APPLICATION

TO

THE REGISTRAR

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

BY

INDUS ENERGY LIMITED (IEL)

FOR

GENERATION LICENSE

FOR 31 MW

NEW BAGASSE BASED HIGH-PRESSURE COGENERATION POWER PLANT

AT INDUS SUGAR MILLS LIMITED, MAIN INDUS ROAD, KOT BAHADUR, DISTRICT RAJANPUR, PUNJAB, PAKISTAN

INDUS ENERGY LIMITED

Head Office:
17-Tipu Block, New Garden Town
Lahore. Ph: 042-35882801-03
Fax: (042) 35835180
info@indusenergy.com.pk

Ref. No. IEL/NEPRA/0032-2017

Dated: February 13, 2017

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

Subject: Application for a new Generation License of M/s Indus Energy Limited

Dear Sir

I, Muhammad Abbas Raza, General Manager(Power) being the authorized representative of M/S INDUS ENERGY LIMITED by virtue of Board Resolution dated 07th October, 2016, hereby apply to National Electric Power Regulatory Authority for grant of Generation license to the M/S INDUS ENERGY LIMITED pursuant to section (3) 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 provision 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.

Bank Draft No. PO. 0254.2865898 dated: February 02, 2017 in the sum of PKR 292,382/- (Pak Rupees Two Hundred Ninety Two Thousand Three Hundred and Eighty Two Only), and Bank Draft No. PO 0254.3104552 dated: February 06, 2017 in the sum of PKR 514/- (Pak Rupees Five Hundred and Fourteen Only)being the non-refundable license application fee calculated in accordance with the schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

We shall be pleased to provide any further information you may require.

We request an early action in this matter.

Thanking You.
For Indus Energy Limited

Muhammad Abbas Raza
General Manager (Power)

EXTRACT OF
BOD RESOLUTION
INDUS ENERGY LIMITED

INDUS ENERGY LIMITED

Head Office:
17-Tipu Block, New Garden Town
Lahore. Ph: 042-35882801-03
Fax: (042) 35835180
info@indusenergy.com.pk

EXTRACTS OF THE RESOLUTION OF BOARD OF DIRECTORS OF INDUS ENERGY LIMITED PASSED IN THEIR MEETING HELD ON OCTOBER 07, 2016 AT 17-TIPPU BLOCK, NEW GARDEN TOWN, LAHORE.

The Board of Directors of Indus Energy Limited, a Public Limited Company, duly formed and registered in the Islamic Republic of Pakistan having incorporation No. 0096891 (the Company) and having its registered office at 17--Tipu Block, New Garden Town, Lahore, in their meeting held on 07th October, 2016, passed the following resolution:

Unanimously resolved, that the Company should approach National Electric Power Regulatory Authority (NEPRA) for Generation License under the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

Further Resolved that Mr. Abdul Sattar Qureshi (Financial Advisor) and Mr. Muhammad Abbas Raza (General Manager-Power) are hereby jointly and/or singly authorized to do any or all of the following acts, deeds and things, on behalf of the company in connection with this application to be filed with NEPRA under the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 and the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999.

- Represent the Company before NEPRA and in doing so perform all lawful acts, deeds and things, including but not limited to filing, signing, presenting, modifying, amending, withdrawing applications and other documents, responding to any query and meeting any objections receiving notices and documents; and

- Do all acts, deeds and things, which are ancillary and incidental to the aforesaid purposes.

Further resolved, that extracts of this resolution be provided to the NEPRA with the seal/stamp duly affixed thereon.

Certified to be true copy

INDUS ENERGY LIMITED LAHORE

RANA SAEED AKHTAR
(Company Secretary)

CERTIFIED COPIES OF CERTIFICATE OF INCORPORATION AND MEMORANDUM & ARTICLES OF ASSOCIATION

INDUS ENERGY LIMITED

-- CERTIFICATE OF INCORPORATION

-- CERTIFICATE OF COMMENCEMENT OF BUSINESS

-- MEMORANDUM OF ASSOCIATION

-- ARTICLES OF ASSOCIATION

-- FORM A (ANNUAL RETURN)

A0074[illegible]

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, LAHORE

Company Registration Office

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. 0096891

I hereby certify that **INDUS ENERGY 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 **Lahore** this **Twenty Eighth** day of **December** Two **Thousand** and **Fifteen**.

CERTIFIED TO BE TRUE COPY

REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE

Fee Rs.622,000/-

(SHAUKAT HAMEED)
Joint Registrar

No.ARL/[illegible] DATED: 28-12-2015

021757

SECP

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

LAHORE

[Under section 146(2) of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No.**0096891**

CERTIFICATE FOR COMMENCEMENT OF BUSINESS

I hereby certify that the "INDUS ENERGY LIMITED" which was incorporated under the Companies Ordinance, 1984 (XLVII of 1984), on the 28th day of December, 2015 and which has filed a duly verified declaration in the prescribed form that the conditions of clauses (a) to (e) of sub-section (1) of section 146 of the said Ordinance have been complied with, is entitled to commence business.

Given under my hand at Lahore this 11th day of March, 2016 (Two Thousand and Sixteen).

Fee Rs.600/-

(LIAQAT ALI DOLLA)
Additional Registrar

No.ARL/ 23196 Dated: 11/03/16

THE COMPANIES ORDINANCE, 1984

-- :o: --

(PUBLIC COMPANY LIMITED BY SHARES)

-- :o: --

Memorandum of Association

of

INDUS ENERGY LIMITED

I. The name of the Company is "**INDUS ENERGY LIMITED**".

II. The Registered Office of the Company shall be situated in the Province of Punjab.

III. The objects for which the Company is established are all or any of the following (and in construing the following sub-clauses, the scope of no one of such sub-clauses shall be deemed to limit or affect the scope of any other such sub-clauses) :-

1. To carry on all or any of the businesses of generating, purchasing, importing, transforming, converting, distributing, supplying, exporting and dealing in electricity and all other forms of energy and power, and products or services associated therewith and of promoting the conservation and efficient use of electricity and to perform all other acts which are necessary or incidental to the business of electricity / power generation, transmission, distribution and supply, subject to permission from NEPRA/other regulatory authorities.

2. To identify, design, develop, construct, acquire, procure, install, manufacture, operate, maintain and own electricity generation stations using conventional and non-conventional fuel/energy resources (including natural gas, oil, coal, bagasse, solar, hydel, wind, bio-mass or any other energy resources whether indigenous or imported), fuel/energy resources supply chain and storage systems, water desalination plants and related facilities, power grid stations, transforming, switching, conversion, and transmission facilities, grid stations, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps and plant and equipment for combined heat and power schemes, together with such other activities as are necessary to carry out the foregoing, subject to permission from NEPRA/other regulatory authorities.

3. To engage in transmission and distribution of energy from/to public and private sector and any entity and to perform all acts directly or indirectly related or incidental to the business of the Company permitted under law, subject to permission from NEPRA/other regulatory authorities.

4. To take part in the formation, subsidizing, supervision or control of the business or operations of any company or undertaking and for this purpose to act as consultants, representatives or in any other capacity and to appoint and remunerate any directors, managers, accountants, other experts and agents.

5. To design, develop, construct, acquire, procure, manage, manufacture, operate, maintain and own power generation plants of all types and to carry on the business of electricity generation, power transmission and distribution services, over hauling and re-powering of power plants and to deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of electricity including electrical and other appliances cables, dry cells accumulators, lamps etc., and to work, generate, accumulate, distribute and supply electricity for the purpose of light, heat, motive power and for all other purposes for which electrical energy can be employed and to manufacture and deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of electricity, including in the term electricity all power that may be incidentally thereafter discovered in dealing with electricity.

6. To design, develop, construct, acquire, procure, manage, manufacture, operate, maintain and own combined heat and power generation [illegible] generation plants and to carry on the business of heat / steam generation, heat / steam transmission and distribution services, over hauling and re-powering of such plants and to deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of heat / steam and to work, generate, accumulate, distribute and supply heat / steam for all such purposes for which heat and steam can be employed and to manufacture and deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of heat / steam.

7. To act as consultants and render advisory and technical services in the field of civil, electrical, power, mechanical, chemical engineering and other engineering projects and to carry on the business of consultancy and contracts in public, government and private sectors in or outside Pakistan.

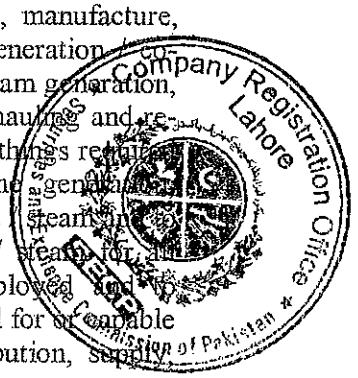
3. To engage in transmission and distribution of energy from/to public and private sector and any entity and to perform all acts directly or indirectly related or incidental to the business of the Company permitted under law, subject to permission from NEPRA/other regulatory authorities.

4. To take part in the formation, subsidizing, supervision or control of the business or operations of any company or undertaking and for this purpose to act as consultants, representatives or in any other capacity and to appoint and remunerate any directors, managers, accountants, other experts and agents.

5. To design, develop, construct, acquire, procure, manage, manufacture, operate, maintain and own power generation plants of all types and to carry on the business of electricity generation, power transmission and distribution services, over hauling and re-powering of power plants and to deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of electricity including electrical and other appliances cables, dry cells accumulators, lamps etc., and to work, generate, accumulate, distribute and supply electricity for the purpose of light, heat, motive power and for all other purposes for which electrical energy can be employed and to manufacture and deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of electricity, including in the term electricity all power that may be incidentally thereafter discovered in dealing with electricity.

6. To design, develop, construct, acquire, procure, manage, manufacture, operate, maintain and own combined heat and power generation / co-generation plants and to carry on the business of heat / steam generation, heat / steam transmission and distribution services, over hauling and re-powering of such plants and to deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of heat / steam and to work, generate, accumulate, distribute and supply heat / steam for all such purposes for which heat and steam can be employed and to manufacture and deal in all apparatuses and things required for or capable of being used in connection with the generation, distribution, supply, accumulation and employment of heat / steam.

7. To act as consultants and render advisory and technical services in the field of civil, electrical, power, mechanical, chemical engineering and other engineering projects and to carry on the business of consultancy and contracts in public, government and private sectors in or outside Pakistan.



8. To purchase, take on lease or in exchange, hire, apply for or otherwise acquire and hold for any interest, any rights, privileges, lands, building, easements, trade marks, 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 or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.

9. 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, trade marks, 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.

10. To purchase or acquire, protect, prolong and renew, whether in Pakistan or elsewhere, any patent rights, inventions, licenses, protections, concessions, and the like, which may appear likely to be advantageous or useful to the Company and to use, turn to account and / or manufacture under or grant licenses or privileges in respect of the same and to spend money in experimenting upon and testing in or improving or seeking to improve any patents, inventions or rights which the Company may acquire or propose to acquire.

11. To acquire, hold or dispose of investments in shares, modaraba certificates, term finance certificates, musharika certificates, unit trust certificates, mutual fund certificates, debentures, debenture stocks, bonds, obligations and securities issued or guaranteed by any company, any Government, commission, public body, authority, supreme, municipal, local or otherwise.

12. To engage in reforestation, and other works relating to pollution abatement and to acquire land for this purpose.

13. To form new entity or entities, and enter into joint ventures, for the purposes of the business of the Company.

14. To adopt such means of making known the products and business of the Company as may seem expedient and in particular by advertisement and publicity in the press or otherwise, exhibitions, publication of books and periodicals and by donations.

15. To conduct research and incur expenditure for the purposes of the Company's business.

16. To subscribe for, take, acquire or underwrite stocks, shares, bonds, mortgages, modaraba certificates participation term certificates, term finance certificates, obligations and securities of all kinds and purchase or otherwise acquire and undertaken all of any part of the business, property and liabilities of any person or company carrying on any business which the Company is authorized to carry on, or possessing property suitable for the purposes of this Company.

17. To borrow monies and funds and avail loans and finances, in local and foreign currencies, from any local or foreign bank, financial institution, non-banking finance company etc., and to obtain any banking or financial facility either funded or contingent either by way of term finance loan, export finance, current finance, overdraft arrangements, letter of credit facility, bills discounting facility, leasing facilities, morabaha facility, musharika facility, issuance of term finance certificates, sukuks, redeemable capital or other instrument or mode permitted under law, and to secure such borrowings, financing or facility by the Company's undertaking, properties, assets and guarantees.

18. To establish subsidiaries or associated companies, firms or entities and to carry on business in any part of Pakistan or in any part of the world, and to take such steps as may be necessary to give the Company such rights or privileges in any part of the world as are possessed by local corporations in such location.

19. To pay for any property or rights acquired by the Company, either in cash or fully paid shares or by the issue of securities, or partly in one mode and partly in another and generally on such terms as may be determined.

20. To draw, make, accept, endorse, discount, execute and issue cheques, promissory notes, bills of exchange, bills of lading, warrants, debentures and other negotiable or transferable instruments but not to act as a banking company.

21. To support and subscribe to any charitable or public object including donations to charitable and benevolent foundations and any institution, society, or club or for any purpose which may be for the benefit of the Company or its employees or may be connected with or for the benefit and welfare of any town or place where the Company carries on business, to give pensions, gratuities or charitable aid to any persons who may have been directors of or may have served the Company, or the wives, children, or other relatives or dependents of such persons to make payments towards insurance, and to form and contribute to provident and benevolent funds for the benefit of any such persons, or of their wives, children or other relatives or dependents.

Company Registration Office Lahore * Securities & Exchange Commission of Pakistan *

22. To establish, purchase, maintain and contribute to any pension, provident, gratuity, superannuation, retirement, redundancy, injury, death benefit or insurance funds, trusts, schemes, entities, or policies for the benefit of, and to give or procure the giving of pension, annuities, allowances, gratuities, donation, emoluments, benefits, of any description (whether in kind or otherwise), incentives, bonuses, assistance (whether financial or otherwise) and accommodation in such manner and on such terms as it thinks fit to, and to make payments for or towards the insurance of, any individuals who are or were at any time in the employment of, or directors or officers of (or held comparable or equivalent office in), or acted as consultants or advisers to or agents for, the Company or any company which is its holding company or is a subsidiary of the company or any such holding company, or any person to whose business the Company or any subsidiary of the company is, in whole or in part, a successor directly or indirectly or any person which is otherwise allied to or associated with the Company and to other individuals whose service has been of benefit to the Company or who the Company considers to have a moral claim on the Company, and the spouses, widows, widowers, families and dependents of any such individuals as aforesaid; and to establish, provide, manage and maintain and provide financial assistance to welfare, sports and social facilities, associations, clubs, funds and institutions which the Company considers likely to benefit or further the interests of any of the aforementioned individuals and spouses, widows, widowers, families and dependents of any such aforementioned individuals, and to mange, maintain, support and provide financial assistance to any such facility, association, club, fund, institution which has been established, provided for, managed, maintained., supported or subscribed to by any person to whose business the Company or any subsidiary of the Company is, in whole or in part, a successor.

23. To deal with the surplus monies of the Company not immediately required in such lawful form as may be thought expedient.

24. To open an account or accounts with any bank, financial institution, non-banking financial institution and to pay into and to withdraw monies from such account or accounts.

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

26. To promote a company to be registered or recognised in any foreign country or any place for the promotion of any business of the Company.

27. To enter into contracts or arrangements with any Government or Authority, Federal, Provincial, Municipal, Local or otherwise, public bodies or any corporations, companies or persons that may seem conducive to the Company's objects, or any of them and to obtain any licences, permits, authorisations as may be required in this regard.

28. To enter into partnership or arrangement in the nature of a partnership, cooperation or union of interest or amalgamation, with any person or persons, company or corporation engaged or interested or about to become engaged or interested in the carrying on or conduct of any business or enterprise which the Company is authorised to carry on or conduct or from which the Company would or might derive any benefit.

29. To sell or dispose of the whole of the undertaking of the Company or any part thereof in such manner and for such consideration as the Company may think fit and in particular for shares, debentures, debenture stock or securities of any other company whether promoted by this Company for the purpose or not.

30. To pay all preliminary expenses of any kind and incidental to the formation and incorporation of the Company out of the funds of the Company.

31. To pay any expenses incurred in connection with the formation, promotion and incorporation of the Company or to contract with any person, firm or company to pay the same, and to pay commission to brokers and others for underwriting, plain, selling, or guaranteeing the subscription of any shares, debentures, debenture stock or securities.

32. To distribute any of the Company's property among the members in specie or in any manner whatsoever in the event of winding up of the Company.

33. To accept shares, modaraba certificates, term finance certificates, musharika certificates, bonds, debentures or other securities of any other Company in payment or part payment of any services rendered or for any sale made to or debt owing from any such company.

34. To advance money to staff members, customers and others having dealing with the Company, with or without security, upon such terms as may deem expedient, but not to act as banking or finance company.

35. To guarantee the performance of the contracts and obligations of the Company, including in relation to the payment of any loan, debenture stock, bonds, obligations or securities by or in favor of the Company and/or any other person and to guarantee the payment or return on such investments or of dividends on any share of the Company.

36. To underwrite, acquire, hold or dispose of any shares, debentures, debenture stocks, modaraba certificates, musharika certificates, unit trust certificates, mutual fund certificates, term finance certificates, bonds, obligations or securities by original subscriptions, participation in syndicate, tender, purchase, exchange or otherwise and to guarantee the subscription thereof and to exercise and enforce all rights and powers conferred by or incidental to the ownership thereof.

37. To create any reserve fund, sinking fund, insurance fund or any other special fund whether for depreciation or for repairing, insuring, improving, extending, or maintaining any of the property of the Company or for any other purpose conducive in the interests of the Company.

38. To issue any share of the Company at par or at premium or at a discount, subject to any permission required by law.

39. To remunerate any person or company for services rendered or to be rendering in placing or assisting to place or guaranteeing the placing of or underwriting of any of the shares in the Company's capital or any debentures, debenture stocks or other securities of the Company, or in or about the formation and promotion of the Company or the conduct of this business.

40. To do all such other things as are incidental or conducive to the attainment of the above objects or any of them.

41. Notwithstanding anything stated in any object clause, the Company shall obtain such other approval or licence from the competent authority as may be required under any law for the time being in force, to undertake a particular business.

42. It is declared that notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association, nothing contained herein shall be construed as empowering the Company to undertake or indulge in the business of a banking company, non-banking finance company, leasing, investment managing agency or insurance business, directly or indirectly as restricted under the law or any other unlawful business operations. Furthermore, the Company shall not launch multilevel marketing, pyramid or Ponzi Schemes.

IV. The liability of the members is limited.

V. The Authorised Capital of the Company is Rs. 200,000,000/- (Rupees Two Hundred Million only) divided into 20,000,000 ordinary shares of Rs. 10/- (Rupees Ten each), with powers to the Company to increase or reduce, consolidate, sub-divide or otherwise reorganize the share capital of the Company in accordance with the provisions of the Companies Ordinance, 1984 and subject to any permission required under the law.

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

Name and Surname (Present & Former) in Full (in Block Letters)	C.N.I.C. No. (in case of foreigner, Passport No)	Father's / Husband's Name (in Full)	Nationality with any former Nationality	Occupation	Residential Address (in Full)	Number of shares taken by each subscriber	Signature
1. AYUB SABIR IZHAR	35202-2887441-9	*S/o* Izhar Ahmed Qureshi	Pakistani	Businessman	House No. 102 - C, Model Town, Lahore.	15,000 Fifteen Thousand	
2. GHULAM DASTGIR LAK	38403-1540536-1	*S/o* Jahan Khan	Pakistani	Businessman	House No. 415, Bahadur Shah Zafar Road, Old Civil Line, Sargodha.	15,000 Fifteen Thousand	
3. MASOOM ZEHRA	35202-2763286-6	*W/o* Malik Ahmed Arsalan Nawaz	Pakistani	Businessman	House No. 352, Block - III, Gulberg - III, Lahore.	15,000 Fifteen Thousand	
4. TASNEEM AKHTAR	38403-0261300-0	*W/o* Mehar Ghulam Dastgir Khan Lak	Pakistani	House Wife	House No. 415, Old Civil Line, Sargodha.	15,000 Fifteen Thousand	
5. SARDAR ALI RAZZA KHAN DRESHAK	35202-2958801-7	*S/o* Sardar Nasrullah Khan Dreshak	Pakistani	Business Woman	House No. 352 A - III, Gulberg - III, Lahore.	15,000 Fifteen Thousand	
6. MARGHOOB SHAKIR IZHAR	35202-9235130-1	*S/o* Izhar Ahmed Qureshi	Pakistani	Businessman	102 - C, Model Town, Lahore.	15,000 Fifteen Thousand	
					Total Number of Shares Taken	90,000 Ninety Thousand	

Company Registration Office Lahore Securities and Exchange Commission of Pakistan

CERTIFIED TO BE TRUE COPY

JOINT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE

Dated this 08th Day of December, 2015.

Witness:

National Institutional Facilitation Technologies (Pvt.) Ltd.
5th Floor, AWT Plaza,
I. I. Chundrigar Road,
Karachi.

THE COMPANIES ORDINANCE, 1984

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(PUBLIC COMPANY LIMITED BY SHARES)

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Articles of Association

of

INDUS ENERGY LIMITED

PRELIMINARY

1. The regulations in Table "A" in the First Schedule to the Companies Ordinance, 1984 shall not apply to the Company except as reproduced herein : Table 'A' Not to apply.

2. In these Articles, unless the context or the subject matter otherwise requires : Interpretation

(a) "Articles" means these Articles as originally framed or as from time to time altered in accordance with law.

(b) "Board" means a meeting of the Directors duly called and constituted or as the case may be, the Directors assembled at a Board.

(c) "Company" means "**INDUS ENERGY LIMITED**".

(d) "Directors" means the Directors for the time being of the Company or as the case may be, the Directors assembled at a Board.

(e) "Month" means calendar month according to the English Calendar.

(f) "Office" means the Registered Office for the time being of the Company.

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

(h) "Register" means, unless the context otherwise requires, the register of members to be kept pursuant to Section 147 of the Ordinance.

(i) "Seal" means the common or official Seal of the Company.

(j) "Section" means Section of the Ordinance.

(k) "Special Resolution" means the special resolution of the Company as defined in Section (2) (1) (36) of the Ordinance.

(l) Words importing masculine gender include the feminine gender.

(m) Words importing singular number include the plural number and vice versa.

(n) Expression referring to writing shall, unless the contrary intention appears, be construed as including references to printing, lithography, photography and other modes of representing or reproducing words in a visible form.

(o) Words importing persons shall include bodies corporate.

(p) The head notes are inserted for convenience and shall not affect the construction of these Articles.

(q) Unless the context otherwise requires words or expressions contained in these Articles shall bear the same meaning as in the Ordinance.

PUBLIC COMPANY

Public Company

3. The Company is a Public Company within the meanings of Section 2 (1) (30) of the Companies Ordinance, 1984.

CAPITAL

Capital

4. The Authorised Capital of the Company is Rs. 200,000,000/- (Rupees Two Hundred Million only) divided into 20,000,000 ordinary shares of Rs. 10/- (Rupees Ten only) each with powers to increase and reduce the Capital of the Company and to divide the shares in the Capital for the time being into several classes in accordance with the provisions of the Companies Ordinance, 1984.

Allotment of Shares

5. The Directors shall, as regards to any allotment of shares duly comply with such of the Provisions of Section 68 to 73 as may be applicable to the Company. The minimum subscription upon which the Directors may proceed to make the first allotment has been fixed as Rs. 500,000/-.

Shares Certificates

6. Every person whose name is entered as a member in the Register shall, without payment, be entitled to receive within ninety days after allotment or within forty-five days of the application for registration of transfer, a certificate under the Seal specifying the share or shares held by him and the amount paid up thereon. Provided that, in respect of a share or shares held jointly by several persons, the Company shall not be bound to issue more than one certificate, and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery to all.

Issuance of new Certificates

7. If a Share Certificate is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one rupee, and on such terms, if any, as to evidence and indemnity any payment of expenses incurred by the Company in investigating title as the Directors think fit.

Bar on use of Company Funds

8. Except to the extent and in the manner allowed by Section 95, no part of the funds of the Company shall be employed in the purchase of, or in loans upon the security of, the Company's shares.

TRANSFER OF SHARES

Transfer

9. The instrument of transfer of any share in the Company shall be 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.

Form of Transfer

10. Shares in the Company shall be transferred, without fee, in the following form, or in any usual or common form which the Directors shall approve;

I.....of..... in consideration of the sum of Rs.....Paid to me by..... of.....(hereinafter called the "Transferee") do hereby transfer to the Transferee.....the share(s) numbered..... to .....inclusive, in **INDUS ENERGY LIMITED** to hold into 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 I, the Transferee, do hereby agree to take the said share (or shares) subject to the conditions aforesaid.

As witness our hands this.....day of.....20

Transferor

_____

Signature

Transferee

_____

Signature

WITNESSES :

1. _____

(Signature)

2. _____

(Signature)

Full Address : _____

_____

_____

Full Address of _____

_____

_____

Non-refusal of Transfer of Shares

11. The Directors shall not refuse to transfer any fully paid shares unless the transfer deed is defective or invalid. The Directors may also suspend the registration of transfer prior to the determination of entitlement or rights of the shareholders by giving seven days previous notice in the manner provided in the Ordinance. The Directors may decline to recognize any instrument of transfer unless the duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the Directors may reasonably require to shows the right of the transferor to make the transfer

Notice in case of Refusal

12. If the Directors refuse to register a transfer of shares, they shall within thirty (30) days after the date on which the transfer deed was lodged with the Company send to the transferee and the transferor notice of the refusal indicating the defect or invalidity to the transferee, who, shall, after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the Company. The transferor or transferee or the person who gave intimation of the transmission by operation of law, as the case may be, may appeal to the commission against any refusal of the Company to register the transfer or transmission or against any failure on its parts within period as specified in Section 78 for which Section 78/A will be applicable.

TRANSMISSION OF SHARES

Transmission

13. The executors, administrators, heirs, or nominees as the case may be, of a deceased sole holder of a share shall be the only persons recognized by the Company as having any title to the shares. In the case of a share registered in the names of two or more holders, the survivor or survivors, or executors or administrators of the deceased survivor shall be the only persons recognized by the Company as having any title to the share.

Election to Register or Transfer

14. Any person becoming entitled to a share in consequence of the death or insolvency of a member shall, upon such evidence being produced as may from time to time be required by the Directors, have the right, either to be registered as a member in respect of the share or, instead of being registered himself, to make such transfer of the share as the deceased or insolvent person could have made ; but the Directors shall, in either case have the same right to decline or suspend registration as they would have had in the case of a transfer of the share by the deceased or insolvent person before the death or insolvency.

Rights of Person entitled by Transmission

15. 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.

ALTERATION OF CAPITAL

Power to Increase Capital

16. The Company may from time to time, by special resolution increase the share capital by such sum, to be divided into shares of such amount, as the resolution shall prescribe.

Offer to existing Members

17. Subject to the Provisions of the Ordinance, all new shares shall, before issue be offered to such persons as at the date of the offer are entitled to receive notices from the Company of General Meetings in proportion, as nearly as the circumstances admit, to the amount of the existing shares to which they are entitled. The offer shall be made by notice specifying the number of shares offered, and limiting a time within which the offer if not accepted, will be deemed to be declined and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the Directors may dispose of the same in such manner as they think most beneficial to the Company. The directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the Directors, be conveniently offered under this regulation.

18. Subject to the provisions of Section 87 of the Ordinance, the Company may issue ordinary shares or grant option to convert into ordinary shares the outstanding balance of any loans advances or credit or other non-interest bearing securities and obligations or having a term of not less than three years in the manner provided in any contract with any scheduled bank or financial institution to the extent of twenty per cent (20%) of such balance. Conversion of Loan to Ordinary shares

19. 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. Provisions applicable to new Shares

20. The Company may, by ordinary resolution : Consolidation and Subdivision

(a) Consolidate and divide its share capital into shares of larger amount than its existing shares ;

(b) Sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the Company's Memorandum of Association, subject, nevertheless, to the provisions to clause (d) of sub-section (1) of Section (92).

(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.

21. The Company may, by Special Resolution, reduce its share capital in any manner and with, and subject to any incident authorized and consent required by law. Reduction of Share Capital

GENERAL MEETINGS

22. The Statutory General Meeting of the Company shall be held within the period required by Section 157. Statutory Meeting

23. A General Meeting to be called Annual General Meeting, shall be held in accordance with provisions of Section 158, within eighteen months from the date of incorporation of the Company 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 as may be determined by the Directors. Annual General Meeting

24. All General Meetings of the Company other than the Annual General Meeting shall be called Extraordinary General Meetings. Other Meetings

Extraordinary Meeting

25. The Directors may whenever they think fit, call an Extraordinary General Meeting and Extraordinary General Meetings shall also be called on such requisition or in default, may be called by such requisitionists, as is provided by Section 159. If at any time there are not within Pakistan sufficient Directors capable of acting to form a quorum, any Director of the Company may call an Extraordinary General Meeting in the same manner as nearly as possible as that in which Meetings may be called by the Directors.

NOTICE AND PROCEEDINGS OF GENERAL MEETINGS

Notice of Meeting

26. Twenty one day 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 and, in case of special business,

the general nature of that business, shall be given in the manner provided by the Ordinance for the General Meeting, to such persons as are, under the Ordinance or the regulations of the Company, entitled to receive such notices from the Company; but the accidental omission to give notice to, or the non-receipt of notice by, any member shall not invalidate the proceedings at any General Meeting.

Special Business

27. All business shall be deemed special that is transacted at an Extraordinary General Meeting, and also all that is transacted at an Annual General Meeting, with the exception of declaring a dividend, the consideration of the accounts, balance sheet and the reports of the Directors and auditors, the election of Directors, the appointment of and the fixing, of the remuneration of the auditors.

Quorum

28. No business shall be transacted at any General Meeting unless a Quorum of members is present at that time when the meeting proceeds to business. Two members present personally who represent not less than twenty five per cent of the total voting power, either on their own account or as proxies shall be a quorum.

Effect of Quorum Not being present

29. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the 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, if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than two, shall be a quorum.

Chairman of Meeting

30. The Chairman of the Board of Directors, if any, shall preside as Chairman at every General Meeting of the Company, but if there is no such Chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as Chairman, any one of the Directors present may be elected to be Chairman, and if none of the Directors is present, or willing to act as Chairman, the members present shall choose one of their member to be Chairman.

Adjournment

31. The Chairman may, with the consent of any meeting at which a Quorum is present (and shall if so directed by the meeting), adjourn the meeting from time to time but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting.

32. 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 result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the Chairman 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 of the proceedings of the Company shall be conclusive evidence of the fact, without proof of the number or proportion or the votes recorded in favour of, or against, that resolution. Voting

33. A Poll may be demanded only in accordance with the provisions of Section 167. Demand for Poll

34. If a Poll is duly demanded it shall be taken in accordance with the manner laid down in Section 168 and the result of the Poll shall be deemed to be the resolution of the meeting at which the Poll was demanded. Manner of taking Poll

35. A Poll demanded on the election of Chairman or on a question of adjournment shall be taken at once. Time of taking Poll

36. In the case of an equality of Votes, whether on a show of hands or on a poll, the Chairman of the meeting at which the show of hands takes place, or at which the Poll is demanded, shall have and exercise a second or Casting Vote. Casting Vote

VOTES OF MEMBERS

37. On a show of hands every member present in person shall have one Vote except for election of Directors in which case the provisions of Section 178 shall apply. On a Poll every member shall have voting rights as laid down in Section 160. Right [illegible]

38. In case of Joint holders, the Vote of the senior who tenders a Vote, 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 the names stand in the register. Voting by Joint Holders

39. 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 show of hands or on a poll, by his committee or other legal guardian, and any such committee or guardian, on a poll vote by proxy. Member of Unsound Mind

40. On a poll vote may be given either personally or by proxy. Provided that nobody corporate shall vote by proxy as long as a resolution of its Directors in accordance with the provisions of Section 162 is in force. Voting by Corporation Representations

41. The instrument appointing a Proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing. A Proxy must be a member of the Company. Proxy to be in Writing

Instrument appointing Proxy to be deposited

42. The Instrument appointing a Proxy and the power of attorney or other authority (if any) under which it is signed, or a notarial certified copy of that power or authority, shall be deposited at the Registered 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.

43. An instrument appointing a proxy may be in the following form or a form as near thereto as may be.

INDUS ENERGY LIMITED

Form of Proxy

44 I/We ..... of ..... (full address) being the member(s) of **INDUS ENERGY LIMITED** hereby appoint Mr. / Mrs. / Miss ..... of ..... (who is also member of the Company vide Registered Folio No. ..... (being member of Company) as my / our Proxy to attend at and vote for my / us and on my / our behalf at the ..... Annual / Extra Ordinary General Meeting of the Company to be held at ..... on ..... at ..... and at any adjournment thereof.

Revocation of Authority

45. 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 share 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.

DIRECTORS

Number of Directors

46. Unless otherwise determined by the Company in General Meeting the number of Directors shall not be less than three and if the Company applies for listing on Stock Exchanges, then the number of Directors shall not be less than seven.

First Directors

47. The following are the First Directors of the Company who shall hold office till the first Annual General Meeting.

1. **AYUB SABIR IZHAR**
2. **GHULAM DASTGIR LAK**
3. **SARDAR ALI RAZA KHAN DRESHAK**
4. **TASNEEM AKHTAR**
5. **MASOOM ZEHRA**
6. **MARGOOB SHAKIR IZHAR**

qualification of Directors

48. Save as provided in Section 187, no person shall be appointed as a Director unless he is a member of the Company and holds shares of the minimum value of Rs. 10,000/- in his own name relax able in the case of Directors representing interest holding shares.

49. The remuneration of a Director for performing extra services, including holding of the office of Chairman, and the remuneration to be paid to any Director for attending the meetings of the Directors or a committee of Directors shall from time to time be determined by the Board of Directors in accordance with law. Remuneration of Directors

CHAIRMAN

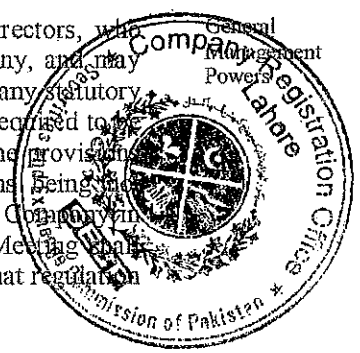
50. The Directors may from time to time appoint one of their members to be the Chairman of the Company for a period not exceeding three years on such terms and conditions as they deem fit. The Chairman shall preside over the meetings of the Board of Directors and members of the Company. In his absence, the Directors may elect one of them to preside over the Board Meeting. The questions arising at the meeting of the Directors shall be decided by a majority of votes. In the case of equality of votes, the Chairman, or the Director presiding over the meeting, as the case may be, shall have a casting vote. Chairman

CHIEF EXECUTIVE

51. The first Chief Executive of the Company will be appointed by the Board of Directors within fifteen days from the date of incorporation of the Company who shall hold office till the first Annual General Meeting. Chief Executive

POWERS AND DUTIES OF DIRECTORS

52. The business of the Company shall be managed by the Directors, who may pay all expenses incurred in promoting and registering the Company, and may exercise all such powers of the Company as are not by the Ordinance or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the Company in General Meeting, subject nevertheless to the provisions of the Ordinance or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed 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 that regulation had not been made. General Management Powers



BORROWING POWERS

53. The Board may from time to time borrow any money for the purposes of the Company from its members or from any other person, firms, companies, corporations, Government Agencies, institutions or the Directors may themselves lend moneys to the Company. Borrowing Powers and giving of Securities

54. The Board may raise and secure payment of such sums of money in such manner and upon such terms and conditions in all respects as it may think fit, and in particular by the issue of TFC's bonds, perpetual or redeemable debentures or by mortgage or charge or other security on the whole or any part of the property, assets and rights of the Company (both present and future), of the Company. Raising Moneys

Condition of Bond / Securities

55. Any TFC's, bonds, debentures or other securities issued or to be issued by the Company shall be under the control of the Board which may issue them upon such terms and conditions and in such manner and for such consideration as shall be considered to be for the benefit of the Company.

Special Powers to Issue Securities

56. Any TFC's, bonds, debentures or other securities may be issued with any special privileges as to redemption, surrender, drawing, convertibility into shares, attending and voting at General Meetings of the Company, appointment of Directors, and otherwise, provided that debentures with the right to vote or to be converted into shares shall be issued with the consent of the Company in General Meeting in terms of Section 114 of the Ordinance.

Power to appoint Attorney

57. The Directors may from time to time, by Power of Attorney under the Company's seal, appoint any person or persons to be the 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 presents) and for such period and subject to such conditions as the Directors may from time to time think fit. Any such attorney(s) may, if authorised by the Directors, delegate all or any of the powers vested in him/them.

Duties of Directors

58. The Directors shall duly comply with the provisions of the Ordinance and in particular with the provisions in regard to the registration of the particulars of mortgages and charges affecting the property of the Company or created by it, to the keeping of a register of the Directors, and to the sending to the Registrar of an annual list of members and a summary of particulars relating thereto and notice of any consolidation or increase of share capital, or sub-division of shares, and copies of Special Resolutions and a copy of the register of Directors and particulars of any changes therein.

Minutes Books

59. The Director shall cause minutes to be made in books provided for the purpose of :

(a) all appointments of officers made by the Directors ;

(b) the names of the Directors present at each meeting of the Directors and of any Committee of the Directors ;

(c) all resolutions and proceedings at all meetings of the Company and of the Directors and of Committees of Directors;

(d) and every Director present at any meeting or Directors of Committee of Directors shall sign his name in a book to be kept for that purpose.

DISQUALIFICATION OF DIRECTORS

Disqualification of Directors

60. No person shall become a Director of the Company if he suffers from any of the disabilities or disqualifications mentioned in Section 187 and, if already a Director, shall cease to hold such office from the date he so becomes disqualified or disabled or provided, however, that no Director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for the Company but such Director shall not vote in respect of any such contract or work, and if he does so his vote shall not be counted.

PROCEEDINGS OF DIRECTORS

Meeting of Directors

61. The Directors may meet together for the despatch of business, adjourn and otherwise regulate their meetings, as they think fit. The quorum for a meeting of Directors shall not be less than one-third or two, whichever is greater. Questions arising at any meeting shall be decided by a majority of votes. In case of an equality of votes, the Chairman shall have and exercise a second or casting vote. A Director may, and the secretary on the requisition of a Director shall, at any time, summon a meeting of Directors. It shall not be necessary to give notice of a meeting of Directors to any Director for the time being absent from Pakistan.

Chairman of Directors Meetings

62. The Directors may elect a Chairman of their meetings and determine the period for which he is to hold office but, if no such Chairman is elected, or if at any meeting the Chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as Chairman, the Directors present may choose one of their number to be Chairman of the meeting.

Committee

63. The Directors may delegate any of their powers not required to be exercised in their meeting to Committees consisting of such member or members of their body as they think fit. Any Committee so formed shall, in the exercise of the powers so delegated, conform to any restrictions that may be imposed on them by the Directors.

Chairman of Committee Members

64. A Committee may elect a Chairman of its meetings, but, if no such Chairman is elected, or if at any meeting the Chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as Chairman, the members present may choose one of their numbers to be Chairman of the meeting.

65. A Committee may meet and adjourn as it thinks proper. Questions arising [illegible] at any meetings shall be determined by a majority of votes of the members present [illegible] case of an equality of votes, the Chairman shall have and exercise a second or casting vote.

Validity of Directors Acts

66. All acts done by any meeting of the Directors or of a committee of Directors, or by any person acting as a Director, shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of such Directors or persons acting as aforesaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be a Director.

Resolution in Writing

67. A resolution in writing circulated to all the Directors signed by all the Directors or affirmed by them through telex or telegram shall be as valid and effectual as if it had been passed at a meeting of the Directors duly convened and held.

ELECTION AND REMOVAL OF DIRECTORS

Election & Term of Directors

68. At the first Annual General Meeting of the Company, all the Directors shall stand retired from office, and thereafter shall be re-elected in their place in accordance with Section 178 for a term of three years.

Eligibility for Re-election

69. A retiring Director shall be eligible for re-election.

Mode of Election

70. The Directors of the Company, unless the number of persons who offer themselves to be elected is not more than the number of Directors fixed by the Board of Directors, shall be elected to office by the members in General Meeting in the following manner :

(a) A member shall have such number of votes as is equal to the product of the number of voting shares or securities held by him and the number of Directors to be elected.

(b) A member may give all his votes to a single candidate or divide them between more than one of the candidates in such manner as he may choose.

(c) The candidate who gets the highest number of votes shall be declared elected as Director and then the candidate who gets 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.

Change in number of Directors

71. Subject to the provisions of the Ordinance, the Company may from time to time in General Meeting increase or decreases the number of Directors.

Filling of Casual Vacancy

72. Any Casual vacancy occurring on the Board of Directors may be filled up by the Directors, but the person so chosen shall be subject to retirement at the same time as if he had become a Director on the day on which the Director in whose place he is chosen was last elected as Director.

Removal of Director

73. The Company may remove a Director but only with compliance with the provisions of the Ordinance.

NOMINEE DIRECTOR

74. In addition to the elected Directors, the Financial Institutions shall be entitled, during the currency of their respective loan(s) to the Company, to appoint one person on the Board of Directors of the Company to be called Nominee Director and to recall and/or replace such a person from time to time. Such Nominee Director on the Board of Directors of the Company may not be holder of Share(s) in the Capital of the Company and the Articles 67 to 72 and other regulations and or rules pertaining to the election, retirement, qualification and/or disqualification of the Director shall not apply to him.

THE SEAL

Common Seal

75. The Directors shall provide a Common Seal of the Company which shall not be affixed to any instrument except by the authority of a resolution of the Board or by a committee of Directors authorised in that behalf by the Directors, and two Directors of one Director and the secretary of the Company shall sign every instrument to which the Common Seal is affixed.

76. The Directors may provide for the use in any territory, district or place not situated in Pakistan, of an Official Seal which shall be a facsimile of the Common Seal of the Company, with the addition on its face of the name of every territory, district or place where it is to be used. The provisions of Section 213 shall apply to the use of the Official Seal. Official Seal

DIVIDENDS AND RESERVES

77. The Company in General Meeting may declare dividends but no dividend shall exceed the amount recommended by the Directors. Declaration of Dividends

78. The Directors may from time to time pay to the members such interim dividends as appear to the Directors to be justified by the profits of the Company. Interim Dividends

79. No dividend shall be paid otherwise than out of profits of the year or any other undistributed profits. Dividends Payable out of Profits

80. Subject to the rights of persons (if any) entitled to shares, all dividends shall be declared and paid according to the amounts paid on the shares, but if and so long as nothing is paid upon any of the shares in the Company, dividends may be declared and paid according to the amounts of the shares. Dividends Payable on Amount Paid on Shares

81. The Directors may, before recommending any dividend 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 equalizing dividends, or for any other purpose to 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 (other than shares of the Company) as the Directors may, subject to the provisions of the Ordinance, from time to time think fit. Reserve Fund

82. The Directors may carry forward any profits which they may think prudent not to distribute, without setting them aside as a reserve. Profit carried Forward

83. Any General Meeting may resolve that any moneys, investments, or other assets forming part of the undivided profits of the Company standing to the credit of any reserve or other fund or in the hands of the Company and available for dividend (or representing premiums received on the issue of shares and standing to the credit of the shares premium account) be capitalized and distributed amongst such of the shareholders as would be entitled to receive the same if distributed by way of dividend and in the same proportions on the footing that they become entitled thereto as capital and that all or any part of such capitalized fund be applied on behalf of such shareholders in paying up in full, any unissued shares, debentures or debenture-stock of the Company which shall be distributed accordingly and that such distribution or payment shall be accepted by such shareholders in full satisfaction of their interest in the said capitalized sum. Capitalization of Reserve

Effect of Transfer

84. A transfer of shares shall not pass the right to any dividend declared thereon before the registration of the transfer.

Dividends to Joint Holders

85. If several persons are registered as joint holders of any share, any one of them may give effectual receipt for any dividend payable on the shares.

Notice of Dividend

86. Notice of any dividend that may have been declared shall be given in the manner hereinafter mentioned to the persons entitled to share therein.

Period for Payment of Dividend

87. The dividend shall be paid within the period laid down in Section 251.

Unclaimed Dividends

88. All dividends unclaimed for six years after having been declared shall be kept in trust by the Company but may be invested or otherwise made use of by the Directors for the benefit of the Company until claimed.

ACCOUNTS

Books of Account

89. The Directors shall cause to be kept proper Books of Account as required under Section 230.

Place where Books kept

90. 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 always be open to inspection by the Directors during business hours.

Inspection by Members

91. 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 Book or papers of the Company except as conferred by law or authorised by the Directors or by the Company in General Meeting.

Annual Accounts

92. The Directors shall as required by Sections 233 and 236 caused to be prepared and to be laid before the Company in General Meeting such Profit and Loss Accounts and Balance Sheets and reports as are referred to in those sections.

Balance Sheet and Profit and Loss Account

93. A Balance Sheet, Profit and Loss Account, and other reports referred to in the preceding Article shall be made out in every year and laid before the Company in the Annual General Meeting made up to a date not more than four 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 Directors.

Copy of Accounts to be sent to Members

94. A copy of the Balance Sheet and Profit and Loss Account and reports of Directors and auditors shall, at least twenty one days preceding the meeting, be sent to the persons entitled to receive notices of General Meetings in the manner in which notices are to be given as hereinafter provided.

When Accounts Settled

95. Every Account of the Directors when audited and approved by a General Meeting shall be conclusive except as regards any errors discovered therein within three months next after the approval thereof. Whenever any such error is discovered within that period the account shall forthwith be corrected and thenceforth shall be conclusive.

Compliance with Ordinance

96. The Directors shall in all respect comply with the provisions of Sections 230 to 236.

AUDIT

Audits

97. Once at least every year the accounts of the Company shall be audited and the correctness of Profit and Loss Account and Balance Sheet ascertained by one or more Auditors. The Auditors shall be appointed and their duties regulated in accordance with Sections 252 to 255 of the Companies Ordinance 1984.

SECRETARY

Secretary

98. The Board may appoint a Secretary of the Company who shall perform such functions and duties as are required in these Articles, or as may be directed by the Board.

NOTICES

Notice to Members etc.

99. Notices shall be given by the Company to Members and Auditors of the Company and other persons entitled to receive notices in accordance with Section 50.

SECRECY

Secrecy

100. Every Director, Manager, Adviser, Auditor, Trustee, Member of [illegible] Committee, Officer, Servant, Agent, Accountant or other person employed in the business of the Company shall, if so, required by the Directors, before entering upon his duties, sign a declaration pledging himself to observe a strict secrecy respecting all transactions of the Company with its customers and the state of accounts with individuals and in matters relating thereto, and shall by such declaration pledge himself not to reveal any of the matters which may come to his knowledge in the discharge of his duties except when required to do so by the Directors or by any General Meeting or by any Court of Law and except so far as may be necessary in order to comply with any of the provisions in these presents.

DISPUTE RESOLUTION

Dispute Resolution

101. In the event that a dispute, claim or controversy arises between the company, its management and its shareholders, or between the shareholders inter-se, or the Directors inter-se, all steps may be taken to settle the dispute and resolve the issue through mediation by an accredited mediator before taking recourse to formal dispute resolution such as arbitration or litigation.

Members access to Company premises

102. No member or other person (not being a Director) shall be entitled to enter upon the property of the Company or examine the Company's premises or properties without the permission of the Directors, and to require discovery of or any information respecting any detail of the Company's trading or any matter which is or may be in the nature of a trade secret, mystery of trade, or secret process or of 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 communicate.

RECONSTRUCTION

Reconstruction

103. On any sale of the undertakings of the Company the Directors or the liquidators on a winding up may, if authorised by a Special Resolution, accept fully paid shares, debentures or securities of any other company, either then existing or to be formed for the purchase in whole or in part of the property of the Company, and the Directors (if the profits of the Company permit), or the liquidators (in a winding up), may distribute such shares or securities, or any other properties of the Company amongst the members without realization, or vest the same in trustees for them and any Special Resolution may provide for the distribution or appropriation of the cash, shares or other securities, benefits or property, otherwise than in accordance with the strict legal rights of the members or contributories of the Company for the valuation of any such securities or property at such price and in such manner as the meeting may approve and all holders of shares shall be bound to accept and shall be bound by any valuation or distribution so authorised and waive all rights in relation thereto save only such statutory rights (if any) as are, in case the Company is proposed to be or in the course of being wound up, incapable of being varied or excluded by these presents.

WINDING UP

Division and Distribution of Assets upon Dissolution

104. 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 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 same kind or not) and may, for such purpose, set such value as he deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the members or different classes of members. 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, shall think fit, but so that no member shall be compelled to accept any shares or other securities whereon there is any liability.

INDEMNITY

Indemnification

105. Every officer or agent for the time being of the Company may be indemnified out of the assets of the Company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the Company, except those brought by the Company against him, in which judgment is given in his favor or in which he is acquitted, or in connection with any application under Section 488 in which relief is granted to him by the Court.

ARBITRATION

Difference to be Referred to Arbitrator(s)

106. Whenever any difference arises between the Company on the one hand and any of the members, their executors, administrators or assignees on the other hand, touching the true intent or construction, or the incident or consequences of these Articles or of the statutes or touching anything there or thereafter done, executed, omitted or suffered in pursuance of these Articles or of the statutes or touching any breach or alleged breach of these Articles, or any claim on account of any such breach or alleged breach, or otherwise relating to the premises, or to these Articles or to any statute affecting the Company or to any of the affairs of the Company, every such difference shall, as a condition precedent to any other action at law be referred in conformity with the Arbitration Act, 1940, or any statutory modification thereof and any rules made thereunder, to the decision of an Arbitrator to be appointed by the parties in difference or if they cannot agree upon a single Arbitrator to the decision of two Arbitrators of whom one shall be appointed by each of the parties in difference, or in the event of the two Arbitrators not agreeing, then of an umpire to be appointed by the two Arbitrators, in writing, before proceeding on the reference, and such decision shall be final and binding on the parties.

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 as set opposite to our respective names.

Name and Surname (Present & Former) in Full (in Block Letters)	C.N.I.C. No. (in case of foreigner, Passport No)	Father's / Husband's Name (in Full)	Nationality with any former Nationality	Occupation	Residential Address (in Full)	Number of shares taken by each Subscriber	Signatures
1. AYUB SABIR IZHAR	35202-2887441-9	S/o Izhar Ahmed Qureshi	Pakistani	Businessman	House No. 102 - C, Model Town, Lahore.	15,000 Fifteen Thousand	
2. GHULAM DASTGIR LAK	38403-1540536-1	S/o Jahan Khan	Pakistani	Businessman	House No. 415, Bahadur Shah Zafar Road, Old Civil Line, Sargodha.	15,000 Fifteen Thousand	
3. MASOOM ZEHRA	35202-2763286-6	W/o Malik Ahmed Arsalan Nawaz	Pakistani	Businessman	House No. 352, Block - III, Gulberg - III, Lahore.	15,000 Fifteen Thousand	
4. TASNEEM AKHTAR	38403-0261300-0	W/o Mehar Ghulam Dastgir Khan Lak	Pakistani	House Wife	House No. 415, Old Civil Line, Sargodha.	15,000 Fifteen Thousand	
5. SARDAR ALI RAZZA KHAN DRESHAK	35202-2958801-7	S/o Sardar Nasrullah Khan Dreshak	Pakistani	Business Woman	House No. 352 A - III, Gulberg - III, Lahore.	15,000 Fifteen Thousand	
6. MARGHOOB SHAKIR IZHAR	35202-9235130-1	S/o Izhar Ahmed Qureshi	Pakistani	Businessman	102 - C, Model Town, Lahore.	15,000 Fifteen Thousand	
					Total Number of Shares Taken	90,000 Ninety Thousand	

CERTIFIED TO BE TRUE COPY

JOINT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE

Dated this 08th Day of December, 2015.

Witness:

National Institutional Facilitation Technologies (Pvt.) Ltd.
5th Floor, AWT Plaza,
I. I. Chundrigar Road,
Karachi.

THIRD SCHEDULE

(Se section 156)

FORM A - ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL

1. Registration No.	0096691
2. Name of the Company	INDUS ENERGY LIMITED
3. Form A made upto (Day/Month/Year)	31/10/2016
4 Date of AGM (Day/Month/Year)	31/10/2016

PART - A

5 Registered Office Address	17-TIPU BLOCK, NEW GARDEN TOWN LAHORE Punjab
6. Email Address	rsaeed@itcomrade.net
7. Office Tel. No.	04235852801
8. Office Fax No.	04235835180
9. Nature of Business	-POWER GENERATION - ALLIED (OTHER)

10. Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares		200,000,000.00	

11. Paid upShare Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares		900,000.00	

12. Amount of indebtedness on the date upto which form A is made in respect of all Mortgages/Charges	0.00

13. Particulars of the holding company

Name			
Registration No.		% Shares Held	

14. Chief Executive

Name	AYUB SABIR IZHAR	NIC	35202-2887441-9
Address	102-C, MODEL TOWN, LAHORE, Punjab		

Next Page

Company Registration Office Lahore Securities and Exchange Commission of Pakistan

15. Chief Accountant

Name | NIC

Address

16. Secretary

Name: RANA SAEED AKHTAR | NIC: 35301-1979565-5

Address: 17-TIPU BLOCK, NEW GARDEN TOWN, LAHORE, Punjab

17. Legal Advisor

Name: CORNELIUS, LANE AND MUFTI

Address: NAWA-E-WAQT HOUSE, 4, SHAHRAH-E-FATIMA JINNAH, LAHORE

18. Auditors

Name: Grant Thornton Anjum Rehman Chartered Acc

Address: 1-Inter Floor, Eden Center, 43- Jail Road, Lahore.

Company Registration Office Lahore Securities and Exchange Commission of Pakistan

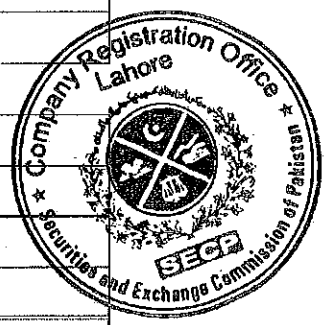
19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC / Passport No. if foreigner
AYUB SABIR IZHAR	102-C, MODEL TOWN LAHORE Punjab Pakistan	Pakistan	35202-2884479-9
GHULAM DASTGIR LAK	H. NO. 415, BAHADURSHAH ZAFAR ROAD, OLD CIVIL LINE, SARGODHA Punjab Pakistan	Pakistan	38403-1540536-1
MARGHOOB SHAKIR IZHAR	102-C, MODEL TOWN LAHORE Punjab Pakistan	Pakistan	35202-9235130-1
MASOOM ZEHRA	352-A-III, GULBERG-III LAHORE Punjab Pakistan	Pakistan	35202-2763286-6
SARDAR ALI RAZA KHAN DRESHAK	352-A-III, GULBERG-III LAHORE Punjab Pakistan	Pakistan	35202-2958801-7
TASNEEM AKHTAR	H. NO. 415, BAHADURSHAH ZAFAR ROAD, OLD CIVIL LINE, SARGODHA Punjab Pakistan	Pakistan	38403-0261300-0

Previous Page | Next Page

19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No. if Foreigner)

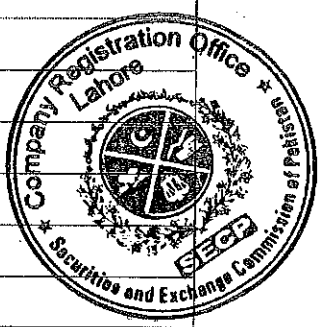


Previous Page Next Page

PART-B

20. List of members & debenture holders on the date upto which this Form A is made

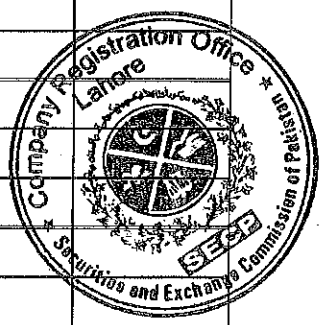
Folio	Name of Members/Debenture Holders	Address	Nationality	No. of Shares	NIC (Passport No. if Foreigner)
1	AYUB SABIR IZHAR	102-C, MODEL TOWN, LAHORE	Pakistan	15000	35202-2887441-9
2	GHULAM DASTGIR LAK	H. NO. 415, BAHADURSHAH ZAFAR ROAD, OLDCIVIL LINE,	Pakistan	15000	38403-1540536-1
3	MASOOM ZEHRA	352-A-III, GULBERG-III, LAHORE	Pakistan	15000	35202-2763286-6
4	MARGHOOB SHAKIR IZHAR	102-C, MODEL TOWN, LAHORE	Pakistan	15000	35202-9235130-1
5	SARDAR ALI RAZA KHAN DRESHAK	352-A-III, GULBERG-III, LAHORE	Pakistan	15000	35202-2958801-7
6	TASNEEM AKHTAR	H. NO. 415, BAHADURSHAH ZAFAR ROAD, OLD CIVIL	Pakistan	15000	38403-0261300-0

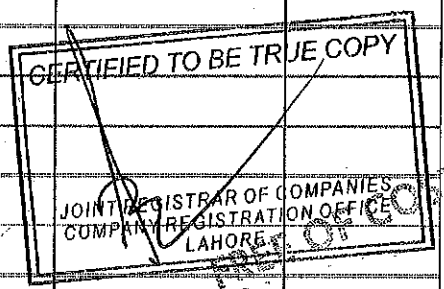


Previous Page Next Page

21. Transfer of shares (debentures) since last Form A was made

No.	Name of Transferor (Members)	Name of Transferee	Number of Shares Transferred	Date of Registration of





22. I certify that this return and the accompanying statements state the facts correctly and completely as on the date upto which this Form-A is made

Date (DD/MM/YYYY) 13/12/2016

Signature MASOOM ZEHRA

Designation

- ☐ Chief Executive
- ☐ Secretary
- ☑ Director check appropriate button

< Previous Page | Next Page >

INSTRUCTIONS FOR FILLING FORM-A

1. The form shall be made upto the date of last AGM of the company or the last date of the year where no AGM is held during the year.

2. Under nature of business, please give precisely the specific nature of business in which the company is engaged.

3. Under S. No. 20 above, the aggregate number of shares held by each member should be shown, and the aggregates must be added up so as to agree with the number of shares stated against S.No. 11.

4. When the shares are of different classes the columns should be subdivided so that the number of each class held, or transferred, is shown separately against S. Nos. 10, 11, 20 and 21.

5. If the space provided in the Form is insufficient, the required particulars should be listed in a separate statement attached to this return which should be similarly certified and signed.

6. The return and any statement attached hereto shall be signed by the chief executive or the secretary.

7. In case a body corporate is a member, NIC number may be omitted to be given.

8. In case of foreign nationals, indicate "passport number" in the space provided for "NIC No." Pakistani nationals will only indicate "NIC No."

9. This form is to be filed within 30 days (45 days in case of listed companies) of the date indicated in S. No. 3 above.

Previous Page

LETTER OF INTENT

ISSUED BY A.E.D.B

M/S INDUS ENERGY LIMITED

D.No 0014
Date: 8.11.2016

Government of Pakistan
Alternative Energy Development Board
Ministry of Water & Power
2nd Floor, OPF Building, Sector G-5/2, Islamabad
Tele: 051-9222360, Fax: 051-9222364

Ref: B/3/21/2015/Biomass/ISML

November 07, 2016

Mr. Muhammad Abbas Raza
General Manager,
M/s Indus Sugar Mills Limited,
17-Tippu Block New Garden Town,
Lahore.
Ph: 042-35882801-3
Fax: 042-35835180

Subject: **REVISION IN LOI CAPACITY I.E. FROM 30MW (GROSS) TO 31MW (GROSS) HIGH PRESSURE COGENERATION POWER PROJECT OF M/S INDUS ENERGY LIMITED AT M/S INDUS SUGAR MILLS LTD MAIN INDUS ROAD AT KOT BAHADUR, TEHSIL JAMPUR, DISTRICT RAJANPUR, PUNJAB.**

This refers to **(a)** your letter No. IEL/LOI/2016-0013 dated August 19, 2016 on the subject cited above through which you have requested AEDB for revision in your LoI capacity i.e. from 30MW (Gross) to 31MW (Gross) capacity as recommended by your engineering consultants to achieve maximum benefit of the available Bagasse, **(b)** subsequent AEDB's letter of even No. dated October 07, 2016 through which you were requested to submit the Bank Guarantee No. CBD/LOG-0201/23/16 dated April 15, 2016 in accordance with 31MW (Gross) capacity and **(c)** your response received vide letter No. IEL/BG/2016-0017 dated October 18, 2016 through which you have submitted aforementioned Guarantee as per requirement under section 8.9.1 of RE Policy.

2. AEDB has received confirmation from respective Bank and hereby pleased to revise LOI capacity i.e. from 30MW (Gross) to 31MW (Gross).

3. You are now required to complete the LOI milestones in accordance with revised LOI capacity i.e. 31MW (Gross) before **May 16 2017** ("expiry of LOI"). All other terms and conditions of the LOI No. B/3/21/2015/Biomass/ISML dated May 17, 2016 shall remain the same.

Regards.

(Muhammad Yaseen)
Deputy Director (Bioenergy)

Cc:
i. Director (Finance), AEDB.
ii. Panel of Expert (PoE) members.
iii. PS to CEO, AEDB.

Government of Pakistan
Alternative Energy Development Board
Ministry of Water & Power
2nd Floor, OPF Building, Sector G-5/2, Islamabad
Tele: 051-9222371, Fax: 051-9222364
Email: sulmanmalik@aedb.org

May 17, 2016

Ref: B/3/21/2015/Biomass/ISML

Mr. Muhammad Sohail Khokhar
Sr. General Manager Finance,
M/s Indus Energy Limited,
M/s Indus Sugar Mills Limited,
17-Tippu Block New Garden Town,
Lahore.
Ph: 042-35882801-3
Fax: 042-35835180

Subject: **LETTER OF INTENT TO M/S INDUS ENERGY LIMITED FOR DEVELOPMENT OF 30MW (GROSS) COGENERATION POWER PROJECT AT M/S INDUS SUGAR MILLS LTD, MAIN INDUS ROAD AT KOT BAHADUR, TEHSIL JAMPUR, DISTRICT RAJANPUR, PUNJAB UNDER THE FRAMEWORK FOR POWER COGENERATION 2013 (BAGASSE /BIOMASS)**

Reference: Your initial proposal received vide letter No. ISML/Cogen/2015-1713, revised proposal received vide letter No. IEL/Regn.IEL/2016-0118 dated June 18, 2015 and February 11, 2016 respectively and subsequent AEDB's letter of even No. dated April 05, 2016 on the subject cited above.

Alternative Energy Development Board ("AEDB") hereby confirms its interest in your proposal for establishing a 30 MW (Gross) with the contract capacity of 28MW (maximum spillover during Off crushing season) Bagasse /Biomass based High Pressure Co-generation Power Plant, Indus Sugar Mills Limited, Main Indus Road at Kot Bahadur, Tehsil Jampur, District Rajanpur, Punjab ("Project") under the Framework for Power Co-Generation 2013 (Bagasse/Biomass). AEDB acknowledges receipt of the Bank Guarantee No. CBD/LOG-0201/23/2016 furnished by the Sponsor(s) dated April 15, 2016 to the tune of USD$ 15,000/- with validity period up to October 12, 2017.

2. The Sponsor(s) is required to achieve the milestones listed at the Annex to this LOI ("LOI Milestones") for the subject project, at no risk and at no cost to, and without any obligation on the part of the AEDB, the Government of Pakistan, any Provincial Government or their respective agencies, within a period of 12 calendar months from the date of issuance of this Letter of Intent ("LOI").

3. The Sponsor(s) is required to carry out grid interconnection studies and environmental study. The Sponsor is also advised to liaise with the power purchaser while determining the sub-station design and layout, the transmission line, interconnection arrangements, and other related matters.

4. The validity of this LOI is 12 calendar months from the date of its issue, where after it will automatically lapse immediately (unless extended pursuant to clauses 5 or 6), being the **May 16, 2017** (the "Expiry Date"). Issuance of this LOI or the lapsing of its validity, cannot form the basis of any claim for compensation or damages by the Sponsor(s) or the project company or any party claiming through or under them against the Government of Pakistan, the Provincial Government, AEDB or any of their agencies, employees or consultants on any grounds whatsoever, during or after the expiry of the validity of the LOI.

5. The Sponsor(s) is therefore required to achieve the LOI Milestones for the subject project within the validity of this LOI. The Sponsor(s) is also required to submit monthly progress reports. Provided the Sponsor(s) continues to pursue the project diligently, the Expiry Date of this LOI shall be extended on a day-for-day basis for the number of days of delay by which the approval or review by the relevant public sector entity listed in the LOI Milestones is delayed beyond the corresponding period stated in the LOI Milestones. In case there is a delay in achieving milestones within the validity of this LOI for reasons not attributable to a public sector entity, a one-time extension may be granted up to a maximum period of 90 days if AEDB is satisfied with the progress, provided that the Sponsor(s) enhance the amount of the bank guarantee to twice its original amount and extend its validity for a period of 06 months beyond the extended Expiry Date.

6. The Sponsor(s) shall apply to NEPRA for award of Upfront tariff within the period of validity of this LOI. Upon Upfront tariff being given, the Sponsor(s) shall forthwith submit a new Performance Guarantee in the sum of US$ 75,000/- (US Dollars Seventy Five Thousands Only) and obtain the Letter of Support ("LOS") from AEDB within the validity period of this LOI, provided, if the award of the Upfront tariff is delayed beyond the initial validity of the LOI, the Sponsor(s) shall extend the bank guarantee for a further period of 06 months and the Expiry Date shall be extended *ipso facto* for a further period of 03 months, and the Sponsor(s) shall obtain the LOS and submit the Performance Guarantee within the extended period afore-said.

7. In case the Sponsor(s) fails to meet the LOI Milestones or perform any other obligations set forth in the Policy and this LOI, including the extension of the date of expiry of bank guarantee as provided herein, AEDB will terminate this LOI and encash the bank guarantee.

8. M/s Indus Energy Limited and its majority shareholders as of the date of this LOI shall be the Main Sponsors of the Project.

9. Arrangement of land and fuel (Biomass/Bagasse) will be the responsibility of Sponsor.

10. This LOI is not assignable and non-transferable. This LOI shall be void upon any actual or purported assignment or transfer hereof without the prior written consent of AEDB.

11. This LOI is issued in duplicate on the date hereof, and it shall come into effect when one copy is received by AEDB after being duly countersigned by you. Nevertheless, this LOI shall lapse if the countersigned copy is not received at AEDB within 07 days of its issuance.

(Mr. Muhammad Sohail Khokhar)
Senior General Manager Finance
M/s Indus Energy Limited

(Mr. Amjad A. Awan)
Chief Executive Officer
Alternative Energy Development Board

Annex

S.No.	Activity	Maximum Time
1	Power Producers to submit request for Letter of Intent (LOI) with Standard proposal document and Bank Guarantee to AEDB.	
2	Issuance of Standard LOI by AEDB.	i) 7 days for sugar mills ii) 30 days for other entities as per procedure described in Renewable Energy Policy 2006.
3	Generation License to be issued by NEPRA.	10 days
4	Acceptance of Upfront tariff to the project.	10 days
5	Power Purchaser to approve Grid Interconnection Study.	30 days after submission of Grid Interconnection Study to the relevant agency by the Power Producer.
6	Issuance of LOS by AEDB upon submission of Performance Guarantee by Power Producer.	15 days
7	Energy Purchase Agreement finalization.	30 days
8	Signing of Implementation Agreement.	15 days

SPONSOR PROFILE OF
M/S INDUS ENERGY LIMITED

SPONSOR PROFILE

COMPANY PROFILE

M/s Indus Sugar Mills Ltd (ISML), Kot Bahadur, Rajanpur is engaged in the manufacturing / sale of sugar and it operates as one of the prominent sugar mills in the country with crushing capacity of 10000 TCD (tons cane crushing capacity per day) and capacity to generate substantial power by developing of Power Plant based on high pressure boilers technology.

M/s ISML has already been operating and maintaining a Bagasse based 11 MW Power Plant based upon 2 x 60 Tons + 1x80 ton Low Pressure Boilers and 2 x 3 + 1 x 5 MW Steam Turbine Generators, to meet with its own steam and power requirements successfully. M/s ISML had also entered into Power Purchase Agreement with MEPCO for supply of up to 4.0 MW surplus power under PEPCO's SPPs/CPPs Policy. M/s ISML is successfully supplying the contracted power to MEPCO regularly during crushing seasons.

Keeping in view its crushing capacity, the BoD of M/s ISML resolved to develop a new 31 MW (Gross) Bagasse/Biomass based Co-Generation Power Project as a separate entity for power generation to meet with power requirements of ISML and sale of spillover power to national grid. Consequent thereupon, a new power company has been got incorporated under the name and style of "**Indus Energy Limited**" (IEL).

The proposed 31 MW (Gross) Bagasse/Biomass based Cogeneration Power Project shall be developed by M/s Indus Energy Ltd (IEL) under and pursuant to the GoP's Policy for Development of Renewable Energy for Power Generation read with Framework for Power Co-generation 2013 (Bagasse/Biomass) and Upfront Tariff determined by NEPRA for new Bagasse based Co-generation Projects in May, 2013 (modified in July, 2015).

Generation License
INDUS ENERGY LIMITED
17- Tipu Block, New Garden Town,
Lahore

DIRECTORS PROFILE

Board of Directors

• Mr. Ayub Sabir Izhar	Director/Chief Executive
• Mrs. MasoomZehra	Director/Dy. Chief Executive
• Mr. Mehar Ghulam Dastgir Lak	Director
• Mr. Sardar Ali Raza Khan	Director
• Mr. MarghoobShakirIzhar	Director
• Mrs. Tasneem Akhtar	Director

Chief Executive, **Mr. Ayub Sabir Izhar** is a well known personality of the construction business and he is attached with this project since 1992. Currently, as a Chief Executive, he is playing a vital role in the progress of Indus Sugar Mills.He is an action oriented, goal driven and innovative person. Having ability to translate broad goals into achievable steps, and to anticipates and solves problems and takes advantage of opportunities.

Dy. Chief Executive, **Mrs. MasoomZehra**has done MBA from LUMS. She joined the project in1997 as a working director and Dy. Chief Executive. She has an extensive experience in the sugar industry havingstrong leadership skills in board governance, and new business development. She has comprehensive understanding of financial management principles. Sheis results-oriented with a positive outlook having a clear focus on high quality and business profit.

Director **Mr. Mehar Ghulam Dastgir Lak** is agriculturist basically andhas work experience which spans over many decades in the field of Agriculture and Business. He is also serving as a Director of Indus Sugar mills Limited for more than 15 years, where he had been instrumental in various achievements.

Director **Mr. Sardar Ali Raza Khan** has done bar at law from Lincoln's Inn, London. He is an agriculturist and associated with sugar industry for more than 10 years. While playing a pivotal role, he had many high points in his career.

Director**Mr. Marghoob Shakir Izhar**has over 25 years of extensive experience in construction and engineering sector. With an MBA degree in finance, his career started with Izhar group of companies where, from 1991, he is serving on various senior positions including his term as Director.

Director **Mrs. Tasneem Akhtar** also serving as Director in Indus Sugar mills Limited. She had also enjoyed various commanding positions in different organizations.She has a distinguished name in the business world as a Corporate Leader.

POWER EXPERIENCE OF SPONSORS

1.	Project Name	Indus Sugar Mills Ltd.
2.	Capacity	11 MW
3.	Role Performed	Project Company
4.	Location	Kot Bahadur, Dist. Rajanpur
5.	Power Purchaser for Surplus Power	Multan Electric Power Company (MEPCO) – Up to 04 MW
6	Type	Cogeneration Power Plant based on Low Pressure Boilers
7.	Fuel	Bagasse
8.	Boilers	2 x 60 tons, 24.0 bar 1 x 80 tons, 23.5 bar
8.	Steam Turbine Generators	1 x 5 MW (operational since 2004) 2 x 3 MW (operational since 1992)
9.	Status	Surplus contracted power is being supplied to MEPCO during crushing seasons.

PROJECT COST AND SOURCES OF PROPOSED POWER PLANT

PROJECT COST AND SOURCES EQUITY AND DEBT

The proposed investment is expected to be approximately PKR 4,000 Million and shall be made through a mixture of Debt (60%) and Equity (40%). Meezan Bank Limited as a Lead Bank has shown significant interest for Funding for the project. Duly signed Term Sheet is attached. EPC cost is yet to be finalized.

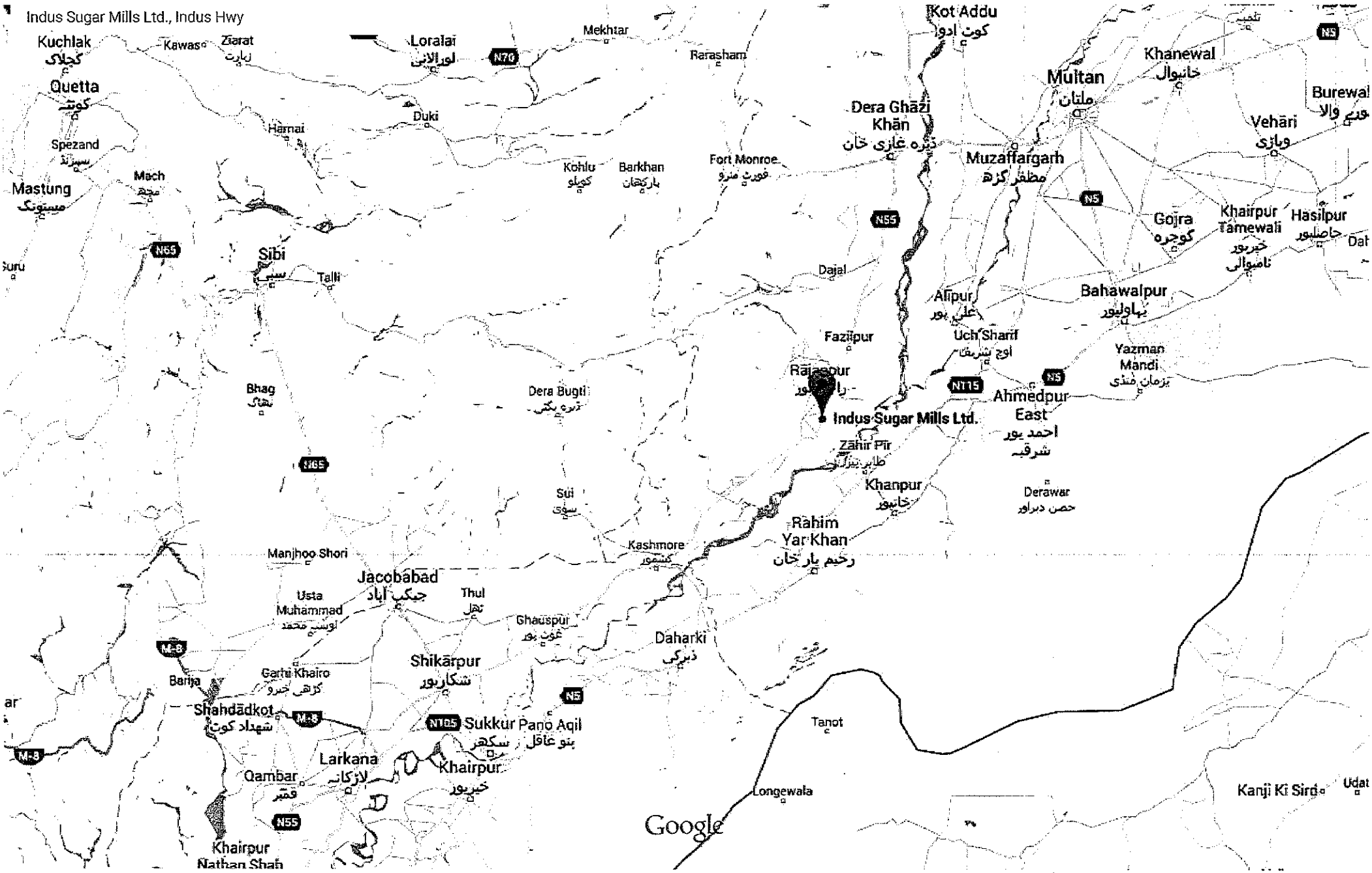
LOCATION OF PROPOSED POWER PLANT

LOCATION OF COGENERATION POWER PLANT
INDUS ENERGY LIMITED

The proposed Cogeneration Power Plant of M/s Indus Energy Limited shall be located at M/s Indus Sugar Mills Limited, Main Indus Highway, Kot Bahadur, Rajanpur.

The geographical locations maps showing altitude and longitude of the proposed site are enclosed herewith.

Indus Sugar Mills Ltd.



INFRASTRUCTURE OF PROPOSED POWER PLANT

Infrastructure

The road and infrastructure can be subdivided as:

Main highway

Indus Energy Limited can be accessed from the Main Indus Highway which passes from the Main gate of Indus Sugar Mills Limited.

Railway Station

The nearest railway station is Rajanpur station which is at the distance of around 9.6 km from the mills.

Airport

Rahimyar Khan International Airport is around 103 km away from Indus Energy Limited.

Hospital

Nearest hospital is at Ranjanpur which is approximately 11 km away from Indus Energy Limited.

Nearest City

Nearest city is Rajanpur which is approximately 9.2 km away from Indus Energy Limited.

PROSPECTUS OF PROPOSED POWER PLANT

Prospectus

BRIEF INTRODUCTION OF THE APPLICANT

Indus Energy Limited ("IEL"), is setting up a new project of 31.00 MW bagasse fired cogeneration power plant of latest high pressure technology of 110 bar under the Framework for Power Cogeneration 2013 for Bagasse / Biomass to include bagasse/biomass under the ambit of the Renewable Energy Policy, 2006. The vision behind establishing IEL is to create a strong, well-capitalized power generation company which will develop and operate a power project operating at highest international standards in an economic and environmental friendly manner within shortest possible time.

IEL is an associated concern of Indus Sugar Mills Limited (ISML) which is a company located at Kot Bahadur, District Rajanpur which owns and operates 10,000 TCD sugar mill with 11 MW low pressure bagasse based power house which it uses to meets its internal requirements and also sells surplus to MEPCO under PEPCO's Captive Power Policy (SPPs/CPPs Policy).

The cogeneration will be based primarily on bagasse while ensuring that all requisite measures are in place to ensure that the project is environmentally compliant. During crushing season, bagasse being a by-product of ISML process, will be the primary fuel for the project for power generation to meet the power requirements of ISML and sale of surplus power to National Grid. During rest of the year, the un-utilized bagasse of ISML as well as from outside market (if available) will be utilized for power generation.

SALIENT FEATURES OF THE FACILITY FOR WHICH LICENSE IS SOUGHT

The Facility shall employ 31 MW Steam Turbo Generator (STG) for power generation. After meeting the power requirement of ISML, power shall be dispatched to the National Grid by looping in/out arrangement at 132kV Rojhan-Rajanpur Transmission Line.

1	Plant location	On Main Indus Highway, Kot Bahadur, District Rajanpur, Province of Punjab
2	Plant Capacity	31.00MW (Gross)
3	Technology	Conventional steam power cycle
4	Installed capacity	31,000 KW (Gross)
5	Plant details i. Steam Turbo generators ii. Boiler	1 X 31 MW Steam Turbo Generator (STG) 1X160-165 TPH approximately, 110 Bar bagasse fired boiler

The company shall opt for the upfront tariff for New Bagasse Based Co-Generation projects determined by NEPRA in May 2013 under the Framework for Power Cogeneration 2013 for Bagasse/Biomass to include bagasse/biomass under the ambit of the Renewable Energy Policy, 2006.

PROPOSED INVESTMENT

The proposed investment is expected to be approximately PKR 4,000 Million and shall be made through a mixture of Debt (60%) and Equity (40%). Meezan Bank Limited as a Lead Bank has shown significant interest for Funding for the project and the Financial Close is expected in May, 2017.

SOCIAL AND ENVIRONMENTAL IMPACT OF THE PROPOSED FACILITY

Bagasse is a by-product produced during the sugar manufacturing process and is an environmental friendly biomass fuel and helps reduce emission of Green House Gasses. Governments across the Globe including Pakistan and neighboring India have incentivized biomass based generation to reduce the effects of Global Warming and to promote the use of indigenous energy sources for electricity generation.

Bagasse based generation like IEL, provide the following benefits:

- Import substitution by replacing costly furnace oil, saving precious foreign exchange. It is estimated that approximately 3,000 MW can be generated by sugar mills located in various parts of the country.
- Contributing towards reducing the electricity shortfall during the low generation months as sugar mills operate in the winter months i.e. non-gas and non-hydel months
- Since bagasse based generation offers direct replacement for furnace oil/diesel based generation it offers a clear price advantage.
- Environment friendly nature of the fuel, helps in reducing Green House Gases and Carbon Footprints.
- The Project will use a high pressure boiler to generate electricity for sale to the national grid. The higher steam parameters shall result in more energy dispatch from the same fuel.
- Reducing distribution costs. Sugar Mills are located in rural areas and are vastly spread and, therefore, are ideal vehicles for cheap distribution of power to rural areas and non-traditional load centers.

DETAIL OF PROPOSED POWER PLANT

Plant Details

1. General Information

(i)	Applicant's Name	Indus Energy Limited
(ii)	Registered Office	17- Tipu Block, New Garden Town, Lahore
(iii)	Plant Location	At Indus Sugar Mills Ltd., Main Indus Road, Kot Bahadur, District Rajanpur
(iv)	Type of Generation Facility	Bagasse fired Cogeneration Power Plant
(v)	Expected Commissioning/Commercial Operation Date	18 months from Financial close
(vi)	Expected Life of the Facility from Commercial Operation/Commissioning	30 years (Minimum)
(vii)	Expected Remaining Useful Life of the Facility	30 years (Minimum)

2. Plant Configuration

(i)	Plant Size Installed Capacity (Gross ISO)	31 MW (Gross)
(ii)	Type of Technology	Cogeneration Power Plant with high pressure boiler and Steam Turbine
(iii)	Number of Units	One
(iv)	Boiler	160-165 TPH approximately, High pressure 110 bar
(v)	Steam Turbine	Steam Turbine - Extraction cum condensing type 31 MW.

(vi)	Installed Capacity	Power Generation: 31 MW (Season operation) 31 MW (Off-season operation)
(vii)	Auxiliary Consumption	11.29 % approx.
(viii)	Interconnection	6 km from proposed project site with 132 KV MEPCO transmission system

3. Fuel / Raw Material Details

(i)	Primary Fuel	Bagasse
(ii)	Alternate Fuel	Bagasse/ biomass
(iii)	Fuel Source (Imported/Indigenous)	Indigenous
(iv)	Fuel Supplier	Indus Sugar Mills Limited/ from local market
(v)	Supply Arrangement	Through conveyor belts/loading trucks/tractor trolleys etc.,
(vi)	Sugarcane Crushing Capacity	10,000 TCD
(vii)	Bagasse Generation Capacity	2900 Tons per day (TPD)
(viii)	Bagasse Storage Capacity	Bulk Storage
(ix)	Number of Storage Tanks	Not Applicable, bagasse shall be stored in open yard

4. Emission Values

Emission values will remain in the limits prescribed by the National Environment Quality Standards (NEQs).

5. Cooling System

(i)	Cooling Water Source / Cycle	Deep Bore well water/ Cooling Towers

6. Plant Characteristics

(i)	Generation Voltage	11000 volts	
(ii)	Frequency	50 Hz	
(iii)	Power Factor	0.8 Lagging, 0.95 Leading	
(iv)	Automatic Generation Control (AGC)	By Turbine Governing System	
(v)	Ramping Rate	To be provided Later	
(vi)	Estimated Time Required to Synchronize to Grid.	During cold start (i.e. when plant is started later than 72 hours after shutdown)	600 minutes
		During warm start (i.e. when plant is started at less than 36 hours after shutdown)	200 minutes
		During Hot start (i.e. when plant is started at less than 12 hours after shutdown)	60 minutes

Note:
All the above figures are indicative in nature. The Net Capacity available for dispatch will be determined through procedure(s) contained in the Energy Purchase Agreement, Grid code or any other applicable document(s).

CONTROL, METERING, INSTRUMENTATION & PROTECTION SYSTEMS
M/S INDUS ENERGY LIMITED

Control, Metering, Instrumentation & Protection

The plant will have an internal control, metering, and protection system and can be monitored locally and/or from remote locations by using **DCS system.**

In addition to this, the plant and equipment for the new proposed Cogeneration system will consist of the high pressure boiler, extraction condensing steam turbine, water cooled condensing system, Main and auxiliary cooling water system, Main and Back up metering panels, Protection panels, water treatment plant system, condensate and feed water system, compressed air system and electrical system consisting of switchgears, LT distribution panels, Variable Frequency Drives, step up transformer to export the power, step down transformers for meeting the in-house power requirement, outdoor switchyard equipment etc.

All the Grid Station, Protection, Telecom, Metering and Control systems shall be as per Technical Schedules of Energy Purchase Agreement.

GRID INTERCONNECTON STUDY APPROVAL AND INTERCONNECTION ARRANGEMENT OF PROPOSED POWER PLANT OF M/S. INDUS ENERGY LIMITED

INTERCONNECTION ARRANGEMENT FOR THE DISPERSAL OF POWER FROM THE POWER PLANT OF M/S INDUS ENERGY LIMITED

The Power generated by Indus Energy Limited (IEL) from its Bagasse based Thermal Power Generation facility shall be dispersed to the Load center of Multan Power Company Limited (MEPCO).

The Interconnection/Transmission Arrangement will be at 132 KV voltage level by making in/out arrangement at 132kV Rojhan-132kV Rajanpur Transmission Line located at a distance of 6 KM from the Generation Facility of M/s Indus Energy Limited.

The Grid Interconnection Study Report has been approved by MEPCO. Photocopies of Approval Letter issued by MEPCO and Single Line Diagram (SLD) of the proposed network are enclosed herewith.

A copy of Grid Interconnection Study Report is placed at Annex-**"A".**

MULTAN ELECTRIC POWER COMPANY LIMITED

Tel #. 9220192
Fax #. 9220249

Office of the
Chief Executive
MEPCO Ltd, Multan

Memo No. 11898 /C.E (P&E)

Dated 10 FEB 2017

CHIEF ENGINEER / CS DIRECTOR
MEPCO LTD. MULTAN

SUB: GRID INTERCONNECTION STUDY FOR 27 MW SPILL OVER (OFF-SEASON) & 19.5 MW (CRUSHING SEASON) FROM 31 MW (GROSS) HIGH PRESSURE CO-GENERATION POWER PROJECT OF M/S INDUS SUGAR MILLS LTD. MAIN INDUS ROAD AT KOT BAHADUR, TEHSIL JAMPUR, DISTRICT RAJANPUR, PUNJAB

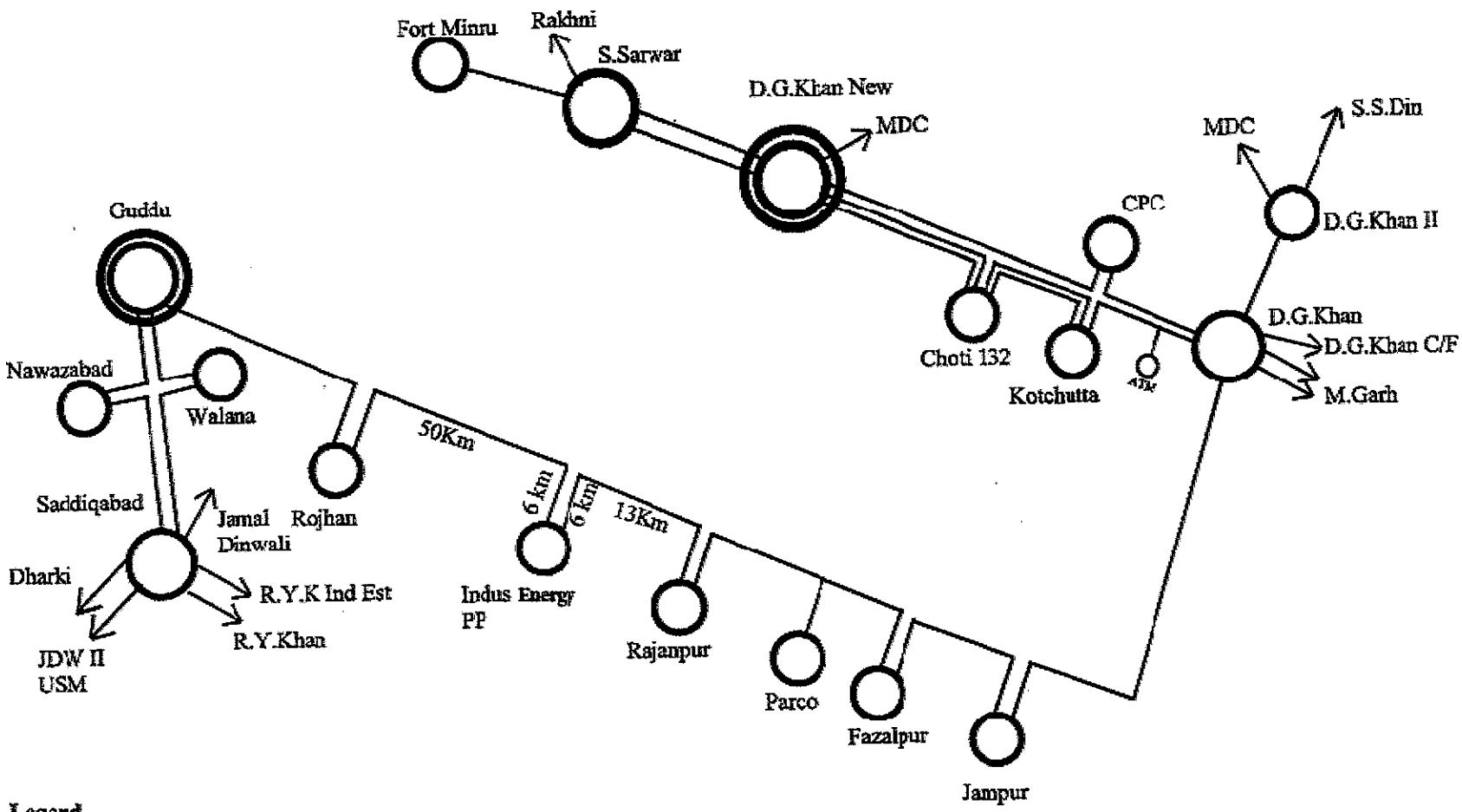
Ref: Chief Engineer / C.S Director Office letter No 627/CE/MEPCO/CSD/D(MKT)/PP-102/ dated February 03, 2017.

This office received the final report of the subject power plant vide above referred letter. After review of the report and electronic PSS/E Study files, the contents of the subject study are found to be appropriate. Therefore, the interconnection study report of 31 MW (Gross) Indus Sugar Mills Ltd. Main Indus Road At Kot Bahadur, Tehsil Jampur, District Rajanpur, Punjab is approved from MEPCO as per assumptions, study results and proposed reinforcement presented in the report (Adding, In-Out of 132 KV Jampur Grid Station at 132 KV Guddu – Kot Chutta transmission line).

It is however intimated that the subject report has been vetted only for interconnectivity aspect of the power plant. Any commitment regarding project execution or for any other legal aspect/conflict/court case regarding Indus Sugar Mills Ltd. should be discussed/considered at your own level and other relevant departments of MEPCO. NTDC may endorse / approve the said study in light of NEPRA letter No. 9046-57 dated 24.07.2016.

It is further intimated that during EPA, if there is any major change in the parameters used in the Interconnection Study, then study will have to be revised.

CHIEF ENGINEER (P&E)
MEPCO LTD, MULTAN

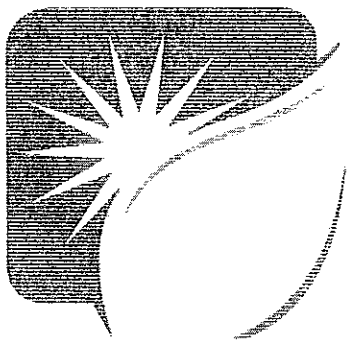


Legend

220 kV ————

132 kV ————

Proposed 132 kV ————



INDUS ENERGY LIMITED

FEASIBILITY REPORT

FOR

31 MW COGENERATION PROJECT

AT

INDUS SUGAR MILLS LIMITED

RAJANPUR, PAKISTAN

TABLE OF CONTENTS

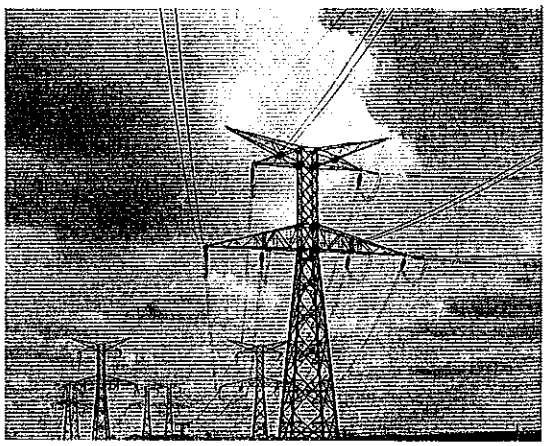
IMPORTANCE & BACKGROUND OF THE PROJECT

Despite severe challenges, the economy has shown resilience in the outgoing year. Growth in Gross Domestic Product (GDP) for 2014-15, on an inflation adjusted basis, has been recorded at a 4.24%. This compares with GDP growth of 4.02% in the previous year.

The economy has been growing at an average rate of 4.91% over the past six years ending June 2015. The expected growth objective will need a commensurate rise in energy use. Considering the strong correlation between economic growth and energy demand growth, there is an imperative need for sustained increase in energy supply not only to sustain the growth momentum but also to protect the economy from disruptions caused by energy deficits reflected in demand management, popularly known as load shedding.

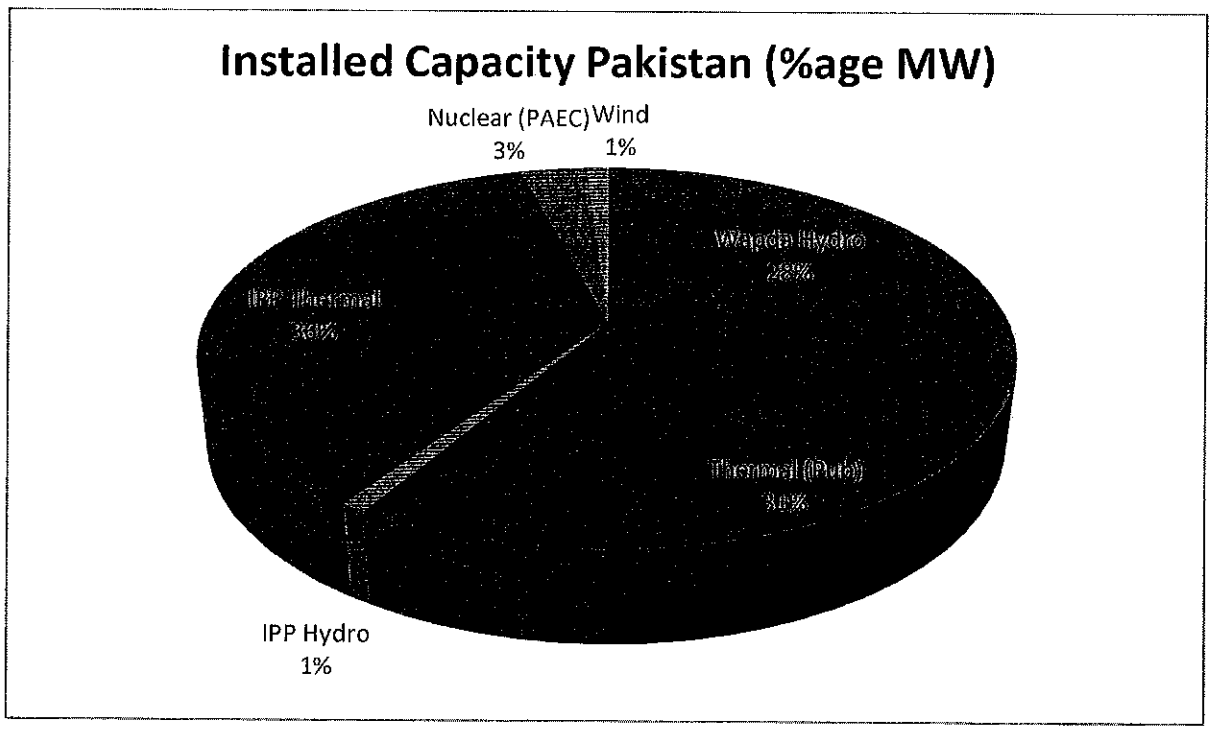
As a result of serious power shortages, load shedding is frequent in Pakistan. The gap between power supply and demand is further on the increase. Consequently, all walks of life are being adversely affected.

To sustain growth, Pakistan needs an integrated National Energy Plan. The Government of Pakistan (GOP) is making concerted efforts to ensure development of energy resources. The government has encouraged the private sector to meet this additional demand. In order to bridge the gap between power demand and supply, Pakistan Government liberalized its investment policies. The policy has resulted in investments in the power generation sector from both local and foreign sources.



Pakistan is energy deficit country. Fossil fuels are already in short supply, and the available ones are fastly depleting. On the other hand, their industrial use is fast on the increase. In order to meet the present day requirements of the fuels and to fulfill the future increased demand, alternate fuels have to be inducted on a priority basis. With increasingly more disparity between energy supply and demand, and keener attention of the Government to environmental protection, use of non-conventional energy resources such as bagasse as primary fuel for power generation has been favored in government's policies. The GOP has announced a Co-Gen Power Policy for sugar mills to generate power using bagasse more efficiently. Bagasse is currently being used in the sugar industry in an uneconomical way for producing heat/steam and power in low-pressure boilers.

Pakistan has an installed electricity generating capacity of about 24,906 MW whereas current electricity demand is 22,000 MW against production of 15,500 MW which creates shortfall of 6,500 MW. Projection for the demand in year 2030 is forecast to be 100,000 MW. The Government of Pakistan has recognized that bagasse-based cogeneration power plants can play a significant role in augmenting the country's power generation capacity.

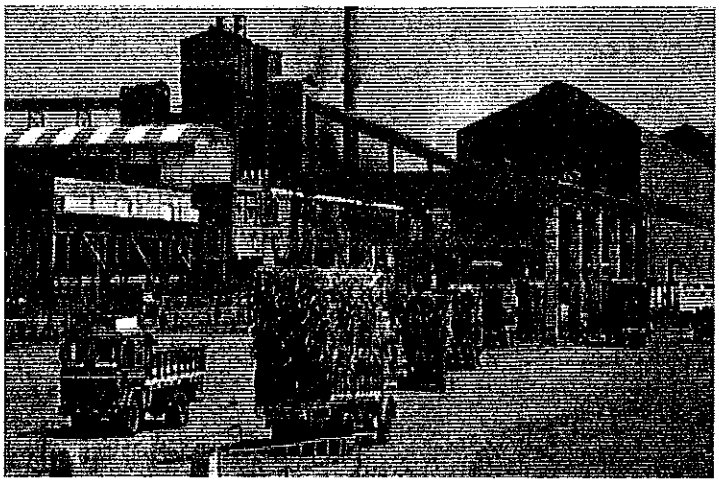


From National Transmission and distribution company 2015.

According to a report issued by World Alliance for Decentralized energy (WADE), bagasse based cogeneration can deliver 25 percent of the power requirements of cane producing countries including Pakistan. Accordingly, the "National Policy for Power cogeneration by Sugar Industry" was promulgated in January, 2008. It is estimated that Pakistan has a potential of generating more than 3,000 MW of electricity through Cogeneration from its existing sugar industry.

Industry Structure

The sugar industry in Pakistan evolved from a relatively small base at the time of partition to its present status of importance in the agribusiness and agriculture sectors. As a cash crop, by 1988 it was second only to cotton, and it trailed only textiles in order of importance in the processing sector and by that time there were 48 sugar mills in Pakistan with the production capacity over 1.8 million tons of sugar per year. Presently 89 sugar mills are operating in Pakistan with a total production capacity of more than 5 million tons per year.



A potential complication for consideration of the sugar industry as a source of energy for grid electricity is the fact that until recently, bagasse was used as a feed stock for both paper and chipboard manufacture. While this might confirm that some of the sugar mills are relatively efficient, as they apparently generate their own power and steam from bagasse, yet still supply bagasse as a by-product, it also suggests that there is already a market value for bagasse which electricity production will have to compete with. In reality, the bagasse sold as a by-product might be a tradeoff where the revenues are used to buy furnace oil as an energy replacement.

Pakistan is the 15th largest producer of sugar in the world, 5th largest in terms of area under sugar cultivation and 60th in yield. The sugar industry is the 2nd largest agro based industry which comprises of 89 sugar mills with crushing capacity of more than 50 million tons per year.

Potential

The sugar is produced predominantly from sugarcane. The acreage under cane was reported as 1,149,929 hectares (2015) produced about 63 million tons of sugarcane. Punjab province accounted for 65% (41million tons) of the total cane produced. About 80% of the total cane production is used by the sugar mills.

It has been estimated that 50 million tons of residue/waste is produced every year from major crops (including 6.88 million tons of sugarcane bagasse). This bagasse is being used for power generation by the sugar industry; consequently, the remaining 43 million tons of crop waste is available in the province of Punjab. Excluding domestic consumption and commercial usage, the net available resource potential of four crops i.e. (wheat, cotton, rice & corn) for biomass power generation is estimated to be about 10.942 million tons.

Sugarcane is among the most valuable crops of Pakistan. It is a source of raw material for entire sugar industry. Production efficiency has become an important determinant for the future of this industry in Pakistan due to declining competitiveness of the domestic sugar industry because of increasing imports, and high costs of production. The Development and adoption of new production technologies can improve productive efficiency. Therefore, this industry can improve the efficiency of its operations using currently available technology.

Measures of productivity, its growth and sources for the sugar industry of Pakistan play a significant role for policy development.

Bagasse is traditionally a waste product in the production of sugar used to be a nuisance and a liability to be disposed of and was thus burnt rather carelessly in low efficiency systems to produce electricity for self-use. In the times of low oil prices, there was no market for selling electricity at the prices sugar industry could offer. With the rise in oil prices and general energy scarcity, it is now possible for the sugar mills to produce electricity at rather competitive prices. Of course, they have to replace their existing low pressure-efficiency systems by high pressure (80/100 bars) and efficiency of the order of 25-28%

The use of cogeneration has large environmental benefits in terms of reduced usage of fossil fuels. As an example, if one assumes that the full cogeneration potential of 1000 MW is utilized in Pakistan, then comparing it with a 1000 MW coal fired power station operating on Thar coal (calorific value of 2,960 kcal/kg), the savings in coal used is 6 million tonnes per annum and this translates to a reduction of carbon dioxide emissions of 5 million tonnes per annum.

Supply Chain Mechanism

An average sugar mill may be able to produce around 31 MW. The problem, however, is that there is a very short crushing season of 100/120 days. What to do with an investment of US$50-60 million for the other remaining days of the year. One solution is to look for other biomass sources such as agricultural residue and the other is to use coal. Environmentalists argue that biomass should be used, while investors are skeptic of biomass. Although, there are quite optimistic estimates of biomass availability, there is no established market and supply system. The resource is widely distributed and point sources are far and few.

There is large variability in crop residues generation and their uses in different areas of the province depending on the cropping intensity, productivity and crops grown. The cost of crop residues increases with increase in the quantity to be collected, because of the long distance over which these have to be transported.

Justification

Energy generation from crops biomass is an innovative approach in the province of the Punjab and required to be adopted thoroughly according to our conditions to improve the socio-economic conditions through the best use of crops residue, wastes, and reduction in field losses without compromising the sustainability of crops/livestock production, soil health and environment.

The proposed project comprises installation of improved cogeneration system generating greater amount of electricity burning the same amount of bagasse as being used currently

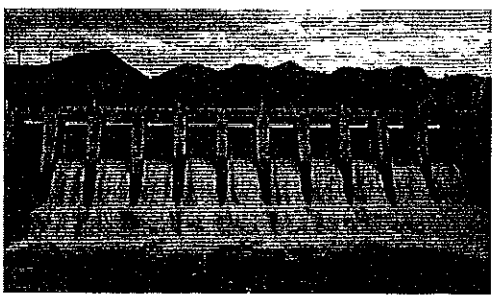
and thus additional electricity from this project will displace the electricity generation of the equal capacity based on gas or oil.

With the application of efficient processing and energy management systems, energy from the bagasse is available and can be exported conveniently in the form of electric power. Application of bagasse based cogeneration for the proposed power plant will displace a part of fossil-based electricity generation leading to a more sustainable mix in power generation.

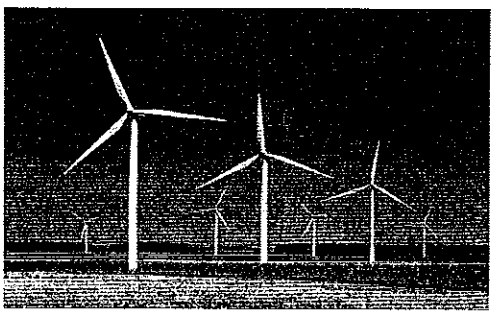
The capital costs of bagasse cogeneration plant are the lowest of all renewable forms of power generation, equal to those of biomass gasification projects, whilst generation costs, despite being higher than biomass gasification projects, small hydroelectric (HEP) and photovoltaic (PV), are at par with biomass power and lower than wind. Bagasse cogeneration projects also have short development periods, as the technologies used are proven and well established.

Cogeneration is more energy efficient than the separate generation of electricity and thermal energy. Heat that is normally wasted in conventional power generation is recovered as useful energy for satisfying an existing thermal demand, thus avoiding the losses that would otherwise be incurred from separate generation of power. Conventional electricity generation is inherently inefficient, converting only about a third of a fuel's potential energy into usable energy. The significant increase in efficiency with combine heat & power (CHP) results in lower fuel consumption and reduced emissions compared with separate generation of heat and power. This reduced primary fuel consumption, a key to the environmental benefits of cogeneration, because burning the same fuel more efficiently means fewer emissions for the same level of output.

RENEWABLE ENERGY ALTERNATIVES



Renewable resources such as wind power, micro hydro, and solar photovoltaic are not feasible options at the current time, but are subject to future consideration, particularly with respect to the price of fuel. With availability of bagasse for approximately 166 days the option of using other renewable energy sources will be highly cost ineffective.



Moreover, high wind speed is only apparent for short periods of time in the project site area and hydro potential does not exist. Therefore, none of the

currently available other renewable energy sources, at the utility level, will be able to meet the current needs.

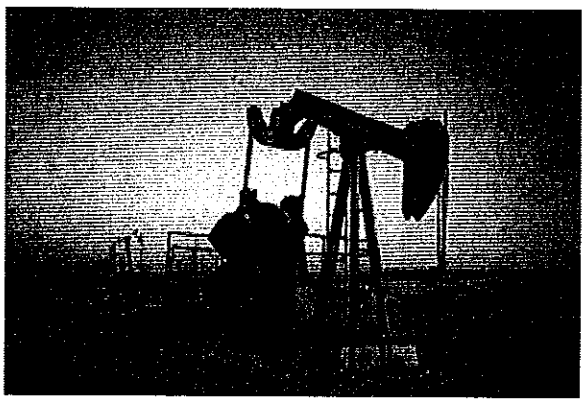
WHY COGENERATION OPTION?

Cogeneration has been adopted as standard means of energy generation since long by the sugar industry. With the use of efficient processing and energy management systems, energy from bagasse, over and above the sugar factory needs, is available and can be exported conveniently in the form of electric power. Application of sugar cogeneration will replace a part of fossil-based electricity generation leading to a more sustainable mix in power generation.

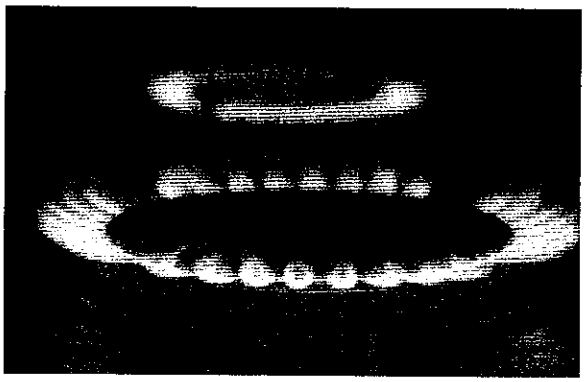
Cogeneration with power export will assist in reducing greenhouse gases (GHGs) emissions. In order to continue reliable, efficient and safe operation, the existing steam and power generation system will be partially closed down and replaced with the more efficient system in proposed power plant.

Presently, sugar industry world-wide except for Pakistan uses high-pressure boilers by burning bagasse and the high pressure steam for power generation and the low pressure steam for process heat. Introduction of high-pressure technology in Pakistan will result in more power production to supply to the national grid and less emission of GHG.

FUEL OPTIONS



Fossil energy resources consist primarily of natural gas and furnace oil. Domestic oil supply is considered negligible and natural gas resources are becoming scarce in Pakistan. However, substantial coal deposits are available in the country, but mining of all of them is quite expensive. Moreover, domestic coal is very high in sulphur and ash content, which will lead to severe environmental hazards. And for the project's using of imported coal, is not the best option for environmental and economic reasons. So in the absence of any cheaper fuel, bagasse utilization is of prime importance.



The use of a local fuel source guarantees a certain degree of security of energy supply, improving and increasing the trade balance with imported fuels. Onsite crop use ensures that delivery times are short and costs are kept low.

The advantages of bagasse cogeneration in increasing security of power supply issues also include the capacity to generate during the off-season. Power plants based on bagasse from sugar mills that produce and export electricity also increase grid stability and reliability.

Currently, centralized electricity-generation system wastes over two-thirds of the energy contained in the fuel and continues to produce ever increasing carbon and other harmful emissions because of a continued demand for energy worldwide. At least half of this wasted energy could be recaptured when shifting from centralized generation to distributed systems that cogenerate power and thermal energy onsite or nearby. Cogeneration offers significant, economy-wide energy-efficiency improvement and emissions reductions. Besides saving energy and reducing emissions, distributed generation also addresses emerging congestion problems within the electricity transmission and distribution grid.

As a decentralized mode of electricity generation, bagasse cogeneration reduces transmission & distribution (T&D) losses by supplying electricity near its generation point whilst reducing loads on grid wires.

Integration of cogeneration technologies in the sugar industry, especially in extra-high pressure and temperature configurations, will almost certainly be essential for the long-term growth and economic survival of the sugar industry. The ability to meet all of the Indus Sugar Mills (ISML) increased energy needs as well as the promise of revenues from the sale of exportable surpluses to utilities could become key factors in securing the sugar industry's viability

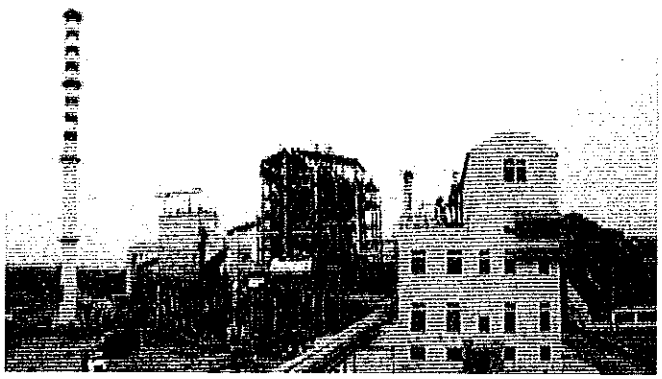
OBJECTIVES OF THE PROJECT

The main objective of the proposed project is to generate cleaner, economical and reliable energy from indigenous biomass fuel which will not only provide a better alternate source of energy but also boost to agriculture sector and save millions of dollars which is wasted to import expensive oil to be used as fuel for producing electricity. It will also reduce environmental hazards caused by burning furnace oil as fuel for producing electricity.

TYPE OF THE PROJECT

At present, approximately 1.2 million tonnes of sugar cane is being crushed per year at ISML. Ample amount (348,000 MT) of bagasse through this activity is available that will be

used as a primary fuel for the cogeneration power plant in order to fulfill the electricity and steam energy requirements. The project feasibility is based on bagasse as primary fuel.



ISML is planning to install a 31 MW co-generation power plant. One condensing and extraction steam turbines (31 MW) with one high-pressure boiler, having bagasse as primary fuel, will be installed close to the already operational ISML at Kot Bahadur, Rajanpur. The project will use the sugar mill's by-product, bagasse, as fuel source which is not only economically supportive but also environmentally friendly at the same time.

Capacity

In line with Co-Gen Policy 2008, ISML is planning to install a 31 MW Cogeneration power plant with bagasse as primary fuel near its Sugar Mill at Indus highway, Kot Bahadur, Rajanpur.

ISML existing total equivalent energy requirement, from bagasse, for electric and steam driven system is 8 MW. With operation of the ISML for 120 days the energy requirement works out at 23,040 MWH. The proposed project activity with operation of 31 MW generators will produce 123,504 MWH from bagasse during 166 days of operation. Net export from the proposed project to national grid will be around 85,968 MWH.

The power plant will be spread over a total of 20 acres. The total estimated cost of the project is Rs. 4,000 million (Annexure-1).

EXISTING POWER GENERATION FACILITY

Present sugar cane crushing capacity of Indus Sugar Mills Limited (ISML), is 10,000 tonnes per day or 416.66 tonnes per hour. The sugar mill is situated at Kot Bahadur, Rajanpur, in the Southern Punjab region of Pakistan. The project site is connected to the entire Pakistan through the national highway and railway track from Karachi to Peshawar through Lahore, the second largest city of the country after Karachi.

The sugar mill is about 15 kms from the city Rajanpur. Normally, cane crushing operation is carried out for 120 days in a year. The Indus Group also manages a sugar cane farm of around 2,300 acres. This, besides other advantages, ensures a continuous supply of sugarcane to the mill.

There are 6 cane crushing mills with the capacity of 10,000 TCD. The fiber content of cane is reasonably high and hence the bagasse generation in the plant is 30% on crushed cane. After a deduction of 1% towards the use of bagacillo (fine bagasse used for enhancing filtration) in the sugar process and towards losses, a bagasse quantity of 29% of cane crushed is available for use in the boilers. ISML presently utilizes the bagasse produced in its captive low-pressure boilers and sells surplus bagasse to nearby consumers.

Indus Sugar Mills Limited (ISML) present total steam requirement is approximately 180-185 tones per hour at a pressure of 24 bar (a) and at about 350 °C temperature for various consumption points in the sugar mill. Presently, the total power requirement of the plant works out to about 8 MW.

The total steam generation for the plant is being met from 3 steam boilers. Two of the boilers have a capacity of 60 TPH (tones per hour) each and one of the boiler is with capacity of 80 TPH. All the 3 existing boilers produce steam at 24 bar (a) pressure and 350 °C temperature. All boilers are designed to use bagasse as fuel. Normally, all boilers operate at their rated capacity to meet with the process and electric generation steam requirements of approximately180-185 TPH. The mills and shredders are driven with back pressure steam turbines.

The electric power requirement of the sugar plant is being met by a battery of 6.6 KV generators. The installed capacities of the generators are 11 MW. All the turbines used for power generation are of the backpressure type using steam of 24 bar (a) pressure and about 350 °C temperature. The exhaust pressure of the turbines is at 1 bar (a) pressure about 150 °C temperature, and the entire exhaust steam from all the turbines is used for the sugar processing. The balance of the process steam requirement is met through the steam drawn through the pressure reducing valve and desuperheating stations.

There are two diesel generator sets with the respective capacities of 630 KVA each, all with the generation voltage of 400 V. Steam will be supplied to ISML with a maximum of 115 TPH from the proposed power plant keeping in view the planned steam economy measures.

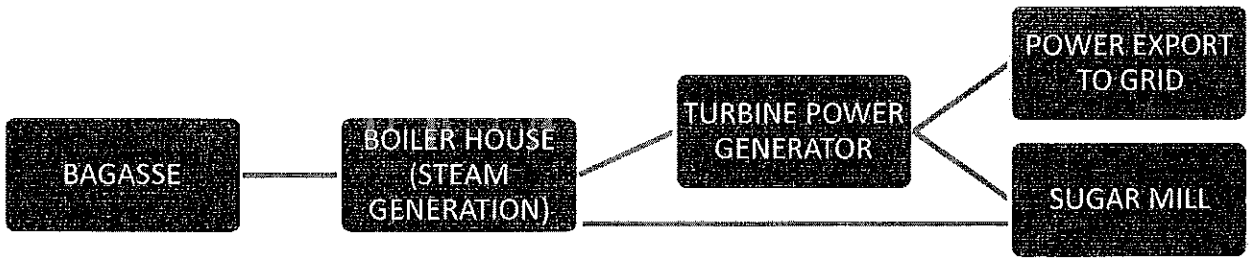
PROPOSED COGENERATION POWER PROJECT

The project proponent of Indus Energy LTD proposes to establish a modern high pressure bagasse based cogeneration power plant at ISML with 31 MW installed capacity. There are numerous EPC contractors under consideration including M/S Descon Engineering Limited, Pakistan.

Cogeneration is generally defined as the coincident generation of electrical power and useful thermal energy from the same input fuel. High pressure steam is generated and used in a steam turbine for generating power and the steam is extracted from the turbine at low

pressures and the heat energy in the low pressure steam is used in the sugar process. This type of cogeneration is also known as combined heat & power cycle (CHP).

The cogeneration scheme proposed at Indus Energy Limited (IEL), envisage a unit of 31 MW capacity. This unit will be designed with a approximately 160-165 tones per hour capacity boiler with the outlet steam parameters of 110 bar (a) pressure and 540 °C temperature.



The cogeneration plant boilers will be designed with a traveling grate with hydraulic drive to burn bagasse. The steam turbines will be double extraction-cum-condensing machines with water cooled condensers. Cogeneration concept proposed uses higher pressure and temperature steam to get more power out of the system with surplus power, over and above that required for the operation of the sugar plant, which will be exported to the national grid. The plant will be exporting surplus power to the national grid system during sugar cane crushing season and all available power during off-season.

During the sugarcane crushing season, bagasse will be used as the fuel source. During the off-season, surplus bagasse will be available for about 46 day's operation.

Since most of the steam will required to be condensed during off-season, the steam turbines surface condensers will be sized for taking in the off-season exhaust steam flow.

Table - 2.1 indicates material balance during sugar cane crushing season and off-season, covering: fuels requirement, production of steam & its distribution and generation of electricity and its distribution. During sugar cane crushing season about 19.5 MW of electricity will be exported to national grid and during offseason the power plant will be able to export approximately 27 MW of electricity. This feasibility study for the project assumes that on an average cane crushing will carried out for 120 days.

Table – 2.1 – MATERIAL BALANCE (During Project Operation)

	Sugar Season	Off-Season
Bagasse Input, TPH (approximately)	67	48
Boiler Steam Production, TPH (approximately)	160-165	118~125
Steam used in Steam Turbine, TPH (approximately)	160-165	118~125
Steam extracted for Sugar Processing, TPH	115	-
Losses	-	-

Total Steam Consumed, TPH (approximately)	160-165	125
Power Generation, MW	31	31
Electricity Consumed in Power Plant, MW	3.5	3.5
Electricity Consumed in ISML, MW	8	0.5
Electricity Exported, MW	19.5	27
Total Electricity internal Used, MW	11.5	4

Note: TPH = tonnes per hour

Table - 2.2 REQUIREMENT OF ELECTRICITY AND ITS GENERATION

Description	Bagasse as Fuel	
	Season	Off-Season
Operating Days	120	46
Installed Capacity, MW	31	31
Internal Power Requirement MW	11.5	4
Power House Internal Use, MW	3.5	3.5
Sugar Plant Use, MW	8	0.5
Power Export, MW	19.5	27
Annual Power Production, MWH	89,280	34,224
Power House Internal Use, MWH	10,080	3,864
Sugar Plant Use, MWH	23,040	552
Power Export, MWH	56,160	29,808

During 120 days of crushing season, 19.5 MW of surplus power will be exported to the national grid. Net electricity export during this period works out at:

Net Electricity Export, crushing season = 19.5 x 24 x 120 = 56,160 MWH

During 46 days of off-season with use of bagasse as fuel, 27 MW of power will be exported to the national grid. Net electricity export during off-season, utilizing bagasse as fuel, works out at:

Net Electricity Export (bagasse as fuel), off-season = 27 x 24 x 46 = 29,808 MWH

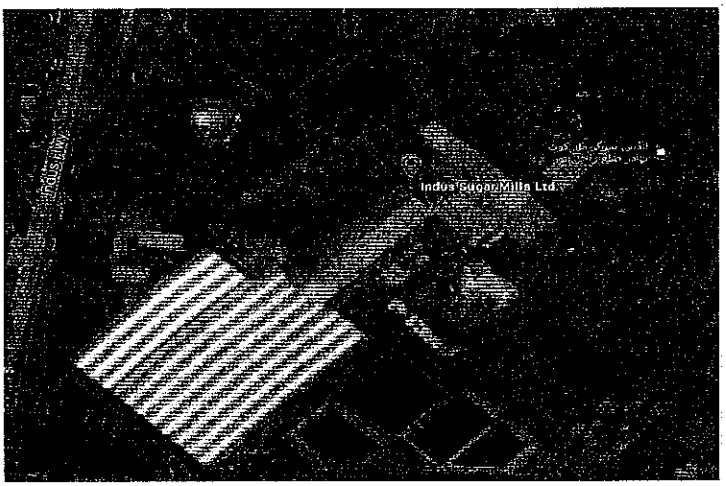
Total exportable power to national grid generated from proposed project, utilizing bagasse, is estimated at 85,968- MWH.

SITE FOR THE PROPOSED PROJECT & PLANT LAYOUT

The plant site is located at an altitude of about 150 meters above mean sea level. The global co-ordinates of the plant are 29.0195 N (latitude) and 70.3328 E (Longitude). The proposed

project is located west of the ISML plant site. Sufficient land is available for the power plant installations close to ISML.

The proposed new power plant will be constructed at western side of the existing ISML; the proposed power plant is considered a green field development.



The final design of the plant will be determined during the detailed engineering works to be conducted prior to construction. However, the main features will be the generator house, boiler plant and stack, water supply & process water treatment facilities (including cooling water unit), wastewater treatment plants, electric distribution and switchyard, bagasse storage and handling areas/facilities, ash handling facilities, fire-fighting & safety facilities and laboratory facilities. The most prominent feature of the site within the surrounding areas is likely to be the boilers chimney (stack).

BASIC INFRASTRUCTURE AND FACILITIES

All the basic infrastructure like roads; transport; water; repair and maintenance workshops and technicians; communication facilities like telephone, fax and email; utilities required to run the plant smoothly, office buildings, hostel, medical facilities, security etc., already exist at ISML, Kot Bahadur, Rajanpur. Sharing of these facilities with the upcoming Power plant will not only reduce the initial capital cost of the project but also reduce its recurring cost thus making the project more cost effective.

Infrastructure Facilities

There is no instance of flooding of the area where the proposed project is to be located. ISML has adequate sewerage management system. Water supply for ISML is being provided from ground water by tube-wells. The proposed power plant and the existing ISML sugar plant are located in a rural area. The surrounding villages and settlements have not experienced any problem of ground water, surface water, sewerage and flooding. Sui Northern Gas Pipelines Limited natural gas pipeline, supplying gas to northern part of the country, runs along the national highway close to Rajanpur.

Transport

Rajanpur, the district headquarters of the proposed project area is connected with other parts of the country by roads, railway and airport (at Rahim Yar Khan). The airport even

provides good air link to other countries. The economy of the district is growing quite fast. The proposed plant site is already connected with National Highway (N-5) through adequate road network and additional roads are not required to be constructed.

Land Use

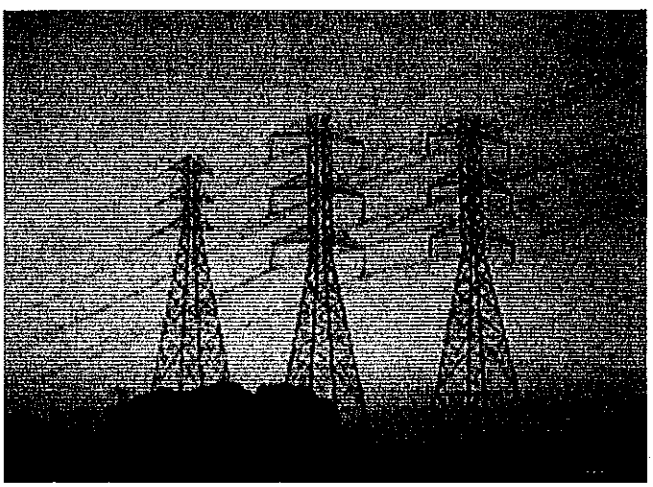
Sufficient land is available for the power plant installations close to its mother project, ISML in Kot Bahadur, District Rajanpur. The proposed project is to be located west of existing ISML sugar plant. The land for the proposed project has already been selected. Since the land is uninhabited, re-location/resettlement will not be required.

Since the power plant is to operate within the required emission levels of the National Environmental Quality Standards NEQS Pakistan therefore, there is no possibility of any change in the land use.

About 50% to 60 % of the liquid effluents will be recycled thus reducing the requirement of raw make up water by 40% to 50%. The remaining effluent will be treated on the project site to the levels as applicable under the NEQS Pakistan including also the Thermal Discharges as well as for the other parameters. After due treatment, the effluent, will be discharged into the nearby canal. Thus there is no possibility of any damage to the agriculture crops.

Power Sources and Transmission

The area has adequate power transmission and distribution network. Agriculture tube wells requirement of power in the area is being met through the WAPDA distribution system.



A separate power transmission line will be required from the proposed power plant to connect to the already existing 132 KV Rojhan-Rajanpur line. As per the Pakistan power policy, this transmission line will be constructed by the National Transmission & Distribution Company (NTDC)/WAPDA. NTDC/WAPDA will also carry out the Environmental Impact Assessment (EIA) study for the transmission line in due course as per established practice.

Fuel Supply

BAGASSE

Sugar cane on crushing and extraction leaves a residue called bagasse. The cultivated area surrounding the sugar mill is about 258,000 acres. The major crops in the area are cotton, wheat and sugar cane. About 26% (68,000 acres) of the area is under sugar cane cultivation and is growing. ISML Corporate Farms currently manage about 2,300 acres of cultivable land and nearly 4% of the cane supply to the mill comes from the farms. Cane supply to ISML comprises of 96% supply from local growers and 4% supply from the ISML Corporate Farms. ISML has not experienced any shortage of sugar cane during its operation.

With 416.7 tonnes per hour crushing of cane, the bagasse generated in the plant will be 125 tonnes per hour (TPH). Out of this, 4.1 TPH of bagasse (about 3% of the bagasse generated) is set aside for meeting with the bagacillo requirements for vacuum filtration in ISML, losses, etc., and balance (120.9 tonnes per hour) is available for IEL for use as fuel in the boilers of cogeneration plant.

During sugar cane crushing season (120 days) 348,027 tonnes of bagasse will be available as surplus for utilization during crushing season and off-season. At full power plant capacity utilization during off-season the bagasse will be available for about 46 days operation. Technically the power plant will operate on bagasse as fuel for 166 days (120 + 46) at full power generation capacity utilization.

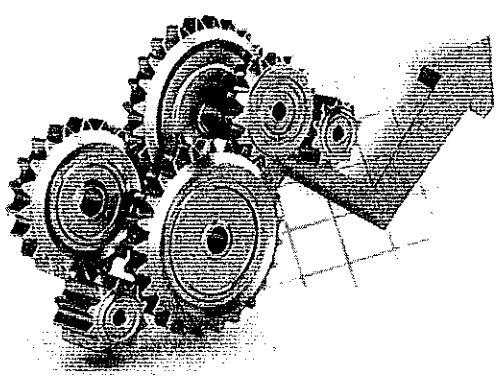
Of the major advantages of using bagasse as fuel in the power plant and locating it adjacent to the sugar plant is that transportation costs are eliminated. The bagasse will be consumed in the vicinity where it is generated. The bagasse from ISML will be transported to the cogeneration plant through conveyors and the surplus bagasse will be stored for future use during off-season.

At full capacity utilization for power generation during off-season boiler will consume approximately 48 TPH of bagasse with the Higher Heating Valve (HHV) of 2,224 kcal/kg.

OPERATION EFFICIENCY

During Cane Crushing Season

Boiler efficiency at HHV of bagasse has been estimated to be an average of 71%. The boiler efficiency with Lower Heating Value (LHV) of bagasse will be approximately 88.8%. HHV and LHV of 50% moisture bagasse respectively are 2,224 kcal/kg and 1,778 kcal/kg respectively.



The fuel supplied for the operation of boiler will be approximately 67 TPH of bagasse with HHV of 2,224 kcal/kg or 9,305 kj/kg. The LHV of bagasse fuel will be 1,778 kcal/kg or 7,437 kJ/kg.

The net electric efficiency of the plant will be approximately 19.87% during the season operation of the cogeneration plant. Taking into consideration the thermal energy supplied from the cogeneration plant, the efficiency called the Combined Heat and Power (CHP) Efficiency works out to approximately 74.37 % as discussed below:

During Off-season

The boiler efficiency with HHV of bagasse is estimated to be 71%. The boiler efficiency with LHV of bagasse will be approximately 88.8%. The fuel supplied for the operation of the boiler, under bagasse firing will be approximately 48 TPH.

Under the off-season operation, the CHP efficiency is not applicable and only the plant electric efficiency is applicable. The net electric efficiency of the plant, based on LHV, under bagasse firing will be approximately 27.73%

The ISML project will approximately replace 86,795 MT of coal per annum, based on the electrical energy exported to the national grid when using bagasse as fuel. Apart from saving in the foreign exchange outflow, this will have a very great mitigating effect on the greenhouse gas emissions to the atmosphere. The above discussion justifies the project from the point of view of augmenting the generation capacity without much deleterious effect on the environment. In addition to the above, the project will add to the much needed additional generating capacity to the grid.

Overall energy efficiency of the proposed ISML plant will be increased vis-à-vis the existing ISML boiler & generators, using available bagasse. These will be achieved by use of new high pressure high efficiency boilers & generators and by retiring ISML existing inefficient boilers partially and turbo generators.

The renewable energy bagasse based cogeneration plant achieves the objective of a clean sustainable development without damage to the environment. The proposed bagasse based cogeneration project will be responsible for curtailment of the Green House Gases (GHGs) to the atmosphere.

PROPOSED PROJECT TIME-LINE SCHEDULE

The cogeneration plant is expected to be in operation within about 18 months from the signing of the EPC contract. Construction of the proposed project is expected to take place for about 18 months, with varying degrees of activity occurring during different phases of construction. Construction phases are expected to include excavation, concrete pouring,

steel erection, mechanical/electrical installation and cleanup. However following documentation status is as follows

Description	Status
Letter of Intent	Completed
Bank Guarantee by Sponsors	Completed
Initial Environmental Examination Report	Completed
Grid Interconnection Study	Completed
Generation License	To be started
Upfront Tariff Determination	To be started
Letter of Support	After Tariff Determination
Energy Purchase Agreement (EPA)	After Tariff Determination
Signing of Implementation Agreement	After EPA

PROPOSED POWER PLANT SITE

When the need for additional power generation capacity was confirmed, IEL had reviewed a number of siting options prior to the selection of the final proposed location.

Selection of site for installation of a cogeneration power plant is based on following criteria:

- Availability of land;
- Availability of fuel;
- Availability of water for cooling and process;
- Access to electric grid station and transmission system;
- Availability of infrastructure;
- Availability of managerial and skilled personnel.

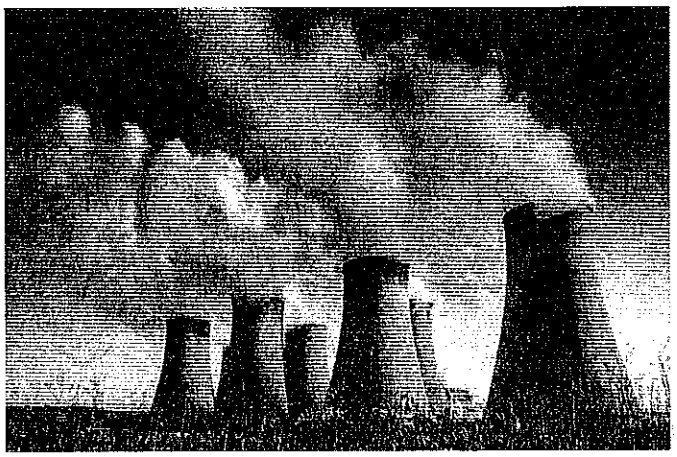
The cogeneration power plant is intrinsically linked with the sugar factory as discussed within the project description. This linkage is twofold, firstly the supply of bagasse from the factory to the cogeneration power plant and secondly the provision of steam and electricity to the factory from the cogeneration plant with the return of good quality condensate

Due to the physical restrictions within the ISML factory site and the requirements for the two plants to be in close proximity, no practical alternative site locations exist, except the site that has been proposed.

Major relocation of the plant, away from the ISML sugar factory, would add significant additional capital and operational costs (steam/condensate pipe work and bagasse transport) and was not therefore considered a practical or reasonable option. The base case site is also the least environmentally sensitive of any alternative location that may exist around the site.

The proposed site; adjacent to the ISML; has the entire infrastructure available. Water will be available from tube-wells (ground water); NTDC proposed interconnection is located at about 6 kilometers distance; adequate workshop and maintenance facilities, along with trained, experienced and skilled workshop technicians are available who are already running the workshop available at ISML. Similarly, experienced and skilled managerial manpower is also available in the area.

ENVIRONEMENT IMPACT



Environmental protection and the control of solid, liquid and gaseous effluents or emissions are key elements in the design of all steam and power generating systems. The emissions from combustion systems are tightly regulated by Governments regulations and specific rules and requirements are constantly changing

Environmental control is primarily driven by Government legislation and the resulting regulations at the local and National levels. These have evolved out of a public consensus that the real costs of environmental protection are worth the tangible and intangible benefits now and in the future.

One major redeeming factor about IEL's Bagasse based Cogeneration power plant is that, for a substantial period in a year, the dust or the greenhouse gases released into the atmosphere are no more than what would have been produced by alternative methods of bagasse disposal. The bagasse that is being burnt in the new high pressure cogeneration boiler will be less than that the quantity that is being used in the existing low pressure boiler. Hence, there is no net addition of pollutants to the atmosphere. Also this power plant, feeding the additional power to the National Electricity grid, indirectly prevents a pro-rata quantum of pollutants being let into the atmosphere from the utility plant, from where otherwise the equal quantum of power would have been generated. This power plant thus being environment friendly deserves encouragement. Also it is a fact that bagasse being a bio-mass renewable fuel does not add any net Carbon-di-Oxide to the atmosphere, because of the carbon recycling during the growth of cane.

BENEFITS

ECONOMIC BENEFITS

Benefits and advantages of bagasse cogeneration include:

a) Fuel costs paid in local currency and valuation of bagasse as a waste product;

b) Increased fuel efficiency;
c) Increasing diversity and security of electricity supply; and
d) Location near to electricity distribution system, leading to minimal transmission and distribution (T&D) costs.
e) Reduction of greenhouse gases (ghg) and pollution at the area of the project.

Increasing the Viability of Sugar Mills

The long-term economic viability of sugar mills has become more vulnerable, mainly due to fiercely competitive domestic and global sugar markets. The inherent energy inefficiency of design and operation as well as the industry's high energy requirements are also factors of growing importance. Appropriate remuneration of electricity from bagasse cogeneration would increase the added value to the sugar sectors.

SOCIAL BENEFITS

Due to operation of power plant following improvement can also be noticed in the area

- Socio cultural environment of the project area.
- Transport and communication services.
- Employment due to increased business, trade commerce and service sector. Resultantly, with the increase in the income of a common man, there will be a great encouragement among this sector of the people to get their children educated.

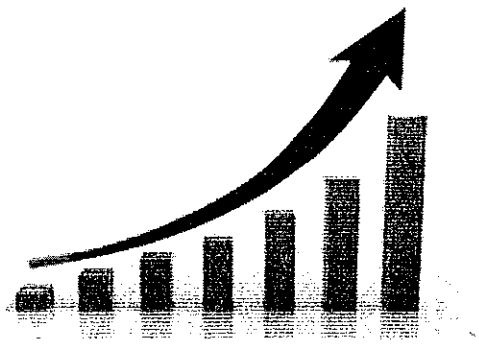
Since the project does not involve any land ouster or home ousters and resettlement or displacement of any community, there will be no impact due to project on the social environment.

Installation of the power plant in the area will open up employment opportunities which in turn follow a chain of indirect socio-economic benefits

Economic Impact

The establishment of the cogeneration IEL power plant will provide new jobs at the plant site. Most people of the area make their living directly or indirectly from agriculture and cottage industry.

Short-term economic benefit will be realized by providing janitorial services, horticultural services, loading/unloading workers, canteen, and semi-skilled & some skilled activities, as well as by increased use of available rental property.



Long-term benefits will include indirect employment, as a result of improved and reliable electricity and other economic benefits provided by increased and reliable supply of electricity. As a result, continued operation of the proposed plant will generate revenue into the Country's economy.

The installed electricity capacity is insufficient to meet current and near future demand for power. Without additional capacity, the need for load shedding becomes likely in order to maintain a balance between demand and generation capacity. Therefore, the proposed project is designed to add to the current and future needs providing reliable additional electricity generation capacity.

There are no negative or detrimental potential impacts on the socio-economic setting of the area arising as a result of the proposed project. As such no mitigation measures are required.

FINANCIAL, LEGAL AND TAXATION INCENTIVES

- No customs duty or sale tax on import of machinery equipment and spares.
- Exemption from income tax, including turnover tax and withholding tax on imports.
- No levy of sales tax on such plant, machinery and equipment, as the same will be used in production of taxable electricity
- The minimum equity requirement to finance project is 20% of the total financial outlay of the project.
- GOP guarantee on payment obligations of public sector entities. If some or all of the utilities are restructured or privatized during the term of various agreements, appropriate safeguards shall be built in the privatization agreements so that the IPP contracts are wholly securitized over their respective full terms.
- Suitable indexation of tariff components to cover the risk of exchange rate variations.
- It shall be mandatory for the power distribution utilities to buy all the electricity offered to them by IPP.

- Power generated by the IPP will be purchase by the NTDC or concerned DISCO companies at agreed rate to be approved by the NEPRA.
- Energy purchase agreement will be valid for the period of 30 years

PRESENT MANAGEMENT

Board of Directors

• Mr. Ayub Sabir Izhar	Director/Chief Executive
• Mrs. Masoom Zehra	Director/Dy. Chief Executive
• Mr. Mehar Ghulam Dastgir Lak	Director
• Mr. Sardar Ali Raza Khan	Director
• Mr. Marghoob Shakir Izhar	Director
• Mrs. Tasneem Akhtar	Director

Chief Executive, **Mr. Ayub Sabir Izhar** is a well known personality of the construction business and he is attached with this project since 1992. Currently, as a Chief Executive, he is playing a vital role in the progress of Indus Sugar Mills. He is an action oriented, goal driven and innovative person. Having ability to translate broad goals into achievable steps, and to anticipates and solves problems and takes advantage of opportunities.

Dy. Chief Executive, **Mrs. Masoom Zehra** has done MBA from LUMS. She joined the project in 1997 as a working director and Dy. Chief Executive. She has an extensive experience in the sugar industry having strong leadership skills in board governance, and new business development. She has comprehensive understanding of financial management principles. She is results-oriented with a positive outlook having a clear focus on high quality and business profit.

Director **Mr. Mehar Ghulam Dastgir Lak** is agriculturist basically and has work experience which spans over many decades in the field of Agriculture and Business. He is also serving as a Director of Indus Sugar mills Limited for more than 15 years, where he had been instrumental in various achievements.

Director **Mr. Sardar Ali Raza Khan** has done bar at law from Lincoln's Inn, London. He is an agriculturist and associated with sugar industry for more than 10 years. While playing a pivotal role, he had many high points in his career.

Director **Mr. Marghoob Shakir Izhar** has over 25 years of extensive experience in construction and engineering sector. With an MBA degree in finance, his career started with Izhar group of companies where, from 1991, he is serving on various senior positions including his term as Director,

Director **Mrs. Tasneem Akhtar** also serving as Director in Indus Sugar mills Limited. She had also enjoyed various commanding positions in different organizations. She has a distinguished name in the business world as a Corporate Leader.

KEY PERSONNEL

Mr. Abul Sattar Qureshi FCA	Financial Consultant
Mr. Izhar Pervaiz Khan	Resident Director
Mr. M. Abbas Raza	General Manager Power

Financial Consultant **Mr. Abdul Sattar Qureshi FCA** is a qualified chartered accountant and has a rich experience and good reputation in the sugar industry. He is handling all financial affairs of the Company. He is a result driven finance executive with expertise in leadership, business development and operation across challenging environments and emerging markets. Having keen understanding of business priorities, committed to managing highly effective team in delivering seamless services while contributing to business development, financial management and revenue generation.

Resident Director, **Mr. Izhar Pervaiz Khan** has a vast experience of about 30 years in the sugar industry. He is looking after technical as well as management side of the project. He has vast experience and extensive expertise in the power sector also. He is playing an instrumental role in this project.

Mr. Abbas Raza is working as General Manager Power. He has done Bachelors of Engineering (Electronics Engineering) from NED University of Engineering & Technology, Karachi. He has worked at various senior positions in reputable organizations. He has more than 18 years of experience in power sector.

Financial Plan

Total project cost is expected to Rs. 4,000 million (Annexure-1). This will be finance as follows.

	Rs. Million
Sponsor's Equity	2,400
Long Term Loan	1,600
	4,000

Debt Equity Ratio	40:60

CONCLUSION

If commissioned, the new plant would replace the two existing inefficient boilers and turbo generators and so provide an improvement to local air quality and the noise environment.

The project will be using available quantity of bagasse (renewable energy source) for generation of 31 MW electricity during 120 days of cane crushing season and for around 46 days of off-season to supply much needed power to national grid. Displacement of fossil fuel energy production during bagasse use period will also result in a net reduction in CO_2 emissions so contributing to the control of climate change.

The project would also provide additional revenue to the sugar mill which will help to secure its future and so offset some of the current and increasing pressures on the financial viability of the sugar mill.

The proposed power plant will improve the economic status of the region and also contribute significantly to the overall economic growth of the country, when due to acute shortage of electric power long drawn out load sheddings are salient feature across the entire country. This state of affairs is resulting in huge economic loss to the national exchequer in the form of taxes and duties and drastic decrease in Industrial Productivity resulting in cut of the foreign exchange earnings, joblessness especially among the workers and related socio-economic issues.

INDUS ENERGY LIMITED

UPTO 30-MW BAGASSE BASED COGENERATION PROJECT AT KOT BAHADUR, DISTRICT RAJANPUR

INITIAL EVIRONMENTAL EXAMINATION

(IEE) REPORT

Prepared by:

INTEGRATED ENVIRONMENT CONSULTANTS

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March – 2016

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March – 2016

TABLE OF CONTENTS

LIST OF APPENDIXES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
BHU	Basic Health Unit
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantities
COD	Chemical Oxygen Demand
DM	De -Mineralized
EA	Environmental Approval
EIA	Environmental Impact Assessment
EMMP	Environment Mitigation and Monitoring Plan
EMP	Environmental Management Plan
EMtP	Environmental Management & Monitoring Plan
EPA	Environmental Protection Agency –Punjab
EPC	Environmental Protection Council
ESP	Electrostatic Precipitator
Eqvt	Equivalent
Ft	Feet
GoP	Government of Pakistan
GRM	Grievance Redress mechanism
GCv	Gross Conversion
HIV	Human Immunodeficiency Virus
HSE	Health Safety Equipment
IEE	Initial Environmental Examination
ISML	Indus Sugar Mills Limited
ID	Indirect Fan

IUCN	International Union of Nature Conservation
LAA	Land Acquisition Act
M&E	Monitoring and Evaluation
MT	Metric Tons
MSW	Municipal Solid Wastes
MW	Megga Watt
MEPCO	Muzafargarh Electric Power Company Limited
NCS	National Conservation Strategy
NDIR	Non Dispersive Infra Red
NEQS	National Environment Quality Standards
NGOs	Non–Government Organizations
NOC	No Objection Certificate
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
Pak–EPA	Pakistan Environment Protection Agency
PEPA	Punjab Environmental Protection Agency
PEPC	Pakistan Environment Protection Council
PHED	Public Health Engineering Department
PKR	Pak Rupees
PM	Project Manager
PPC	Pakistan Penal Code
PPE	Personal Protective Equipment
PSDP	Public Sector Development Project
PSQCA	Pakistan Standards Quality Control Authority
PTCL	Pakistan Telecommunication Limited

PTV	Pakistan Television
PVC	Poly Vinyl Chloride
RNR	Renewable Natural Resources
RO	Reverse Osmosis
RCC	Reinforced Cement Concrete
RNR	Renewable Natural Resources
SFA	Social Framework Agreement
SHE	Health Safety Equipment
SPM	Suspended Particulate Matter
TMA	Tehsil Municipal Administration
TPH	Tons Per Hour
TCD	Tons of Crushed Cane Per Day
TCH	Tons of Crushed Cane Per Hour
VOC	Volatile Organic Compounds
WAPDA	Water and Power Development Authority
WHO	World Health Organization

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

- This report deals with the Environmental Assessment and social soundness pertaining to proposed 30-MW baggase based power project.
- Indus Sugar Mills Limited (ISML) was established in the most economically undeveloped area of Rajanpur. Initially, the project was having a capacity of 4,000 TCD and producing refined sugar. The process steam & power demand were being met by 2 x 60 TPH @ 22 kg/cm^2. Boilers and matching turbines in the mill house and power house. The capacity has gradually enhanced to about 10,000 TCD with vigorous efforts in cane development activity in the area and addition of 2-No. Mills and 80 TPH @ 22 Kg/cm2 Boiler in the subsequent years (1996). The company has presently installed 11-MW low pressure Cycle Co-generation plant and license from NEPRA for export of 4-MW surplus power to MEPCO. In addition to increase the crushing capacity, the company has been focusing on improvement in performance of the sugar mill by reducing process steam consumption from about 53 % to 47% on cane. Continuous efforts are being made to further reduce it to 43 % on cane in the near future and less than 40% in the long run, in line with the international standards. The power & steam system is well balanced and sizable quantity of bagasse is saved and stored due to Energy Efficiency measure adopted by the company. A part from modernization exercise, the management has now decided to take up the installation of highly efficient, high pressure cycle cogeneration plant in the sugar mill. This will help in optimum utilization of Bagasse & generation of surplus power, which will be sold to MEPCO. Based on 10,000 TCD (400 TCH) crushing capacity & process steam demand of 43 % on cane, the optimum Co-gen project capacity has been estimated at 30-MW, consisting of one 160 TPH, 110 ata, 540 boiler, extraction–cum-condensation turbine generator set with necessary balance plant equipment. Keeping in view the regulatory requirements of the Punjab Environment Protection Act 2012 (amended act), Section 12, this Initial Environmental Examination Report has been prepared to get the environmental approval from the Environment Protection Agency (EPA), Government of the Punjab.

- The on-going power supply shortage in the country besides the high fuel costs and low quality oil are causing a significant loss of production resulting in negative economic impact. The use of Bagasse as source of energy production is on high priority of government. Thus, use of Bagasse may provide cost component energy units. Therefore, as a responsible corporate citizen company, the management has focused on energy efficiency using best available resource. The proponent's environment friendly initiatives has already recognized by many local and international organizations. Therefore, Indus Energy Limited is planning to set up 30 MW co-generation power plant in Kot Bahadur, District Rajanpur.
- The main object of the proposed project is to generate cleaner, economical and reliable energy from indigenous fuel which will not only provide a better source of energy but also cause a compensatory role in reducing the shortage of energy demand.
- Initial Environmental Examination (**IEE**) report is being submitted to the Environmental Protection Agency (**EPA**), Government of the Punjab, Lahore in compliance with the legal requirement for Punjab Environment Protection Act-2012 (amended act), Section-12 for obtaining the Environmental Approval (**EA**)/No Objection Certificate (**NOC**) before commencement of the project work at the proposed project site.
- The following person is the contact person for the proposed project:

  Mr. Muhammad Sohail Khokar
  Sr. General Manager (Finance)
  Address: 17-Tipu Block, new Garden Town, Lahore. Pakistan.
  Phone: + 92 423 35882801-3
- The following are the project consultants preparing environmental report;

  Integrated Environment Consultants

  Office: Office # 11, 2nd Floor, Anwar Tower,
  99-Shadman Chowk, Lahore, Pakistan.
  Phone: (042)-35960091
  Email: inenvconsultants@yahoo.com

- The construction will also sometimes go round the clock, therefore, during all activities the followings will be the major pollutants/wastes or project related pollution aspects:
  - Soil erosion
  - Particulate matter/dust and gaseous emissions from construction machinery and vehicles transporting materials.
  - Noise from construction machinery and vehicles transporting materials
  - Garbage as construction waste including clay, sand, crush stones, paper, plastic, wood pieces, iron and steel as scarp, wires, rags, ropes etc
  - Dust during raw materials unloading and its use in construction
  - Sewage and solid wastes from construction camp
  - Some social impacts due to accumulation of workers may arise
  - Some problems to utilities infrastructure of the area may occur especially due to labor negligence

  A number of machinery and equipment is in operation for the construction which includes:

  - Excavators
  - Truck
  - Transport vehicles
  - Concrete mixers
  - Vibrators
  - Welding plants
  - Rigging
  - Generators etc.

  Most of these are using diesel engines that generate noise and exhaust emissions. The possibility of exhaust emissions increases when old vehicles/plants are utilized for the execution purposes. Generally, the above activity is generating particulate- matter (PM_{10}), smoke, dust, CO and NO_x in the ambient air, which is deteriorating the air quality and resulting in potential impacts on human health. The movement of heavy machinery and vehicles on the dirt

tracks is also causing fugitive dust emissions. Source of air pollution for this project activities are unpaved roads. Dust plumes behind vehicles moving along unpaved roads represent a typical occurrence, since as the vehicle travels over an unpaved road, the force of the wheels on the road surface causes pulverization of the surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. As an approximation, fugitive dust (dust generated from unpaved roads is termed "fugitive dust" because it is not discharged into the atmosphere in a confined-flow stream) from unpaved roads can be considered to average. This dust would be a problem for the nearest communities.

- ❖ The following mitigation measures will be adopted to overcome the impacts on resources;
  - Tuning of vehicles should be made mandatory to reduce the emissions of NOx, SO_x, CO and PM_{10}. Emissions from the batching plants will be controlled with appropriate control equipment (such as fabric filters or cyclone separators). Equipment and vehicles powered with diesel should be well maintained to minimize particulate emissions. Trucks carrying, sand, aggregate and other materials should be kept covered during transportation of materials and during storage at site, with tarpaulin. For the construction machinery generating noise level in excess of that prescribed in NEQS, Contractor will make arrangements to bring the noise level within applicable limits (including proper tuning of vehicles and mufflers/silencers). Movements of the trucks and other construction machinery causing high noise levels must be restricted at night time to avoid disturbance to the nearby locality. Truck drivers should be instructed not to play loud music at night and stop use of horn. It is suggested that noise barriers should be installed at construction site during the construction phase of the project. The fugitive dust emission will be a problem for the nearby communities which will be mitigated by sprinkling of water.

- During the operation phase of the project to the control the air pollution the following mitigation measures will be adopted;
  - To control the particulates from the stack Electrostatic precipitators will be installed.
  - The gaseous emissions will be controlled by installing the low NOx burners to make the emissions up to NEQS levels.
  - Ash will be landfill with proper lining in the land or will be sold to the bricks manufacturing unit or cement units.
  - The effluents will be treated till the NEQS levels.
- The Environmental Management Plan (EMP) aims to provide:
  - An integrated plan for the comprehensive monitoring and control of impacts.
  - Auditable commitments displaying practical achievable strategies for management to ensure that environmental requirements are specified and complied with.

  For this purpose, an outline of EMP has been developed which includes;
  - what has to be managed and monitored, how and why
  - when and where
  - by whom
  - whom to report and who to follow up if there is any problem
  - The monitoring program is designed to ensure that the requirements of the NEQS compliance. Monitoring Program (MP) provides important information that allows for more effective planning and an adaptive response based on the assessment of the effectiveness of mitigation measures. The monitoring of various parameters will help to determine the extent to which project construction/operation activities will cause environmental disturbance.
  - The cost for environmental management and monitoring will be the part of contract of Contractor and Consultants respectively. However, a lump sum amount of Rs. 2.5 million will be allocated by the project proponent as cost

for environmental training and monitoring for a period of two years during construction and operation of the project.

- Public Discussions were held with the inhabitant of the surrounding area and the farmer of the land to e acquired. They are quite positive to the project and see the project as growing business and accomplishing towards the positive development in the area at local and in country as whole. The people observe strong positive impacts regarding employment, business and structural development due to this project. Social assessments findings depict that people perceive overall positive social and economic impacts by the project. Their attitude towards the project installation is highly optimistic. Majority of the people are convinced for development in the area and they correlate this progress with the pace of their social mobility.
- Under the light of detailed discussions in IEE Study about likely impacts of the proposed project intervention, it can be safely concluded that the proposed Project would not cause any significant adverse impacts for which detailed EIA is required. On the basis of the facts summarized as above, the project merits for issuing No Objection Certificate/Environmental Approval by the Environmental Protection Agency, Government of Punjab Lahore.

IMPACT CHARACTERIZATION CONSTRUCTION PHASE

Impact	Nature	Duration	Geo-Extent	Reversibility	Likelihood	Consequence Severity/Utility
Physical Impact	ID	ST	LO	RE	LK	MN
Air Quality	D	ST	LO	RE	LK	MN
Ground Water	ID	ST	LO	RR	PO	MO
Water consumption and water availability	D	ST	LA	RE	PO	MN
Biological	ID	ST	LO	RE	LK	MN
Natural Vegetation	ID	ST	LO	RE	LK	MN
Wildlife	ID	ST	LO	RE	LK	MN
Social and Socio economic Impacts	D	LT+	LA	IR	PO	MJ
Traffic Congestion	D/ID	ST	LO	RE	PO	MN
Noise and Vibration	D	ST	LO	RE	CE	MO
Safety Hazards	D	ST/LT	LO	RE/IR	CE	MU
Employment	D	LT	LO/LA	RE/IR	CE	MU
Infrastructure	D/ID	LT	LO/LA	RE/IR	CE	MO
Public Health and Nuisance	D	ST/LT	LO	RE/IR	LK	MN

D: Direct: **ID:** Indirect; **CN:** Certain; **LK**: Likely; **LT**: Long Term; **ST**: Short Term; **PO**: Possibly; **MN:** Minor; **MJ**: Major; **MT**: Medium Term; **MO**: Moderate; LO: Local; **LA:** Large; **SV**: Severe; **RE:** Reversible; **IR:** Irreversible.

IMPACT CHARACTERIZATION OPERATIONAL PHASE

Impact	Nature	Duration	Geo-Extent	Reversibility	Likelihood	Consequence Severity/Utility
Physical Impact	D	ST	LA	RE	LK	MN
Air Quality	D	LT	LO	RE	PO	MN
Ground Water	ID	ST	LO	RR	PO	MO
Water consumption and water availability	D	ST	LA	RE	PO	MO
Biological	ID	ST	LO	RE	LK	MN
Natural Vegetation	ID	ST	LO	RE	LK	MN
Wildlife	ID	ST	LO	RE	LK	MN
Social and Socio economic Impacts	D	LT+	LA	IR	PO	MJ
Traffic Congestion	D/ID	ST	LO	RE	PO	MN
Noise and Vibration	D	ST	LO	RE	CE	MO
Safety Hazards	D	ST/LT	LO	RE/IR	CE	MU
Employment	D	LT+	LO/LA	RE/IR	CE	MU
Infrastructure	D/ID	LT	LO/LA	RE/IR	CE	MO
Public Health and Nuisance	D	ST/LT	LO	RE/IR	LK	MN

D: Direct: **ID:** Indirect; **CN:** Certain; **LK**: Likely; **LT**: Long Term; **ST**: Short Term; **PO**: Possibly; **MN:** Minor; **MJ**: Major; **MT**: Medium Term; **MO**: Moderate; LO: Local; **LA:** Large ; **SV**: Severe; **RE**: Reversible; **IR**: Irreversible.

SECTION-1
INTRODUCTION

Section-1

INTRODUCTION

1 PROJECT HISTORICAL PERSPECTIVE

Indus Sugar Mills Limited (ISML) was established in the most economically undeveloped area of Rajanpur. Initially, the project was having a capacity of 4,000 TCD and producing refined sugar. The process steam & power demand were being met by 2 x 60 TPH @ 22 kg/cm^2. Boilers and matching turbines in the mill house and power house. The capacity has gradually enhanced to about 10,000 TCD with vigorous efforts in cane development activity in the area and addition of 2-No. Mills and 80 TPH @ 22 Kg/cm2 Boiler in the subsequent years (1996). The company has presently installed 11-MW low pressure Cycle Co-generation plant and license from NEPRA for export of 4-MW surplus power to MEPCO. In addition to increase the crushing capacity, the company has been focusing on improvement in performance of the sugar mill by reducing process steam consumption from about 53 % to 47% on cane. Continuous efforts are being made to further reduce it to 43 % on cane in the near future and less than 40% in the long run, in line with the international standards.

The power & steam system is well balanced and sizable quantity of bagasse is saved and stored due to Energy Efficiency measure adopted by the company. A part from modernization exercise, the management has now decided to take up the installation of highly efficient, high pressure cycle cogeneration plant in the sugar mill. This will help in optimum utilization of Bagasse & generation of surplus power, which will be sold to MEPCO. Based on 10,000 TCD (400 TCH) crushing capacity & process steam demand of 43 % on cane, the optimum Co-gen project capacity has been estimated at 30-MW, consisting of one 160 TPH, 110 ata, 540 boiler, extraction–cum-condensation turbine generator set with necessary balance plant equipment.

Keeping in view the regulatory requirements of the Punjab Environment Protection Act 2012 (amended act), Section 12, this Initial Environmental

Examination Report has been prepared to get the environmental approval from the Environment Protection Agency (EPA), Government of the Punjab.

1.1 IMPORTANCE & BACKGROUND OF PROJECT

The on-going power supply shortage in the country besides the high fuel costs and low quality oil are causing a significant loss of production resulting in negative economic impact. The use of Bagasse as source of energy production is on high priority of government. Thus, use of Bagasse may provide cost component energy units. Therefore, as a responsible corporate citizen company, the management has focused on energy efficiency using best available resource. The proponent's environment friendly initiatives has already recognized by many local and international organizations. Therefore, Indus Energy Limited is planning to set up 30 MW co-generation power plant in Kot Bahadur, District Rajanpur.

1.2 OBJECTIVES OF THE PROJECT

The main object of the proposed project is to generate cleaner, economical and reliable energy from indigenous fuel which will not only provide a better source of energy but also cause a compensatory role in reducing the shortage of energy demand.

1.3 PURPOSE OF REPORT

Initial Environmental Examination (**IEE**) report is being submitted to the Environmental Protection Agency (**EPA**), Government of the Punjab, Lahore in compliance with the legal requirement for Punjab Environment Protection Act-2012 (amended act), Section-12 for obtaining the Environmental Approval (**EA**)/No Objection Certificate (**NOC**) before commencement of the project work at the proposed project site. The other relevant regulations and guidelines considered while preparing this IEE report include:

1. Policy and procedures for filing, review and approval of environmental assessments.
2. Guidelines for the preparation and review of environmental reports.
3. Guidelines for public participation.
4. Guidelines for sensitive and critical areas.
5. Detailed sectoral guidelines.

Different environmental aspects like social, physical, biological and other related features of the project both during construction and its regular occupancy are highlighted in this IEE report. Measures necessary to be adopted to mitigate negative environmental impacts on any part of the environment around are also described. All the important information is also provided as described under present format used to help decision makers, EPA Punjab in the present case, before issuing the desired Environmental Approval (EA).

1.4 IDENTIFICATION OF PROJECT PROPONENT

Mr. Muhammad Sohail Khokar
Sr. General Manager (Finance)
Address: 17-Tipu Block, new Garden Town, Lahore. Pakistan.
Phone: + 92 423 35882801-3

1.5 CONSULTANTS PREPARING ENVIRONMENTAL REPORT

Integrated Environment Consultants
Office: Office # 11, 2nd Floor, Anwar Tower,
99-Shadman Chowk, Lahore, Pakistan.
Phone: (042)-35960091
Email: inenvconsultants@yahoo.com

1.6 NEED OF THE EIA STUDY

Government of Pakistan in the year 2000 has adopted the regulations for the Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), under these review regulations, the Environmental Protection Agency (EPA) stipulated relevant procedures for the proponents to be compliance with environmental quality requirements for the preparation of environmental assessment studies (either IEE or EIA). These environmental studies are planning instruments that aim to contribute to design phases of the development as well as functions as management tools to minimize potential negative impacts and maximize benefits during construction and operational phases of a project. To be effective in this role the IEE or EIA needs to form an integral part of the project design process. In this way the

environmental implications of various design alternatives can be evaluated and the cost benefits of different trade-offs assessed. The result is the potentially negative impacts can often be avoided and almost always reduced, without compromising the real cost of the project. Conversely, positive environmental outcomes associated with the project can be enhanced.

1.7 OBJECTIVE OF THE REPORT

Objectives to conduct this IEE are as following:

i. A legal binding in accordance to Punjab Environmental Protection Act-2012 (amended Act).
ii. To identify the potential environmental issues pertaining to the proposed site.
iii. To evaluate the ability of the site in view of social acceptance and environmental soundness.
iv. To provide the maximum information to the proponent and other stakeholders about the existing environmental conditions and the implications of the proposed project.
v. Collection of available data, reports, drawings and other relevant information about area of proposed project.
vi. Review of applicable existing environmental legislation and national environmental quality standards (NEQS).
vii. Propose mitigation measures to eliminate or to reduce the negative impacts to an acceptable level.
viii. Development of well resourced environmental management and monitoring plans to identify mitigation strategies targeted towards avoidance, minimization and rehabilitation of the impacts.

1.8 EXTENT OF THE STUDY

In compliance with PEPA-2012 (amended act) requirements, an IEE report has been prepared by M/S Integrated Environment Consultants, Lahore. This document covers all environmental impacts, due to installation of the 30 MW co-gen power project, in and around the project area comprising the physical, ecological and socio-economic aspects together with identification of the

potential positive and negative impacts. Any developmental activities outside the project area, the transmission lines for dispatch of electricity and establishment of the other factories outside the project vicinity have not been covered under this IEE study.

1.9 METHODOLOGY

The methodology adopted to carry out the IEE study of the proposed project was as follow:

a) Orientation
b) Planning of Data Collection
c) Data Collection
d) Site Reconnaissance
e) Analysis of Maps
f) Literature Review
g) Desk Top Research
h) Stakeholders Consultations
i) Field Studies
j) Laboratory Analysis
k) Evaluation of Impacts and their analysis
l) Categorization of impacts based on their potential environmental significance and prescription of preventive / mitigation measures

In addition to the evaluation and review of the available records, data and the facts for the previous project, detailed discussions were held with the concerned members of the project management as well as other project stakeholders. Notes and proposals for measures to be taken to mitigate and compensate for any detrimental environmental impacts are contained in the Environmental Management Plan (EMP) as well as a Monitoring Plan, including all parameters that need to be measured, and the frequency of monitoring actions.

A comprehensive qualitative and quantitative methodology was adopted to conduct this study inter-alia in due compliance with the IEE requirements. The study included collection of both primary and secondary data regarding environmental status and other relevant factors. This IEE report has been

accomplished after carrying out thorough visit to the proposed site and detailed investigation to identify the following Environmental areas of concern:

1) To achieve the desired environmental compliance standards; as per the national environmental regulatory requirements; as applicable to the project.
2) Plans and activities to prevent/mitigate any potential impacts and the gaps that could probably remain after implementation.
3) Any other points/steps to be taken which could be beneficial to mitigate environmental adverse impacts that may accrue both during construction and regular operation of the project.

A view of methodology for environmental assessment is given in table 1.1:

Table 1.1: Environmental and Social Assessment Process

Phase	Activities	Status	Responsibility
Screening and Scoping	Reconnaissance and initial site visit and consultations, identification of environmental and social issues & applicable safeguard environment policy, categorization and working out an action plan.	carried out during the present IEE	Project Management (PM) Consultants
Impact Assessment	Identification of potential environmental and social impacts through site visits, stakeholders consultations, review	during the present IEE	PM Consultants

Phase	Activities	Status	Responsibility
	of drawings, alternatives etc		
Impact categorization	The significant potential impacts were tabulated and mitigation/preventive measures were prescribed	during the present IEE	PM Consultants
EMP Preparation	Stakeholders/Women consultation	carried out during/prepared as part of the present EIA	PM Consultants
	EMP		
Final EMP	Final version of EMP produced	included in the present EIA	PM Consultants

1.10 SCOPE OF THE STUDY

The purpose of this IEE study is identification of key environmental and social issues which will likely arise during construction and operation of the power plant along with the assessment of the significant negative impacts and mitigation measures to be adopted for their minimization.

The ultimate goal of this IEE report, among others, is also to produce an Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMtP) for the construction and operation stages of the proposed project. Compliance of EMP together with the provisions for mitigation measures for the significant negative impacts will ensure the implementation of this project in an environmentally sustainable manner both at construction as well as operation stages of the project.

The IEE report ensures compliance to all national and local regulations enforced in Pakistan, especially Punjab for such report. While taking into consideration the corporate standards, it was further sought to ensure that the project under reference of this IEE report, is to be developed in a manner that is socially responsible and reflects sound environmental management practices.

This IEE report also discusses the legal and administrative framework within which the IEE has been prepared. A brief project description is included in the IEE report together with a description of the baseline environmental conditions and the actual environmental situation at the proposed site for the project. The technical section of the report and the environmental baseline situation form the basis for the detailed impact assessment during construction and operation phases of the project. Based on the findings of this report, an environmental management system has been devised, outlining necessary mitigation and compensation measures together with monitoring practices.

1.11 PERSONS PERFORMING THE STUDY (TEAM MEMBERS)

The proponent has assigned the task of preparing EIA report to M/S **Integrated Environment Consultants, Lahore**. The EIA study of the proposed project has been conducted according to Environmental Assessment Procedures, 1997, Review of IEE and EIA Regulation 2000 as prescribed by the Federal Environmental Protection Agency (Pak EPA), Government of Pakistan. The EIA guidelines for Baggase fired power plant published through National Impact Assessment Program was also considered during this EIA process.

The study team of M/S **Integrated Environment Consultants** which completed the IEE report consists of experts as mentioned in table 1.2.

Table 1.2: Members Completed IEE Process

Name	Qualification	Status in Project
Mr. Ahtasham Raza	M.Phil (Env. Sciences) GC University, Lahore Ph.D Scholar, (Env. Sciences) University of the Punjab, Pakistan	Project Incharge
Mr. M. A. Nouman	M.Sc Environmental Sciences. M.Phil Environmental Sciences University of the Punjab, Lahore	Team Leader
Mr. Asher Azad	M.Sc Chemistry GC University, Lahore	Monitoring Incharge
Mr. Zaheer Bhati	M.Sc Chemistry GC University, Lahore	Monitoring incharge
Mr. Mubroor Hassan	M.Sc Chemistry M.Phil Environmental Sciences	Monitoring Engineer
Mr. Hamaza Ahmad	B.Sc. Civil Engineering (UET) M.Sc. Env. Engineering (UET)	Geo Technical Engineer
Mr. M.A. Sheraz	M.A Sociology University of the Punjab, Lahore	Sociologist
Ms. Hina Gillani	M.Sc. Environmental Sciences	Environmentalist
Mr. Adnan Sharif	B.S Environmental Sciences	Environmentalist

*Only the main roles of the team members are given. However, their role was not restricted to these, rather it also includes many other studies in their respective fields in the context of this IEE studies.

1.12 PROJECT CLASSIFICATION

The project envisages the installation of 30-MW bagasse based cogeneration power project at Tehsil Kot Bahadur, District Rajanpur. In accordance with the

Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project falls in Schedule –I, Part-A 'Energy' Serial 2 'Thermal power generation less 200 MW; therefore, requires the Initial Environmental Examination (IEE) study for sustainable development and to submit in provincial Environmental Protection Agency (EPA), for issuance of Environmental Approval (EA).

1.13 BRIEF DESCRIPTION OF NATURE, SIZE AND LOCATION OF PROJECT

1.13.1 Location

The proposed project is located within the battery limits of the Indus Sugar Mills Limited, Kot Bahadur, District Rajanpur (Figure-1). The site is situated about 29-Km from main Fazilpur city on Grand Trunk road. No population exists within a radius of 3-Km of the project site.

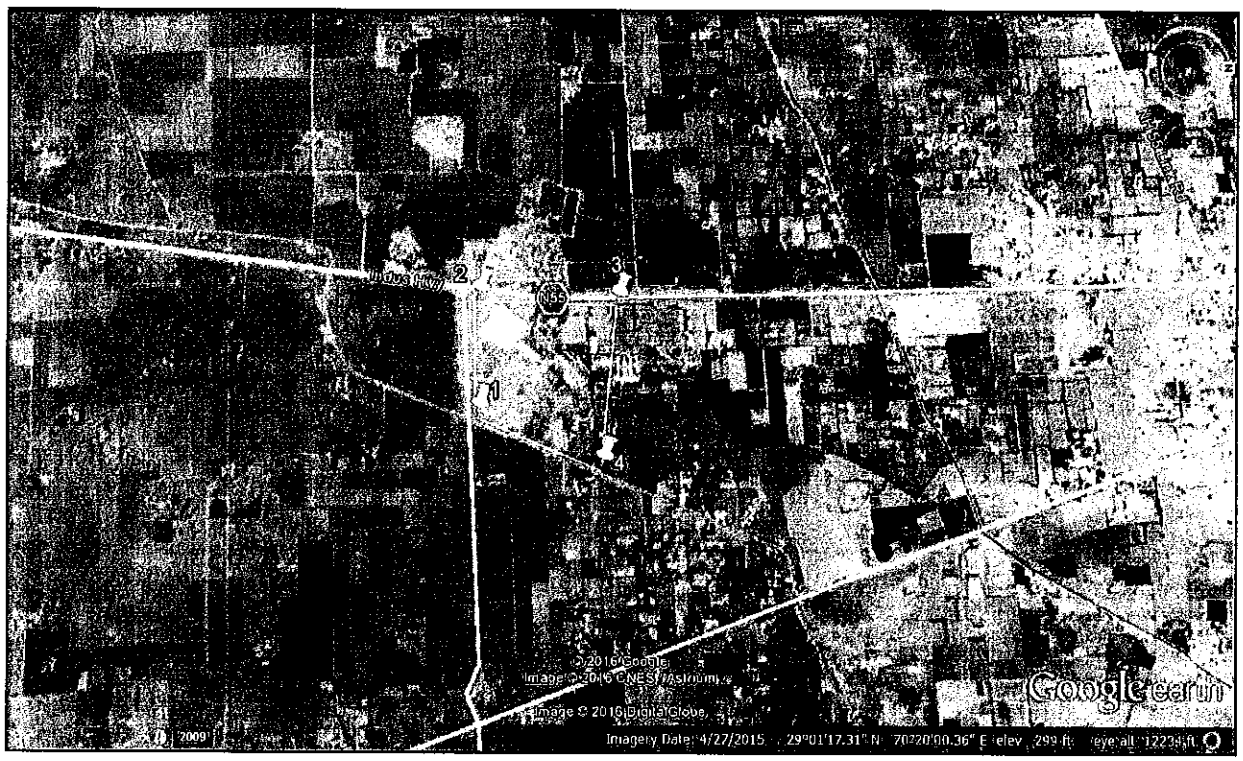


Figure 1: Location Map of the Project

1.13.2 Nature & Size of the Project

The project envisages on the installation of 30-MW, consisting of one 160 TPH, 110 ata, 540 boiler, extraction–cum-condensation turbine generator set

with necessary balance plant equipment. About 5-acre land will be required for proposed power plant. Indus Sugars is built in an area of about 84 acres of land, where the existing sugar factory is installed. Sufficient additional vacant space is available to install necessary plant & machinery required for 30-MW Co-gen plant. No additional land is required for this purpose. Layout of various sections for all the plant & machinery has been worked out in order to utilize the land very economically, without sacrificing the ease of operation & maintenance.

1.14 THE REPORT STRUCTURE

This IEE document is structured as follow:

Section – 1:

Introduction: Containing general information about the project and process of carrying out the study.

Section – 2:

National Environmental Policy, Legal And Administrative Framework: Describes the national policy, laws and regulations governing this IEE.

Section – 3:

The Project Description: Describes an overall detail of the works to be done pertaining to the proposed project.

Section –4:

The Description of the Environment: Gives information on Physical, Biological and Social conditions collected through survey of the Project Area.

Section – 5:

Environmental Impacts Due To Project & Mitigation Measures: Identifies various environmental impacts and their preventive actions. This makes the basis of the Environment Management Plan.

Section – 6:

Environment Management Plan (EMP): Contains comprehensive prescriptions regarding environmental impacts and their mitigation measures. This also includes institutional arrangements and Environmental Management & Monitoring Plan.

Section – 7:

Stakeholders Consultations: Explains the process of public consultation and disclosure of the project in related stakeholder. It makes this document a legal public document.

Chapter – 8:

Emergency Response Plan & Evacuation/Exit Plan: Explains about the arrangements to avoid any natural or anthropogenic emergency.

Chapter – 9:

Conclusion and Recommendation: Concludes the IEE report with some practical recommendation.

SECTION-2
NATIONAL ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Section - 2
NATIONAL ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

This section deals with the policy and legal framework which apply for protection, conservation, restoration, rehabilitation and also related to sustainable development in context of project implementation and its operation. The Project is expected to comply with all the legislations related to the environmental aspects as regards of Pakistan.

2.2 NATIONAL POLICY FRAMEWORK

Following elements of national policy framework are considered the most relevant to this project:

2.2.1 National Conservation Strategy

The Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992).

The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources.

The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are:

- pollution prevention and abatement,
- restoration of rangelands,
- increasing energy efficiency,
- conserving biodiversity,
- supporting forestry and plantations, and
- the preservation of the cultural heritage.

2.2.2 National Environment Policy 2005

The national environmental policy 2005 aims to protect conserve and restore the environment in order to improve quality of the life of citizens through sustainable development and resource conservation.

The main objectives of the policy are;

- Conservation, restoration and efficient management of the natural resources.
- Integration of the environmental considerations in policy making and planning process.
- Capacity building of government agencies and other stakeholders at all levels for the better environmental management.
- Meeting international obligations effectively in line with the national aspirations.
- Creation of a demand for environment through mass awareness and community mobilization.

2.2.3 The National Forest Policy 2001 of Pakistan

This policy covers the Renewable Natural Resources (RNR) of Pakistan i.e. Forests, Watersheds, Rangelands, Wildlife, Biodiversity and their habitats. The policy seeks to launch a process for eliminating the fundamental causes of the depletion of RNR through the active participation of all the concerned agencies and stakeholders, to realize the sustainable development of the resources. It is an umbrella policy providing guidelines to the Federal Government, Provincial Governments and territories for the management of their RNR. In consonance with it, the Provincial and District Governments may devise their own policies in accordance with their circumstances.

The goal of this policy is to foster the sustainable development of RNR of Pakistan, for the maintenance and rehabilitation of its environment and the enhancement of the sustainable livelihoods of its rural masses especially women, children and other deprived groups.

The elements of the policy are as follow:

- Population planning in critical eco-systems.
- Providing substitutes to firewood in the wooded mountains.

- Reducing the impact of socio-economic causes.
- Reducing poverty, poverty of opportunity, and powerlessness.
- Reducing political interference in the Forestry and Wildlife Departments.
- Renovating and invigorating the institutions of RNR.
- Supporting Local Governments in the sustainable development of their RNR.
- Policies for fragile natural Eco-systems.
- Riverain forests.
- Irrigated Plantations.
- Preservation of relict and unique forests.
- Wildlife.
- Rangelands and desert eco-systems.
- Planting of trees and fodders on farmlands.

2.3 PUNJAB ENVIRONMENTAL PROTECTION ACT (PEPA), 2012 AND ADMINISTRATIVE FRAMEWORK

2.3.1 General

PEPA 2012 (amended act) is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

The salient features of the law are:

- No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Provincial Environmental Protection Agency (EPA) an EIA, and has obtained a No Objection Certificate (NOC)/Environmental Approval (EA).
- Establishment and Formation of the Punjab Environmental Protection Council.
- Powers and Functions of the Provincial Environmental Protection Agency.
- Prohibition of certain discharges or emissions.

- National Environmental Quality Standards (NEQS) for wastewater, air emissions and noise.
- This act also empowers Provincial EPA to issue notices and to enforce them for the protection of the environment and resource conservation.

For the effective implementation of the provisions of PEPA 2012, EPA headed by a Director General has been constituted.

The capability of regulatory institutions for environmental management largely achieves the success of environmental assessment for ensuring that development projects are environmentally sound and sustainable. For decision-making and policy formulation in the environmental and conservation issues, the institutional framework is described in following paragraphs.

2.4 PAKISTAN ENVIRONMENTAL PROTECTION AGENCY REGULATIONS, 2000 FOR REVIEW OF INITIAL ENVIRONMENTAL EXAMINATION (IEE)/ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Under Section 12 (and subsequent amendment) of the 2012 amended Act, a project falling under any category specified in Schedule I or II requires the proponent to file an IEE or EIA, as the case may be, with the provincial agency. Within ten working days of the IEE or EIA having been submitted, the provincial agency will confirm that the documents submitted are complete for the purpose of review. During this time, should the provincial agency requires the proponent to submit any additional information; the IEE or EIA will be returned to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the provincial agency shall make every effort to complete an IEE review within 45 days and an EIA review within 90 days of filing of the complete information of report.

After the successful review, the EPA will issue the NOC/EA according to the rules and regulations as prescribed in Regulation 2000. During the project execution the proponents are required to comply with the recommendations of the IEE/EIA and also the conditions of the NOC/EA set forth by the relevant EPA, in present case, EPA, Lahore, Punjab. During the construction or post EIA monitoring and reporting is mandatory according to clause 19 of Regulation-2000. These Regulations requires proponent of all projects to submit environmental monitoring reports during and on completion of

construction, and regular operation of the project. Any additional requirements of the report as desired by the EPA are also necessary for the proponent, however, the format and contents of such reports are not specified in the law.

2.5 PAKISTAN ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

These guidelines are descriptive documents describing the format and content of IEE/EIA reports to be submitted to Provincial EPA for obtaining NOC. Following are the major areas, which are covered by these guidelines:

- The Environmental Assessment report formation (scoping, type and category of project, description of project, alternatives, site selection, baseline data).
- Assessing impacts (identification, analysis and significance).
- Mitigation and impact management and preparing an environmental management plan.
- Reporting (format, main features, shortcomings, other forms of presentation).
- Review and decision making (role, steps, remedial options, checks and balances).
- Monitoring and auditing (systematic follow up, effective data management).
- Project Management (inter-disciplinary teams, programming and budgeting).

2.6 GUIDELINES FOR PUBLIC CONSULTATION

The Federal EPA provides these guidelines to deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.

These guidelines cover:

- Consultation, involvement and participation of stakeholders
- Effective public consultation (planning, stages of EIA/IEE where consultation is appropriate)
- Facilitation involvement (including the poor, women and Non-Governmental Organizations (NGOs)

2.7 NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS), 2000

The NEQS 2000 specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers).
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources.
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust.
- Maximum allowable noise levels from vehicles.

These standards apply to the gaseous emissions and liquid effluents. Standards for ambient air quality have not been prescribed as yet.

2.7.1 National Ambient Air Quality Standards (NAAQSs)

The Ministry of Environment, Government of Pakistan vide its Notification, Islamabad, the 18th October, 2010 under S.R.O. 102 (1)/2010 established standards which provide the maximum allowable limits, in the ambient air, of Sulphur Dioxide (SO_2), Oxides of Nitrogen as (NOx) and as (NO), Suspended Particulate Matter-(SPM), Respirable Particulate Matter-PM_{10}, Respirable Particulate Matter-$PM_{2.5}$, Lead and Carbon Monoxide (CO).

Table 2.1: National Environmental Quality Standards Ambient Air

Pollutants	Time-Weighted Average	Concentration in Ambient Air Effective from 1st January 2013	Method of Measurement
Sulfur Dioxide (SO_2)	Annual Average*	80 µg/m^3	Ultraviolet Fluorescence
	24 hours**	120 µg/m^3	
Oxides of Nitrogen as	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescen

Pollutants	Time-Weighted Average	Concentration in Ambient Air Effective from 1st January 2013	Method of Measurement
(NO)	24 hours**	40 µg/m^3	ce
Oxides of Nitrogen as (NO_2)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m^3	
Ozone (O_3)	1 hour	130 µg/m^3	Non dispersive UV absorption
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1m^3/minute)
	24 hours**	500 µg/m^3	
Respirable Particulate Matter. PM_{10}	Annual Average*	120 µg/m^3	βRay absorption
	24 hours**	150 µg/m^3	
Respirable Particulate Matter. $PM_{2.5}$	Annual Average*	15 µg/m^3	βRay absorption
	24 hours**	35 µg/m^3	
		15 µg/m^3	
Lead (Pb)	Annual Average*	1.0 µg/m^3	ASS Method after sampling using

Pollutants	Time-Weighted Average	Concentration in Ambient Air Effective from 1st January 2013	Method of Measurement
	24 hours**	1.5 µg/m^3	EPM 2000 or equivalent Filter paper
Carbon Monoxide (CO)	8 hour	5 µg/m^3	Non Dispersive Infra Red (NDIR)
	1 hour	10 µg/m^3	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly/8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.

2.7.2 National Drinking Water Quality Standards (NDWS)

The Ministry of Climate Change, Government of Pakistan vide its Notification, Islamabad, the 18th October, 2010 under S.R.O. 102(1)/2010 established standards for Drinking Water Quality. The major quality parameters fixed depend upon Bacterial, Physical and Chemical ones.

Table 2.2: National Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan
All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water entering the distribution system (E.Coli or thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water in the distribution system (E.Coli or thermo tolerant	Must not be detectable in any 100 ml samples In case of large

Properties/Parameters	Standard Values for Pakistan
coliform and total Coliform bacteria)	supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.
Physical	
Color	Non objectionable/Acceptable
Taste	Non objectionable/Acceptable
Odor	Non objectionable/Accept able
Turbidity	< 5 NTU
Total hardness as $CaCO_3$	< 500 mg/l
TDS	< 1000
pH	6.5 – 8.5
Chemical	
Essential Inorganic	mg/Litre
Aluminum (Al)	≤0.2
Antimony (Sb)	≤0.005 (P)
Arsenic (As)	≤0.05 (P)
Barium (Ba)	0.7
Boron (B)	0.3
Cadmium (Cd)	0.01

Properties/Parameters	Standard Values for Pakistan
Chloride (Cl)	<250
Chromium (Cr)	≤0.05
Copper (Cu)	2
Toxic Inorganic Cyanide (Cn)	**mg/Litre** ≤0.05
Fluoride (F)*	≤1.5
Lead (Pb)	≤0.05
Manganese (Mn)	≤0.5
Mercury (Hg)	≤0.001
Nickel (Ni)	≤0.02
Nitrate (NO_3)*	≤50
Nitrite (NO_2)*	≤3 (P)
Selenium (Se)	0.01 (P)
Residual chlorine	0.2-0.5 at consumer end; 0.5-1.5 at source
Zinc (Zn)	5.0
Organic	
Pesticides mg/l	PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted.

Properties/Parameters	Standard Values for Pakistan
Phenolic compound (as phenols) mg/l	WHO standards: ≤0.002
Polynuclear Aromatic hydrocarbon(as PAH) g/L	WHO standards: ≤0.01v(by GC/MS method)
Radioactive	
Alpha Emitters bq/L or pCi	0.1
Beta Emitters	1

2.7.2 National Environmental Quality Standards - Noise

The Ministry of Climate Change, Government of Pakistan vide its Notification, Islamabad, and the 18th October, 2010 under S.R.O. 102(1) /2010 established standards for Noise. These standards are based on Category/zone i.e. Residential area, Commercial area, Industrial area and Silence zone. The limiting values for day and night have also been fixed for all categories/zones.

Table 2.3: National Environmental Quality Standards - Noise

Category of Area/Zone	Effective from 1st July 2012	
	Day time	Night time
Residential area	55	45
Commercial area	65	55
Industrial area	75	65
Silence zone	50	45

Limit in dB (A) Leq*

Notes:

1. Day time hours: 6:00 a.m. to 10:00 p.m.
2. Night time hours: 10:00 p.m. to 6:00 a.m.

3. Silence zone::Zones that is declared as such by the competent authority. An area comprising not less than 100 m around the hospitals, educational institutions, and courts.

4. Mixed categories of areas may be declared as one of the four above-listed categories by the competent authority.

* dB(A) Leq: Time weighted average of the level of sound in decibels on Scale A which is relatable to human hearing.

2.8 NATIONAL RESETTLEMENT POLICY AND ORDINANCE

As referred above, at present the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. Experience with large-scale infrastructure development projects implemented by institutions such as WAPDA has demonstrated the need for a cohesive national policy for resettlement. Following a national consultative process, a national resettlement policy and a related ordinance were drafted known as Draft Resettlement Policy, 2002 which still has to be approved by the government. The salient applicable features of the Draft Resettlement Policy are given below:

- The Pak-EPA will be responsible for both environment-related as well as resettlement-related matters.
- The responsibilities for implementation at a provincial level are to be delegated to the concerned provincial EPAs with overall control of the provincial Planning and Development (P&D) Departments.
- All categories of 'loss' arising from development projects that entail resettlement, need to be addressed: these include not only loss of land, built-up property, other infrastructure, and crops and trees, but also loss of income, job opportunities, and access to natural resources, etc.
- Vulnerable groups whose issues need to be addressed in particular include: women, children, destitute persons, tribal communities, squatters, those with usurper rights, and landless groups.
- There should be a special emphasis on consultation with affected groups when preparing a Resettlement Action Plan.

2.9 OTHER ENVIRONMENT RELATED STATUTES

This section outlines the other statutes apart from Pakistan Environmental Protection Act, 1997, which are relevant to the project.

2.9.1 The Land Acquisition Act (LAA), 1894

At this point, the only legislation relating to land acquisition and compensation is the LAA of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods.

The Project will involve acquisition of about 500 Acres of land owned by the Cholistan Development Authority and some portion leased by the local farmers. The land will be acquired under the LAA 1894. In the Act there are provisions for normal acquisition of land under Section 6 (4) or emergency acquisition under Section 17 (4).

2.9.2 Pakistan Explosives Act, 1884

Under the Explosives Act, the project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting, and other purposes.

2.9.3 The Forest Act, 1927

The Forest Act empowers provincial governments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and toping of trees, branches in reserved or protected areas.

2.9.4 Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of environment, the Penal Code empowers the local authorities to control noise, noxious emissions and disposal of effluents. The NEQS enforced by the EPAs supersede the application of this legislation on industries and municipalities.

2.9.5 Provincial Wildlife Act, 1974

In addition to empowering the provincial wildlife departments to establish game reserves, parks, and wildlife sanctuaries, this Act regulates the hunting and disturbance of wildlife.

2.10 INTERNATIONAL AND NATIONAL NON-GOVERNMENTAL ORGANIZATIONS

International and national Non-Government Organizations (NGOs), such as the International Union for Conservation of Nature and Natural Resources (IUCN) and the World Wide Fund for Nature (WWF), have been active in Pakistan for some time. Both of these NGOs have worked closely with the governments at the federal as well as provincial levels and have positively contributed to the cause of environment. They have played significant role with regard to the formulation of environmental and conservation policies. And last but not the least, another the most prominent NGO namely "Sustainable Development Policy Institute (SDPI) "has also played very significant role in upholding the cause of environmental protection in Pakistan. Environmental NGOs have been particularly active in the advocacy for promoting sustainable development approaches. Most of the government's environmental and conservation policies, even at the provincial and federal levels, have been formulated in consultation with these leading NGOs, who have also been involved in drafting new legislation on conservation.

2.11 PROVINCIAL LOCAL GOVERNMENT ORDINANCES, 2001

These ordinances, issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents, as well as matters related to public health and safety.

2.12 PUNJAB INDUSTRIAL RELATIONS BILL 2010

In December 2010 Punjab Assembly passed new legislation that will govern the formation of trade unions, relations between industries and their workers, and the process for the settlement of labour disputes.

2.13 INDUSTRIAL RELATIONS ORDINANCE 2011 PROMULGATION

The Government has promulgated Industrial Relations Ordinance 2011. The Ordinance has been approved by the President on the Advice of the Prime

Minister. The Government has promulgated Industrial Relations Ordinance, 2011 in view of the current legal vacuum created due to deletion of the concurrent Legislative List through the 18th Constitutional Amendment. The Industrial Relations has also been transferred to the Provinces which have promulgated provincial laws to regulate industrial relations. However, there is no law in place to deal with Industrial Relations in the Islamabad Capital Territory or in respect of national level trade federations and for resolutions of trans-provincial industrial issues. The Parliament has yet to promulgate the Ordinance as law.

2.14 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ACT 1997

The NEPRA Act was approved by Parliament and signed into law in December 1997. It seeks to create an autonomous, independent regulatory authority, which will be solely responsible for the power sector. It will be responsible for the oversight of the power sector and will exercise control through its power to license power generation, transmission and distribution. It will regulate tariffs for all these activities. It will perform its functions through transparent processes to be enshrined in rules that are being framed in a transparent manner through appropriate rules.

2.15 LAND USE

The project site is situated in the area where agriculture area and in surroundings the industrial activities are lacking. The land is agricultural in nature productive; some land is non-productive due to absence of fresh water and presence of highly saline soil.

SECTION-3
DESCRIPTION OF THE PROJECT

Section-3

DESCRIPTION OF THE PROJECT

3. GENERAL

This section deals with project components, which are the part of installation of 30-MW bagasse based cogeneration power plant and its related construction activities for execution of this project. It also describes the category of the project, availability of construction materials, type of vegetation in the project area, construction time and cost of the project, construction and operation equipments etc. The information presented in this section is based on project site survey, preliminary design report, and the information provided by the client.

3.1 TYPE AND CATEGORY OF THE PROJECT

Acute shortage of energy in the country besides the high fuel costs and use of low quality oil is causing a significant loss of production resulting in negative economic impact. Thus, use of baggase from local source may provide cost component energy units. The use of bagasse as source of energy production is on high priority of government to overcome this energy shortage. Therefore, Indus Energy Limited is planning to set up 30 MW co-generation power plant. The purpose of the project is to provide the reliable baggase energy with affordable cost. In accordance with the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project falls in Schedule –I, Part-A 'Energy' Serial 2 'Thermal power generation less 200 MW; therefore, requires the Initial Environmental Examination (IEE) study for sustainable development and to submit in provincial Environmental Protection Agency (EPA), for issuance of Environmental Approval (EA).

3.2 OBJECTIVE OF THE PROJECT

The main objective of the proposed project is to generate cleaner, economical and reliable energy from available fuel which will not only provide a better alternate source of energy but also provide a relief to overcome acute

shortage of energy and save millions of dollars which is being wasted to import expensive oil being used as fuel for producing electricity. By using a cleaner technology and fuel it will also reduce environmental hazards caused by burning of fossil fuel for producing electricity.

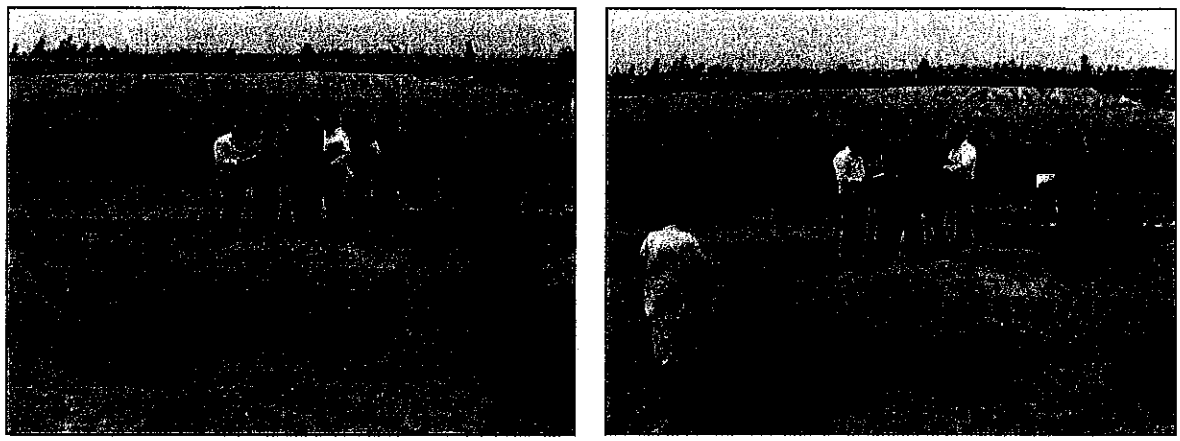


Figure 3.1: A View of Project Site During Survey

3.3 LAND USE ON THE SITE

Currently the proposed land for installation of power project is barren land of Indus Sugar Mills from where the raw material Baggase will be generated.

3.4 VEGETATION FEATURES OF THE SITE

The project site and its vicinity have some sort of shrubs with no significant importance. The land is barren and non-cultivated except some part of land which is far away from the proposed project site.

3.5 SCHEDULE OF IMPLEMENTATION

It is planned that the following schedule of project implementation will be adhered to. This is subject to the conditions that everything goes according to planning and no serious bottlenecks are encountered.

The implementation stages of the project activity include:

1st Stage

The stage–1 comprises the onsite contouring studies and soil investigations.

2nd Stage

The stage –2 comprises Finalization of EPC and the following task:

i- Laying of foundations excavation and commencement of erection work.

ii- Start of civil, electrical and mechanical work.

iii- Development of basic infrastructure.

iv- Fitting of instrumentation.

3rd Stage

The stage –3 comprises the following task:

v- Plant Equipment erection completion.

vi- Completion of the basic infrastructures water supply system, electricity supply etc.

4th Stage

The stage –3 comprises the Tests & Commissioning.

5th Stage

The Last stage will be commencement of regular production (December 2019).

3.6 DESCRIPTION OF THE PROJECT (PROCESS FLOW CHART/STEPS)

Project is installation of 30 MW bagasse fired power plant. A flow sheet diagram of the proposed project is given in **figure 3.2:**

3.7 CONSTRUCTION ASPECTS & OPERATIONAL ARRANGEMENTS

3.7.1 Construction Materials

Comparatively reasonable quantities of buildings and other facility construction materials will be required for construction of the proposed facility. The materials mainly required are listed below:

- Coarse and fine aggregate for concrete works
- Sandy gravel for backfilling, embankment raising, etc.
- Cement
- Steel
- Bitumen
- Electric Equipments
- Lights
- Other materials etc.

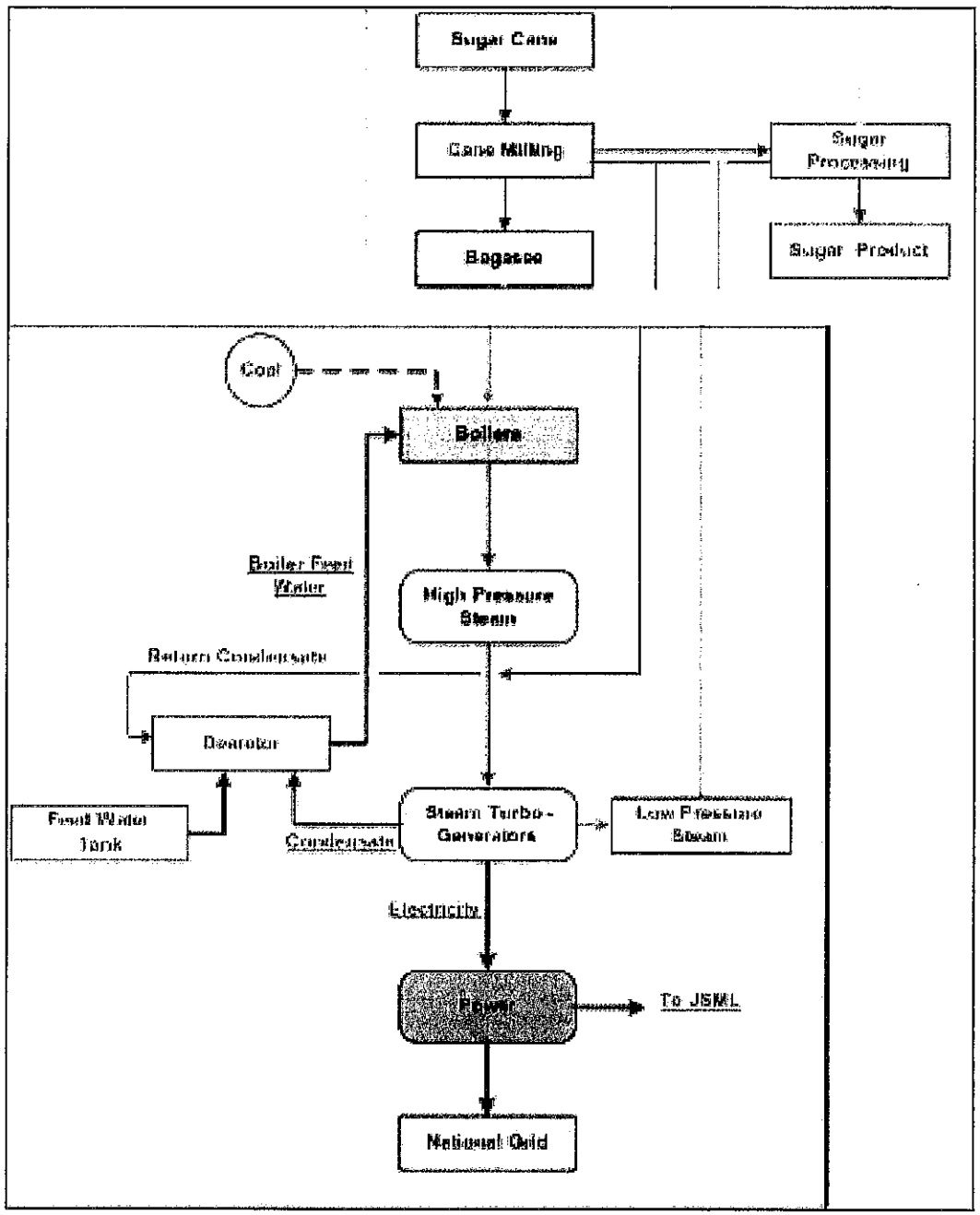


Figure 3.2: Process Flow Sheet Diagram of the Project

(Source: Project Concept Note)

3.7.2 Construction Camps

The establishment of the construction camp will be done within the plant facility. Location of the camp will be selected in a way that there will not be any disturbance to the nearest community and it is also close to the site of

work or within the project site. Camp will be properly fenced and guarded. This site camp will be constructed mainly for construction staff and to accommodate Contractor's machinery. The area of the camp will be kept sufficiently large to accommodate parking areas for machinery, construction materials and workshops.

3.7.3 Work Force and Work Machinery

The details of the construction staff has been shown below in **Table 3.1**. The labour will work in one shift of eight (8) hours. The construction machinery which will be utilized for construction is shown in **Table 3.2.**

Table 3.1: List of Construction Staff

Sr. No.	Category of Staff	Tentative Number
1	Engineer	5
2	Construction Manager	1
3	Planning Engineer	3
4	Material Engineer	3
5	Site Engineer	2
6	Supervisor	5
7	Foreman	15
8	Skilled Worker	210
9	Semi Skilled Worker	550
10	Machinery Operator	16
11	Admin.	2

Table 3.2: List of Construction Machinery to be used for Construction

Sr. No.	Type of Machinery	Quantity
1	Excavator	5
2	Dumper & Loader	15
3	Tractor & Trolley	4
4	Water Bowser	5
5	Lift/Crane	2
6	Generator	10
7	Concrete Pump	5
8	Water Pump	3
9	Welding Plant	5
10	Concrete Mixing Plant	1

At operation stage, the project proponent will be involved for operation and maintenance of the proposed facility.

3.8 GOVERNMENT APPROVALS AND LEASES REQUIRED BY PROJECT

The project is in feasibility stage, the drawings are under process of completion and approval of project feasibility and tariff determination is under process. The environmental approval according to the Section 12 of Punjab Environmental Protection Act-2012 is the mandatory requirement of the project. All the other approvals pertaining to the project are under process from various departments.

3.9 COGENERATION PROPOSAL

A new Efficient, high pressure Co-generation plant is proposed, which will provide the low pressure steam for the Process & generate Surplus Power for

sale to MEPCO/ other Buyers. The proposed Co-gen Plant will consist of a 160 TPH, 110Kg/cm^2, 5400 C Bagasse fired, traveling Grate Boiler and 50 Hz Extraction cum Condensing Turbine Generator sets.

The bagasse generated from sugar mill will be sufficient to meet requirements of both the Boilers and some quantity will be saved during season. The co-gen plant will be operated in condensing mode during the Off-season using the saved bagasse. During off-season power generation will be 20 MW. Efforts will be made to source some other biomass Fuels (mainly agro residues) and mixed with Bagasse in small quantities to extent the plant Operational period.

3.10 COGENERATION PROPOSAL

A new Efficient, high pressure Co-generation plant is proposed to be added, which will provide the low pressure steam for the Process & generate Surplus Power for sale to MEPCO/ other Buyers. Balance low pressure steam will be catered from the existing 11 MW Pressure TG sets by operating 1 × 80 TPH Boiler.

The proposed Co-gen Plant will consist of a 160 TPH, 110Kg/cm^2, 5400 C Bagasse fired, traveling Grate Boiler, 11KV, 50-Hz Extraction cum Condensing Turbine Generator sets.

The bagasse generated from sugar mill will be sufficient to meet requirements of both the Boilers and some quantity will be saved during season. The co-gen plant will be operated in condensing mode during the Off-season using the saved bagasse. During off-season power generation will be 20 MW. Efforts will be made to source some other biomass Fuels (mainly agro residues) and mixed with Bagasse in small quantities to extent the plant Operational period. Provision will also be made for using Coal in future and to extend Off-season days operation.

Necessary Electrical System for Integration with the existing Plant at 6.6 KV & WAPCO Grid at 132 KV will be provided, to meet Power demands of the Sugar Plant (at expanded crushing capacity) and sale of the surplus Power.

3.11 LAND & BUILDING REQUIREMENTS

Indus Sugars is built in an area of about 84 acres of land, where the existing sugar factory with Cogen unit are installed. Sufficient additional vacant space is available to install necessary plant & machinery required for 30 MW Co-gen plants. No additional land is required for this purpose. Layout of the various sections for all the plants & machinery have been worked out in order to utilize the land very economically, without sacrificing the ease of operation & maintenance. The Civil works in Cogen plant will mainly include the main building for the Turbine-generator house, Control Room and Machinery & Equipment Foundations, the Boiler, Turbo-generator set, Switch yard, Cooling Tower basin, Chimney & Ash Silo, etc.

Non-factory buildings, like time office, security office, administrative office, guest house and the residential quarters already exist & will be used without any additions / alterations.

3.12 PLANT AND MACHINERY

3.12.1. Boiler

One no. Travelling Grate Boiler, 160 TPH steam generation capacity at 110 ata and 540+/-5 deg C, with accessories like ID, FD & SA Fans, Electro Static Precipitator, Heaters, De-aerator system, Softener and DM water Plant, etc. to ensure continuous & trouble free operation of the boilers.

Sufficient Bagasse Storage & Handling Space is available near the proposed Boiler area. Supply & Return Bagasse Feeding Conveyers, etc, are proposed to be suitably modified for feeding Bagasse to the new Boiler during Season & Off –Season operations. The Boiler operations will be fully automatic.

The Boiler Plant will be complete with fuel storage, fuel conveying & firing systems, ash handling and storage system, HP & LP chemical dosing systems, Electro Static Precipitator, ID, FD & SA fans, Boiler Feed Tank, De-aerator, BFW pumps, etc. with necessary controls and safety devices. Boiler control panel will be housed in the boiler House to facilitate operational convince. Facilities will also be provided for storage, Handling & Feeding of Alternate Fuels for the proposed Boiler, so as to achieve continuous plant

operation during the period of low Cane/Bagasse availability & also during the Off-season.

Table 3.3: Proposed Boiler Specs

Sr. No.	Description	Unit	Qty
1	Steam generation, MCR	TPH	160
2	Quantity	Nos.	1
3	Steam pressure at Super Heater outlet	Ata	110
4	Steam temp. at Super Heater outlet	Deg C	540
5	Feed water temp at Economizer inlet	Deg C	215
6	Expected temp. loss from Boiler to TG	Deg C	5
7	Expected pressure loss form Boiler to TG	ata	5
8	Blow down water loss	%	2
9	Fuel Main Support	100%	Bagasse/ Coal

Source: Project Concept Note

3.12.2 Turbine Generator

One no. Bleed, Extraction cum Condensing type TG set of 30 MW, 11 KV, 50 Hz capacity, along with the inter connecting Steam & Condensate piping & Cooling Water circulation system. The proposed TG set will be capable of meeting the balance Process Steam & Power requirements of the Sugar Mill & Cogen Plant Auxiliaries.

Part of the steam will be condensed in the condensed and condensate recycled back to the boiler. Bleed steam is used for heating the broiler feed water in the Heaters and Ejector to create vacuum in condenser. Extracted

steam will be used in the process house for making sugar as well as in the de-aerator for feed water heating.

The TG set will be provide with Electronic Speed Governor, 11KV switchgear with VCB, control panels, synchronizing facility, safety devices, earthing network & grid interfacing facility, etc.

Table 3.4: Heat & Mass Balance Table

Description	Unit	Season	Off Season
Rated Capacity of the TG set (one unit)	MW	30	
Steam flow at the inlet of the turbine	TPH	153.2	119.7
Steam pressure at inlet of the Turbine	ata	105	
Steam temperature at STG inlet	Deg. C	535	
Bleed Flow (HP Heater 1)	TPH	11	7.1
Bleed Pressure	ata	22	17
Bleed Flow (HP Heater 2)	TPH	13.5	8.9
Bleed Pressure	Ata	10	8
Extraction Flow (to process & De-aerator)	TPH	13.6	13
Extraction Pressure	Ata	3	3
Exhaust flow	TPH	27	90.7
Exhaust pressure	Ata	0.07	0.1
Cooling water temp at Condenser I/L	Deg. C	32.0	
Cooling water temperature at O/L	Deg. C	40.0	
Power Generated with synchronous generator	MW KV	30 11±10%	

Description	Unit	Season	Off Season
	Phase	3	
	Hz	50	
	PF	0.8	
	RPM	1500	

Source: Project Concept Note

3.12.3 Piping

Steam Piping: The materials are selected based on Temp. Profile

- For Temp. above 535°C- SA 335 P22/P91/ Eqvt.
- For Temp. 427°C to 535°C- SA 335 P11 / Eqvt.
- For Temp. below 427°C-SA 106 Gr.
- For Cooling water, Raw Water & Services- IS 1239/ IS 3589-ERW/ IS 2062/ Eqvt
- For instrument Air – GI Pipe as per IS:1239 Part 1 / Eqvt

3.12.4 Fuel Conveying Systems

Fuel conveying systems will be designed considering the future expansion of additional 30 MW Co-gen plants.

3.12.5 Bagasse Handling System:

Bagasse generated from the Sugar Mill is fed to the existing boilers through a conveying system & surplus bagasse is conveyed to the storage area. The conveyor is proposed to be modified to handle the additional quantity & extended to feed the new Boiler.

Excess bagasse from the New Boiler will be fed to a Belt conveyor and conveyed to the Yard in parallel to the existing Conveyer.

During off season/ stoppage of Mill, the stored Bagasse will be fed using the existing Return Conveyor and dropped to a new conveyor proposed for the Boiler.

3.12.6 Coal Handling System

To meet any exigencies & also to extend Co-gent plant operation during off-season, the proposed boiler is designed to operate efficiently using indigenous / imported coal, with an average GCv of about 5600 Kcal/ Kg.

Coal Handling system is worked out considering Imported Coal. While the boiler will be provided with the necessary coal feeding facility now, coal handling conveyor and hopper, etc will be added as & when considered necessary by the Mill management.

3.12.7 4. Ash Handling System

Ash handling system will comprise

A. Bed Ash: Submerged Ash conveyor

The bed ash is collected in front of the boiler in a submerged Ash Conveyor and conveyed to MS Ah Silo of about minimum 8 hrs storage (Keeping future expansion) through a Belt Conveyor.

B. Fly Ash: Pneumatic Ash Handling

It is envisaged to provide Dense Phase type Ash Handling System for handling Fly ash generated from Air pre-heater, Economizer & ESP. The system will consist of Surge Hoppers below Air pre-heater, Economizer and ESP hopper, Conveying Pipes and Ash storage Silo for minimum 8 hrs storage capacity (Keeping future expansion).

3.12.8 WATER TREATMENT SYSTEM

Water treatment plant will comprise:

- Pre-treatment plant
- RO based DM plant
- Softener plant

Particulars	
Soft water requirement for Co-gen Plant	120.0 m^3/hr
Raw water requirement for DM plant	12.0 m^3/hr
Total Raw water requirement	132.0 m^3/hr
Total Raw water required per day	3200 m^3

Source: Project Concept Note

The capacity of DM plant is considered as 30 m3/hr keeping in view that the sugar mill condensate may get contaminated sometimes.

3.12.9 RO BASED DM PLANT

3.12.9.1 Quality of water attained at DM Plant:

Hardness	Nil
Conductivity at 25°C	< 0.2 micro Siemens/ sec (Before ph Correction)
ph at 250C	8.5-9.2 (After ph Correction)
Silica - Max	<0.02 ppm

Source: Project Concept Note

Make-up water required per Boiler (Process loss+ Blow down+ De-aerator loss) is estimated as 8 m^3/hr. Considering margin, regeneration and Start up requirement RO based DM plant will be designed for 30 m^3/hr.

3.12.10 RO BASED DM PLANT

Quality of water attained at Softener Plant:

Total Hardness as $CaCO_3$	< 5 ppm

Make- up water required for proposed Cooling Tower is estimated at 120 m^3/hr. Considering regeneration and keeping some margin, it is proposed to install Softener capacity of 1×140 m^3/hr, i.e. 3,000 m^3 capacity is considered keeping future expansion.

3.12.11 COOLING TOWER

One number cooling tower of induced Draft, Counter Flow type shall be provided. The cooling tower will have RCC basin & filled with PVC film. The cooling tower shall be designed for catering the cooling water requirement for the Cogen plant auxiliaries including condenser, oil coolers, air coolers, air compressors, Boiler feed pumps, etc.

The capacity of the cooling tower will be 6,300 m^3/hr, consisting of two/three cells, depending upon the OEM design considerations. The cooling tower

shall be designed for a cooling range of 80C and an approach of 50C while operating under the atmospheric wet bulb temperature of about 280C.

The cooling water system will be provided with chlorination dosing system and circulating water chemical treatment system to prevent against algae growth and to maintain circulating water quality. Three nos. (2W+1S) of horizontal, centrifugal type Split Casing Pumps each of 3,000 m^3/hr capacity with sufficient head will be installed near cooling tower to circulate the cooling water to condenser.

Two nos. (1W+1S) of horizontal, centrifugal type, Pumps each of 400 m^3/hr capacity with sufficient head will be installed near Main Cooling Water pumps to circulate the Cooling water to Boiler & TG auxiliaries.

3.12.12 EOT CRANE

One EOT (Electrical Operated Overhead Traveling) Crane will be provided in the power house for undertaking maintenance of the turbine and Generator. Capacity of the Crane is considered at 30/5 (approximately) Tones, for lifting heaviest component during maintenance. An auxiliary hoist of 5 Tones is also foreseen along with main hoist.

3.12.13 COMPRESSED AIR SYSTEM

This compressor system will meet with both instrument air as well as the service air requirement of the planet. The service air shall be tapped off from the air receiver, without passing through the air dryer. Compressed air system will consist of Compressors, inter & after Cooler, Refrigeration Type air Drier, Air receiver & Instrument Air Distribution Network. The distribution Network will cover instrument air requirement for the pneumatic devices in power plant.

Table 3.5 Showing Compressor Specs

No. of Compressors	2×100%
Rated flow	250 cfm
Rated Discharge Pressure	7 Kg/cm^2
Minimum instrument air pressure required for safe operation of plant	5 Kg/cm^2

instrumentation	
Rated continuous Air Flow through Air Dryer	250 CFm
Design Pressure downstream of Compressors	7 Kg/cm^2
Maximum Air Velocity in the Piping	12 to 18 m/sec
Set value of Safety Valve	7 Kg/cm^2

Source: Project Concept Note

3.12.14 THERMAL INSULATION

All exposed portions of the plant, which operate at temperature of 600C and above during normal operation will be thermally insulated. The thermal insulation is carried out to restrict the temperature on the souter surface of the cladding to 200C above ambient. The insulation is designed based on a wind velocity of 3m/sec.

3.12.15 PERSONAL PROTECTION

Piping and equipment within reach that do not require insulation to prevent heat loss, but having a surface temperature exceeding 600C will be insulated for personal protection

3.12.16 VENTILATION AND AIR CONDITIONING SYSTEM

Ventilation and Air conditioning facilities will be provided for the various plant premises to ensure proper working environment both for men & machines and to maintain necessary environmental conditions for proper storage of plant machinery, Equipment and Materials. While the Control Room will be provided with Floor standing / wall mounted Split ACs. Redial Exhaust Fans will be provided in the TG Hall & Electrical Switchgear Room for proper ventilation

SECTION-4
DESCRIPTION OF ENVIRONMENT

Section - 4

DESCRIPTION OF ENVIRONMENT

4.1 INTRODUCTION

This chapter describes the baseline conditions, which cover the existing physical, ecological and socio-economic environment of the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the project area as well as information obtained through visits to the Government departments and other agencies namely Irrigation Department, Meteorological Department, Forest offices and prevailing environmental laws and environmental quality standards etc.

4.1.1 Desk Studies

Building design data was collected from proponent. This data included the available documents, drawings, reports, etc related to the proposed project of commercial and related utilities. The experts conducted a detailed desk study of the above available data before the field visit. Salient features of the project were thoroughly reviewed to assess their environmental implications. The documents which were consulted and departments visited are project site, Irrigation Department, Meteorological Department, Forest offices and other related officials.

4.1.2 Site Visits

A team of experts visited to the proposed site for collection of baseline environmental data for ambient air, noise levels, drinking water and waste water sampling, public consultation, baseline ecological environment data etc. After the survey of the project area the environmental data regarding physical, ecological and socioeconomic aspects were collected for carrying out environmental assessment. Secondary data were also collected from various sources mainly studies carried out by project proponents and reports of other line Departments. A social survey of the proposed area was carried in which people living around the proposed site were interviewed to ascertain their views about the building and utility facilities commissioning and operational activities to perceive the impacts on the natural and socioeconomic

environment around the proposed project site. This included information on land, surface water, groundwater, air, vegetation, animals and human. Photographs of the various environmental aspects both inside and outside the proposed project area were also taken and are given as photologs in this IEE report.

4.2 PHYSICAL ENVIRONMENT

4.2.1 Topography

Pakistan lying in the northwestern part of the Southern Asian Subcontinent, occupies the western end of the Indo-Genetic Plain, which is beyond bounded in the north by mountain wall of the Great Himalayas and their offshoots. Physiology of the earth is description of the behavior of the upper crust. Accordingly, some knowledge of the geology is desirable. The project site has a flat topography with terrain slope of about 19-22 cm/km. Rajanpur, is a city and the headquarters of Rajanpur District in the far southwestern part of Punjab, Pakistan. The district lies entirely west of the Indus River it is a narrow, 32 kilometres (20 mi) to 64 kilometres (40 mi) wide strip of land sandwiched between the Indus River on the east and the Sulaiman Mountains on the west. The town is approximately 15 kilometres (9 mi) from the west bank of the river. It had a population of 42,986 in 1998. China is financing a new coal project in the area. Rajanpur was named by a warlord Makhdoom Shaikh Rajan in 1772–73. It remained a small and little known village located on the road from Dera Ghazi Khan (Punjab) to Sukkur in (Sindh) until 1862. In that year, Mithankot, a larger and more prosperous town located southeast of Rajanpur and closer to the Indus River, was completely destroyed by floods. The administrative offices of the Assistant District Commissioner of the British government were moved from Mithankot to Rajanpur, because of its location at a safer distance from the river. Many prosperous Hindu Arora merchants and traders also moved from Mithankot to Rajanpur. Rajanpur District derives its name from the town of Rajanpur which was founded by Makhdoom Sheikh Rajan Shah about 1770. Rajanpur District was carved out from Dera Ghazi Khan District in 1982. Rajanpur is situated on the right bank (west side) of River Indus. It is bounded on the north by

Dera Ghazi Khan District, to the west by Dera Bugti district of Balochistan, to the east by Muzaffargarh and Rahim Yar Khan districts, in the south lies Kashmore District of Sindh Province. The Sulaiman Mountains rise to the west of the district.

It became a municipality and the tehsil headquarters in 1873. Now it is a well developed city of south Punjab. The predominantly Muslim population supported Muslim League and Pakistan Movement. After the independence of Pakistan in 1947, the minority Hindus and Sikhs migrated to India while the Muslim refugees from India settled in the Rajanpur.

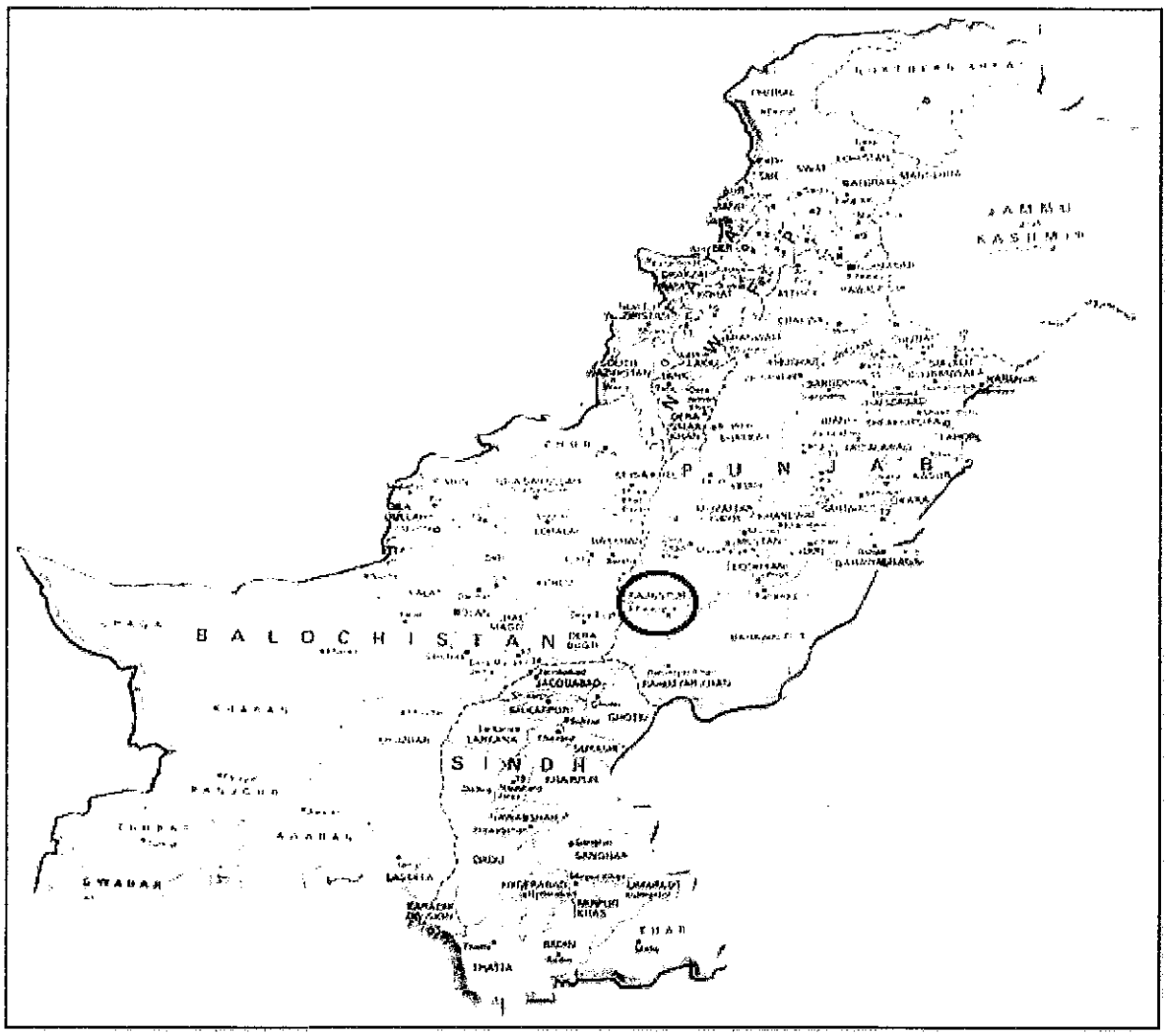


Figure 4.1: District Rajanpur on the Map of Pakistan

4.2.2 Soils

Soils form major part of environment. Their fertility and other special characteristics have great relationship with environment. Climate has great influence on the formation of soil, therefore, study of these factors is of great importance. Soil is dynamic layer in which many complex physical, chemical and biological activities are taking place. Therefore, soil is a dynamic changing body.

Soil scientists restrict the word soil or solum to the surface materials which over the ages have adopted the distinctive layers or horizon. Soils are made up of solids, liquids and gases. The solid part of the soil is made up of both inorganic and organic. While weathering of rocks make inorganic particles, the organic solids consist of living and decayed plants. In order to classify the entire soils in Pakistan, the Soil Survey of Pakistan has divided the entire country into nine ecological zones. The soil of area on the whole is very fertile.

The geotechnical investigations carried out at the site for this project have revealed the presence of the three distinct lithological units. First one is Lean Clay (CL) present in a firm to stiff state up to a depth of 3.0 to 4.0 m below NSL. Second is Silty fine Sand (SM) and poorly graded Sand with Silt (SP-SM) present in medium dense to very dense state following the top layer and extending up to maximum investigation depth of 30 m. Third layer is Lean Clay/Sandy Lean Clay (CL) of thickness ranging from 1.0 to 9.0 m is present at depths ranges from 14.0 to 23.0 m. The groundwater table was observed at a depth of 25 to 38 m below of earth.

4.2.3 Seismology

Earthquakes are generated due to tectonic processes in the upper part of the earth called lithosphere, which is divided into several rigid parts called "Plates". Due to the movement of these plates, stress build up takes place and results in the deformation of the crustal mass in the form of folding and faulting. The energy produced due to movement along the faults is depicted in the form of earthquakes.

The Project site is located south of the collision zone between the Indian and Eurasian plates. This contact represented by the Himalayas, has always been generating moderate to large earthquakes including Kashmir (2005), Kangra (1905), Nepal-Behar (1934) and Assam (1897 and 1950) that caused huge damage to life and property. Any major to large earthquake along Himalayan frontal faults can cause appreciable ground motion at site. The Punjab Plain, in which the Project is located, also shows low to moderate level of seismicity which is associated with the faulting in the Basement rocks covered by the alluvial deposits. A concentration of earthquakes has been observed west of the site between Shahkot and Sargodha which could be associated with faults in the Basement High. A minor to moderate earthquake originated from the Basement rocks in Punjab Plain could also produce appreciable ground shaking due to thick alluvial deposits. The project site lies in **2A** category as shown in the figure 4.2.

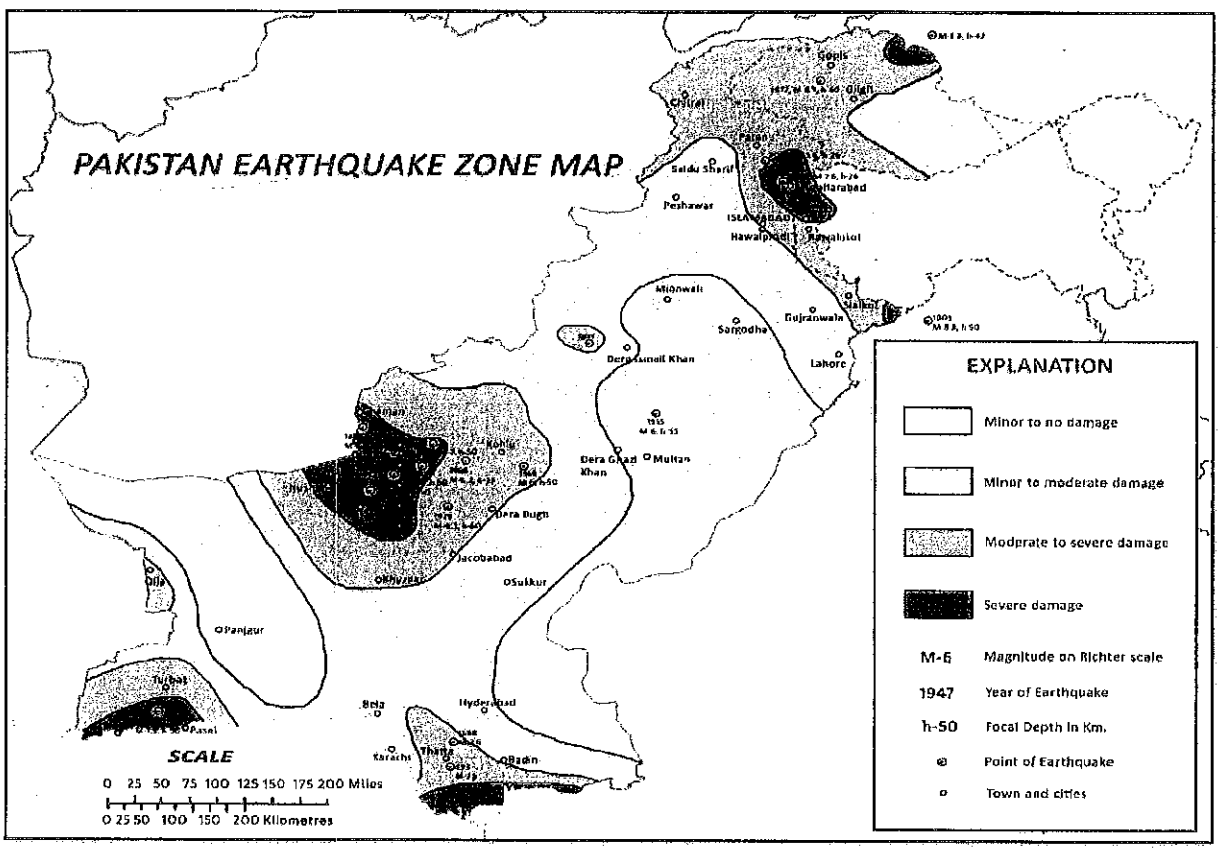


Figure 4.2: Seismic Map of Pakistan

According to Seismic Zoning Map of Pakistan included in the Pakistan Building Code Seismic Provisions (2007), the project site falls in Zone 2A, therefore project structures should be designed in accordance with the requirement of seismic designing Zone 2A after giving due consideration to the foundation material.

4.2.4 Administration

Rajanpur District is a district of Punjab province in Pakistan. According to the 1998 census of Pakistan it had a population of 1,103,618 of which 14.27% were urban. Its administrative centre is Rajanpur. The district is divided into three tehsils, which contain a total of 44 Union Councils:

Tehsil	No. of Union Councils
Jampur	19
Rajanpur	16
Rojhan	9

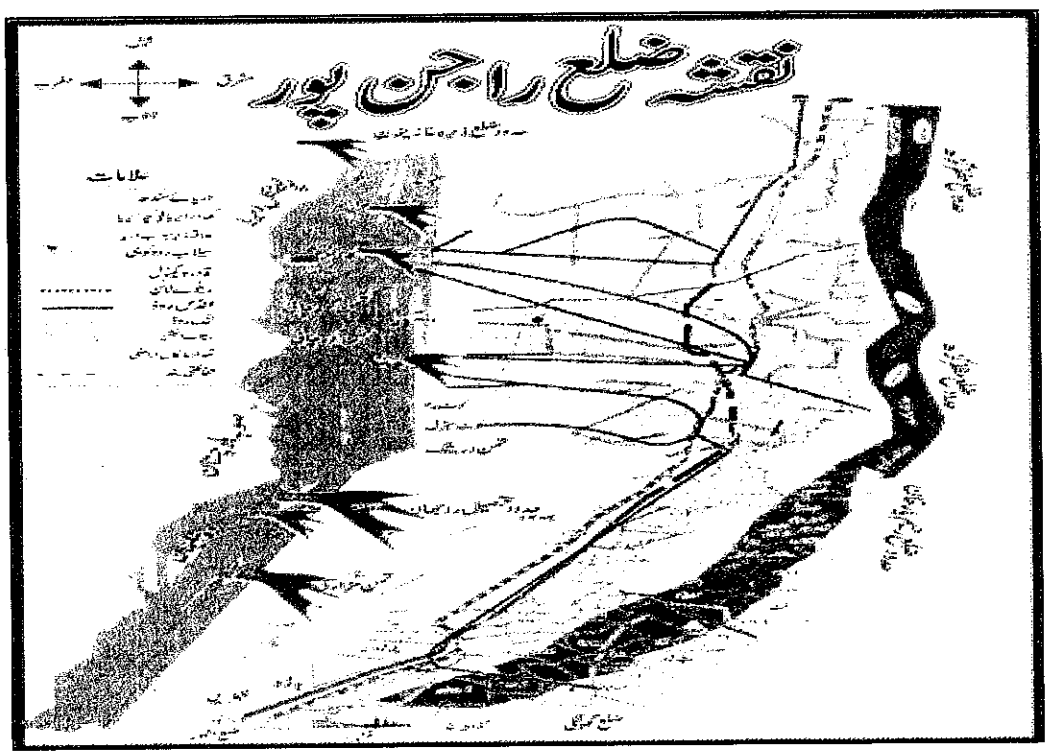


Figure 4.3: Area Distribution of Rajanpur District

4.2.5 Meteorology and Climatology

Summers are quite hot with moderate humidity, whilst winters are of extreme cold. Mean winter temperature (December/January) ranges between 6.5°C and 10.5°C. Mean summer temperature remains around 37°C with frequent spells crossing 44-47°C. The mean of the maximum temperature ranges between 36-38°C and mean of the minimum ranges from 19 to 20°C. Spring and autumn seasons are the most pleasant parts of the year and full of colorful activities. The season is divided into a dry period called "Rabi" extending from October to March and a wet one called "Kharif' with substantial precipitation (approx. 50% of annual total) occurring in July and August. Long-term climate trend data was obtained from the Met office, located at the Jail road, in Lahore. The meteorological and climatic features of the project site are shown in Table 4.1.

Rajanpur is hot and humid during the summer and cold during the winter. June and July are the hottest months. The maximum temperature during winter may drop to -2 °C.

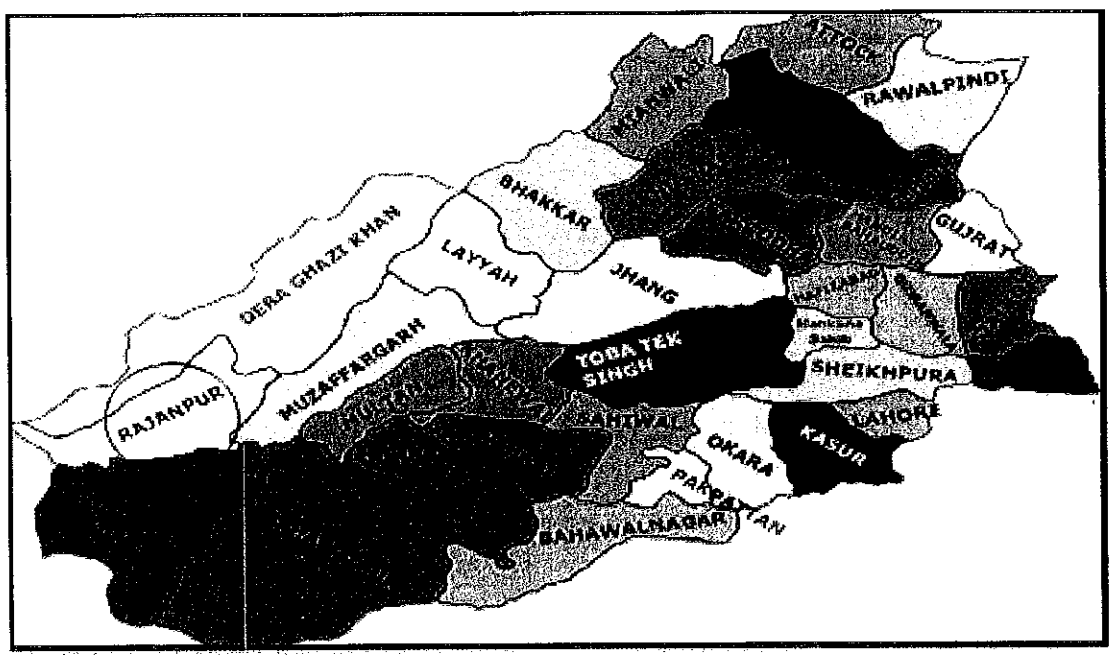


Figure 4.3b: District Rajanpur

TABLE 4.1: CLIMATE DATA FOR RAJANPUR, PAKISTAN													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	26.1 (79)	30.0 (86)	35.0 (95)	42.2 (108)	47.3 (117.1)	48.9 (120)	44.4 (111.9)	41.1 (106)	39.0 (102.2)	37.2 (99)	33.3 (91.9)	27.2 (81)	48.9 (120)
Average high °C (°F)	18.5 (65.3)	21.0 (69.8)	25.7 (78.3)	32.8 (91)	38.0 (100.4)	39.9 (103.8)	34.9 (94.8)	33.6 (92.5)	33.6 (92.5)	31.7 (89.1)	26.1 (79)	20.1 (68.2)	29.7 (85.5)
Daily mean °C (°F)	11.6 (52.9)	13.8 (56.8)	18.6 (65.5)	25.0 (77)	30.0 (86)	32.2 (90)	29.8 (85.6)	29.0 (84.2)	27.9 (82.2)	23.7 (74.7)	17.8 (64)	12.8 (55)	22.6 (72.7)
Average low °C (°F)	5.0 (41)	7.1 (44.8)	11.8 (53.2)	17.3 (63.1)	22.0 (71.6)	25.1 (77.2)	25.1 (77.2)	24.8 (76.6)	22.3 (72.1)	16.0 (60.8)	9.6 (49.3)	5.6 (42.1)	16.0 (60.8)
Record low °C (°F)	−1.1 (30)	−1.0 (30.2)	3.0 (37.4)	9.0 (48.2)	13.4 (56.1)	18.0 (64.4)	19.5 (67.1)	18.7 (65.7)	13.3 (55.9)	8.5 (47.3)	3.0 (37.4)	−0.6 (30.9)	−1.1 (30)
Rainfall mm (inches)	41.1 (1.618)	43.8 (1.724)	53.7 (2.114)	30.1 (1.185)	28.0 (1.102)	65.6 (2.583)	288.4 (11.354)	259.1 (10.201)	94.1 (3.705)	14.5 (0.571)	9.1 (0.358)	30.4 (1.197)	957.9 (37.712)

Table- 4.2: Showing Climatic Data (Temperature & Rain Fall)

Month	Temperature		Monthly Heaviest Rainfall (mm) (mm/yyyy)
	Highest Maximum (dd/mm/yyyy)	Lowest Minimum (dd/mm/yyyy)	
January	27.8 (23/01/1952)	-2.2 (17/01/1935)	121.2 (01/1981)
February	33.3 (27/02/1953)	0.0 (02/02/1934)	509.0 (02/1934)
March	37.8 (26/03/1942)	2.8 (05/03/1945)	254.5 (03/1934)
April	46.1 (29/04/1941)	10.0 (01/04/1940)	141.0 (04/1983)
May	48.3 (23/01/1952)	14.0 (14/05/1977)	129.0 (05/1958)
June	47.2 (08/16/1972)	18.0 (18/16/1977)	208.6 (06/1996)
July	46.1 (03/07/1948)	20.0 (04/07/1974)	477.9 (07/1981)
August	42.8 (02/08/1947)	19.0 (10/08/1980)	825.5 (08/1955)
September	41.7 (16/09/1938)	16.7 (23/08/1972)	523.2 (09/1954)
October	40.6 (07/10/1951)	8.3 (31/10/1949)	155.0 (10/1985)
November	35.0 (**/11/1943)	1.7 (30/11/1962)	77.9 (11/1997)
December	30.0 (07/12/1998)	-1.1 (28/12/1950)	111.8 (12/1967)
Annual	48.3 (30/05/1944)	-2.2 (17/01/1935)	1317.5 (1955)
Source: Pakistan Meteorological Department			

4.2.6 Water Resources

4.2.6.1 Canal irrigation

The agriculture of Rajanpur depend upon canal irrigation system. However, in some areas of Rajanpur people drinks canal water for drinking purpose.

4.2.6.2 Rode Kohi

Major Rod Kohi areas traversed by hill torrents constitute nearly 65 percent of the total area of Pakistan and encompass entire Balochistan i.e. (Makran coastal Basin and Kharan closed Desert Basin). The other major hill torrent areas include D.G.Khan and D.I.Khan, FATA and AJK. In Sindh province, the systems are

spread in Dadu district (Kirthar range). There are around 17,130,000 acres (69,300 km^2) as the potential area under hill torrent / Rode-Kohi / Sailaba fanning excluding riverine areas. Indigenous Spate Irrigation/ hill torrent-irrigation systems traditionally called Rode-Kohi. Rod means water channel and Kohi pertains to mountains. In these areas major constraint is the use of flood flow which is highly variable in quantity and distribution, both in time and space. Annual rainfall is low, uncertain and patchy. Flow is laden with high silt in each flood. It is unfortunate that in spite of scarcity of water, major part of flood flows is lost due to mismanagement. Spate irrigation often takes place in environments that are arid and remote. Poverty in these areas is a major issue. There are very few options for generating income and improvement of livelihood. Abject poverty in the areas affected by the Rod-Kohi water calls for a rational and scientific management of flood flows.

Rod-Kohi or hill torrent cultivation is a unique system of agriculture being practiced in all the four provinces. In NWFP, D.I.Khan tract represents the major part of the system fed by five large tributaries locally named as "Zams". In the Punjab, major part of the system falls in the districts of D.G.Khan, Rajanpur and Jampur. In Balochistan, this system falls in the districts of Barkhan, Musakhail, Loralai, Zhob, Bolan and Lasbella. In Sindh province; the system is spread in Dadu & Larkana district (Kirthar range). The largest area under the system of agriculture lies in Balochistan.

Spate Irrigation is traditionally used system for diverting hill torrents into cultivable command areas for growing seasonal crops. The farming system is characterized by extreme events of floods and droughts. It usually entails the construction of an earthen diversion weir across the torrent with large channel on one or both sides of the river to convey flood water across large distances. These earthen diversion structures and water conveyance system has traditionally been constructed by the beneficiaries / communities themselves, making use of traditional technology. Farmers construct field by making embankments from 3 to 6 feet (1.8 m) high to store the water depending upon the soil type, share in water and various other factors. Upon drying crops are sown which thrive on the

moisture stored in the soil. There is no further irrigation except rains, if any occurs. The economic significance of Rod-Kohi Irrigation agriculture is centered around subsistence agriculture and live-stock raising which are the main sources of income. Another aspect of the Spate Irrigation System of Rod-Kohi areas is the occurrence of the perennial water (known as Kalapani), which is available throughout the year in the upper reaches. It contributes significantly to sustainable farming in the area and used for high value crops like fodder, fruits and vegetables. The development potential in Rod-Kohi Hill torrent areas is listed below.

4.2.6.3 Floods

Rajanpur is a District of Punjab. It is located in southern Punjab. The total population of this district is 1,522,511. As a city, Rajanpur is a clean with wide Streets & good sanitation system. It consists of three tehsils namely Rohjan Mazari, Jam pur, Fazil Pur. In August 2008 due to the heavy rains flash floods started. Peshawar and Rajan Pur districts were badly affected by these flash floods. In Rajan Pur flood water came from Kah Sultan and Shacher torrent (rivulet). This flood water hit the different union councils of Rajan Pur. Hundreds of houses damaged fully and partially and inhabitants sitting under open sky. The displaced people have sought shelter in streets and other public buildings in and around their chaks (villages). List of Affected UCs:Table of affected union councils with Current population No District Tahsel U/C Population Damaged H.H 1 Rajan Pur Rajan Pur Jahan Pur 34886 Fully damaged 2 Rajan Pur Rajan Pur Fatih Pur 25867 Partially damaged 3 Rajan Pur Jam Pur Hajji Pur 22745 Partially damaged 4 Rajan Pur Rojahan Umer Kot 30978 Fully damaged 5 Rajan Pur Daajil Tal Shuamili 20478 Partially damaged 6 Rajan Pur Dajil Buriri wala 19456 Partially damaged 7 Rajan Pur Daajil Noshira Gherbi 21568 Partially damaged 8 Rajan Pur Daajil Noor Pur 23789 Partially damaged Analysis:In assessment and initial findings from the flood-affected district Rajan Pur show that, 04 union councils are completely damaged U/C Jahan Pur, U/C Fatih Pur, U/C Hajji Pur, and Umer Kot U/C. Thus, there is an urgent need for non food items (NFIs) including mattresses, mosquito nets, Kitchen utensils, fuel for daily cooking and

hygiene kits. Yearly food stock is almost completely washed away, while livestock has sufferedconsiderable loss. Thus affected people facing critical condition and will suffer economically for at least one whole year as their current crop is damaged at large scale. According to affectees this flood is larger than the one, some 40 years ago.

4.2.6.4 Noise Levels

The major source of noise at the project Site is the vehicular traffic on the main road near to the project site. Mostly, the noise level reaches its peak during the daytime and afternoon in rush hours. Overall, the noise level at this Road is presently much less than the other congested roads in city.

Table –4.3: Noise Levels Monitored Data

REFERENCE POINT	DATE	TIME HOURS	DB(A)									LEQ / AVERAGE
Road on Main Kot Bahadur Village	10.03.2016	06:00	45	46	46	46	47	45	47	47	45	46.0
	10.03.2016	09:00	61	63	63	62	68	70	70	61	66	64.88
	10.03.2016	12:00	70	68	68	68	61	59	59	60	61	63.77
	10.03.2016	15:00	62	69	72	62	60	61	60	59	60	62.77
	10.03.2016	18:20	64	63	63	62	68	73	74	61	63	65.66
	10.03.2016	21:30	45	46	49	49	48	45	41	42	42	45.22
	10.03.2016	24:00	35	36	36	36	37	35	37	37	35	36.0
	11.03.2016	03:00	34	33	31	31	31	32	33	31	32	32.0
	11.03.2016	06:00	45	46	46	46	47	45	47	47	45	46.0

* High Noise levels were associated with moving of Bicycle and Heavy Tractors during the monitoring hours.

4.2.6.4 Air Quality

The project area is thinly populated and mainly surrounded by agricultural dwelling. The containment in the air could be particulate matter which is naturally occurring from the loose surface soil and gets suspended in the air due to human activities (traffic and others) and wind flow.

Table – 4.4: Ambient Air Monitored Data

REFERENCE POINT	DATE	TIME HOURS	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/Nm^3)	PM_{10} ($\mu g/m^3$)
Road on Main Kot Bahadur Village	10.03.2016	06:00	21.2	22.5	1.3	23.9
	10.03.2016	09:00	34.1	31.2	2.5	41.7
	10.03.2016	12:00	35.8	36.7	2.6	42.5
	10.03.2016	15:00	36.1	37.2	0.1	43.1
	10.03.2016	18:20	25.7	25.3	1.8	42.8
	10.03.2016	21:30	11.1	12.3	2.5	23.8
	10.03.2016	24:00	21.0	22.2	2.3	23.7
	11.03.2016	03:00	20.9	21.9	1.0	23.1
	11.03.2016	06:00	21.0	22.1	1.1	23.1
NEQS			**80 $\mu g/m^3$**	**80 $\mu g/m^3$**	**10 mg/Nm^3**	**150 $\mu g/m^3$**

NEQS = National Environmental Quality Standards for Ambient Air.

* High concentration of air pollutants are associated with burring of the post cultivated land, ruing moving of Bicycle and Heavy Tractors during the monitoring hours.

4.3 Ecological Resources/Biodiversity

The project area lies in the commercial and agricultural area having dominant trends of commercialization. The surrounding area of project site consists of barren uncultivated land.

4.3.1 Fauna

The major fauna of the project site is list in below table.

Table-4.5 List of Birds

#	Common Name	Zoological Name
1	Bank Myna	*Acridotheresginginianus*
2	Blackbird	*Turdusmerula*
3	Black drongo	*Dicrurusmacrocerus*
4	Rock Pigeon	*Columbia livia*
5	Common babbler	*Turdoides caudate*
6	Common Myna	*Acridotherestristis*
7	Garden Warbler	*Sylvia borin*
8	Indian Robin	*Saxicoloides*
9	Whiite-browed wagtail	*Motacillamadaraspatensis*
10	Little green bee-eater	*Meropsorientalis*
11	Asian Pied Starling	*Sturnus contra*
12	Red turtle dove	*Streptopeliatranquebarica*
13	Red-vented bulbul	*Pycnonotuscafer*
14	Ring-necked dove	*Streptopeliacapicola*
15	Lang-tailed Shrike	*Laniusschach*
16	Great spotted woodpecker	*Dendrocopos major*
17	White-browed wagtail	*Motacillamaderaspatensis*
18	Asian Koel	*Eudynamysscolopacea*

#	Common Name	Zoological Name
19	Common hawk-cuckoo	*Cuculusvarius*
20	Coomon Koel	*Eudynamysscolopacea*
21	Pied Cuckoo	*Clamatorjacobinus*
22	Red turtle dove	*Streptopeliatranquebarica*
23	Ring-neck dove	*Streptopeliarisoria*
24	Rose-ring parakeet	*Psittaculakrameri*
25	White-backed vulture	*Gyps africanus*
26	White-breasted kingfisher	*Halcyon smynensis*

Not only the birds, but different other classes of the animal species also play an important role for the habitat of the area as shown in Table-4.6.

Table-4.6 List of Different Classes of Animals

Mammals	Reptiles	Amphibians	Insects
Stray dogs	Monitor Lizard	Indus valley bullfrog	Dragonfly
Feral cats	Geckos	Common frogs	Damselfly
Donkeys	-	Toads	Butterflies
Cows	-	-	Honey bees
Bats	-	-	Earthworms
Goats	-	-	Centipedes
Small Indian mongoose	-	-	-
Indian palm squirrel	-	-	-
Buffalo	-	-	-

Mole	-	-	-
Horse	-	-	-
Sheep	-	-	-

Source: WWF

4.3.2 Flora

The present site topography shows that no tree cutting will be involved during construction of the project as land area was exclusively used for agricultural activities in past, now it is barren and some area is under the stagnant water. Several types of floral species are present in project area, some of the principal trees, shrubs (plants) and herbs (ground covering plants). In addition, there are few floral species which are at the risk of extinction. However, there were no species reported by Forest and Wildlife Departments to be threatened at project site, which are included in the IUCN Red data book.

4.4 LANGUAGE OF THE PROJECT AREA

Following are the demographics of the Rajan pur district, by spoken language:

- Punjab province local people different dialects: 90%
- Other: 10%

Inhabitants of Rajanpur District speak a great variety of Punjabi dialects, although few of these dialects are called as separate language "Saraiki", but because of good and loving nature of people there is no distinction or hate among different dialects and have a mix culture of Great (North and South) Punjab.

- Derawali (Mainly)
- Punjabi dialects or standard (Sizeable population in cities also in newly cultivated areas)
- Raangri (A mixture of Rajasthani, Urdu and Punjabi spoken by sizeable population in cities)
- Riyasti (Border areas near Rahimyar khan district)

- Thalochi (Border areas near Muzafargarh district)

Other Languages include:

- Urdu is mother tongue of few people but being national language is spoken and understood by the sizeable population.
- English is also understood and spoken by the educated elite.
- Baluchi is also spoken by sizeable population in the district.
- Sindhi is also spoken by few population in the Sindh province border areas.

4.5 AGRICULTURAL

Agriculture in Rajanpur depends solely upon canal irrigation since rainfall is negligible in the region. The five rivers of the Punjab meet at the locality of Wang near Mithankot; hence these rivers provide water for irrigation as well as for domestic usage. Rainfall occurs during the monsoon season (July–September). Occasional heavy rainfall causes flooding in this region, but such floods are rare. In Rajanpur, flood waters come from the Kah Sultan and Shacher torrents (rivulets), as well as the Indus. Rajanpur district is famous for cotton and sugarcane crop, although they are cultivating wheat and rice as well and tobacco to very little extent too.

4.6 PUBLIC HEALTH OF THE PROJECT AREA

The health of the project area is very much sound, private and government medical facilities are available in colossal quantity within the project area.

4.7 EMPLOYMENT SOURCES IN THE PROJECT STUDY AREA

Most of the people have adopted multiple sources of income to sustain their lives. Government and private services, petty business and transport are the other sources of income of the people.

4.8 BASIC FACILITIES AVAILABLE IN THE STUDY AREA

Basic facilities including electricity, water, gas, telephone, roads and transport are available to every pocket of the area. Cellular/mobile telephones are available with a large number of the people.

4.9 IMPORTANT PLACES

Mithankote is the shrine of the great Sufi Saraiki poet Khawaja Ghulam Farid is the historical place in Kot Mithan. Thousands of his disciples come to Rajanpur every year on the anniversary of Hazrat Khawaja Ghulam Farid.

Fazilpur is the shrine of the great Peer/Sufi Hazrat Chan Charagh Shah Sain a.k.a. Ghorrey Shah Sain is the historical place in Fazilpur.Fazilpur is situated in the center (heart) of District Rajanpur. And its importance in district Rajanpur is like heart in every field specially politics. Major cost living in Fazilpur are Gopang, Mastoi, Mohajir (usifzai, sherwani, Lodhi, Qureshi), Dreshak, Korai, Thaheem, Bhati and Zargar (Sunara).

Harrand Fort

This fort, built in British era, is situated in the tribal area of Rajanpur.

Lalgarh

Lalgarh is situated in the foot-hills of Suleman Range Mountains. It is HQ of Gorchani tribe. It is a small village having a population of about 3000 inhabitants. Government offices include a Police Station, a Higher Secondary School, a Girls Middle School, a Civil Dispensary, a Veterinary Dispensary, a Telephone Exchange & NADRA office.

Maari

Marri is the resort Hill Station in Rajanpur similar to Muree. Its Altitude Is 4800 ft Cold Weather In Summer. Dragal mountain is an altitude of 5400 feet.

Ada Chiragh Shah

It is situated on Indus highway. There is a shrine of Baba Chiragh Shah, a Sufi peer.

SECTION-5
ENVIRONMENTAL IMPACTS DUE TO PROJECT & MITIGATION MEASURES

Section-5

ENVIRONMENTAL IMPACTS DUE TO PROJECT & MITIGATION MEASURES

5.1 METHODOLOGY FOR ANTICIPATING ENVIRONMENTAL IMPACTS

Baseline data and conditions form the basis for evaluation of the environmental impacts of the proposed baggase fired cogeneration power project.

A tabulated evaluation procedure has been used for purpose of presentation. The severity of the impact is presented on point scale. The evaluation scale, that is used for the IEE Study is given below:

Scale: Extent of Impact

▲▲▲= High
▲▲ = Medium
▲ = Low
O = No impact
▼▼ = locally favorable
▼ = regionally favorable.

For evaluation rating, the National Environmental Quality Standards (NEQS) and National Ambient Air Quality Standards (NAAQS)-Pakistan, are used as guidelines. Various parameters of extent of environmental impacts are described below:

Table 5.1 Evaluation of Impacts

Extent of Environmental Impact	Description
High (▲▲▲)	National Standards are exceeded.
Medium (▲▲)	Between National Standards.
Low (▲)	National Standards are met.

5.2 ENVIRONMENTAL IMPACTS ASSESSMENT DURING CONSTRUCTION PHASE

This section discusses the potential impacts anticipated due to the installation of 30-MW power plant and associated facilities on the natural resources and various environmental segments of the site and its vicinity.

5.2.1 Soil Erosion

The proposed project requires minor land clearing, leveling and site preparation for the installation of the power house its associated facilities. No wetlands are present within the project boundaries or up to long distances (15-km) around the project site. The proposed construction area is not anticipated to impact the entire area available. General site preparation and construction activities associated with the overall development of the project site include the following:

- Clearing/grubbing of all un-cleared portions of the construction area and lay-down area;
- Stabilizing, grading, filling, and contouring the area for power plant facilities;
- Construction of permanent storm water management system;
- Performing groundwork as necessary for construction of facility footings, foundations and underground utilities including electrical, water, wastewater, and other piping systems;
- Power plant facilities construction and
- Earthmoving, grading, re-contouring and landscaping.

Site preparation will consist of clearing and grubbing, followed by grading and leveling. Topsoil that is suitable for reuse will be stockpiled for landscaping and for establishing vegetation after construction has been completed.

Mitigation Measures

During early site preparation activities, temporary storm water management structures and soil erosion and sedimentation control devices (e.g. ditches, retention basins, berms, and siltation fencing) will be used to minimize runoff during the construction phase.

Site preparation and construction activities will not require any explosives. Rough grading, excavation, and backfill activities will be performed to prepare the site

for underground utilities, concrete foundations, and surface drainage. Structural backfill materials may be imported to the site for constructing concrete foundations and to raise grade site elevation to achieve proper drainage.

After construction of the baggase boiler project is complete, any remaining areas that do not have an impervious surface will be vegetated with native plants, ornamental shrubs, flowers, trees and grass materials. The plant site will be altered to construct new facilities. Structural and general fill will be added to elevate the site to design elevations. Soils excavated for the major equipment foundations may be used as general backfill or structural fill, if appropriate. Fill may be required to raise portions of the site to grade.

Since the site is in a flat area, the fill should not cause adverse impacts to site topographic conditions. Very little, if any, runoff flows onto the proposed site. Therefore, the fill will not impede existing drainage patterns. Added fill, with compaction, will shift areas of percolation within the site. Runoff will be managed with the storm water management system to mimic pre-construction conditions. During construction, erosion at the site will be managed with the erosion control plan. After construction, pervious areas will be planted predominantly with native vegetation, trees, grass and flowers to control erosion.

Extent of Impact on Erosion/Sedimentation = ▲ (Low)

5.2.2 Air Quality

Expected impacts on air quality during the construction phase of the proposed project are:

- dust engraftation during construction activities including leveling, excavation for foundations of the boiler and its associated equipment, compaction, backfilling etc, and
- emissions of Sulphur Dioxide (SO_2) , Nitrogen Oxides (NO_x), Carbon Monoxide (CO),and unburnt hydrocarbons , Particulate Matter (PM) and noise from vehicles and construction machines to be deployed during construction activities.

Dust generation from construction activities is an important concern during construction phase. Dust particles generally larger than 10 µm will be thrown up, resulting in visible deposition close to the construction activities.

The quantity of any emissions released during the construction process will generally be very low, but will vary on an hourly and daily basis as construction progresses. Fugitive dust emissions will be greater during land clearing and site preparation phases. Fugitive dust emissions will also be greater during the more active construction periods as a result of increased vehicle traffic on the site. The dust to be generated during construction activities will be mostly inorganic. quantum dust generation will depend on weather conditions, wind velocity, precipitation rate, and type of construction activities. Expected main sources of site of dust emissions during construction are:

- land clearing
- excavation
- earthwork
- ground leveling
- vehicles movement.

Dust and grit are expected to be present in the air during the construction phase in dry months. This will end when the major civil works finish. Some dampening of the exposed areas, by employing dust control methods, may therefore be necessary during periods of dry weather in order to reduce the risk of dust entrainment in the ambient air. Peak dust generation, if construction activities coincide, will be during the drier months and this dust will tend to become dispersed within the ambient air as a result of vehicle movements. It will therefore be necessary to ensure that loads are duly covered to prevent fine dust blowing from open-top trucks and through vehicles tires. In dry periods, it may also be necessary to employ dust control measures. There will be an overall increase in traffic and heavy machinery movement during construction phase for a limited period leading to rise in emission level. These emissions together with exhaust emissions from equipment deployed during the construction phase are likely to result in marginal increases in the levels of sulphur dioxide (SO_2), nitrogen oxides

(NO_X), carbon monoxide (CO), and unburnt hydrocarbons (HCs). Potential minor sources of volatile organic compounds include evaporative losses from onsite painting, refueling of construction equipment and the application of adhesives and waterproofing chemicals. The background levels of these pollutants are considered to be non-existent based upon the low frequency of traffic use proximal to the site. However, even with the predicted increase in construction related traffic and associated site activities, any increase in these pollutants is considered to be insignificant. The project site is very vast and carrying capacity of air around has not yet been utilized because no worth mentioning industry is in functioning around. This will be an additional advantage to the project for dissipating the emissions into the air and reducing emissions in such virgin air.

Mitigation Measures:

Fugitive dust emissions from the construction site will be minimized using appropriate dust suppression control methods. These standard control methods will include;

- paving or placement of gravel on roads,
- applying dust suppressing agents or water to roads and other exposed surfaces, or other methods, as needed.
- existing public road upon exiting the site is paved.
- spilled and tracked dirt (or other materials) will be removed from the adjacent road in a timely manner.
- all construction related fugitive dust emissions will be temporary and will stop once construction is completed. Emissions from open burning will be limited by removing materials whose burning would produce excessive smoke e.g., green vegetative materials.
- regular sprinkling of water with time intervals will reduce the impacts of the dust during construction.

The proposed mitigation measures will reduce the impacts to an acceptable level, especially as they are limited to the construction phase. The overall construction period is expected to have duration of 18-months.

Extent of Impact on Air Quality = ▲(Low) [with adoption of mitigation measures.]

5.2.3 Groundwater

The proposed project site is located within the aquifer that is still un-explored for surrounding communities. The subsoil water is highly saline and cannot be use for drinking purpose. Based upon the importance and sensitivity of this aquifer, as well as a good construction practices, all precautions necessary will be required to reduce the potential for site impacts on ground water to a minimum. While the proposed site preparation and facility construction activities for the Proposed Project are not anticipated to cause any short-term or long-term groundwater impacts to the site, Best Management Practices (BMP) will need to be employed during construction to ensure impacts (if any) are minimal and are properly mitigated.

Mitigation Measures:

During construction all contractors, technicians and laborers will be required to implement best practices to minimize the potential for spills of fuels or chemicals. Maintenance will be performed only in designated areas. In the unlikely event that spills do occur, they will be managed in accordance with the project's Environmental Management & Monitoring Plan (EMMP). To further minimize potential environmental impacts, it is recommended that full-time environmental monitoring is conducted during construction, particularly during all refueling operations to minimize potential concern. The environmental monitoring could be under the Environmental & Safety Department or a member of the safety department with the authority of "Stopping the Job" in the event that noncompliance of environmental regulation is being observed.

Extent of Impact on Ground Water = ▲(Low) [with adoption of mitigation measures.]

5.2.4 Solid Waste

The major solid wastes to be generated during construction activities are:

- Bricks waste

- Waste from Quality Control
- Paper bags
- Used oil/lubricants
- Metal/wooden waste
- Medical waste
- Empty drums or containers
- Cotton rags
- Miscellaneous waste: Miscellaneous solid wastes include batteries, tires, tubes, filters, belts, nylon strips, bag filters, scrap wood, steel scrap, house hold articles etc., which will be sold in the market through scrap dealers.

Mitigation Measures:

- During the site clearance stage, it is anticipated that relatively large quantities of solid waste would be generated from labour camps, top-soil and sub-soil. Part of the excavated material would be used for leveling and grading and the balance would be stockpiled at designated locations on the site. Other solid wastes including, cooking waste and general solid waste are often associated with a relatively large work forces. Cooking wastes and general garbage will be collected at regular intervals and land filled at an approved disposal site.
- Adequate number of solid waste container should be provided at the project site at various places and shall not in any case dispose of waste indiscriminately outside of the boundary wall of the project site.
- The wastes like organic, inorganic, hazardous, non-hazardous waste etc should be collated and stored according to the nature of the wastes. These waste should be dispose off through a certified contractor who shall dispose the waste in consultation of Tehsil Municipal Administration (TMA) with environment sustainable manner. However, while disposing any waste material, all environmental aspects/impacts of such wastes should be communicated clearly to the concerned contractor. Record of all such sales shall be maintained for later use if and when required.

Extent of Impact Due Solid Waste = ▲ (Low) [with adoption of mitigation measures.]

5.2.5 Noise Impact

Construction of the proposed project is expected to take place for about 48-months, with varying degrees of activity occurring during different phases of construction. Construction phases are expected to include excavation, concrete pouring, steel erection, mechanical/electrical installation and cleanup. Noise will be generated by operation of heavy equipment and increased frequency of vehicular traffic in the area during construction activities. Vibration levels will also increase due to these activities. However, these impacts are short term, intermittent and temporary in nature and are not likely to be felt outside the boundary of the proposed project. The exact noise levels are a complex function of variables such as the actual noise levels emitted from each major noise-emitting equipment, their location and orientation within the construction area, and their operation and load.

Mitigation Measures:

The adjoining localities are outside the range of impact of noise emissions due to construction activities. Overall, the impact of noise generated during construction on the environment is temporary and mainly confined to daylight hours. It is anticipated that it will be possible to reduce noise impacts during construction to an acceptable minimum by properly examine and tuning of the noise producing machinery, installation of noise barriers and noise abatement measures. It is recommended that project noise should meet the NEQS for noise as mentioned in table 5.2 of this section.

Table 5.2: National Environmental Quality Standards - Noise

Category of Area/Zone	Effective from 1st July 2012	
	Day time	Night time
Residential area	55	45
Commercial area	65	55
Industrial area	75	65

Category of Area/Zone	Effective from 1st July 2012	
	Day time	Night time
Silence zone	50	45

Extent of Impact on Noise = ▲ (Low) [with adoption of mitigation measures.]

5.2.6 Fire Risk

Fire and explosion hazard impacts are not expected during the construction phase due to the limited quantities of flammable and combustible materials to be imported to the site. The availability and use of portable extinguishing systems would limit the impacts of small fires, and personnel will be required to receive training on the proper use and locations of this equipment.

Mitigation Measures:

During construction, any waste disposal burning will be conducted in a cleared and dedicated area under controlled conditions, on those days when ambient air conditions will not permit embers to drift into the surroundings.

Extent of Impact on Noise = ▲ (Low) [with adoption of mitigation measures.]

5.2.7 Ecological Impacts

5.2.7.1 Terrestrial Systems

During construction activities, only very minor land clearing is required as a component of the proposed development activity. Land clearing, as proposed, will be limited to that required for the needs of the project, and will be conducted in such a manner that is protective of the environment.

5.2.7.2 Fauna and Flora

No ecological important flora and fauna is present at the site. The construction area is not perceived as including sensitive habitat. Under normal dry weather conditions, a significant amount of dust will be thrown up by excavating activities.

Hence, vegetation and animal habitats in the vicinity village near the site and roads will be affected by wind-blown dust and its deposition. The contribution to the natural dust concentration in the air will only be of relevance at the beginning of the construction phase, during the main excavation activities. During this period, dust can be expected to settle on plant leaves and aerial roots, which could hinder air exchange and assimilation by the plants. The temporarily increased vehicular traffic coupled with high noise levels due to various construction activities may also have some negative impacts on animals. Especially birds and other acoustically orientated animals living in the vicinity of the site and the roads used can be disturbed by noise. Disturbances during the period of construction could drive noise sensitive bird species from their habitats, but these are expected to return after construction has finished. No endangered species were found in the construction area. During the visual inspections of the site no nests or nesting was observed. No birds or wild animals were discerned in the site vicinity. The influence of dust is unavoidable but mainly restricted to the first period of the construction phase. No major impacts by dust and noise on the flora and fauna in the vicinity of the site and the used roads are to be expected. The construction related impacts on fauna and flora may be considered to be low.

Mitigation Measures:

- It is suggested that extensive tree plantation should be carry out to maintain the natural habitat.

Extent of Impact on Fauna & Flora = ▲(Low) [with adoption of mitigation measures.]

5.2.7 Impacts on Human Population

Construction related noise is not anticipated to be a concern to the nearest receptor, but to mitigate this potential concern, construction will normally occur during daylight hours and will run during one shift per day. In addition, any excessive noise generated by construction related activities will be short term and short duration, and will generally not expected to exceed the NEQS.

However, there might be a notable increase in road traffic as freight is moving to the site. No direct impacts to the communities or neighborhoods are anticipated. Based upon visual inspection of the site and site vicinity, the proposed power plant site and roadway are absent of any residences. As a result, no relocation impacts are anticipated.

Extent of Impact on Human Population = ▲(Low) [with adoption of mitigation measures.]

5.2.9 Traffic Impact

It may be anticipated that an overall increase in traffic would occur directly as a consequence of the proposed construction. An increase in traffic will occur to and from the project site subsequent to freight arrival. The temporary traffic impacts are not expected to affect significantly the local residents since residential development is sparse in the immediate site vicinity. No significant traffic problems are expected during the construction period, other than minimal delays for start and stop time for the workers commuting to their residences and due to occasional heavy equipment and materials moving to and from the site. Construction traffic generation should be viewed at the most as a temporary inconvenience.

Mitigation Measures:

The constructor should prepare a traffic management plan in consultation with the local population and project proponents.

Extent of Impact on Traffic = ▲(Low) [with adoption of mitigation measures.]

5.2.10 Socio-economic Impacts

Most of construction workers are anticipated to be hired from within the Rajanpur. In addition, general contractors/vendors, consultants and engineers from within the country will provide technical and specialized services. The construction impacts on the local employment opportunities are beneficial, although relatively short term. Indirect employment in the local area will also occur primarily in retail, eating and drinking establishments. During construction of the plant an estimated

employment opportunities (of 500 - 700 workers) will be created both for skilled and unskilled local workers.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

5.2.11 Public Services and Facilities

Construction related impacts to public services and facilities, such as police, fire, and medical services and water, wastewater and solid waste disposal are not expected to be significant. With minimal relocations to the project area expected, existing facilities and services will be adequate to meet the demands on these services. The selected general contractor will be responsible for removing and disposing of construction related debris, in environmentally safe manner and at some suitable designated site.

Extent of Public Services and Facilities Impact = ▲(Low) [with adoption of mitigation measures.]

5.2.12 Cultural Resource Impacts

Fugitive dust emissions will be properly controlled so that no impact on visibility will occur. Also as discussed, due to attenuation with distance, construction noise will not affect the quality of life at the nearest habitats. Some minor inconvenience may occur through increased traffic and equipment creating conflicts on Indus Highway/Road. However, during construction of the power plant, no conflicts are anticipated with cultural resources in the area.

Extent of Cultural Resource Impacts = ▲(Low) [with adoption of mitigation measures.]

5.2.13 Waste Water

Sewage and waste water will be generated at the construction camps and from construction activities. If generate effluents are not properly treated or disposed off this may contaminate the surface and any other source of water and land. It is anticipated the following estimated effluents will be generate during the construction of the site.

Table 5.3: Estimated Effluent Generation

Source	Estimated Quantity (liter/day)	Disposal Practice
Workers/Labour Staff (about 500 maximum)	40,00	✓ Disposal through Septic Tanks ✓ Sewage Disposal facility
Construction Waste	200	Disposal through Sprinkling on unpaved area and septic tanks

Mitigation Measures:

- For effluents draining installation of proper sewage disposal facility for the entire site should be considered.
- Proper septic tanks of adequate size should be established.

Extent of Impact on Ground Water = ▲(Low) [with adoption of mitigation measures.]

5.3 ENVIRONMENTAL IMPACTS ASSESSMENT DURING OPERATION PHASE

This section discusses the potential impacts from regular operation of the proposed project and associated facilities on the natural resources and environment of the site and vicinity. The power plant invariably has potential for environmental impacts during the operational phase of the project. During the operational phase the following impacts are normally the most significance:

- Air quality impacts
- Ecological impacts
- Impacts associated with the abstraction and discharge of water
- Impacts arising from solid waste management
- Noise and vibration impacts
- Soil, groundwater and surface water contamination
- Accidents
- Socio economic impacts

5.3.1 Air Quality Impacts

The combustion of Bagasse fired boiler operation inevitably results in emission of gaseous pollutants to the atmosphere. The pollutants of potential concern are sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2) and particulate matter (PM).

In general, the most significant emissions from the combustion in boiler of the proposed project are sulfur dioxide (SO_2), oxides of nitrogen (NOx), carbon dioxide (CO_2) and particulate matter. Carbon monoxide (CO) is much less problematic as developments aimed at improving combustion efficiency in the boilers have also addressed these pollutants.

5.3.2 Ecological Impacts

5.3.2.1 Impacts on Fauna and Flora of

a) Air Emissions

The effect of air emissions from the stacks upon breeding birds (if any) proximal to the site will not be clear without careful monitoring. During the preparation of the IEE, no nest or nesting birds were observed on or proximal to the project site. Recommendations for a monitoring program include review of areas immediately adjacent and proximal to the site. Since birds are generally mobile, it is anticipated that they will relocate beyond the sphere of influence of the plant. The effect of gaseous and PM emissions on the adjacent areas, after adoption of necessary mitigation measures, is not anticipated to be a concern, because the air quality levels are predicted to remain within those approved by NEQS for human health. Consequently, air emissions are not likely to affect local fauna and flora.

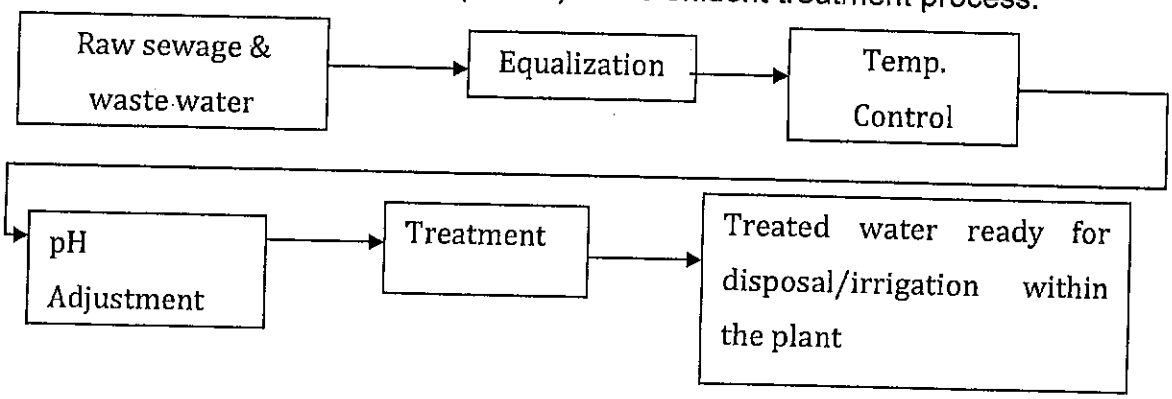
b) Noise

Noise from the operation of the proposed project, after adoption of necessary measures, will result in its level not exceeding the limits set by the NEQS. Thus, noise from the project activity will not give rise to any serious adverse impacts on the surrounding fauna and flora.

c) Waste Water

Waste Water and Sewage from all sources will be treated in effluent treatment plant. It is anticipated that about eight hundred gallon (800 g) of domestic sewerage will be generated which will be treated till the NEQS levels before its final discharge, therefore, there is no question of any adverse impacts from waste water to fauna and flora.

A tentative summary flow sheet (sketch) of the effluent treatment process:



Extent of Impact on Fauna & Flora = ▲(Low) [with adoption of mitigation measures.]

5.3.2.2 Landscaping

At the completion of construction activities, landscaping should include use of native plant species.

After completion of construction phase, the site will be mostly dominated by buildings, plant & machinery, stacks and baggase storage. Within this area of low visual impact, the additional visual intrusion due to realization of the project may be assessed as low.

Extent of Impact of Landscape = ▲ (Low)

5.3.3 Solid Waste Management

The types, sources, and management of solid wastes anticipated to be generated during the operation of the proposed project facilities are as follows:

- Plant wastes such as office wastes, packaging materials, ashes, garbage, refuse, redundant electric gadgets, various types of wastes of a large variety and rubbish/trash will be generated during the operational phase of the proposed project in addition to general solid waste. According to nature of

solid waste, some of these will be recycled on the site while others will be sold in the market through an approved contractor while keeping all the records. The contractor will be fully informed/educated about the nature of the wastes. Other plant wastes, such as lead acid batteries will be segregated from other waste streams, collected and stored in suitable containers, and will be transported off-site and disposed at an approved land fill site by an approved waste transporter and contractor.

- Special wastes such as hazardous waste, industrial solvents and other chemical wastes, and used oil, will be generated during the operational phases of the proposed project. Special wastes could also include items such as waste oils, waste lubricants, paints, maintenance-related wastes, used air and liquid filtration media, and empty or nearly empty chemical containers. Most, if not all, of these materials will be disposed of by incineration through contractor. While others will be sold in the market through a contractor, keeping record of them and informing the contractor of their hazards and rational use.

Extent of Impact of Solid Waste = ▲ (Low) [with adoption of mitigation measures proposed.]

5.3.5 Noise & Vibration Impacts

Once operational, additional ambient noises may be of concern. According to the project feasibility study, ambient noise measurements of the equipment/machinery will be designed to operate with a total noise level not exceeding 50 to 65 dB (A) in the very near vicinity of the machinery. While at the property boundary, the noise level is expected to be less than 60 dB (A) as against the limiting value of 65 dB (A) by the NEQS for industrial areas. Therefore, in case the built in design of the plant achieves these noise levels then no excessive ambient noise impacts are anticipated at the receptors especially the human settlements near to the project site.

Extent of Impact on Noise Level = ▲(Low) [with adoption of mitigation and control measures.]

5.3.6 Societal Impacts During Operations

5.3.6.1 Neighborhood and Communities

Human settlements are present with in the distance of about 6 to 8 kilo meters (KM) from the project boundary line. None of these villages have any health facility or adequate drinking water supply. Education facilities are not adequate. Being very near to the project site, any environmental catastrophe or routine type pollutant emissions and their concentration above the limiting values of NEQS-Pakistan can cause adverse impacts on human health or any element of the environment around. Therefore, the project needs to be operated seriously keeping in view the environmental management plan and sticking to the NEQS emissions standards. Failing which to operate without following strict environmental control, there could be adverse effects of human health, wild flora and fauna, ecology and whatever comes in contact with the emissions from the project.

Extent of Impact = ▲ (Low after strict compliance with the required environmental management systems)

5.3.6.2 Relocation Impact

As mentioned earlier, since relocation will not be required during implementation of the project, no impacts are anticipated in the project area of influence during operation phase.

Extent of Impact = ▲ (Low)

5.3.6.4 Economic Impact

The establishment of proposed project will provide new jobs at the plant site. Most people of the area make their living directly or indirectly from agriculture and cottage industry. Short-term economic benefit will be realized by providing janitorial services, horticultural services, loading/unloading workers, canteen, and semi-skilled & some skilled activities, as well as by increased use of available rental property. There are no negative or detrimental potential impacts on the socio-economic setting of the area arising as a result of the proposed project. As such no mitigation measures are required.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

5.4 Positive Socio–Economic Impacts on the Overall Project Area

In ultimate analysis the impacts of project on social and economic activities in the project area will be mostly positive. The economic analysis shows very high economic benefits compared to the cost. Salient economic benefits of the project are:

❖ **Electric Generation**

The power plant is expected to generate 30 MW of electricity. Given that Pakistan is facing the acute shortage of the energy this project will help towards meeting a potion of the shortfall, thus providing some measures of relief to the people of Pakistan. The generation of electricity will not only help the industrial sector and its outputs but will also help to raise the standards of living as it will reduce load shedding.

Furthermore, the proposed power plant is based on imported or some extent local baggase which will prove to be less costly than the thermal power plants based on furnace oil.

❖ **Economic Boost**

Increased economic activity with improved transport will ensure easy marketing of agriculture and livestock produce. With improved economy, there will be further improvement in services in the area and opportunities for employment, education, healthcare, especially for women and children, will improve.

❖ **Employment Generation**

Employment during construction phase will take up and train a large number of unemployed youth. They will receive a life time benefit through skill training, capacity building and poverty alleviation. A large number of semi and unskilled workers in the project area will be hired.

❖ **Health Awareness**

Greater awareness about Health care including HIV/AIDS and infectious diseases amongst the labor and the close by community will be created.

❖ **Improvement in Livelihood**

At micro–level the hustle and bustle and increase in economic activities may bring the cost of living down by making essential commodities available at cheaper rates. This combined with higher incidence of employments will bring the poverty line and crime rate much lower.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

SECTION-6
ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Section-6

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This EMP describes the mitigation and management measures to address the environmental issues during construction, its regular operation phases of the proposed project.

6.1 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN

The objectives of the EMP are as follow:

a) To outline functions and responsibilities of responsible persons.
b) To state standards and guidelines, which are required to be achieved in term of environmental legislation.
c) To outline mitigation measures and environmental specifications which are required to be implementation for all phase of the project in order to minimize the extent of environmental impacts and to manage environmental impact associated with the proposed project.
d) To prevent long term or permanent environmental degradation.
e) To identify training requirement at various levels.

6.2 SCOPE OF ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides mitigation and management measures for the following phases of the project:

6.2.1 Construction Phase

This section of EMP provides management principles for the construction phase of the project. Environmental actions, procedures and responsibilities as required within the construction phase are specified. These specifications will form part of the contract documentation and therefore, the contractor will be required to comply with the specifications to the satisfaction of the project Manager and Environmental Control Officer, in terms of the construction contract.

6.2.2 Operation and Mitigation Phase

This section of EMP provides management principles for the operation and maintenance phase of the project. Environmental actions, procedure and

responsibilities are required from proponent within the operation and maintenance phase are satisfied.

TABLE 6.1: ENVIRONMENTAL MANAGEMENT PLAN FOR 30 MW COGEN POWER PROJECT

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
Pre-Construction Phase						
1.	Legislation, permits and agreements	• Full compliance with all relevant National & Local Legislation	• In all instances, Proponent, service providers, contractors and consultants require to remain in compliance with relevant local and national legislation.	Once at Design Stage and prior to moving onto site by proponent.	Proponent, Contractor/ Engineers, Consultants	Project Proponent
2.	Land Acquisition,	• Site preparation/ clearance and	• Develop an appropriate "land	Prior to start construction by	Contractor and Design	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	Loss of private land, agriculture field, trees, residential/ commercial structures	proper landscaping without any kind of grievance for construction of proposed thermal power plant	acquisition & Resettlement Action Plan" • Land acquisition must be conducted in compliance with relevant laws and legislation • The cost related to relocation will be given to the relocated residents • Ensure maximum possible	Proponent.	Engineers & Supervision Consultants	

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			employment to local residents			
3.	Planning & Design	• High degree of structural competence, reliability, safety and ease	• The design specification will be followed to withstand local standards regarding noise and vibration and use of familiar and culturally relevant materials wherever consistent with functional needs • Project	• At Design Stage by proponent with coordination of Design Engineers	Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			performance must be enhanced by incorporating innovative and sustainable design strategies.			
4.	Local Conflicts of interest among residents, workers, government officers & local politician	• Settle down each of conflict arise to best possible extent	• Ensure consideration of affected people's emotions • Provide maximum project benefits to local affected person (e.g. employment)	Prior to start construction by contractor with coordination of proponent	Contractors and Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
5.	Misdistribution of Benefits and Compensation among residents, workers, government officers and others.	• Equal and fair distribution of benefits and compensation	• Implement the same mitigation as outlined in the "Local conflict of interest"	Prior to commence construction activity by contractor with coordination of proponent	Contractors and Design Engineers & Supervision Consultants	Project Proponent
6.	Access to Site may result in damage to existing roads due to heavy machinery/ equipments	• Ascertain existing conditions of road for safe access to site for transportation of	• Access to site will be via existing roads. The Contractor will need to ascertain the existing condition of the	Contractor with coordination of Engineer and Consultant	Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	mobilization	construction equipments and materials	roads and repair major damage to avoid delays in transporting construction materials • All roads for construction access must be planned and approved by the Engineer and Consultant • No trees, shrubs or groundcover may be removed			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			or vegetation stripped without the prior permission of Engineer/ Consultant • The Local Traffic Police Department shall be involved in the planning stages of the road closure and detour and shall be available on site for the			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			monitoring of traffic in the early stages of the operations during road closure • The Local Traffic Department must be informed at least a week in advance if the traffic in the area will be affected			
7.	Setting up of Construction Camps	• Availability of environmentally sound construction	• Choice of site for the Contractor's camp requires the Engineer's	Contractor with coordination of proponent	Design Engineers & Supervision Consultant	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		camp facilities	permission and must take into account location of local residents, businesses and existing land uses, if any. • If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the Engineer and the landowner			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			• Cut and fill must be avoided where possible during the set up of the construction camp • Camp must be properly fenced and secured • The Contractor shall make adequate provision for temporary toilets for the use of their employees.			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced • Bins and/ or skips shall be provided at convenient intervals for disposal of waste			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			within the construction camp • Bins shall have liner bags for efficient control and safe disposal of waste • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
Construction Phase						
1.	**Air Quality** • Dust resulting from construction work • Use of heavy machinery can generate exhaust and dust emissions – Dispersion of particles from	– Compliance with prescribed NEQs to control air pollution	– Necessary measures like sprinkling of water on regular basis especially during dry climatic conditions should be taken to limit pollution from dust and other windblown materials. – Covering or use of wind sheets	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultants	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	stockpiles during high velocity wind – Smoke from burning of waste materials or burning of firewood in the labor camp		around the stockpiles to avoid air pollution through dispersion – Periodic maintenance and management of all the construction machinery and vehicles – Cutting and burning shrubs for fuel will be			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			prohibited. Instead gas cylinders should be used in the labor camp for cooking purposes. Similarly waste burning will not be allowed.			
2.	**Water Quality** • Run-off water from construction area – Drainage of	– Control of groundwater or surface water pollution from construction activities	– Use of spill prevention trays and impermeable sheets to avoid contamination of	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultants	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	wastewater on ground can contaminate the soil and groundwater. – Inappropriate disposal of waste. – Open sewerage water disposal on land can contaminate		the groundwater/surface water – Furthermore, septic tanks will need to be constructed which will be cemented to prevent the groundwater contamination – Proper disposal of waste material on dumping sites to			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	ground water and cause generation of mosquitoes and various other insects in the area. • Leakage of oil and chemical materials from construction activity		avoid leachate generation and contamination of groundwater/surface water – Prohibit illegal dumping of waste – The contractor will repair / replace / compensate for any damages caused by the Construction activities to the			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			drinking water source/s.			
3.	**Waste** • Construction waste from construction activities • Domestic waste from workers camp • Hazardous waste such as dry batteries, chemicals	– Proper & safe handling and disposal of construction related waste – Compliance with applicable waste management rules for hazardous and non-hazardous waste disposal – Implementatio	– Ensure prevention of inappropriate disposal of waste material – Conduct separate collection of construction and domestic waste to promote recycling and re-use – Dispose non-	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	etc.	n of waste management plan	recyclable and hazardous waste material properly according to waste management rules – Proper disposal of waste on agreed site as per agreed method. The area to be leveled and contoured after			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			disposing excess material. No waste or debris will be thrown in the nearest canal water or other water bodies – Contractor will prepare waste management plan related to construction activities; get its approval from site engineer			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			and ensure its full implementation			
4.	**Noise** • Noise caused by construction machinery and vehicles used for mobilization of construction equipment and workers	– Compliance with prescribed NEQs to control Noise pollution	– The contractor will strictly follow the NEQS for ambient noise – Control noise thr ough con-trol of working hours and selection of less noisy equipment. – Prohibit use of pressure horns – Provision of	During Construction Phase by Contractor with coordination of Proponent staff	Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			acoustic enclosures (hood and shrouds) on generator – Proper maintenance of vehicles and construction equipment. – Minimize/avoid unnecessary use of pneumatic drills and other noisy machinery – The personal			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			protective equipment (PPE) will be provided to the construction workers and its usage will be made mandatory			
5.	Materials Management	– Safe and secure environment for construction workers	– Stockpiles shall not be situated such that they obstruct natural water pathways – Stockpiles shall not exceed 2m	Contractor with coordination of proponent and Engineer	Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			in height unless permitted by Concerned Engineer on site – If stockpiles are exposed to windy conditions or heavy rain, they shall be covered either depending on the duration of the project. Stockpiles may further be protected by the			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			construction of low brick walls around their bases – All substances required for vehicle/ machinery maintenance and repair must be stored in sealed containers until they can be disposed of / removed from			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			the site – Hazardous substances / materials are to be transported in sealed containers or bags – Spraying of insecticide shall not take place under windy conditions			
6.	**Biological Resources** – Removal of	– Obligation to respect wildlife, Forest	– Re-plantation of maximum number of trees.	Contractor with coordination of proponent staff	Design Engineer & Supervision	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	vegetation covers by cutting of trees, crops, herbs and shrubs – Fauna including birds and animals will be affected during excavation, movement of labor and carriage of	and Fisheries Laws. – Conserve biodiversity and its terrestrial as well as aquatic habitat	– Staff and workers should be instructed not to damage nearby vegetation of the surrounding area. – Open fires should be prohibited in the area to avoid the hazard of fire and impact on nearby flora and fauna.		Consultant	

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	goods and machinery		– Contractor staff should be given clear instructions that they should not hunt any birds/ animal in the project area/ site – Barriers/ fencing/ or boundary wall should be installed at project site to protect movement of			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			animals at the project site during constructions. – Proper disposal of organic waste (if any) generated during the construction stage to avoid rodents and other insects' generation.			
7.	Staff Conduct	– Timely completion of	– The Contractor must monitor the	Contractor	Design Engineer &	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		project activities	performance of construction workers to ensure that point relayed during their induction have been properly understood and being followed		Supervision Consultant	
8.	Leakages/ spills/ Paints/ Used oil	– Compliance with standards set forth by "Guide Lines for Oil Spill Waste	– Contractor will apply strict rules on his workers and labor to ensure that no spill or leakages			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		Minimization and Management" issued by International Petroleum Industry Environmental Conservation Associate	are caused – All fuels, oils and bitumen will be stored appropriately, with concrete padding and bunding for containment in case of leakage – Proper maintenance of vehicles and machinery – Chemical waste will be disposed			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			off in approved disposal site. – All fuel tanks, chemicals including paints, pesticides or other hazardous substances will be properly marked to highlight their content – PPE will be enforced to use during the handling and			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			application of chemicals – Used oil/ oil rags will be disposed through approved recyclable waste vendors – The contractor will employ the general criteria for oil and leakage at construction sites, as per standards			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
9.	Workers Health & Safety	– Prevention of any possibility of work site accident /impact on worker's health	– Provision of Personal Protective Equipment to the workers – Provision of first aid box at work site to cope with emergency situation – Safety training to the workers – Safe driving training to the drivers – Adequate safety	Contractor	Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			signs on site – Provide training regarding proper handling and use of chemicals/ paints – Install fire extinguishers at fire handling places – Inspect and ensure that any lifting devices, such as cranes, are appropriate			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			for expected loads – Any loss of public/ private property will be compensated by the contractor – Regular checks should be carried out to ensure a contractor's is following safe working procedures and practices.			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
10.	Socio-economic Impacts	– Prevention of conflicts among locals and make the project socially acceptable – Empowerment of locals to possible extent – Increase in employment and business opportunities for locals	– Contractor's activities and movement of staff to be restricted to designated construction areas – The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is	Contractor with coordination of proponent staff	Supervision Engineer	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			polite and courteous all the time – Lighting on the construction site shall be pointed downwards and away from oncoming traffic. – The site must be kept clean to minimize the visual impact of site – Machinery and vehicles are to			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			be kept in good working order for the duration of the project to minimize noise nuisance to neighbors – Noisy activities must be restricted to the times given in the Project Specification or General Conditions of contract			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			– The Contractor are responsible for ongoing communication with those people that are interested in / affected by the projects – Employ local residents as much as possible – Promote communication between			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			external workers and local people (e.g. join local events).			
11.	Clearance of site from extra / surplus material and construction equipment	– Restoration of site to a similar condition prior to the commencement of the work or to a condition agreed with the project management and	– Timely removal of waste from the site to avoid congestion at work place. – Construction waste should be collected and disposed separately from other waste. – Care will be	Contractor	Supervision Engineers	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		landscaping of the site	taken during handling and disposal of waste. – Contaminated soil (if generated) due to accidental spills will be removed and transported to suitable site for disposal. – Avoid mixing of hazardous waste with non-			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			hazardous waste. – Safe transportation of construction equipment from the site. – The contractor must ensures that all structure, equipment, materials and facilities used or created on site for/or during construction			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			activities are removed. – Empty/available space will be covered with grassy lawns. – Use of native vegetation as a part of landscape. Ornamental plant species like roses, jasmine, and seasonal flowers can be used in			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			proposed landscaping, which is a common practice in this part.			
Operational Phase						
1.	**Air Quality** – Exhaust gas from stacks – Dust from ash disposal activity – Exhaust gas from vehicles	– Compliance With Emission gas standards, Ambient air quality (NEQs) standards, Prevention of air pollution in surrounding	❖ **Power Plant Operational Activities** – To reduce PM emissions, Electrostatic precipitator of 99.8% efficiency will	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	used for mobilization of equipment – Dust from bagasse handling activities and baggase yard	area; appropriate handling of ash; appropriate bagasse handling during stock and unloading activities	be installed – To reduce NO_2 emissions, firing system will use low combust technology – For stack design, height will be 90 m – Duct will be provided with Electrostatic Precipitator with the			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			supported infrastructure as required under the gas emission standards of NEQS ❖ **Ash Handling** – Shifting the fly ash and bottom ash to the ash pond[1] using air sealed			

[1] An ash disposal pond (10 ha) will be built at the project site. The nominal capacity of the ash disposal pond is calculated based on the total volume of the ash to be accumulated for the duration of 5 years operation with 5000 hours of full load factor each. Leakage from the bottom of the ash pond will be prevented by using an impermeable layer, such as high density polyethylene (HDPE) sheet or silt layer.

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			conveyer – Watering in the ash pond as required for dry season – Re-greening especially along the boundary of the plant site surrounding ash pond with domestic plants according to			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			local climate conditions ❖ **Gas Emissions from Vehicles** – Periodic maintenance and management of vehicles			
2.	**Water Quality** – Thermal effluent from cooling system – Wastewater from plant	– Compliance with Wastewater standards of NEQS	❖ **Thermal Effluents** – Thermal effluents will be discharge far from the intake point of	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	process – Rainwater drainage from ash pond and baggase yard – Leakages of oil and chemical materials		cooling water to reduce the impact on surrounding area ❖ **Wastewater** – Installation of wastewater treatment system by neutralization, settling and oil separation so any wastewater produced			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			complies with wastewater standards of NQES ❖ **Runoff water** – Runoff water is collected in the pond and discharged after appropriate treatment – The bottom of the ash pond shall have an impermeable			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			layer (less than 10^{-6}cm/sec) such as impermeable geo-membrane, sheet and clay ❖ **Oil & chemical materials leakage** – Storage of oil and chemical material in appropriate			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			tank with retaining wall and method to prevent permeation into ground			
3.	**Waste** – Fly ash and bottom ash – Sludge from wastewater treatment and waste oil from equipment	– Compliance with waste management rules – Appropriate handling of baggase ash – Management of waste,	❖ **Ash disposal** – Ash pond is designed with capacity of 5 years of operation ❖ **Waste management** – Implementation o	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	etc. – Sewage and garbage from workers	especially hazardous waste – Prevention of inappropriate waste disposal	waste management program consisting o reduce, reuse and re-cycling o materials. – Systematic collection and protected storage of waste – Waste disposal at appropriate and			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			designated site – Hazardous waste must be treated under related regulation – Prohibition of dumping of any contaminating material			
4.	**Noise & Vibration** – Noise and vibration	– Compliance with prescribed NEQs to control Noise	– Installation of low noise/ low vibration type equipment	EHS officer of Project Proponent	Environment Consultant hired by Project	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	from steam turbines, generators and pumps etc. – Noise by ash disposal/ baggase handling activity – Noise from vehicles used for mobilization of equipment	pollution	– Proper maintenance of equipments – Adequate basis of equipment to reduce the vibration – Adequate enclosure of equipment to reduce noise – Provision of PPEs to workers like ear muffles – Ensure use of PPEs by		Proponent	

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			workers			
5.	**Access to social services** – Social facilities like road, school etc. – Employment opportunities	– Improved social infrastructure and living standards of local residents along with power plant	❖ Increased access to social services – Construction of access road, community road, and road around the power plant boundary – Service facilities such as school and	Project Proponent	EHS officer/ Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			medical centre are made available to the local residents as required – Electrification of surrounding area must be examined – Provision of employment to every affected			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			person on fair basis			
6.	**Work environment (including work safety)** – Labor accidents due to handling heavy loads; working at heights; electric shocks – Diseases	– Prevention measures against labor accidents and health problems	❖ **Labor accidents** – Prepare a manual for labor accident prevention including safety education and training – Provide workers with appropriate protective	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	caused by air pollutants, water pollutants, and noise from the operation of the power plant – Fire Hazards		equipment – Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads – Keep lifting devices well maintained and perform maintenance checks as			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			appropriate – Use equipment that protects against electric shock ❖ **Environment Pollution** – Observe related standards and provide workers with appropriate facilities\			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			❖ **Fire Hazards** – Installing fire extinguishers in fire handling places – Installing fire fighting system – Developing fire fighting organization and implementing fire drills – Spraying			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			water in baggase yard			

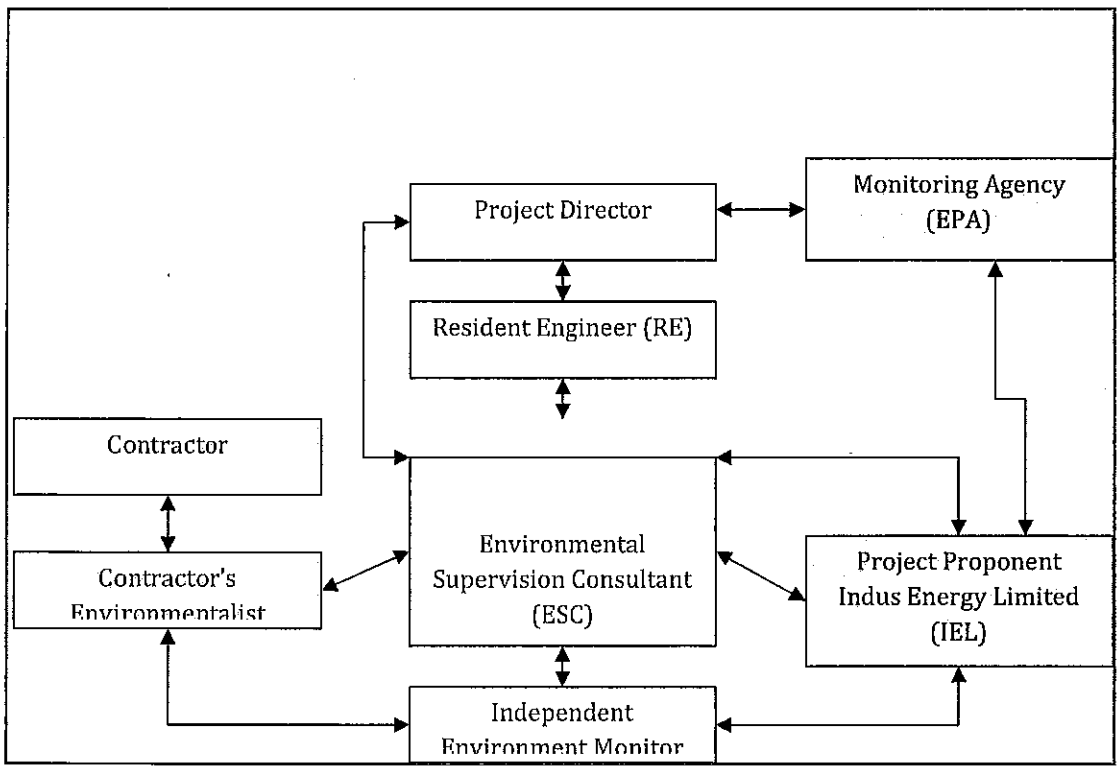


Figure 6.1: ORGANOGRAM FOR IMPLEMENTATION OF EMP

6.3 ENVIRONMENTAL MONITORING PROGRAM

It will be in the fitness of the things to operate this project under the Environmental Management Plan (EMP). The EMP will ensure that even all type of pollutants from project is within the prescribed limiting values of the NEQS. Thus, the environment and human health around the project will be safeguarded. Regular monitoring of all the significant environmental issues is essential to check the compliance status of EMP.

The main objective of the monitoring will be;

- To verify the results of the environmental study with respects to the proposed project.
- To estimate the trends of concentrated values of the issues, which have been identified as critical and then planning the mitigating measures.
- To assess the efficiency of pollution control mechanism.

- To ensure that any additional parameters, other than those identified in the IEE report, do not turn critical after the commissioning of proposed project.

Table 6.2- Recommended Activities of Environmental Monitoring

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Water Quality	▪ Ground Water ▪ Surface Water	Discrete grab sampling and laboratory testing of water samples.	▪ Sampling and laboratory testing should be done on monthly basis during the construction and annually during the operational stage. ▪ Discharges from the construction sites should be tested for temperature, pH and turbidity. ▪ Treated effluent discharges from the worker's camp

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			to be tested for pH, TSS and BOD_5.
Dust Emissions	▪ Tracks along the roads during construction period.	Ambient Particulate Matter Monitoring.	▪ Sampling and laboratory testing should be done on monthly basis during the construction and through Quarterly basis during the operational stage.
Noise Levels	▪ Camp sites, ▪ Selected locations along the project access.	Noise meter	▪ Monthly during the construction and operational stage.
Stack emission	Silencers of heavy machinery, trucks and other vehicles.	Emissions monitoring system. Monitoring of ambient air quality.	▪ Monthly monitoring of air pollution parameters including PM_{10}, NO_X, SO_X, CO, Hydrocarbons

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			during the construction period, and through the online monitoring system of PM_{10}, NO_X, CO, during the operation stage.
Ecological Environment			
Cutting of trees	In all Project Area during the construction stage and operation stage.	Periodic visits at site to ensure that only those trees should be cut, which are demarcated for cutting.	▪ Weekly during routine monitoring and reported on monthly basis during the construction period, and once in a year monitoring and reporting during the operation

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			period.
Socio-Cultural Environment			
Inconvenience to community	All around the Project Area	Consultations with community to get feedback about inconvenience due to the construction activities to perform their daily routine chores.	• Monthly monitoring and reporting during the construction period.

6.4 ENVIRONMENT MANAGEMENT COST

The total cost for the environmental management is estimated as 2.5 million Pak Rupees. The estimations are as followings;

Table 6.3 Environmental Management Cost

Environmental Component	Quantity	Amount (PKR)
(i) Tree Plantation (local species)	1500	700,000.0
(ii) Health and Safety Measures and Provision of PPEs	L.S.	500,000.0
(iii) Air and Water Quality & Noise Monitoring	L.S.	800,000.0

Environmental Component	Quantity	Amount (PKR)
(iv) Environmental Trainings	L.S	500,000.0
Total Environmental Management and Monitoring Cost		**2,500,000.0**

6.5 TRAINING NEEDS

In order to effectively operate the EMP all the staff to be engaged in this activity should be trained extensively. All the environment management staff to be engaged for operating plant, monitoring and testing should be duly trained. Laboratory chemist should be trained in all operations of laboratory testing of the effluents and other relevant materials/samples. He should be trained in applying analytical methods/techniques of testing, data processing, interpretation and reporting. He should know the local laws, rules and regulations as applicable to the testing of effluents.

The designated HSE Officer will be charged with an ongoing program of environmental training. This will include:

- General promotion of environmental awareness;
- Specific training for staff working in sensitive areas;
- Updating staff on changes to environmental standards; and
- Reporting to staff on the station's environmental performance.

The person to monitor gaseous emissions, PM and noise levels should be extensively trained to handle his job capably. Training program should include use of monitoring instruments, data generation, processing, interpretation, recording and presentation.

6.6 MONITORING & EVALUATION (INSTITUTIONAL ARRANGEMENT)

Project Director will be responsible for Monitoring and Evaluation, but Environment consultant (of the proponent) will responsible to monitor EMP implementation in the field and reporting to the Project Director. The Project Director will integrate monitoring reports in the main monthly reports of the project. The Environment

Specialist of Supervision Consultant will carry out a final evaluation at the end of the Project. In addition, for external monitoring, proponent is to engage an independent agency (an NGO, an academic institute or an individual consultant) to conduct 3rd party validation of EMP implementation. District Office of the EPA at Rajanpur will monitor the overall activity at the site.

6.7 SOCIAL MANAGEMENT PLAN

6.6.1 Recommendations and Mitigation Measures

Based on the initial benchmark study the recommendations are made:

- The management of the Project can capitalize on the positive attitude of the people of area towards proposed Project by offering them maximum employment opportunities at the construction stage and stage of operational phase of the power plant.
- Insufficient and inadequate socio-economic structure of the community of the area also provides ample opportunities to project management to win sympathies of local people in their favor, by introducing meaningful and manageable plan of community development.
- Aggressive and comprehensive plantation plan can also lessen fear of local people towards environmental issues.
- Plant management can explore direct or indirect chances of female employment opportunities. Such efforts can be fruitful to minimize negative social impacts.
- Sustainable development approach through conservation of natural resources would be the best strategy to compensate negative socio-environmental impacts.
- Plant management should offer technical training opportunities to the local youth, if possible, to remove relative sense of deprivation.

SECTION -7
PROJECT SOCIAL SOUNDNESS

Section-7

PROJECT SOCIAL SOUNDNESS

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability. Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the IEE process in Punjab province but also to improve and enhance the social and environmental design of the project.

7.1 OBJECTIVES OF STAKEHOLDERS CONSULTATION

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference named as Agenda 21.

Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

A study was carried out with the broad objective to evaluate the impact of the project on the local population through public consultation process. The specific impact assessment aims were:

- Promote better understanding of the project, its objective, and its likely impact
- Identify and address concerns of all interested and affected parties of project area.

- Provide a means to identify and resolve issues before plans are finalized and potentially costly delays development commences, thus avoiding public anger and resentment.
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership.

7.2 PUNJAB ENVIRONMENTAL PROTECTION ACT 2012 (AMENDED ACT)

Public consultation is mandated under Punjab's environmental law. The Provincial Agency, under Regulation 6 of the IEE-EIA Regulations 2000, has issued a set of guidelines of general applicability and sectoral guidelines indicating specific assessment requirements. This includes Guidelines for Public Consultation, 1997 (the 'Guidelines'), that are summarized below:

a) Objectives of Public Involvement

To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders.

b) Stakeholders

People who may be directly or indirectly affected by the proposed project will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of proposed project, but should also include those who can affect the outcome of a proposal.

c) Mechanism

Provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance.

d) Timing and Frequency

Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the IEE process. In particular for present project the consultation was carried for six consecutive days.

e) Consultation Tools

Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; community meetings and workshops. In particular for this a performa was developed to get the related information.

f) Important Considerations

The development of a public involvement program would typically involve consideration of the following issues;

- objectives of the proposal and the study;
- identification of stakeholders;
- identification of appropriate techniques to consult with the stakeholders
- identification of approaches to ensure feedback to involved stakeholders; and
- mechanisms to ensure stakeholders consideration are taken into account.

7.3 CONSULTATION PROCESS

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Punjabi and Urdu languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and

environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation.

By reaching out to a wider segment of the population and using various communication tools such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal; present IEE involved the community in active decision-making. This process will continue even after this IEE has been submitted, as well as during future EIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues.

In the Secondary stakeholder consultations were more formal as they involved government representatives and local welfare organizations, NGO's consulted during face-to-face meetings and through telephonic conversations. They were briefed on the IEE process, the project design, and the potential negative and positive impact of the project on the area's environment and communities. It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with community's leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the IEE report.

7.3.1 Points Discussed

Following points were discussed during the public consultations:

- Project components, its activities and impacts.
- Needs, priorities and reactions of the affected population regarding the proposed Project.
- Grievances redress procedures.
- Entitlement checklist development for the affectees of the Project.
- Evaluation criteria of the buildings.

- Basis for determining the rates of the land, houses, and other infrastructures.
- Compensation framework for the Project affectees.
- Compensation criteria to be followed for the payment to the affectees.
- Role of the affectees in implementation of the project.

7.4 STAKEHOLDER CONSULTATION TECHNIQUE

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory techniques were employed during stakeholder consultations:

- Informal meetings with communities.
- Focus Groups with participants in communities.

In the consultation process for IEE, following key stakeholders were consulted:

- Local communities,
- Men
- Women and
- Community's elders attended meetings.

Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women.

7.4.1 Government Representatives

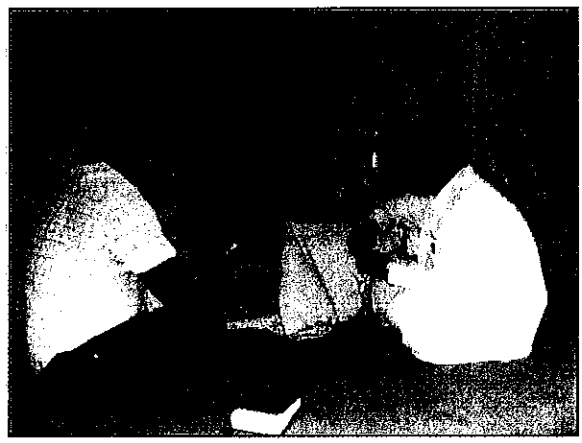
The consultations were carried out with the local government officials and officials of the following departments:

- Forestry

- Fisheries
- Irrigation
- Wild Life

The officials of Wildlife and Forest department perceived that the employment opportunities and business development would be the positive impacts on the community and people during the construction phase of the proposed project. Among the perceived negative impacts during construction phase of the project include especially road blockage, dust emissions, noise and nuisance due to heavy traffic. All officials of project study area were in favor of the project. They expect many positive, conducive and constructive impacts on socio-economic life of local community regarding jobs, business opportunity and social structure development. They were in opinion that project would improve area development through development of existing infrastructure etc. The project will also raise their level of awareness, initiate cultural diffusion, activate social mobility and bring social change regarding various aspects of their life.

The officials from Fisheries and Irrigation departments appreciated the proposed activity. They also expressed that the jobs and business opportunities for the local community will be increased due to project activities and that the infrastructure will developed that automatically lead to the development of the project area. They also expressed the concern that most of the unskilled and skill jobs should be provided for the local communities.

Consultation with the Government Officials

7.4.2 Stakeholder Concerns and Recommendations

The findings of the Community consultations are given as followed. All these have been addressed in various sections of the IEE and the mitigation plans have been incorporated into the EMP.

The summary of the various stakeholder consultations is given below.

- The people foresee positive impacts like employment opportunities, business, development of the area etc.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of power plant siting. Therefore, their attitude towards the project establishment is quite positive.
- As far as the Environmental Assessment is concerned, positive social impacts are dominant over hardly conceived any negative social impacts observed during the study.
- The people have high expectations and hope from the project activity and its management.
- They correlate their positive attitude towards the project with many socio-economic opportunities and benefits.
- The people believe that the project in the area will open up vast employment opportunities which in turn follow a chain of indirect socio-

economic benefits.

- They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area. Directly or indirectly, hundreds of the local people will get employment and business from the project e.g, shopkeepers, traders, suppliers, contractors, transporters, technicians, etc.
- People foresee many socio-cultural and psychological positive impacts on their lives and the community.
- They feel that the project and its related activities will provide a strong base for social change.
- They reckon that invasion of the people and technology in the area will improve the quality of life of the people. It will also improve the level of general awareness of the people about different aspects of life.

From the above facts one can conclude that many positive economic and social impacts will appear in the quality of the lives of the people of the Study Area due to proposed power project. These positive impacts include improvement in female status, employment and business opportunities, infrastructure development, reducing rural urban migration, generating income resources and improving quality of life.

7.5 PROCEDURE FOR REDRESS OF GRIEVANCES

Suggested procedures to be adopted for the redressal of the grievances are given below:

- Project affectee will submit his/her application to the Field Implementation Unit for consideration. Within 15 days of the receipt of the complaint, action will be taken up for redressal of the grievance. Wherever policy matters are involved, the case will be referred to the appropriate authority or committee appointed by the Project to decide the matter.
- In case some response on the complaint is not received within 15 days of the receipt of the complaint, the complainant may also send a reminder to within 15 days notice to take legal remedial measures.

- In case the matter has been decided but the complainant is not satisfied, he/she may go to the court of law.
- In case of such eventualities, all affected persons should be exempted from legal and administrative fees made/paid/incurred pursuant to the grievance redressal procedures.
- All complaints received in writing or written when received verbally will be properly recorded and documented.

7.6 PROPOSED MECHANISM FOR GRIEVANCE REDRESS

Under the Project the following will be established or appointed to ensure timely and effective handling of grievances:

- A Public Complaints Unit (PCU), which will be responsible to receive, log, and resolve complaints; and,
- A Grievance Redress Committee (GRC), responsible to oversee the functioning of the PCU as well as the final non-judicial authority on resolving grievances that cannot be resolved by PCU;
- Grievance Focal Points (GFPs) having educated people from each community that can be approached by the community members for their grievances against the Project. The GFPs will be provided training by the Project in facilitating grievance redress.

Details of the proposed mechanism are given below.

7.6.1 PCU – Function and Structure

PCU will be set up as part of the environment, health and safety department of the Project. A senior official with experience in community and public liaison will lead the unit. Two assistants, one male and one female will be responsible for coordinating correspondence and preparing documentation work and will assist the senior official. The senior official will be responsible to review all documentation. The PCU will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their homes, the female PCU staff will be required to undertake visits to the local communities. The frequency of visits

will depend on the nature and magnitude of activity in an area and the frequency of grievances.

7.6.2 GRC – Function and Structure

The GRC will function as an independent body that will regulate PCU and the grievance redress process. It will comprise of:

- Officials of environment, health and safety of the proposed Project.
- Senior engineer that is responsible to oversee the contractors.
- Two literate representatives from the communities residing near the project site;
- A representative of the local government. In case the local government elections take place, this could be the Naib-Nazim or Nazim (the district governor). If not, this would be the District Coordinating Officer (DCO) or an appointed representative;
- Senior member from the local civil society with experience in community relations;
- A female member from the local civil society.
- The GRC will meet once every three months to review the performance of the PCU; the frequency can be changed depending on the nature and frequency of grievances received. The performance will be gauged in terms of the effectiveness and the timeliness with which grievances were managed. In case there are any unresolved or pending issues, the GRC will deliberate on mechanisms to resolve those and come up with solutions acceptable to everyone.

7.6.3 Grievance Focal Points

The GFPs will be literate people from each community that will facilitate their community members in reporting grievances from the Project. The GFPs will be provided training by the Project in facilitating grievance redress. Each community will have a male and female GFP appointed for this purpose.

7.6.4 Procedure of Filing and Resolving Grievances

Grievances will be logged and resolved in the following steps:

Step 1: Receive and Acknowledge Complaint

Once the PCU receives a complaint, which could be the complainant giving it in person, via letter or email, through phone call, or through a GFP, an acknowledgement of receipt of the complaint has to be sent within two working days to the complainant. The complainant will be issued a unique complaint tracking number for their and PCU's record.

Step 2: Investigation

PCU will work to understand the cause of the grievance for which the PCU may need to contact the complainant again and obtain details. The PCU will be required to complete preliminary investigations within five working days of receiving the complaint and send a response to the complainant documenting the results of their investigations and what the PCU plans to do ahead.

Step 3: Resolution through PCU

Once the PCU have investigated a grievance, it will share with the complainant the proposed course of action to resolve the complaint, should PCU believe any to be necessary. If the complainant considers the grievance to be satisfactorily resolved, the PCU will log the complaint as resolved in their records. In case the grievance remains unresolved it will be reassessed and GRC will have further dialogue with the complainant to discuss if there are any further steps, which may be taken to reach a mutually agreed resolution to the problem.

For minor grievances, Steps 1, 2 and 3 or Steps 2 and 3 can be merged.

Step 4: Resolution through GRC

In case the PCU is unable to resolve the issue, the matter will be referred to GRC. All complaints that could not be resolved within four weeks will by default be referred to GRC. However, the complainant or the PCU can convene the GRC at any point in time, depending on the nature and urgency of the issue.

7.6.5 Operating Principles for PCU

The PCU will operate on the principles of transparency, approachability and accountability. To achieve these, the PCU will be required to:

- Be equipped to handle grievances in the local languages;
- Be equipped to work through all possible modes of communication, such as, emails, surface mail and face-to-face meetings at project site or requiring visits;
- Employ female staff, preferably from the nearby communities, to oversee complaints and issues of the female community members.
- Maintain a log of all grievances, with record of the date and time of the complaint logged and stakeholder information, such as, name, designation and contact details;
- Provide opportunity to the stakeholder to revert with their comments on the proposed plan of action;
- Keep the stakeholder informed of the progress in grievance resolution;
- Obtain stakeholder consent on the mechanism proposed to redress the grievance and document consent; and,
- Maintain confidentiality of the stakeholder, if requested so.

7.6.6 Stages of Grievances

Once a grievance is logged with the PCU, it could acquire the following stages:

Stage 1: it is resolved by the PCU or if not PCU, by the GRC;

Stage 2: If the stakeholders are still not satisfied, they can go through local judicial proceedings.

7.6.7 Awareness

The stakeholders will be informed of the establishment of the PCU, GRC and GFPs through a short and intensive awareness campaign. Under the awareness campaign, the proponent will share:

- Objective, function and the responsibilities of the PCU, GRC and GFPs;
- Means of accessing the PCU and the mechanics of registering a grievance at the PCU,
- GRC and GFPs;
- Operating principles of the PCU, GRC and GFPs; and,

- Contact details.
- Additional awareness campaigns may be organized, if necessary

7.7 COMMUNITY CONCERNS

Project Approval

The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities was evident. The consultations were considered a good gesture and appreciated, especially by the men and women. This project will provide employments to the local as well as non local poor community in its construction as well as in operational stages.

Resettlement/ Relocation

The owner of the private land demanded the followings;

- Lucrative Land against land
- Fair Compensation against acquiring land
- Compensation of Land before the commencement of the work

Local Employment

Communities in the project area emphasized that local poor community should be given priority when employing people for various project-related works and activities according to their skills.

Interaction with Local Community

Non-Local work force coming in the project area that will not be aware of the local customs and norms, may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

Impact on Livelihood

The communities also expressed some fear that project construction would disturb their living because of noise and vibration of constructional woks and due to vehicular movement. Another concern of local community is the road blockage and traffic problem in the surrounding areas of proposed project sites during construction.

7.8 LOCAL GOVERNMENT REPRESENTATIVES

The consultations were considered a good gesture and appreciated. They also expressed the jobs and business opportunities for the local community will be increased due to project activities. They also expressed the concern that most of the unskilled and skill jobs should be reserved for the local communities.

SECTION -8
EMERGENCY RESPONSE PLAN & EVACUATION PLAN

Section - 8

EMERGENCY RESPONSE PLAN & EVACUATION/EXIT PLAN

8. EMERGENCY PREPAREDNESS AND RESPONSE

a. Policy:

It is the policy of project proponent to establish an Emergency Response Program and guidelines for the protection of plant people, equipment damage, environment and community.

b. Purpose:

The objective of the Emergency Preparedness and Response System is to:

1. Recognize and plan for appropriate responses to an emergency so that the safety risks associated with the emergency may be prevented or mitigated.
2. Train and prepare individuals working inside the installation so that they can respond effectively in the following:
   i) Potential Risk Assessment
   ii) Fire detection and Alarm System
   iii) System for Intervention and Actions to control any incident
   iv) Emergency Evacuation Procedure / Drills in order to meet the emergency situations, like Bomb Threatening Message or Terror Act / Threat etc Emergency Response Plan at a Glance:

c. Incident Categories:

Category	Title	Definition & Effect	Causing Incident
1	Minor Incident	Incident, which may involves injury or damage to plant controllable by personnel on the spot	1. Small Fire, 2. Small Hydrocarbon Spill, 3. Process Leakage, 4. Small leakage of Hazardous Chemicals, 5. Minor Gas release (Toxic or

Category	Title	Definition & Effect	Causing Incident
			Flammable)
2	Serious Incident	Incident, which may involves injury, damage or serious damage to plant beyond resources of personnel on the spot and controllable by Emergency Response Team	1. Fire, 2. Small explosion with minor knock on effects, 3. Serious Spill containable, 4. Gas Release but controllable.
3	Major Incident	Incident involving injury, death or major damage to plant or environment beyond resources of Site Emergency Response Team and external Aid required.	1. Major Fire, 2. Major Explosion, 3. Major Spill, 4. Major Gas Release 5. Major or multiple injuries or illness.
4	Disaster	Escalating incident involving large-scale injury, death or damage, beyond the resources of External and Internal Emergency Services and threatening civilian population.	1. Toxic Gas Cloud, 2. Flammable Gas Cloud, 3. Disastrous Fires and Explosion

8.1 EMERGENCY EVACUATION PLAN

a. Objective:

The purpose of this procedure is to facilitate and to organize individual's actions during workplace emergencies and get working people of power plant out of danger quickly and efficiently. A disorderly evacuation under emergency condition can lead to confusion, injury and property damage.

b. Possible Situations:

A wide variety of emergencies both man-made and natural may require a workplace to be evacuated. These emergencies include but are not limited to fires, bomb threats, toxic material releases etc

c. Responsibilities:

1. Observer or First on Scene

- Activate alarm from local panel to inform CCR if it is not activated or Inform CCR by radio, telephone 111or 222, by paging system, then call. If cannot do all above, shout loudly to alert the colleagues.
- Try to understand the type of emergency and communicate to CCR as detailed as possible.
- Location, extent and type of Fire / Accident / Incident
- If it is safe to fix the problem, try to fix it without putting anyone at Risk.
- When relieved by emergency response team, proceed to assembly area.

2. On Duty CRE

- Respond to the alarm / call.
- Arrange available emergency response team
- Arrange fire tender to the scene
- Arrange to sound emergency siren
- Inform Doctor and arrange ambulance
- Inform emergency team leader and fire chief.
- Inform Safety and Security Team Leaders.

- Inform to the security gates and Reception, and will request to stop the entrance of contractors/visitors. Also brief the security for Fire tender and ambulance and for plant entry sheets.
- Start Ground activities.

Note: CRE will coordinate the ground activities till emergency team leader comes. If due to operational activities or manpower shortage it is difficult for CRE to go out, he will nominate any area engineer to coordinate the ground activities.

3. **Emergency Response Team**

- Proceed to scene of incident.
- Select a leader and act under the instructions of leader till Fire chief arrival.
- Communicate on Radio.
- Give necessary assistance e.g. Evacuation, first aid etc.
- Report to Emergency Team Leader when incident is under control.

4. **Fire Chief**

- Communicate using the radio.
- Appoint himself as External Aid Service Coordinator/ Mutual Aid Coordinator.
- Assist with the follow up services as required.
- Do liaison with Incident Controller/ Emergency Main Controller and provide any specific advice or technical expertise as may be required.
- Ensure 24 hrs coverage of the control center during an Extended Emergency.

5. **Emergency Team Leader**

- Proceed to scene of incident.
- Communicate by using radio.
- Emergency Team Leader or his designee will announce the category of the incident if it is 1 or higher.

- Appoint himself as Incident Controller.
- Inform other team leaders and Plant Manager.
- Guide Fire Chief for positioning Emergency Services / Fire Fighting.
- Nominate a person for head count.
- Coordinate Emergency response team.
- Help in Search and Rescue.
- Do identification of casualties.
- When Incident scene is in secure position, announce EMERGENCY OVER or "ALL CLEAR".
- Plant if previously shutdown due to emergency shall be started as per standard procedure recommended by OEM.
- Assist with investigation.

6. Plant Manager

- Proceed to emergency control center (CCR or nominated control center).
- Communicate by using radio.
- Declare himself as Emergency Main Controller.
- Alert mutual aid partners.
- Check call out response.
- Support the on scene response.
- Brief the security services.
- Maintain regular contacts with all the team involved in controlling the incident.
- Liaise with local authorities.
- After examining the emergency, he will declare the shift people evacuation.
- When incident is secure, announce "ALL CLEAR".
- Commence investigation of the incident.

7. Doctor

- Respond to call out.
- Carry out specified task and report to assembly area.

8. **All Site Personnel (Except shift people)**

- Make safe exit and report to assembly area
- Assist as required.
- If required, after head count, will be evacuated to safe place.

Note: People before leaving will make sure their work area is in safe condition and equipment they were using is in safe position.

9. **All people** are responsible for the contractor people working in their area to guide them to the assembly area.
   The person receiving visitors to the site will be responsible for the visitor's health and safety.
10. **All shift personnel** will report in CCR for head count. They will remain on duty to continue operation of plant or shut down activities as required unless main emergency controller (Plant Manager) asks them to evacuate.
11. **All Contractors:** Contractor workers will be made aware of Emergency Response Plan prior to commencing the work. Prior to leave the site they will ensure that their work area is in safe position. On emergency call they will report in assembly area.
12. **Roll Call at Assembly:** To ensure that all personnel are accounted for and searches mounted for any missing persons, a head count after any evacuation, must be carried out.
13. **Responsibility of Plant Security System:**
    - Security Team Leader shall pass necessary information to Security Supervisor.
    - Security Supervisor or his designee will collect the plant entry sheets in case of emergency and submit at assembly area.
    - Small gate near admin building can be opened in case of emergency. For this purpose key should be kept on reception.
    - Security Guards should not block the people, in case of emergency exit from the plant.

- Security Guards should not block the entrance of fire tender and/or ambulance and its crew and the persons permitted by the Incident Controller having **RED BADGE.**
- Information should be given to security gates about the emergency situation and ALL Clear announcement.
- Security Guards should not leave the gate without the permission of Security Team Leader or his designee.

14. **Annual Drill:** An annual drill will be conducted to test the emergency program and its record will be kept with Emergency Response Team for at least one year.

8.1.1 Evacuation of Persons with Disabilities

After an evacuation call the disable people must be evacuated immediately and plant ERT team is responsible for whole coordination. The following guidelines should be considered when assisting people with disabilities during an evacuation. ERT team must be familiar with following guidelines;

- FIRST, communicate the nature of the emergency to the person.
- SECOND, ask the person how he would like to be assisted.
- THIRD, evacuate mobility aids with the person, if possible (i.e., crutches, wheelchairs).
- VISUAL IMPAIRMENTS: Describe the nature of the emergency and offer to guide him to the nearest emergency exit. Have the person take your elbow and escort him, advising of any obstacles such as stairs, narrow passageways or overhanging objects. When you have reached safety, orient the person to where he is and ask if further assistance is needed.
- HEARING IMPAIRMENTS: Some buildings are not equipped with flashing light alarms, and persons with impaired hearing may not perceive that an emergency exists. Communicate with the person by writing a note or through simple hand gestures.
- PERSONS USING WHEELCHAIRS: Ask the person what method of assistance he prefers. Some people have minimal ability to move, and lifting

them may be dangerous. Some people who use wheelchairs have respiratory complications and should be immediately escorted out of buildings that contain irritating smoke or fumes. If the person wants to be moved in his wheelchair, keep the following considerations in mind:

1. Ask if he wants to move forward or backward down stairs.
2. Wheelchairs have many movable or weak parts so while moving the wheel chairs, a proper care must be taken. Some people have no upper trunk or neck strength.
3. For a person using wheelchair may be moved through Ambulance in emergency or in case of plant evacuation.

8.1.2 Evacuation in Case of Adverse Weather Condition

A. In the event of an adverse weather emergency or flood emergency on plant, the plant manager or CEO, or their designee, will initiate the appropriate announcements concerning the emergency flood warning or hurricane warning and the instructions for preparation and/or evacuation when and if necessary.

B. In the event of a major weather emergency or disaster, the Safety team leader will coordinate with the local or state authorities and plant people.

C. Any personnel who discovers an emergency weather condition or problems like flood due to severe weather or facilities damage, should follow these procedures:

1. Stay out of the area. Do not enter until electrical power has been turned off.
2. There is an extreme danger of electrical shock if the water has contacted any electrical devices. Post people at all entrances to the flooded area to prevent entry by unauthorized personnel.
3. ERT team personnel will be responsible for pumping water out of the area.
4. Identify a temporary shelter to house water-soaked materials.

8.1.3 Fire Response Program

a. Purpose:

To provide for safety against potential fires and minimize the risks of damaged or personal injuries in the event of a fire at project facility.

b. Classifications of Fire:

FIRE CLASSIFICATION	
Fire Classification	Description
A	Solid combustible materials that are not metals like, Paper, wood, cloth, etc. where quenching by water or insulating by dry chemical is effective. (Class-A fires generally leave an Ash)
B	Any non-metal in a liquid state, on fire. This classification also includes flammable gases like, gasoline, oil, grease , acetone etc (Class-B fires generally involve materials that Boil or Bubble)
C	Live electrical equipment where the non-conductivity of extinguish ant is vital.
D	Material used in laboratories like, potassium, sodium, aluminum, magnesium. It takes special extinguishing agents (Metal-X, foam) to fight such a fire.

c. Responsibilities

The responsibilities of observer or First on Scene, CRE, ERT, Fire Chief, Emergency Team Leader, Plant Manager, Doctor. The responsibilities of other areas are as follows,

1. Observer or First on Scene

See section 8.1(a) for Observer or First on Scene responsibilities. Other responsibilities are,

In case of Minor Fire:

Minor fire is one that can be extinguished with portable extinguisher.

- Inform CCR.
- Extinguish the fire by using suitable extinguisher.

In-case of Major Fire:

Major fire is one that cannot be extinguished with portable extinguishers alone.

- Inform CCR.
- Check Automatic fire system operated or not, if not operate it.

2. **On Duty BOP Engineer**
   - In case of fire he must arrange make up water for filtered water basin.
   - Check the fire pumps performance.
3. **In case of HFO or HSD Tanks Fire**
   - Foam Area Alarm will receive in CCR.
   - CRE will inform Area Engineer, Area Engineer will confirm the Heat detection Alarm for Fuel Tank and Smoke physically. Then intimate to CRE about Fire. With the consent of CRE, Area Engineer will pull the Pull Station either inside the foam shed fire panel or from near the tank. Area Engineer will then confirm the water/Foam flow towards the effected Fuel Tank.
   - Start water sprinkling through ground monitor, fire tender or from fire hoses, if required.

Note: Each fire breakout must be reported as per Incident / Accident Reporting Procedure before the end of shift.

4. **HVAC:**

   Operation of the fire alarm in the buildings having HVAC system automatically shuts down the HVAC and ventilation fans, in order to clear the smoke when the main fire outbreak is extinguished, the

ventilation fans may be started. The switches of these fans MUST NOT ARE OPERATED except on the instructions of the Incident Controller or CRE.

Fire in Community:

Following sequence of events will be observed during any emergency,

- Inform CCR.
- A small fire can be extinguished with the dry chemical Fire extinguisher available in houses.
- Fire response team will handle the situation with Fire tender if required.
- Fire tender make up can be done from nearest Fire hydrants.
- Orderly evacuation of the building.
- Head count at designated assembly point.
- Search and Rescue.
- Identification of casualties.
- Medical Care for injured.
- Security of building, prevent unauthorized entrance.

Note: The community fire water system has five (5) hydrants strategically located. These hydrants have approximately 30-PSI water pressure.

8.2 FIRE / EMERGENCY SYSTEM INSPECTION, TESTING AND MAINTENANCE PLAN

a. Purpose:

This document establishes the minimum requirements for the periodic inspection, testing, and maintenance of fire protection systems

b. Scope:

The purpose of this document is to ensure healthiness and to provide requirements that ensure a reasonable degree of protection for life and property from fire through minimum inspection, testing, and maintenance methods for fire protection systems.

c. Fire System Testing and Preventive Maintenance Plan:

Item	Activity	Responsible	Frequency
Sprinklers	1. Inspection for corrosion, paint, physical damage 2. Replace faulty one.	Maintenance	Annually
	1. Nozzle discharge pattern and direction. 2. Automatic & Manual system test. 3. Record the response Time.	ERT, Operation	Annually
Alarm Devices	Inspection for physical damage and calibration.	I&E	Annually
	1. Testing the water flow alarms 2. Pressure switches signals	I&E, ERT, Operation	Quarterly
Gauges	1. Calibration	I&E	5 yearly or when required
Strainers, Filters	Inspection & Cleaning	Maintenance	Annually
Monitor Nozzles	Lubrication	Maintenance	Annually
	Test	ERT, Operation	Monthly

Item	Activity	Responsible	Frequency
Fire Hoses	Test	ERT, Operation	Monthly
Hydrants	Test	ERT, Operation	Annually
	Lubrication	Maintenance	Annually
Fire Pump	Auto Cut In Test for 30 minutes.	Operation	Weekly
	Preventive Maintenance	Maintenance	
Foam System	1. Foam Sample 2. Foam Concentration Testing 3. System Testing 4. Manual Actuation devices Test	ERT, Operation	Annually Annually Quarterly Annually
Deluge Valves	Full Flow Test	ERT, Operation	Annually but not exceed from 3 years.
	Preventive Maintenance	Maintenance	Annually
Item	**Activity**	**Responsible**	**Frequency**
Foam Chambers at Fuel oil Tanks	Cleaning	Maintenance	Annually
Valves	Lubrication of outside	Maintenance	Annually

Item	Activity	Responsible	Frequency
	screw and Yoke.		
Check Valves	Internal Inspection	Maintenance	5 yearly
Heat & Smoke detectors	Preventive Maintenance	I&E	Annually
Cl_2 leak detectors	PM and Testing	I&E	Annually
CO_2 cylinders for CCR	Weight & Inspection	ERT, Operations	Annually
Fire Protection System Log	Readings as per standard sheet (attached)	Operation	Quarterly
Pull Stations	Preventive Maintenance	I&E	Annually

d. Fire / Emergency System Audits and Follow up:

Item	Activity	Responsible	Frequency
Fire Extinguishers	Inspection & Follow up	Safety Committee	Monthly
Fire Cabinets	Inspection & Follow up	Safety Committee	Monthly
Emergency Shower/ Eye wash	Inspection	Safety Committee	Monthly
Exit Light	Inspection	Safety Committee	Monthly

Item	Activity	Responsible	Frequency
SCBA	Inspection & Follow up	ERT	Monthly
Plant Paging System	Audit, Inspection & Follow up.	ERT	Monthly
Fire Alarm Panels	Audit and Follow up for any standing Alarm	ERT	Monthly
Fire Tender	Check List & Maintaining	ERT	Weekly
Fire House Stock for Fire Extinguishers and SCBA	Check List and Maintaining	ERT	Monthly or when required.
Exit Light Audit	Inspection	Safety Committee	Monthly
Cl2 Cylinder Repair kit	Inspection	ERT	Monthly

8.3 CHEMICAL SPILL / RELEASE RESPONSE PROGRAM

a. Purpose:

Although every effort is made at site to prevent spills of potentially hazardous chemicals or fuels in the workplace, accidents resulting from the release of chemicals can occur. This procedure is provided to mitigate the effects of spills of potentially hazardous chemicals in workplace.

b. Minor Spill:

A spill of solid or liquid materials which involves the release of a type or quantity of a chemical which does not pose an immediate risk to health and does not involve chemical contamination to the body

c. Major Spill / Release:

A spill of solid or liquid materials which involves:

- Release of a type or quantity of a chemical that poses an immediate risk to health
- An uncontrolled fire or explosion

d. Major Spill Release:

- Heavy Chlorine Leak
- A major Oil leak where there is a contamination of the drains or outbreak of fire or explosion.
- A Hazardous Chemical Leak that is thought to be a hazard to personnel.

e. Response Program:

1. In case of Minor Oil Leakage or Hazardous Material:

- Inform CCR.
- Locate the source of the spill, and stop the spill.
- Close secondary containment drain valve.
- Remove ignition sources and unplug nearby electrical equipment.
- Establish exhaust ventilation. Vent vapors to outside of building.
- Choose appropriate PPE (goggles, face shields, gloves, clothing, etc).

- Make arrangement to collect or dispose off the spilled hazardous substance safely and properly as per procedure contained in section-16 "Hazardous Substances Handling Procedure".
- In case of Major Fire, follow "Fire Response Program" along with " Emergency Evacuation Plan"

2. **In case of Major Oil Leakage or Hazardous Material:**
   - Inform CCR
   - CRE will inform to other plant people and worker in shift
   - Isolate the area
   - Close secondary containment drain valve
   - Remove ignition sources and unplug nearby electrical equipment
   - Establish Exhaust vapour source, if possible
   - Choose appropriate PPE
   - Make arrangement to collect or dispose off the spilled hazardous substance safely and properly as per procedure contained in section-16 "Hazardous Substances Handling Procedure".
3. **Spills involving Injured People:**

   If a spill involves personal injury, follow the procedures appropriate to the type of spill above and, concurrently;

   - Move the victim from the immediate area of the spill (if this can be done without further injury to the victim or emergency response people).
   - Locate the nearest emergency eyewash or safety shower.
   - Remove any contaminated clothing from the victim and flush all areas of the body contacted by chemicals with high volumes of water for at least 15 minutes.
4. **In case of Chlorine Gas release**

   A leak on a Chlorine cylinder would require a kit designed for this purpose. The team will have to be trained in its use and practice occasionally to be proficient with this equipment. If the cylinder has a

liquid leak the leak can be rolled up to minimize the cloud escaping. Depending on wind conditions, a shelter in place may have to be called for the community until the cylinder has depressurised.

The team should wear the SPPE if an attempt is made to apply the cylinder kit. If the decision to lessen the cloud with water fog sprays, the spray must be put on the gas cloud, NOT on the cylinder or directly on the leak.

Following sequence of event will be observed during any emergency,

- Inform CCR.
- CRE will inform to Emergency Response Team, other plant people and Lal Pir people in shift.
- In case of leakage in Chlorine cylinder room, open fire water sprinklers.
- Fire response team will fix the problem by using Cl_2 leak fixing kit available in Cl_2 rooms of both units.
- Incident Controller will announce if evacuation is required. (Follow Emergency Evacuation Plan)

Confined Space Rescue

a. If there is a need of persons to be rescued from the confined space, inform CRE who will arrange rescue team.
b. Wear SCBA during Rescue Operation in confined space if required.
c. Take confined space rescue stretcher if required.
d. Casualties at a fire have first priority and if possible, should be evacuated to the safe place. Do CPR and First Aid till the doctor arrives.
e. CRE will arrange Ambulance for shifting the casualties to the clinic. Contact at Telephone # 555 during clinic hours and Tele. # 437 during odd hours.

Bomb Threat Message

a. Purpose:

This procedure outlines the responsibilities of people in dealing with bomb / threat warnings.

1. In the event of a telephonic Bomb Threat, the receiver of the call should endeavour to keep the caller talking and try to obtain as much information as possible.
2. The receiver must inform CRE.
3. CRE will inform Security Team Leader and security gates.
4. Security Team Leader will arrange evacuation of the site if he feels the need of evacuation.
5. Security Team leader will arrange a site search with the help of Emergency response team.
6. If a suspected object found, Police and Army bomb Disposal Squad will be informed and site will be kept clear.
7. Emergency Team Leader will announce to shut down the plant, if it is safe for the area and plant.
8. If the search reveals nothing, Emergency team Leader will announce to re-enter non-operation people.

b. Action On Completion Of Search

1. Each Search Group Leader must report back to the Security Team Leader when they have completed a search of their designated area.
2. The Security Team Leader will then decide when people can be allowed back into their work area. The Security Officer will be available to give guidance on this aspect.
3. The people MUST NOT leave the Assembly Point without the personal permission of the Security Team Leader.
4. The Security Gate Staff will be notified when the emergency condition is over.

SECTION -9
CONCLUSION AND RECOMMENDATIONS

Section -9

CONCLUSION AND RECOMMENDATIONS

9. CONCLUSION AND RECOMMENDATIONS

The project embarks upon the installation of 30 MW cogeneration baggase based power project. On the basis of this IEE Report it is concluded that:

1- There are no sensitive elements /segments of environment around the project site.

2- The project has inbuilt efficient, state of the art and reliable mechanisms to control all type of pollutants like PM, gaseous emissions and noise in compliance levels well within the NEQS limits of the Pakistan.

3- The project shall not increase the load on the ground water table as the existing water resources will be utilized for the new project activity.

4- EMP and EMtP as recommended in this IEE Report are to be put in place during the entire operation of the project.

5- Quarterly monitoring of all out environmental pollution sources by a third party also certifies that the project will run in accordance with legal requirements.

6- The regular environmental monitoring for the existing plant ensures the environmental soundness of the project.

7- The use of bagasse as main fuel for the operation of the power plant will displace fossil-fuel based electricity generation.

8- EMP and EMtP, as recommended in this EIA Report, are to be implemented during construction and operation phases. This will manage all type of pollutants.

9- The proposed power plant will improve the economic status of the region and also contribute significantly to the overall economic growth of the country, when due to acute shortage of electric power long drawn out load sheddings are salient feature across the entire country. This state of affairs is resulting in huge economic loss to the national exchequer in the form of taxes and duties and drastic decrease in Industrial Productivity resulting in cut of the foreign exchange earnings, joblessness especially among the workers and related socio-economic issues.

Under the light of detailed discussions in IEE Study about likely impacts of the proposed project intervention, it can be safely concluded that the proposed Project would not cause any significant adverse impacts for which detailed EIA is required. On the basis of the facts summarized as above, the project merits for issuing No Objection Certificate/Environmental Approval by the Environmental Protection Agency, Government of Punjab Lahore.

TERM OF REFERENCES

TERMS OF REFERENCES

Listed below are some of the documents, reports and other references consulted during the preparation of this report:

a. Information and data provided by project proponents;
b. Project Pre-feasibility Study Report;
c. Technical Design Data related to the project.
d. Information gathered through discussions with the project related persons of the project proponent;
e. Discussion with concerned government officials;
f. Information collected from the Technical documents of various suppliers of machinery/equipment.
g. Guidelines for Self- Monitoring and Reporting by the Industry (SMART)," Final Report, March 1998, approved by Pakistan Environmental Protection Council (PEPC), August 1999;
h. National Environment Quality Standards for Municipal and Liquid Industrial Effluents, Statutory Notification (S.R.O.), Government of Pakistan, Ministry of Environment, Local Government and Rural Development, S.R.O.549 (1)/2000, Islamabad, the 8th August 2000;
i. National Environment Quality Standards for Ambient Air November 2010;
j. National Environment Quality Standards Noise Levels November 2010;
k. National Environment Quality Standards for Drinking Water November 2010:
l. Pakistan Environmental Protection Act, 1997;
m. The Punjab Environmental Protection (Amendment) Act 2012 covers aspects related to:
    - the protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development;
    - establishing complete regulatory and monitoring bodies, policies, rules, regulations and national environmental quality standards; and

- to ensure enforcement, the act establishes regulating bodies i.e. Punjab Environmental Protection Council (PEPC) and responsible bodies i.e. Punjab Environmental Protection Agency (Punjab EPA) at Provincial level.

a. Land Use Policies and Environmental Legal Framework including;
b. Environment related Laws in Pakistan and the Province of Punjab;
c. The Pakistan National Conservation Strategy, Environment and Urban Affairs' Division (presently- Ministry of Environment, Urban Affairs and Wild Life), Government of Pakistan, Islamabad;
d. Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995, Prepared and published jointly by: American Public Health Association, American Water Works Association, Water Environment Federation; Publication office: American Public Health Association, 1015 Fifteenth Street, NW Washington, DC 2005;
e. Government of Pakistan, Pakistan Environmental Protection Agency, Policy and Procedures for Filing, Review and Approval of Environmental Assessment, 2000;
f. The Canal and Drainage Act, 1873;
g. Environmental Assessment Requirements and Environmental Review Procedures of the Asian Development Bank, 1993;
h. Google Earth, Maps.
i. Guidelines for Public Consultations - These guidelines cover:
   - Consultation, involvement and participation of Stakeholders
   - Techniques for public consultation (principles, levels of involvements, tools, building trust)
   - Effective public consultation (planning, stages of EIA where consultation is appropriate)
   - Consensus building and dispute resolution.
j. Factories Act, 1934;
k. Applicable International Environmental and Occupational Safety and Health Laws and Regulations;

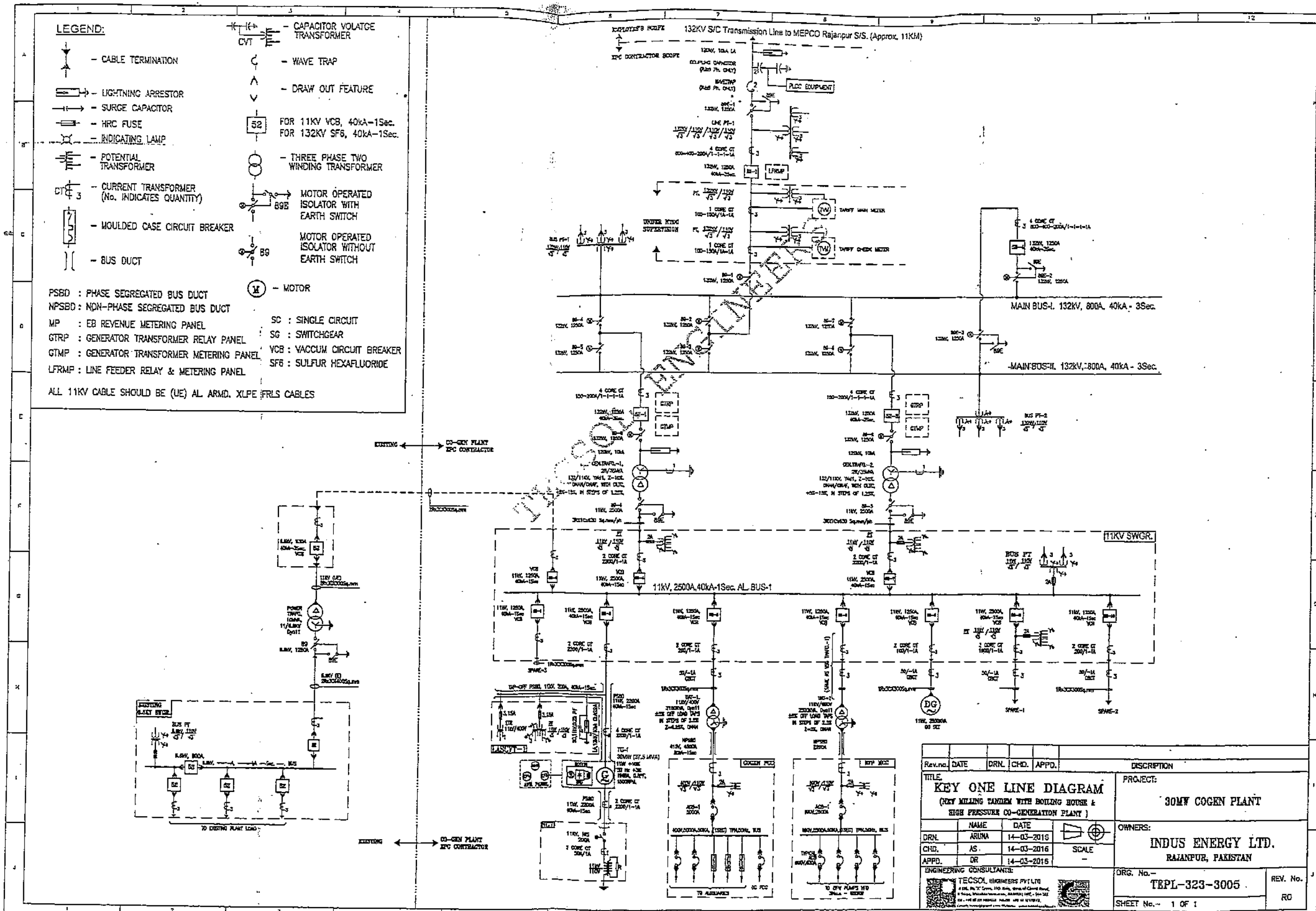
l. Applicable International Environmental and Occupational Safety and Health Laws and Regulations;

m. Pollution Prevention and Abatement Handbook, The World Bank, 1998;

n. International Finance Corporation's Policy on Energy and Social Sustainability, January 1, 2012;

o. National Resettlem ent Policy (Draft), Government of Pakistan, March 2002.

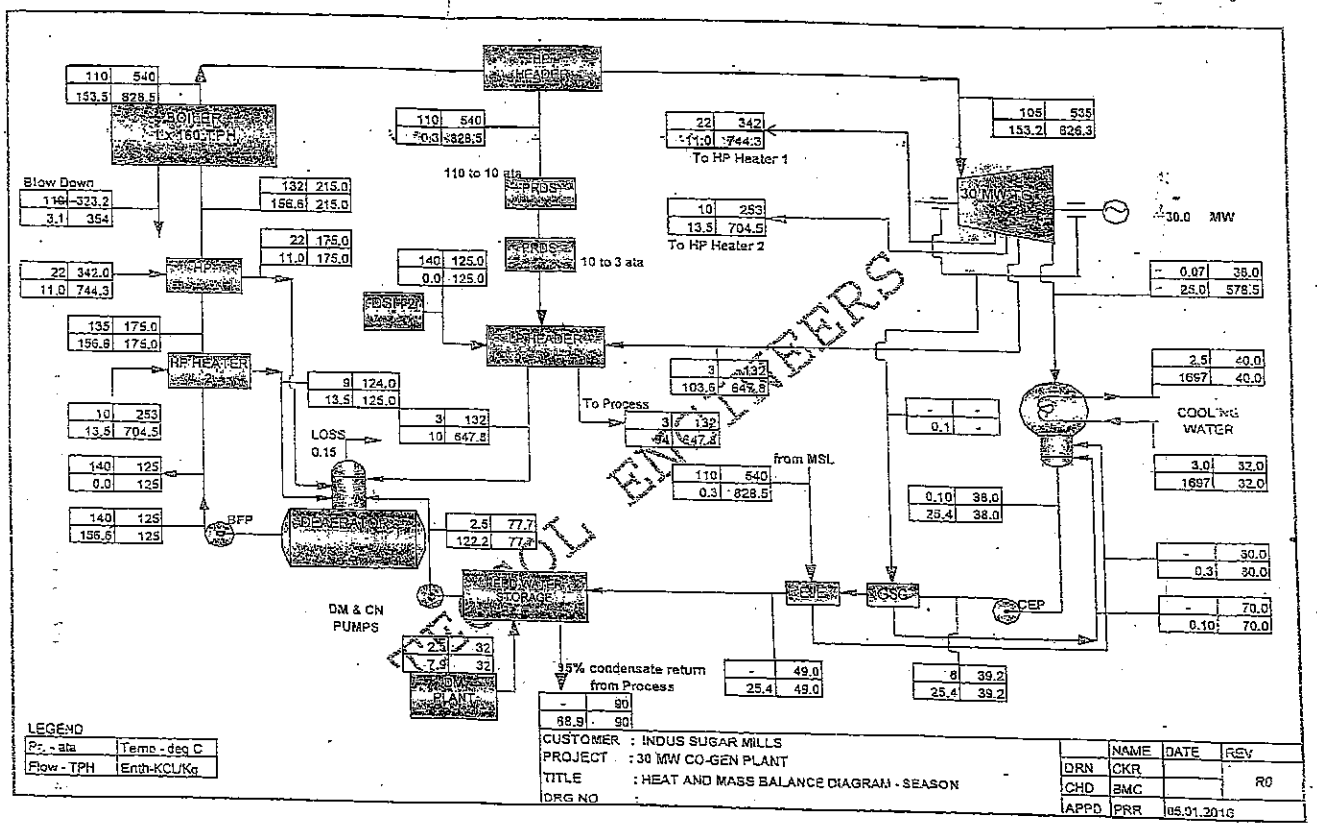
Appendix -1
Single Line Diagram of the Proposed Power System


LEGEND:
- CABLE TERMINATION
- LIGHTNING ARRESTOR
- SURGE CAPACITOR
- HRC FUSE
- INDICATING LAMP
- POTENTIAL TRANSFORMER
CT 3 - CURRENT TRANSFORMER (No. INDICATES QUANTITY)
- MOULDED CASE CIRCUIT BREAKER
- BUS DUCT
CVT - CAPACITOR VOLATGE TRANSFORMER
- WAVE TRAP
- DRAW OUT FEATURE
52 FOR 11KV VCB, 40kA-1Sec. FOR 132KV SF6, 40kA-1Sec.
- THREE PHASE TWO WINDING TRANSFORMER
89E MOTOR OPERATED ISOLATOR WITH EARTH SWITCH
89 MOTOR OPERATED ISOLATOR WITHOUT EARTH SWITCH
M - MOTOR
PSBD : PHASE SEGREGATED BUS DUCT
NPSBD : NON-PHASE SEGREGATED BUS DUCT
MP : EB REVENUE METERING PANEL
GTRP : GENERATOR TRANSFORMER RELAY PANEL
GTMP : GENERATOR TRANSFORMER METERING PANEL
LFRMP : LINE FEEDER RELAY & METERING PANEL
SC : SINGLE CIRCUIT
SG : SWITCHGEAR
VCB : VACCUM CIRCUIT BREAKER
SF6 : SULFUR HEXAFLUORIDE
ALL 11KV CABLE SHOULD BE (UE) AL ARMD. XLPE FRLS CABLES
132KV S/C Transmission Line to MEPCO Rajanpur S/S. (Approx. 11KM)
PLCC EQUIPMENT
LFRMP
TARIFF MAIN METER
TARIFF CHECK METER
MAIN BUS-I, 132KV, 800A, 40kA - 3Sec.
MAIN BUS-II, 132KV, 800A, 40kA - 3Sec.
GTRP
GTMP
EXISTING
CO-GEN PLANT EPC CONTRACTOR
11KV SWGR.
11KV, 2500A,40kA-1Sec. AL BUS-1
BUS PT
SPARE-1
SPARE-2
SPARE-3
DG
COGEN PCC
TO AUXILIARIES
TO EXISTING PLANT LOAD
Rev.no. DATE DRN. CHD. APPD. DISCRIPTION
TITLE.
KEY ONE LINE DIAGRAM
(KEY MILLING TANDEM WITH BOILING HOUSE & HIGH PRESSURE CO-GENERATION PLANT)
PROJECT:
30MW COGEN PLANT
NAME DATE
DRN. ARUNA 14-03-2016
CHD. AS 14-03-2016
APPD. DR 14-03-2016
SCALE
-
OWNERS:
INDUS ENERGY LTD.
RAJANPUR, PAKISTAN
ENGINEERING CONSULTANTS:
TECSOL ENGINEERS PVT LTD
DRG. No.-
TEPL-323-3005
REV. No.
R0
SHEET No.- 1 OF 1

Appendix -2
Heat & Mass Balance Sheet For The Proposed Project-Season

10000 TCD WITH 30 MW CO-GEN

Indus Sugar Mill



LEGEND

Pr. - ata	Temp - deg C
Flow - TPH	Enth-KCL/Kg

CUSTOMER : INDUS SUGAR MILLS
PROJECT : 30 MW CO-GEN PLANT
TITLE : HEAT AND MASS BALANCE DIAGRAM - SEASON
DRG NO

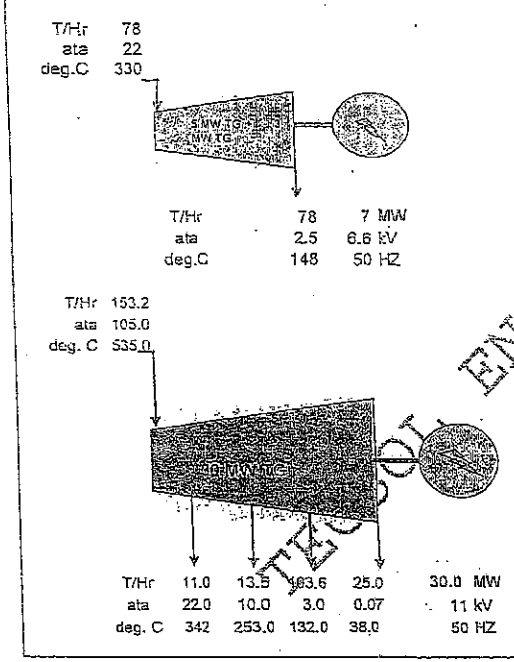
	NAME	DATE	REV
DRN	CKR		R0
CHD	BMC		
APPD	PRR	05.01.2016	

TECSOL ENGINEERS PVT. LTD., BANGALORE

Appendix -3
Power Generation Scheme –Season

10000 TCD SUGAR MILL WITH 30 MW CO-GEN PLANT

POWER GENERATION SCHEME - SEASON



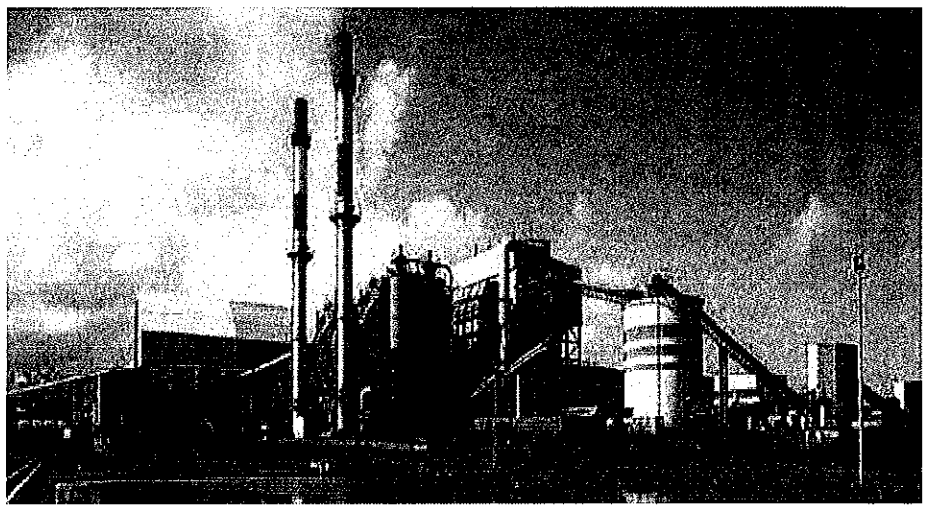
Cane crushing rate	10000 TCD
Cane crushing rate	400 TCH
Bagasse available @ 29% on Cane	116 T/hr
Bagasse required for new Boiler	60 T/hr
Bagasse required for old Boiler	37 T/hr
Bagasse saved per hour	18 T/hr
Steam generation from Old Boiler	78 T/hr
Steam generation from New Boiler	154 T/hr
Steam required for process @ 3 ata, 43% on Cane	172 T/hr
Steam drawn to process from old Power Turbines	78 T/hr
Steam drawn to process from new Turbine	94 T/hr
Steam distribution	
5+3 MW TG Set Inlet	78 T/hr
30.0 MW TG Set Inlet	154 T/hr
Steam to HP Heater 1 at 22 ata	11 T/hr
Steam to HP Heater 2 at 10 ata	14 T/hr
Steam to Process & Deaerator at 3 ata	182 T/hr
Steam to Condenser at 0.07 ata	25 T/hr
Power generation	
5+3 MW Old Power Turbines	7 MW
New Bleed, Extn cum Cond TG Set	30 MW
Total Power Generated	37 MW
Plant Load	15 MW
Power for Sale	22 MW

Report No. PPI-200.4-Final/17

INTERCONNECTION STUDY

For

31 MW INDUS ENERGY LIMITED POWER PLANT AT INDUS SUGAR MILLS FOR SUPPLY OF 19.5 MW AND 27 MW (DURING CRUSHING AND NON-CRUSHING SEASON) SPILLOVER TO THE NATIONAL GRID



Final Report
(February 2017)

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Executive Summary

- The Draft Report of 31 MW Indus Energy Limited Power Plant at Indus Sugar Mills for the Supply of 19.5 MW during crushing while 27 MW during non-crushing season, spillover to the national grid is submitted herewith.
- Indus Energy Limited Power Plant at Indus Sugar Mills, referred to as Indus Sugar Mills in the remainder of the report, would like to go for high pressure cogeneration in the sugar mill with the aim of exporting nearly 19.5 MW of power to the national grid during the sugar cane crushing season i.e. from November to March and 27 MW during the Non-crushing season i.e. from April to October as per availability of bagasse.
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The latest system data of NTDC as available with PPI has been used for this project.
- The nearest interconnection facilities are the 132 kV substations of Rojhan and Rajanpur. The 132 kV single circuit line from Rojhan to Rajanpur lies near the site of Indus Sugar Mills.
- Due to the location of Indus Sugar Mills, the most feasible interconnection scheme would be looping in-out the existing 132 kV circuit between Rojhan to Rajanpur at Indus Sugar Mills. The looping distance would be 6 km. The upcoming chapters discuss in detail the location and interconnection of the generating unit. A few approximate sketches are shown in Appendix-B.
- The two breaker bays of 132 kV at Indus Sugar PP to connect with the 132 kV circuits each from Rojhan to Rajanpur respectively are should be installed for Indus Sugar Mills.
- In view of the planned COD of the Indus Sugar Limited in June 2018, the above proposed interconnection scheme has been assessed for steady state conditions through detailed load flow studies, short circuit analysis and stability criterion for September 2018 (non-crushing season), and January 2019 for maximum thermal power dispatches in the grid during winter for the crushing season.
- In an extended term scenario, September 2021 (non-crushing season) and January 2022 (crushing season) has been studied to evaluate the performance of the

proposed interconnection scheme. The system conditions of normal and N-1 contingency have been examined for all scenarios to meet the reliability criteria.

- For the future scenario of September 2021, following reinforcements are proposed in the surrounding area to keep the loading on the surrounding transmission lines within satisfactory limits:
  - Guddu – Kot Chutta 132 kV Single circuit which is currently not operational due to faulty circuit breakers is proposed to be energized by replacing the faulty equipment.
  - Looping In-Out of Guddu – Kot Chutta 132 kV Single Circuit at 132kV Jampur substation.
- The short circuit analysis carried out to calculate maximum fault levels at Indus Sugar Mills and the substations of 132 kV in its vicinity reveals that short circuit current levels for the proposed scheme are significantly less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to fault current from Indus Sugar PP.
- The short circuit level of the Indus Sugar PP 132 kV for 3-phase and 1-phase faults is 3.84 kA and 4.18 kA for the Year 2019, 4.27 kA and 4.57 kA for the Year 2022 (Scenario-I), and 4.25 kA and 4.55 kA for the Year 2022 (Scenario-II). It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It will provide sufficient margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has also been carried out. The stability of the network has been tested for the worst cases, i.e. three phase fault right on the 132 kV bus bar of Indus Sugar Mills substation, followed by the final trip of 132 kV circuits emanating from this substation, has been performed for fault clearing of 5 cycles (100 ms), as understood to be the normal fault clearing time of 132 kV protection system. The extreme worst case of stuck breaker (breaker failure) has also been studied where the fault clearing time is assumed to be 9 cycles i.e. 180 ms. The stability of system for far end faults of 3-phase occurring at Rojhan 132 kV bus bar has also been checked.

- ❖ Steady state analyses by load flows, short circuit and stability criterion reveal that the proposed scheme is adequate to export the output, 19.5 MW to the national grid during the sugar cane crushing season and 27 MW during the non-crushing season, of the plant under normal and contingency conditions.

Report Contents

1. INTRODUCTION

1.1 Background

Indus Sugar Mills aims to install a 31 MW unit and go for high pressure cogeneration in the sugar mill with the aim of exporting nearly 19.5 MW to the national grid during the sugar cane crushing season i.e. from November to March and 27 MW during the Non-crushing season i.e. from April to October as per availability of Bagasse. The project is expected to start commercial operation by June 2018. The electricity generated from this project would be supplied to the grid system of MEPCO through 132 kV grids, as that Rojhan, Rajanpur and Jampur, available in the vicinity of this project. The location of Indus Sugar Mills can be seen in sketch-2 attached in Appendix – B.

1.2 Objectives

The overall objective of the Study is to evolve an interconnection scheme between Indus Sugar Mills Power Project and MEPCO network, for stable and reliable evacuation of electrical power, 19.5 MW to the national grid during the sugar cane crushing season and 27 MW during the Non-crushing season as per availability of Bagasse, generated from this plant, fulfilling the N-1 reliability criteria. The specific objectives of this report are:

- To develop scheme of interconnections at 132 kV for which Right of Way (ROW) and space at the terminal substations is available.
- To determine the performance of interconnection scheme during steady state conditions of system, normal and N-1 contingency, through load-flow analysis.
- To check if the fault levels at the adjoining substations at 132 kV voltage levels stay within the rating of equipment of these substations after the contribution of fault current from the plant unit, and also determine the

short circuit ratings of the proposed equipment of the substation at Indus Sugar Mills PP.

- To check if the interconnection withstands dynamic stability criteria of post fault recovery with good damping.

1.3 Planning Criteria

The planning criteria required to be fulfilled by the proposed interconnection is as follows:

Steady State:

Voltage	± 5 %, Normal Operating Condition
	± 10 %, Contingency Conditions
Frequency	50 Hz Nominal
	49.8 Hz to 50.2 Hz variation in steady state
Power Factor	0.8 Lagging; 0.95 Leading

Short Circuit:

132 kV Substation Equipment Rating 31.5 kA or 40 kA

Dynamic/Transient:

The system should revert back to normal condition after transients die out, without losing synchronism, with good damping.

a) Permanent three-phase fault on any primary transmission element, including: transmission circuit, substation bus section, transformer, or circuit breaker. It is assumed that such a fault shall be cleared by the associated circuit breaker action in 5 cycles.

b) Failure of a circuit breaker to clear a fault ("Stuck Breaker" condition) in 5 cycles, with back up clearing in 9 cycles after fault initiation.

2. ASSUMPTIONS OF DATA

There will be one generating unit at Indus Sugar Mills PP. As per the data provided by the client the following assumptions have been made:

2.1 Indus Sugar Mills PP Data

Installed capacity of power plant	= 1 x 31 = 31 MW
Power factor	= 0.80 lagging, 0.95 leading
Lump sum MVA capacity	= 1 x 41.25 MVA = 41.25 MVA
Inertia Constant	= 0.9102 MW-sec/MVA
Generating Voltage	= 11 kV
Transformer Rating	= 2 x 40 MVA
Auxiliary Consumption	= 3.5 MW
Estimated Sugar Mills Consumption	= 8 MW (Season) & 0.5 MW (Off-Season)

2.2 Network data

The 132 kV network in the area near Indus Sugar Limited Power Project are as shown in Sketches in Appendix-B. The latest Generation Expansion Plan and Load Forecast has been used as provided by NTDC and is shown in Appendix-A. The network of MEPCO in the vicinity of Indus Sugar Mills was verified during a visit of the site by PPI engineers. Further verification of the network was done during meetings between MEPCO GSO and Planning engineers and PPI engineers during the same visit.

3. STUDY APPROACH AND METHODOLOGY

3.1 Understanding of the Problem

Indus Sugar Mills is about to install a generating unit of 31 MW to meet its own load demand i.e. auxiliary load of 3.5 MW with an estimated Sugar Mill consumption of 8 MW during crushing and 0.5 MW during non-crushing season. The spillover to the National Grid from the site will be about 19.5 MW during crushing and 27 MW during non-crushing season.

As suggested previously, the most feasible interconnection of Indus Sugar Mills PP is by looping in-out of the Rojhan to Rajanpur 132 kV circuit at Indus Sugar Mills PP since it meets the N-1 contingency criteria. The distance of the plant from the looping point will be about 6 km. The conductor used shall be 132 kV Lynx. Indus Sugar Mills added to the existing network is shown in Sketch-2 in Appendix-B. The proposed power plant embedded in local network in this area shall provide relief to the source substations such as Guddu which are feeding the local network distantly.
The adequacy of MEPCO network at 132 kV voltage level, in and around the proposed site of Indus Sugar Mills PP, will be investigated in this study for absorbing and transmitting this power while fulfilling the reliability criteria.

3.2 Approach to the problem

The following approach has been applied to the problem:

- A base case network model has been prepared for the year 2019, in which the peak load scenario will occur after the commissioning of Indus Sugar PP in June 2018, comprising of the entire 500kV, 220kV and 132 kV system, envisaging the load forecast, the generation additions and transmission expansions for that year particularly in MEPCO.
- Load flow studies for the month September 2018 have been carried out to analyze the performance of the plant during non-crushing season when the spillover is greater than crushing season.
- The month of January 2019 has been selected for the study because it represents the maximum thermal dispatch conditions during the crushing

season after the COD, June 2018, of Indus Sugar Power Project. Thus, lines in the vicinity of this plant will be loaded to the maximum extent, allowing us to judge the complete impact of the plant on the transmission system in its vicinity.

- Load flow, short circuit and dynamic stability studies have also been performed for September 2021 and January 2022 to determine the performance of the proposed plant in extended term scenario.
- Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, have been identified.
- Technical system studies for peak load conditions have been performed to confirm technical feasibility of the interconnections. The scheme will be subjected to standard analyses like load flow, short circuit, and transient stability study to check the strength of the machines and the proposed interconnection scheme under disturbed conditions.
- Determine the relevant equipment for the proposed technically feasible scheme.
- Recommend the most technically feasible scheme of interconnection.

4.DEVELOPMENT OF SCHEME OF INTERCONNECTION

4.1 The Existing and Ongoing Network

Indus Sugar Mills are located near District Rajanpur embedded in the distribution network of MEPCO. The proposed interconnection scheme of Indus Sugar Mills PP (1 x 31 MW) by looping in-out the 132 kV circuit between Rajanpur and Rojhan at Indus Sugar Mills. The distance of the plant from the looping point is about 6 km. The conductor used is 132 kV Lynx conductor.

There is a strong 220 kV network in the vicinity connecting Guddu 220/132 kV grid station with Shikarpur 220 kV, Sibbi 220 kV and Guddu 500 kV substations. The D.G.Khan 220/132 kV substation will also be present in the vicinity. A strong system helps in stable operation of a power plant.

4.2 The Scheme of Interconnection of Indus Sugar PP

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of the Indus Sugar Mills PP, the interconnection scheme developed is the by looping in-out the 132 kV circuit between Rajanpur and Rojhan at Indus Sugar Mills. The distance of this generating unit from the looping point is about 6 km. The conductor used will be 132 kV Lynx conductor. This proposed interconnection scheme is shown in Sketch-2 of Appendix-B. The scheme of interconnection of Indus Sugar PP also requires that the Guddu – Kot Chutta 132 kV Single circuit, which is currently not operational due to faulty circuit breakers, be energized by replacing the faulty equipment to keep the surrounding system in within satisfactory limits in the future scenario (September 2021).

5. DETAILED LOAD FLOW STUDIES

The base cases have been developed for the peak conditions of January 2019 (crushing season) using the network data of NTDC and MEPCO available with PPI. The peak loads of the year 2019 for MEPCO have been modeled as per the latest PMS Demand forecast as provided by NTDC. Detailed load flow studies have also been carried out for September 2018 for non-crushing season, when the spillover is greater to the national grid. The cases of September 2021 and January 2022 have also been studied for future scenario.

5.1 Peak Load Case September 2018

The peak load case in September 2018, which is the non-crushing season and spillover from the plant becomes 27 MW, has been studied in detail for the conditions of without and with Indus Sugar Mills PP.

5.1.1 Without Indus Sugar Power Plant

The results of load flow analysis without Indus Sugar Mills have been plotted under normal conditions in Exhibit 0.0 in Appendix-C. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit 0.1	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit 0.2	Fazalpur to Jampur 132 kV Single Circuit Out
Exhibit 0.3	Guddu-2 to Walana 132 kV Single Circuit Out
Exhibit 0.4	Rojhan to Rajanpur 132 kV Single Circuit Out

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 132 kV circuits under normal and contingency conditions.

5.1.2 With Indus Sugar Mills PP

The scenario of Indus Sugar Mills PP after the COD of the plant when it starts exporting 27 MW to the MEPCO network has been studied. The results of load flows with Indus Sugar Mills under normal conditions have been plotted in Exhibit 1.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit 1.1	Indus Sugar 132/11 kV Single Transformer Out
Exhibit 1.2	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit 1.3	Indus Sugar to Rajanpur 132 kV Single Circuit Out
Exhibit 1.4	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit 1.5	Fazalpur to Jampur 132 kV Single Circuit Out
Exhibit 1.6	Guddu-2 to Walana 132 kV Single Circuit Out

We find that power flows on the circuits are seen to be well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 132 kV circuits under normal and contingency conditions.

5.2 Peak Load Case January 2019

The scenario of Indus Sugar Mills PP after the COD of the plant when it starts exporting 19.5 MW to the MEPCO network has been studied. The results of load

flows with Indus Sugar Mills under normal conditions have been plotted in Exhibit 2.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit-2.1	Indus Sugar 132/11 KV Single Transformer Out
Exhibit-2.2	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit-2.3	Indus Sugar to Rajanpur 132 KV Single Circuit Out
Exhibit-2.4	Guddu-2 to Rojhan 132 KV Single Circuit Out
Exhibit-2.5	Fazalpur to Jampur 132 KV Single Circuit Out
Exhibit-2.6	Guddu-2 to Walana 132 KV Single Circuit Out

5.3 Peak Load Case September 2021: Extended Term Scenario

We have also studied the future scenario of September 2021 to assess the impact of the plant in the extended term of its installation.

In this future scenario of September 2021, following reinforcements are proposed in the surrounding area to keep the loading on the surrounding transmission lines within satisfactory limits:

- Guddu – Kot Chutta 132 kV Single circuit which is currently not operational due to faulty circuit breakers is proposed to be energized by replacing the faulty equipment.
- Looping In-Out of Guddu – Kot Chutta 132 kV Single Circuit at 132kV Jampur substation.

Two scenarios are studied depending upon the replacement of faulty equipment at Guddu Grid Station.

The normal case for Scenario-I is shown in Exhibit 3.0 where Indus Sugar Mills PP and its surrounding area are shown. In this first scenario both sections of the above mentioned reinforcements i.e. from Guddu to Jampur and from Jampur to Kot Chutta

are considered to be energized. Load Flow reveals that the power flows on the circuits are well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit-3.1	Indus Sugar 132/11 kV Single Transformer Out
Exhibit-3.2	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit-3.3	Indus Sugar to Rajanpur 132 kV Single Circuit Out
Exhibit-3.4	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit-3.5	Fazalpur to Jampur 132 kV Single Circuit Out
Exhibit-3.6	Guddu-2 to Walana 132 kV Single Circuit Out

The normal case for Scenario-II is shown in Exhibit 3.0a where Indus Sugar Mills PP and its surrounding area are shown. In this second scenario only one section of the above mentioned reinforcements i.e. from Jampur to Kot Chutta is considered to be energized. The other section is not considered operational due to the faulty equipment at Guddu Grid Station. Load Flow reveals that the power flows on the circuits are well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit-3.1a	Indus Sugar 132/11 kV Single Transformer Out
Exhibit-3.2a	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit-3.3a	Indus Sugar to Rajanpur 132 kV Single Circuit Out
Exhibit-3.4a	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit-3.5a	Fazalpur to Jampur 132 kV Single Circuit Out

Exhibit-3.6a Guddu-2 to Walana 132 kV Single Circuit Out

The power flows on the circuits in both scenarios are seen to be well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria

We find that there are no capacity constraints in the proposed connectivity scheme even in the upcoming years i.e. 2021.

5.4 Peak Load Case January 2022: Extended Term Scenario

We have also studied the future scenario of January 2022 to assess the impact of the plant in the extended term of its installation.

As part of the interconnection scheme of Indus Sugar PP, it is proposed that the Guddu – Kot Chutta 132 kV Single circuit, which is currently not operational due to faulty circuit breakers, should be energized by replacing the faulty equipment. It is also proposed to Loop In- Out this line at 132kV Jampur Grid Station. Two Scenarios are studied for this case as well as discussed above.

Exhibit 4.0 shows the normal case of 2022 of the region with Indus Sugar PP for Scenario - I. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit-4.1	Indus Sugar 132/11 kV Single Transformer Out
Exhibit-4.2	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit-4.3	Indus Sugar to Rajanpur 132 kV Single Circuit Out
Exhibit-4.4	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit-4.5	Fazalpur to Jampur 132 kV Single Circuit Out
Exhibit-4.6	Guddu-2 to Walana 132 kV Single Circuit Out

Exhibit 4.0a shows the normal case of 2022 of the region with Indus Sugar PP for Scenario - II. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit-4.1a	Indus Sugar 132/11 kV Single Transformer Out
Exhibit-4.2a	Rojhan to Indus Sugar 132 kV Single Circuit Out
Exhibit-4.3a	Indus Sugar to Rajanpur 132 kV Single Circuit Out
Exhibit-4.4a	Guddu-2 to Rojhan 132 kV Single Circuit Out
Exhibit-4.5a	Fazalpur to Jampur 132 kV Single Circuit Out
Exhibit-4.6a	Guddu-2 to Walana 132 kV Single Circuit Out

The power flows on the circuits in both scenarios are seen to be well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria

We find that there are no capacity constraints in the proposed connectivity scheme even in the upcoming years i.e. 2022.

5.5 Analysis of Voltage Profile and Transmission Line Losses

a) Voltage Profile

The voltage profile on the buses near Indus Sugar Mills was analysed. The voltages on the bus bars in the vicinity of Indus Sugar mills have been shown in Table 5.1 for comparison. These voltages are also shown in Exhibit 0.0 (without Indus Sugar Mills) and Exhibit 1.0 (with Indus Sugar Mills).

Table – 5.1

Bus Bars	Voltage (kV)	
	Without Indus PP	With Indus PP
Rojhan 132 kV	134.7	136.4
Rajanpur 132 kV	131.9	133.9
Fazalpur 132 kV	132.7	134.2
Guddu 132 kV	138.1	138.3

It can be seen that the overall voltage profile of the area improves after the introduction of Indus Sugar mills into the system.

b) Transmission Line Losses

The transmission line losses were evaluated for normal case of peak load September 2018 from Indus Sugar Mills PP to the point of interconnection (looping distance is 6 km). The PSS/E generated report of transmission line losses is shown in the report included at the end of Appendix-C.

% Power Loss from Indus PP towards Rojhan = (0.17)/49.7
= 0.0034x 100 = **0.34 %**

% Power Loss from Indus PP towards Rajanpur = (0.39)/76.7
= 0.0051x 100 = **0.51%**

It can be seen that the transmission loss of the transmission line from Power plant to the point of interconnections is less than 1%.

5.6 Conclusion of Load Flow Analysis

From the analysis discussed above, we conclude that the proposed interconnection scheme of looping in-out the Rajanpur – Rojhan 132 kV single circuit at Indus Sugar PP is adequate to evacuate the spillover power of Indus Sugar Mills i.e. 19.5 MW and 27 MW during crushing and non-crushing season respectively under normal and contingency conditions.

It was found that in 2018 all the contingency cases with Indus Sugar Mills, the surrounding circuits remain within the rated capacity. Also the bus bar voltages were well within the permissible limits in all the contingency events. The scenario of Sep 2021 and Jan 2022 were also evaluated and found to be stable under normal and contingency cases. Moreover the transmission loss of the transmission line from Power plant to the point of interconnections is less than 1%.

6. SHORT CIRCUIT ANALYSIS

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies.

The maximum fault currents have been calculated with the following assumptions under IEC 909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence
- Desired voltage magnitude at bus bars set equal to 1.10 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydel, thermal and nuclear plants in the system in the years 2019 and 2022 i.e. all the generating units have been assumed on-bar in fault calculation's simulations.

The assumptions about the generator and the transformers data are the same as mentioned in Chapter.2 of this report.

6.2 Fault Current Calculations without Indus Sugar PP– Year 2019

In order to assess the short circuit strength of the network of 132 kV without Indus Sugar PP for MEPCO in the vicinity of the site of the Plant near Rajanpur and Rojhan, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions in the year 2019. These levels will give us the idea of the fault levels without Indus Sugar PP and later on how much the contribution of fault current from Indus Sugar PP may add to the existing levels,.

The results are attached in Appendix – D.

The short circuit levels have been calculated and plotted on the bus bars of 132 kV of substations lying in the electrical vicinity of our area of interest and are shown plotted in the Exhibit 5.0 attached in Appendix-D. Both 3-phase and 1-phase fault currents

are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-D for the 132 kV bus bars of our interest. The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 132 kV substations which normally are 20 kA, 25 kA or 31.5 kA for older substations and 40 kA for new substations.

Table-6.1
Maximum Short Circuit Levels without Indus Sugar PP

Bus Name	3-Phase Fault Current	1-Phase Fault Current
Guddu-2 132kV	**11.48**	**11.29**
Rojhan 132kV	**4.14**	**3.52**
Rajanpur 132kV	**3.24**	**3.49**
Fazalpur 132kV	**3.47**	**3.67**
Kotchuta 132kV	**8.17**	**7.78**
D.G.Khan New 132kV	**15.32**	**15.29**
D.G.Khan-II 132kV	**11.34**	**10.82**
D.G.Khan	**13.07**	**13.10**

6.3 Fault Current Calculations with Indus Sugar PP interconnected – Year 2019

Fault currents have been calculated for the electrical interconnection of proposed scheme. Fault types applied are three phase and single-phase at the 132 kV bus bar of Indus Sugar PP itself and other bus bars of the 132 kV substations in the electrical vicinity of Indus Sugar Mills. The graphic results are shown in Exhibit 5.1.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the electrical vicinity of Indus Sugar PP and the 132 kV bus bars of Indus Sugar PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.2

Table-6.2
Maximum Short Circuit Levels with Indus Sugar PP

Bus Name	3-Phase Fault Current	1-Phase Fault Current
Indus Sugar 132Kv	3.84	4.18
Indus PP 11kV	31.31	24.0
Guddu-2 132kV	11.64	11.38
Rojhan 132kV	4.39	3.69
Rajanpur 132kV	3.65	3.99
Fazalpur 132kV	3.70	3.84
Kotchuta 132kV	8.19	7.78
D.G.Khan New 132kV	15.41	15.33
D.G.Khan-II 132kV	11.42	10.84
D.G.Khan 132kV	13.21	13.16

6.4 Fault Current Calculations with Indus Sugar PP interconnected – Year 2022

Fault currents have been calculated with Indus Sugar PP connected as per the proposed interconnection scheme of looping in-out the Rajanpur to Rojhan 132 kV Single Circuit at Indus Sugar PP. Fault currents have been evaluated for both scenarios of the peak case of 2022 in order to observe the maximum fault current on Indus Sugar PP and the bus bars in the vicinity of Indus Sugar PP after its interconnection with the MEPCO/NTDC network. Fault types applied are three phase and single-phase at 132 kV bus bars of Indus Sugar PP itself and other bus bars of the 132 kV substations in the electrical vicinity of Rajanpur and Rojhan. The graphic results showing maximum 3-phase and 1-phase fault levels are indicated in Exhibits 5.2 and 5.2a. Both 3-phase and 1-phase fault currents are indicated in the exhibits which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the electrical vicinity of Indus Sugar PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in tables 6.3 and 6.3a

Table-6.3
Maximum Short Circuit Levels with Indus Sugar PP – Scenario I

Bus Name	3-Phase Fault Current	1-Phase Fault Current
Indus Sugar 132 kV	4.27	4.57
Indus PP 11 kV	32.80	24.82
Guddu-2 132 kV	15.79	15.16
Rojhan 132 kV	4.92	4.03
Rajanpur 132 kV	4.17	4.46
Fazalpur 132 kV	4.64	4.60
Kotchuta 132 kV	9.95	9.56
D.G.Khan New 132 kV	16.56	15.89
D.G.Khan-II 132 kV	12.21	11.38
D.G.Khan 132 kV	14.33	13.98

Table-6.3a
Maximum Short Circuit Levels with Indus Sugar PP – Scenario II

Bus Name	3-Phase Fault Current	1-Phase Fault Current
Indus Sugar 132 kV	4.25	4.55
Indus PP 11 kV	32.72	24.78
Guddu-2 132 kV	15.02	15.53
Rojhan 132 kV	4.92	4.03
Rajanpur 132 kV	4.11	4.41
Fazalpur 132 kV	4.46	4.46
Kotchuta 132 kV	9.43	9.21
D.G.Khan New 132 kV	16.10	15.60
D.G.Khan-II 132 kV	11.80	11.12
D.G.Khan 132 kV	13.70	13.56

Comparison of Tables 6.1, 6.2 and 6.3 shows an increase in short circuit levels for three-phase and single-phase faults due to connection of Indus Sugar PP on the 132 kV bus bars in its vicinity. We find that even after some increase, these fault levels are

much below the rated short circuit values of the equipment installed on these substations.

For Indus Sugar PP 132 kV, it would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.

6.5 Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of Indus Sugar PP with Rajanpur and Rojhan Substations, we don't find any problem of violations of short circuit ratings of the already installed equipment on the 132 kV equipment of substations in the vicinity of Indus Sugar PP due to fault current contributions from this power house under three-phase faults as well as single phase faults.

The short circuit level of the Indus Sugar PP 132 kV for 3-phase and 1-phase faults is 3.84 kA and 4.18 kA for the year 2019, 4.27 kA and 4.57 kA for the year 2022 (Scenario-I), and 4.25 kA and 4.55 kA for the year 2022 (Scenario-II). Therefore industry standard switchgear of the short circuit rating of 40 kA would serve the purpose, and can be installed at 132 kV switchyard of Indus Sugar PP as per NTDC requirement taking care of any future generation additions and system reinforcements in its electrical vicinity.

7. DYNAMIC STABILITY ANALYSIS

7.1 Assumptions & Methodology

7.1.1 Dynamic Models

The assumptions about the generator and its parameters are the same as mentioned in Chapter.2 of this report.

We have employed the generic dynamic models available in the PSS/E model library for dynamic modeling of the generator, exciter and the governor as follows;

Generator	GENROU
Excitation System	IEET1
Speed Governing System	TGOV1
Inertia Constant	H = 0.9102 MW-sec/MVA

7.1.2 System Conditions

Month of January 2019 has been selected for the study because it represents the peak load season after the COD of Indus Sugar Mills Power Plant and thus the loading on the lines in the vicinity of Indus Sugar PP will be maximum allowing us to judge the full impact of the plant.

The proposed scheme of looping in-out the single circuit of the 132 kV Rajanpur to Rojhan at Indus Sugar PP has been modeled in the dynamic simulation.

All the power plants of WAPDA/NTDC from Tarbela to Hub have been dynamically represented in the simulation model.

7.1.3 Presentation of Results

The plotted results of the simulations runs are placed in Appendix-E. Each simulation is run for its first one second for the steady state conditions of the system prior to fault or disturbance. This is to establish the pre fault/disturbance conditions of the network under study were smooth and steady. Post fault recovery has been monitored for nine seconds. Usually all the transients due to non-linearity die out within 2-3 seconds after disturbance is cleared in the system.

7.1.4 Worst Fault Cases

Three phase faults are considered as the worst disturbance in the system. We have considered 3-phase fault in the closest vicinity of Indus Sugar PP i.e. right at the 132 kV bus bar of Indus Sugar PP substation, cleared in 5 cycles, as normal clearing time for 132 kV i.e. 100 ms, followed by a permanent trip of a 132 kV single circuit emanating from this substation.

7.2 Dynamic Stability Simulations' Results with Indus Sugar PP interconnected - January 2019

7.2.1 Fault at 132 kV Indus Sugar -PP

We applied three-phase fault on Indus Sugar-PP 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132 kV single circuit between Indus Sugar-PP and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 1.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 1.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 1.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 1.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 1.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit

between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 1.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV, Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations

7.2.2 Fault at 132kV Indus PP

We applied Single-phase fault on Indus PP 132 kV bus bar, cleared fault in 9 cycles (180 ms), followed by trip of a 132 kV single circuit between Indus and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 2.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 2.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 2.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 2.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 2.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 2.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV, Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.3 Fault at Rojhan 132 kV (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Rojhan to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) followed by trip of 132 kV single circuit between Indus PP to Rojhan. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 3.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 3.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 3.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 3.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 3.5 MW/MVAR Flow on Indus to Rajanpur PP 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rojhan causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rajanpur 132kV circuit. This causes significant loading on the Indus PP to Rajanpur 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 3.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.3 Dynamic Stability Simulations' Results with Indus Sugar PP interconnected - September 2021 – Scenario - I

7.3.1 Fault at 132 kV Indus Sugar -PP

We applied three-phase fault on Indus Sugar-PP 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132 kV single circuit between Indus Sugar-PP and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 4.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 4.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 4.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 4.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 4.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 4.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations

7.3.2 Fault at 132kV Indus PP

We applied Single-phase fault on Indus PP 132 kV bus bar, cleared fault in 9 cycles (180 ms), followed by trip of a 132 kV single circuit between Indus and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 5.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 5.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 5.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 5.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 5.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 5.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.3.3 Fault at Rojhan 132 kV (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Rojhan to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) followed by trip of 132 kV single circuit between Indus PP to Rojhan. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 6.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 6.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 6.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 6.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 6.5 MW/MVAR Flow on Indus to Rajanpur PP 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rojhan causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rajanpur 132kV circuit. This causes significant loading on the Indus PP to Rajanpur 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 6.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.4 Dynamic Stability Simulations' Results with Indus Sugar PP interconnected - September 2021 – Scenario - II

7.4.1 Fault at 132 kV Indus Sugar -PP

We applied three-phase fault on Indus Sugar-PP 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132 kV single circuit between Indus Sugar-PP

and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 7.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 7.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 7.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 7.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 7.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 7.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations

7.4.2 Fault at 132kV Indus PP

We applied Single-phase fault on Indus PP 132 kV bus bar, cleared fault in 9 cycles (180 ms), followed by trip of a 132 kV single circuit between Indus and Rajanpur 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 8.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 8.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 8.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 8.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 8.5 MW/MVAR Flow on Indus to Rojhan 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rajanpur causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rojhan 132kV circuit. This causes significant loading on the Indus PP to Rojhan 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 8.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines

swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.4.3 Fault at Rojhan 132 kV (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Rojhan to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) followed by trip of 132 kV single circuit between Indus PP to Rojhan. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 9.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 9.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 9.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 9.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 9.5 MW/MVAR Flow on Indus to Rajanpur PP 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rojhan causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rajanpur 132kV circuit. This causes significant loading on the Indus PP to Rajanpur 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 9.6 Rotor Angles

swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.4.3 Fault at Rojhan 132 kV (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Rojhan to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) followed by trip of 132 kV single circuit between Indus PP to Rojhan. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 9.1 Bus Voltages

The bus voltages of 11 kV bus bar of Indus PP, 132 kV bus bars of Indus-PP, Rajanpur, Rojhan, Guddu and 220 kV bus bars of Guddu are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 9.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 9.3 MW/MVAR Output of Generators of Indus PP

The MW/MVAR output of Indus PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a slightly different value.

Fig. 9.4 Speed and mechanical power of Generators at Indus PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 9.5 MW/MVAR Flow on Indus to Rajanpur PP 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Indus PP to Rojhan causes the entire output of Indus-PP to flow on the intact 132 kV circuit between Indus PP to Rajanpur 132kV circuit. This causes significant loading on the Indus PP to Rajanpur 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 9.6 Rotor Angles

The rotor angles of the generators of Indus PP 11 kV, Fatima Energy 132 kV, Guddu-2 132 kV, Saif P/H 132 kV and Hamza-Power 132 kV are plotted relative to machines at Hub 500 kV. The results show that the rotor angle of Indus PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.5 Conclusion of Dynamic Stability Analysis

The results of dynamic stability carried out for January 2019 and September 2021 show that the system is very strong and stable for the proposed scheme for the severest possible faults of 132 kV systems near to and far of Indus Sugar Mills PP under all events of disturbances. Therefore there is no problem of dynamic stability for interconnection of Indus Sugar Mills PP; it fulfills all the criteria of dynamic stability.

8.CONCLUSIONS

- Due to the location of Indus Sugar Mills, the most feasible interconnection scheme would be looping in-out the existing 132 kV circuit between Rojhan to Rajanpur at Indus Sugar Mills. The looping distance would be 6 km. The up-coming chapters discuss in detail the location and interconnection of the generating unit. A few approximate sketches are shown in Appendix-B.
- The two breaker bays of 132 kV at Indus Sugar PP to connect with the 132 kV circuits each from Rojhan to Rajanpur respectively are should be installed for Indus Sugar Mills.
- In view of planned COD of the Indus Sugar Limited in June 2018, the above proposed interconnection scheme has been assessed for steady state conditions through detailed load flow studies, short circuit analysis and stability criterion for September 2018 for non-crushing and January 2019 for maximum thermal power dispatches in the grid during winter for the crushing season.
- In an extended term scenario, September 2021 for non-crushing and January 2022 for the crushing season has been studied to evaluate the performance of the proposed interconnection scheme. The system conditions of normal and N-1 contingency have been examined for all scenarios to meet the reliability criteria.
- For the future scenario of September 2021, following reinforcements are proposed in the surrounding area to keep the loading on the surrounding transmission lines within satisfactory limits:
    - Guddu – Kot Chutta 132 kV Single circuit which is currently not operational due to faulty circuit breakers is proposed to be energized by replacing the faulty equipment.
    - Looping In-Out of Guddu – Kot Chutta 132 kV Single Circuit at 132kV Jampur substation.
- The short circuit analysis carried out to calculate maximum fault levels at Indus Sugar Mills and the substations of 132 kV in its vicinity reveals currents for the proposed scheme are much less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from Indus Sugar PP.

- The short circuit level of the Indus Sugar PP 132 kV for 3-phase and 1-phase faults is 3.84 kA and 4.18 kA for the Year 2019, 4.27 kA and 4.57 kA for the Year 2022 (Scenario-I), and 4.25 kA and 4.55 kA for the Year 2022 (Scenario-II). It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out. The stability has been tested for the worst cases, i.e. three phase fault right on the 132 kV bus bar of Indus Sugar Mills substation followed by the final trip of 132 kV circuits emanating from this substation has been performed for fault clearing of 5 cycles (100 ms), as understood to be the normal fault clearing time of 132 kV protection system. Also the extreme worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms. The stability of system for far end faults of 3-phase occurring at Rojhan 132 kV bus bar has also been checked.
- Steady state analysis by load flows, short circuit and stability criterion reveals that the proposed scheme is adequate to export, 19.5 MW to the national grid during the sugar cane crushing season and 27 MW during the Non-crushing season, output of the plant under normal and contingency conditions.