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IN TRIPLICATE

Dec 02, 2014

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

Ref: EPTL-001-11/2014

Subject: **Application for a Generation License of 2X330 MW Thar Coal Based Power Plant at Thar Block II Sindh**

I, **Shamsuddin A. Shaikh** being the duly authorized representative of **Engro Powergen Thar (Pvt.) Limited** by virtue of **Board Resolution** dated November 12, 2014, hereby apply to the National Electric Power Regulatory Authority for the grant of a GENERATION LICENCE to the **Engro Powergen Thar (Pvt.) Limited** pursuant to section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

I certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, and undertake to abide by the terms and provisions of the above-said regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of my knowledge and belief.

A **Demand Draft** in the sum of Rs. 690,080/- (Rupees Six Hundred Ninty Thousand Eighty Only), being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Yours Truly,

Shamsuddin A. Shaikh
Chief Executive Officer

Engro Powergen Thar Limited
4th Floor, The Harbor Front Building, HC-3, Marine Drive, Block 4, Clifton, Karachi 75600 Pakistan
T 00 92 (21) 35297501-10 F 00 92 (21) 35296018
engro.com

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CERTIFIED COPY OF RESOLUTION OF BOARD OF DIRECTORS

I, Muneeza Iftikar, Company Secretary, Engro Powergen Thar (Pvt.) Limited hereby certify that the following resolution was passed by the Board of Directors in their 2nd meeting held on November 12, 2014

Quote

"**RESOLVED THAT** Engro Powergen Thar (Pvt.) Limited (a company incorporated under the laws of Pakistan with its registered office located at 4th Floor, The Harbor Front Building, HC-3, Marine Drive, Block 4, Clifton, Karachi 74600, Pakistan.

Engro Powergen Thar (Pvt.) Limited be and is hereby authorised to file application for the grant of Generation License for submission at National Electric Power Regulatory Authority (NEPRA) in respect of **its 2 X 330 (660MW) mine mouth Circulating Fluidized Bed Technology** Coal Based Power Plant to be located **at Thar Block II, District Tharparkar, Sindh** (the Project) and in relation thereto, enter into and execute all required documents, make all fillings and pay all applicable fees, in each case, of any nature whatsoever as required."

"**FURTHER RESOLVED THAT** in respect of application for the Grant of Generation License (including any modification to the application for the Grant of Generation License) for submission to National Electric Power Regulatory Authority, **Mr. Shamsuddin A. Shaikh** as **Chief Executive** be and hereby empowered and authorised for and on behalf of the Company to:

(i) review, execute, submit and deliver the Generation License Application (including any modification to the application for the Grant of Generation License) and related documentation required by National Electric Power Regulatory Authority, including any contracts, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements, and any other instruments of any nature whatsoever;

(ii) sign and execute necessary documentation, pay the necessary fees, appear before the National Electric Power Regulatory Authority as needed, and do all acts necessary for completion and processing of the Generation License Application (modification to the application for the Grant of Generation License);

(iii) do all such acts, matters and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolutions/resolution".

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"**AND FURTHER RESOLVED THAT** **Mr. Shamsuddin A. Shaikh** as **Chief Executive** be and is hereby authorized to delegate all or any of the above powers in respect of the foregoing to any other officials of the Company as deemed appropriate." ***Unquote***

For and on behalf of
ENGRO POWERGEN THAR (PVT.) LIMITED

MUNEEZA IFTIKHAR
Company Secretary

November 25, 2014

Engro Powergen Thar (Pvt) Limited

A004641

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. **0089995**

I hereby certify that **ENGRO POWERGEN THAR (PVT.) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is **limited by shares.**

Given under my hand at **Karachi** this **Twenty Third** day of **September,** Two **Thousand** and **Fourteen**.

Incorporation fee Rs. **9,22,000/=** only

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

Company Registration Office
Karachi
Securities and Exchange Commission of Pakistan

Certified to be True Copy
07/11/2014
Asstt. Deputy Registrar of Company

THE COMPANIES ORDINANCE, 1984

COMPANY LIMITED BY SHARES

Memorandum of Association

OF

ENGRO POWERGEN THAR (PVT.) LIMITED

I. The name of the Company is "ENGRO POWERGEN THAR (PVT.) LIMITED."

II. The Registered Office of the Company will be situated in the Province of the SIND, Pakistan.

III. The objects for which the Company is established are all or any of the following: -

1. To carry on at suitable locations at Thar, Sind and other places in Pakistan the business of power generation, distribution, transmission and sale in all its branches and aspects and by the use of such forms of energy and in such manner as may be deemed feasible and sell and deliver the electricity thus generated.

2. To finance, design, construct, own, operate and maintain a power station together with all machinery, equipment and works ancillary thereto (hereinafter referred to as "Power station") and to do all such acts, deeds, and things, without limitation whatsoever as may be necessary or desirable in that connection.

3. To carry on anywhere in Pakistan the business of power generation, transmission, sale and distribution in all its branches and aspects and in particular to construct, lay down, establish, maintain and fix all necessary power stations together with ancillary works, cables, wires, lines, accumulators, lamps, and to generate, accumulate, distribute, sell and supply electricity.

4. To construct and maintain roads, bridges, wharves, quays, jetties and piers, pipelines and storage tanks for water, petroleum products, natural gas and other substances, gas processing and compression plants, water desalination

and treatment plants and such other works as may be required for all or any of the above purposes.

5. To provide engineering, construction, consultancy and design services and any facilities, equipment and installations whether related to such services and systems or otherwise.

6. To carry on the businesses of manufacturing, supplying, servicing, engineering, contractors, consultants, agents and import, export, buying, selling, manufacturing and/or dealing in all types of machinery, plant or equipment used in connection with the generation, transmission, distribution and supply of electricity or any other form of energy.

7. To buy, sell, import, hire, manufacture, deal in, and turn to account plant, machinery, implements, conveniences, provisions, articles, and products capable of being used in connection with the operations of or required by workmen and others employed by the Company or incidentally or conveniently connected with any such business as aforesaid.

8. To explore for, produce, import or otherwise obtain any fuel or other raw materials for use in connection with the generation of electricity or any other form of energy and to process and deal in any such raw materials or any by-products thereof and to process and deal in any by-products which may be obtained from the activities of generating, transmitting, distributing or supplying electricity or any other form of energy.

9. To carry on the businesses in all their branches of retailers, suppliers and dealers in electrical appliances, household and general domestic equipment, fixtures and fittings and all kinds of goods, equipment, materials or installations connected with the use of electricity or any other form of energy whether for domestic, industrial, commercial or other purposes.

10. To conduct, promote and commission research of all kinds and research and development activities of all kinds, whether related to the generation, transmission, distribution and supply of electricity or other form of energy or otherwise, and to exploit and turn to account the results of any such research or research and development carried out by or for the Company.

11. To acquire by any means and hold and deal with any heritable, real or personal property or corporeal or incorporeal rights whatsoever, whether or not for the purposes of or in connection with any of the foregoing activities, and (without prejudice to the generality of the foregoing) to purchase, take on lease or in

exchange, hire or otherwise acquire and hold any heritable or real property and any estate or interest in such property, including without limitation any lands, buildings, installations, structures, servitudes, easements, privileges and concessions and to use, exploit and develop the same.

12. To abstract and divert water from any appropriate source for use in connection with the generation of electricity.

13. To carry on any other trade or business whatever which, in the opinion of the Directors of the Company, can be advantageously carried on in connection with or ancillary to any of the above mentioned businesses or is calculated directly or indirectly to enhance the value of, or render profitable any of, the property or rights of the Company.

14. To carry on any other trade, commerce, industry and/or business whatsoever, which, in the opinion of the Directors of the Company, is or may be capable of being carried on directly or indirectly for the benefit of the Company.

15. To purchase or by any other means acquire and take options over any property whatever, and any rights or privileges of any kind over or in respect of any property.

16. To apply for, register, purchase, or by other means acquire and protect, prolong and renew, whether in Pakistan or elsewhere, any trademarks, patents, copyrights, trade secrets, or other intellectual property rights, licences, secret processes, designs, protections and concessions and to disclaim, alter, modify, use and turn to account and to manufacture under or grant licences or privileges in respect of the same, and to expend money in experimenting upon, testing and improving any patents, inventions or rights which the Company may acquire or propose to acquire.

17. To acquire or undertake the whole or any part of the business, goodwill, and assets of any person, firm, or company carrying on or proposing to carry on any of the businesses which the Company is authorised to carry on and as part of the consideration for such acquisition to undertake all or any of the liabilities of such person, firm or company, or to acquire an interest in, amalgamate with, or enter into partnership or into any arrangement for sharing profits, or for co-operation, or for mutual assistance with any such person, firm or company, or for subsidising or otherwise assisting any such person, firm or company, and to give or accept, by way of consideration for any of the acts or things aforesaid or property acquired, any shares, debentures, debenture stock or securities that may be agreed upon.

18. To enter into any arrangements with any government or authority (municipal, local, or otherwise) that may seem conducive to the attainment of the Company's objects or any of them, and to obtain from any such government or authority any charters, decrees, rights, privileges or concessions which the Company may think desirable and to carry out, exercise, and comply with any such charters, decrees, rights, privileges, and concessions.

19. To carry on and undertake trading business of all sorts and to act as indentors, importers, exporters, traders, suppliers, and commission agents of products, commodities and materials in any form or shape manufactured or supplied by any company, firm, association of persons, body, whether incorporated or not, individuals, Government, Semi- Government or any local authority.

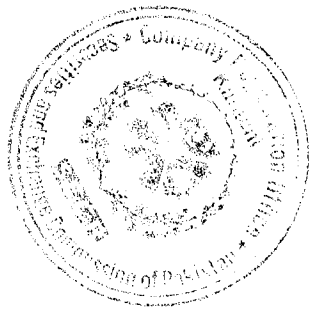
20. To apply for, tender, offer, accept, purchase, enter into or otherwise acquire any contracts and concessions for or in relation to the projection, execution, carrying out, improvements, management, administration or control of works and conveniences and undertake, execute, carry out, dispose of or otherwise turn to account the same.

21. To carry on in or outside Pakistan the business of manufacturers, transmittors, suppliers, importers, exporters, indentors, transporters, dealers in all articles and commodities akin to or connected with any of the business of the Company capable of being conveniently carried on or necessary for the promotion of the objects herein contained, as permissible under law.

22. To carry on business and obtain licences for shipping agents, clearing and forwarding agents, purchasing and indenting agents, selling agents, (except managing agent) on such terms and conditions as the Company may think proper, subject to any permission as required under the law.

23. To carry on agency business (except managing agency) and to acquire and hold selling agencies and to act as selling agents, commission agents, manufacturers' representatives and distributing agents of and for the distribution of all kinds of merchandise, goods, commodities, products, materials, substances, articles and things whether finished, semi-finished, raw, under process, refined, treated or otherwise pertaining to trade and commerce and for that purpose to remunerate them and to open and maintain depots and branches.

24. To purchase, take on lease or in exchange, hire, apply for or otherwise acquire and hold any interest, any rights, privileges, lands, building, easements,



trademarks, patents, patent rights, copyrights, licences, machinery, plants, stock-in-trade and any movable and immovable property of any kind necessary or convenient for the purposes of or in connection with the Company's business or any branch or department thereof and to use, exercise, develop, grant licences in respect of or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.

25. To acquire by concession, grant, purchase, barter, licence either absolutely or conditionally and either solely or jointly with others any lands, buildings, machinery, plants, equipments, privileges, rights, licences, trademarks, patents, and other movable and immovable property of any description which the Company may deem necessary or which may seem to the Company capable of being turned to account, subject to any permission as required under the law.

26. To act as representatives, for any person, firm or company and to undertake and perform sub-contracts, and also act in the business of the Company through or by means of agents, sub-contractors and to do all or any of the things mentioned herein in any part of the world and either alone or in collaboration with others and by or through agents, sub-contractors or otherwise.

27. To establish, promote or assist in establishing or promoting and subscribe to or become a member of any other company, association or club whose objects are similar or in part similar to the objects of this Company or the establishment or promotion of which may be beneficial to the Company or its employees.

28. To open accounts with any Bank or Banks and to draw, make, accept, endorse, execute, issue, negotiate and discount cheques, promissory notes, bills of exchange, bills of lading, warrants, deposit notes, debentures, letter of credit and other negotiable instruments and securities.

29. To arrange local and foreign currency loans from scheduled & other banks, leasing companies and modarbas and other financial institutions for the purpose of purchase, manufacture, market, supply, export and import of machinery, construction of factory, building and for the purpose of working capital or for any other purpose.

30. To sell or otherwise dispose of the whole or any part of the undertaking of the Company, either together or in portions for such consideration as the Company may think fit and in particular, for shares, debenture-stock or securities of any Company purchasing the same.

31. To borrow or raise money by means of loans or other legal arrangements from banks, or other financial institutions, or Directors in such manner as the Company may think fit and in particular by issue of debentures, debenture stock, perpetual or otherwise convertible into shares and to mortgage, or charge the whole or any part of the property or assets of the Company, present or future, by special assignment or to transfer or convey the same absolutely or in trust as may seem expedient and to, purchase, redeem or payoff any such securities.

32. To pay all costs, charges, and expenses preliminary or incidental incurred in formation or about the promotion and establishment of the Company and to remunerate any person, firm or company for services rendered or to be rendered in or about the formation or promotion of the Company or the conduct of its business.

33. To give any servant or employee of the Company commission in the profits of the Company's business or any branch thereof and for the purpose to enter into any agreement or scheme of arrangement as the Company may deem fit and to procure any servants or employees of the Company to be insured against risk of accident in the course of their employment by the Company.

34. To establish and support or aid in the establishment and support of associations, trusts, institutions, funds and conveniences calculated to benefit persons who are or have been Directors of or who have been employed by or who are serving or have served the Company or any other Company which is a subsidiary or associate of the Company or the dependents of such persons and to grant pensions, gratuities, provident funds, allowances, relief and payments in any other manner calculated to benefit the persons described herein.

35. To distribute any of the Company's property and assets among the members in specie or in any manner whatsoever in case of winding up of the Company.

36. To guarantee the performance of contracts and obligations of the Company or any of its associated companies or persons or any other person or company whatsoever.

37. To cause the Company to be registered or recognised in any foreign country.

38. To do and perform all other acts and things as are incidental or conducive to the attainment of the above objects or any of them.

39. To apply for and obtain necessary consents, permissions and licences from any Government, State, Local and other Authorities for enabling the Company to carry on any of its objects into effect as and when required by law.

40. It is declared that the company shall not engaged in business of banking company, banking, leasing, investment, managing agency or insurance business or directly or indirectly as restricted under the law or any unlawful operation and the company shall not indulge in multi level marketing, launching of ponzy or pyramid schemes for marketing purposes.

41. Notwithstanding anything stated in any object clause, the company shall obtain such other approval or license from Competent Authority, as may be required under any law or the time being in force, to undertake a particular business.

IV. The liability of the members is limited.

V. The authorised share capital of the Company is Rs. 300,000,000/- (Rupees Three Hundred Million) divided into 30,000,000 (Thirty Million) shares of the nominal value of Rs. 10.00 (Rupees ten) each with the rights, privileges and conditions attached thereto as are provided for the time being, with power to increase and reduce the capital of the Company and to divide the shares in the capital for the time being, into several classes.

We, the several, persons, whose names and addresses are subscribed below are desirous of being formed into a Company, in pursuance of these Memorandum of Association and we respectively agree to take the number of shares in the capital of the company set opposite our respective names.

NAME AND SURNAME (PRESENT & FORMER) IN FULL (IN BLOCK LETTERS)	FATHER'S/ HUSBAND'S NAME IN FULL	NATIONALITY & CNIC NO.	OCCUPATION	RESIDENTIAL ADDRESS IN FULL	NUMBER OF SHARES TAKEN BY EACH SUBSCRIBER	SIGNATURE
MUHAMMAD ALIUDDIN ANSARI	MUHAMMED SAIFUDDIN ANSARI	PAKISTANI 42201-3641868-9	BUSINESS EXECUTIVE	30-G, 5TH GIZRI STREET PHASE IV, DHA KARACHI	01 (ONE)	
SHAMSUDDIN AHMAD SHAIKH	SYED AHMAD SHAIKH	PAKISTANI 42301-6789487-9	BUSINESS EXECUTIVE	93/1, 22ND STREET, KHY-E-MUHAFIZ, PHASE VI, DHA, KARACHI	01 (ONE)	
RUHAIL MOHAMMED	YOUSUF MOHAMMED	PAKISTANI 42301-0895452-9	BUSINESS EXECUTIVE	H.NO.101-I, KHYABAN-E-BADBAN, PHASE V, DHA, KARACHI	01 (ONE)	
TOTAL NUMBER OF SHARES					**3 (THREE)**	

Dated. September 18, 2014

WITNESS TO ABOVE SIGNATURES

(NIFT (PVT) LTD, 5TH FLOOR AWT PLAZA, I.I. CHUNDRIGAR ROAD, KARACHI – 74000)

Certified to be True Copy
06/11/2014
Deputy Registrar of Companies

THE COMPANIES ORDINANCE, 1984

COMPANY LIMITED BY SHARES

Articles of Association

OF

ENGRO POWERGEN THAR (PVT.) LIMITED

1. The regulations in Table A in the first Schedule to the Companies Ordinance 1984, shall not apply to the Company except in so far as the same are reproduced or contained in or expressly made applicable by these Articles.

2. **Definitions:**

"The Ordinance" means the Companies Ordinance, 1984, or any statutory modification or re-enactment thereof for the time being in force.

"The Articles" means these Articles of Association as originally framed or as from time to time altered by Special Resolution.

"Special Resolution" has the meaning assigned to it by Section 2(l)(36) of the Ordinance.

"The Company" means Engro Powergen Thar (Pvt.) Limited

"Member" means member of the Company in accordance with the provisions of Sections 2(1)(21) of the Ordinance.

"Directors" means the Directors for the time being of the Company.

"Chief Executive" means the Chief Executive for the time being.

"Board" means the Board of Directors for the time being.

"Chairman" means the Chairman of the board appointed from time to time pursuant to these Articles.

"Secretary" means the Secretary for the time being of the Company.

"Office" mean the Registered Office for the time being of the Company.

"Register" means the Register of Members to be kept pursuant to Section 147 of the Ordinance.

"Dividend" includes bonus.

"Seal" means the Common Seal of the Company.

"Month" means calendar month according to the Gregorian Calendar.

"Proxy" includes an attorney duly constituted under power of attorney.

BUSINESS

3. The business of the Company shall include all or any of the objects enumerated in the Memorandum of Association and can be commenced, subject, to any other provision of the Ordinance to which the Company is subject, immediately after the incorporation of the Company as the Directors may think fit, notwithstanding that only part of the capital has been subscribed.

SHARE CAPITAL & SHARES

4. The authorized share capital of the Company is Rs. 300,000,000 (Rupees Three Hundred Million) divided into 30,000,000 (Thirty Million) ordinary shares of Rs. 10 each.

5. The Company in General Meeting may from time to time increase the share capital by such sum to be divided into shares of such amount as may be deemed expedient.

6. The new shares shall be issued upto such terms and conditions and with such rights and privileges annexed thereto as the General Meeting creating the same shall direct and if no direction be given the Directors shall comply with the provisions of these Articles. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.

7. The Directors may from time to time increase the issued share capital by such sum as they think fit. In respect of any intended issue of shares, the Directors shall be entitled to seek a resolution of the company in General Meeting as to any person or class of persons to whom the shares may be offered or as to any other matter

relating to the issue. Subject to any resolution to the contrary that may be given by the company in General Meeting, all shares intended to be issued by the Directors shall, before issue, be offered to the Members strictly in proportion to the amount of the issued shares held by each Member (irrespective of class) in accordance with the provision of Section 86 of the Ordinance.

8. Subject to the provisions of Section 92 of the Ordinance the company may;

   a) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares;

   b) sub-divide shares or any of them into shares of smaller amount than is fixed by the Memorandum of Association;

   c) cancel any shares which at the date of passing of the resolution have not been taken or agreed to be taken by any person.

   The resolution by which any share is sub-divided or consolidated may determine that as between holders of shares resulting from sub-division or consolidation rights of profits, votes and other benefit attaching to them will be proportionate to their paid up value and where shares issued as sub-divided or consolidated shares are of same class as those previously issued that rights attaching to them, subject as aforesaid, shall be the same as those attaching to the shares previously held.

9. Subject to Section 96 of the Companies Ordinance, the Company may by special resolution reduce its share capital.

10. Except to the extent permitted by Section 95 of the Ordinance no part of the funds of the Company shall be employed in the purchase of any shares of the Company, and the Company shall not give, whether directly or indirectly, and whether by means of a loan, guarantee, the provisions of security or otherwise, any financial assistance for the purchase of or in connection with a purchase made or to be made by a person of any shares of the Company or give any loan upon the security of any shares of the Company.

11. The Company may at any time pay a commission to any person for subscribing or agreeing to subscribe (whether absolutely or conditionally) for any shares or debentures or redeemable capital of the Company or procuring or agreeing to procure subscriptions (whether absolute or conditional) for any shares or debentures or redeemable capital of the Company. In case any commission shall be paid the Company shall comply with the provisions of Section 82 of the Ordinance.

The Company may also pay such brokerage as may be lawful on any issue of shares or debentures.

SHARES

12. Shares may be registered in the name of any individuals, limited Company or other corporate body but not more than four persons shall be registered as joint-holders of any shares.

13. If any share stands in the name of two or more persons, the person first named in the Register shall, as regards receipt of dividend or service of notice, and all or any other matters connected with the Company except voting at a meeting and the transfer of shares, be deemed the sole holder.

14. In the case of the death of anyone or more of the persons named in the Register as the joint-holders of any share, the survivor or survivors shall be the only person or persons recognized by the Company as having any title to or interest in such share, but nothing herein contained shall be taken to release the estate of a joint-holder from any liability on shares held by him jointly with any other person.

15. Every member shall name to the Company a place in Pakistan, to be registered as his address and such address shall for all purposes be his place of residence.

CERTIFICATES

16. Every member whose name is entered as a Member in the Register shall without payment be entitled to receive, after allotment or registration of transfer, one certificate for all his shares or several certificates each for one or more of his shares.

17. The certificates of shares and duplicates or replacements thereof when necessary shall be issued under the seal of the Company and signed by two Directors, or by one Director and the Secretary.

18. The Company shall not issue more than one share certificate in respect of a share or shares held jointly by two or more persons, and delivery of a certificate for a share to anyone of the joint holders shall be sufficient delivery to all.

19. The Company shall, within ninety days, after the allotment of any of its shares, and within forty five days after the date on which the application for the registration of transfer has been lodged, complete and have ready for delivery the certificates of all shares, allotted or transferred.

20. If any certificate be worn out, defaced, destroyed or lost, or if there is no further space on the back thereof for endorsement of transfer it may be renewed or replaced on payment of such sum, as the Directors may from time to time prescribe. Provided however, that such new certificate shall not be granted except upon delivery of the worn out or defaced or used up certificate for the purpose of cancellation or upon proof of destruction or loss to the satisfaction of the Directors and on such indemnity as the Directors may deem adequate in case of certificates having been lost or destroyed.

TRANSFER OF SHARES

21. (a) The members shall not be entitled to transfer the shares standing in their name to outsiders except with the approval of the Directors.

(b) Subject to the provisions of Article 21 (a) above the Directors shall not refuse to register a transfer of fully paid shares unless the transfer deed is defective or invalid or is not accompanied by the certificate of the shares to which it relates. The Directors may also decline to recognize any instrument of transfer unless it is accompanied, in addition to the certificate of the shares to which it relates, by such other evidence as the Directors may require to show the right of the transferor to make the transfer.

If the Directors refuse to register a transfer of any shares they shall, within thirty (30) days after the date on which the instrument of transfer was lodged with the Company, send to the transferee and the transferor notice of the refusal indicating the reason for such refusal; provided that if the Directors refuse to register a transfer of shares on account of a defect in or the invalidity of the instrument of transfer, the transferee shall be entitled, after removal of such defect or invalidity to re-lodge the instrument of transfer with the Company.

(c) The number of Members of the Company shall not exceed fifty (50).

(d) No offer of shares shall be made to the public for subscription.

22. The instrument of transfer of any share in the Company shall be duly stamped and executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the Register in respect thereof.

23. The instrument of transfer of any share shall be in writing in the following form or in any usual or common form:

I, _____ of _____ in consideration of the sum of Rs. _____ paid to me by _____ of _____ (the "Transferee") do

hereby transfer to the Transferee the shares(s) numbered _____ to _____ inclusive in Engro Powergen Thar (Pvt.) Limited to hold unto the Transferee, his executors, administrators and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and 1, the Transferee, do hereby agree to take the said share (or shares) subject to the conditions aforesaid.

As witness our hands this _____ day of _____

TRANSFEROR TRANSFEREE

Signature Signature
Full Address Full Name, Father's
Husband's Name
Nationality
NIC Number
Occupation
Full Address

Signature Witness
Full Address Signature
Full Address

I wish the cash dividend declared by the company, if any, be directly credited in my bank account, instead of issue of dividend warrants. Please tick " √ " any of the following boxes:

YES	NO

If YES then please provide the following information:

Transferee's Details	
Title of Bank Account	
Bank Account Number	
Bank's Name	
Branch Name and Address	
Cell number of transferee	
Landline number of transferee	

It is stated that the above-mentioned information is correct, that I will intimate any future changes in the above mentioned information to the company and the concerned Share Registrar, as soon as these occur.

Signature of transferee

24. Where it is proved to the satisfaction of the Directors that an instrument of transfer signed by the transferor and the transferee has been lost, the Company may, if the Directors shall think fit, by any application in writing made by the transferee and bearing the stamps required by an instrument of transfer, register the transfer on such terms as to indemnity as the Directors may think fit.

25. No fee will be charged for registering transfer of shares.

26. The transfer books of the Company may be closed for any time or times not exceeding fifteen days at a time.

27. Nominees, if any, appointed under the provisions of Section 80 of the Ordinance, or legal representatives of a deceased Member shall be the only persons recognized by the Company as having title to his share except in case of joint-holders in which case the surviving holder(s) or the executors or administrators of the last surviving holder shall be the only person(s) entitled to be so recognized. The Company shall not be bound to recognize such nominee or legal representative except as provided in Section 80 of the Ordinance unless he shall have obtained probate or letter of administration or other legal representation, as the case may be, from a duly constituted court in Pakistan. Provided nevertheless that in special cases it shall be lawful for the Directors to dispense with the representation upon such terms as to indemnity or otherwise as the Directors may deem fit.

28. A person becoming entitled to a share by reason of the death or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share except that he shall not before being registered as a Member in respect of the share be entitled in respect of it to exercise any right conferred by membership in relation to meetings of the Company.

29. Save as herein otherwise provided, the Company shall be entitled to treat the registered holder of any share as the absolute owner thereof and, accordingly, shall not except as ordered by a court of competent jurisdiction or as required by statute, be bound to recognize any equitable contingent future or other claim to or interest in such share on the part of any other person.

GENERAL MEETINGS

30. The Company shall comply with all requirements of the Ordinance regarding General Meetings.

31. A General Meeting to be called Annual General Meeting shall be held, in accordance with the provisions of Section 158, within eighteen months from the date of incorporation of the Company and thereafter once at least in every calendar year within a period of four months following the close of its financial year and not more than fifteen months after the holding of its last preceding Annual General Meeting on a date and time as may be decided by the Directors.

32. The Directors may, whenever they think fit, and they shall on the requisition of the holders of not less than 10% of the issued capital of the Company, forthwith proceed to convene all Extraordinary General Meeting of the Company and in case of such requisition, the provisions of Section 159 of the Ordinance shall apply.

NOTICE OF MEETING

33. Subject to the provisions of Section 158 and 159 of the Ordinance twenty one days notice at least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of meeting along with a statement complying with Section 160 (1)(b) of the Ordinance shall be given in the manner hereinafter provided or in such other manner, if any, as may be prescribed by the Company in General Meeting or in the manner provided by the Ordinance, to such persons as are under the Ordinance or under these Articles, entitled to receive such notice from the Company.

34. The accidental omission to give notice of a meeting to or the non-receipt of notice of a meeting, by any person entitled to receive notice shall not invalidate the proceedings at the meeting.

PROCEEDINGS AT GENERAL MEETINGS

35. The ordinary business of a General Meeting shall be to receive and consider the balance sheet, profit and loss account and the reports of the Directors and of the Auditors, to elect Directors, to declare dividends, to appoint Auditors and fix their remuneration. All other business transacted shall be deemed special.

36. No business shall be transacted at any General Meeting unless the quorum of Members, as required by Section 160 of the Ordinance, is present at the time when the meeting proceeds to business and throughout its proceedings.

37. If within half-an-hour from the time appointed for the meeting, a quorum is not present, the meeting, if called upon requisition of Members, shall be dissolved. In any other case it shall stand adjourned to the same day in the next week at the same time and place and at the adjourned meeting the quorum shall be the same as provided in the above Article.

38. The Chairman, if any, of the Board of Directors shall preside as Chairman at every General Meeting of the Company, or if there is no such Chairman, or if he shall not be present within fifteen minutes after the time appointed for the holding of the meeting or is unwilling to act, the Directors present shall elect one of their number to be, Chairman of the Meeting, or if no Directors be present or if all the Directors present decline to take the chair, the Members present shall choose one of their number to be Chairman of the Meeting.

39. The Chairman may with the consent of any meeting at which a quorum is present (and shall if so directed by the meeting) adjourn any meeting from time to tine and from place to place, but no business shall be transacted at any adjourned meeting except the business left unfinished at the meeting from which the adjournment took place.

40. At any General Meeting a resolution put to the vote of the meeting shall be decided on a show of hands, unless a poll is (before or on the declaration of the show of hands) demanded in accordance with the provision of Section 167 of the Ordinance.

    (a) by the Chairman of the meeting on his own motion; or

    (b) by atleast five members having the right to vote on the resolution and present in person or proxy or

    (c) by any Member or Members present in person or by proxy and having not less than onetenth of the total voting power in respect of the resolution.

    Unless a poll is so demanded, a declaration by the Chairman of the meeting that a resolution has on a show of hands been carried or carried unanimously or by a particular majority, or lost, and an entry to that effect in the book containing the minutes of the proceedings of the Company, shall be conclusive evidence of the fact without proof of the number or proportion of the votes recorded in favour of or against such resolution.

41. If a poll is demanded on any matter other than the election of a Chairman or on a question of adjournment, it shall be taken in the manner laid down in Section 168 of the Ordinance at such time, not more than fourteen days from the day on which it is

demanded, as the Chairman of the meeting may direct. The results of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded. The demand for a poll may be withdrawn at any time by the person or persons who make the demand.

42. The demand of a poll shall not prevent the continuance of the meeting for the transaction of any business other that the question on which the poll has been demanded.

43. The Chairman of any meeting shall be the sole judge of the validity of every vote taken at such meeting. The Chairman present at the taking of a poll shall be the sole judge of the validity of every vote tendered at such poll.

VOTES OF MEMBERS

44. On a show of hands every Member present in person shall have one vote. In the case of joint holders the vote of the senior Member present whether in person or by proxy shall be accepted to the exclusion of the votes of the other joint holders and for this purpose seniority shall be determined by the order in which their names stand in the Register. The Chairman shall have the casting vote in case of an equality of votes.

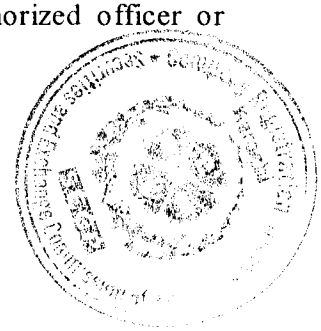
45. A Member of unsound mind, or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on a show of hands or on a poll, by his committee or other legal guardian or their proxy.

46. On a poll every Member present in person or by proxy shall have one vote in respect of each share held by him. The Chairman shall have the casting vote in case of an equality of votes.

47. No objection shall be raised to the qualification of any vote except at the meeting or adjourned meeting at which the vote objected to is given or tendered, and every vote not disallowed at such meeting shall be valid for all purposes. Any such objection made in due time shall be referred to the Chairman of the meeting whose decision shall be final and conclusive.

48. On a poll, votes may be given either personally or by proxy.

49. The instrument appointing a proxy shall be in writing under the hands of the appointer or of his attorney duly authorized in writing, or if the appointer is a corporation, under its common seal or the hand of a duly authorized officer or attorney. A proxy need not be a Member of the Company.



50 The instrument appointing a proxy and the power of attorney or other authority (if any) under which it is signed or a notarially certified copy of that power or authority shall be deposited at the office not less than forty eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote, and in default the instrument of proxy shall not be treated as valid.

51. An instrument appointing a proxy may be in the following form, or in any other usual or common form.

ENGRO POWERGEN THAR (PVT.) LIMITED

I/We,_____ of being a member of Engro Powergen Thar (Private) Limited and holder of _____ ordinary shares as per Share Register Folio No. _____ and/ or CDC Participant ID No. _____ and sub- account No. _____ hereby,_____ of _____ appoint _____ of _____ or failing him _____ of _____ as my proxy to vote for me and on my behalf at the annual or extra-ordinary (as the case may be) general meeting of the Company to be held on the _____ day of _____ and any adjournment thereof.

SIGNED this _____ day of _____,_____.

52. The instrument appointing a proxy shall be deemed to confer authority to demand or join in a demand for a poll.

53. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the shares in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the Company at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.

54. Any corporation which is a Member of the Company may by resolution of its Directors or other governing body authorise such person as it thinks fit, to act as its representative at any meeting of the Company or of any class of Members of the Company, and the person so authorised shall be entitled to exercise the same powers on behalf of the corporation which he represents as that corporation could exercise if it were an individual Member of the Company, present in person. A corporation

attending a meeting through such representative shall be deemed to be present at the meeting in person.

DIRECTORS

55. The number of Directors shall not be less than three.

    The subscribers to the Memorandum of Association shall be deemed for all purposes to be the first Directors.

56. The Directors shall fix the number of Directors not later than thirty five days before the convening of the General Meeting at which the Directors are to be elected and the number so fixed shall not be changed except with the prior approval of the Company in General Meeting. The Directors shall, unless the number of persons who offer themselves to be elected is not more then the number of Directors fixed under this Article, be elected by the Members of the Company in General Meeting in the following manner, namely:

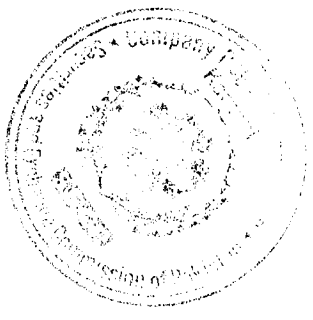
    a. every Member present in person or by proxy or by representative shall have such number of votes as is equal to the product of the number of voting shares held by him and the number of Directors to be elected.

    b. the number of votes calculated in accordance with the preceding clause (a) may be given to a single candidate or may be divided between two or more candidates in such manner as the person voting may choose; and

    c. the candidate who get the highest number of votes shall be declared elected as Director and then the candidate who get the next highest number of votes shall be so declared and so on until the total number of directors to be elected has been so elected.

57. Any person who seeks to contest an election to the office of Director shall, whether he is a retiring Director or otherwise, file with the Company, not later than fourteen days before the date of the meeting at which elections are to be held, a notice of his intention to offer himself for election as a Director, provided that any such person may at any time, before the holding of elections withdraw such notice.

58. A Director must be a Member, unless he represents the Government an institution or authority which is a Member or is a whole time working director who is an employee of the Company;



59. Subject to the provisions of Section 177 of the Ordinance, retiring Directors shall continue to perform their functions until their successors are elected. Retiring Directors shall be eligible for reelection.

60. A Director elected by the Members in General Meeting, not being a Director appointed in accordance with section 183 of the Ordinance, shall hold office for a period of three years following the date from which his election is effective unless he earlier resigns, becomes disqualified from being a Director or otherwise ceases to hold office.

61. The remuneration of a Director for attending meetings of the Board or a Committee formed by the Board shall from time to time be determined by the Board of Directors, provided that a Director who is an executive of the Company shall not be entitled to any remuneration for attending meetings of the Board or a Committee of the Board. The Directors may also be paid all travelling, hotel and other expenses, properly incurred by them in attending and returning from meetings of the Directors or any Committee of the Directors or general meetings of the Company or in connection with the business of the Company. Where a Director or a firm of which such Director is a partner or a private company of which such Director is a director

62. Subject to the provisions of Section 181 of the Ordinance, at any time the Company may by resolution in General Meeting remove a Director elected under Section 178 of the Ordinance.

63. Any casual vacancy occurring among the elected Directors may be filled up by the Directors and the person so appointed shall hold office for the remainder of the term of the Director in whose place he is appointed.

64. A Director who is about to leave or is absent for a period of three months or more from Pakistan may with the approval of the Directors appoint any person to be an alternate Director during his absence from the country and such appointment shall have effect and such appointee, whilst he holds office as an alternate Director, shall be entitled to exercise in place of his appointer all the functions of appointer as a Director of the Company but he shall ipso facto vacate his office as and when his appointer returns to the country or vacates office as a Director or removes the appointee from office. Any appointment or removal under this Article shall be effected by notice in writing under the hand of the Director making the same. Such alternate Director may be one of the Directors of the Company. In such case he shall be entitled to act in both capacities. Subject to Section 187 of the Ordinance, an alternate Director need not be a Member of the Company.

65. The Directors shall elect one of their member as the Chairman of the Board upto terms and conditions as the Board may decide from time to time.

66. The Directors may from time to time delegate any of their powers except those powers required to be exercised by the Board under Section 196(2) of the Ordinance to a committee or committees consisting of such number of members of their body as they think fit. Any committee so formed shall conform to any regulations that may be imposed upon it by the Directors and shall be governed, in the exercise of the powers so delegated, by the provisions herein contained for regulating meetings and proceedings applicable to the Directors.

POWERS AND DUTIES OF DIRECTORS

67. The business of the Company shall be managed by the Directors who may pay all expenses incurred in setting up and registering the Company and may exercise all such powers of the Company as are not by the Ordinance' or by any other law or these Articles, required to be exercised by the Company in General Meeting but no regulation made by the Company in General Meeting shall invalidate any prior act of the Directors which would have been valid if the regulation had not been made.

68. Subject to the provisions in these Articles, the Directors may exercise all the powers of the Company to borrow money and to mortgage or charge its undertaking, and property, or any part thereof, and to issue securities and debentures whether outright or as security for any debt, liability or obligation of the Company or of any third party.

69. Subject to the provisions Section 196(2) of the Ordinance, the Directors may from time to time and at any time by power of attorney appoint any company, firm or person or body of persons, to be the attorney or attorneys of the Company for such purposes and with such powers, authorities and discretions not exceeding those vested in or exercisable by the Directors under these Articles for such period and subject to such conditions if any as they may think fit.

70. Subject to the provision of the Ordinance, the Directors shall not be disqualified from contracting with the Company either as vendor, purchaser, or otherwise, nor shall any such contract or agreement entered into by or on behalf of the Company with any company or partnership of or in which any Director of the Company shall be a member or partner or otherwise interested be avoided nor shall any such Director so contracting or being such member or partner or so interested be liable to account to the Company for any profit realised by any such contract or arrangement by reason of such Director holding that office or of the fiduciary relation thereby established but the nature of his interest must be disclosed by him at the meeting of the Directors at which the contract or arrangement is determined on, if the interest then exists, or in any other case at the first meeting of the Directors after the

acquisition of the interest. A general notice that any Director of the Company is a director or a member of any other company or a member or partner of any named firm and is to be regarded as interested in any subsequent transaction with such company or firm shall as regards any such transaction be sufficient disclosure under this Article and subject to the provision of Section 214 of the Ordinance, after any such general notice it shall not be necessary to give any special notice relating to any particular transaction with such firm or company. A copy of each such general notice shall be provided to each Director including alternate Directors.

71. A Director of the Company may be, or become a director of all or any other company promoted by the Company or in which in the Company may be interested as a vendor shareholder or otherwise, and no such Director shall be accountable for any benefits received as director or member of such other company.

72. In accordance with the provisions of Section 219 of the Ordinance a Register shall be kept by the Directors in which shall be entered particulars of all required contacts or arrangements and which shall be open to inspection by any Member at the office during business hours

73. All cheques, promissory notes, drafts, bills of exchange and other negotiable instruments, and all receipts for moneys paid to the Company shall be signed, drawn, accepted, endorsed, or otherwise executed, as the case may be, in such manner as the directors shall from time to time, by resolution determine.

74. The Directors shall duly comply with the provisions of the Ordinance, and in particular with the provisions with regard to the registration of the particulars of mortgages and charges affecting the property of the Company or created by it, and to keep a Register of the Directors and Managers and to send to the Registrar all returns and statements required under the Ordinance.

75. The Directors shall cause Minutes to be made in books provided for the purposes:

    a) of the name of the Directors present at each meeting of the Directors and of any committee of the Directors;

    b) of all resolutions and a fair and accurate summary of proceedings of all General Meetings of the Company and of the Directors and of committees of Directors,

A copy of each such minutes shall be provided to each Director including alternate Directors. Every Director present at any meeting of Directors or committee of Directors shall sign his name in a book to be kept for the purpose and any such minute of such a meeting if purporting to be signed by the Chairman thereof, or by

the Chairman of the next succeeded meeting of the same body shall be sufficient evidence without any further proof of the facts therein stated.

76. The office of a Director shall be vacated if:

a) he is ineligible on anyone or more grounds enumerated in Section 187 of the Ordinance;

b) he absents himself from three consecutive meetings of the Directors or from all meetings of the Directors for a continuous period of three months whichever is the longer without leave of absence from the Board of Directors;

c) he or any firm of which he is a partner or any private company of which he is a director without the sanction of the Company in general meeting accepts or holds any office of profit under the Company other than that of chief executive or a legal or technical adviser or banker;

d) he resigns his office by notice in writing to the Company.

PROCEEDINGS OF DIRECTORS

77. The Directors may meet together for the despatch of business, adjourn and otherwise regulate their meetings, as and where, subject to the provisions of the Ordinance and these Articles, they deem fit. The Chairman may, and the Secretary shall, on the requisition of one Director, at any time, summon a meeting of Directors.

Notice of a Board meeting setting forth the agenda shall be sent to every Director (including a person who is an alternate Director for the time being) not less than 7 days before the meeting is scheduled to take place and such notice may be sent by fax. However, in urgent situations, the Board Meetings may be called at shorter notice.

78. The quorum required for meetings of the Board of Directors shall be not less than one third of their number of four whichever is greater.

79. The continuing Directors may act notwithstanding any vacancy in their body, but if and so long as their number is reduced below the number fixed by or pursuant to the regulations of the Company as the necessary quorum of Directors, the continuing Directors may act for the purpose of filling vacancies in their body or summoning a General Meeting of the Company, but for no other purpose.

80. All acts done at any meeting of the Directors by any person acting as a Director shall notwithstanding that it shall afterwards be discovered that there was some defect in the appointment or continuance in office of any such Director or person acting as aforesaid, or that they or any of them were disqualified or had vacated office, or were not entitled to vote, be as valid as if every such person had been duly appointed or had duly continued in office and was qualified and had continued to be a Director and had been entitled to be a Director.

81. Except as provided for by Section 196 of the Ordinance, a resolution in writing signed by all the Directors for the time being present in Karachi shall be as valid and effectual as if it has been passed at a meeting of the Directors duly called and constituted.

82. If at any meeting the Chairman is absent, the Directors may elect any Director to act as the Chairman for the meeting.

CHIEF EXECUTIVE

83. The Directors may from time to time appoint any person as Chief Executive in accordance with the provisions of Section 199 to 201 of the Ordinance and may subject to the provisions of Section 202 of the Ordinance from time to time remove or dismiss him from office and appoint another in his place. The remuneration of a Chief Executive shall from time to time be fixed by the Directors.

84. The Directors may from time to time entrust or confer upon a Chief Executive for the time being such of the powers exercisable under these presents by the Directors as they may think fit and may confer such powers for such time and to be exercised for such objects and purposes, and upon such terms and conditions and with such restrictions as they think expedient, and they may confer such powers either collaterally with or to the exclusion of and in substitution for all or any of the powers of the Directors in that behalf, and may from time to time revoke, withdraw, alter or vary all or any of such powers.

SECRETARY

85. The Secretary shall be appointed by the Directors for such term, at such remuneration and upon such conditions as they may think fit, and any Secretary so appointed may be removed by them. Where there is no Secretary capable of acting, the Directors may appoint an assistant or deputy secretary or any other officer of the Company to perform the duties of the Secretary.

THE SEAL

86. The Directors shall provide for the safe custody of the seal which shall he used by the authority of the Directors and every instrument to which the seal shall be affixed shall either be signed by one Director and countersigned by the Secretary or by a second Director or by some other person appointed by the Directors for the purpose.

DIVIDENDS AND RESERVES

87. The Company in General meeting may declare Dividends, but no Dividend shall exceed the amount recommended by the Directors.

88. No Dividend shall be paid by the Company otherwise than out of the profits of the Company and to the extent recommended by the Board or in contravention of Section 249(2) of the Ordinance.

89. The Directors may from time to time pay to the Members such interim Dividend as appear to the Directors to be justified by the profits of the Company

90. The Directors may, before recommending any Dividends, set aside out of the profits of the Company, such sums as they think proper as a reserve or reserves, which shall, at the discretion of the Directors, be applicable for meeting contingencies, or for any other purpose which the profits of the Company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of the Company or be invested in such investments as the Directors may from time to time think fit.

91. When any shareholder is indebted to the Company all Dividends payable to him or a sufficient part thereof, may be retained and applied by the Directors in or towards satisfaction of the debt.

92. Any Dividend or other moneys payable in cash in respect of shares may be paid by cheque or warrant sent through the post direct to the registered address of the holder or, in the case of joint holders to the registered address of that one of the joint

holders who is first named on the Register or to such persons and to such address as the holder or joint holders may in writing direct. Every such cheque or warrant shall be made payable to the order of the person to whom it is sent. Any of two or more joint holders may give effectual receipt for any dividends, bonuses, or other money payable in respect of the shares held by them as joint holders. The dividend shall be paid within the period laid down in Section 251 of the Ordinance.

93. No dividend or other moneys payable on or in respect of shares shall bear interest against the Company. Dividends unclaimed after having been declared may be invested or otherwise used by the Directors for the benefit of the Company until claimed.

CAPITALIZATION OF PROFITS

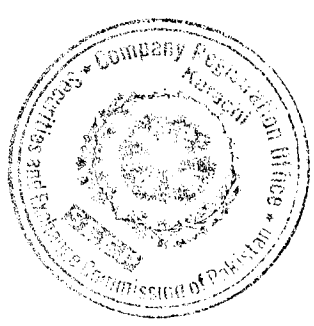
94. The Company in General Meeting may upon the recommendation of the Directors resolve that it is desirable to capitalize any part of the amount for the time being standing to the credit of the Company's reserve accounts or to the credit of the profit and loss account or otherwise available for distribution and accordingly that such sum be set free for distribution amongst the Members who would be entitled thereto if distributed by way of dividend and in the same proportion on condition that the same be not paid in cash but be applied in paying up in full unissued shares of the Company to be allotted and distributed/credited as fully paid up to and amongst such Members in the proportion aforesaid, and the Directors shall give effect to such resolution.

ACCOUNTS

95. The Directors shall cause proper books of account to be kept as required by Section 230 of the Ordinance.

96. The books of account shall be kept at the registered office of the Company or at such other place as the Directors shall think fit and shall be open to inspection by the Directors during business hours.

97. The Directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the Company or any of them shall be open to the inspection of Members not being Directors, and no Member (not being a Director) shall have any right of inspecting any account and books or papers of the Company except as conferred by law or authorised by the Directors or by the Company in General Meeting.



98. The Directors shall, as required by Sections 233, 234 and 236 of the Ordinance cause to be prepared and to be laid before the Company in General Meeting such balance sheet and profit and loss account duly audited and reports as are referred to in those sections.

99. A balance sheet, profit and loss account, and other report referred to in following Article shall be made out in every year and laid before the Company in Annual General Meeting made up to a date not more than three months before such meeting. The balance sheet and profit and loss account shall be accompanied by a report of the auditors of the Company and the report of the Directors.

100. A copy of the balance sheet and profit and loss account together with reports of the Directors and Auditors shall, at least twenty one days preceding the Annual General Meeting, be sent to the persons entitled to receive notices of General Meeting in the manner in which notices are to be given hereunder and a copy thereof shall be deposited at the registered office of the Company for the inspection of Members for a period of twenty one days prior to such meeting.

AUDIT

101. Auditors shall be appointed and their duties regulated in accordance with Sections 252 to 255, of the Ordinance or any statutory modifications thereof for the time being in force.

NOTICES

102. A Notice may be given by the Company to any Member either personally, or by sending it by post to him to his registered address. Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice, and, unless the contrary is proved, to have been effected at the time that the letter would be delivered in the ordinary course of post.

103. A notice may be given by the Company to the joint holders of a share by giving the notice to the joint holder named first in the Register in respect of the share and a notice so given shall be sufficient to all the holders of such shares.

104. A notice may be given by the Company to the persons entitled to a share in consequence of the death or insolvency of a Member through the post in a prepaid letter addressed to them by name or by title or to representatives of the deceased or to an assignee of the insolvent at the address, (if any) in Pakistan supplied for the purpose by the persons claiming to be entitled, or (until such an address has been so

supplied) by giving the notice in any manner in which the same might have been given if the death or insolvency had not occurred.

105. Notice of every General Meeting shall be given in the manner herein before authorized to (a) every Member of the Company, except those Members who have no registered address in Pakistan or have not supplied to the Company an address in Pakistan for giving of notice to them, and also (b) every person entitled to a share in consequence of the death or insolvency of a Member, who but for his death or insolvency would be entitled to receive notice of the meeting.

WINDING UP

106. (1) Subject to the provisions of the Ordinance, if the Company is wound up, the liquidator may, with the sanction of a Special Resolution of the Company and any other sanction required by the Ordinance, divide amongst the Members, in specie or kind the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.

(2) For the purpose aforesaid, the liquidator may set such value as he deems fair upon any property to be divided as aforesaid and may determine how division shall be carried out as between the Members or different classes of Members.

(3) The liquidator may, with the like sanction vest the whole or any part of such assets in trustees upon such trust for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no member shall be compelled to accept any shares or other securities whereon there is any liability.

SECRECY

107. Save as otherwise provided in the Ordinance no Member or other person (not being a Director) shall be entitled to visit and inspect any of the Company's premises or properties of the Company without the permission of the Directors of the Company for the time being or any person authorised in this behalf by the Directors or to require discovery of or information respecting any detail of the Company's trading or any matter whatsoever which may relate to the conduct of the business of the Company and which in the opinion of the Directors will be inexpedient in the interest of the Members of the Company to be communicated to the public.

INDEMNITY

108. Every Director or officer of the Company and every person employed by the Company as auditor shall be indemnified out of the funds of the Company against all liability incurred by him as such Director, officer or auditor in defending any proceedings, whether civil or criminal, in which judgment is given in his favour, or in which he is acquitted, or in connection with any application under the relevant provisions of the Ordinance in which relief is granted to him by the court.

We, the several persons, whose names and addresses are subscribed below are desirous of being formed into a Company, in pursuance of these Articles of Association and we respectively agree to take the number of shares in the capital of the company set opposite our respective names.

NAME AND SURNAME (PRESENT & FORMER) IN FULL (IN BLOCK LETTERS)	FATHER'S/ HUSBAND'S NAME IN FULL	NATIONALITY & CNIC NO.	OCCUPATION	RESIDENTIAL ADDRESS IN FULL	NUMBER OF SHARES TAKEN BY EACH SUBSCRIBER	SIGNATURE
MUHAMMAD ALIUDDIN ANSARI	MUHAMMED SAIFUDDIN ANSARI	PAKISTANI 42201-3641868-9	BUSINESS EXECUTIVE	30-G, 5TH GIZRI STREET PHASE IV, DHA KARACHI	01 (ONE)	
SHAMSUDDIN AHMAD SHAIKH	SYED AHMAD SHAIKH	PAKISTANI 42301-6789487-9	BUSINESS EXECUTIVE	93-1, 22ND STREET, KHY-E-MUHAFIZ, PHASE VI, DHA, KARACHI	01 (ONE)	
RUHAIL MOHAMMED	YOUSUF MOHAMMED	PAKISTANI 42301-0895452-9	BUSINESS EXECUTIVE	H.NO.101-1, KHYABAN-E-BADBAN, PHASE V, DHA, KARACHI	01 (ONE)	
TOTAL NUMBER OF SHARES					**3 (THREE)**	

Dated. September 18, 2014

WITNESS TO ABOVE SIGNATURES
(NIFT (PVT) LTD, 5TH FLOOR AWT PLAZA, I.I. CHUNDRIGAR ROAD, KARACHI – 74000)

Certified to be True Copy
06/11/2014
Deputy Registrar of Companies

Management Profile

- **Mr. Shamsuddin A. Shaikh** as Chief Executive Officer. Prior to this, Mr. Shaikh was Senior Vice President at Engro Foods. He is a member of the Board of Directors of Sindh Engro Coal Mining Company, Thar Power Company, Engro Powergen Limited; Engro Eximp Ltd & Engro Eximp AgriProducts (Private) Ltd. Mr. Shaikh has an extensive career of 25+ years in Manufacturing, Sales, Commercial and Supply Chain at different levels and subsidiaries of Engro Corporation. He played an instrumental role in development of EFoods supply chain from scratch. He holds BE (Mechanical) from NED University, MS in Industrial Engineering and an MBA from Colorado State University.

- **Ahsan Zafar Syed** as Director. Mr. Ahsan did his bachelors in Mechanical Engineering from NED University. He also holds Masters Degree in Mechanical Engineering from Manhattan College. Having 22+ years of professional experience in different functions and was serving as Head of Manufacturing – Engro Eximp Agriproducts Ltd. He started his career in Engro Chemicals ltd in 1991 as a Purchase Officer. He also provided services as Unit Manager Project Engineer & Unit Manager Plant Expansion. After the demerger of Engro Chemical Pakistan Ltd, Mr. Ahsan served as Construction Manager [Enven] in Engro Fertilizer Ltd. Later on, he was moved to Engro Powergen Ltd as Wind Project Manager.

- **Mohammed Saqib** as CFO –. Mr. Saqib did his MBA from IBA and holds CFA qualification as well. He has 15+ years of professional experience in different finance functions including different subsidiaries of Engro. Mr. Saqib served as Treasury Manager at Engro Chemical during urea expansion project and was part of team that raised around USD 700m from a mix of local and international lenders for the project

- **Shahab Qader** as General Manager Commercial. Mr. Qader did his MBA from LUMS and also holds engineering degree from UET in Electronics. He has 15+ years of professional experience including time served at HUBCO and Engro Powergen Qadirpur Limited. He played an instrumental role in project management of EPQL as Engineering Manager.

- **Fahim as GM Treasury** – Fahim is a Chartered Accountant with 10+ years of professional experience. He joined Engro in 2006 and held various assignments in Accounting, Finance and Human Resources of Engro Chemical Pakistan Limited till demerger and Engro Fertilizers Limited post demerger. He successfully managed the IPO of Engro Fertilizers as Finance & Planning Manager and prior to that as Treasury Manager was instrumental in successful re-profiling of the debt. During his tenure with Human Resources he was responsible for developing the first Executive Salary Program of Engro Corporation Limited

ICBC

HBL

December 01, 2014

Mr. Shamsuddin Ahmed Shaikh
Chief Executive Officer
Engro Thar Power Company Limited
4th Floor, The Harbor Front Building
HC-3, Marine Drive, Block 4 Clifton
Karachi – 75600

SUBJECT: **2x330 MW (GROSS) MINE MOUTHCOAL-FIRED POWER PROJECT– EXPRESSIONOF INTEREST FOR DEBT ARRANGEMENT**

Dear Sir,

This is with reference to arrangement of debt financing for Engro Thar Power Company in a mix of offshore and onshore facilities for which you have signed a mandate letter with Industrial and Commercial Bank of China ("ICBC") and Habib Bank Limited ("HBL").

We, ICBC and HBL, understand that Engro Thar Power Company Limited is setting up 2 x 330 MW gross Mine Mouth Coal-fired Power Project at Thar, Sindh. The project will be fuelled by coal supplied by Sindh Engro Coal Mining Company ("SECMC") which is developing a coal mine project besides the project. Total project cost is expected to be approximately USD 1,100 Mn which will be funded in debt-equity ratio of 75:25. Accordingly, total equity requirement will be USD 275 Mn. We further understand that the majority of the equity investment for the project is expected to be from Engro Powergen Limited (100% subsidiary of Engro Corporation Limited) which is part of Engro Group ("Engro" or "Sponsor") and its affiliates.

Based on our above understanding, we would like to express our interest for arrangement of project debt of USD 825 million on a best effort basis in a mix of offshore and onshore financing.

Please note that this letter is an expression of interest and should not be construed as a commitment to finance the project and may not be relied or enforced in any court or tribunal.

We look forward to working with you on this important transaction. Should you have any queries please do not hesitate to contact the undersigned.

Yours sincerely,

Walter Fan Wei
General Manager
Wholesale Banking
ICBC, Karachi Branch

Usman Hameed
Head of Project Finance
Investment Banking
Habib Bank Limited

Detail of Generation Facility/ Power Plant

(A). General Information

(i).	Name of Company/Licensee	Engro Powergen Thar (PVt.) Limited
(ii).	Registered /Business Office	4th Floor, Harbor Front Building Marine Drive, Block 4, Clifton Karachi,
(iii).	Plant Location	The Project site is located at Block II of Thar Coalfields (Latitude: 24° 43' 38" - 24° 50' 18" & Longitude: 70° 17' 36" - 70° 26' 16"), Thar Parker District, and eastern part of Sindh Province, Pakistan. Thar block II has total lignite reserves of 2 billion ton. It is 20 Km from City of Islamkot, near the villages of Singharo-Bitra. The Power Project is located at 5 Km from Thar Block – II Open Cast mine , near the village of Bitra
(iv).	Type of Generation Facility	Mine Mouth Lignite fired power generation

(B). Plant Configuration

(i).	Plant Size Installed Capacity	2x330 MW	
(ii).	Type of Technology	Subcritical parameters	
(iii).	Number of Units/Size (MW)	2	330
(iv).	Unit Make/Model/Type & Year of Manufacture Etc.	Boiler	Circulating Fluidized Bed (CFB) Boiler , with subcritical steam parameters

		Steam turbine	N330-16.67/538/538 Sub Critical ,Two Cylinder, Tandem compound , double exhaust ,one reheat , condensing turbine
		Generator	330 MW, an inner-cooled generator with rotor and stator core cooled by hydrogen, and stator winding cooled by water, horizontal shaft, cylindrical rotor, 20 KV, 50Hz, 3-phase.
(v).	Commissioning/ Commercial Operation Date of the Generation Facility	Planned to be December, 2017	
(vi).	Expected Useful Life of the Generation Facility from Commercial Operation/ Commissioning Date	30 years	

(C). Fuel/Raw Material Details

(i).	Primary Fuel	Unit-1	Unit-2
		Thar Block II Lignite	Thar Block II lignite
(ii).	Alternative Fuel	Unit-1	Unit-2
		Imported Indonesian Coal	Imported Indonesian Coal
(iii).	Start-Up Fuel	Unit-1	Unit-2
		HSD	HSD
(iv).	Fuel Source for each of the above (i.e. Imported/ Indigenous)	The main fuel source is indigenous, produced from Thar Block II lignite mine, owned & operated by Sindh Engro Coal Mining company (SECMC)	

(v).	Fuel Supplier for each of the above	Primary Fuel	Alternative Fuel	Start-Up Fuel
		SECMC / Thar Block II lignite mine	Imported from Indonesian Coal mines	PSO
(vi).	Supply Arrangement for each of the above	Primary Fuel	Alternative Fuel	Start-Up Fuel
		3,800,000 MT per annum via trucks from adjacent mine	Required capacity to be supplied via trucks from Karachi port	Approx. 175 m^3 per annum
(vii).	No of Storage Bunkers/Tanks/ Open Yard	Primary Fuel	Alternative Fuel	Start-Up Fuel
		Two Open stockyards (One at Power Plant , One near mine)	Power Plant stockyard will be used	Two oil tanks
(viii).	Storage Capacity of each Bunkers/Tanks/ Open Yard	Primary Fuel	Alternative Fuel	Start-Up Fuel
		Approx. 180,000 t	Approx. 180,000 t	500m^3
(ix).	Gross Storage	Primary Fuel	Alternative Fuel	Start-Up Fuel
		Approx. 360,000 t	Approx. 360,000 t	1000m^3

(D). Emission Values

		Primary Fuel	Alternative Fuel	Start-Up Fuel
(i).	SO_x (mg/Nm^3)	<850	<850	<850
(ii).	NO_x (mg/Nm^3)	<510	<510	<510
(iii).	CO_2 %	$CO_2 + O_2$: 18.77 % (volume basis of flue gas)	N/A	-

(E). Cooling System

(i).	Cooling Water Source/Cycle	LBOD Water from GoS Scheme (primary source) and Well water from mine (backup source) / Cycle : Close Cycle cooling system

(F). Plant Characteristics

(i).	Generation Voltage	20 KV (Transmission Voltage 500 kV)
(ii).	Frequency	50Hz
(iii).	Power Factor	0.8 (lagging) / 0.95(leading)
(iv).	Automatic Generation Control (AGC) (MW control is the general practice)	Yes
(v).	Ramping Rate (MW/min)	0.5~1% rated load (1.65~3.3MW/Minute). This figure is indicative and will be confirmed after engineering design of the plant.
(vi).	Time required to Synchronize to Grid (Hrs.)	8hours for cold start (this time is considering steam turbine cold start) This figure is indicative and will be confirmed after engineering design of the plant.

SCHEDULE-II

(1).	Total Gross Installed Capacity of the Generation Facility	660 MW
(2).	De-rated Capacity of Generation Facility at Reference Site Conditions	660 MW
(3).	Auxiliary Consumption of the Generation Facility	59.4 MW
(4).	Total Installed Net Capacity of Generation Facility at Reference Site Condition	600.6 MW

Note

All the above figures are indicative as provided by the Licensee. The Net Capacity available to Power Purchaser for dispatch will be determined through procedure(s) contained in the Power Purchase Agreement or any other applicable document(s).

Interconnection Facilities/ Transmission Arrangements for Dispersal of Power from the Generation Facility

The electric power from the Coal based generation facility of Engro Powergen Thar Limited (EPTL) will be will be dispersed to the National Grid.

(2). The Interconnection Facilities (IF)/Transmission Arrangements (TA) for supplying to National Grid from the above mentioned generation facility shall be at 500 kV level. The dispersal/interconnection arrangement for supplying to National Grid will be consisting of a 500kV double circuit transmission line measuring about 250 Kilometer connecting the generation facility with 500 KV Matiari Grid Station.

(3). Any change in the above mentioned IF/TA for dispersal of electric power as agreed by the Licensee and the Power Purchaser shall be communicated to the Authority in due course of time.

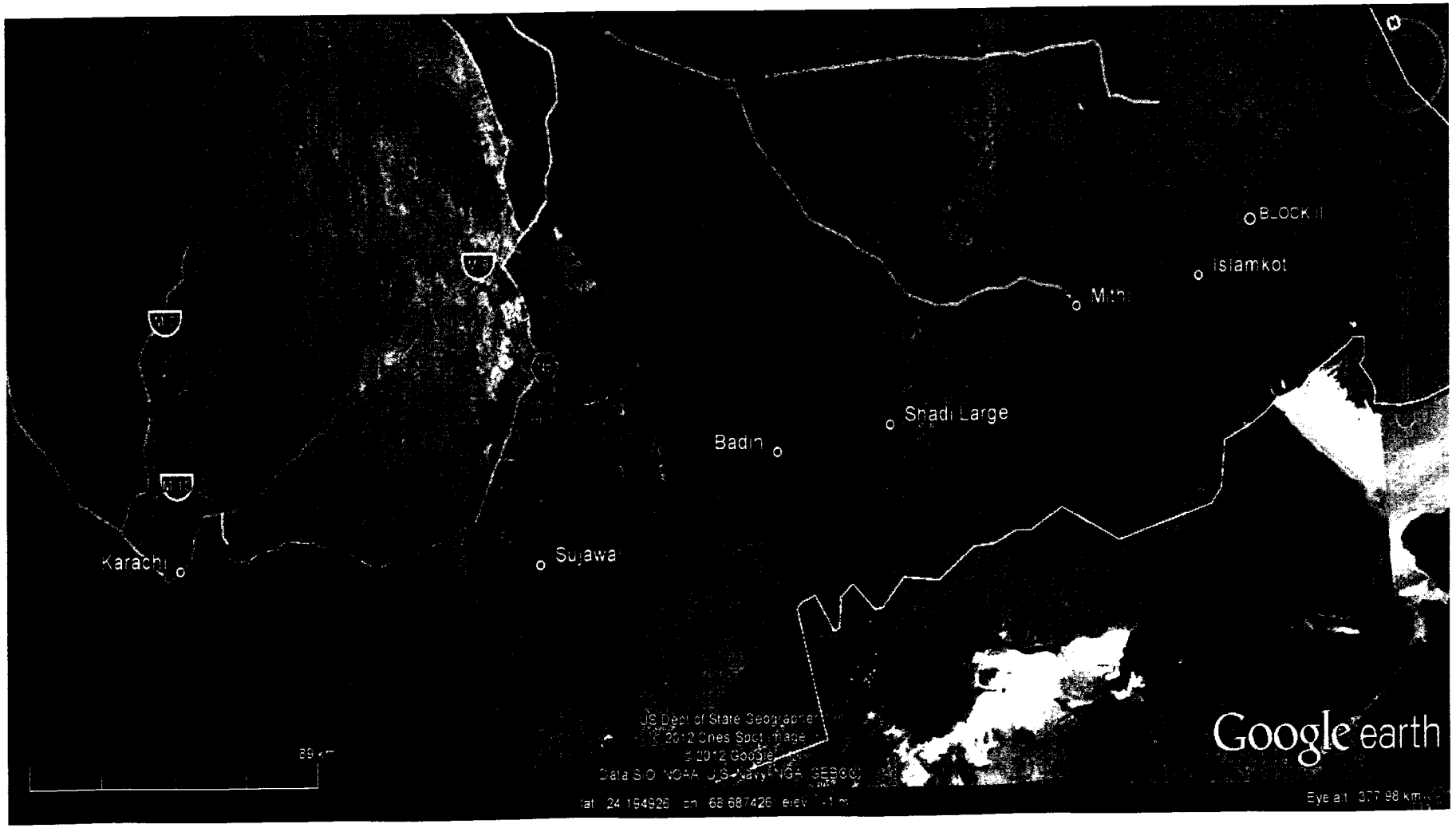
Attachment (V)

Project Schedule

EPC Contract Finalization for Power	October, 2014
LOI	20th November, 2014
Generation License Application	1st Week, December, 2014
Security Package (PPA,IA etc)	1Q, 2015
Financial Close & Contractor's Mobilization	1Q, 2015
NTDC Grid	2Q, 2017
Power Plant Unit # 1 COD	**December, 2017**
Power Plant Unit # 2 COD	**April, 2018**

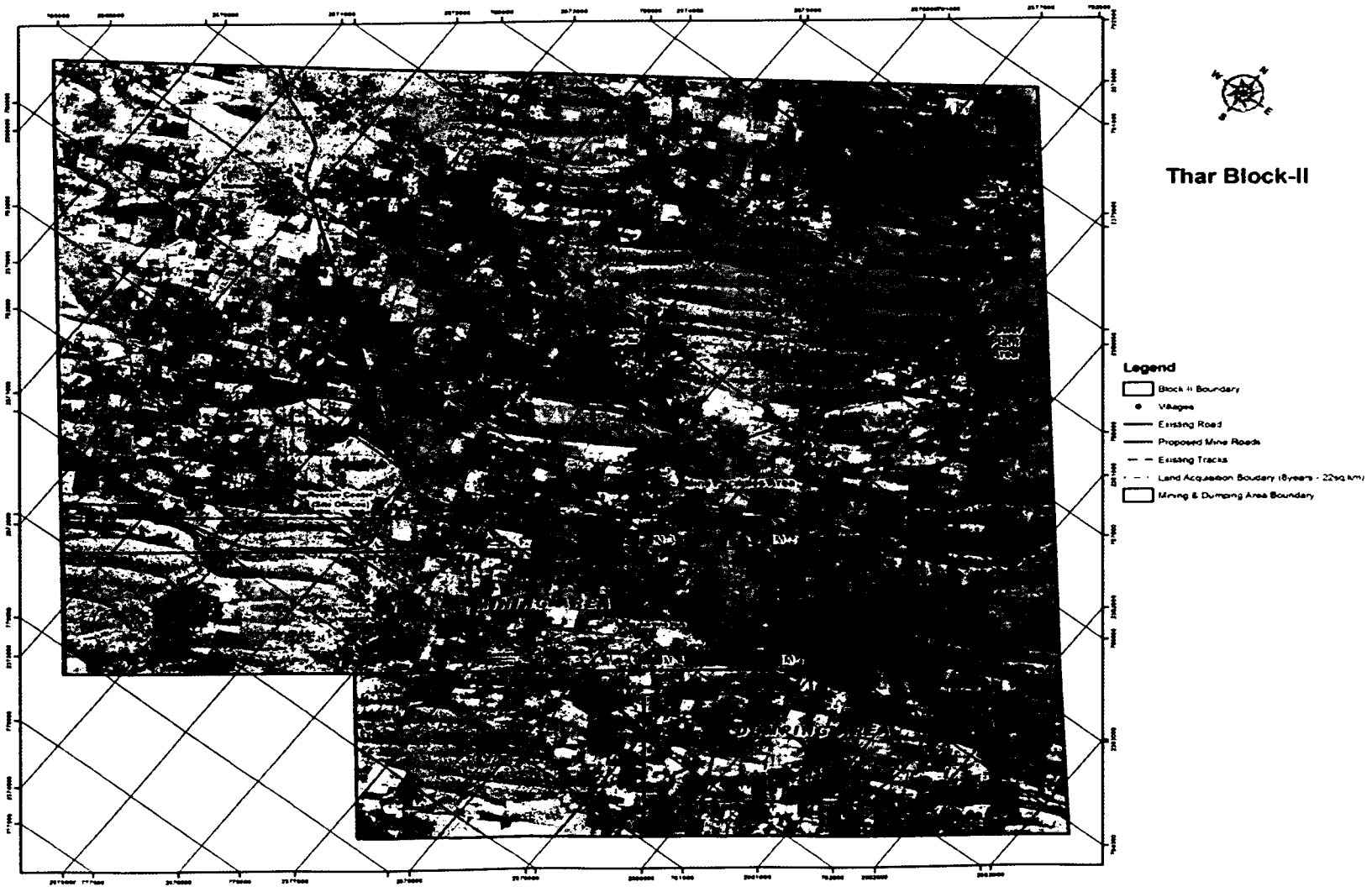
Attachment 1:

Map for Thar Block II.



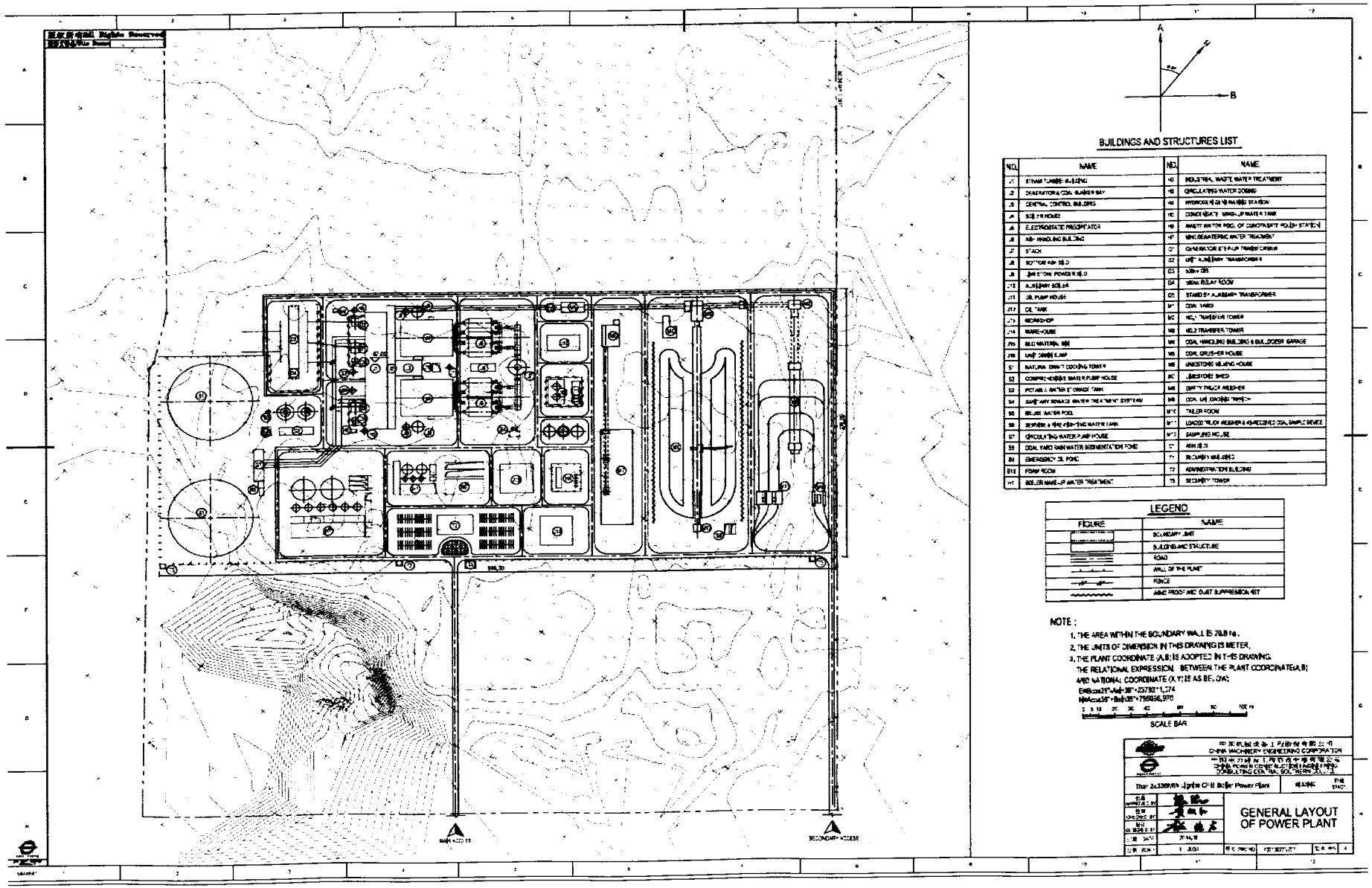
Attachment 2 :

Site Map

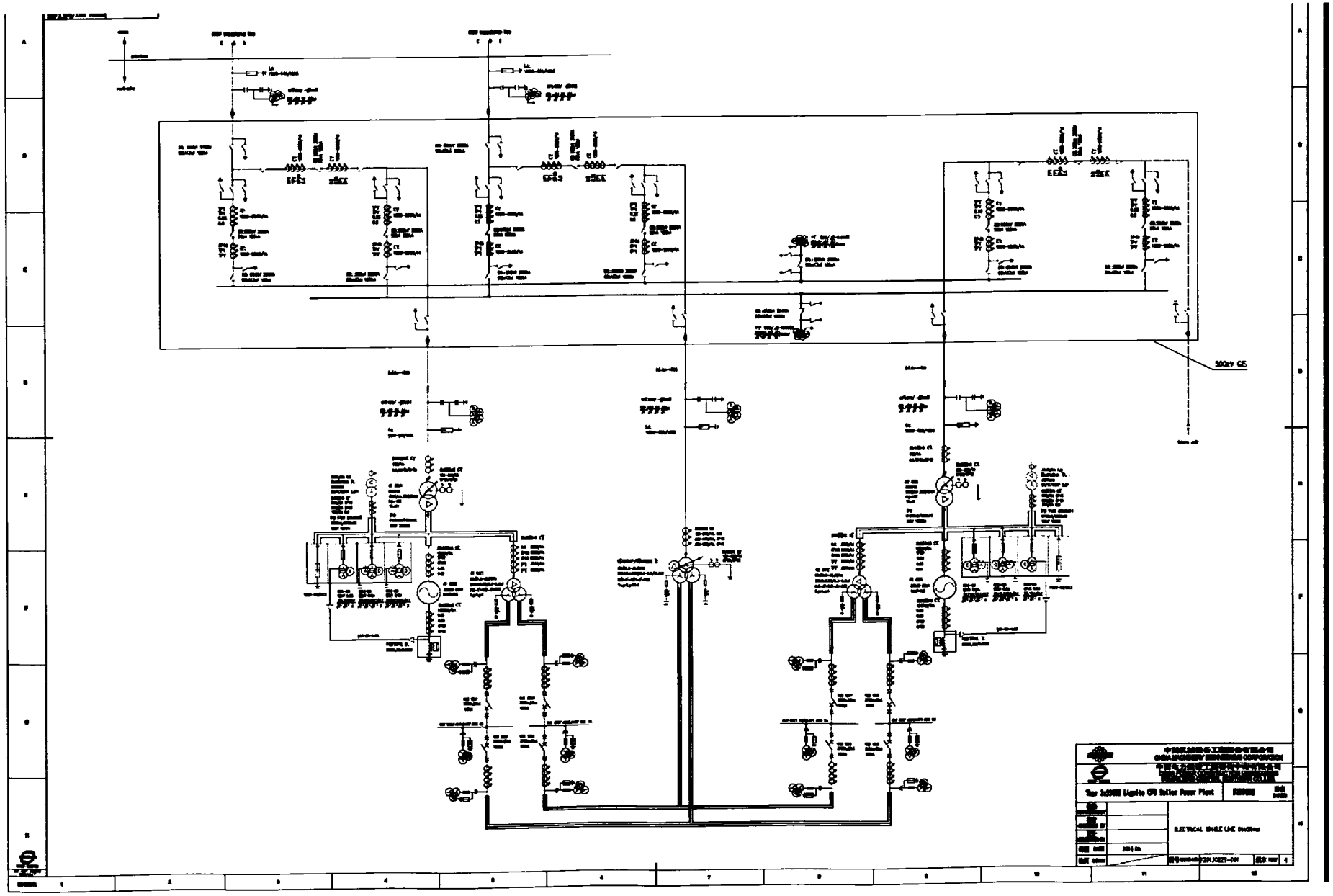


Attachment 3 :

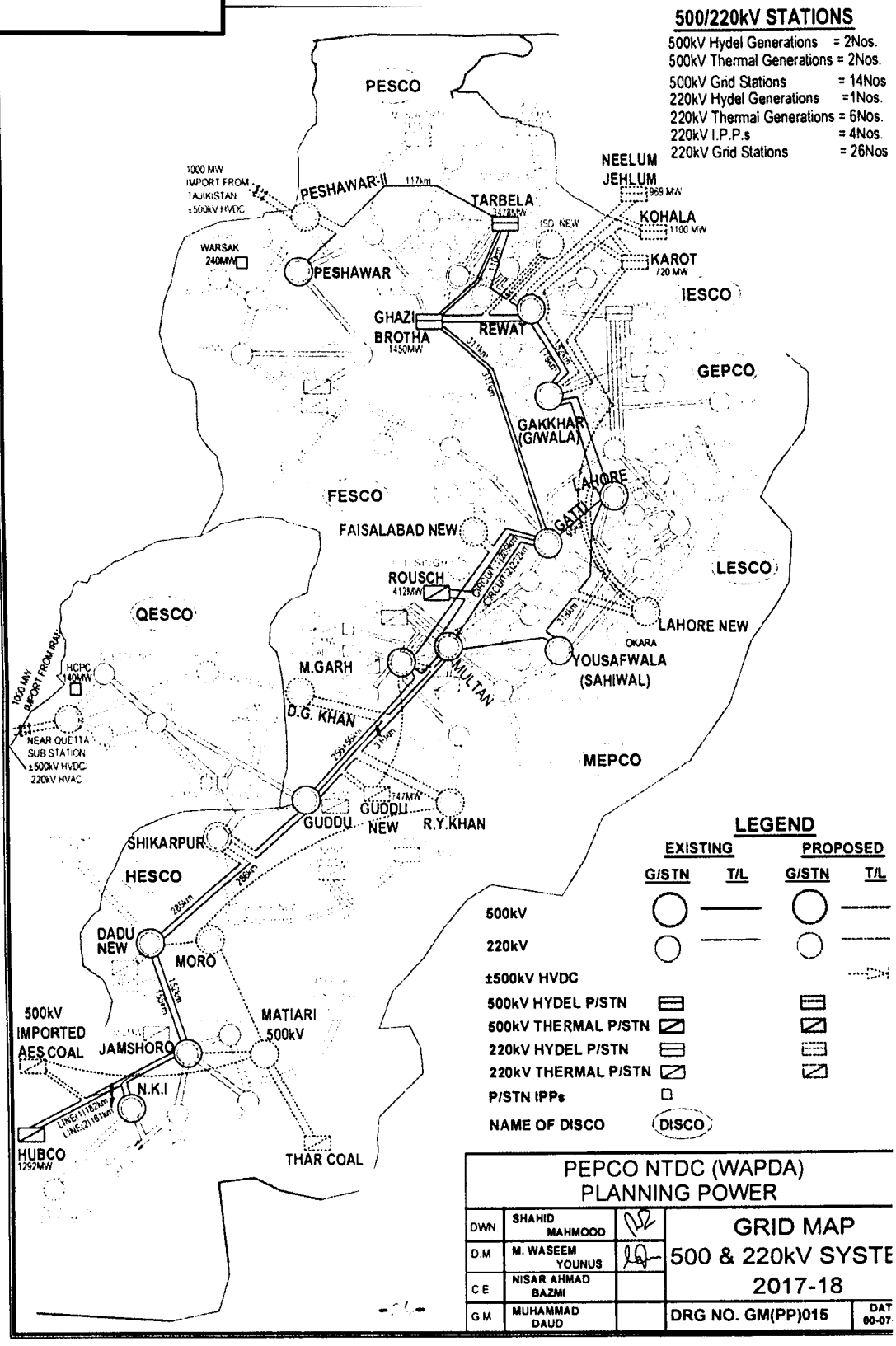
General layout



Attachment 4:



Attachment 5

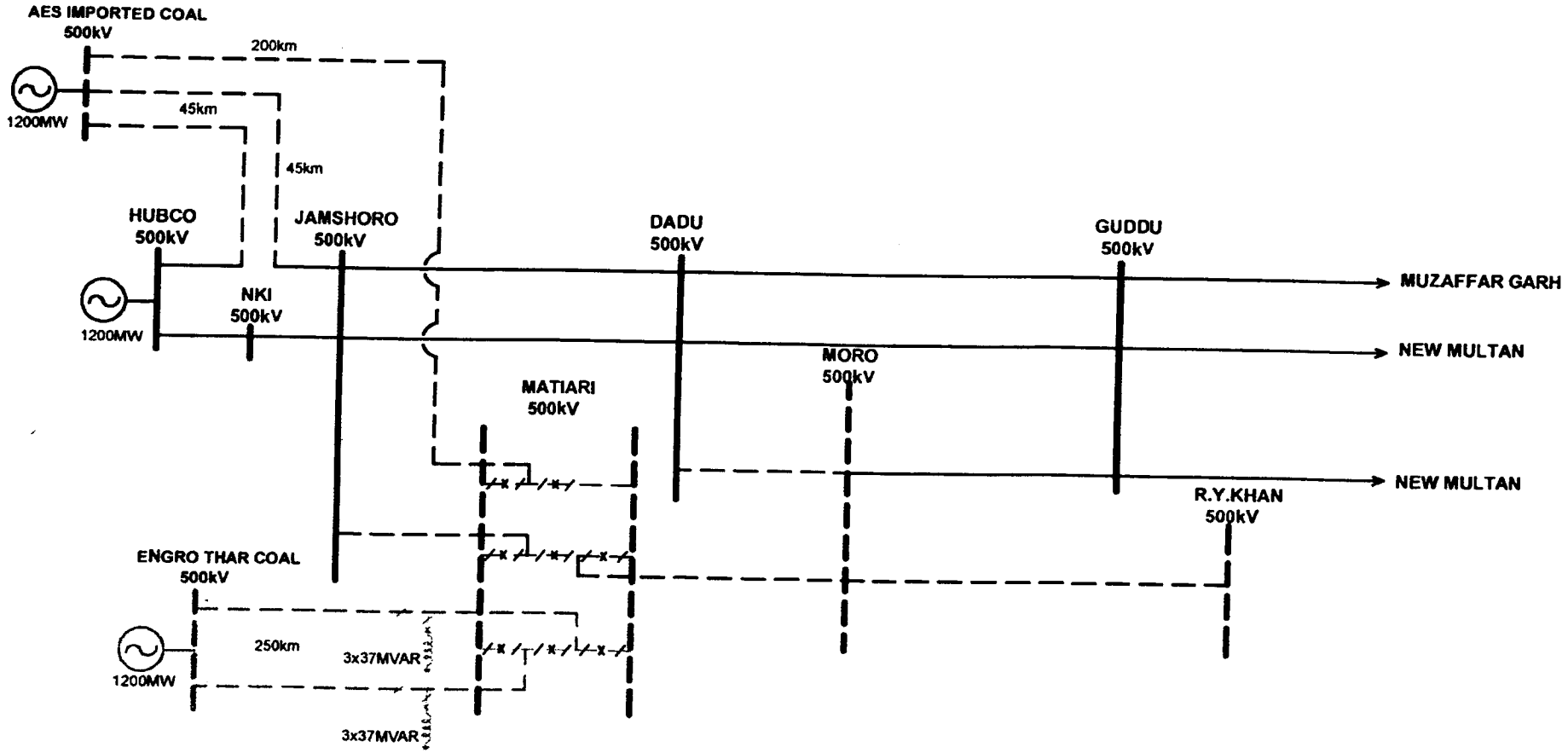


APPENDIX 14

Annex-VI

LOAD FLOW STUDIES

SINGLE LINE DIAGRAM OF 500kV NETWORK SHOWING PROPOSED INTERCONNECTION SCHEME FOR THAR COAL BASED 1200 MW ENGRO POWER PLANT AT THAR AND 1200 MW AES IMPORTED COAL BASED PLANT AT KARACHI, WITH NTDC SYSTEM



LEGEND

SCOPE OF PC-1 FOR AES POWER PLANT

SCOPE OF PC-1 FOR ENGRO THAR COAL PP

Load Flow Studies for PC-1 of Dispersal of Power from 1200 MW Engro Thar Coal Power Project

Load flow studies have been carried out to propose the interconnection scheme for dispersal of power from 1200 MW Engro coal power project, located at Thar, to the National Grid System. The studies are based on the following assumptions;

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs.
- The system has been assumed to be operating in an interconnected manner.
- The gross and net output capacities for Engro coal power plant have been assumed as 1200 MW and 1134 MW respectively.
- AES imported coal plant with net capacity of 1134 MW in coastal area near Karachi and significant amount of wind power generation in Sindh province have also been assumed in the studies.
- 1000 MW import of power from Iran has been assumed in the studies.
- 300 MW load of Al-Tuwariqi Steel Mill fed through a 220 kV D/C line from NKI has been assumed.
- Export of power from NTDC to KESC has been assumed as 650 MW.

1. Proposed Interconnection Scheme

The following interconnection scheme has been proposed in view of location of 1200 MW Engro Coal power project and the system network in its vicinity;

"A 500 kV D/C transmission line, approx. 250 km long on quad-bundled Araucaria conductor, from Engro Thar Coal Power Project to Matiari."

The geographical diagram showing above interconnection scheme for power dispersal of 1200 MW Engro Coal power plant is attached as Figure #1.

2. Load Flow Studies

Load flow study for peak load January 2017 has been carried out in order to assess the adequacy of the proposed interconnection scheme for power dispersal of Engro coal power project. The load flow study under normal system condition is attached as Exhibit #1. As per load flow study, the power flows on transmission lines and transformers in the vicinity of proposed Engro coal power project are well within their capacities. In general, the study depicts that the voltage profile of the system would remain within limits and there would be no transmission system constraints in the flow of power from the proposed Engro coal power project to the system under normal system condition.

Load flow study has also been carried out for N-1 contingency analysis from Engro coal power project to Matiari and it has been found that power flows on the other transmission lines & transformers as well as the voltage profile of the system would remain within limits (Exhibit #2).

3. Conclusions

a) The power from 1200 MW Engro coal power plant may be dispersed to the National Grid System with the following proposed interconnection scheme:

"A 500 kV D/C transmission line, approx. 250 km long on quad-bundled Araucaria conductor, from Engro Thar Coal Power Project to Matiari."

b) It is important to mention that in the simulated scenario, the 500 kV lines in the NTDC network, i.e, especially Jamshoro to Dadu and Matiari to Moro, would become heavily stressed/overloaded under N-1 conditions. In this regard, it is also intimated that the firm date of implementation of AES imported coal power plant is not confirmed yet. Similarly, the status of implementation of all the wind power projects, assumed in the studies, has not been finalized yet. In the absence or reduction of power output from these projects, the reinforcement of 500 kV network of NTDC from Jamshoro/Matiari to up-country would not be required even under N-1 condition.

c) In view of GoP's preference for development of Thar coal generation, a huge quantum of generation has been proposed at Thar to follow, after the addition of Engro coal power project, in the recently developed National Power System

Expansion Plan (NPSEP) with the assistance of the International Consultant, M/s SNC Lavalin, Canada. The proposed 500 kV D/C line from Engro Thar Coal project to Matiari will cater for its power evacuation and the envisaged bulk generation at Thar will be evacuated on ±600 kV HVDC bipolar lines to the mid-country load centers. In this way, the stress on the Southern 500 kV network under N-1 condition would be eliminated even with AES imported coal plant and all the wind power plants.

d) The requirement of 500 kV S/C line from Matiari upto R.Y. Khan via Moro to cater for N-1 contingency provision will be considered in stage-2, in case the future development of power generation at Thar is not matured during next 2-3 years and AES imported coal plant & other wind generation projects are matured.

PC-1 FOR INTERCONNECTION OF 1200 MW ENGRO COAL POWER PROJECT

PEAK LOAD JANUARY 2017

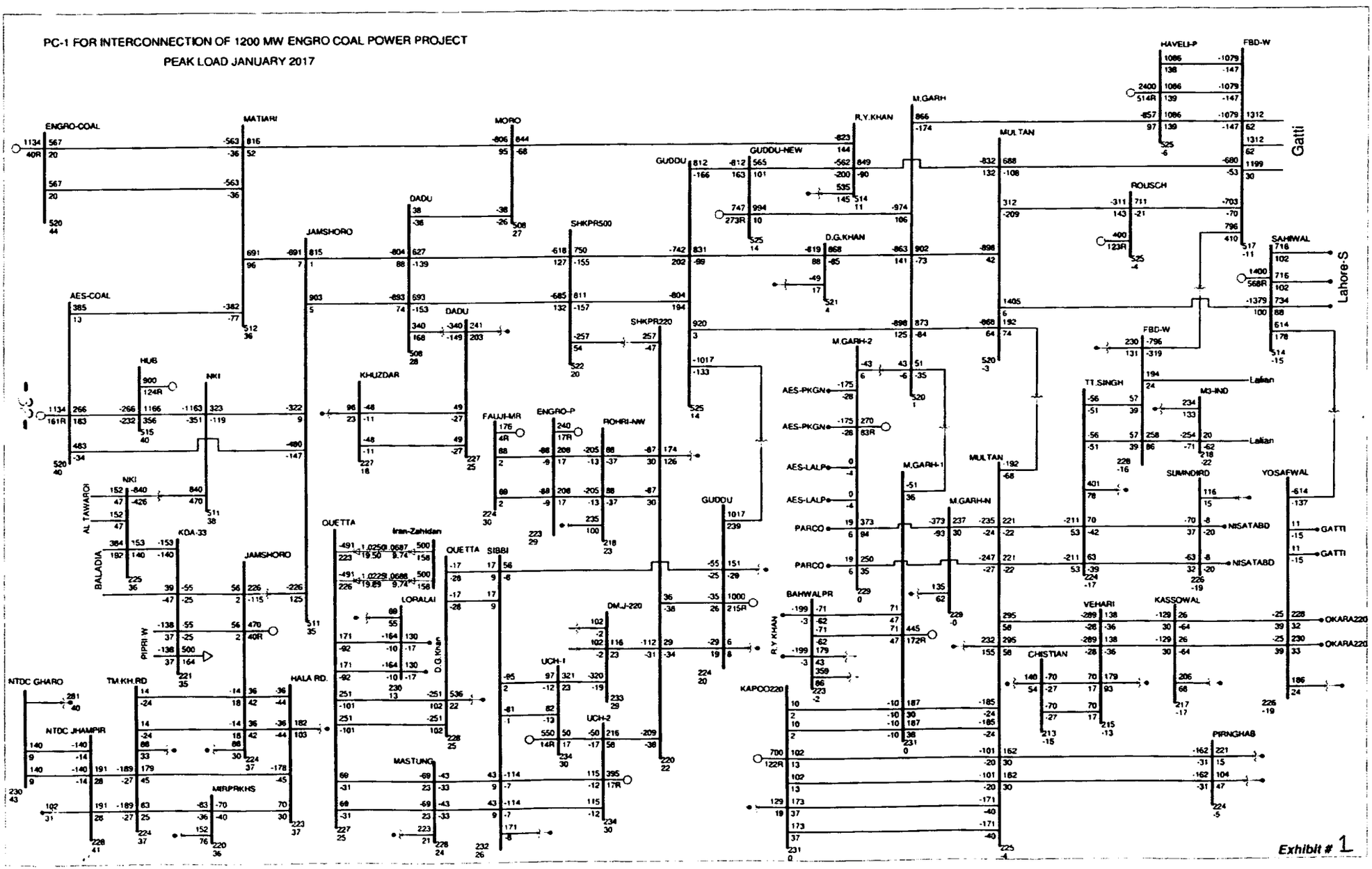


Exhibit # 1

PC-1 FOR INTERCONNECTION OF 1200 MW ENGRO COAL POWER PROJECT

PEAK LOAD JANUARY 2017

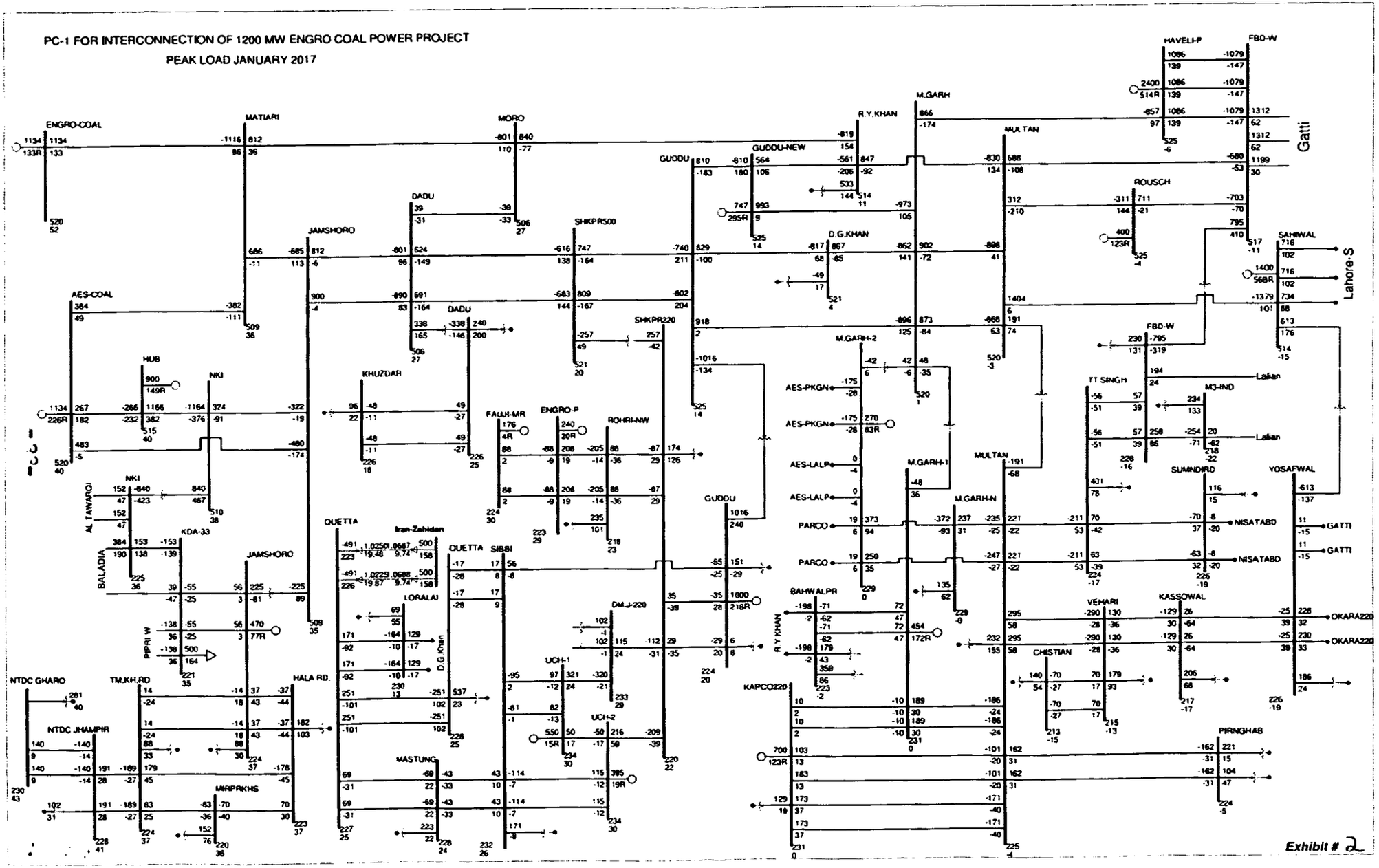
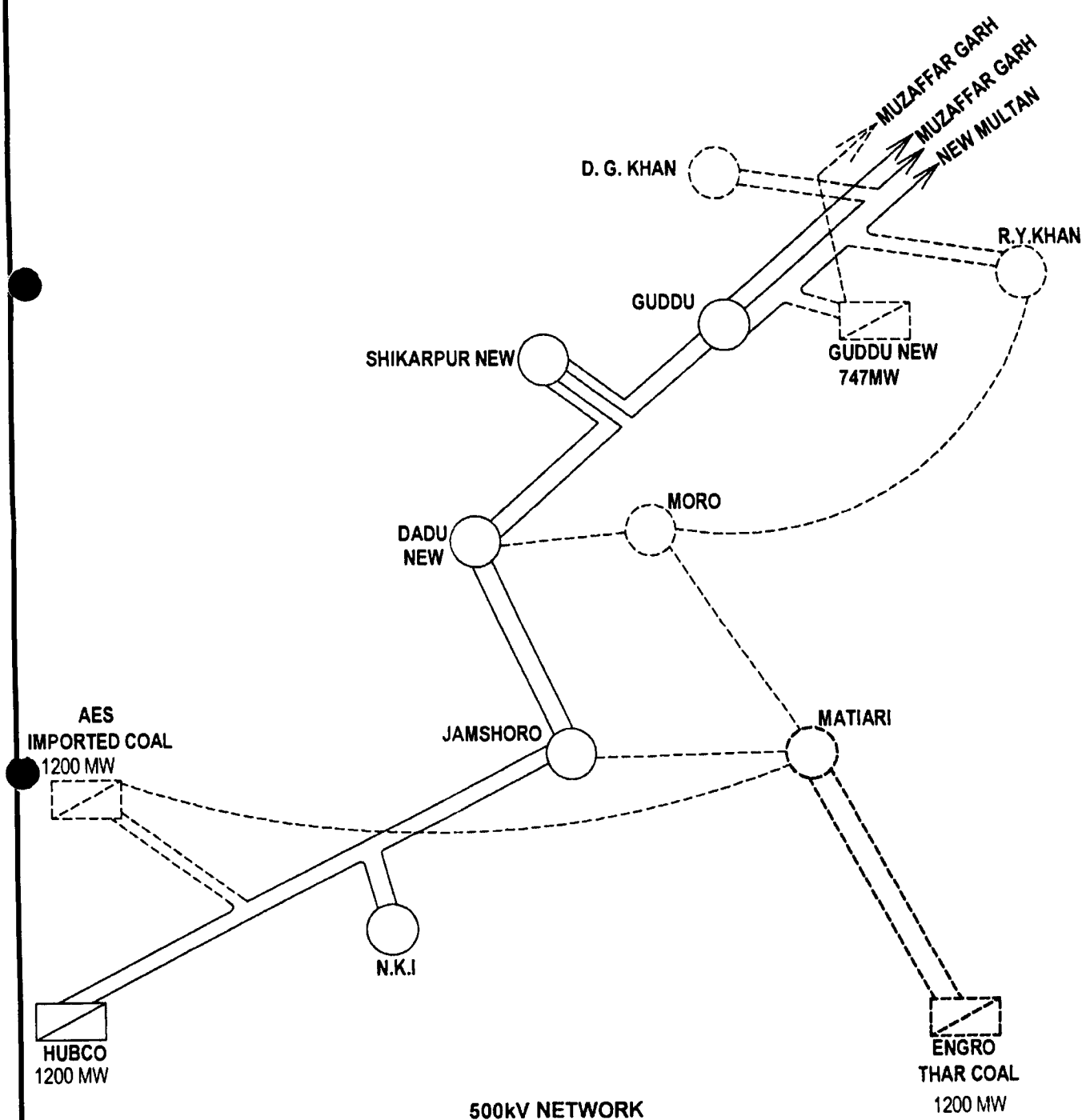


FIGURE # 1: GEOGRAPHICAL DIAGRAM FOR 1200 MW AES AND 1200MW ENGRO POWER PLANTS WITH 3rd. 500kV CIRCUIT



LEGEND

SCOPE OF THE PROJECT -----

Attachment (II)

Feasibility Report of the project

RWE Power International

Sindh Engro Coal Mining Company Limited

"SECMC BFS PAKISTAN"

MODULE 1
BFS Framework Document

A-1618-300-022
Rev 1

March 2014

RWE
The energy to lead

Foreword

The present study is based on design concepts which were elaborated for a CFB plant technology which consists of two separate power trains of the 300 MW class and one Pulverised Fuel single power train of the 600 MW class.

The given net electrical output figures of 300 MW respectively 600 MW are standing as medians of the related power plant performance classes which are clustering several plant performance types within a limited range.

The net electrical output design range which is classifiable to such a performance class can vary around +/- 15-20% to its representative value.

The given bandwidth allowance for each performance class is necessary because power plant components from different suppliers around the world are not yet standardized to the exact power plant output of 300 or 600 MW.

To keep the competition for a power plant delivery open it is necessary to allow limited deviations from the 300 MW net output median.

Within the given tolerance bands the up- respectively downsize of the output performance is based on linear dependencies which means that the adaptations within mass-and volume flows can be simply done by rule of proportion (as long as the calorific value of the fuel and the overall plant efficiency will stay untouched.)

For example a plant with a net electrical output of 330 MW will have a mark- up of +10% to the given volume –and mass balance parameters which were calculated for this study.

Even though there are some exponential dependencies like pipe diameters or boiler heights the changes to the given BFS concepts are minor and will not raise any new bottlenecks or unconsidered extra risks in time, budget or operation.

The specifications of the systems engineering module will be valid for the whole cluster of the 300 MW class.

Subsequently through the whole study the terms '300MW' or '600MW' are standing for the 300 MW or 600 MW performance class.

The only module within this BFS study which needs to be adapted in case of another output rate will be the 'Financial Report' which will be in case of need given as a separate version to the 300MW net output module.

On request a calculation re-check of combustion process and heat diagram can be done for an output performance which is different to the median output and add as an amendment to this study.

This Document is part of the Bankable Feasibility Study which consists of 09 Documents

1) A1618-300-022 BFS Framework Document
2) A1618-300-001 Project Assumptions Book
3) A1618-300-002 Project Management Manual
4) A1618-300-014 Site Evaluation Report
5) A1618-300-015 Assessment Report Process Engineering
6) A1618-300-017 System Engineering – Concept of Design / Basis of Design
7) A1618-300-019 Financial Report
8) A1618-300-020 Risk Assessment Report
9) A1618-300-021 Project Execution Plan

Revision

1	20.03.2014	Extension Executive Summary	U. Brauckmann	J.-J. Geese	U. Brauckmann
0	14.02.2014	1st Issue	U. Brauckmann	J.-J. Geese	U. Brauckmann
Rev.	**Date**	**Issue, Modification**	**Prepared**	**Checked**	**Approved**

A.0) BFS Table of Content

Module	Subject
1	**D.0 BFS Framework Document**
2	**D.1 Project Assumptions Book**
3	**D.2 Project Management Manual**
4	**D.3 Site Evaluation Report**
5	**D.4 Assessment Report Process Engineering**
6	**System Engineering** **D.5 Concept of Design /** **D.6 Basis of Design**
7	**D.7 Financial Report**
8	**D.8 Risk Assessment Report**
9	**D.9 Project Execution Plan**

B.0) Introduction

B.1 Background

As response to the order of Sindh Engro Coal Mining Company Limited (hereinafter referred to as "Client"), RWE Power International - RE GmbH (herein after referred to as "Consultant") provides within this "Bankable Feasibility Study Framework Document" the modularized result documents which encompasses the scope of services for a Bankable Feasibility Study with subject to the development of two mine-mouth lignite fired power plants (2 x 300 MW Circulating Fluidized Bed / 1 x 600 MW Pulverized Combustion).

The Consultant is fully knowledgeable in the power business especially with Lignite Fired Power Stations and demonstrated several times by own projects a comprehensive technical and commercial understanding of the mine mouth based lignite fired power plant technology. The Consultant possess the capability and knowledge of identifying & evaluating project risks and recommending solutions to mitigate the identified project risks within the given power plant battery limits.As there is an option to purchase and finance the EPC turnkey powerplant project through Chinese Stakeholders, Consultant should be well versed with Chinese manufacturing facilities and Chinese EPC contractors.

The Bankable Feasibility Study was made in order to verify the profitable use of the circulating fluidized bed boiler process and pulverized fuel boiler process for the given lignite analysis results of the Thar II block lignite verified by the process- and system engineering reports.

With more than 180 Billion tons of explored lignite deposit in the Thar Field it is about the biggest national fossil energy resource of Pakistan which will give in case of use a high independency from foreign energy imports for the national economy.

For the expansion and back up of the national power generation capacities in Pakistan, in compliance with the local laws and regulations of Pakistani government and with the intention to create a long-term competitive power generation source in balance with the maximum hauling capacities of the Thar II open pit mine a related Energy Park is under development. The project development process is focused on a new build park capacity of 6 x 600 MW. The park will be build up by an independent power producers (IPP) investment concept. So each plant should be autonomous.

The initial step for the park realization will be the construction and operation of a 2x 300 MW Circulating Fluidized Bed (CFB) Power Plant. Because of the simultaneous project developments of the open pit mine and the power plant it could be the case that both projects will not be operateable by same date.

In case that the mine will have a significant lag in achieving the full hauling capacity as a mitigation it is planned to build up a temporary fuel supply with imported Indonesian Lignite.

Because the quality of Thar II and Indonesian Lignite is different it will be necessary to design a combustion system which can handle these differences in quality.

A CFB boiler system keeps the upside of beeing flexible to quality variations in a wider range without capacity losses coupled with the down side of a lower system efficiency against PC boiler systems.

So for the subsequent energy park new builds PC boiler systems will be first choice therefore this technology is as well part of the process and system engineering steps of this BFS.

The greenfield area for the power plant erection is approx. 5 km away from the open pit mine in an area where the overburden /coal ratio is very poor so that this area will not be in the focus of mine hauling activities for measurable future.

Because of the high water content of the lignite fuel a short distance of power plant to the mine is mandatory with regards to economy. Therefore the lignite will be supplied from a central mine storage, which is situated in 5 km radius from power plant boundary to its storage by trucks.

The combustion residues will be dumped beside the mine within the overburden dump area or later on in the dead zones of the mine.

B.2 Objective

The objective was to provide a 'Bankable Feasibility Study'(BFS) and a corresponding RfP for the development of power plants as a reliable basis for decision making and further development of the Thar II coal and power generation project.

Main task of the power plant study is to determine the technical and economical feasibility for utilisation of the fuel stock and its use in the power plants in order to produce electricity under the framework of a competitive environment.

This document covers power plant section of services.

Mining data is available within RWE Power International produced in the course of service delivery for Engro in the past and during delegation period of this study.

B.3 RWE Power International (RPI)

Please also refer for further references, information and latest news and updates to:

RWE Power International: http://www.rwepi.com/

RWE Technology: http://www.rwe.com/web/cms/en/346820/rwe-technology/

RPI is a leading global independent consulting and engineering company, providing services to the mining and power generation industry. To date RPI has completed several large scale projects on fields of mining, power generation, and environmental services. RPI is the global consulting company of the German based RWE Group , one of Europe's leading utility groups with strong market positions in coal mining, power generation, gas, water and Renewables.

RPI can draw on the extensive operations and engineering knowledge and practical experience of one of Europe's leading power station owner, operator and developer[1].

To date RPI has completed numerous projects in the fields of mining, power generation, and environmental services comprising e.g. :

- **Project Management**
- **Owner's Engineering**
- **Management Assistance**
- **Due Diligences**
- **(Pre-)Feasibility Studies, Bankable Feasibility Studies**
- **Detailed Engineering Studies**
- **Environmental Impact Assessments**
- **Least Cost Investment Planning**
- **Sector Studies**
- **Project Development and Implementation**
- **Tendering, Procurement and Contract Administration**
- **Operations Management**
- **Institutional Strengthening**
- **Training**

B.4 The Experts

RPI's success is driven by its interdisciplinary core team of worldwide recognised experts consisting of geologists, engineers, designers, planners, environmental scientists, economists and project managers. Their expertise is strongly rooted in the vast operational experience of RWE and thus provides best practice methods as well as innovative solutions and techniques across the whole range of engineering disciplines for international mining and power generation projects in a variety of commercial and political environments.

[1] RWE POWER's mining and power generation assets in key figures:
From its 3 opencast mines in the western part of Germany, RWE POWER is producing some 100 mill t of lignite per year, of which 90% are consumed by its lignite-fired thermal power stations. RWE POWER deploys a total of more than 33,000 MW of all types of power generation facilities, out of some which 11,000 MW are based on lignite. Some 3,700 MW are currently under construction or in commissioning in Germany. Further Power Plants are under construction across Europe within the RWE Group.

Next to its core team, RPI regularly integrates a selection of the 3,000 engineers and technicians of its parent company RWE into its projects.

By aligning with strong local project partners and/or drawing on locally available resources and additional local knowledge, RE experts combine global reach with local understanding wherever applicable.

B.5 The Services

RPI is a credible business partner having successfully carried out projects financed or underwritten by major international lenders and international agencies. RPI's experts are comfortable working within the disciplines they impose, including quality and environmental standards.

RPI's project specific background consists of planning and assisting in mine and power plant development and rehabilitation projects on five continents. This global experience can be exploited by the costumer to benefit his project.

C) Methodology

The methodology to elaborate this Bankable Feasibility Study was defined in the consulting contract in the following way and adequatly realized:

The Consultant had to review existing documents and available data, such as e.g. Feasibility Studies provided by the Client and incorporated such information in the Bankable Feasibility Study, if applicable.

The Bankable Feasibility Study shows a compilation of main data and main information for the new power plants design and a description of the technical concepts with calculations, diagrams and drawings, based on the findings and results of the Consultant's work.

Beyond the information which is required to evaluate the new lignite fired units, the Consultant's work also covered the aspects from the day to day operation routines as well as strategic issues, such as:

Clear definition of interfaces and battery limits for the new units

Co-operation experiences with suppliers/service providers (domestic and international)

One objective of the Bankable Feasibility Study was to define the project based on its framework parameters. Project investment cost (CAPEX) and project operating costs (OPEX) are based on the defined technical concepts. The prices for the specified equipment are verified by e.g. contacts of the Consultant or own market experience.2 Assumptions concerning the staffing of the power plant and the operational regime are provided.

The findings and analyses of the study period are summarised respectively highlighted within each module of the Bankable Feasibility Study. Impacts which might affect the realisation of the new units within the battery limits are considered, also a choice of key risks outside battery limit are indicatively evaluated. By incorporating the background of the Consultant's own experts and data from the Consultant's own operations, projects and maintenance and operation procedures, additional value for the Client is integrated in the study. This put the Client into the position to make reliable business decisions regarding the new power plant projects.

In order to achieve a comprehensive and reliable Bankable Feasibility Study the Consultant created in sequence the development modules for 2 x 300 Mwel CFB / 1 x 600 MWel PC.

On base of the given, inspected and evaluated Thar II power plant site conditions a master layout for the arrangement of new power plants design (2x 300MW CFB// 1x 600MW PC) within the planned Thar Energy Park structure of 6x 600 MW was developed for wet cell cooling respectively wet natural draft cooling tower operated by mine drainage water.

Under consideration of the plant layout all necessary power plant the related scope of key components were defined including for example the reverse osmosis plant for the mine water preparation.

[2] Tenders for supplier's quotes - performed by the Consultant - are not considered in the study

The project investment cost (CAPEX) and project operating costs (OPEX) for the Financial Report were calculated on the defined technical concept under the given site conditions.

The Risk Assessment was concentrated on the project lifetime cycle of the initial 2x 300MW lignite power plant units of the planned 3600 MW Thar II energy park.

The initial Project Execution Plan gives a project related overview about the main organisational structure for the realization of the 2x 300MW power plant units.

The present -Bankable Feasibility Study- was finalized by taking the following process steps:

- A. Project Definition
- B. Site Survey/Evaluation
- C. Process Engineering
- D. System Engineering
- E. Financial Modelling
- F. Risk Assessment
- G. Project Execution Planning

The main tasks and results created by each process step are presented in key documents so called -Modules-. The main tasks and outcome of these BFS constituents are shortly described in the following chapter D) to give an executive overview of the overall results and the way of its determination.

D) Executive Summary

STEP A: - Project Definition -

The results of a thorough investigation for the initial design data base which has to be used as input data for the –BFS- are written down in the "Assumptions Book" this book is a living document which will be improved constantly.

MODULE 3 - Assumptions Book -

The assumptions are based on available local data out of former investigations and studies as well as on assumptions and recommendations based on RWE T's expert knowledge.

The -Assumptions Book- consists of assumptions which are including following engineering disciplines:

- General / Site Specifications
- Plant Design
- Civil
- Boiler
- Turbine
- Flue Gas Cleaning
- BoP
- EI & C
- Material Handling
- Process Engineering

STEP B: - Site Survey/Evaluation -

MODULE 4 –Site Evaluation Report-

Main outcome of the key assessment criteria based on the given data sources and a related site inspection visit in June 2013.

Mine Mouth Location

There is no free-market price formation for lignite used in power generation. The low calorific value of lignite fuel makes transport uneconomic over longer distances, the cost of lignite per unit of energy, including transport, is higher than hard coal which is its main competitor. This restricts a lignite mine since it cannot offer its product to far away power plants. Similarly, lignite-fired power plants cannot purchase fuel from distant mines. Both producer and consumer co-exist in a captive market. it is common to build lignite-fired power plants adjacent to lignite mines. A power plant and surface mine then form a single economic entity. Lignite is most economically transported by a dedicated infrastructure to the nearby power plant.The moisture or water present in the fuel represents a significant dead weight during transport and therefore international best practice dictates to the construction of the power plants close to the related fuel supply mine area.The specific economic limits for lignite fuel transportation from the source mine to the power plant are in the range of 20 - 50km. Fuel procurement and transportation is the single largest operational cost (opex) variable for any power plant operation. Economic rules indicate that the closer the Thar Block II 2x 300 MWe power plant units are located to the fuel supply and mining area the more profitable the electricity generation process. The only double accounting factor in this case is the aspect of back transport of combustion residues (ash) to the mine for back filling in the dead zones of the open mine pit.

In addition to the favourable fuel transportation economics, the advantage of locating the power plant in the vicinity of the Thar Block II mine is the close proximity of process water which can be utilised from the mine drainage process as a back up option if the LBOD water supply is temporary unavailable.

For the Thar Desert region this is a considerably valuable reserve option that will permit continued power plant generation is case of temporary suspension of the LBOD water supply.

Constructability / Availability of land

The designated area for the energy park sited 5km away from the lignite open cast mine is large enough for the construction and operation of 2x 300MWe CFB.The soil condition permits construction of the power plant without any constraints. Because of the favourable topography, clearing and leveling works for the site preparation will be moderate. The water table is approximately 60m below the surface. Adequate seismic engineering design considerations are needed for the plant design. The climate at the site is a desert climate (mostly dry and hot). There is one heavy rain period a year which could cause flooding. Adequate drainage provision during the construction phase is required. Sandstorm and creeping sand shelter is recommended. Sufficient area is available to extend the number of units for future projects.

Grid connection

Currently there is no high voltage grid connection available to the site. A 500kV / 1200 MW double circuit long distance (235 km) transmission line is planned to be ready for start of the first 2x 300MWe CFB unit. The plant operation will be fully dependent on the double circuit transmission line - no alternative is given. The fulfillment of grid stability criteria and usability for commissioning of the new transmission line has to be verified in detail through various simulations. The long transmission line with the huge generation units at its end might pose a considerable challenge for grid stability.

Cooling media resources

As cooling media water and air will be available at site. For process water two options are feasible:

1. Mine water (high TDS content which needs treatment)
2. LBOD water (water treatment and supply scheme will be realized by Government of Sindh)

The mine water preparation and conditioning through reverse osmosis will produce brine with a high TDS content which needs to be discharged. Because of the high TDS content, the authorities will not allow it to be discharged with the mine drainage water into the pipeline running from the power plant to the salt lake. An alternative for the brine issue will be total avoidance by substitution of the wet cooling systems with air cooling systems and reducing the brine volume by reducing the percentage of wet cooling capacity at peak ambient temperatures.
The other alternative is the installation of a sophisticated brine discharge system that will use the brine for dust prevention or re-injection of the brine into the aquifer far away from the take out point. The choice of cooling system (wet/dry) will be dependent on the technical efficiency and commercial optimization. That will need a deeper analysis but will not be a knock out criteria.

Infrastructure

The site is in a very remote part of the country (desert landscape). For that reason the site could be seen as an offshore location where all required infrastructure to execute and complete the project either has to be imported or constructed on-site. The build-up and installation of an adequate infrastructure to permit the construction and building of the power plant will in itself be a significant project which must be completed ahead of the power plant construction project. Synergies and/or drawbacks might occur with the parallel realization of the mining project. Synergies with regards to infrastructure should be considered with the subsequent energy park projects.

Acceptance (Permission / Society)

The ESIA for the TPP has started and is under progress. The given limits for emissions determined by the local ESIA consultant Hagler Bailly was analyzed by RWE ESIA experts, their finding was that the limits are lower than BAT standard and should be met by Chinese vendors. Currently the complete authority approval process for the first lignite fired power plant at the given site is not yet completely defined.

Stakeholder relations

Different stake holders to the project are mentioned. Main stakeholders will be the Government of Sindh, Thar Energy, SECMC, Chinese vendor, financing bank(s), NEPRA,

WAPDA, adjacent communities and other Thar Field unit owners, all associated authorities for issuing permits and granting permissions, NGO's and others.Because of the major importance of the power plant project to the Pakistan power supply market the stakeholders mainly support the project, no significant opposition is known. Nevertheless, the project should be supported by an overarching stakeholder management process to achieve the highest synergy effects especially in case of the interface management and overlapping functional areas (Mine/TSO/Infrastructure Projects).

Residue discharge

A proper residue discharge management process will be achievable at the given site by adequate dumps for solid waste materials and a sophisticated management of brine discharge. The CFB solid wastes will be dumped at the designated dump areas beside the mine and in later years in the abandoned parts of the mine.
All other waste streams and volumes from the power plant operation will be treated in accordance with the legal regulations with govern operations in Pakistan and with adequate consideration to appropriate technologies and processes.

Fuel Supply

The supply of fuel for the power plant is guaranteed from the adjacent mine which has sufficient volumes of coal to supply the fuel requirements over the power plant operating life. CFB technology is resilient to fuel quality fluctuations. Additional fuel procurement strategy includes importing Indonesian coal during the initial years of the power plant operations. Adequate fuel for operation of the mobile plant and site vehicles will need to be procured in large quantities through long term fuel procurement contracts.

Consumables

Consumables cover a wide portfolio of items ranging from diesel fuel for site vehicles to oils and greases to operate the power plant. Resources for process related high quality bulk materials like sand and limestone are not yet finally defined; nevertheless indigenous sources will be available. Provided long term supply contracts and

appropriate volumes are negotiated, the costs of consumables can be economically managed. A strong procurement team should keep the costs competitively priced.

Economical fit

The highest cost element in the operation of any power plant is the cost of fuel. The fuel cost is influenced by procurement, transportation-to-site and heating value components. For this project, the fuel supply is owned by the power plant owners and there is no premium cost elements attached to its procurement. The cost of the fuel is its extraction and handling cost and the cost of transportation to the power plant which is 5 km away. It therefore will become the most competitive fuel option in Pakistan in the long-term especially with the extension of the planned energy park up to 3600MWe. The lack of available generation capacity in Pakistan to meet its baseload requirements means that any new additional capacity utilizing cheap and abundant fuel will be profitably compensated by the industry. The two unknown cost elements for this project that cannot be directly controlled by the power plant owners are the transmission network use of system charge and process water cost.

STEP C: - Process Engineering –

The objective of the Process Engineering Study document (PES) is to explain advantages and disadvantages of boiler technologies such as pulverized coal firing (PC) or circulating fluidized bed (CFB) or Integrated Gasification Technology (IGCC). The preferred technology will be recommended at the end of this document and will serve as foundation for the Concept and Base of Design, which will be issued afterwards. These works will be executed under RWE T best engineering practice and ISO 9001 quality standards. The works are following well proven engineering methods, applied in German Power and Energy Industry.

After intensive analysis of the requirements and the study of the mentioned site conditions all available data for further process calculation were extracted, structured and prepared for subsequent process calculations. Non extract able data was defined on base of similar process calculation.

The CFB process engineering started with the combustion calculation and the related mass balance for different load cases which gave input to related heat balance calculations. With the results of this core process design calculations related disciplines like turbine & cold end, material handling, water management etc. elaborated their basic concepts. The developments of the overarching disciplines like plant design EIC, civil, HVAC etc. completed the total concept design.

The Concept of Design shows the main dimensions of the power plant system and the functional relation of plant units adapted to the current site situation and the future extension plan.

The process engineering step created as well preliminary plant operation data which are needed as input for the financial modelling.

Because of the high grade and quality stable lignite fuel source the process data range over all load cases is relatively narrow which is a positive outcome.

On base of given results it could be expected that the power generating process based on the indigenous coal reserve will be uncritical.

In case of the cooling system it is possible to operate the plant with temporary constraints for air cooling at hottest days with wet or dry cooling radiator cells as well as with wet cooling tower.

MODULE 5 – Assessment Report Process Engineering –

Process Design for 2x 300 MW CFB Unit

The main disciplinewise results at a glance:

Process Design (especially Water/Steam Cycle)

To achieve the targets listed above, the water/steam cycle process has been designed as a standard cycle typically used for a coal-fired thermal power plant of the 300 MW class, featuring:

Moderate, sub-critical steam parameters

Single pressure, drum-type or once-through boiler with single reheat

Typical 300 MW steam turbine split into an HP, IP and LP section

7-stage condensate and feedwater preheating with a boiler approach temperature of about 270°C, suited for the typical boiler design as well as the typical steam turbine design (extractions) of the 300 MW class.
Feed water pump with electric drive
Wet cooling tower
The design features listed above are very common for a 300 MW class coal-fired power plants, and RWE expects that many bidders, including Asian and especially Chinese vendors, should be able to offer such a plant using "off-the-shelf" component design to utilize the benefits of standardized design in terms of engineering, manufacturing and erection procedures, delivery times and – last but not least – prices.

Cold end

The choice of a particular technology and type of cooling systems depends on many factors, such as the process, the site, environmental and economic requirements.
In general three options were considered to cool down the low pressure steam back to condensate. The following choices of the preferred cooling system based on the adoption based on the given water source information. In general with an Air Cooled Condenser it would be very difficult to reach the required plant efficiency.

- Induced draught wet cooling tower (eg. Multi-Cell)
- Natural draught wet cooling tower
- Air cooled condenser

Alternative Coal Fuel

The size of the power plants should match the mine production schedule, to be able to use Thar coal as early as possible from the mine to reduce mine development costs (which would be ultimately borne by the power plant and the consumer).
In this regard alternative coal fuel will be arranged, with similar specifications as Thar coal lignite to make sure that the plant is running even if the mine schedule is delayed. This coal will be purchased from Indonesia.
The plant design has to be flexible use this alternative type of coal. Specifications of the alternate coal fuel:

Base of design is the supply of alternative fuels by truck with a loading capacity of 25 – 35 tons. The lump size must be 0 ... 300 mm for transport and preparation inside the power station.
The road transport capacity and the capacity of truck unloading devices must be 1000 t/h for full load consumption of 2 x 300 MW units.
The alternative coal fuel specification is given.

Process flow

The power plant will be fed with lignite from the adjacent mine being operated by SECMC. The mine capacity is 6.5 Mt/a. The total annual operating days of the mine will be 328 days, which means that around 1,000 t/hr of lignite will be available.
Overburden and lignite will be winning by shovel excavators with a capacity of about 2 to 6 m^3. Mining trucks with a capacity of 55 tons each carry the overburden to the dump and the lignite to the mouth of the mine.
For the future a stockyard with a capacity of 450,000 tons (power plant demand of over 19 days) is planned by the mine. The stockyard would be filled by means of trucks from the mine.
Two semi-mobile crushers with a capacity of 1,000 tons per hour each receive the lignite and mill the lignite to a lump size < 300 mm. The part of fines, produced from the crusher, should be as low as possible.
Behind each crusher a belt conveyer with stacker feeds the lignite to the stockyard. The stockyard is subdivided in some stocks, about 50 x 100 x 12 m high with about 28,000 tons each. The automated traveling stacker on rails fills every stock by the "Windrow Method" to reach a good blend of the lignite.
Two bucket wheel excavators, driving on crawler tracks, feed the lignite to the power station by a belt conveyor system. The excavators are manual operated.
The described stockyard is a part of the mine. At the beginning of mining activities the stockyard can be located near the power station. Later the stockyard follows the mining progress. The connection between stockyard and power station can be with mining typical overland belt conveyors or by mining trucks. The continuous transport with belt conveyors is more efficient.

Fuel Handling System

The fuel handling of the power station starts with a truck receiving unit to handle the imported fuels in the start phase. The capacity of this unloading station is about 1000 t/h to feed the first two 300 MW units and balance out the inconstancy of road delivery. Later, in the regular operation of mine stockyard with a belt connection to the energy park, the truck receiving station might be used as a backup for irregular situations.RWE Technology suggests an enclosed intermediate stockyard with a stacker with lift and lowerable boom and a bridge type scraper reclaimer.The enclosed stockyard protects the fuel against wind and heavy rainfall. It guaranteed a continuous fuel supply and the best blending quality.

Water Management System

The water supply of the power station can be realised by two types of raw water.

Option 1 (preferred): Ground water (aquifers), pumped out of the mining area with an TDS up to 7000 ppm

The available amount of ground water is sufficient for the water requirements of 2x 300MW, even for peak loads.

Option 2: LBOD (Left bank outfall Drainage) as pre-treated raw water with a TDS up to 500 ppm.The raw water should be provided for the production of process water which is mainly required for the following systems:

- Process Water and Service Water
- Main Cooling Water System
- Auxiliary Cooling Water System
- Fire Fighting Water
- Deionised / Demineralised Water
- Potable Water

All of the above process waters require pre-treatment by means of a suitable water treatment facility to ensure the production of water of adequate quantity and quality as needed for operation of the entire plant. Each stage of the project is required to operate independently; therefore, the facilities described herein do not consider later plant extensions.

Option 1: Ground water
The available amount of ground water is between 5000 m³/h at the initial years of the project and 2500 m³/h during the later years of the 2x 300 MW project.

The expected demand of ground water has been estimated to be approximately 1750 m³/h.
Option 1 (Ground water):
To minimize the **R**everse **O**smosis water treatrment plant effluent, the brine from RO2 system is always used as raw water for RO1system.

The RO2 brine quality is similar or even better than the Ground water. This set-up has no significant impact on the power demand.

The quality of RO1 brine is below the Ground water and the costs to make up this water are comparatively high.

The only target to use the RO1 brine as feed water for RO3 is to minimize the amount of high TDS waste water from 700 m³/h down to 350 m³/h.

The outgoing waste water of about 350 m³/h mainly consists of RO 3 concentrate.
The TDS is app. 28.000 mg/l.

Option 2 (LBOD water):
In normal operation there is no outgoing waste water.

Electric

The following design data will be considered:
Unit power output is 300MWgross / 267MWnet
Unit power consumption is estimated to 33MWel/41.25MVA
The redundancy for the electrical auxiliary power supply follows the n-1 criteria. Main reason for the n-1 criteria is; single fault of equipment shall not cause a trip of the whole power plant. Certain redundancy (e.g. 2 x 100% / 3 x 50% / 4 x 33% / etc.) will be specified in later design stage to fulfill the n-1 criteria as well as to secure the functionality of critical/essential systems.

The power train includes all components and their auxiliary systems that are necessary to generate electrical power and feed it into the local grid connection point. Also included are all systems that are necessary to feed the electrical consumption of the balance of plant.

As a rule, the construction of electrical equipment must be conform to the regulations of the relevant construction standards (e.g. IEC, EN (consultant recommendation)), or equivalent). For the plant and its equipment a risk assessment has to be performed and the results have to be fixed in a HAZOP study and SIL classification in the detailed design phase. In addition the "THE GRID CODE" (by The National Transmission and Despatch Company LTD.) shall be fulfilled by the units.

The commissioning of the 2x 300 MW units in combination with the commissioning of the new built high voltage transmission line needs to be planned and prepared very carefully in advance.

Civil - Site / Levelling / Height reference-

The site of the Lignite Power Plant Thar Block II is characterised by a rather flat to slightly inclined landscape with an elevation of approx. 84m to 87m above sea level (asl). From this level dunes rise in several places with heights between 20m and 30m (dune top 108masl to 119masl). The surface is loosely covered by desert vegetation. To achieve a power plant property with a surface (flood protection) slightly above the surrounding countryside the area of future buildings and other sensitive power plant installations will be backfilled to a level of +87masl.

It is good engineering practice to define a „power plant zero level" which can be referred to, all through the design and construction process. Typically the height of the ground floor in the buildings is defined as 0,00m. A reasonable choice for this zero level is a value that coincides with the outside ground-level plus approx. 50cm to protect the building´s inside from flooding and sand / dust entry. In the following +87.50masl is preliminarily defined as 0,00m for the Lignite Power Plant Thar Block II project.

Geotechnics

Soil conditions at the designated Lignite Power Plant Thar Block II site were investigated and documented on behalf of the Owner in 2013.

On the basis of the available information the underground of the site consists almost entirely of fine sand. Only with one borehole a layer of shale was explored 30m below ground level, 2,5m thick.

The conducted sieve and hydrometer analyses show fine sand with some varying content of silt and with a very narrow grain size distribution ("single grain size soil"). The SPT-results show that the density of the sand increases steadily from medium dense close below ground level to dense / very dense at about 10m depth.

In general the soil is suitable to bear foundation loads. No "problematic layers" like soils with high organic content, very loose sand or unconsolidated clay were amongst the findings.

Due to the small number of investigation points some uncertainty / a rather high ground risk remains. The available information is deemed sufficient for the tendering process of the power plant and preliminary considerations about applicable foundation systems. However, for the detail design a denser grid of soil investigations and additional testing is inevitable.

Groundwater / stratum water

The accomplished geotechnical investigation encountered no subterranean water down to depths of 60m below surface level. Nevertheless, no data from long term measurements on the groundwater table are available. Therefore the impact of seasonal variations and especially the effects of singular extreme heavy monsoon events on the groundwater level are unknown.

With the given information about the local groundwater conditions no dewatering has to be foreseen for open pits during the construction period. If the construction timetable comprises earthworks and / or the realisation of basements during the monsoon season there might be the need to pump rainwater out of the pits that does not soak away into the sandy-silty soil quickly enough

To protect basements from surface and seepage water during and after heavy rainfalls the outer walls shall be realised using "watertight" concrete including the engineered sealing of construction joints and the limitation of crack widths by the choice of appropriate rebar and concrete mixtures.

Foundation

When developing foundation concepts for the several power plant buildings, beside the absolute load and the geotechnical conditions the tolerable deformation –allowable settlement and especially settlement differences– must be considered. Therefore different foundation systems will be applied for different types of buildings. For every individual foundation a geotechni cal calculation is required to determine the dimensions of the foundation and to envisage and evaluate the settlements to be expected.

Wind loads

A site and specific wind study or wind tunnel study (for design) will be conducted – not within the scope of this study.

Seismic loads

Uniform Building Code (UBC) of 1997 classifies the region in which Thar Block II is located under zone '2B' which means a "moderate" influence of seismic impacts. RWE would take into consideration the seismic requirement of the UBC or of Pakistan´s national Seismic Standard for Zone 2B, whichever is more stringent, but would not go beyond the demands of these standards. Whichever standard is more stringent will turn out only during the detail engineering calculations.

It must be absolutely emphasised that the civil design according to UBC does not aim at any availability targets but shall only assure the personnel´s safety in the case of a design-earthquake. Neither the design of non-Civil components of the plant nor the stability of any power-generation process fall under the regulations of the UBC.

A (non-nuclear) power-plant would be not classified – neither by the German authorities nor by RWE – as a building of major importance in the case of an earthquake, which results in a low "importance-factor" and by this way to minor design requirements compared e.g. to a hospital. Thus a power-plant designed according to the UBC under civil aspects will probably shut down even when affected by minor earthquakes or might even be severely damaged.

The decision whether the availability of power generation shall be maintained during seismic events must be made in front of the background of the local power grid. If the Owner decides that the generation capacity at Thar Block II is absolutely crucial for the stability of the Pakistan grid, it might be reasonable to spend higher efforts in realising a high earthquake resistance to ensure power production even in the case of an earthquake (of a defined magnitude) or at least a quick restart of the plant afterwards.

If this shall be the target it must be absolutely clear that the seismic civil design is only a small contribution to the whole picture. Each and every process, relevant for power generation, must then be designed and realised "earthquake-proof". Also the power lines transporting the energy out of the region affected by an earthquake must then have sufficient resistant to withstand at least the same design earthquake that is the basis of the power plant design.

Corrosion protection

Due to the ambient conditions (temperatures, sandstorms) and the partly high salt concentration in soil and air the requirements for the corrosion protection of steel components are demanding. Suitable coating materials and minimum coating thickness must be defined for specific steel elements. The actual coating thickness depends on the components stressing (located inside / outside, mechanical stress of surface, etc.). A minimum coating thickness of 300µm should not be underrun within the Lignite Power Plant Thar Block II project.

Due to the lack of groundwater the chemical stress on concrete foundations is not to be expected overly aggressive. Nevertheless a proper design of the concrete mixture and an appropriate concrete coverage above the rebar is important. The actual coverage shall be the result of the design process for specific components. A minimum coverage of 3cm must but not be underrun.

Flood protection

The site is located remote from open waters (rivers, lakes, sea). Thus flooding could only be caused by the surface runoff after extreme heavy monsoon rainfalls. To prevent negative impacts from such runoffs the landscape will be modelled in an appropriate way to protect the power plant components. A dewatering system consisting of gutters and open ditches will be designed and installed that ensures a save effluent of rainwater towards the rainwater detention pool.

Hydrological data (e.g. large-scale and long-term runoff studies for the region) to evaluate the real risk of flooding are not available and shall be delivered latest until the beginning of detailed engineering
– Not within the scope of this study.

Sand / dust protection

Approx. 8m high earthwork dams are recommended around the power perimeter in the prevailing wind directions. These dams must be revegetated with bushes and trees to protect the soil from erosion and to enhance the dust binding effect. Even if drought resistant plants are chosen, some irrigation will be required to maintain the "protective green belt". For this purpose purified sanitary waste water may be deployed.

Building envelope / facade / cladding

The facades / outer walls of the buildings with the necessary amount of doors, windows and ventilation equipment shall be designed to the demands of noise and heat protection, water- and dust tightness. A metal cladding shall be applied.

Ventilation

Ventilation systems fulfil several purposes depending on the requirements of the respective facility. These may be e.g.

- sufficient supply of breathing air within the buildings
- air purification

- discharge of heat surplus
- adherence to required inside air temperatures
- adherence to required inside humidity
- mechanical smoke extraction

Ventilation systems shall be designed to the specific demands of the different power plant systems.

Cooling / Air condition / Heating

Taking into account the considerable demand for cooling capacity under the local climate conditions at the Lignite Power Plant Thar Block II site a cooling concept shall be developed by an experienced designer that is integrated in the structural design of the buildings. E.g. by including the masses of structural concrete as coldness storages into this concept, peak demands for cooling may be avoided in operation.
The different requirements of different components (offices / admin building, switch gear storeys, machine hall) shall be determined thoroughly on the one hand to design cooling machines properly but on the other hand to prevent a waste of cooling power.
Considering the local climate conditions (hot summers, moderate warm winters) no central heating system for buildings is envisaged. In case rooms with permanent working place require heating temporarily, this may be supplied by the air condition (e.g. backwards activation of heat pumps) or electric heaters.

Site and Layout Engineering 2 x 300 MW CFB

The given topography of the Thar Block II site is basis for the layout planning.
The architectural concept of the plant is based on a twin block arrangement with a combined turbine hall and a centered switch yard building.
In the elevated part of the Turbine hall (Intermediate building) the feed water tank and the feed water pumps are been placed.
In direction south the boiler, electrostatic precipitator and the induced fan building.
The stacks are positioned in the middle between the induced fans.

The lignite fuel supply is build up with linear process units starting at the southern battery limit side.
The power evacuation corridor is directed towards north starting from generator clamp via step up transformer and the gas insulated switchyard to the 500 kV national grid transmission line.
The auxiliary units are concentrated in the western part of the plant to optimize conveying distances.
The main transport route to the plant is via the southern gate.

STEP D: - System Engineering –

MODULE 6 – System Engineering 'Concept of Design / *Basis of Design' –

*Note: The 'Basis of Design' document contains the detailed specifics of the 'Concept of Design' explicitly presented in the Module 6 document and not in this executive summary.

The main disciplinewise results at a glance:

Concept of Design

The described technical concept in the following text was developed in the 'Process Engineering Stage' and the related functional specifications to the technical concept are described in the 'System Engineering Report'.

This 'Concept of Design'- chapter summarizes the Circulating Fluidized Bed (CFB) combustion and the Pulverized Coal (PC) combustion as lignite power generation concepts based on the assumptions of the 'Project Assumptions Book' for Thar II Block power plant site.

The final target is to build a standard power generation system which is reliable and proven on lignite combustion as well as state of the art in relation to availability, efficiency and environment-friendliness.

It is very important to meet the given fast track realization criteria.
The plant should be designed and manufactured on basis of market proven components from brand manufacturers with long-term experiences and revisable references.

The power plant must meet the availability criteria of > 7500 h / a.

Main features of the power plant

- Net efficiency of the power plant > 37 % for CFB (new and clean)
- Gross efficiency of the power plant > 40 % for CFB (new and clean)
- Emission output must be in compliance with the Pakistan laws and regulations
- Wet cooling system on base of mine water (refined by RO purification) or LBOD water
- Lignite Fuel from Thar II open pit mining or Indonesian Import Lignite with given quality analysis
- Lignite Storage with in power plant boundary capacity of minimum 2,5 d. The Storage must be covered in a weather proofed manner.
- Commercial operation planned by end of 2018
- Construction time at site 20 month per boiler block
- Plant availability > 85%
- Minimum Life time 30 years
- Black start ability will be given by the 500 kV national grid connection
- High grade of automation
- Operation control system for aging and length of life control
- Computer aided documentation- and maintenance management system
- Total suitability for the given desert conditions
- Total suitability for the given cooling media situation
- Flexibilities (space wise / compatibility wise) for necessary plant up-grades in future

Type of contract

- EPC turnkey t.b.d.

Environmental Data

The currently available data is mainly mentioned in the ‚Project Assumptions Book' or in the 'Site Evaluation Report'. The verification of mentioned data and all other design relevant data that will be needed for design have to be notified to the Client and as the case may be, investigated by the vendors themselves.

Air quality

In minimum the Pakistani laws and regulations have to be fulfilled as well as worldbank emission standards.

Sound protection

Typical desert landscape with minor housing has to be considered.

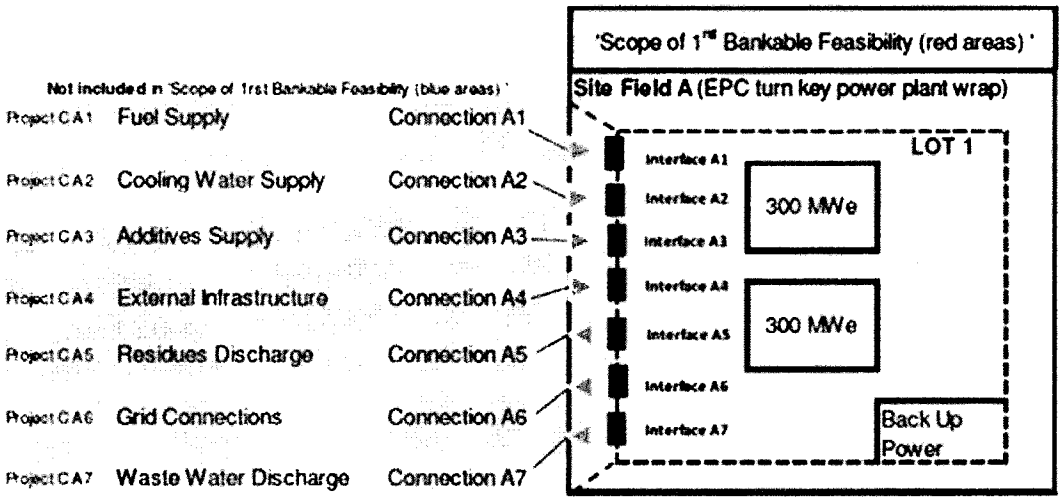
Grid connection

The interface to the 500 kV national grid will be at the grid exit portal of the plant switchyard.

The requirements of the current Pakistan grid code have to be kept.

Site

The working panel is described in the ‚Site Evaluation Report' and shown in detail in the 'Plant Layouts' of the 'Process Engineering Assesment Report'.



Interfaces

As an initial interface overview the above shown scheme could be taken further definitions will be done by further clarifications.

Thermodynamic Design / water steam cycle

The minimum requirements to the process and its parameters are shown by the "Heat Balance Calculations" of the 'Process Engineering Assessment Report'.

Fuels

Definition of the fuels:

Main fuel:	Lignite from Thar II field
Fuel Option:	Lignite from Indonesia
Ignition Fuel / Start-up fuel:	Light Fuel Oil

Disposal of Ashes/Combustion & FGD Residues

The CFB Boiler process will produce a combustion residue mixture of sand / bottom ash /fly ash /dry gypsum / free limestone etc.. In case of future emission aggravation wet gypsum from a spray absorption unit could occur as well.
A possible disposal process will start with the mixture and wetting (by RO brine water) of the residue fractions. The wetted residues will be transported by truck to the overburden dump yard of the mine for further disposal. In future the residues could be dumped in the dead zones of the mine as well.
All related parts of the ash disposal system within the power plant boundary has to be installed and managed in a way that it will meet all given legal regulations. The vendor has to verify that within all residue preparation processes where water is getting in contact with the residues no curing processes occur in a way that the operate ability of the related or sub-sequent related equipment is not reduced or blocked. The volumes, compositions and parameters of the residues and the RO brine are mentioned in the related chapters of the 'Process Engineering Assessment Report'.

Limestone

The limestone will be used from local resources the chemical and physical properties which will be reference of the related process guarantees have t.b.d. in co-operation with the client. It is expected to get the pre-crushed limestone delivered to a sheltered central limestone storage adjacent to the plant and the further preparation and milling has to be done under the responsibility of the power plant.

In the related chapter of the 'Process Engineering Assessment Report' information is given about limestone characteristics and its further preparation which has to be seen as exemplary.

Sand

The sand will be used from local resources the chemical and physical properties which will be reference of the related process guarantees t.b.d. in co-operation with the

client. It is expected to get the prepared sand delivered to a raw sand silo and the further preparation and sieving has to be done under the responsibility of the power plant.

In the related chapter of the 'Process Engineering Assessment Report' information is given about sand characteristics and its further preparation which has to be seen as examplary.

Gypsum Disposal (in case of FGD operation)

From current point of view it will be assumed that produced FGD gypsum will be disposed together with all the other combustion residues at the ash dump beside the mine or in prepared mine zones.

With regards to this assumption no special requirements to the gypsum quality are expected. That assumption could change if in future a recycling concept will turn up which will use the gypsum as civil construction material. In this case adaptable changes in FGD operation might occur and have to be feasible by the given FGD system.

Water Supply and Waste Water Disposal

Raw water / Process water

At the site location in the Thar Desert there will be two man-made raw water sources (as described in the 'Site Evaluation Report'):

A) Mine Drainage Water (availability 2017)
B) Left Bank Outfall Drainage. (availability 2017)

After full availability of both sources LBOD will be the main supply system backed by the mine water drainage. Because the mine water is very brackish in any case an adequate preparation for subsequent use as process water is needed. Reverse Osmosis or Evaporation Systems could be used for that purpose.

The prepared raw water will be used (after required specific preparation and specific water conditioning (anti-fouling/anti-bacteria/anti-corrosion etc.)) a o for:

- Cooling system make up water

- Process water
- Firefighting water
- Demineralized Water

Potable water

In the related chapter of the 'Process Engineering Assessment Report' there is more exemplary information about the required water preparation processes, characteristics and quality needs. The vendor has to design and offer adequate water preparation systems.

Water disposal

Through a sophisticated water management system the amount of waste water should be reduced to a minimum. In case of mine drainage water use the RO / Evaporation rest waters have to be disposed in a way which will not harm soil, drinking water sources or any other surface water.
Because of the concentrated TDS content with higher than 20 000 ppm the brine couldn't be dumped via pipeline together with the untreated mine drainage water into the Rann of Kutch. Even for dust prevention spraying to the raw lignite it could not be used because the solved chlorates could harm the boiler materials after combustion.
For a limited time (as long as the LBOD is not available) an option maybe the re-infiltration of the brine into the related underground aquifer far away from the mine drainage take outs.

Details will be found in the related "Re-infiltration Study".

All water disposal systems up to the defined take over points are within vendor's scope.

Blow down water

Parts of it can be used as process water for the FGD or for the wetting of residues before disposal. The rest can be used as input water for the reverse osmosis.
In the related chapter of the 'Process Engineering Assessment Report' there is more exemplary information about water preparation processes, characteristics and quality needs.

Process waste water / Sewage Water / Storm water

For the process waste water and sewage water disposal adequate state of the art cleaning systems should be foreseen in accordance to the local laws and guidelines for waste water treatment and disposal.
The storm water should be collected and treated in a way that no adverse effects to the plant operation will occur and a high grade of re-use is guaranteed.
It is mandatory to keep all water flows free from unnecessary pollutions by e.g. chemicals/ biocides/oily constituents etc. and to keep polluted volumes as small as possible.

Consent process

In co-operation between client, an external ESIA consultant and the governmental institutions an operating permission due to consideration of Pakistani law will be elaborated. The vendor has to give all information and documents in time and quality which are requested from the responsible authorities for the consent process.

Design of the power plant and its components

The power plant complex should be build-up modular as lignite fired plant and should consist mainly (amongst others) out of the following modularized units:

Power Island

- Once-through forced flow boiler with reheat cycle

- Multi-casing steam turbine
- Live steam, cold and hot intermediate superheating systems
- Multi-stage preheating systems
- Condensate- and feed water systems
- Condensate polishing system
- Main cooling system
- Closed intermediate cooling system
- Conditioning and sampling systems
- Piping
- Auxiliary boiler system
- Generator
- Generator shunt
- IC&E Systems
- Switching Units
- Process control system
- Communication systems

Auxiliary and supporting systems / Balance of Plant

- Cooling system make-up water preparation unit
- Reverse osmosis systems
- Main cooling system (wet cooling tower/ wet cooling radiator)
- Fuel transport and storage systems, including crusher, mills & conveying belts
- Ash disposal systems
- Lubrication systems
- Liquid fuel handling and storage systems
- Limestone-, Gypsum- Handling and Preparation Systems
- Raw Water Preparation Systems, Demineralization System , Water storage and
- Pumps
- Fire detection and Firefighting Systems
- Pressurized Air Systems
- HVAC

- Hoists and Cranes
- Buildings, Shelters, Steelworks and other civil constructions
- All connections to given Infrastructure, Streets, Grid, Pipelines etc.
- Emergency power- , Emergency Light Systems

Site related auxiliary systems outside power plant battery limit

All main components which in case of failure or tripping could cause a shutdown of the plant need to have a sufficient redundancy to keep the guaranteed availability of the power plant.

-Fuel Supply Handling

-Lignite Supply

-General

The fuel supply has to guarantee a constant and safe delivery of lignite fuel to the combustion process.

The delivery of the raw crushed lignite from the mine storage to the receiving station of the power plant will happen via truck transportation.

The fuel take over of the each truck load will be at the weighing bridge of the power plant after the monitoring and registration of each truck load with the subsequent dumping of the lignite in the truck receiving hopper.

The fuel supply has to guarantee a constant and safe quantity and quality delivery of lignite fuel to the combustion process.

The delivery of the raw crushed lignite from the mine storage to the receiving station of the power plant will happen via truck transportation.

The fuel takeover of the each truck load will be at the weighing bridge of the power plant after the monitoring and registration of each truck load with the subsequent dumping of the lignite in the truck receiving hopper.

Because of the short distance to the lignite mine which will keep a storage for roundabout three weeks the storage at the power plant site can be kept in the range of half a week storage size.

To keep the dust emissions tolerable and to reduce the stake of water spraying for dust prevention the power plant storage has to be a closed building.

As well as it will raise the independency from weather impacts to keep highest availability of the plant.
In the plant arrangements of the 2x 300 MW CFB and the sub-sequent following 1 x 600 MW PC plant two separately operate able power plant lignite storage areas are foreseen. The modules of the material handling systems should give the chance to be compatible to each other to achieve highest synergies in O & M and a possible redundancy effect.
The monitoring of hot spots from possible lignite self ignition processes and the adequate exstinguishment is one of the important fire fighting aspects.
An adequate explosion proof concept with the related primarely measures in all areas of the matrial handling zone where lignite dust can occur has to be considered intensively.
In the unlikely case that imported lignite from Indonesia has to be procured the material handling system within its interface points has to guarantee a full function ability with that fuel as well. The different delivery volumes through natural oscillation of fuel parameters as well as part and peak load situations have to be considered in the design.

Material Handling 2 x 300 MW CFB Plant / 1 x 600 MW PC Plant

A description of a practice proofed concept for a 24 h operation adapted to the given site conditions is given in the related chapter of the 'Process Engineering Report' the related functional specifications of concept modules and com-ponents is given in the 'System Engineering Report'.

The scope of concept covers all necessary processing, conveying and storage steps from mine lignite takeover to the head of conveyor point at the lignite service bunkers.

Boiler

The boiler has to be designed in a way that the calculable oscillation in lignite fuel quality over 30 years lifetime will be considered. No availability decrease should occur through abnormal fouling, slagging, corrosion, dusting, wear etc..
All related investigations in fuel analysis for the long-term suitability in the related boiler and combustion process to achieve the guaranteed performance parameters has to be carried out and verified by the boiler vendor.
Especially for all constituents/elements that will have a negative impact to the boiler process and its performance or availability.
All necessary technical mitigations to control the calculable fuel quality oscillation and its impacts to the boiler operation has to be implemented in the boiler design.
The co-firing of biomass or other lignite fuel substitutes is not foreseen, yet.
In case of CFB technology the design has to consider the qualities of the long-term procure able sand and limestone qualities from the local market and be reconfirmed to the client. All related sand and limestone quality assessments for further use has to be carried out by the vendor.
The boiler will work in base load operation mainly the related flexibility is given in the functional specification
The auxiliary steam production should be sufficient for the startup of a second same sized boiler.

The boiler should be covered in a way that the high availability criteria can be fulfilled under the given desert conditions including extreme weather situations like sand & thunder storms and monsoon rain.
A description of a practice proofed concept for a 24 h operation (CFB & PF) adapted to the given site conditions is given in the related chapter of the 'Process Engineering Assessment Report' the related functional specifications of concept modules and components is given in the 'System Engineering Report'.

Auxiliary Boiler

The auxiliary boiler has to be designed for the given auxiliary fuel.
The boiler has to be designed in a way that enough auxiliary steam will be produced for the start-up of one CFB boiler.

Ash / Residue removal Systems

1 x 600 MW PC Wet Ash Handling System (separate)
1 x 600 MW PC Fly Ash (see Flue Gas Cleaning) (separate)
1 x 600 MW PC Fly Ash / Wet Ash / Gypsum Handling mutual system together with unsaleable gypsum stakes.

CFB Residue Handling System (ash/sand/dry-gypsum/limestone)

A description of a practice proofed technical concept for a 24 h operation adapted to the given site conditions is given in the related chapter of the 'Process Engineering Assessment Report' the related functional specifications of concept modules and components is given in the 'System Engineering Report'.

Flue Gas Cleaning

The requirements to the flue gas cleaning will be determined on base of the given Pakistani emission laws and regulations for lignite power plants or given comparable power plant laws and regulations.
The flue gas system consists in minimum out of the sub-sequent mentioned units.
The units should be compatible to possible future extensions or upgrades with regards to space and/or process interfaces of the power plant process.
Flue gas cleaning will produce sell able materials which could be used in civil construction (PF bottom ash) or lightweight building boards (gypsum) or for cement industry (Fly Ash). The recycling processes are well known and the local standard qualities for further use of the materials have to be achievable.

The Flue Gas Cleaning concept encompasses amongst others:

- Flue Gas Dust Precipitation
- Flue Gas Conveying and exit through Stack
- Options: with separate stack / with stack integrated in cooling tower
- Flue Gas Desulphurization
- Options: Spray Absorption / Dry Absorption
- FGD water management
- waste water preparation
- raw water supply and preparation
- Fly Ash Handling System up to truck loading for disposal/recycling
- Gypsum Handling System up to truck loading for disposal/recycling
- Operation Material Handling (limestone slurry) incl. receiving stations

A description of a practice proofed technical concept for a 24 h operation of a flue gas cleaning systems for a CFB and a PF plant adapted to the given site conditions is given in the related chapter of the 'Process Engineering Assessment Report' the related functional specifications of concept modules and components is given in the 'System Engineering Report'.

Process Control

The process control system concept encompasses amongst others:

- General
- Automation level
- Features
- Components of Process Control System
- Process Operation and -Observation
- Visualization of Process
- IT- Safety
- Data Management
- Architecture of the Process Control System

- Online lifetime monitoring system
- Plant operation optimisation system
- Electronic documentation and maintenance support system

A description of a practice proofed process control system for a CFB and a PF plant adapted to the given requirements is given in the related chapter of the 'Process Engineering Report' the related functional specifications of concept modules and components is given in the 'System Engineering Report'.

Electrical Systems

The electrical engineering of the plant encompasses:

Generator

The generator system includes amongst others:

- Generator incl. exciting facility
- Auxiliary facilities for generator cooling
- Steering-, control-, operation-, monitoring- and protection systems including all related indicators, sensors, data transformers and -amplifiers including all adequate cablings
- Signalizing- and remote control facilities
- Synchronization facilities
- Generator specific auxiliary power supply
- H2-/CO2 exhaust stack
- Generator-power switch
- Emergency Power System
- Earthing and Lightning Protection Systems
- Decentralized electrical sub-distribution
- Auxiliary Power Supply System
- Energy Evacuation System from Generator to Grid Portal
- Switch Yard Control System
- Start- and Shut down programs:

Possible Scenarios

- Start Up via 500 kV-grid
- Black start
- Shut down of the power island under the use of auxiliary transformers
- Emergency shut down situations
- Unit downtime during revision

A description of a practice proofed concept for a 24 h operation adapted to the given site conditions is given in the related chapter of the 'Process Engineering Assessment Report' the related functional specifications of concept modules and components is given in the 'System Engineering Report'.

Civil Engineeering

All structural design & construction services of the power island are under the responsibility of the vendor beyond that all other structures and buildings of the plant which are necessary for the final architectural design of the plant have to be listed and offered optional.

All buildings and structures have to be designed in a way that under all calculable weather conditions the plant will be able to be operated or maintained or to be repaired.

The complete seismic design to meet the relevant Pakistani laws and regulations of the determined seismic zone is under responsibility of the contractor.

All buildings and structures have to keep in minimum the relevant laws and guidelines for industrial and/or power plant buildings and structures including the Health & Safety and environmental requirements.

The following civil engineering items to achieve a complete and under all calculable conditions operatable power plant and where the staff can work in a safe and long term healthy way have to be encompassed a o in vendors responsibility:

- Ground / Subsoil
- Foundations
- Building sub-/superstructure / supporting formworks
- Outer walls /Claddings
- Roofs/Shelters/Wind & Creeping sand barriers
- Stormwater & Flooding Protection
- Coating / Colouring / Signage
- HVAC
- All facilities for plant safety & protection (e.g. Gates / Fences / Firefighting / Air traffiic warning lights etc.)
- All facilities for the staff care (e.g. ambulance/rest rooms /canteens etc.)
- All road traffic and infrastructural facilities
- All workshop and storage facilities
- Architectural finish of the plant including Planting and Gardening

In the related chapter of the 'Process Engineering Assessment Report' and the 'System Engineering Report' there is more exemplary information about civil engineering items and needs.

Layout Planning / Arrangement Planning

The planning should take into account the overall interests of the energy park with regards to autonomous operate ability but compatibility to possible synergy effects between adjacent plants as well.
In the related chapter of the 'Process Engineering Assessment Report' and the 'System Engineering Report' there is more exemplary information about Layout Planning / Arrangement Planning

STEP E: - Financial Modelling -

MODULE 7 – Financial Report-

Introduction

A financial model for the project is prepared on the basis of Excel spread sheets. The model covers the period from financial close to commissioning and the operation time of the plant. It considers the interdependence of the planned local Thar Block-II lignite mine and the power station.
The model is in a form that meets the requirements of the international lending institutions and banks. It includes the following amongst other:

Cash flow
Financing (as a ratio of debt and equity)
Depreciation
Maintenance
Taxes & Duties
Income Statement
Balance Sheet
Financial ratios
Project Financial Internal Rate of Return (IRR)
Sensitivity analysis.

The model leading currency is US-$. It can be adjusted to give results in alternative currencies. The model is in real terms (year 2014) or alternative in nominal terms i.e. includes the ability to introduce inflation. All expenses in nominal terms are calculated with a year-on-year US-$ inflation of 2.0%. The revenue of the project will depend on the agreed electricity feed-in tariff with the authorities of the Pakistan government.
The financial model for the Thar Block -II power plant 2x 300MW power plant (Stage-I) allows to calculate a feed-in tariff of electricity (Upfront tariff) to reach a target Return on Equity (RoE) respectively IRR for the shareholders (Equity IRR) on the basis of a Cost-Plus mechanism.

Results

The financial report is part of the Bankable Feasibility Study (BFS) for the development of a mine mouth power plant consisting of two units with each 300 MW Circulated Fluidized Bed (CFB) boiler technology (Stage-I) operating at Block–II of Thar Coal Fields, Pakistan.

A profitable Thar power plant Stage-I with an attractive Return on Equity (RoE) of 20.5% is feasible under acceptable financial risks.

Main financial premise is to build and operate the power plant Stage-I under the framework of Pakistan Power Generation Policy 2002 which provides a number of incentives like guaranteed RoE on the basis of a Cost-Plus mechanism and tax exemption.

High sensitivities on the profitability exist for a deviation of Capex, of technical availability of the plant and of construction schedule. A deviation of start of mine operation i.e. the use of an alternative coal supply or a change of Thar coal price scheme will have no influence on the probability as these risks are expected to be covered by a pass through mechanism within the Power Purchase Agreement (PPA).

With regard to a high portion of fixed costs (80%) a split into fixed and variable portion within the PPA is mandatory. To reduce the risk of underestimating it is important to select appropriate cost indices for main cost items to cover the price escalation from real to nominal tariff.

The feed-in tariff considers debt and the equity requirements of the investor. A breakdown of the tariff is given for variable and fixed cost portions i.e. an Energy Purchase Price (EPP) and a Capacity Purchase Price (CPP).

Beside this calculation a tariff reference based on a NEPRA concept is provided for benchmark purposes.

Finally a sensitivity analysis for the IRR on Equity with a change of main economic parameters is prepared.

STEP F: - Risk Analysis –

MODULE 8 – Risk Assessment Report-

The project ENGRO THAR BLOCK-II POWER PLANT STAGE-I is in a project phase to prepare a medium level assessment for risk identification and risk mitigation strategies. The risk assessment is prepared by use of a standardized methodology for fossil-fired power plants in order to identify and categorize current risks, their causes, potential impacts and their treatment options.

Results

The project ENGRO THAR BLOCK-II POWER PLANT STAGE-I is in a development phase in which an intensive risk assessment with risk identification and development of mitigation strategies is mandatory.

The risk assessment for the Thar power plant stage-I identified sixteen (16) important risk items with a high impact on project success and high probability of occurence (red area of classification matrix) which need to be prevented (reduce probability) or reduced (reduce impact) by mitigation measures. For all sixteen (16) high classified risks a mitigation approach is developed which reduces the impact or prevents the probability in a sufficient way so that the remaining risk should be acceptable for the project owner.

Eight (8) risk items are identified with a medium impact on project success and medium probability of occurrence (yellow area of classification matrix) which have to be mitigated as well.

After mitigation eight (8) risks with a "yellow" classification and sixteen (16) "green" classified risks are remaining i.e. all main risks of the project should be acceptable for the project owner. A recommendation for mitigation measures is worked out in the report.

The Monte Carlo analysis after risk mitigation indicates a risk budget of 17 mUS-$ for the probability P-50 and of 40 mUS-$ for the probability P-90. The P-50 approach,

which is an usual approach for conventional coal fired power plants, should be considered as a minimum for residual risk in the project contingency for Capex of Thar Coal power plant Stage-I.
The power plant related risks together with the corresponding risks of interfaces are in the focus of the risk analysis described in this report. In addition an over-the-boundary consideration of possible risk factors to the power plant investment was made as an additional contribution to an overall project risk assessment.

On the basis of the detected site related risks during construction, commissioning and further operation phase of the power plant the risks of the planned project are not extraordinary different from similar fast track investment projects in South East Europe. In the case that the supply chain up to the power plant site is working as planned with respect to quality, quantity and schedule this project will be comparable to similar mine mouth projects which have been realized in the past.
It is essential that all identified risks are mitigated in a sustainable way by an adequate risk management process. A high professional management and strategy of quality assurance for the overall project including mine and infrastructure is mandatory for the final project success.
Because of a positive long-term energy demand forecast for Pakistan a profitable market situation is expected for power producing. A significant risk reduction for the power plant project will be achieved by an attractive power purchase agreement (PPA) with NTDC. Especially the 2x 300MW CFB project will be the opener for the development of huge energy park in the Thar region and has therefore a national importance. The conditions of the up front tariff contract must protect the pioneer entrepreneurship of the project.

STEP G: - Project Execution Planning –

MODULE 9 – Project Execution Plan-

The Project Execution Plan (PEP) launched as a living document for the whole execution phase is the single data and information source between all members of the Project Management Office.

The PEP will explain to all Execution Team members the objectives of the realization phase as well as the methods and routines how to achieve the targets.
The PEP is an individual project related document which has to be regularly refreshed by the Project Director and/or the Project Manager indicating to their own team a.m. such factors as background of the project, risks and related mitigation methods, the principles of project economics, HSE philosphy, changes in master milestone plan etc.
The PEP will include in minimum the following key functional areas of the project:

- Engineering	- Procurement	- HSE
- Construction	- Commisioning	- QA/QC
- Cost control	- Document Control	- Project Management

The given PEP in the BFS is a best practice template filled with the available project related data of 2013 which is prepared for direct use by the PMO after slight upgrades are done.

For Example the Project Milestone Plan with the data situation from end of 2013 needs to be upgraded.

Milestones with examplaric dates within a fast track realisation window showing below:

No	Description	Date
M01	Final Investment Decision (FID)	15-1-14
M02	Effective Date & Contract award EPC contract lot 1 CFB plants	15-1-14
M03	Access road to site ready	17-3-14
M04	Notice to Proceed	15-10-14
M05	Site facilities completed	1-4-15
M06	Start civil works	1-4-15
M07	Start construction Unit A	2-3-16
M08	Start Construction Unit B	15-8-16
M09	Beginning of cold commissioning Unit A	15-6-17
M10	HV connection backfeed	15-8-17
M11	Start hot commissioning Unit A	15-11-17
M13	Beginning of cold commissioning Unit B	29-11-17
M14	First firing Unit A	1-12-17
M15	Synchronisation of Unit A	1-2-18
M16	First full load Unit A	2-4-18
M17	Start trial run Unit A	30-4-18
M18	Start hot commissioning Unit B	1-5-18
M19	First firing Unit B	15-5-18
M20	Commercial Operating Date (COD) Unit A	2-7-18
M21	Synchronisation of Unit B	17-7-18
M22	First full load Unit B	17-9-18
M19	Start trial run Unit B	15-10-18
M20	Commercial Operation Date (COD) Unit B	14-12-18
M21	Final Take Over (FTO)	

Final Conclusion

The Entrepreneurship into the Pakistan Lignite Power Generation Market with the investment of the initial Thar II Energy Park Generation Plant has to be a big and safe step forward.
The present 'Bankable Feasibility Study' - Framework was made to safeguard the Final Investment Decision for the 2x 300 MWe CFB in combination with the consideration of the 1x 600 MWe PC successor plant.

The principle technical feasibility of 300 MWe CFB process based on current given Thar II lignite analysis. The needed process components and units are mature proven market products.
The current information about the site conditions lead to the conclusion that no obvious restrictions for the operation of the initial power plant based on Thar II lignite are given.
The decision to use CFB technology for the first lignite generation plant is comprehensible and logic with regards to performance, availability and efficiency criteria as well as for the fulfillment of environmental standards.
In a further step the procurable lignite 300 MW CFB plant technology reference for the given coal quality has to be qualified to assure a stable CFB combustion process even in the start up phase of the plant.
A CFB plant realization period of 36 month could be achievable under the management of a professional general contractor management.
The detected risks do not exceed risks of similar projects in South East Europe remarkably.
Under the predicted governmental investment incentive regime for lignite power plants including an adapted long-term power purchase agreement the economic risks for the 2x 300Mwe CFB startup plant should be manageable with an attractive interest rate.

Attachment (III)

Environmental Study of the project

Reference No: EPA/2014/01/28/EIA/03

ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF SINDH

Plot # ST-2/1, Sector 23, KIA, Karachi-74900
Ph: 5065950, 5065598, 5065637
5065532, 5065946, 5065621
epasindh@cyber.net.pk
Facsimile: 5065940

Date: 20th June, 2014

SUBJECT: - DECISION ON ENVIRONMENTAL IMPACT ASSESSMENT

1.	**Name and Address of Proponent:**	Chief Executive Officer, M/s Thar Power Company Limited Karachi.
2.	**Description of Project:**	Construction and Operation of a 660 MW (2x330) coal-fired Thermal Power Plant in Thar Coal Field Block – II.
3.	**Location of Project:**	Thar Block - II, Union Council Islamkot, Tauluka Mithi, District Tharparkar, Sindh,
4.	**Date of Filing of EIA:**	January, 2014

5. After careful review of the Environmental Impact Assessment (EIA) the Environmental Protection Agency (EPA), Sindh, has decided to accord its approval subject to the following conditions:-

(i) The Thar Power Company Limited hereinafter referred as proponent shall comply with all Environmental Quality Standards applicable to the project activities and in force during operation of the project in the province of Sindh.

(ii) Emissions from stacks and the ambient air quality will be monitored to ensure compliance of Environmental Quality Standards in force.

(iii) Environmental Standards of Noise levels shall be implemented in order to minimize noise impact of the proposed project. For this purpose an appropriate buffer/extensive plantation will be carriedout.

(iv) An optimum stack height shall be designed to effectively disperse the pollutants at the project area and its surroundings.

(v) All issues handling of waste, water consumption, air quality, effluent, solid waste management and disposal will be dealt in accordance to the environmental management plan provided in the EIA report.

(vi) An effective and environmental friendly ash disposal system will be developed which would cater to collection, transfer and final disposal of ash to a designated disposal site developed so that it should avoid contamination of soil or ground water.

(vii) The proponent shall submit quarterly monitoring reports for stake emissions, ambient air quality and wastewater in order to check compliance status of Environmental Quality Standards.

(viii) The proponent shall ensure installation of proposed emission control measures before commission of power plant.

(ix) No untreated effluent will be released to the environment. A dedicated wastewater treatment plant will be constructed to comply with Environmental Quality Standards enforce. The proponent shall ensure that emissions/effluents from project site do not pose an unacceptable risk to human health or become nuisance to the neighborhood.

(x) Mitigation measures recommended in the EIA report must be strictly adhered to minimize any negative environmental effect on the ecology of the project area.

(xi) Emergency response or contingency plan for any accident / incident on the plant should be developed before the operational phase of the project. The same shall be furnished to the EPA at least thirty days before for approval, failing which the plant shall not be made operative.

(xii) A complete Health, Safety and Environment (HSE) commissioning management system shall be developed. For this purpose, HSE setup should be supervised by a designated HSE officer at the senior level with sufficient administrative and technical authority to perform the designated functions. Proponent will make sure that the operating instructions and emergency actions are made available to every worker/labor/commuter at the site.

(xiii) The proponent shall hire an Independent Monitoring Consultant (IMC) having expertise in carrying out Environmental & Social Impact monitoring. IMC shall monitor the implementation of proposed activities against the

commitments made in EIA report and during public hearing. The report of the same shall be submitted to SEPA on quarterly basis.

6. This approval and any considerations thereof shall be treated as null and void if the conditions, mentioned in para-5 above, are not complied with.
7. The proponent shall be liable for compliance of EIA/IEE Regulations, in force relating to conditions for approval, confirmation of compliance, entry, inspection and monitoring.
8. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force.
9. The approval is accorded only for the project activity described in the EIA Report. Proponent shall submit separate EIA or IEE as required under regulation for any enhancement or change in the design of project.
10. Implementation Report of all the mitigation measures and EMP laid down in the EIA report shall be ensure by Thar Power Company Limited. No violation of any regulations, rules, instruction and provision of applicable Environmental Laws in force shall be made. In case of any such violation of the rules/laws this approval shall stand cancelled without any further notice.
11. All the environmental conditions of this approval shall be incorporated in the terms and conditions of contract document of the project for commitment and compliance.

Naeem Ahmed Mughal
Director General

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Thar Coal Block II Power Project

Environmental and Social Impact Assessment

Final Report

Volume 1 of 2

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Sindh Engro Coal Mining Company

Karachi

Executive Summary

The Thar coal field has total lignite reserves of 175 Billion tons which can be utilized to produce 100,000 Megawatt (MW) for over 200 years. The Thar Block II Coal Mining & Power project presents a tremendous energy and economic growth opportunity. The reliability of this energy resource and the scalability potential of the project make it one of the most suitable and sustainable growth propositions to end the energy crisis and bring energy security to the country.

Sindh Coal Authority (SCA) has awarded a 95.5 square kilometer (km^2) area of the coalfield, known as Thar Block II, to Sindh Engro Coal Mining Company (SECMC) for exploration and development of the coal deposits in the block (**Exhibit I**).

Thar Power Company Limited (TPC), a fully-owned subsidiary of SECMC is planning to set-up a 660 MW (2×330 MW, that is, two units of 330 MW each) mine mouth power plant within Block II (the "Project" or the "Power Plant").

The Proposed Project

The proposed Project will be located on a 33 ha (about 82 acres) plot located within Block II of Thar Coalfields in Tharparker District. The power plant site is shown in **Exhibit II**.

It is proposed to develop a 2 × 330 MW power plant in the first stage utilizing circulating fluidized bed (CFB) boiler technology and sub-critical steam parameters. The major systems of the proposed plant include:

- Coal handling and processing system
- CFB boiler
- Steam turbine and condenser
- Electrical power generator and power export system
- Cooling water system
- Ash handling system
- Utilities and waste management system.

Exhibit I: Location of Block II and Power Plant

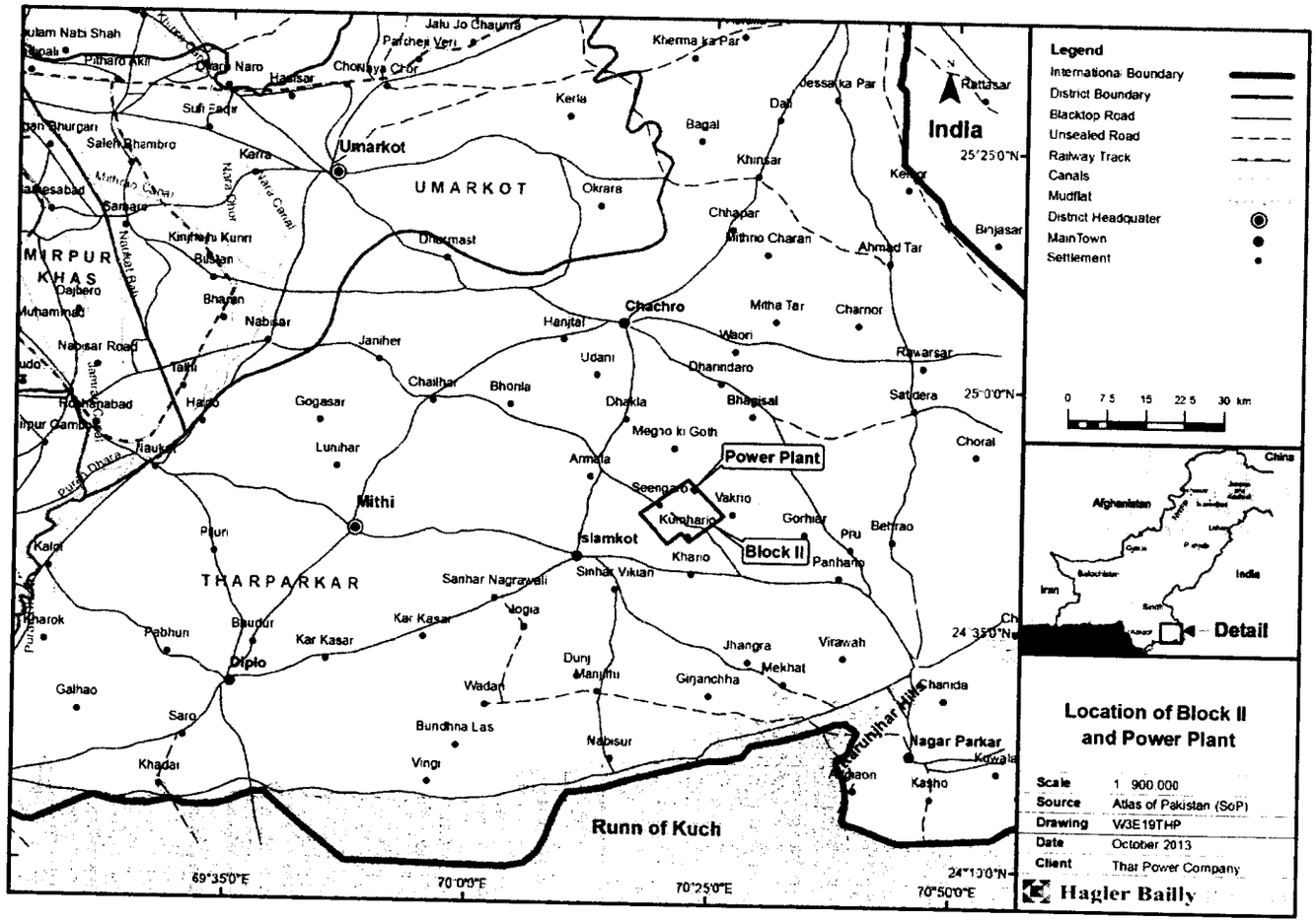
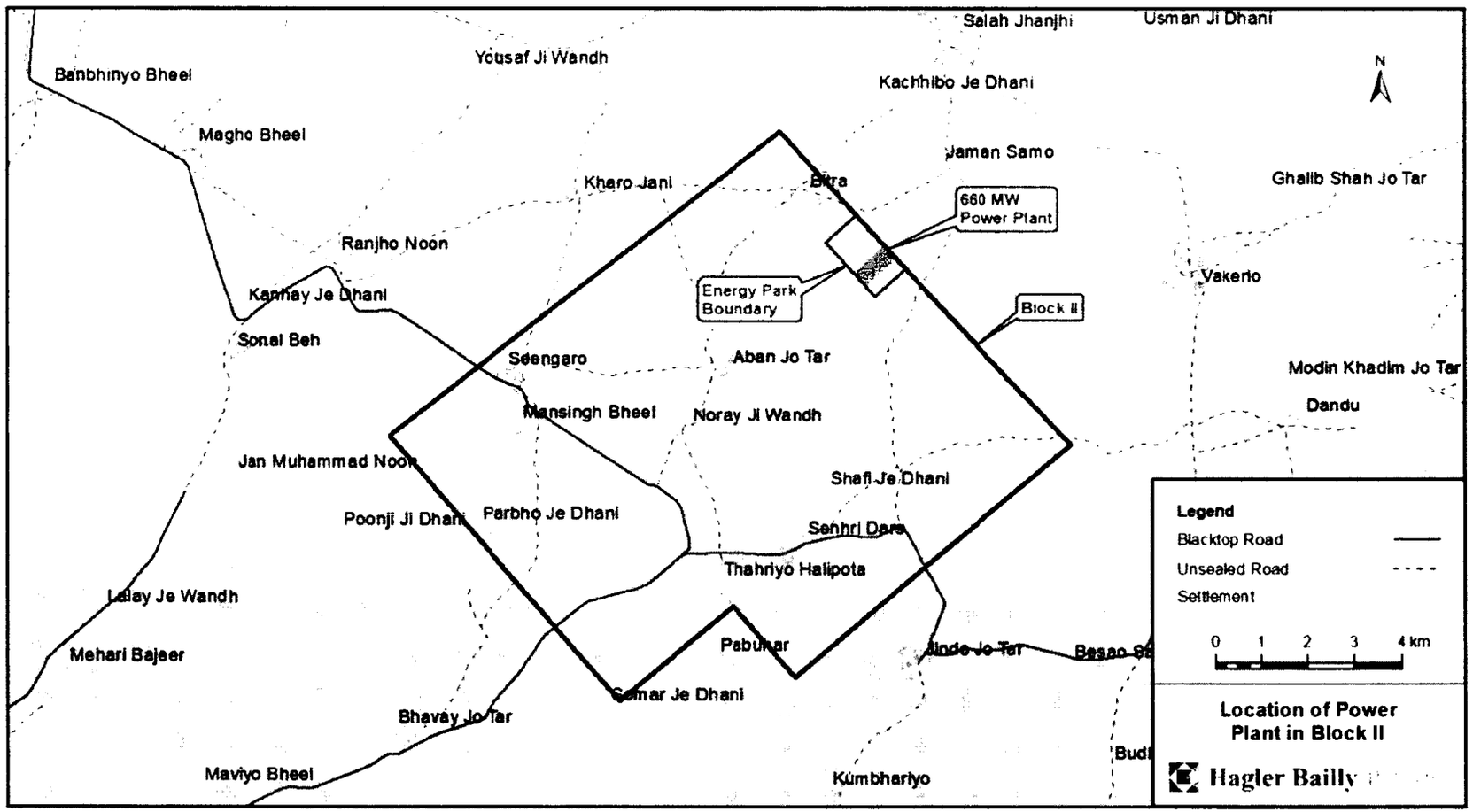


Exhibit II: Location of Power Plant in Block II



Coal for the power plant will be received at the coal yard at Power plant site. The coal will be transported to the power plant site after preliminary crushing and storage at mine stockyard (i.e. 5 km away from Power plant).

Coal Handling and processing system stores and process the coal for the boilers. The heat released from the combustion of coal in the CFB Sub-critical boiler will be used to generate steam at a pressure of around 175 bar. The steam will then be fed into the steam turbine, where it will rotate the turbine to generate mechanical energy. The steam, after passing through the turbine, will be condensed back to water and to be re-injected into the boiler after passing through condensate polishing system. The rotating steam turbine will operate the power generator, which will generate electricity. The voltage of the electricity will then be increased or 'stepped-up' and exported through the high tension transmission system of 500 KV.

For the CFB boiler the added advantage is that, there will be no requirement of Post Boiler treatment of Flue gases, the NOx reduction and SOx reduction will be all be carried out in the Boiler combustion zone. The lime stone will be added to the boiler into the circulating bed which will convert the produced SOx into gypsum which will be subsequently removed with the bottom Ash of the boiler. The gas from the riser pipe of cyclone will be carrying the Ash particulates which will be passed through a Particulate removal device called Electrostatic Precipitator, the particulates will be removed from the gas stream and gas will be discharged into the atmosphere.

Cooling water is required for condensation of the steam at the low-pressure end of the steam turbine condenser. The water will be sourced from the ground water produced from mine dewatering. The water will be treated and will be utilized into the mechanical draft or natural draft cooling towers.

Bottom ash from the boiler and fly ash from the flue gas treatment system will be collected and disposed of through the ash handling system.

Two 330 MW gross power unit will be installed at the Thar Block II , basic design parameters for which are listed below:

Capacity:	2 × 330 MW gross
Power technology:	Sub Critical Circulating Fluidized bed Boiler
Steam conditions:	Main steam 175 bar at 541 °C Single reheat steam 36 bar at 541 °C
Plant efficiency LHV:	Net 37%
Fuel:	Lignite from Thar Block II (2 × 255 t/h)
Circulating water cooling:	Mechanical / Natural draft cooling tower
Emission control:	ESP efficiency > 99.9% De-SOx efficiency > 90 %

Water Supply and Treatment System

Raw water supply will be form groundwater, which is brackish in nature and will be supplied from adjacent mining area dewatering facility. The treatment facility will be

located near the mine stockyard and Service facilities. The treated water will be pumped to the power plant, the effluent generated from the treatment facility will be re-injected into the third aquifer. The anticipated power plant normal demand of raw water is about 2,400 m^3/h. As the raw water is brackish in nature, the water will be treated for meeting the power plant requirement according to water quality analysis. The raw water treatment capacity is 2,868 m^3/h.

Design Coal Specification

The main fuel for the power plant will be Thar Coal from Block II mine. The design specification of the fuel is shown in **Exhibit III**.

Exhibit III: The Design Specification of the Fuel

	Coal Quality of Thar Block-II Lignite for Power Plant Design	*Average Quality*
A	**Proximate Analysis**	
i	Moisture (a.r)	45.71%
ii	Ash (a.r)	9.69%
iii	Volatile Matter (a.r)	25.00%
iv	Fixed Carbon (a.r)	19.6%
B	**Calorific Value**	
i	Gross Calorific value, kcal/kg (kJ/kg)	2,984 (12,491)
ii	Low Calorific value, kcal/kg (kJ/kg)	2,630 (11,011)
C	**Ultimate Analysis**	
i	C (a.r)	33%
ii	H (a.r)	2.7%
iii	N (a.r)	0.5%
iv	O (a.r)	7.02%
v	S.t (a.r)	1.38%

a.r = as received

Coal Handling System

The function of the coal handling system is to receive, store and deliver coal to the boiler silos. The design scope of coal conveying system in this project is a whole process system including the coal sampling after entering the plant, coal metering, coal unloading and coal conveying to raw coal bucket. Thus the design includes the entire coal conveying process of coal unloading, coal storage, transportation, crushing and sampling.

Coal Unloading Equipment

The coal will be transported through trucks to the plant site from the mine. The truck will have the capacity of 30 m^3 of coal. The coal arriving at the coal yard will be automatically unloaded using unloading equipment. For improving efficiency of coal unloading system, there sets an automobile coal unloading ditch.

Coal Yard

The coal yard will be in parallel with the coal unloading ditch. The proposed coal pile is 13.5 m high, 215 m long and 112 m wide; it can store 15.4 × 104 t coal, which can meet 15 days' of 2 × 330 MW coal consumption.

Dust Suppression and Temperature Monitoring

To prevent contamination of the atmosphere with coal dust, a water spray system will be located at strategic locations at the coal yard for use by yard personnel, as needed. Fixed conveyer belts above ground, except those associated with the stacker/reclaimers, will be in enclosed galleries.

Ash Handling and Disposal System

Coal combustion residuals (CCRs), commonly referred to as coal ash, are the materials that remain after burning coal for electricity. CCRs to be produced at the Project include the following:

- Fly ash;
- Bottom ash (with gypsum)

All the waste streams including fly ash and bottom ash if not exported for commercial use will be sluiced or conveyed to a mixing vessel where water will be added and the product will be transferred to the mine overburden area where the ash solids (wet) will be mixed with the mine overburden and will be dumped there.

Flue Gas Treatment System

Electrostatic Precipitators

The steam generator will be equipped with a dry electrostatic precipitator (ESP). The purpose of the ESP will be to minimize loading of particulates (fly ash and unburned carbon), primarily in order to meet product quality requirements of saleable gypsum as well as to meet the stack emission limits for particulates. The efficiency of the system will be more than 99.9%.

Sulfur Dioxide Control

SO_2 control will be provided by the injection of limestone in the CFB Boiler and converting sulfur to gypsum (calcium sulfate). The efficiency of the system will be more than 90%.

Nitroge Oxide Control

NO_X control will be provided by using low NO_X burners.

Hazardous Waste Facility and Overall Waste Management

A Hazardous Waste Storage Facility (HWSF) will be constructed at site to store and handle hazardous wastes generated at facility during all phase of Project.

All the liquid effluent out from the plant boundary will be NEQS compliant; the emissions will also be NEQS compliant. The Reject from RO plants, will be disposed with continuous Reinjection or in the evaporation ponds near dewatering disposal lake.

Environmental Baseline

Assessment of environmental and social impacts of the Project required development of a detailed environmental and social baseline of the study area (Power Plant and 5 km of area around it). Baseline information has been developed using secondary literature as well as surveys conducted in the Study Area.

Environmental Setting

Geomorphology, Gology and Soils

The desert sands of Thar belong to three different geologic periods, early Precambrian gneiss, sedimentary rocks, and, more recent material deposited by rivers (alluvium). The Thar area in which the Project is located is covered by dune sand that extends to an average depth of over 80 meters and rests upon a structural platform in the eastern part of the desert. The platform is underlain by relatively shallow granite basement rock. There are seven main groups of soils found in the Thar. These are desert soils, red desertic soils, Sierozems (rowinsh gray soils), red and yellow spoils of the foothills, saline soil of the depressions, lithosols (shallow, weathered soils), and rigosols (soft loose soils) found in the hills.

Water Resources

The communities residing in the Thar area rely on rainfall and groundwater aquifers to meet their water needs. As the evaporation rate is high, very little moisture is retained in the soil. There are no perennial surface flows and hence no system of natural drainage lines and streams is found in the Thar region. Rainwater either seeps through the soil or flows to the nearest *dhand* or playa[1] where it accumulates and is used by the community while it lasts.

Water for domestic use is acquired from wells tapping the rain-fed top or quaternary aquifer. The thickness of the top aquifer varies between 4 m to 18 m and the aquifers are 30 m to 80 m below the ground level. The Monsoon rain feeding the aquifer occurs from July to September. By February or March, the shallower parts of the aquifer get depleted and the wells become saline.

The hydrogeological studies conducted by the GSP indicate the presence of at least three aquifer zones: one above the coal zone (the top aquifer), one within the coal and the third below the coal zone.

A groundwater baseline survey looking at the groundwater table and water quality was conducted in the Study Area. The groundwater resource survey covered 13 villages in the Study Area. There are about 150 wells in these 13 villages. Of these, 40 wells were selected for monitored for age, depth, construction details, usage, extraction rates, users, and water table. The salient results are as follows:

- The wells that were surveyed are all individually owned. There are no wells owned collectively by the village or the neighborhood.

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[1] A nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water (Definition from The American Heritage® Dictionary of the English Language, Third Edition ©1996 by Houghton Mifflin Company. Electronic version).

- The minimum, maximum and average depths of the well with respect to ground are 48.0 m, 86.4 m, and 60.9 m, respectively; 90% of the wells are between 50 and 70 m in depth.
- The minimum, maximum and average depths of the well with respect to mean sea level are –10.38 m, 31.43 m, and 19.26 m, respectively; 95% of the wells are between 10 and 30 m in depth.
- The minimum, maximum and average depths of the water table with respect to ground as recorded in January 2010 was 48.6 m, 81.2 m, and 59.9 m, respectively; the water table in 80% of the wells was between 80 and 75 m.
- The wells are open dug wells; no mechanically drilled boreholes were found in the Study Area. Most of the wells are brick-lined.
- Water is lifted from the wells using a bucket tied to a rope. The rope passes over a wooden pulley installed near the well opening. Given the relatively deep water table, the prime source of power are beasts of burden, mainly donkeys.
- Anecdotal information was also collected on the daily quantity of water extracted from the wells. There is considerable variation in the reported value with the lower limit being as low as 1,000 liters per day (l/d) and the upper limit as 60,000 l/d. Based on the reported number of families using each well, the per capita consumption is approximately 26 liters per day. There is a large uncertainty in these numbers and a rigorous measurement of water extraction rate and usage needs to be conducted.

Water quality samples were obtained from the 40 wells and were analyzed for common chemical parameters and heavy metals. The results indicate that in general the water is unfit for human consumption. Sodium, sulfate, chlorides, and hence the total dissolved solids, exceed the drinking water standards for almost all the wells.

Climate

The weather station nearest to the Power Plant area is located at Mithi, about 60 km west of Block II. The weather station is operated by the Pakistan Meteorological Department (PMD); however, limited data is available for this station since it operating since 2004 only. A minimum of 30 years of data is generally accepted as being required to adequately characterize the climate.[2] Therefore, two other weather stations for which climatic data is available were also considered. These are located at Badin, about 145 km to the west of the project site and at Chhor, about 100 km to the north of the project site. Thirty-years (1961-90) of data are available for these stations.[3]

Relatively mild winters and moderation of temperature by the monsoon winds makes it difficult to categorize the climate of the project area in terms of the traditional spring-

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[2] This is the classical definition of climates as used by World Meteorological Organization (http://www.wmo.int/pages/prog/wcp/ccl/faqs.html)

[3] As per international convention prescribed by the World Meteorological Organization, climate of a location is described in terms of monthly averages of weather data collected over a 30-year period. The last standard period was 1961-1990. Pakistan Meteorological Department has prepared climatic data, called climatic normals for 1961-1990, for over 50 weather stations in Pakistan.

summer-autumn-winter categories. Using the temperature profile and the monsoon effects, the climate of the project area can be classified into four distinct seasons as follows:

- Summer (Mid March to Mid June) characterized by very hot temperatures, dry conditions, moderate wind from the southwest, and low humidity;
- Monsoons (Mid June to Mid September) characterized by high rainfall, high temperatures, high humidity, and high winds from the southwest. Although the temperatures are milder compared to summer but high humidity makes the heat oppressive;
- Post-monsoon summer (Mid September to Mid November) characterized by cessation of rains and reduction in wind speed. Temperature increases by couple of degrees and humid decreases by about 10%; and
- Winters (Mid November to Mid March) are characterized by moderate temperature, dry conditions, low humidity, and low winds from the north and northeast.

A distinct feature of the monsoons is the complete reversal in wind direction. Mild wind blows from north and northeast during winter and swings to southwest and picks up speed during the summer, increasing from an average of 1.5 meters per second (m/s) to almost 6 m/s. Winds in excess of 15 m/s have been recorded in the region. Dust storms are often associated with the high winds.

One feature of the weather that is not apparent from the data is the extreme variability of the monsoon. Rains during monsoon tend to fail after every four to six years. The drought period may last two to three years. There were major droughts in 1951-1956, 1962-1963, 1968-1969, 1979-1981, 1985-1988, and several in the 1990s and 2000s. Although the average rainfall in the project area is about 219 mm, the actual rainfall during a "wet" season may be more than twice the average amount.

To supplement the regional climatic information and provide specific input into any future air quality modeling, an automatic weather station (AWS) was established in Block II to collect site-specific information.

Air Quality

Air quality sampling was carried out at five locations in and around the Block II.

The results are shown in **Exhibit IV**.

Exhibit IV: Ambient Air Quality in the Study Area

Pollutant	*Concentration ($\mu g/Nm^3$)*	*NEQS ($\mu g/Nm^3$)*	
		24-hour	*Annual*
Sulfur Dioxide (SO_2)	5.7 ± 3.3	120	80
Nitrogen Dioxide (NO_2)	3.5 ± 1.3	80	40
Coarse particulate matter, less than 10 Microns (PM_{10})	137.2 ± 49.0	150	120
Fine particulate matter, less than 2.5 Microns ($PM_{2.5}$)	24.3 ± 14.4	35	15

A comparison of the results with the NEQS for the ambient air quality indicates that the NO_2 and SO_2 concentrations meet NEQS limits. The level of PM_{10} and $PM_{2.5}$ is higher in the air due to the desert environment.

Ecology

The Thar Desert is a large ecoregion lying to the west of the Aravalli Mountain Range in northwestern India. The relief in the Thar Desert varies between near sea level to more than 150 meters. The sand dunes defining the topography are mostly longitudinal forming a NE-SW trend and are stabilized by shrubs and grass. In the inter-dunal valleys, the alluvial soil brought by rainwater is deposited in the depressions. The vegetation in Thar Desert is desertic and semi-desertic.

Habitat Classification and Distribution

Habitats within the Study Area were classified relying primarily upon geomorphology and soil texture, with consideration of variations within habitat types. The Study Area was classified by geomorphological characteristics into agricultural fields, sand dunes and plains. Agriculture fields are the dominant habitat, constituting 56% of habitats of the Study Area. There is only one cropping season in the summer (called *kharif* season) in which a variety of summer crops are grown. Sand dunes are the second dominant habitat, constituting 35% of the total habitat. They vary in height, ranging from a few meters to over a hundred meters. Plains constitute 9% (including 2% of the area covered by settlements) of the total habitat of the Study Area. An established tradition of preservation of trees contributes to maintaining the vegetation cover in the Thar Desert. Grazing pressure, however, is significant and the ground vegetation in terms of grasses, scrubs and bushes can be considered as uniformly degraded.

Vegetation

A total of 137 plant species have been reported from the Tharparkar area. These plant species are the base for the animal and human life in the desert. The plants are used for a variety of purposes, including production of medicines, resins, dyes and fibers, and for construction, forage and fodder making. The habitat in the Thar Desert is influenced by the extreme climate. The vegetation consists of xerophilious grasslands. Scrub vegetation consists of low trees and shrubs. None of the plant species found during the survey is listed under either the IUCN Red List 2010 or under the Pakistan legislation.

Mammals

Twenty seven mammalian species belonging to 15 families are reported in the literature to occur in the study area, of which 20 were either observed or trapped in the Study Area during the baseline surveys. The small mammal species, Balochistan gerbil *Gerbillus nanus* was found to be the most abundant followed by *Tatera indica* and Indian desert jird *Meriones hurrianae*. Common medium sized mammals included long-eared desert hedgehog *Hemiechinus collaris* and Five-striped palm squirrel *Funambulus pennantii.* The large mammal species, fox *Vulpes sp.,* Indian hare *Lepus nigricollis* and Indian hedgehog *Paraechinus micropus* are the abundant species in the Study Area while the rest of the species are comparatively less common. Striped hyaena *Hyaena hyaena* is listed as Near Threatened in the IUCN Red List 2010. It was not sighted but signs (foot print) indicating its presence were seen during the April 2010 survey. Dens of this species were also not observed in the Study Area. None of the mammalian species observed is exclusively found in the Study Area and the habitat of the species found is widespread across the Thar desert.

Birds

There is no permanent wetland close to the Study Area; therefore avifauna of the area predominantly consists of terrestrial birds. During the surveys 50 bird species were observed of which 43 are classified as resident, five as passage migrants and irregular year round visitors, one as summer breeder and one was isolated or occasional breeder in the Study Area.

A total of seven nests of Egyptian vulture *Neophron percnopterus* were identified in the Study Area, of which five were empty and two were occupied. A further three empty nests were located on *Prosopis cineraria* trees, which are thought to be nests of either the white-backed vulture *Gyps bengalensis* or Egyptian vulture *Neophron percnopterus*. One active nest of a tawny eagle *Aquila rapax*, one active nest of a spotted owlet and a further 10 nests of unknown bird species were identified in the Study Area.

The subfamily *Aegypinae* contains 15 species of old world vultures, 8 of which are reported in Pakistan. Of the four belonging to the genus *Gyps*, three including Oriental white-backed vulture *Gyps bengalensis,* are listed as critically endangered in the IUCN's Red List 2010. Egyptian vulture *Neophron percnopterus* is listed as Endangered (IUCN Red List 2010). The greater spotted eagle is listed as Vulnerable in the IUCN Red List 2010. It was seen in the Study Area in the April 2010 survey. The Laggar falcon *Falco jugger* is listed as Near Threatened in the IUCN Red List 2010 and was also seen in the Study Area during the April 2010 surveys.

Reptiles

Of the 32 species of reptiles reported in the literature and likely to be found in the area, 17 were observed during the surveys conducted in the Study Area. Of these, common species were the Indian fringe-toed sand lizard *Acanthodactylus cantoris*, Three-toed snake skink *Ophiomorus tridactylus,* garden lizard *Calotes v. versicolor*, yellow-tailed sand gecko *Crossobamon orientalis* and brilliant ground agama *Trapelus agilis*. The species found were evenly distributed across the three habitats in the Study Area, namely, agricultural fields, sand dunes and plains. None of the species observed or reported in the area are on the IUCN Red List 2010.

Socioeconomic Baseline

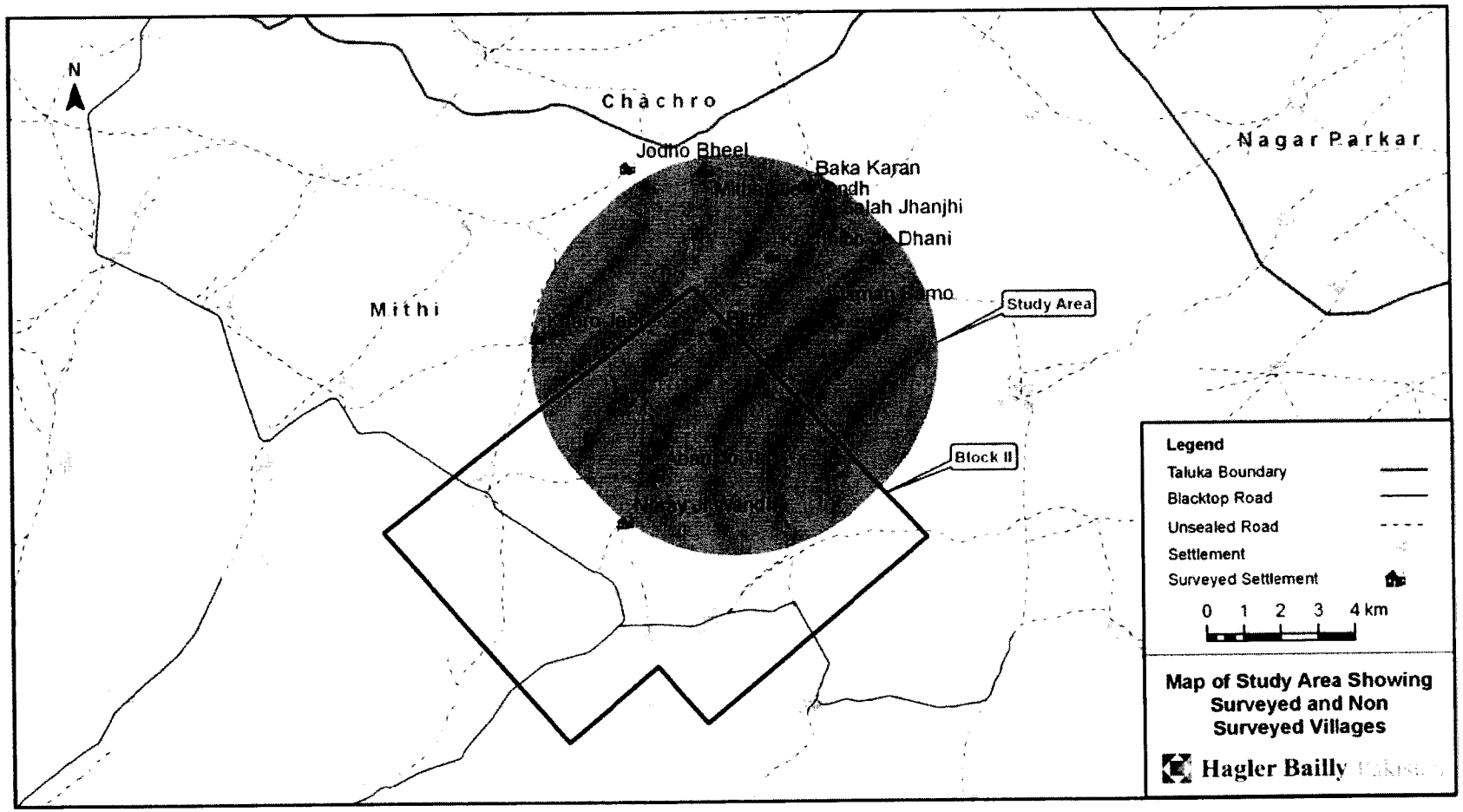
There are ten villages in the area around the power plant. The inhabitants of the area, like that of Thar Desert, belong to different religions, sects and castes which gives the area a rich multifaceted culture. The population of the area is estimated to be in excess of 6,000. Most of the living structures in the villages are *chaunras*, mud huts with thatched roof. The area has a weak infrastructure when compared to other districts provincially and nationally. Water supply is one of the major problems faced by villages in the area. Most of the underground water is brackish. The villagers travel to the nearby towns of Mithi and Islamkot for health facilities. The literacy rate in the surveyed population of ages 10 years and above in the area was 21%. Primary school facilities for boys exist in seven of the ten villages, while primary school for girls is present in only one of the villages. The unemployment rate for males is 28%.

All ten villages in the potential impact zone were surveyed. The villages belong to Seengaro Union Council. The estimated population of the villages is shown in **Exhibit V**. The villages are shown in **Exhibit VI**.

Exhibit V: Populations of Villages

Block II		*Potential Impact Zone*	
Surveyed Village	*Population*	*Surveyed Village*	*Population*
Aban Jo Tar	1,100	Baka Karan	500
Bitra	600	Jaman Samo	900
Noray Ji Wandh	60	Jodho Bheel	200
		Kachhibo je Dhani	210
		Kharo Jani	1,200
		Mithay Je Wandh	120
		Salah Jhanjhi	1,500

Exhibit VI: Map of the Study Area



Socioeconomic Setting

The largest settlement in the Study Area has a population of about 1,500. Limited permanent migration was observed in some villages. However, seasonal migration was seen in almost all of the villages. Seasonal migration is usually undertaken by the men of those households who have enough resources to leave their women and children behind, whereas poorer families are forced to migrate entirely. The statistics indicate that the population of the Study Area is relatively static, only moving seasonally, therefore showing attachment of the communities to their land.

The *Bheel* and *Kolhi* castes of the *Hindu* faith usually move with families and livestock to the 'barrage areas', canal-irrigated districts of Sindh province, for three to four months (February to April) every year to work there as seasonal agricultural labor to earn grains and supplement their small incomes at home, as well as feed their livestock with far richer fodder and grazing resources. These families move back with their earnings as soon as the first monsoon precipitation occurs enabling them to grow crops.

Ethno-Religious Composition

Villages in Tharparkar have Muslim and Hindu neighborhoods, and communities of different castes. Successive immigration has created a mosaic of cultures and ethnic groups but all have, in time, taken up similar means of livelihoods.

Despite these socio-cultural and economic differences, social interrelationships between the Hindus and Muslims, as well as among the various caste subgroups of both religious groups, are reported to be harmonious. There are almost no reported cases of conflicts, feuds, animal thefts, land disputes or other serious crimes.

Infrastructure and Services

In Tharparkar high quality (blacktop) roads form only about 28% of the total road length, and most parts of the district are covered by telephone and mobile phone services. The towns of Mithi and Islamkot have provision shops, medical stores, internet facilities and hotels. A weekly livestock market (*mal piri*) is also held at Mithi. However, the access to postal, police and local markets are relatively limited.

Housing

The majority of the housing units in rural Tharparkar are huts with pointed thatched roofs called *chaunras* and these are particular to the area. *Chaunras* are built on mud plastered platforms and have conical roofs covered with shrubs and grasses. Over 50% of the structures in the surveyed villages were *chaunras*, while only 12% were of *pakka* or masonry construction.

Water Supply and Sanitation

Water supply is one of the major problems faced by villages in rural Tharparkar. There are no rivers and perennial springs are rare (none in the Study Area). In addition, the underground water is brackish and saline and does not meet the WHO standards for drinking water. The main source of drinking water is therefore rainwater, which is collected in traditional channels called *tarais*, underground and overhead tanks, and earthen jars. A large number of underground and overhead tanks to catch and store rainwater for drinking purposes are used in the surveyed villages.

Health

A lack of adequate health facilities and a low awareness for health issues in Tharparkar is demonstrated by a high maternal mortality rate of 800 deaths per 100,000 live births in 1992, and a high infant mortality rate (IMR) of the district in 1992 at 150 (deaths per 1,000 live births); compared to a national IMR rate of 100 and that for Sindh at 98. Health services are mainly provided through basic health units (BHUs), rural health centers (RHCs) and district head quarter hospitals that are equipped for primary health care services and to some extent comprehensive emergency obstetric care services.

The most common ailments reported were cholera and diarrhea in children and tuberculosis in adults, followed by influenza and malaria. Almost all villages reported using local herbal medicines.

Education

Though literacy rates in Tharparkar are still well below those of Sindh and Pakistan, female literacy has doubled since 1998, with male literacy also increasing significantly. Tharparkar fares better nationally and provincially in terms of net primary enrollment rate, ranking Tharparkar 51st out of 98 national districts, and 7th out of 16 provincial districts.

Livelihoods

Results from the socioeconomic baseline survey show majority of the work force are occupied in agriculture and livestock rearing. Other occupations include skilled and unskilled labor, handicraft making, government and private jobs, and business and trade. Women were mostly employed in making handicrafts.

A large number of livestock was recorded in the surveyed villages. Livestock holding was found to be pre-dominantly goats and sheep, followed by cows and oxen, donkeys and camels. A small number of horses were also found in the surveyed villages.

Agriculture in the surveyed villages is rain-fed. The average land holding per landowner in the surveyed villages is less than 30 acres. Survey results show that crops grown in these villages include millet, guar, moth beans and mung beans. Sesame is generally cultivated mixed with other crops. There is only one cropping season in the summer (called *kharif* season) in which a variety of summer crops are grown.

The ratio of indebtedness in Tharparkar is reported as high (more than 80%) due to droughts and poverty. As options for borrowing are limited, the families rely on local money lenders for loans for which the interests range as high as 40% to 120%. Survey results show that indebtedness is common in all villages. Loans are usually taken from people within the village, or from money lenders in nearby towns with interest. The most common reasons for taking loans were reported to be marriages and treatment of illnesses.

Tharparkar has been consistently ranked as one of the most deprived districts provincially and nationally. In 2005, the provincial ranking for Tharparkar was 15th out of 16 districts in Sindh. Land is categorized by three major land uses, namely: (i) private housing lands; (ii) private agricultural lands; and, (iii) common grazing lands (locally known as *gaochar*). The locals claim that these lands have belonged to them since pre-historic

times, and they can use these lands as and when they need for any purpose. In contrast, the Government claims ownership of this land and states that the people have been allotted and allowed pieces of land for various purposes.

Culture

The Thar Desert has a number of sites of archaeological, religious and cultural significance, which include hills of Karunjhar and sacred places of worship for Hindus in Nagarparkar. The ancient religious architecture of the Thar and Parkar region is represented by a mosque and some Jain temples situated at different places, scattered mostly over southern Thar, around the small town of Nagarparkar (outside the Study Area). There are no designated sites of archeological significance in the Study Area.

Outcome of Stakeholder Consultation

Consultations were conducted in multiple phases. The communities in 10 villages (men and women), elected local government representatives, non-governmental organizations (NGOs), community based organizations (CBOs), press, and traders were consulted. The purpose of the consultations was to gather information about the concerns of affected communities regarding the Project, which would help define the stakeholder engagement requirements for the ESIA. The community elders and village activists raised several issues and gave a number of pertinent comments. The main issues and concerns emerging from these consultations related to relocation (not required for power plant), employment, and groundwater.

Potential Impacts and Management Measures

An exhaustive list of potential project-related impacts is provided in the report. The impacts are organized in three groups, potential environmental impacts, potential social impacts, and hazards with potential to cause environmental and community risks. For each of the potential impacts the corresponding conceptual management measures are also discussed. Impacts are defined where there is a plausible pathway between the project aspects and receptors. The potentially significant issues identified are discussed below.

Construction Impact

Some of the environmental and social impacts of construction activities relate to activities at the construction site whereas others relate to the setting up and operation of the construction crew camp. Typical issues include:

- Site clearance leading to dust emission
- Removal of vegetation leading to loss of vegetation cover
- Erosion and sedimentation due to large scale earthwork
- Air quality impact from operation of construction machinery and earthwork
- Noise and vibration from machinery and construction work
- Generation of waste and its disposal
- Off-site impacts such as those related to borrow pits

- Disposal of effluent from construction camp
- Cultural impact related to presence of non-local workers

Typically, the construction impacts are temporary and end with the completion of the construction activity. However, poor management can result in long-term residual impacts. To avoid adverse impact of the construction activities on the environment, following measures are proposed:

- To the extent possible, the camp of the construction contractor(s) will be located within the premises of Power Plant Site.
- The construction contractor will develop a specific construction management plan (CMP) based on the CMP included in the EMP. The CMP will clearly identify all areas that will be utilized during construction for various purposes using a site plan.

The plant construction and installation of equipment will generate considerable amount of waste. It will include metals (mainly iron and copper), concrete, wood, cotton, plastic, packing materials, electronic, and insulation material. A comprehensive Waste Management Plan will be instituted at TPC and re-use opportunities for waste generated during construction will be investigated. Hazardous waste identified, if any, will be segregated and stored in the Hazardous Waste Storage Facility to be constructed at the site.

Air Quality Impacts During Operation

The 2 × 330 MW power plant units are modeled with the following assumptions:

- Thar Lignite as fuel source
- Plant Efficiency 37.0% Net
- Control efficiencies: PM_{10} (99.9%), SO_2 (90%), and NOx (based on USEPA emission factor)
- Constant load factor of 85%

USEPA screening model AERSCREEN was used to simulate criteria pollutants from major sources in the project area and predict air quality impact for SO_2, NO_2 and PM_{10} and $PM_{2.5}$. This is a conservative model that gives the result including a margin of error.

There are no major schools or hospitals in Study Area. All villages falling in the Study Area are considered as sensitive receptors. There are about 30 villages in this zone. Three of the closest villages, Bitra (2.1 km), Kachhibo Je Dhani (3.8 km), and Jaman Samo (2.7 km) are considered in the evaluation.

The maximum concentration levels in ambient air are calculated for SO_2, NO_2, PM_{10}, and $PM_{2.5}$. The maximum concentration levels were modeled for 24-hour averaging period and annual averaging period to correspond with the NEQS requirements. The NEQS permit the 24-hour to be exceeded 2% of the time in a year, but not on two consecutive days. As it is not possible to assess the 98^{th} percentile using AERSCREEN only the maximum concentration was modeled. The maximum value gives the extreme high, highest concentration reached for a particular averaging period. The modeling is done for

two stack heights, 180 m and 220 m. The results presented here are for the 180 m stack. The concentration for 220 m is typically 3% lower than the 180 m results.

Ambient Air Quality

The compliance status of the project against the applicable standards and guidelines is summarized in **Exhibit VII**.

Exhibit VII: Compliance with Ambient Guidelines and Standards

		NEQS (µg/m³)	*IFC Guidelines (µg/m³)*	*Increment due to 2x330 MW (µg/m³)*	*Background (µg/m³)*
SO_2	Maximum 24–hr	120	125	61.1	5.7 ± 3.3
	Annual	80		12.2	
NO_2	Maximum 24–hr	80		39.8	3.5 ± 1.3
	Annual	40	40	8.0	
PM_{10}	Maximum 24–hr	150	150	1.7	137.2 ± 49.0
	Annual	120	70	0.3	
$PM_{2.5}$	Maximum 24–hr	35	75	0.69	24.3 ± 14.4
	Annual	15	35	0.13	

The exhibit indicates that compliance (comparison of project increment plus background concentration with the standards) with SO_2, and NO_2 ambient air quality standards are not an issue since they are well within limit. However, despite the fact the contribution of the power plant to PM_{10} and $PM_{2.5}$ levels are fraction of the existing levels, strict compliance with PM_{10} and $PM_{2.5}$ standards may not be achieved. The primary reason for noncompliance is high background PM_{10} and $PM_{2.5}$ levels in the area. It may be pointed out that the ambient air quality NEQS for $PM_{2.5}$ requires rationalization. The project proponent for one of the project has approached the SEPA in Government of Sindh for review of the $PM_{2.5}$ standards. SEPA has indicated its willingness to review the standards.

Stack Emission

The compliance status of the 600 MW project is shown in **Exhibit VIII**. It shows that the plant will meet the NEQS for emission parameters.

Exhibit VIII: Compliance with Emission Standards

Parameter	*Units*	*Standards*	*Emission*	*Notes*
Particulate matter	mg/Nm^3	500	16.4	Per stack
Sulfur oxides	Tons per day	100-500	33.8	From both stacks
Oxides of nitrogen	nanogram per Joule of heat input	260	144.1	Per stack

Ash Disposal and Gypsum Disposal

The annual ash produced from the Project will be about 256,000 tons. Options for disposal of fly ash and prospects for sale to the cement industry exist. Similarly, fly ash which constitutes about 70% of the total ash production can be used for manufacture of brick and cement blocks locally. If these options are not available, the total volume of the ash generated annually will be between 240,000 and 260,000 m^3. The overburden generated by the production of coal for the power plant will be about 80 times the ash generated from the power plant. The ash produced from the power plant can easily be mixed (with a ratio of about 1:80) with the overburden and disposed with it.

Gypsum can also be utilized in the cement industry. In absence of any recycling gypsum can gypsum can also be disposed with overburden.

Wastewater Discharge

The wastewater from the project includes the blowdown from cooling tower, blowdown from boilers and other sources most of which will be reused. However the waste generated from the desalination has to be disposed separately. It has been determined that the wastewater can be re-injected into the ground without having any impact on the groundwater resources. A complete assessment of this plan is underway.

For some of the low volume waste, an evaporation pond will be constructed at the site.

Socioeconomic Impacts

The Project activities will mainly result in positive socioeconomic impact on the existing socioeconomic environment locally as well as the broader region. The positive impacts include:

- Increased power generation reducing energy shortfall and reviving associated economy
- Additional employment opportunities, resulting in increased prosperity and wellbeing due to higher and stable incomes of employed people.

Pakistan is suffering from an acute energy crisis. The unreliable power supply is affecting the productive end-uses of power due to which the direct and multiplier benefits of productive activities are foregone and the economy incurs a loss. Due to the Project, 660 MW will be added to the system. The power generated by the Project would be supplied to various sectors that are currently impacted by the power shortages and bridge part of the energy shortfall facing the country. This, in turn, will have a positive impact on the country's economy through increase in gross domestic product (GDP). The impact will last through the life of the Project and thus, be of a long duration.

The Project will invest in equipment, construction materials, infrastructure and human resources. This investment and the return from the project will get distributed through wages, payments for procured goods and services, revenue to government and social investment for community development. The total economic impact of the Project will be the sum of the direct, indirect and induced impacts.

Employment Impact

The Project will create additional job opportunities. It is expected that more than 200 staff positions will be created under the Project. Most of these positions will be skilled, having expertise in handling the new equipment and processes. During construction period several thousand (typically 1,000- 2,000) people will be hired.

To maximize employment of people from within the Study Area in both the construction and operational phases of the Project, the Project will invest in training programs that focus on the Study Area. This investment will be needed to overcome the lack of education and skills in the labor force of the Study Area. The training programs will be implemented in time for local people to at least benefit from unskilled employment opportunities that are available during the construction phase of the Project. The proportion of locals in the workforce of the Project will increase over time as training programs are completed. Training and preparation of local people for jobs will also increase their access to indirect and induced employment opportunities.

The total employment impact for the construction phase will be more pronounced than the total employment impact for the operational phase since a higher number of unskilled workers will be required for the construction phase. However, the impact during the construction phase will be for a shorter duration than the impact during the operational phase.

The jobs created by the Project will lead to higher and more stable incomes than otherwise of people employed by the Project (directly and indirectly). This will increase prosperity and well-being within the local communities and is also expected to contribute to alleviating poverty in the Study Area. The impacts will be of more significance during the operational phase, rather than the construction phase, because of the longer duration of the operational phase.

Changes to Society

The economic opportunities created by the Project could result in in-migration of people, change social processes and practices, and increase economic inequality. The increased job opportunities offered by the Project and by service providers to the Project, in conjunction with the lack of opportunities available in the rest of Tharparkar District, will lead to an influx of job seekers in the Study Area. Some service providers to the Project may open new offices in the towns of Islamkot and Mithi, which are situated close to the Study Area. The influx of job seekers would lead to the development of informal settlements due to the absence of surplus housing stock. The rate of growth of informal settlements in and around the Study Area will be highest during the construction phase and decline in the operational phase.

Proposed mitigation, enhancement and good-practice measures include:

- Prohibit employment of non-locals from the Study Area or within Tharparkar District. In support of this, establish and raise awareness of recruitment offices for 'non locals' in identified locations outside of Tharparkar District (such as Karachi).
- In association with other community development programs, support local authorities in Mithi to increase their capacities to deliver services to an increased

population. Determine the nature of support, which may include town planning, waste management and access to basic health care and education.

- Encourage local communities to use the grievance procedure for concerns related to deterioration of local services and conflicts over land ownership.
- Work with the concerned legal and traditional authorities to establish land ownership in the Study Area before commencement of construction.
- Support local government in the management of informal settlement.
- Support NGOs specializing in informal settlements to assist local government.

In-migration of people in the Study Area can result in deterioration in public health due to increased chances of exposure to communicable diseases such as tuberculosis, diarrhea, and malaria. The potential spread of communicable diseases can be exacerbated by factors associated with the development of informal settlements.

Proposed mitigation, enhancement and good-practice measures include:

- Develop and implement management policies for tuberculosis, diarrhea, malaria and other communicable diseases, focusing on prevention, control, diagnosis and treatment in coordination with NGOs and local government.
- Provide health and hygiene education awareness programs to local communities, educational establishments and employees.
- Undertake health screening of employees.

The increase in income due to the Project can lead to inflation and economic inequality, which can have adverse impacts specifically on the economically poorer sections of the population. Proposed mitigation, enhancement and good-practice measures include:

- In association with the training measures indicated elsewhere, develop a training program targeted at local people living below the poverty line.
- In association with the community development measures, develop a program to create alternative employment creation initiatives aimed at local people living below the poverty line.

Social Conflicts

Negative perceptions about the Project could lead to tension and discord. Negative perceptions could result from unequal access to opportunities created by the Project, population influx and associated pressures on services and infrastructure, deterioration in public health and increases in social ills associated with the population influx, and deterioration in roads or traffic congestion as a result of the Project traffic. Disputes over the right to land and natural resources of the Study Area could also arise. Risks associated with the Project's infrastructure and activities, including concerns over human rights abuses, could also create tension within the communities in the Study Area. To mitigate these concerns, TPC will ensure that there is strong two-way communication between the Project and local communities in the Study Area.

Proposed mitigation, enhancement and good-practice measures include:

- Implement the Community Development Program in a 'fair and transparent' way.

- Maintaining regular communication with local communities and other stakeholders to minimize tensions arising from Project activities;
- Maintaining a grievance procedure to facilitate stakeholders in expressing concerns; and
- Establish a community based monitoring strategy to monitor the potential impacts on fisheries in conjunction with the Project monitoring plan.

Community Development

The community development initiatives described in this section are aimed at enhancing the economic growth benefits, mitigating possible negative impacts and promoting economic development that is sustainable. The initiatives, once undertaken, may result in further positive impacts, which are described in this section.

TPC intends, through its community development strategy, to support activities that advance the community's interests and contribute to its development, thus, benefiting the local communities. TPC's strategy will focus on community development activities that benefit the locals beyond the closure of the Project. It intends to provide support in a manner that avoids dependency on the mine after closure and ensures that the Project is viewed favorably by the local communities in the Study Area and within Tharparkar District. TPC anticipates giving preference to activities strengthening people's capacities to realize their own ambitions and to activities benefiting the community as a whole, instead of just individuals.

The initiatives may include skills development and capacity building of potential local employees; building capacity of local organizations and government; creation of alternative livelihoods resulting in sustainable socioeconomic development

Ecological Impacts

Any ecological impact from the project will be incremental over the impact of the mining. In the mining ESIA, it is stated that other than potential impact on the vulture habitat, no significant impact of the mining on the flora and fauna of the area are anticipated. No threatened mammals or reptiles are found in the Study Area. The habitat in the Thar Desert area is important for survival of vultures as one Endangered and three Critically Endangered species of vultures are breeding in the Thar Desert. Availability of nesting sites and food are principle factors that determine the population of vultures in an area. Clearing of land for power plant will reduce the potential habitat area of these vultures. While the trees for nesting and the feeding areas are widespread in the Thar Desert, a program for management of vulture population in the immediate vicinity and within Block II supported by the mining project will be required to contribute to the ongoing efforts of the Sindh Wildlife Department and other conservation groups in preventing the extirpation of this species from the Thar area. Vultures prefer to make nests on *Prosopis cineraria* trees in the Thar Desert. *Prosopis cineraria* trees can be planted outside the area that will be directly impacted by mining operations so the vultures can have access to alternate nesting sites. Such plantation may be started early during the project to minimize the potential impact of habitat loss during the construction period.

Environmental Management Plan

The main objective of the Environmental Management Plan (EMP) is to identify mechanisms to implement the environmental mitigation measures-. It is the fundamental tool that ensures that all mitigation measures are consolidated, their implementation responsibilities identified and the resources required to implement the measures are provided. Further, the EMP includes monitoring measures as a feedback mechanism on implementation and effectiveness of the mitigation measures.

EMP is prepared for all the identified environmental impacts during design, pre-construction, construction, operation, and closure stages. The methodology followed for preparing the EMP consists of the following steps:

- Identify mitigation and enhancement measures for each identified impacts and risks,
- Identifying the organization or person that would be responsible for implementing the measures,
- Developing a mechanism for monitoring the proposed mitigation measures.

The main components of the EMP include:

1. Mitigation Plan for design, construction, operation and maintenance phases.
2. Monitoring Plan for monitoring of environmental components and mitigation measures during implementation and operation stages. The objectives of the monitoring are to (i) monitor changes in the environment during various stages of the project life cycle with respect to baseline conditions; and (ii) manage environmental issues arising from construction works through closely monitoring the environmental compliances. A monitoring mechanism is developed for each identified impact and it includes:
3. Institutional Framework for Implementation of EMP
4. Reporting and Feedback Mechanism
5. Performance Indicators
6. Emergency Response Plan
7. Training Program
8. Construction Management Plan
9. Coal Dust Management Plan
10. Grievance Redress Mechanism
11. Change Management

Conclusion

The ESIA was conducted to comply with the national environmental regulations and best industry practice. For this purpose social, ecological and physical surveys were conducted over more than one season to established the baseline conditions. Some of the potential impacts identified in the ESIA include:

Impact on air quality impacts due to combustion of lignite

- Environmental and social impacts due to construction activities
- Traffic impact
- Ash disposal issue
- Occupational health and safety issues
- Socioeconomic impacts due to employment, in-migration, and cultural difference; and
- Ecological impacts

These issues have been discussed in the report and mitigation measures for these and other aspects have been proposed.

Assuming effective implementation of the mitigation measures and monitoring requirements as outlined in the Environmental Management Plan, the potential adverse environmental and social impacts of the proposed Project are likely to be within the acceptable limits.