2016

Subject: **Decision of the Authority in the matter of Motion for Leave for Review filed by Northern Power Generation Company Ltd. (NPGCL) against Authority's Determination for FY 2014-15 to 2016-17** [Case # NEPRA/TRF-304/NPGCL-2015]

Dear Sir,

This is in continuation of this office letter No. NEPRA/TRF-304/NPGCL-2015/832-834 dated January 22, 2016 whereby Determination of the Authority in the matter of Tariff Petition filed by Northern Power Generation Company Ltd. (NPGCL) for the Determination of its Generation Tariff for the FY 2014-15 to 2016-17 was sent to the Federal Government for notification in the official Gazette.

2. Please find enclosed herewith the subject decision of the Authority (12 pages) in the matter of Motion for Leave for Review filed by Northern Power Generation Company Ltd. against Determination of the Authority dated 22nd January, 2016.

3. The Decision is being intimated to the Federal Government for the purpose of notification in the official gazette pursuant to Section 31(4) of the Regulation of Generation. Transmission and Distribution of Electric Power Act, 1997.

Enclosure: As above

19.X.16

(Syed Safeer Hussain)

Secretary
Ministry of Water & Power
'A' Block, Pak Secretariat
Islamabad

CC:

1. Secreta ry, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secreta ry, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.

petition i.e. maintenance cost of railway track, working capital, isolated auxiliaries etc may also be considered and allowed. The Authority directed the NPGCL to submit the documentary evidence in support of its claim.

5. Issue-wise Discussion & Decision

5.1 The issue-wise discussion, findings and decision of the Authority is as under:

6. Reduction in Capacity Price

6.1 The Authority considered the submissions of NPGCL with respect to the above issues. In accordance with the provision of Regulation 3(2) of NEPRA Review Procedure Regulations 2009 *"Any party aggrieved from any order of the Authority and who, from the discovery of new and important matter of evidence or on account of some mistake or error apparent on the face of record or from any other sufficient reasons, may file a motion seeking review of such order."* The Authority observed that all the above issues pertaining to 2.1(a) above has already been discussed in detail in the original determination dated 22.1.2016 and no new evidence / justification / rationale is provided by the Petitioner which requires review for modification in the Authority's earlier decision. Similarly no error on part of it has been found. The Authority has therefore decided to maintain the earlier decision with respect to capacity charges allowed to NPGCL.

7 Miscellaneous Issues

7.1 The Authority further observed that NPGCL requested for isolated auxiliaries, working capital, and maintenance cost of railway track which was not part of the original petition. The review can only be requested on account of some error, new evidence with respect to the original decision. However, the aforesaid issues were not part of the original petition. Therefore the Authority has decided to not consider the same in the instant review. As regards the sustainability charges the Authority has already directed NPGCL to come up with mutual agreement with NTDC in original determination dated 22nd January 2016.

8 Reduction in Energy Price Price

8.1 The submissions of NPGCL with respect to review of reduction in energy charges and decision is as under:

8.2 Transformation and Switchyard losses

8.2.1 The Authority allowed 0.25% in respect of adjustment of Transformation and Switchyard Losses, against the claimed 1.84%. The Petitioner claimed that the nameplate loss in capacity mentioned by the manufacturer is 0.5% while the actual loss at site is 1.84% which is also endorsed by the Independent Engineer. The Petitioner further claims that the Authority while determining this figure did not consider losses due to various technical reasons, including part load operation, cyclic operation and ambient site conditions. Going further, the Petitioner submits that this figure has grown to 2.43% for the year 2014 – 15, therefore, the Authority may allow the same.

8.2.2 The Authority considered the submissions of the NPGCL and documentary evidence produced in support of their claim. The Authority observed that the nameplate loss in capacity mentioned by the manufacturer is 0.5%. The Authority considers that the loss beyond this is on part of NPGCL and cannot be allowed. The Authority has therefore considering the nameplate loss in capacity

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Annex - D

National Electric Power Regulatory Authority
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Registrar

No. NEPRA/TRF-304/NPGCL-2015/832-834
January 22, 2016

Subject: **Determination of the Authority in the matter of Tariff Petition filed by Northern Power Generation Company Ltd. (NPGCL) for the Determination of its Generation Tariff for the FY 2014-15 [Case # NEPRA/TRF-304/NPGCL-2015]**

Dear Sir,

Please find enclosed herewith the subject Determination of the Authority (36 pages) in Case No. NEPRA/TRF-304/NPGCL-2015.

2. The Determination is being intimated to the Federal Government for the purpose of notification in the official gazette pursuant to Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

Enclosure: As above

22-01-16
(Syed Safeer Hussain)

Secretary
Ministry of Water & Power
'A' Block, Pak Secretariat
Islamabad

CC:
1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.

12.3 The Petitioner requested to allow Part Load Adjustment Charges as per the curves and equations mentioned on graphs.

12.4 In order to analyze the claim of the Petitioner regarding part load adjustment charges, the hourly dispatch data of TPS Muzaffargarh units 1-6, for the month of January, 2015, was obtained which is as under:

	Unit No. 1	*Unit No. 2*	*Unit No. 3*	*Unit No. 4*	*Unit No. 5*	*Unit No. 6*
Tested Capacity Gross (MW)	190	182.50	183.50	272.20	181.44	173.88
Tested Capacity Net (MW)	175.81	169.108	171.352	247.20	168.11	158.89
Operation in January, 2015	- 62% of the time unit operated at 102.4% of tested capacity - 18% of the time unit operated at 90.4% of the tested capacity - 20% of the time unit operated at 73.4% of the tested capacity	- 74% of the time unit operated at 106.4% of the tested capacity - 26% of the time unit operated at 94% of the tested capacity.	- 80% of the time unit operated at 105.1% of the tested capacity. - 20% of the time unit operated at 99.2% of the tested capacity.	*85% of the time unit operated at 44.5% of the tested capacity - 15% of the time unit operated at 40.4% of the tested capacity	- 76% of the time unit operated at 107.1% of the tested capacity - 24% of the time unit operated at 104.1% of the tested capacity	- 96% of the time unit operated at 106.9% of the tested capacity - 04% of the time unit operated at 69.2% of the tested capacity

Unit 4 remained on outage for 27 days (87.77%) and available for only 04 days (12.23%).

12.5 From the above, it is noted that, except unit 4, all other units of TPS M/garh was dispatched at more than 100% of the tested capacity. As far as, unit 4 is concerned, it was observed that 87.77% of the time (27 days) during the January, 2015, the unit remained on outage and was available for only 04 days. The above comparison for part load adjustment charges was made by excluding the shutdown/stand by periods of the units and based on net tested capacity of the units. The Petitioner was directed to provide the relevant documentary evidence in support for part load adjustment. Accordingly the Petitioner vide letter dated 17.12.2015 provided the same which were reviewed. The Authority keeping in view the documentary evidence considers that the Petitioner's request for part-load adjustment seems legitimate. Based on the OEM data and partial loading curves the correction factor are being determined for part load operation of the Petitioner's units 1-6 which are as under

Correction Factors on Various loadings as Per OEM Data Provided by NPGCL

Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Unit 6	
% Loading	Correction Factor	% Loading	Correction Factor	% Loading	Correction Factor	% Loading	Correction Factor	% Loading	Correction Factor	% Loading	Correction Factor
100	1.0000	100	1.0000	100	1.0000	100	1.0000	100	1.0000	100	1.0000
								95	1.0093	95	1.0093

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90	1.0002	90	1.0002	90	1.0002			90	1.0188	90	1.0188
								85	1.0283	85	1.0283
80	1.0068	80	1.0068	80	1.0068			80	1.0380	80	1.0380
						75	1.0003	75	1.0477	75	1.0477
70	1.0200	70	1.0200	70	1.0200	70	1.0057	70	1.0575	70	1.0575
						65	1.0129	65	1.0675	65	1.0675
60	1.0397	60	1.0397	60	1.0397	60	1.0219	60	1.0776	60	1.0776
						55	1.0326	55	1.0877	55	1.0877
50	1.0659	50	1.0659	50	1.0659	50	1.0451	50	1.0980	50	1.0980

12.6 The above adjustment of partial loading will be made, if the Petitioner's units are dispatched on partial load as per instructions of system operator (NPCC). On the other hand the Petitioner will not be entitled for partial loading, if the units are dispatch on part load dueto various maintenance issues or in-efficiency on the part of the Petitioner.

13. **Whether Revision in fuel cost component based on the latest heat rate test.**

13.1 The Petitioner submitted that the units of Thermal Power Station Muzaffargarh have been commissioned during 1993 to 1997. Since then the units are being operated on dual fuel as per their design till 2007. The routine maintenance had been carried out as recommended by OEM, however these had been deferred by NPCC most of the time due to system constraints. Accordingly, as a natural process, Heat rate of the machines had been deteriorated due to natural wear and tear. In addition due to shortage of gas, these units were mostly being run on furnace oil which had not only adversely affected the loading capability but also affected the heat rate thereby increase in the production cost. This in fact was recognized in the determination dated May 02 2006. However, the company's delay to comply with the decision of the Authority is primarily due to financial constraints and certain other reasons including but not limited to inadequate fuel stock, non- availability of Gas, delays in major overhauling and annual Boiler inspections. However, the heat rate of all units has now been tested by an Independent consultant hired by USAID, under the grant available from USAID, besides other rehabilitation works that has been done to recapture the loading capability of these units. As per the directions of the Authority, Heat Rates tests were conducted by Pakistan Engineering Services (PES) for block 1, 2 and 3 of Muzaffargarh Plant under USAID Energy Power Policy after the rehabilitation of the plant. The details of tested heat rates are presented as below:

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