BEFORE THE HON'BLE PUNJAB STATE ELECTRICITY REGULATORY COMMISSION, CHANDIGARH

PETITION No. _____ of 2020

IN THE MATTER OF:

GVK Power (Goindwal Sahib) Limited .....Petitioner

- Versus -

Punjab State Power Corporation Limited .....Respondent

INDEX

	dated 20.04.2020.	
11.	**Annexure P-10:** A copy of IBA Letter dated 08.08.2018	**268**
12.	**Annexure P-11 (Colly):** A copy of the tender issued by GVK along with the Notices published in Financial Express and Economic Times inviting Expression of Interest for Design, Supply, Installation, Testing, Erection and Commissioning of FGD system	**269-274**
13.	**Annexure P-12:** A copy of GVK letter dated 19.07.2018 to PSPCL	**275-278**

GVK Power (Goindwal Sahib) Limited

Petitioner

Through

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New Delhi – 110049

Place:
Date:

BEFORE THE HON'BLE PUNJAB STATE ELECTRICITY REGULATORY COMMISSION, CHANDIGARH

PETITION No. _____ of 2020

IN THE MATTER OF:

Application for approval of Capital Investment Plan and Business Plan for 2X270 MW Goindwal Sahib Thermal Power Plant at Goindwal Sahib, Punjab for the control period FY 2020-21 to 2022-23 Under Regulation 9 of "Punjab State Electricity Regulatory Commission (Terms and Conditions for Determination of Generation, Transmission, Wheeling and Retail Supply Tariff) Regulations, 2019" (PSERC MYT Regulations 2019).

AND IN THE MATTER OF:

GVK Power (Goindwal Sahib) Limited

Plot No. 10 Paigah House,

Sardar Patel Road,

Secunderabad – 500003 .....Petitioner

- Versus -

Punjab State Power Corporation Limited

The Mall, Patiala (Punjab) .....Respondent

MOST RESPECTFULLY SHOWETH THE PETITION AS FOLLOWS: -

A. INTRODUCTION

1. BRIEF

1.1 GVK Power (Goindwal Sahib) Limited ("**the Petitioner/GVK**") is a company incorporated under the provisions of Companies Act 1956 with the object of engaging in the business of establishing, maintaining and operating a 2X270MW (540 MW) coal based thermal power station at Goindwal Sahib in the State of Punjab ("**Project**"). For the generation, sale and purchase of electricity from the Project, an Amended and Restated Power Purchase Agreement, dated 25.06.2009 ("**PPA"**) was entered into between the Petitioner and the Punjab State Power Corporation

Limited ("**the Respondent/PSPCL"**). Under the terms of the PPA, the entire power generated by the Petitioner from the Project shall be sold exclusive to the Respondent, including the full capacity of the Project.

1.2 The petitioner has filed Petition No. 14 of 2020 before this Hon'ble Commission for approval of the Aggregate Revenue Requirement for the control period FY 2020-21 to FY 2022-23. As per Regulation 9.1 of the PSERC (Terms and Conditions for Determination of Generation, Transmission, Wheeling and Retail Supply Tariff) Regulations 2019 ("**PSERC Tariff Regulation 2019**"): -

> *"The Applicant shall file the Business Plan including the Capital Investment plan for its Generation, Transmission, SLDC and/or Distribution businesses, as the case may be for approval of the Commission on or before 20th August of the year preceding the first year of the Control Period for a duration covering the entire Control Period."*

1.3 It is submitted that the Business Plan (**BP**) and the Capital Investment Plan (**CIP**) could not be filed within the timeline provided in Regulation 9.1 of PSERC Tariff Regulations 2019 However, this Hon'ble Commission condoning the delay has directed the Petitioner on 05/08/2020 to file the Petition for approval of Capital Investment Plan and Business Plan for the control period FY 2020-21 to FY 2023-24 by 12/08/2020.

1.4 The petitioner states that in line with the above proceedings and provisions of PSERC Tariff Regulations the Petitioner is filing the CIP and BP for the control period FY 2020-21 to FY 2023-24 for approval by this Hon'ble Commission.

B. CAPITAL INVESTMENT PLAN AND BUSINESS PLAN FOR CONTROL PERIOD FROM FY 2020-21 TO FY 2022-23

2. CAPITAL INVESTMENT PLAN

2.1 Petition for approval of CIP has to be filed in accordance with and in the manner prescribed in Regulation 9.7 to Regulation 9.13 of PSERC Tariff Regulations: -

> *"The Capital Investment Plan covering the entire MYT Control Period will be submitted in the following two parts:*

a) Ongoing schemes of the previous MYT Control Period (i.e. works / schemes which are under construction or where full payments have not yet been made). All spill over works will be included in this;

b) Schemes to be taken up in the order of priority giving the schedule over the full MYT Control Period. In case it is likely to take more than 3 years, the likely date of completion should also be given. This will also include such schemes which were part of the Capital Investment Plan of the previous MYT Control Period but could not be started and which the Applicant considers necessary to take up during the present Control Period.

9.8 The Applicant shall submit the Detailed Project Reports (DPRs) for all the schemes as per Part (a) and (b) above which shall include:

(a) Purpose of investment;

(b) Broad Technical Specifications of the proposed investment and supporting details;

(c) Capital Structure;

(d) Capitalization Schedule;

(e) Financing Plan, including identified sources of investment;

(f) Physical targets;

(g) Cost-benefit analysis;

(h) Prioritization of proposed Investments:

Provided that DPRs will not be necessary for schemes under Rs. 10 Crore for Generation and

Transmission Businesses, Rs. 5 Crore for Distribution Business and Rs. 1 Crore for SLDC:

Provided further that the total capital expenditure on non-DPR schemes in any year should not exceed 20% of that for DPR schemes during that year.

9.9 The capital investment plan shall match with:

(a) For Generation Business:

i) capacity addition during the Control Period;

ii) renovation and modernisation of the generating plant as allowed in CERC Regulations;

(b) For Transmission Business

i) Nature of investment (evacuation project, system augmentation, system strengthening, IT

related projects etc.);

ii) Details of physical parameters of the project such as circuit-kms, capacity in MVA, location

of the project etc.;

iii) Break-up of investment in capacitor banks, reduction in reactive power drawl and transmission losses;

(c) For Distribution Business:

i) Replacement of existing assets;

ii) Meeting load growth;

iii) Technical loss reduction;

iv) Non-technical loss reduction;

v) Meeting reactive energy requirements;

vi) Customer service improvement;

vii) Improvement in quality and reliability of supply etc.

9.10 In case of existing Generation and Transmission projects, the capital investment for Renovation and Modernization shall consist of a Detailed Project Report which will include the following elements:

(a) Complete scope and justification;

(b) Estimated life extension;

(c) Improvement in performance parameters;

(d) Cost-benefit analysis;

(e) Phasing of expenditure;

(f) Schedule of completion;

(g) Reference price level;

(h) Estimated completion cost including IDC etc.;

(i) Other aspects.

9.11 The Capital Investment Plan in case of a new or expansion in an existing generating station shall also include cost of approved rehabilitation and resettlement (R&R) plan of the project in conformity with the National R&R Policy and R&R package.

9.12 In case, the Commission approves lesser amount of capital expenditure than filed by the Applicant for approval, the Commission may allow the

respective Applicant to determine the priority of schemes to be considered within the approved amount.

9.13 In the normal course, the Commission shall not revisit the approved capital investment plan during the Control Period. The Licensee shall file details of the capital expenditure incurred for the preceding financial year by 30th June of the current financial year to enable the Commission to monitor and review the progress of the capital expenditure incurred by the Applicant vis-à-vis the approved capital expenditure:

Provided that the capital expenditure incurred shall be only for the schemes as per the approved capital investment plan."

2.2 It is submitted that the capital investment for the control period FY 2020-21 to FY 2023-24 has been estimated as Rs. 540 Cr on account of installation of Flue Gas Desulphurization ("**FGD'**) System in the Plant in compliance of Ministry of Environment, Forest & Climate Change ('**MoEFCC**') Notification dated 01.12.2015 ("**MoEFCC Notification**"). The MoEFCC notification is an event of Change in Law in terms of Article 13_of the PPA dated 25.06.2009 and Regulation 3.15 of PSERC Tariff Regulations 2019. The status of MoEFCC Notification dated 07.12.2015 is no more res-integra, as the Hon'ble Appellate Tribunal for Electricity (**'Tribunal'**) by its Judgment dated 28.08.2020 passed in Appeal No. 21 of 2019 titled ***Talwandi Sabo Power Ltd. v. Punjab State Electricity Regulatory Commission & Anr***, has: -

(a) Declared the MoEFCC Notification and its consequent mandate i.e., installation of FGD system and DeNOx System for compliance with emission level of SO2 and NOx as an event of Change in Law.

(b) Held that the additional expenditure to be incurred by the generating company including all allied cost like taxes, duties etc., has to be included as Additional Capital Cost and reimbursed to the generating company along with Carrying Cost to bring the generator to the same economic position as if such Change in Law event has not occurred.

(c) Directed the Electricity Regulatory Commission to devise a mechanism for payment by the procurers of the additional cost and other expenses to be incurred by the generating company in relation to procurement, installation, commissioning, operation and maintenance of FGD System.

(d) Held that additional funds including debt funds required for installation of FGD system will not be sanctioned by lenders (as amount involved is significantly high) in the absence of regulatory certainty qua the methodology/mechanism of arriving at compensation to mitigate the impact of Change in Law event. The relevant extract of the Judgment is extracted below: -

"139. It is also seen additional funds including debt funds, which will not be sanctioned by lenders (as amount involved is significantly high) in the absence of regulatory certainty for the methodology/mechanism of arriving at compensation to mitigate the impact of Change in Law event.

140. In the light of our discussion and reasoning, we are of the opinion that the impugned Orders, dated 21.12.2018 and 09.01.2019 challenged in both the appeals deserve to be set aside and accordingly set aside by allowing the appeals.

a) The MoEF & CC Notification dated 07.12.2015 is a Change in Law event under PPAs in question having regard to the facts and circumstances of the case of the Appellants.

b) The installation and operation of the FGD and associated system to comply with emission levels of SO2 is Change in Law and additional expenditure for the same including all allied cost like taxes, duties etc., has to be included as Additional Capital Cost to be incurred by the Appellants.

c) In case technology for installing and operating SNCR and/or any other appropriate technology is mandated in future for complying with the emission levels of NOx in terms of Notification of 2015, it also amounts to Change in Law event.

d) The Respondent-Commission is directed to devise a mechanism for payment of above amounts by the procurers to both the Appellants towards additional cost and other expenses in relation to procurement, installation, commissioning, operation and maintenance of FGD for SO2 as approved by the concerned authority, after prudence check.

e) Appellants are entitled for carrying cost in terms of provisions of the PPAs to bring the seller-Appellants to the same economic position as if such Change in Law event has not occurred."

2.3 The phasing of the proposed Additional Capital expenditure to be incurred by GVK during the MYT Control Period is detailed below: -

Table 1 Proposed Additional Capital expenditure for Control Period (Rs Crore)

S. No.	Particulars	FY 2020-21	FY 2021-22	FY 2022-23
1	Plant and equipment	0	0	540
	Total	**0**	**0**	**540**

2.4 The details pertaining to statutory promulgation and directions mandating installation of FGD system and the consequential impact on tariff along with the Capital and Operational expenditure required to be incurred by the Petitioner are detailed in the subsequent paragraphs.

RE: MOEF Notification dated 07.12.2015.

2.5 On 07.12.2015, Ministry of Environment, Forest & Climate Change ('**MoEFCC**'), Government of India ('**GoI**') in exercise of power conferred by Sections 6 and 25 of the Environment (Protection) Act 1986, issued the Environment (Protection) Amendment Rules, 2015 mandating all Thermal Power Plants ('**Plants**') installed till December 2016, like Petitioner's Project, to comply with revised emission standards of Sulphur Dioxide ("**SO_2**"), Oxides of Nitrogen ("**NOx"**) and other terms and conditions stipulated under the MoEFCC Notification on or before 06.12.2017: -

Summary of Norms to be complied for Environment Protection Measures as per Rules applicable on various dates			
S.No	**Parameters**	**Prior to MoEFCC Notification**	**MOEF&CC Notification No. S.O. 3305 (E) dated 07.12.2015***
1.	Particulate matter (mg/Nm^3)	50	50
2.	**SO_2 (mg/Nm^3)**	No limit specified in Applicable Rules	**600 (500 MW and below)**
3.	**NOx (mg/Nm^3)**		**300**
4.	Mercury (mg/Nm^3)		0.03
5.	Specific water consumption (m^3/MWh)		3.5

6.	Stack Height for Chimneys		As per formula specified in MoEF&CC Notification dated 28.06.2018

(Cumulatively referred to as "***Revised Emission Norms***"). A copy of MoEFCC Notification dated 07.12.2015 is annexed herewith and marked as **Annexure P-1.**

2.6 It is submitted that the MoEFCC Notification has introduced new norms and amended the existing/applicable environmental norms, for all existing as well as future TPPs. Therefore, in compliance of the MoEFCC Notification, GVK is mandated to install/ retrofit various Emission Control Systems (**ECS**) like Flue Gas De-sulfurization (**"FGD"**) System, Combustion Modification System etc. in its Project, which will require GVK to carry out major capital works. Further, installation of such ECS will result in: -

(a) One-time Additional Capital Expenditure on account of installation of various Emission Control Systems.

(b) Recurring Operational Expenditure during the term of the Amended and Restated PPA i.e., increase in operation and maintenance expenses of the Project

(c) Increase in auxiliary consumption of the Project

(d) Disruption in power generation during the installation phase of various Emission Control Systems.

(e) Loss of Fixed cost recovery during the shutdown period.

2.7 On 14.12.2017, Central Pollution Control Board ('**CPCB**') in exercise of power under Section 5 of the Environment (Protection) Act, 1986 directed the Petitioner to install various Emission Control Systems including FGD System in its Project in compliance of the revised emission standards prescribed by MoEFCC Notification. CPCB issued the following directions: -

(a) GVK shall meet emission limit of PM immediately by installing ESP

(b) GVK shall install FGD by 30.04.2020 and 28.02.2020 in Unit I & II respectively to comply with SO2 emission limits

(c) GVK shall take immediate measures like installation of low NOx burners, providing Over fire Air (OFA) (**'De-NOx System')** and achieve progressive reduction; to comply NOx emission limit by 2022.

(d) GVK shall ensure compliance of all the aforementioned directions, failing which action will be taken under the Environment Act 1986.

A copy of CPCB letter dated 14.12.2017 is annexed herewith and marked as **Annexure P-2.**

2.8 On 30.05.2018, Ministry of Power (**MoP**) in exercise of power conferred under Section 107 of the Electricity Act 2003 issued directions to Ld. CERC for smooth implementation of the Revised Emission Norms under the MoEFCC Notification. The following directions were issued by MoP: -

(a) MoEFCC Notification dated 07.12.2015 requiring compliance of Environment (Protection) Amendment Rules, 2015, is a Change in Law event.

(b) The additional cost implication due to installation/up-gradation of various Emission Control System and its operational cost to meet the Revised Environment Norms, shall be considered for being made pass through in tariff in accordance with law.

(c) The respective TPPs may approach the Appropriate Commission for approval of additional capital expenditure and compensation for additional cost on account of this change in law event in respect of PPA(s) entered under Section 62 or Section 63 of the Electricity Act, 2003.

(d) Ld. CERC shall develop appropriate regulatory mechanism to address the impact on tariff, and certainty in cost recovery on account of additional capital and operational cost.

A copy of the MoP Notification dated 30.05.2018 is annexed hereto and marked as **Annexure P-3.**

2.9 On 10.04.2018 and 31.05.2018, CEA wrote to GVK directing that it approach the concerned regulator and submit a detailed feasibility report for approval of appropriate technology and associated cost implications in installing FGD system

before approaching CEA. A copy of CEA letter dated 10.04.2018 and 31.05.2018 is annexed herewith and marked as **Annexure P – 4 (Colly)**.

2.10 On 30.01.2019, GVK engaged M/s Save Urja for availing their consultancy service for detailed feasibility study of its Project, qua identifying suitable technology and cost estimate for complying with the Revised Emission Norms prescribed under the MoEFCC Notification.

2.11 On 06.02.2019, CEA wrote to GVK stating that it is accepting the feasibility report by TPPs and was not insisting for prior approval from the concerned Regulator. In view thereof, CEA directed GVK to submit its detail feasibility report for installation of FGD system at its Plant. A copy of CEA letter dated 06.02.2019 is annexed hereto and marked as **Annexure P - 5.**

2.12 On 08.03.2019, M/s Save Urja after conducting a detailed study submitted the Feasibility Report of the Project to GVK. The Feasibility Report proposes to retrofit GVK's Project with emission control technology on DeSOx and DeNOx i.e., by installation of wet lime FGD System and Primary NOx reduction measures (combustion optimisation). A copy of GVK's Feasibility Report is annexed hereto and marked as **Annexure P – 6**.

2.13 In March 2019,GVK submitted the Feasibility Report of its Project to CEA seeking its recommendation on the suitable technology and associated cost implications qua installation of FGD system. It is pertinent to note that the proposed technology, estimated associated cost and other ancillary details recommended in the Feasibility Report are in line with the operational norms and guidelines issued by CEA on 20.02.2019 and 15.04.2019.

2.14 On 30.04.2019, CEA vide its letter provided an advisory report detailing suggestive technology and estimated indicative cost qua installation of FGD System at GVK's Project. CEA also stated that the cost of retrofitting of FGD for the plant needs to be discovered through open competitive bidding in consultation with representatives of major PPA stakeholder. The recommendations by CEA *inter-alia* were: -

(a) As per the Feasibility Report, GVK has opted for the "Wet Limestone based FGD Technology". Under this technology, the reagent source may be selected based on availability of limestone, limestone purity, cost and quality. Additionally, Source of limestone should be chosen with life cycle cost analysis.

(b) The maximum Additional Auxiliary Power Consumption for complete FGD facilities (limestone based FGD) would be maximum of 1%. However, if the existing chimney is used, the requirement of Gas to Gas Heater ("**GGH**") would have to be seen and the Additional Auxiliary Power Consumption with GGH (only if using old chimney) would be 0.3%.

(c) The indicative estimated cost for Wet limestone base FGD works out to Rs. 0.45 Cr/MW (CAPEX only for Limestone based FGD). This indicative cost is the "Base Cost" only and does not include Opportunity cost (associated with generation loss due to interconnection of chimneys with absorber) and Taxes-Duties. This Indicative "Base cost is calculated considering new chimney without GGH.

(d) GVK shall approach the concerned Regulator at appropriate stage for any piling related additional Cost implications on account of installation of FGD system.

(e) The cost of retrofitting the FGD for GVK ought to be discovered through open competitive bidding in consultation with the lead procurer. The lead procurer (to be invited by GVK) may participate in bidding process till final award of FGD contract.

(f) As per the Feasibility Report, GVK has opted for new wet chimney. However, final selection of chimney may only be made after conducting a lifecycle cost benefit analysis and seeing technical feasibility of available options.

(g) As regards Opportunity Cost, GVK was advised to minimize the interconnection time by taking suitable measures so that 'Opportunity Cost' may have least impact on tariff revision.

(h) For Opex, the same would include reagent cost, additional water consumption associated with FGD, manpower cost, APC and By-product handling and revenue earned through disposal of by product. Opex should be kept as low as possible by reducing APC and producing good quality of saleable by-product.

A copy of CEA's letter dated 30.04.2019 along with the Advisory Report submitted by CEA is annexed hereto and marked as **Annexure P – 7.**

Re: Change in Law provisions under the PPA and PSERC Tariff Regulations 2019

2.15 Regulation 18.2(c)&(d) read with Regulation 18.3 of PSERC Tariff Regulations 2014, allows additional capital expenditure (not included in original project cost) incurred by GVK after the Cut-off-Date (i.e., 31.03.2019, i.e., 31st March of the year closing after two years of the year of commercial operation of the project) on account of Change in Law to be passed through in tariff as under: -

"18.2. The Capital Expenditure of the following nature actually incurred after the cut-off date may be admitted by the Commission subject to prudence check:

a. Un-discharged/Deferred liabilities relating to works/services within the original scope of work;

b. Liabilities to meet award of arbitration or for compliance of the order or decree of a court;

c. On account of change of law;

d. Any additional works/services which have become necessary for efficient and successful operation of the project, but were not included in the original project cost; and

18.3. Impact of additional capitalization in tariff revision within the approved project cost shall be considered by the Commission once during a particular year."

2.16 It is submitted that in Article 1.1 of the PPA: -

(a) "Law" has been defined to mean "*all laws including Electricity Laws in force in*

India and any statute, ordinance, regulation, notification or code, rule, or any interpretation of any of them by an Indian Governmental Instrumentality and having force of law and shall further include all applicable rules, regulations, orders, notifications by an Indian Governmental Instrumentality pursuant to or under any of them and shall include all rules, regulations, decisions and orders of the Appropriate Commission"

(b) "Indian Governmental Instrumentality" has been defined to mean "*the GOI, Government of Punjab, and any ministry or, department or board or agency other regulatory or quasi-judicial authority controlled by GOI or Government of Punjab where the Procurer and Project are located and includes the Appropriate Commission*"

(c) The term "*Operating Period*" means "*In relation to the Unit means the period from its COD and in relation to the Power Station the date by which all the Units achieve COD, until the expiry or earlier termination of this Agreement in accordance with Article 2 of this Agreement*".

2.17 Article 13 of the PPA provides the mechanism to recognize and deals with Change in Law, including the manner in which GVK has to be compensated, as reproduced below: -

"13 ARTICLE 13 CHANGE IN LAW 13.1 Definitions

In this Article 13, the following terms shall have the following meanings:

13.1.1 "Change in Law" means the occurrence of any of the following events

(i) the enactment, bringing into effect, adoption, promulgation, amendment, modification or repeal, of any Law or (ii) a change in interpretation of any Law by a Competent Court of law, tribunal or Indian Governmental Instrumentality provided such Court of law, tribunal or Indian Governmental Instrumentality is final authority under law for such interpretation or (iii) change in any consents, approvals or licenses available or obtained for the Project, otherwise than for default of the Seller, which results in any change in any cost of or revenue from the business of selling electricity by the Seller to the Procurer under the terms

of this Agreement,

but shall not include (i) any change in any withholding tax on income or dividends distributed to the shareholders of the Seller, or (ii) change in respect of UI Charges or frequency intervals by an Appropriate Commission.

13.2 Application and Principles for computing impact of Change in Law

While determining the consequence of Change in Law under this Article 13, the Parties shall have due regard to the principle that the purpose of compensating the Party affected by such Change in Law, is to restore through Monthly Tariff payments, to the extent contemplated in this Article 13, the affected Party to the same economic position as if such Change in Law has-not occurred.

……..

(b)Operation Period

As a result of Change in Law, the compensation for any increase/decrease in revenues or cost to the Seller shall be determined and effective from such date, as decided by the Punjab State Electricity Regulatory Commission whose decision shall be final and binding on both the Parties, subject to rights of appeal provided under applicable Law.

Provided that the above mentioned compensation shall be payable only if and for increase/ decrease in revenues or cost to the Seller is in excess of an amount equivalent to 1% of the Letter of Credit in aggregate for a Contract Year.

……..

13.4 Tariff Adjustment Payment on account of Change in Law

13.4.1 Subject to Article 13.2, the adjustment in Monthly Tariff Payment shall be effective from:

(i) the date of adoption, promulgation, amendment, re-enactment or repeal of the Law or Change in Law; or

(ii) the date of order/judgment of the Competent Court or tribunal or Indian Governmental Instrumentality, if the Change in Law is on

account of a change in interpretation of Law.

13.4.2 The payment for Changes in Law shall be through Supplementary Bill as mentioned in Article 11.8. However, in case of any change in Tariff by reason of Change in Law, as determined in accordance with this Agreement, the Monthly Invoice to be raised by the Seller after such change in Tariff shall appropriately reflect the changed Tariff."

A copy of GVK's PPA dated 25.06.2009 is annexed herewith and marked as **Annexure P-8**.

2.18 It is submitted that as per Article 13 of the PPA, the following conditions have to be met with while claiming a Change in Law during Operation Period: -

(a) The underlying principle of Article 13 is to determine the consequence of Change in Law and to compensate a party affected by a Change in Law such that the party is restored to the same economic position as if such Change in Law had not occurred.

(b) The coming into effect of:

(i) The enactment or coming into force of any Law.

(ii) Change in interpretation of any Law

(iii) Change in any consents, approvals or licenses available or obtained for the Project.

(c) GVK is entitled to be compensated for any Change in Law which has an effect in any cost of or revenue pf the Project i.e., from the business of selling electricity by GVK to PSPCL. The compensation will only be granted if the impact of the Change in Law is more than 1% of the aggregate Letter of Credit Amount in a Contract Year.

2.19 It is submitted that once 'Change in Law' is established, the compensation must follow in order to compensate the affected party such that the affected party is restored to the same economic position as if the 'Change in Law' had not occurred. Accordingly, in terms of Article 13.2(b) of the PPA, GVK is entitled to be compensated for any increase in cost which would include additional capital cost

incurred during the Operating Period. The change in law event being MoEFCC Notification and consequent *inter-alia* installation of FGD will lead to an increase in cost for which GVK should be compensated.

Re: MoEFCC Notification mandating installation of FGD System is a Change in Law for GVK

2.20 It is submitted that there existed no applicable standards for emission of Sulphur Dioxide (SO_2) and Nitrogen Oxide (NOx) in: -

(a) Environment Protection Rules, 1986

(b) Environmental Clearances dated 09.05.2008 and its amendments dated 19.02.2014 and 09.03.2016 issued by MoEF for the Project.

(c) Amended and Restated PPA dated 25.06.2009.

Accordingly, GVK has conceptualized its Project on the then existing laws and government policies including the applicable environmental policies.

2.21 It is submitted that the MoEFCC Notification dated 07.12.2015 has:-

(a) Introduced additional parameters/limits for TPPs qua emission norms for Sulphur Dioxide and Oxides of Nitrogen.

(b) Directed all TPPs with Once-Through Cooling (OTC) to install Cooling tower (CT).

2.22 It is submitted that for compliance with the MoEFCC Notification, GVK is mandated to install/retrofit various Emission Control Systems i.e., FGD System and Combustion Modification Systems etc in the Project. Statutory compliance of these Revised Emission Norms stipulated therein will require GVK to carry out major capital works, thereby incurring substantial additional capital expenditure and recurring operational expenditure. Hence MoEFCC Notification qualifies as an event of Change in Law under Article 13 of the PPA as it fulfils the following conditions: -

(a) Existing statutory Rules being the 1986 Rules have been amended by way of the MoEFCC Notification.

(b) MoEFCC Notification dated 07.12.2015 has been issued by Ministry of

Environment Forest and Climate Change in exercise of power conferred by Sections 6 and 25 of the Environment (Protection) Act 1986, which comes within the ambit of 'Law' under the PPA.

(c) This Notification was issued by Ministry of Environment Forest and Climate Change, which is an Indian Governmental Instrumentality. Accordingly, the said Notification has the force of law.

(d) MoEFCC Notification is an enactment of a Law under Article 13.1.1(i) of the PPA.

(e) Compliance of the MoEFCC Notification will have substantial impact on the Capital and Operational Costs of the Project resulting in increase in cost for GVK during the operating period; and

(f) The Revised Emission Norms by way of the MoEFCC Notification have also brought about a change in consents and approvals required for obtaining Environmental Clearance for TPPs thereby qualifying as a Change in Law event as per Article 13.1.1(iii) of the PPA.

(g) Since the aggregate amount claimed for Changes in Law is approximately Rs. 540 Crore, it is more than the threshold amount prescribed under Article 13.2(b) of the PPA.

2.23 The MoEFCC Notification has substantially altered the premise on which GVK had established the Project. It is submitted that issuance of MoEFCC Notification could not have been taken into account by GVK while conceptualizing the Project since:

(a) The revised SO_2 and NOx norms as notified made the installation of FGD system for SO_2 control and installation of primary NOx control measures like Over Fire Air system (OFA) a necessary requirement for the Project for the first time.

(b) While mandating the FGD installation and installation of low NOx burners, providing Over Fire Air (OFA) etc., the CPCB letter dated 14.12.2017 specifically notes that the MOEF&CC Notification ***prescribed new emission***

limits for SO_2 and NOx.

2.24 It is therefore submitted that the aforesaid change in legal position during "Operation Period", which shall have an adverse financial impact on the Project of GVK (approximately to the extent of Rs. 45 Lakhs/MW on CAPEX), qualifies as a 'Change in Law'.

Re: In-Principal approval of FGD Cost is necessary for securing funding from the lenders

2.25 It is submitted that as per CEA Report, the indicative Base Cost for installation of FGD systems for GVK's Plant is estimated to be Rs. 45 lakhs/MW as CAPEX.. Such substantial expenditure for GVK's 540 MW (2 x 270 MW) Plant cannot be arranged internally and requires additional funding from lenders/banks. Thus, given the implications of implementing these changes to meet the Revised Emission Norms prescribed by MoEFCC, it is important that there is a certainty of regulatory treatment and recovery of these costs and charges. Therefore, in-principle regulatory approval of the cost is critical for arranging funds for implementation of Emission Control Systems.

2.26 In the present circumstances, lenders/banks are reluctant to provide funding to generating companies for compliance of MoEFCC Notification without a Change in Law declaration of the said Notification and in-principal approval of the associated cost from the concerned Regulatory Commission.

2.27 The requirement of in-principal approval of the FGD cost has been discussed and affirmed by: -

(a) Hon'ble Tribunal Judgment dated 28.08.2020 passed in Appeal No. 21 of 2019 titled ***Talwandi Sabo Power Ltd. v. Punjab State Electricity Regulatory Commission & Anr***, holding that additional funds including debt funds required for installation of FGD system will not be sanctioned by lenders (as amount involved is significantly high) in the absence of regulatory certainty qua the methodology/mechanism of arriving at compensation to mitigate the impact such Change in Law event i.e., MoEFCC Notification.

(b) Ld. CERC Order dated 23.04.2020 passed in Petition No. 446/MP/2019 titled ***Sasan Power Limited vs MP Power Management Company Limited & Ors***: -

"18. We have considered the submissions of the Petitioner and the Respondents. There has been material change in the situation as regards the Petitioner after the Commission issued orders in Petition No. 133/MP/2016 wherein request for in-principle approval was denied since no such provision existed in the PPA. As per directions of the Commission, the Petitioner approached CEA that has indicated the appropriate technology for installation of FGD system in the Project. CEA has also indicated tentative base cost for such installation. Through competitive bidding process, the Petitioner has selected a vendor for installation of FGD system. ***The Petitioner has approached financial institutions for loans where the banks through IBA have expressed difficulty in funding in view of prevailing situation in the power sector. Similar is the case with PFC that has informed the Petitioner that it needs comfort in terms of approval of the Commission so that there are no problems in debt servicing of loans that may be availed by the Petitioner. Commission is also conscious of the fact that the installation of FGD system in thermal power stations is being monitored by the Hon'ble Supreme Court. Any further delay in securing loan from financial institutions is likely to further delay installation of FGD system.***

*39…..**Therefore, it would be appropriate to adopt a uniform compensation mechanism in respect of all such generating stations.***

40. We have approved provisional capital cost and other costs related to installation of FGD system that is likely to provide enough comfort to financial institutions. However, we recognise that certainty of stream of cash flow in form of tariff is likely to give further comfort to these financial institutions and that it is also equally important for the procurers as well as sellers to know the tariff implications on account of installation of FGD system."

(c) MoP's Office Memorandum dated 20.04.2020: -

"4. Independent Power Producers (IPPs) informed that CERC normally takes 6-12 months for issuing any Change in Law related Orders for FGD commissioning and sometimes when multiple States are involved, States also resort to unwarranted delay in any reply to CERC, to avoid paying any increased amount at an early date. So Cash flows become a major issue during this time, as any further equity infusion is spent only on past debt servicing. ***Secretary, CERC assured that they would ensure any such petition on FGD installation be settled in around 3 months or so,*** *and even in some cases of deliberate delays by States, ex-parte decisions might be taken.* ***Secretary (Power) suggested CERC to devise a proper process vide which applications of Gencos for installation of FGD as per norms of CEA, may be decided by the Appropriate Commission within a period of three months for Investment approval. The investment approval to power plants for installation of FGD based on the CEA's benchmark cost and indicative technologies, would facilitate the cash flow to the power projects immediately after completion of FGD installations without any delay to recover the cost incurred on the FGD equipment. This will encourage banks to fund the FGD installation in the coal-based power plants. Similar process may also be taken up with SERCs. This be may be conveyed in a fortnight to MoP."***

A copy of MoP OM dated 20.04.2020 is annexed herewith and marked as **Annexure P-9.**

(d) Indian Banking Association (**IBA**) letter dated 08.08.2018 to Association of Power Producers (**APP**) highlighting their inability to fund Power sector for installation of FGD/emission control equipment's. A copy of IBA Letter dated 08.08.2018 is annexed herewith and marked as **Annexure P-10**.

2.28 Therefore, without 'regulatory certainty' on the treatment of MoEFCC Notification and associated cost, it is impossible for GVK to install FGD system to meet the mandatory revised emission norms. It is submitted that non-compliance of MoEFFCC Notification will result in violation of:-

(a) Environment Protection Act, 1986 and Environment Protection Rules, 1986 and the consequences of such non-compliance are to be faced under Section

14 read with Section 26 & 27 of the National Green Tribunal Act, 2010.

(b) Terms and conditions prescribed under the Environmental Clearance issued to the Project, which will entail revocation and closure of Plant operation.

(c) CPCB direction dated 14.12.2017, which will entail levy penalty by way of Environment Compensation and penal action against the Directors of GVK under the Environment Protection Act, 1986.

2.29 Accordingly, prior in-principle approval of the resultant expenditure on account of installation of Wet Lime FGD System and primary NOx reduction measures is required in order to: -

(a) Obtain / deploy additional funds including debt funds, which will not be sanctioned by lenders in the absence of regulatory certainty with regard to the methodology / mechanism of arriving at compensation to be provided to GVK to mitigate the impact of Change in Law event;

(b) Ensure that the entire process of compliance is carried out in a transparent manner under the orders of this Hon'ble Commission and with the cooperation of PSPCL.

(c) Prevent multiplicity of proceedings which may crop up on account of disputes in relation to change in law claims; and

(d) Ensure that project economics and time value of money is secured, which will also be beneficial to the Procurers who can avoid incurring interest / carrying cost.

2.30 In view thereof, GVK is seeking approval of the costs to be incurred in implementation of the Revised Norms as well as the revised tariff such that it may be able to secure the required funding from the lenders.

2.31 In the present case, GVK has been under severe financial stress on account of the cancellation of its captive coal block in terms of the Hon'ble Supreme Court of India's judgement in ***Manohar Lal Sharma vs UoI*** (2014) 9 SCC 516 and subsequent cancellation Order dated 24.09.2014 (2014) 9 SCC 614. The financial stress faced by GVK has been noted by this Hon'ble Commission in its provisional

tariff order dated 28.03.2018 in Petition No. 54 of 2017. It is submitted that GVK has been declared a non-performing asset since August 2017 and is currently under going a resolution process with its lenders in terms of the RBI Circular dated 07.06.2019. In these circumstances, the lenders are reluctant to provide credit facilities towards the additional capital required for the installation of the FGD Systems. Therefore, it is prayed that this Hon'ble Commission may approve the Capital Investment Plan of Rs.540 Cr. on account of installation of FGD System and grant in-principle approval for the increase in cost/or revenue expenditure on account of implementation of revised emission norms. This is necessary as it will aid GVK in securing the required funds from the lenders for complying with the mandate of MoEFCC Notification.

2.32 The costs/expenditure stated in the present Petition are only estimated based on preliminary studies carried out. GVK has to mandatorily comply with the MoEFCC Notification dated 07.12.2015. However, the actual adjustment of tariff will be based on actual spent subject to prudence check by this Hon'ble Commission, after the installation of the FGD Systems.

Re: Details pertaining to Competitive Bidding Process for FGD installation

2.33 On 18.06.2018, GVK published Notice in Financial Express (Chandigarh edition) and Economic Times (Delhi edition) inviting Expression of Interest for Design, Supply, Installation, Testing, Erection and Commissioning of FGD system through International Competitive Bidding (ICB) process. Pursuant to the tender issued by GVK, total seven companies expressed interest. Out of which M/s GE Power and Hamon Research-Cottrell India Private Limited submitted technical bids on 16.07.2018. However, Financial bid was only submitted by M/s GE Power**.** A copy of the tender issued by GVK along with the Notices published in Financial Express and Economic Times is annexed herewith and marked as **Annexure P - 11 Colly**.

2.34 On 19.07.2018, GVK informed PSPCL that it has floated International Competitive Bidding tender inviting bids for installation of FGD system at its Project. A copy of letter dated 19.07.2018 is annexed herewith and marked as **Annexure P – 12**.

2.35 Funding of Capital Investment

The petitioner submits that the proposed capital investment during the control period shall be funded at a normative debt equity ratio of 70:30.

3. Business Plan

3.1 As per regulation 9.2 and 9.3 of the PSERC Tariff Regulations 2019: -

"9.2 The Distribution Licensee carrying out the Generation Business shall file separate Business Plans for its Generation and Distribution businesses.

9.3 The Business Plan for Generation Business shall contain among other things the following:

(a) Capacity addition / reduction;

(b) Availability forecasts;

(c) Future performance targets;

(d) Proposed efficiency improvement measures;

(e) R&M of existing generation units/projects and any other new measures to be initiated for the

Generation Business, e.g.; automation, IT initiatives etc.;

(f) Capital Investment Plan based on the above;

(g) Man Power Plan"

The petitioner submits the Business Plan for the Control Period Form FY 2020-21 to FY 2022-23 is as follows: -

3.2 Capacity Addition/ Reduction

The Petitioner wants to submit that no capacity addition or deletion has been envisaged during the Control Period.

3.3 Availability Forecast

90% availability factor has been estimated for the Control Period.

3.4 Future Performance targets

Regulation 35 of the PSERC Tariff Regulations 2019 specifies that the norms regarding the Availability, Station Heat Rate **(SHR)**, Auxiliary Energy Consumption shall be as per the CERC norms or as per the norms of the Hon'ble Commission. Since, the Hon'ble Commission has not laid down

specific operational norms qua FGD installation, the Petitioner has considered the norms regarding SHR, Auxiliary Energy consumption, secondary oil consumption as per the **Regulation 49 of CERC (Terms and Conditions of Tariff) Regulations 2019.**

Table 2 Plant Operational Norms

Parameter	Unit	FY 2020-21	FY 2021-22	FY 2022-23
Station Heat Rate	Kcal/kWh	2332	2332	2332
Auxiliary Consumption	%	9%	9%	9%
Specific Consumption of Secondary Fuel	ml/kWh	0.5	0.5	0.5

3.5 Generation forecast and performance targets

The Petitioner has assumed a PLF of 55% for the next Control Period. Thus, the Petitioner estimates the following generation target for the Control Perion FY 2020-21 to FY 2022-23:

Table 3 Projections of Generation

S. No.	Particulars	Unit	FY 2020-21	FY 2021-22	FY 2022-23
1	Plant Load Factor	%	55.00%	55.00%	55.00%
2	Gross Generation	MU	2602	2602	2602
3	Auxiliary Consumption	%	9.00%	9.00%	9.00%
4	Net Generation	MU	2368	2368	2368

3.6 Efficiency Improvement Measures

The Petitioner proposes to install Flue Gas Desulphurisation **(FGD)** system during the Control Period for reducing the emissions from the plant. FGD is

required to be installed to comply with the revised emission norms as defined in MOEFCC notification dated 17.05.2015. This expenditure is envisaged by the petitioner in the last year of the control period i.e. FY 2022-23

3.7 R&M of Existing generation units and other new measures

No major R&M of existing generation units is envisaged during the control period.

3.8 Capital Investment Plan

As the Petitioner propose the installation of FGD during the control period. The capital investment estimated for the FGD has been estimated as Rs.540 Cr.

Table 4 Proposed Additional Capital expenditure for Control Period (Rs Crore)

S. No.	Particulars	FY 2020-21	FY 2021-22	FY 2022-23
1	Plant and equipment	0	0	540
	Total	**0**	**0**	**540**

3.9 Manpower Plan

The Petitioner has not envisaged any manpower addition during the control period and hence the current manpower has been considered for the entire control period

4. PRAYERS

4.1 The Petitioner therefore respectively prays that the Hon'ble Commission may be pleased to:-

a) Condone the delay in filing the present petition

b) Admit the petition and grant approval for the Business Plan and Capital Investment Plan for the Control Period from FY 2020-21 to FY 2022-23 as detailed out by the petitioner.

c) Grant in-principle approval of the additional expenditure to be incurred by the Petitioner in installing and operating FGD System in compliance of statutory mandate i.e., MoEFCC Notification dated 07.12.2015.

d) Pass any other order as the Hon'ble Commission may deem fit and appropriate.

GVK Power (Goindwal Sahib) Limited

Petitioner

Through

J. Sagar Associates
Advocates for the Petitioner
B-303, 3rd Floor, Ansal Plaza,
Hudco Place, August Kranti Marg,
New Delhi – 110049

Place:
Date:

BEFORE THE PUNJAB STATE ELECTRICITY REGULATORY COMMISSION AT CHANDIGARH

PETITION NO. OF 2020

IN THE MATTER OF:

Application for approval of Capital Investment Plan and Business Plan for 2X270 MW Goindwal Sahib Thermal Power Plant at Goindwal Sahib, Punjab for the control period FY 2020-21 to 2022-23 Under Regulation 9 of "Punjab State Electricity Regulatory Commission (Terms and Conditions for Determination of Generation, Transmission, Wheeling and Retail Supply Tariff) Regulations, 2019

IN THE MATTER OF:

GVK Power (Goindwal Sahib) Limited
Paigarh House,
156 – 159, Sardar Patel Road,
Secunderabad – 540 003 ...Petitioner

Versus

Punjab State Power Corporation Limited
The Mall, Patiala (Punjab)

AFFIDAVIT

I, P. Rama Mohana Rao, son of P. Krishna Murthy, aged about 61 years, resident of E-308, First Lane, Czech Colony, Sanath Nagar, Hyderabad - 500018, working as Assistant Vice President (Finance) with the Petitioner Company, do solemnly affirm and state as follows:-

1. I say that I am duly authorized and competent to affirm this Affidavit for and on behalf of the GVK Power (Goindwal Sahib) Ltd. and I am acquainted with the facts and circumstances of the present case. I state that I have read and understood the contents of the accompanying Petition.

2. I state that the facts stated in the accompanying Petition are true and correct to the best of my knowledge based on the records maintained by the Petitioner and that the legal submissions made therein are based upon information received by me and believed to be true. The present Petition has been drafted pursuant to my instructions and its contents are true and correct.

3. I state that the Annexures, if any, annexed to the Petitioner are true copies of the respective originals.

MOHD HAMEED KHAN, BA B.Ed LL.B NOTARY Regn.No. 4339/07 Appointed by Govt. of India

For GVK POWER (GOINDWAL SAHIB) LTD

Authorised Signatory

4. I say that no similar petition, writ petition, suit or appeal regarding the matter in respect of which the present Petition has been preferred or is pending before any Court or any other authority.

For GVK POWER (GOINDWAL SAHIB) LTD.

DEPONENT
Authorised Signatory

VERIFICATION

I, the deponent above named, do hereby verify that the contents of my above affidavit are true and correct, no part of it is false and nothing material has been concealed therefrom.

Verified at on this day of , 2020.

For GVK POWER (GOINDWAL SAHIB) LTD.

DEPONENT
Authorised Signatory

MOHD HAMEED KHAN, B.A.B.Ed.LL.B
NOTARY
Regn.No. 4339/07
NOTARIAL
Appointed by Govt. of India

ATTESTED
8/9/2020
Mohd Hameed Khan
B.A.B.Ed., LL.B
ADVOCATE & NOTARY
H.No. 1-8-495/19/C,
Vikar Nagar, Near Prakash Nagar,
Begumpet, Secunderabad, Hyd.
Cell: 9391025702

रजिस्ट्री सं० डी० एल०-33004/99 REGD. NO. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY
भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)
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सं. 2620] नई दिल्ली, मंगलवार, दिसम्बर 8, 2015/अग्रहायण 17, 1937
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पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 7 दिसम्बर, 2015

का.आ. 3305(अ).— केंद्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :—

1.(1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) संशोधन नियम, 2015 है।

(2) ये उनके राजपत्र में प्रकाशन की तारीख को प्रवृत्त होंगे।

2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची 1 में,—

(क) क्रम सं. 5 और उससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित क्रम सं. और प्रविष्टियां अंत:स्थापित की जाएंगी, अर्थात् :—

क्रम सं.	उद्योग	मापदंड	मानक
1	2	3	4
5क	**ताप विद्युत संयंत्र (जल उपभोग सीमा)**	**जल उपभोग**	I. एक बार शीतलन (ओटीसी) के माध्यम से सभी संयंत्र शीतलन टावरों (सीटी) को प्रतिष्ठापित करेंगे और अधिसूचना की तारीख से दो वर्ष की अवधि के भीतर अधिकतम 3.5m^3/MWh के विनिर्दिष्ट जल उपभोग को हासिल करेंगे।

			II. सभी विद्यमान सीटी-आधारित संयंत्र 3.5m^3/MWh इस अधिसूचना के प्रकाशन की तारीख से दो वर्ष के भीतर अधिकतम 3.5m^3/MWh तक के विनिर्दिष्ट जल उपभोग को कम करेंगे। III. जनवरी, 2017 के पश्चात् प्रतिष्ठापित किए जाने वाले नए संयंत्र अधिकतम 2.5 m^3/MWh तक के विनिदिष्ट जल उपभोग को पूरा करेंगे और शून्य जल दुर्व्यय को हासिल करेंगे।

(ख) क्रम सं. 25 और उससे संबंधित प्रविष्टियों के पश्चात् निम्नलिखित क्रम सं. और प्रविष्टियां रखी जाएंगी, अर्थात् :—

क्रम सं.	उद्योग	मापदंड	मानक
1	2	3	4
		विवक्त पदार्थ	100 mg/Nm^3
		सल्फर डायोक्साइड(SO_2)	600 mg/Nm^3 (500 मेगावाट से कम क्षमता की इकाईयों से लघु इकाईयां) 200 mg/Nm^3 (500 मेगावाट और उससे अधिक क्षमता की इकाईयां)
		नाइट्रोजन के आक्साइड (NOx)	300 mg/Nm^3
		पारा (Hg)	0.03 mg/Nm^3 (500 मेगावाट और उससे अधिक क्षमता की इकाईयां)
		1 जनवरी, 2003 के पश्चात् 31 दिसंबर, 2016* तक प्रतिष्ठापित टीपीपी (इकाईयां)	
		विवक्त पदार्थ	50 mg/Nm^3
		सल्फर डायोक्साइड (SO_2)	600 mg/Nm^3 (500 मेगावाट से कम क्षमता की इकाईयों से लघु इकाईयां) 200 mg/Nm^3 (500 मेगावाट और उससे अधिक क्षमता की इकाईयां)
		नाइट्रोजन के आक्साइड (NOx)	300 mg/Nm^3
		पारा (Hg)	0.03 mg/Nm^3
		1 जनवरी, 2017** से प्रतिष्ठापित टीपीपी (इकाईयां)	
		विवक्त पदार्थ	30 mg/Nm^3
		सल्फर डायोक्साइड (SO_2)	100 mg/Nm^3
		नाइट्रोजन के आक्साइड	100 mg/Nm^3

		(NOx)	
		पारा (Hg)	0.03 mg/Nm^3

* टीपीपी (इकाईयां) इस अधिसूचना के प्रकाशन की तारीख से दो वर्ष के भीतर परिसीमाओं को पूरा करेंगी ।

** इसके अंतर्गत सभी टीपीपी (इकाईयां) हैं, जिन्हें पर्यावरणीय निकासी प्रदान की गई है और संनिर्माण के अधीन है ।

[फा. सं. क्यू-15017/40/2007-सीपीडब्ल्यू]

डा. राशिद हसन, सलाहकार

टिप्पण :- मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उपखंड (ii) में सं. का.आ. 844(अ) 19 नवंबर, 1986 द्वारा प्रकाशित किए गए थे और उनका पश्चातवर्ती का.आ. 433(अ) तारीख 18 अप्रैल, 1987 ; सा.का.नि 176(अ) तारीख 2 अप्रैल, 1996; सा.का.नि. 97 (अ), तारीख 18 फ़रवरी, 2009 ; सा.का.नि 149(अ) तारीख 4 मार्च, 2009 ; सा.का.नि. 543(अ) तारीख 22 जुलाई, 2009 ; सा.का.नि. 739(अ) तारीख 9 सितम्बर, 2010 ; सा.का.नि. 809(अ) तारीख 4 अक्टूबर, 2010, सा.का.नि. 215(अ) तारीख 15 मार्च, 2011 ; सा.का.नि. 221(अ) तारीख 18 मार्च, 2011 ; सा.का.नि. 354(अ) तारीख 2 मई, 2011 ; सा.का.नि. 424(अ) तारीख 1 जून, 2011 ; सा.का.नि. 446(अ) तारीख 13 जून, 2011 ; सा.का.नि. 152(अ) तारीख 16 मार्च, 2012 ; सा.का.नि. 266(अ) तारीख 30 मार्च, 2012 ; सा.का.नि. 277(अ) तारीख 31 मार्च, 2012; सा.का.नि. 820(अ) तारीख 9 नवम्बर, 2012 ; सा.का.नि. 176(अ) तारीख 18 मार्च, 2013 ; सा.का.नि. 535(अ) तारीख 7 अगस्त, 2013 ; सा.का.नि. 771(अ) तारीख 11 दिसम्बर, 2013 ; सा.का.नि. 2(अ) तारीख 2 जनवरी, 2014 ; सा.का.नि. 229(अ) तारीख 28 मार्च, 2014 ; सा.का.नि. 232(अ) तारीख 31 मार्च, 2014 ; सा.का.नि. 325(अ) तारीख 7 मई, 2014, सा.का.नि. 612(अ) तारीख 25 अगस्त, 2014 और अन्तिम संशोधन सा.का.नि. 789(अ) तारीख 11 नवम्बर, 2014 किया गया था ।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 7th December, 2015

S.O. 3305(E).— In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:–

1. (1) These rules may be called the Environment (Protection) Amendment Rules, 2015.

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

2. In the Environment (Protection) Rules, 1986, in Schedule – I, -

(a) after serial number 5 and entries relating thereto, the following serial number and entries shall be inserted, namely:–

Sr. No.	Industry	Parameter	Standards
1	2	3	4
"5A.	**Thermal Power Plant (Water consumption limit)**	**Water consumption**	I. All plants with Once Through Cooling (OTC) shall install Cooling Tower (CT) and achieve specific water consumption upto maximum of 3.5m^3/MWh within a period

			of two years from the date of publication of this notification. **II.** All existing CT-based plants reduce specific water consumption upto maximum of 3.5m^3/MWh within a period of two years from the date of publication of this notification. **III.** New plants to be installed after 1st January, 2017 shall have to meet specific water consumption upto maximum of 2.5 m^3/MWh and achieve zero waste water discharged";

(b) for serial number 25, and the entries related thereto, the following serial number and entries shall be substituted, namely:-

Sr. No.	Industry	Parameter	Standards
1	**2**	**3**	**4**
"25.	**Thermal Power Plant**	**TPPs (units) installed before 31st December, 2003***	
		Particulate Matter	100 mg/Nm^3
		Sulphur Dioxide (SO_2)	600 mg/Nm^3 (Units Smaller than 500MW capacity units) 200 mg/Nm^3 (for units having capacity of 500MW and above)
		Oxides of Nitrogen (NOx)	600 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3(for units having capacity of 500MW and above)
		TPPs (units) installed after 1st January,2003, upto 31st December, 2016*	
		Particulate Matter	50 mg/Nm^3
		Sulphur Dioxide (SO_2)	600 mg/Nm^3 (Units Smaller than 500MW capacity units) 200 mg/Nm^3 (for units having capacity of 500MW and above)
		Oxides of Nitrogen (NOx)	300 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3
		TPPs (units) to be installed from 1st January, 2017**	
		Particulate Matter	30 mg/Nm^3
		Sulphur Dioxide (SO_2)	100 mg/Nm^3
		Oxides of Nitrogen (NOx)	100 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3

*TPPs (units) shall meet the limits within two years from date of publication of this notification.

**Includes all the TPPs (units) which have been accorded environmental clearance and are under construction".

[F. No. Q-15017/40/2007-CPW]

Dr. RASHID HASAN, Advisor

Note: - The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number S.O. 844(E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications:—

S.O. 433(E), dated 18th April 1987; G.S.R. 176(E) dated 2nd April, 1996; G.S.R. 97(E), dated the 18th February, 2009; G.S.R. 149(E), dated the 4th March , 2009; G.S.R. 543(E), dated 22nd July, 2009; G.S.R. 739(E), dated the 9th September, 2010; G.S.R. 809(E), dated, the 4th October, 2010, G.S.R. 215(E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354(E), dated the 2nd May, 2011; G.S.R. 424(E), dated the 1st June, 2011; G.S.R. 446(E), dated the 13th June, 2011; G.S.R. 152(E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277(E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176(E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229(E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 07th May, 2014, G.S.R. 612,(E), dated the 25th August, 2014 and lastly amended vide notification G.S.R. 789(E), dated 11th November, 2014.

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केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

SPEED POST

B-33014/07/2017-18/IPC-II/TPP/ 15925 December 14, 2017

To

M/s Gonidval Sahib Thermal Power Plant,
GVK Power, Goindwal Sahib
Dist. **Taran Taran 143 422**,
Punjab

Sub: Directions under Section 5 of the Environment (Protection) Act, 1986 regarding compliance of emission limit notified vide notification No.S.O.3305 (E) dated 07.12.2015 – reg.

WHEREAS, taking into consideration pollution from thermal power plants, Ministry of Environment, Forest & Climate Change had issued notification in the year 1984 laying out standards for thermal power plants. Further, the stack height regulation was notified in the year 1989 and effluent standard for thermal power plants was notified in the year 1986. The revised temperature limit of discharge of cooling water from the plants was notified in the year 1999 and thereafter use of beneficiated coal in the plants was issued in June 2002. The fly ash utilization notification was also issued 0n 14th September, 1999 and amended in the year 2003 and 2009. Thereafter, MoEF&CC vide Notification No.S.O.3305 (E) dated 07.12.2015 has amended emission limit for particulate matter and notified new limits for Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) and mercury emission, and water consumption limit for coal/lignite based thermal power plants. As per the notification dated 07.12.2015, thermal power plants are required to achieve the notified limit within two years from the date of the notification i.e. by 07.12.2017;

WHEREAS, with the implementation of the amendment dated 07.12.2015, it is expected that there would be reduction in emission of PM, Sulphur dioxide and oxide of Nitrogen, which in turn will help in improvement in Ambient Air Quality in and around thermal power plants, besides reduction of mercury emission and water use in the thermal power plants will reduce;

WHEREAS, in the meeting on Coal Washeries (Environment & Forest Clearances) and Emission Norms for Thermal Power Plants chaired by the Hon'ble Minister of Environment, Forest & Climate Change and Minister of Power, Coal & Renewable Energy on June 08, 2016, it was decided that a committee comprising representatives from MoEF& CC, Ministry of Power (MoP),Central electricity Authority(CEA), Ministry of Coal (MoC), Power Grid Corporation of India Limited (PGCI) and Central Pollution Control Board (CPCB) may be constituted to look into the all issues related to implementation of norms;

WHEREAS, following decisions were taken in the meeting:

1. MoP/CEA shall submit action plan by December 2016 for phasing out of the power plants commissioned before December, 2003.
2. MoP / CEA shall submit action plan by December, 2016 in respect of power plants commissioned during January, 2004 to December, 2016 indicating unitwise retrofit / renovation for each power plant. The implementation of action plan shall be taken up in backword manner starting from the plants commissioned in the 2015 and the shall be completed by 15.08.2022
3. MoP and CEA shall coordinate with each State Public Sector Undertakings separately for submission of action plan by December, 2016 for all the power plants.

WHEREAS, it was further decided that MoP shall take action for installation of Flue gas Desulphurisation (FGD) if needed to achieve prescribed SO_2 norms based on the SO_2 emission levels from power plants;

WHEREAS, it was also pointed out that NOx control technology in case of Indian coal is not established. Selective Catalytic Reduction (SCR) technology is used for NOx control, however, its feasibility for Indian coal needs to be established.MoP suggested that Pilot studies may be taken up in two plants and based on the results, further action plan to be drawn regarding retrofitting of SCR in plants to achieve prescribed NOx norms;

WHEREAS, the MoP constituted a committee under the Chairmanship of Chairman, Central Electricity Authority (CEA) on 21.09.2016 to prepare an action plan for implementation of new emission limits;

WHEREAS, to ensure compliance of the new emission norms the MOEF&CC convened a meeting on 23.05.2017 in which CEA, NTPC and the Central Pollution Control Board participated;

WHEREAS, the MOEF&CC received a letter from Secretary Ministry of Power *vide* their D.O. letter No. FU-1/2016-IPC dated 30th June, 2017 indicating the concerns of various thermal power plants in the country with regard to the compliance with the new emission norms for the thermal power plants notified on 7.12.2015 particularly w.r.t. Particulate Matter (PM), Sulphur dioxide (SO_2) & Oxides of Nitrogen (NO_x);

WHEREAS, it was noted that out of present 196667 MW installed capacity, about 60 % capacity (1,15,214 MW) meets the new PM norms with existing ESP installations. Remaining capacity of 64,334 MW which does not meet the new environmental norms regarding PM, requiring retrofitting additional fields in Electrostatic Precipitator (ESP)/replacement of ESP in existing plants to meet the new emission norms of PM;

WHEREAS, Ministry of Power after consultation with Central electricity Authority informed that retrofitting additional fields in

ESP/replacement of ESP in existing plants will need complete shutdown of 4-6 months for each unit;

WHEREAS, in order to meet SO_2 emission norms, FGD system shall be required to be installed in all plants. MoP informed that about 30-36 months required for design & engineering, approvals, funds arrangements, tendering, erection and commissioning of FGD. Besides, planned shutdown will be required as all plants cannot be shut down simultaneously. Another challenge highlighted for installation of FGD was availability of technologies/suppliers. In addition, issues relating to availability of good quality lime stone for operation of FGD and disposal of Gypsum to run the FGD in existing plants were also taken note of;

WHEREAS, the standard of 300 & 100 mg/NM^3 would require installation of Selective Non Catalytic Reduction (SNCR) or Selective Non Catalytic Reduction (SCR). While these technologies are established globally, these are not established for Indian Coal, which has high ash content. Therefore, it was decided to engage various technology vendors to run pilots at NTPC stations to validate technology of SNCR/SCR system for Indian coal;

WHEREAS, the Ministry of Power in the letter dated 30.06.2017 enclosed the report outlining the plan of action for implementation of the new norms keeping in mind the techno-economic feasibility and ensuring availability of power to all at affordable cost without any disruption;

WHEREAS, as per the phasing plan proposed by MOP after consultation with CEA and Regional Power Committees, out of the installed capacity of 1, 87,162 MW (as on December, 2016), 8217 MW have been identified for retirement/already retired. Further, 12,974 MW of capacity already have either CFBC boilers or FGDs.

WHEREAS, a phasing plan was proposed for the balance 165971 MW of coal based thermal capacity for achieving compliance with 145977 MW capacity proposing installation of FGDs within a period of 7 years to be undertaken in a phased manner. About 3205 MW of coal based capacity was stated to be compliant with revised norms of SO_2 emission;

WHEREAS, it was further noted that approximately about 16789 MW would not be able to install FGDs due to various constraints which include lack of space, etc.;

WHEREAS, CEA has worked out the requirement of capacity of coal based thermal power plants including hydro, wind, solar, gas based units to meet the estimated peak demand of 225 GW in 2021-22;

WHEREAS, MoP suggested that the compliance period of PM for the plants installing FGD may be kept same as per the FGD phasing plan;

WHEREAS, it was requested that for implementation of NOx normsin the plants installed before 31.12.2003 a period of three years may be permitted

to achieve specified standards of 600 mg/Nm^3. For other plants a relaxation of 600 mg/Nm^3 in place of 300 and 100 mg/Nm^3 for a period of 3 yearswas also requested;

WHEREAS, taking into account the issues/concerns raised by the MoP and the sensitivity involved in the matter as it relates to general public of the country, the Ministry undertook detailed analysis of each of the issues in the meetings held on 06.07.2017, 27.07.2017, 11.08.2017 and 01.09.2017. These meetings were also attended by the various stakeholders including Ministry of Power, CEA, NTPC etc.;

WHEREAS, MOEF & CC in the meeting with MoP, CEA, NTPC & CPCB etc. held on September 1, 2017decided that the action plan submitted by MoP for 7 years i.e. up to 2024 was too long and it should instead commence from 2018 and implemented by 2022 with respect to all pollutants. It was further suggested that action plan should be revised prioritising the plants located in critically polluted area /close to habitation /urban area. Based on the decisions taken in the meeting Ministry of Power vide letter No. FU-1/2017-IPC dated 13.10.2017 submitted the revised action plan, to implement/phasing FGD installation/ ESP upgradation to meet new emission norms for thermal power plants;

WHEREAS, as per the revised plan submitted by the MoP vide letter dated 13.102.17, 650 units comprising 196667 MW need to meet the new emission limits. Out of 650 units, FGD will be installed to achieve the emission limit of $SO_2$by the year 2022 in all 415 units comprising 161522 MW (01 unit by 2018, 08 units by 2019, and 55 units by 2020, 172 units by 2021 and 178 units by 2022, for 01 units with 150 MW capacity plan is not received). Remaining 235 units comprised of 35145MW either complying with SO2 emission limits or planned for phasing out;

WHEREAS, ESP upgradation to achieve emission limit of particulate matter will be completed by the year 2022 in PM for 231 units comprising of 65925 MW capacity out of 650 units (01 unit by 2018, 02 units by 2019, 28 units by 2020, 97 units by 2021 and 94 units by 2022, for 09 units of 1400 MW capacity plan by 2022);

WHEREAS, with regard to compliance of emission limit of NOx, it is suggested that pre combustion modification such as in situ modification in boiler, installation of Low NOx burners and Over Fire Air shall be adopted besides installation of SCR/SNCR systems wherever needed by the year 2022;

WHEREAS, electricity is cleanest form of energy which helps in mitigating house hold air pollution which is matter of concern;

WHEREAS, there is need to provide electricity supply to people who do not yet have access to it;

WHEREAS, taking into consideration the technical challenges and time requirements for installation of FGD and other technologies to meet the new

emission limits, the MoEF&CC vide its letter F. No. Q-15017/40/2007-CPWdated 07.12.2017 has directed CPCB to direct all the thermal power plants to ensure compliance with the norms laid down in the 07.12.2015 notification in accordance with the revised Plan submitted by the Ministry of Power letter dated 13.10.2017as well as NOx by 2022;

WHEREAS, the Ministry of Environment, Forest& Climate Change , Government of India, vide Notifications No. S. O. 157 (E) of 27.02.1996 and S. O. 730 (E) dated 10.07.2002, has delegated the powers vested under Section 5 of the Environment (Protection) Act, 1986 (29 of 1986) to the Chairman, Central Pollution Control Board, to issue directions to any industry or any local body or any other authority for violations of the standards and rules notified under the Environment (Protection) Rules, 1986 and amendment thereof.

NOW, THEREFORE, taking into consideration all material facts including environmental concerns and ensuring stability of power supply and need for phasing the implementation, in exercise of powers vested under Section 5 of the Environment (Protection) Act, 1986, following directions are issued to M/s Gonidval Sahib Thermal Power Plant:

i. That plant shall meet emission limit of PM immediately by installing Electrostatic Precipitator (ESP).

ii. That plant shall install FGD by April 30, 2020 and February 28, 2020 in Unit 1 & 2 respectively so as to comply SO_2 emission limit

iii. That plant shall take immediate measure like installation of low NOx burners, providing Over Fire Air (OFA) etc. and achieve progressive reduction so as to comply NOx emission limit by the year 2022

The time line mentioned above (i to iii) for compliance of PM, SO_2 & NOx emission limits shall be reviewed by CPCB within a period of three months and shall be brought down further considering the location specificity of the plant such as critical polluted area/ closeness to habitation/ urban area.

The time line for compliance of water consumption limit shall also be finalised in consultation of plants

M/s Gonidval Sahib Thermal Power Plant shall ensure compliance of directions mentioned above (i to iii) failing which action will be taken under the appropriate provisions of the Environment (Protection) Act, 1986.

(A.K. Mehta)
Chairman

No. 23/22/2018-R&R
Government of India
Ministry of Power
***

Shram Shakti Bhawan, Rafi Marg,
New Delhi, 30th May, 2018

To

The Chairperson,
Central Electricity Regulatory Commission,
Chanderlok Building,
Janpath, New Delhi-110001

Subject: Mechanism for Implementation of New Environmental Norms for Thermal Power Plants (TPP) supplying power to distribution licensees under concluded long term and medium term Power Purchase Agreement (PPA).

Sir,

Ministry of Environment, Forest and Climate Change (MoEFCC) has notified the Environment (Protection) Amendment Rules, 2015 on 7th December, 2015 thereby introducing revised emission standards for Thermal Power Plants (TPPs). The revised emission standards are applicable to existing as well as upcoming TPPs. To meet the revised emission standards, the TPPs would have to install or upgrade various emission control systems like Flue-Gas desulfurization (FGD) system, Electro-Static Precipitators (ESP) system etc.

2. As per implementation plan prepared by Central Electricity Authority (CEA), the existing TPPs are required to comply with the new emission standards by the year 2022.

3. Implementation of revised emission standards would face challenges relating to stringent timelines, availability of suppliers and technology, shut down for longer periods, and revenue loss during shutdown. It would also have significant implications on the tariff agreed under the long term and medium term power purchase agreement (PPA) due to additional infrastructure and operational cost on account of large scale installations, renovations & retrofitting of existing plant and machinery to meet revised emission norms.

4. In view of the nature of cost involved in implementation of revised standards of emission and the provisions of Power Purchase Agreement, there is a need to develop the appropriate regulatory framework specifying the mechanism or enabling guidelines for providing regulatory certainty to the TPPs about recovery of such additional costs through tariff. It is important to ensure implementation of the revised standards of emission for TPPs for controlling pollution level in the larger public interest.

....2/-

5. After considering all aspects and with due regard to the need for safeguards against environmental hazards, and accordingly to ensure timely implementation of new environment norms, the Central Government has decided that –

5.1 The MoEFCC Notification requiring compliance of Environment (Protection) Amendment Rules, 2015 dated 7th December, 2015 is of the nature of Change in Law event except in following cases:

a) Power Purchase Agreements of such TPPs whose tariff is determined under Section 63 of the Electricity Act, 2003 having bid deadline on or after 7th December, 2015; or

b) TPPs where such requirement of pollutions control system was mandated under the environment clearance of the plant or envisaged otherwise before the notification of amendment rules;

5.2 The additional cost implication due to installation or up-gradation of various emission control systems and its operational cost to meet the new environment norms, after award of bid or signing of PPA as the case may be, shall be considered for being made pass through in tariff by Commission in accordance with the law.

5.3 The respective TPPs may approach the Appropriate Commission for approval of additional capital expenditure and compensation for additional cost on account of this Change in Law event in respect of the Power Purchase Agreement entered under Section 62 or Section 63 of the Electricity Act, 2003.

5.4 For the TPPs that are under the purview of the Central Commission, the Commission shall develop appropriate regulatory mechanism to address the impact on tariff, and certainty in cost recovery on account of additional capital and operational cost, under concluded long term and medium term PPAs for this purpose.

6. The Central Government, in exercise of the power conferred under section 107 of the Electricity Act 2003 issues directions to the Central Electricity Regulatory Commission to implement the above decision of the Government. This direction is being issued to facilitate the smooth implementation of revised emission standards of the Environment (Protection) Amendment Rules, 2015 dated 7th December, 2015 for Thermal Power Plants in the larger public interest.

7. This issues with the approval of Minister of State (IC) for Power and NRE.

Yours faithfully,

30/5/18

(Ghanshyam Prasad)
Chief Engineer
Tel: 2371 0389

Copy to:
i) Secretary (MoEFCC), Government of India
ii) Chief Secretaries of all State Governments and Union Territory Administrations
iii) The Principal Secretary/ Secretary (in charge of energy) of all State Governments and UT Administrations.

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
अल्ट्रा मेगा विद्युत परियोजना विकास प्रभाग
Ultra Mega Power projects Development Division

सं.:44/FGD/ यूएमपीपी/सीईए/ 2018/276 दिनांक: 10-04-2018

सेवा में,
The Chairman, GVK Power and Infrastructure Ltd.,
Paigah House,156-159, SP Road
Secunderabad 500003, Telangana, India

Subject: **Adherence to Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations- Implementation of FGD reg.**

Reference: **i) No. 44/FGD/UMPP/CEA/2017/602-616**
ii) No. 44/FGD/UMPP/CEA/2018 dated 23.01.2018

Sir,

This is in reference to our various communications/meeting on adherence to Notification of Ministry of Environment, Forest and Climate Change (MOEF&CC) on new Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations and also the phasing plan for compliance by all power producers in the country. As you are aware the notification has stipulated the time frame of two years (maximum) for compliance. It is implicit that the power plants have already started taking necessary action in this regard.

It is inferred that CERC and some SERCs in the matter of Private Power Producers have directed to approach CEA for advising the specific technology and associated costs and other related matters in installation of systems as per the new norms. In this regard we had requested all power producers to provide us data with an aim to formulate a baseline reference data.

In light of the above and also in order to suggest Power Producers an appropriate technology and related cost implications, IPPs are requested to approach concern regulators and submit a detailed feasibility report consisting of following.

I. Brief details of the plant
II. Present Emissions and water usage of the plant
III. Comparison of available technologies for reduction of emission levels and selection of technology, reasons thereof.
IV. Proposed scheme and impact on existing plant including study on reagent and by-product, where so necessary.
V. Implementation plan along with schedule
VI. Cost estimates including Capex, Opex etc.
VII. Impact on Tariff
VIII. Layout and flow diagrams of the proposed system

The phasing plan for implementation of FGD system is strict and the power producers across the country is expected to meet the specified timeline. It is requested to submit the detail feasibility report of the concern plants. This would enable IPPs to approach respective regulatory commission for further action.

भवदीय,

(चन्द्र शेखर)
मुख्य अभियंता
Tel. 26195472

सेवा भवन ,आर. के. पुरम ,I-नई दिल्ली110066- टेलीफैक्स: 011-26102119 ईमेल:ceumpp.cea@gov.in वेबसाइट: www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26102119 Email: ceumpp.cea@gov.in .Website: www.cea.nic.in

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

अल्ट्रा मेगा विद्युत परियोजना विकास प्रभाग

Ultra Mega Power projects Development Division

सं.:44/FGD/ यूएमपीपी/सीईए/**2017/** 392

दिनांक: 31-05-2018

सेवा में,

The Chairman, GVK Power and Infrastructure Ltd.,
Paigah House,156-159, SP Road
Secunderabad 500003, Telangana, India

Subject: **Adherence to Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations- installations of FGD systems by the year 2020-reg.**

Sir,

Kindly refer our various communications/meeting on adherence to Notification of Ministry of Environment, Forest and Climate Change (MOEF&CC) on new Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations and also the phasing plan for compliance by all power producers in the country.

The timeline for installations of FGD in your power plant is in the year 2020 and it is mentioned here that the phasing plan for implementation of FGD system is strict and the power producers across the country is expected to meet the specified timeline. It is again specified here that the whole process of installations of FGD Systems would take not less than two years of time.

It is inferred that CERC and some SERCs in the matter of Private Power Producers have directed to approach CEA for advising the specific technology and associated costs and other related matters in installation of systems as per the new norms. In light of this, IPPs are requested to approach concern regulators and submit a detailed feasibility report so that the whole process could be completed in the specified timeline.

भवदीय,

(चन्द्र शेखर)
मुख्य अभियंता
Tel. 26195472

सेवा भवन ,आर. के. पुरम ,I-नई दिल्ली110066- टेलीफैक्स: 011-26102119 ईमेल:ceumpp.cea@gov.in वेबसाइट: www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26102119 Email: ceumpp.cea@gov.in .Website: www.cea.nic.in

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Ultra Mega Power projects Development Division

स.:44/FGD/ यूएमपीपी/सीईए/ 2019/ 176 दिनांक: 06.02.2019

सेवा में,
The Chairman, GVK Power and Infrastructure Ltd.,
Paigah House,156-159, SP Road
Secunderabad 500003, Telangana, India

Subject: Adherence to Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations- Implementation of FGD reg.

Sir,

This is in reference to our various communications/meeting on adherence to Notification of Ministry of Environment, Forest and Climate Change (MOEF&CC) on new Environmental norms as per Environment (Protection) Amendment Rules 2015 for Thermal Power Stations and also the phasing plan for compliance by all power producers in the country. The phasing plan for implementation of FGD system is strict and the power producers across the country is expected to meet the specified timeline. It is again mentioned here that the whole process of installations of FGD Systems would take not less than two years of time.

CERC and some SERCs in the matter of Private Power Producers have directed to approach CEA for advising the specific technology and associated costs and other related matters in installation of systems as per the new norms. In this regard, it is mentioned here that CEA is accepting the feasibility reports submitted by power plants and are not insisting for prior approval of CERC or concerned regulators. Standard formats (Templates) have been designed and circulated to all power plants vide Ref. Letter nos. 44/FGD/UMPP/CEA/2017 & 2018 dated 22.08.2017/ 14.09.2017/ 09.10.2017 & 23.01.2018. The formats are made available in the CEA's website (http://www.cea.nic.in/umpp.html). Also vide our letter Ref. No. 44/FGD/UMPP/CEA dated 10.04.2018, chapter wise outline for preparing feasibility report had been suggested to all IPPs. Though some of the power plants have forwarded their data in the formats mentioned above, most of the others have either forwarded half of the information or data which are not correct; as on analysis lot of anomalies have been found.

In light of the above, power producers are requested again to forward the correct data to CEA in the formats designed for the purpose only (Format 1,2,3 & 4, available in CEA's website) and prepare the feasibility report mainly consisting of the chapters as mentioned below:

I. Brief details of the plant
II. Present Emissions and water usage of the plant
III. Comparison of available technologies for reduction of emission levels and selection of technology, reasons thereof.
IV. Proposed scheme and impact on existing plant including study on reagent and by-product, where so necessary.

V. Implementation plan along with schedule
VI. Cost estimates including Capex, Opex etc.
VII. Impact on Tariff
VIII. Layout and flow diagrams of the proposed system

In order to suggest Power Plants an appropriate technology and related cost implications in FGD installations, studies of the existing plant facilities and the emissions that are generated at the present level are done and also to meet the new emission norms of MOEF & CC the modifications / new equipment to be added/ modified/ retrofitted to the existing system are studied in detail. In this context the following is analyzed:

a. Estimation & analysis of the present plant emission levels based on fuel nature & operating conditions.
b. Comparative study of the various types of emission abatement technologies commercially available in the market and selection of optimal technology solutions considering the space required for retrofit, percentage reduction of emissions, availability, source & cost of reagents, utilization of by-product, auxiliary power consumption, utilities requirement, plant operating conditions, proven nature of technology and life cycle cost analysis etc.
c. Study of space/provision available in the existing plant for installation of the proposed abatement technologies with relevant sub-systems and impact/modification of the existing plant equipment, civil aspects, plant instrumentation & control, electrical power supply system & other plant parameters, due to the retrofit.
d. Study of existing water system and consumption pattern and modification/installation of new equipment to meet the water requirement of the new systems added and to maintain the water requirement as per the revised MOEF & CC norms.
e. Estimation of cost estimates of CAPEX and OPEX with break-ups under major heads for the selected commercially available optimal technologies so as to have minimum loading on the tariff.
f. Project Implementation schedule for above to meet the new norms.
g. A site visit is also carried out, if required.

It is reiterated that the power plants should provide complete & correct information and a detailed feasibility report at earliest so that recommendation on specific technology, associated indicative costs and other related matters could be provided in time. In case of any further query regarding preparation, submission, acceptance and recommendation towards feasibility report, power plants may contact the undersigned if need be.

This is for your information and necessary action please.

भवदीय,

(चन्द्र शेखर)
मुख्य अभियंता
Tel. 26195472

FEASIBILITY REPORT

TO MEET NEW EMISSION REGULATIONS OF MOEF & CC

GVK POWER (GOINDWAL SAHIB) LIMITED

2X 270 MW COAL BASED THERMAL POWER PROJECT

GOINDWAL SAHIB, PUNJAB

MARCH, 2019

PREPARED BY :

Save Urja

M/s Save Urja

GVK

Date of Issue:	**Project Site:**
08/03/2019	GVK POWER (GOINDWAL SAHIB) LIMITED PUNJAB 2 X 270 MW COAL BASED THERMAL POWER PROJECT
Project Title:	
Consultancy services for detailed feasibility study to meet new emission regulations of MOEF & CC for DeNOx & DeSOx measures	
Organisation:	**Client:**
M/s Save Urja	GVK POWER (GOINDWAL SAHIB) LIMITED PUNJAB 2 X 270 MW COAL BASED THERMAL POWER PROJECT

Technical Review:	☒ No Distribution (without permission from the Client or responsible organisational unit) ☐ Limited Distribution ☐ Unrestricted Distribution
Date: 08/03/2019 Name: Vishal Goyal	
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CONTENTS

List of Tables

List of Figures

ACKNOWLEDGMENT

Throughout the conductance of this Technical Review (Feasibility Report), the assistance and cooperation from internal and external staff of GVK Power (GOINDWAL SAHIB) Limited has been invaluable.

We at M/s Save Urja are thankful to the management of GVK Power (GOINDWAL SAHIB) Limited for awarding work for Consultancy services for detailed feasibility study to meet new emission regulations of MOEF & CC for DeNOx & DeSOx measures for GVK Power Limited Punjab Location

The cooperation and full-fledged support from all GVK Power Limited personnel is acknowledged.

The plant is located at Goindwal Sahib, Punjab. This report captures the outcomes of analysis of primary data available with the plant, analysis, calculations, best available technologies and secondary research.

1 EXECUTIVE SUMMARY

This Feasibility Study Report provides proposals to retrofit the GVK Power (Goindwal Sahib) Limited 2X270 MW Coal fired thermal power plant in Punjab by emission control technology on $DeSO_x$.

The target on emission figures is given by the new Indian law published by Ministry of Environment, Forest and Climate Change (MoEF&CC) vide notification dated 07-12-2015.

GVK Power has retained the services of M/s Save Urja to study and analyze the impact of the new MOEF & CC norms for 2 x 270 MW operating unit at Goindwal Sahib in Punjab state and provide comprehensive optimal solutions to comply with the new regulation standards.

Presently the plant has two streams of four fields electrostatic precipitator (ESP) for 270 MW Unit to control the SPM level in the flue gas to 50 mg/Nm^3 which meets the new emission regulations. Also, based on the input data furnished by GVK Power, the level of SPM being monitored is less than 50 mg/Nm^3. Hence, there is no additional abatement required.

Data Provided by the plant shows that plant current NO_x emission are going up to 390 mg/Nm^3 And above the norms of MoEF and CC. Therefore, abatement is required for NO_x emissions.

Presently GVK Power is suggested to carry out Primary NO_x reduction process (combustion optimisation) to meet the new emission norms of MoEF& CC. However, a combustion optimisation expert team need to be deployed for studying existing combustion process and optimising the NO_x levels generated in boilers.

Regarding DeSOx measures, Considering the extent of sulphur absorption required, flexibility of fuel firing, meeting further stringent emission norms in future, and the large volume of flue gas to be treated, limestone slurry sorbent based once-through, wet type FGD with forced oxidation, having a minimum designed SO_2 absorption efficiency of 93.53% is selected as the optimum technology. Other factors like reliability, low cost reagent, marketable by-product, unavailability of seawater, proven nature of technology and cost effectiveness, make the above wet limestone based desulphurization of flue gas more suitable and hence, is recommended. Currently system is operating at 1,670 mg/ Nm^3. However, during worst coal the operating value reached up to 1,689 mg/ Nm^3 at 0.6% sulphur in coal. Hence system will be designed to operate for sulphur percentage up to 0.65%.

The wet lime FGD would treat 100% of flue gas quantity. FGD system would require maximum of about 6.6 TPH of limestone feed for treatment of flue gas, considering ≥ 90% purity of limestone. The limestone requirement would depend on the sulphur content of the coal and purity of the limestone. The total requirement of limestone per day for both unit FGD would be about 158 TPD.

FGD Unit would require a maximum of about 100 m^3/h of fresh make up water for the process, and subsequently generate about a maximum of 25 m^3/h of waste water which requires further treatment.

The gypsum which is a by-product generated from FGD would be a maximum of about 12 TPH and the total generation of gypsum per day would be about 277 TPD. It is proposed to convey the gypsum directly on to trucks for disposal or could be dumped in the storage yard located adjacent to the gypsum dewatering building.

Traces of mercury present in the coal would be present as mercury oxides in flue gas. Based on the input coal data provided by GVK Power, the present coal analysis does not indicate any traces mercury content. Further, the ESP would reduce mercury emission to the extent of 21% as per US EPA. Hence, no new mercury emission control equipment is proposed presently. It is hereby advised to get the coal tested for any trace metal in order to check for mercury and to install mercury analyzers, if traces of mercury are found.

Currently, the maximum water consumption of GVK Power is nearly 3.43 m^3/MWh. Hence additional water requirement for the FGD system would be met from existing water allocation. However additional cost towards additional clarified water consumption and waste water treatment need to be incurred.

The schedule of implementation of FGD system would be approximate 30 months from the date of order of the FGD. The duration for construction of a new 100 m two flute wet chimney is around 18 months.

The CAPEX for implementation of all proposed emission control systems into GVK Power under this project is estimated ₹ 263 Crores. Detailed calculations are provided in chapter 7 of the report.

2 INTRODUCTION

2.1 BACKGROUND

Ministry of Environment Forest and Climate Change (MOEF& CC) Government of India, has released new environmental regulations applicable to coal fired thermal power plants in the country on 7th December 2015 and the draft amendment on 15th October, 2017. The new norms shall be complied by all operating Thermal Power Stations and new Thermal Power Projects within a period of 2 years from the date of the notification.

GVK Power (Goindwal Sahib) Limited consists of 2 X 270 MW Coal based thermal power plant at Goindwal Sahib District of Punjab State, India. The power plant consists of two units of 270 MW.

Table 1: Date of Commissioning

Capacity	2 X 270MW
Commercial Operation Declaration	06-04-2016 - #U 1 16-04-2016 - #U 2

GVK Power has retained the services of M/s Save Urja to study and analyze the impact of the new MOEF & CC norms for 2 X 270 MW at Goindwal Sahib in Punjab state and provide comprehensive optimal solutions to comply with the new regulation standards.

2.2 BRIEF REVIEW OF THE NEW REGULATION

Ministry of Environment & Forest (MOEF&CC) of Government of India (GOI) has issued Gazette Notification dated 7th December 2015 which modifies existing norms related to emission of SPM and introduces new norms for emission of SO_2, NOx and mercury from Thermal Power Plants (TPP). It also specifies modified limits for specific water consumption by TPPs and insists to convert existing once through based condenser cooling system to recirculation type.

Different limits are specified based on capacity of power plant and year of installation.
A summary of new regulations on air emission is given below:

Table 2: Summary of New Regulations on Air Emission

Year	SPM	SO_2	NO_x	Mercury	Remarks
Pre 2003	100mg/Nm^3	600mg/ Nm^3 for <500MW 200mg/ Nm^3 for >500MW	600mg/ Nm^3	0.03mg/ Nm^3 for >500MW	Not applicable
2003-2016	50mg/ Nm^3	600mg/ Nm^3 for <500MW 200mg/ Nm^3 for >500MW	300mg/ Nm^3	0.03mg/ Nm^3	Applicable for GVK Power
Post 2017	30mg/ Nm^3	100mg/ Nm^3	100mg/ Nm^3	0.03mg/ Nm^3	Not applicable

The new regulations related to water is given below

Table 3: New Water Regulations

Summary of new regulations on water use Sl. No.	New requirement	Remarks
1	All plants with Once Through Cooling (OTC) shall install Cooling Tower (CT) and achieve specific water consumption up to maximum of 3.5m^3/MWh within a period of two years from the date of publication of notification.	Not applicable
2	All existing CT-based plants reduce specific water consumption upto maximum of 3.5m^3/MWh within a period of two years from the date of publication of notification	Applicable for GVK Power
3	New plants to be installed after 1st January 2017 shall have to meet specific water consumption upto maximum of 2.5 m^3/MWh and achieve zero waste water discharged	Not applicable

Note: Unit of 2 X 270 MW at Goindwal Sahib, Punjab was commissioned in year 2016.

Table 4: Applicable Air Emission Norms for The GVK Power Plant

Year of Commissioning	SPM	So2	NOx	Mercury
2003-2016	50 mg/Nm^3	600mg/Nm^3 for <500MW 200mg/Nm^3 for >500MW	300 mg/Nm^3	0.03mg/ Nm^3

Further, to the above MOEF & CC notification have subsequently issued a draft amendment dated 16th October 2017 for stack height post FGD which is as per Table below:

Table 5: New Draft Amendment on Stack Height Post FGD

Industry	Parameter	Standards	Remarks
Thermal Power plants with Flue gas Desulphurization (FGD)	Stack Height/Limit in Meters	Power Generation capacity: 100 MW and above H = 6.902 $(QX0.277)^{0.555}$ Or 100 m Whichever is more	Applicable for GVK Power
		Less than 100 MW H = 6.902 $(QX0.277)^{0.555}$ or 30 m Whichever is more Q = Emission rate of SO2 in kg/h H = Physical stack height in meter	Not Applicable

2.3 SCOPE OF WORK

GVK Power Limited has a major power portfolio of utility scale TPP. GVK Power would like to implement Emission Control in the following power plants

a) 2 X 270 MW Goindwal Sahib, Punjab

The scope of this report is to study the existing plant facilities and the emissions that are generated at the present level. To meet the new emission norms of MOEF & CC, the modifications / new equipment to be added/ modified/ retrofitted to the existing system are studied in details. The following studies were carried out:

- Estimation & analysis of the present plant emission levels based on fuel nature & operating conditions
- Comparative study of the various types of emission abatement technologies commercially available in the market and selection of optimal technology solutions considering the space required for retrofit, percentage reduction of emissions, availability, source & cost of reagents, utilization of by-product, auxiliary power consumption, utilities requirement, plant operating conditions, proven nature of technology and life cycle cost analysis, as required.
- Study of space/provision available in the existing plant for installation of the proposed abatement technologies with relevant sub-systems and impact/modification of the existing plant equipment, civil aspects, plant instrumentation & control, electrical power supply system & other plant parameters, due to the retrofit.
- Estimation of first order cost estimates of CAPEX and OPEX with break-ups under major heads for the selected commercially available optimal technologies
- Project Implementation schedule for above to meet the new norms.

2.4 PROJECT AT A GLANCE

GVK Thermal Power Plant is situated at a distance of 6.0 kms to the South-East of Khadoor sahib railway station on the Beas section of Northern railway at latitude of 31021'35" to 31024'40" north and a longitude of 75007'30" to 75010'55" east, adjacent to villages Goindwal sahib to its south, and Vairowal to its north, and about 25 kms East of Tarn Taran town and 27 kms West of Kapurthala in the State of Punjab.

Project Authority	:	GVK Power (Goindwal sahib) Ltd. a part of GVK group
Project	:	Implementation of FGD in the plant
Type	:	Wet Limestone based FGD
Location	:	Village- Goindwal Sahib, Tehsil- Khadur Sahib, Dist. Tarn Taran, Punjab.
Latitude	:	$31^0$21'35" to $31^0$24'40"
Longitude	:	$75^0$07'30" to $75^0$10'55"
Access by Rail	:	Nearest Railway Station – Khadur Sahib
Nearest Airport	:	Amritsar
Nearest Sea Port	:	Kandla Port, Gujrat
Site Elevation	:	220 meters

Proposed Project Particulars

FGD Type	:	Wet Limestone based FGD
Availability of Limestone	:	Available from nearby Cement Manufacturers
Water availability	:	Available in the plant
Land	:	Within existing plant boundary

Environmental Aspects

The entire project is envisaged to implement the requirements of MOEF&CC of limiting the SO_2 emission in the flue gas.

3 PRESENT AIR EMISSION AND WATER UASGE OF THE PLANT

3.1 AIR EMISSIONS

3.1.1 SUSPENDED PARTICULATE MATTER (SPM)

Presently the plant has two streams of four fields electrostatic precipitator (ESP) for each unit of 270 MW Unit to control the SPM level in the flue gas to 50 mg/Nm^3 which meets the new emission regulations. Also, based on the input data furnished by GVK Power, the level of SPM being monitored is less than 50 mg/Nm^3. Hence, there is no additional abatement required.

3.1.2 SULPHUR DIOXIDE (SO_2) EMISSIONS

Sulphur oxides are generated as a result of oxidation of the sulphur present in the coal at the combustion zone. The SO_2 emission levels would vary depending on the sulphur content and the composition of the coal fired. Based on the input coal analysis report furnished by GVK Power, the estimated SO_2 emission levels for design and worst coal are shown in the table. Since, the estimated emission levels of SO_2 exceed the applicable norm of 600 mg/Nm^3 in dry basis at 6% O_2, the percentage abatement of SO_2 is required to meet the new regulation is as per table below:

Table 6: Current SO_2 Emissions Values

Particulars	2 X 270 MW, GVK Power	2 X 270 MW, GVK Power
	Maximum	**Worst**
SO_2 level	1,670 mg/ Nm^3	1,689 mg/ Nm^3
SO_2 limit values	600 mg/Nm^3	600 mg/Nm^3
Required removal efficiency	>93.53 %	>93.53 %

Note: Further details are attached in Annexure of the report.

3.1.3 NITROGEN OXIDE (NO_x) EMISSIONS

Nitrogen oxides are generated as a result of combustion of coal at elevated temperatures. The NO_x emission levels depend on the composition of coal, operating load and nature of operation.

Table 7: Current NO_x Emissions Values

Particulars	2X270 MW, GVK Power
NO_x (Worst)	390 mg/Nm^3
NO_x (Maximum)	347 mg/Nm^3

Note: Further details are attached in Annexure of the report.

3.1.4 MERCURY (HG) EMISSIONS

Traces of mercury present in the coal would be present as mercury oxides in flue gas. Based on the input coal data provided by GVK Power, the present coal analysis does not indicate any traces mercury content. Further, the ESP would reduce mercury emission to the extent of 21% as per US EPA. Hence, no new mercury emission control equipment is proposed presently. It is hereby advised to get the coal tested for any trace metal in order to check for mercury and to install mercury analyzers, if traces of mercury are found.

Table 8: Present Air Emission and need for Abatement for GVK Power

Pollutant	Maximum Estimated Emissions (without Abatement) mg/Nm^3 at 6% O_2, dry basis		Allowable Limits as per new regulation mg/Nm^3	Abatement Requirement
	Design Coal	Worst Coal		
SPM	< 50	< 50	< 50	Not Required
SO_2	1670	1689	600	Required
NOx	347	390	300	Required
Mercury	-	-	0.03	Not Required

3.2 WATER USAGE

The raw water is pumped from Beas River to the plant raw water reservoir located inside the plant boundary and meets the plant water requirements. The plant is already provided with re-circulating type condenser cooling water system and hence, does not require any change with respect to this aspect to meet the requirements of new environmental norms

Plant has furnished the data provided to CPCB for last five year which shows the water consumption of the plant is less than the norms of MoEF and CC.

Currently, the maximum water consumption of GVK Power is nearly 3.43 m^3/MWh. Hence additional water requirement for the FGD system would be met from existing water allocation. However additional cost towards additional clarified water consumption and waste water treatment need to be incurred.

Table 9: Annual Water Consumption for the Year 2017-18

ANNUAL WATER CONSUMTION FOR THE YEAR 2017-18

NAME OF THE THERMAL POWER STATION: GVK Power (Goindwal Sahib) Limited, Kapurthala Road, Near Goindwal Sahib, TarnTaran, 143 422

TYPE OF FUEL USED: Coal

LATTITUDE AND LONGITUDE OF THE PLANT: 31° 21' 35" N 31° 24' 40" N 75° 07' 30" E 75° 07' 30" E

CONTACT NO., EMAIL AND FAX NO. Phone no. 01859-225103, bivashchandra.ghosh@gvk.com, Fax: 01859-225113

Unit No.	Capacity (MW)	Gross actual Generation (GWh)	Type of Water Source (River/Canal/Sea etc.)	Name of the water source	Type of Cooling (OTCW/CT/ACC)	Annual Allocated Quantity of Water (1000m3)	Annual Actual Consumption of Water (1000 m3)		Total Annual actual Consumption of Water (1000m3)	Actual Consumption (m3/MWh)	Applicable Water Norm (m3/MWh)	%Deviation From Norms*	Whether Zero Liquid Discharge (yes/No)
							Metered	Unmetered					
1 & 2	(2X270)	1538.066	River	Beas River	CT	17849230	5280656		5280656	3.43	3.5	Nil	YES
Total	**540**	**1538.066**				**17849230**	**5280656**		**5280656**	**3.43**	**3.5**		

OTCW- Once Through Cooling Water System, CT- Cooling Tower Along with type of CT, ACC- Air Cooled Condencer.
**Reasion of such Deviations, if exceeding norms and corrective measures under taken against the deviation, if any.*

GVK Power (Goindwal Sahib) Limited
Authorised Signatory

4 COMPARISON AND SELECTION OF TECHNOLOGY FOR REDUCING EMISSIONS AND WATER USAGE

This chapter includes description of major technological options broadly available for the plant to control emissions which require abatement measures to meet the new regulations. i.e. for SO_2 and NO_x. It also includes technical details of the treatment of waste water with introduction of FGD which would be required to meet new regulations.

4.1 EXPLORING TECHNOLOGIES FOR REDUCING SULPHUR DIOXIDE (SO_2) EMISSIONS

4.1.1 WET LIMESTONE FLUE GAS DESULFURIZATION

In this technology, limestone is used as reagent, which is ground in the mill and mixed with water to make slurry and sprayed on the absorber through nozzles. The flue gas coming out from the ID fan is sent to absorber where it reacts and forms the gypsum. The cleaned flue gas is sent to the chimney. The system is a once-through, wet type in which the SO_2gas is permanently bound by the sorbent which must be disposed of as a by-product, gypsum. The by-product is produced is wet in nature, and flue gas leaving the absorber is saturated with moisture.

Chemical reactions taking place are given below,

- Absorption:$SO_2 + H_2O \rightarrow H_2SO_3$
- Neutralization: $CaCO_3 + H_2SO_3 \rightarrow CaSO_3 + CO_2 + H_2O$
- Oxidation: $CaSO_3 + 1/2O_2 \rightarrow CaSO_4$
- Crystallization: $CaSO_4 + 2H_2O \rightarrow CaSO_4.H_2O$

A typical Scheme of Wet Limestone FGD is illustrated in below figure:

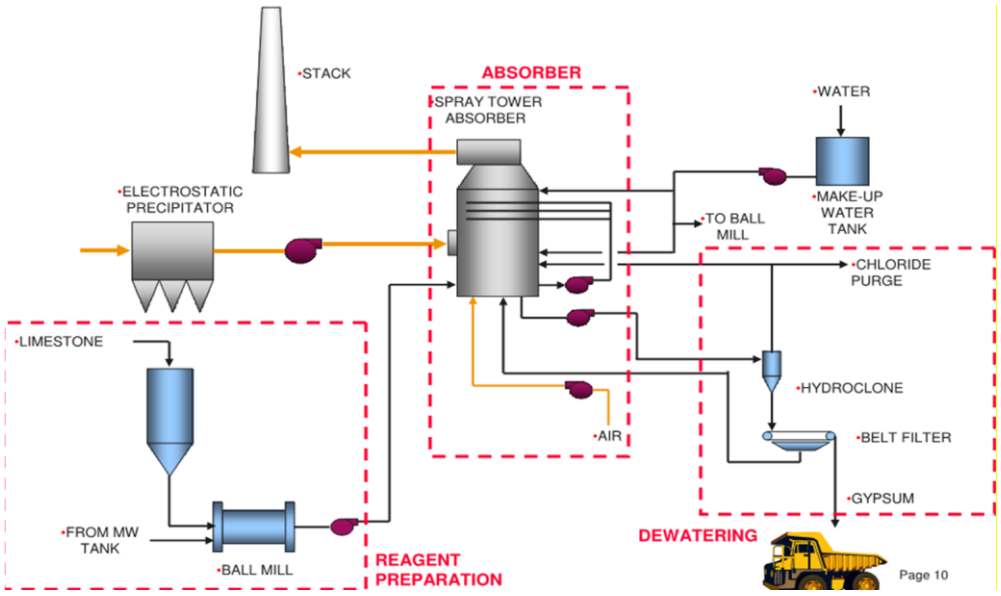


Figure 1: Wet Limestone Based FGD System

Advantages of Wet FGD:

- Well-established FGD technology on a variety of world coals with proven reliability
- SO2 removals up to 95% are common and removals as high as 98% can be attained.
- Adequate and commercially viable suppliers offer the technology.
- Reagents used by the process are plentiful and readily available.
- Waste gypsum is stable for landfills without blending with fly ash and lime and it can also be designed to produce wallboard-grade gypsum as a saleable by-product.
- The FGD system is not sensitive to boiler operational aspects like cyclical variations.

Disadvantages of Wet FGD:

- In this process, large quantities of slurry is circulated leading to high pumping power consumption.
- The pressure drop across the absorber increases the induced draft (ID) fan power consumption.
- These processes can produce a large volume of gypsum. The reuse/ saleability of this by-product is dependent on a sufficiently sized gypsum market near the plant.
- The high potential for corrosion requires extensive use of costly corrosion-resistant alloys or non-metallic liners as materials of construction for the absorber and other system components.
- Either Wet stack with condensate collection system or Gas to Gas heater is required to avoid corrosion in Stack.
- Difficulty in sourcing/ handling of Limestone
- Disposal/handling of generated waste

4.1.2 SEA-WATER BASED FLUE GAS DESULFURIZATION

In this technology, sea water is used as the absorbet of SO_2 in the flue gas. The flue gas from the ID fan outlet is sent to the absorber where the sea water is sprayed through nozzles. Sea water contains significant amounts of HCO_3^- and other alkaline compounds that help sulphur dioxide in flue gas dissolve in water and convert to sulphate which is natural constituent of seawater. The acidic absorbent liquid reacts with alkaline components naturally existing in the sea water. The hydrogen ions are neutralized by the bicarbonates and turns into water and carbon dioxide.

Every ton of seawater contains approximately 0.9 kg of sulfur, which is an essential substance to the marine environment.

The seawater discharge post scrubbing passes through aeration and dilution stage. The pH and dissolved oxygen levels of seawater are maintained prior to discharge back to sea.

Chemical reaction:

$SO_2 + H_2O \Rightarrow HSO_3^- + H^+$

$HCO_3^- + H^+ \Rightarrow CO_2 + H_2O$

$CO_3^{2-} + 2H^+ \Rightarrow CO_2 + H_2O$

$HSO_3^- + ½\ O2 \Rightarrow SO_4^{2-} + H^+$

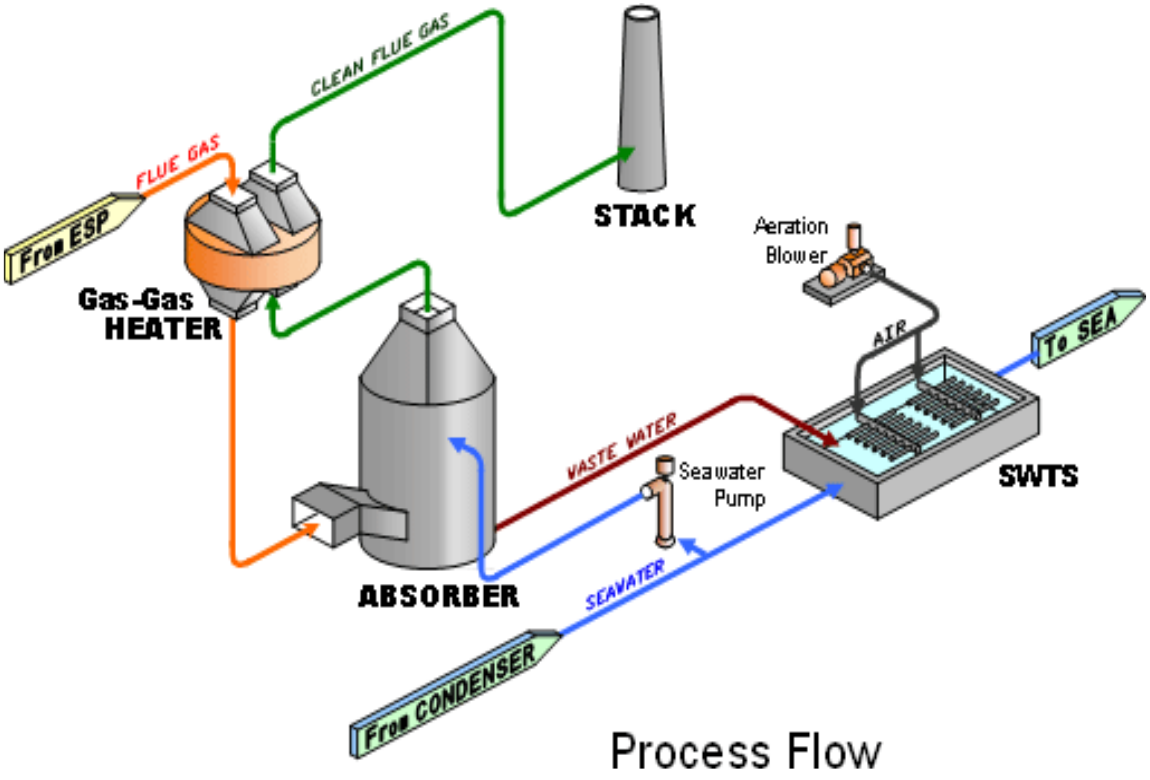


Figure 2: Sea Water Based FGD System

Advantages of Sea Water FGD:

- Less capital cost
- Lower auxiliary power consumption
- No reagent and no by-product
- No Effluent discharge
- Flexibility of handling varied range of sulphur content in coal
- No handling hazardous material

Disadvantages of Sea Water FGD:

- The plant must be located nearby sea

Since GVK Power TPP is far away from sea, hence this technology is not considered for further evaluation.

4.1.3 SEMI DRY/ DRY FLUE GAS DESULFURIZATION

This technology use lime slurry as reagent. The lime (slaked or quick lime) is mixed with water at a controlled rate to maintain a high slaking temperature that helps to generate fine hydrates of lime with high surface area. The flue gas post ESP enters the spray dryer absorber where gas stream is cooled by the reagent slurry spray. The mixture then passes through the fabric filter for removal of particulate before entering the ID fan. A portion of the un-reacted lime, gypsum and the reaction products collected in the fabric filter is mixed with water and returned to the process as high solid slurry. The remaining solids are directed to a storage silo for by product. The by-product is semi-dry/dry in nature and flue gas leaving the absorber is not fully saturated with moisture.

- Primary reactions in the spray dryer are as follows:

$Ca(OH)_2 + SO_2 \rightarrow CaSO_3.1/2H_2 + H_2O$
$Ca(OH)_2 + SO_3 + H_2O \rightarrow CaSO_4.2H_2O$
$CaSO_3 + 1/2\ O_2 \rightarrow CaSO_4$

A Typical Scheme of Dry FGD is illustrated in the figure

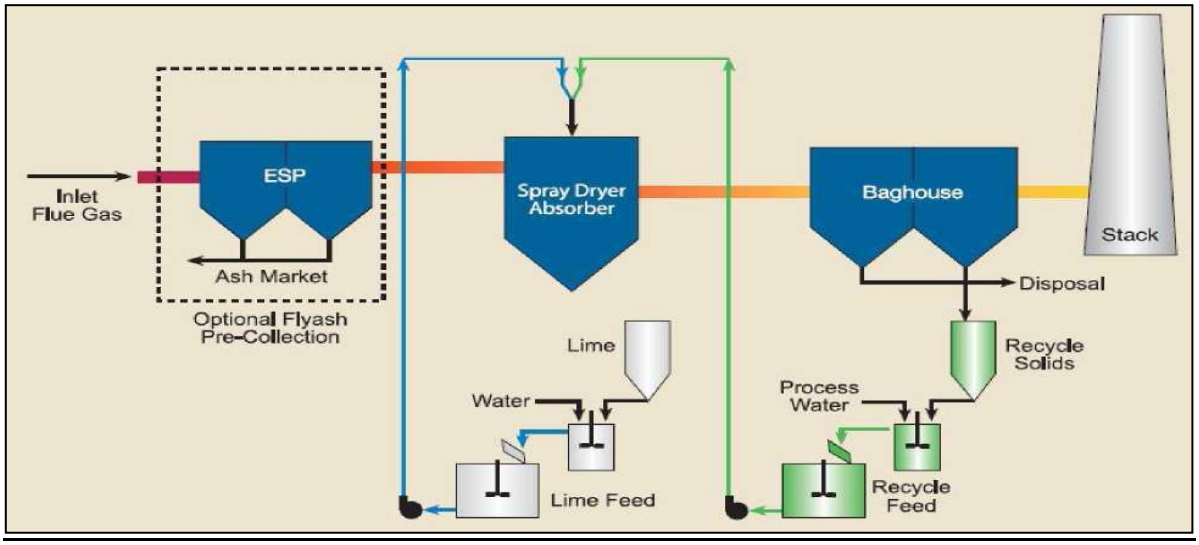


Figure 3: Dry Based FGD System

Advantages

- Has less capital cost for smaller units of less than 300 MW
- Has Lower water consumption and auxiliary power consumption
- Production of dry solid by products with minimum need for dewatering
- There is no visible moisture plume in stack, as the flue gas leaving absorber is not saturated with moisture.
- High percentage capture of mercury present in flue gas

Disadvantages

- Cost of Lime, and lime Storage is higher
- Limited to low sulphur fuel because of high reagent cost
- Limited reagent utilization
- Relatively lower Sox reduction efficiency
- Increases particulate flow, requires fabric filters or enhancement of ESP capacity
- By product generated cannot be utilized in commercial applications and requires land

Other Operational Issues:

- O&M costs high with high SO_2 levels
- Sorbent costs four (4) times higher than limestone costs
- Installation costs comparable with limestone system
- Technology is not widely accepted by the industry and hence not proven

Note: Due to the above mentioned reasons this FGD process technology is not considered for further evaluation.

4.1.4 AMMONIA BASED FGD SYSTEM

In Ammonia based FGD process, ammonia with high reactivity is used as absorbent to capture SO_2 in the flue gas, and the by-product of the process is ammonium sulfate fertilizer.

$SO_2 + H_2O + x\ NH_3 \Longrightarrow (NH_4)\ x\ H_2\ x\ SO_3$ (1)

$(NH_4)\ x\ H_2\ x\ SO_3 + ½\ O_2 + (2\text{-}x)\ NH_3 \Longrightarrow (NH_4)_2\ SO_4$ (2)

$SO_2 + H_2O \longleftrightarrow H_2SO_3$ Dissolution of SO2

$H_2SO_3 + NH_3 + H_2O \longrightarrow (NH_4)_2SO_3$ Neutralization

$(NH_4)_2SO_3 + H_2SO_3 \longrightarrow NH_4HSO_3$

Neutralization

$(NH_4)_2SO_3 + ½\ O_2 \longrightarrow (NH_4)_2\ SO_4$ Oxidation

$NH_4HSO_3 + ½\ O_2 \longrightarrow NH_4HSO_4$ Oxidation

$NH_4HSO_4 + NH_3 + H_2O \longrightarrow (NH_4)_2SO_4$

Neutralization

Reaction (1) shows SO_2 dissolution in water to form sulfurous acid.

Reaction (2) shows neutralization of sulfurous acid with ammonia to form ammonia sulphite.

Reaction (3) shows additional neutralization of sulfurous acid with ammonium sulphite to form ammonium bisulphate.

Reaction (4) and (5) show oxidation of sulphites to form sulfate and bisulphate

Reaction (6) shows neutralization of bisulphate with ammonia to form ammonium sulphate.

$SO_2+2NH_3+H_2O$ $(NH_4)_2SO_3$ *(1)*

$(NH_4)_2SO_3+ ½ O_2$ $(NH_4)_2SO_4$ *(2)*

For every kilogram of SO_2 removed:

- *~ One half kilogram Ammonia reagent consumed*
- *~ Two kilogram of marketable Ammonium Sulphate produced*

One Kilogram of Ammonia generates ~ four kilogram of Ammonium Sulphate fertilizer.

Ammonium sulphate solution is refined through concentration, crystallization, solid-liquid separation, drying to obtain ammonium sulphate fertilizer

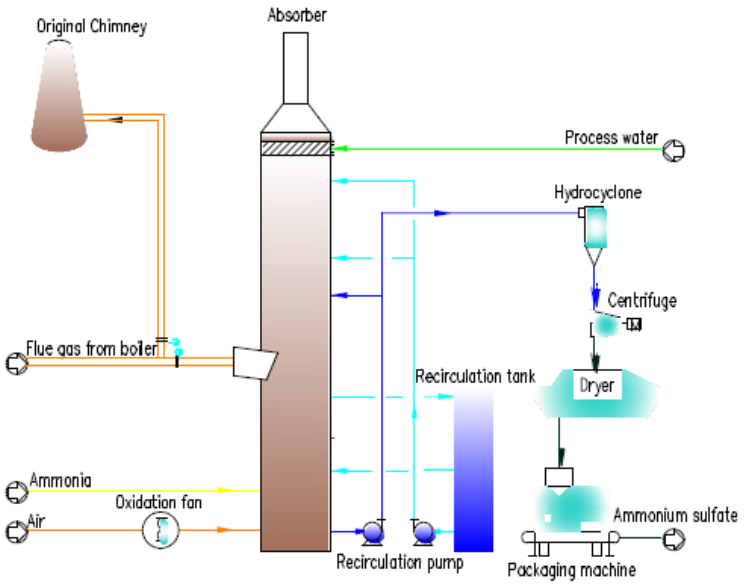


Figure 4: Ammonia Based FGD System

Advantages of EADS based FGD:

- No waste water and solid waste is generated in the process
- High flexibility to handle fluctuations in gas flow rate and Sulphur content from 0.3 to 8% and flue gas with SO_2 content from 300 to 30,000 mg/Nm^3 or higher

Disadvantages of EADS based FGD:

- Higher OPEX due to costly reagent. Even if we are not able to sell 25% by-product generated, this technology becomes unviable.
- Safety concerns related to handling and storage of anhydrous ammonia as permission is required for installation of same
- Locating anhydrous ammonia storage and handling system within existing plant may be an issue because of safe distance required between existing structure and ammonia storage tanks.
- It is not economically viable, where Sulphur % is less than 0.5%.
- Operating experience of Ammonia based FGD Technology is not available in India.

4.1.5 SORBENT POLYMER CATALYST (SPC) TECHNOLOGY

It is a unique fixed catalyst and sorbent system for removing gas phase SO_2 and mercury from industrial flue gas. The SO_2 Control System has an added advantage of mercury control. The system is based on discrete stackable Modules that are installed downstream of a particulate collection system (i.e., tail-pipe solution). The modules utilize an open channel design which results in very low pressure drop. In practice, flue gas after a Particulate Matter collection device (bag house or ESP) is first quenched with water to cool and humidify the gas stream (< 60 °C and > 95% relative humidity preferred operating window). The cooled gas is then directed through a bank of modules. Operation is passive; the modules will continuously convert SO_2 to liquid sulfuric acid in the presence of H20 and excess air in flue gasses, and chemically absorb mercury for many years without requiring any adjustment, regeneration or replacement. The system is completely scalable- modules can be stacked in the direction of the gas flow to achieve desired SO2 removal efficiency.

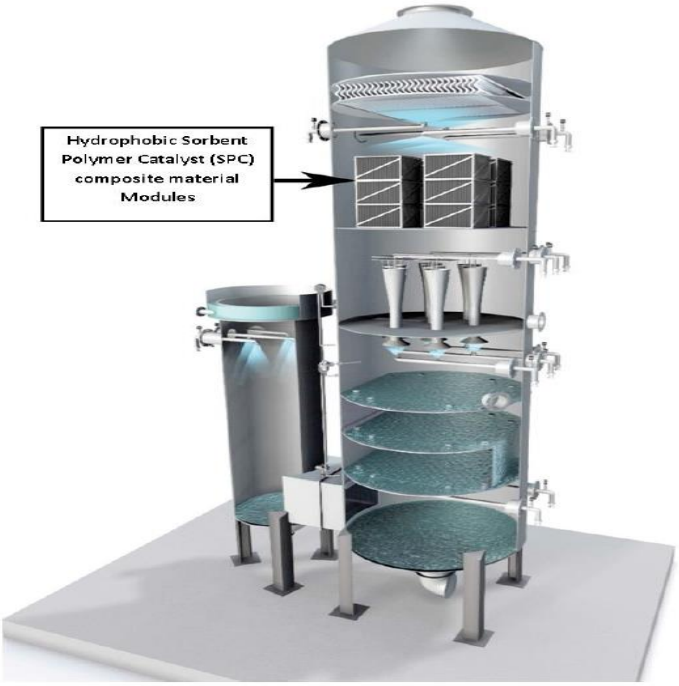


Figure 5: SPC Based FGD System

- **Technology is proprietary (USA based) and there are very less installations worldwide and no installation in India.**
- **Moreover, being patented technology dependency will be there for supply of material on single vendor during operation phase.**
- **Exposure to foreign currency variation risk due to imported technology.**
- **Moreover, this technology is used prominently where both mercury emissions along with SO_x emission control is to be done. However, there is no requirement of Mercury control in this project.**
- **Water requirement for this technology is relatively higher compared to other technologies including wet FGD.**
- **In view of the foregoing, this technology is not considered for this project.**

4.1.6 SELECTION OF SUITABLE TECHNOLOGIES

Selection of FGD technology mainly depends on following factors.

Technical:

Existing SO_2 emission levels, SO_2 removal efficiency required, location of the plant (inland/coastal/access to reagent source), space requirements, process water requirement, wastewater quality/quantity & treatment required, outage requirements, layout feasibility, quality/quantity of waste by-product generated & its disposal/reuse, suitability of technology for Indian conditions.

Economical:

Capital cost, operating cost (Cost of reagent chemical, cost of utilities required and cost of increased Aux. power consumption), development of techno-economically feasible model for reuse of waste by-product.

Commercial:

Impact on tariff, reliable suppliers, proven technology, Supplier guarantee.

Table 10: Qualitative comparison of FGD Technologies

Description	WFGD	DFGD	Ammonia based FGD	Seawater FGD
Reagent	Lime stone	Hydrated Lime	Ammonia	Sea water
Byproduct	Saleable gypsum or Gypsum for landfill	Landfill	Ammonium Sulphate	Treated Seawater
Sulphur	<6%	<2.5 %	<6%	<2%
Removal efficiency	> 95%	> up to 90%	>99%	>95%
Footprint	Large	Small	Moderate	Moderate
Pros	• Low cost reagent • Marketable by-product • Large reference list • Fuel flexibility • Ease of retrofit	• Low capital cost • Moderate Auxiliary Power consumption • Dry by-product • Operational simplicity, • Medium maintenance costs • No lining required	• Low capital cost • Low Auxiliary Power consumption • Marketable by-product • No Effluent discharge	• Low capital cost • Low Auxiliary power consumption • No reagent • No by-product • No Effluent discharge • Fuel flexibility • No handling of reagent, hazardous material

Description	WFGD	DFGD	Ammonia based FGD	Seawater FGD
Cons	• High capital cost • High Auxiliary power consumption • GGH or costly lining required in chimney/ ducts • Difficulty in sourcing of Limestone in the vicinity. • Disposal / handling of generated waste	• High cost of reagent • By-product use is limited • Difficulty in sourcing & handling of Lime	• Very High cost of reagent • High risk of selling by-product • Permission reqd. for ammonia storage	• Limited applicability as applicable only to the plants located nearby sea

The above FGD technologies compared are more relevant, commercially available and proven. Other patented reagent technologies, single party patented technologies and technologies having lower absorption efficiencies are not considered for this project.

Based on the evaluation of above mentioned FGD technologies primarily on the basis of its suitability for the site, its proven track record in the country, fuel flexibility, availability of reputed vendors, reagent cost, SO_2 removal efficiency, saleability / disposal of by-product, safety and hazardous aspects etc, wet limestone based FGD technology would be most optimum and suitable for GVK Power plant. Moreover, to meet any future stringent emission norms the wet limestone FGD can be utilized with minor modifications.

Note: Considering the above-mentioned factors wet scrubbing FGD system is recommended as the optimum technology for GVK Power (Goindwal Sahib) Limited.

4.2 EXPLORING TECHNOLOGIES FOR REDUCING NITROGEN OXIDES (NO_x) EMISSION

NOx emission control technologies are grouped as combustion modification/control and post combustion process. Combustion controls reduce the level of NOx emissions by altering or modifying the firing conditions under which combustion is achieved.

4.2.1 LOW NOX BURNERS (LNB)

LNB operate on the principle of fuel and air staging during fuel injection, which results in fuel-lean and fuel-rich combustion zones in the furnace. In the centre or core of the burners, there is fuel rich primary combustion zone, and NOX formation is restricted by creating low temperature reducing environment deprived of oxygen. The fuel lean zone enveloping the fuel rich zone further reduces NOx formation as it has low combustion temperature and also helps in complete combustion and prevent CO generation.

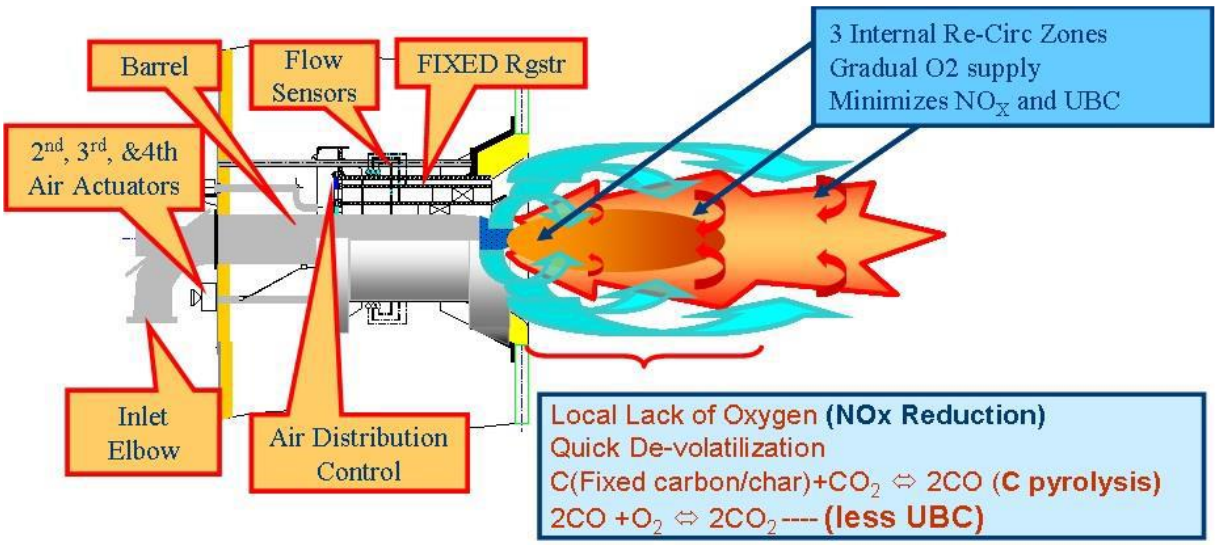


Figure 6: A Typical Low NOx Burner

The burners presently installed at plant are of latest design of LNB and thus there is no scope of exploring installation of LNB of more improved design to reduce NOx further.

4.2.2 OVER-FIRE AIR (OFA)

Air flow from the burners is reduced resulting in a fuel rich primary combustion zone to limit the NOX formation by creating low temperature reducing environment. The combustion of the CO produced in the primary combustion zone is completed using the air supplied by the over-fire air ports, called as the OFA. Two types of over-fire air systems can be used to accomplish NOx emission reductions, Close-Coupled Over-Fire Air (OFA) and Close-Coupled Over-Fire Air (OFA) systems. OFA systems are implemented by adding air injectors immediately above the existing furnace burners. And OFA is supplied from the top of the existing wind-box. With OFA, Higher NOx reductions would be achieved by increasing the separation of the over-fire air ports from the primary combustion zone and increasing the air velocity through the ports.

The efficiency of combustion process and CO emissions are often affected by the implementation of combustion controls. In general, combustion controls are the least cost approach for obtaining an initial reduction in the NOx emissions but would have an impact on boiler performance and hence, it is advisable to consult the boiler OEMs.

4.2.3 LOW EXCESS AIR FIRING

This technique, a burner optimization strategy, is used to improve furnace combustion efficiency by supplying low excess air in combustion zone to form oxygen-deficient fuel-rich zone, thus reducing NOx formation in furnace. The objective of this method is to operate the furnace at the lowest excess air level that provides safe, efficient and complete combustion. The effectiveness of the furnace heat transfer surfaces will also be impacted.

Minimizing the excess air, since this reduces the total flue gas flow. This method could be tried on replacement of burners as discussed above provided adequate instrumentation for monitoring the combustion characteristics and control of fuel air to individual burners are available.

4.2.4 SELECTIVE CATALYTIC REDUCTION SYSTEM (SCR)

Aqueous ammonia is injected into hot flue gas between economizer and APH where flue gas temperature is in the range 340–400˚C through an injection grid. The flue gas is mixed with reagent and passes through catalyst surface where NOx is converted into N2 and water. The reagent is vaporized by steam/ electric heater/ air in the evaporator/vaporizer, mixed and is carried to the grid injection nozzles by air. Figure-IV.6 illustrates Typical SCR Catalyst reaction.

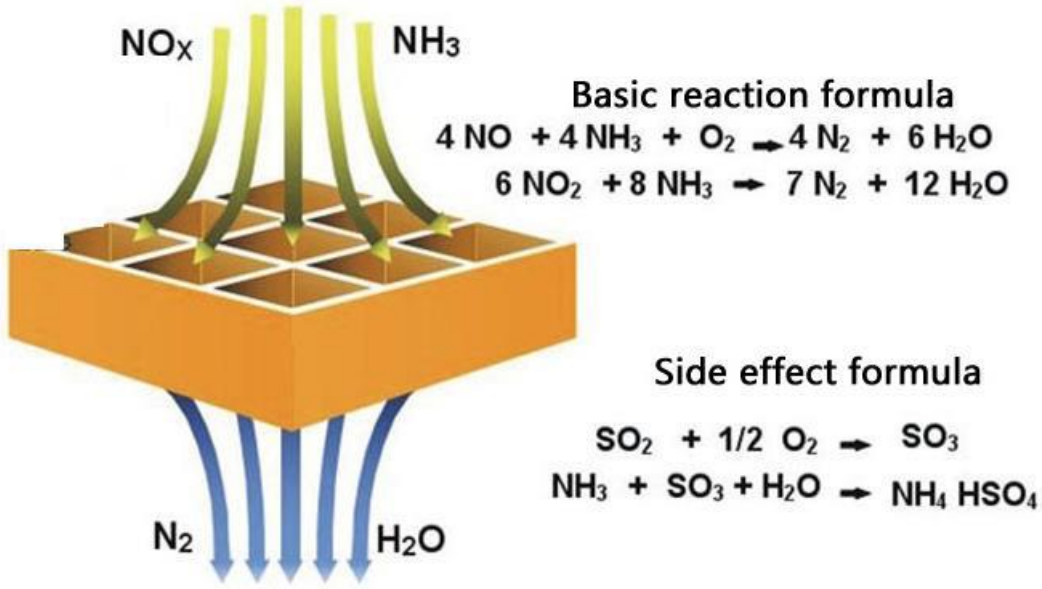


Figure 7: Typical SCR Catalyst Reactions

4.2.5 SELECTIVE NON-CATALYTIC REDUCTION SYSTEM (SNCR)

SNCR is based on the chemical reduction of NOx molecule into molecular nitrogen (N2) and water vapour (H2O). A Nitrogen based reducing agent (reagent) such as ammonia or urea is injected into the post-combustion flue gas. The reduction reaction with NOx is favoured over other chemical reaction processes at temperatures ranging from 870 Deg.C to 1100 Deg.C. Therefore it is considered a selective chemical process. The reagent is generally injected within the boiler super-heater and re-heater radiant or convective regions where the temperature of flue gas is at the required temperature range. The design of injector and the locations of injection are an important part of SNCR system including the time for carrying the medium to vaporize. The NOx reduction efficiency varies typically between 40%~75%.

4.2.6 HYBRID SNCR-SCR

The Hybrid SNCR-SCR/ Advanced SCR/ In-duct SCR technology is the modified design of SNCR system along with introduction of in-duct catalyst layer for reaction enhancement. The system is generally comprised of multiple layers of reagent injection in the furnace similar to SNCR system. Post reagent injection, the flue gas then flows to a reactor consisting of usually a single layer of SCR catalyst, situated inside the duct between economizer outlet and APH inlet. Further, reduction of NOx level occurs due to enhanced chemical reaction in the catalyst bed in the in-duct reactor.

4.2.7 SELECTION OF SUITABLE TECHNOLOGIES

Considering all available data, site conditions, requirement of reduction in NOx emission quantity and difficulty in retrofitting it can be concluded that one or combination of the following fuel preparation & post combustion NOx control methods would be implemented after consultation with boiler OEM.

- The optimization of firing systems and the installation of over fire air systems (OFA) are proposed as primary measures on DeNOx for GVK TPP.
- Considering 390 mg/Nm³ actual NOx emissions it is expected to lower the emission values to below 300 mg/Nm³ by using primary measures only.
- It might be possible achieving 300 mg/Nm³ just by adjusting the combustion strategy and parameters regarding a low-NOx combustion process. However, this statement needs some more investigations in form of a boiler test period of around 2-3 weeks.
- OFA means to distribute approx. 15% of fresh air flow into the upper section of boiler chamber. This needs to install an extension of air duct system including flaps into the boiler area.
- The tentative size is approx. 15% of the fresh air flow. Air duct system and motorized flaps have to be sized accordingly.

Presently GVK Power is suggested to carry out Primary NO_x reduction process (combustion optimisation) to meet the new emission norms of MoEF& CC. However, a combustion optimisation expert team need to be deployed for studying existing combustion process and optimising the NO_x levels generated in boilers.

4.3 EXPLORATION TECHNOLOGIES FOR REDUCTION OF WATER CONSUMPTION

Water conservation concepts are classified into two broad concepts as below:

- Recycling and Reuse
- Modification of consumption pattern at individual consumer level

This is further elaborated into different techniques to bring in better water management in power plant.

4.3.1 RECYCLING AND REUSE

Recycle and reuse of waste water would be adopted to minimize the fresh water consumption. In this philosophy, the waste water generated in one system is reused in some other systems/applications wherever such quality of water is permissible to use.

Note: GVK Power is already a zero-liquid discharge plant and complying to the water consumption norms less than 3.5 m^3/MWh. However, water requirement for FGD system will increase water quantity which will lead to plant water consumption near to 3.5 m^3/MWh.

Listed below is some of the waste water re-use options as shown in below table

Table 11: Options for reuse of waste water

Sl. No	Waste water	Characteristics	Possible Treatment Options	Point of Reuse
1.	Cooling tower blow down	Low TSS Moderate TDS based on COC adopted Slightly high temperature	TDS in the water have to be maintained below 2000 ppm to be suitable for irrigation. The blow down have to be treated to reduce the TDS (may be RO) to suitable limits acceptable for lime slurry preparation	Coal dust suppression Irrigation FGD
2.	Back wash water from filtration Unit	High TSS Low TDS	Recycled in plant clarifier	Raw water feed
3.	Floor wash	Moderate TSS Low TDS	Need to be treated in a sludge handling system (sludge clarifier, thickener and dehydrator)	Raw water feed
4.	Oily waste water	Moderate TSS Low TDS Contains oil	To be treated in oily water separator and the clear water can be reused	Gardening

Sl. No	Waste water	Characteristics	Possible Treatment Options	Point of Reuse
5.	Sewage	Moderate TSS Low TDS High BOD	To be treated in sewage treatment plant and the clear water can be reused	Gardening

4.3.2 MODIFICATION OF CONSUMPTION PATTERN AT INDIVIDUAL CONSUMER LEVEL

This approach aims at choosing the alternative water efficient technologies at individual consumer level so as to reduce the water consumption by the consumers. Such alternatives of the major individual consumers are briefed here. However, each option would be evaluated for its potential in saving water as against the effort and cost associated in implementing the same.

4.3.3 INCREASING COC OF COOLING TOWER

As stated above increasing the COC gives significant reduction in water intake to the plant. The power plant already employs several reuse techniques include treating the CT blowdown and reusing it, which limits the water consumption to limits as acceptable by the MOEF & CC. Hence, existing scheme need not be altered. However, additional sets of pumps would be installed to supply water for the FGD requirements.

5 PROPOSED SCHEME AND IMPACT ON EXISTING PLANT

Wet Limestone based Flue Gas Desulphurization (FGD) system is one of the suitable alternative to reduce SO_x emission to atmosphere through flue gas for existing 2 X 270 MW Coal Based Thermal Power Plant of GVK Power (Goindwal Sahib) Limited located at Punjab.

Wet Limestone Forced Oxidation based FGD System shall be provided with an independent/dedicated absorber. However, the Wet Limestone based Flue Gas Desulphurisation (FGD) System will essentially include but not be limited to the following subsystem:

- Flue Gas System with Booster Fans, Absorber, Chimney and associated ducting arrangement
- Limestone Unloading, Crushing, Grinding and Slurry makeup system
- Gypsum Dewatering System
- Process Water Storage & Pumping System
- FGD Plant Waste Water Treatment & Reuse System (ZLD)
- Utility systems

5.1 FLUE GAS SYSTEM WITH BOOSTER FANS, ABSORBER, CHIMNEY AND ASSOCIATED DUCTING ARRANGEMENT

5.1.1 FLUE GAS BOOSTER FANS

Two (2) nos. Flue Gas Booster fans shall be provided for existing 2 X 270 MW unit at the downstream of ID fans to compensate the pressure drop across FGD plants and the loss of thermal draft (due to reduction of flue gas temperature in FGD plant) in the chimney. The booster fans shall be capable of fully meeting the pressure drop of the FGD plant and the associated ducting/dampers/fitting under all loading conditions. Booster fan shall provide for sufficient positive pressure at the inlet of the wet chimney so as to facilitate effective discharge of wet flue gases into the atmosphere through the new wet chimney. Booster Fans shall be complete with drive motor, coupling, base plates fixing bolts and nuts. The booster fans shall meet the following requirements:

Capacity of each fan shall correspond to 60% BMCR flow. Over and above value thus calculated, following margins shall also be applied for sizing the fan:

Margin on volume flow rate: 20%

Margin on pressure corresponding to rated flow: 44%

However, the best efficiency point for the fans shall be at unit TMCR. The bidder shall furnish the fan sizing calculations for approval of purchaser during detail engineering.

The flue gas booster fans for the 270 MW unit shall be variable speed, axial flow centrifugal type. The maximum speed of the fans shall be limited to 750 rpm.

5.1.2 ABSORBER SYSTEM

Flue Gas, from existing Induced Draft (ID) fans discharge duct, will lead to the absorber through the Flue Gas Booster Fans.

In the absorber, SO2 in flue gas will be removed by a spray of limestone recirculating slurry, pumped by Absorber recirculation pumps. In the Absorber, the sulphur oxides (SO_2 and SO_3) in the flue gas react with the limestone slurry forming $CaSO_3$ and $CaSO_4$.

Compressed oxidation air will be blown through the slurry in the oxidation tank, to oxidize the Calcium sulfite to Calcium sulfate and thereafter crystallizing to gypsum.

The pH – value in the absorber sump is controlled by the limestone dosing and will be approximately 5.6 - 5.8. The retention time in the absorber sump is kept long enough to form good quality gypsum crystals.

Clean gas from the absorber will be passed through number of stages of mist eliminators before being discharged through Stack.

The system shall be so designed to ensure that SO_2 emissions do not exceed the limit stipulated in the Section-2 of this DPR, irrespective of boiler load and fuel quality.

5.1.3 CHIMNEY AND CHIMNEY LINER

i) Treated flue gas from the absorber shall be discharged through either through the existing chimney flue or through a new wet chimney. In case the gas is to be passed through the existing chimney flue, it shall be suitably lined. The flue duct shall be lined with 51 mm thick Borosilicate glass block OR 2 mm thick Titanium (Grade 2 as per ASME SB265) OR C-276 alloy. Cladding shall be done to achieve the required quality as per ASTM B 898-11. External surface of chimney flue liner projecting over the chimney roof shall be wrapped with 2 mm thick Titanium / C-276 sheet over insulation. The design & construction of steel chimney liners shall be based on the guidelines of EPRI Revised Wet Stack Design guide.

ii) New Wet Chimney

Alternatively, new lined RCC wet chimney shall also be constructed as per MoEF&CC guidelines in close proximity of existing chimney. The design & construction of the chimney liners shall be based on the guidelines of EPRI Revised Wet Stack Design guide.

iii) Wet stack model study

A wet stack study shall be performed for the unit with a wet stack installation where there does not exist an identical or mirror image installation that has already had a wet stack study performed. A wet stack model study shall consist of the following

a) Condensation calculations.
b) Minimum 1:12 scale physical flow model for liquid collector design.
c) Computational flow model for plume downwash analysis.
d) Physical or computational flow model for CEMS elevation flow performance.

iv) Wet Stack Wind Tunnel Study

A wet stack wind tunnel study shall be performed for the unit with a wet stack installation to avoid any vortex formation around existing chimney in case of construction of new chimney in close proximity.

5.1.4 DUCTING ARRANGEMENT

Additionally, following ducting connection including dampers shall be provided from ID fan discharge duct to Wet FGD plant and connected to the chimney:

a) Existing ID fan discharge to booster fan suction.
b) Booster fan discharge duct to Absorber inlet.
c) Absorber outlet to the new wet stack.
d) FGD bypass duct/isolating damper to existing chimney.

5.2 LIMESTONE UNLOADING, CRUSHING, GRINDING AND SLURRY MAKEUP SYSTEM

Limestone of (-) 250 mm size will be received at the Power Station by road trucks from nearby mines and stored in a Limestone storage building.

Uncrushed limestone will be dozed to the unloading hoppers and fed to Conveyor through Vibrating Feeders. Conveyors shall discharge limestone to Crusher house. In Crusher House, limestone from shall be fed to Crusher through Rod gate and Rack & Pinion gate. In the Crushers, Limestone will be crushed to (-) 20mm size.

The crushed product shall be fed to Belt feeders which in turn will transfer the product to Bucket Elevators. The Bucket Elevators will discharge to Limestone silos for further preparation and use in the Flue gas desulphurization process.

Two parallel streams shall be completely independent so that maintenance of any equipment will not affect the operation of the other stream.

A common limestone preparation system shall be provided for the unit. Limestone of (-) 20 mm size will be stored in silos. From the silo, limestone will be fed to wet ball mills through a gravimetric feeder and reversible belt conveyor. The ground limestone will be mixed with water, classified and the resultant slurry stored in limestone slurry storage tanks. Thereafter, the slurry will be pumped to the absorber by dedicated limestone slurry pumps. All slurry systems shall be provided with the necessary facilities to allow flushing of the system prior to it being taken out of service

5.3 Gypsum Dewatering and Handling System

5.3.1 Gypsum Dewatering System

A common gypsum de-watering system shall be provided for the unit. A portion of recirculating slurry from the absorber will be pumped by dedicated gypsum bleed pumps to a Gypsum Dewatering system consisting of dual streams of primary and secondary dewatering equipment. The recovered water will be recycled back to the absorbers. The Gypsum Dewatering equipment will consist of a primary hydro cyclone and a secondary vacuum belt filter. Washed and dewatered gypsum cake from the dewatering system will be fed above the belt conveyor and transferred to Gypsum storage area. The moisture content in gypsum will be such as to make it saleable in the present market.

5.3.2 Gypsum Handling System

Washed and dewatered gypsum cake from the dewatering system will be fed by belt conveyors to the Gypsum storage area. The stored gypsum will be transported by road to the end user.

Two parallel streams shall be provided, which shall be completely independent so that maintenance of any equipment will not affect the operation of the other stream.

5.4 Process Water Storage & Pumping System

Process water requirement for FGD plant will be drawn from Station clarified water system and stored in a Process water tank. Process water pumps will be provided for distribution in the FGD Plant as per system requirement such as mist eliminator washing, gypsum washing, limestone slurry system make-up, flue gas quenching, line flushing, etc.

5.5 FGD PLANT WASTE WATER TREATMENT & REUSE SYSTEM (ZLD)

Waste water from the FGD plant will be collected in FGD Waste water collection tank for further treatment. Tentative waste water quality is envisaged as follows:

Sr. No	Description	Unit	Parameter
1	Total Suspended Solid (TSS)	ppm	10000-20000
2	Chloride as Cl	ppm	15000 (max)
3	Total Dissolved Solids	ppm	35000-40000

The waste water from the system will be treated to achieve zero liquid discharge (ZLD) concept.

The waste water from FGD waste water collection tank will be pumped to primary plate or tube settler by waste water transfer pumps to remove the total suspended solids (TSS). Sludge from the primary plate or tube settler will be collected in sludge collection sump and further pumped to filter press to recover the maximum water from the sludge. Suitable chemicals shall be dosed into the primary plate or tube settler and filter press to enhance the suspended solids removal efficiency. Air blowers shall be provided to agitate the sludge in the sludge collection sump. The wet cake generated from the filter press needs to be disposed suitably by the owner.

Clear water from the primary plate or tube settler will be further routed to a secondary plate or tube settler for further treatment. Secondary plate and tube settler is provided with suitable chemical dosing system to reduce the hardness. The sludge generated by the secondary plate or tube settler will be further treated in filter press to recover maximum water.

Clear water from the secondary plate and tube settler will be collected in clear water collection tank. The clear water with high chloride (around 15000 ppm) from clear water tank will be pumped to thermal evaporator to recover the fresh water. Concentrated water from thermal evaporator will be further treated in dryer. Crystals (Wet) formed in dryer will be disposed by the owner suitably. The recovered water from the dryer will be collected in a fresh water tank and shall be pumped to ETP.

5.6 UTILITY SYSTEM

The various utility services such as service water, demineralized cooling water, compressed air, fire water, etc. required for FGD plant are envisaged to be drawn from the existing services.

6 PLAN & SCHEDULE FOR PROJECT IMPLEMENTATION

Successful execution of the project largely depends on the coordinated approach of the project implementing agencies. Proper co-ordination between the various project execution agencies, monitoring of project schedules, appropriate mobilization of manpower and other resources can achieve effective cost control and timely completion of the project.

The proposed FGD system for GVK Power Thermal Power Plant is expected to be commissioned within 22 months from the date of issue of contract to EPC service provider.

It is envisaged that the proposed project shall be executed on the following basis which would lead to shortest gestation period, obtain firm guarantees on performance and completion schedule.

1) Complete Flue Gas Desulphurization system including Electro-mechanical, civil, structural & architectural works, Control & Instrumentation works.
2) Miscellaneous Electrical works to supply power up to FGD.
3) Chimney works for FGD.
4) FGD system is expected to be commissioned within 24 months from the date of NTP.

The proposed FGD system would consist of the following major equipments

1. **FGD System**

a) Main Scrubber for each unit along with it's Auxiliaries.
b) Ductwork, Dampers along with supporting structure.
c) Chimney
d) Limestone unloading & handling System.
e) Limestone Slurry preparation system including Milling system for Limestone.

Gypsum handling system

e) Control & Instrumentation system

f) Illumination & Inter communication System

2. **Civil construction, mechanical and electrical erection services.**

The entire FGD project would be monitored by Owner's Engineer / Engineering Consultant for appropriate engineering interface with different systems of the project.

6.1 PROJECT MANAGEMENT

It is envisaged that an experienced and well-equipped project management group shall be deployed for overview and steer the project through from inception to commissioning. The team would co-ordinate and controls all the following basic activities:-

i. Interfacing with O&M team, different organizations entrusted with engineering, supply and erection activities.
ii. Procurement activities covering control and monitoring of preparation of specification, tender evaluation, negotiation, ordering, vendor drawing review etc.
iii. Material Management & Quality Assurance.
iv. Supervision of construction and erection activities.
v. Preparation of Progress Reports & updating project schedule.
vi. Certification of Performance Testing and acceptance in association with Consultant.

A site office will be established which will take up supervision and construction management during the construction stage.

Basic engineering for the equipment/systems may be carried out by an Engineering Consultants to be appointed by the Project owner. The construction, erection and commissioning of the entire FGD upgradation project will be included in the package specification. Supervisory field support would be provided by representatives from the Consultants as considered necessary. It is envisaged that involvement of the Consultant's from the early phase of the project can enhance the engineering progress and site construction smoothly.

6.2 PROJECT MONITORING, CO-ORDINATION & CONTROL

6.2.1 PROJECT MONITORING INFORMATION SYSTEM

Progress of each activity at every stage would be physically monitored by respective supervising engineers. All detailed information would be passed on to the Central Monitoring Cell to keep track of the work progress. The detailed PERT / CPM network for the project would be monitored on monthly / fortnightly basis to compare with scheduled progress Vs actual progress achieved at site.

6.2.2 CO-ORDINATION

Regular meetings would be held at site among the representatives of the Contractors, the Consultants and the Engineers of Projects Department to review the progress of each activity. At these meetings, slippages in progress would be identified and corrective measures shall be taken. The problems arising out of site and material constraints would be promptly sorted out. The meetings would also be attended to by one of the senior executives of the company to facilitate on-the-spot decision. Minutes of meetings would be circulated among all concerned for necessary follow-up action.

Co-ordination meetings between the Consultants and the senior executives of the Project Authority would be held regularly for major decisions in regard to planning, designing of various plant and equipment, execution procedures, manpower deputations, industrial relations, security, etc. Steps would be taken to ensure regular interactions between the Contractor, the Consultants and Projects Department. Experienced site engineers will be working under the site manager at the site office. The computer system set-up will allow close coordination with the home offices, which will also be used for back-up and to solve any upcoming design issue. Owner will organize and supervise construction work on site. Site activities of the subcontractors' site teams will be coordinated by owner to ensure that working areas are clearly assigned and safe. Special emphasis will be put on the proper coordination of interfaces between different packages to ensure, that erection and commissioning work runs continuously and smoothly.

6.2.3 REPORTING

Various reports would be generated in regard to the physical and financial progress of the project on monthly, quarterly and yearly basis for internal use & if required for forwarding to the various Government Departments, Financial Institutions. Daily progress of the major items of work, along with their weekly/ monthly targets, would be reported to the project head. The progress measurement system and weighting according to various activities will be mutually decided and agreed based on the Consultant's proposal.

6.2.4 FINANCIAL CONTROL

Actual cost records would be regularly monitored against forecasts, which would be forwarded to Finance Department by the Projects Department on monthly, half-yearly and yearly basis, depending on the actual progress of delivery and erection/construction. Fund requirements would be assessed and arranged accordingly.

6.3 CONSTRUCTION FACILITIES

The proposed FGD project will be located within the existing plant premises of GVK Thermal Power Plant, adequate construction facilities will therefore, be available for timely implementation of the project.

Adequate space is available for offices, covered and open storages, fabrication and pre-assembly yard, etc., required during construction period.

6.3.1 CONSTRUCTION OF ROADS

An access road of heavy duty class emanating state highway constructed during power plant implementation stage will facilitate the movement of materials and equipment during construction / erection of FGD project.

6.3.2 CONSTRUCTION BUILDINGS

Existing O&M service building shall be used by the owner's construction team for setting up it's office. Housing for owner's construction staff shall be provided in the existing housing colony of the plant. Contractor shall set up it's office in portable Porta Cabin. Contractor shall arrange temporary barracks/housing near the plant area for the Contractors' workmen during the period of construction work.

6.3.3 CONSTRUCTION WATER

Construction water for the FGD project shall be provided from the existing water distribution network of the Plant.

6.3.4 CONSTRUCTION POWER

The construction power required for the FGD project shall be provided from existing power distribution network of the plant. The construction power requirement will be around 1.5 MVA.

6.3.5 CONSTRUCTION EQUIPMENT'S

A number of construction equipment, namely Bull-dozers, Crawlers and Tyre-mounted cranes, tractors-trailers, road tankers, winches, lighting-tackle, etc. are proposed to be utilized by the project authorities.

Though, the major construction equipment is presumed to be brought by the Contractors, the above essential equipment are proposed to be procured in the interest of the project and these may be rented out to deserving Contractors as found necessary.

Road weigh-bridge as installed during main power plant construction phase will be utilized for FGD project construction.

6.3.6 CONSTRUCTION MATERIAL

Stone Aggregates
There are quite a few stone deposits in the surrounding areas. The aggregates would be transported by road trucks.

Sand
Coarse to medium sand is available from the river beds in the nearby area and may be transported by road.

Bricks
There are brick manufacturing agencies in the nearby areas and hence no difficulty is envisaged in getting sufficient quantity of bricks required for the project.

6.3.7 MANPOWER

Semi-skilled and unskilled workmen are expected to be available from local population in these areas to meet the manpower requirement during construction and erection of FGD project. Proper manpower planning by both the contractors and project authority need prime attention well in advance to ensure smooth and timely execution of the project.

The project headed by an executive of suitable rank will look after the overall activities in compliance with the project schedule. He will be assisted by a team of experienced managers and engineers in different disciplines including technical, administration, staff welfare, finance, safety and security, material management, traffic and legal affairs.

7 PRELIMINARY FIRST ORDER COST ESTIMATES

The cost of recent Wet Limestone based FGD plants using Coal as fuel varies between Rs. 0.3 Cr/MW to Rs. 0.56 Cr/MW. However, the Sulphur content of Coal is around 0.6% to 0.93%, with a worst calorific value of 5158 kCal/kg.

Basis of Project Cost Economics

- ✓ The cost estimate presented is preliminary in nature. The project cost estimate has been presented on the basis of prevailing prices, in house data, previous project experiences, budgetary quotations and market information and can change as per cost offers to be received by GVK Power during the tendering process.
- ✓ Technical parameters considered in the cost estimation are furnished in the below tables
- ✓ The CAPEX cost estimates, Revenue loss due to plant shut down and OPEX are shown below:

7.1 Estimated Capital Expenditure (CAPEX) for Wet Limestone FGD installation (2X270) of GVK Power

Table 12: Estimated Capital Expenditure (CAPEX) for Wet Limestone FGD

Estimated Capital Expenditure (CAPEX) for Wet Limestone FGD installation in all Two units of GVK Power					
Sl.No.	**CAPEX ITEM**	**Base Cost**	**Transportation & Insurance Cost @ 6% of Base Cost**	**Taxes & Duties @ 18% of Base Cost**	**Total Cost including Taxes & Transportation and Insurance**
FGD- Capital Expenditure (CAPEX)		**Rs. Lakhs**	**Rs. Lakhs**	**Rs.Lakhs**	**Rs. Lakhs**
1	**FGD system including Limestone unloading storage, conveying system and Gypsum handling and storage system**	18692	1121.52	3364.56	23178.08
2	**Electrical system cost associated with FGD**	1538	92.28	276.84	1907.12
3	**Chimney & duct lining cost for Two units of GVK Power**	3231	193.86	581.58	4006.44
4	**Pile Foundation**	572	34.32	102.96	709.28
5	**Clarifier for Pre Treated Water for FGD**	300	18	54	372
6	**Waste water treatment plant**	192	11.52	34.56	238.08
7	**Spares @ 3% on Items 1, 2, 3 & 4**	710	42.6	127.8	880.4
8	**Pre Operating Expenses**	900		162	1062
9	**Water & Electricity**	500		90	590
10	**Start up and Trial Run**	1000		180	1180
11	**Total Cost of FGD works**	**27635**	**1514.1**	**4974.3**	**34123.4**
12	**Financing Charges**	**200**		36	236
13	**Interest During Construction@ 14% on 75% Rs. 35815.5 lakhs .i.e.26900**	**4858**			4858
14	**Total Cost of FGD works including IDC**	**32693**	**1514.1**	**5010.3**	**39217.4**

Estimated Capital Expenditure (CAPEX) for Wet Limestone FGD installation in all Two units of GVK Power					
Sl.No.	**CAPEX ITEM**	**Base Cost**	**Transportation & Insurance Cost @ 6% of Base Cost**	**Taxes & Duties @ 18% of Base Cost**	**Total Cost including Taxes & Transportation and Insurance**
FGD- Capital Expenditure (CAPEX)		**Rs. Lakhs**	**Rs. Lakhs**	**Rs.Lakhs**	**Rs. Lakhs**
15	**Contingency @ 5% on item 13**	1634.65	75.705	250.515	**1960.87**
16	**Project Management & Engineering cost @ 3% on item no 13**	980.79	NA	NA	980.79
17	**Total Cost of FGD including Contingency, Engineering & Project Management**	**35308.44**	**1589.805**	**5260.815**	**42159.06**
FGD COST PER MW IN Rs. CRORES/MW		**0.65**	**0.03**	**0.10**	**0.78**

7.2 Loss of Revenue Due To unit Shutdown (2x270 MW) required for RETROFIT OF GVK Power

Table 13: Loss of Revenue Due to Unit Shutdown Required for Retrofit

Loss of Revenue Due to Unit Shutdown Required for Retrofit			
SL. No.	**DESCRIPTION**	**UNIT**	**VALUE**
1	**Shutdown duration**	Days	60
2	**Capacity Charge considered for revenue loss**	Rs. /kWh	2.80
3	**Loss of plant Availability due to unit shutdown**	Million Units	611
4	**Capacity charge loss due to plant shutdown**	Rs. Lakhs	17122
5	**Startup cost of plant post FGD retrofit**	Rs. Lakhs	210
6	**Total Loss of Revenue due to Plant Shutdown**	Rs. Lakhs	17332

7.3 Estimated Operating Expenditure (OPEX) for Wet Limestone FGD installation (2X270) of GVK Power

Table 14: Estimated Operating Expenditure (OPEX) for Wet Limestone FGD

Estimated Operating Expenditure (OPEX) for Wet Limestone FGD installation in all Two Units of GVK Power			
SL. No.	**DESCRIPTION**	**UNIT**	**Values**
FGD- OPEX ESTIMATE			
1	**Cost of Reagent**		
a	Total Landed Cost Inclusive of Taxes	Rs/MT	2500
b	Reagent Requirement for four units	MT/h	6.6
c	FGD Operating Hours @ 85 % PLF	h	7446
d	Total Reagent Consumption	Tonnes/year	49144
e	Cost of Reagent per Annum	Rs Lakhs/Year	1229
2	**Cost of additional auxiliary power consumption for FGD**		
a	Auxiliary power consumption required @1%	KW	5400
b	Annual power consumption required @ 85% PLF	Units consumed	40208400
c	Cost of power	Rs/unit	7
d	Additional power consumption cost per annum	Rs Lakhs/Year	2815
3	**Cost of additional clarified water**		
a	Additional Clarified water required	m^3/h	200
b	Clarified water consumption per annum	m^3/Year	1489200
c	Clarified water rate	Rs./m^3	0.78
d	Additional Clarified water consumption cost per annum	Rs. Lakhs/Year	12
4	**Cost of additional operating cost of waste water treatment plant**		
a	Quantity of Waste water discharged	m^3/h	20
b	Annual waste water discharged	m^3/Year	148920

Estimated Operating Expenditure (OPEX) for Wet Limestone FGD installation in all Two Units of GVK Power			
SL. No.	**DESCRIPTION**	**UNIT**	**Values**
FGD- OPEX ESTIMATE			
c	waste water treatment cost	Rs./m^3	60
d	Cost of waste water Treatment per annum	Rs. Lakhs/Year	89
5	**Additional Maintenance & Manpower Cost due to FGD**		
a	O & M Cost	Lakhs/MW/Year	1.26
b	Additional O&M cost per Annum	Rs. Lakhs/Year	680
6	**Gypsum disposal costs**		
a	Gypsum Generation	TPH	12
d	Gypsum unloading cost	Rs./MT	125
c	Annual Gypsum unloading cost	Rs. Lakhs/Year	108
7	**Total Annual Operating Cost (OPEX)**	**Rs. Lakhs/Year**	**4931**
8	**Annual Insurance cost**		
a	Insured value of FGD	Rs. Lakhs/Year	33987
b	Insurance cost @ 0.07% premium	Rs. Lakhs/Year	24
9	**Additional Working Capital Interest cost**		
a	Working capital interest cost at 12.00% for one month	Rs. Lakhs/Year	49
10	**TOTAL Annual OPEX Including Working Capital Interest cost and Insurance Cost**	Rs. Lakhs/Year	5004
11	**FGD-CAPITALISED OPEX PER MW**	**Rs.Crores/MW**	**0.09**
12	**TOTAL OPEX CAPATILISED @ 11% discounting factor & annual escalation of 5% for 15 years' plant life**	**Rs. Lakhs**	**49525**
	FGD-CAPITALISED OPEX PER MW	**Rs.Crores/MW**	**0.92**

7.4 ESTIMATED TOTAL COST PER MW (CAPEX+OPEX) FOR INSTALLATION/RETROFIT OF WET LIMESTONE FGD (SUMMARY)

Table 15: ESTIMATED Total Cost per MW (CAPEX+OPEX) for Installation/Retrofit of Wet Limestone FGD

ESTIMATED Total Cost per MW (CAPEX+OPEX) for Installation/Retrofit of Wet Limestone FGD			
Sl.No.	**Particulars**	**Units**	**Values**
1	FGD system CAPEX per MW	Rs. Crores / MW	0.78
5	FGD-Capitalized OPEX of per MW per Annum	Rs. Crores / MW	0.09
TOTAL CAPEX and CAPITALISED OPEX AND CAPEX per MW (FGD)		**Rs. Crores / MW**	**0.87**

The following costs, taxes & duties have been excluded for above Capital cost estimation:

I. *Incidental Expenditure During Construction (IEDC)*
II. *Margin money for working capital*
III. *Exchange rate variation and cost of hedging*
IV. *Impacts due to price variation of various commodities.*
V. *Cost of OEM services regarding interconnection with existing facilities*
VI. *Escalation on the Secondary Fuel Oil Costs and Start Up Power*
VII. *Return on Equity (ROE)*
VIII. *Land acquisition cost for gypsum disposal dyke*

7.5 ADDITIONAL DEEP PILING FOUNDATION REQUIREMENT FOR MOST OF THE EQUIPMENT

GVK Power is having very poor Soil condition & High ground water table and existence of uniform granular size sand with liquefaction effect results heavier Pile foundations to most of the equipment of FGD (Soil report attached). During main plant design and construction cast in-situ bored piles were adopted, for most of the equipment. The size of the piles varying from 750 mm to 450 mm diameter with a length of 26 m.

The preliminary estimate for project of 2 X 270 MW is around 500 number of piles (for FGD unit ~ 500 piles are required), the estimated cost for these 500 piles foundations is Rs. 5.72 Cr. This number may go higher side during details engineering. (Refer to the Soil Investigation Report attached in annexure).

Table 16: Additional Piling Requirement

Capacity	No of Pile	Dia of Pile (mm)	Length (M)	Total Pile Length (M)	Cost per Metre	Cost for Piling
60T	500	600	26	13000	4000	52,000,000
				Overhead@10%		5,200,000
				Total Cost		57,200,000

Note: Cost has already been considered under capex.

8 ANNEXURE

8.1 MoEF and CC Notification for Thermal Power plants

8.2 CEA & CPCB LETTER TO GVK POWER

8.3 CURRENT PLANT EMISSIONS (AIR & WATER) – REPORTED TO CPCB

8.4 CURRENT PLANT EMISSIONS – THIRD PARTY TESTS

8.5 SITE PLAN FOR WFGD SPACE AVAILABILITY

8.6 PERT CHART

8.7 SOIL TEST REPORT

8.8 CEA FORMS – 1,2,3 & 4

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
अल्ट्रा मेगा विद्युत परियोजना विकास प्रभाग
Ultra Mega Power Projects Development Division

सं.:**44/FGD/** यूएमपीपी/सीईए/**2019/**413-414 दिनांक: **30-04-2019**

सेवा में,

Sh. M. Rama Murty.
Director
GVK Power (Goindwal Sahib) Limted
Sardar Patel Road,
Secunderabad 500 003, India.

Subject: Advice on suitable technology and indicative cost in installation of FGD to meet the new MOEF & CC Emission norms in 2X270 MW GVK Power (Goindwal Sahib) Limited, Punjab.

Sir,
In reference to the new Environmental norms as per Environment (Protection) Amendment Rules 2015- Installations of FGD at GVK Power (Goindwal Sahib) Limited, Punjab; GVK Power had submitted the revised feasibility report wherein the best suited technology and estimated indicative cost was proposed for installations of systems to control emission from the power plant.

Also, on the basis of plant specific data provided by GVK Power (Goindwal Sahib) Limited, Punjab as well as the present technologies available and other related conditions, an advisory report has been prepared detailing suggestive technology and estimated indicative cost in installations of FGD (Flue Gas Desulphurization Systems) at 2X270 MW thermal Power Plant at Tarn Taran, Punjab. The cost of retrofitting of FGD for the plant needs to be discovered through open competitive bidding in consultation with representatives of major PPA stakeholder. GVK Power (Goindwal Sahib) Limited, Punjab may invite the major PPA stakeholder to participate in bidding process till final award of FGD contract.

However, in respect of installations of FGD systems; it would be the sole responsibility of Power Plant to meet the time-limit as prescribed by appropriate Pollution Control Board. Further, GVK Power (Goindwal Sahib) Limited, Punjab may submit the status of progress of all activities of installation starting from biding stage till commissioning of FGD to CEA on monthly basis.

Enclosed: Advisory report

भवदीय,

(चन्द्र शेखर)
मुख्य अभियंता
Tel. 26195472

Copy:

Secretary, PSERC: for information

सेवा भवन ,आर. के. पुरम ,I-नई दिल्ली110066- टेलीफैक्स: 011-26102119 ईमेल:ceumpp.cea@gov.in वेबसाइट: www.cea.nic.in
Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26102119 Email: ceumpp.cea@gov.in .Website: www.cea.nic.in

RECOMMENDATION OF CEA FOR FGD INSTALLATION AT GVK POWER (GOINDWAL SAHIB) LIMITED, GVK GROUP

INTRODUCTION

BRIEF REVIEW OF THE NEW MoEF REGULATION

The present notification from MoEF&CC amends existing norms related to emission of SPM and introduces new norms for emission of SO_2, NO_x and Mercury from Thermal Power Plants (TPPs). It also specifies modified limits for specific water consumption by TPPs and insists to convert existing once through based condenser cooling system to recirculation type. Different limits are specified based on capacity of power plant and year of installation. A summary of new regulations on air emission is given in below;

NEW REGULATIONS ON EMISSION

Date of Installation	PM	SO_2	NO_x	Mercury (Hg)
Before 31-12 2003	100 mg/Nm^3	600 mg/Nm^3 for <500MW 200 mg/Nm^3 for >=500MW	600 mg/Nm^3	0.03 mg/Nm^3 for >=500MW
After 01-01-2003 & Upto 31-12-2016	50 mg/Nm^3	600 mg/Nm^3 for <500MW 200 mg/Nm^3 for >=500MW	300 mg/Nm^3	0.03 mg/Nm^3
On or after 01-01-2017	30 mg/Nm^3	100 mg/Nm^3	100 mg/Nm^3	0.03 mg/Nm^3

SUMMARY OF NEW REGULATIONS ON WATER USE

Sl. No.	New requirement
1	All plants with Once Through Cooling (OTC) shall install Cooling Tower (CT) and achieve specific water consumption up to maximum of 3.5 m^3/MWh within a period of two years from the date of publication of notification.
2	All existing CT-based plants reduce specific water consumption up to maximum of 3.5 m^3/MWh within a period of two years from the date of publication of notification.
3	New plants to be installed after 1st January 2017 shall have to meet specific water consumption up to maximum of 2.5 m^3/MWh and achieve zero waste water discharged.

Further, to the above MoEF & CC notification, MoEF &CC has subsequently issued an Amendment dated 28th June 2018 for stack height post FGD and water Consumption which is mentioned below:

SUMMARY OF NEW DRAFT AMENDMENT

Chimney Height post FGD installation:

Sl. No.	Industry	Parameter	Standards
1	Thermal Power plants with Flue gas Desulfurization (FGD)	Chimney Height/Limit in Meters	Power Generation capacity : **100 MW and above** $H = 6.902 (QX0.277)^{0.555}$ Or 100 m Whichever is more
			Less than 100 MW $H = 6.902 (QX0.277)^{0.555}$ Or 30 m Whichever is more Q = Emission rate of SO_2 in kg/hr* H = Physical chimney height in meter * Total of all units connected with chimney. **Note:** These standards shall apply to coal / lignite based thermal power plants.

- All monitored values for SO_2 and NOx shall be corrected to 6% Oxygen, on dry basis.
- Specific water consumption shall not exceed maximum of 3.0 m^3/MWh for new plants installed after the 1st January 2017 and these plants shall also achieve zero waste water discharge.
- Seawater based plants are exempted from conversion of once through cooling system to Cooling Tower based system.

TARGET SO_2 EMISSION VALUE FOR GVK THERMAL POWER (GOINDWAL SAHIB) PLANT:

The two (02) units of 270 MW at GVK Thermal Power (Goindwal Sahib) Plant were commissioned on :

Unit#1 06 April 2016

Unit# 2 16 April 2016

The applicable SO_X emission limit for GVK Thermal Power (Goindwal Sahib) Plant is 600 mg/Nm^3. However, to take care of variation in operating input parameters such as deterioration in coal quality, higher sulphur content in coal, higher flue gas temperature and flow, higher plant heat rate etc. sufficient design margin needs to be considered on actual performance parameters.

APPLICABLE NORMS FOR GVK THERMAL POWER (GOINDWAL SAHIB) PLANT

Year	SPM	SO_2	Nox	Mercury
2003-2016	50mg/Nm^3	600 mg/Nm^3	300mg/Nm^3	0.03mg/Nm^3

Salient Features Of Power Plant:

1. Plant Capacity: 2x270 MW=540 MW with Sub-critical technology.
2. Average Availability (2018-19 Apr-to Jan) :63.5 %
3. Average PLF(2018-19 Apr-to Jan): 47.9 %
4. Major PPA: 90.7% PSPCL
5. Average actual GCV (2018-19 Apr-to Jan): 3320 Kcal/kg.
6. Average Sulphur in Coal (2018-19 Apr-to Jan): 0.45%

TECHNOLOGY

In feasibility report GVK Thermal Power (Goindwal Sahib) Plant has opted for "Wet Lime Stone" based FGD technology. However following two So_2 removal technologies are technically & commercially feasible at GVK Thermal Power (Goindwal Sahib) Plant .

i. Wet Lime stone Base FGD.
ii. Ammonia Based FGD.

In case Wet FGD (Lime stone based) is considered by GVK Thermal Power (Goindwal Sahib) Plant, the reagent source may be selected based on availability of limestone, limestone purity, cost and quality. Additionally Source of limestone should be chosen with life cycle cost analysis.

In case of Ammonia based FGD, utmost care shall be needed to handle the reagent and the demand of the by product may be ascertained. Also disposal/use of byproduct if no demand is available may be taken care off.

GVK Thermal Power (Goindwal Sahib) Plant to make lifecycle cost benefit analysis and technical feasibility before opting for either of above mentioned technologies for optimization of CAPEX, OPEX and subsequent implication on tariff.

ENGINEERING ASPECTS

1. **Absorber**-Individual absorber for each Unit.
2. Limit SO_2 below environment norms with up to 0.6
3. 5 % Sulfur content in Coal.
4. **Absorber Lining** – Such as Ceramic Tiles/clad sheet of C-276/Alloy 59 /Steel Alloy/Glass flake filled multi-functional epoxy /glass flake lining etc.
5. **Other lining** - All ducts, effluent handling pits or concrete zone etc. to be protected with glass flake based coating/ Steel Alloy Lining etc. Piping may be of flake glass based coating/carbon steel rubber lined (CSRL)/rubber lining however lesser diameter pipes can be of GRP(Glass Reinforced Plastic)/FRP (Fibre Glass reinforced Plastic)/ Alloy Steel material etc.
6. **Monitoring System-** Measurement of SO_2 in the outlet and inlet are important for the calculation of the FGD efficiency and control the amount of reagent. The important parameters for deciding monitoring system are response time (shorter the better), less inventory (common for inlet and outlet), less maintenance (high maintenance interval). In view of this proven advance technology may accordingly be selected considering the plant specific requirements.
7. **Auxiliary Power Consumption-** The maximum Additional Auxiliary power Consumption for complete FGD facilities will be maximum 1.0% for Limestone based FGD and maximum 0.8% for Ammonia based FGD.

   If the existing chimney is used, the requirement of GGH may be seen. The additional Auxiliary Power Consumption with GGH (only if using old chimney) will be maximum 0.3%.

INDICATIVE COST ESTIMATION

An indicative Base cost estimation is done by CEA in order to facilitate GVK Thermal Power (Goindwal Sahib) Plant determine the price for installation of FGD on the major heads of CAPEX & OPEX.

CAPEX

The indicative estimated cost for Wet limestone base FGD works out to Rs. 0.45 Cr/MW (CAPEX only for Lime stone based FGD).This indicative cost is the "Base Cost" only and does not include Opportunity cost (associated with generation loss due to interconnection of chimneys with absorber) and Taxes-Duties. This Indicative "Base cost is calculated considering new chimney without GGH.

In case of ammonia based FGD,CAPEX (BASE COST) is typically around 10 % less as compared to wet lime stone based FGD, considering the fact that Pulverizes / crushers / milling system / transfer belts are not required as ammonia is in liquid form. The circulation pumps and associated system will be much smaller and also the waste water disposal system is not required in ammonia based FGD.

NOTE: GVK Thermal Power (Goindwal Sahib) Plant has shown the piling foundation requirement for FGD facilities structures, resulting in additional CAPEX beside the Indicative "Base Cost". GVK Thermal Power (Goindwal Sahib) Plant is advised to approach regulator at appropriate stage for any piling related additional Cost implications.

The cost of retrofitting FGD for GVK Thermal Power (Goindwal Sahib) Plant should be discovered through open competitive bidding in consultation with lead procurer. The lead procurer (to be invited by GVK Thermal Power (Goindwal Sahib) Plant) may participate in bidding process till final award of FGD contract.

OPEX

Operating Cost (OPEX) will include Reagent cost, Additional water consumption associated with FGD, Manpower cost, Auxiliary Power Consumption, By-product handling and revenue earned through disposal of by product. The OPEX should be kept as low as possible by reducing Auxiliary Power Consumption and producing good quality of saleable by-product.

OPPORTUNITY COST

Since interconnection of chimneys with absorber may result in loss of generation of the plant, hence GVK Thermal Power (Goindwal Sahib) Plant is advised to minimize this interconnection time by taking suitable measure so that the "Opportunity cost" associated with interconnection may have least impact on tariff revision.

CHIMNEY & LINING

In feasibility report GVK Thermal Power (Goindwal Sahib) Plant has opted for new wet chimney.

Option I (As opted by GVK Thermal Power (Goindwal Sahib) Plant)

Single new wet chimney with 02 flue on ground.

The other chimney options for GVK Thermal Power (Goindwal Sahib) Plant are as follows

Option II

New permanent wet chimney above each Absorber.

Option III

Separate new wet chimney over ground for each absorber.

Option IV.

Using Existing chimney by converting it to Wet Chimney by applying appropriate corrosion protection lining and to avoid loss of generation a temporary chimney may be provided above each absorber or on ground.

Final selection of chimney may only be made after conducting a lifecycle cost benefit analysis and seeing technical feasibility of available options before opting for either of above option.

Corrosion Protection Lining for Chimney:

Currently there are various lining material are available in the industry which can resist the sulfur based acids and which can be used for corrosion protection as mentioned below.

i. Borosilicate Block lining
ii. Steel Alloy lining
iii. Glass flake filled epoxy phenol novolac .
iv. Glass flake lining etc.

GVK THERMAL POWER (GOINDWAL SAHIB) PLANT is advised to study "the cases of failure" of all lining material used for corrosion protection for various sections of FGD system. The life cycle cost analysis for selection of these materials may be done considering these failure studies for optimum selection.

****

Amended and Restated Power Purchase Agreement
between

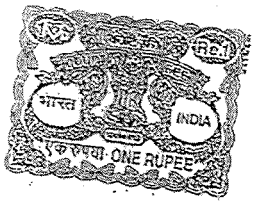
Punjab State Electricity Board
(the "Procurer ")

And

GVK Power (Goindwal Sahib) Limited
(the "Seller")

Date:26/05/2009

2x270MW COAL FIRED THERMAL POWER PLANT AT
GOINDWAL SAHIB, DISTRICT TARN TARAN
PUNJAB



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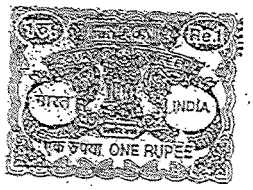
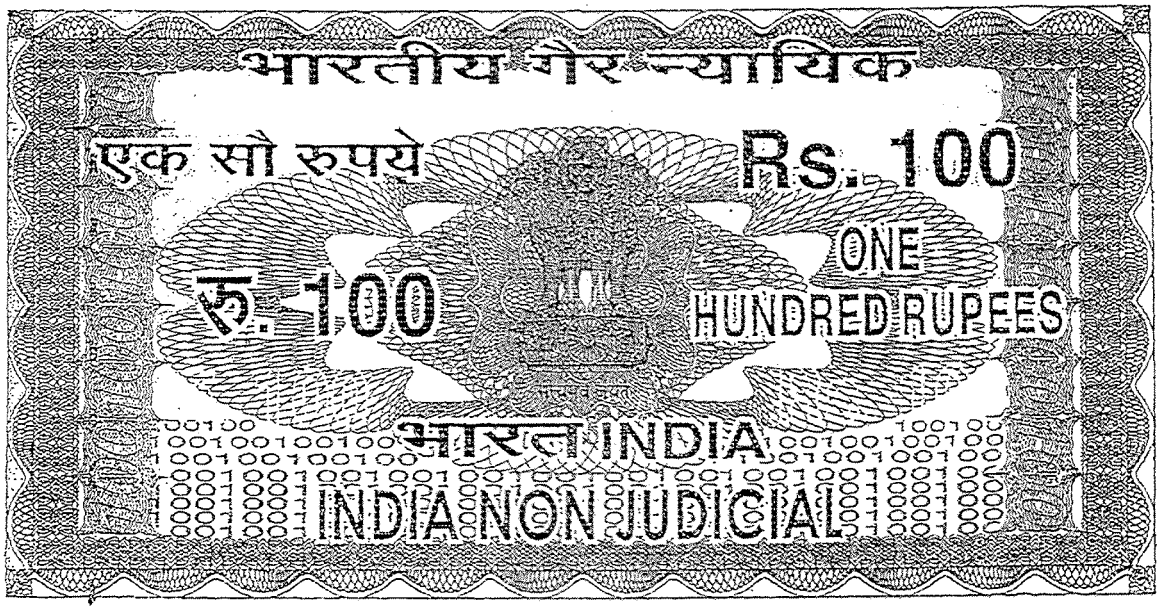




आंध्रप्रदेश आन्ध्र प्रदेश ANDHRA PRADESH Saleema AA 241197

S.No. 3624 Date 23/05/2009 Rs. 100

Name V. Mohan

S/o. W/o. D/o. Shankar

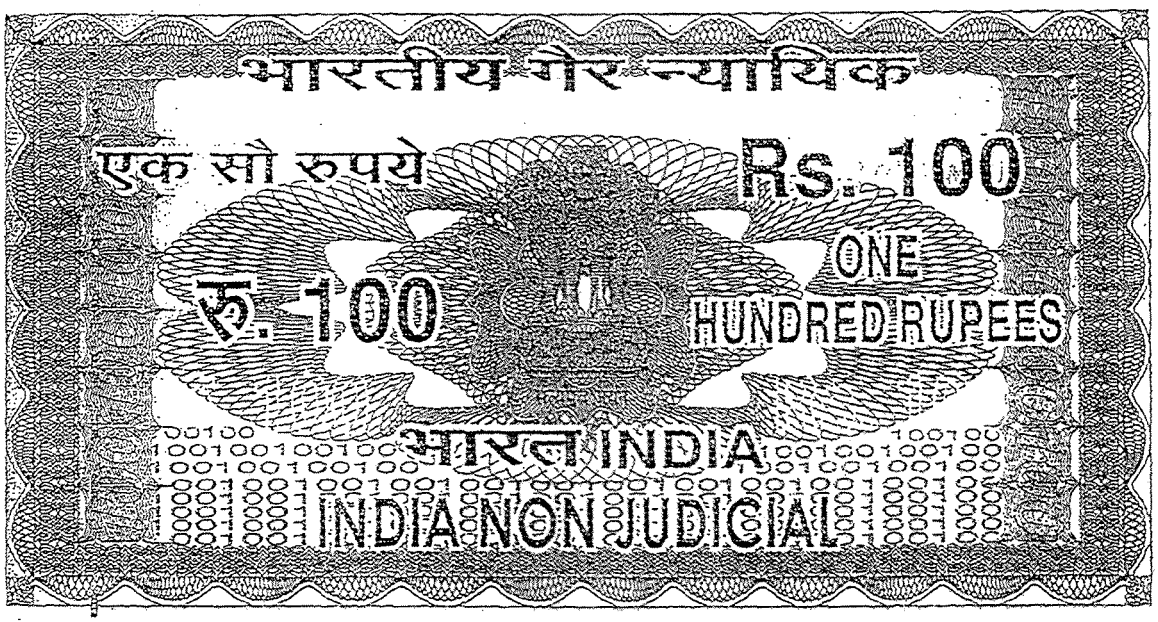
For Whom GVK Power (Goindwal Sahib) Ltd. Sec-bad

SALEEMA ANJUM
STAMP VENDOR
S.V.L.No.3/2009
H.No.13-4-661/A,
KARWAN, HYDERABAD.

This Amended and Restated Power Purchase Agreement (the "Agreement") is entered into on this 26th day of May 2009 between

1. **Punjab State Electricity Board,** a Board established under The Electricity (Supply) Act 1948, having its Head Office at "The Mall, Patiala - 147 001, Punjab, India" (hereinafter referred to as the "**Procurer**", which expression unless repugnant to the context or meaning thereof shall be deemed to include its successors, and permitted assigns) of the first part ; and

2. **GVK Power (Goindwal Sahib) Limited,** a Company incorporated under The Companies Act, 1956, having its registered office at **"Paigah House", 156-159, Sardar Patel Road, Secunderabad- 500 003, Andhra Pradesh, India"** (hereinafter referred to as the **"Seller"**, which expression unless repugnant to the context or meaning thereof shall be deemed to include its successors, and permitted assigns) of the second part. hereinafter referred to as "Party" or "Parties" as appropriate;



ఆంధ్రప్రదేశ్ आन्ध्र प्रदेश ANDHRA PRADESH Saleema AA 241198

S.No. 3625 Date 23/05/2009 Rs. 100

Name V. Mohan

S/o W/o D/o Shankar

For Whom G.V.K. Power (Goindwal Sahib) Ltd Secbad

SALEEMA ANJUM
STAMP VENDOR
S.V.L.No.3/2009
H.No.13-4-661/A,
KARWAN, HYDERABAD.

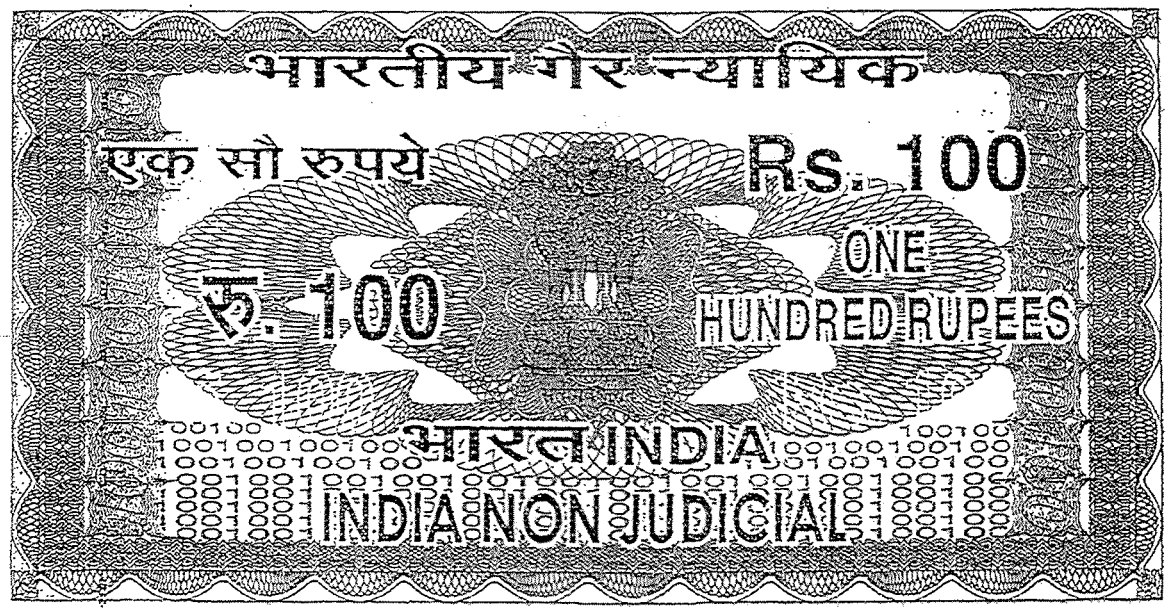
Whereas:

The Government of Punjab and the Procurer had invited proposals during the year 1996 to establish a coal based power station with an Installed Capacity of approximately 462.5 MW at Goindwal Sahib, Amritsar District in the state of Punjab, India and the Seller having been selected by the Government of Punjab and the Procurer on the basis of International Competitive Bidding has accepted the invitation of the Government of Punjab and the Procurer to Build, Own and Operate the coal based power station;

Whereas the Procurer and the Seller entered into a Power Purchase Agreement (PPA) on 17th April 2000.

Whereas the Parties have entered into a Memorandum of Understanding on 8th February 2006 and have agreed to modify the Power Purchase Agreement dated 17th April 2000 to incorporate among other things the revised capacity 2 x 250 MW (+20%) of the Power Station agreed between the Parties, adoption of CERC norms for Tariff calculation and schedule for achieving commercial operation of Unit-1 & Unit-2 of the Power Station;

Whereas the Punjab State Electricity Regulatory Commission ("PSERC") (hereinafter referred to as "Commission") was established after the signing of the Power Purchase



आंध्रप्रदेश आन्ध्र प्रदेश ANDHRA PRADESH Saleema AA 241199

S.No. 3676 Date 23/05/2009 Rs. 100

Name V. Mohan

S/o. W/o. D/o. Shankar

For Whom GVK Power (Goindwal Sahib) Ltd. Secbad

SALEEMA ANJUM
STAMP VENDOR
S.V.L.No.3/2009
H.No.13-4-661/A,
KARWAN, HYDERABAD.

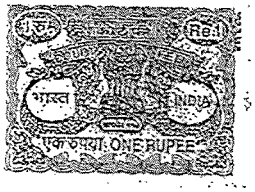
Agreement (PPA) dated 17th April 2000 and PSERC is empowered to regulate electricity purchase and procurement process of the Procurer, the terms and conditions of this Agreement including the price at which electricity shall be procured from the Seller

Whereas the Seller has agreed to sell the entire Contracted Capacity and energy generated by the Project to the Procurer and the Procurer has agreed to purchase the Contracted Capacity and scheduled energy from the Seller in accordance with the terms and conditions of this Amended and Restated Power Purchase Agreement

Whereas subsequently the Seller filed Petition for an amendment in the capacity of the Project to 2x270 MW from 2x300 MW indicated in the Amended & Restated PPA initialled between the Parties in January,2007, and accordingly the Contracted Capacity of the project shall now be 2x270 MW.

Whereas the Project has been since allotted the Tokisud North Sub Block as a captive coal mine and a part of Saregarha Block in the state of Jharkhand for supply of coal to the Project;

Whereas the PSERC had issued the order dated 29.04.08 in case of Petition No. 4 of 2007 filed by M/s GVK for approval of capital cost of the project and M/s GVK filed an Appeal



No. 104 of 2008 in the Appellate Tribunal for Electricity against this order to which the Tribunal has issued the order dated 08.04.2009 allowing additional costs to M/s GVK.

Whereas the estimated costs as approved by PSERC and additional costs allowed by Appellate Tribunal shall now be indicated in the estimated cost listed in the Schedule-11.

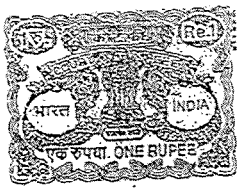
Whereas the Parties mutually desire to amend and restate the Power Purchase Agreement dated 17th April 2000 and enter into this Agreement, as per the order of the PSERC dated 06 March 2009 on Petition no. 3 of 2007 filed for approval of the initialed Amended and Restated PPA between the Parties;

Whereas M/s GVK Power (Goindwal Sahib) Ltd. filed the Appeal No. 70 of 2009 in the Appellate Tribunal for Electricity against the order of PSERC dated 06.03.09 which is yet to be decided.

Whereas M/s GVK Power also filed an Interim Application No. 167 of 2009 before the Appellate Tribunal to allow them to sign the Amended & Restated PPA as per the order of PSERC dated 6.3.2009 without prejudice to their right to appeal.

Whereas the Appellate Tribunal has issued the order dated 19.05.09 against I.A. No. 167 of 2009 allowing both the parties to sign the Amended & Restated PPA as per the order of PSERC dated 6.3.2009 and reserving the right to appeal of both the parties in any Court of Law.

Now therefore, in consideration of the premises and mutual agreements, covenants and conditions set forth herein, it is hereby agreed by and between the Parties, in supercession of all agreements, letters, communications and the like, anterior to this Agreement, as follows:



ARTICLE 1: DEFINITIONS AND INTERPRETATION

1.1 *Definitions*

The terms used in this Agreement, unless as defined below or repugnant to the context, shall have the same meaning as assigned to them by the Electricity Act, 2003 and the rules or regulations framed there under, including those issued/framed by Appropriate Commission (as defined hereunder), as amended or re-enacted from time to time.

The following terms when used in this Agreement shall have the respective meanings, as specified below:

"Act" or "Electricity Act 2003"	means the Electricity Act 2003 or any amendments made to the same or any succeeding enactment thereof;
"Agreed Form"	means, in relation to any document, the form of the said document most recently agreed to by the Parties and initialled by them for identification;
"Agreement" or "Power Purchase Agreement" or "PPA"	means this document including its recitals and Schedules;
"Appropriate Commission"	means the Punjab State Electricity Regulatory Commission (PSERC) or its successors;
"Availability Based Tariff" or "ABT"	Shall mean all the regulations contained in the Central Electricity Regulatory Commission (terms and conditions of Tariff) Regulations as applicable.
"Availability Factor" or "Availability"	shall have the meaning ascribed thereto in ABT ;
"Available Capacity"	shall have the meaning ascribed thereto in ABT;
"Auxiliary Energy Consumption or AUX"	means, in relation to a period in case of a generating station means, the quantum of energy consumed by auxiliary equipment of the generating station and transformer losses within the generating station expressed as a percentage of the sum of the gross energy generated at the generator terminals of all the Units of the generating station.
"Bill Dispute Notice"	means the notice issued by a Party raising a Dispute regarding a Monthly Bill or a Supplementary Bill issued by the other Party;
"Business Day"	means with respect to the Seller and the Procurer, a day other than Sunday or a statutory holiday, on which the banks remain open for business in the State in which the Procurer's registered office is

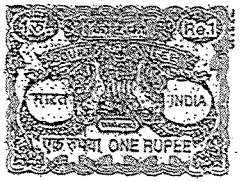
located;

"Capacity Charge" or "Capacity Charges"	shall have meaning ascribed thereto in Schedule 6
"Capacity Notice"	shall have the meaning ascribed thereto under ABT or the Grid Code;
'Capital Cost'	means actual capital cost of the Project on a relevant date which shall not be later than the Commercial Operation Date of the Power Station, as certified by the auditors appointed jointly by the Seller and Procurer and as approved by PSERC. provided that Capital Cost shall always exclude cost overruns arising due to a Seller Event of Default, or costs due to events for which compensation has been received by the Seller from the Procurer or Insurers or third parties; Provided further that the Capital Cost in relation to a Unit shall be the Capital Cost allocated in proportion to the Contracted Capacity of the said Unit.
'Capital Structure Schedule'	shall mean sources of finance used to finance the Capital Cost as provided in the Financing Agreements;
"Captive Coal Mine(s)"	means the Tokisud North Sub Block" in the Hazaribagh District of Jharkhand State in India, and any other coal mine/block allocated by the Government of India for supplying coal to the Project and associated fuel transport system up to the Power Station; "
"Central Transmission Utility" or "CTU"	shall have the meaning ascribed thereto in the Electricity Act, 2003;
"CERC"	means the Central Electricity Regulatory Commission, as defined in the Electricity Act, 2003, or its successors;
"CERC Tariff Regulations"	Means the regulations formed by CERC under section 178 of the Electricity Act, 2003 and titled the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations as applicable.
"CERC Norms"	means the norms for determination of tariff for the coal based power stations under the CERC (Terms and conditions of Tariff) Regulations as applicable.
"Change in Law"	shall have the meaning ascribed thereto in Article 13.1.1;
"Commercial Operation	means, in relation to a Unit, the date one day after the date when the

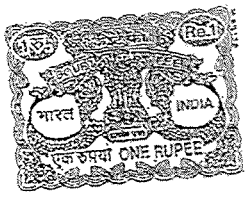
Date" or "COD"	Procurer receives a Final Test Certificate of the Independent Engineer as per the provisions of Article 6.3.1 and in relation to the Power Station shall mean the date by which such Final Test Certificates as per Article 6.3.1 are received by the Procurer for all the Units;
"Commissioning" or "Commissioned" with its grammatical variations	means, in relation to a Unit, that the Unit or in relation to the Power Station, all the Units of the Power Station have passed the Commissioning Tests successfully;
"Commissioning Tests" or "Commissioning Test"	means the tests provided in Schedule 4 herein;
"Commissioned Unit"	means the Unit in respect of which COD has occurred;
"Construction Contractor/s"	means one or more main contractors, appointed by the Seller to design, engineer, supply, construct and commission the Project;
"Construction Period"	means the period from (and including) the date upon which the Construction Contractor is instructed or required to commence work under the Construction Contract up to (but not including) the Commercial Operation Date of the Unit in relation to a Unit and of all the Units in relation to the Power Station;
"Consultation Period"	means the period, commencing from the date of issue of a Seller Preliminary Default Notice or a Procurer Preliminary Default Notice as provided in Article 14 of this Agreement, for consultation between the Parties to mitigate the consequence of the relevant event having regard to all the circumstances
"Contract Year"	means the period beginning on the Effective Date (as defined hereunder) and ending on the immediately succeeding March 31 and thereafter each period of 12 months beginning on April 1 and ending on March 31 provided that :

(i) in the financial year in which Scheduled COD of the first Unit would have occurred, a Contract Year shall end on the date immediately before the Scheduled COD of the first Unit and a new Contract Year shall begin once again from the Scheduled Commercial Operation Date of the first Unit and end on immediately succeeding March 31 and provided further that

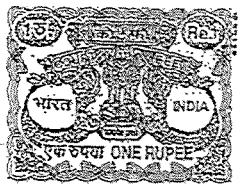
(ii) the last Contract Year of this Agreement shall end on the last day of the term of this Agreement;



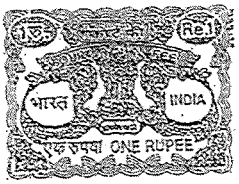
"Contracted Capacity"	means a) (i) for the first Unit, [270] MW; (ii) for the second Unit, [270] MW; rated capacity and in relation to the Power Station as a whole means [540] MW rated capacity at the generator terminals of the units. or such rated capacities as may be determined in accordance with Article 6.3.4 or Article 8.2 of this Agreement;
"Control Centre" or "Nodal Agency"	means the RLDC or SLDC or such other load control centre designated by the Procurer from time to time through which the Procurer shall issue Dispatch Instructions to the Seller for the Power Station;
"Debt Service"	means the amounts which are due under the Financing Agreements by the Seller to the Lenders, expressed in Rupees (with all amounts denominated in currencies other than Rupees being converted to Rupees at the Reference Exchange Rate, the selling rate in Rupees for the Foreign Currency on the relevant day, as notified by the State Bank of India as its TT Rate at 12:00 noon on the Notice to Proceed);
"Declared Capacity"	In relation to a Unit or the Power Station at any time means the net capacity of the Unit or the Power Station at the relevant time (expressed in MW at the Interconnection Point) as declared by the Seller in accordance with the Grid Code and dispatching procedures as per the Availability Based Tariff;
" Delivery Point " or "Interconnection Point"	means the points of delivery specified in Schedule 7 for fulfilling the obligation of the Seller to deliver the Contracted Capacity less Auxiliary Energy Consumption to the Procurer;
"Direct Non-Natural Force Majeure Event"	shall have the meaning ascribed thereto in Article 12.3(ii)(1).
"Dispute"	means any dispute or difference of any kind between the Procurer and the Seller, in connection with or arising out of this Agreement including any issue on the interpretation and scope of the terms of this Agreement as provided in Article 17;
"Dispatch Instruction"	means any instruction issued by the Procurer through the respective SLDC and RLDC to the Seller, in accordance with applicable Grid



	Code and this Agreement;
"Due Date"	means the thirtieth (30th) day after a Monthly Bill or a Supplementary Bill is received and duly acknowledged by the Procurer (or, if such day is not a Business Day, the immediately succeeding Business Day) by which date such bill is payable by the Procurer;
"Effective Date"	means the date of signing of this Agreement by the Parties;
"Electricity Laws"	means the Electricity Act, 2003 and the rules and regulations made thereunder from time to time along with amendments thereto and replacements thereof and any other Law pertaining to electricity including regulations framed by the Appropriate Commission;
"Electrical Output"	means the net electrical output of the Power Station at the Delivery Point, as expressed in kWh;
"Emergency"	means a condition or situation that, in the opinion of the Procurer or RLDC or SLDC or the agency responsible for operating and maintaining the Interconnection and Transmission Facilities or the transmission company, as the case may be, poses a significant threat to the Procurer's or the said agency's or transmission company's ability to maintain safe, adequate and continuous electricity supply to its customers, or seriously endangers the security of persons, plant or equipment;
Energy Charges	shall have the meaning ascribed to this term under Schedule - 6
"Energy Output"	means for any period, the Energy Units actually delivered by the Project, as metered at the Interconnection Point, reduced by the Energy Units supplied by the Procurer to the Seller at the Interconnection Point or to any Project facility for which the Seller is responsible located inside or outside the Project boundary such as raw water or other pumping stations;
"Expiry Date"	means the 25th anniversary of the Commercial Operation Date of the Power Station. For the avoidance of doubt, in case the COD of the Power Station occurs on June 1, 2013, then the 25th anniversary of the Scheduled COD of the Power Station shall occur on June 1, 2038, i.e. in the Contract Year 2038-39;
"Final Test Certificate"	means a) a certificate of the Independent Engineer certifying and accepting the results of a Commissioning Test/s in accordance with Article 6.3.1 of this Agreement; or b) a certificate of the Independent Engineer certifying the result of a Repeat Performance Tests in accordance with Article 8.2.1 of this Agreement;

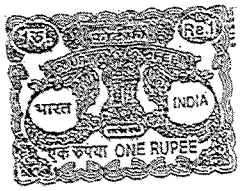


"Financial Closure" or "Financial Close"	means the execution of all the Financing Agreements required for the Project and fulfilment of conditions precedents and waiver, if any, of any of the conditions precedent for the initial draw down of funds there under.
"Financing Agreements"	means all the loan agreements, notes, indentures, security agreements, letters of credit and other documents relating to the financing of the Project on or before the COD of the Power Station, as may be amended, modified, refinanced or replaced from time to time, but without in anyway increasing the liabilities of the Procurer therein;
"Force Majeure"	shall have the meaning ascribed thereto in Article 12.3;
"Forced Outage"	shall have the meaning ascribed thereto in Grid Code;
"Fuel"	means primary fuel used to generate electricity namely, domestic coal
"Fuel Supply Agreements"	means the agreement(s) entered into between the Seller and the Fuel Supplier for the purchase, transportation and handling of the Fuel, required for the operation of the Power Station. In case the transportation of the Fuel is not the responsibility of the Fuel Supplier, the term shall also include the separate agreement between the Seller and the Fuel Transporter for the transportation of Fuel in addition to the agreement between the Seller and the Fuel Supplier for the supply of the Fuel;
"Functional Specifications"	means the technical requirements and parameters described in Schedule 3 of this Agreement and as provided in Grid Code relating to the operation, maintenance and dispatch of any Unit and the Power Station;
"Grid Code" or "IEGC"	means any set of regulations or codes issued by Appropriate Commission as amended and revised from time to time and legally binding on the Seller' and theProcurer' governing the operation of the Grid System or any succeeding set of regulations or code;
"Grid System"	means the Interconnection and Transmission Facilities and any other transmission or distribution facilities through which the Procurer's supply electricity to their customers or the transmission company transmits electricity to the Procurer;
"Independent Engineer"	means an independent consulting engineering firm or group appointed jointly by the Procurer and the Seller to carry out the functions in accordance with Article 4.7.1 and Article 6, Article 12 and Article 8 herein.



	functions in accordance with Article 4.7.1 and Article 6, Article 12 and Article 8 herein. provided that separate Independent Engineer may be appointed for the purposes of Article 4.7.1, Article 6, Article 12 and Article 8; provided further that the separate Independent Engineer may be appointed for each financial year for the purposes of Article 8, and in such case, such Independent Engineer shall be appointed at least ninety (90) days prior to the beginning of the financial year.
"Indirect Non-Natural Force Majeure Event"	shall have the meaning ascribed thereto in Article 12.3(ii)(2).
"Indian Governmental Instrumentality"	means the GOI, Government of Punjab, and any ministry or, department or board or agency other regulatory or quasi-judicial authority controlled by GOI or Government of Punjab where the Procurer and Project are located and includes the Appropriate Commission;
"Infirm Power"	means energy produced by a generating unit and delivered to the Procurer prior to the Commercial Operation Date of such generating unit;
"Initial Consents"	shall mean the consents listed in Schedule 2;
"Initial Performance Retest Period"	shall have the meaning ascribed thereto in Article 6.3.3 of this Agreement;
"Interconnection Facilities" or "Interconnection and Transmission Facilities"	means the facilities on the Procurer's side of the Interconnection Point for receiving and metering Electrical Output in accordance with this Agreement and which shall include, without limitation, all other transmission lines and associated equipment, transformers and associated equipment, relay and switching equipment and protective devices, safety equipment and, subject to Article 9, the Metering System required for the Project. The Interconnection Facilities also include the facilities for receiving power at the Delivery Point where the transmission line from the Power Station Switchyard end is injecting power into the transmission network (including the dedicated transmission line connecting the Power Station with the STU /CTU transmission network) ;

"Invoice" or "Bill"	means either a Monthly Tariff Invoice, a Supplementary Invoice or a Procurer Invoice;
"Late Payment Surcharge"	shall have the meaning ascribed thereto in Article 11.3.4;
"Law"	means, in relation to this Agreement, all laws including Electricity Laws in force in India and any statute, ordinance, regulation, notification or code, rule, or any interpretation of any of them by an Indian Governmental Instrumentality and having force of law and shall further include all applicable rules, regulations, orders, notifications by an Indian Governmental Instrumentality pursuant to or under any of them and shall include all rules, regulations, decisions and orders of the Appropriate Commission ;
"Lenders"	means the banks, other financial institutions, multilateral agencies, RBI registered non banking financial companies, mutual funds and agents or trustees of debenture / bond holders, including their successors and assignees, who have agreed as on or befor COD of the power station to provide the Seller with the senior debt financing described in the Capital Structure Schedule, and any successor banks or financial institutions to whom their interests under the Financing Agreements may be transferred or assigned: Provided that, such assignment or transfer shall not relieve the Seller of its obligations to the Procurer under this Agreement in any manner and shall also does not lead to an increase in the liability of the Procurer;
"Letter of Credit" or "L/C"	shall have the meaning ascribed thereto in Article 11.4.1;
"Meters" or "Metering System"	means meters used for accounting and billing of electricity in accordance with Central Electricity Authority (Installation and Operations of Meters) Regulations, 2006, Grid Code and ABT, as amended from time to time;
"Maintenance Outage"	shall have the meaning as ascribed to this term as per the provisions of the Grid Code.
"MCR"	means gross Power Station or Unit Maximum Continuous Rating as defined in the Grid Code;
"Minimum Offtake Guarantee"	means guaranteed offtake of sixty five per cent (65%) of the total



	contracted capacity for the procurer during a contract year.
"Month"	means a period of thirty (30) days from (and excluding) the date of the event, where applicable, else a calendar month;
"Monthly Bill" or "Monthly Invoice"	means a monthly invoice comprising Capacity Charges (applicable after COD of the first unit) and Energy Charges, including incentive and penalty, as per Schedule 6 hereof;
"Natural Force Majeure Event"	shall have the meaning ascribed thereto in Article 12.3(i).
" Non-Natural Force Majeure Event"	shall have the meaning ascribed thereto in Article 12.3(ii).
"Normative Availability"	means equal to eighty per cent (80%) Availability at the Delivery Point on Contract Year basis[8].
"Operating Period"	in relation to the Unit means the period from its COD and in relation to the Power Station the date by which all the Units achieve COD, until the expiry or earlier termination of this Agreement in accordance with Article 2 of this Agreement;
"O&M Contract" or "O&M Contracts"	means the contract/s entered into by the Seller with the Operator or operators, if any;
"Operating Procedures "	shall have the meaning ascribed thereto in Grid Code;
"Operator" or "Operators"	means one or more contractors appointed as operator of power generation facilities of the Power Station pursuant to an O&M contract, if any;
"Party" and "Parties"	shall have the meaning ascribed thereto in the recital to this Agreement;
"Performance Guarantee"	means the irrevocable unconditional bank guarantee, submitted and to be submitted by the Seller to the Procurer from a scheduled bank specified by the Procurer , in the form attached hereto as Schedule 9, in accordance with Article 3 of this Agreement and which shall include the additional bank guarantee furnished by the Seller under this Agreement;
"Performance Test "	means the test carried out in accordance with Article 1.2 of Schedule 4 of this Agreement;
"Preliminary Default Notice"	shall have the meaning ascribed thereto in Article 14 of this agreement;
"Power Station"	means the:

(a) Thermal power generation facility comprising of any or all the Units;

(b) any associated fuel handling, treatment or storage facilities of the power generation facility referred to above;

(c) any water supply, treatment or storage facilities required for the operation of the power generation facility referred to above;

(d) the ash disposal system including ash dyke [as applicable];

(e) township area for the staff colony; and

(f) bay/s for transmission system in the switchyard of the power station,

(g) all the other assets, buildings/structures, equipments, plant and machinery, facilities and related assets required for the efficient and economic operation of the power generation facility;

whether completed or at any stage of development and construction or intended to be developed and constructed as per the provisions of this Agreement.

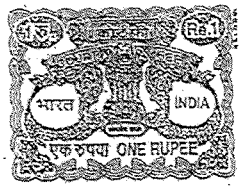
"Project" means the coal based Thermal Power Station to be established at Goindwal Sahib undertaken for design, financing, engineering, procurement, construction, operation, maintenance, repair, refurbishment, development and insurance by the Seller in accordance with the terms and conditions of this Agreement;

"Project Documents" mean

a) Construction Contracts;
b) Fuel Supply Agreements including the Fuel Transportation Agreement,
c) O&M contracts;

d) any other agreements designated in writing as such, from time to time , jointly by the Procurer and the Seller;

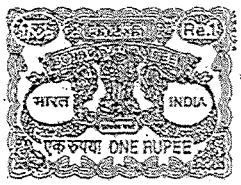
"Prudent Utility Practices" means the practices, methods and standards that are generally accepted internationally from time to time by electric utilities for the purpose of ensuring the safe, efficient and economic design, construction, commissioning, operation and maintenance of power generation equipment of the type specified in this Agreement and which practices, methods and standards shall be adjusted as



	necessary, to take account of: a) operation and maintenance guidelines recommended by the manufacturers of the plant and equipment to be incorporated in the Project; b) the requirements of Indian Law; and c) the physical conditions at the Site;
"Repeat Performance Test "	shall have the meaning ascribed thereto in Article 8.1 of this agreement;
"RPC"	means the relevant Regional Power Committee established by the Government of India for a specific Region in accordance with the Electricity Act, 2003 for facilitating integrated operation of the power system in that Region;
"RBI"	means Reserve Bank of India;
"Regional Energy Accounts" or "REA"	means as defined in the Grid Code and issued by the relevant RPC secretariat or other appropriate agency for each Week and for each Month (as per their prescribed methodology), including the revisions and amendments thereof;
"RLDC"	means the relevant Regional Load Dispatch Centre as defined in the Electricity Act, 2003, in the region in which the Project is located;
"Rupees" or "Rs."	means the lawful currency of India;
"SBAR"	means the prime lending rate per annum applicable for loans with one (1) year maturity as fixed from time to time by the State Bank of India. In the absence of such rate, any other arrangement that substitutes such prime lending rate as mutually agreed to by the Parties;
"Selectee"	means a new company (i) proposed by the Lenders pursuant to Schedule 10 hereof and approved by the Procurer (ii) or proposed by the Procurer in accordance with Schedule 10 hereof and approved by the Lenders, for substituting the Seller for the residual period of the PPA by amendment of the PPA or by execution of a fresh PPA in accordance with the terms and conditions contained in the said Schedule.
"SERC"	means the State Electricity Regulatory Commission, as defined in the Electricity Act, 2003, or its successors;
"Scheduled COD" or "Scheduled Commercial Operation	means the date on or before which COD of a Generating Unit is required to occur, which shall be thirty six (36) Months from the date of Financial Closure for the First Generating Unit and six (6)

Date"	months from the COD of the First Generating Unit for the Second Generating Unit or such other dates from time to time, specified in accordance with the provisions of this Agreement;
"Scheduled Connection Date"	Shall mean the date falling 210[10] days before the Scheduled COD of first Unit;
"Scheduled Energy" or "Scheduled Generation"	means scheduled generation as defined in the ABT;
"Scheduled Outage"	shall have the meaning ascribed to this term as per the provisions of the Grid Code;
"Scheduled Synchronisation Date"	means in relation to a Unit, the date, which shall be maximum of one hundred and eighty (180) days prior to the Scheduled COD of the respective Unit;
"Settlement Period"	means the time block for issue of daily generation and drawal schedules as provided in ABT;
Site	means the land over which the Project will be developed as provided in Schedule 1;
"SLDC"	means the relevant State Load Dispatch Centre as defined in the Electricity Laws, in the State where the Procurer's registered office is located;
"State Transmission Utility" or "STU"	shall have the meaning ascribed thereto in the Electricity Act 2003;
"Supplementary Bill"	means a bill other than a Monthly Bill raised by any of the Parties in accordance with Article 11;
"Tariff Payment"	means the payments under Monthly Bills as referred to in Schedule 6 and the relevant Supplementary Bills;
"Tariff"	means the tariff as computed in accordance with Schedule 6 and approved by PSERC.
"Tested Capacity"	in relation to a Unit, or the Power Station as a whole (if all the Units of the Power Station have been Commissioned) means the results of the most recent Performance Test or Repeat Performance Test carried out in relation to the Power Station in accordance with Article 6, Article 8 and Schedule 4 of this Agreement;
"Termination Notice"	shall mean the notice given before termination of this Agreement in accordance with relevant clauses of this Agreement
"Term of Agreement"	shall have the meaning ascribed thereto in Article 2.1;

"Total Debt Amount"	Means the sum of the following amounts, expressed in Rupees (with all amounts denominated in currencies other than Rupees being converted to Rupees at the Reference Exchange Rate, the selling rate in Rupees for the Foreign Currency on the relevant day, as notified by the State Bank of India as its TT Rate at 12:00 noon on the date of issuance of Substitution Notice by the Lenders (a) the principal amount of the senior debt incurred by the Seller (as per the terms of the Financing Agreements) to finance the Project according to the Capital Structure Schedule which remains outstanding on the date of issuance of Substitution Notice by the Lender after taking account of any senior debt repayments which could have been made out of the Monthly Tariff Payments received by the Seller on or before the date of issuance of Substitution Notice by the Lender as per the terms provided in the Financing Agreements ; and (b) all accrued interest and financing fees payable under the Financing Agreements on the amounts referred to in (a) above from the date of the Capacity Charge payment (as specified in paragraph 1.2 of Schedule 6 hereof) immediately preceding the date of issuance of Substitution Notice by the Lender or, if the Capacity Charges have not yet fallen due to be paid, from the most recent date when interest and financing fees were capitalised, and (c) if this Agreement is terminated during the Construction Period, any amounts owed to the Construction Contractor for work performed but not paid for under the Construction Contract (other than amounts falling due by reason of the Seller's default);
"Unit"	Means one steam generator, steam turbine, generator and associated auxiliaries of the Power Station
"Unscheduled Interchange" or "UI"	shall have the meaning ascribed thereto in Rule 24 of the CERC (Terms and Conditions of Tariff) Regulations as applicable.
"Week"	means a calendar week commencing from 00:00 hours of Monday, and ending at 24:00 hours of the following Sunday;
"Wheeling Charges" or "Transmission Charges"	are the charges paid by the Procurer to the CTU or STU or any other agency for the transfer of power from the Power Station switchyard end to the Procurer's network.



1.2 *Interpretation*

Save where the contrary is indicated, any reference in this Agreement to:

1.2.1 A "Recital", an "Article", a "Schedule" and a "paragraph/Clause" shall be construed as a reference to a Recital, an Article, a Schedule and a paragraph/clause respectively of this Agreement.

1.2.2 An "affiliate" of any party shall mean a company that either directly or indirectly controls or is controlled by or is under common control of the same person which controls the concerned party; and control means ownership by one company of at least twenty six percent (26%) of the voting rights of the other company.

1.2.3 A "crore" means a reference to ten million (10,000,000) and a "lakh" means a reference to one tenth of a million (1,00,000);

1.2.4 An "encumbrance" shall be construed as a reference to a mortgage, charge, pledge, lien or other encumbrance securing any obligation of any person or any other type of preferential arrangement (including, without limitation, title transfer and retention arrangements) having a similar effect.

1.2.5 "indebtedness" shall be construed so as to include any obligation (whether incurred as principal or surety) for the payment or repayment of money, whether present or future, actual or contingent;

1.2.6 A "person" shall be construed as a reference to any person, firm, company, corporation, society, trust, government, state or agency of a state or any association or partnership (whether or not having separate legal personality) of two or more of the above and a person shall be construed as including a reference to its successors, permitted transferees and permitted assigns in accordance with their respective interests.

1.2.7 The "winding-up", "dissolution", "insolvency", or "reorganization" of a company or corporation shall be construed so as to include any equivalent or analogous proceedings under the Law of the jurisdiction in which such company or corporation is incorporated or any jurisdiction in which such company or corporation carries on business including the seeking of liquidation, winding-up, reorganization, dissolution, arrangement, protection or relief of debtors.

1.2.8 Words importing the singular shall include the plural and vice versa.

1.2.9 This Agreement itself or any other agreement or document shall be construed as a reference to this or to such other agreement or document as it may have been, or may from time to time be, amended, varied, novated, replaced or supplemented.

1.2.10 A Law shall be construed as a reference to such Law including its amendments or re-enactments from time to time.

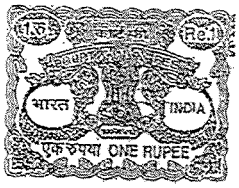
1.2.11 A time of day shall, save as otherwise provided in any agreement or document be construed as a reference to Indian Standard Time.

1.2.12 Different parts of this Agreement are to be taken as mutually explanatory and supplementary to each other and if there is any inconsistency between or among the parts of this Agreement, they shall be interpreted in a harmonious manner so as to give effect to each part.

1.2.13 The tables of contents and any headings or sub-headings in this Agreement have been inserted for ease of reference only and shall not affect the interpretation of this Agreement.

1.2.14 All interest payable under this Agreement shall accrue from day to day and be calculated on the basis of a year of three hundred and sixty five (365) days.

1.2.17 The words "hereof" or "herein", if and when used in this Agreement shall mean a reference to this Agreement.



2 ARTICLE 2 : TERM OF AGREEMENT

2.1 *Effective Date and Term of Agreement*

This Agreement shall come into effect from the Effective Date. This Agreement shall be valid for a term commencing from the Effective Date until the Expiry Date ("Term of Agreement") unless terminated earlier pursuant to Article 2.2. Upon the occurrence of the Expiry Date, this Agreement shall, subject to Article 18.9, automatically terminate, unless mutually, extended by the Parties on mutually agreed terms and conditions, atleast one hundred and eighty (180) days prior to the Expiry Date, subject to approval of the Appropriate Commission, as necessary.

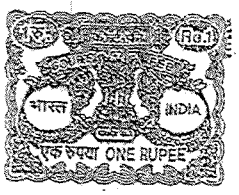
2.2 *Early Termination*

This Agreement shall terminate before the Expiry Date:

i. if either the Procurer or Seller exercises a right to terminate, pursuant to Article 3.3.2, Article 3.3.3, , Article 4.5.3, , Article 14.4.5 or Schedule 8 of this Agreement or any other provision of this Agreement; or
ii. in such other circumstances as the Seller and the Procurer may agree, in writing.

2.3 *Survival*

2.3.1 The expiry or termination of this Agreement shall not affect accrued rights and obligations of the Parties under this Agreement, including the right to receive Liquidated Damages as per the terms of this Agreement, nor shall it affect any continuing obligations for which this Agreement provides, either expressly or by necessary implication, the survival of, post its expiry or termination.



3 ARTICLE 3 : CONDITIONS SUBSEQUENTTO BE SATISFIED BY THE SELLER AND THE PROCURER

3.1 *Satisfaction of conditions subsequent by the Seller and the Procurer*

3.1.1 Prior to the Effective Date, the Seller have provided to the Procurer, the Performance Guarantee from any of the banks specified by the Procurer, of an aggregate amount of Rupees 40.5 crores. Subject to Article 3.4, the Performance Guarantee shall be initially valid till three (3) Months after the Scheduled COD of the Power Station and which shall be extended from time to time to be valid up to three (3) Months after the actual COD of the Power Station. In case the validity of Performance Guarantee is expiring before the validity period specified in this Article, the Seller shall at least thirty (30) days before the expiry of the Performance Guarantee replace the Performance Guarantee with another Performance Guarantee or extend validity of existing Performance Guarantee which is valid and in force till the validity period specified in this Article.

3.1.2 The Seller agrees and undertakes to duly perform and complete the following activities within 12 (twelve) Months from the Effective Date unless such completion is affected due to any Force Majeure event or if any of the activities is specifically waived in writing by the Procurer :

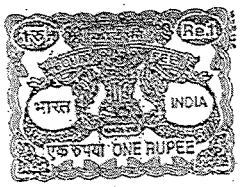
i). the Seller shall have received the Initial Consents as mentioned in Schedule 2, either unconditionally or subject to conditions which do not materially prejudice its rights or the performance of its obligations under this Agreement ;

ii) the Seller shall have executed Fuel Supply Agreement and provided the copies of the same to the Procurer;

iii)the Seller shall have

a) awarded the main plant contract for boiler, turbine and generator ("BTG"), for the Project and shall have given to such contractor an irrevocable notice to proceed ; and

b) the Seller shall have achieved Financial Closure;



iv. the Seller shall have made available to the Procurer the data with respect to the Project for design of Interconnection Facilities and Transmission Facilities, if required;

v. the Seller shall have finalised the specific delivery point for supply of power in consultation with the Procurer;

vi. the Seller shall have taken the possession of the land for the Power Station and have paid the Price of the Land, if any to the State Government authority acquiring the land,

vii. the Seller shall have provided an irrevocable letter to the Lenders duly accepting and acknowledging the rights provided to the Lenders under the terms of this Agreement and all other Project Documents.

3.1.3 **Joint responsibilities of the Procurer and the Seller**

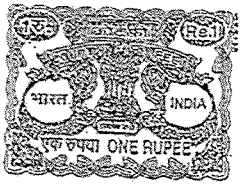
The Procurer and Seller shall jointly appoint the Independent Engineer for the purposes of carrying out the functions as specified in Article 4.7.1, Article 6, Article 8 and Article 12, herein within a period of eight (8) months from the Effective Date.

3.2 *Progress Reports*

The Seller and the Procurer shall notify one another in writing at least once a Month on the progress made in satisfying the conditions in Articles 3.1.2, and 3.1.3.

3.3 *Consequences of non-fulfillment of conditions under Article 3.1*

3.3.1 If any of the conditions specified in Article 3.1.2 is not duly fulfilled by the Seller even within three (3) Months after the time specified under Article 3.1.2, then on and from the expiry of such period and until the Seller has satisfied all the conditions specified in Article 3.1.2, the Seller shall be liable to furnish to the Procurer additional weekly Performance Guarantee of Rs. 2.025 crores within two (2) business days of expiry of every such week. Such additional Performance Guarantee shall become part of the Performance Guarantee and all the provisions of this Agreement shall be construed accordingly. The Procurer shall be entitled to hold and/or invoke the Performance Guarantee, including such increased Performance Guarantee, in accordance with the provisions of this Agreement.



3.3.2 Subject to Article 3.3.3 if:

(i). fulfilment of any of the conditions specified in Article 3.1.2 is delayed beyond the period of three (3) Months and the Seller fails to furnish any additional Performance Guarantee to the Procurer in accordance with Article 3.3.1 hereof; or

(ii). the Seller furnishes additional Performance Guarantee to the Procurer in accordance with Article 3.3.1 hereof but fails to fulfil the conditions specified in Article 3.1.2 for a period of eight (8) months beyond the period specified therein,

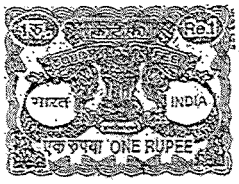
the Procurer or Seller shall have the right to terminate this Agreement by giving a Termination Notice to the Seller / Procurer in writing of at least seven (7) days.

If the Procurer or the Seller elect to terminate this Agreement in the event specified in the preceding paragraph of this Article 3.3.2, the Seller shall be liable to pay to the Procurer an amount of Rupees 54 crores only as liquidated damages. The Procurer shall be entitled to recover this amount of damages by invoking the Performance Guarantee to the extent of Rupees 54 crores and shall then return the balance Performance Guarantee, if any, to the Seller. If the Procurer is unable to recover the said amount of Rupees 54 crores or any part thereof from the Performance Guarantee the amount not recovered from the Performance Guarantee, if any, shall be payable by the Seller to the Procurer within ten (10) days from the end of eight (8) Months period from the due date of completion of conditions subsequent.

It is clarified for removal of doubt that this Article shall survive the termination of this Agreement.

3.3.3 In case of inability of the Seller to fulfil the conditions specified in Article 3.1.2 due to any Force Majeure event, the time period for fulfilment of the Condition Subsequent as mentioned in Article 3.1.2 shall be extended for the period of such Force Majeure event, subject to a maximum extension period of ten (10) Months, continuous or non-continuous in aggregate. Thereafter, this Agreement may be terminated by either the Procurer or the Seller by giving a notice of at least seven (7) days, in writing to the other Party.

3.3.4 Due to the provisions of Article 3.3.3 if there is any increase in the time period for completion of Conditions Subsequent mentioned under Article 3.1.2 there



shall be an equal increase in the time period for Scheduled COD and Scheduled Connection Date.

3.4 *Reduction in the amount of Performance Guarantee*

3.4.1 On the due fulfilment by the Seller of all the conditions specified under Article 3.1.2 and investment by the Seller of at least twenty five percent (25%) of the total equity required for the Project as certified by the lead lender of the Seller, the Performance Guarantee then existing shall be reduced by an aggregate amount of Rupees 13.5 crores. for the period specified in Article 3.4.2.

3.4.2 The Performance Guarantee specified in Article 3.4.1 hereof shall be in substitution of the earlier Performance Guarantee furnished under Article 3.1.1

The Performance Guarantee furnished under this Article shall be initially valid till three (3) Months after the Scheduled COD of the Power Station and which shall be extended from time to time to be valid upto three (3) Months after the actual COD of the Power Station.

3.4.3 The Performance Guarantee furnished under Article 3.1, 3.3 and 3.4 shall be for guaranteeing the due and timely completion of the Project and achievement of Scheduled Commercial Operation Date of each Unit within the time specified in this Agreement.

3.4.4 The failure on the part of the Seller to furnish and maintain the Performance Guarantee as mentioned above shall be a material breach of the term of this Agreement on the part of the Seller.

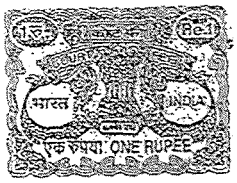
3.4.5 If the Seller fails to achieve COD of each of the Units on their respective Scheduled Commercial Operation Date specified in this Agreement, subject to conditions mentioned in Article 4.5.1, the Procurer shall have the right to encash the Performance Guarantee and appropriate in its favour as liquidated damages an amount specified in Article 4.6.1, without prejudice to the other rights of the Procurer under this Agreement.

3.5 *Return of Performance Guarantee*

3.5.1 The Performance Guarantee as submitted by Seller in accordance with Article 3.4 shall be released by the Procurer within three (3) Months from the actual Commercial Operation Date of the Power Station. In the event of delay in achieving Scheduled COD of any of the Units by the Seller (otherwise than due to Force Majeure event) and consequent part invocation of the Performance Guarantee by the Procurer, the Procurer shall release the Performance Guarantee if any, remaining unadjusted under Article 3.4, after the satisfactory completion by the Seller of all the requirements regarding

achieving the Scheduled Commercial Operation Date of the remaining Units of the Power Station. It is clarified that the Procurer shall also return/release the Performance Guarantee in the event of (i) applicability of Article 3.3.2 to the extent the Performance Guarantee is valid for an amount in excess of Rupees 54 crores, or (ii) termination of this Agreement under Article 3.3.3.

3.5.2 The release of the Performance Guarantee shall be without prejudice to other rights of the Procurer under this Agreement.



4 ARTCLE 4 : DEVELOPMENT OF THE PROJECT

4.1 *The Seller's obligation to build, own and operate the Project*

4.1.1 Subject to the terms and conditions of this Agreement, the Seller undertakes to be responsible, at Seller's own cost and risk, for:

a) obtaining the Initial Consents and maintaining in full force and effect all Consents required by it pursuant to this Agreement and Indian Law;

b) executing the Project in a timely manner so as to enable each of the Units and the Power Station as a whole to be Commissioned no later than its Scheduled Commercial Operations Date and such that as much of the Contracted Capacity as can be made available through the use of Prudent Utility Practices will be made available reliably to meet the Procurer's scheduling and dispatch requirements throughout the term of this Agreement

c) owning the Project throughout the term of this Agreement free and clear of encumbrances, except those expressly permitted by Article 16;

d) procure the requirements of electricity at the Project (including construction, commissioning and start-up power) and to meet in a timely manner all formalities for getting such a supply of electricity;

e) provide on a timely basis relevant information on Power Station specifications which may be required for interconnecting system with the transmission system;

f) fulfilling all other obligations undertaken by him under this Agreement.

4.2 Procurer's obligation

Subject to the terms and conditions of this Agreement, the Procurer:

a) shall be responsible for procuring the Interconnection and Transmission Facilities[14] to enable the Power Station to be connected to the Grid System not later than the Scheduled Connection Date;

b) shall ensure that the Seller is provided an electrical connection for reasonable construction, commissioning and start up power at the Project as reasonably requisitioned by the Seller by written intimation to the Procurer, on the then prevalent terms and conditions as applicable to such consumers.;

c) shall be responsible for payment of the Transmission Charges and RLDC and SLDC charges;

d) shall make all reasonable arrangements for the evacuation of the Infirm Power from the Power Station; subject to the availability of transmission lines and

e) fulfilling obligations undertaken by them under this Agreement.

4.2 Purchase and sale of Available Capacity and Scheduled Energy

4.3.1 (a) Subject to the terms and conditions of this Agreement, the Seller undertakes to sell to the Procurer, and the Procurer undertakes to pay the Tariff for all of the Available Capacity up to the Contracted Capacity and Scheduled Energy of the Power Station, throughout the term of this Agreement.

b) Prior to the Commercial Operation Date of any generating Unit, the Seller shall sell and the Procurer shall purchase all the Infirm Power produced by that generating Unit for the consideration which shall be as per clause 1.2.9 of Schedule 6.

4.3.2Unless otherwise instructed by the Procurer , the Seller shall sell all the Available Capacity up to the Contracted Capacity of the Power Station pursuant to Dispatch Instructions.

4.4 Right to Available Capacity and ScheduledEnergy

4.4.1 Subject to other provisions of this Agreement, the entire Contracted Capacity of the Power Station and all the Units of the Power Station shall at all times be for the exclusive benefit of the Procurer and the Procurer shall have the exclusive right to purchase the entire Contracted Capacity from the Seller. The Seller shall not grant to any third party or allow any third party to obtain any entitlement to the Available Capacity and/or ScheduledEnergy

4.4.2 Notwithstanding Article 4.4.1, the Seller shall be permitted to sell power, being a part of the Available Capacity of the Power Station to third parties if:

(a) there is a part of Available Capacity which has not been Dispatched by the Procurer, ordinarily entitled to receive such part;

4.4.3 If the Procurer does not avail of power upto the Available Capacity provided by the Seller and the provisions of Article 4.4.2 have been complied with, the Seller shall be entitled to sell such Available Capacity not procured, to any person without losing the right to receive the Capacity Charges from the Procurer for such un-availed Available Capacity. In such a case, the sale realization in excess of Energy Charges,

shall be equally shared by the Seller with the Procurer. In the event, the Seller sells such Available Capacity to the shareholders of the Seller or any direct or indirect affiliate of the Seller/shareholders of the Seller without obtaining the prior written consent of the Procurer, the Seller shall be liable to sell such Available Capacity to such entity at tariffs being not less than the Tariff payable by the ProcurerIn such case, fifty percent (50%) of the excess over Energy Charges recovered by the Seller from sale to third party shall be retained by the Seller and the balance fifty percent (50%) shall be provided by the Seller to the Procurer/s During this period, the Seller will also continue to receive the Capacity Charges from the Procurer. Upon the Procurers intimating to the Seller of its intention and willingness to avail of the part of the Available Capacity not availed of and therefore sold to the third party, the Seller shall, notwithstanding anything contained in the arrangement between the Seller and said third party, commence supply of such capacity to the Procurer/s from the later of two (2) hours from receipt of notice in this regard from the Procurer/s or the time for commencement of supply specified in such notice.

4.4.4 The Seller shall not itself use any of the electricity generated by the Power Station during the term of this Agreement, except for the purpose of meeting the Power Station's auxiliary load requirements, as per the norms laid down by theAppropriate Commission and load requirements of the housing colony for the staff.

4.4.5 The sale under Unscheduled Interchange shall not be considered as sale to third party for the purposes of this Agreement.

4.5 Extensions of time

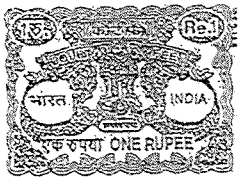
4.5.1 In the event that:

(a) the Seller is prevented from performing its obligations under Article 4.1.1(b) by the stipulated date, due to any Procurer Event of Default; or

(b) a Unit cannot be Commissioned by its Scheduled Commercial Operations Date because of Force Majeure Events.

the Scheduled Commercial Operations Date, the Scheduled Connection Date and the Expiry Date shall be deferred, subject to the limit prescribed in Article 4.5.3, for a reasonable period but not less than 'day for day' basis, to permit the Seller through the use of due diligence, to overcome the effects of the Force Majeure Events affecting the Seller or in the case of the Procurer's Event of Default, till such time such default is rectified by the Procurer.

4.5.2 If the Parties have not agreed, within thirty (30) days after the affected Party's performance has ceased to be affected by the relevant circumstance, on how long the Scheduled Commercial Operation Date, the Scheduled Connection



Date or the Expiry Date should be deferred by, any Party may raise the Dispute to be resolved in accordance with Article 17.

4.5.3 In case of extension occurring due to reasons specified in Article 4.5.1(a), the original Scheduled Commercial Operation Date of any Unit or the original Scheduled Commercial Operations Date of the Power Station as a whole, would not be extended by more than two (2) years or the date on which the Seller elects to terminate this Agreement, whichever is earlier.

As a result of such extension, the date newly determined shall be deemed to be the Scheduled Commercial Operations Date for the purposes of this Agreement.

4.6 Liquidated damages for delay in providing Contracted Capacity

4.6.1 If any Unit is not Commissioned by its Scheduled Commercial Operation Date other than for the reasons specified in Article 4.5.1, the Seller shall pay to the Procurer liquidated damages, for the delay in such Commissioning or making the Unit's Contracted Capacity available for dispatch by such date. The sum total of the liquidated damages payable by the Seller to the Procurer for such delayed Unit shall be calculated as follows:

$SLDb = [CCun \times dn \times DR1]$, if $dn <= 60$

$SLDb = [CCun \times 60 \times DR1] + [CCun \times (dn - 60) \times DR2]$, if $dn > 60$

Where:

a) "SLDb" are the liquidated damages payable by the Seller during the period beginning with the day from the Scheduled Commercial Operation Date of a Unit up to and including the day on which Unit is actually Commissioned;

b) "CCun" is the Contracted Capacity of Unit "n";

c) "d" is the number of days in the period beginning with the day after the Scheduled Commercial Operation Date of Unit "n" up to and including the day on which such Unit is actually Commissioned;

d) "DR1" is Rs. Ten Thousand (10,000) of damages per MW per day of delay in case "d" is less than 60 days and "DR2" is Rs. Fifteen Thousand (15,000) of damages per MW per day of delay in case "d" is equal to or more than 60 days

4.6.2 The Seller's maximum liability under this Article 4.6 shall be limited to the amount of liquidated damages calculated in accordance with Article 4.6.1 for

and upto twelve (12) Months of delay for the Unit. Provided that in case of failure of the Seller to Commission the Unit even after expiry of twelve (12) Months from its Scheduled Commercial Date, the provisions of Article 14 shall apply.

4.6.3 The Seller shall pay the amount calculated pursuant to Article 4.6.1 to the Procurer within ten (10) days of the earlier of:

(a) the date on which the Unit is actually Commissioned; or
(b) expiry of the twelve (12) month period mentioned in Article 4.6.2.

If the Seller fails to pay the amount of damages within the said period of ten (10) days, the Procurer shall be entitled to recover the said amount of the liquidated damages by invoking the Performance Guarantee. If the then existing Performance Guarantee is for an amount which is less than the amount of the liquidated damages payable by the Seller to the Procurer under this Article 4.6, then the Seller shall be liable to forthwith pay the balance amount.

4.6.4 The Parties agree that the formula specified in Article 4.6.1 for calculation of liquidated damages payable by the Seller under this Article 4.6, read with Article 14 is a genuine and accurate pre-estimation of the actual loss that will be suffered by the Procurer in the event of Seller's delay in achieving Commissioning of a Unit by its Scheduled COD.

4.7 Liquidated damages for delay due to Procurer Event of Default and Non Natural Force Majeure Events and Natural Force Majeure Event (affecting the Procurer)

4.7.1 If

a) a Unit cannot be commissioned by its Scheduled Commercial Operations Date, due to a Procurer Event of Default or due to Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer) provided such Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer/s) has continued for a period of more than three (3) continuous or non-continuous Months; or

b) a Unit is available for conducting Commissioning Tests and is anticipated to be capable of duly completing the Commissioning Tests as certified by the Independent Engineer, but the said Commissioning Tests are not undertaken or completed due to such Procurer Event of Default or due to Non Natural Force Majeure Event (or Natural Force

Majeure affecting the Procurer) provided such Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer) has continued for a period of more than three (3) continuous or non-continuous Months:

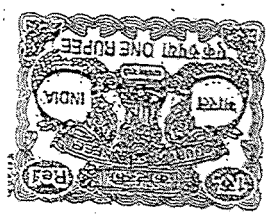
such Unit shall, until the effects of the Procurer Event of Default or of Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer) no longer prevent the Seller from undertaking a Commissioning Test/s, be deemed to have a Tested Capacity equal to the Contracted Capacity and to this extent, be deemed to have been Commissioned with effect from the Scheduled COD without taking into account delay due to such Procurer Event of Default or Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer) and shall be treated as follows.

a) In case of delay on account of the Procurer Event of Default, the Procurer shall make payment to the Seller of Capacity Charges calculated on Normative Availability of Contracted Capacity of such Unit for and during the period of such delay

b) In case of delay on account of Direct Non Natural Force Majeure Event, the Procurer shall make payment to the Seller of Capacity Charges calculated on Normative Availability of Contracted Capacity of such Unit for the period of such events in excess of three (3) continuous or non-continuous Months in the manner provided in (d) below.

c) In case of an Indirect Non Natural Force Majeure Event (or Natural Force Majeure affecting the Procurer), the Procurer shall make payments for amounts ("Debt Service") relatable to such Unit, which are due under the Financing Agreements, subject to a maximum of Capacity Charges based on Normative Availability, for the period of such events in excess of three (3) continuous or non-continuous Months in the manner provided in (d) below.

d) In case of delay due to Direct and Indirect Non Natural Force Majeure Events (or Natural Force Majeure affecting the Procurer), the Procurer shall be liable to make payments mentioned in (b) and (c) above, after Commissioning of the Unit, in the form of an increase in Capacity Charges. Provided such increase in Capacity Charges shall be determined by Appropriate Commissionon the basis of putting the Seller in the same economic position as the Seller would have been in case the Seller had been paid amounts mentioned in (b) and (c) above in a situation where the Direct Non Natural Force Majeure or Indirect Non Natural Force Majeure Event, as the case may be, had not occurred.



For the avoidance of doubt, it is specified that the charges payable under this Article 4.7.1 shall be paid by the Procurer as per the Contracted Capacity.

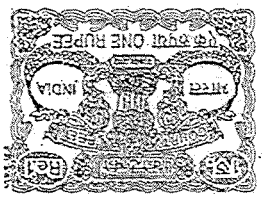
4.7.2 In every case referred to in Article 4.7.1 hereinabove, the Seller shall undertake a Commissioning Test/s as soon as reasonably practicable [and in no event later than two (2) weeks or such longer period as mutually agreed between the Seller and the Procurer] after the point at which it is no longer prevented from doing so by the effects of Force Majeure Events or Procurer Event of Default (as appropriate) and if such Commissioning Test/s is not duly completed and / or demonstrate/s a Tested Capacity of a Unit which is less than ninety five (95) percent of its Contracted Capacity, then:

a) The Unit which fails the Commissioning Tests, shall be deemed to have not been Commissioned from the deemed COD referred to in Article 4.7.1;
b) The Seller shall repay to the Procurer, all sums received by way of Capacity Charge for such Unit along with interest at the same rate as Late Payment Surcharge; and
c) If the Seller fails to achieve Commissioning by the Scheduled Commercial Operation Date, it shall also pay liquidated damages to the Procurer for such Unit calculated in accordance with Article 4.6.

4.8 Limit on amounts payable due to default

4.8.1 The Parties expressly agree that the Procurer's only liability for any loss of profits or any other loss of any other kind or description whatsoever (except claims for indemnity under Article 15), suffered by the Seller by reason of the Procurer's failure to meet its obligations under Article 4.2(a) to Article 4.2(d) shall be to pay the Seller the amounts specified in Article 4.7 and Article 14.

4.8.2 Similarly, Seller's only liability for any loss suffered by the Procurer of any kind or description whatsoever (except claims for indemnity under Article 15), by reason of the Seller's failure to meet its obligations of Commissioning the various Units on their Scheduled COD, shall be as per Article 4.6 and Article-14.



5 ARTICLE 5 : CONSTRUCTION

5.1 *Seller's Construction Responsibilities*

The Seller shall be responsible for designing, constructing, erecting, commissioning, completing and testing the Power Station in accordance with the following, it being clearly understood that in the event of inconsistency between two or more of the following, the order of priority as between them shall be the order in which they are placed, with 'applicable law' being the first:

a) applicable Law;
b) the Grid Code;
c) the terms and conditions of this Agreement;
d) the Functional Specifications; and
e) Prudent Utility Practices.

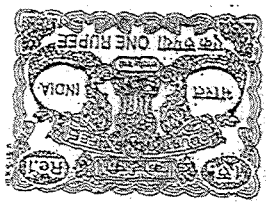
Notwithstanding anything to the contrary contained in this PPA, the Seller shall ensure that the technical parameters or equipment limits of the Project shall always be subject to the requirements as specified in points (a) to (e) above and under no event shall over-ride or contradict the provisions of this Agreement and shall not excuse the Seller from the performance of his obligations under this Agreement.

5.2 *The Site*

The Seller acknowledges that, before entering into this Agreement, it has had sufficient opportunity to investigate the Site and accepts full responsibility for its condition (including but not limited to its geological condition, on the Site, the adequacy of the road and rail links to the Site and the availability of adequate supplies of water) and agrees that it shall not be relieved from any of its obligations under this Agreement or be entitled to any extension of time or financial compensation by reason of the unsuitability of the Site for whatever reason.

5.3 *Information Regarding Interconnection Facilities*

The Procurer shall provide the Seller, on a timely basis, all information with regard to the Interconnection and Transmission Facilities as is reasonably necessary to enable the Seller to design, install and operate all interconnection plant and apparatus on the Seller's side of the Interconnection Point.



5.4 *Quality of Workmanship*

The Seller shall ensure that the Power Station is designed, built and completed in a good workmanlike manner using sound engineering construction practices and using only materials and equipment that are new and of international utility grade quality such that, the useful life of the Power Station will be till the Expiry Date.

The Seller shall ensure that design, construction and testing of all equipment, facilities, components and systems of the Project shall be in accordance with Indian Standards and Codes issued by Bureau of Indian Standards and/or internationally recognised Standards and Codes, such as:

i. American National Standards Institute (ANS)
ii. American Society of Testing and Materials (ASTM)
iii. American Society of Mechanical Engineers (ASME)
iv. American Petroleum Institute (API)
v. Standards of the Hydraulic Institute, USA
vi. International Organization for Standardization (ISO)
vii. Japanese Industrial Standards (JIS)
viii. Tubular Exchanger Manufacturer's Association (TEMA)
ix. American Welding Society (AWS)
x. National Electrical Manufacturers Association (NEMA)
xi. National Fire Protection Association (NFPA)
xii. International Electro-Technical Commission (IEC)
xiii. Expansion Joint Manufacturers Association (EJMA)
xiv. Heat Exchange Institute (HEI)
xv. American Water Works Association (AWWA)
xvi. Deutsches Institut fur Normung (DIN)

Other international standards, established to be equivalent or superior to the above standards shall also be acceptable. However, in the event of any conflict between the requirements of the international codes and standards and the requirements of the Indian standards/regulations, the latter shall prevail.

5.5 *Consents*

The Seller shall be responsible for obtaining all Consents (other than those required for the Interconnection and Transmission Facilities) and the Initial Consents required for developing, financing, constructing, operating and maintenance of the Project and maintaining/ renewing all such Consents in

order to carry out its obligations under this Agreement in general and this Article 5 in particular and shall supply the Procurer promptly with copies of each application that it submits, and copy/ies of each consent/approval/license which it obtains. For the avoidance of doubt, it is clarified that the Seller shall also be responsible for maintaining/renewing the Initial Consents and for fulfilling all conditions specified therein.

5.6 *Construction Documents*

The Seller shall retain at the Site and make available for inspection to the Procurer at all reasonable times copies of the results of all tests specified in Schedule 4 hereof.

5.7 *Co-ordination of Construction Activities*

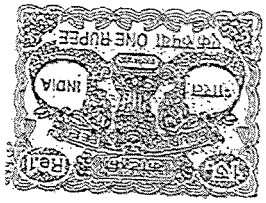
5.7.1 Before the tenth (10th) day of each Month, during the Construction Period:

(a) the Seller shall prepare and submit to the Procurer a monthly progress report, in the Agreed Form; and

(b) The Procurer shall prepare and submit to the Seller a monthly progress report, in the Agreed Form, regarding the Interconnection and Transmission Facilities.

The Seller and the Procurer shall designate from time to time, by giving a written notice to the other Party up to five (5) of its/their employees who shall be responsible for coordinating all construction activities relating to the Project and who shall have access at all reasonable times to the other Party's land for the purpose of apprising the progress of the work being carried on, subject to such designated persons or the Party appointing them giving reasonable notice to the other Party of such visit and subject to their complying with all reasonable safety procedures.

For the avoidance of doubt, it is clarified that the total number of the representatives of the Procurer shall not exceed five (5).



6 ARTICLE 6 : SYNCHRONISATION, COMMISSIONING AND COMMERCIAL OPERATION

6.1 *Synchronization*

6.1.1 The Seller shall give the Procurer and RLDC or SLDC at least sixty (60) days advance preliminary written notice and at least thirty (30) days advance final written notice, of the date on which it intends to synchronise a Unit to the Grid System.

6.1.2 Subject to Article 6.1.1, a Unit may be synchronised by the Seller to the Grid System when it meets all connection conditions prescribed in any Grid Code then in effect and otherwise meets all other Indian legal requirements for synchronisation to the Grid System

6.2 *Commissioning*

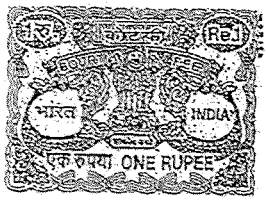
6.2.1 The Seller shall be responsible for ensuring that each Unit is Commissioned in accordance with Schedule 4 at its own cost, risk and expense.

6.2.2 The Seller shall give the Procurer and the Independent Engineer not less than ten (10) days prior written notice of Commissioning Test of each Unit.

6.2.3 The Seller, the Procurer and the Independent Engineer (individually) shall each designate qualified and authorised representatives to witness and monitor Commissioning Test of each Unit.

6.2.4 Testing and measuring procedures applied during each Commissioning Test shall be in accordance with the codes, practices and procedures mentioned in Schedule 4 of this Agreement.

6.2.5 Within five (5) days of a Commissioning Test, the Seller shall provide the Procurer and the Independent Engineer with copies of the detailed Commissioning Test results. Within five (5) days of receipt of the Commissioning Test results, the Independent Engineer shall provide to the Procurer and the Seller in writing, his findings from the evaluation of Commissioning Test results, either in the form of Final Test Certificate certifying the matters specified in Article 6.3.1 or the reasons for non-issuance of Final Test Certificate.



6.3 Commercial Operation

6.3.1 A Unit shall be Commissioned on the day after the date when the Procurer receives a Final Test Certificate of the Independent Engineer stating that:

a) the Commissioning Tests have been carried out in accordance with Schedule -4 and are acceptable to him; and

b) the results of the Performance Test show that the Unit's Tested Capacity, is not less than ninety five (95) percent of its Contracted Capacity, as existing on the Effective Date. .

6.3.2 If a Unit fails a Commissioning Test, the Seller may retake the relevant test, within a reasonable period after the end of the previous test, with three (3) day's prior written notice to the Procurer and the Independent Engineer. Provided however, the Procurer shall have a right to require deferment of any such re-tests for a period not exceeding fifteen (15) days, without incurring any liability for such deferment, if the Procurer are unable to provide evacuation of power to be generated, due to reasons outside the reasonable control of the Procurer or due to inadequate demand in the Grid.

6.3.3 The Seller may retake the Performance Test by giving at least fifteen (15) days advance notice in writing to the Procurer, up to eight (8) times, during a period of one hundred and eighty (180) days ("Initial Performance Retest Period") from a Unit's COD in order to demonstrate an increased Tested Capacity over and above as provided in Article 6.3.1 (b). Provided however, the Procurer shall have a right to require deferment of any such re-tests for a period not exceeding fifteen (15) days, without incurring any liability for such deferment, if the Procurer are unable to provide evacuation of power to be generated, due to reasons outside the reasonable control of the Procurer or due to inadequate demand in the Grid.

6.3.4 (i) If a Unit's Tested Capacity after the most recent Performance Test mentioned in Article 6.3.3 has been conducted, is less than its Contracted Capacityas existing on the Effective Date, the Unit shall be de-rated with the following consequences in each case with effect from the date of completion of such most recent test:

a) the Unit's Contracted Capacity shall be reduced to its Tested Capacity, as existing at the most recent Performance Test referred to in Article 6.3.3

and Capacity Charges shall be paid with respect to such reduced Contracted Capacity;

b) the Seller shall not be permitted to declare the Available Capacity of the Unit at a level greater than its Tested Capacity;

c) the Availability Factor of the derated Unit shall be calculated by reference to the reduced Contracted Capacity; and

d) the Capital Cost and each element of the Capital Structure Schedule shall be reduced in proportion to the reduction in the Contracted Capacity of the Power Station as a result of that derating (taking into account the Contracted Capacity of any Unit which has yet to be Commissioned).

(ii) If at the end of Initial Performance Retest Period or the date of the eighth Performance Test mentioned in Article 6.3.3, whichever is earlier, , the Tested Capacity is less than the Contracted Capacity as existing on the Effective Datethe consequences mentioned in Article 8.2.2 shall apply for a period of one year. Provided that such consequences shall apply with respect to the Tested Capacity existing at the end of Initial Performance Retest Period or the date of the eighth Performance Test mentioned in Article 6.3.3, whichever is earlier

6.3.5 If a Unit's Tested Capacity as at the end of the Initial Performance Retest Period or the date of the eighth Performance Test mentioned in Article 6.3.3, whichever is earlier, is found to be more than it's Contracted Capacity as existing on the Effective Date, the Tested Capacity shall be deemed to be the Unit's Contracted Capacity if the Procurer agrees and intimates the same to the Seller within thirty (30) days of receipt of the results of the last Performance Test to purchase such excess Tested Capacity and also provide to the Seller additional Letter of Credit and Collateral Arrangement for payments in respect of such excess Tested Capacity agreed to be purchased by the Procurer. In case the Procurer decides not to purchase such excess Tested Capacity, the Seller shall be free to sell such excess Tested Capacity to any third party and the Unit's Contracted Capacity shall remain unchanged, notwithstanding that the Tested Capacity exceeded the Contracted Capacity.

Provided that in all the above events, the Seller shall be liable to obtain/maintain all the necessary consents (including Initial Consents), permits

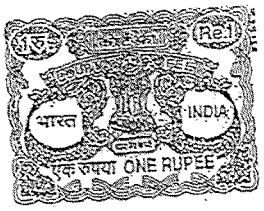
and approvals including those required under the environmental laws for generation of such excess Tested Capacity.

6.4 *Costs Incurred*

The Seller expressly agrees that all costs incurred by him in synchronising, connecting, Commissioning and / or Testing or Retesting a Unit shall be solely and completely to his account and the Procurer's liability shall not exceed the amount of the Energy Charges payable for such power output, as set out in Schedule 6.

7 ARTICLE 7 : OPERATION AND MAINTENANCE

The Parties shall comply with the provisions of the applicable Law including, in particular, Grid Code as amended form time to time regarding operation and maintenance of the Power Station and all matters incidental thereto. Provided however the Seller shall not schedule the Maintenance Outage of a Unit when another Unit of the project is shut down or expected to be shut down except under Force Majeure or when the operation of Unit is not permissible due to technical considerations.



8 ARTICLE 8: CAPACITY, AVAILABILITY AND DISPATCH

8.1 Repeat Performance Tests

8.1.1 The Procurer may from time to time during the Operating Period, but only if the Available Capacity has not been one hundred per cent (100%) of the Contracted Capacity of the commissioned units (excluding the unit(s) under planned outage for capital maintenance in consultation with the Regional Power Committee, if any) even for one continuous period of at least three (3) hours during any three continuous months, require the Seller to demonstrate a Unit's or (if all the Units have been Commissioned, the Power Station's) Tested Capacity by carrying out a further Performance Test (a "**Repeat Performance Test**") in accordance with this Article 8.1. A Repeat Performance Test shall be carried out in accordance with Schedule 4, save that the test shall last twenty-four (24) hours instead of seventy two (72) hours. Provided that if the Tested Capacity after such test is less than one hundred percent (100%) of the Contracted Capacity as existing on the Effective Date of the Commissioned Units, the Seller shall also have a right to conduct not more than two (2) Repeat Performance Test within a period six (6) months, by giving a notice of not less than fifteen (15) days to the Procurer for each such test. Provided that the Procurer shall have a right to require deferment of each such re-tests for a period not exceeding five (5) days, without incurring any liability for such deferment, if the Procurer are unable to provide evacuation of power to be generated, due to reasons outside the reasonable control of the Procurer or due to inadequate demand in the Grid.

8.1.2 The Procurer shall give the Seller not less than seven (7) days' advance written notice of the time when a Repeat Performance Test of a Unit (or if all the Units have been Commissioned, of the Power Station's) is to begin. A Repeat Performance Test may not be scheduled for any period when the Unit to be tested is due to undergo a Scheduled Outage.

8.1.3 The Procurer and Seller shall jointly appoint the Independent Engineer to monitor the Repeat Performance Test and to certify the results in accordance with Article 8.2.

8.1.4 If the Seller wishes to take any Unit, out of service for repair before a Repeat Performance Test, it shall inform the Procurer in writing before its scheduled start of the repairs and the estimated time required to complete the repairs. The Parties shall then schedule a Maintenance Outage in accordance with the Grid

Code to enable the Seller to carry out those repairs and in such a case, the Procurer, , shall defer the Repeat Performance Test until such Unit is returned to service following that Maintenance Outage. Provided however the Seller shall not schedule the Maintenance Outage of a Unit when another Unit of the project is shut down or expected to be shut down except under Force Majeure or when the operation of Unit is not permissible due to technical considerations.

8.1.5 The Procurer, may for reasonable cause, defer any Repeat Performance Test for up to fifteen (15) days from the date originally notified to the Seller in accordance with Article 8.1.2 if the Procurer notifies the Seller in writing at least one (1) day before the Repeat Performance Test starts, the reason for the deferral and when the test is to be rescheduled.

Provided that, such deferment shall be permitted only once in respect of each of the Repeat Performance Tests.

8.1.6 The Seller, the Procurer and the Independent Engineer individually shall have the right to designate qualified and authorised representatives (but not more than three each) to monitor the Repeat Performance Test.

8.1.7 Testing and measurement procedures applied during the Repeat Performance Test shall be in accordance with the codes, practices of procedures as generally/normally applied for the Performance Tests.

8.1.8 Within five (5) days of a Repeat Performance Test, the Seller shall provide the Procurer and the Independent Engineer with copies of the detailed test results.

8.1.9 Within one (1) Month of the date by which all the Units have been Commissioned, the Seller shall conduct a Performance Test of the Power Station (hereinafter referred to as "Power Station Performance Test") whereafter the provisions of Article 8.2 shall apply. A Power Station Performance Test shall be carried out in accordance with Article 1.1 of Schedule 4, save that the test shall last twenty-four (24) hours instead of seventy two (72) hours.

8.2 Derating

8.2.1 A Repeat Performance Test shall be concluded when the Procurer receives the Final Test Certificate of the Independent Engineer stating that the Repeat Performance Test has been carried out satisfactorily in accordance with Schedule 4 and certified the Unit's (or if all the Units have been

commissioned), the Power Station's) then current Tested Capacity as demonstrated by the results of the Repeat Performance Test.

8.2.2 (i) If a Unit's (or if all the Units have been Commissioned, of the Power Station's) then current Tested Capacity as established by the Repeat Performance Test and the Final Test Certificate issued by the Independent Engineer, is less than its Contracted Capacity as existing on the Effective Date, the Seller shall not be permitted to declare the Available Capacity of the Unit (or if all the Units have been Commissioned, of the Power Station's) at a level greater than its Tested Capacity, in which case:

a) the Unit's (or if all the Units have been Commissioned, of the Power Station's) Contracted Capacity shall be reduced to its most recent Tested Capacity and Capacity Charges shall be paid with respect to such reduced Contracted Capacity.

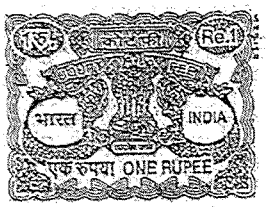
b) the Availability Factor of the derated Unit (or if all the Units have been Commissioned, of the Power Station's) shall be calculated by reference to the reduced Contracted Capacity, and:

c) the Capital Cost and each element of the Capital Structure Schedule shall be reduced in proportion to the reduction in the Contracted Capacity of the Power Station as a result of that derating (taking into account the Contracted Capacity of any Unit which has yet to be Commissioned);

(ii) The consequences mentioned in sub-Article (i) above shall apply from the completion date of each Repeat Performance Test.. If at the end of second Repeat Performance Test conducted by the Seller or the last date of the end of the six month period referred to in Article 8.1.1, whichever is earlier, the Tested Capacity is less than the Contracted Capacity as existing on the Effective Date the consequences mentioned in Article 8.2.2 shall apply for a period of at least one year after which the Seller shall have the right to undertake a Repeat Performance Test. Provided that such consequences shall apply with respect to the Tested Capacity existing at the end of second Repeat Performance Test conducted by the Seller or the last date of the end of the six month period referred to in Article 8.1.1, whichever is earlier

8.2.3 If the Independent Engineer certifies that it is unable to give a Final Test Certificate because events or circumstances beyond the Seller's reasonable control have prevented the Repeat Performance Test from being carried out in accordance with Schedule 4, the Procurer shall reschedule a Repeat Performance Test as soon as reasonably practicable.

8.2.4 If a Unit's or if all the Units have been Commissioned, of the Power Station's, Tested Capacity is found to be more than it's Contracted Capacity, the provisions of Article 6.3.5 shall apply mutatis mutandis.

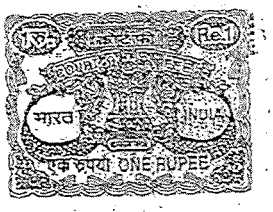


8.3 Availability

The Seller shall comply with the provisions of the applicable Law regarding Availability including, in particular, to the provisions of the ABT and Grid Code relating to intimation of Availability and the matters incidental thereto.

8.4 Dispatch

The Seller shall comply with the provisions of the applicable Law regarding Dispatch Instructions, in particular, to the provisions of the ABT and Grid Code relating to Dispatch and the matters incidental thereto.



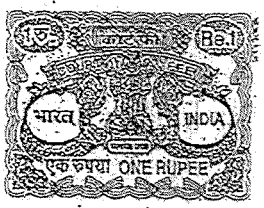
9 ARTICLE 9: METERING AND ENERGY ACCOUNTING

9.1 *Meters*

For installation of Meters, Meter testing, Meter calibration and Meter reading and all matters incidental thereto, the Seller and the Procurer shall follow and be bound by the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006, the Grid Code and ABT as amended and revised from time to time. In addition, the Seller shall also allow and facilitate /STU in installation of one set of required main and standby special energy meters for accurate recording of energy supplied by Seller. For these /STU meters (110V, 1A, 4-wire), the Seller shall provide the required connection from EHV current transformers/ bushing CTs/ voltage transformers/ CVTs on EHV side of all generator-transformers, station transformers and outgoing lines, of meter accuracy of 0.2 class or better. The Seller may install any further meters for its own comfort at its own cost.

9.2 *RLDC / SLDC Charges*

All scheduling and RLDC / SLDC charges applicable shall be borne by the Procurer.



10 ARTICLE 10: INSURANCES

10.1 Insurance

The Seller shall effect and maintain or cause to be effected and maintained during the Construction Period and Operating Period , Insurances against such risks, with such deductibles and with such endorsements and co-insured(s), which the Prudent Utility Practices would ordinarily merit maintenance of and as required under the Financing Agreements.

10.2 Application of Insurance Proceeds

Save as expressly provided in this Agreement or the Insurances, the proceeds of any insurance claim made due to loss or damage to the Project or any part of the Project shall be first applied to reinstatement, replacement or renewal of such loss or damage.

If a Natural Force Majeure Event renders the Project no longer economically and technically viable and the insurers under the Insurances make payment on a "total loss" or equivalent basis, the Procurer shall have no claim on such proceeds of such Insurance

10.3 Effect on liability of the Procurer

Notwithstanding any liability or obligation that may arise under this Agreement, any loss, damage, liability, payment, obligation or expense which is insured or for which the Seller can claim compensation, under any Insurance shall not be charged to or payable by the Procurer.

11 ARTICLE 11 : BILLING AND PAYMENT

11.1 General

From the COD of the first Unit, the Procurer shall pay the Seller the Monthly Tariff Payment, on or before the Due Date, , determined in accordance with this Article 11 and Schedule 6. All Tariff payments by the Procurer shall be in Indian Rupees.

The Procurer shall pay the seller for any Electrical Output from the Seller prior to the Commercial Operation Date ("**Infirm Power**") of a Unit the Energy Charges for Infirm Power generated by such Unit. The quantum of Infirm Power generated by Units synchronized but not have been put on COD shall be computed from the energy accounting and audit meters installed at the Power Station as per Central Electricity Authority (installation and operation of meters) Regulations 2006 as amended from time to time.

11.2 Delivery and content of Monthly Bills

11.2.1 The Seller shall issue to the Procurer a signed Monthly Bill for the immediately preceding Month.
Provided that:

i. if the COD of the first Unit falls during the period between the first (1st) day and up to and including the fifteenth (15th) day of a Month, the first Monthly Bill shall be issued for the period until the last day of such Month, or
ii. if the COD of the first Unit falls after the fifteenth (15th) day of a Month, the first Monthly Bill shall be issued for the period commencing from the COD of the first Unit until the last day of the immediately following Month.

Provided further that if a Monthly Bill is received on or before the second (2nd) day of a Month, it shall be deemed to have been received on the second (2nd) Business Day of such Month.

11.2.2 Each Monthly Bill and Provisional Bill shall include:

i. Availability and energy account for the relevant Month as per REA for

Monthly Bill and RLDC's daily energy account for Provisional Bill;

ii. the Seller's computation of the components of the Monthly Tariff Payment in accordance with Schedule 6 and

iii. supporting data, documents and calculations in accordance with this Agreement.

11.3 Payment of Monthly Bills

11.3.1 The Procurer shall pay the amount payable under Monthly Bill on the Due Date to such account of the Seller, as shall have been previously notified by the Seller to the Procurer in accordance with Article 11.3.3 below.

All payments made by the Procurer shall be appropriated by the Seller in the following order of priority:

1. towards Late Payment Surcharge, payable by the Procurer, if any;
2. towards earlier unpaid Monthly Bill, if any; and
3. towards the then current Monthly Bill.

11.3.2 All payments required to be made under this Agreement shall only include any deduction or set off for:

i. deductions required by the Law; and

ii. amounts claimed by the Procurer from the Seller, through an invoice duly acknowledged by the Seller, to be payable by the Seller, and not disputed by the Seller within thirty (30) days of receipt of the said invoice and such deduction or set-off shall be made to the extent of the amounts not disputed. It is clarified that the Procurer shall be entitled to claim any set off or deduction under this Article, after expiry of the said 30 day period.

Provided further, the maximum amounts that can be deducted or set-off by the Procurer under this Article in a Contract Year shall not exceed Rupees 13.5 crores only, except on account of payments under sub Article (i) above.

11.3.3 The Seller shall open a bank account at Patiala (the "Designated Account") for all Tariff Payments to be made by the Procurer to the Seller, and notify the Procurer of the details of such account at least ninety (90) days before the dispatch of the first Monthly Bill to the Procurer. The Procurer shall instruct its bankers to make all payments under this Agreement to the Designated Account and shall notify the Seller of such instructions on the same day. The Procurer shall also designate a bank account at Patiala for payments to be

made by the Seller (including Supplementary Bills) to the Procurer and notify the Seller of the details of such account ninety (90) days before the COD of the first Unit.

11.3.4 In the event of delay in payment of a Monthly Bill by the Procurer beyond its Due Date month billing, a Late Payment Surcharge shall be payable by the Procurer to the Seller at the rate of two (2) percent in excess of the applicable SBAR per annum, on the amount of outstanding payment, calculated on a day to day basis (and compounded with Monthly rest), for each day of the delay.

11.3.5 For payment of any Bill before Due Date, the following rebate shall be paid by the Seller to the Procurer in the following manner.

a) Provisional Bill will be raised by the Seller on the last Business day of the Month where the Capacity Charges shall be based on the Declared Capacity for the full Month and the Energy Charges shall be based on the final implemented Scheduled Energy upto 25th day of the Month. Rebate shall be payable at the rate of two point two five percent (2.25%) of the amount (which shall be the full amount due under the Provisional Bill) credited to Seller's account on first day of the Month and rebate amount shall reduce at the rate of zero point zero five percent (0.05%) for each day, upto fifth (5th) day of the Month.

b) Applicable rate of rebate at (a) above shall be based on the date on which payment has been actually credited to the Seller's account. Any delay in transfer of money to the Seller's account, on account of public holiday, bank holiday or any other reasons shall be to the account of the Procurers.

c) Two percent (2%) rebate for credit to Sellers account made within one (1) Day of the presentation of Monthly Bill for the Month for which the Provisional Bill was raised earlier.

d) For credit to Seller's account made on other days the rebate on Monthly Bill shall be as under:

Number of days before Due Date of Monthly Bill	Rates of Rebate applicable
29	Two percent (2.00%)
Each day thereafter upto the Due Date	2% less [0.033% x {29 less number of days before Due Date when the payment is made by the Procurers}]

e) Rebate of two point two five percent (2.25%) to two point zero five percent (2.05%) will be available only if the Procurer credits one hundred

percent (100%) of the Provisional Bill within first five (5) days of the Month to Seller's account/designated account and balance amount, if any, based on Monthly Bill (as per REA) within the Month.

f) In the event only part amount of Provisional Bill is credited to Seller's account, within first five (5) days and the balance amount is credited to Sellers account during other days of the Month, rebate will be paid on such part amount, at the rate of two percent (2%) plus zero point zero three three percent (0.033%) per day for the number of days earlier than the 6th day when such part amount is credited to Sellers' account;

g) The above rebate will be allowed only if the Procurer credits to Seller's account the full Monthly Bill.

h) No rebate shall be payable on the bills raised on account of Change in Law relating to taxes, duties and cess;

i) If the Provisional Bill has not been paid by the date of receipt of the Monthly Bill then such Provisional Bill shall not be payable, provided in case the Provisional Bill has already been paid, then only the difference between the Monthly Bill and Provisional Bill shall be payable.

11.4 Payment Mechanism

11.4.1 *Letter of Credit:*

The Procurer shall provide to the Seller, in respect of payment of its Monthly Bills, a monthly unconditional, revolving and irrevocable letter of credit ("**Letter of Credit**"), opened and maintained by the Procurer, which may be drawn upon by the Seller in accordance with Articles 11.4.1.1 through 11.4.1.5. . The Letter of Credit shall be provided from the bank which is appointed as Default Escrow Agent under the Default Escrow Agreement.

11.4.1.1 Not later than one (1) Month prior to the the Scheduled COD of the first Unit, the Procurer shall through a scheduled bank at Patiala open a Letter of Credit in favour of the Seller, to be made operative from a date prior to the Due Date of its first Monthly Bill under this Agreement. The Letter of Credit shall have a term of twelve (12) Months and shall be renewed annually, for an amount equal to:

i) for the first Contract Year, equal to one point one (1.1) times the estimated average monthly billing based on Normative Availability;

ii) for each subsequent Contract Year, equal to the one point one (1.1) times the average of the Monthly Tariff Payments of the previous Contract Year plus the estimated monthly billing during the current year from any additional Unit(s) expected to be put on COD during the current Contract Year based on Normative Availability.

Provided that the Seller shall not draw upon such Letter of Credit prior to the Due Date of the relevant Monthly Bill, and shall not make more than one drawal in a Month.

Provided further that if at any time, such Letter of Credit amount falls short of the amount specified in Article 11.4.1.1 or 11.4.1.8 otherwise than by reason of drawal of such Letter of Credit by the Seller, the Procurer shall restore such shortfall within seven (7) days.

11.4.1.2 The Procurer shall cause the scheduled bank issuing the Letter of Credit to intimate the Seller, in writing regarding establishing of such irrevocable Letter of Credit.

11.4.1.3 In case of drawal of the Letter of Credit by the Seller in accordance with the terms of this Article 11.4.1, the amount of the Letter of credit shall be reinstated in the manner stated in Article 11.4.2.3 of this Agreement.

11.4.1.4 If the Procurer fails to pay a Monthly Bill or part thereof within and including the Due Date, then, subject to Article 11.6.7, the Seller may draw upon the Letter of Credit, and accordingly the bank shall pay without any reference or instructions from the Procurer, an amount equal to such Monthly Bill or part thereof plus Late Payment Surcharge, if applicable, in accordance with Article 11.3.4 above, by presenting to the scheduled bank issuing the Letter of Credit, the following documents:

i) a copy of the Monthly Bill which has remained unpaid by the Procurer;
ii) a certificate from the Seller to the effect that the bill at item (i) above, or specified part thereof, is in accordance with the Agreement and has remained unpaid beyond the Due Date; and

iii) calculations of applicable Late Payment Surcharge, if any.

For the avoidance of doubt it is clarified that the Seller shall not be entitled to drawdown on the Letter of Credit for any failure of the Procurer to pay a Supplementary Bill.

11.4.1.5 The Procurer shall ensure that the Letter of Credit shall be renewed not later than forty five (45) days prior to its expiry.

11.4.1.6 All costs relating to opening and maintenance of the Letter of Credit shall be borne by the Procurer, however, Letter of Credit negotiation charges shall be borne and paid by the Seller.

11.4.1.7 Where necessary, the Letter of Credit may also be substituted by an unconditional and irrevocable bank guarantee or an equivalent instrument as mutually agreed by the Procurer and the Seller.

11.4.1.8 Upon fulfilment of the conditions mentioned under Article 11.4.2.2 the Letter of Credit amount as mentioned in Article 11.4.1.1 shall be changed to one (1) time the average of the Monthly Tariff Payments of the previous Contract Year instead of one point one (1.1) times the average of the Monthly Tariff Payments of the previous Contract Year.

11.4.2 **Collateral Arrangement**

11.4.2.1 As further support for the Procurer's obligations, on or prior to the Effective Date, the Procurer and the Seller shall execute Default Escrow Agreement (referred as "Default Escrow Agreement") for the establishment and operation of the Default Escrow Account in favour of the Seller, through which the revenues of the Procurer shall be routed and used as per the terms of the Default Escrow Agreement. The Procurer and the Seller shall contemporaneously with the execution of the Default Escrow Agreement enter into a separate Agreement to Hypothecate Cum Deed of Hypothecation, whereby the Procurer shall agree to hypothecate,to the Seller, effective from forty five (45) days prior to the Scheduled COD the amounts to the extent as required for the Letter of Credit as per Article 11.4.1.1 routed through the Default Escrow Account and the Receivables in accordance with the terms of the Agreement to Hypothecate Cum Deed of Hypothecation. The Default Escrow Agreements and the Agreement to Hypothecate Cum Deed of Hypothecation are collectively referred to as the "Collateral Arrangement". The minimum revenue flow in any Month in the Default Escrow Account shall be at least equal to the amount required for the Letter of Credit as per Article 11.4.1.1.

Provided that the Procurer shall ensure that the Seller has first ranking charge on the revenues routed through the Default Escrow Account and the 'Receivables' in accordance with the terms of the Agreement to Hypothecate Cum Deed of Hypothecation. However, such first ranking charge shall be on the amounts, in excess of amounts, which have already been charged or agreed to be charged prior to the date of the execution of the Default Escrow Agreement.

11.4.2.2 On the occurrence of all of the following events in respect of the Procurer:

(i) A period of not less than two (2) years from COD of Power Station, has elapsed; and

(ii) The Procurer has achieved, for its ability to honour its Tariff Payment obligations to the Seller under this Agreement, a credit rating of 'A' or better, from a SEBI registered Indian credit rating agency mutually agreed between Seller and the Lender/s, consistently for a period of at least three (3) years; and

(iii) Immediately prior to the three (3) year period mentioned in sub-clause (ii) above,, for a period of at least two (2) years there has been no Procurer Event of Default under Article 14 of the PPA, by the Procurer,

the Procurer shall intimate the Seller in writing of the occurrence of the same and its intention to discontinue the Collateral Arrangement. If the Seller desires to continue with the Collateral Arrangement, it shall intimate the same to the Procurer in writing within thirty (30) days of receipt of intimation from the Procurer and in such case the Seller shall be liable to bear the costs of continuation of the Collateral Arrangement with effect from such date. In case the Seller fails to respond or agrees to discontinue, the Collateral Arrangement shall forthwith cease and the Default Escrow Agreement and the routed through the Default Escrow Account and the 'Receivables' in accordance with the terms of the Agreement to Hypothecate Cum Deed of Hypothecation shall stand terminated as per terms thereof.

Provided that in case of any of conditions mentioned under (i), (ii) or (iii) in Article 11.4.2.2 ceases to be true, then within 90 days of the occurrence of such event, the Procurer shall reinstate the Collateral Arrangement, at its own cost.

11.4.2.3 If the Letter of Credit is insufficient to pay for the due payments to the Seller or is not replenished for the drawals made, then within a period of seven (7) days from the date such shortfall in the Letter of Credit occurs, the Letter of Credit shall be reinstated to the requisite amount specified in this Agreement, and in the manner specified in the Default Escrow Agreement.

11.5 Third Party Sales on default

11.5.1 Notwithstanding anything to the contrary contained in this Agreement, upon the occurrence of an event where the Procurer has not made payment by the Due Date of an Invoice through the payment mechanism provided in this Agreement, the Seller shall follow the steps as enumerated in Articles 11.5.2 and 11.5.3.

11.5.2 On the occurrence of the event mentioned in Article 11.5.1 and after giving a notice of at least seven (7) days to the Procurer,-the Seller shall have the right to offer twenty five (25) per cent of the Contracted Capacity ("Default Electricity") to third parties.

11.5.3 On the occurrence of the event mentioned in Article 11.5.1 and after giving a notice of at least seven (7) days to the Procurer,-the Seller shall have the right (but not the obligation) to make available and sell the Default Electricity or a part thereof to a third party, namely:

(a) any consumer, subject to applicable Law; or

(b) any licensee under the Electricity Act, 2003;

11.5.4 If the Collateral Arrangement is not fully restored by the Procurer within thirty (30) days of the non-payment of a Invoice by its Due Date,the provisions of Article 11.5.2 and Article 11.5.3 shall apply with respect to one hundred (100) per cent of the Contracted Capacity. Provided that in case the events mentioned in Article 11.4.2.2 (i), (ii) and (iii) are true, then this Article 11.5.4 shall be applicable as per Article 11.4.2.2.

11.5.5 Provided that, in the case of Article 11.5.3 or 11.5.4, the Seller shall ensure that sale of power to the shareholders of the Seller or any direct or indirect affiliate of the Seller/shareholders of the Seller, is not at a price less than the Energy Charges.

11.5.6 In case of third party sales as permitted by this Article 11.5, the adjustment of the surplus revenue over Energy Charge attributable to such electricity sold, shall be adjusted as under :

(a) the surplus upto the Tariff shall be used towards the extinguishment of the subsisting payment liability of the Procurer towards the Seller; and
(b) the surplus if any above the Tariff shall be retained by the Seller.

The liability of the Procurer towards making Capacity Charge payments to the Seller even for electricity sold to third parties or remaining unsold during such periods will remain unaffected. Provided such Capacity Charge payment liability shall cease on the date which occurs on the Expiry of a period of three (3) years and hundred (100) days from the date of occurrence of the Procurer Event of Default under Article 14.2 (i), provided if prior to such date, the Procurer Event of Default has not ceased and regular supply of electricity for a period of at least ninety (90) continuous days has not occurred.

11.5.7 Sales to any person or Party, under Article 11.5, shall cease and regular supply of electricity to the Procurer in accordance with all the provisions of this Agreement shall commence and be restored on the later of the two following dates or any date before this date at the option of Seller:

(a) the day on which the Procurer pays the amount due to the Seller and renews the Letter of Credit and restores Default Escrow Account (if applicable) as mentioned in Article 11.4.2.1 ; or
(b) the date being "x" days from the date on which the defaulting Procurer pays the amount due to the Seller, where "x" days shall be calculated in accordance with Schedule 12.

11.6 *Disputed Bill*

11.6.1 If a Party does not dispute a Monthly Bill, Provisional Bill or a Supplementary Bill raised by the other Party within thirty (30) days of receiving it, such bill shall be taken as conclusive.

11.6.2 If a Party disputes the amount payable under a Monthly Bill, Provisional Bill or a Supplementary Bill, as the case may be, that Party shall, within thirty (30) days of receiving such bill, issue a notice (the "Bill Dispute Notice") to the invoicing Party setting out:

i) the details of the disputed amount;
ii) its estimate of what the correct amount should be; and
iii) all written material in support of its claim.

11.6.3 If the invoicing Party agrees to the claim raised in the Bill Dispute Notice issued pursuant to Article 11.6.2, the invoicing Party shall revise such bill within seven (7) days of receiving such notice and if the disputing Party has already made the excess payment , refund to the disputing Party such excess amount within fifteen (15) days of receiving such notice. In such case excess

amount shall be refunded along with interest at the same rate as Late Payment Surcharge which shall be applied from the date on which such excess payment was made to the invoicing Party and upto and including the date on which such payment has been received.

11.6.4 If the invoicing Party does not agree to the claim raised in the Bill Dispute Notice issued pursuant to Article 11.6.2, it shall, within fifteen (15) days of receiving the Bill Dispute Notice, furnish a notice to the disputing Party providing:

i) reasons for its disagreement;
ii) its estimate of what the correct amount should be; and
iii) all written material in support of its counter-claim.

11.6.5 Upon receipt of notice of disagreement to the Bill Dispute Notice under Article 11.6.4, authorised representative(s) or a director of the board of directors/member of board of each Party shall meet and make best endeavours to amicably resolve such dispute within fifteen (15) days of receiving such notice of disagreement to the Bill Dispute Notice.

11.6.6 If the Parties do not amicably resolve the Dispute within fifteen (15) days of receipt of notice of disagreement to the Bill Dispute Notice pursuant to Article 11.6.4, the matter shall be referred to Dispute Resolution in accordance with Article 17.

11.6.7 In case of Disputed Bills, it shall be open to the aggrieved party to approach the Appropriate Commission for Dispute Resolution in accordance with Article 17 and also for interim orders protecting its interest including for orders for interim payment pending Dispute Resolution and the Parties shall be bound by the decision of the Appropriate Commission, including in regard to interest or Late Payment Surcharge, if any directed to be paid by the Appropriate Commission.

11.6.8 If a Dispute regarding a Monthly Bill, Provisional Bill or a Supplementary Bill is settled pursuant to Article 11.6 or by Dispute resolution mechanism provided in this Agreement in favour of the Party that issues a Bill Dispute Notice, the other Party shall refund the amount, if any incorrectly charged and collected from the disputing Party or pay as required, within five (5) days of the Dispute either being amicably resolved by the Parties pursuant to Article 11.6.5 or settled by Dispute resolution mechanism along with interest at the same rate as Late Payment Surcharge from the date on which such payment had been made to the invoicing Party or the date on which such payment was originally due, as may be applicable.

11.6.9 For the avoidance of doubt, it is clarified that despite a Dispute regarding an Invoice, the Procurer shall, without prejudice to its right to Dispute, be under an obligation to make payment, of the lower of (a) an amount equal to simple average of last three (3) Months invoices (being the undisputed portion of such

three Months invoices) and (b) Monthly Invoice which is being disputed, provided such Monthly Bill has been raised based on the REA and in accordance with this Agreement.

11.7 Quarterly and Annual Reconciliation

Both Parties acknowledge that all payments made against Monthly Bills, Provisional Bill and Supplementary Bills shall be subject to quarterly reconciliation at the beginning of the following quarter of each Contract Year and annual reconciliation at the end of each Contract Year to take into account REA, Tariff Adjustment Payments, Tariff Rebate Payments, Late Payment Surcharge, or any other reasonable circumstance provided under this Agreement. The Parties, therefore, agree that as soon as all such data in respect of any quarter of a Contract Year or a full Contract Year as the case may be has been finally verified and adjusted, the Seller and the Procurer shall jointly sign such reconciliation statement. Within fifteen (15) days of signing of a reconciliation statement, the Seller or the Procurer, as the case may be, shall raise a Supplementary Bill for the Tariff Adjustment Payments for the relevant quarter/ Contract Year and shall make payment of such Supplementary Bill for the Tariff Adjustment Payments for the relevant quarter/Contract Year. Late Payment Surcharge shall be payable in such a case from the date on which such payment had been made to the invoicing Party or the date on which any payment was originally due, as may be applicable. Any dispute with regard to the above reconciliation shall be dealt with in accordance with the provisions of Article 17.

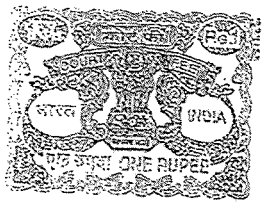
11.8 Payment of Supplementary Bill

11.8.1 Either Party may raise a bill on the other Party ("Supplementary Bill") for payment on account of:

i) Adjustments required by the Regional Energy Account (if applicable);
ii) Tariff Payment for change in parameters, pursuant to provisions in Schedule 6; or
iii) Change in Law as provided in Article 13,

and such Bill shall be paid by the other Party.

11.8.2 The Procurer shall remit all amounts due under a Supplementary Bill raised by the Seller to the Seller's Designated Account by the Due Date and notify the Seller of such remittance on the same day. Similarly, the Seller shall pay all amounts due under a Supplementary Bill raised by the Procurer by the Due



Date to the Procurer's designated bank account and notify the Procurer of such payment on the same day. For such payments by the Procurer, rebates as applicable to Monthly Bills pursuant to Article 11.3.5 shall equally apply.

11.8.3 In the event of delay in payment of a Supplementary Bill by either Party beyond its Due Date, a Late Payment Surcharge shall be payable at the same terms applicable to the Monthly Bill in Article 11.3.4.

11.9 Payment for Start up Power

The Seller shall be liable to pay, for the power and energy consumed for start-up of the Project and commissioning, to the Procurer at the then prevalent rates payable by such industrial consumers.

11.10 The copies of all notices/offers which are required to be sent as per the provisions of this Article 11, shall be sent by either Party, simultaneously to both Parties.

12 ARTICLE 12 : FORCE MAJEURE

12.1 Definitions

In this Article 12, the following terms shall have the following meanings:

12.2 Affected Party

An affected Party means the Procurer or the Seller whose performance has been affected by an event of Force Majeure.

An event of Force Majeure affecting the CTU/STU or any other agent of the Procurer, which has affected the Interconnection Facilities, shall be deemed to be an event of Force Majeure affecting the Procurer.

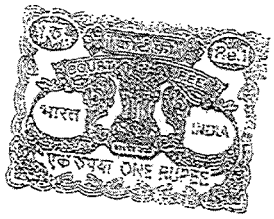
Any event of Force Majeure affecting the performance of the Seller's contractors, shall be deemed to be an event of Force Majeure affecting Seller only if the Force Majeure event is affecting and resulting in:

a. late delivery of plant, machinery, equipment, materials, spare parts, Fuel, water or consumables for the Project; or
b. a delay in the performance of any of the Seller's contractors.

Similarly, any event of Force Majeure affecting the performance of the Procurer's contractor for the setting up or operating Interconnection Facilities shall be deemed to be an event of Force Majeure affecting Procurer only if the Force Majeure event is resulting in a delay in the Performance of Procurer's contractors.

12.3 Force Majeure

A 'Force Majeure' means any event or circumstance or combination of events and circumstances including those stated below that wholly or partly prevents or unavoidably delays an Affected Party in the performance of its obligations under this Agreement, but only if and to the extent that such events or circumstances are not within the reasonable control, directly or indirectly, of the Affected Party and could not have been avoided if the Affected Party had taken reasonable care or complied with Prudent Utility Practices:



i. Natural Force Majeure Events:

act of God, including, but not limited to lightning, drought, fire and explosion (to the extent originating from a source external to the Site), earthquake, volcanic eruption, landslide, flood, cyclone, typhoon, tornado, or exceptionally adverse weather conditions which are in excess of the statistical measures for the last hundred (100) years,

ii. Non-Natural Force Majeure Events:

1. Direct Non - Natural Force Majeure Events

a) Nationalization or compulsory acquisition by any Indian Governmental Instrumentality of any material assets or rights of the Seller or the Seller's contractors; or

b) the unlawful, unreasonable or discriminatory revocation of, or refusal to renew, any Consent required by the Seller or any of the Seller's contractors to perform their obligations under the Project Documents or any unlawful, unreasonable or discriminatory refusal to grant any other consent required for the development/ operation of the Project. Provided that an appropriate court of law declares the revocation or refusal to be unlawful, unreasonable and discriminatory and strikes the same down.

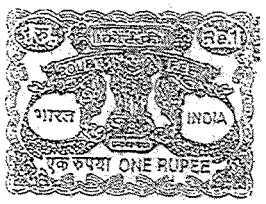
c) any other unlawful, unreasonable or discriminatory action on the part of an Indian Government Instrumentality which is directed against the Project. Provided that an appropriate court of law declares the revocation or refusal to be unlawful, unreasonable and discriminatory and strikes the same down.

2. Indirect Non - Natural Force Majeure Events

a) any act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, revolution, riot, insurrection, terrorist or military action; or

b) Radio active contamination or ionising radiation originating from a source in India or resulting from another Indirect Non Natural Force Majeure Event excluding circumstances where the source or cause of contamination or radiation is brought or has been brought into or near the site by the Affected Party or those employed or engaged by the Affected Party.

c) Industry wide strikes and labor disturbances having a nationwide impact in India.



12.4 Force Majeure Exclusions

Force Majeure shall not include (i) any event or circumstance which is within the reasonable control of the Parties and (ii) the following conditions, except to the extent that they are consequences of an event of Force Majeure:

a. Unavailability, late delivery, or changes in cost of the plant, machinery, equipment, materials, spare parts, Fuel or consumables for the Project;

b. Delay in the performance of any contractor, sub-contractors or their agents excluding the conditions as mentioned in Article 12.2;

c. Non-performance resulting from normal wear and tear typically experienced in power generation materials and equipment;

d. Strikes or labour disturbance at the facilities of the Affected Party;

e. Insufficiency of finances or funds or the agreement becoming onerous to perform; and

f. Non-performance caused by, or connected with, the Affected Party's:

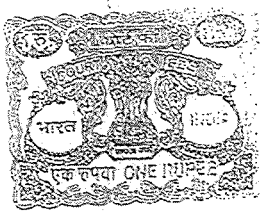
i) Negligent or intentional acts, errors or omissions;

ii) Failure to comply with an Indian Law; or

iii) Breach of, or default under this Agreement or any Project Documents.

12.5 Notification of Force Majeure Event

The Affected Party shall give notice to the other Party of any event of Force Majeure as soon as reasonably practicable, but not later than seven (7) days after the date on which such Party knew or should reasonably have known of the commencement of the event of Force Majeure. If an event of Force Majeure results in a breakdown of communications rendering it unreasonable to give notice within the applicable time limit specified herein, then the Party claiming Force Majeure shall give such notice as soon as reasonably practicable after reinstatement of communications, but not later than one (1) day after such reinstatement. Provided that such notice shall be a pre-condition to the Seller's entitlement to claim relief under this Agreement. Such notice shall include full particulars of the event of Force Majeure, its effects on the Party claiming relief and the remedial measures proposed. The Affected Party shall give the other Party regular (and not less than monthly) reports on the progress of those



remedial measures and such other information as the other Party may reasonably request about the situation.

The Affected Party shall give notice to the other Party of (i) the cessation of the relevant event of Force Majeure; and (ii) the cessation of the effects of such event of Force Majeure on the performance of its rights or obligations under this Agreement, as soon as practicable after becoming aware of each of these cessations.

12.6 Duty to perform and duty to mitigate

To the extent not prevented by a Force Majeure event pursuant to Article 12.3, the Affected Party shall continue to perform its obligations pursuant to this Agreement. The Affected Party shall use its reasonable efforts to mitigate the effect of any event of Force Majeure as soon as practicable.

12.7 Available Relief for a Force Majeure Event

Subject to this Article 12:

(a) no Party shall be in breach of its obligations pursuant to this Agreement to the extent that the performance of its obligations was prevented, hindered or delayed due to a Force Majeure Event;

(b) both the Parties shall be entitled to claim relief in relation to a Force Majeure Event in regard to its obligations, including but not limited to those specified under Article 4.5.

(c) For the avoidance of doubt, it is clarified that no Tariff shall be paid by the Procurer for the part of Contracted Capacity affected by a Natural Force Majeure Event affecting the Seller, for the duration of such Natural Force Majeure Event. For the balance part of the Contracted Capacity, the Procurer shall pay the Tariff to the Seller, provided during such period of Natural Force Majeure Event, the balance part of the Power Station is declared to be Available for scheduling and dispatch as per ABT for supply of power by the Seller to the Procurer.

(d) If the average Availability of the Power Station is reduced below sixty (60) percent for over two (2) consecutive months or for any non consecutive period of four (4) months both within any continuous period of sixty (60) months, as a result of an Indirect Non Natural Force Majeure, then, with effect from the end of that period and for so long as the daily average Availability of the Power Station continues to be reduced below sixty (60) percent as a result of an Indirect Non Natural Force Majeure of any kind, the Procurer shall make payments

for Debt Service, subject to a maximum of Capacity Charges based on Normative Availability, relatable to such Unit, which are due under the Financing Agreements and these amounts shall be paid from the date, being the later of a) the date of cessation of such Indirect Non Natural Force Majeure Event and b) the completion of sixty (60) days from the receipt of the Financing Agreements by the Procurer from the Seller, in the form of an increase in Capacity Charge. Provided such Capacity Charge increase shall be determined by Appropriate Commissionon the basis of putting the Seller in the same economic position as the Seller would have been in case the Seller had been paid Debt Service in a situation where the Indirect Non Natural Force Majeure had not occurred.

Provided that the Procurer will have the above obligation to make payment for the Debt Service only (a) after the Unit(s) affected by such Indirect Non Natural Force Majeure Event has been Commissioned, and (b) only if in the absence of such Indirect Non Natural Force Majeure Event, the Availability of such Commissioned Unit(s) would have resulted in Capacity Charges equal to Debt Service.

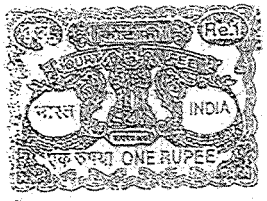
e) If the average Availability of the Power Station is reduced below eighty (80) percent for over two (2) consecutive months or for any non consecutive period of four (4) months both within any continuous period of sixty (60) months, as a result of a Direct Non Natural Force Majeure, then, with effect from the end of that period and for so long as the daily average Availability of the Power Station continues to be reduced below eighty (80) percent as a result of a Direct Non Natural Force Majeure of any kind, the Seller may elect in a written notice to the Procurer, to deem the Availability of the Power Station to be eighty (80) percent from the end of such period, regardless of its actual Available Capacity. In such a case, the Procurer shall be liable to make payment to the Seller of Capacity Charges calculated on such deemed Normative Availability, after the cessation of the effects of Direct Non Natural Direct Force Majeure in the form of an increase in Capacity Charge. Provided such Capacity Charge increase shall be determined by Appropriate Commission on the basis of putting the Seller in the same economic position as the Seller would have been in case the Seller had been paid Capacity Charges in a situation where the Direct Non Natural Force Majeure had not occurred.

(f) For so long as the Seller is claiming relief due to any Non Natural Force Majeure Event (or Natural Force Majeure Event affecting the Procurer under this Agreement, the Procurer may from time to time on one (1) days notice inspect the Project and the Seller shall provide Procurer's personnel with access to the Project to carry out such inspections, subject to the Procurer's personnel complying with all reasonable safety precautions and standards. Provided further the Procurer shall be entitled at all times to request Repeat Performance Test, as per Article 8.1, of the Unit(s) Commissioned earlier and now affected by Direct or Indirect Non Natural Force Majeure Event (or Natural Force Majeure Event affecting the Procurer, where such Testing is possible to be undertaken in spite of the Direct or Indirect Non Natural Force Majeure Event (or Natural Force Majeure Event affecting the Procurer), and the Independent Engineer accepts and issues a Final Test Certificate certifying such Unit(s) being capable of delivering the Contracted Capacity and being Available, had there been no such Direct or Indirect Non Natural Force Majeure Event (or Natural Force Majeure Event affecting the Procurer). In case, the Available Capacity as established by the said Repeat Performance Test (provided that for such Repeat Performance Test, the limitation imposed by Article 8.1.1 shall not apply) and Final Test Certificate issued by the Independent Engineer is less than the Available Capacity corresponding to which the Seller would have been paid Capacity Charges equal to Debt Service in case of Indirect Non Natural Force Majeure Event (or Natural Force Majeure Event affecting the Procurer), then the Procurer shall make pro-rata payment of Debt Service but only with respect to such reduced Availability. For the avoidance of doubt, if Debt Service would have been payable at an Availability of 60% and pursuant to a Repeat Performance Test it is established that the Availability would have been 40%, then the Procurer shall make payment equal to Debt Service multiplied by 40% and divided by 60%. Similarly, the payments in case of Direct Non Natural Force Majeure Event (and Natural Force Majeure Event affecting the Procurer) shall also be adjusted pro-rata for reduction in Available Capacity.

g) In case of a Natural Force Majeure Event affecting the Procurer which adversely affects the performance obligations of the Seller under this Agreement, the provisions of sub-proviso (d) and (f) shall apply.

12.8 Additional Compensation and Procurer's Subrogation

If the Seller is entitled, whether actually or contingently, to be compensated by any person other than the Procurer as a result of the occurrence of a Non Natural Force` Majeure Event (or Natural Force Majeure Event affecting the Procurer) for which it has received compensation from the Procurer pursuant to this Article 12, including without limitation, payments made which payments would not have been made in the absence of Article 4.7.1, the Procurer shall be fully subrogated to the Seller's rights against that person to the extent of the compensation paid by the Procurer to the Seller. Provided that in case the Seller has actually received compensation from the any person other than the Procurer as well as the Procurer as a result of the occurrence of a Non Natural Force` Majeure Event (or Natural Force Majeure Event affecting the Procurer), then the Seller shall forthwith refund the compensation received by it from the Procurer but only to the extent of the compensation received by the Seller from any person other than the Procurer.



13 ARTICLE 13 : CHANGE IN LAW

13.1 Definitions

In this Article 13, the following terms shall have the following meanings:

13.1.1 "Change in Law" means the occurrence of any of the following events

(i) the enactment, bringing into effect, adoption, promulgation, amendment, modification or repeal, of any Law or (ii) a change in interpretation of any Law by a Competent Court of law, tribunal or Indian Governmental Instrumentality provided such Court of law, tribunal or Indian Governmental Instrumentality is final authority under law for such interpretation or (iii) change in any consents, approvals or licenses available or obtained for the Project, otherwise than for default of the Seller, which results in any change in any cost of or revenue from the business of selling electricity by the Seller to the Procurer under the terms of this Agreement,

but shall not include (i) any change in any withholding tax on income or dividends distributed to the shareholders of the Seller, or (ii) change in respect of UI Charges or frequency intervals by an Appropriate Commission.

13.1.2 "Competent Court" means:

The Supreme Court or any High Court, or any tribunal or any similar judicial or quasi-judicial body in India that has jurisdiction to adjudicate upon issues relating to the Project.

13.2 Application and Principles for computing impact of Change in Law

While determining the consequence of Change in Law under this Article 13, the Parties shall have due regard to the principle that the purpose of compensating the Party affected by such Change in Law, is to restore through Monthly Tariff payments, to the extent contemplated in this Article 13, the affected Party to the same economic position as if such Change in Law has not occurred.

a) Construction Period

As a result of any Change in Law, the impact of increase/decrease of Capital Cost of the Project in the Tariff shall be as approved by PSERC:

b)Operation Period

As a result of Change in Law, the compensation for any increase/decrease in revenues or cost to the Seller shall be determined and effective from such date, as decided by the Punjab State Electricity Regulatory Commission whose decision shall be final and binding on both the Parties, subject to rights of appeal provided under applicable Law.

Provided that the above mentioned compensation shall be payable only if and for increase/ decrease in revenues or cost to the Seller is in excess of an amount equivalent to 1% of the Letter of Credit in aggregate for a Contract Year.

13.3 Notification of Change in Law

13.3.1 If the Seller is affected by a Change in Law in accordance with Article 13.2 and wishes to claim a Change in Law under this Article, it shall give notice to the Procurer of such Change in Law as soon as reasonably practicable after becoming aware of the same or should reasonably have known of the Change in Law.

13.3.2 Notwithstanding Article 13.3.1, the Seller shall be obliged to serve a notice to the Procurer under this Article 13.3.2 if it is beneficially affected by a Change in Law. Without prejudice to the factor of materiality or other provisions contained in this Agreement, the obligation to inform the Procurer contained herein shall be material. Provided that in case the Seller has not provided such notice, the Procurer shall have the right to issue such notice to the Seller.

13.3.3 Any notice served pursuant to this Article 13.3.2 shall provide, amongst other things, precise details of:

(a) the Change in Law; and

(b) the effects on the Seller of the matters referred to in Article 13.2.

13.4 Tariff Adjustment Payment on account of Change in Law

13.4.1 Subject to Article 13.2, the adjustment in Monthly Tariff Payment shall be effective from:

(i) the date of adoption, promulgation, amendment, re-enactment or repeal of the Law or Change in Law; or

(ii) the date of order/judgment of the Competent Court or tribunal or Indian Governmental Instrumentality, if the Change in Law is on account of a change in interpretation of Law.

13.4.2 The payment for Changes in Law shall be through Supplementary Bill as mentioned in Article 11.8. However, in case of any change in Tariff by reason of Change in Law, as determined in accordance with this Agreement, the Monthly Invoice to be raised by the Seller after such change in Tariff shall appropriately reflect the changed Tariff.

14 ARTICLE 14 : EVENTS OF DEFAULT AND TERMINATION

14.1 Seller Event of Default

The occurrence and continuation of any of the following events, unless any such event occurs as a result of a Force Majeure Event or a breach by the Procurer of their obligations under this Agreement, shall constitute a Seller Event of Default:

i) the failure to Commission any Unit by the date falling twelve (12) Months after its Scheduled Commercial Operation Date, or

ii) after the commencement of construction of the Project, the abandonment by the Seller or the Seller's Construction Contractors of the construction of the Project for a continuous period of two (2) Months and such default is not rectified within thirty (30) days from the receipt of first notice from the Procurer in this regard, or

iii) if at any time following a Unit being Commissioned and during its retest, as per Article 8, such Unit's Tested Capacity is less than ninety two (92) percent of its Contracted Capacity , as existing on the Effective Date, and such Tested Capacity remains below ninety two (92) percent even for a period of three (3) Months thereafter; or

iv) after Commercial Operation Date of all the Units of the Power Station, the Seller fails to achieve Average Availability of sixty five percent (65%), for a period of twelve (12) consecutive Months or within a non-consecutive period of twelve (12) Months within any continuous aggregate period of thirty six (36) Months, or

v) the Seller fails to make any payment (a) of an amount exceeding Rupees One (1) Crore required to be made to the Procurer under this Agreement, within three (3) Months after the Due Date of an undisputed invoice /demand raised by the Procurer on the Seller or (b) of an amount upto Rupees One (1) Crore required to be made to the Procurer under this Agreement within six (6) Months after the Due Date of an undisputed invoice/demand, or

vi) any of the representations and warranties made by the Seller in Schedule 8 of this Agreement; being found to be untrue or inaccurate. Provided however, prior to considering any event specified under this sub-article to be an Event of Default, the Procurer shall give a notice to the Seller in writing of at least thirty (30) days, or

vii) if the Seller:

a) assigns or purports to assign any of its assets or rights in violation of this Agreement; or

b) transfers or novates any of its rights and/or obligations under this agreement, in violation of this Agreement; or

viii) if (a) the Seller becomes voluntarily or involuntarily the subject of any bankruptcy or insolvency or winding up proceedings and such proceedings remain uncontested for a period of thirty (30) days, or (b) any winding up or bankruptcy or insolvency order is passed against the Seller, or (c) the Seller goes into liquidation or dissolution or has a receiver or any similar officer appointed over all or substantially all of its assets or official liquidator is appointed to manage its affairs, pursuant to Law,
Provided that a dissolution or liquidation of the Seller will not be an Event of Default if such dissolution or liquidation is for the purpose of a merger, consolidation or reorganization and where the resulting company continues to meet the financial and technical requirements of the seller as certified by the lenders till COD of the Power Station, and retains creditworthiness similar to the Seller and expressly assumes all obligations of the Seller under this Agreement and is in a position to perform them; or

ix) the Seller repudiates this Agreement and does not rectify such breach even within a period of thirty (30) days from a notice from the Procurer in this regard; or

x) except where due to any Procurer's failure to comply with its material obligations, the Seller is in breach of any of its material obligations pursuant to this Agreement, and such material breach is not rectified by the Seller within thirty (30) days of receipt of first notice in this regard given by the Procurer to the Seller.

xi) the Seller fails to complete/fulfill the activities/conditions specified in Article 3.1.2, beyond a period of 8 Months from the specified period in Article 3.1.2 and the right of termination under Article 3.3.2 is invoked by the Procurer; or

xii) The Seller fails to provide additional bank guarantee to the Procurer in accordance with Article 3.3 of this Agreement, or

xiii) Occurrence of any other event which is specified in this Agreement to be a material breach/default of the Seller.

14.2 Procurer Event of Default

The occurrence and the continuation of any of the following events, unless any such event occurs as a result of a Force Majeure Event or a breach by the Seller of its obligations under this Agreement, shall constitute the Event of Default on the part of the Procurer:

i) the Procurer fails to pay (with respect to a Monthly Bill or a Supplementary Bill) an amount exceeding fifteen (15%) of the undisputed part of the most recent Monthly/Supplementary Bill for a period of ninety (90) days after the Due Date and the Seller is unable to

recover the amount outstanding to the Seller through the Collateral Arrangement and Letter of Credit; or

ii) the Procurer repudiates this Agreement and does not rectify such breach even within a period of thirty (30) days from a notice from the Seller in this regard; or

iii) except where due to any Seller's failure to comply with its obligations, the Procureris in material breach of any of its obligations pursuant to this Agreement, and such material breach is not rectified by the Procurer within thirty (30) days of receipt of notice in this regard from the Seller to the Procurer;

iv) any representation and warranties made by the Procurer in Schedule – 8 of this Agreement being found to be untrue or inaccurate. Provided however, prior to considering any event specified under this sub-article to be an Event of Default, the Seller shall give a notice to the Procurer in writing of at least thirty (30) days; or

v) if (a) the Procurer becomes voluntarily or involuntarily the subject of any bankruptcy or insolvency or winding up proceedings and such proceedings remain uncontested for a period of thirty (30) days, or (b) any winding up or bankruptcy or insolvency order is passed against the Procurer, or (c) the Procurer goes into liquidation or dissolution or has a receiver or any similar officer appointed over all or substantially all of its assets or official liquidator is appointed to manage its affairs, pursuant to Law, except where such dissolution or liquidation of the Procurer is for the purpose of a merger, consolidation or reorganization and where the resulting entity has the financial standing to perform its obligations under this Agreement and has creditworthiness similar to the Procurer and expressly assumes all obligations of the Procurer under this Agreement and is in a position to perform them; or;

vi) occurence of any other event which is specified in this Agreement to be a material breach or default of the Procurer.

14.3 Procedure for cases of Seller Event of Default

14.3.1 Upon the occurrence and continuation of any Seller Event of Default under Article 14.1, the Procurer shall have the right to deliver to the Seller a Procurer Preliminary Default Notice, which shall specify in reasonable detail, the circumstances giving rise to the issue of such notice.

14.3.2 Following the issue of Procurer Preliminary Default Notice, the Consultation Period of ninety (90) days or such longer period as the Parties may agree, shall apply.

14.3.3 During the Consultation Period, the Parties shall, save as otherwise provided in this Agreement, continue to perform their respective obligations under this Agreement.

14.3.4 Within a period of seven (7) days following the expiry of the Consultation Period unless the Parties shall have otherwise agreed to the contrary or the Seller Event of Default giving rise to the Consultation Period shall have been remedied, the Lenders may exercise or the Procurer may require the Lenders to exercise their substitution rights and other rights provided to them, if any, under Financing Agreements and the Procurer would have no objection to the Lenders exercising their rights if it is in consonance with provisions of Schedule 10. Alternatively, in case the Lenders do not exercise their rights as mentioned herein above, the Capacity Charge of the Seller shall be reduced by 20% for the period of Seller Event of Default.

14.4 Termination for Procurer Events of Default

14.4.1 Upon the occurrence and continuation of any Procurer Event of Default pursuant to Article 14.2 (i), the Seller shall follow the remedies provided under Articles 11.5.2

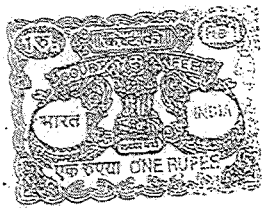
14.4.2 Without in any manner affecting the rights of the Seller under Article 14.4.1, on the occurrence of any Procurer Event of Default specified in Article 14.2 the Seller shall have the right to deliver to the Procurer a Seller Preliminary Default Notice, which notice shall specify in reasonable detail the circumstances giving rise to its issue.

14.4.3 Following the issue of a Seller Preliminary Default Notice, the Consultation Period of ninety (90) days or such longer period as the Parties may agree, shall apply.

14.4.4 During the Consultation Period, the Parties shall continue to perform their respective obligations under this Agreement.

14.4.5 (i) After a period of seven (7) days following the expiry of the Consultation Period and unless the Parties shall have otherwise agreed to the contrary or the Procurer Event of Default giving rise to the Consultation Period shall have been remedied, the Seller shall be free to sell the then existing Contracted Capacity to any third party of his choice. Provided the Procurer shall have the liability to make payments for Capacity Charges based on Normative Availability to the Seller for the period three (3) years from the eighth day after the expiry of the Consultation Period. Provided further that in such three

year period, in case the Seller is able to sell electricity to any third party at a price which is in excess of the Energy Charges, then such excess realization will reduce the Capacity Charge payments due from the Procurer. For the avoidance of doubt, the above excess adjustment would be applied on a cumulative basis for the three year period. During such period, the Seller shall use its best effort to sell the Contracted Capacity of the Procurer generated or capable of being generated to such third parties at the most reasonable terms available in the market at such time, having due regard to the circumstances at such time and the pricing of electricity in the market at such time. Provided further, the Seller shall ensure that sale of power to the shareholders of the Seller or any direct or indirect affiliate of the Seller/shareholders of the Seller, is not at a price less than the Tariff, without obtaining the prior written consent of the Procurer. Such request for consent would be responded to within a maximum period of 3 days failing which it would be deemed that the Procurer has given his consent. Provided further that at the end of the three year period, this Agreement shall automatically terminate and thereafter, the Procurer shall have no further Capacity Charge liability towards the Seller. Provided further, the Seller shall have the right to terminate this Agreement with respect to the Procurer even before the expiry of such three year period provided on such termination, the future Capacity Charge liability of the Procurer shall cease immediately.



15 ARTICLE 15 : LIABILITY AND INDEMNIFICATION

15.1 Indemnity

15.1.1 The Seller shall indemnify, defend and hold the Procurer harmless against:

(a) any and all third party claims, actions, suits or proceedings against the Procurer for any loss of or damage to property of such third party, or death or injury to such third party, arising out of a breach by the Seller of any of its obligations under this Agreement, except to the extent that any such claim, action, suit or proceeding has arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the Procurer, its contractors, servants or agents; and

(b) any and all losses, damages, costs and expenses including legal costs, fines, penalties and interest actually suffered or incurred by the Procurer from third party claims arising by reason of (i) breach by the Seller of any of its obligations under this Agreement, (provided that this Article 15 shall not apply to such breaches by the Seller, for which specific remedies have been provided for under this Agreement) except to the extent that any such losses, damages, costs and expenses including legal costs, fines, penalties and interest (together to constitute "Indemnifiable Losses") has arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the Procurer, its contractors, servants or agents or (ii) any of the representations or warranties of the Seller under this Agreement being found to be inaccurate or untrue.

15.1.2 Procurer shall indemnify, defend and hold the Seller harmless against:

(a) any and all third party claims, actions, suits or proceedings against the Seller, for any loss of or damage to property of such third party, or death or injury to such third party, arising out of a breach by the Procurer of any of its obligations under this Agreement except to the extent that any such claim, action, suit or proceeding has arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the Seller, its contractors, servants or agents; and

(b) any and all losses, damages, costs and expenses including legal costs, fines, penalties and interest ('Indemnifiable Losses') actually suffered or incurred by the Seller from third party claims arising by reason of (i)

a breach by the Procurer of any of its obligations under this Agreement (Provided that this Article 15 shall not apply to such breaches by the Procurer, for which specific remedies have been provided for under this Agreement.), except to the extent that any such Indeminifiable Losses have arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the Seller, its contractors, servants or agents or (ii) any of the representations or warranties of the Procurer under this Agreement being found to be inaccurate or untrue.

15.2 Monetary Limitation of liability

Each Party shall notify the other Party promptly of its entitlement, and intention, to make any claim for indemnification pursuant to this Article 15.

A Party ("Indemnifying Party") shall not be liable to indemnify the other Party ("Indemnified Party") under this Article 15 for any indemnity claims made in a Contract Year until the aggregate of all indemnity claims of the Indemnified Party in a given Contract Year exceeds half a percent (0.5%) of the average annual Tariff Payment for all the Contract Years up to the Contract Year in which the indemnity claim is made

15.3 Procedure for claiming indemnity

15.3.1 Third party claims

(a) Where the Indemnified Party is entitled to indemnification from the Indemnifying Party pursuant to Article 15.1.1(a) or 15.1.2(a), the Indemnified Party shall promptly notify the Indemnifying Party of such claim, proceeding, action or suit referred to in Article 15.1.1(a) or 15.1.2(a) in respect of which it is entitled to be indemnified. Such notice shall be given as soon as reasonably practicable after the Indemnified Party becomes aware of such claim, proceeding, action or suit. The Indemnifying Party shall be liable to settle the indemnification claim within thirty (30) days of receipt of the above notice. Provided however that, if:

(i) the Parties choose to contest, defend or litigate such claim, action, suit or proceedings in accordance with Article 15.3.1(b) below; and;

(ii) the claim amount is not required to be paid/deposited to such third party pending the resolution of the Dispute,

the Indemnifying Party shall become liable to pay the claim amount to the Indemnified Party or to the third party, as the case may be, promptly following the resolution of the Dispute, if such Dispute is not settled in favour of the Indemnified Party.

(b) The Indemnified Party may contest, defend and litigate a claim, action, suit or proceeding for which it is entitled to be indemnified under Article 15.1.1(a) or 15.1.2(a) and the indemnifying Party shall reimburse to the indemnified Party all reasonable costs and expenses incurred by the indemnified party. However, such indemnified Party shall not settle or compromise such claim, action, suit or proceedings without first getting the consent of the indemnifying Party, which consent shall not be unreasonably withheld or delayed.

An Indemnifying Party may, at its own expense, assume control of the defence of any proceedings brought against the Indemnified Party if it acknowledges its obligation to indemnify such Indemnified Party, gives such Indemnified Party prompt notice of its intention to assume control of the defence, and employs an independent legal counsel at its own cost that is reasonably satisfactory to the Indemnified Party.

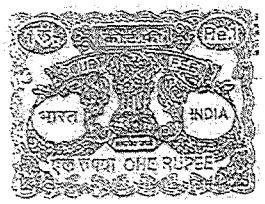
15.4 Indemnifiable Losses

Where an Indemnified Party is entitled to Indemnifiable Losses from the Indemnifying Party pursuant to Article 15.1.1(b) or 15.1.2(b), the Indemnified Party shall promptly notify the Indemnifying Party of the Indemnifiable Losses actually incurred by the Indemnified Party. The Indemnifiable Losses shall be reimbursed by the Indemnifying Party within thirty (30) days of receipt of the notice seeking Indemnifiable Losses by the Indemnified Party. In case of non payment of such losses after a valid notice under this Article 15.4, such event shall constitute a payment default under Article 14.

15.5 Limitation on Liability

Except as expressly provided in this Agreement, neither the Seller nor the Procurer nor their respective officers, directors, agents, employees or Affiliates (or their officers, directors, agents or employees), shall be liable or responsible to the other Party or its Affiliates, officers, directors, agents,

employees, successors or permitted assigns (or their respective insurers) for incidental, indirect or consequential damages, connected with or resulting from performance or non-performance of this Agreement, or anything done in connection herewith, including claims in the nature of lost revenues, income or profits (other than payments expressly required and properly due under this Agreement), any increased expense of, reduction in or loss of power generation production or equipment used therefore, irrespective of whether such claims are based upon breach of warranty, tort (including negligence, whether of the Procurer, the Seller or others), strict liability, contract, breach of statutory duty, operation of law or otherwise. The Procurer shall have no recourse against any officer, director or shareholder of the Seller or any Affiliate of the Seller or any of its officers, directors or shareholders for such claims excluded under this Article. The Seller shall have no recourse against any officer, director or shareholder of the Procurer, or any affiliate of the Procurer or any of its officers, directors or shareholders for such claims excluded under this Article.



16 ARTICLE 16: ASSIGNMENTS AND CHARGES

16.1 Assignments

This Agreement shall be binding upon, and inure to the benefit of the Parties and their respective successors and permitted assigns. Subject to Article 16.2, this Agreement shall not be assigned by any Party (and no Party shall create or permit to subsist any encumbrance over all or any of its rights and benefits under this Agreement) other than by mutual consent between the Parties to be evidenced in writing:

Provided that, such consent shall not be withheld if the Procurer seeks to transfer to any transferee all of its rights and obligations under this Agreement; and

(a) such transferee is either the owner or operator of all or substantially all of the distribution system of the Procurer and /or such transferee is a successor entity of the Procurer; and

(b) this Agreement and the other Project Documents shall continue to remain valid and binding on such successor.

Seller shall be entitled to assign its rights and obligations under this Agreement in favor of the Selectee duly appointed pursuant to the terms of Schedule 10 of this Agreement.

16.2 Permitted Charges

16.2.1 Notwithstanding anything contained in Article 16.1, the Seller may create any encumbrance over all or part of the receivables, Payment Mechanism or the other assets of the Project or the Project Documents in favour of the Lenders or the Lender's Representative on their behalf, as security for:

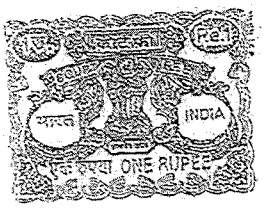
(a) amounts payable under the Financing Agreements; and

(b) any other amounts agreed by the Parties,

Provided that:

I the Lenders or the Lender's Representative on their behalf shall have agreed in writing to the provisions of Schedule 10 of this Agreement; and

II any encumbrances granted by the Seller in accordance with this Article 16.2.1 shall contain provisions pursuant to which the Lenders or the Lender's Representative on their behalf agrees unconditionally with



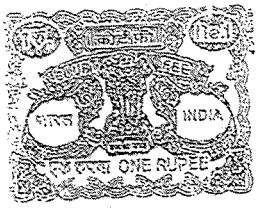
the Seller acting for itself and as trustee of the Procurer to release from such encumbrances all of the right, title and interest to Additional Compensation so as to enable the Procurer to claim its right of subrogation. For the purposes of this Article, Additional Compensation shall mean the compensation that the Seller is entitled, whether actually or contingently, to receive from the Procurer as well as compensated by any person other than the Procurer for the same event.

16.2.2 Article 16.1 does not apply to:

(a) liens arising by operation of law (or by an agreement evidencing the same) in the ordinary course of the Seller carrying out the Project;

(b) pledges of goods, the related documents of title and / or other related documents, arising or created in the ordinary course of the Seller carrying out the Project; or

(c) security arising out of retention of title provisions in relation to goods acquired in the ordinary course of the Seller carrying out the Project.



17 ARTICLE 17: GOVERNING LAW AND DISPUTE RESOLUTION

17.1 Governing Law

This Agreement shall be governed by and construed in accordance with the Laws of India.

17.2 Amicable Settlement

17.2.1 Either Party is entitled to raise any claim, dispute or difference of whatever nature arising under, out of or in connection with this Agreement including its existence or validity or termination (collectively "Dispute") by giving a written notice to the other Party, which shall contain:

(i) a description of the Dispute;
(ii) the grounds for such Dispute; and
(iii) all written material in support of its claim.

17.2.2 The other Party shall, within thirty (30) days of issue of dispute notice issued under Article 17.2.1, furnish:

(i) counter-claim and defences, if any, regarding the Dispute; and
(ii) all written material in support of its defences and counter-claim.

17.2.3 Within thirty (30) days of issue of notice by any Party pursuant to Article 17.2.1 or Article 17.2.2, both the Parties to the Dispute shall meet to settle such Dispute amicably. If the Parties fail to resolve the Dispute amicably within thirty (30) days of receipt of the notice referred to in the preceding sentence, the Dispute shall be referred to Dispute. Resolution in accordance with Article 17.3.

17.3 Dispute Resolution

17.3.1 Where any Dispute arises from a claim made by any Party for any change in or determination of the Tariff or any matter related to Tariff or claims made by any Party which partly or wholly relate to any change in the Tariff or determination of any of such claims could result in change in the Tariff or (ii) relates to any matter agreed to be referred to the Appropriate Commission under Articles 4.7.1, 13.2, 18.1 or clause 10.1.3 of Schedule 10 hereof, such

Dispute shall be submitted to adjudication by the Appropriate Commission. Appeal against the decisions of the Appropriate Commission shall be made only as per the provisions of the Electricity Act, 2003, as amended from time to time.

17.3.2 If the Dispute arises out of or in connection with any claims not covered in Article 17.3.1, such Dispute shall be resolved by arbitration under the Indian Arbitration and Conciliation Act, 1996 and the Rules of the Indian Council of Arbitration, in accordance with the process specified in this Article. In the event of such Dispute remaining unresolved as referred to in Article 17.2.3 hereof, any party to such Dispute may refer the matter to registrar under the Rules of the Indian Council of Arbitration.

(i) The Arbitration tribunal shall consist of three (3) arbitrators to be appointed in accordance with the Indian Council of Arbitration Rules

(ii) The place of arbitration shall be Chandigarh, India. The language of the arbitration shall be English.

(iii) The arbitration tribunal's award shall be substantiated in writing. The arbitration tribunal shall also decide on the costs of the arbitration proceedings and the allocation thereof.

(iv) The award shall be enforceable in any court having jurisdiction, subject to the applicable Laws.

(v) The provisions of this Clause shall survive the termination of this PPA for any reason whatsoever.

17.4 Parties to Perform Obligations

Notwithstanding the existence of any Dispute and difference referred to the Appropriate Commission or the arbitral tribunal as provided in Article 17.3 and save as the Appropriate Commission or the arbitral tribunal may otherwise direct by a final or interim order, the Parties hereto shall continue to perform their respective obligations (which are not in dispute) under this Agreement.

18 ARTICLE 18 : MISCELLANEOUS PROVISIONS

18.1 Amendment

This Agreement may only be amended or supplemented by a written agreement between the Parties and after duly obtaining the approval of the Appropriate Commission, where necessary.

18.2 Third Party Beneficiaries

This Agreement is solely for the benefit of the Parties and their respective successors and permitted assigns and shall not be construed as creating any duty, standard of care or any liability to, any person not a party to this Agreement.

18.3 No Waiver

A valid waiver by a Party shall be in writing and executed by an authorized representative of that Party. Neither the failure by any Party to insist on the performance of the terms, conditions, and provisions of this Agreement nor time or other indulgence granted by any Party to the other Party shall act as a waiver of such breach or acceptance of any variation or the relinquishment of any such right or any other right under this Agreement, which shall remain in full force and effect.

18.4 Entirety

18.4.1 This Agreement and the Schedules are intended by the Parties as the final expression of their agreement and are intended also as a complete and exclusive statement of the terms of their agreement.

18.4.2 Except as provided in this Agreement, all prior written or oral understandings, offers or other communications of every kind pertaining to this Agreement or the sale or purchase of Electrical Output and Contracted Capacity under this Agreement to the Procurer by the Seller shall stand superseded and abrogated.

18.5 Confidentiality

The Parties undertake to hold in confidence this Agreement and Project Documents and not to disclose the terms and conditions of the transaction contemplated hereby to third parties, except:

(a) to their professional advisors;

(b) to their officers, contractors, employees, agents or representatives, financiers, who need to have access to such information for the proper performance of their activities; or

(c) disclosures required under Law.

without the prior written consent of the other Party.

Provided that the Seller agrees and acknowledges that the Procurer may at any time, disclose the terms and conditions of the Agreement and the Project Documents to any person, to the extent stipulated under the Law .

18.6 Affirmation

The Seller and the Procurer, each affirm that:

(i) neither it nor its respective directors, employees, or agents has paid or undertaken to pay or shall in the future pay any unlawful commission, bribe, pay-off or kick-back; and

(ii) it has not in any other manner paid any sums, whether in Indian currency or foreign currency and whether in India or abroad to the other Party to procure this Agreement, and the Seller and the Procurer hereby undertake not to engage in any similar acts during the Term of Agreement.

18.7 Severability

The invalidity or enforceability, for any reason, of any part of this Agreement shall not prejudice or affect the validity or enforceability of the remainder of this Agreement, unless the part held invalid or unenforceable is fundamental to this Agreement.

18.8 No Partnership

None of the provisions of this Agreement shall constitute a partnership or agency or any such similar relationship between the Seller and the Procurer.

18.9 Survival

Notwithstanding anything to the contrary herein, the provisions of this Agreement, including Article 3.3.2, Article 10.2 (Application of Insurance

Proceeds), Article 12 (Force Majeure), Article 14 (Events of Default and Termination), Article 15 (Liability and Indemnification), Article 17 including Article 17.3.2 (Governing Law and Dispute Resolution), Article 18 (Miscellaneous), and other Articles and Schedules of this Agreement which expressly or by their nature survive the term or termination of this Agreement shall continue and survive any expiry or termination of this Agreement.

18.10 Notices

All notices to be given under this Agreement shall be in writing and in the English Language.

All notices must be delivered personally, by registered ~~or certified mail~~post or any method duly acknowledged or facsimile to the addresses below:

Seller :
The Managing Director
GVK Power (Goindwal Sahib) Limited
Paigah House, 156-159, S. P. Road
Secunderabad – 500 003
Fax : 040 - 27902665

Procurer :
The Chairman
Punjab State ElectricityBoard
The Mall
Patiala – 147 001

All notices or communications given by email or facsimile shall be confirmed by sending a copy of the same via post office in an envelope properly addressed to the appropriate Party for delivery by registered mail. All Notices shall be deemed validly delivered upon receipt evidenced by an acknowledgement of the recipient, unless the Party delivering the notice can prove in case of delivery through the registered post that the recipient refused to acknowledge the receipt of the notice despite efforts of the post authorities..

Any Party may by notice of at least fifteen (15) days to the other Parties change the address and / or addresses to which such notices and communications to it are to be delivered or mailed.

18.11 Language

The language of this Agreement and all written communication between the Parties relating to this Agreement shall be in English.

18.12 Breach of Obligations

The Parties acknowledge that a breach of any of the obligations contained herein would result in injuries. The Parties further acknowledge that the amount of the liquidated damages or the method of calculating the liquidated damages specified in this Agreement is a genuine and reasonable pre-estimate of the damages that may be suffered by the non-defaulting party in each case specified under this Agreement.

18.13 Nomination Restriction

Notwithstanding anything contained to the contrary in this Agreement, wherever a reference is made to the right of the Procurer to nominate a third Party to receive benefits under this Agreement, such Third Party shall have a financial standing comparable to that of the Procurer in question.

18.14 Commercial Acts

The Procurer and Seller unconditionally and irrevocably agree that the execution, delivery and performance by each of them of this Agreement and those agreements included in the Collateral Arrangement to which it is a Party constitute private and commercial acts rather than public or governmental acts;

18.15 Restriction of Shareholders/Owners Liability

Both Parties expressly agree and acknowledge that none of the shareholders of the Parties hereto shall be liable to the other Parties for any of the contractual obligations of the concerned party under this Agreement. Further, the financial liabilities of the shareholder/s of each Party to this Agreement, in such Party, shall be restricted to the extent provided in Section 426 of the Indian Companies Act, 1956.

The provisions of this Article shall supercede any other prior agreement or understanding, whether oral or written, that may be existing between the Procurer, Seller, shareholders/ owners of the Seller, shareholders/ owners of

the Procurer before the date of this Agreement, regarding the subject matter of this Agreement.

18.16 No Consequential or Indirect Losses

The liability of the Seller and the Procurer shall be limited to that explicitly provided in this Agreement. Provided that notwithstanding anything contained in this Agreement, under no event shall the Procurer or the Seller claim from one another any indirect or consequential losses or damages.

IN WITNESS WHEREOF the Parties have executed these presents through their authorized representatives at Patiala.

For and on behalf of
Punjab State Electricity Board

(Er. H. S. Brar), Chairman
Signature with seal
CHAIRMAN
P.S.E.B. PATIALA

Witness:

1. Er. G.S. Sra
   Member/Generation

2. Er. V. K. Singal
   Chief Engineer/Hydel Projects

For and on behalf of
GVK Power (Goindwal Sahib) Limited

(S. Madhusudan), Director
Signature with seal

Witness:

1. Debashis Ghosh
   General Manager

2. Oliver Tyagi
   Dy. G.M. (PD)

1. SCHEDULE 1: SITE

2x270 MW Goindwal Sahib Thermal Power Project:

SITE DESCRIPTION

Sr.No.	Item	Details
1.	Location	About 45 Km from Amritsar, 24 km. from Tarn-Taran and 40 km from Jalandhar, Tarn Taran- Kapurthala Road about 3 km to Amrtisar, Punjab (India).
2.	Nearest Railway Station	Khadoor Sahib terminal station .
3.	Nearest air port	Amritsar
4.	Plant Elevation	222.5 m above MSL
5.	Ambient Air temperature	
	a) Maximum	46.7 Degree Centigrade
	b) Minimum	- 2.8 Degree Centigrade
	c) Reference Temp. for design of Electricla/I&C equipment.	50 Degree Centigrade
6.	Relateive humidity a) Maxiinum b) Minimum	 74% 46%
7.	Rainfall a) Annual average b) Maximum for one day	South Westerly summer monsoons 649.1 mm 169 mm
8.	Wind data a) Prevailing wind direction	North west to south east for nine months and reverse for 3 months.
	b) Mean wind speed	1.3 km/hr to 12.3km/hr
	c) Basic wind speed	47 meters/second
	d) Wind pressure	As per IS 875 (Part-3)-1987
9.	SEISMIC DATA	
	a) Zone	IV as per latest revision of IS:1893
10.	Climate	Generally dry except the brief south westerly monsoon season, a hot summer and a bracing winter.

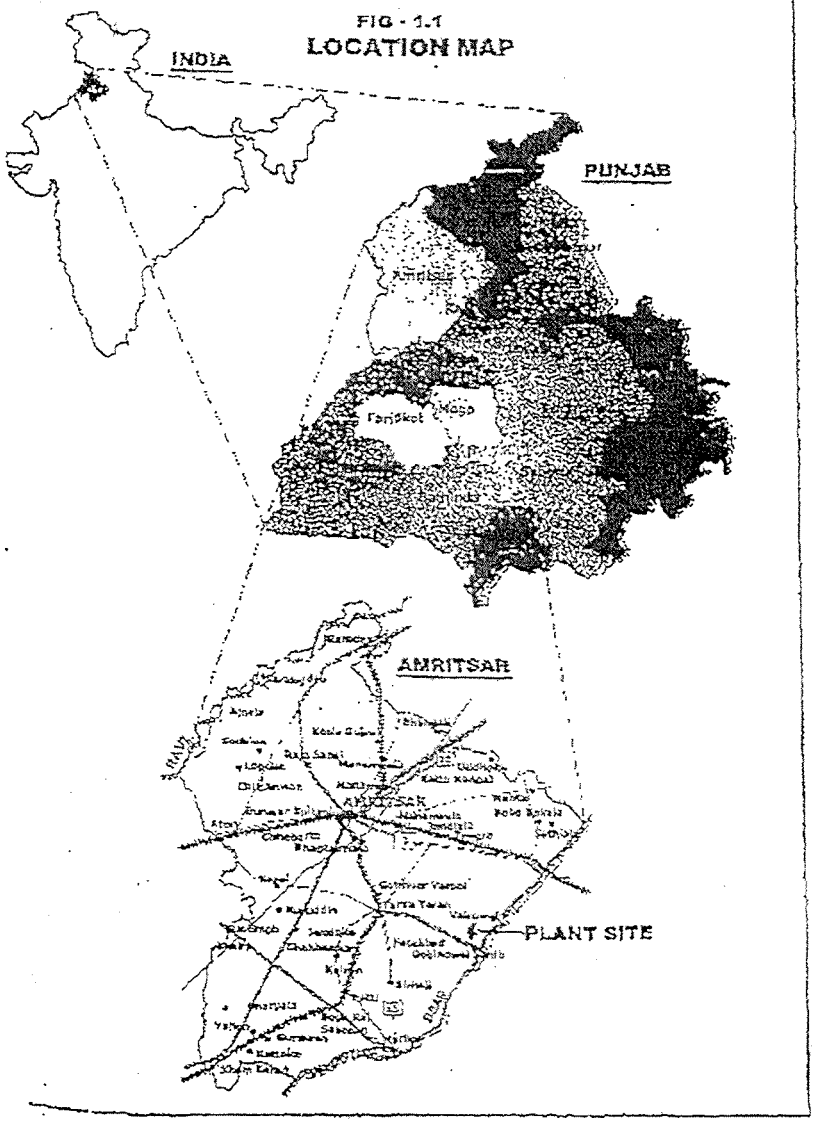
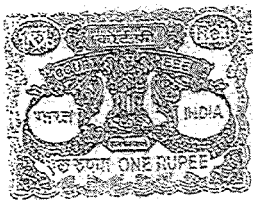


FIG - 1.1
LOCATION MAP
INDIA
PUNJAB
AMRITSAR
PLANT SITE



2. SCHEDULE 2: INITIAL CONSENTS

S.No	Name of the Clearance
1	Approval from Government of Punjab
2	No Objection Certificate from Punjab State Pollution Control Board
3	Environmental and Forest Clearance from MOEF, GOI
4	Water Availability from State Government and Water Supply Agreement
5	Civil Aviation Clearance for Chimney height from National Airports Authority
6	NOC from Ministry of Defence
7	Permission to discharge effluents

3. SCHEDULE 3: FUNCTIONAL SPECIFICATION

S No.	Description	Unit	Particulars
1.1	*Grid Conditions at Interconnection Point*		
(i)	Voltage :Nominal	KV	[220]
	Variation ±10%		Min.- 200KV Max.-245 KV
(ii)	Frequency : Nominal	Hz.	[50]
	Variation	%	-3% to +1.5%
(iii)	Combined Voltage and Frequency variation for Contracted Capacity	%	[±5]
(iv)	Power Factor : Nominal		[.85] lag
	Variation		[0.8] lag to [0.95] lead
(v)	Basic Impulse Level (Peak)	kV	[1050]

1.2 Fault Levels:

(i) 3 Phase Minimum S.C Current rating and duration for Switchgear- 40kA for 1second

(ii) Target fault Clearance time Maximum ms 100

1.3 Ramp Rates

All Units of the Power Station shall be capable of increasing or decreasing their output (generation level) by not less than one percent (1%) per minute. Such capability shall be demonstrated during the Unit load of more than 50%.

4. SCHEDULE 4: COMMISSIONING AND TESTING

1.1 Performance Test

(i) (a) The Performance Test shall be conducted under any and all ambient conditions (temperature, humidity etc.) and any and all Fuel qualities that may exist during the time of the Performance Test and no corrections in final gross and net output of the Unit will be allowed as a result of prevailing ambient conditions or Fuel quality.

(b) The correction curves will only be used if the Grid System operation during the Performance Test exceeds electrical system limits.

(c) The Performance Test shall be deemed to have demonstrated the Contracted Capacity of the Unit under all designed conditions and therefore no adjustments shall be made on account of fuel quality or ambient conditions.

(d) The Seller shall perform in respect of each Unit a Performance Test, which such Unit shall be deemed to have passed if it operates continuously for seventy two consecutive hours at or above ninety five (95) percent of its Contracted Capacity ,as existing on the Effective Date,and within the electrical system limits and the Functional Specifications.

(ii) For the purposes of any Performance Test pursuant to this sub-article 1.1, the electrical system limits to be achieved shall be as follows:

(a) Voltage

The Unit must operate within the voltage levels described in the Functional Specification for the duration of the Performance Test. If, during the Performance Test, voltage tests cannot be performed due to Grid System, data supplied from tests of the generator step-up transformers and generators supplied by the manufacturers shall be used to establish the ability of the Unit to operate within the specified voltage limits.

(b) Grid System Frequency

The Unit shall operate within the Grid System frequency levels described in the Functional Specification for the duration of the Performance Test.

(c) Power Factor

The Unit shall operate within the power factor range described in the Functional Specification for the duration of the Performance Test. If, during the Performance Test, power factor tests cannot be performed due to the Grid System, data supplied from tests of the generators and the generator step-up transformers supplied by the manufacturers shall

be used to establish the ability of the Unit to operate within the specified power factor range.

(d) **Fuel quality and cooling water temperature**
The Unit must operate to its Contracted Capacity with Fuel quality and water temperature available at the time of Testing and no adjustment shall be allowed for any variation in these parameters.

iii As a part of the Performance Test, the Seller shall demonstrate that the Unit meets the Functional Specifications for Ramping rate as mentioned in Schedule 3 . For this purpose, representative samples of ramp rates shall be taken, by ramping up or down the gross turbine load while maintaining the required temperatures and temperature differences associated with each ramp rate within the turbine while maintaining all other operational parameters within equipment limits;.

1.2 Testing and Measurement procedures applied during Performance Test shall be in accordance with codes, practices or procedures as generally/ normally applied for the Performance Tests

1.3 The Seller shall comply with the prevalent Laws, rules and regulations as applicable to the provisions contained in this Schedule from time to time.

5. SCHEDULE 5 : AVAILABILITY FACTORS

The following matters shall be determined as per the provisions of the Grid Code and ABT:

a. Availability declaration and calculation of Availability or Availability Factor;

b. Requirement for Spinning Reserves;

c. Procedure for revision of Availability;

d. Consequences of failure to demonstrate capacity or misdeclarations of capacity; and

e. Other matters which may be related to Availability or Availability Factor.

6 SCHEDULE 6: TARIFF

1.1 General

i. The method of determination of Tariff Payments for any Contract Year during the Term of Agreement shall be in accordance withthis Schedule. For the purpose of payments, the Tariff will be determined by the PSERC after the receipt of an application for determination of the Tariff from the Seller

ii. The Tariff shall be paid in two parts comprising of Capacity and Energy Charge.

iii. The full Capacity Charges shall be payable based on the Contracted Capacity at Normative Availability and Incentive shall be provided for Availability beyond 85% as provided in this Schedule. In case of Availability being lower than the Normative Availability, the Capacity Charges shall be payable on proportionate basis in addition to the penalty to be paid by Seller as provided in this Schedule.

1.2 Monthly Tariff Payment

1.2.1 Components of Monthly Tariff Payment

The Monthly Bill for any Month in a Contract Year shall consist of the following:

i. Monthly Capacity Charge Payment in accordance with Article 1.2.2 below;
ii. Monthly Energy Charge for Scheduled Energy in accordance with Article 1.2.3 below;
iii. Incentive Payment determined in accordance with Article 1.2.4 below (applicable on annual basis and included only in the Monthly Tariff Payment for the first month of the next Contract Year);
iv. Penalty Payment determined in accordance with Article 1.2.5 below (applicable on annual basis and included only in the Monthly Tariff Payment for the first month of the next Contract Year);
v. Penalty Payment determined in accordance with Article 1.2.8 below (applicable on annual basis and included only in the Monthly Tariff Payment for the first month of the next Contract Year)

1.2.2 **Monthly Capacity Charge Payment** - The Monthly Capacity Charges based on the Capital Cost as approved by PSERC shall be paid as per CERC (Terms & Conditions of tariff) Regulations as applicable.Provided, no Capacity Charges shall be paid for the Settlement Period during which the RLDC has not allowed the operation of the Power Station due to Seller's failure to operate the Power Station as per the provisions of Grid Code.

1.2.3 **Monthly Energy Charges**

1.2.3.1 The Energy Charges shall be calculated and paid as approved by PSERC as per CERC (Terms & Conditions of tariff) Regulations as applicable.

1.2.3.2 **Source and Cost of Coal and Secondary Fuel**

1.2.3.2.1. The fuel charges linked to Coal cost based on the quantity and quality of coal delivered at the Project Site (Goindwal Sahib) are not to exceed the cost as prevailing in the PSEB's existing Pachhawara Captive Coal Mine. Thus the coal cost of Pachhawara mine will be the maximum price at which coal would be supplied to GSTPS. The Seller in association with the procurer shall resort to a competitive bidding process, preferably international both for developing and operating the captive coal block at Tokisud North subblock and any other block allocated to the project and the lowest cost emanating as a result of this exercise shall not be more than the cost of the existing Pachhawara captive coal block which will form part of the mining agreement and be adopted for the purpose of working out the variable (fuel) charges. However the discount rate for 'F' grade coal will be decided by PSERC.

1.2.3.2.2 If the coal production rate from the Captive Coal Mine and the additional coal block partly allocated for the project is higher than the requirement of the Project such surplus coal production, if any, will be delivered to other thermal projects of the Procurer, as directed by the Procurer. In case the Project is shut down due to Force Majeure, the coal produced by the Captive Coal Mine and the additional coal block shall be supplied to any or all of the existing power projects of Procurer as directed by Procurer. Similarly in case Captive Coal Mine commences the production of coal ahead of the COD of the project, coal so produced shall be supplied to the existing thermal power stations of Procurer as directed by Procurer. The coal shall be supplied to the Procurer's other Projects at the same coal

price as mentioned in the Fuel Supply Agreement for the Project. Sale to the existing projects of the Procurer shall be subject to the approval of Ministry of Coal, Govt. of India. The delivery point for supply of coal to the Procurer's other Projects shall be the premises of the Captive Coal Mine. However the Seller shall arrange for transportation of coal to other projects by diverting the supplies under the fuel transportation agreement with the Railways for which freight charges shall be payable by PSEB.

1.2.3.2.3 The Seller shall purchase the Secondary Fuel from the Public Sector Undertakings like Indian Oil Corporation Ltd., Bharat Petroleum Corporation Ltd, Hindustan Petroleum Corporation Ltd etc. through Competitive Bidding.

1.2.4 Contract Year Energy Incentive Payment.

If and to the extent the Availability in a Contract Year exceeds eighty five percent (85%), an incentive at the rate of forty (40%) of the Capacity Charges (in Rs./kWh) for such Contract Year subject to a maximum of twenty five (25) paise /kwhr, shall be allowed on the energy (in kwh) corresponding to the Availability in excess of eighty five percent (85%).

1.2.5 Contract Year Penalty for Availability below 75% during the Contract Year

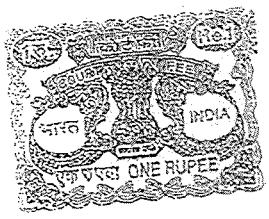
In case the Availability for a Contract Year is less than 75%, the Seller shall pay a penalty at the rate of twenty percent (20%) of the simple average Capacity Charge (in Rs./kWh) for all months in the Contract Year applied on the energy (in kwh) corresponding to the difference between 75% and Availability during such Contract Year.

1.2.6 Deviation from the schedule

Variation between Scheduled Energy and actual energy at the Delivery Point shall be accounted for through Unscheduled Interchange (UI) Charges as detailed in the Grid Code and ABT.

1.2.7 Transmission/Wheeling Charges and Scheduling Charges

The payment of transmission/wheeling charges shall be settled between the CTU/STU and the Procurer. The payment of scheduling charges to the respective nodal agency (RLDC or SLDC) shall be the responsibility of the Procurer.



1.2.8 *Penalty and rights relating to minimum guaranteed quantity of fuel*

In case Seller has to pay penalty to the Fuel supplier for not purchasing the minimum guaranteed quantity of Fuel mentioned in the Fuel Supply Agreement and if during that Contract Year Availability of the Commissioned Units is greater than the Minimum Offtake Guarantee but the Procurer has not Scheduled Energy corresponding to such Minimum Off-take Guarantee during that Contract Year, then Seller will raise an invoice for the lower of the following amount, (a) penalty paid to the Fuel supplier under the Fuel Supply Agreement in that Contract Year, along with documentary proof for payment of such penalty, or

(b) an amount corresponding to twenty percent (20%) of cumulative Monthly Capacity Charge Payment (in Rs.) by the Procurer made for all the months in that Contract Year multiplied by (1- x/y) where:

X is the Scheduled Energy during the Contract Year for the Procurer (in kwh); and

Y is the Scheduled Energy corresponding to Minimum Offtake Guarantee for the Procurer during the Contract Year (in kwh).

Provided within ten (10) days of the end of each Month after the COD of the Ist Unit, the Seller shall provide a statement to the Procurer, providing a comparison of the cumulative despatch for all previous months during the Contract Year with the Minimum Offtake Guarantee of the Procurer. Further, such statement shall also list out the deficit, if any, in the Fuel Offtake under the Fuel Supply Agreement, due to Cumulative Despatch being less than the Minimum Offtake Guarantee. In case of a Fuel Offtake Deficit within a period of fifteen (15) days from the date of receipt of the above statement from the Seller and after giving a prior written notice of atleast seven (7) days to the Seller, the Procurer shall have the rights to avail himself such deficit at the same price at which such deficit fuel was available to the Seller under the Fuel Supply Agreement and to sell such deficit to third parties.

1.2.9 Sale of Infirm Power:

The procurer shall pay only the primary & secondary fuel charges for all infirm power delivered to it by the seller.

1.3 *Settlement of Bills:*

1. The penalty of actual Availability shortfall during the Contract Year, Deviation from the schedule, Transmission & Scheduling Charges, and Penalty to be paid to fuel supplier will be settled as detailed in Article 1.2.2, Article 1.2.5, Article 1.2.6, Article 1.2.7 and Article 1.2.8 of this Schedule.

2. Notwithstanding anything contained in this agreement, no separate reimbursement shall be allowed for the cost of the secondary fuel.

7 SCHEDULE 7: DETAILS OF INTERCONNECTION POINT AND FACILITIES

1. Supply of Information

The Seller shall within a period of two (2) Month after the date of Financial Closing (or such other date as is mutually agreed between the Parties), provide the Procurer with such information about the design of the Project as it may reasonably require to enable it to design the Interconnection Facilities.

2. Cost of Interconnection Facilities

The Procurer shall be responsible for the financing, design, construction, installation commissioning, operation and maintenance of the Interconnection Facilities and shall bear all costs associated with its rights and obligations under this Schedule 7 in accordance with the terms of this Agreement.

3. Ownership of Interconnection Facilities

The Procurer shall own the Interconnection Facilities.

4. Interconnection Equipment on Seller's side of Interconnection Point

The Seller shall be responsible for designing, constructing, installing and maintaining all auxiliary and interconnecting equipment on the Seller's side of the Interconnection Point and the Seller shall have ownership rights in all such auxiliary and Interconnection Equipment.

5. Protection Devices

Protection devices shall be approved by the Procurer (which devices shall conform to the Procurer's system requirements) on or prior to the date of Financial Closing. After the date of Financial Closing, subject to giving the Seller reasonable notice, the Procurer may require the Seller to modify or expand the requirements for protective devices and the Procurer shall reimburse the Seller for the reasonable costs of such modification or expansion.

6. Power Line Carrier Communication (PLCC)

The Seller and Procurer will liase with each other for design, installation of PLCC equipment on or prior to the date of Financial Closing. The Seller and

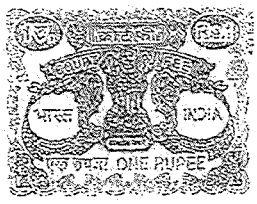
the Procurer will bear the cost of the equipment at their ends of the Interconnection Facility.

7. **Changes Affecting Protective Devices**

Each Party shall notify the other Party as soon as is reasonably practical any changes to either the Project's or the Procurer's transmission system that may affect the proper co-ordination of protective devices between the two systems.

8. **Testing**

The Parties shall co-operate in testing the Interconnection Facilities prior to Synchronisation of a Generating Unit and from time to time as either Party may reasonably require. All such testing shall be carried out on a timely basis.



8 SCHEDULE 8: REPRESENTATION AND WARRANTIES

1. *Representations and Warranties by the Procurer*

The Procurer hereby represents and warrants to and agrees with the Seller as follows and acknowledges and confirms that the Seller is relying on such representations and warranties in connection with the transactions described in this Agreement:

1.1 The said Procurer has all requisite powers authorising and has been duly authorised to execute and consummate this Agreement ;

1.2 This Agreement is enforceable against the said Procurer in accordance with its terms;

1.3 The consummation of the transactions contemplated by this Agreement on the part of the said Procurer will not violate any provision of nor constitute a default under, nor give rise to a power to cancel any charter, mortgage, deed of trust or lien, lease, agreement, license, permit, evidence of indebtedness, restriction, or other contract to which the said Procurer is a party or to which said Procurer is bound, which violation, default or power has not been waived;

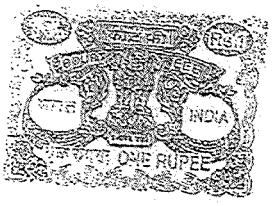
1.4The said Procurer is not insolvent and no insolvency proceedings have been instituted, nor threatened or pending by or against the said Procurer;

1.5There are no actions, suits, claims, proceedings or investigations pending or, to the best of the said Procurer's knowledge, threatened in writing against the said Procurer at law, in equity, or otherwise, and whether civil or criminal in nature, before or by, any court, commission, arbitrator or governmental agency or authority, and there are no outstanding judgements, decrees or orders of any such courts, commission, arbitrator or governmental agencies or authorities, which materially adversely affect its ability to comply with its obligations under this Agreement.

1.6 The Procurers makes all the representations and warranties above to be valid as on the date of this Agreement.

2. *Representation and Warranties of the Seller*

The Seller hereby represents and warrants to and agrees with the Procurer as follows and acknowledges and confirms that the Procurer is relying on such representations and warranties in connection with the transactions described in this Agreement:



2.1The Seller has all requisite power authorising and has been duly authorised to execute and consummate this Agreement;

2.2This Agreement is enforceable against the Seller in accordance with its terms;

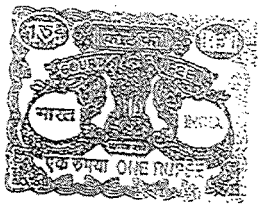
2.3The consummation of the transactions contemplated by this Agreement on the part of the Seller will not violate any provision of nor constitute a default under, nor give rise to a power to cancel any charter, mortgage, deed of trust or lien, lease, agreement, license, permit, evidence of indebtedness, restriction, or other contract to which the Seller is a party or to which the Seller is bound which violation, default or power has not been waived;

2.4The Seller is not insolvent and no insolvency proceedings have been instituted, or not threatened or pending by or against the Seller;

2.5There are no actions, suits, claims, proceedings or investigations pending or, to the best of Seller's knowledge, threatened in writing against the Seller at law, in equity, or otherwise, and whether civil or criminal in nature, before or by, any court, commission, arbitrator or governmental agency or authority, and there are no outstanding judgements, decrees or orders of any such courts, commission, arbitrator or governmental agencies or authorities, which materially adversely affect its ability to execute the Project or to comply with its obligations under this Agreement.

2.6The Seller has neither made any statement nor provided any information, which was materially inaccurate or misleading at the time when such statement was made or information was provided. Further, all the confirmations, undertakings, declarations and representations made by the Seller are true and accurate and there is no breach of the same.

2.7 The Seller makes all the representations and warranties above to be valid as on the date of this Agreement,.



9. SCHEDULE 9: FORMAT OF THE PERFORMANCE GUARANTEE

In consideration of the [Insert name of the Selected Bidder or Selected Bidder on behalf of the Seller] agreeing to undertake the obligations under the PPA and the other Project Documents and [Insert the name of the Procurer], agreeing to execute the PPA and the other Project Documents inter alia with the Seller, regarding setting up the Power Station of the capacity of ..... MW, at .....[Insert name of the place] for supply of power there from on long term basis, the _____ (insert name of bank] (hereinafter referred to as "Guarantor Bank") hereby agrees unequivocally, irrevocably and unconditionally to pay to [Insert Name of the Procurer] at [insert the Place from the address of the respective Procurer indicated in PPA] forthwith on demand in writing from [Name of the Procurer] or any Officer authorised by it in this behalf, any amount upto and not exceeding Rupees _____only [Insert the amount of the bank guarantee in respect of the respective Procurer as per the terms of PPA], on behalf of M/s. _____ [Insert name of the Seller or the Selected Bidder on behalf of the Seller].

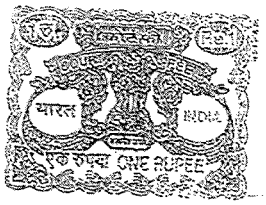
This guarantee shall be valid and binding on this Bank up to and including _____ and shall not be terminable by notice or any change in the constitution of the Bank or the term of contract or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between parties to the respective agreement.

Our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only). Our Guarantee shall remain in force until _____. The Procurer shall be entitled to invoke this Guarantee till _____ [Insert date which is 30 days after the date in the preceding sentence].

The Guarantor Bank hereby agrees and acknowledges that the Procurer shall have a right to invoke this BANK GUARANTE in part or in full, as it may deem fit.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand by the Procurer, made in any format, raised at the above mentioned address of the Guarantor Bank, in order to make the said payment to the Procurer.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection by the Seller and/or any other person. The Guarantor Bank shall not require the Procurer to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against the Procurer in respect of any payment made hereunder



This BANK GUARANTEE shall be interpreted in accordance with the laws of India.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly the Procurer shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against the Seller, to make any claim against or any demand on the Seller or to give any notice to the Seller or to enforce any security held by the Procurer or to exercise, levy or enforce any distress, diligence or other process against the Seller.

The Guarantor Bank acknowledges that this BANK GUARANTEE is not personal to the Procurer and may be assigned, in whole or in part, (whether absolutely or by way of security) by Procurer to any entity to whom the Procurer is entitled to assign its rights and obligations under the PPA.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only) and it shall remain in force until _____ [Date to be inserted on the basis of Article 3.1.1 of PPA] with an additional claim period of thirty (30) days thereafter. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if the Procurer serves upon us a written claim or demand.

Signature _____
Name _____
Power of Attorney No_____
For

_____

Banker's Stamp and Full Address.
Dated this ____ day of ____, 20_

10. SCHEDULE 10: SUBSTITUTION RIGHTS OF THE LENDERS

1. Substitution of the Seller

a) Subject to the terms of the PPA, upon occurrence of a Seller Event of Default under the PPA, the Lenders shall, have the right to seek substitution of the Seller by a Selectee for the residual period of the PPA, for the purposes of securing the payments of the Total Debt Amount from the Seller and performing the obligations of the Seller, in accordance with the provisions of this Schedule.

b) The Lenders may seek to exercise right of substitution by an amendment or novation of the PPA and other Project Documents executed between the Procurer and the Seller in favour of the Selectee, the Procurer and the Seller shall cooperate with the Lenders to carry out such substitution.

2. The Procurer Notice of Default

The Procurer shall, simultaneously also issue a copy of the same to the Lenders.

3. Substitution Notice

In the event of failure of the Seller to rectify the Event Of Default giving rise to Preliminary Default Notice, the lenders, upon receipt of a written advice from the procurer confirming such failure, either on their own or through its representative ("the Lenders' Representative") shall be entitled to notify the Procurer and the Seller of the intention of the Lenders to substitute the Seller by the Selectee for the residual period of the PPA (the "Substitution Notice").

4. Omitted

5. Interim operation of Project

a) On receipt of a Substitution Notice, no further action shall be taken by any Party to terminate the PPA, except under and in accordance with the terms of this Schedule 10 of this Agreement.

b) On issue of a Substitution Notice, the Lenders shall have the right to request the Procurer to enter upon and takeover the Project for the interim and till the substitution of the Selectee is complete and to otherwise take all such steps as are necessary for the continued operation and maintenance of the Project, including levy, collection and appropriation of payments thereunder, subject to, the servicing of monies owed in respect of the Total Debt Amount as per the Financing Agreements and the Seller shall completely cooperate in any such takeover of the Project by the Procurer. If the Procurer, at his sole and exclusive discretion agrees to enter upon and takeover the Project, till substitution of the Selectee in accordance with this Agreement, the Procurer shall be compensated for rendering such services in accordance with clause10.1.3 herein.

c) If the Procurer refuses to takeover the Project on request by the Lenders in accordance with clause 5(b) above, the Seller shall have the duty and obligation to

continue to operate the Project in accordance with the PPA till such time as the Selectee is finally substituted under clause 8.8 hereof.

d) The Lenders and the Procurer shall, simultaneously have the right to commence the process of substitution of the Seller by the Selectee in accordance with these terms and the Seller hereby irrevocably consents to the same.

6. Process of Substitution of Seller

The Lenders' Representative may, on delivery of a Substitution Notice notify the Procurer and the Seller on behalf of all the Lenders about the Lenders' decision to invite and negotiate, at the cost of the Lenders, offers from third parties to act as Selectee, either through private negotiations or public auction and / or a tender process, for the residual period of the PPA. Subject to and upon approval of the Procurer referred to in clause 8.5, such Selectee shall be entitled to receive all the rights of the Seller and shall undertake all the obligations of the Seller under the PPA and other Project Documents executed between the Seller and the Procurers, in accordance with these terms of substitution.

The Lenders and the Seller shall ensure that, upon the Procurer approving the Selectee, the Seller shall transfer absolutely and irrevocably, the ownership of the Project to such Selectee simultaneously with the amendment or novation of the PPA and other Project Documents executed between the Seller and the Procurers in favour of the Selectee as mentioned in clause 1 (b).

7. Modality for Substitution

7.1 Criteria for selection of the Selectee.

The Lenders and / or the Lenders' Representative shall in addition to any other criteria that they may deem fit and necessary, apply the following criteria in the selection of the Selectee:

(a) if the Seller is proposed to be substituted during the Construction Period, the Selectee shall possess the technical and financial capability comparable to that of the seller to perform and discharge all the residual duties, obligations and liabilities of the Seller under the PPA. If the Seller is proposed to be substituted during the Operation Period, this criteria shall not be applicable.

(b) the Selectee shall have the capability and shall unconditionally consent to assume the liability for the payment and discharge of dues, if any, of the Seller to the Procurer under and in accordance with the PPA and also payment of the Total Debt Amount to the Lenders upon terms and conditions as agreed to between the Selectee and the Lenders;

(c) the Selectee shall have not been in breach of any agreement between the Selectee and any Bank or any Lender or between the Selectee and any of the Procurer, involving sums greater than Rupees twenty (20) crores at any time in the last two (2) years as on the date of the substitution of the Seller.

(d) any other appropriate criteria, whereby continuity in the performance of the Selectee's obligations under the PPA is maintained and the security in favour of the Lenders under the Financing Agreements is preserved.

8. Modalities

The following modalities shall be applicable to any substitution of the Seller by the Selectee pursuant to this Agreement:

8.1 The Lenders' Representative shall on behalf of the Lenders propose to the Procurer (the "Proposal") pursuant to sub-clause 8.2 below, the name of the Selectee for acceptance, seeking:

(a) grant of all the rights and obligations under the PPA and the other Project Documents executed between the Procurer and the Seller, to the Selectee (as substitute for the Seller);

(b) amendment of the PPA and the other Project Documents executed between the Procurer and the Seller, to the effect that the aforementioned grant to the Selectee, shall be such that the rights and obligations assumed by the Selectee are on the same terms and conditions for the residual period of the PPA as existed in respect of the Seller under the original PPA and the other Project Documents executed between the Procurer and the Seller; and

(c) the execution of new agreements as necessary, by the proposed Selectee for the residual period of the PPA on the same terms and conditions as are included in this Agreement.

8.2 The Proposal shall contain the particulars and information in respect of the Selectee the data and information as the Procurer may reasonably require. The Procurer may intimate any additional requirement within thirty (30) days of the date of receipt of the Proposal.

8.3 The Proposal shall be accompanied by an unconditional undertaking by the Selectee that it shall, upon approval by the Procurer of the Proposal:

(a) observe, comply, perform and fulfil the terms, conditions and covenants of the PPA and all Project Documents executed between Seller and the Procurer or a new power purchase agreement or respective Project Document (in the case of the novation thereof), which according to the terms therein are required to be observed, complied with, performed and fulfilled by the Seller, as if such Selectee was the Seller originally named under the PPA; or the respective Project Document; and

(b) be liable for and shall assume, discharge and pay the Total Debt Amount or then outstanding dues to the Lenders under and in accordance with the Financing Agreements or in any other manner agreed to by the Lenders and the Procurer as if such Selectee was the Seller originally named under such Financing Agreements.

8.4 At any time prior to taking a decision in respect of the Proposal received under clause 8.1, the Procurer may require the Lender / Lenders' Representative to satisfy it as to the eligibility of the Selectee. The decision of the Procurer as to acceptance or rejection of the Selectee, shall be made reasonably and when made shall be final, conclusive and binding on the Parties.

8.5 The Procurer shall convey his approval or disapproval of such Proposal, , to the Lender / Lender's Representative. Such decision shall be made by the Procurer at his reasonably exercised discretion within twenty one (21) days of:

(a) the date of receipt of the Proposal by the Procurer; or
(b) the date when the last of further and other information and clarifications in respect of any data, particulars or information included in the Proposal requested by the Procurer under clause 8.2 above.is received;
whichever is later.

Notwithstanding anything to the contrary mentioned in this Agreement, the approval of the Procurer for the Selectee shall not be withheld in case the Selectee meets the criteria mentioned in Clause 7.1.

8.6 Upon approval of the Proposal and the Selectee by the Procurer, the Selectee mentioned in the Proposal shall become the Selectee hereunder.

8.7 Following the rejection of a Proposal, the Lenders and/or the Lenders' Representative shall have the right to submit a fresh Proposal, proposing another Selectee (if the rejection was on the grounds of an inappropriate third party proposed as Selectee) within sixty (60) days of receipt of communication

regarding rejection of the Selectee previously proposed. The provisions of this clause shall apply mutatis mutandis to such fresh Proposal.

8.8 The substitution of the Seller by the Selectee shall be deemed to be complete upon the Selectee executing all necessary documents and writings with or in favour of the Seller, the Procurer and the Lenders so as to give full effect to the terms and conditions of the substitution, subject to which the Selectee has been accepted by the Lenders and the Procurer and upon transfer of ownership and complete possession of the Project by the Procurer or the Seller, as the case may be, to the Selectee. The Procurer shall novate all the Project Documents, which they had entered in to with the Seller in order to make the substitution of the Seller by the Selectee effective. The quantum and manner of payment of the consideration payable by the Selectee to the Seller towards purchase of the Project and assumption of all the rights and obligations of the Seller under the PPA and the Project Documents as mentioned in this Agreement shall be entirely between the Seller, Selectee and the Lenders and the Procurer shall in no way be responsible to bear the same.

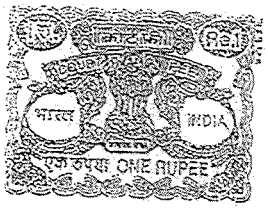
8.9 Upon the substitution becoming effective pursuant to sub-clause 8.8 above, all the rights of the Seller under the PPA shall cease to exist:
Provided that, nothing contained in this sub-clause shall prejudice any pending / subsisting claims of the Seller against the Procurer or any claim of the Procurer against the erstwhile Seller or the Selectee.

8.10 The Selectee shall, subject to the terms and conditions of the substitution, have a period of ninety (90) days to rectify any breach and / or default of the Seller subsisting on the date of substitution and required to be rectified and shall incur the liability or consequence on account of any previous breach and / or default of the Seller.

8.11 The decision of the Lenders and the Procurers in the selection of the Selectee shall be final and binding on the Seller and shall be deemed to have been made with the concurrence of the Seller. The Seller expressly waives all rights to object or to challenge such selection and appointment of the Selectee on any ground whatsoever.

8.12 The Lenders shall be solely and exclusively responsible for obtaining any and all consents/approvals or cooperation, which may be required to be obtained from the Seller under this Agreement and the Procurer shall not be liable for the same.

8.13 All actions of the Lenders' Representative hereunder shall be deemed to be on behalf of the Lenders and shall be binding upon them. The Lenders' Representative shall be authorised to receive payment of compensation and any other payments, including the consideration for transfer, if any, in



accordance with the Proposal and the Financing Agreements and shall be bound to give valid discharge on behalf of all the Lenders.

9. Seller's Waiver

9.1 The Seller irrevocably agrees and consents (to the extent to which applicable law may require such consent) to any actions of the Lenders, the Lender's Representative and the Procurer or exercise of their rights under and in accordance with these terms.

9.2 The Seller irrevocably agrees and consents (to the extent to which applicable law may require such consents) that from the date specified in clause 8.9, it shall cease to have any rights under the PPA or the Financing Agreements other than those expressly stated therein.

9.3 The Seller warrants and covenants that any agreement entered into by the Seller, in relation to the Project, shall include a legally enforceable clause providing for automatic novation of such agreement in favour of the Selectee, at the option of the Lenders or the Procurer. The Seller further warrants and covenants that, in respect of any agreements which have already been executed in relation to the Project and which lack a legally enforceable clause providing for automatic novation of such agreement, the Seller shall procure an amendment in the concluded agreement to incorporate such clause.

10. Interim Protection Of Service And Preservation Of Security

10.1 Appointment of a Receiver

10.1.1 In every case of the Lenders issuing a Substitution Notice and the Procurer refusing to takeover the Project and the Seller failing to operate the Project in accordance with Clause 5(c) above and the Procurer not electing to act as Receiver as per sub-clause 10.1.1A hereof, the Lenders may institute protective legal proceedings for appointment of a receiver (the "Receiver") to maintain, preserve and protect the assets held as security by the Lenders if such right is granted under the terms of the Financing Agreements.

10.1.1A Provided that in event of the Procurer refusing to take over the Project and the Seller failing to operate the Project in accordance with Clause 5 (c) above, and if the assets of the Project are, in the opinion of the Procurer, necessary and required for the operation and maintenance of the Project, the Procurer shall be entitled to elect to act as the Receiver for the purposes of this Clause and be entitled to maintain, preserve and protect the said assets by engaging an operator/service provider to act on their behalf and the Lenders and Seller

hereby consent and agree to the same. Upon the Procurer so intimating the Seller and the Lender's representative their desire to act as Receiver, the Seller and the Lender's representative shall co-operate with the Procurer to facilitate the same.

10.1.2 Upon appointment of the Court appointed Receiver or the Procurer acting as Receiver, all the Receivables received by such Receiver shall be deposited by the Receiver in the bank account jointly designated by the Procurer and the Lenders. The Receiver shall be responsible for protecting the assets in receivership and shall render a true and proper account of the receivership to the lenders in accordance with the terms of its appointment.

10.1.3 When acting as a Receiver or operator in accordance with this clause 10 or clause 5(b), the Procurer shall be entitled to be remunerated for such services as may be determined by Punjab State Electricity Regulatory Commission. Furthermore, when acting as a Receiver, the Procurer shall not be liable to the Lenders, the Lenders' Representative, Seller or any third party for any default under the PPA, damage or loss to the Power Station or for any other reason whatsoever, except for wilful default of the Procurer.

11. Substitution Consideration

11.1 The Lenders and the Procurer shall be entitled to appropriate any consideration received for the substitution of the Seller as hereinabove provided, from the Selectee towards the payment of Lenders' and the Procurer's respective dues, to the exclusion of the Seller.

11.2 The Seller shall be deemed to have nominated, constitutes and appoints the Lenders' Representative as its constituted attorney for doing all acts, deeds and things as may be required to be done for the substitution of the Seller by the Selectee pursuant to these terms.

12. Change in Lenders:

The Parties hereto acknowledge that during the subsistence of the PPA, it is possible that any Lender may cease to remain as a Lender by reason of repayment of the debt or otherwise. Further it may possible that any Lender may be substituted or a new Lender may be added. In the event of any Lender ceasing to be a party to the Financing Agreement, the term and conditions as prescribed in this Schedule shall cease to automatically apply to such Lender. Further, upon any entity being added as a Lender and in the event such entity is given the right to substitute the Seller under the Financing Agreement and then the contents of this Schedule shall be applicable to the exercise of such right by the said new entity.

11. SCHEDULE 11: ESTIMATE OF CAPITAL COST AS APPROVED BY PSERC VIDE ORDERS DATED 29.04.2008 & 06.08.2008 AND MODIFIED AS PER APPELLATE TRIBUNAL ORDER DATED 08.04.2009)

Sr. No.	Item	Estimates of Capital Cost accepted by PSERC and modified as per Appellate Tribunal order dated 08.04.2009 (in Rs. Crore)
1	Land	109.35
2	Rehabilitation & Resettlement	5.00
3	Preliminary Expenses	0.25
4	Boiler Turbine Generator Package	1070.58 (See Notes 5a & 5b)
5	Balance Of Plant	955.00 (See Notes 6a & 6b)
6	Engineering , Erection , Civil Works	Included in BTG BOP contracts
7	Taxes and Duties	Included in BTG BOP contracts
8	Recommended spares for BTG and BOP package	39.65
9	Non EPC	86.00
10	Site grading and Ash Pond	49.00
11	Start-up Expenses	15.00
12	Power and Water for Construction	12.00
13	Consultancy and Engineering	7.50
14	Pre-operative Expenses	50.00
15	Operator Training & Mobilisation	5.00
16	Insurance	11.44
17	Capital Cost excluding IDC , Financing Charges & Contingency	2415.77
18	Interest During Construction (IDC)	365.19 (See Notes 3 & 4)
19	Financing Charges	70.00

20	Contingency	66.85
21	Estimated Capital Cost excluding WCM	2917.81
22	Working Capital Margin(WCM)	46.00
23	Estimated Capital Cost	2963.81

Notes :

1.Estimated Costs against Sr. No. 1,2, 3,4,5,9,13,15&16 are as per PSERC orders dated 29.04.2008 & 06.08.2008.

2.Estimated Costs against Sr. No.8,10,11,12,14,18,19,20&22 are as per PSERC orders dated 29.04.2008 & 06.08.2008 and modified as per the Appellate Tribunal order dated 08.04.2009.

3. Interest During Construction will be at actuals, based on phasing of expenditure consistent with the finalized packages with various contractors.

4. IDC at actuals as per Financing Agreements will be considered for completed Capital Cost determination.

5a. BTG contract price will be subject to price variation formulae for supply price component , freight charges and erection testing & commissioning as indicated in the LOI dated 12 November 2007 issued to M/s BHEL.

5b. Contract price in the order placed with BHEL for the BTG package is payable in Indian Rupee only and the exchange rates for the Euro and US Dollar will be applicable on the date of payment. The BHEL contract price is based on the following exchange rates :

- US $ = Rs.41.00
- Euro =Rs.57.50

6a. The BOP contract price of Rs.955 Crore is for execution of the contract with 'Induced Draft Cooling Towers'. If Natural Draft Cooling Towers are provided instead of Induced Draft Cooling Towers the increase in the BOP contract price will be Rs 50 crore for both the Units.

6b. BOP contract price will be subject to change as per any variation in cement and steel prices at the time of supply , upto the estimated quantities , as indicated in the LOI dated 14 April 2008 issued to M/s Punj Lloyd Ltd.

SCHEDULE 12: CALCULATION OF 'X' DAYS

(Refer Article 11.5.7)

Percentage of Monthly Invoice which is the subject of default under Article 11.4 as notified in the Notice (issued under Article 11.5.2) relatable to the present occurrence	Number of times a Notice has been issued under Article 11.5.2 to the defaulting Procurer prior to present occurrence			
	1st time	2nd time	3rd time	4th time and onwards
Less than 5%	x = 20 days	x = 25 days	x = 40 days	x = 60 days
5% to 10%	x = 20 days	x = 30 days	x = 45 days	x = 65 days
More than 10% to 30%	x = 20 days	x = 35 days	x = 50 days	x = 70 days
More than 30% to 50%	x = 20 days	x = 40 days	x = 55 days	x = 75 days
More than 40%	x = 20 days	x = 45 days	x = 60 days	x =90 days

	CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Sheet No. i

REPORT ON :

GEOTECHNICAL INVESTIGATION FOR 2x270 MW GVK POWER GOINDWAL SAHIB THERMAL POWER PROJECT, NEAR GOINDWAL SAHIB VILLAGE, PUNJAB

- TRIAL AREA
- BOILER UNIT 1 & 2

(POST COMPACTION)

Submitted to:

M/s. GVK Power (Goindwal Sahib) Ltd.
Paigah House
156-159, Sardar Patel Road
Secunderabad-500 003 (A.P.)

TABLE OF CONTENTS

	CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Sheet No. iii

TABLES

ILLUSTRATIONS

Typical Calculations : Sheet Nos. 1 and 2

1.0 INTRODUCTION

1.1 Project Description

M/s. GVK Power Ltd. as owner is setting up a 2x270 MW Coal Based Power Plant at Goindwal Sahib, Tarn Taran Distt., Punjab. M/s. TCE Consulting Engineers Limited is the project consultant from the owner side. M/s. Punj Lloyd Ltd. (PLL) is constructing the proposed Coal-Based Thermal Power Plant. M/s Fichtner Consulting Engineers is the Engineering Consultant for PLL. M/s Cengrs Geotechnica Pvt. Ltd. is the Geotechnical Engineering consultant for PLL/GVK.

We had earlier conducted a detailed geotechnical investigation at the site (Refer to our Report No. 209049). Based on the detailed investigations and analysis, it was concluded that the project site is susceptible to liquefaction to about 10.0 m below EGL (RL208.5~209.0 m) in the event of an earthquake.

The clients decided to adopt vibro-compaction technique for the ground improvement at the site for all planned structures to mitigate the liquefaction potential. As per the information provided to us, the vibro-compaction has been carried out on 3x3 m grid pattern for various structures/units.

To confirm the safe bearing capacity for open foundations after ground improvement by vibro compaction; two plate load tests and two boreholes (BH-1&2) were conducted in the trial area. Two boreholes were also conducted in Boiler-1 and Boiler-2 areas. This report presents the results of four (4) boreholes and two (2) plate load tests and our engineering recommendations.

According to the information provided to us, ground levels at the site vary from RL 219.3 m to RL 219.6 m. A layout plan showing the locations of our field investigation is illustrated on Fig. No.'s 1a &1b.

1.2 Purposes of Study

The overall purpose of this study is to assess the safe bearing capacity for shallow open foundations on the treated ground, based on the results of the plate load tests and boreholes data. To accomplish these purposes, the study was conducted in the following phases:

a) drilling four (4) boreholes to 10 m depth and conducting standard penetration tests (SPT) at 1.5 m depth intervals, in order to investigate the site stratigraphy and to collect disturbed soil samples for laboratory testing;

b) performing two (2) plate load tests in the trial area using 30 cm x 30 cm plate at a depth of 1.5 m below EGL so as to assess the load-settlement behavior of the underlying soil after vibro compaction; and

c) analyzing the plate load test results and borehole data to assess the safe bearing capacity.

1.3 Details of Field Work

The test details are summarized below:

Test Location	Test Designation	Coordinates*	Existing* Ground Level, m
Trial Area	BH-1	S:255.748-W:265.819	219.61
	BH-2	S:279.756-W:297.448	219.61
	PLT-1	S:277.485-W:263.099	219.61
	PLT-2	S:256.672-W:301.219	219.59
Boiler-1	BH-3	N:33.981-W:62.717	219.35
Boiler-2	BH-4	N:135.252-W:66.019	219.35

* as per the information given to us on site

1.4 Related Reports

Details of past investigations carried out in the areas under consideration are presented below for reference:

Trial Area (Refer to Fig. No. 1a):

Test Designation	Co-ordinates*	Surface Elevation (RL), m	Termination Depth, m	Remarks	Report Reference
SCPT-1	244.144 S, 270.181W	219.480	15.0	Pre-compaction	Report No. 209188
SCPT-2	244.144 S, 300.181W	219.485	15.0		
SCPT-3	274.144 S, 300.181W	219.475	15.0		
SCPT-4	274.144 S, 270.181W	219.445	15.0		
SCPT-5	259.144 S, 285.181W	219.505	15.0		
SCPT-1	244.144 S, 270.181W	219.480	15.0		
SCPT-1	244.144 S, 220.181W	219.586	11.0	Post-compaction	Report No. 209188-A
SCPT-2	244.144 S, 300.181W	219.591	7.4		
SCPT-3	274.144 S, 300.181W	219.641	15.0		
SCPT-4	274.144 S, 270.181W	219.616	11.0		
SCPT-5	259.144 S, 285.181W	219.641	9.4		
SCPT-6	281.644 S, 262.681W	219.700	13.6		

Boiler-I and II (Refer to Fig. No. 1b):

Location	Test Desig-nation	Co-ordinates	Surface Elevation (RL); m	Termina-tion Depth, m	Remarks	Report Reference
Boiler Area-1	SCPT-B1	60.238 N, 48.489 W	219.400	15.0	Pre-Compaction	Report No. 209188-B
	SCPT-B2	4.649 N, 74.815 W	219.400	15.0		
Boiler Area-2	SCPT-B3	130.000 N, 50.000 W	219.450	15.0		
	SCPT-B4	160.000 N, 60.000 W	219.450	15.0		

Location	Test Desig-nation	Co-ordinates	Surface Elevation (RL), m	Termina-tion Depth, m	Remarks	Report Reference
ESP-1	SCPT-B5	51.583 N, 148.262 W	219.226	15.0	Pre-Compaction	Report No. 209188-B
ESP-2	SCPT-B6	163.962 N, 154.699 W	219.260	15.0		
Boiler Area-1	SCPT-A1	60.238 N, 48.489 W	219.400	14.2		
	SCPT-A2	18.439 N, 63.588 W	219.500	15.0		
Boiler Area-2	SCPT-A3	130.000 N, 50.000 W	219.500	15.0		
	SCPT-A4	160.000 N, 60.000 W	219.500	14.6		
ESP-1	SCPT-A5	33.50 N, 130.60 W	219.530	15.0		
ESP-2	SCPT-A6	163.962 N, 154.699 W	219.410	15.0		

2.0 FIELD INVESTIGATION

2.1 Soil Borings

The borehole was progressed using a mechanized shell and auger to the specified depth or refusal, whichever is encountered earlier. The borehole diameter was 150 mm. Where caving of the borehole occurred, 150 mm diameter casing was used to keep the borehole stable. The work was in general accordance with IS: 1892-1979.

Standard Penetration Tests (SPT) were conducted in the boreholes at 1.5 m depth intervals upto 10.0 m depth. The test was performed by connecting a split spoon sampler to 'A' rods and driving it by 45 cm using a 63.5 kg hammer falling freely from a height of 75 cm. The tests were conducted in accordance with IS: 2131-1981.

The number of blows for each 15 cm of penetration of the split spoon sampler was recorded. The blows required to penetrate the initial 15 cm of the split spoon for seating the sampler is ignored due to the possible presence of loose materials or cuttings from the drilling operation. The cumulative number of blows required to penetrate the balance 30 cm of the 45 cm of split spoon sampler is termed the SPT value or the 'N' value.

The SPT N-values (field and corrected) are presented in a graphical format on Fig. No's. 3a and 3b.

Disturbed samples were collected from the split spoon after conducting SPT. The samples were preserved in transparent polythene bags. All samples were transported to our NABL accredited laboratory at Delhi for further examination and testing.

2.2 Plate Load Tests

Plate load tests were performed at the site at specified level using a 30 x 30 cm size test plate. The test procedure is in general accordance with IS: 1888-1982.

An anchoring system by earth augers was used to provide the reaction. The plate was loaded by pushing up against the reaction anchors using a 50-ton capacity hydraulic jack.

Three dial gauges measured the plate settlement with reference to a stable reference bar. The load is applied in small increments upto a maximum loading intensity of 6.0 kg/cm^2 or 40 mm settlement of the plate, whichever occurs first.

Each load was held until the time rate of settlement became negligible (less than 0.02 mm per minute). The load was applied in stages about till the maximum applied pressure of 6.0 kg/cm^2 load was reached or until the total settlement exceeded 40 mm.

Test results are presented on Fig. Nos.4 and 5 as curves of bearing pressure on plate versus the measured settlement on liner and log-log scales.

3.0 LABORATORY TESTS

The laboratory testing has been carried out in our NABL accredited laboratory. The quality procedures in our laboratory conform to ISO/IEC-17025-2005.

The laboratory testing programme was aimed at verifying the field classifications and developing parameters for engineering analysis. All testing was performed in accordance with the current applicable IS specifications.

The following tests were conducted on selected soil samples recovered from the boreholes:

Laboratory Tests	IS : Code Referred
Bulk density	By calculation
Natural moisture content	IS : 2720 (Part-2) -1973
Grain size analysis	IS : 2720 (Part-4) -1985
Atterberg Limits	IS : 2720 (Part-5) -1985

4.0 GENERAL SITE CONDITIONS

4.1 Site Stratigraphy

4.1.1 Trial Area

The surficial soils in the trial area generally consist of fine sand/silty sand from the ground surface to the final explored depth of 10.45 m (RL 208.9 m).

Field SPT values range from 31 to 39 to 3.0 m depth and 18 to 24 to about 4.0 m depth. Below this, field SPT values range from 43 to 50 to 5.0~6.0 m depth, 16 to 32 to 9.0 m depth, and 32 to 42 to the final explored depth of 10.45 m.

Corrected SPT values range from 43 to 54 to 3.0 m depth and 21 to 29 to about 4.0 m depth. Below this, corrected SPT values range from 32 to 36 to 5.0~6.0 m depth, 16 to 18 to 9.0 m depth, and 23 to 28 to the final explored depth of 10.45 m.

There is significant variation in the recorded SPT N-values at BH-1 and BH-2 locations with depth as well as laterally across the site at the same depth.

4.1.2 Boiler-I and II Area

The surficial soils in the Boiler-I and II area generally consist of fine sand/silty sand from the ground surface to the final explored depth of 10.45 m (RL 208.9 m). A discontinuous layer of sandy silt is encountered at BH-3 between 0.5 m and 2.0 m depths.

Field SPT values range from 12 to 15 to 3.0 m depth. Below this, field SPT values at BH-3 range from 21 to 25 to about 5.0 m depth, whereas field SPT values at BH-4 are relatively higher and range from 39 to 62 to about 5.0 m depth. Below this, field SPT values range from 20 to 25 to about 8.0 m depth, about 45 to 10.0 m depth, and 32 to 34 to the final explored depth of 10.45 m.

Corrected SPT values range from 17 to 21 to 3.0 m depth. Below this, corrected SPT values at BH-3 range from 20 to 28 to about 5.0 m depth, whereas corrected SPT values at BH-4 are relatively higher and range from 31 to 43 to about 5.0 m depth. Below this, corrected SPT values range from 18 to 23 to about 8.0 m depth, about 30 to 10.0 m depth, and 23 to 24 to the final explored depth of 10.45 m.

4.1.3 Presentation of Results

The soil profiles (BH-1 to BH-4) with all necessary laboratory results are given on the Tables 1 to 4. Summary of the borehole profiles is illustrated on Fig. No.2. Field and corrected SPT results are plotted on Fig. No's. 3a and 3b.

Plate load test results are plotted on Fig No's 4 and 5. Grain size analysis curves are presented on Fig No's. 6 to 9.

4.2 Groundwater

Groundwater level was measured in the boreholes 24 hours after drilling and sampling was completed. Based on our measurements in the completed boreholes, groundwater was met at 3.2~3.6 m depth (RL 216.0-216.1 m) below EGL at the time of our field investigation (March, 2010).

5.0 EVALUATION OF PLATE LOAD TESTS

5.1 Load-Settlement Data

Two plate load tests have been conducted at specified locations over the treated ground (i.e by vibro compaction). The tests were carried out upto a maximum load intensity of 6.0 kg/cm^2.

The following table presents the measured settlements of the two plate load tests carried out in the trial area:

Test No.	Test Level, m	Measured Settlement (mm) under Applied Bearing Pressure of				Ultimate Bearing Capacity, T/m^2
		10 T/m^2	12 T/m^2	15 T/m^2	20 T/m^2	
PLT-1	RL 218.116 m	4.4	4.5	4.8	5.2	38.0
PLT-2	RL 218.091 m	5.3	5.8	6.2	7.8	30.0

5.2 Analysis of Test Results

The test results have been extrapolated for open foundations (2.5-3.0 m width) using the following equation:

$$\frac{S_f}{S_p} = \left[\frac{B_f(B_p + 0.3)}{B_p(B_f + 0.3)}\right]^2$$

where

S_f = Settlement of footing with width of footing as B_f
S_p = Settlement of plate with width of plate as B_p

Settlement of isolated square foundations for width of footing 2.5~3.0 m has been extrapolated using the above equation. A suitable multiplying factor has been applied to account for saturation of soils as well as variations in the soil conditions.

Analyzing the test results, the following table presents the extrapolated settlement of the 2.5 - 3.0 m wide square footing:

Location	Test No.	Estimated Settlement (mm) of 2.5 m wide footing under an Applied Bearing Pressure of				Estimated Settlement (mm) of 3.0 m wide footing under an Applied Bearing Pressure of			
		10 T/m^2	12 T/m^2	15 T/m^2	20 T/m^2	10 T/m^2	12 T/m^2	15 T/m^2	20 T/m^2
Trial area	PLT-1	44.0	45.0	48.0	52.0	42.1	43.0	45.9	49.7
	PLT-2	53.0	58.0	62.0	78.0	50.7	55.5	59.3	74.6

5.3 Discussion of Results

1. The ultimate capacity of 30 cm square plates bearing at RL 218.1 m in the trial area (*Refer to Fig. No. 1a*) is in the range of 30-38 T/m^2. Applying a factor of safety of 2.5, the safe bearing capacity is in the range of 12-15 T/m^2 for 30 cm plate size.

2. The initial settlement of the plate upon application of the first load increment (corresponding to an applied bearing pressure of about 1.1 kg/cm^2) was 4.4 mm and 5.3 mm at PLT-1 and PLT-2 locations, respectively. This indicates that the surficial soils below the test level are loose in condition. We suggest that the top layers be properly compacted prior to construction in these areas.

3. From the analysis of plate load test results, the settlement of 2.5~3.0 m wide footings bearing at RL 218.1 m for a net allowable bearing pressure of 10 T/m^2 works out to be about 44~53 mm. However, we expect that the actual foundation settlements may be lower if the top layers are properly compacted prior to foundation construction.

4. We suggest that the plate load test results be reviewed in conjunction with borehole and SCPT data in the area.

5.4 Limitations of Plate Load Tests

The analysis presented in this report is governed by the inherent limitations of plate load test, some of which are listed below:

(a) The analysis is applicable only for uniform isotropic formations. Stratified deposits are not modelled effectively by the test.

(b) The test stresses the soils only to a depth of "2 B_p" below test level (B_p = plate width). Large size foundations will stress the deeper soils also. However, the behavior of the deeper soils cannot be evaluated by the test.

(c) The settlement measured during the test is primarily immediate settlement. Consolidation or long-term settlement cannot be determined by the test.

6.0 RECOMMENDATIONS

1) Trial Area : Based on the results of plate load tests, boreholes and static cone penetration tests (SCPT's) carried out in the Trial area (Refer to Fig. No. 1a); we suggest a net allowable bearing capacity of 10 T/m^2 for open foundations of minor or lightly-loaded structures bearing on the improved ground at RL 218.0 m. The total settlement of the foundations is expected to be about 40~50 mm. Due to the presence of loose soils at this level in some areas, we suggest that the soil at foundation level be thoroughly compacted using vibratory rollers, prior to laying the foundation.

2) Boiler-I and Boiler-II : Based on the results of boreholes and SCPT's carried out in this area; we suggest a net allowable bearing pressure of 10 T/m^2 for the design of open foundations of minor or lightly-loaded structures bearing on the improved ground at RL 218.0 m. The total settlement of the foundations is expected to be about 40~50 mm. Due to the presence of loose soils at this level in some areas, we suggest that the soil at foundation level be thoroughly compacted using vibratory rollers, prior to laying the foundation.

7.0 CLOSURE

We appreciate the opportunity to perform this investigation for you and have pleasure in submitting this report. Please contact us when we can be of further service to you.

for CENGRS GEOTECHNICA PRIVATE LIMITED

(RAVI SUNDARAM)
DIRECTOR

(SANJAY GUPTA)
MANAGING DIRECTOR

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 1

TERMINATION DEPTH 10.45 m

Table No: 1a

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 255.748 S, 265.819 W

Surface Elevation 219.61 m

WATER TABLE : 3.6 m

Location : Trial Area

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
	219.61	0.00	DS1		Dense grey fine sand (SP)														
	219.11	0.50																	
	219.11	0.50	DS2			0	97	3	0										
	218.61	1.00			(1.5m)														
39	218.11	1.50	SPT1		Dense brown silty fine sand (SM)														
	217.66	1.95																	
	217.36	2.25	UDS1			0	81	19	0					1.82	1.56	16.8			
	217.06	2.55			(3.0m)														
18	216.61	3.00	SPT2		Medium dense to dense grey fine sand (SP-SM)														
	216.16	3.45			- medium dense, 3.0 to 4.5 m														
43	215.11	4.50	SPT3		- dense, 4.5 to 7.5 m														
	214.66	4.95																	
	214.36	5.25	DS3			0	94	6	0										
	214.06	5.55																	
32	213.61	6.00	SPT4																
	213.16	6.45																	
16	212.11	7.50	SPT5		- medium dense, 7.5 to 9.0 m														
	211.66	7.95																	
	211.36	8.25	DS4																
	211.06	8.55			- dense, 9.0 to 10.45 m														
39	210.61	9.00	SPT6		- with traces of gravel, 9.0 to 10.45 m	2	93	5	0										
	210.16	9.45																	

(Cont'd on Table No. 1b)

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 1

TERMINATION DEPTH 10.45 m

Table No: 1b

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 255.748 S, 265.819 W

Surface Elevation 219.61 m

WATER TABLE : 3.6 m

Location : Trial Area

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
32	209.61 209.16	10.00 10.45	SPT7		Dense grey fine sand with traces of gravel (SP-SM) (10.45m)														

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 2

TERMINATION DEPTH 10.45 m

Table No: 2a

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 279.756 S, 297.448 W

Surface Elevation 219.61 m

WATER TABLE : 3.55 m

Location : Trial Area

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm³	Dry Density gms/cm³	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm²	Cohesion Intercept Kg/cm²	Angle of Internal Friction
	219.61	0.00	DS1		Dense grey fine sand (SP-SM)														
	219.11	0.50																	
	219.11	0.50	DS2			0	93	7	0										
	218.61	1.00																	
31	218.11	1.50	SPT1																
	217.66	1.95			(2.0m)														
	217.36	2.25	UDS1		Medium dense brown silty fine sand (SM)	0	86	14	0					1.86	1.76	5.63			
	217.06	2.55			(3.0m)														
24	216.61	3.00	SPT2		Medium dense to dense grey fine sand (SP-SM) - medium dense, 3.0 to 4.5 m														
	216.16	3.45																	
50	215.11	4.50	SPT3		- dense, 4.5 to 6.0 m														
	214.66	4.95																	
	214.36	5.25	UDS2			0	92	8	0					1.92	1.55	23.9			
	214.06	5.55																	
17	213.61	6.00	SPT4		- medium dense, 6.0 to 9.0 m														
	213.16	6.45																	
20	212.11	7.50	SPT5																
	211.66	7.95																	
	211.36	8.25	DS3			0	95	5	0										
	211.06	8.55																	
					- dense, 9.0 to 10.45 m														
42	210.61	9.00	SPT6		- with traces of gravel, 9.0 to 10.0 m														
	210.16	9.45																	

(Cont'd on Table No. 2b)

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 2

TERMINATION DEPTH 10.45 m

Table No: 2b

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 279.756 S, 297.448 W

Surface Elevation 219.61 m

WATER TABLE : 3.55 m

Location : Trial Area

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
40	209.61 209.16	10.00 10.45	SPT7		Dense grey fine sand (SP-SM) (10.45m)														

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 3

TERMINATION DEPTH 10.45 m

Table No: 3a

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 33.981 N, 62.717 W

Surface Elevation 219.35 m

WATER TABLE : 3.2 m

Location : Boiler-1

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm³	Dry Density gms/cm³	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm²	Cohesion Intercept Kg/cm²	Angle of Internal Friction
	219.35	0.00																	
	218.85	0.50	DS1		Medium dense grey fine sand (SP-SM)	0	90	10	0										
					(0.5m)														
	218.85	0.50			Medium dense brown sandy silt, low plastic (CL)														
	218.35	1.00	DS2			0	33	56	11										
15	217.85	1.50								32.5	20.2	12.3							
	217.40	1.95	SPT1																
					(2.0m)														
	217.10	2.25			Medium dense to dense grey fine sand (SP)														
	216.80	2.55	UDS1		- medium dense, 2.0 to 4.5 m	0	97	3	0					1.74	1.62	7.38			
21	216.35	3.00																	
	215.90	3.45	SPT2																
35	214.85	4.50			- dense, 4.5 to 6.0 m														
	214.40	4.95	SPT3																
	214.10	5.25																	
	213.80	5.55	UDS2			0	96	4	0					1.66	1.51	9.85			
29	213.35	6.00			- medium dense, 6.0 to 8.0 m														
	212.90	6.45	SPT4																
20	211.85	7.50																	
	211.40	7.95	SPT5																
					(8.0m)														
	211.10	8.25			Dense grey fine sand (SP-SM)														
	210.80	8.55	DS3			0	91	9	0										
45	210.35	9.00																	
	209.90	9.45	SPT6																

(Cont'd on Table No. 3b)

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 3

TERMINATION DEPTH 10.45 m

Table No: 3b

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 33.981 N, 62.717 W

Surface Elevation 219.35 m

WATER TABLE : 3.2 m

Location : Boiler-1

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
34	209.35 208.90	10.00 10.45	SPT7		Dense grey fine sand (SP-SM) (10.45m)														

* Outside NABL scope

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 4

TERMINATION DEPTH 10.45 m

Table No: 4a

JOB NO. 210025

Certificate No.T-0809

Co-ordinates 135.252 N, 66.019 W

Surface Elevation 219.35 m

WATER TABLE : 3.25 m

Location : Boiler-2

N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
	219.35	0.00	DS1		Medium dense grey fine sand (SP-SM)														
	218.85	0.50																	
	218.85	0.50	DS2			0	90	10	0										
	218.35	1.00			(1.5m)														
12	217.85	1.50	SPT1		Medium dense to very dense brown silty fine sand (SM)														
	217.40	1.95			- medium dense, 1.5 to 3.0 m														
	217.10	2.25	UDS1			0	79	21	0					1.61	1.41	14.3			
	216.80	2.55																	
39	216.35	3.00	SPT2		- dense, 3.0 to 4.5 m														
	215.90	3.45																	
62	214.85	4.50	SPT3		- very dense, 4.5 to 5.0 m														
	214.40	4.95			(5.0m)														
	214.10	5.25	UDS2		Medium dense to dense grey fine sand (SP-SM)														
	213.80	5.55			- medium dense, 5.0 to 9.0 m	0	94	6	0					2.01	1.61	25.2			
22	213.35	6.00	SPT4																
	212.90	6.45																	
25	211.85	7.50	SPT5																
	211.40	7.95																	
	211.10	8.25	DS3			0	93	7	0										
	210.80	8.55																	
45	210.35	9.00	SPT6		- dense, 9.0 to 10.45 m														
	209.90	9.45																	

(Cont'd on Table No. 4b)

* Outside NABL scop

376

SOIL PROFILE

Project : 2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

BH.No: 4

TERMINATION DEPTH 10.45 m

Table No: 4b

JOB NO. 210025

Certificate No.T-9809

Co-ordinates 135.252 N, 66.019 W

Surface Elevation 219.35 m

WATER TABLE : 3.25 m

Location : Boiler-2

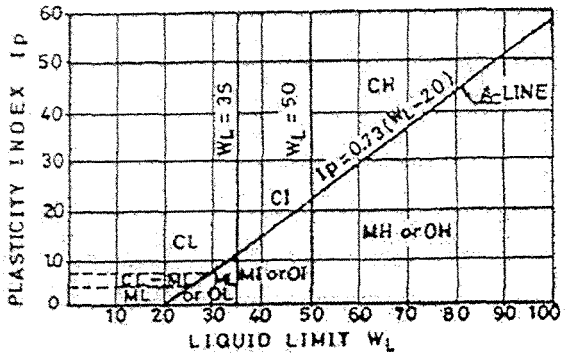
N-Value*	Reduced Level, m	Depth (m)	Sample No.	Symbol	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
32	209.35 208.90	10.00 10.45	SPT7		Dense grey fine sand with gravel SP) (10.45m)	9	89	2	0										

* Outside NABL scope

	CENGRS GEOTECHNICA PVT. LTD.	Job No.: 210025	Table No.: 5

PLASTICITY OF CLAY

Plasticity	Liquid Limit
Low Plastic	< 35
Medium Plastic	35 to 50
High Plastic	> 50



PLASTICITY CHART

CONSISTENCY OF COHESIVE SOILS

Consistency	Cohesion Intercept, kg/sq.cm	SPT (N) Value
Very Soft	< 0.1	0 to 2
Soft	0.1 to 0.25	2 to 4
Firm/Medium	0.25 to 0.5	4 to 8
Stiff	0.5 to 1.0	8 to 15
Very Stiff	1.0 to 2.0	15 to 30
Hard	> 2.0	> 30

DENSITY CONDITION OF GRANULAR SOILS

Density Descriptor	SPT (N) Value	Static Cone Tip Resistance kg/sq.cm
Very Loose	0 to 4	< 20
Loose	4 to 10	20 to 40
Medium Dense	10 to 30	40 to 120
Dense	30 to 50	120 to 200
Very Dense	> 50	> 200

DEGREE OF EXPANSION OF FINE GRAINED SOILS

Liquid Limit	Plasticity Index	Shrinkage Index	Free Swell Percent	Degree of Expansion	Degree of Severity
20 – 35	< 12	< 15	< 50	Low	Non-critical
35 – 50	12 – 23	15 – 30	50 – 100	Medium	Marginal
50 – 70	23 – 32	30 – 60	100 – 200	High	Critical
70 – 90	> 32	> 60	> 200	Very High	Severe

ENGINEERING DESCRIPTION OF SOILS

	CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Table No. 6

NABL ACCREDITED LABORATORY

Our laboratory is accredited to National Accreditation Board for Laboratories (NABL), New Delhi. The quality procedures in our laboratory conform to the International Standard ISO/IEC: 17025-2005.

The accreditation assures our clients of work quality in conformance with international norms and practices. It authorizes us to use the NABL logo on test results.

To maintain the necessary level of quality and reliability in all measurements on a continual basis, we indulge in the following:

- Use of calibrated equipment, regular maintenance and good housekeeping are a part of our work culture.
- Inter-laboratory comparison, proficiency testing and replicate testing, continuing education - ensure uniform quality of results.
- Internal Audit of quality procedures is done by our qualified ISO 17025 auditors to maintain the requisite standards. NABL conducts external audit.

UNCERTAINTY

Every measurement entails an uncertainty. It is well known that no measuring instrument can determine the true value of any measurement. The cumulative effect of factors such as sensitivity of equipment, accuracy in calibration, human factors and environmental conditions will determine the overall uncertainty in the parameter determined from these measurements.

As a part of our commitment to our clients, we have worked out the uncertainty in the parameters reported by our laboratory. Although this does not form a part of our contract agreement, we present below our statistical estimate of uncertainty of various parameters based on our most recent evaluation (March 2009).

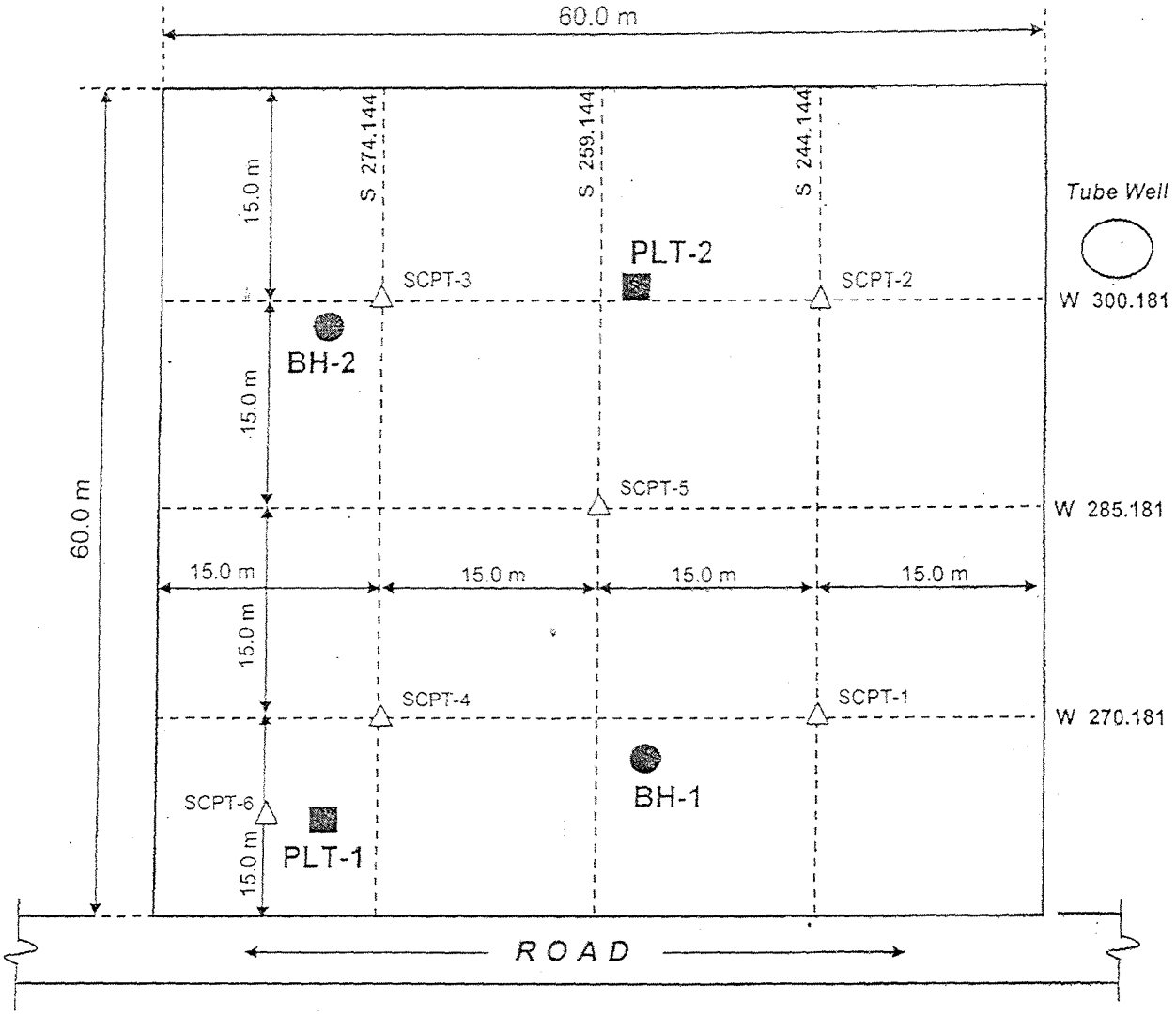
Test / Parameter		Uncertainty*
Moisture Content, %		± 0.22 %
Bulk & Dry Density		± 0.003 g/cc
Specific Gravity		± 0.02
Liquid Limit		± 0.22 %
Plastic Limit		± 0.22 %
Shrinkage Limit		± 0.12 %
Unconfined Compression	c	0.01 kg/cm^2
UU Triaxial Test	c	± 0.07 kg/cm^2
	ϕ	± 0.2°
Std/Mod Proctor Compaction	MDD	± 0.03 g/cc
	OMC	± 0.22 %
Laboratory CBR		± 0.07 %

Test / Parameter		Uncertainty*
Free Swell Index, %		± 0.20 %
Swell Pressure		± 0.43 kg/cm^2
Consolidation	c_{c1}	± 0.0003
	c_{c2}	± 0.003
	m_v	± 0.0003 cm^2/kg
	p_c	± 0.15 kg/cm^2
CD Direct Shear Test	ϕ	± 0.25°
Soil Gradation	Sands & Silty sands	± 0.5% of particle size
	Sandy silt / clayey silt	± 1.5% of particle size
Coefficient of Permeability		± 1.3 % of value
Rock	Crushing strength	± 0.80% of value
	Point Load strength index	± 2.40% of value

* at 95 percent confidence level for coverage factor of 2

UNCERTAINTY IN LABORATORY MEASUREMENTS

CENGRS GEOTECHNICA PVT. LTD.	Job No. : 210025	Fig No. : 1a



Test No.	Co-ordinates S	Co-ordinates W	Surface Elevation,m
BH 1	255.748	266.819	219.610
BH 2	279.756	297.448	219.610
PLT 1	277.485	263.099	218.116
PLT 2	256.672	263.099	218.091

Test No.	Co-ordinates S	Co-ordinates W	Surface Elevation,m
SCPT1	244.144	270.181	219.586
SCPT2	244.144	300.181	219.591
SCPT3	274.144	300.181	219.641
SCPT4	274.144	270.181	219.616
SCPT5	259.144	285.181	219.641
SCPT6	281.644	262.681	219.700

CURRENT INVESTIGATION

SYMBOL	TYPE OF TEST
●	Borehole (Post Compaction) BH
■	Plate Load Test (Post Compaction) PLT

PREVIOUS INVESTIGATION

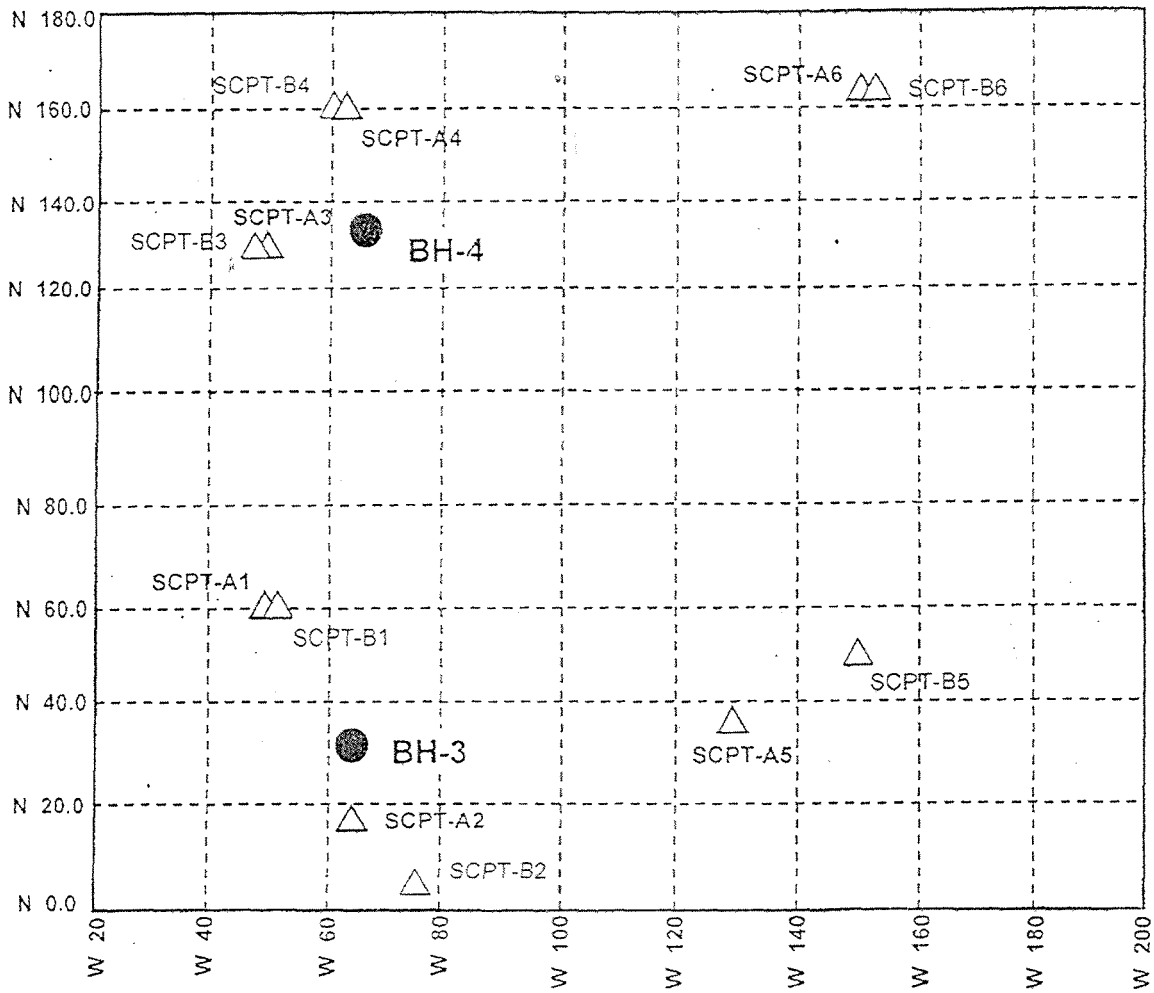
SYMBOL	TYPE OF TEST
△	Static Cone Penetration Tests conducted before and after vibro compaction (Refer to report nos. 209188 & 209188-A (SCPT)

PLAN OF FIELD INVESTIGATION (TRIAL AREA)

2 x 270 MW Thermal Power Project Goindwal Sahib, Punjab

Not to Scale

CENGRS GEOTECHNICA PVT. LTD. | Job No. : 210025 | Fig No. : 1b



Borehole No.	Co-ordinates N	Co-ordinates W	RL, ,m	Location
BH - 3	33.981	62.717	219.350	Boiler -1
BH - 4	135.252	66.019	219.350	Boiler -2

Test No.	Co-ordinates N	Co-ordinates W	RL, m	Location
SCPT-B1	60.238	48.489	219.400	Boiler Area 1
SCPT-B2	4.649	74.815	219.400	
SCPT-B3	130.000	50.000	219.450	Boiler Area 2
SCPT-B4	160.000	60.000	219.450	
SCPT-B5	51.583	148.262	219.226	ESP-1
SCPT-B6	163.962	154.699	219.260	ESP-2
SCPT-A1	60.238	48.489	219.400	Boiler Area 1
SCPT-A2	18.439	63.588	219.500	
SCPT-A3	130.000	50.000	219.500	Boiler Area 2
SCPT-A4	160.000	60.000	219.500	
SCPT-A5	33.500	130.000	219.530	ESP-1
SCPT-A6	163.962	154.000	219.410	ESP-2

LEGEND

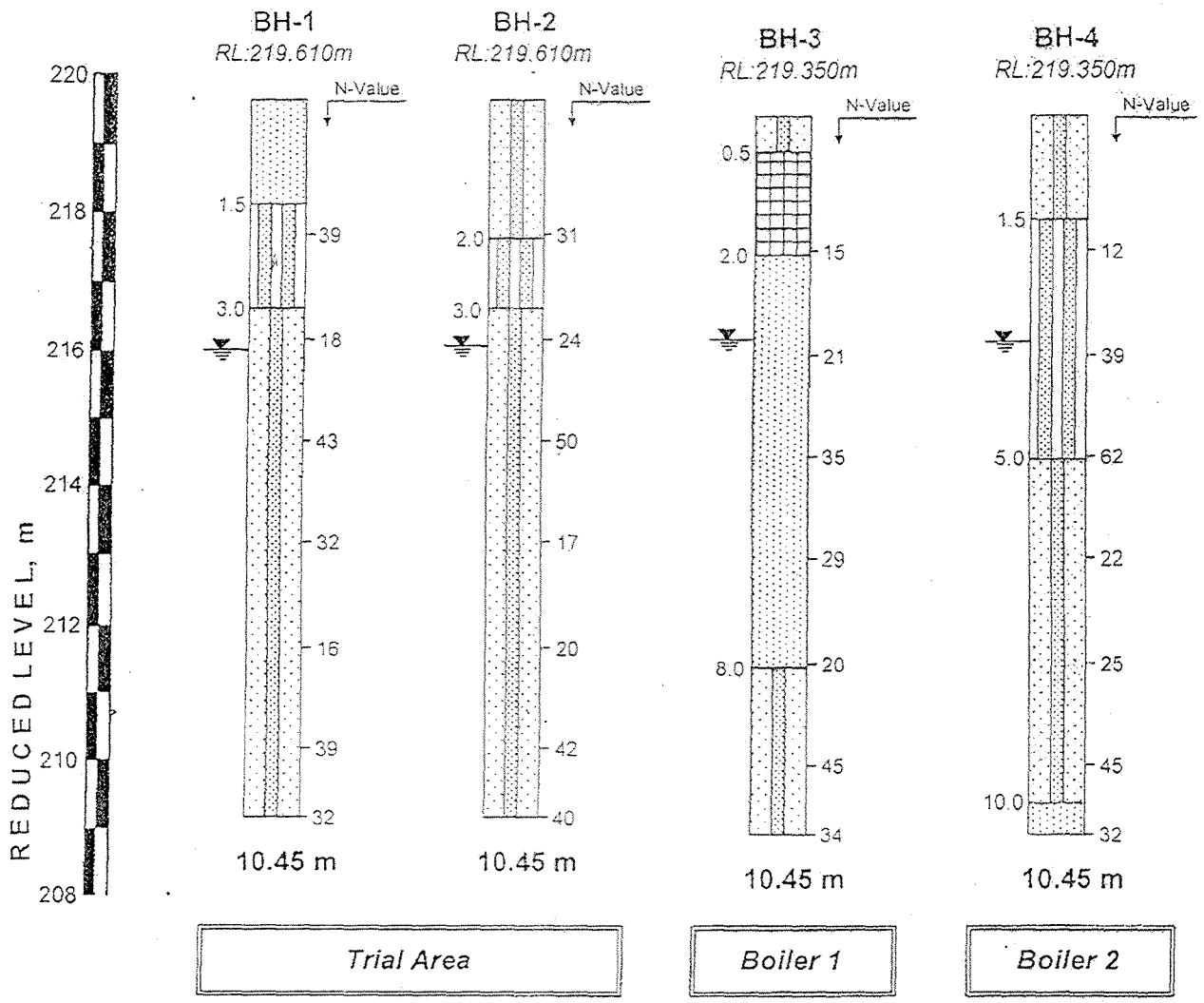
SYMBOL	TYPE OF TEST
●	Borehole (Current Investigation) (BH)
△	Static Cone Penetration Test (Pre Compaction) Job No.209188-B (SCPT)
△	Static Cone Penetration Test (Post Compaction) Job No.209188-B (SCPT)

PLAN OF FIELD INVESTIGATION (Boiler Area- -1&2)

2 x 270 MW Thermal Power Project Goindwal Sahib, Punjab

Not to Scale

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 2



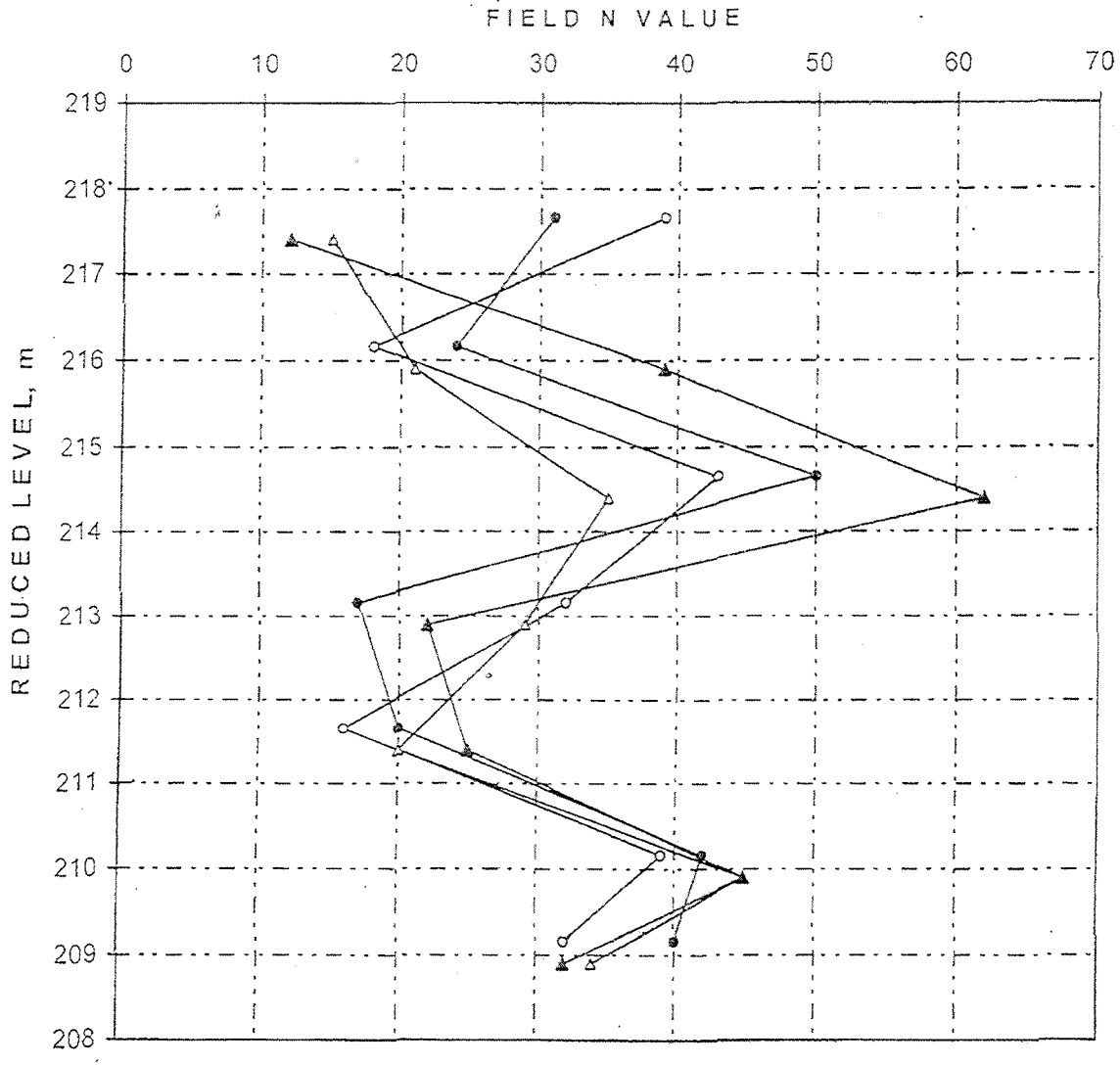
LEGEND	
SYMBOL	DESCRIPTION
	Fine sand (SP)
	Fine sand (SP-SM)
	Silty fine sand (SM)
	Sandy silt (CL)
	Water Table

SUMMARY OF BOREHOLE PROFILE

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 3a

STANDARD PENETRATION TEST

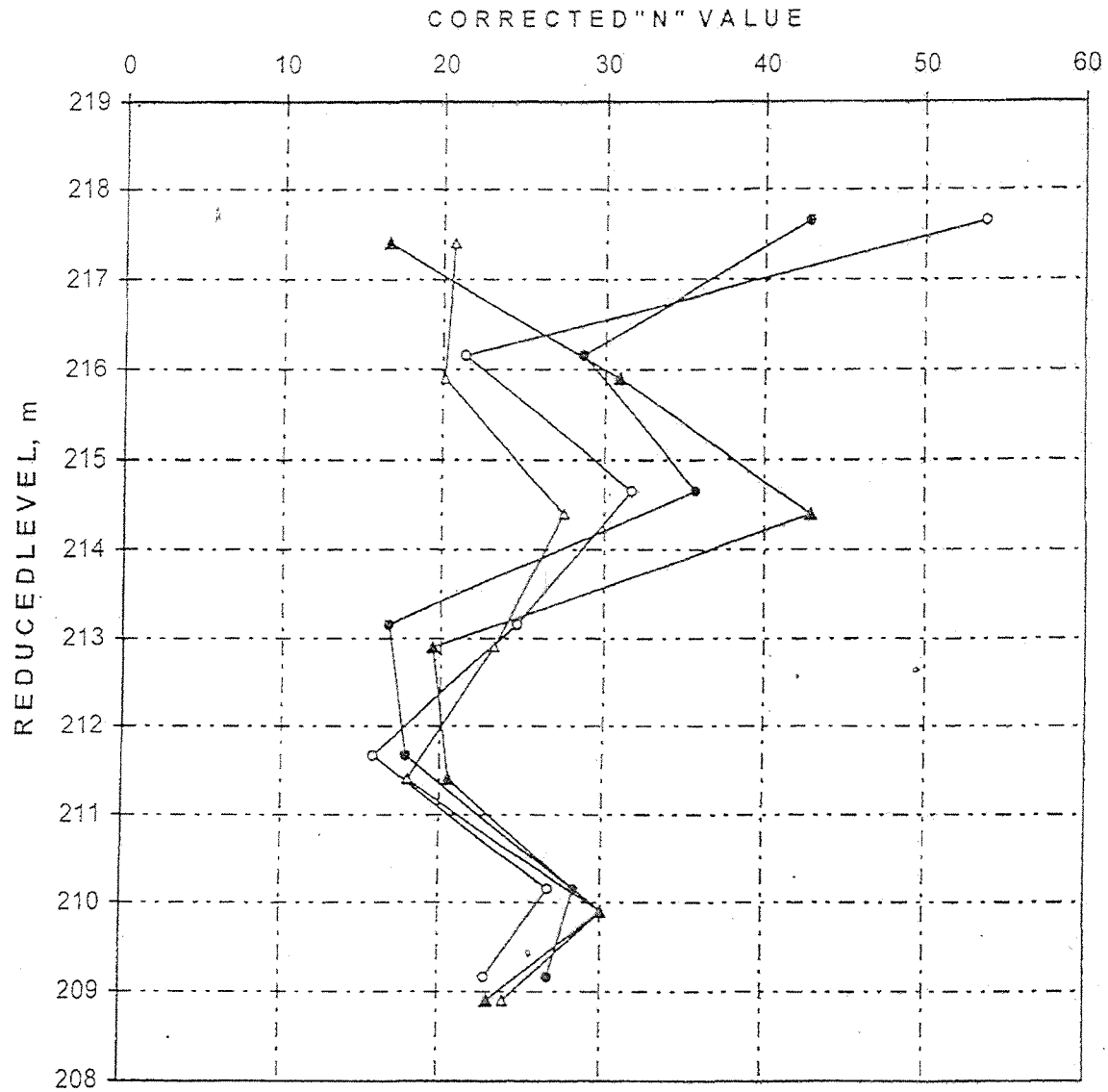


LEGEND			
Symbol	BH.No.	Location	Reduced Level,m
—○—	1	Trial Area	219.610
—●—	2		219.610
—△—	3	Boiler 1	219.350
—▲—	4	Boiler 2	219.350

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 3b

STANDARD PENETRATION TEST

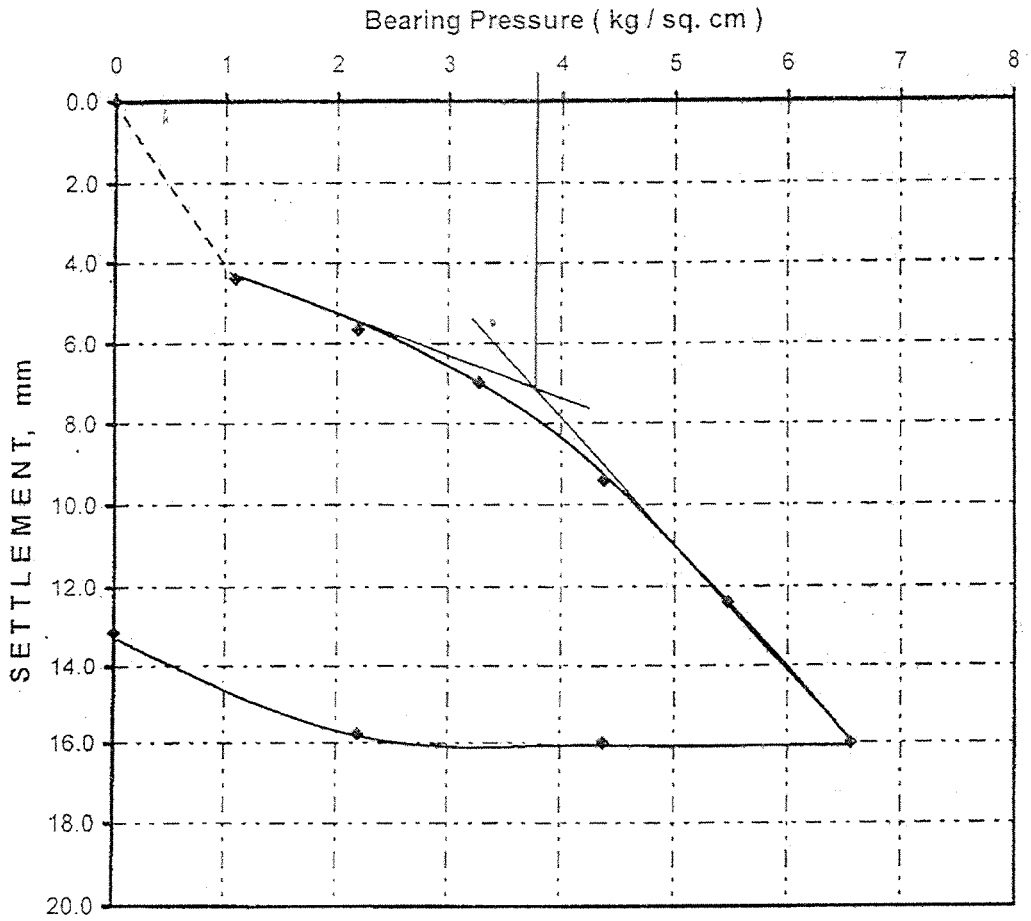


LEGEND			
Symbol	BH.No.	Location	Reduced Level,m
—○—	219.61	Trial Area	219.610
—●—	219.61		219.610
—△—	219.35	Boiler 1	219.350
—▲—	219.35	Boiler 2	219.350

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 4a

PLATE LOAD TEST No.-1



Ultimate Bearing Capacity :	3.8 kg/cm^2
Size of Plate, cm :	30 X 30
Size of Pit, m :	1.5 X 1.5 X 1.5
Co-ordinates :	277.485 S, 263.099 W
Test Level :	218.116 m

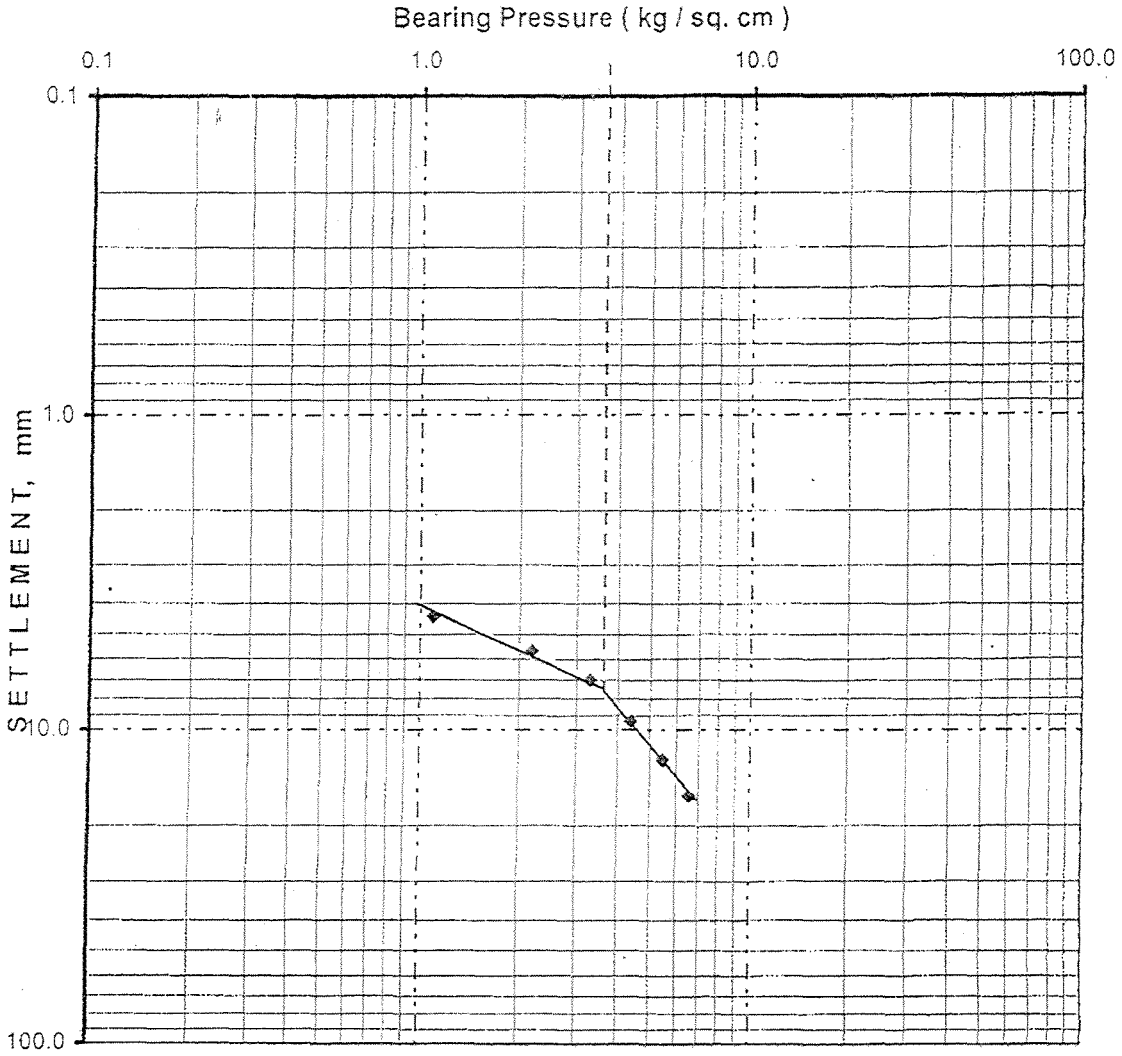
Location : Trial Area

2X270 MW Thermal Power Project Goindwal Sahib, Punjab

(Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 4b

PLATE LOAD TEST No.-1



Ultimate Bearing Capacity :	3.8 kg/cm^2
Settlement at q_{ult} :	7.6 mm
Size of Plate, cm :	30 X 30
Co-ordinates :	277.485 S, 263.099 W
Test Level :	218.116 m

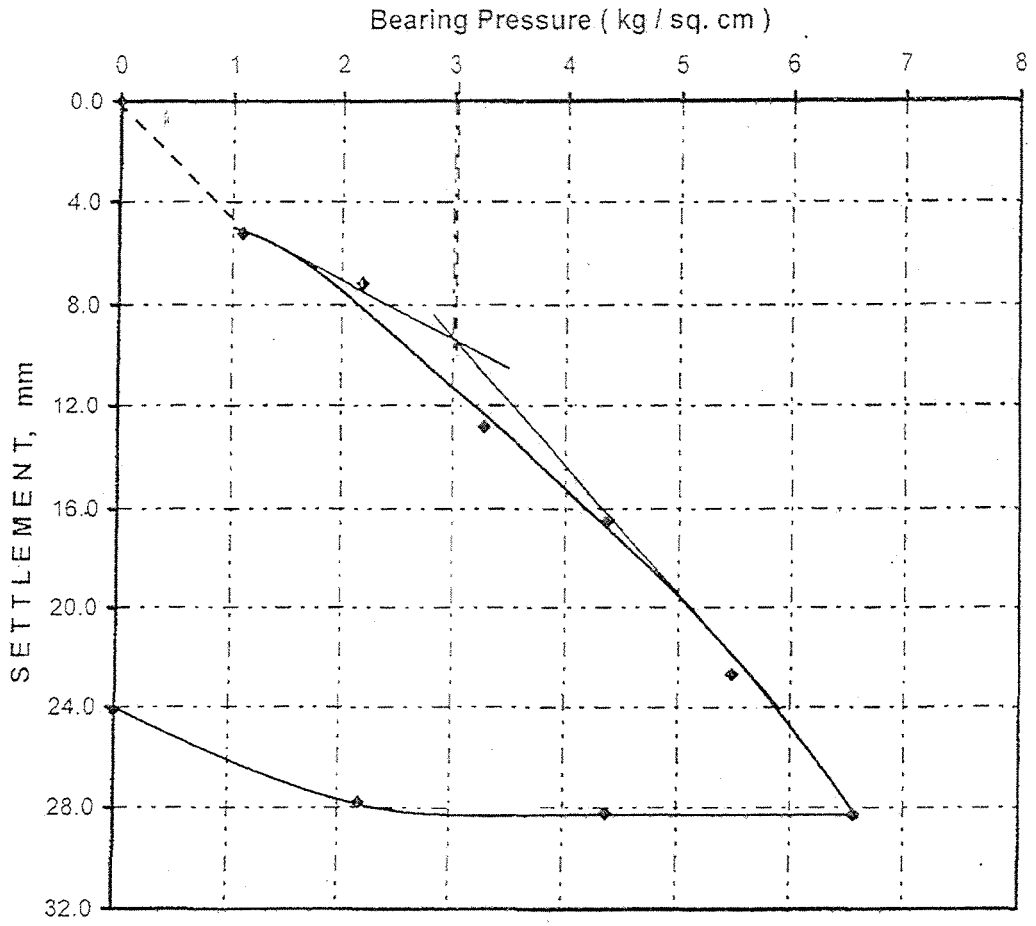
Location : Trial Area

2X270 MW Thermal Power Project Goindwal Sahib, Punjab

(Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 5a

PLATE LOAD TEST No.-2



Ultimate Bearing Capacity :	3.0 kg/cm^2
Size of Plate, cm :	30 X 30
Size of Pit, m :	1.5 X 1.5 X 1.5
Co-ordinates :	256.672 S, 301.219 W
Test Level :	218.091 m

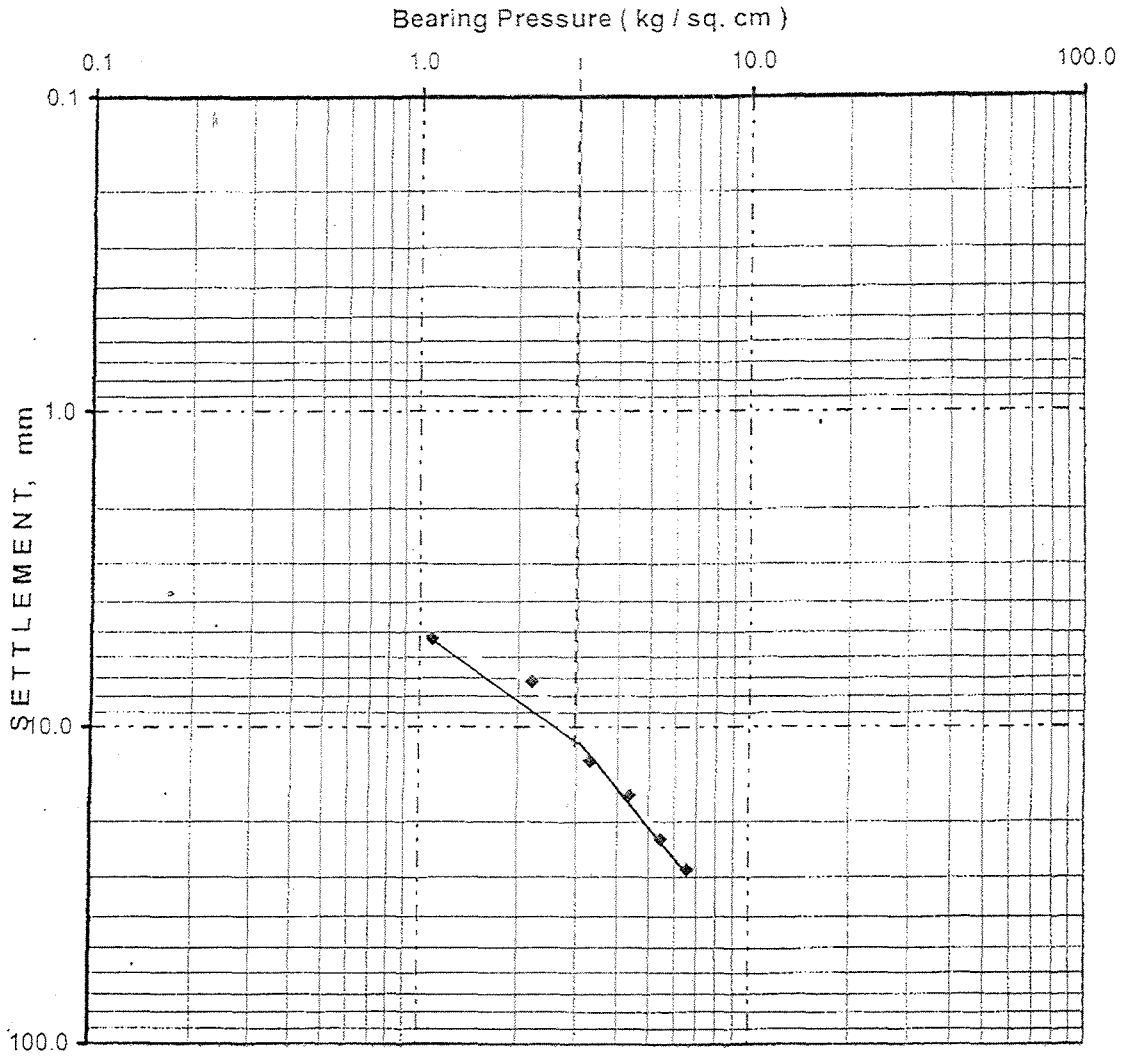
Location : Trial Area

2X270 MW Thermal Power Project Goindwal Sahib, Punjab

(Post Vibro Compaction)

CENGRS GEOTECHNICA PVT. LTD.	Job No. 210025	Fig No. 5b

PLATE LOAD TEST No.-2



Ultimate Bearing Capacity :	3.0 kg/cm^2
Settlement at q_{ult} :	11.4 mm
Size of Plate, cm :	30 X 30
Co-ordinates :	256.672 S, 301.219 W
Test Level :	218.091 m

Location : Trial Area

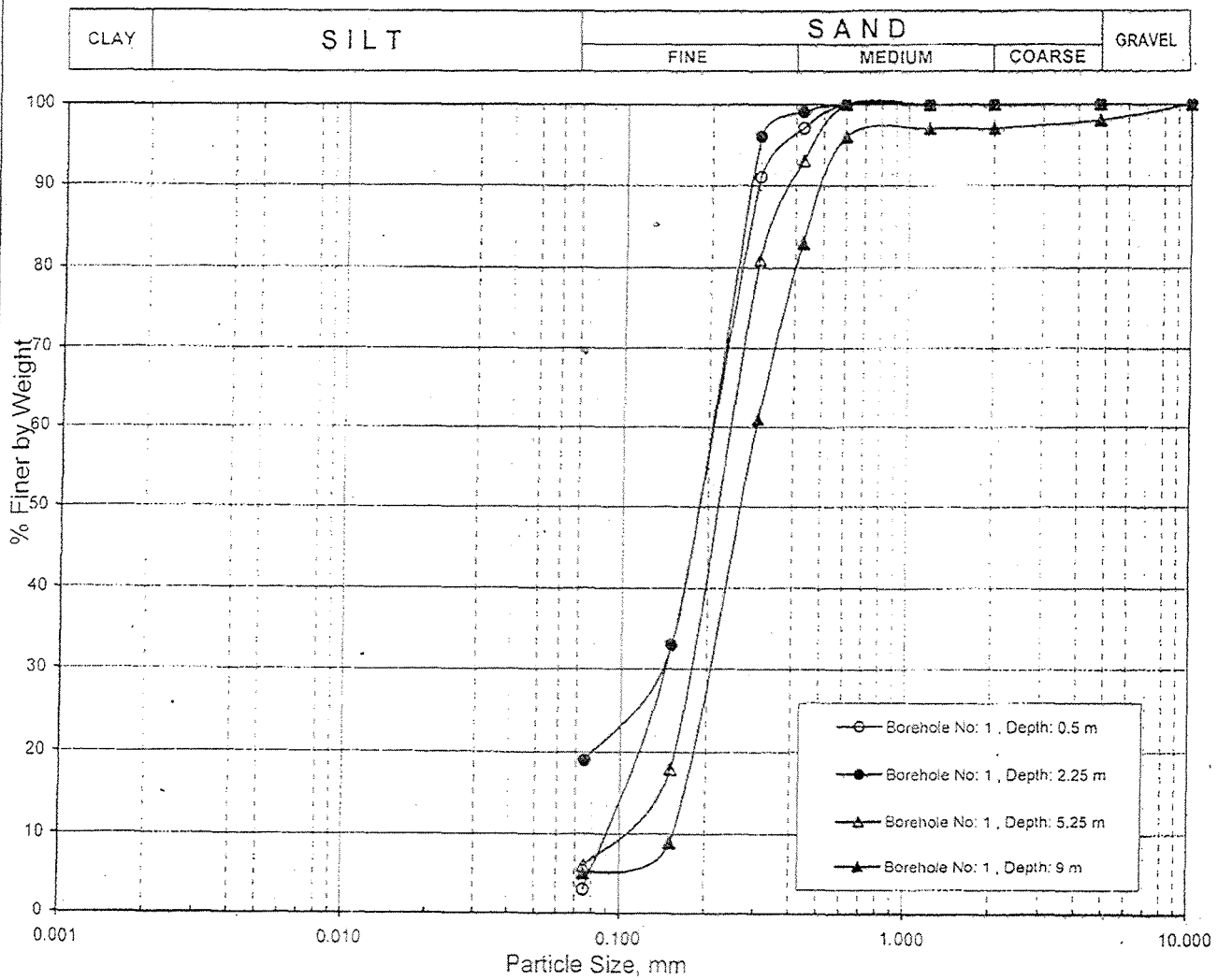
2X270 MW Thermal Power Project Goindwal Sahib, Punjab

(Post Vibro Compaction)

LABORATORY: CENGRS GEOTECHNICA PVT. LTD. An ISO /IEC: 17025-2005 accredited Laboratory	Job No.: 210025	Fig. No. 6	Certificate No.T-0809

Grain Size Analysis

SAMPLE DETAILS			TEST RESULTS						
Borehole Number	Sample Depth, m	Sample Description	% Gravel	% Sand	% Silt	% Clay	D_{60}	D_{10}	C_u
BH-1	0.50	Fine sand (SP)	0	97	3	0	0.220	0.093	2.4
BH-1	2.25	Silty fine sand (SM)	0	81	19	0	0.214		
BH-1	5.25	Fine sand (SP-SM)	0	94	6	0	0.250	0.100	2.5
BH-1	9.00	Fine sand with traces of gravel (SP-SM)	2	93	5	0	0.297		



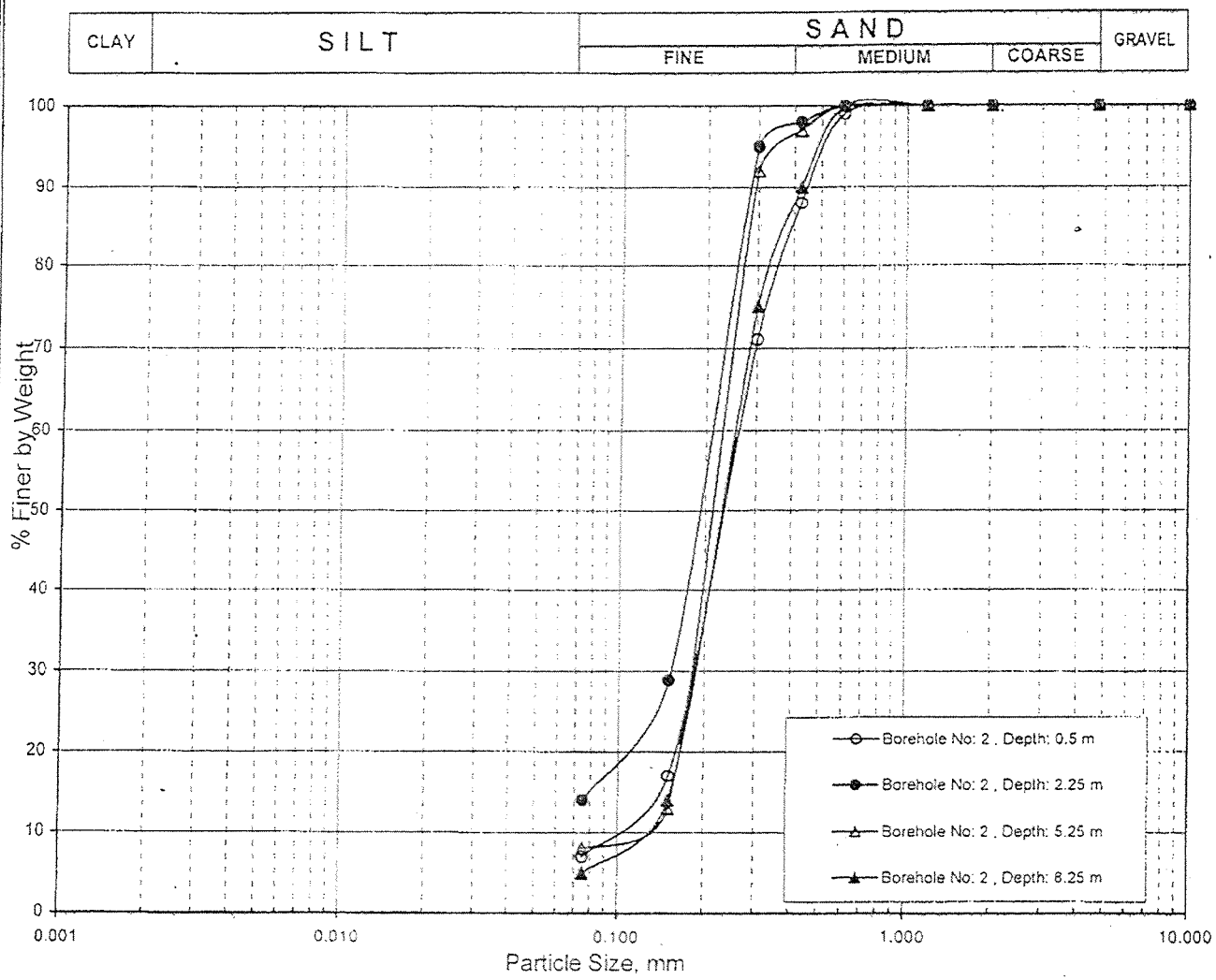
Location: Trial Area

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

LABORATORY: CENGRS GEOTECHNICA PVT. LTD. An ISO /IEC: 17025-2005 accredited Laboratory	Job No.: 210025	Fig. No. 7	Certificate No.T-0809

Grain Size Analysis

SAMPLE DETAILS			TEST RESULTS						
Borehole Number	Sample Depth, m	Sample Description	% Gravel	% Sand	% Silt	% Clay	D_{60}	D_{10}	C_u
BH-2	0.50	Fine sand (SP-SM)	0	93	7	0	0.269	0.098	2.8
BH-2	2.25	Silty fine sand (SM)	0	86	14	0	0.220		
BH-2	5.25	Fine sand (SP-SM)	0	92	8	0	0.239	0.105	2.3
BH-2	8.25	Fine sand (SP-SM)	0	95	5	0	0.263	0.117	2.3



Location: Trial Area

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

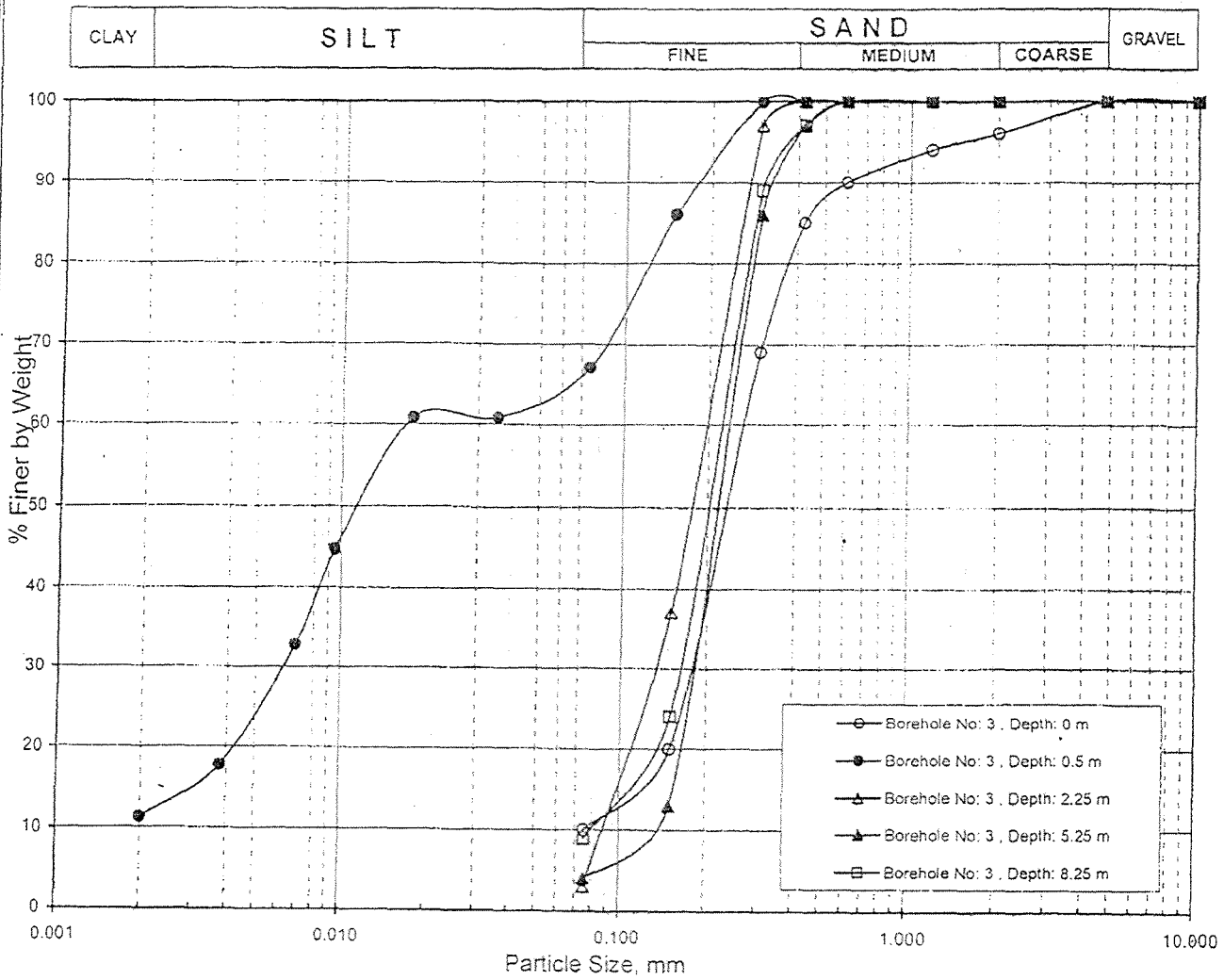
LABORATORY: CENGRS GEOTECHNICA PVT. LTD.
An ISO /IEC: 17025-2005 accredited Laboratory

Job No.: 210025

Certificate No.T-0809

Grain Size Analysis

SAMPLE DETAILS			TEST RESULTS						
Borehole Number	Sample Depth, m	Sample Description	% Gravel	% Sand	% Silt	% Clay	D_{60}	D_{10}	C_u
BH-3	0.00	Fine sand (SP-SM)	0	90	10	0	0.272		
BH-3	0.50	Sandy silt (CL)	0	33	56	11	0.017		
BH-3	2.25	Fine sand (SP)	0	97	3	0	0.208	0.090	2.3
BH-3	5.25	Fine sand (SP)	0	96	4	0	0.247	0.125	2.0
BH-3	8.25	Fine sand (SP-SM)	0	91	9	0	0.233	0.080	2.9



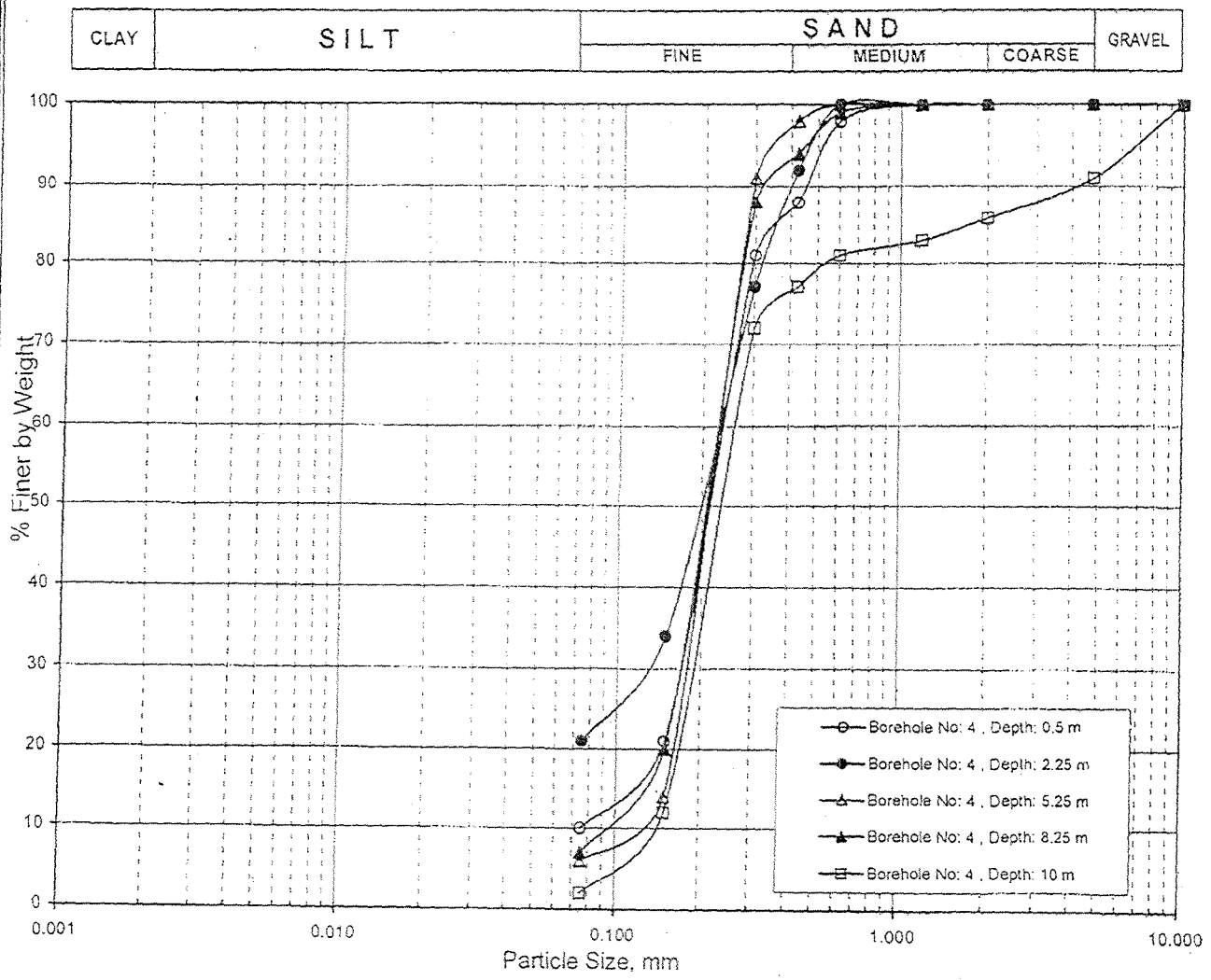
Location: Boiler-1

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

LABORATORY: CENGRS GEOTECHNICA PVT. LTD. An ISO /IEC: 17025-2005 accredited Laboratory	Job No.: 210025	Fig. No. 9	Certificate No.T-0609

Grain Size Analysis

SAMPLE DETAILS			TEST RESULTS						
Borehole Number	Sample Depth, m	Sample Description	% Gravel	% Sand	% Silt	% Clay	D_{60}	D_{10}	C_u
BH-4	0.50	Fine sand (SP-SM)	0	90	10	0	0.248		
BH-4	2.25	Silty fine sand (SM)	0	79	21	0	0.241		
BH-4	5.25	Fine sand (SP-SM)	0	94	6	0	0.240	0.113	2.1
BH-4	8.25	Fine sand (SP-SM)	0	93	7	0	0.238	0.092	2.6
BH-4	10.00	Fine sand with gravel (SP)	9	89	2	0	0.270	0.135	2.0



Location: Boiler-2

2X270 MW Thermal Power Project Goindwal Sahib, Punjab (Post Vibro Compaction)

No. 10/1/2018-St. Th. (part)
Government of India
Ministry of Power

Shram Shakti Bhawan, Rafi Marg
New Delhi dated 20.04.2020

OFFICE MEMORANDUM

Sub:- Minutes of the Meeting chaired by Secretary (Power) on 09.04.2020 at 3.30 PM through Video Conferencing to discuss the issue of Provisional Tariff for Thermal Power Plants (TPPs) on account of installation of Flue Gas Desulphurisation (FGD) units - reg.

The undersigned is directed to refer to the Meeting chaired by Secretary (Power) on 09.04.2020 at 3.30 PM through Video Conferencing to discuss the issue of Provisional Tariff for Thermal Power Plants (TPPs) on account of installation of Flue Gas Desulphurisation (FGD) units. In this regard, minutes of the meeting is enclosed for information and necessary action.

Enclosed: as stated.

(Bhanu Joshi)
Section Officer (St. Thermal)
Tel: 23715507, Ext: 280
e-mail-bhanu.joshi@gov.in

To,

i. Secretary, Department of Financial Services, 3rd floor, JeevanDeep Building, Sansad Marg, New Delhi, Delhi 110001.
ii. Chairperson, CEA, Sewa Bhawan, R.K Puram, New Delhi.
iii. Secretary, CERC, 3 rd & 4 th Chanderlok Building 36, Janpath Rd, New Delhi, Delhi 110001
iv. CMD, NTPC Ltd., NTPC Bhawan, Scope Complex, Lodhi Road, New Delhi
v. Chief Engineer (R&R), MoP.
vi. DG, APP, 501-502, 5th Floor, Mohan Dev Building, 13-Tolstoy Marg, New Delhi, Delhi 110001.

Minutes of the Meeting chaired by Secretary (Power) on 09.04.2020 at 3.30 PM through Video Conferencing to discuss the issue of Provisional Tariff for Thermal Power Plants (TPPs) on account of installation of Flue Gas Desulphurisation (FGD) units - reg.

List of the participants is annexed.

2. At the outset, Secretary (Power) welcomed the participants. Joint Secretary (Thermal) informed that in the meeting chaired by Secretary (Power) on 29.01.2020, it was decided that CERC/SERC (through Forum of Regulators, FOR) may be advised to consider the proposal of provisional tariff for TPPs before the commissioning of FGD. On the advice of Ministry of Power (MoP), FOR took up the issue in its 70th meeting held on 31.01.2020 at Diu and it was, inter-alia, agreed by the Forum that as the new environmental norms for installation of FGDs have been considered as change in law by CERC in various orders, these orders of CERC and such issues (viz., efficiency and remaining useful life of the power plant, availability of power for the State from other sources) along with benchmark cost & norms by CEA can serve as reference documents for SERCs to decide such matters on case to case basis after taking a holistic view in the matter. However, CERC also mentioned that grant of provisional tariff was likely to violate provisions of the Electricity Act, 2003 in reference to a few decisions of Hon'ble High Courts. It was observed that CERC was also contemplating to amend the Tariff Regulations 2019-24 to provide for norms for installation of FGDs for complying with the environmental operating norms as Change in Law.

2.1 It was noted that as per NTPC's investment approval of FGD installations in some of their power plants, it might result into an increase in tariff ranging from Rs.0.19 to Rs.0.23 per unit of electricity. It was deliberated whether based on this, some provisional tariff (for similar technology based FGD units) could be considered which would be trued up after completion of FGD installation.

3. Secretary (Power) inquired whether some indicative tariff on the investment made by a plant when FGD bid was awarded and final tariff getting approved later on FGD commissioning, would provide comfort for banks for lending. Representative from SBI informed that any indicative/provisional cost consists only of the hard cost and does not have other soft costs involved. Further, delay on commissioning was another issue for Bankers to lend, that also needs to be addressed.

4. Independent Power Producers (IPPs) informed that CERC normally takes 6-12 months for issuing any Change in Law related Orders for FGD commissioning and sometimes when multiple States are involved, States also resort to unwarranted delay in any reply to CERC, to avoid paying any increased amount at an early date. So Cash flows become a major issue during this time, as any further equity infusion is spent only on past debt servicing. Secretary, CERC assured that they would ensure any such petition on FGD installation be settled in around 3 months or so, and even in some cases of deliberate delays by States, ex-parte decisions might be taken. Secretary (Power) suggested CERC to devise a proper process vide which applications of Gencos for installation of FGD as per norms of CEA, may be decided by the Appropriate Commission within a period of three months for Investment approval. The investment approval to power plants for installation of FGD based on the CEA's benchmark cost and indicative technologies,

would facilitate the cash flow to the power projects immediately after completion of FGD installations without any delay to recover the cost incurred on the FGD equipment. This will encourage banks to fund the FGD installation in the coal based power plants. Similar process may also be taken up with SERCs. This be may be conveyed in a fortnight to MoP.

(Action: CERC)

5. IPPs raised the issue of funding for installation of FGD for those power plants that do not have any PPAs and were selling power through Discovery of Efficient Electricity Prices (DEEP) Portal and Power Exchanges viz., IEX etc. Secretary (Power) advised them to submit a detailed Note and suggestions on the way forward on this issue.

(Action: IPPs)

6. Further, IPPs raised the issue of time extension for FGD installation in power plants, on account of the disruption in works due to outbreak of COVID-19 and international bidders (including from China) were not able to participate in the bidding process. Secretary (Power) informed that Hon'ble Supreme Court had taken cognizance of the timelines for installation of FGD units in Power plants upto Dec 2022, duly submitted by MoEF&CC/ Central Pollution Control Board (CPCB) and MoP has no locus-standi to consider individual cases for any extension. Joint Secretary (Thermal) informed that IPPs were also filing the affidavit individually in the Supreme Court in this regard. Therefore, decision about any extension in time lines for FGD Installation has to be taken by Hon'ble Supreme Court on the basis of individual affidavits or individual representation made to MoEF&CC/ CPCB by IPPs in this regard about sincere efforts being taken by them in this regard.

(Action: IPPs)

7. It was observed that MoP had taken up with MoEF&CC for time extension of stressed thermal power with effect from the date of taking over the project by the new owner after getting resolved in NCLT or outside NCLT under One Time Settlement (OTS) in respect of 34 Stressed projects identified by Department of Financial Services (DFS). However, MoEF&CC has written back to MoP that the matter was sub-judice as affidavits have been filed by MoEF&CC and MoP with the CEA's plan of FGD installations in Thermal Power Plants by Dec, 2022 in the Hon'ble Supreme Court. The issue is now being examined in MoP/CEA. Secretary (Power) directed to examine the same and put up the issue for further resolution of the matter.

(Action: State Thermal Section, MoP)

8. IPPs informed that in some cases, State Regulators have not accepted the tariff review under 'Change in Law' for FGD installation and the same had been challenged in APTEL. APTEL, in some cases had reserved its orders. IPPs requested if APTEL could pass such orders during this stressed time, it could provide some certainty in the sector. Secretary (Power) requested to provide the list of such cases to MoP.

(Action: IPPs)

9. IPPs informed that there was no provision in the PPAs under Section 63 for increase in fixed charge after the construction of the plant and this needs to be addressed as some plants wanted to increase their CAPEX on account of

FGD installation. Further, there were some issues on delayed payment of Fixed Charge/Billing by States DISCOMs even after MoP directions. Secretary (Power) advised CE(R&R) to look into these issue.

(Action: R&R Division, MoP)

10. The meeting ended with a vote of Thanks to the Chair.

****

List of Participants

Ministry of Power

1. Sh. S.N Sahai, Secretary(Power) ……. in Chair
2. Sh. SKG Rahate, Additional Secretary
3. Sh. Vivek Kumar Dewangan, Joint Secretary
4. Sh. Ghanshyam Prasad, CE(OM, R&R)
5. Sh. S.K Kassi, Director (Thermal)
6. Sh. R.K Das, Under Secretary (DVC & St. Thermal)
7. Sh. Bhanu Joshi, Section Officer (St. Thermal)

Central Electricity Authority

1. Ajay Talegaonkar, Chief Engineer (F&CA)

NTPC

1. Sh. A.K Gupta, Director (Commercial)
2. Sh. Udayan Kumar, GM
3. Sh. P.K Gupta, AGM

CERC

1. Sh. S.K Jha, Secretary
2. Dr S.K Chatterjee, Chief
3. Mr S.C Srivastav, Chief Engineering

State Bank of India

1. Team Lead, Project Finance & Structuring

IPPs

1. Sh. Jatinder Bhatnagar, Adani Power
2. Sh. Madan Gupta, JPVL
3. Sh. Aditya Agarwal, JSW
4. Sh. Ajay Kapoor
5. Sh. Sudipta Kumar Mukherjee
6. Sh. Ajay Kapoor
7. Sh. Ratul Puri, Chairman, Hindustan Power
8. Sh. Dinesh Batra
9. Sh. Aditya Puri
10. Sh. Balaji S.
11. Sh. Dinesh Batra
12. Sh. MR Krishna Rao, Adani Power
13. Sh. Mahesh Vipradas

Indian Banks' Association

Corporate & International Banking

C&I-II/Power/2018-19/**5660**

August 8, 2018

Shri Ashok Khurana
Director General
Association of Power Producers
501-502, 5th Floor, Mohan Dev Building
13, Tolstoy Marg
New Delhi - 110001

Dear Sir,

Banks/lenders refusal to lend to Power sector, for installation of emission control equipment, threatens another wave of likely NPA

We are in receipt of your letter on the above subject matter. In this context we appreciate that you have rightly observed the constraint faced by banks in providing additional finance for installation of emission control equipment due to prevalent stress in the sector as well other reasons mentioned in your letter.

2. We are of the opinion that it would be advisable that in order to meet the required funding, the ideal recourse in the present circumstances would be either in the form of equity or alternatively soft loan by Ministry of environment and Ministry of Power, Government of India. You may approach the concerned departments.

With regards,

Yours faithfully,

R. Raj Kumar
Dy. Chief Executive

Annexure P-17 269

Centre calls off ceasefire in J&K

PRESS TRUST OF INDIA
New Delhi, June 17

Home minister Rajnath Singh in New Delhi on Sunday PTI

THE CENTRE ON Sunday called off its month-long suspension of operations against terror groups in Jammu and Kashmir (J&K) during the holy month of Ramzan, and directed the security forces to take "all necessary action" at the earliest to prevent terrorists from launching attacks and indulging in violence.

"Security forces are being directed to take all necessary actions to prevent terrorists from launching attacks and indulging in violence and killings," home minister Rajnath Singh said in a statement, but made it clear that the government will continue with its endeavour to create an environment free of terror and violence in the state.

"It is important that all sections of peace-loving people come together to isolate terrorists and motivate those who have been misguided to return to the path of peace," Singh said.

The Centre had announced suspension of operations on May 17 and said the decision was being taken in the interests of the peace-loving people of the state, in order to provide them a conducive atmosphere during the fasting month.

Rajnath on Sunday commended the role of the security forces for having implemented the decision in letter and spirit in the face of grave provocation to enable Muslim brothers and sisters to observe Ramazan in a peaceful manner.

"This has been widely appreciated by the people all over the country, including Jammu and Kashmir, and has brought relief to common citizens," he said, adding it was expected that everyone will cooperate in ensuring the success of this initiative.

"While the security forces have displayed exemplary restraint during this period, terrorists have continued with their attacks on civilians and security forces, resulting in deaths and injuries," the home minister said.

According to officials, there were 18 incidents of terror between April 17 and May 17 this year and the figure rose to above 50 during suspension of operations.

The security agencies had alerted the government about designs by certain terror groups to disrupt the forthcoming Amarnath Yatra beginning June 28 and the need for conducting some operations in south Kashmir.

"We have to take the decision in the right spirit. The home ministry has taken note of all the inputs available and decided that suspension of operation, which was carried out for one month, will no longer continue," minister of state in the PMO Jitendra Singh said.

6000 MHz spectrum identified as available for 5G services

PRESS TRUST OF INDIA
New Delhi, June 17

THE 5G COMMITTEE of the telecom ministry has said around 6000 Mhz of spectrum can be made available without delay for the next generation mobile services.

If accepted, the panel's recommendation, which has been submitted to the government, can lead to the largest-ever spectrum allocation for a service.

An expert member of the panel, Arogyaswami Paulraj, said initially the service will enhance mobile data speed in India by up to 50% compared to current levels.

Paulraj is professor emeritus, Stanford University, and a pioneer of MIMO wireless communications, a technology breakthrough that enables improved wireless performance. MIMO is now incorporated into all new wireless systems, as per the Stanford site.

The panel has spotted spectrum for 5G service across 11 bands of which 4 bands — premium 700 Mhz band, 3.5 gigahertz (Ghz), 24 Ghz and 28 Ghz band — can be immediately made available for the service.

2x270 MW GOINDWAL SAHIB THERMAL POWER PROJECT

AT

GOINDWAL SAHIB, TARN TARAN DISTRICT

PUNJAB

SYSTEM DESCRIPTION FOR INSTALATION FLUE GAS DESULPHURISATION (FGD) SYSTEM

Address for Correspondence:
GVK Power (Goindwal Sahib) Ltd.
Plot No.10, Paigah Colony
Sardar Patel Road,
Secunderabad-500003
Telangana

Project Office:
GVK Power (Goindwal Sahib) Ltd.
Goindwal Sahib, Kapurthala Road
Goindwal Sahib Village
District Tarn Taran,. 143 422.
Punjab

Project Information &Details

S No	Details	
1	Project	2x270 MW Goindwal Sahib Thermal Power Plant
2	Capacity	2x270 MW
3	Site Location	Goindwal Sahib Village, Khadoor Sahib Tehsil, Tarn Taran District, Punjab
4	Latitude & Longitude	$31^0$21'35"N -$31^0$24'40"N $75^0$07'30"E – $75^0$10'55"E
5	Soil type	Alluvial/Sandy loam and liquefaction Prone
6	Nearest Village/Town/City	Village : Goindwal – 1.0 km south Town : Tarn Taran – 20 km North West City : Amritsar– 40 km North West
7	Nearest Road	1. State Highway connecting Tarn Taran – Goindwal – Kapurthala touching plant site on south. 2. NH-1 connecting Amritsar-Delhi – 20 km North
8	Nearest Air port	Sri Guru Ram Dass Jee International Airport, Amritsar – 60 km North West
9	Nearest Railway Station	Goindwal Sahib – 3.0 km South Khadur Sahib – 6.0 km North West (on broad gauge line)
10	Railway Siding	Having its own Railway Siding in the plant premises
11	Ambient temperature for Performance in Deg. C	27
12	Average of mean daily max. temperatures Deg. C	30.5
13	Average of mean daily minimum temperature Deg. C	15.9
14	Extreme highest, Deg. C	47.7
15	Extreme lowest, Deg. C	-3.3
16	Relative humidity (%) Maximum Minimum For Performance & Guarantee	 74.0 46.0 65.0
17	Annual average rain fall	681 mm

18	Whether FGD space available	Yes
19	Average Height above MSL (m):	222.00 m above MSL
20	Fuel	Primary Fuel – Coal, Secondary Fuel – LDO/HFO
21	Source of coal	1.70MTPA from CCL mines, Jharkhand (Provides 62% PLF)
22	Source of Balance Coal	1. e –auction 2. Imported Coal from South Africa
23	Owner& Address	GVK Power (Goindwal Sahib) Ltd., Plot No.10, Paigah Colony, Sardar Patel Road, Secunderabad-500003, Telangana State

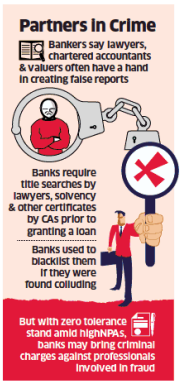
II. Specified New Emission norms for Pollutants for 270MW units*

Pollutant	**New Norms**
Particulate Matter	50 mg/ Nm^3
Sulphur Dioxide (SO2)	600 mg/Nm^3
Oxides of Nitrogen (NOx)	300 mg/Nm^3
Mercury (Hg)	0.03mg/Nm^3

*Source as per Ministry of Environment, Forest and Climate Change (MOEF &CC) notification no: S.O.3305 (E) titled 'Environmental (Protection) Amendment rules, 2015 dated 7.12.2015.

SINGED BY NIRAV SCAM PNB directive says FIRs should be filed against third parties like advocates, accountants and valuers too, if they have a hand in perpetrating a fraud

CAs, Lawyers in the Line of FIR



Sugata.Ghosh@timesgroup.com

Mumbai: Lawyers, chartered accountants and valuers, who collude with fraudulent borrowers, will soon find their names in FIRs lodged by banks.

Shaken by the Nirav Modi fraud, India's second largest lender, Punjab National Bank (PNB), last week directed its offices that FIRs be filed not just against borrowers and guarantors but also against third parties like advocates, accountants and valuers if they have a hand in perpetrating frauds.

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Banks generally require title searches by lawyers and solvency and other certificates by CAs prior to granting a loan. Since banks rely on these reports by independent professionals, it amounts to a clear breach of trust and fraud if such reports are blatantly wrong. A properly conducted search based on parameters set out by the Bombay High Court in the past should bring out such gaps in titles; and, a failure to do so would result in a breach of trust by professionals who have a duty of care towards their clients.

Under the circumstances, few would disagree that banks are correct in pursuing this avenue against professionals who collude with fraudsters and dupe lenders. However, unless a bank actually commissions professionals under an arrangement, it may be difficult for the banks to bring an action against these professionals. In some cases title reports and other certificates are commissioned by the borrowing client rather than the lending back.

"It's evident lawyers and accountants cannot wriggle out easily by submitting false reports. Commissioning independent and reliable professionals from an internally prepared panel may be the best way forward, rather than lengthy and expensive recoveries. In relation to bad debts, the only solution is to strengthen risk assessment policies so gaps can be identified at origination stage," said Kaushik Mukherjee, partner, Shardul Amarchand Mangaldas & Co. A witch hunt, he said, may not help in salvaging lost loans.

According to advocate L Vishal Kumar, "Lawyers are often given very little time to complete search and they end up doing a shoddy job. Also, they keep an exit route to cover their tracks by stating upfront that the report is 'based on documents supplied by the bank.' Accountants who cook up books at the clients' instruction complicate accounts through numerous transactions to such an extent that lenders are left confused."

In quickening loan disbursal, such borrowers often hire professionals already on the bank panel of lawyers and CAs. However, a lender is not obliged to accept their reports. "Inflated valuation of properties and land is another tool in the hands of a corrupt borrower. It has been rampantly used. But this is a more tricky area, with reports differing from valuer to valuer," said a banker.

More Individuals Under CBI Lens for AirAsia Lobbying

Allegedly paid to 'liaise' with representatives, ministry officials on scrapping 5/20 rule

ARINDAM

Raghav.Ohri@timesgroup.com

New Delhi: Investigative agencies are examining involvement of more "players" in facilitating relaxation of the 5/20 aviation rule by lobbying officials at the behest of AirAsia, said people with knowledge of the matter.

These individuals are in addition to Sunil Kapur, Deepak Talwar and Rajender Dubey who figure as accused in the criminal case registered by the Central Bureau of Investigation. According to the agency, the three acted as "lobbyists" for AirAsia.

These individuals were allegedly engaged by Kapur and Talwar to "reach out" to politicians and officials. Under the 5/20 rule, carriers needed to have been operational for five years and have 20 planes to be eligible to fly overseas. The five-year norm was scrapped in June 2016.

AirAsia group chief executive Tony Fernandes hired Kapur's firm for catering services in order to legitimise the relationship, said people cited above. Payments were made in the garb of inflight catering services at inflated bills for lobbying with government officials, they said.

The individuals allegedly engaged by Kapur and Talwar were paid for "liaising" with government officials and representatives on the 5/20 rule. They were paid in cash and attended secret meetings with Fernandes' deputy Bo Lingam at hotels and restaurants, according to people cited above.

The first information report (FIR) registered by CBI points to one such alleged incident at a Mumbai coffee shop December 2014 when Kapur purportedly "handed over a closed packet containing cash of ₹50 lakh to one Sriram, which was given by Bo Lingam to facilitate the removal of the then 5/20 rule."

CBI registered the FIR on May 29 following a case filed by the Enforcement Directorate (ED) on charges of money laundering. Kapur has already been questioned by CBI in relation with the case.

The FIR also elaborated on the allegedly pivotal role played by Singapore-based HNR Trading in lobbying. For these "services," AirAsia allegedly paid HNR Trading.

"Information has revealed that during the year 2015-16, M/s AirAsia remitted about Rs 12.28 crore to M/s HNR Trading Singapore for a sham contract on the basis of a bogus agreement on plain papers," it said.

This money, according to the agency, was utilised in bribing unknown Indian public servants.

AirAsia has denied the accusations. "AirAsia India (AAIL) refutes any wrongdoing and is cooperating with all regulators and agencies to present the correct facts," the company said in a May 29 release. "We hope to bring early resolution to all such issues."

'NHPS Package Rates Too Low'

Topic of Debate Government rejects IMA's contention that even 30% of procedure costs are not covered

Prabha.Raghavan
@timesgroup.com

New Delhi: Even as India prepares to roll out what is described as the "largest" health protection scheme in the world, a lobby group of over 200,000 doctors has expressed doubts over its success. The Indian Medical Association (IMA) has criticised the scheme for reimbursement rates set for treatments covered in the scheme, popularly known as Modicare, being too low.

"The highly optic National Health Protection Scheme (NHPS) fails to create any new national asset," said Ravi Wankhendkar, national president and RN Tandon, honorary secretary general, IMA. "Rates quoted by the government are abysmal and impracticable."

According to IMA, most package rates set by the government do not cover even 30% of the cost of the procedure and "no hospital" can work on these rates without "seriously compromising patient safety." It said the scheme would be a "non-starter" owing to this.

However, Indu Bhushan, CEO of the Ayushman Bharat National Health Protection Mission (ABNHPM), said the government has done a "rigorous" job in setting the package rates based on available data and current benchmarks. "We believe marginal costs of hospitals can be more than covered through these rates," Bhushan told ET. At the same time, the government is planning to conduct a costing study to correct the rates for any packages that may warrant an adjustment, he said.

Ayushman Ahead

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Niti Aayog and the Indian Council of Medical Research (ICMR) are "most likely" to help conduct this study over the next few months as the scheme is rolled out.

IMA has demanded costing be transparent and in public domain. "We don't want to set the package rates too high that they are not viable (for the coverage proposed) or too low that they are unsustainable," said Bhushan. "We are open to learning. We are going to do a costing study… to be able to define the package rates going forward."

States are allowed to revise package rates to match the reimbursements provided in their own schemes if they are higher or lower, said Bhushan. NABH-accredited hospitals are also allowed to increase package prices by 10-15%, depending on whether they have basic or advanced accreditation, he said.

ET reported on June 1 that five of India's largest private hospitals have asked the government to reconsider the treatment package rates, saying it would be unviable to provide quality care to patients at the current rates. At the same time, several smaller private hospital and hospital chains have communicated their willingness to participate in AB-NHPM at these rates, according to Bhushan.

IMA has raised issue with states having the option to implement the scheme through Insurance modes, saying it would not encourage the creation of new public sector hospitals. "The insurance driven healthcare is a failed experiment," said Wankhedkar, alleging that the scheme would "lose" ₹400 crore to the private health insurance companies for managing it. The money allotted for the scheme would be better put to use if ₹2 crore was invested to strengthen infrastructure of every government district hospital, according to the body.

However, Bhushan said that ABNHPM will "significantly" strengthen government hospitals.

"I do not necessarily agree that support for the private sector is 'losing' money. We need to strengthen both public as well as private sector provision of health services," Bhushan said, adding that the public sector on its own will never be able to meet the demand for health services. "Several treatment packages are reserved for public sector. Large proportion of NHPM payment will go to public hospitals and they will retain these revenues for strengthening their infrastructure and providing salary top-up to their staff," he told ET.

Such support to government hospitals is more effective and efficient as it is directly linked to their providing services to the poor, he added.

Bengal Set to Join Scheme: Bhushan

West Bengal said to have given 'in-principle' approval for Ayushman Bharat

Prabha Raghavan & Madhuparna Das

New Delhi | Kolkata: West Bengal is ready to join the Ayushman Bharat National Health Protection Mission (AB-NHPM), according to the programme's chief executive Indu Bhushan.

The state had previously indicated that it wasn't ready to do so.

West Bengal chief minister Mamata Banerjee gave her "in-principle" approval during a Niti Aayog governing council meeting chaired by Prime Minister Narendra Modi, Bhushan said.

Chandrima Bhattacharya, West Bengal's minister of state for health and family welfare, said she wasn't aware of the development. "If (the chief minister) has given any indication, it might be that she has given it (in Delhi)," Bhattacharya said. The chief minister has also not given such an indication publicly.

"As far as the health insurance scheme is concerned, we already have this in our state. People in Bengal get free treatment in all government hospitals," Banerjee had told media persons on Sunday.

West Bengal was earlier the first to opt out of the scheme, with the chief minister reportedly terming it a "waste" of the state's hard-earned resources when it already had its own health protection scheme.

Bhushan told ET that he was hoping to meet the West Bengal health secretary soon to finalise a memorandum of understanding (MoU) for the state.

Andhra Pradesh is also expected to sign an MoU this Thursday to implement the scheme, he added.

The likes of Punjab, Odisha and Delhi are yet to formally communicate whether they will be joining the scheme, according to a senior health ministry official.

Odisha and Delhi were not present at the meeting on Sunday, while Punjab has agreed to meet with the Centre to "resolve some differences" over the scheme, Bhushan said.

The health secretary of Karnataka, another state which was not clear on its position, is expected to meet with the Centre on Tuesday to resolve its own queries about the scheme. The state has otherwise given its in-principle approval to implement AB-NHPM, said Bhushan.

Ahead of the Niti Aayog meet, the chief ministers of West Bengal, Andhra Pradesh, Kerala and Karnataka on Saturday had addressed a joint conference in support of Delhi chief minister Arvind Kejriwal, reportedly seeking the Prime Minister's intervention in the ongoing rift between the Aam Aadmi Party government and Delhi Lt Governor Anil Baijal.

GLOBAL INTEREST

KKR, Advent, Carlyle in Race to Buy Manjushree

Reghu.Balakrishnan
@timesgroup.com

Mumbai: Global private equity investors The Carlyle Group, Advent International, KKR & Co and US-based leading firms IPG Inc and Graham Packaging Inc are in separate discussions to acquire a controlling stake in Bengaluru-based packaging solutions company Manjushree Technopack, two people aware of the development said.

A Thai packaging company too is believed to be in the fray, but its identity could not be ascertained.

Domestic PE firm Kedaara Capital holds about 24% stake in Manjushree while the rest is held by promoters. The proposed sell-out will value the company at $250-300 million, said one of the persons cited above. Investment bank Citi is advising the promoters for the sale.

Set up in 1983 by Vimal Kedia, Bengaluru-based Manjushree Technopack offers rigid packaging solutions to customers across different end segments including food and beverages, home & personal care, pharma & healthcare, liquor and dairy. Manjushree, India's largest PET manufacturer, has clients such as GlaxoSmithKline, Reckitt Benckiser, Coca-Cola, PepsiCo, Nestle, Mondelez, Perfetti Van Melle, Dabur and Patanjali. For the fiscal year 2017, Manjushree Technopack posted a revenue of Rs 741 crore.

Kedaara Capital, which handles two PE funds worth about $1.3 billion, had acquired 24% in Manjushree at a valuation of about $100 million in 2015. In the same year, Kedaara Capital had picked up a stake in Mumbai-based manufacturer of folding cartons Parksons Packaging Ltd.

"We are engaged in discussions with promoters. However, its in very early stages," said a PE fund manager. Spokespersons with Kedaara Capital, KKR and Carlyle declined comment while mails sent Vimal Kedia, MD at Manjushree, spokespersons at IPG, Graham packaging and Advent did not elicit responses till press time.

After Kedaara's investment, Manjushree has expanded inorganically through acquisition of Delhi-based packaging firm Varahi Ltd. With the acquisition, Manjushree expanded its footprint in north India and increased production capacity by 20% to 120,000 metric tonnes a year.

Ref: GPGSL/PSPCL/2018/322
Date: 19th June, 2018

To
The Chief Engineer/ PP&R,
Punjab State Power Corporation Limited (PSPCL),
Thermal Design Complex, Patiala-147001
Punjab.

(WITHOUT PREJUDICE)

Sir,

Sub: 2 X 270 MW GVK Goindwal Sahib Coal based thermal power plant at Goindwal Sahib Village, Tarn Taran District, Punjab – Installation of FGD –reg.

Ref: 1. Your Memo No. 803 dated 11-04-2018.
2. Ministry of Power letter no.23/22/2018- R&R dated 30-05-2018.
3. CEA letter dated 31-05-2018.

It is to inform you that we have floated International Competitive Bidding notice for Design, Supply, Installation, Testing and Commissioning of Flue Gas Desulphurization (FGD) Wet Limestone System. Copies of the Public Notice published in The Economic Times, New Delhi edition and The Financial Express, Chandigarh edition is enclosed for your kind ready and kind reference

This is for your information and records please.

Thanking you,
Yours sincerely,
for **GVK Power (Goindwal Sahib) Limited**

M. Rama Murty

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Director

Cc: 1.The CMD, PSPCL, PSEB Head Office, The Mall, Patiala, Punjab.
2. The Chief Engineer/ Fuel, PSPCL, Thermal Design Complex, Patiala-147001.

Enclosed: As above.

GVK Power (Goindwal Sahib) Limited
PLOT NO 10, PAIGAH COLONY, Sardar Patel Road,
Secunderabad – 500 003, Telangana, India.

T+91 40 2790 2663/64 F+91 40 2790 2665
www.gvk.com
CIN : U40109TG1997PLC028483

GVK

2x270 MW GVK GOINDWAL SAHIB COAL BASED THERMAL POWER PLANT

INVITING EXPRESSION OF INTEREST

Design, Supply, Installation, Testing and Commissioning of Flue Gas Desulphurization (FGD) Wet Limestone System for a coal sulphur range of 0.5% to 1.0% at 2x270 MW GVK Goindwal Sahib Coal Based Thermal Power Plant, Goindwal Sahib village, Tarn Taran District, Punjab. Interested suppliers can submit Expression of Interest (EOI), Technical and Commercial offers as per the schedule given below:

S. No.	Description	Last Date of submission	Opening of bids
1.	Submission of Expression of Interest by	25.06.2018	25.06.2018
2.	Submission of Technical Offer by	02.07.2018	02.07.2018
3.	Submission of Commercial Offer by	02.07.2018	10.07.2018

Brief on project specific details will be supplied on request.

R. Raghunath, Vice President-Materials
GVK Power (Goindwal Sahib) Ltd.,
Plot No.10, Paigah Colony, Sardar Patel Road, Secunderabad-500003, Telangana State, Phone Nos 040-27902663/4, Fax No.040-27902665
email: raghu@gvk.com/mvl@gvk.com

Centre calls off ceasefire in J&K

PRESS TRUST OF INDIA
New Delhi, June 17

THE CENTRE ON Sunday called off its month-long suspension of operations against terror groups in Jammu and Kashmir (J&K) during the holy month of Ramzan, and directed the security forces to take "all necessary action" at the earliest to prevent terrorists from launching attacks and indulging in violence.

"Security forces are being directed to take all necessary actions to prevent terrorists from launching attacks and indulging in violence and killings," home minister Rajnath Singh said in a statement, but made it clear that the government will continue with its endeavour to create an environment free of terror and violence in the state.

"It is important that all sections of peace-loving people come together to isolate terrorists and motivate those who have been misguided to return to the path of peace," Singh said.

The Centre had announced suspension of operations on May 17 and said the decision was being taken in the interests of the peace-loving people of the state, in order to provide them a conducive atmosphere during the fasting month.

Rajnath on Sunday commended the role of the security forces for having implemented the decision in letter and spirit in the face of grave provocation to enable Muslim brothers and sisters to observe Ramazan in a peaceful manner.

Home minister Rajnath Singh in New Delhi on Sunday PTI

"This has been widely appreciated by the people all over the country, including Jammu and Kashmir, and has brought relief to common citizens," he said, adding it was expected that everyone will cooperate in ensuring the success of this initiative.

"While the security forces have displayed exemplary restraint during this period, terrorists have continued with their attacks on civilians and security forces, resulting in deaths and injuries," the home minister said.

According to officials, there were 18 incidents of terror between April 17 and May 17 this year and the figure rose to above 50 during suspension of operations.

The security agencies had alerted the government about designs by certain terror groups to disrupt the forthcoming Amarnath Yatra beginning June 28 and the need for conducting some operations in south Kashmir.

"We have to take the decision in the right spirit. The home ministry has taken note of all the inputs available and decided that suspension of operation, which was carried out for one month, will no longer continue," minister of state in the PMO Jitendra Singh said.

6000 MHz spectrum identified as available for 5G services

PRESS TRUST OF INDIA
New Delhi, June 17

THE 5G COMMITTEE of the telecom ministry has said around 6000 Mhz of spectrum can be made available without delay for the next generation mobile services.

If accepted, the panel's recommendation, which has been submitted to the government, can lead to the largest-ever spectrum allocation for a service.

An expert member of the panel, Arogyaswami Paulraj, said initially the service will enhance mobile data speed in India by up to 50% compared to current levels.

Paulraj is professor emeritus, Stanford University, and a pioneer of MIMO wireless communications, a technology breakthrough that enables improved wireless performance. MIMO is now incorporated into all new wireless systems, as per the Stanford site.

The panel has spotted spectrum for 5G service across 11 bands of which 4 bands — premium 700 Mhz band, 3.5 gigahertz (Ghz), 24 Ghz and 28 Ghz band — can be immediately made available for the service.

Annexure P-12

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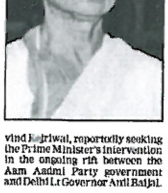
Andhra Pradesh is also expected to sign an MoU this Thursday to implement the scheme, he added.

The likes of Punjab, Odisha and Delhi are yet to formally communicate whether they will be joining the scheme, according to a senior health ministry official.

Odisha and Delhi were not present at the meeting on Sunday, while Punjab has agreed to meet with the Centre to "resolve some differences" over the scheme, Bhushan said.

The health secretary of Karnataka, another state which was not clear on its position, is expected to meet with the Centre on Tuesday to resolve its own queries about the scheme. The state has otherwise given its in-principle approval to implement AB-NHPM, said Bhushan.

Ahead of the Niti Aayog meet, the chief ministers of West Bengal, Andhra Pradesh, Kerala and Karnataka on Saturday had addressed a joint conference in support of Delhi chief minister Arvind Kejriwal, reportedly seeking the Prime Minister's intervention in the ongoing rift between the Aam Aadmi Party government and Delhi Lt Governor Anil Baijal.



GLOBAL INTEREST

KKR, Advent, Carlyle in Race to Buy Manjushree

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Mumbai: Global private equity investors The Carlyle Group, Advent International, KKR & Co and US-based leading firms IPG Inc and Graham Packaging Inc are in separate discussions to acquire a controlling stake in Bengaluru-based packaging solutions company Manjushree Technopack, two people aware of the development said.

A Thai packaging company too is believed to be in the fray, but its identity could not be ascertained.

Domestic PE firm Kedaara Capital holds about 24% stake in Manjushree while the rest is held by promoters. The proposed sell-out will value the company at $250-300 million, said one of the persons cited above. Investment bank Citi is advising the promoters for the sale.

Set up in 1983 by Vimal Kedia, Bengaluru-based Manjushree Technopack offers rigid packaging solutions to customers across different end segments including food and beverages, home & personal care, pharma & healthcare, liquor and dairy. Manjushree, India's largest PET manufacturer, has clients such as GlaxoSmithKline, Reckitt Benckiser, Coca-Cola, PepsiCo, Nestle, Mondelez, Perfetti Van Melle, Dabur and Patanjali. For the fiscal year 2017, Manjushree Technopack posted a revenue of Rs 741 crore.

Kedaara Capital, which handles two PE funds worth about $[illegible] billion, had acquired 24% in Manjushree at a valuation of about $100 million in 2015. In the same year, Kedaara Capital had picked up a stake in Mumbai-based manufacturer of folding cartons Parksons Packaging Ltd.

"We are engaged in discussions with promoters. However, its in very early stages," said a PE fund manager. Spokespersons with Kedaara Capital, KKR and Carlyle declined comment while mails sent Vimal Kedia, MD at Manjushree, spokespersons at IPG, Graham packaging and Advent did not elicit responses till press time.

After Kedaara's investment, Manjushree has expanded inorganically through acquisition of Delhi-based packaging firm Varahi Ltd. With the acquisition, Manjushree expanded its foothold in north India and increased production capacity by 20% to 120,000 metric tonnes a year.