

**APPROVAL OF CAPITAL COST
&
AGGREGATE REVENUE REQUIREMENT FOR
FY 2019-20 TO FY 2021-22
&
DETERMINATION OF TARIFF FOR FY 2019-20
FOR LAKWA REPLACEMENT POWER PROJECT
To
ASSAM ELECTRICITY REGULATORY COMMISSION**



Prepared by
ASSAM POWER GENERATION CORPORATION LTD
Bijulee Bhawan, Paltanbazar
Guwahati – 781 001

AFFIDAVIT – LRPP PETITION

BEFORE THE ASSAM STATE ELECTRICITY REGULATORY
COMMISSION, GUWAHATI.

Petition No. –

Case No.
(to be filed by the Office)

IN THE MATTER OF

Filing of Petition for Aggregate Revenue Requirement for the FYs 2019-20 to 2021-22

AND

Determination of Tariff for the FY 2019-20

AND

IN THE MATTER OF

Lakwa Replacement Power Project,
Assam Power Generation Corporation Limited,
Maibella, Charaideo,
Saffry-785689

Petitioner

I, Mrs Meena Bordoloi Choudhury, daughter of Lt Mohan Ch. Bordoloi, aged 59 years, residing at Meghmallar Apartment, FA-101, A. K. Azad Road, Rehabari, Guwahati-781008, do solemnly affirm and say as follows:

I am the General Manager (HQ) of Assam Power Generation Corporation Limited, the petitioner in the above matter and am duly authorized by the said Petitioner to make this affidavit for and on behalf of the Assam Power Generation Corporation Limited.

The Statement made in the Petition based on information received from official records and I believe them to reflect truly and no material has been concealed from the statements so made or documents or supporting data etc. attached.

Solemnly affirm at Guwahati on 6th December' 2018 that the contents of this affidavit are true to my knowledge, no part of it is false or no material has been concealed therefore and misleading material included therein.

Deponent



(M. B. Choudhury)

General Manager (HQ),

Assam Power Generation Corporation Ltd.

Place: Guwahati

Date: 6th December' 2018

By order of the Commission

Secretary of the Commission

PRAYER – LRPP PETITION

BEFORE THE HON'BLE ASSAM ELECTRICITY REGULATORY COMMISSION

FILINGNO

CASENO.....

IN THE MATTER OF:

Petition for Aggregate Revenue Requirement for the FYs 2019-20, 2020-21 & 2021-22 and Determination of Tariff for the FY 2019-20 under the Assam Electricity Regulatory Commission (Terms & Conditions for Determination of Multi Year Tariff) Regulations, 2015 & 2018

AND IN THE MATTER OF:

Lakwa Replacement Power Project (hereinafter referred to as "LRPP") of Assam Power Generation Corporation Limited (hereinafter referred to as "APGCL") incorporated under the provisions of the Companies Act, 1956 and having its registered office in the State of Assam

THE HUMBLE APPLICANT ABOVE NAMED MOST RESPECTFULLY SHEWETH:

- 1 That the APGCL is a successor corporate entity of former ASEB, formed in pursuant to the notification of the Government of Assam, notified under sub-sections (1), (2), (5), (6) and (7) of Section 131 and Section 133 of the Electricity Act 2003(Central Act 36 of 2003), for the purpose of transfer and vesting of functions, properties, interests, rights, obligations and liabilities, along with the transfer of Personnel of the Board to the successor corporate entities.
- 2 That the APGCL is a company incorporated with the main object of generation of electricity in the state of Assam.
- 3 That the APGCL is a generating company under the provisions laid down in Section 14 Proviso 5, read with Section 131 (2) of the Electricity Act 2003.
- 4 That the APGCL submitted Petition for Aggregate Revenue Requirement and approval of provisional Tariff for the FY 2018-19 for LRPP on 26-09-2018 under the Regulation 41.4 of MYT Regulations, 2015.
- 5 That the Hon'ble Assam Electricity Regulatory Commission issued the provisional Tariff Order for LRPP on 19-03-2018 and directed APGCL to submit the final Tariff Petition for LRPP after its COD with up to date capital cost as on COD and the Performance Guarantee Test (PGT) Report.
- 6 That the COD of LRPP was declared w.e.f. 26-04-2018 and PGT Report was signed on 19-11-2018.
- 7 That the APGCL is now filing a Petition for Aggregate Revenue Requirement for the FYs 2019-20, 2020-21 & 2021-22 and Determination of Tariff for the FY 2019-20 of LRPP.

Place: Guwahati

Deponent

Date: 6th December' 2018

M. B. Choudhury
(M. B. Choudhury)
General Manager (HQ),
Assam Power Generation Corporation Ltd.

By order of the Commission

Secretary of the Commission

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Sl. No.	Particulars	Annexure(s)
1.	Auditor Certificate for the capital expenditure undertaken up to 26 th April 2018 (COD)	Annexure 1.
2.	Amendments to the Project Management Consultant's Cost	Annexure 2.
3.	Technical Proposal 4A of the EPC documents for LRPP	Annexure 3.
4.	Technical Proposal 4B of the EPC documents for LRPP	Annexure 4.
5.	Copy of relevant excerpts from CERC order no. 15 of 2014 dated 05.02.2016	Annexure 5.
6.	Ministry of Power document of 'Normalization Document and Monitoring & Verification Guidelines' for Thermal power plants	Annexure 6.
7.	Performance Guarantee Test Report of LRPP	Annexure 7.
8.	IIT Report on "Evaluation of Station Heat Rates for Namrup & Lakwa Thermal Power Stations" of APGCL	Annexure 8.
9.	Copy of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010	Annexure 9.
10.	Regulatory Formats	Annexure 10.



1 Background of APGCL

1.1 Profile of APGCL

- 1.1.1 Under the provisions of Electricity Act 2003 (hereinafter referred to as "Electricity Act") the Assam Electricity Reforms First Transfer Scheme, 2004 (hereinafter referred to as "Transfer Scheme") was notified by Government of Assam on 10th December 2004. Under Section 5 (2) of the transfer scheme the functions and undertakings as set out in Schedule-A of the transfer scheme stands transferred to Assam Power Generation Corporation Limited (APGCL). The final transfer scheme was notified by Govt. of Assam vide notification No: PEL/151/2003/Pt.349 dated 16th Aug' 2005 w.e.f. 1st April'05.
- 1.1.2 Section 131 (2) of the Electricity Act provides "...Any property, interest in property, rights and liabilities vested in the State Government under sub-section (1) shall be re-vested by the State Government in a Government company or in a company or companies, in accordance with the transfer scheme so published along with such other property, interest in property, rights and liabilities of the State Government as may be stipulated in such scheme, on such terms and conditions as may be agreed between the State Government and such company or companies being State Transmission Utility or generating company or transmission licensee or distribution licensee,...".
- 1.1.3 Section 62 of the Electricity Act 2003 requires the generating company to furnish details as may be specified by the Commission for determination of tariff.
- 1.1.4 As per AERC Tariff Regulation, 2015 the licensee is now filing the Petition for Capital cost approval for the Lakwa Replacement Power Plant.
- 1.1.5 As per AERC Tariff Regulation, 2018 the licensee is now filing the Petition for Multi year tariff petition for FY 2019-20 to FY 2021-22 for the Lakwa Replacement Power Plant.
- 1.1.6 The various data formats and forms, as required by the Hon'ble Commission, are furnished in Annexure -10.



1.2 LRPP Project Summary

- 1.2.1 Lakwa Thermal Power Station (LTPS) had installed capacity of 157.2 MW consisting of seven gas turbine Units. Out of these, three Units have capacity of 20 MW each and the remaining four are of 15 MW each. Of the four nos. of 15 MW Units operating in open cycle, three were commissioned in 1980-81 and one was commissioned in 1986.
- 1.2.2 The first four Units, on average, were in operation for over thirty. As they were operating in open cycle mode, the heat rate of these Units at 3513 kcal/kWh on NCV was twice as much as that of the modern combined cycle plants. Considering the age of the gas turbines, replacement of these gas turbines was inevitable.
- 1.2.3 In view of the above, it was decided to replace the first four Units with a modern plant with better heat rate and thus, the Lakwa Replacement Power Project of 69.755 MW (70 MW nominal), with 7 Units of 9.965 MW each, was conceived.
- 1.2.4 Lakwa Replacement Power Project (LRPP) was planned under Assam Power Sector Investment programme (MFF-II) of Asian Development Bank (ADB) and Govt of Assam for arranging fund (90% as Grant and 10% as Term Loan for the ADB fund). The loan agreement was signed between ADB, GOI and GoA on February 20, 2015. The equity part of the Project is being funded by GoA. The Letter of Award for execution of the project was issued to the consortium of Wartsila India Pvt. Ltd and Wartsila Finland on December 11, 2015 through process of competitive bidding, and the Contract Agreement was signed on January 19, 2016 and Zero Date started from March 9, 2016.

1.3 Commissioning of LRPP

- 1.3.1 Lakwa Replacement Power Project was commissioned on 26th April 2018.

1.4 Approval of provisional tariff by AERC

- 1.4.1 APGCL had filed a Petition for approval of ARR and determination of provisional tariff for FY 2018-19 for LRPP under Regulation 41.4 of the Tariff Regulations, 2015.
- 1.4.2 The Hon'ble Commission vide its order dated 19th March 2018 approved the provisional tariff for LRPP.
- 1.4.3 In the same order, the Hon'ble Commission directed APGCL to submit the final Tariff Petition for LRPP with the audited Capital Cost till COD.



2 Capital cost approval of LRPP

2.1 Regulatory provisions

2.1.1 The Hon'ble Commission in its Tariff Regulation, 2015 has stated the following on Capital Cost approval under the regulations. The same is reproduced below for ready reference.

"29 Capital Cost and capital structure

29.1 Capital cost for a project shall include:

- a. the expenditure incurred or projected to be incurred upto the date of commercial operation of the project, any gain or loss on account of foreign exchange risk variation on the loan during construction up to the date of commercial operation of the project, as admitted by the Commission, after prudence check*
- b. Interest during construction and financing charges, on the loans (i) being equal to 70% of the funds deployed, in the event of the actual equity in excess of 30% of the funds deployed, by treating the excess equity as normative loan, or (ii) being equal to the actual amount of loan in the event of the actual equity less than 30% of the funds deployed*
- c. Increase in cost in contract packages as approved by the Commission;*
- d. Interest during construction and incidental expenditure during construction as computed in accordance with Regulation 30.8 of these regulations*
- e. capitalised initial spares subject to the ceiling rates specified in this Regulation; and*
- f. additional capital expenditure or de-capitalization determined under Regulation 30*
- g. Adjustment of revenue due to sale of infirm power in excess of fuel cost prior to the COD as specified under Regulation 46 of these regulations; and*
- h. Adjustment of any revenue earned by the transmission licensee by using the assets before COD.*
- i. the capital cost admitted by the Commission prior to 1.4.2016 duly true'd up by excluding liability, if any, as on 1.4.2016*
- j. expenditure on account of renovation and modernization as admitted by this Commission in accordance with regulation 30.5*

Provided that the cost of the common assets forming part of the project, should be considered based on the suitable allocation and such allocated cost shall form part of the capital cost:

Provided that the assets forming part of the project, but not in use, shall be taken out of the capital cost."

29.2 The capital cost admitted by the Commission after prudence check shall form the basis for determination of tariff:"



2.2 Capital Expenditure

- 2.2.1 The Capital expenditure as on COD (26th April 2018) and as on 15th November 2018 is as shown in the table below.

Table 1: Capital expenditure of LRPP as on COD

Heads	Revised Total project cost	Expenditure as on COD (26th April 2018)
	Rs. Cr.	Rs. Cr.
Civil works	21.22	21.22
P&M	246.99	224.65
Total	268.21	245.87

- 2.2.2 We submit that the auditor certificate for the capital expenditure undertaken upto 26th April 2018 (COD) is attached as Annexure No. 1.

2.3 Financial progress

- 2.3.1 The funding pattern for the above capital expenditure as on 26th April 2018 (COD) is as shown in the table below. Further, the funds received from ADB has been considered at 90%:10% Grant and Loan Ratio.

Table 2: Financial progress of LRPP

Sr. No.	Fund Source	Total amount	Amount received	Expenditure as on COD (26 th April 2018)
		Rs. Cr.	Rs. Cr.	Rs. Cr.
1	ADB Grant	213.98	202.545	202.545
2	GOA loan	1.53	1.53	1.31
3	ADB Loan	23.776	22.51	22.51
4	GOA equity	28.92	28.92	19.50
	Total	268.21	255.505	245.87

Note: Foreign Exchange Rate Value (FERV) is included upto 26th April 2018 (COD) in details show above. The FERV impact in FY 2018-19 will be claimed on actuals.

- 2.3.2 We submit there has been a revision in the total project as the Project Management Consultant's fees has been revised from Rs 3.94 crore to Rs. 4.66 crore due to addition in scope of work. The copy of the amendments to the original documents are attached as Annexure No. 2.

2.4 Foreign exchange risk variation

- 2.4.1 As per regulation 29.1 (a) above, any loss or gain on account of Foreign exchange risk variation will form part of the capital cost for the plant. The loss on account of Foreign exchange risk variation is as shown below.



Table 3: FERV loss for LRPP

Particulars	Euro to INR conversion considered during bidding	Euro payment done upto COD	INR amount considered during bidding @68.66	Actual INR amount paid	FERV loss upto COD
					5 = 4-3
FERV loss in Rs. Crore	1 Euro = 68.66 INR	Euro 1.80 crore	INR 123.72 Crore	INR 130.41 crore	6.69

- 2.4.2 We submit that this FERV loss upto 26th April 2018 (COD) has already been considered as part of the capital cost shown above.
- 2.4.3 We further submit that a payment of around Euro 20 lakhs is pending to the EPC contractor, the actual impact of FERV on such payment will be claimed on actuals during True-up of FY 2018-19.

2.5 Interest during construction and incidental expenditure during construction

- 2.5.1 We submit that as per Regulation 30.8 of the Tariff Regulations, 2015 IDC is allowed is allowed as part of the capital cost of the project. The regulation is reproduced below for ready reference.

"30.8 Interest during construction (IDC), Incidental Expenditure during Construction (IEDC)

A. Interest during Construction (IDC):

- i. Interest during construction shall be computed corresponding to the loan from the date of infusion of debt fund, and after taking into account the prudent phasing of funds upto SCOD.*
- ii. In case of additional costs on account of IDC due to delay in achieving the SCOD, the generating company or the transmission licensee as the case may be, shall be required to furnish detailed justifications with supporting documents for such delay including prudent phasing of funds:*

Provided that if the delay is not attributable to the generating company or the transmission licensee as the case may be, and is due to uncontrollable factors, IDC may be allowed after due prudence check:

Provided further that only IDC on actual loan may be allowed beyond the SCOD to the extent, the delay is found beyond the control of generating company or the transmission licensee, as the case may be, after due prudence and taking into account prudent phasing of funds.

B. Incidental Expenditure during Construction (IEDC):



- i. Incidental expenditure during construction shall be computed from the zero date and after taking into account pre-operative expenses upto SCOD:*

Provided that any revenue earned during construction period up to SCOD on account of interest on deposits or advances, or any other receipts may be taken into account for reduction in incidental expenditure during construction.

- ii. In case of additional costs on account of IEDC due to delay in achieving the SCOD, the generating company or the transmission licensee as the case may be, shall be required to furnish detailed justification with supporting documents for such delay including the details of incidental expenditure during the period of delay and liquidated damages recovered or recoverable corresponding to the delay:*

Provided that if the delay is not attributable to the generating company or the transmission licensee, as the case may be, and is due to uncontrollable factors, IEDC may be allowed after due prudence check:

Provided further that where the delay is attributable to an agency or contractor or supplier engaged by the generating company or the transmission licensee, the liquidated damages recovered from such agency or contractor or supplier shall be taken into account for computation of capital cost.

- iii. In case the time over-run beyond SCOD is not admissible after due prudence, the increase of capital cost on account of cost variation corresponding to the period of time over run may be excluded from capitalization irrespective of price variation provisions in the contracts with supplier or contractor of the generating company or the transmission licensee.”*

Table 4: Interest during construction for LRPP

Particulars	IDC upto COD
IDC in Rs. Crore	3.19

- 2.5.2 We submit that this Interest during construction upto 26th April 2018 (COD) has already been considered as part of the capital cost shown above.

2.6 Additional capital expenditure or de-capitalization determined under Regulation 30

- 2.6.1 As per Regulation 30 of the Tariff regulations, 2015, the additional expenditure post COD is allowed by the Hon'ble Commission as per following regulations.

“30 Additional capitalization and de-capitalization

30.1 The following capital expenditure, actually incurred or projected to be incurred, on the following counts within the original scope of work, after the date of commercial operation and up to the cut-off date may be admitted by the Commission, subject to the prudence check.



- a. *Undischarged liabilities recognized to be payable at a future date;*
- b. *Works deferred for execution;*
- c. *Procurement of initial capital spares within the original scope of work, in accordance with the provisions of Regulation 29.5;*
- d. *Liabilities to meet award of arbitration or for compliance of the order or decree of a court; and*
- e. *Change in law or compliance of any existing law:*

Provided that the details of works asset wise/work wise included in the original scope of work along with estimates of expenditure, liabilities recognized to be payable at a future date and the works deferred for execution shall be submitted along with the application for determination of tariff."

2.6.2 APGCL has undertaken the following expenditure post COD for LRPP.

Table 5: Expenditure proposed post COD for LRPP

Particulars	Proposed expenditure in FY 2018-19
Expenditure post COD in Rs. Crore	22.34

Note: The above estimated expenditure is excluding any FERV. The FERV impact in FY 2018-19 will be claimed on actuals.

2.6.3 We submit that the expenditure to be undertaken post COD of LRPP is within the original scope of work and these were either works deferred for execution or undischarged liabilities recognized to be payable at a future date. Hence, APGCL prays to the Hon'ble Commission to approve the additional capitalization planned in FY 2018-19.

2.7 Fuel cost consumed before COD.

2.7.1 We submit that for LRPP a fuel cost of Rs. 6.70 crore was billed to APDCL fuel consumed before COD. The details of the same are shown below.

Table 6: Energy And Gas Consumption Statement Of LRPP (Feb'18-Apr 18)

Months	Gross Gen. (MU)	Gas Consumption (MMSCM)	Rate (Rs/1000 SCM)	Total (Rs)
Feb-18	1.858	0.43	6057	26,28,471.34
Mar-18	21.628	5.04	6658	3,35,70,193.54
Apr-18 (01/04/18 to 25/04/18)	19.036	4.47	6888	3,08,17,147.68
Total Amount (Feb'18-Apr'18)	42.522	9.951		6,70,15,812.56
				6.70 Cr

2.7.2 We pray to the Hon'ble Commission to approve the capital cost of LRPP



3 Performance Estimate of LRPP for FY 2018-19

3.1.1 The performance estimate of LRPP for FY 2018-19 is discussed below.

4 Norms of operations

4.1 Regulatory provisions

4.1.1 The Hon'ble Commission had set norms of operations under Tariff Regulations 2010. The regulation is reproduced below for ready reference

“48 Norms of operation for Thermal Generating Stations

48.1 Recovery of capacity charge, energy charge and incentive by the generating company shall be based on the achievement of the operational norms specified in the regulations 48.1 to 50.

48.2 The Commission may on its own revise the norms of Station Heat Rate specified in Regulation 49.4 in respect of any of the generating stations for which relaxed norms have been specified”

“51 Norms of operation for Hydro Generating Stations

51.1 The norms of operation as given hereunder shall apply for existing hydro stations in the state:”

4.1.2 The 6 months actual and 6 months estimated performance vis-a-vis norms of operations set is discussed below:

4.2 Snapshot of plant wise performance for FY 2018-19

4.2.1 The following table shows the operating performance parameters of LRPP for FY 2018-19.

Table 7: Operating Performance for FY 2018-19 of LRPP

LRPP	Approved	April - Sept (actual)	Oct - March (estimated)	Estimated total
Gross Energy in MU	508.03	178.43	294.60	473.03
Aux. Power Cons. (%)	3.50%	3.08%	3.50%	3.29%
Net Energy in MU	490.25	172.93	284.29	457.22
Availability (%)	85.00%	73.58%	96.42%	85.00%
PLF (%) for incentive	90.00%	67.75%	96.42%	82.09%
Gross Station Heat Rate on GCV (kcal/ kWh)	2,000	2127	2150	2138



4.3 Normative Annual Plant Availability Factor (NAPAF)

- 4.3.1 As per Regulation 49.1 of the Tariff Regulations, 2015 the Normative Plant Availability factor for recovery of full fixed charges, is 85% for new plants commissioned on or after 1st April 2016. The Hon'ble Commissioned had approved the same. The approved and estimated numbers are shown in the table below.

Table 8: Availability for 2018-19 of LRPP

LRPP	Approved	April - Sept (actual)	Oct - March (estimated)	Estimated total
Plant Availability Factor (%)	85.00%	73.58%	96.42%	85.00%

- 4.3.2 For LRPP, the estimated Normative Annual Plant Availability Factor is 85.00% for FY 2018-19 and is expected to achieve the same.

4.4 Normative Annual Plant Load Factor (NAPLF)

- 4.4.1 As per Regulation 49.2 of the Tariff Regulations, 2015 the Normative Plant Load factor, is 90% for new plants commissioned on or after 1st April 2016. The Hon'ble Commissioned had approved the same. The approved and estimated numbers are shown in the table below.

Table 9: Plant Load Factor for 2018-19 of LRPP

LRPP	Approved	April - Sept (actual)	Oct - March (estimated)	Estimated total
Plant Load Factor (%)	90.00%	67.75%	96.42%	82.09%

- 4.4.2 As LRPP is newly commissioned plant, it is facing teething problems for initial months. Hence, the Normative Plant Load Factor may not be achieved in FY 2018-19.

- 4.4.3 The Hon'ble Commission has provided stabilisation period for coal and gas based power plants under Tariff Regulations 2015. The regulation is reproduced below for ready reference.

“49.6 Stabilization period and availability levels:

In relation to a unit, stabilization period shall be reckoned commencing from the date of Commercial operation of that unit as follows, namely:

		PAF (%)	Stabilization period
I	Coal-based thermal generating stations	65	180 days
II	Gas turbine/ combined cycle generating stations	65	90 days

- 4.4.4 Hence, APGCL requests the Hon'ble Commission to provide similar stabilisation



period of 90 days for Gas engine based thermal power plants as APGCL is also facing stabilisation issues for LRPP.

- 4.4.5 Again, APGCL requests the Hon'ble Commission to invoke "Power to remove difficulties" under Regulation 115 of Tariff Regulations 2015 while providing treatment for the same.

4.5 Gross Station Heat Rate (SHR)

- 4.5.1 As per Regulation 49.4(c), of the Tariff Regulations, 2015 the Normative Station Heat Rate, is 2000 kCal/kWh for gas engine based generating station of 5 MW and above in open cycle mode of operation. The regulation is reproduced below for ready reference.

"49.4 Gross Station Heat Rate (GSHR):

i.

ii. New plants commissioned on or after 1st April, 2016:

c. Gas-engine based generating station

Capacities	Heat Rate*
1 to 3 MW	As per CEA Regulation
3 to 5 MW	As per CEA Regulation
>5 MW	2000 kCal / kWh for open cycle
>5 MW	1825 kCal / kWh for combined cycle

**The Commission may decide to amend and notify the revised norms on case to case Basis"*

- 4.5.2 The approved and estimated numbers are shown in the table below for LRPP.

Table 10: SHR for 2018-19 of LRPP

LRPP	Approved	April - Sept (actual)	Oct - March (estimated)	Estimated total
Station Heat Rate (kCal/kWh)	2,000	2127	2150	2138

- 4.5.3 In case of LRPP, the actual SHR value is higher than the approved value and APGCL prays to the Hon'ble Commission to revise the norms for LRPP as discussed below.

- 4.5.4 APGCL prays that the Hon'ble Commission to revise the norms for LRPP as per its Regulation 114 of 'Power to Relax' and also as per Regulation 49.4, where the Commission may decide to amend and notify the revised norms on case to case Basis under the Tariff Regulations, 2015.

- 4.5.5 The Commission in its order dated 19th March 2018 has stated that the



contention of APGCL that the guaranteed engine wise Gross station heat rate is on NCV basis is not justified. The excerpts from the order are reproduced below for ready reference.

“7.4.7 As regards SHR, Regulation 49.4 (c) of the MYT Regulations, 2015 specifies SHR norms of 2000 kcal/kWh for open cycle for capacity more than 5 MW. Based on contract document of LRPP as submitted by APGCL, the Commission notes that Guaranteed Gross Heat Rate of LRPP is 1873 kcal/kWh. The Guarantee data clearly mentioned the Design Heat Rate as Gross Heat Rate, hence, the contention of APGCL regarding the heat rate on NCV is not justified. Hence, the Commission provisionally approves the SHR for LRPP as 2,000 kcal/kWh, as specified in the MYT Regulations, 2015.”

- 4.5.6 However, as per the technical proposal 4A of the EPC documents with M/s Wartsila for development of LRPP, the guaranteed engine wise Gross Heat Rate was 1873 kCal/kWh on NCV basis (lower heating value). The copy of the technical proposal 4A and 4B of the EPC documents for LRPP are attached as Annexure No. 3 and Annexure No. 4.
- 4.5.7 We submit that there is a difference between considering of Gross SHR on GCV basis and NCV basis. We submit that conversion of Gross station heat rate (GSHR) from NCV basis to GCV basis was also referred in CERC order no. 15 of 2014 dated 05.02.2016. The relevant excerpts from the order is shown below and also the relevant excerpts from the order are attached as Annexure No. 5.

“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."

- 4.5.8 We submit that it is clear from the above CERC order that there is a difference in GSHR on GCV basis and GSHR on NCV basis.
- 4.5.9 We would also like to state that difference between calculation of Gross station heat rate and Net station rate is clearly illustrated at page 5 of the Ministry of Power document of 'Normalization Document and Monitoring & Verification Guidelines' for Thermal power plants. The formulas given in this document are used as the base document for setting and verification of targets under the PAT scheme of Ministry of Power. The relevant pages of the document are attached as Annexure No. 6.
- 4.5.10 In summary, we clearly want to state that there is a difference between Gross station heat rate of GCV basis, Gross station heat rate on NCV basis, Net station heat rate of GCV basis and Net station heat rate on NCV basis. The parameters considered for calculation of each is shown in the table below.

Particulars	Gross station heat rate on GCV basis	Gross station heat rate on NCV basis	Net station heat rate of GCV basis	Net station heat rate on NCV basis
Parameters considered for calculation	Gross generation with fuel values on GCV basis	Gross generation with fuel values on NCV basis	Net generation with fuel values on GCV basis	Net generation with fuel values on NCV basis

- 4.5.11 We submit that the Hon'ble Commission via its order dated 14th June 2018 against the Review petition of APGCL had order APGCL to submit the PG test report and also stated that the SHR issues will be considered at the time to determination of final tariff of LRPP. The excerpts from the order are reproduced



below for ready reference.

"The Commission in the Order has clearly stated that it will take view regarding Station heat Rate of LRPP based on performance guarantee tests at time of determination final Tariff, after commissioning of the LRPP. In Tariff Order for FY 2018-19, the Commission has determined provisional tariff for LRPP. Therefore, this issue will be considered by the Commission at the time of determination of final tariff for LRPP. "

4.5.12 We further submit that as the above difference between GSHR on GCV and NCV is clearly established, the values obtained during PG test report for LRPP are discussed.

4.5.13 As per page 1 of the summary of the PG test report for LRPP, the actual values obtained during PG test for engine wise Gross Heat Rate was around 1873 kCal/kWh on NCV basis (lower heating value). Also, as per page 4 of the summary of the PG test report for LRPP, the actual values obtained during PG test for Plant Heat Rate was around 2109 kCal/kWh on GCV basis (higher heating value). The summary of the PG test report for LRPP is attached as Annexure No. 7.

4.5.14 For conversion of heat rate from NCV basis to GCV basis, we have used a conversion factor of 1.11. The conversion factor of 1.11 for conversion of heat rate from NCV basis to GCV basis has been considered as the average ratio of GCV and NCV of fuel received for LTPS in the last 2.5 years. The calculation is shown below.

Table 11: Average ratio of GCV and NCV of fuel received for LTPS for FY 2016-17

Month	2016-17								
	GAIL NCV	GAIL GCV	GCV:NCV	OIL NCV	OIL GCV	GCV:NCV	Wtd. Avg. NCV	Wtd. Avg. GCV	GCV:NCV
April	9875	10892	1.10	8242	9139	1.11	9025	9980	1.11
May	9918	10938	1.10	8320	9223	1.11	9073	10031	1.11
June	9932	10953	1.10	8415	9325	1.11	9199	10166	1.11
July	9980	11004	1.10	8086	8974	1.11	9005	9959	1.11
August	10021	11048	1.10	8193	9087	1.11	9085	10044	1.11
September	10033	11060	1.10	8042	8926	1.11	9105	10066	1.11
October	9917	10936	1.10	8123	9012	1.11	9026	9981	1.11
November	9935	10956	1.10	7991	8872	1.11	8952	9903	1.11
December	10022	11053	1.10	8158	9048	1.11	9028	9984	1.11
January	9710	10718	1.10	8069	8954	1.11	8814	9755	1.11



Month	2016-17								
	GAIL NCV	GAIL GCV	GCV:NCV	OIL NCV	OIL GCV	GCV:NCV	Wtd. Avg. NCV	Wtd. Avg. GCV	GCV:NCV
February	9092	10057	1.11	7952	8827	1.11	8427	9339	1.11
March	8827	9773	1.11	8173	9066	1.11	8506	9426	1.11
Avg	9782	10793	1.10	8145	9036	1.11	8941	9890	1.11

Table 12: Average ratio of GCV and NCV of fuel received for LTPS for FY 2017-18

Month	2017-18								
	GAIL NCV	GAIL GCV	GCV:NCV	OIL NCV	OIL GCV	GCV:NCV	Wtd. Avg. NCV	Wtd. Avg. GCV	GCV:NCV
April	8747	9688	1.11	8015	8898	1.11	8390	9303	1.11
May	8702	9639	1.11	8098	8986	1.11	8363	9273	1.11
June	8547	9475	1.11	7973	8851	1.11	8202	9100	1.11
July	8530	9453	1.11	8119	9007	1.11	8305	9209	1.11
August	8364	9280	1.11	7968	8844	1.11	8153	9047	1.11
September	8493	9419	1.11	7936	8810	1.11	8194	9092	1.11
October	9530	10524	1.10	8299	9197	1.11	8853	9794	1.11
November	9107	10073	1.11	8180	9072	1.11	8616	9543	1.11
December	8308	9220	1.11	7965	8864	1.11	8109	9014	1.11
January	8325	9238	1.11	8105	8992	1.11	8306	9216	1.11
February	8436	9357	1.11	8063	8946	1.11	8294	9201	1.11
March	8320	9232	1.11	8092	8978	1.11	8192	9090	1.11
Avg	8632	9566	1.11	8065	8951	1.11	8338	9247	1.11

Table 13: Average ratio of GCV and NCV of fuel received for LTPS for FY 2018-19

Month	2018-19								
	GAIL NCV	GAIL GCV	GCV:NCV	OIL NCV	OIL GCV	GCV:NCV	Wtd. Avg. NCV	Wtd. Avg. GCV	GCV:NCV
April	8297	9208	1.11	7935	8810	1.11	8108	9001	1.11
May	8357	9272	1.11	7938	8814	1.11	8118	9011	1.11
June	8411	9330	1.11	7998	8880	1.11	8187	9086	1.11
July	8403	9322	1.11	8017	8899	1.11	8185	9083	1.11
August	8359	9275	1.11	8020	8901	1.11	8182	9079	1.11
September	8527	9454	1.11	8037	8920	1.11	8252	9154	1.11
October	8363	9279	1.11	7925	8797	1.11	8126	9018	1.11

4.5.15 The values obtained after conversion of values obtained in PG test are shown below:



Table 14: SHR values after conversion to gross heat rate on GCV basis

Particulars	Guaranteed values	As per PG test report		PG test values obtained after conversion to gross heat rate on GCV basis	
	Engine wise Gross Heat Rate on NCV basis	Plant Heat Rate on GCV basis	Engine wise Gross Heat Rate on NCV basis	Plant Heat Rate on GCV basis	Engine wise Gross Heat Rate value on GCV basis
	1	2	3	4	6 = 3*1.11
SHR in kCal/kWh	1873	2109	1873	2109	2079

4.5.16 We submit that the actual SHR values (Gross SHR on GCV basis) obtained in FY 2018-19 are close to values obtained through conversion of PG test values to Gross heat rate on GCV basis. The same is as shown below.

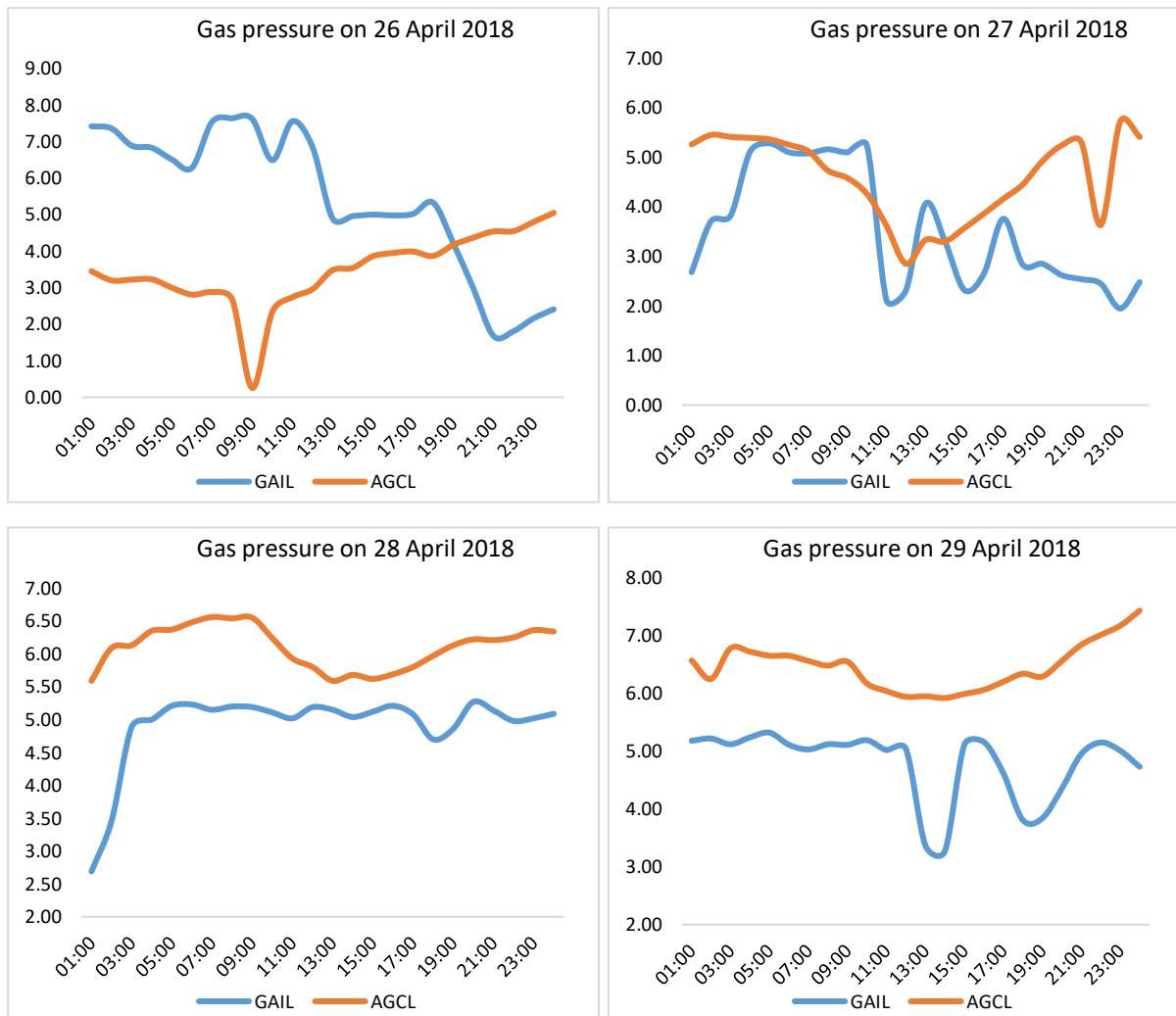
Table 15: Comparison of converted PG test values and actual SHR values of FY 2018-19

Particulars	PG test values obtained after conversion to gross heat rate on GCV basis		Actual Values obtained for FY 2018-19
	Plant Heat Rate on GCV basis	Engine wise Gross Heat Rate value on GCV basis	Gross plant (Station) Heat rate on GCV basis
SHR in kCal/kWh	2109	2079	2127

4.5.17 We also submit that the actual Gross SHR on GCV basis is higher than the PG test report values, as during PG test report ideal conditions were made for completion of the test. The ideal conditions that were prepared for PG test was - LTPS load was decreased to facilitate PG test report because the gas pressure keeps changing frequently and corrections were applied to arrive at PG test numbers due to low load and knock state.

4.5.18 We also submit that the commission is aware of the fluctuating gas pressure faced by APGCL as per earlier submissions of the APGCL. The variation in gas pressure is also established by the variation in gas pressure shown below for LRPP during PG test.





4.5.19 Hence, practically when both LRPP and LTPS operate simultaneously, the changing gas pressure and quantity of gas has an impact on SHR of both the plants. Thus, the values obtained in PG test report can never be achieved in practical scenario. This was also established for LTPS and NTPS in the IIT report on 'Evaluation of Station Heat rates for Namrup and Lakwa Thermal Power Station of APGCL' which was already accepted by the Hon'ble Commission. The relevant pages of the IIT report is attached as Annexure No. 8.

4.5.20 We further submit that CEA under Regulation 24(5)(b) at page 42 of its CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 has considered SHR as 2150 KCal/ kWh for gas engines greater than 5 MW. The relevant pages of the CEA regulations are attached as Annexure No. 9. The regulation is reproduced below for ready reference.

"24 Operating Capabilities of IC Engine based Generating Sets (Gensets)-

(5)



(a)

(b)

(c) Gas engine based Gen- sets

Table 5

Gen- Set Rating	Gross Heat Rate (on HHV basis) in kcal/ kWh at 100% load
>1 MW to 3 MW	2400
> 3 MW to 5 MW	2300
>5 MW	2150

4.5.21 APGCL submits that the actual values of SHR for LRPP are close to the SHR values considered by CEA and values obtained through conversion of PG test values to Gross heat rate on GCV basis. The same is as shown below.

Table 16: Comparison of converted PG test values, actual SHR values of FY 2018-19 and as per CEA regulations

Particulars	PG test values obtained after conversion to gross heat rate on GCV basis		Actual Values obtained for FY 2018-19	As per CEA regulations
	Plant Heat Rate on GCV basis	Engine wise Gross Heat Rate value on GCV basis	Gross plant (Station) Heat rate on GCV basis	Gross plant (Station) Heat rate on GCV basis
SHR in kCal/kWh	2109	2079	2127	2150

4.5.22 As can be clearly seen from the table above, the converted PG test values, actual SHR values of FY 2018-19 and values as per CEA regulations are very close. Thus, APGCL prays to the Hon'ble Commission to revise the SHR norms for LRPP issued vide order dated 19 March 2018 to 2150 KCal/kWh as per CEA regulations from 26th April 2018 (COD).

4.5.23 We also submit that for Gas engine based gen-sets of 1 to 3 MW and 3 to 5 MW, the Hon'ble Commission has considered SHR values as per CEA regulations. The comparison of SHR values as per AERC Tariff regulations and as per CEA is shown below.

Table 17: Station heat rate as per AERC Tariff regulations and as per CEA regulations

Gen- Set Rating	As per CEA	AERC Tariff regulations
>1 MW to 3 MW	2400	'As per CEA Regulation'
> 3 MW to 5 MW	2300	'As per CEA Regulation'
>5 MW	2150	2000kCal / kWh for open cycle
>5 MW	2150	1825kCal / kWh for combined cycle



- 4.5.24 We further submit, that and a SHR norm of 2150 KCal/kWh will provide the requisite margin for LRPP to compensate for partial loading, start-stop etc. which are practically required during running of power plant.
- 4.5.25 It is also submitted that similar margin is provided over and above the Design heat rate (PG heat rate) to coal and gas / liquid based plants under the Tariff regulations 2015.
- 4.5.26 In view of the above, APGCL prays to the Hon'ble Commission to revise the SHR norms for LRPP to 2150 KCal/kWh as per CEA regulations.

4.6 Auxiliary Energy Consumption

- 4.6.1 As per Regulation 49.3(ii) of the Tariff Regulations, 2015 the Normative Auxiliary energy consumption, is 3.50% for gas engine based generating station in open cycle mode of operation with gas booster compressor.
- 4.6.2 The approved and estimated numbers are shown in the table below.

Table 18: Auxiliary energy consumption for 2018-19 of LRPP

LRPP	Approved	April - Sept (actual)	Oct - March (estimated)	Estimated total
Auxiliary energy consumption (%)	3.50%	3.08%	3.50%	3.29%

- 4.6.3 APGCL prays to the Hon'ble Commission to approve the estimated numbers.



5 Fixed Cost of the Plant

5.1 Annual fixed cost for FY 2018-19

- 5.1.1 As per regulation 43.1 of the AERC Tariff regulations, 2015 the following components of fixed cost have been considered for Performance estimate of the tariff for the power plant:
- (a) Return on Equity
 - (b) Interest on Long Term Loan
 - (c) Depreciation
 - (d) Operation and Maintenance Expenses
 - (e) Interest on Working Capital
 - (f) Less: Non-Tariff Income
- 5.1.2 Since LRPP was commissioned on 26th April 2018, all costs have been considered for 340 days i.e. (365-25) days for FY 2018-19.
- 5.1.3 For the computation of the fixed components, the Petitioner has considered the principles provided in the Tariff Regulations, 2015. These components have been discussed in detail in the following sections of the petition.

5.2 Return on Equity (ROE)

- 5.2.1 The Hon'ble Commission in its regulation has considered the pre-tax return on equity at 15.5% of equity capital. The Regulation 34 of the Tariff Regulations, 2015 is reproduced below for reference.

“34 Return on Equity Capital

34.1 Return on equity capital shall be computed on the equity capital determined in accordance with Regulation 32

34.2 Return on equity shall be computed at the rate of 15.50% for Generating Stations, Transmission Licensee and SLDC and at the rate of 16.00% for Distribution Licensee on a post-tax basis.”

- 5.2.2 The Petitioner has determined the Return on Equity (RoE) at a rate of 15.5% in accordance with the Tariff Regulations, 2015. The Petitioner submits that no addition in Equity is envisaged in FY 2018-19.

Table 19: Computation of Plant wise Return in Equity for 2018-19

Station	Particulars	Approved for FY 2018-19	Performance estimate for FY 2018-19
LRPP	Opening Equity	10.71	19.50



Station	Particulars	Approved for FY 2018-19	Performance estimate for FY 2018-19
	Closing Equity	10.71	28.92
	Rate of Return	15.50%	15.50%
	Return on Equity	1.53	3.50

5.2.3 APGCL prays to the Hon'ble Commission to approve the plant wise Return on Equity as shown above.

5.3 Interest on Loan Capital

5.3.1 As per Regulation 35 of the Tariff Regulations, 2015, the Commission will consider interest on Loan capital on normative basis with repayment equal to depreciation allowed for that year and rate of interest will be the weighted average rate of interest calculated on the basis of the actual loan portfolio at the beginning of each year. The regulation is reproduced below for ready reference.

"35 Interest on loan capital

35.1 The loans arrived at in the manner indicated in Regulation 32 shall be considered as gross normative loan for calculation of interest on loan.

Provided that in case of retirement or replacement of assets, the loan capital approved as mentioned above, shall be reduced to the extent of 70% (or actual loan component based on documentary evidence, if it is higher than 70%) of the original cost of the retired or replaced assets.

35.2 The normative loan outstanding as on April 1, 2016, shall be worked out by deducting the cumulative repayment as admitted by the Commission up to March 31, 2016, from the gross normative loan.

35.3 The repayment for each year of the Control period shall be deemed to be equal to the depreciation allowed for that year:

35.4 Notwithstanding any moratorium period availed by the Generating Company or the Transmission Licensee or the Distribution Licensee or the SLDC, as the case may be, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed.

35.5 The rate of interest shall be the weighted average rate of interest calculated on the basis of the actual loan portfolio at the beginning of each year applicable to the Generating Company or the Transmission Licensee or the Distribution Licensee or SLDC:"

5.3.2 In view of the above, the Petitioner has computed the Interest on long term Loan on normative basis for FY 2018-19. The Petitioner has considered normative loan



portfolio and the repayment shown is considered equal to the depreciation for FY 2018-19. The interest rate has been considered as the expected weighted average rate of interest for FY 2018-19 for APGCL as a whole.

- 5.3.3 The table below summarizes the interest on loan and finance charges considered for Performance estimate of LRPP for FY 2018-19.

Table 20: Computation of Plant wise Interest and finance charges for 2018-19

Station	Particulars	Approved for FY 2018-19	Performance estimate for FY 2018-19
LRPP	Net Normative Opening Loan	25.00	24.04
	Addition of normative loan during the year	0.00	1.27
	Normative Repayment during the year	1.05	5.16
	Net Normative Closing Loan	23.95	20.15
	Avg. Normative Loan	24.48	22.09
	Interest Rate	10%	10.12%
	Interest on Loan Capital	2.25	2.08
	Add: Bank Charges	0.00	0.00
	Net Interest on Loan Capital	2.25	2.08

- 5.3.4 APGCL prays to the Hon'ble Commission to approve the total interest and finance charges as shown above.

5.4 Depreciation

- 5.4.1 The Hon'ble Commission in its Tariff Regulations, 2015 has considered following principals for determination of depreciation.

33 Depreciation

33.1 *The value base for the purpose of depreciation shall be the Capital Cost of the asset admitted by the Commission.*

Provided that depreciation shall not be allowed on assets funded through Consumer contribution and Capital Subsidies/Grants.

33.2 *The salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the capital cost of the asset.*

Provided that in case of hydro generating stations, the salvage value shall be as provided in the agreement signed by the developers with the State Government for creation of the site:

Provided further that the capital cost of the assets of the hydro generating station for the purpose of computation of depreciable value shall correspond to the percentage of sale of electricity under long-term power purchase agreement at regulated tariff.



Provided also that any depreciation disallowed on account of lower availability of the generating station or generating unit or transmission system as the case may be, shall not be allowed to be recovered at a later stage during the useful life and the extended life.

33.3 *Land, other than the land held under lease and the land for reservoir in case of hydro Generating Station, shall not be a depreciable assets and its cost shall be excluded from the capital cost while computing depreciable value of the assets.*

33.4 *Depreciation shall be calculated annually based on Straight Line Method and at rates specified in Appendix-I to these Regulations:*

Provided that, the remaining depreciable value as on 31st March of the year closing after a period of 12 years from date of commercial operation shall be spread over the balance useful life of the assets.

33.5 *In case of the existing projects, the balance depreciable value as on April 1, 2016, shall be worked out by deducting the cumulative depreciation including Advance against Depreciation as admitted by the Commission upto March 31, 2016, from the gross depreciable value of the assets.”*

5.4.2 In view of the above, the Petitioner has computed the Depreciation considering Capital Cost of the asset with 10% salvage value. Also, depreciation of grants has not been considered. The table below summarizes the Depreciation considered for Performance estimate of LRPP for FY 2018-19

Table 21: Depreciation for 2018-19 of LRPP

Particulars	FY 2018-19
Opening GFA	245.87
Addition during the year	22.34
Closing	268.21
Average GFA	257.04
Rate of Depreciation	4.77%
Total Depreciation	12.26
Grant	202.55
Additions during the year	11.44
Closing grant	213.98
Average grant	208.26
Rate of Depreciation	3.66%
Depreciation on grants	7.10
Net Depreciation	5.16



Table 22: Summary of Depreciation claimed for FY 2018-19

Station	Particulars	Approved FY 2018-19	Performance estimate for FY 2018-19
LRPP	Depreciation	8.7	12.26
	<u>Less:</u> Depreciation on assets funded by Grants	7.65	7.10
	Net Depreciation	1.05	5.16

5.4.3 APGCL prays to the Hon'ble Commission to approve the Depreciation for FY 2018-19 as shown above.

5.5 Interest on Working Capital

5.5.1 As per Regulation 37 of the Tariff Regulations, 2015, the interest on working capital will be considered on normative basis. The regulation is reproduced below for ready reference.

"37 Interest on Working Capital

37.1 Generation projects

- a)***
- b) In case of Gas Turbine/Combined Cycle/ Gas-engine based Generating Stations, working capital shall cover:***
 - i. Fuel cost for one (1) month corresponding to target availability duly taking into account the mode of operation of the Generating Station on gas fuel and / or liquid fuel;***
 - ii. Liquid fuel stock for fifteen (15) days corresponding to target availability subject to required storage availability;***
 - iii. Operation and maintenance expenses for one (1) month;***
 - iv. Maintenance spares @ 30% of operation and maintenance expenses; and***
 - v. Receivables equivalent to two (2) months of capacity charges and energy charges for sale of electricity calculated on target availability,***
- c) In case of Hydro power Generating Stations including pumped storage hydro-electric generating station, working capital shall cover:***
 - i. Operation and maintenance expenses for one (1) month;***
 - ii. Maintenance spares @15% of operation and maintenance expenses; and***
 - iii. Receivables equivalent to two (2) months of the annual fixed charges.***
- d) Rate of interest on working capital shall be on normative basis and shall be equal to the interest rate equivalent to State Bank of India base rate as on 1st April of the respective year plus 350 basis points."***

5.5.2 As per the above regulations, the Petitioner has claimed normative interest on working capital. However, as APGCL does not have liquid fuel stock facility, it has not considered working capital on storage of liquid fuel. The rate of interest has been considered as shown equal to the interest rate equivalent to State Bank of India base rate as on 1st April of the respective year plus 350 basis points, which



$9.10\% + 3.50\% = 12.60\%$. The plant wise interest on working capital considered is shown in the table below:

Table 23: Summary of Interest on working capital claimed for FY 2018-19

Station	Particulars	Approved FY 2018-19	Performance estimate for FY 2018-19
LRPP	Fuel Cost for one month	6.11	6.78
	O&M Expenses for one month	1.58	1.58
	Maintenance Spares-30% of O&M	5.68	5.68
	Receivables for two months	16.82	19.20
	Total Working Capital Requirement	30.18	33.23
	Rate of interest	12.60%	12.60%
	Interest on Working capital	3.80	4.19

- 5.5.3 APGCL prays to the Hon'ble Commission to approve the Interest on Working Capital for FY 2018-19 as shown above.

5.6 Operation and Maintenance Expenses (O&M Expenses)

- 5.6.1 The Tariff Regulations, 2015 does not provide for separate approval of Employee expenses, A&G expenses and R&M expenses. The actual O&M expenses and APGCL's claim for O&M expenses for FY 2018-19 are as shown in the table below

Table 24: Operation and Maintenance claimed for FY 2018-19

Station	Approved for FY 2018-19	Performance estimate for FY 2018-19
LRPP	18.92	18.92

- 5.6.2 As per Regulation 2.1(49) of the Tariff Regulations, 2015, Operation and maintenance expense include manpower, repairs, spares, consumables, insurance and overheads but excludes fuel expenses and water charges. The regulation is reproduced below for ready reference.

"2.1 In these Regulations, unless the context otherwise requires:

(49) "Operation and Maintenance expenses" or "O&M expenses" means the expenditure incurred on operation and maintenance of the project, or part thereof, and includes the expenditure on manpower, repairs, spares, consumables, insurance and overheads but excludes fuel expenses and water charges"

- 5.6.3 The Petitioner submits that Special R&M and increase in Terminal liabilities will be claimed separately as per the Tariff Regulations 2015 during True-up. APGCL



prays to the Hon'ble Commission to approve the O&M expenses for FY 2018-19 as shown above.

5.7 Non-Tariff Income

- 5.7.1 As per Regulation 47 of the Tariff Regulations, 2015, the non-tariff income shall be deducted from the Annual Fixed Cost in determining the Annual Fixed Cost of the Generation Company. The regulation is reproduced below for ready reference.

47 Non-Tariff Income

47.1 The amount of non-tariff income relating to the Generation Business as approved by the Commission shall be deducted from the Annual Fixed Cost in determining the Annual Fixed Cost of the Generation Company

- 5.7.2 In view of the above regulations, the details of non-tariff income for FY 2018-19 are shown in the table below

Table 25: Non-Tariff income for FY 2018-19

Station	Approved for FY 2018-19	Performance estimate for FY 2018-19
LRPP	0.00	0.00

- 5.7.3 APGCL prays to the Hon'ble Commission to approve the Non-Tariff income for FY 2018-19 as shown above.

5.8 Total Fixed Cost

- 5.8.1 The recovery of Annual fixed charges is to be done as per regulation 53.1 of the Tariff Regulations, 2015. The regulation is reproduced below for ready reference.

“53 Computation and Payment of Annual Fixed Charges and Energy Charges for Thermal Generating Stations

53.1 Annual Fixed Charges

a. The total Annual Fixed Charges shall be computed based on the norms specified under these Regulations and recovered on monthly basis.

b. The full Annual Fixed Charges shall be recoverable at Normative Annual Plant Availability factor (NAPAF) specified in these Regulation. Recovery of Annual Fixed Charges below the level of NAPAF shall be on pro rata basis. At zero Availability, no Capacity Charges shall be payable.

c. Payment of Annual Fixed Charges shall be on monthly basis in equal instalments in proportion to contracted capacity subject to adjustment at the end of the year with respect to NAPAF.”



5.8.2 Based on the above, the Annual fixed charges for FY 2018-19 has been computed. The Hon'ble Commission is requested to approve the fixed charges as discussed in the table below:

Table 26: Annual Fixed charges for 2018-19 of LRPP

Particulars	Approved for FY 2018-19	Amount Estimated for Performance estimate
Operation & Maintenance Expenditure	18.92	18.92
Employee Expenses		
R&M Expenses		
A&G Expenses		
Interest & Finance Charges	2.25	2.08
Interest on working Capital	3.80	4.19
Depreciation	1.05	5.16
Return on Equity	1.53	3.50
<u>Less:</u> Other Income	0.00	0.00
Total Fixed Charges	27.56	33.84

5.8.3 The Petitioner prays to the Hon'ble Commission to approve the Fixed Costs for FY 2018-19 as discussed in the table above.



6 Energy Charges

6.1 Fuel Price and Calorific Value

- 6.1.1 As per Regulation 11 of the Tariff Regulations 2015, 'Fuel Price' and 'Calorific Value of Fuel' are uncontrollable items. The actual values of 'Fuel Price' and 'Calorific Value of Fuel' are shown in the table below:

Table 27: Actual Plant wise GCV and Price for FY 2018-19

Station	Wt. Avg. Gross Calorific Value of Gas (kcal/SCM)	Wt. Avg. Price of Gas (Rs./1000 SCM)
LRPP	9,095	7,315

- 6.1.2 The month wise copies of actual fuel bills raised by APGCL's suppliers for FY 2018-19 up to September 2018 have been already submitted to AERC by APGCL in its quarterly FPA Reports.
- 6.1.3 The Petitioner submits that the Gas prices has been revised to USD 3.36 / MMBTU from October 2018. Hence, the weighted average price of gas has been considered for FY 2018-19.
- 6.1.4 The Petitioner prays to the Hon'ble Commission to approve the Price of Gas and GCV of gas for LRPP for FY 2018-19 as shown in the table above.

6.2 Fuel cost

- 6.2.1 The table below shows the approved fuel cost and the actual total fuel cost incurred for FY 2018-19.

Table 28: Fuel cost for LRPP for FY 2018-19

Particulars	Derivation	Unit	FY 2018-19 Approved	FY 2018-19 Estimated
Gross Generation	A	MU	508	473
Heat Rate	B	kcal/kWh	2,000	2138
GCV of gas	C	kcal/SCM	9,491	9095
Overall Heat	D= A x B	G. cal.	10,16,060	1011488
Gas consumption	E= D/C	M. SCM	107	111
Price of Gas	F	Rs./ 1000 SCM	6,850	7315
Total cost of Gas	G= E x F /10000	Rs. Crore	73.33	81.35

- 6.2.2 The Petitioner prays to the Hon'ble Commission to approve the estimated Fuel cost Price for LRPP for FY 2018-19 as shown in the table above.

6.3 Incentives

- 6.3.1 Incentives for FY 2018-19 will be claimed during True-up of FY 2018-19.



7 Summary of submissions of Performance estimate for FY 2018-19

7.1 Annual Fixed Cost

7.1.1 The summary of plant wise annual fixed costs are shown in the tables below.

Table 29: Annual Fixed charges for 2018-19 of LRPP

Particulars	Approved in Tariff Order for FY 2018-19	Amount Estimated for Performance estimate
Operation & Maintenance Expenditure	18.92	18.92
Employee Expenses		
R&M Expenses		
A&G Expenses		
Interest & Finance Charges	2.25	2.08
Interest on working Capital	3.80	4.19
Depreciation	1.05	5.16
Return on Equity	1.53	3.50
<u>Less: Other Income</u>	-	0.00
Total Fixed Charges	27.56	33.84

7.1.2 The Petitioner prays to the Hon'ble Commission to approve the plant wise fixed costs for FY 2018-19 as discussed in the tables above

7.2 Energy Charges

7.2.1 The summary of plant wise fuel costs are shown in the tables below.

Table 30: Fuel cost for LRPP for FY 2018-19

Particulars	Derivation	Unit	FY 2018-19 Approved	FY 2018-19 Estimated
Gross Generation	A	MU	508	473
Heat Rate	B	kcal/kWh	2000	2138
GCV of gas	C	kcal/SCM	9491	9095
Overall Heat	D= A x B	G. cal.	1016060	1011488
Gas consumption	E= D/C	M. SCM	107	111
Price of Gas	F	Rs./ 1000 SCM	6850	7315
Total cost of Gas	G= E x F / 10000	Rs. Crore	73.33	81.35

7.2.2 The Petitioner prays to the Hon'ble Commission to approve the estimated Fuel cost Price for LRPP for FY 2018-19 as shown in the table above.

7.3 Net Annual Revenue Requirement

7.3.1 The plant wise Net Annual Revenue Requirements for FY 2018-19 are as shown in the tables below.



Table 31: Net Annual Revenue Requirements for LRPP for FY 2018-19

Particulars	Approved in Tariff Order for FY 2018-19	Amount estimated Performance estimate
Total Fixed Charges	27.56	33.84
Fuel Cost	73.33	81.35
Total Revenue Requirement	100.89	115.19

7.3.2 The Petitioner prays to the Hon'ble Commission to approve the plant wise Net Annual Revenue Requirement for FY 2018-19 as discussed in the tables above.



8 Multi Year Tariff framework and Capital Investment plan for FY 2019-20 to FY 2021-22

8.1 Regulatory provisions for Multi-Year Tariff framework

8.1.1 The Hon'ble Commission in its Tariff regulations 2018 has stated the following on Multi-year Tariff framework for the control period from FY 2019-20 to FY 2021-22. The same is reproduced below for ready reference:

"4 Multi-Year Tariff Framework

4.1 The Commission shall determine the tariff for matters covered under clauses (i), (ii), (iii), (iv) and (v) of Regulation 3.3 above under a Multi-Year Tariff framework with effect from 1st April 2019.

4.2 The Multi-Year Tariff framework shall be based on the following elements, for calculation of Aggregate Revenue Requirement and expected revenue from tariff and charges for Generating Companies, Transmission Licensee, SLDC, Distribution Wheeling Business and Retail Supply Business:

- (i) Before commencement of Control Period, a forecast of the Aggregate Revenue Requirement and expected revenue from existing tariff and charges shall be submitted by the applicant and approved by the Commission;***
- (ii) A detailed Capital Investment Plan for each year of the Control Period, shall be submitted by the applicant for the Commission's approval;***
- (iii) The applicant shall submit operating norms and trajectories of performance parameters for each year of the Control Period, for the Commission's approval***
- (iv) The applicant shall submit the forecast of Aggregate Revenue Requirement and expected revenue from existing tariff for each year of the Control Period, and the Commission shall approve the tariff for Generating Companies, SLDC, Transmission Licensee, Distribution Wheeling Business and Retail Supply Business, for each year of the Control Period;***
- (v) In its tariff petition, a generating company shall submit information to support the determination of tariff for each generating station***

5 Control Period and Baseline

5.1 The first Control Period under these Regulations shall be of three financial years from April 1, 2019 to March 31, 2022 and for every block of three years thereafter or such other period as may be decided by the Commission.

.....

5.2 The Commission shall determine baseline values for various financial and operational parameters of ARR for the Control Period taking into consideration the figures approved by the Commission in the past, actual average figures of last three years, audited accounts, estimate of the figures for the relevant year, Industry benchmarks/norms and other factors considered appropriate by the Commission;



Provided that in case of substantial difference between the estimates earlier provided/considered for determination of baseline values and the actual audited accounts, the Commission may re-determine the baseline values for the base year suo-moto or on an application filed by the Applicant"

9 Norms of operations

9.1 Regulatory provisions

- 9.1.1 The Hon'ble Commission had set norms of operations under Tariff Regulations 2018. The regulation is reproduced below for ready reference

8 Specific trajectory for certain variables

8.1 The Commission shall stipulate a trajectory while approving the MYT Petition for certain variables having regard to the reorganization, restructuring and development of the electricity industry in the State.

8.2 Provided that the variables for which a trajectory may be stipulated include, but are not limited to,

a) In case of Generating Stations:

Generating station's availability, Station heat rate, secondary oil consumption, auxiliary consumption, Transit losses, etc.

46 Norms of operation for Thermal Generating Stations

46.1 Recovery of capacity charge, energy charge and incentive by the generating company shall be based on the achievement of the operational norms specified in the regulations 47.1 to 49.

46.2 The Commission may on its own revise the norms of Station Heat Rate in respect of any of the generating stations for which relaxed norms have been specified

- 9.1.2 The future year projections has been based on Normative basis as set out in Tariff Regulations 2018.

- 9.1.3 The projected performance vis-a-vis norms of operations set is discussed below:

9.2 Snapshot of plant wise performance projection for FY 2019-20 to FY 2021-22

- 9.2.1 The following table shows the projection of performance parameters of gas based LRPP for FY 2019-20 to FY 2021-22.



Table 32: Projected Operating Performance for FY 2019-20 to FY 2021-22 of LRPP

LRPP	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
Gross Energy in MU	473.03	549.95	549.95	549.95
Aux. Power Cons. (%)	3.29%	3.50%	3.50%	3.50%
Net Energy in MU	457.22	530.70	530.70	530.70
Plant Availability Factor (%)	85%	85%	85%	85%
Plant Load Factor (%)	82%	90%	90%	90%
Gross Station Heat Rate on GCV (kcal/ kWh)	2138	2150	2150	2150

9.3 Normative Annual Plant Availability Factor (NAPAF)

9.3.1 In absence of norms of NAPAF for LRPP under Tariff Regulations, 2018, the NAPAF of 85% has been considered for FY 2019-20 to FY 2021-22. This is same as approved by Hon'ble Commission for FY 2018-19 in its order dated 19th March 2018. The projected numbers are shown in the table below.

Table 33: Projected Availability for FY 2019-20 to FY 2021-22 of LRPP

LRPP	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
Plant Availability Factor (%)	85%	85%	85%	85%

9.4 Normative Annual Plant Load Factor (NAPLF)

9.4.1 In absence of norms of NAPLF for LRPP under Tariff Regulations, 2018, the NAPLF of 90% has been considered for FY 2019-20 to FY 2021-22. This is same as approved by Hon'ble Commission for FY 2018-19 in its order dated 19th March 2018. The projected numbers are shown in the table below.

Table 34: Projected Availability for FY 2019-20 to FY 2021-22 of LRPP

LRPP	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
Plant Load Factor (%)	82%	90%	90%	90%

9.5 Gross Station Heat Rate (SHR)

9.5.1 As stated in the petition earlier, for LRPP the actual SHR value is higher than the approved value of FY 2018-19 and APGCL prays to the Hon'ble Commission to revise the norms for LRPP. The projected SHR has been considered as 2150 kCal/kWh as per CEA regulations as discussed earlier in the petition.

9.5.2 The projected numbers are shown in the table below.



Table 35: Projected SHR for FY 2019-20 to FY 2021-22

LRPP	2018-19	2019-20	2020-21	2021-22
	Estimated	Projected	Projected	Projected
Gross Station Heat Rate on GCV (kCal/ kWh)	2138	2150	2150	2150

9.6 Auxiliary Energy Consumption

9.6.1 In absence of norms of auxiliary consumption for LRPP under Tariff Regulations, 2018, the auxiliary of 3.50% has been considered for FY 2019-20 to FY 2021-22. This is same as approved by Hon'ble Commission for FY 2018-19 in its order dated 19th March 2018. The projected numbers are shown in the table below

Table 36: Projected Auxiliary energy consumption for FY 2019-20 to FY 2021-22

LRPP	2018-19	2019-20	2020-21	2021-22
	Estimated	Projected	Projected	Projected
Aux. Power Cons. (%)	3.29%	3.50%	3.50%	3.50%



10 Fixed Cost of Plant

10.1 Annual fixed cost for FY 2019-20 TO FY 2021-22

10.1.1 As per regulation 42.1 of the AERC Tariff regulations, 2018 the following components have been considered for projecting of fixed cost under the Multi Year Tariff framework for the power plants:

- (a) Return on Equity Capital
- (b) Interest on Loan capital
- (c) Depreciation
- (d) Operation and Maintenance Expenses
- (e) Interest on Working Capital
- (f) Less: Non-Tariff Income

10.1.2 For the computation of the fixed components, the Petitioner has considered the principles provided in the Tariff Regulations, 2018. These components have been discussed in detail in the following sections of the petition.

10.2 Return on Equity (ROE)

10.2.1 The Hon'ble Commission in its regulation has considered the pre-tax return on equity at 15.5% on equity capital. The Regulation 33 of the Tariff Regulations, 2018 is reproduced below for reference.

"33 Return on Equity Capital

33.1 Return on equity capital shall be computed on the equity capital determined in accordance with Regulation 31

33.2 Return on equity shall be computed at the rate of 15.5% for Generating Stations, Transmission Licensee and SLDC and at the rate of 16.00% for Distribution Licensee on a post-tax basis."

10.2.2 APGCL has projected the Return on Equity (RoE) at a rate of 15.5% in accordance with the Tariff Regulations, 2018. It is submitted that the actual tax paid would be claimed separately during True-up of respective years.

10.2.3 The future year projections has been based on Normative basis as set out in Tariff Regulations 2018.

Table 37: Projected Return on Equity capital for FY 2019-20 to FY 2021-22

Station	Particulars	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
LRPP	Opening Equity	19.50	28.92	28.92	28.92



Station	Particulars	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
	Closing Equity	28.92	28.92	28.92	28.92
	Rate of Return	15.50%	15.50%	15.50%	15.50%
	Return on Equity	3.50	4.48	4.48	4.48

10.2.4 APGCL prays to the Hon'ble Commission to approve the projected Return on Equity as shown above.

10.3 Interest on Loan Capital

10.3.1 As per Regulation 34 of the Tariff Regulations, 2018, the Commission will consider interest on Loan capital on normative basis with repayment equal to depreciation allowed for that year and rate of interest will be the weighted average rate of interest calculated on the basis of the actual loan portfolio. The regulation is reproduced below for ready reference.

"34 Interest on loan capital

34.1 The loans arrived at in the manner indicated in Regulation 31 shall be considered as gross normative loan for calculation of interest on loan.

Provided that in case of retirement or replacement of assets, the loan capital approved as mentioned above, shall be reduced to the extent of 70% (or actual loan component based on documentary evidence, if it is higher than 70%) of the original cost of the retired or replaced assets.

34.2 The normative loan outstanding as on April 1, 2019, shall be worked out by deducting the cumulative repayment as admitted by the Commission up to March 31, 2019, from the gross normative loan.

34.3 The repayment for each year of the Control period shall be deemed to be equal to the depreciation allowed for that year:

34.4 Notwithstanding any moratorium period availed by the Generating Company or the Transmission Licensee or the Distribution Licensee or the SLDC, as the case may be, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed.

34.5 The rate of interest shall be the weighted average rate of interest calculated on the basis of the actual loan portfolio at the beginning of each year applicable to the Generating Company or the Transmission Licensee or the Distribution Licensee or SLDC"

10.3.2 In view of the above, the Petitioner has projected the Interest on long term Loan on normative basis for FY 2019-20 to FY 2021-22. The Petitioner has considered normative loan portfolio and the repayment shown is considered equal to the depreciation for FY 2019-20 to FY 2021-22. The interest rate has been considered as the weighted average rate of interest considered for FY 2018-19.



10.3.3 The table below summarizes the interest on loan and finance charges considered for Performance estimate of FY 2019-20 to FY 2021-22.

Table 38: Projected Interest and Finance charges for FY 2019-20 to FY 2021-22

Station	Particulars	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
LRPP	Net Normative Opening Loan	24.04	20.15	14.23	8.31
	Addition of normative loan during the year	1.27	0.00	0.00	0.00
	Normative Repayment during the year	5.16	5.92	5.92	5.92
	Net Normative Closing Loan	20.15	14.23	8.31	2.39
	Avg. Normative Loan	22.09	17.19	11.27	5.35
	Interest Rate	10.12%	10.30%	10.18%	10.10%
	Interest on Loan Capital	2.08	1.77	1.15	0.54
	Add: Bank Charges	0.00	0.00	0.00	0.00
Net Interest on Loan Capital		2.08	1.77	1.15	0.54

10.3.4 APGCL prays to the Hon'ble Commission to approve the projected Total interest and finance charges as shown above.

10.4 Depreciation

10.4.1 The Hon'ble Commission in its Tariff Regulations, 2018 has considered following principals for determination of depreciation.

“32 Depreciation

32.1 The value base for the purpose of depreciation shall be the Capital Cost of the asset admitted by the Commission.

Provided that depreciation shall not be allowed on assets funded through Consumer contribution and Capital Subsidies/Grants.

32.2 The salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the capital cost of the asset.

Provided that in case of hydro generating stations, the salvage value shall be as provided in the agreement signed by the developers with the State Government for creation of the site:

Provided further that the capital cost of the assets of the hydro generating station for the purpose of computation of depreciable value shall correspond to the percentage of sale of electricity under long-term power purchase agreement at regulated tariff.

Provided also that any depreciation disallowed on account of lower availability of the generating station or generating unit or transmission system as the case may be, shall not be allowed to be recovered at a later stage during the useful life and the extended life.

32.3 Land, other than the land held under lease and the land for reservoir in case of hydro Generating Station, shall not be a depreciable assets and its cost shall be excluded from the capital cost while computing depreciable value of the assets.



32.4 Depreciation shall be calculated annually based on Straight Line Method and at rates specified in Appendix-I to these Regulations:

Provided that, the remaining depreciable value as on 31st March of the year closing after a period of 12 years from date of commercial operation shall be spread over the balance useful life of the assets.

32.5 In case of the existing projects, the balance depreciable value as on April 1, 2019, shall be worked out by deducting the cumulative depreciation including Advance Against Depreciation as admitted by the Commission upto March 31, 2019, from the gross depreciable value of the assets.”

10.4.2 In view of the above, the Petitioner has computed the Depreciation considering the Capital Cost of the asset admitted by the Commission and projected asset addition with 10% salvage value. Also, depreciation on grants has been subtracted. The table below summarizes the Depreciation projected for FY 2019-20 to FY 2021-22.

Table 39: Projected Depreciation for FY 2019-20 to FY 2021-22 of LRPP

(Rs. Crore)

Particulars	2018-19	2019-20	2020-21	2021-22
Opening GFA	245.87	268.21	268.21	268.21
Addition during the year	22.34	0.00	0.00	0.00
Closing GFA	268.21	268.21	268.21	268.21
Average GFA	257.04	268.21	268.21	268.21
Rate of Depreciation	4.77%	5.13%	5.13%	5.13%
Total Depreciation	12.26	13.75	13.75	13.75
Grant	202.55	213.98	213.98	213.98
Additions during the year	11.44	0.00	0.00	0.00
Closing grant	213.98	213.98	213.98	213.98
Average grant	208.26	213.98	213.98	213.98
Rate of Depreciation	3.66%	3.66%	3.66%	3.66%
Depreciation on grants	7.10	7.83	7.83	7.83
Net Depreciation	5.16	5.92	5.92	5.92

10.4.3 APGCL prays to the Hon'ble Commission to approve the projected Depreciation for FY 2019-20 to FY 2021-22 as shown above.

10.5 Interest on Working Capital

10.5.1 As per Regulation 36 of the Tariff Regulations, 2018, the interest on working capital will be considered on normative basis. The regulation is reproduced below for ready reference.

“36 Interest on Working Capital

36.1 Generation projects

a)



- b) *In case of Gas Turbine/Combined Cycle/ Gas-engine based Generating Stations, working capital shall cover:*
 - i. *Fuel cost for one (1) month corresponding to target availability duly taking into account the mode of operation of the Generating Station on gas fuel and / or liquid fuel;*
 - ii. *Liquid fuel stock for fifteen (15) days corresponding to target availability subject to required storage availability;*
 - iii. *Operation and maintenance expenses for one (1) month;*
 - iv. *Maintenance spares @ 30% of operation and maintenance expenses; and*
 - v. *Receivables equivalent to two (2) months of capacity charges and energy charges for sale of electricity calculated on target availability,*
- c) *In case of Hydro power Generating Stations including pumped storage hydro-electric generating station, working capital shall cover:*
 - i. *Operation and maintenance expenses for one (1) month;*
 - ii. *Maintenance spares @15% of operation and maintenance expenses; and*
 - iii. *Receivables equivalent to two (2) months of the annual fixed charges.*
- d) *Rate of interest shall be at interest rate equivalent to the normative interest rate of three hundred (300) basis points above the average State Bank of India MCLR (One Year Tenor) prevalent during the last available six months for the determination of tariff. "*

10.5.2 As per the above regulations, the Petitioner has projected normative interest on working capital. However, as APGCL does not have liquid fuel stock facility, it has not considered working capital on storage of liquid fuel. The rate of interest has been considered equal to the normative interest rate of three hundred (300) basis points above the average State Bank of India MCLR (One Year Tenor) prevalent during the last available six months , which $8.5\% + 3.00\% = 11.50\%$.

10.5.3 The future year projections has been based on Normative basis as set out in Tariff Regulations 2018.

10.5.4 The interest on working capital considered is shown in the table below:

Table 40: Summary of Interest on working capital projected for FY 2019-20 to FY 2021-22
(Rs. Crore)

Station	Particulars	2019-20 Projected	2020-21 Projected	2021-22 Projected
LRPP	Fuel Cost for one month	9.71	9.72	9.74
	O&M Expenses for one month	1.68	1.78	1.89
	Maintenance Spares-30% of O&M	6.03	6.41	6.82
	Receivables for two months	25.62	25.77	25.94
	Total Working Capital Requirement	43.04	43.69	44.40
	Rate of interest	11.50%	11.50%	11.50%
	Interest on Working capital	4.95	5.02	5.11

11.5.4. APGCL prays to the Hon'ble Commission to approve the Interest on Working



capital for FY 2019-20 to FY 2021-22 as shown above.

10.6 Operation and Maintenance Expenses (O&M Expenses)

10.6.1 The Operation and maintenance expense are to be projected as per Regulation 50.1 of the Tariff Regulations, 2018. The Regulation is reproduced below for ready reference.

"50 Operation and Maintenance cost (O&M)

50.1 Existing Generating Station

- a. *The Operation and Maintenance expenses including insurance shall be derived on the basis of the average of the actual Operation and Maintenance expenses for the three (3) years ending March 31, 2018, based on the audited financial statements, excluding abnormal Operation and Maintenance expenses, if any, subject to prudence check by the Commission.*
- b. *The average of such operation and maintenance expenses shall be considered as operation and maintenance expenses for the financial year ended March 31, 2017 and shall be escalated based on the escalation factor as approved by the Commission for the respective years to arrive at operation and maintenance expenses for the base year commencing April 1, 2018.*
- c. *The O&M expenses for each subsequent year shall be determined by escalating the base expenses determined above for previous FY at the escalation factor 6.30% to arrive at permissible O&M expenses for each year of the Control Period.*
- d. *Provided that in case, an existing Generating Station has been in operation for less than three (3) years as at on the date of effectiveness of these Regulations, the O&M Expenses shall be as specified at Regulation 50.2 for New Generating Stations"*

10.6.2 The future year projections has been based on Normative basis as set out in Tariff Regulations 2018, considering escalation factor of 6.3%.

*Table 41: Summary of O&M expenses projected for FY 2019-20 to FY 2021-22
(Rs. Crore)*

Station	2019-20 Projected	2020-21 Projected	2021-22 Projected
LRPP	20.11	21.38	22.73

10.6.3 APGCL prays to the Hon'ble Commission to approve the O&M expenses for FY 2019-20 to FY 2021-22 as shown above.

10.7 Non-Tariff Income

10.7.1 As per Regulation 45 of the Tariff Regulations, 2018, the non-tariff income shall be deducted from the Annual Fixed Cost in determining the Annual Fixed Cost



of the Generation Company. The regulation is reproduced below for ready reference.

"45 Non-Tariff Income

45.1 The amount of non-tariff income relating to the Generation Business as approved by the Commission shall be deducted from the Annual Fixed Cost in determining the Annual Fixed Cost of the Generation Company:

Provided that the Generation Company shall submit full details of its forecast of non-tariff income to the Commission in such form as may be stipulated by the Commission from time to time.

The indicative list of various heads to be considered for non-tariff income shall be as under:

- a. *Income from rent of land or buildings;*
- b. *Income from sale of scrap;*
- c. *Income from statutory investments;*
- d. *Income from sale of Ash/rejected coal;*
- e. *Interest on delayed or deferred payment on bills;*
- f. *Interest on advances to suppliers/contractors;*
- g. *Rental from staff quarters;*
- h. *Rental from contractors;*
- i. *Income from hire charges from contractors and others;*
- j. *Income from advertisements, etc.;*
- k. *Any other non-tariff income"*

10.7.2 The non-tariff income for FY 2019-20 to FY 2021-22 are projected same as estimated for FY 2018-19, the same is as shown in the table below

*Table 42: Station-wise Non-tariff income projected for FY 2019-20 to FY 2021-22
(Rs. Crore)*

Station	2018-19 Estimated	2019-20 Projected	2020-21 Projected	2021-22 Projected
LRPP	-	-	-	-

10.7.3 APGCL submits that Non-Tariff Income for FY 2019-20 to FY 2021-22 will be claimed during True-up of the same.

10.7.4 APGCL prays to the Hon'ble Commission to approve the Non-tariff income for FY 2019-20 to FY 2021-22 as shown above.

10.8 Total Fixed Cost

10.8.1 The recovery of Annual fixed charges is to be done as per regulation 51.1 of the Tariff Regulations, 2018. The regulation is reproduced below for ready reference

"53 Computation and Payment of Annual Fixed Charges and Energy Charges for Thermal Generating Stations



53.1 Annual Fixed Charges

- a. *The total Annual Fixed Charges shall be computed based on the norms specified under these Regulations and recovered on monthly basis.*
- b. *The full Annual Fixed Charges shall be recoverable at Normative Annual Plant Availability factor (NAPAF) specified in these Regulation. Recovery of Annual Fixed Charges below the level of NAPAF shall be on pro rata basis. At zero Availability, no Capacity Charges shall be payable.*
- c. *Payment of Annual Fixed Charges shall be on monthly basis in equal instalments in proportion to contracted capacity subject to adjustment at the end of the year with respect to NAPAF."*

10.8.2 Based on the above, the Annual fixed charges for FY 2019-20 to FY 2021-22 has been computed. The Hon'ble Commission is requested to approve the fixed charges as discussed in the table below:

Table 43: Annual Fixed charges for FY 2019-20 to FY 2021-22 of LRPP

(Rs. Crore)

Particulars	2019-20 Projected	2020-21 Projected	2021-22 Projected
Operation & Maintenance Expenditure	20.11	21.38	22.73
Interest & Finance Charges	1.77	1.15	0.54
Interest on working Capital	4.95	5.02	5.11
Depreciation	5.92	5.92	5.92
Return on Equity	4.48	4.48	4.48
<u>Less:</u> Other Income	0.00	0.00	0.00
Total Fixed Charges	37.23	37.95	38.77

10.8.3 The Petitioner prays to the Hon'ble Commission to approve the fixed costs for FY 2019-20 to FY 2021-22 as discussed in the tables above.



11 Energy Charges

11.1 Fuel Price and Calorific Value

11.1.1 As per Regulation 11 of the Tariff Regulations 2018, 'Fuel Price' and 'Calorific Value of Fuel' are uncontrollable items. The values of 'Calorific Value of Fuel' are considered same as considered in FY 2018-19. The projected values of 'Fuel Price' and 'Calorific Value of Fuel' are shown in the table below:

Table 44: Projected GCV and Price for FY 2019-20 to FY 2021-22

(Rs. Crore)

Station	Wt. Avg. Gross Calorific Value of Gas (kcal/SCM)	Wt. Avg. Price of Gas (Rs./1000 SCM)
2019-20	9095	8961.76
2020-21	9095	8975.83
2021-22	9095	8991.25

11.1.2 The Petitioner submits that the Gas prices has been revised to USD 3.36 / MMBTU from October 2018. Hence, the same price of gas has been considered for FY 2019-20 to FY 2020-21.

11.1.3 The Petitioner prays to the Hon'ble Commission to approve the projected Price of Gas and GCV for LRPP for FY 2019-20 to FY 2021-22 as shown in the table above.

11.2 Fuel cost

11.2.1 The Commission, in the Tariff Order dated 19.03.2018 had approved the Fuel Cost for FY 2019-20 to FY 2021-22. The table below shows the projected fuel cost for FY 2019-20 to FY 2021-22.

Table 45: Fuel cost for LRPP for FY 2019-20 to FY 2021-22

Particulars	Derivation	Unit	2019-20 Projected	2020-21 Projected	2021-22 Projected
Gross Generation	A	MU	550	550	550
Heat Rate	B	kcal/kWh	2150	2150	2150
GCV of gas	C	kcal/SCM	9095	9095	9095
Overall Heat	D=AxB	G. cal.	1182389	1182389	1182389
Gas consumption	E=D/C	M. SCM	130	130	130
Price of Gas	F	Rs./1000 SCM	8962	8976	8991
Total cost of Gas	G=ExF/10000	Rs. Crore	116.50	116.69	116.89

11.2.2 The parameters considered for calculating the landed gas price of gas for the MYT Control period are as follows:

- Basic Non-APM Gas price = \$ 3.66 / MMBTU
- Basic APM Gas price = \$ 2.02 / MMBTU (60% of Non-APM gas price)
- USD exchange rate = ₹ 73.63 (USD exchange rate for the month of Oct'18 in Rs as obtained from RBI website)



- MMBTU to 1000 SCM conversion factor = 39.68254
- As per agreement, the transportation cost has been escalated by 3%.

11.2.3 The petitioner submits the gas price projections in table below

Lakwa Replacement Power Project		2019-20	2020-21	2021-22	Remarks
A.	Gas supply by GAIL (APM)				
1	Basic Price (for G.C.V. 10000)/ 1000 SCM	5890.58	5890.58	5890.58	As per new gas price implemented from Oct'16
2	10% Royalty /1000 SCM	Included	Included	Included	
	Total	5890.58	5890.58	5890.58	
3	Basic Price after adjustment with CV	5485.54	5485.54	5485.54	
4	Marketing Margin (for NCV 10000) /1000 SCM	200.00	200.00	201.00	
5	Marketing Margin after adjustment with CV	167.89	167.89	168.73	
6	Fixed Monthly Service charge (Rs./ 1000 SCM)	23.25	23.94	24.66	Yearly escalation 3% on TC as per agreement.
7	Sales Tax @ 14.5 % on above	823.12	823.22	823.45	
	Landed price of gas supply to LRPP by GAIL / 1000 SCM(A)	6476.55	6476.65	6477.72	

Lakwa Replacement Power Project		2019-20	2020-21	2021-22	Remarks
B.	Gas supplied by OIL Duliajan (Non APM)				
1	Basic Price (for G.C.V. 10000)/ 1000 SCM	9817.64	9817.64	9817.64	As per new gas price implemented from Oct'16
2	Basic Price after adjustment with CV	8707.68	8707.68	8707.68	
3	Marketing Margin (for NCV 10000) /1000 SCM	200.00	200.00	201.00	
4	Marketing Margin after adjustment with CV	159.79	159.79	160.59	
	Total	8867.47	8867.47	8868.27	
5	Sales Tax @ 14.5 % on above	1285.78	1285.78	1285.90	
	Landed price of gas supply to LRPP by OIL (B)	10153.26	10153.26	10154.17	
C.	T.C for Transportation of OIL gas by AGCL				
1	T.C./ 1000 SCM	760.25	783.06	806.55	Yearly escalation 3% on TC as per agreement.
2	GST @ 12% on TC	91.23	93.97	96.79	
	Total T.C. (C)	851.48	877.03	903.34	



Lakwa Replacement Power Project		2019-20	2020-21	2021-22	Remarks
D.	Landed price of gas supply to LRPP by OIL (B+C)/ 1000 SCM	11004.74	11030.28	11057.51	
	Wtd Avg landed price of LRPP gas	8961.76	8975.83	8991.25	

11.2.4 The Petitioner prays to the Hon'ble Commission to approve the projected Fuel cost Price for LRPP for FY 2019-20 to FY 2021-22 as shown in the table above.

11.3 Incentives

11.3.1 APGCL submits that the Incentives for FY 2019-20 to FY 2021-22 will be claimed in True-up as per Regulations.



12 Summary of submissions for MYT period of FY 2019-20 to FY 2021-22

12.1 Summary

12.1.1 The Summary of the MYT for FY 2019-20 to FY 2021-22 for LRPP is shown below.

Table 46: MYT for FY 2019-20 to FY 2021-22 for LRPP

Sl. No		Particulars	2019-20 Projected	2020-21 Projected	2021-22 Projected	(Rs. Crore)
POWER GENERATION (MU)						
Gross Generation		549.95	549.95	549.95		
Net Generation		530.70	530.70	530.70		
Auxiliary Consumption Loss %		3.50%	3.50%	3.50%		
I	Fixed Charges					
Operation & Maintenance Expenditure		20.11	21.38	22.73		
Interest & Finance Charges		1.77	1.15	0.54		
Interest on working Capital		4.95	5.02	5.11		
Depreciation		5.92	5.92	5.92		
Return on Equity		4.48	4.48	4.48		
<u>Less:</u> Other Income		0.00	0.00	0.00		
Total Fixed Charges		37.23	37.95	38.77		
II	Fuel Cost	116.50	116.69	116.89		
IV	Total Revenue Requirement	153.74	154.64	155.66		
Fixed charges (Rs. / kWh)		0.70	0.72	0.73		
Energy charges (Rs. / kWh)		2.20	2.20	2.20		
V	Proposed tariff (Rs. / kWh)	2.90	2.91	2.93		

12.2 Net Annual Revenue Requirement

12.2.1 The Net Annual Revenue Requirements for FY 2019-20 to FY 2021-22 are as shown in the tables below.

Table 47: Net Annual Revenue Requirements for LRPP for FY 2019-20 to FY 2021-22
(Rs. Crore)

Particulars	2019-20 Projected	2020-21 Projected	2021-22 Projected
Total Fixed Charges	37.23	37.95	38.77
Fuel Cost	116.50	116.69	116.89



Particulars	2019-20 Projected	2020-21 Projected	2021-22 Projected
Total Revenue Requirement	153.74	154.64	155.66

12.1 Tariff for LRPP for FY 2019-20

12.1.1 The tariff proposed for LRPP for FY 2019-20 is as shown below

Table 48: Tariff proposed for LRPP for FY 2019-20

(Rs. Crore)

Particulars	
Annual fixed charges (Rs crore)	37.23
Monthly fixed charges (Rs crore)	3.10
Energy charge rate (Rs./ kWh)	2.20

12.1.2 The Petitioner prays to the Hon'ble Commission to approve the Net Annual Revenue Requirement for FY 2019-20 to FY 2021-22 as discussed in the tables above.



List of Annexures

Sl. No.	Particulars	Annexure(s)
1.	Auditor Certificate for the capital expenditure undertaken up to 26 th April 2018 (COD)	Annexure 1.
2.	Amendments to the Project Management Consultant's Cost	Annexure 2.
3.	Technical Proposal 4A of the EPC documents for LRPP	Annexure 3.
4.	Technical Proposal 4B of the EPC documents for LRPP	Annexure 4.
5.	Copy of relevant excerpts from CERC order no. 15 of 2014 dated 05.02.2016	Annexure 5.
6.	Ministry of Power document of 'Normalization Document and Monitoring & Verification Guidelines' for Thermal power plants	Annexure 6.
7.	Performance Guarantee Test Report of LRPP	Annexure 7.
8.	IIT Report on "Evaluation of Station Heat Rates for Namrup & Lakwa Thermal Power Stations" of APGCL	Annexure 8.
9.	Copy of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010	Annexure 9.
10.	Regulatory Formats	Annexure 10.



Annexure 1 :

**Auditor Certificate for the capital
expenditure undertaken up to 26th
April 2018 (COD)**



NILOTPAL DHAR & ASSOCIATES
CHARTERED ACCOUNTANTS

CHILARAI NAGAR, BHANGAGARH,
HOUSE NO. 17, BYE LANE-3
GUWAHATI: 781032
Phone: +91-361-2527675
MOBILE: +9194353-07003
e-mail: nilotpaldhar@yahoo.co.in

PROJECT COST & YEAR WISE CAPITAL EXPENDITURE OF LAKWA REPLACEMENT POWER PROJECT AS ON COD i.e.
26th April'2018

NAME OF VENDOR	Amount	F. Y.	(Rs. In Crore)
Wartsila Finland Oy, Finland	14.83		
Wartsila India Pvt. Ltd. (Advances)	8.27		
TUV-SUD South Asia Private Limited(Consultant)	0.43		
Other Expenses	1.09		
Sub Total (A)	24.62		
	0.00		
Wartsila India Pvt. Ltd. (Civil Works)	1.93		
Wartsila Finland Oy. (Offshore Material/LC)	101.36		
TUV-SUD South Asia Private Limited(Consultant)	0.73		
Taxes of Tuv-Sud Asia Pvt. Ltd.	0.23		
Taxes(S.Tax+VAT+I.Tax +L.Cess)	1.21		
Custom Clearance	0.05		
Other Expenses	0.21		
Sub Total (B)	105.71		
Wartsila India Pvt. Ltd. (Civil Works)	14.25		
Wartsila Finland Oy. (Offshore Material/LC)	19.78		
Wartsila India Pvt. Ltd. (Onshore LC)	42.94		
Wartsila India Pvt. Ltd. (Transporation)	6.30		
Wartsila India Pvt. Ltd. (Installatioon)	12.87		
Taxes(S.Tax+VAT+I.Tax +L.Cess)+CST	8.18		
TUV-SUD South Asia Private Limited(Consultant)	1.56		
Taxes of Tuv-Sud Asia Pvt. Ltd.	0.28		
Entry Tax	3.34		
Excise Duty Reimbursement	0.11		
Fund Transfer (Monthly)	0.20		
Training	0.23		
Other Expenses	2.32		
Sub Total (C)	112.35		
W.e.f 01/04/2018 to 25/04/2018, no expenditures were incurred	0.00	till 26/04/18	
Sub Total (D)			
Total (A+B+C+D)	242.68		
Interest During Construction (IDC)	3.19		
Grand Total	245.87		

Date: 06.12.2018

Place: Guwahati

For, NILOTPAL DHAR & ASSOCIATES

Nilesh
(NILOTPAL DHAR)
CHARTERED ACCOUNTANTS
PROPRIETOR
MEM NO.066620
FRN:326586E



Annexure 2 :

Amendments to the Project

Management Consultant's Cost





AMENDED CONTRACT FOR CONSULTANT'S SERVICES
Time-Based

Project Name: Assam Power Sector Investment Program

Consultancy Services for Project Management and Construction Supervision for Lakwa replacement Gas Engine based Power plant for APGCL

Contract No. 3140-IND
Between

Assam Power Generation Company Ltd
And
TUV SUD South Asia Pvt. Ltd.



Appendix – C Remuneration Cost Estimate

Item	As Per Original Contract	As Per Extended Contract	Adjustment/Increment % on 31st July 2017 as per clause no. 42.3 of SCC of Contract*	Applicable cost for Adjustment/Increment (As on date 31st July 2017**	Adjustment/ Increment	Final Cost of Contract
	Cost in INR	Cost in INR		Cost in INR	Cost in INR	Cost in INR
Competitive components						
(1) Remuneration, Key Experts	2,80,86,000.00	2,98,05,214.28	2.90%	92,71,544.31	2,68,874.79	3,00,74,089.07
(2) Remuneration, Non Key Expert	23,74,000.00	25,19,318.47	2.90%	7,83,687.47	22,726.94	25,42,045.41
(3) Reimbursable Expenses	13,58,000.00	13,58,000.00	Nil	Nil	Nil	13,58,000.00
(4) Reimbursable Additional Man days					39,48,637.37	39,48,637.37
(5) Pre-shipment inspection-additional Work Order					16,07,360.00	16,07,360.00
Sub Total	3,18,18,000.00	3,36,82,532.75	-		1,07,15,504.23	3,95,30,131.85
Non Competitive components						
Provisional sums	Nil	Nil	Nil	Nil	Nil	Nil
Contingency	Nil	Nil	Nil	Nil	Nil	Nil
Sub Total	Nil	Nil	Nil			
Total cost of financial proposal	3,18,18,000.00	3,36,82,532.75				3,95,30,131.85
Indirect local tax estimates						18% GST (As per Govt. Norms)
i. Service tax / GST	39,32,704.8	As per Govt. Norms				
Total Cost	3,57,50,704.8	3,36,82,532.75 + Service Tax				4,66,45,555.58



Annexure 3 :

Technical Proposal 4A of the EPC documents for LRPP



Section 4 - Bidding Forms

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Technical proposal -4A		
Engine generator each package guaranteed data in test bed conditions		
Name of bidder	Wärtsilä India Pvt Ltd and Wärtsilä Finland Oy (as consortium partners)	
Number of machine offered	7 (seven) nos.	
Name of engine manufacturer	WÄRTSILÄ FINLAND Oy	
Name of generator manufacturer	ABB	
Ambient temperature	Max. / Min.: 31 / -36 deg.C	
Atmospheric pressure	1.001 bar	
Altitude	03 Mtrs a.s.l.	
Relative humidity	Max./Min.: 93% / 65%	
Charge air cooler inlet temperature	< 50.4 deg. C (LT Water Inlet Temperature)	
Net calorific value of fuel	8,144 kCal/sm ³ *) note 1)	
Fuel composition (submit separately)	- later on -	
Power factor ,0.8 lagging	Confirmed	
Speed	750 rpm	
Engine driven auxiliaries	includes:	
1	- Lubricating Oil Pump	
2	- HT Water Pump	
etc	- LT Water Pump	
Stabilization time	35 secs (to attain rated speed)	
Operation duration At 100 % of rated load ,	120 Minutes	
Fuel consumption in 120 minutes at 100 % rated load	4,584 sm ³ *) note 1)	
Guaranteed rated output at generator terminal ,MW	9.965	
Guaranteed gross heat rate ,Kcal/Kwh (at 0% tolerance)	1,873	
	gm/kwh	0.25 *) note 2)
Guaranteed lube oil consumption	gms per running hours at rated capacity	2,550 gms per hour
Emissions	15% dry Oxygen, measured at stack	
Nox emission	< 91 ppm-v	
Sox emission	N/A at test bed *) note 3)	
PM10	B.D.L. *) note 3)	
PM2.5	B.D.L. *) note 3)	
Noise	<120 dB(A) at 1 mtr distance *) note 4)	
Vibration	<45 mm/s RMS (on engine *) note 4)	
Exhaust gas temperature after turbocharger °C (non guaranteed Value)	-355 deg.C +/- 15 deg.C	

Note:

- Guaranteed gross heat rate in Kcal/Kwh of engine generator package in test bed conditions = { fuel consumed (cubic meter) multiplied by net calorific value of fuel(Kcal/cubic meter)} divided by(energy meter reading at generator terminals)
- While Indicating Guaranteed parameters bidders are to include all deviations in values as permissible by relevant standards. Corrections on account of such deviations shall not be applied to the performance guarantee test values.

- Notes:
- 1) NCV of the Natural Gas varies from batch to batch. The correct NCV of the Natural Gas during the testing shall be recorded and shared with customer to arrive at the Gross Heat Rate value at alternator terminal during Factory Acceptance Test (F.A.T.).
 - 2) The figure mentioned is at Engine shaft and at 100% engine loading condition.
 - 3) This is in relation to the Sulphur and Ash content in the Fuel respectively and readings taken during F.A.T. has no relevance to those to be demonstrated at site.
 - 4) The figures are at 100% engine loading conditions.
 - 5) Sm³ relates to STP conditions i.e. Temperature = 15.5 deg.C and Pressure = 1.013 bar.

For and to the extent of scope applicable to Wartsila India Pvt Ltd. For and to the extent of scope applicable to Wartsila Finland Oy

Annexure 4 :

Technical Proposal 4B of the EPC

documents for LRPP



Section 4 - Bidding Forms

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Technical proposal -4B		
Engine generator each package guaranteed data in Site conditions		
Name of bidder	Wärtsilä India Pvt Ltd and Wärtsilä Finland Oy (as consortium partners)	
Number of machine offered	7 (seven) nos.	
Name of engine manufacturer	WÄRTSILÄ FINLAND Oy	
Name of generator manufacturer	ABB	
Ambient temperature (Min. / Design / Max.)	2 / 30 / 40 deg.C	
Atmospheric pressure	-1.013 bar	
Altitude	110 Mtrs a.s.l	
Relative humidity	Min. 65% / Max. 98%	
Charge air cooler inlet temperature	<50.4 deg.C (LT Water Inlet Temperature)	
Net calorific value of fuel	8,245 kCal/sm ³	
Fuel composition (submit separately)	(as per OIL Gas)	
Power factor ,0.8 lagging	Confirmed	
Speed	750 rpm	
Engine driven auxiliaries	Includes:	
1	- Lubricating Oil Pump	
2	- HT Water Pump	
3	- LT Water Pump	
4	-	
etc	-	
Stabilization time	35 secs (to attain rated speed)	
Operation duration At 100 % of rated load ,	24 hours	
Fuel consumption in 24 hours at 100 % rated load	54,329.5 sm ³ per engine	
Guaranteed rated output at generator terminal ,MW	9.965	
Guaranteed Generator efficiency at full load at 0.8 p.f lagging	97.7%	
Guaranteed gross heat rate ,Kcal/Kwh (at 0% tolerance)	1,873	
Guaranteed minimum annual availability	92.5%	
Guaranteed lube oil consumption	gm/kwh gms per running hours at rated capacity	0.25 *) note 1) 2,550 gms/hr
Emissions	@ 15% dry Oxygen Level *) Refer note 2)	
Nox emission	1.12 g/kWh	
Sox emission	0.09 g/kWh *) Refer note 3)	
PM10	B.D.L. (Below Detectable Level)	
PM2.5	B.D.L. (Below Detectable Level)	
Noise	<118 db(A) at 1 m distance from engine *) Refer note 2)	
Vibration	<45 mm/s RMS on engine *) Refer note 2)	
Exhaust gas temperature after turbocharger °C (non guaranteed Value)	358 deg.C (+/- 15 deg.C)	
Note:		
1. Gross output of engine generators set shall be the MW meter reading at generator terminals		
2. Guaranteed gross heat rate in Kcal/Kwh of engine generator package in site conditions = { fuel consumed (cubic meter) multiplied by net calorific value of fuel(Kcal/cubic meter)} divided by(energy meter reading at generator terminals).		
3. While Indicating Guaranteed parameters bidders are to include all deviations in values as		

Lakwa Replacement Power Project

Single Stage Two Engines

For and to the extent of scope
applicable to Wärtsilä India Pvt Ltd

For and to the extent of scope
applicable to Wärtsilä Finland Oy

[Signature]

Section 4 - Bidding Forms

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permissible by relevant standards. Corrections on account of such deviations shall not be applied to the performance guarantee test values.

4 (i) Where PM emissions are very negligible to measure mention below " detectable level.

(ii) NOx emission unit shall be gm/kwh

iii. SOx emission unit shall be gm/kwh

Note:

- 1) The value given is at Engine Shaft and at 100% Engine loading conditions.
- 2) The value given are at 100% Engine loading conditions.
- 3) The value is given based on the max. sulphur content in the fuel as 5 mg/kg, and
- 4) sm³ relates to STP condition i.e. Temperature = 15.5 deg.C and Pressure = 1.013 bar

[Signature]

For and to the extent of scope applicable to Wärtsilä India Pvt Ltd

[Signature]

For and to the extent of scope applicable to Wärtsilä Finland Oy

Lakwa Replacement Power Project

Single Stage Two Envelops



Annexure 5 :

Copy of relevant excerpts from CERC

order no. 15 of 2014 dated 05.02.2016



**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,



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.

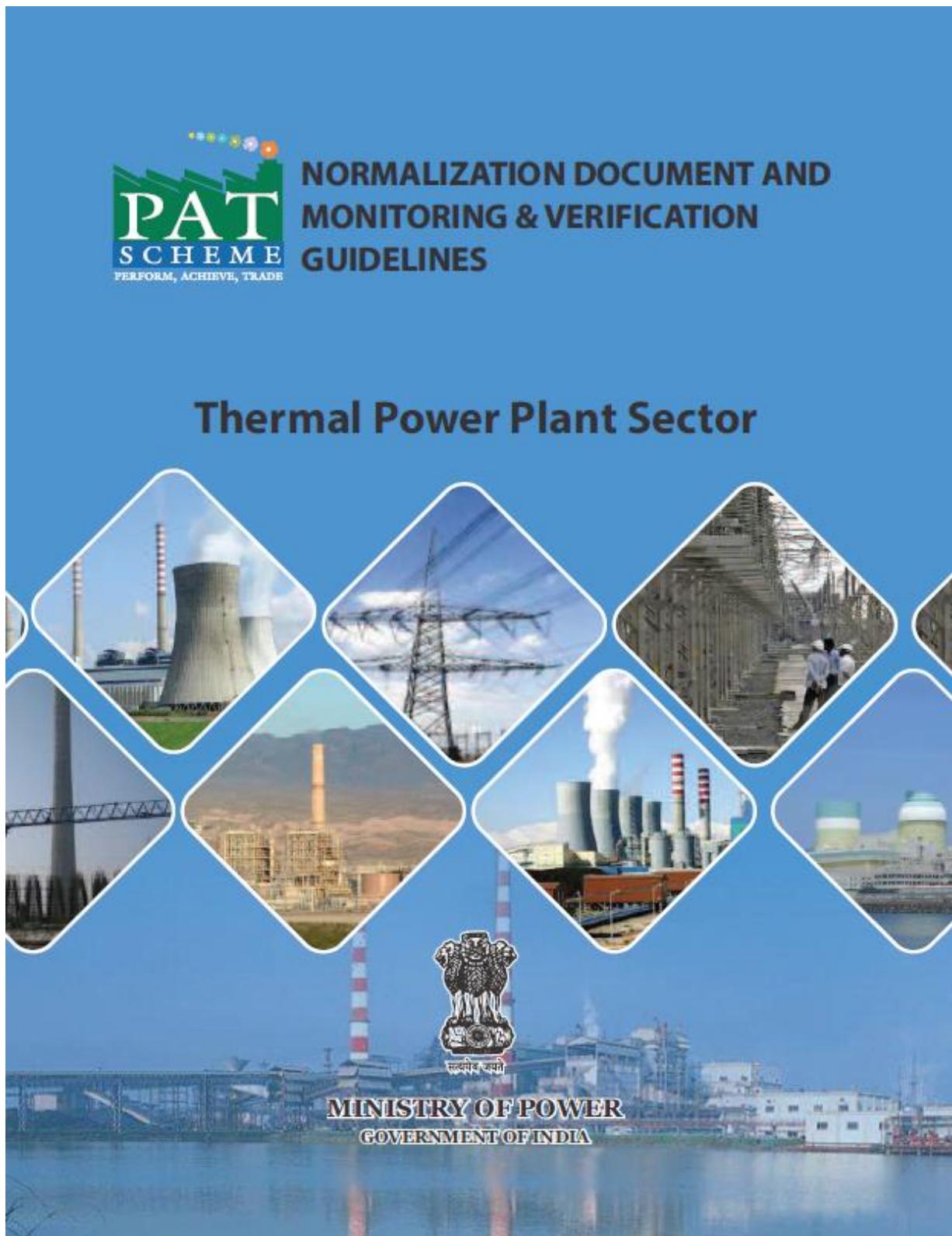
(b) Subsequently, the petitioner observed that there was an inadvertent problem in the operational data, more specifically in the normative Gross Station Heat Rates prescribed by the Commission in the 2009 Tariff



Annexure 6 :

Ministry of Power document of
'Normalization Document and
Monitoring & Verification Guidelines'
for Thermal power plants







6. Formula for Target Setting

Section 6.01 Formula for target setting for Coal based Thermal Power Plant

(a) Design Net Heat Rate

Station Installed Capacity (MW)

$$= [U\#1 \text{ Capacity (MW)} + U\#2 \text{ Capacity (MW)} + \dots \dots \dots]$$

Station Design Boiler Efficiency

$$= ([U\#1 \text{ Installed Capacity (MW)} \times U\#1 \text{ Boiler Efficiency (\%)}) + [U\#2 \text{ Installed Capacity (MW)} \times U\#2 \text{ Boiler Efficiency (\%)}) + \dots \dots \dots]$$

Station DGHR(kcal/kWh)

$$= ([U\#1 \text{ DGHR} \times U\#1 \text{ Installed Capacity (MW)} + U\#2 \text{ DGHR} \times U\#2 \text{ Installed Capacity (MW)} + \dots \dots \dots] / (\text{Station Installed Capacity (MW)}))$$

$$\text{Efficiency (\%)} + \dots \dots \dots] / (\text{Station Installed Capacity (MW)})$$

Station THR (kcal/kWh)

$$= ([U\#1 \text{ THR} \times U\#1 \text{ Installed Capacity (MW)} + U\#2 \text{ THR} \times U\#2 \text{ Installed Capacity (MW)} + \dots \dots \dots] / (\text{Station Installed Capacity (MW)}))$$

Unit DGHR (kcal/kWh)

$$= \text{Unit THR (kcal/kWh)} / \text{Boiler Efficiency (\%)}$$

$$\boxed{\text{Station Design Net Heat Rate (kcal/kWh)} = \frac{(\text{Station DGHR (kcal/kWh)})}{(1 - \text{Operating APC})}}$$

Where

DGHR = *Design Gross Heat Rate (kcal/kWh)*

THR = *Turbine Heat Rate (kcal/kWh)*

DNHR = *Design Net Heat Rate (kcal/kWh)*

APC = *Auxiliary Power Consumption (%)*
[Operating APC in Baseline Year]

Station Loading Factor (%)

$$= ([U\#1 \text{ loading factor (\%)} \times U\#1 \text{ Gross Generation (MU)}] + [U\#2 \text{ loading factor (\%)} \times U\#2 \text{ Gross Generation (MU)}] + \dots \dots \dots] / (\text{Station Gross Generation (MU)}))$$

Station Gross Generation (MU)

$$= (U\#1 \text{ Gross Generation (MU)} + U\#2 \text{ Gross Generation (MU)} + \dots \dots \dots)$$

Station Net Generation (MU)

$$= \text{Station Gross Generation (MU)} \times [1 - \text{APC (\%)} / 100]$$

Station OGHR (kcal/kWh)

$$= ([U\#1 \text{ OGHR (kcal/kWh)} \times U\#1 \text{ Gross Generation (MU)}] + [U\#2 \text{ OGHR (kcal/kWh)} \times U\#2 \text{ Gross Generation (MU)}] + \dots \dots \dots] / (\text{Station Gross Generation (MU)}))$$

$$\boxed{\text{Station ONHR (kcal/kWh)} = \frac{\text{Station ONHR (kcal/kWh)}}{1 - \text{Operating APC}}}$$





Where

OGHR = Operating Gross Heat Rate

ONHR = Operating Net Heat Rate

APC=Auxiliary Power Consumption [Operating APC in Baseline Year]

on a Heat Rate higher than the target, penalty will be levied on the Station. On the other hand, if the station over achieves its target, i.e., operates at a Heat Rate lesser than the target, it will be granted E-Certs, which can be traded in open market.

(c) Heat Rate Reduction Target

The target in Thermal Power Sector under PAT Scheme is set by taking the deviation of NHR of Baseline year and design NHR. Based on the deviation percentage (to design), the target values for Heat Rate reduction are set in the slab.

Let the deviation percentage be "X", then

If X is <= 5(five), then the HR reduction target is 10% of the deviation.

If X is >5, but <=10, then the HR reduction target is 17% of the deviation.

If X is >10, but <=20, then the HR reduction target is 21% of the deviation.

If X is >20, then the HR reduction target is 24% of the deviation.

(d) Coal based thermal Power Plant Station Target Net Operating Heat Rate without Normalization

The Station Net Operating Heat Rate without Normalization is the ONHR of baseline year minus the heat rate reduction target given to it.

Target Station ONHR (kcal/kWh)

= Station Operating NHR for BY- Heat Rate Reduction Target

Where

OGHR = Operating Gross Heat Rate

ONHR = Operating Net Heat Rate

APC= Auxiliary Power Consumption

This Heat Rate has to be attained by the Station. If the station fails to meet its target, i.e., operates

Section 6.02 Formula for target setting for Gas based Thermal Power Plant

(a) Design Parameters

Station Installed Capacity (MW)

$$= [U\#1 \text{ Capacity (MW)} + U\#2 \text{ Capacity (MW)} + \dots \dots \dots]$$

Station Design Module Efficiency

$$= ([U\#1 \text{ Installed Capacity (MW)} \times U\#1 \text{ Module Efficiency}] + [U\#2 \text{ Installed Capacity (MW)} \times U\#2 \text{ Module Efficiency}] + \dots \dots \dots) / (\text{Station Installed Capacity (MW)})$$

Station Module Heat Rate (Gross Heat Rate) (kcal/kWh)

$$= ([U\#1 \text{ THR} \times U\#1 \text{ Installed Capacity (MW)}] + [U\#2 \text{ THR} \times U\#2 \text{ Installed Capacity (MW)}]) / (\text{Station Installed Capacity (MW)})$$

Station Design Net Heat Rate (kcal/kWh)

$$= \frac{(\text{Station DGHR (kcal/kWh)})}{(1-\% \text{Operating APC})}$$

(b) Operating Parameters

Station Operating Load (MW)=U#1 Operating Load (MW)+U#2 Operating Load (MW)+...

Station Gross Generation(MU)=

$$(U\#1 \text{ Gross Generation (MU)} + U\#2 \text{ Gross Generation (MU)} + \dots)$$

Station OGHR (kcal/kWh)

$$= ([U\#1 \text{ OGHR (kcal/kWh)} \times U\#1 \text{ Gross Generation (MU)}] + [U\#2 \text{ OGHR (kcal/kWh)} \times U\#2 \text{ Gross Generation (MU)}] + \dots)$$



Annexure 7 :

Performance Guarantee Test Report of LRPP.



2

WÄRTSILÄ India

Title: Technical Proposals – Result Summary

Project: P/15302 LAKWA REPLACEMENT POWER PROJECT

Installation Type: 7 X 20V34SG

Technical Proposal -4B						
1 Stabilization time						
<i>Committed Value: 35 seconds (to attain rated speed)</i>						
<i>Actual Value:</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
33 sec	31 sec	32 sec	32 sec	33 sec	33 sec	31 sec
<i>Result: Test Passed</i>						
2 Fuel consumption in 24 hours at 100% rated load						
<i>Committed Value: 54,329.5 sm³ per engine</i>						
<i>Actual Fuel Consumption in 24 hours (in sm³)</i>						
<i>(Gensets operated on low load for certain times on account of knocking caused by gas quality)</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
51501.21419	53869.75793	53782.08563	52060.64697	53577.51693	52332.01361	51776.75571
<i>Actual Fuel Consumption in 4 hours: (operated at 100% load)</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
6319 kg	6476 kg	6472 kg	6467 kg	6454 kg	6468 kg	6361 kg
<i>Calculated fuel consumption for 24 hrs based on 4 hours value</i>						
37914 kg	38856 kg	38832 kg	38802 kg	38724 kg	38808 kg	38166 kg
52762 sm ³	54072 sm ³	54039 sm ³	53998 sm ³	53889 sm ³	54006 sm ³	53113 sm ³
<i>Result: Test Passed</i>						
3 Guaranteed rated output at generator terminal, MW						
<i>Committed Value: 9.965</i>						
<i>Actual Value:</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
9.981	9.999	9.990	10.012	10.001	9.983	10.003
<i>Result: Test Passed</i>						
4 Guaranteed gross heat rate,Kcal/Kwh - 24 hours at 100% rated load						
<i>Committed Value: 1873</i>						
<i>Actual Value in 24 hours:</i>						
<i>Comment : Gensets are operating on low load and knock state hence the heat rate and Power out puts are varied from contractual guarantees and corrections shall be applicable</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
1840	1885	1884	1881	1874	1886	1856
<i>Actual Value in 4 hours at 100% rated load:</i>						
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7
1827	1872	1870	1864	1862	1869	1842
<i>Result: Test Passed</i>						



5	Guaranteed lube oil consumption													
	<i>Committed Value: 0.25 gm/kwh</i>													
	<i>Actual Value:</i>													
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7								
0.0982	0.0421	0.073	0.0526	0.077	0.042	0.084								
<i>Result: Test Passed</i>														
6	Emissions													
	<i>Committed Value: NOx<91ppm at 15% dry oxygen level (at 100% engine loading condition)</i>													
	<i>Actual Value: Values are within limit.</i>													
<i>Result: Test Passed</i>														
7	Noise													
	<i>Committed Value: < 118 db at 1m distance from engine</i>													
	<i>Actual Value: < 118 db</i>													
<i>Result: Test Passed</i>														
8	Vibration													
	<i>Committed Value: <45 mm/s</i>													
	<i>Actual Value: <45 mm/s</i>													
<i>Result: Test Passed</i>														
Exhaust gas temperature after turbocharger °c (non-guaranteed value)														
	<i>Committed Value: 358 deg.C (+/-15 deg.c)</i>													
	<i>Actual Value:</i>													
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7								
369.5°c	361.5°c	365.5 °c	367 °c	372 °c	364.5 °c	368.5 °c								
Technical Proposal -5														
1	Stabilization time													
	<i>Committed Value: 35 seconds (to attain rated speed)</i>													
	<i>Actual Value:</i>													
Engine-1	Engine-2	Engine-3	Engine-4	Engine-5	Engine-6	Engine-7								
33 sec	31 sec	32 sec	32 sec	33 sec	33 sec	31 sec								
<i>Result: Test Passed</i>														
2	Fuel consumption in 72 hours													
	<i>Committed Value: 1140919 sm^3 for entire plant</i>													
	<i>Actual Fuel Consumption in 72 hours (in sm^3)</i>													
	(Gensets operated on low load for certain times on account of knocking caused by gas quality)													
	Kg: 803208													
	sm^3:1117763.38													
	<i>Actual Fuel Consumption in 4 hours: (operated at 100% load)</i>													
	Kg:45017													
	<i>Calculated fuel consumption for 72 hrs based on 4 hrs value:</i>													
	Kg: 810306 sm^3:1127641.128													
<i>Result: Test Passed</i>														
3	Guaranteed net plant output at 132 KV side of step up transformers, MW													
	<i>Committed Value: 68.709</i>													
	<i>Actual Value: 69.443</i>													
<i>Result: Test Passed</i>														



4	Guaranteed net Plant heat rate, Kcal/Kwh
	<i>Committed Value: 1901</i>
	<i>Actual Value in 72 hours: 1902</i>
	Comment : Gensets are operating on low load and knock state hence the heat rate and Power out puts are varied from contractual guarantees and corrections shall be applicable
	<i>Actual Value in 4 hours at 100% rated load: 1893</i>
	<i>Result: Test Passed</i>

Technical Proposal -6	
1	Engine room ventilation guarantee- Guaranteed temp difference between engine room temp and ambient temp <i>Committed Value: health and safety at work (General workplace conditions) regulations 2003 of ILO.</i>
	<i>Actual Value: temp is Within limit</i>
	<i>Result: Test Passed</i>
2	Engine room ventilation guarantee- Maximum air to be handled in cum/min in highest ambient temperature outside the engine room <i>Committed Value: Max 12,500 cum/min of fresh air supply flow from outside the engine room.</i>
	<i>Actual value: > committed value</i>
	<i>Result: Test Passed</i>

Technical Proposal -7	
1	Environmental guarantee- aggregate noise from plant at the nearest plant boundary <i>Committed Value: <75 dB at 1mtr distance from the plant boundary</i>
	<i>Actual Value: <75dB</i>
	<i>Result: Test Passed</i>
2	Gaseous emissions National Ambient Air Quality Standard, India(CPCB) <i>Committed Value: NOx<91ppm at 15% dry oxygen level (at 100% engine loading condition)</i>
	<i>Actual Value: Value is within limit</i>
	<i>Result: Test Passed</i>
3	Effluents as per CPCB standard <i>Committed Value: Oil & grease <10 mg/l</i>
	<i>Actual Value: 4.8 mg/l</i>
	<i>Result: Test Passed</i>

1	Technical Proposal -8
1	Control room air conditioner guarantee- Guaranteed dry bulb temperature & relative humidity range <i>Committed Value: As per ASHRAE Standards</i>
	<i>Actual Value: Values are as per standard</i>
	<i>Result: Test Passed</i>

Technical Proposal -9	
1	Control room air conditioner guarantee- Other air conditioner space guarantee <i>Committed Value: As per ASHRAE Standards</i>
	<i>Actual Value: Values are as per standard</i>
	<i>Result: Test Passed</i>




The above tests are performed as per the technical proposals agreed in the contract ref: Section -4 of bidding forms and witnessed by the parties (APGCL and assigned Consultants from APGCL).

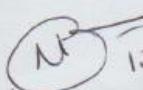
The test records and results are found to be within the agreed figures. All test records with calculations are submitted in detail to the APGCL for review and necessary approvals.

Plant heat rate, Kcal/Kwh – on higher heating value of gas

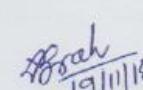
Committed Value: Not applicable

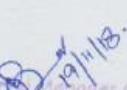
Actual Value in 72 hours: 2109

Comment: Plant heat rate calculation based on HHV of gas has been prepared on request of APGCL and it is not stated in section-4 of bidding forms. Hence it does not have any committed value.

 12.07.18
Nagabhushan Jambog

Wartsila

 19/11/18
Abrah
Deputy Manager (LRPP) APGCL
Lakwa Thermal Power Station
APGCL, Maibella

 19/11/18
Asst. General Manager (L)
Lakwa Thermal Power Sta
APGCL, Maibella



Annexure 8 :

IIT Report on “Evaluation of Station

Heat Rates for Namrup & Lakwa

Thermal Power Stations” of APGCL



ORIGINAL

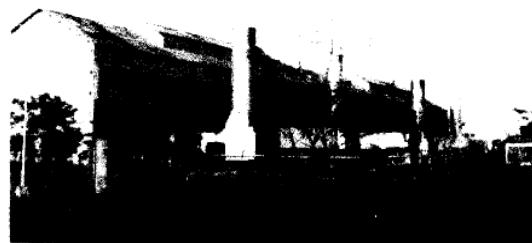
Report

On

Evaluation of Station Heat Rates For Namrup and Lakwa Thermal Power Stations of APGCL



Namrup TPS



Lakwa TPS

By Dr. Praveen Kumar
&
G.B. Shrestha
Dept. of Electronics and Electrical Engineering
IIT, Guwahati

October, 2013

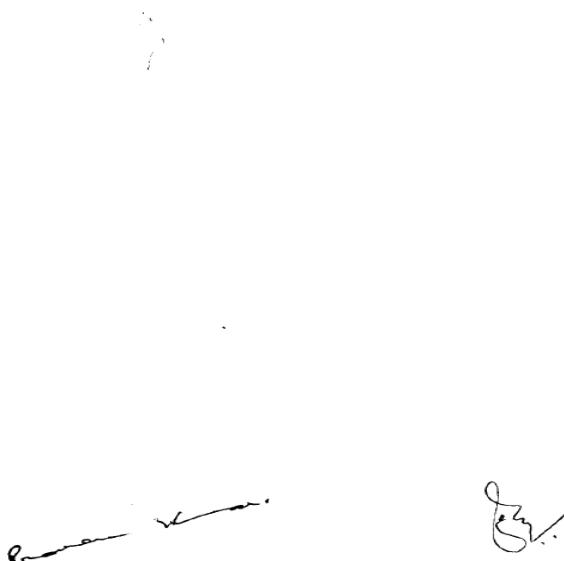


Special Issues:

- It was observed during site visit and the experimentation that the gas pressure at LTPS and NTPS station seems to vary intermittently without control, which affects the operation of the generating units making it not possible to operate at a specific desired output levels. It was observed that the power output under such conditions remained at very low levels and therefore high heat rates.
- The load profile data obtained from APGCL do not contain any such low power output data and therefore do not account for such low power output operation.

Additional attachments:

1. NTPS test data
2. NTPS generation data
3. LTPS test data
4. LTPS generation data



Handwritten signatures are present in the lower left area of the page. One signature is a stylized 'R' and the other is a stylized 'B.' A horizontal line is drawn below the signatures.



Annexure 9 :

**Copy of CEA (Technical Standards for
Construction of Electrical Plants and
Electric Lines) Regulations, 2010**





भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग III—खण्ड 4

PART III—Section 4

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं. २११]

नई दिल्ली, शुक्रवार, अगस्त २०, २०१०/श्रावण २९, १९३२

No. २११]

NEW DELHI, FRIDAY, AUGUST 20, 2010/SHRAVANA 29, 1932

CENTRAL ELECTRICITY AUTHORITY

NOTIFICATION

New Delhi, the 20th August, 2010

No. CEA/TETD/MP/R/01/2010.—In exercise of the powers conferred by sub-section (2) of Section 177 of the Electricity Act, 2003, the Central Electricity Authority hereby makes the following regulations namely :—

1. Short Title and Commencement.—(1) These regulations may be called the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions.—(1) In these regulations, unless the context otherwise requires,—

(a) "Act" means the Electricity Act, 2003;

(b) "Authority" means the Central Electricity Authority established under sub-section (2) of Section 70 of the Act;

(c) "Base Load Operation" means operation at maximum continuous rating (MCR) or its high fraction;

(d) "Basic Insulation Level (BIL)" means reference voltage level expressed in peak (crest) voltage with standard 1.2/50 μ s lightning impulse wave. Apparatus should be capable of withstanding test wave of basic insulation level or higher;

(e) "Black Start" means the start up of a generating unit or gas turbine or internal combustion (IC) engine based generating set without use of external power following grid failure;

(f) "Boiler Maximum Continuous Rating (BMCR)" means the maximum steam output, the steam generator (boiler) can deliver continuously at rated parameters;



(2) The IC engine and all rotating auxiliaries shall be suitable for continuous operation within the frequency range of 47.5 Hz to 51.5 Hz.

(3) For grid connected generating stations, design of the equipment and control system shall be suitable for operation of the Gen-set in automatic load frequency control.

(4) The Gen-set shall have auto start, auto loading, auto stop features and capable of parallel operation in the power distribution system with synchronizing facilities.

(5) The gross heat rate of Gen-set as guaranteed by the manufacturer shall not exceed the following values:

(a) **Diesel engine based Gen-sets (four stroke)**

Table 3

Gen-Set Rating	Gross Heat Rate (on HHV basis) in kcal/ kWh at 100% load
100 kW to 1 MW	2350
>1 MW to 3 MW	2250
> 3 MW to 10 MW	2200
>10 MW	2150

(b) **Diesel engine based Gen-sets (two stroke)**

Table 4

Gen-Set Rating	Gross Heat Rate (on HHV basis) in kcal/ kWh at 100% load
3 MW to 10 MW	2000
> 10 MW	1950

(c) **Gas engine based Gen-sets**

Table 5

Gen-Set Rating	Gross Heat Rate (on HHV basis) in kcal/ kWh at 100% load
>1 MW to 3 MW	2400
> 3 MW to 5 MW	2300
>5 MW	2150

25. **IC Engine and Auxiliaries-** (1) The IC engine and auxiliaries shall comply with latest versions of applicable IS/ ISO/ BS (British Standard) or equivalent codes.



Annexure 10 :

Regulatory Formats

