Kashmir Power (Pvt) Limited

Head Office : 40-B-II, Gulberg-III, Lahore - Pakistan
Ph: (042) 35765021-26 Fax: (042) 35759546
E-mail: info@alshafigroup.com Web: www.alshafigroup.com

Date: 18-01-2017
Ref. No. KPPL/HO-16/0

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

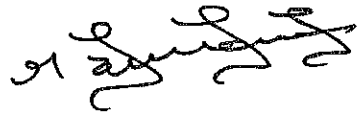
Subject: **Application for a Generation License**

I Mr. Muhammad Husnain Tariq Shafi, Chief Executive, being the duly authorized representative of *Kashmir Power Private Limited* (KPPL) by virtue of Resolution of Board of Directors dated 8th December 2016, hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation License to KPPL pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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

A Bank Draft No. 02886115 dated 17th January 2017 drawn on Meezan Bank, Ghalib Market Branch Lahore, in the sum of Rupees Two Hundred Ninety Two Thousand and Three Hundred Eighty Four only (PKR 292,384), being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Yours faithfully



Mr. Muhammad Husnain Tariq Shafi
Chief Executive

RESOLUTION OF BOARD OF DIRECTORS

Kashmir Power (Pvt) Limited

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Ph: (042) 35765021-26 Fax: (042) 35759546
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EXTRACTS OF THE RESOLUTIONS OF BOARD OF DIRECTORS OF KASHMIR POWER PRIVATE LIMITED PASSED IN THEIR MEETING HELD ON 8th December 2016 AT 40- B-II Gulberg III, LAHORE

The Board of Directors of **KASHMIR POWER PRIVATE LIMITED** a private company duly formed and registered in the Islamic Republic of Pakistan having incorporation **No. 0103273**(the "Company') and having its registered office at 40-B-II, Gulberg III Lahore, in their meeting held on loth December 2016, passed the following resolutions:

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. Muhammad Husnain Tariq Shafi, Chief Executive Officer, Mr. Ahsan-Ul- Haq Abid, Group General Manager Finance & Accounts, and Company Secretary, of the Company be and are hereby jointly and 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 he 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 die 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 queries and meeting any objections, receiving notices and documents; and

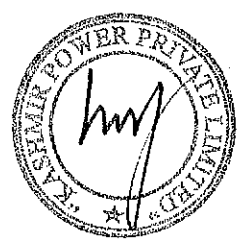
- Do all acts, deeds and things, which are ancillary and incidental to the afore-said purposes.

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

MR, AHSAN UL-HAQ ABID
Company Secretary

MR, MUHAMMAD HASNAIN TARIQ SHAFI
Chief Executive Officer

CERTIFIED TRUE COPY OF CERTIFICATE OF INCORPORATION



A024178

SECP

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, LAHORE

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No.**0103273**

I hereby certify that **KASHMIR POWER (PRIVATE) 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 **Second** day of **November,** Two **Thousand** and **Sixteen.**

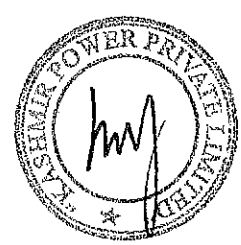
Fee Rs.5,500/-

CERTIFIED TO BE TRUE COPY
2/11/16
ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

(LIAQAT ALI DOLLA)
Additional Registrar

No.ARL/ 8049 **DATED: 02-11-2016**

CERTIFIED TRUE COPY OF MEMORANDUM OF ASSOCIATION



THE COMPANIES ORDINANCE, 1984

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(PRIVATE COMPANY LIMITED BY SHARES)

--:0:--

Memorandum of Association

of

KASHMIR POWER (PRIVATE) LIMITED

I. The name of the Company is "**KASHMIR POWER (PRIVATE) LIMITED**".

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

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

1. To design, insure, construct, acquire, own, operate and maintain power generation complexes and to carry on the business of electricity generation, power transmission, power transmission lines and distribution services, over hauling and re-powering of power plants and to deal in electrical and other appliances cables, dry cells accumulators, lamps 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 hereafter discovered in dealing with electricity, Subject to permission from NEPRA/other regulatory authorities.

2. To carry out the business of manufacturers and suppliers of power generation plants and distribution systems of power, steam, gas, diesel, hydro thermal power, solar, transfer of technology, manufacturing of solar cell / biogas / windmills and any other new technology, gasgenerators, farmers, carriers and merchants, and to buy, sell, manufacturer, repair, convent, alter, let on hire, and deal in machinery including workshops and field services, Subject to permission from NEPRA/other regulatory authorities.

3. 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 hereafter discovered in dealing with electricity and also to deal in sale of spares and equipments required for the above purposes whether as manufacturers, importer and / or as indentor / trader.

4. To provide consultancy services and to enter into and perform any plant / power plant operation and maintenance (O&M) agreement as contractor or subcontractor or any other engineering, construction erection, and supervision contract with regard to the plants / power plants and to enter negotiation and agreements with governments authorities / agencies semi government bodies or any other private associations, persons, corporations and companies for the sale of fuel supply or other inputs, sale of electricity in any mode.

5. To carry on the business of hydro electric sides, operation and maintenance, services of power generation plants and distribution systems of power, steam, gas, diesel, solar, gas-generators, farmers, carriers and merchants, and to buy, sell, manufacturer, repair, convent, alter, let on hire, and deal in machinery including workshops and field services, Subject to permission from NEPRA/other regulatory authorities.

6. To register the company with National and International bodies for availing carbon credit against emission reduction and to market carbon credit in local and international market for the benefit of the company.
7. To carry on business of agricultural farming, dairy farming, poultry farming, sheep farming and fish farming in all perspectives and to sell, process, store or deal in any manner with the products and by-products derived from all such farms and for that purpose to undertake do all such acts, deeds, and things which would be required to carry on the above said functions effectively and efficiently.
8. To make use of the by-products derived from the agricultural farming, dairy farming, fish farming, poultry farming, animal keeping, slaughter house and other operations mentioned in these presents in any profitable manner including preparation of manure, fertilizer, bio-fuels and any other feasible use thereof and to do all such acts, deeds and things as would be required to derive maximum benefit of the products and byproducts.
9. To carry on and undertake trading business and to act as indentors, importers, exporters, traders, suppliers, manufacturers and commission agents of general item products and materials in any form or shape manufactured or supplied by any company, firm, association of persons, body, whether incorporated or not, individuals, Government, Semi Government or any local authority.
10. To acquire, own, construct, establish, install, maintain, work, manage, operate, control or aid in or contribute or subscriber to the construction, erection and maintenance of recreational water games park, equipment and machines of amusement, swimming pools, fountains, pleasure grounds and parks.
11. To apply for tender, offer, accept, purchase or otherwise acquire any contracts and concessions for or in relation to the projection, 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.
12. 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, in respect of or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.
13. 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.
14. To enter into arrangements with the government or authority (supreme, municipal, local or otherwise) or any corporation, company or persons that may seem conducive to the Company's objects or any of them and to obtain from any such government, authority, corporation, company or person any charters, contracts, rights, privileges and commission which the Company may think desirable and to carry on exercise and comply with any such charters, contracts, decrees, rights, privileges and concessions.

15. To setup, establish, operate, manage, generate and run Power generation Plants, from different means and sources and to generate and supply electricity to all concerns, the Company shall be authorized, Subject to permission from NEPRA/other regulatory authorities.

    (a). To generate, produce, manufacture, store, sell, export to supply electricity to all concerns, by whatever means for industrial, commercial and residential use through distribution network and to construct, install, operate and maintain thereon power house, civil and mechanical works and structures, grid stations, transmission towers, power lines, building, workshops and other facilities as may time to time be necessary for the attainment of the object of the company.

    (b). To construct, lay-down, establish, fix, and carry out all necessary power station, cables, wires, lines, accumulators, and works and to generate accumulate, distribute and supply electricity to cities, towns, streets, markets, theaters, industrial zones, sites, areas and parks, buildings and places public and private.

    (c). To carry, on and undertake all civil, electrical and mechanical works related to aforementioned business, and to generate, accumulate, distribute and such by electricity for the purposes of light, heat, motive power and for all other purposes for which electrical energy can be employed, and to deal in all apparatuses and things required for or cable of being used in connection with the generation with the distribution, supply, accumulation and employment of elect.

    (d). To manufacture, process, buy, sell, exchange, alter improve, otherwise deal in all kinds of electrical plants, machinery, equipments, appliance, energy saving devices, and products, gadgets, components and parts including specialized equipments for the purposes of the business for the Company, and to manufacture, import, export. Sell, buy, and deal in all accessories, articles, apparatus, equipments and goods, which may seem calculated to promote or to be capable of being used in connection with the use of electric power supply.

    (e). To enter into, make and perform contracts and arrangements of every kind and description with the Central, provincial government, City Government, or Local Authority or person that may be conducive to the Company's Object and to obtain from any Government Authority, firm or person any rights, privileges, contracts, concessions, exemptions, permissions approvals and grants which the company may think desirable, and to obtain and carry out, exercise and comply with any arrangements, rights, privileges, contracts and concession and dispose off the same or turn into account the same.

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

17. To secure the loan / loans of subsidiary company companies by issuing corporate guarantees in favor of banks, DFI's and other financial institutions.

18. To stand as guarantor and offer guarantee for the performance and obligations of associated companies or give any guarantee or security by creating charge on all assets, collateral securities in shapes of property of the company for the purpose of procurement and repayment of any loan, debenture, stick, bonds, redeemable capital obligation or securities issued by associated companies and to guarantee the repayment of markup and other charges thereon.

19. To guarantee the performance of contracts, agreements, obligations or discharge of any debt of the company or on behalf of any other company or person subject to the provisions of section 195 of the companies ordinance, 1984 in relation to the payment of any financial facility including but not limited to loans, advance, letter of credit or other obligations through creation of any or all types of mortgages, charges, pledges, hypothecations, on execution of the usual banking documents or instruments or otherwise encumbrance on any or all of the movable and immovable properties of the company, either present or future or both and issuance of any other securities or sureties by any mean in favour of banks, Non-Banking Finance Companies (NBFCs) or any financial institutions and to borrow money for purpose of the company on such terms and conditions as may be considered proper.
20. To arrange local and foreign currency loans from scheduled banks, industrial banks and financial institutions for the purpose of purchase, manufacture, market, supply, export and import of machinery, construction of factory, building and for the purpose of working capital or for any other purpose.
21. To sell or otherwise dispose of the whole or any part of the undertaking of the Company, either together or in portions for such consideration as the Company may think fit and in particular, for shares, debenture-stock or securities of any Company purchasing the same.
22. To distribute any of the Company's property and assets among the members in specie or in any manner whatsoever in case of winding up of the Company.
23. To carry out joint venture agreements with other companies or countries within the scope of the objects of the Company.
24. To cause the Company to be registered or recognised in any foreign country.
25. To do and perform all other acts and things as are incidental or conducive to the attainment of the above objects or any of them.
26. To apply for and obtain necessary consents, permissions and licences from any Government, State, Local and other Authorities for enabling the Company to carry on any of its objects into effect as and when required by law.
27. 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.
28. It is declared that notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association nothing contained therein shall be construed as empowering the Company to undertake or to indulge in business of payment systems, Electronic funds transfers in and outside Pakistan, deposit taking from general public, network marketing, referral marketing & direct selling banking company, leasing, investment, managing agency, insurance business, any of the NBFC business, multi-level marketing (MLM), Pyramid and Ponzi Scheme, commodity, future contract or share trading business locally or internationally, directly or indirectly as restricted under the law or any unlawful operation.

IV. The liability of the members is limited.

V. The Authorised Capital of the Company is Rs. 1,000,000/- (Rupees One Million only) divided into 100,000 ordinary shares of Rs. 10/- (Rupees Ten only) each with powers to the company from time to time to increase and reduce its capital 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	Signatures
1. SHEHZAD JAVED	35202-4773094-7	S/o Muhammad Javed Shafi	Pakistani	Business	House No. 179 / 11, Model Town, Lahore.	5,000 Five Thousand	
2. ALI PERVAIZ	35200-0946105-5	S/o Mian Muhammad Pervaiz Shafi	Pakistani	Business	House No. 179-182, Block - H, Model Town, Lahore.	5,000 Five Thousand	
3. MUHAMMAD HASNAIN TARIQ SHAFI	35202-9179631-7	S/o Muhammad Tariq Shafi	Pakistani	Business	House No. 179-182, Model Town, Lahore.	5,000 Five Thousand	
4. YOUSAF ZAHID	35200-3235698-1	S/o Zahid Shafi	Pakistani	Business	House No. 179-182, Block - H, Model Town, Lahore.	5,000 Five Thousand	
5. MUHAMMAD ARHAM SHAHID	35200-3331648-1	S/o Muhammad Shahid Shafi	Pakistani	Business	House No. 179, Block - H, Model Town, Lahore.	5,000 Five Thousand	
					Total Number of Shares Taken	25,000 Twenty Five Thousand	

Dated this 26 day of SEPT 2016

Witness to the above signatures :

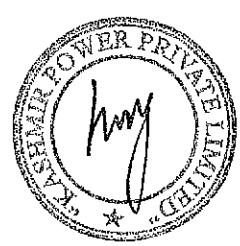
NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT) LTD

5th FLOOR, AWT PLAZA I.I CHUNDRIGAR ROAD, KARACHI

CERTIFIED TO BE TRUE COPY

ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

CERTIFIED TRUE COPY OF ARTICLES OF ASSOCIATION



THE COMPANIES ORDINANCE, 1984

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(PRIVATE COMPANY LIMITED BY SHARES)

--:o:--

Articles of Association

of

KASHMIR POWER (PRIVATE) LIMITED

PRELIMINARY

1. Subject as hereinafter provided, the Regulations contained in Table 'A' of the First Schedule to the Companies Ordinance, 1984, (hereinafter referred to as Table 'A') shall apply to the Company so far as those are applicable to Private Companies, with the exception of the Regulations which are modified, altered or added hereunder.

PRIVATE LIMITED COMPANY

2. The Company is a Private Company within the meaning of Clause (28) of Section 2(1) of the Companies Ordinance, 1984 and accordingly:-

(a) No invitation shall be issued to the public to subscribe for any shares, debentures or debenture-stocks of the Company;

(b) The number of members of the Company (exclusive of persons in the employment of the Company) shall be limited to fifty provided that for the purpose of this provision when two or more persons hold one or more shares in the Company jointly they shall for the purposes of this clause be treated as a single member ; and

(c) The right to transfer shares in the Company is restricted in the manner and to the extent hereinafter appearing.

BUSINESS

3. The Company is entitled to commence business from the date of its incorporation.

4. The business of the Company shall include all or any of the objects enumerated in the Memorandum of Association.

5. The business of the Company shall be carried out at such place or places in the whole of Pakistan or elsewhere as the Directors may deem proper or advisable from time to time.

CAPITAL

6. The Authorized Capital of the Company is Rs. 1,000,000/- (Rupees One Million only) divided into 100,000 ordinary shares of Rs. 10/- (Rupees Ten only) each with powers to increase, reduce, consolidate, sub-divide or otherwise re-organize the share capital of the Company.

7. The shares shall be under the control of the Board of Directors who may allot or otherwise dispose of the same to such persons, firms, corporation or corporations on such terms and conditions and at any such time as may be thought fit.

8. The shares in the capital of the Company may be allotted or issued in payment of any property, land, machinery or goods supplied or any services rendered to the Company or promotion or formation of the Company or conduct of its business and any shares so allotted may be issued as fully paid shares.

SHARES, TRANSFER AND TRANSMISSION

9. Every person whose name is entered, as a member in the Register of Members shall without payment be entitled to a certificate under the Common Seal of the Company specifying the shares held by several persons. The Company shall not be bound to issue more than one certificate and delivery of a share certificate to any one of several joint holders shall be sufficient delivery to all.

10. The Directors may decline to register any transfer of share to transferee of whom they do not approve and shall be bound to show any reasons for exercising their discretion subject to the provisions of Sections 77 and 78 of the Companies Ordinance, 1984.

11. No share can be mortgaged, pledged, sold, hypothecated, transferred or disposed off by any member to a non-member without the previous sanction of the Board of Directors.

12. The legal heirs, executors or administrators of a deceased holder shall be the only persons to be recognized by the Directors as having title to the shares. In case of shares registered in the name of two or more holders the survivors and the executors of the deceased shall be the only persons to be recognized by the Company as having any title to the shares.

GENERAL MEETING

13. The First Annual General Meeting shall be held within 18 months from the date of incorporation of the Company in accordance with the provisions of Section 158 and thereafter once at least in every year and 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 Directors. The Directors may, whenever they think fit, call an Extraordinary General Meeting of the shareholders in terms of Section 159 of the Companies Ordinance, 1984.

PROCEEDINGS AT GENERAL MEETING

14. Twenty one days' notice at least specifying the place, day and hour of the General Meeting and in case of special business the general nature of such business, shall be given to the members in the manner provided in Table "A" but accidental omission to give such notice to or non-receipt of such notice by the member shall not invalidate the proceedings of the General Meeting.

15. The Chief Executive, with the consent of a meeting at which quorum is present and shall if so directed by the meeting may adjourn the meeting from time to time and from place to place, but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place.

QUORUM

16. No business shall be transacted at any General Meeting unless a Quorum of members is present at the time when the meeting proceeds to business. Two members, present in person, representing not less than 25% of the total voting power either on their own account or as proxies, shall form a Quorum for a General Meeting.

VOTES OF MEMBERS

17. At any General Meeting a resolution put to the vote of the General Meeting shall be decided on a show of hands, unless a poll is demanded in accordance with the provisions of Section 167 of the Companies Ordinance, 1984.

18. On a show of hands every member present shall have one vote and on a poll, every member present in person or by proxy shall have one vote in respect of each share held by him.

19. The instrument appointing a proxy and the power of attorney or other authority under which it is signed or notarially certified copy of that power of attorney or authority shall be deposited at the Registered Office of the Company 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 will not be treated as valid.

CHAIRMAN

20. 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 Board's / General Meetings. 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.

CHIEF EXECUTIVE

21. 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.

DIRECTORS

22. Unless otherwise determined, the number of Directors shall not be less than two. The following will be the first Directors of the Company:

1. SHEHZAD JAVED
2. ALI PERVAIZ
3. MUHAMMAD HASNAIN TARIQ SHAFI
4. YOUSAF ZAHID
5. MUHAMMAD ARHAM SHAHID

23. The election of the Directors shall be held in accordance with the provisions of Section 178 of the Companies Ordinance, 1984.

24. The first Directors including the Chief Executive shall hold office up to the First Annual General Meeting in accordance with the provisions of the Companies Ordinance, 1984, unless any one of them resigns earlier or becomes disqualified for being Director or otherwise ceases to hold office.

25. A resolution for removing a Director shall not be deemed to have been passed if the number of votes against him is equal to, or less than the number of votes that would have been necessary for the election of Directors at the immediately preceding annual election of Directors in the manner aforesaid but as provided under Section 181 of the Companies Ordinance, 1984.

26. The remuneration of Directors except regularly paid Chief Executive and full time working Directors shall, from time to time, be determined by the Board of Directors but it shall not exceed Rs. 500/- per meeting at which the Directors are present.

27. The Directors may sanction the payment of such additional sums as they may think fit to any Director for any special service he may render to the Company or be thought capable of rendering either by fixed sum or in any other form as may be determined by the Directors subject to the provisions of the Companies Ordinance, 1984.

28. The Director who resides out of station shall also be entitled to be paid such traveling and other expenses for attending the meeting for the Company as may be fixed by the Directors from time to time according to the provisions of the Companies Ordinance, 1984.

29. Any casual vacancy occurring on the Board of Directors shall be filled in by a resolution of the Board of Directors and the person so appointed shall hold office for the remainder of the term of the Directors in whose place he is appointed.

30. No Director shall be disqualified from his office by contracting with the Company either as vendor, purchaser or otherwise nor shall any Director be liable to account for any profit realized from any such contract or arrangement or the fiduciary relation thereby established, but the nature of his interest must be disclosed by him at the first meeting of the Directors after acquisition of his interest.

NOMINEE DIRECTOR

31. 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 holders of share(s) in the Capital of the Company and regulations and/or rules pertaining to the election, retirement, qualification and/or disqualification of Directors shall not apply to him.

NOTICES

32. Notices for every meeting of the Board of Directors will be given in writing and there must be given a reasonable time in advance. The nature of the business to be transacted at an intended Board meeting will be specified in the notice.

MANAGEMENT

33. The whole business and affairs of the Company shall, subject to the control and supervision of the Board of Directors, be managed and controlled by the Chief Executive.

34. Subject to the limit fixed by the Directors, the Chief Executive may from time to time raise or borrow any sums of money for and on behalf of the Company from other companies, banks or financial institutions on such terms as may be approved by the Board of Directors from time to time.

35. Without prejudice to the powers conferred by these Articles, the Board of Directors shall have the following powers :-

(a) To take on lease, purchase, erect or otherwise acquire for the Company any assets, stocks, lands, buildings, property, rights or privileges which the Company is authorized to acquire at such price and generally on such terms and conditions as they think fit.

(b) To let, mortgage, sell, exchange or otherwise dispose of absolutely or conditionally all or any part of the assets, stocks, raw materials, properties, privileges and undertaking of the Company upon such terms and conditions and for such consideration as they think fit.

(c) To appoint any person or persons to be attorney or attorneys of the Company for such purposes and with such powers, authorities and discretions and for such period and subject to such conditions as they may, from time to time, think fit.

(d) To enter into, carry out, rescind or vary all financial arrangements with any bank, person, company, firm or corporation or in connection with such arrangements to deposit, pledge or hypothecate property of the Company or the documents representing or relating to the same.

(e) To make and give receipts, release and discharge all moneys payable to the Company and for the claims and demands of the Company.

(f) To compound or allow time to the payment or satisfaction of any debt due to or by the Company and any claim and demands by or against the Company and to refer claims or demands by or against the Company to arbitration and observe and perform the awards.

(g) To institute, prosecute, compromise, withdraw or abandon any legal proceedings by or against the Company or its affairs or otherwise concerning the affairs of the Company.

(h) To raise and borrow money from time to time for the purposes of the Company, on the mortgage of its property or any part thereof and/or on any bond or debenture payable to bearer otherwise repayable in such a manner and generally upon such terms as they think fit.

(i) To open, operate and maintain bank/banks account(s) individually or jointly as the Board may authorize or to any other person on its behalf.

BORROWING POWERS

36. The Directors may from time to time raise, borrow or secure the payment of any sums for the purposes of the Company in such manner and upon such terms and conditions as they think fit and in particular by the issue of debentures, debenture-stock or other securities charged upon all or any part of the property of the Company present or future.

37. Debentures, debenture-stock, or other securities may be issued with any special privileges as to redemption, surrender, allotment of shares, attending and appointment of Directors or other privileges subject to any permission required by law.

THE SEAL

38. The Company shall have a Common Seal and the Directors shall provide for the safe custody of the same. The Seal shall not be applied on any instrument except by the authority of the Board of Directors and in the presence of at least two Directors who shall sign every instrument to which the Seal shall be affixed in their presence. Such signatures shall be conclusive evidence of the fact that the Seal has been properly affixed.

ACCOUNTS

39. The Directors shall cause to be kept proper books of account as required under Section 230 of the Companies Ordinance, 1984.

40. 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 subject to the provisions of Section 230 of the Companies Ordinance, 1984.

AUDIT

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

INDEMNITY

42. In connection with carrying on the business of the Company, the Chief Executive, every Director, or other officers of the Company shall be indemnified by the Company for all losses and expenses occasioned by error of judgment or oversight on his part, unless the same happens through his own dishonesty or willful act and defaults.

SECRECY

43. No member shall be entitled to visit and inspect the Books of the Company without the permission of the Chief Executive or one of the Directors or to require discovery of any information regarding any detail of the Company's business or any matter which is or may be in the nature of trade secret, or secret process which may relate to the conduct of the Company's business and which in the opinion of the Directors, will not be in the interest of the members of the Company to communicate to the public.

DISPUTE RESOLUTION

44. 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.

ARBITRATION

45. Whenever any difference arises between the Company on the one hand and the members, their executors, administrators or assignee on the other hand, touching the true intent or construction or the incident or consequence of these present or of the statutes or touching any thing thereafter done, executed, omitted or suffered in pursuance of these presents or otherwise relating to these presents or to any statutes affecting the Company, every such difference shall be referred for the decision of the arbitrator who will be qualified in Islamic law.

46. The cost incidental to any such reference and award shall be at the discretion of the arbitrator or umpire respectively who may determine the amount thereof and direct the same to be shared between the attorney and client or otherwise and may award by whom and in what manner the same shall be borne and paid.

WINDING UP

47. If the Company is wound up whether voluntarily or otherwise the liquidator may, with the sanction of a special resolution, divide amongst the contributories in specie any part of the assets and liabilities of the Company, subject to Section 421 and other provisions of the Companies Ordinance, 1984 as may be applicable.

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a Company, in pursuance of this 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. SHEHZAD JAVED	35202-4773094-7	S/o Muhammad Javed Shafi	Pakistani	Business	House No. 179 / H, Model Town, Lahore.	5,000 Five Thousand	
2. ALI PERVAIZ	35200-0946105-5	S/o Mian Muhammad Pervaiz Shafi	Pakistani	Business	House No. 179-182, Block - H, Model Town, Lahore.	5,000 Five Thousand	
3. MUHAMMAD HASNAIN TARIQ SHAFI	35202-9179631-7	S/o Muhammad Tariq Shafi	Pakistani	Business	House No. 179-182, Model Town, Lahore.	5,000 Five Thousand	
4. YOUSAF ZAHID	35200-3235698-1	S/o Zahid Shafi	Pakistani	Business	House No. 179-182, Block - H, Model Town, Lahore.	5,000 Five Thousand	
5. MUHAMMAD ARHAM SHAHID	35200-3331648-1	S/o Muhammad Shahid Shafi	Pakistani	Business	House No. 179, Block - H, Model Town, Lahore.	5,000 Five Thousand	
					Total Number of Shares Taken	25,000 Twenty Five Thousand	

Dated this 26 day of SEPT 2016

Witness to the above signatures :

NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT) LTD

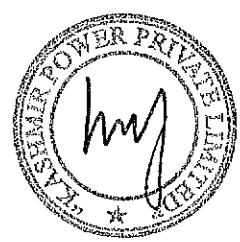
5th FLOOR, AWT PLAZA I.I CHUNDRIGAR ROAD, KARACHI

CERTIFIED TO BE TRUE COPY

2/11/16

ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

FORM-29



PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE, 1984 **FORM 29**

[SECTION 205]

Please Complete in typescript or in bold block capitals. Web Form

1. Incorporation Number: 0103273
2. Name of Company: KASHMIR POWER (PVT.) LIMITED
3. Fee Paid (Rs.): 300.0 Name and Branch of Bank: LAHORE, MCB - Main Market Gulberg [0183]
4. Receipt No.: E-2016-506691 Date (DD/MM/YYYY): 08/11/2016
5. Mode of Payment (Indicate): Bank Challan
6. **Particulars*:**

Company Registration Office Lahore — Securities and Exchange Commission of Pakistan — SECP

6.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)
MUHAMMAD HASNAIN TARIQ SHAFI	3520291796317	MUHAMMAD TARIQ SHAFI	179-182, H, MODEL TOWN LAHORE PUNJAB	Chief Executive	Pakistan	Business Man	05/11/2016	Appointed
Kaleem and Co Chartered Accountants		Firm	H. No 134 C, Link 4 St # 2, Cavlary Ground Lahore Cantt Lahore	Auditor	Pakistan	Chartered Accountant	05/11/2016	Appointed
Muhammad Shahzad	3450247437213	Abdul Majeed	H. No 158, Jade Park View Housing Society Multan Road Lahore	Legal Adviser	Pakistan	Legal Advisor	05/11/2016	Appointed
Ahsan ul Haq Abid	3520229288801	Muhammad Bashir	362 A, PCSIR Phase II, Lahore	Secretary	Pakistan	Nil	05/11/2016	Appointed

6.2. Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)

6.3. Any other change in particulars relating to columns (a) to (g) above

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)

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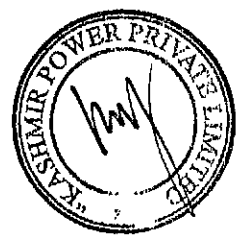
ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE

Name of Signatory	MUHAMMAD HASNAIN TARIQ SHAFI	Designation	Director
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	08/11/2016

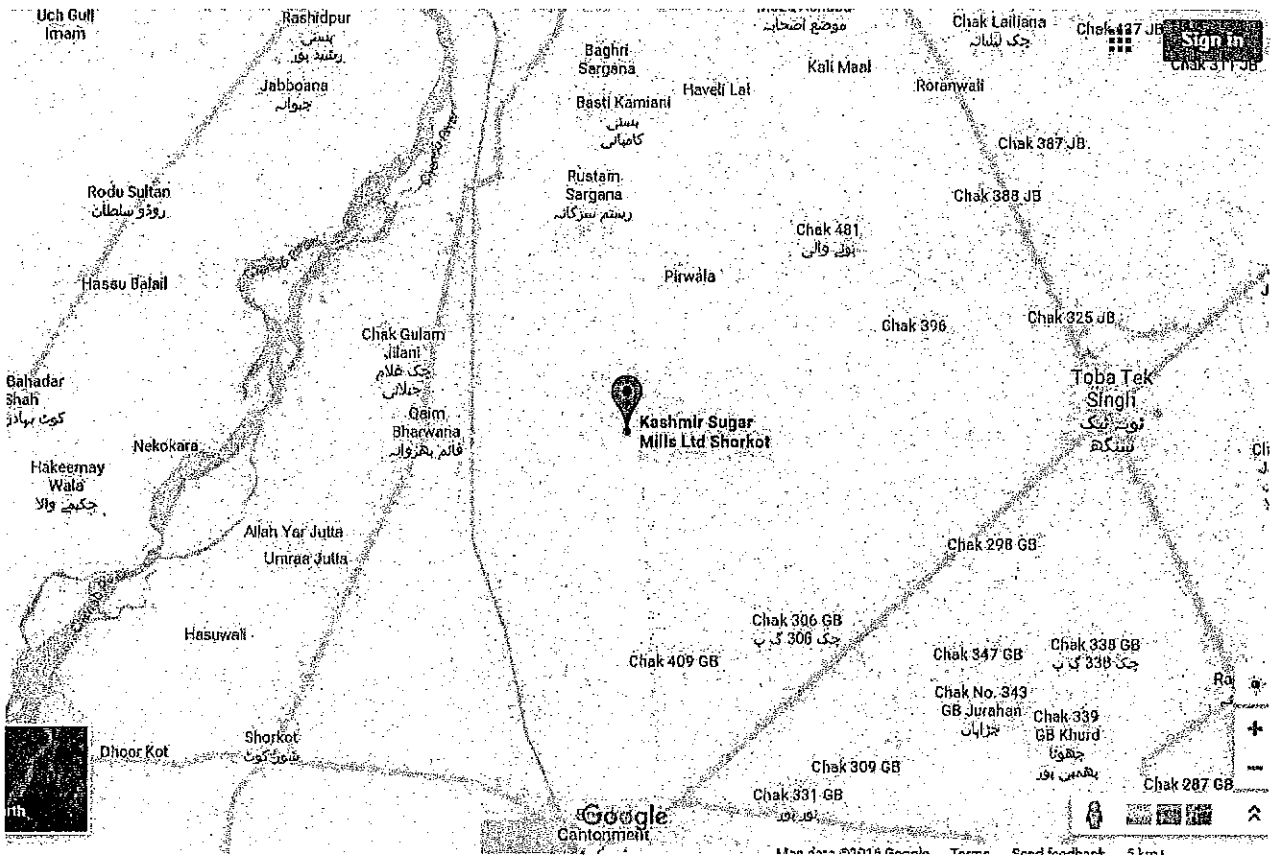
* In the case of a firm, the full name, address and above mentioned particulars of each partner, and the date on which each became a partner
** In case the nationality is not the nationality of origin, provide the nationality of origin as well.
*** Also provide particulars of other directorships or offices held, if any.

PLANT LOCATION AND CHARACTERISTICS



Location of the project:

This power plant will be installed within the premises of Kashmir sugar mills limited, 11 km off Shorkot cant. Road, Shorkot City, District Jhang. The location of the proposed project is given hereunder;



KASHMIR POWER PRIVATE

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Plant Details

1. General Information

(i)	Applicant's Name	Kashmir Power (Pvt) Limited
(ii)	Registered Office	40 B-II, Gulberg-III, Lahore
(iii)	Plant Location	11-KM Shorkot Cantt Road, The, Shorkot, District Jhang, Punjab (Coordinates: 30.823°N, 72.143°E).
(iv)	Type of Generation Facility	Bagasse fired Cogeneration Power Plant
(v)	Commissioning/Commercial Operation Date	19 months from Financial Close
(vi)	Expected Life of the Facility from Commercial Operation/Commissioning	30 years
(vii)	Expected Remaining Useful Life of the Facility	30 years

2. Plant Configuration

(i)	Plant Size Installed Capacity (Gross ISO)	40 MW (Gross)
(ii)	Type of Technology	Cogeneration Power Plant with high pressure boilers and Turbo-Generators
(iii)	Number of Units	One (01) in Phase 1
(iv)	Unit Make and Model	110 bar Travelling grate boiler with steam capacity of 200 TPH from Wuxi China Turbo generator - Extraction cum condensing type based on SIEMENS Design from Hangzhou Steam Turbine Company Limited China

(v)	Installed Capacity	Power Generation: 40 MW (Season operation) 40 MW (Off-season operation)
(vi)	Auxiliary Consumption	9.0 %
(vii)	Interconnection	1.5 km from proposed project site.

3. Fuel / Raw Material Details

(i)	Primary Fuel	Bagasse
(ii)	Alternate Fuel	NIL
(iii)	Fuel Source (Imported/Indigenous)	Indigenous
(iv)	Fuel Supplier	Kashmir Sugar Mills Limited
(v)	Supply Arrangement	Through conveyor belts/loading trucks/tractor trolleys etc.,
(vi)	Sugarcane Crushing Capacity	416.67 TPH
(vii)	Bagasse Generation Capacity	125 TPH
(viii)	Bagasse Storage Capacity	Bulk Storage
(ix)	Number of Storage Tanks	Not Applicable, bagasse shall be stored in open yard
(x)	Storage Capacity of each tank	Not Applicable
(xi)	Gross Storage	Bulk Storage

4. Emission Values

Emission values shall remain within the limits prescribed by National Environment Quality Standards. (NEQs) and Company would install electrostatic precipitator (ESP) to ensure the same.

KASHMIR POWER PRIVATE LIMITED

5. Cooling System

(i)	Cooling Water Source/Cycle	Ground Water/Closed Circuit

6. Plant Characteristics

(i)	Generation Voltage	11 KV volts	
(ii)	Frequency	50 Hz	
(iii)	Power Factor	0.8 (lag)	
(iv)	Automatic Generation Control (AFG)	By Turbine Governing System	
(v)	Ramping Rate	200 rpm / minute (outside critical band)	
(vi)	Time Required to Synchronize to Grid and Loading the Complex to Full Load from Cold Start	During cold start (i.e. when plant is started later than 72 hours after shutdown)	150 minutes
		During warm start (i.e. when plant is started at less than 36 hours after shutdown)	90 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).

KASHMIR POWER PRIVATE LIMITED

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SINGLE LINE DIAGRAM

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KASHMIR POWER PRIVATE LIMITED

40.0MW BAGASSE BASED COGEN PROJECT

KASHMIR SUGAR MILLS

SHORKOT JHANG PAKISTAN

ELECTRICAL DRAWINGS

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	RNK	MA	11.01.17

CLIENT:
KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35900053, FAX :+92(42)35811005, 35811135
WEBSITE: www.descon.com, EMAIL:descon@descon.com

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT,
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
COVER PAGE

SHEET SIZE	SCALE	E.F.#	PROJECT NO.	SHEETS	REV.
			KASHMIR	NO. 1 TOTAL 1	0
A1	SCALE	DRAWING #			

KASHMIR POWER PRIVATE LIMITED

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40MW BAGASSE BASED COGEN PROJECT KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

LIST OF DRAWINGS

SR.	DRAWING TITLE	DRAWING NOs	REV.
1	PLANT KEY SLD	KASHMIR-00-000-D1381-001-01	0
2	132kV AIS DOUBLE BUS SLD	KASHMIR-00-000-D1381-002-01	0
3	11kV PANELS SLD	KASHMIR-00-000-D1381-003-01	0
4	400V AC MAIN LV PANELS SLD	KASHMIR-00-000-D1381-004-01	0
5	110V DC UPS SLD	KASHMIR-00-000-D1381-005-01	0
6	230V AC UPS SLD	KASHMIR-00-000-D1381-005-02	0
7	230V AC UPS FOR EMERGENCY LIGHTING	KASHMIR-00-000-D1381-005-03	0
8	TYPICAL BLOCK DIAGRAM FOR SCADA SYSTEM	KASHMIR-00-000-D1381-006-01	0

KASHMIR POWER PRIVATE LIMITED

CERTIFIED TRUE COPY

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT: KASHMIR SUGAR MILLS (Pvt) LIMITED

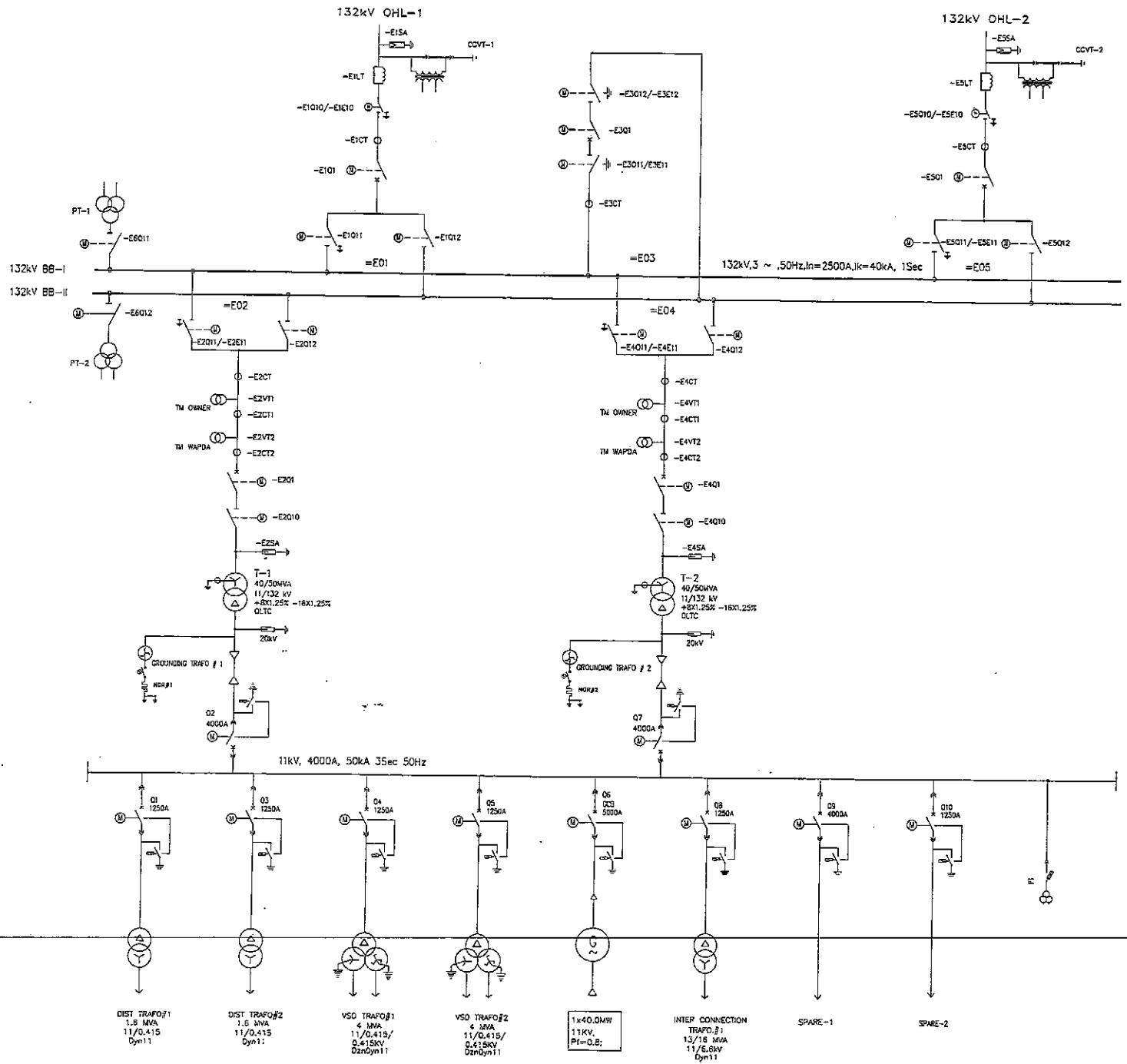
CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
18-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35990053, FAX :+92(42)35811003, 35811135

PROJECT NAME & LOCATION: 40MW BAGASSE BASED COGEN PROJECT KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE: LIST OF DRAWINGS

SHEET SIZE	SCALE		PROJECT NO.	SHEETS NO.	SHEETS TOTAL	REV.
A1	SCALE	DRAWING	KASHMIR	1	1	0



NOTES:

1. EQUIPMENT RATINGS & ARRANGEMENT IS PRELIMINARY. IT SHALL BE FINALIZED AT PROJECT STAGE.

KASHMIR POWER PRIVATE LIMITED

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PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

OWNER:
KASHMIR SUGAR MILLS (Pvt) LIMITED

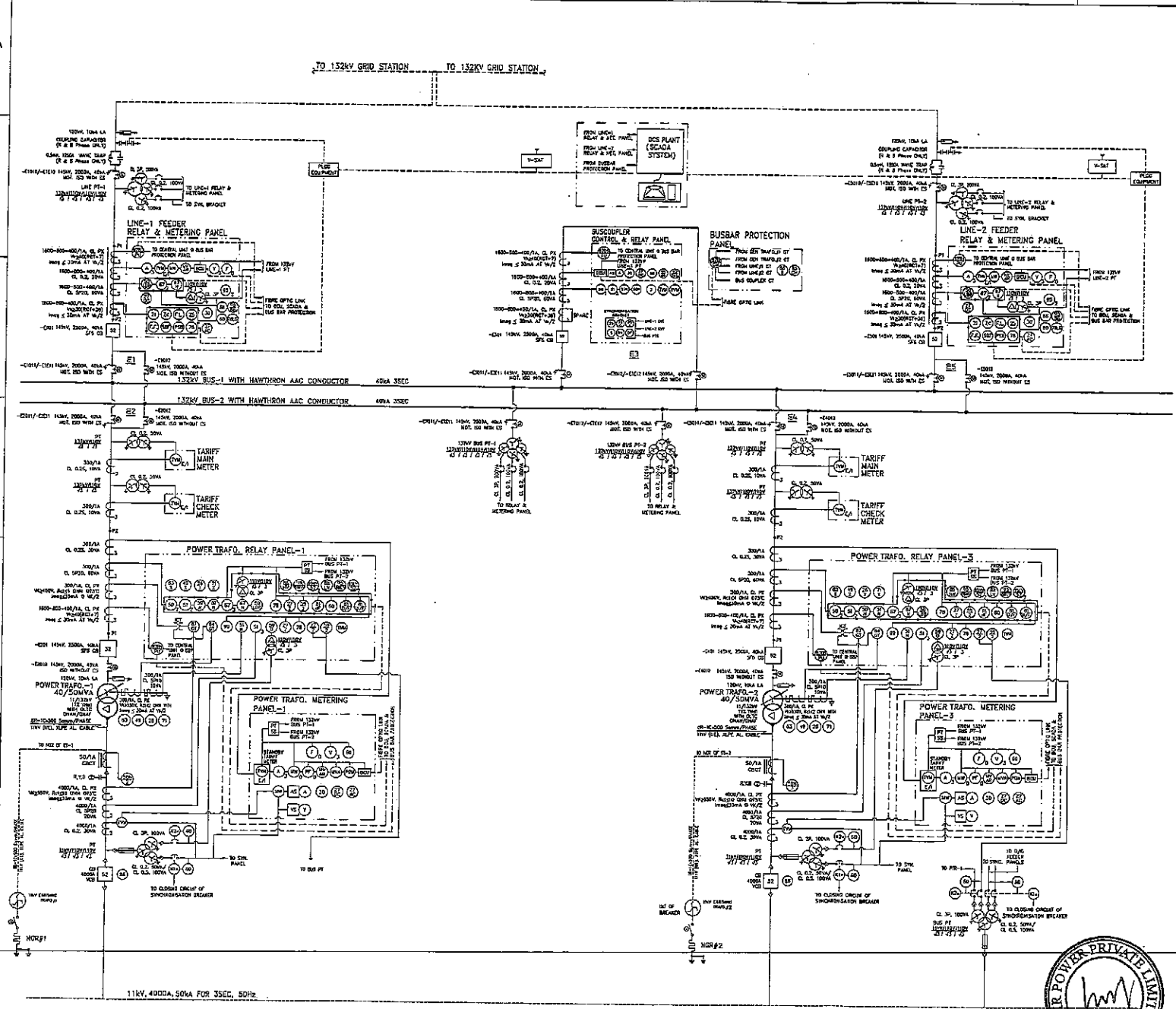
CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35950053, FAX :+92(42)35811003, 35811135
WEBSITE: www.descon.com, EMAIL:descon@descon.com

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
PLANT KEY SLD

SHEET SIZE	SCALE	C.F.S.	PROJECT NO.	SHEETS	REV.
		KASHMIR-00-000-01381-001-01	KASHMIR	NO. TOTAL	
A1	SCALE	DRAWING #. KASHMIR-00-000-01381-001-01		1 1	0



LEGEND:

	HRC FUSE	(A)	AMMETER n = NO. OFF
	CURRENT TRANSFORMER n = NUMBER OF CTs X-Y/1A=ADOPTED CT RATIO	(V)	VOLTMETER n = NO. OFF
	SURGE CAPACITOR	(MW)D	MEGA-WATT METER D=DIGITAL
	POTENTIAL TRANSFORMER	(MVA)	MEGA-VOLTAMPERE METER
		(PF)D	POWER FACTOR METER D=DIGITAL
52	CIRCUIT BREAKER	(MVAR)D	MEGA-VAR METER D=DIGITAL
NGR	NEUTRAL GROUNDING RESISTOR	(TVM)	DIGITAL TRIVECTOR METER E - EXPORT I - IMPORT
89	MOTORISED ISOLATOR	VS	VOLTMETER SELECTOR SWITCH
89E	MOTORISED ISOLATOR WITH EARTH SWITCH	(V)	DOUBLE VOLTMETER
	LIGHTNING ARRESTOR	(HF)D	DIGITAL DOUBLE FREQUENCY METER
PQM	POWER QUALITY METER WITH HARMONIC ANALYSING FACILITY	(F)D	DIGITAL FREQUENCY METER DIGITAL
	INTERPOSING CT	AS	AMMETER SELECTOR SWITCH
	WAVE TRAP	ID	ISOLATING LINK
PT SS	132kV PT SELECTOR SWITCH	BCU	BAY CONTROL UNIT

RELAYING:

NO.	FUNCTION	NO.	FUNCTION
2	INTER RELAY	63	BUCHHOLZ RELAY & OIL SURGE RELAY
21	DISTANCE PROTECTION RELAY	64	RESTRICTED EARTH FAULT RELAY
25	SYNCHRONISM CHECK RELAY	67	DIRECTIONAL O/C RELAY
26	APPARATUS THERMAL DEVICE	71	LEVEL SWITCH
27	UNDER VOLTAGE RELAY	78	VECTOR SHARGE RELAY
30	ANNUNCIATOR	81	FREQUENCY RELAY
32	REVERSE POWER RELAY	86	MASTER TRIP RELAY
49	TRAFO THERMAL RELAY	87	DIFFERNTIAL RELAY
50	INSTANTANEOUS O/C RELAY	89 A,B,C	CT SHORTING / SWITCHING RELAY
51	IDMT O/C RELAY	95	TRIP CIRCUIT SUPERVISION RELAY
59	OVER VOLTAGE RELAY	97	MOTOR PROTECTION RELAY
60	PT FUSE FAILURE RELAY	99	OVERFLUXING PROTECTIVE RELAY
78LG	LOSS OF GRID, OUT OF STEP / PHASE ANGLE MEASURING RELAY		
27/59TN	100% STATOR EARTH FAULT PROTECTION		

SUFFIX FOR RELAYING:

D	NEUTRAL DISPLACEMENT	O/F	OVER FREQUENCY
df	df/dt ELEMENT	T	TURBINE
E	ROTOR EARTH FAULT	U/F	UNDER FREQUENCY
G	GENERATOR	Z	NO VOLT ELEMENT
GT	GRID TRANSFORMER	X	AUXILIARY RELAY
LBB	LOCAL BREAKER BACKUP	LV	LOW VOLTAGE
DC	DIRECT CURRENT	HV	HIGH VOLTAGE
N	EARTH FAULT	TS	TEMPERATURE SCANNER
T	TRANSDUCER	ET	EXCITATION TRANSFORMER
TG	TURBO GENERATOR	UAT	UNIT AUXILIARY TRANSFORMER
TRAFO.	TRANSFORMER	D	OVERALL DIFFERENTIAL
B	BUSBAR PROTECTION	LR	LOADING RESISTOR
PU	PERIPHERAL UNIT	CU	CENTRAL UNIT

NOTES:

1. EQUIPMENT RATINGS & ARRANGEMENT IS PRELIMINARY, IT SHALL BE FINALIZED AT PROJECT STAGE.

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT:

KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:

DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
18-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(+333)9990053, FAX :+92(42)35811008, 35811155
WEBSITE: www.descon.com, EMAIL:descon@descon.com

PROJECT NAME & LOCATION:

40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:

132kV AIS DOUBLE BUS SLD

SHEET SIZE	SCALE	EPS No.	PROJECT NO.	SHEETS	REV.
		KASHMIR-00-000-D1381-002-01	KASHMIR		
A1	SCALE	DRAWING No. KASHMIR-00-000-D1381-002-01	NO.	TOTAL	0
			1	1	

KASHMIR POWER PRIVATE LIMITED

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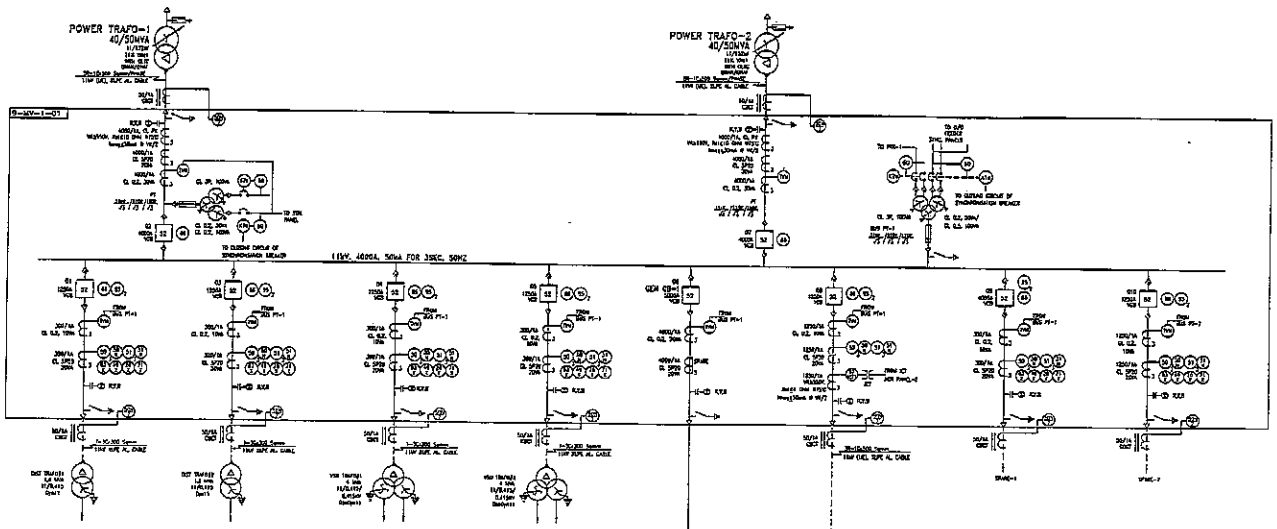

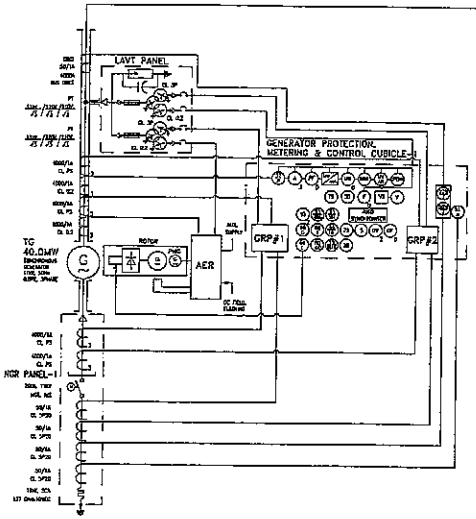

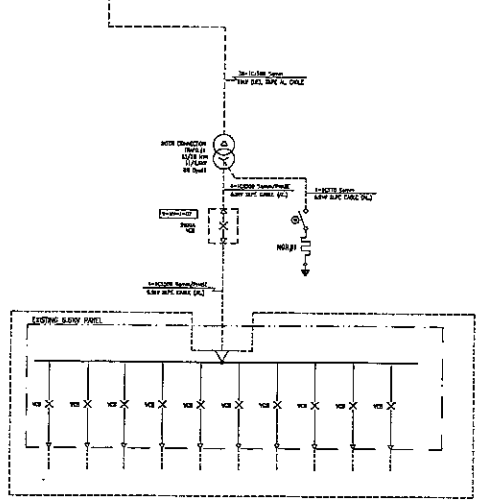

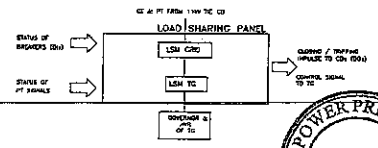

LEGEND:

	HRC FUSE	A	AMMETER n – NO. OFF
	CURRENT TRANSFORMER n – NUMBER OF CTS X-X/1A–MODIFIED CT RATIO	V	VOLTMETER n – NO. OFF
	SURGE CAPACITOR	MWh	MEGA-WATT METER D–DIGITAL
	POTENTIAL TRANSFORMER	MVAh	MEGA-VOLTAMPERE METER
52	DRAW-OUT CIRCUIT BREAKER	PF	POWER FACTOR METER D–DIGITAL
AER	AUTO EXCITATION REGULATOR	MWh	MEGA-WATT METER D–DIGITAL
NGR	NEUTRAL GROUNDING RESISTOR	TVM	DIGITAL TRANSDUCER METER E – EXPORT I – IMPORT
LAVT	LIGHTNING ARRESTER & VOLTAGE TRANSFORMER	VS	VOLTMETER SELECTOR SWITCH
		GPR	GENERATOR PROTECTION RELAY 87 – RELAY1 27 – RELAY2
		S	SYNCHROSCOPE

52	ELECTRICAL MECHANICAL INTERLOCK WITH CB	DV	DOUBLE VOLTMETER
	LIGHTNING ARRESTOR	DF	DIGITAL DOUBLE FREQUENCY METER
PQM	POWER QUALITY METER WITH HARMONIC ANALYSING FACILITY	f	DIGITAL FREQUENCY METER
	INTERPOSING CT	AS	AMMETER SELECTOR SWITCH
G	GENERATOR	CBCT	CORE BALANCE CURRENT TRANSFORMER
M	MOTOR	4-20mA	TRANSDUCER WITH OUTPUT

RELAYING:

NO.	FUNCTION	NO.	FUNCTION
2	TIMER RELAY	60	PT FUSE FAILURE RELAY
25	SYNCHRONISH CHECK RELAY	63	BUCHHOLZ RELAY & OIL SURGE RELAY
26	APPARATUS THERMAL DEVICE	64	RESTRICTED EARTH FAULT RELAY
30	ANNUNCIATOR	71	LEVEL SWITCH
32	REVERSE POWER RELAY	86	MASTER TRIP RELAY
49	TRAFO THERMAL RELAY	87	DIFFERENTIAL RELAY
50	INSTANTANEOUS O/C RELAY	95	TRIP CIRCUIT SUPERVISION RELAY
51	TIME O/C RELAY		

SUFFIX FOR RELAYING:

D	NEUTRAL DISPLACEMENT
dF	dF/dt ELEMENT
E	ROTOR EARTH FAULT
G	GENERATOR
GT	GRID TRANSFORMER
DC	DIRECT CURRENT
N	EARTH FAULT
T	TRANSDUCER
TG	TURBO GENERATOR
TRAFO	TRANSFORMER
T	TURBINE

NOTES:

1. EQUIPMENT RATINGS & ARRANGEMENT IS PRELIMINARY. IT SHALL BE FINALIZED AT PROJECT STAGE.

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
B	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT: KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR: DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 12201,LAHORE-53000 PAKISTAN
TEL:+92(42)35990053, FAX :+92(42)35811005, 35811135
WEBSITE: www.descon.com, EMAIL:descon@descon.com

PROJECT NAME & LOCATION: 40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

TITLE: 11kV PANEL SLD

PAPER SIZE	SCALE	E.F #	PROJECT NO.	SHEETS	REV.
A1	SCALE	KASHMIR-00-000-D1381-003-01	KASHMIR	NO. TOTAL	D
		DRAWING # KASHMIR-00-000-D1381-003-01			

KASHMIR POWER PRIVATE LIMITED

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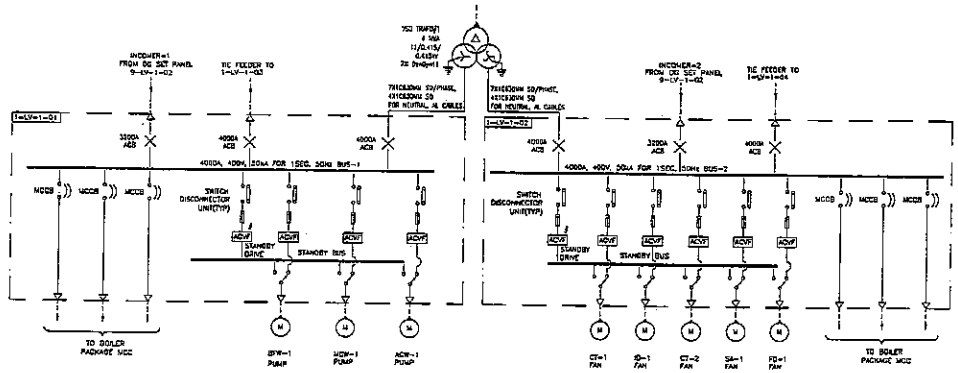

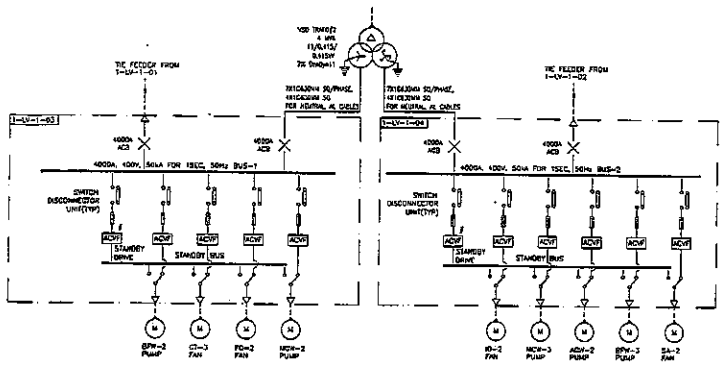

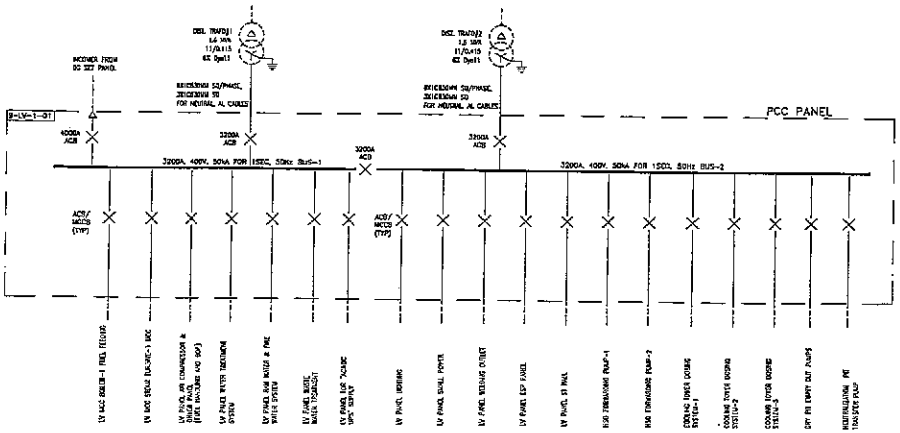

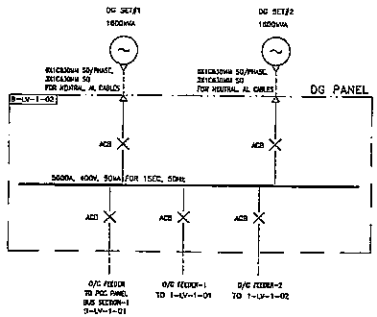

NOTES:

1. EQUIPMENT RATINGS & ARRANGEMENT IS PRELIMINARY, IT SHALL BE FINALIZED AT PROJECT STAGE.

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT:
KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-54000 PAKISTAN
TEL:+92(42)35991653, FAX :+92(42)35811003, 35811135
WEBSITE: WWW.DESCON.COM.PK, EMAIL:DESCON@DESCON.COM

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
400V AC MAIN PANELS SLD

SHEET SIZE	SCALE	DRAWING #	PROJECT NO.	SHEETS	REV.
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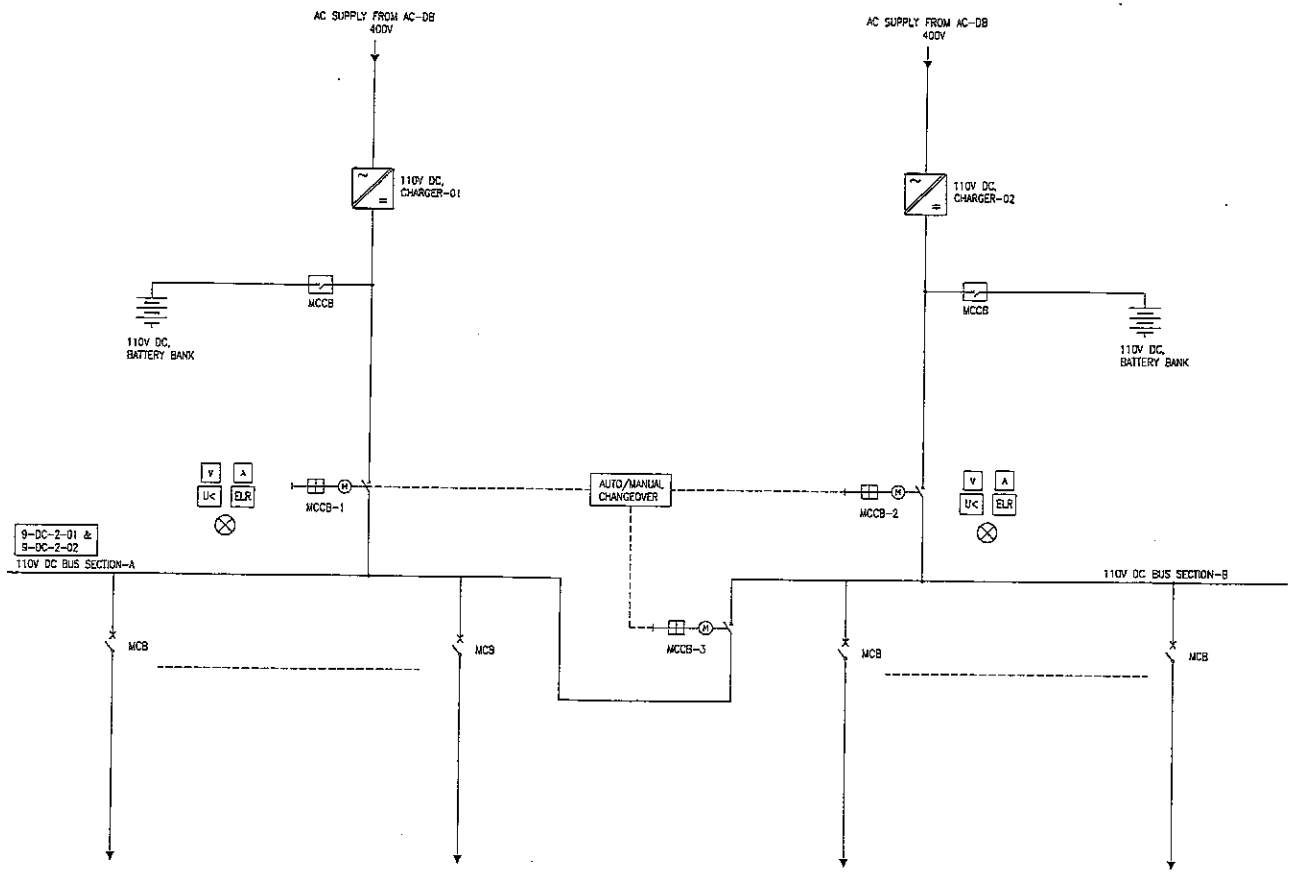

SYMBOL	LEGEND DESCRIPTION
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	MCB, 1, 2, 3 OR 4 POLE AS INDICATED, WITH LSI PROTECTIONS.
	MCCB, 3 OR 4 POLE AS INDICATED, WITH ADJUSTABLE LSI PROTECTIONS.
	MOTORIZED MOULDED CASE CIRCUIT BREAKER
U<	UNDER VOLTAGE RELAY
ELR	BATTERY EARTH LEAKAGE RELAY
	BATTERY CHARGER
	BATTERY BANK
V	VOLT METER
A	AMMETER
	LED INDICATION LAMP

NOTES:-

1- THIS ARRANGEMENT IS PRELIMINARY. IT SHALL BE FINALIZED AT PROJECT STAGE.

PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNX	MA	11.01.17

CLIENT:
KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
18-KM FEROZEPUR ROAD,P.O.BOX 1901,LAHORE-53000 PAKISTAN
TEL:+92(42)35980053, FAX :+92(42)35911005, 35811135
WEBSITE: WWW.DESCON.COM, EMAIL:DESCON@DESCON.COM

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
110V DC UPS SLD

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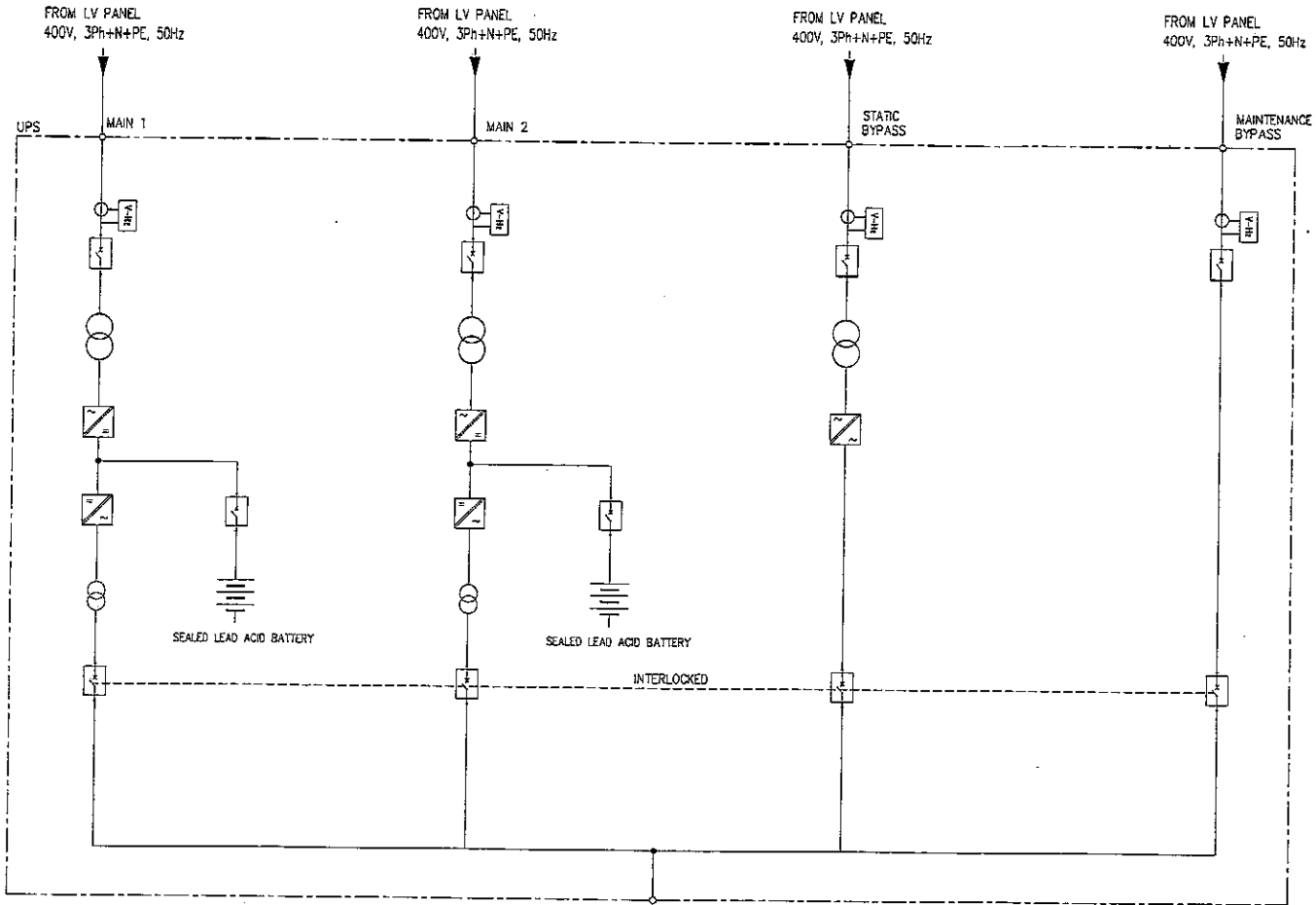

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SYMBOL	DESCRIPTION
	TRANSFORMER
	RECTIFIER
	INVERTER
	STABILIZER
V	VOLT METER
A	AMMETER
	MCB, 1, 2, 3 OR 4 POLE AS INDICATED, WITH LSI PROTECTIONS.
	BATTERY BANK
	TERMINAL POINT
	MCCB, 3 OR 4 POLE AS INDICATED, WITH ADJUSTABLE LSI PROTECTIONS.

NOTES:-

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PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT:
KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35990053, FAX :+92(42)3551 1005, 35811125
WEBSITE: www.descon.com, EMAIL:mmoon@descon.com

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
230V AC UPS SLD

SHEET SIZE	SCALE	EF #.	PROJECT NO.	SHEETS	REV.
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KASHMIR POWER PRIVATE LIMITED

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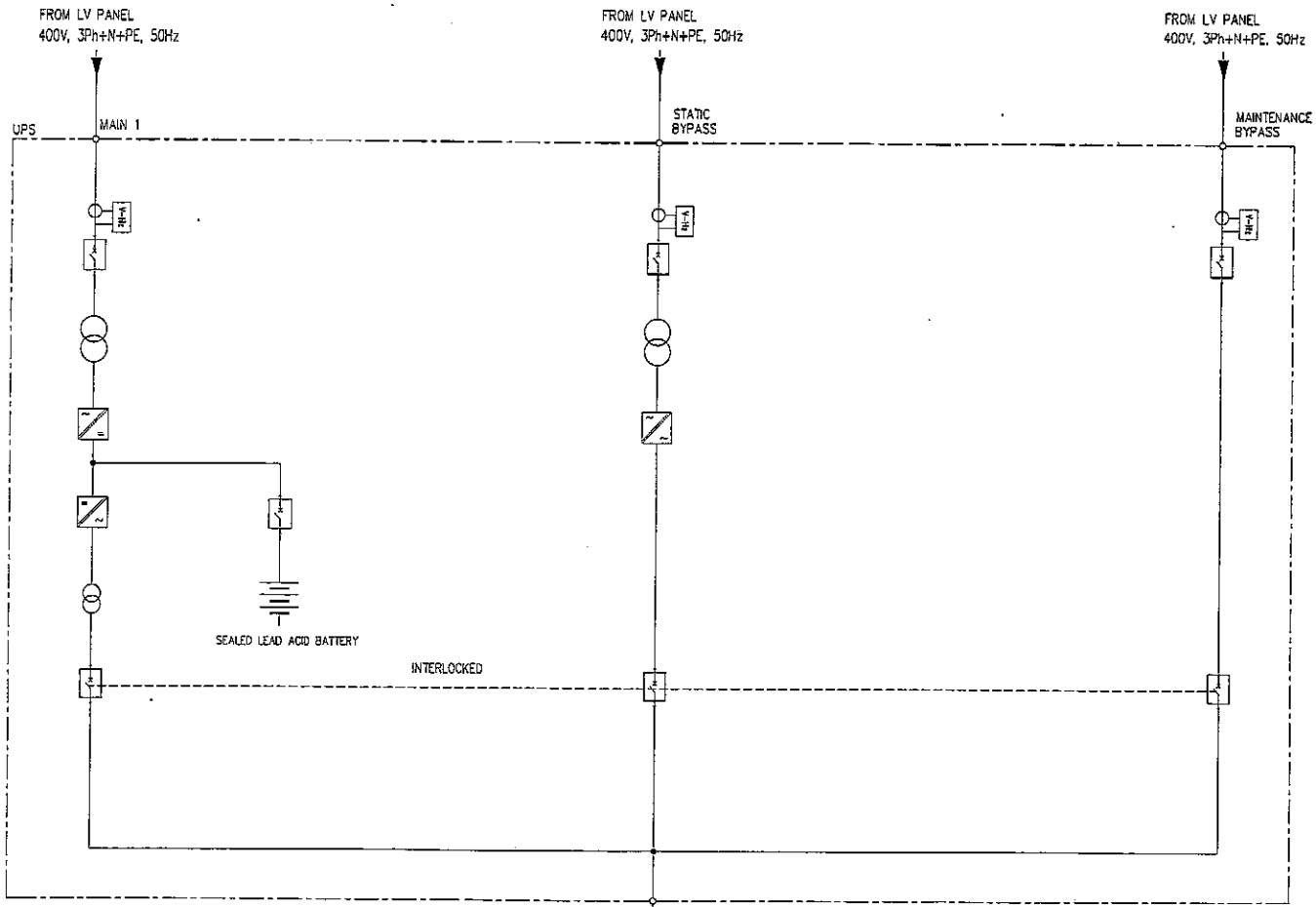

LEGEND	
SYMBOL	DESCRIPTION
	TRANSFORMER
	RECTIFIER
	INVERTER
	STABILIZER
V	VOLT METER
A	AMMETER
	MCB, 1, 2, 3 OR 4 POLE AS INDICATED, WITH LSI PROTECTIONS.
	BATTERY BANK
	TERMINAL POINT
	MCCB, 3 OR 4 POLE AS INDICATED, WITH ADJUSTABLE LSI PROTECTIONS.

NOTES:-

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PRELIMINARY

REV.	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT: KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR: DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
10-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35990053, FAX :+92(42)35811005, 35811135
WEBSITE: www.descon.com, EMAIL:descon@descon.com

PROJECT NAME & LOCATION: 40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE: 230V AC UPS FOR EMERGENCY LIGHTING

SHEET SIZE	SCALE	EF #	PROJECT NO.	SHEETS	REV.
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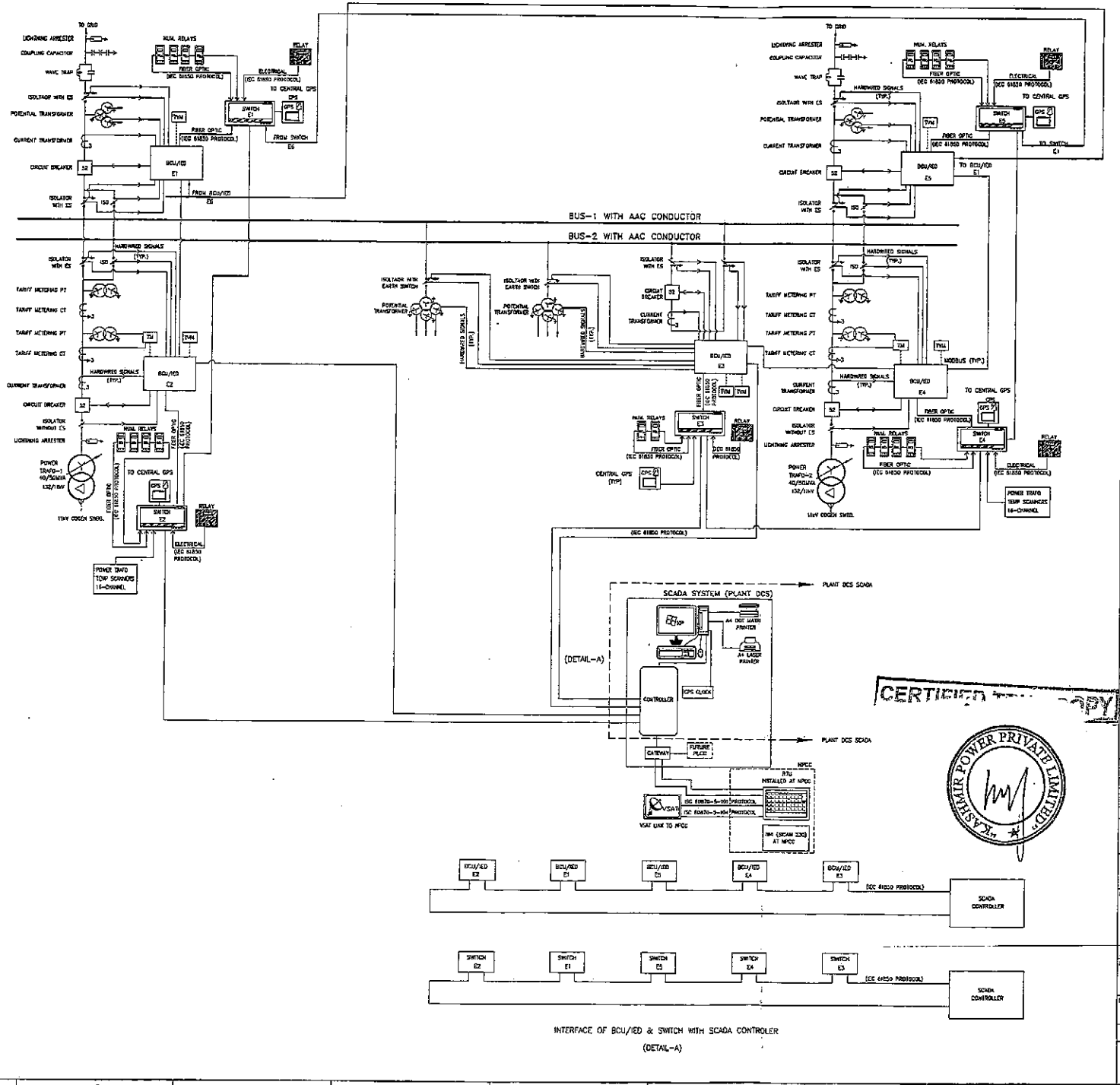
KASHMIR POWER PRIVATE LIMITED



LEGEND

——→	FEEDBACK DIs
←——→	FEEDBACK/COMMANDs (DIs/DOs)
——	COMMUNICATION CABLE
MFM	MULTIFUNCTION METER
BCU	BAY CONTROL UNIT
IED	INTELLIGENT ELECTRONIC DEVICE
RTU	REMOTE TERMINAL UNIT
GPS	GLOBAL POSIRONING SYSTEM
UPS	UN-INTERRUPTIBLE POWER SUPPLY
PLCC	POWER LINE CARRIER COMMUNICATION
TVM	TRIVECTOR METERING
TM	TARIFF METERING

NOTES

1. THIS DRAWING INDICATES ONLY BASIC REQUIREMENT OF THE SCADA. CONTRACTOR SHOULD SUBMIT SCADA ARCHITECTURE DRAWING
2. ALL REQUIRED HARDWARES, ITEMS AND SOFTWARES SHALL BE PART OF SCOPE.
3. BCU/IED SHALL BE PART OF SWITCHYARD CONTROL & RELAY PANEL.
4. RTU, IF REQUIRED AS PER NTDC REQUIREMENTS.

NOTES:

1. EQUIPMENT RATINGS & ARRANGEMENT IS PRELIMINARY. IT SHALL BE FINALIZED AT PROJECT STAGE.

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0	ISSUED FOR INFORMATION	FIR	FNK	MA	11.01.17

CLIENT:
KASHMIR SUGAR MILLS (Pvt) LIMITED

CONSULTANT:

EPC CONTRACTOR:
DESCON ENGINEERING LIMITED
DESCON HEADQUARTERS
16-KM FEROZEPUR ROAD,P.O.BOX 1201,LAHORE-53000 PAKISTAN
TEL:+92(42)35990053, FAX :+92(42)35811005, 35811135
WEBSITE: www.descon.com, EMAIL:@descon@descon.com

PROJECT NAME & LOCATION:
40MW BAGASSE BASED COGEN PROJECT
KASHMIR SUGAR MILLS SHORKOT, JHANG PAKISTAN

DRAWING TITLE:
TYPICAL BLOCK DIAGRAM FOR SCADA SYSTEM

SHEET SIZE	SCALE	DRAWING NO.	PROJECT NO.	SHEETS	REV.
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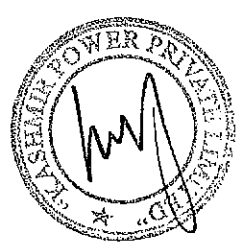
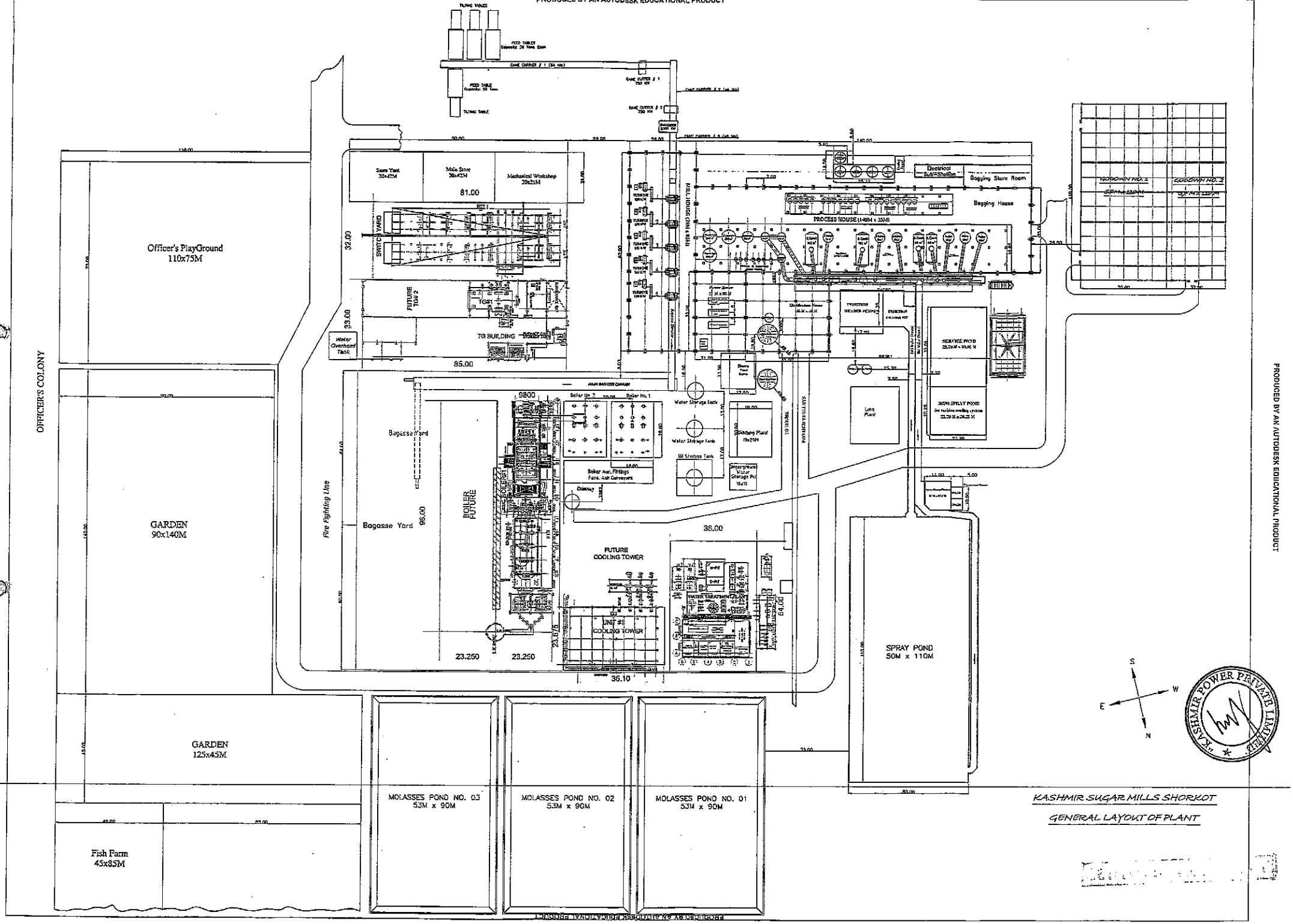
PLANT LAYOT

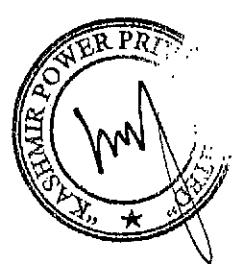




KASHMIR SUGAR MILLS SHORKOT

GENERAL LAYOUT OF PLANT

FEASIBILITY REPORT



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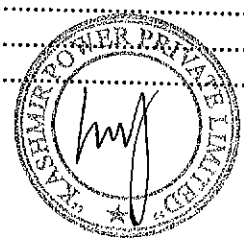
Kashmir Power (Pvt.) Limited

40MW Bagasse-based Cogeneration Power Project
Shorkot, District Jhang, Pakistan

Feasibility Report

Contents



1 Project Background

Kashmir Sugar Mills Limited **("KSML")** through a wholly owned subsidiary Kashmir Power (Private) Limited **("KPPL")** intends to set up a green field 40 MW (Gross) high-pressure bagasse based co-generation power plant **("Project")** under the provisions of the Framework for Power Cogeneration 2013 **("Framework")**and Policy for Development of Renewable Energy for Power Generation 2006 (**"RE Policy"** or **"Policy"**). The Project will be located in the premises of KSML located at Shorkot, District Jhang, Punjab.

The Project will sell power to the national grid through sale of energy to the Central Power Purchasing Agency Guarantee Limited **("CPPA-G")** under a 30-year Energy Purchase Agreement **("EPA")** as well as partially meet the steam and power requirements of KSML during the crushing season. The Project will enable KSML to establish a sustainable market for its by-product, bagasse, and will also allow the sponsors of KSML to take an exposure in the power sector through incentives offered by the Government of Pakistan under the Framework and RE Policy.

The objective of this feasibility report ("Feasibility") is to assist KSML in assessing the viability of the Project under a ***given set of assumptions.***

2 Power Market

2.1 Structure of Power Sector in Pakistan

Historically, the power sector in Pakistan has been owned and operated by government entities, primarily the Water and Power Development Authority ("WAPDA") until the drive to unbundle started in early 1990s. Since then the sector has evolved much with private sector involvement primarily in generation and more recently on the model of a fully vertically integrated utility company. The generation, transmission, distribution and retail supply of electricity in Pakistan is presently undertaken by a number of public and private sector entities comprising of one (1) national transmission company; nine (9) regional public sector-owned distribution companies; four (4) public sector thermal generation companies; one (1) public sector hydropower generation company and several independent power producers (IPPs). These entities enable the supply of power to the entire country except for Karachi. The metropolitan city of Karachi and some of its surrounding areas are supplied power K-Electric, which is a vertically integrated utility owned by the private sector responsible for the generation, transmission and distribution of electricity in its region. The total installed capacity of the entire country in 2015 was 24,823 MW of which 16,814 MW (67.74%) was thermal, 7,116 (28.67%) was hydroelectric, 787 MW (3.17%) was nuclear and 106 MW (0.43%) was wind.

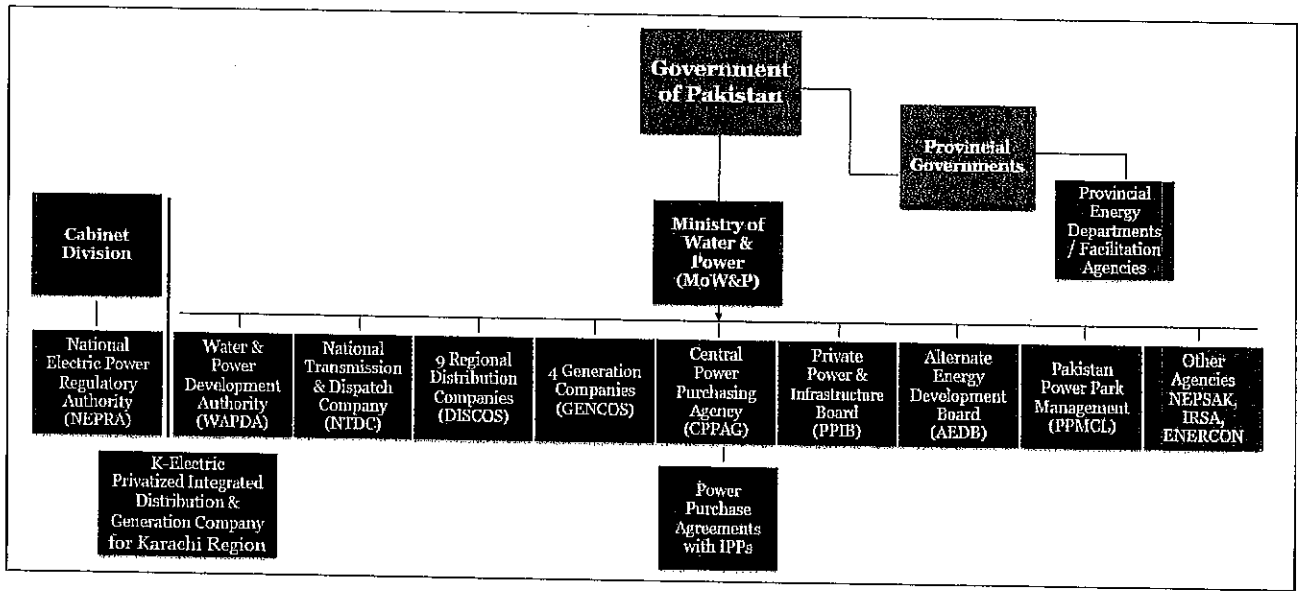
Table 1: Pakistan Power Generation Capacity

As on 30th June	2011	2012	2013	2014	2015
Thermal	15,910	15,969	15,941	15,719	16,814
Hydropower	6,645	6,730	6,947	7,116	7,116
Nuclear	787	787	787	787	787
Wind	0	1	50	106	106
Total	23,342	23,487	23,725	23,728	24,823

All figures in MW; Source: NEPRA State of Industry Report, 2015

More recently the CPPA, previously residing within NTDC, has been converted into a legally separate independent body acting as a central counterparty to power purchase transactions. The present form of the power structure in Pakistan is presented below:

Pakistan Power Sector Structure



2.2 Electricity Generation

Historically, Pakistan has relied on hydropower generation to meet its electricity demands, as the ratio of hydel to thermal installed generation capacity in the country in 1985 was about 67% to 33%. However, with the passage of time, the energy mix has shifted towards thermal power generation, which now generates approximately 65% of total power produced in the country. Electrical energy generated in recent years by fuel type is presented in the table below:

Table 2: Pakistan Energy Generation by Source

As on 30th June	2010-11	2011-12	2012-13	2013-14	2014-15
Thermal	65,169	64,478	64,034	68,082	69,988
% Share	*64.79*	*65.94*	*64.91*	*64.41*	*64.17*
Hydel	31,990	28,643	30,033	32,239	32,979
% Share	*31.80*	*28.85*	*30.44*	*30.50*	*30.24*
Nuclear	3,130	4,872	4,181	4,695	5,349
% Share	*3.11*	*4.91*	*4.24*	*4.44*	*4.90*
Import	295	296	375	419	443
% Share	*0.29*	*0.30*	*0.38*	*0.40*	*0.41*
Wind	0	6	32	263	300
% Share	*0.00*	*0.01*	*0.03*	*0.25*	*0.27*
Total	100,584	99,295	98,655	105,698	109,059

All figures in GWh; Source: NEPRA State of Industry Report, 2015

Given the acute gas shortage in the country, the thermal generation has relied mostly on expensive fuels such as Furnace Oil and High Speed Diesel. Increased dependence on expensive thermal fuel sources has not only led to high cost of generation but has also resulted in large amounts of foreign reserves to be spent on the import of fuel. The fuel wise thermal generation in the country in the recent years is given in the table below:

Table 3: Pakistan Energy Generation by Source (Thermal Fuel Mix)

	2010-11	2011-12	2012-13	2013-14	2014-15
Gas	37,076	30,162	28,190	30,769	31,196
% share of thermal generation	*56.89*	*46.06*	*44.02*	*45.19*	*44.57*
FO + HSD	27,984	35,250	35,804	37,201	38,690
% share of thermal generation	*42.94*	*53.83*	*55.91*	*54.64*	*55.28*
Coal	109	66	40	112	102
% share of thermal generation	*0.17*	*0.10*	*0.06*	*0.16*	*0.15*
Total	65,169	65,478	64,034	68,082	69,988

All figures in GWh; Source: PSS/NTDC/KEL

Due to this skewed energy mix, it has now become imperative upon the power sector in Pakistan to move towards generation technologies that are sustainable and rely on indigenous resources.

2.3 Demand and Supply of Electricity

For the past decade or so, Pakistan has been suffering from an acute energy crisis due to rising demand exacerbated by structural flaws within the sector. Some of the major reasons contributing to this crisis include:

1. Inefficient transmission and distribution
2. Increasing demand
3. Inefficient use of energy
4. Expensive energy mix and
5. Improper pricing.

Installed capacity in the country grew at an average rate of 5.51% during the period 1990-2015. However, this increase in capacity has been unable to meet the demand of electricity leading to a demand-supply gap, which can go as high as 6,600 MW during peak hours. In 2015, the maximum generation capability remained at 16,500 MW, while the maximum peak demand reached 21,701 MW, resulting in a 5,201 MW gap between supply and demand. Projections by government agencies depict that this shortfall is not going to end till 2019. The tables below show the actual and projected surplus/deficit in demand during system peak hours:

Table 4: Pakistan Historical Supply and Demand of Power

Year	Generation Capacity	Peak Demand	Surplus/(Deficit)
2011	15,430	21,086	-5,656
2012	14,483	21,536	-7,053
2013	16,846	21,605	-4,759
2014	18,771	23,505	-4,734
2015	19,132	24,757	-5,625

All figures in MW; Source: NTDC

Table 5: Pakistan Projected Supply and Demand of Power

Year	Planned Generation	Projected Peak Demand	Surplus/(Deficit)
2016	20,303	25,666	-5,363
2017	23,445	27,185	-3,740
2018	28,751	28,678	73
2019	33,545	30,154	3,391
2020	35,590	31,625	3,965

Source: NTDC

Shortage of electricity has become the most critical challenge not only causing social disruption but also hitting the economic growth of the country. According to estimates, energy shortages in the country have resulted in approximately 2% reduction in the annual GDP of the country. Therefore, resolving the energy crisis is amongst the top priorities of the government and steps are being taken to attract new investment in the power sector. Moreover, steps are being taken to optimize the generation mix and add renewable and indigenous energy sources.

2.4 Key Organizations

2.4.1 National Electric Power Regulatory Authority ("NEPRA")

In order to promote fair competition in the industry and to protect the rights of consumers as well as producers/sellers of electricity, the GOP enacted the Regulation of Generation, Transmission and Distribution of Electric Power Regulation Act, 1997 ("NEPRA Act"). Under this Act, the NEPRA Policy for Power Generation Projects was established for regulating electric power generation, transmission and distribution in Pakistan. In performing its functions under this Act, NEPRA shall is required to, as far as practicable, protect the interests of consumers and companies providing electric power services in accordance with guidelines laid down by the government. One of NEPRA's most prominent roles is tariff approval for the Project.

NEPRA's role in the power business, inter alia, is to issue licenses for companies and to regulate their operations according to NEPRA rules and regulations. The prospective applicants will be required to comply with all NEPRA rules/procedures, inter alia, for grant of license before security agreements are concluded for any project.

2.4.2 Private Power and Infrastructure Board ("PPIB")

PPIB provides a one-window facility to IPPs for implementation of projects above 50 MW capacity and issues the Letter of Interest ("**LOI**") and Letter of Support ("LOS"), prepares pre-qualification and bid documents, pre-qualifies the sponsors, evaluates the bids of pre-qualified sponsors, assists the sponsors/project companies in seeking necessary consents / permissions from various governmental agencies, carries out negotiations on the Implementation Agreement, assists the power purchaser, fuel supplier, government authorities in the negotiations, execution and administration of the PPA, fuel / gas / coal supply agreement and water use license respectively, issues and administers the GOP guarantee backing up the power purchaser, fuel supplier and follows up on implementation and monitoring of projects.

2.4.3 Alternate Energy Development Board ("AEDB")

AEDB has been designated as one-window facility for processing all alternative and renewable energy projects in the private sector projects such as wind, biodiesel, bagasse/biomass/waste to energy, small/mini/micro hydro and solar power projects. AEDB also issues bankable IA, EPA, LOI and LOS to alternative energy producers. AEDB shall be the relevant GoP facilitation agency for the issuance of the LOI and LOS as well negotiation of the IA and provision of the GoP guarantee as applicable for the Project.

2.4.4 Central Power Purchasing Authority Guarantee Limited ("CPPA-G")

CPPA-G, a company created by Government of Pakistan, is a non-profit independent company established under the Companies Ordinance, 1984 and solely responsible for implementing and administering the "Single Buyer Plus" market mechanism (ultimately leading to competitive market operations). CPPA purchases powers on behalf of Distribution Companies ("DISCOS") from IPPs. The Project shall be entering into negotiations with CPPA-G for the sale of energy to the national grid and shall enter into an energy purchase agreement in this regard.

2.4.5 Multan Electric Power Company ("MEPCO")

MEPCO is a public limited company incorporated on May 14th, 1998 in line with Government policy of unbundling and corporatization of Pakistan power sector. The company was established to acquire all properties, rights, assets, obligations and liabilities of defunct Multan Area Electricity Board, Grid Stations and transmission lines of the supply system which were directly and exclusively supplying electricity in the jurisdiction of the said Multan Area Electricity Board.

MEPCO is the largest power distribution company in the country operating exclusively in 13 administrative districts of southern Punjab i.e. Multan, Muzaffargarh, Layyah, D.G.Khan, Rajanpur, Lodhran, Bahawalpur, R.Y.Khan, Khanewal, Sahiwal, Pakpattan, Vehari and Bahawalnagar. The Project will evacuate power to MEPCO at the nearest sub-station/transmission line which shall be determined after the finalization of the grid interconnection study, which is in process.

3 Applicable Framework &Policy

The Project is being set up under the Framework for Power Cogeneration 2013 pursuant to the Policy for Development of Renewable Energy for Power Generation 2006 being administered by the AEDB. Under the terms of the Framework and Policy, electricity purchase by the CPPA-G from bagasse-based projects has been made mandatory.

The conditions of the Framework/Policy envisage KSML/KPPL seeking a Letter of Interest ("LOI") from AEDB for the Project. In May 2013, NEPRA has announced an upfront tariff **("Upfront Tariff")** for high-pressure boiler based bagasse projects being set up under the Framework. The Upfront Tariff has subsequently been extended up to May 2017; the Company shall upon completion of the applicable prerequisites apply to NEPRA for the same.

Upon receipt of the Upfront Tariff approval from NEPRA the Project Company shall seek a Letter of Support ("LOS") from AEDB; following which the Company shall enter into negotiations of the EPA and IA with CPPA-G and AEDB respectively, which shall be followed by the financial close of the Project. Under the terms of the Upfront Tariff (and LOS) the Company is required to achieve the commercial operations date of the Project within 24 months from date of approval of the Upfront Tariff for the Company.

In parallel, the Company shall also apply to NEPRA for the issuance of the generation license for the Project. The application for the generation license shall be made following the issuance of the LOI and will be issued, amongst others, aftersubmission of an approved grid interconnection study from MEPCO and environmental studyfrom the relevant authority.

4 Cogeneration

4.1 Bagasse Based Cogeneration

Cogeneration refers to generation of electricity and useful heat from use of a single fuel at high efficiency. Co-generation is a well-known process in sugar industry as every sugar mill requires steam for sugar manufacturing while supply of electricity is also necessary to operate machinery. The steam provides thermal energy which is used in heating and concentrating the juice into syrup. This process of juice concentration to syrup involves the evaporation of a lot of water in the juice and this removal of water is done by using low pressure steam, as the heating medium. With the large quantum of low pressure steam usage, the sugar industry stands as an ideal candidate for Cogeneration. Historically, most sugar mill boilers and the power houses were designed primarily to meet the process steam and electricity requirements of the sugar mill.

Therefore, the boilers and turbo-generators employed are mostly of low pressure and low temperature style.

There has been, of late, increasing awareness of the advantages of installation of high pressure, high efficiency bagasse based systems. With installation of high pressure boilers, electricity over and above internal use can also be produced and sold to national grid, if allowed. Exports of electricity can make cogeneration an attractive and cost-efficient means of cutting production costs, reducing pollution and generating additional revenues depending on the ratio between the price of electricity secured and production cost of electricity generated in the sugar industry.

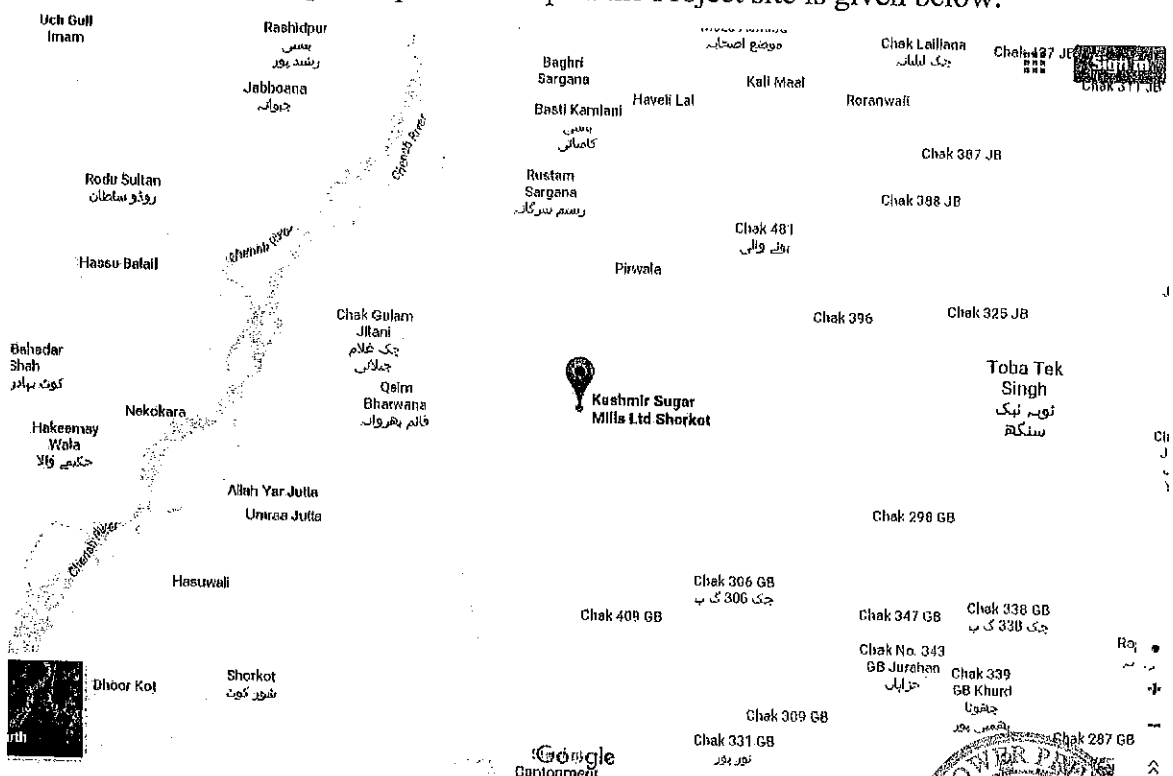
5 The Project

The 40 MW Co-generation Project envisages a 1+1 configuration power plant comprising of a high pressure (110 bar) traveling grate boiler having a steam capacity 200 tons per hour, a40 MW condensing/extraction steam turbine generators and balance of plant **("Plant")**. It is planned that, **during the crushing period,** steam and power for KSML operations will be provided from the existing low pressure **("LP")** system and the balance steam/power requirement of KSML will be met through the high pressure **("HP")** system of the Plant. During the crushing period, bagasse from KSML will be utilized both in the HP and LP Systems to generate steam and power. (Note: Only power generated from the HP system may be sold to CPPA-G). During the non-crushing period only the HP system shall operate, which will use unutilized bagasse available with KSML.

Detailed workings regarding the fuel availability and generation mix are provided in the following sections.

5.1 Project Site

The Project Site will be located within the premises of the sugar mill located at 11Km Shorkot Cantt road, Shorkot City, District Jhang (Coordinates: 30.82°N, 72.14°E). The total area of the sugar mill and its premises is 107 acres and of that, approximately 50 acres will be allocated to the construction of the power plant. A map of the Project site is given below:



5.2 Interconnection

Grid interconnection will be at a FESCO 132 kV grid station/transmission at a distance of 1.5 km from the Project site. A detailed grid interconnection study has been carried out and FESCO has been approved.

6 Plant Design

6.1 General

The design of the Facility is typical for a biomass-fired cogeneration facility which also is specific to the use of bagasse and to the cogeneration requirements.

The boilers will consist of tall water wall furnace with platen generators located at the top of the furnace. The super heater will have three stages. The first stage is a horizontal tube convective super heater located in the boiler second pass. The second stage consists of platens located at the top of the furnace adjacent to the generator section. The third stage consists of pendants located above the furnace arch between the second and first stages. Following the super heater are three horizontal tube economizer sections and four tubular air heater sections.

The steam cycle consists of two high pressure feed water heaters and a deaerator for each unit. The high pressure feed water heaters take steam from the two uncontrolled extractions of the steam turbine. Steam for the deaerator is to be supplied from the controlled extraction of the steam turbine.

The Facility has two modes of operation defined by steam needs of KSML. During the crushing season, KSML needs steam and electricity to crush the sugar cane and produce sugar. Steam for KSML will be supplied from the controlled extraction of the steam turbine which is at approximately 3 bar pressure. The expected steam demand for KSML is 179.17 tons/hr. The electricity demand during the crushing season is 7.07 MW. During the off-season, the electricity demand is 0.5 MW.

6.2 Technology

Combustion technology based on the Rankine Cycle will be utilized in this project which is proven latest technology. The bagasse will be combusted in a high pressure boiler and the steam generated will be fed to the steam turbine to generate power. The turbine will be different from the conventional thermal power plants as the turbine will be provided with a controlled extraction for extracting the process steam required for the sugar mill. To enhance the efficiency of operation, regenerative heaters are used in the feed water circuit. For the Cogeneration power plant proposed for KPPL, the Cogeneration cycle is based on the parameters of 110 bar(a) and 540 degree centigrade at the boiler outlet, currently being used in many countries for the Cogeneration projects. The cycle chosen with the above parameters is the latest used in any of the bagasse fired installations around the world. These above selected parameters make the cycle more efficient and help in the generation of more units for the same quantum of the fuel.

There are already many Cogeneration plants operating in Pakistan & India with these parameters and the operating experience of those plants, in synchronization with the sugar mill operation, has been smooth and without any hitch. The Cogeneration scheme for KPPL proposes 1x155 TPH capacity boilers and 1x40 MW extraction condensing turbo generators. Considering the offseason operation of the plant, the Cogeneration power plant boilers will be designed for firing the saved bagasse and a few other compatible bio-mass fuels.

7 Project Specifications and Equipment

7.1 Bagasse Fired Boiler

The Boiler shall be single drum, natural circulation, radiant furnace with water cooled membrane wall, three stage super-heater with two stage attemperator, balanced draft and travelling grate Bagasse and coal fired boiler. The boiler is capable of a peak generation of 110% of the MCR for a period of half an hour in eight hour shift. The boiler shall be top supported, outdoor type, with adequate provisions for the thermal expansion of the boilers in all directions.

7.2 Design Parameters:

- Bagasse Fired Boiler; 200TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar(a)
- Steam temperature at the Main steam stop valve outlet at MCR: $540 \pm 5\ ^{0}C$
- Boiler feed water temperature at the inlet to the Deaerator: $136^{0}C$.
- Maximum noise level at 1.0 m distance for the boiler: 85 dB(A)
- Maximum noise level at 1.0 m for boiler drum safety valves: 110 dB(A)

The Bagasse through drum feeders, screw feeders and pneumatic spreaders will be fed into the furnace and shall have future provisions for coal through screw feeder and pneumatic spreaders push into the furnace. The travelling grate is selected for efficient combustion system and to avoid heating of grates. The Ash is collected by the continuous movement of travelling grate.

The air will be supplied by primary Forced Draft (FD) fans & secondary air fans. The air towards Bagasse and coal will be controlled by the fuel air control system in order to guarantee safe and optimum combustion. The air supplied from FD fan will be heated up in air pre-heater. The pressure in the furnace will be controlled by the Induced Draft (ID) fans installed at outlet of boiler. These fans will be provided with Variable Frequency Drive (VFD) in order to optimize the power consumption. ID fans will discharge flue gases.

After complete combustion in furnace the flue gases shall enter the super heater section installed in the upper portion of the furnace. From the super heaters the flue gases will flow downwards into modular bank. The evaporator section of the boiler will be designed for a large circulation ratio. Even during quick plant load changes the water circulation will be stable and thus prevent steam blockage in the evaporator sections.

From evaporator section, the flue gas shall enter the bare tube economizer from the top and leave at the bottom to Air flue Gas Preheater. The economizer tubes will be supported in the structure of the economizer casing and will be bottom supported. The economizer will be fully drainable.

The condensate from the sugar mill shall be directly fed into the condensate tank from where it will be pumped to the deaerator via sugar plant exhaust condensate pumps through a level control system.

Dematerialized (DM) water will be supplied to the boiler for makeup. The makeup water will be pumped to the overhead surge tank via DM water distribution pumps. The makeup water will be added in the condenser hot well from the overhead surge tank by gravity through a level control system. The condensate from the condenser and makeup water added to the condenser hot well will be pumped to the deaerator by condensate extraction pumps.

3x50% Boiler Feed Water (BFW) pumps shall be provided. BFW pumps are multistage, centrifugal type with low voltage [400V] drive motors with Variable Frequency Drives (VFDs). The condensate and make-up water lines will have level control valve to control deaerator level.

The control philosophy, boilers interlock and protection logic shall be implemented in Distributed Control System (DCS) for safe operation of boiler.

7.3 Steam Turbine and Auxiliaries

7.3.1 Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with two (2) numbers of uncontrolled extractions and one (1) number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.1 bar (a) pressure during off-season operation.
The low pressure steam at 3 bar (a), 133^{0}C will be supplied to the sugar plant for juice heating in the evaporator station. The medium pressure steam at 9 bar (a), 190^{0}C will supplied for centrifugal washing. 95% condensate of the supplied LP steam will be returned from the sugar mill. There will be no condensate return of medium pressures steam.

7.3.2 Gear Box

Heavy duty reduction gear box of Double helical type with hardened & ground gears will be installed, capable of transmitting maximum power generated by turbine and able to withstand 20% over speed over a period of minimum five (5) minutes.

The gear box will be designed with a service factor of 1.3 as per AGMA requirements.

7.3.3 Couplings

High speed coupling between the turbine & the gear box will be non-lubricating, steel laminated, flexible type. The coupling between the gear box and the alternator will be low speed. Both the couplings will have coupling guards and acoustic covers. Power rating of the couplings shall be in accordance with AGMA 514

7.3.4 Condensing System

Condensing system shall comprise of the following:

- Shell & Tube horizontal type surface condenser with integral hot well, thermal relief valve and atmospheric relief valve.
- Steam Ejector system consisting of:
    - Twin stage main ejectors (1 working + 1 standby) with two surface type inter and after condensers.
    - Startup hogging type ejector with silencer.
- Vertical canister type Condensate extraction pumps (CEP's), with a 3 x 50% capacity with LT motors and suction valves.
- Rupture disc for condenser protection.
- Expansion bellow with spool piece between turbine exhaust and condenser inlet
- Dry air/vapor line within specified battery limit

7.4 AC Generator

AC Generator shall comprise of the following:

- Brush-less exciter with PMG
- Air coolers
- Twin bearings
- AVR cum Excitation panel
- Anti-condensation heaters
- Water leakage detector- 1 per cooler
- Lube oil flow regulator - 1 per bearing

Generator electrical output rating shall be as follow:

- 50 MVA rated capacity at 50° C ambient.
- 11 ± 10% KV
- 50 ± 5% Hz
- 3 Phase
- Power factor (0.8 lag to 0.95 lead)
- ± 0.5% Accuracy Control

7.4.1 Generator Protection and Control System:

Generation protection and control system will consist of the following equipment:

- Generator protection (Relay) Panel
- Metering & Synchronizing Panel
- MCC Panel
- Lightning arrestor, Surge capacitor and Potential transformer (LA, SC & PT) Panel
- Neutral grounding resistor (NGR) Panel
- DC Distribution

7.5 Governing System

The governor system provided will control the acceleration of the turbo generator and prevent over speed without tripping the unit under any operating condition or in the event of maximum load rejection.

The governor system will have the following important functions:

- Speed control
- Over speed control
- Load control
- Inlet steam pressure control
- Extraction pressure control

7.6 Lubrication and Control System

A single forced feed lubrication system will be installed for Turbine, Gearbox & Alternator comprising of the following major components:

- Lube oil tank
- Oil Vapor extractor
- AC Electric Main Oil Pump (MOP) driven by gearbox low speed shaft
- AC electric Motor driven Auxiliary Oil Pump (AOP)
- DC Motor driven Emergency lube Oil Pump (EOP) with auto cut-in & cut-out facility
- Lube oil coolers (1working + 1 standby)
- Lube oil filters (1working + 1 standby)
- AC motor driven oil mist separator mounted on oil tank

7.7 Control Oil System

Control oil system will comprise of the following:

- AC electric Motor driven Auxiliary Control Oil Pump (ACOP) (1 working + 1 standby) to supply oil to Control system.
- Control Oil filter (COF) (1 working + 1 standby)

7.8 Main Cooling Water Pumps

The cooling water system shall be designed to provide cooling water to the following area of the plant:

- Surface Condenser
- Auxiliary cooling water coolers

The cooling water system includes the following major components:

7.8.1 Main Cooling Water Pumps

Three (3) Main Cooling Water Pumps (two working and one standby) each of capacity approximately 3000 m^3/hr shall be provided. Pumps will be horizontal centrifugal type, driven by electric motors.

7.8.2 Auxiliary Cooling Water Pumps

Two (2) Auxiliary Cooling Water Pump (One working and one standby) will be provided. Pumps will be horizontal centrifugal type driven by electric motors.

7.8.3 Cooling Tower System

The Cooling Tower System shall have the following specifications:

- One (1) R.C.C structure mechanically induced draft, counter flow type cooling tower
- Capacity of cooling tower will be approximately 8000 m^3/hr and is combined and common for the whole cogeneration power plant.
- There shall be minimum four (04) cells each having a capacity of approximately 2000m^3/hr.
- The cooling tower will be designed for a cooling range of 10°C, and an approach of 5°C while operating under the atmospheric wet bulb temperature of about 28°C

- Each cell of cooling tower gear box will be equipped with vibration switches, oil temperature and oil level controls.
- The source of cooling water will be Bore Well Water.
- Cooling water supply and return temperature is 33˚C and 41˚C respectively.

7.9 Raw Water System

Raw water system consists off the following components:

7.9.1 Cooling Water Makeup Pump

Two (2) Cooling Tower make up Water Pumps for season and off-season operation will be provided.

7.9.2 Raw Water Transfer Pumps

Two (2) Raw Water Transfer Pumps (one working and one standby) each of capacity 20 m^3/hr will be provided to ensure raw water supply to Water Treatment Plant.

7.10 Compressed Air System

The function of this system is to provide service and instrument air for cogeneration plant operations. Compressed air system provides air to following users:

- **Instrument Air Users**: Instrument air will be required for the operation of pneumatic instruments like I/P converters, purge instruments, pneumatic actuation of control valves, dampers etc.
- **Service Air Users**: Service air will be required for cleaning of filters, strainers and general purpose.

7.11 Bagasse Handling System

The bagasse handling system comprising of chain conveyors & belt conveyors to transport the required quantity of bagasse from sugar mill to cogeneration shall be provided. Bagasse from the sugar mill shall be fed to the boiler from a front mounted chain conveyor. Excess bagasse shall be returned to the bagasse storage yard. During off-season/non availability of bagasse from mill, the cogeneration boiler shall use saved bagasse from the storage yard.

7.12 Ash Handling System

The ash handling system envisaged for the cogeneration boiler shall consist of Submerged Ash Belt Conveyor System and Dense Phase Ash Handling System.

7.12.1 Submerged Ash Belt Handling System

Submerged Ash Belt Handling System consists of conveyor belts, drive assembly, all type of pulleys, all type of idlers, bearing assembly, inlet / outlet chutes, take-up assembly, trough assembly, support frames, cross over, walkway, structural safety switches, water inlet / outlet / drain nozzles etc. The bottom ash at the discharge of travelling grate shall be conveyed by submerged ash conveyor system.

The ash shall be quenched in the water trough of submerged ash conveyor before conveying. The submerged ash conveyor shall discharge the ash directly to a trolley mounted tractor for further disposal.

7.12.2 Dense Phase Ash Handling System

This system will handle fly ash from boiler ash hopper (other than traveling grate & plenum ash hopper) and ESP hoppers. Surge hopper (water cooled for boiler ash hopper and non-water cooled for ESP hopper) arrangement shall be provided below the boiler and ESP hopper. Two air compressors with built in PLC control system and 1x100% air receiver shall be provided near the dense phase equipment. The required conveying air for dense phase ash system will be supplied by these compressors through air receivers. The ash silo storage capacity shall be enough to store 12 hours ash generation from both the boiler and ESP system.

7.13 Water Treatment System

The Cogeneration power plant make up water requirements will be met from the bore wells located in the sugar plant. For the make up for the cycle, it is proposed to take the raw water through a Water Treatment Plant with the following treatment scheme.

2 x Multi-grade Filter → 2 x Two Stage Reverse Osmosis system → 2 x Electro De Ionization system.(2x MGF + 2xRO +2x EDI)There shall be two independent streams. The capacity of water treatment plant is 15 m^3/hr.DM water is collected in two DM water tanks each having a capacity of 300 m^3. Water will be distributed from DM tanks through pumps to different users i.e. Deaerator, Condenser etc.

7.14 Firefighting System

The function of fire-fighting system is to supply water to the main risk areas of the cogeneration power plant.

The fire protection system is required for early detection, containment and suppression of fires. A comprehensive fire protection system shall be provided to meet the above objective and all statutory and insurance requirements of National Fire Protection Association (NFPA).

The fire-fighting system shall consist of the following:

7.14.1 Stand Pipe and Hose System:

Stand pipe and hose system shall be provided to cover the building and structures of the cogeneration plant. The system shall be designed as per the NFPA 14.

Standpipe shall have a hose of 65mm diameter with connection to a large supply of water. The hose connection shall be not less than 0.9m or more than 1.5m above the floor.

7.14.2 Fire Hydrant and Water Monitoring System

The hydrant system shall be provided to cover all areas. The system shall be designed as per NFPA 24. The system shall consist of over ground hydrant mains laid in rings, isolation valves, and stand pipes with hydrant valves (outdoor). A Hydrant shall be placed after every 40m.

7.14.3 Portable Fire Extinguishers:

Dry Chemical Powder, CO^2 and foam type extinguisher system shall be provided. The equipment shall be designed as per NFPA 10.

7.14.4 Automatic High Velocity Water Spray Nozzle System:

Automatic High Velocity Water Spray Nozzle System shall be provided along with deluge valve assembly for outdoor transformers in switchyard, generator & Turbine lube oil system area. The system shall be designed as per NFPA 15. The deluge valve assembly shall be UL/FM listed.

7.14.5 Fire Alarm & Detection System

Fire detection system for the power plant will provide early detection of fire and raise alarm. A comprehensive fire protection system shall be planned to meet the above objective and meet all statutory and insurance requirements of National Fire Protection Association (NFPA). A multitude of systems will be provided to combat various types of fires in different areas of the plant and all such systems for various areas shall form a part of a centralized protection system for the entire plant. Fire alarm system detection system shall be provided in following areas:

- Firm alarm and signaling in all electrical/instrumentation panel rooms in TG building
- Manual call points and Electric Horns in outdoor areas.

7.15 Effluent Handling System

Effluent handling system consists of the following main components:

7.15.1 Neutralizing Pit

Acid/caustic produced (if any) from Water Treatment Plant will be collected in neutralization pit. This effluent will be transferred to effluent pit after neutralization.

7.15.2 Neutralized Effluent Re-circulation cum Transfer Pumps

Two (2) neutralized effluent re-circulation cum transfer pumps (One working & one standby) shall be installed at Neutralization pit to transfer effluents from Neutralization pit to Effluent pit in water treatment plant area.

7.15.3 Effluent Pit

Effluents like Boiler blow down, cooling tower blow down, RO reject, MGF backwash, side stream filter flushing; RO flushing, neutralized effluent from neutralization pit, etc. shall be collected in the separate effluent pit near Water Treatment Plant area.

7.15.4 Effluent Transfer Pump

Two (2) Effluent Transfer Pumps (One working and one standby) will be installed on Effluent pit to transfer effluents. The pumps will also be used to re-circulate the effluent with in Neutralization pit for effective neutralization. The pump capacity shall be minimum 35 m^3/hr.

7.16 Service Water System

Two (2) service water pumps (One working and one standby) will be installed to provide service water to plant users. One (1) expansion vessel will be installed to keep service water header pressurized.

7.17 Electric Overhead Travelling (EOT) Cranes

EOT cranes shall be provided in the following buildings:

7.17.1 TG Hall

An Electrically operated EOT crane shall be provided for the erection and maintenance requirements of turbo generator and its auxiliaries.

The main hook capacity shall be 24 Tons and suitable for lifting single heaviest component in Turbo Generator. The auxiliary hook lifting capacity shall be of 5 Tons. The crane travel will cover the entire length of the TG building. The crane shall be electrically operated, bridge type and shall be designed and equipped for indoor operations complete with all accessories. The

crane bridge shall consist of bridge girders each carrying a rail on which a wheeled trolley is to run. Operation of crane shall be by pendant type push button station from ground level.

7.17.2 Workshop and Store

An Electrically operated EOT crane shall also be provided for routine maintenance activities and store material handling to be carried out in the building.

The single hook crane capacity shall be 5 Tons. The crane travel will cover the entire length of maintenance bay of workshop. Operation of crane shall be by pendant type push button station from ground level.

8 Electrical Design

8.1 Electrical Network

The Plant shall consist of one generator and associated auxiliaries for smooth plant operation. A synchronous alternator for the proposed co-generation power plant with generation at 11 kV will be connected to 132kV system through 11kV switchboard and step-up Power Transformers.

The connection between generator and 11kV switchboard shall be through Isolated Phase Bus Duct and between 11kV switchboard and 11/132kV power transformer shall be through 11kV HT XLPE cables.

The generator will operate in parallel with NTDC National grid. A portion of the power generated in the turbo-generator will meet the power requirements of the Cogeneration plant auxiliary loads and the sugar plant loads through step down transformers.

The surplus power, after meeting the power requirement of cogeneration plant auxiliaries and sugar plant auxiliaries, shall be exported to the grid through 11/132kV power transformer. There shall be total of 2 step-up power transformer (one standby + one working)

Entire Power evacuation system and associated equipment shall be designed so as to export the entire power from cogeneration plant (total generation less auxiliary power consumption), when the sugar plant is not in operation.

All the existing sugar plant loads shall be fed through one (1) interconnecting transformer.

8.1.1 Ambient Conditions for Electrical Equipment

Ambient conditions and design temperatures for electrical equipment are given in Table 6 below:

Table 6: Ambient Conditions for Electrical Equipment

	Deg C
Maximum Temperature	49.0
Minimum Temperature	1.0
Plant Design Temperature	30
Indoor Equipment Design	40
Outdoor Equipment Design	50

8.2 Plant Operating Voltage

The plant shall be designed suitable for operating at a frequency of 50Hz, with voltage levels of various systems of the plant as given in Table 7 below:

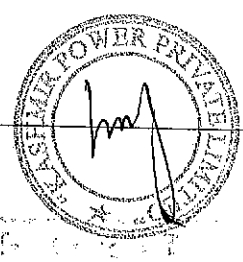


Table 7: Plant Operating Voltage

Generation (TG) system	11 kV
Power evacuation system	132 kV
Non-AC VSD / auxiliaries of cogeneration plant	400 V
AC VSD / auxiliaries of co-generation plant	400 V
DC system of co-generation plant	110 V
UPS system of co-generation plant	230 V

8.3 Basic Electrical Design Parameters

Basic electrical design parameters for the Plant are given in the table below:

Table 8: Basic Electrical Design Parameters

Power Factor (lagging)	0.8
Generation Voltage (kV)	11kV, 3 phase
Parallel operation with Grid	Required with 132kV grid
Grid Voltage	132 kV, 3 phase
System Frequency	50 ± 5%
System Voltage Variation	±10% Variation of Rated Voltage
System Fault Level	
132 kV	40 kA
11 kV	50 kA
400 V	50 kA
Fault Level & Withstand Duration	
132kV Switchgear	40kA for 3 sec
For 11 kV Switchgear	50kA for 3 sec
For 400 V Switchgear	50kA for 1 Sec
400V Lighting System	10kA for 1 Sec
11kV Isolated Phase Bus Ducts	50kA for 1 sec
110VDC	25kA for 1 Sec
48VDC	10kA for 1 Sec
230VAC	10kA for 1 Sec
Transformer and all accessories	All transformers and its accessories shall be capable of withstanding for three (3) seconds short circuit at the terminal
Earthing System	
132 kV	Effectively earthed
11 kV	Neutral grounded (limited to < 50 A) / Unearthed (Whenever the generator is not in service)
400 V	Effectively earthed
110 V DC	Unearthed

8.4 132kV Switchyard

Switchyard shall be supplied for interface with NTDC Grid in line with following specifications and NTDC requirements. Detailed specifications of the switchyard are given in the table below:

Table 9: 132kV Switchyard Specifications

Voltage Level	132kV
Service	Outdoor AIS with SF6 circuit breakers
Number of Bays	2 OHL Bays 2 Transformer Bays 1 Bus-Coupler Bay
Bus Bar	AAC conductor of "Hawthorn"
Short Circuit SF6, gang operated	2500 Amp 40kA 3 sec
Isolator (Centre break, motor operated with copper alloy blades)	2000 Amp
Protection & Metering	As per NTDC Requirements
Highest System Voltage(kV rms)	145 kV
Power frequency withstand capability (kV rms)	275 kV
Basic insulation level (kV peak)	650 kV
Creepage distance for insulators (mm/kV)	31
Instrument Transformers	Hermetically sealed, dead tank design. Rating as per SLD
Insulator	Brown glazed with min 6kN cantilever Strength
Towers & Support Structures	MS galvanized lattice type
Tariff Metering equipment	Three elements four-wire configuration, electronic, digital, with accuracy class of 0.2S; 30 minutes intervals for a period of 70 days with intervals programmable from 5 minutes to 30 minutes

8.5 Steam Generator

Generator shall be supplied in line with the following specifications:

Table 10: Steam Generator Specifications

Description	Parameters
Rating & Count	1 x40 MW
Type	Synchronous type
Number of pole & Excitation System	Four pole, with brushless excitation system.
Power Factor	0.8 PF (lagging) to 0.95 (leading) under entire band of +10% voltage variation and +5% frequency variation
Insulation Class	Class 'F' insulation and shall be suitable for operation within class 'B' limits
Overload Requirements	Over loading of 110% for one hour every 12 hours and 150% for 30 seconds
Short Circuit and Overload Endurance	Generator shall withstand short-circuit of any kind at its terminal, while operating at rated load and 105% rated voltage for at least 3 seconds

8.6 Isolated Phase Bus Duct

Generator shall be connected to 11kV panel through Isolated Phase Bus Duct with Aluminum conductors. All other electrical distribution connections shall be through MV or LV rated cables as per application and voltage grade. Technical details of the Isolated Phase Bus Duct are given in the table below:

Table 11: Insolated Phase Bus Duct Specifications

Application	Steam Generator Connection to 11kV Panel
Power Frequency Withstand Voltage	28kV
BIL	75kVp
Enclosure	Minimum thick of 3mm
Sizing Basis	Maximum through fault current either from 132kV grid or from the generator including contribution from total plant loads through Auxiliary Transformers with 20% margin on higher side or 50kA, whichever is higher

8.7 11kV Switchboard

Switchboard rated 11kV IP4X 3200Amp 50kA for 3 sec shall be provided for feeding transformers and connection to steam generator.

8.8 6.6kV Panel

One (1) 2500A 6.6kV VCB stand-alone panels and HT 6.6kV XLPE Aluminum cables of adequate size shall be provided for interface of co-gen plant with existing sugar mill power house.

8.9 400 V Switchboard

All the cogeneration plant auxiliary loads shall be segregated into two groups, each consisting of AC Variable Speed Drive (AC VSD) driven loads and non-AC VSD driven loads.

All AC VSD loads pertaining to cogeneration plant shall be connected to two (2) AC VSD transformers. Common systems like cooling water [main & auxiliary cooling water pumps and cooling tower fans] shall be distributed uniformly on both VSD transformers.

The co-generation plant non-AC VSD loads shall be fed at 400V with two (2) 11/0.415kV transformers.

8.10 Transformers

Technical specifications of the different transformers to be installed in the Project are given in the table below:

Table 12: Specifications of Transformers

Description	Parameters
Generator transformer (GT) / Power Transformer	40/50 MVA 11/132kV YNd11
VSD transformers [Three winding transformer] for co-generation plant	4 MVA11/0.415/0.415 kV, Dzn0yn11
Distribution transformer for cogeneration Plant auxiliaries	1.6MVA, 11/0.415kV, Dyn11
Interconnection transformer at sugar plant	10/13MVA, 11/6.9kV, Dyn11

Lighting Transformer	Cast Resin Encapsulated 200kVA, 0.4kV/0.4kV, 50Hz, Dyn11, ONAN, Three Phase, Two Windings
Neutral Grounding Transformer	Yd windings, 50A for 10Sec & 500A for 3Sec, 11KV, ONAN

8.11 AC & DC UPS System

AC and DC UPS system will be supplied for loads that require un-interrupted power. Following UPS shall be supplied for this purpose:

Table 13: AC & DC UPS Specifications

Description	Parameters
110VDC	2x100% Dual Redundant UPS with Dedicated Battery Bank [SMF type: Sealed Maintenance Free]
230VAC UPS	2x100% Dual Redundant UPS with Dedicated Battery Bank [SMF type: Sealed Maintenance Free]
Lighting 230VAC UPS	1x100% UPS with single battery bank [SMF type: Sealed Maintenance Free]

8.12 Control Philosophy & Interfacing

Critical and important electrical loads shall be interfaced with SCADA system [built in plant DCS] for local and remote operation in-line with plant operational & safety requirements.

8.13 Energy Management System

The incoming and outgoing feeders of 132kV Switchyard Bays, Main MV [PCC] Panel and AC-VSD panel outgoing feeders shall be provided with PQM/TVM with communication port suitable for MODBUS-RTU protocol. One daisy chained link shall be provided for each switchboard which will communicate soft data to Plant DCS. All these meters shall be hooked up to a dedicated Energy Management System for data logging built in plant DCS.

Communication ports of MODBUS - RTU shall be planned in all TVMs and PQMs provided in the PCCs, AC VSD panels and control panels of the TG, Generator Transformer and switchyard control and relay panels. All the ports shall be hooked up to Energy Management System (Part of DCS) for data logging as well as monitoring purposes. The mimic representation of the complete electrical distribution shall be provided in Energy Management System (part of DCS) from 132 kV level to major/main LT panels.

8.14 RTDs & Thermistors

Thermistors shall be installed on motors rated between 30 to 75kW. RTD shall be made available for motors more than 90kW. All RTDs shall be hooked up with relays in Motor Relays in respective MCC.

8.15 System Earthing

The grounding installation work shall be as per recommendation of IEEE-80. All panels, transformer, LAVT, NGR and motors shall be provided with double earthing. Lightning protection for tall structure shall be in line with IEC standards.

132kV System is solidly grounded through 132 kV side of transformer neutrals at NTDC side as well as neutral of generator transformer on 132 kV side at co-generation plant.

TG system shall be grounded through Neutral Grounding Resistor (NGR) panel to limit the earth fault current to 50A to suit the system requirement, through the 11 kV neutral point of TG. The 11kV system shall be provided with 11 kV Earthing Transformer and Neutral Grounding Resistor (NGR) panel to limit the earth fault current to 50A. This NGR of earthing transformer shall be switched ON whenever the power is imported from the grid with TG circuit breaker in open condition. The 6.6kV system at the secondary side of Interconnection Transformer shall be provided with NGR grounding to limit earth fault current of 100A.

LV system 400V system shall be solidly grounded through transformer neutral. Neutral busbars shall be made available in 400V PCCs, and all MCCs.

400V VSD transformer grounding system shall be as for 6 Pulse AC VSD drives – Solidly grounded.

400V system used for illumination system and small power distribution system shall be solidly grounded.

UPS System shall be of insulated neutral type (ungrounded). DC System shall be of ungrounded type.

8.16 Cable Installation

Cables shall be installed in concrete cable trenches [installed on trays], on cable racks and direct buried as required.

8.17 Cable Trench

Concrete Cable Trenches shall be fitted with ventilation fans, air inlets, normal lighting, emergency lighting, utility sockets, fire alarm detectors, manual call points, and annunciation sirens. All wiring shall be in GI conduits.

Trench shall have access inlets provided with ladders, slopped on two sides having water excavation pits and two pumps.

8.18 Lighting & Small Power

Plant lighting loads shall be fed through two (2) Nos. of 400/400V, Dyn11 connected dry type lighting transformer of minimum rating of 200kVA.

Emergency Lighting Distribution Board (ELDB) shall be fed through inverter of minimum 20 kVA rating.

The number of sockets [where maintenance & operation is required] shall be provided in the indoor area in such a way that approachable distance of any socket is not more than 10M distance. Minimum four (4) nos. of 24V lighting kit shall be provided for the plant.

63A power and welding socket shall be provided in all indoor as well as outdoor area wherever maintenance of mechanical equipment is required. Each socket shall comprise of MCB with ELCB and power / welding socket.

8.19 Plant Communication System

Plant communication shall be provided with following facility:

- Telephone system
- Public Address System
- Walkie-talkies.

8.20 Enclosure Ratings

Enclosure IP ratings for different applications shall be as below:

Table 14: Enclosure Ratings

HV Switchgear	IP4X
LV Switchgears	IP4X
Switchgears located outdoors	IP55
Control Panels	IP42
Motors	IP55
Push Button Stations	IP54 (indoor) IP55 (outdoor)
Isolated Phase Bus ducts	IP54 (indoor) IP55 (outdoor)

8.21 Plant Startup

The co-generation plant shall be started with two (2) numbers of 400V Black start DG sets. These DG sets shall be connected to DG panel, which shall be planned with two incoming DG set feeder and five outgoing feeders.

Plant startup can also be managed either from Grid supply or existing plant sugar mill feeder. In either case power shall be available at the main 11kV MV Panel. Through respective step down distribution transformers power shall be fed to desired STG auxiliaries and common co-generation plant loads.

The DG set shall be with radiator cooled type. Proposed rating of DG set shall be 1500kVA at Prime duty.

8.22 Instrumentation and Control (I&C) Systems

I&C System will ensure control and monitoring of operations of both the technological and electrical part of Co-gen Power Plant including balance of plant (auxiliary operations) and 132 kV switchyard. Control room and its auxiliary equipment will be located in an outbuilding (CCR) adjacent to the Turbine Hall. I&C System will be designed as a complex system capable to control the whole Co-gen unit both in standard conditions and transient operating conditions (start-up, shutdown, etc.). Specific autonomous functions of protections and control for steam turbines will be performed by their dedicated control system, nevertheless this dedicated control system will be an integral part of the whole I&C System from the viewpoint of operation, monitoring and control. I&C System, as a whole, will ensure control and monitoring of the following equipment:

- Boiler and its Auxiliaries
- Fuel Handling System
- Ash Handling System

- Steam turbine with accessories
- Balance of plant
- Electric equipment of Switchyard

8.23 Digital Control System (DCS)

The controlling and monitoring of operation of main power unit, loading and synchronizing, balance of the plant will be provided from the common control room through the operator panels of the process, electrical part including power outlet equipment, frequency control and switchyard etc. The working place of the system operator will be placed at the control room. The working place of shift engineer will be located in separate room with the window to control room. The DCS will be based on fully redundant process and network bus. The power plant will be fully automated with a target of high operation reliability as well as high operation safety. Control system will fulfill required standard functions for securing optimal, economical, safe and ecological operation for installed equipment in nominal and transient operation conditions. System will cover control function from basic level control up to fully automated control of function groups and units, control of system output and optimization of block operation. Specific autonomous functions of the plant safety system and selected regulation and control functions will be realized by special subsystems in a hierarchical model. From a viewpoint of control, these items will create an integrated part of the DCS control system.

Hardware and software will enable realization of loop control, binary control, data functions, monitoring, remote control and emergency manual control. Communication within the system will be handled by bus routing connected to the standard bus system RS 485, Ethernet etc.

8.24 Field Instrumentation

Instrument power circuits will employ an isolation transformer and will be individually protected from fault with the help of MCB's and fuses. Power supply to the individual instrument will be disconnect-able with the help of switch and will be protected with the help of fuse.

All instruments and equipment will be suitable for use in a hot, humid and tropical industrial climate. All instruments and enclosures in field will be dust proof, weather proof of type NEMA 4 and secured against the ingress of fumes, dampness, insects and vermin. All external surfaces will be suitably treated to provide anti-corrosion protection.

The complete instrument system will be designed for safe operation, by using normally closed contacts which open on fault conditions.

The operating value of field instrument will fall between 40% and 60% span for linear and 60% to 80% span for square root.

Transmitter valve manifold block assemblies will be type 316 stainless steel unless process conditions require higher-grade material. Internal wetted parts will be type 316 stainless steel unless process conditions require use of other material.

Process switches e.g. pressure switch and level switch will be of micro switch type.

All field-mounted instruments will be equipped with sufficient isolation device such as a block and bleed valves assembly, and vent and drain valves so as to permit safe maintenance, removal, testing and calibration of instruments during plant operation

9 Operations and Maintenance (O&M)

The Facility will be a standalone operation under the management of the Plant Manager who shall be in charge of both technical and administrative functions of the co-generation facility's operation and maintenance. Most operation and maintenance functions will be performed by permanent staff; however, certain functions, such as performance monitoring of equipment, environmental monitoring, fuel yard operation, ash handling and major maintenance, will be performed under various contracts with specialized vendors. The contracts will be equipment specific performance monitoring and maintenance contracts and will also include contracts for supply of manpower for major maintenance activities. To the extent practical, the operation of the Facility will be automated through a distributed control system.

The Facility operation is planned to be divided into three shifts with a fourth shift in reserve. Each operating shift will include a shift charge engineer, one control room operator, one operator, one boiler operator two field operators and a chemist. All the operations staff will report through the shift charge engineers who report to the Operations Manager reporting to Plant Manager

The maintenance of the Facility will be divided into three work areas – instrumentation, electrical, and mechanical. Each work area will be managed by a manager who reports directly to the Plant Manager. Maintenance staff reporting to the managers will be provided on each shift. The total maintenance staff is as follows:

The maintenance staff will perform the routine maintenance on the Facility. During the off-season periods when the Facility is not operating, the maintenance staff will support any major maintenance work that needs to be performed.

In addition to the operation and maintenance departments, there will be a separate performance department and a fire and safety department. The staffing for these two departments is as follows:

Table 15: O&M Staffing

Mechanical Maintenance		Electrical Maintenance		Instrumentation & Control	
Manager – Mechanical	1	Manager – Electrical	1	Manager – I&C	1
Mechanical Engineer	1	Electrical Engineer	1	I&C Engineer	1
Mechanical Supervisor	1	Electrical Supervisor	1	I&C Supervisor	1
Mechanic/Fitter	8	Electrician	5	I&C Technician	5

The performance/efficiency engineer will be responsible for monitoring the operation of the Facility and identifying any operational issues that affect the performance of the Facility. Additional responsibilities include maintaining the plant design records and drawings.

Hence the total operation and maintenance staffing, including the Plant Manager, is 64. This excludes the contract operation and maintenance staff.

9.1 Maintenance of the Plant

Routine maintenance of the Project will be performed on a shift basis. Most of the routine maintenance activities are expected to be preventative maintenance work and troubleshooting during the time the Facility is operating. There will be some time during the off-season where the Facility will not be operating due to unavailability of bagasse or other appropriate biomass fuels.

During these non-operating periods, which shall last up to one month during a given year, the maintenance staff can perform more extensive repairs.

The major maintenance cycle for the key components will be a function of the number of operating hours accumulated. Given the expected downtime during the off-season, it is logical to expect boiler inspections, cleaning and repairs to be performed each year. The annual boiler work would include measurement of tube thickness in certain areas of the boiler, weld repairs where there is localized tube metal loss, tube replacements where the metal loss is more extensive, refractory repairs, grate bar replacements, grate chain adjustments, ash system repairs, etc. Extensive repairs would not be required for the first ten years of operation, particularly if the fuel burned is primarily bagasse and the operating period is less than 180 days a year.

Major maintenance on the steam turbine and generator is to be performed on a five to seven year basis for a base loaded plant. A thorough inspection of the steam turbine and generator is expected prior to the expiration of the supplier warranties. After that, given the expected operating regime of 180 days per year, the first major inspection of the steam turbine and generator would not be anticipated for ten years unless there are indications of some mechanical or electrical failure.

10 Key Operating Assumptions

The following sections provide a summary of the general, project cost, operating and financing assumptions related to the Project as well as KSML. The feasibility has been prepared following a detailed discussion of these assumptions with Project sponsors. The proceeding sections discuss the following assumptions:

- Sugar Mill Operations & Fuel Availability
- Plant Generation
- General & Timeline
- Project Cost
- Financing Assumptions
- Project Tariff & Revenue
- Operating Cost Assumptions (including fuel)

10.1 Sugar Mill Operations & Fuel Availability

The tariff structure of the Project is based on the availability of the Project to generate power, which in turn depends on the availability of fuel i.e. bagasse to ensure such generation. In such a scenario adequate availability of bagasse for generation is the most important factor for the feasibility of the Project.

As stated above, during the assumed 120-day crushing period, power generation will be based primarily on bagasse provided by KSML. During non-crushing days, the un-utilized bagasse from the crushing period at KSML will be utilized for power generation. Key assumptions with regards to availability of bagasse are summarized below:

- KSML management plans to bring efficiencies in the current sugar mill which will increase the crushing capacity to 10,000 TCD by the time the project comes online
- Based on a 120-day season and 97% capacity utilization, the mill shall be able to generate 337,466.88 MT of bagasse during the crushing period.
- During the 120-day crushing season 297,339.3 MT of bagasse shall be consumed of which 82,640 MT shall be consumed by the LP system.

- Approximately 40127.58 MT of bagasse shall be un-utilized/saved at the end of the season which shall enable the Plant to run approximately 29 days at a 92% capacity factor.
- As a consequence, the based on the above bagasse availability assumptions the Plant shall be capable of operating at a 92% capacity factor for 157 days in a year or an effective 145 days.

10.2 Plant Generation Parameters

As discussed earlier, 40 MW steam turbine generator shall be provided steam by the HP boiler. During the crushing period, the HP boiler and steam turbine shall meet the steam and power requirements of KSML to the extent these are not met by the LP boiler. To meet the steam requirements of the KSML process, the current LP boiler along with a 2X4 MW (net) backpressure turbo generator shall be operational during the crushing period. The steam generation through the LP system shall only be available during the season and will be dedicated to the sugar mill. Key generation parameters during are as follows:

Table 17: Plant Generation

	Crushing Period	Non-Crushing Period
Extracting & Condensing Turbine Capacity	40 MW	40 MW
Auxiliary Consumption of Turbine	3.6 MW	3.6MW
Net Capacity from HP System	36.4 MW	36.4 MW
Gross Capacity of Backpressure Turbo generator	8.00 MW	n/a
Auxiliary Consumption of Backpressure Turbo generator	1.00 MW	n/a
Net Capacity of LP System	7.00 MW	n/a
Sugar Mill Requirement	11.666 MW	0.50 MW
Net Exportable to Sugar Mill from HP System	7.07 MW	0.50 MW
Net Exportable to Grid from HP System	29.33 MW	35.90 MW
Generation (92% PF)	91.204 MWh	52,545 MWh

10.3 Project Timeline

As per discussions with the Sponsors a 19 ~ 20-month construction time following financial close has been assumed for the Project. Financial Close is targeted in end- April 2017 with a target Project commercial operations date **("COD")** of end-November 2018. As per the standard energy purchase agreement ("EPA") the Project life and EPA term has been assumed as 30 years from COD.

10.4 Project Cost

The breakdown of the estimated Project Cost is provided below in Table 8. The engineering, procurement & construction cost accounts for [X] of the total Project Cost. The Project Cost in Pakistan Rupees assumes an annual devaluation of 5.0% over the 19-month construction period. It may be noted that only 40% of the devaluation over the construction period is to be adjusted in the final tariff to be determined by NEPRA and the financial projections incorporate this assumption.

Table 18: Estimated Project Cost

Estimated Project Cost	USD Million	PKR Million
EPC Cost	44.00	4,796.00
Non-EPC Cost	2.50	272.50
Project Development Costs	2.97	323.73
Insurance during Construction	0.44	47.96
Financing Fee & Charges	1.34	145.83
Interest during Construction (IDC)	3.43	373.81
TOTAL	**54.68**	**5959.83**
EPC Cost per MW (USD million)	*1.37*	
Project Cost per MW (USD million)	*1.10*	

10.4.1 EPC Cost

EPC cost at USD 1.10 per kW has been based on applicable costs in precedent transactions with an adjustment for smaller plant size. The Company is in the finalizing the equipment for the Project as well as it development approach i.e. EPC or multiple vendor package and this shall be updated in due course.

10.4.2 Non-EPC

Non-EPC costs include costs related to

- Land, colony and workshop estimated at USD 1.0 million
- Non-reimbursable fuel during testing at USD 0.64 million based on an estimated bagasse consumption of 20,000 MT.
- Other related costs of approximately USD 0.86 million

10.4.3 Project Development

Project Development costs include costs related to technical studies, owners' engineer, construction manager as well as legal and other advisors estimated at USD 1.34 million; fees related to NEPRA, AEDB, SECP as well guarantee costs estimated at USD 0.26 million; and Company overheads during the construction period estimated at USD 1.37 million.

10.4.4 Construction Insurance

Construction Insurance has been budgeted at 1.0% of EPC cost, which is in line with precedent transactions.

10.4.5 Financing Fees & Charges

Financing Fees & Charges have been estimated in line with precedent transactions and have been budgeted in the range of 3.5% of total debt.

10.4.6 Interest during Construction

Interest during Construction has been calculated over a 19-month construction period, a75:25

month period is based on an advance payment of 15.0%; final acceptance payment of 5% and an equal distribution over the remaining 17 months. The payment profile shall be firmed at the time of finalization of the EPC contract(s).

10.5 Project Financing

In line with debt financing parameters with precedent transactions a debt to equity assumption 75 to 25 has been applied to the financial projections; although the Sponsors expect to pursue a 80:20 structure. Under the base case financial projections debt is assumed to be repaid 10 years after COD with debt being amortized over the period through fixed annuity based installments.

The Project meets the eligibility requirements set under the State Bank of Pakistan's "Revised SBP Financing Scheme for Renewable Energy" issued on June 20th, 2016. The Company intends to avail this refinancing scheme, which shall further improve the financial feasibility of the Project due to a lower fixed financing rate of 6% as compared to 3-month KIBOR plus 3.0% in case of conventional financing. Key parameters of the Project funding in case of both the debt financing options are provided in Table 9 below:

Table 19: Project Funding

	Conventional Funding	SBP Refinancing Scheme
Project Cost	PKR 5,959.83 million	*PKR 5,808.47 million
Debt	PKR 4,469.87 million	PKR 4,356.35 million
Equity	PKR 1,489.96 million	PKR 1,452.12 million
Lending Rate	9.44% *(3-month KIBOR + 3.0%)*	6.0%
Repayment Period	10 years	10 years
Repayment Frequency	Quarterly	Quarterly
Annual Installment	PKR 595.98 million	PKR 580.85 million

**Project Cost lower due to lower interest during construction costs. 3-month KIBOR assumed at 6.44%*

10.6 Project Tariff

NEPRA had announced a 30-year Upfront Tariff for high pressure boiler based bagasse power projects in May 2013 which was valid for a period of 2 years. Subsequently, the Upfront Tariff was extended up to May 2017 and in the meanwhile an adjusted Upfront Tariff ("Adjusted Upfront Tariff") was announced based on indexations applicable at May 2015. As per discussions with NEPRA, the Adjusted Upfront Tariff shall be applicable for the Project.

The Adjusted Upfront Tariff is calculated on notional capacity of 1 MW with appropriate indexing of different tariff determining components. This tariff structure is generic in nature and is applicable for various sizes of new bagasse based co-generation power plants of 60 bar or higher pressure boilers. The critical assumptions upon which the tariff is based appear in the table below:

Table 20: Key Assumptions for Adjusted Upfront Tariff

Description	Basis
Auxiliary Consumption	8.5%
Plant Factor	45%
EPC cost per MW	USD 0.7960
Project Cost per MW	USD 0.9795
Construction Period	20 months
Exchange rate (PKR/USD)	101.60
Benchmark Efficiency	24.5%
Bagasse Price	Linked to CIF Karachi Coal Price, Minimum USD 100.67 per MT
Bagasse CV	6,905 BTU/kg
Total O&M Cost	3.25% of EPC
Variable O&M Local	15% of total O&M
Variable O&M Foreign	45% of total O&M
Fixed O&M Local	40% of total O&M
Insurance	1.0% of EPC
Working Capital	45 days of Fuel @ 3 month KIBOR plus 2.0%
Debt	80%
Return on Equity	17.0%
Return on Equity during Construction	17.0%
Loan Repayment Period	10 years
Repayment Frequency	Quarterly
Debt Cost	3 month KIBOR plus 3.0% (Base KIBOR: 6.99%)

Respective tariff components along with relevant indexations are provided in Table 11 below:

The tariff is payable on a take or pay basis based on the declared availability of the Plant by the Company. Key features of the tariff applicability are as follows:

1. For all energy dispatched to the grid, a tariff based on the sum of indexed values of all the above mentioned components shall be payable.
2. During the crushing period, if the Plant is not dispatched following a declaration of energy a tariff based on the sum of indexed values of all the above mentioned components shall still be payable based on the declared energy.

3. During the non-crushing period, if the Plant is not dispatched following a declaration of energy a tariff based on the sum of indexed values of all the above mentioned components (excluding the fuel and variable components) shall be payable based on the declared energy.

4. All upside and downside risk with respect to the annual generation lies with the Company. In case the Company is able to achieve a plant factor above 45% the full indexed tariff shall be payable.

Table 21: Adjusted Upfront Tariff

DESCRIPTION	REFRENCE TARIFF PKR PER KWH		INDEXATION
	YEAR 1-10	YEAR 11-30	
Fuel Cost	5.9825	5.9825	Yearly PKR/USD parity and annual CIF Coal Price w.e.f 1st October of each year
Variable O&M – Local	0.1198	0.1198	Quarterly CPI changes notified by FBS on start of each quarter
Variable O&M – Foreign	0.3393	0.3393	Quarterly changes in PKR/USD and US CPI changes notified by Bureau of Labor Statistics on start of each quarter
Fixed O&M	0.3194	0.3194	Quarterly CPI changes notified by Federal Bureau of Statistics ("FBS") on start of each quarter
Insurance	0.2204	0.2204	No indexation
Working Capital	0.1673	0.1673	Quarterly adjustment for changes 3 M KIBOR After onetime adjustment at COD, annual changes in PKR/USD parity
Return on Equity	1.0345	1.0345	After onetime adjustment at COD, quarterly changes in 3-M KIBOR
Debt Serving Component	3.6658		
Total Tariff	**11.8491**	**8.1833**	
Levelized Tariff	**10.5727**		

Note: The tariff is adjusted quarterly for changes in 3-month KIBOR variations. The financial projections have been prepared on the basis of the recent 3-month KIBOR rate of 6.44% with the tariff and related cost adjusted accordingly.

10.7 Project Revenue

As stated above, the Project shall be selling power to the national grid as well as partially meeting the power and steam requirements of ISML. In such a case, the Project shall be expecting three (3) revenue streams as follows:

Sale of energy to national grid i.e. CPPA-G
Sale of energy to ISML
Sale of steam to ISML

For sake of transparency, energy sold to the sugar mill shall be billed at the same rate as CPPA-G. Steam shall be priced at the increased fuel cost applicable in case of operating in the extraction mode during the crushing period as opposed to a condensing mode during the non-crushing period. For clarity, please refer to the respective fuel consumption of HP system during the crushing and non-crushing period in Section 6.1 above. In case of base case financial projections, the difference in consumption is 14.72 MT per hour.

A breakdown of the energy sold to the national grid and ISML during the crushing and non-crushing period are provided in Table 22 below:

Table 22: Project Generation Mix

	Crushing Period	Non-Crushing Period
Total Generation	91,204 MWh	52,545 MWh
Sale to National Grid	73,489 MWh	51,823 MWh
Sale to Sugar Mill	17,715 MWh	722 MWh

10.8 Operating Cost Assumptions

Operating Costs comprise of fuel costs, operations and maintenance costs as well as insurance costs.

Fuel cost has been assumed based on the consumption parameters for the crushing and non-crushing period stated in Section 6.1 above being 80 MT/hour and 55.20 MT/hour respectively. This translates into an efficiency of 22.80% and 29.90% respectively. Bagasse has been priced as per the methodology stated in the Upfront Tariff.

Operating assumptions are based on input from technical consultants and similar projects. O&M Costs have been assumed at 3% of EPC Cost. Variable costs have been approximated at 60% of total O&M Costs. Variable costs can be further divided into foreign variable, which will be 75% of total variable and local variable, which will be 25% of total variable costs.

Based on the above parameters, Fixed O&M Costs are budgeted/assumed at PKR 58 million while Variable O&M Costs are budgeted/assumed at PKR 86 million.

Insurance cost is assumed at 1.00% of EPC Cost per annum. This results in an annual insurance cost of approximately PKR 48 million.

10.9 Working Capital Assumptions

Working capital is based on 1 month of bagasse advance to sugar mill, 2-months accounts receivable from the power purchaser and 1-month account receivable from associated companies. Interest on working capital is assumed to be 3-month KIBOR plus 2.00%.

11 Financial Assessment

The following section provides a financial evaluation based on the base case financial assumptions stated above.

11.1 General

The base case financial projections show that the Project is expected to generate positive earnings before interest, taxes and depreciation (EBITDA) and net profits throughout the life of the Project. A summary of key investment and financial indicators applicable to Project financing based on base case projected financials over the life of the project is provided in Table 13 below. Please note that the Project generates significant benefits for KSML and therefore indicators have been included which incorporate the net benefit to KSML as well. Net benefit to KSML is defined as Revenue from Sale of Bagasse to KSML less cost of energy and steam paid to the Project Company by KSML.

Table 23: Key Financial Indicators

Indicator	
Project IRR	10.99%
Project IRR (inc. Net KSML Benefit)	15.39%
Equity IRR	17.56%
Equity IRR (inc. Net KSML Benefit)	28.97%
Debt Service Coverage Ratio	1.45
Debt Service Coverage Ratio (inc. Net KSML Benefit)	1.85
Project Payback Period	6 years, 6 months approx.
Project Payback Period (inc. Net KSML Benefit)	5 years, 2 months approx.
Equity Payback Period	11 years, 9 month approx.
Equity Payback Period (inc. Net KSML Benefit)	8 years, 10 month approx..

Note: The above numbers are based on conventional power project financing parameters assuming a lending rate of 3-month KIBOR plus 3.0%. The numbers will approve in case the Project is able to receive funding under the State Bank of Pakistan's "Revised SBP Financing Scheme for Renewable Energy" at a rate of 6.0%.

11.2 Sensitivity Analysis

Sensitivity of investment returns and debt service coverage ratios to a number of key variables are provided in the tables below:

Table 24: Sensitivity to EPC Cost

EPC COST (USD MM/MW)	DSCR		Equity IRR	
	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill
1.00	1.60	2.04	21.79%	33.73%
1.05	1.52	1.94	19.61%	31.26%
1.10	1.45	1.85	17.58%	28.95%
1.15	1.38	1.77	15.72%	26.80%
1.20	1.32	1.69	14.03%	24.82%

Table 25: Sensitivity to Sugar Mill Utilization

Sugar Mill Utilization	DSCR		Equity IRR	
	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill
72%	1.24	1.57	11.97%	21.62%
77%	1.31	1.67	13.78%	24.08%
82%	1.38	1.76	15.65%	26.53%
87%	1.45	1.85	17.51%	28.97%
92%	1.52	1.94	19.49%	31.38%

Table 26: Sensitivity to Third Party Bagasse

Third Party Bagasse M.T	DSCR		Equity IRR	
	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill	Power Project Stand-alone	Incl. Bagasse Sale Benefit to Sugar Mill
0	1.21	1.62	11.33%	23.02%
20,000	1.35	1.75	14.83%	26.42%
40,000	1.49	1.88	18.48%	29.82%
60,000	1.62	2.02	22.20%	33.18%
80,000	1.75	2.14	25.92%	36.47%

11.3 Projected Financial Statements

Projected financial statements and key financial ratios based on the base case assumptions discussed in Section 6 are providing in the following sections. Statements have been prepared assuming the conventional debt financing rate of 3-month KIBOR plus 3.0% as well as the 6.0% fixed rate available under State Bank of Pakistan's "Revised SBP Financing Scheme for Renewable Energy". Financial Statements presented below a limited to the 10-year debt period. Projections for Year 11 onwards may be viewed in the Project financial model.

Table 27: Projected Income Statement (Conventional Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
REVENUE										
Power to Sugar Mill	228	228	228	228	228	228	228	228	228	228
Power to CPPA-G	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550
Steam for Sugar Mill	198	198	198	198	198	198	198	198	198	198
TOTAL REVENUE	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**	**1,975**
UEL & O&M COSTS										
Bagasse Cost	891	891	891	891	891	891	891	891	891	891
Local Variable O&M	22	22	22	22	22	22	22	22	22	22

Foreign Variable O&M	69	69	69	69	69	69	69	69	69	69
Local Fixed O&M	57	57	57	57	57	57	57	57	57	57
Total O&M Cost	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**
Insurance Cost	48	48	48	48	48	48	48	48	48	48
Depreciation	199	199	199	199	199	199	199	199	199	199
EBIT	**690**	**690**	**690**	**690**	**690**	**690**	**690**	**690**	**690**	**690**
Working Capital Cost	29	29	29	29	29	29	29	29	29	29
Interest on LT Loan	416	416	416	416	416	416	416	416	416	416
Net Income	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**245**	**245**

Table 28:Projected Balance Sheet (Commercial Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
Fixed Assets	5,761	5,563	5,364	5,165	4,967	4,768	4,569	4,371	4,172	3,973
Advance										
Accounts Receivable										
Debt Reserve										
Cash										
TOTAL CURRENT	**5,761**	**5,563**	**5,364**	**5,165**	**4,967**	**4,768**	**4,569**	**4,371**	**4,172**	**3,973**
Accounts Payable										
Working Capital										
Debt Current Portion	200	219	241	264	290	319	350	384	422	-
CURRENT LIABILITIES	**200**	**219**	**241**	**264**	**290**	**319**	**350**	**384**	**422**	-
Long Term Debt	4,088	3,869	3,628	3,363	3,073	2,755	2,405	2,021	1,599	1,599
TOTAL LIABILITIES	**3,144**	**2,910**	**2,654**	**2,372**	**2,063**	**1,723**	**1,351**	**942**	**493**	-
Paid-up Capital	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490
Retained Earnings	-17	-15	5	47	113	205	325	476	661	884
TOTAL EQUITY	**1,473**	**1,474**	**1,495**	**1,537**	**1,603**	**1,695**	**1,815**	**1,966**	**2,151**	**2,374**
EQUITY & LIABILITIES	**5,761**	**5,563**	**5,364**	**5,165**	**4,967**	**4,768**	**4,569**	**4,371**	**4,172**	**3,973**

Table: 29 Projected Cash Flows (Conventional Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
Earnings after tax	245	263	282	304	327	353	381	413	447	228
Add: Depreciation	199	199	199	199	199	199	199	199	199	199
Change in Advances										
Change in Accounts										
Receivable										
Change in Debt Services										
Reserve										
Change in Accounts										
Cash										

Table 30: Projected Cash Flows (Conventional Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
Cash Flow from Operations	245	263	282	304	327	353	381	413	447	228
Cash Flow from Investments	199	199	199	199	199	199	199	199	199	199
Repayment of Long Term Debt	(182)	(200)	(219)	(241)	(264)	(290)	(319)	(350)	(384)	(422)
Repayment of Working Capital Loan	-	-	-	-	-	-	-	-	-	-
Disbursement of Equity	-	-	-	-	-	-	-	-	-	-
Cash Flow from Financing	(182)	(200)	(219)	(241)	(264)	(290)	(319)	(350)	(384)	(422)
Net Cash Flow	**261**	**261**	**261**	**261**	**261**	**261**	**261**	**261**	**261**	**261**
Bagasse Sold by Sugar Mill	780	780	780	780	780	780	780	780	780	780
Power Purchase by Sugar Mill	228	228	228	228	228	228	228	228	228	228
Steam purchase by Sugar Mill	198	198	198	198	198	198	198	198	198	198
Net Bagasse Sale Benefit to Sugar Mill	244	244	244	244	244	244	244	244	244	244
Consolidated Net Cash Flow	505	505	505	505	505	505	505	505	505	505

Table 31: Projected Income Statement (SBP Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
REVENUE										
Power to Sugar Mill	228	228	228	228	228	228	228	228	228	228
Power to CPPA-G	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550
Steam for Sugar Mill	198	198	198	198	198	198	198	198	198	198
TOTAL REVENUE	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**	**1,976**
UEL & O&M COSTS										
Bagasse Cost	891	891	891	891	891	891	891	891	891	891
Local Variable O&M	22	22	22	22	22	22	22	22	22	22
Foreign Variable O&M	69	69	69	69	69	69	69	69	69	69
Local Fixed O&M	57	57	57	57	57	57	57	57	57	57
Total O&M Cost	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**	**148**
Insurance Cost	48	48	48	48	48	48	48	48	48	48
Depreciation	194	194	194	194	194	194	194	194	194	194
EBIT	**695**	**695**	**695**	**695**	**695**	**695**	**695**	**695**	**695**	**695**
Working Capital Cost	29	29	29	29	29	29	29	29	29	29
Interest on LT Loan	254	234	213	190	166	140	113	84	39	7
Net Income	**411**	**432**	**453**	**476**	**500**	**525**	**552**	**581**	**627**	**658**

Table 32: Projected Balance Sheet (SBP Financing)

PKR Million	1	2	3	4	5	6	7	8	9	10
Fixed Assets	5,615	5,421	5,228	5,034	4,840	4,647	4,453	4,260	4,066	3,872
Advance										
Accounts Receivable										
Debt Reserve										
Cash										
TOTAL CURRENT ASSETS	**5,615**	**5,421**	**5,228**	**5,034**	**4,840**	**4,647**	**4,453**	**4,260**	**4,066**	**3,872**
Accounts Payable										
Working Capital										
Debt Current Portion	349	370	393	417	442	469	498	544	561	-
CURRENT LIABILITIES	**349**	**370**	**393**	**417**	**442**	**469**	**498**	**544**	**561**	-
Long Term Debt	3,679	3,309	2,917	2,500	2,058	1,588	1,090	561	-	-
TOTAL LIABILITIES	**4,028**	**3,679**	**3,309**	**2,917**	**2,500**	**2,058**	**1,588**	**1,090**	**561**	-
Paid-up Capital	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452
Retained Earnings	135	290	466	665	888	1,137	1,413	1,717	2,053	2,420
TOTAL EQUITY	**1,587**	**1,742**	**1,918**	**2,117**	**2,340**	**2,589**	**2,865**	**3,159**	**3,505**	**3,872**
EQUITY & LIABILITIES	**5,615**	**5,421**	**5,228**	**5,034**	**4,840**	**4,647**	**4,453**	**4,260**	**4,066**	**3,872**

Table 33: Projected Cash Flows (SBP Financing)

PKR Million	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Earnings after tax	411	432	453	476	500	525	552	581	612	644
Add: Depreciation	194	194	194	194	194	194	194	194	194	194
Change in Advances	-	-	-	-	-	-	-	-	-	-
Change in Accounts	-	-	-	-	-	-	-	-	-	-
Receivable	-	-	-	-	-	-	-	-	-	-
Change in Debt Services	-	-	-	-	-	-	-	-	-	-
Reserve	-	-	-	-	-	-	-	-	-	-
Change in Accounts Payable	-	-	-	-	-	-	-	-	-	-
Cash Flow from Operations	**605**	**625**	**647**	**669**	**693**	**719**	**746**	**775**	**805**	**838**
Cash Flow from Investments	-	-	-	-	-	-	-	-	-	-
Repayment of Long Term Debt	(328)	(349)	(370)	(393)	(417)	(442)	(469)	(498)	(529)	(561)
Repayment of Working Capital Loan	-	-	-	-	-	-	-	-	-	-
Disbursement of Equity	-	-	-	-	-	-	-	-	-	-
Cash Flow from Financing	(328)	(349)	(370)	(393)	(417)	(442)	(469)	(498)	(529)	(561)
Net Cash Flow	**277**	**277**	**277**	**277**	**277**	**277**	**277**	**277**	**277**	**277**
Bagasse Sold by Sugar Mill	780	780	780	780	780	780	780	780	780	780
Power Purchase by Sugar Mill	228	228	228	228	228	228	228	228	228	228
Steam purchase by Sugar Mill	198	198	198	198	198	198	198	198	198	198
Net Bagasse Sale Benefit to Sugar Mill	244	244	244	244	244	244	244	244	244	244
Consolidated Net Cash Flow	**521**	**521**	**521**	**521**	**521**	**521**	**521**	**521**	**521**	**521**

Table 34: Financial Summary (All Figures in PKR million other than ratios)

PKR Million	Min	1	2	3	4	5	6	7	8	9	10
Revenue	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976
EBITDA	888	888	888	888	888	888	888	888	888	888	888
EBITDA Consolidated	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133
Net Income	**411**	**411**	**432**	**453**	**476**	**500**	**525**	**552**	**581**	**612**	**644**
Dividend	521	521	521	521	521	521	521	521	521	521	521
Annual Interest	**50**	**283**	**263**	**242**	**219**	**195**	**169**	**142**	**113**	**83**	**50**
Debt Servicing	612	612	612	612	612	612	612	612	612	612	612
Debt Equity	-	2.54	2.11	1.73	1.38	1.07	0.79	0.55	0.34	0.16	-
Times Interest	3.14	3.14	3.38	3.67	4.05	4.56	5.24	6.24	7.83	10.72	17.61
Times Interest (Consolidated)	**4.00**	**4.00**	**4.30**	**4.68**	**5.17**	**5.81**	**6.69**	**7.96**	**9.98**	**13.66**	**22.45**
DSCR	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
DSCR (Consolidated)	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**	**1.85**
Loan Life Cover Ratio	1.32	1.32	1.34	1.35	1.36	1.38	1.39	1.41	1.42	1.44	1.46

12 Risk Analysis and Mitigants

12.1 Power off-take

The risk that the power purchaser may not request off take

The risk is covered through enforceable take or pay clauses in the EPA. The RE Policy provides guaranteed off take to bagasse based co-generation projects during the sugar crushing season. KSML will be entitled for full tariff excluding fuel component & variable component of O&M during off season for all electricity units capable of producing against which CPPA refuses to take delivery. During crushing season, tariff against such units will include fuel cost & variable O&M components as well. Moreover, KSML shall receive full tariff payment against all dispatched units regardless of season/offseason and quantum of units over and above benchmarked for determination of Upfront Tariff.

12.2 Payment Risks

The risk that NTDC (GoP) neglects upon timely payments

The tariff of this project will put this project in the middle of the merit order list of power plants in the country i.e. above furnace and even wind based power project but below gas and hydel project. It is highly unlikely that payments to this project will be delayed. Moreover, as per the EPA, delayed payments from the power purchaser will carry an interest rate of KIBOR plus 450bps.

12.3 Availability of Fuel

The risk that the Project is not able to obtain bagasse for its generation

KSML will be the primary supplier of fuel (bagasse) to CPL. Given the availability of cane in the gate/open area, KSML can conveniently operate the plant at over 90% capacity which will provide produce 302,760 MT of bagasse in the crushing season, whereas additional bagasse can be procured from Sugar mills of the surrounding area.

12.4 Force Majeure

Risks that project stops operation and the debt repayments are terminated due to unforeseen events

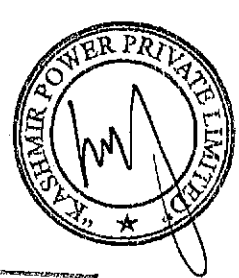
There is similar coverage available to bagasse cogeneration IPP in the event of PPFME and CLFME as is available to thermal and wind IPPs. In fact the coverage in this case is slightly greater as it extends to the debt repayment component in case if COD is delayed because of a force majeure event. Such repayment though recoverable from the equity IRR later on, however protects lenders interests. As such, the FME events pose no greater a risk than in this case.

12.5 Political Risk

The risk that a major unforeseen political event such as an abrupt change in political regime or negative attitude of successive government towards cogeneration projects affects off-takes or payments

Even though the cogeneration policy has been taken up seriously by the present government only, the cogeneration projects generally are very much economically feasible for the country and they also exist throughout the world including neighboring India. Tariff wise the plants are cheapest source of energy given the time it takes for construction (gas, coal and hydel power projects are cheaper but have long gestation periods). Overall, the cogeneration projects and the policy are fully feasible (financially and technically) and hence are expected to flourish in the future.

SAFETY, EMERGENCY, TRAINING & DEVELOPMENT PLANS



Safety Plan

To provide a safe working environment, the company shall follow a well devised safety plan. Key features of safety plan are given below:

Awareness

Staff working at the facility shall be given information to help them to identify the risks and take necessary measures of safety and protection during their working. To create awareness, personnel at the facility shall be briefed through handouts, in-house seminars, mock safety drills. Particular areas of interest shall be:

- Moral Obligation
- Hazard Recognition
- Importance of Personnel Protective Equipment (PPEs)
- Accident Prevention
- Importance of House Keeping
- Machine Guarding
- Fire Prevention
- Fire Protection
- Fire Fighting

Use of Safety Equipment

Use of Personal protective equipment (PPEs) will be made mandatory. PPEs like safety helmet, safety shoes, uniform, dust mask, ear plugs, ear muff, leather apron, leather sleeves, face shield, gloves for their safety shall be issued to all personnel.

Emergency Alarms

Automatic Emergency Alarms shall be installed along with fire suppression system at all fire hazardous locations of the plant site.

Emergency Numbers

Emergency call numbers shall prominently be displayed in bold at prominent places in the facility.

Emergency Shutdown

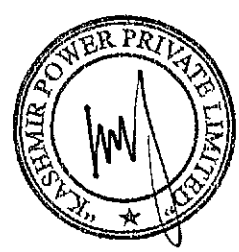
The Emergency Response Team shall be responsible to ensure immediate shutdown of the operational systems and equipment if required in the Emergency.

First Aid Facilities

The availability of first aid facilities and necessary staff to provide urgent and immediate first aid facilities will be ensured at the facility.

Ambulances

Availability of Ambulance at the facility shall be ensured for causality evacuation to the hospitals.



Mock Fire Drills

To keep fire brigade staff in good practice, mock fire drill will be executed by creating mock emergency situations.

Firefighting System

The function of fire-fighting system is to supply water to the main risk areas of the cogeneration power plant.The fire protection system is required for early detection, containment and suppression of fires. A comprehensive fire protection system shall be provided to meet the above objective and all statutory and insurance requirements of National Fire Protection Association (NFPA).The fire-fighting system shall consist of the following:

Stand Pipe and Hose System:

Stand pipe and hose system shall be provided to cover the building and structures of the cogeneration plant. The system shall be designed as per the NFPA 14.
Standpipe shall have a hose of 65mm diameter with connection to a large supply of water. The hose connection shall be not less than 0.9m or more than 1.5m above the floor.

Fire Hydrant and Water Monitoring System

The hydrant system shall be provided to cover all areas. The system shall be designed as per NFPA 24. The system shall consist of over ground hydrant mains laid in rings, isolation valves, and stand pipes with hydrant valves (outdoor). A Hydrant shall be placed after every 40m.

Portable Fire Extinguishers:

Dry Chemical Powder, CO2 and foam type extinguisher system shall be provided. The equipment shall be designed as per NFPA 10.

Automatic High Velocity Water Spray Nozzle System:

Automatic High Velocity Water Spray Nozzle System shall be provided along with deluge valve assembly for outdoor transformers in switchyard, generator & Turbine lube oil system area. The system shall be designed as per NFPA 15. The deluge valve assembly shall be UL/FM listed.

Fire Alarm & Detection System

Fire detection system for the power plant will provide early detection of fire and raise alarm. A comprehensive fire protection system shall be planned to meet the above objective and meet all statutory and insurance requirements of National Fire Protection Association (NFPA). A multitude of systems will be provided to combat various types of fires in different areas of the plant and all such systems for various areas shall form a part of a centralized protection system for the entire plant. Fire alarm system detection system shall be provided in following areas:

- Firm alarm and signalling in all electrical/instrumentation panel rooms in TG building
- Manual call points and Electric Horns in outdoor areas.

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Emergency Plan

A comprehensive emergency plan would be implemented to meet unexpected situation to ensure zero injury, damage or loss of any life/property.

Key features of the emergency plan are as follows;

Emergency Escapes/Evacuation Plan

A comprehensive evacuation plan will be prepared and emergency escape procedure and route maps will be displayed at prominent places in the facility. All personnel at the facility shall be made aware of Emergency escape routes and procedures for a quick and safe escape.

Awareness of Different Types of Emergencies

All personnel at the facility shall be educated on how to react to each type of emergency. All staff working at the facility will be given detailed briefing regarding different types of emergencies and their response so that they would be able to identify emergency situations.

Training to React to an Emergency Alert Alarm

All personnel at the facility shall be trained to react to each emergency to take necessary measures of safety and protection at the earliest.

Emergency Equipment

In addition to emergency combatants training, emergency equipment like fire extinguishers and fire hydrants will be provided at the facility to tackle with different types of Emergency.

Use of Safety Gears and Equipment

The staff working at the facility will be given with proper information, guidance and training about the use the safety gears and equipment.

Emergency Alarm

Easy access to emergency alarms shall be provided to raise the alarm in case of any type of Emergency.

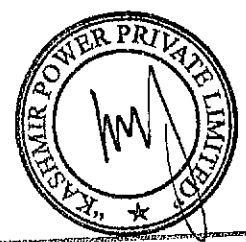
Emergency Numbers

Emergency call numbers shall prominently be displayed at prominent places in the facility.

Emergency Response Team

A well-equipped and specialized team will be formed which will be responsible to take all necessary measures and decisions to deal with the emergency and provide relief, support and first aid to the effected staff. The emergency response team will also be responsible for the evacuation of personnel and material from the premises.

Emergency Shutdown



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The Emergency Response Team shall be responsible to ensure immediate shutdown of the operational systems and equipment if required in the Emergency.

Assembly Areas and Muster Points

Designated assembly areas / Muster points shall be identified and all personnel working at the facility will be educated to muster at the designated assembly area / muster points in the event of an evacuation for head count.

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Training and Development

The major objectives of the operational training shall be to acquaint the operators of the following:

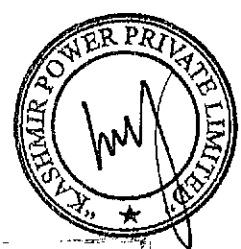
- The nature, purpose and limitations of all plant and equipment.
- The detailed operating instructions on each section and equipment of the plant.
- Normal start up and shutdown program for the unit.
- The emergency procedures.

The basis, for the training shall be the Plant's operating and Maintenance Manual Particulars Book, which shall be compiled from the manufacturers' instructions, the contract documents and the drawings. In addition, the information gathered from the visits to the other operating plants and to the manufacturers works shall also be included in the training. Supervision and co-ordination of the training program requires full time attention of a senior executive of the plant, and also the consultant's assistance may be taken. The training program shall include lectures, expositions by experienced plant operators and maintenance personnel, informal discussions and visits to operating plants and manufacturer's works and exposure to the courses conducted by Institutions like Power Plant Training Institute or any other Institution to be given to the operating & maintenance staff.

The maintenance training program shall be based on the requirements of the individual maintenance functions, like mechanical, electrical, instrumentation etc. The Engineers and the Technicians shall be sent to the manufacturers' works to witness the production and be associated with the erection of plant and equipment.

The Power Plant shall be equipped with proper measuring/testing instrument for periodic cross checking of parameters shown in the control room and power plant area local gauges. Logging of data and periodic review of the plant operation, review of failures, break downs, etc. should be done to improve the availability of the plant.

CONTROL, METERING, INSTRUMENTATION AND PROTECTION



Control. Metering, instrumentation and protection:

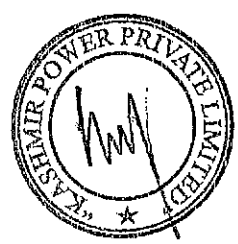
The power generating system will be well equipped with the modern protection & control technologies. All protections in system are capable to safeguard any level of control with onsite metering provision. Below are the main power plant protection panels / instruments planned:

Protections available:

1. List of Protections available in Multifunction Generator Protection Relays —GPR-1 & 2
   a) Generator differential protection (87g)
   b) 95% stator e/f protection (51g1)
   c) Field failure or loss of field protection (40g)
   d) Negative sequence protection (46g)
   e) Low forward power (37)
   f) Reverse power (32)
   g) Under/over voltage (27/59)
   h) Under/over frequency (81u/810)
   i) Over fluxing protection (24)
   j) Non-dir. Inst. Cum IDMT o/c pro. (50/51)
   k) Voltage restrained/dependent over current (Sly) I) Generator pole slipping protection (98)
   m) Accidental energisation protection (50/27)
   n) Local breaker backup pro. (50Ibb)
2. STAN BY E/F PROTECTION (51G)
3. ROTOR E/F RELAY- 2 Stages (64F), Type: RXNB4 / Equivalent

Metering Equipment Available:

1. Ammeter, Analog type, 240Deg. Scale, Ciass 1.5, 96sq.mm
2. Voltmeter, Analog type, 240Deg. Scale, Class 1.5, 96Sq. mm. Red marking at 11KV
3. Frequency Meter, Digital Type, Class 0.2, 965q. mm
4. MW Meter, Digital Type, Class 0.2, 96Sq. mm, 3Ph, 4Wire
5. MVA Meter, 3ph, 4wire, Analog type, 240 Deg. Scale, class 1.5, 96 sq. aim,
6. MVAR Meter, 3Ph, 4Wire, Analog type, 240Deg. Scale, Class 1.5, 96sq. mm.
7. PF Meter, 3Ph, 3Wire, 3Ele, Digital type, Class 2Deg, 96 sq.mm.
8. Power Quality meter with RS 485 port MODBUS RTU protocol and Harmonic analysing facility



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9. MW Transducer, 3Ph, 4Wire, 3Element, Class 0.5, Dual Output: 4-20mA Aux Sup
10. Annunciator for Trip 48 windows for Trip Microprocessor based with first in first out- feature auxiliary supply10V DC with RS 485 port Modbus protocol.
11. Temperature Scanner for Generator No. of channels: 16 Input: RTD (PT100) Display — 7 segment LED Temp. range: 0 to 200deg C, Resolution:0.1degC

Synchronizing components available:

1. Double Voltmeter, analog indicating type, 110V AC, Range 0-15kv with red mark at 11kv, Class 1.0, Size 144sq.mm.
2. Double frequency meter, reed Type, 110V AC Range 45-55 Hz, Class 1.0, Size 144sq.mm.
3. Synchroscope rotating disc type, 110 V AC, Size 144 sq.mm
4. Check synchronizing relay Type: SKE11, Phase angle 10 Deg Aux. supply 110V DC.
5. No Volt Relay, Type: VAG21, Aux. supply 110V DC.-02 Nos
6. Guard Relay, Type: VAA21, Aux. supply 110V DC
7. Isolation VT for synchronizing signal 110/ 110VAC, 50VA, CL: 1.0-02nos
8. Reversing VT 110/110 VAC, 50 VA, CL :1.0
9. Auto Synchronizer Digital Type, Model-SPM-D, Aux. supply 24V DC
10. Synchroscope OFF/ON Selector switch, 90Deg., 2-position (OFF/ON) Stayput type, Spade Handle, non-lockable, 4-pole

Transformer Relay Panel:

1. Transformer differential protection (87gt)
2. Ref protection relay-64gt
3. Non-dir. Inst. Cum IDMT E/F pro. (50n/51n)
4. Non-dir. Inst. Cum IDMT o/C pro. (50/51)
5. Neutral displacement protection (59d)
6. Vector surge protection (78)
7. Over excitation/over fluxing protection (24)
8. Under voltage - (27)
9. Over voltage - (59)
10. Over /under frequency (81o/81u)
11. Local breaker backup pro. (50Ibb)
12. Oil temperature (49q)
13. Winding temperature (49t)
14. Buchholz relay & oil surge relay.-63

Transformer Metering Panel:

1. Ammeter
2. MW meter
3. MVAR meter

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4. PF meter
5. MVA meter
6. HZ meter
7. MW Transducer
8. POWER OUALITY Meter (PQM) with RS 485 port MODBUS RTU protocol and Harmonic analyzing facility
9. TVM -E/1
10. BCU
11. Voltmeter
12. PT Fuse Relay-60
13. Annunciator-30

Tariff Metering:

1. Tariff main meter
2. Tariff check meter

Busbar Protection Panel:

Low impedance busbar protection — 87b Line Feeder

Relay & Metering Panel - Protections

1. Local breaker backup pro (50Ibb)
2. Distance protection relay-21
3. Dir. E/F Pro. (67n)
4. BCU
S. Annunciator-30
6. PT fuse relay-60
7. Synchonizing relay-25

Line Feeder Relay & Metering Panel - Meters

1. MW meter.
2. HZ meter
3. TVM
4. Ammeter.
5. Voltmeter
6. Frequency meter
7. MVAR Meter

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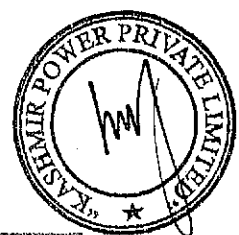
PROSPECTUS



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Prospectus

Introduction of Applicant

Kashmir Sugar Mills Limited through a wholly owned subsidiary Kashmir Power Private Limited intends to set up a green field 40 MW (Gross) high-pressure bagasse based co-generation power plant under the provisions of the Framework for Power Cogeneration 2013 and Policy for Development of Renewable Energy for Power Generation 2006. The Project will be located in the premises of KSML located at 11 Km Shorkot Cantt Road, Shorkot City District Jhang, Punjab.

The Project will sell power to the national grid through sale of energy to the Central Power Purchasing Agency Guarantee Limited under a 30-year Energy Purchase Agreements well as partially meet the steam and power requirements of KSML during the crushing season. The Project will enable KSML to establish a sustainable market for its by-product, bagasse, and will also allow the sponsors of KSML to take an exposure in the power sector through incentives offered by the Government of Pakistan under the Framework and RE Policy.

Salient features of the facility for which license is sought

The broad parameters of the project are as under:

Project Capacity	40 MW (Gross)
Project Location	Shorkot, District Jhang, Punjab.
Land Area	50 Acre
Construction Period	20 months
Technology	Bagasse/Bio-Mass.
Power Purchaser	CPPA/FESCO/NTDC
Steam Turbines	1 X 40 M.W extraction cum condensing
Boilers	1 X 200 TPH , 110 Bar 540°C
Upfront Levelized Tariff	US Cents 10.62 per kWh

Proposed Investment

The total cost for the project is approximated PKR 4,746 Million (USD 45.2 million), which is expected to be financed in a debt to equity ratio of 75:25.

Social and Environmental Impact of the Proposed Facility

Bagasse based Cogeneration power plant, offers a number of advantages both to the sugar industry and to the country. Besides reducing gap between the demand and the supply in the power sector, Bagasse based fuel power cogeneration provides environmentally friendly

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solution for additional power generation, reduces dependence on fossil fuels, saves on hard earned foreign exchange from its outflow from the country for import of fossil fuels and gives sugar industry financial gains in the form of cheaper energy while using Bagasse as fuel.

Major Impacts and Mitigation measures:

The most significant pollutant emitted from Bagasse-fired boilers is Ash. As KSML is already using low pressure boilers and ash is in very little quantity, the high pressure boilers will produce minor quantity of ash which will be controlled by the use of Electrostatic Precipitator separator (fly ash arrestor) to meet the permitted dust concentration as required by NEQS Pakistan. Both of these technologies have the ability to remove 99.9% of ash (PM) in stack exhausts.

Gaseous emissions of Sulphur dioxide (SO2) and nitrogen oxides (NOx) are lower than conventional fossil fuels due to the characteristically very low levels of sulphur and nitrogen associated with Bagasse, therefore, they will remain within the prescribed limiting values of the of the NEQS Pakistan.

The Waste water will be treated in lagoons and after treatment will be used within the four boundary walls of project site, for sprinkling on the unpaved sites, for suppression of dust, for plant entries, and for irrigation of plants. Unconsumed treated waste water will be used for the irrigation of the crops of the project proponent.

The noise levels of 75 dB (A) and 65 dB (A) indicated are at the plant boundary, as the maximum noise level shall be 85dB (A) at 3.0 m from the equipment.

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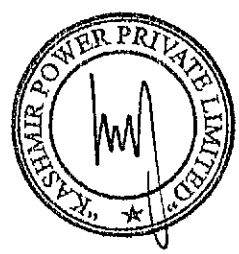
INITIAL ENVIRONMENTAL EXAMINATION REPORT



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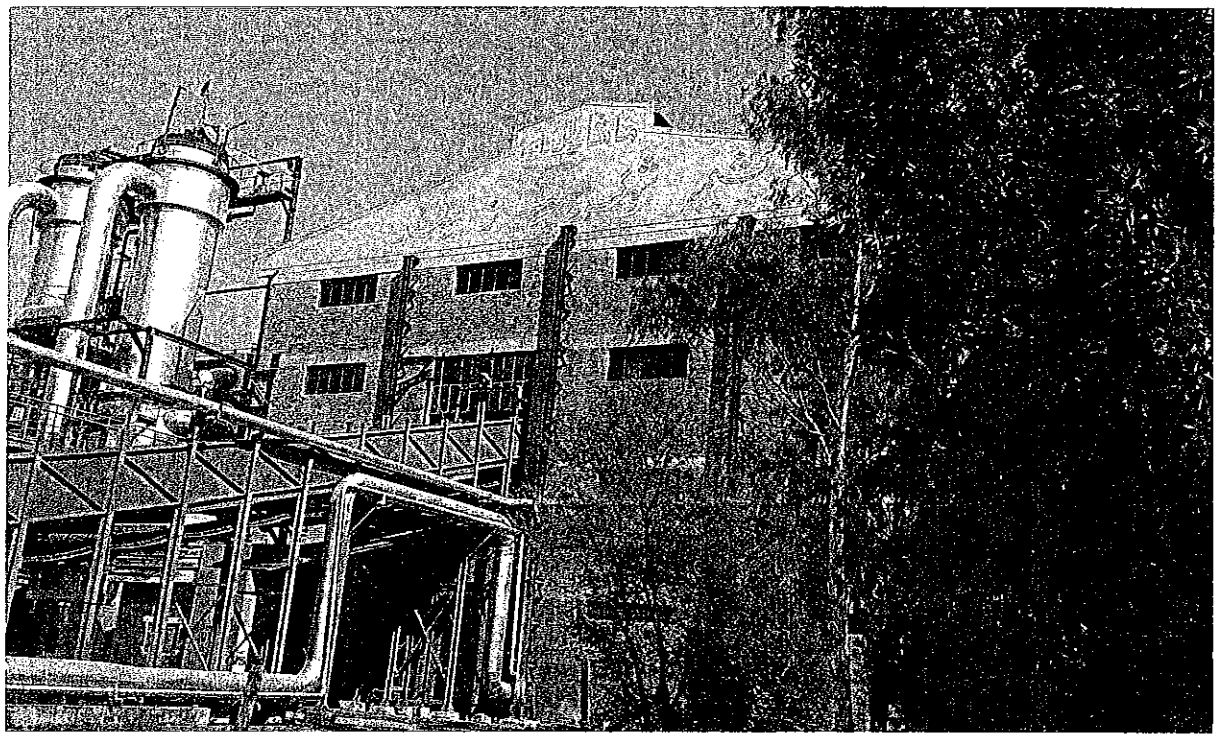
Installation of 40 MW Bagasse Based Co-Generation Power Plant at Kashmir Sugar Mills Limited, Shorkot, Jhang



INITIAL ENVIRONMENTAL EXAMINATION (IEE)

Prepared by:

ECTECH
Environment Consultants

Suite 4, 2nd Floor, Link Arcade, Model Town Link Road, Lahore-Pakistan
Phone: +92 42 35887517, 35925693; **Fax:** +92 42 35855508
Email: ectech_ectech@yahoo.com

November- 2016

KASHMIR POWER PRIVATE LIMITED

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Installation of 40 MW Bagasse Based Co-Generation Power Plant at Kashmir Sugar Mills Limited, Shorkot, Jhang

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

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Suite 4, 2nd Floor, Link Arcade, Model Town Link Road, Lahore-Pakistan
Phone: +92 42 35887517, 35925693; **Fax:** +92 42 35855508
Email: ectech_ectech@yahoo.com

November- 2016

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CONTENTS

List of Annexures

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ACRONYMS

AAUs	Assigned Amount Units
CEO	Chief Executive Officer
COD	Commercial Operation Date
DOC	Designated Operational Entity
DISCOs	Power Distribution Companies
DCS	Distributed Control System
EPA	Environmental Protection Agency
EOT	Electrically Operated Overhead Travelling
EMP	Environmental Management Plan
EMTP	Environmental Monitoring Plan
EA	Environmental Approval
EPO	Environmental Protection Order
ET	Emissions Trading
FSA	Fuel Supply Agreement
FESCO	Faisalabad Electric Supply Company
GOP	Government of Pakistan
GDP	Grass Domestic Product
GEPCO	Gujranwala Supply Company
GHG	Green House Gas
HERP	Hazard and Emergency Response Plan SIEMENS
HP	High Pressure
LP	Low Pressure

HSE	Health Safety Environment
HESCO	Hyderabad Electric Supply Company
IPPS	Independent Power Producers
IEE	Environmental Examination
IEP	Institute of Engineering Pakistan
IESCO	Islamabad Electric Supply Company
JICA	Japan International Cooperation Agency
KESC	Karachi Electric Supply Company
KM	Kilometer
LOS	Letter of Support
LESCO	Lahore Electric Supply Company
MW	Mega Watt
MEPCO	Manpower export Placement Corporation
MOE	Ministry of Environment
NEQSAA	National Environment Quality Standards for Ambient Air
NEQSN	National Environment Quality Standards for Noise
NOC	No objection certificate
NEPRA	National Electric Power Regulatory Authority
NTDC	National Transmission & Dispatch Company
NCS	National Conservation Strategy
PEPC	Pakistan Environmental Protection Council
PEPA	Pakistan Environmental Act
PEPC	Pakistan Environmental Protection Council

PPDB	Punjab Power Development Board
PEPCO	Pakistan electric power company
PPDB	Punjab Power Development Board
PESCO	Peshawar Electric Supply Company
POPs	Parenting Organic pollutants
QESCO	Quetta Electric Supply Company
ISML	Ittefaq Sugar Mill Limited
IPPL	Ittefaq Power Private Limited
SMART	Self- Monitoring and Reporting by Industry
SNGPL	Sui northern gas pipe lines
SIA	Social Impact Assessment
TG	Turbo Generators
USTDA	US Trade and Development Agency
WAPDA	Water and Power Development Authority

Glossary

I. **Environment:** means air, water and land; all layers of the atmosphere; all organic and inorganic matter and living organisms; the ecosystem and ecological relationships; buildings, structures, roads, facilities and works; all social and economic conditions affecting community life; and the inter-relationships between any of the factors mentioned

II. **Environmental Impact Assessment:** means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigatory and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed

III. **Initial Environmental Examination:** means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an environmental effect for requiring preparation of an environmental impact assessment

IV. **Effluent:** means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour

V. **National Environmental Quality Standards:** means the permissible standards for emission of air pollutants and noise and for discharge of effluent and waste

VI. **Discharge:** means spilling, leaking, pumping, depositing, seeping, releasing, flowing out, pouring, emitting, emptying or dumping

VII. **Waste:** means any material, substance, or by-product eliminated or discarded as no longer useful or required after the completion of a process

VIII. **Sustainability:** means such developments that meet the needs of the present generation without compromising the ability of future generations to meet their needs

KASHMIR POWER PRIVATE LIMITED

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1.0 EXECUTIVE SUMMARY

Executive Summary

1.1 Title and Location of the Project

"Initial Environmental Examination (IEE) for Installation of 40 MW Bagasse Based Co-Generation Power Plant at Kashmir Sugar Mills Limited"

1.2 Name of the Proponent

Ahsan-ul-Haq abid
Kashmir Power Private LimitedFull address: 40 BII Gulberg III Lahore
Phone:0300-4000121
Email:ahsan_ggmf@kashmirsteel.com

1.3 Name of the Organization Preparing the Report

ECTECH-Environment Consultants
Suite 4, 2nd Floor, Link Arcade, Model Town Link Road, Lahore
Phone: 042-5887517, 5019308
Fax: 042-5855508
E-mail: ectech_ectech@yahoo.com

1.4 A Brief Outline of the Proposal

Kashmir Sugar Mills Limited (KSML) is a medium sized sugar manufacturing unit with crushing capacity of 8500 tons /day the crushing capacity will enhance to 1000 tons/day. Bagasse generated through crushing is used as a fuel for steam generation which subsequently produces power as well. KSML is currently producing heat and power through topping cycle cogeneration at low pressure around 24 bars. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures.

It is with this background that M/S Kashmir Sugar Mills Limited (KSML) is in the process of installing a 40 MW Bio Mass (Bagasse) based Co-generation power plant for the generation of electricity. Bagasse based co-generation power plant under the name "Kashmir Power Private Limited ("KPPL"). The plant is to be installed at Shorkot, district Jhang, punjab from where Bagasse is already available.

ECTECH

KASHMIR POWER PRIVATE LIMITED

Before the commencement of work, according to the Punjab Environmental Protection (Amendment) Act 2012, Section 12 Initial Environmental Examination and Environmental Impact Assessment. "No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact assessment, and has obtained from the Government Agency approval in respect thereof."

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) regulation, 2000 the project falls in Schedule "I". Therefore, this IEE report has been prepared according to the Guidelines for the preparation and review of environmental reports (1997/2000).

This Initial Environmental Examination (IEE) report is being submitted to the Environmental Protection Agency (EPA)), Government of the Punjab, Lahore for getting No Objection Certificate (NOC) /EA (Environmental Approval).

1.5 The Major Impacts

Environmental problems due to project location:

The power plant is to be installed within the battery limits of its mother project – Kashmir sugar mills limited. No environmentally sensitive areas are present in the project vicinity. Since the project is to run on waste from sugar industry so it is a clear proof that there will be no environmental problems due to project location. It is a unique example of power production with zero emissions.

Environmental problems related to design:

M/S China Wuxi/ HTC / Siemens / PEL/ ABB; the technology suppliers are a world reputed firms, considered among the top power plant designers and its fabricators. The plant is to be designed in a way that it guarantees all out compliance with the National Environmental Quality Standards **(NEQS)**

Environmental problems associated with construction:

The most likely environmental problems to occur during construction phase could be due to:

- construction machinery
- compaction of soil activity
- leveling of land
- moving vehicles
- fabrication of various parts of plant
- Construction of building and associated civil work.

The pollution from these activities could be in the form of:

- Gaseous Emission in the form of SO_2, NO_x and CO.
- Particulate Matter (PM).
- Noise.
- Effluent.

Environmental problems resulting from project operations:

The project activity has been designed in a way so as to avoid any sort of environmental problems either to the environment around or the people in the area during any stage of plant erection or commissioning or its regular operation.

1.6 Recommendations for mitigation measures:

A summary of the mitigation measures/actions being adopted and further strengthening against all possible type of pollutants to be generated from the project are given hereunder.

Effluents

There is not any source of water pollution

Gaseous emissions and particulate matter

Since there is no source of fuel burning therefore there are no gaseous emissions. However, the vehicular emissions during construction phase will be reduce by proper maintenance of vehicles.

The workers are obliged to use all PPE's gears against noise and dust.

Noise levels

Though noise levels within Project boundaries are to remain within the prescribed limits of the NEQS, yet further, they are minimized by proper maintenance of the equipment/machinery at regular intervals of time.

Environmental Management Plan and Environmental Monitoring Plan will be made operational. This will further ensure environmental compliance with the NEQS limiting values.

Schedule for mitigation

Adequate mitigation measures are being adapted. The quarries operations are all well organized, environmentally sustainable and in compliance with the NEQS-Pakistan.

1.7 Proposed monitoring plan

Environmental monitoring system and program should be installed/arranged through a third party prior to the start of main construction activities.

It is recommended that the monitoring program should cover the parameters under the environmental legal requirement.

Meteorological data should be recorded in parallel to air quality monitoring at the same reference location.

Monitoring parameters and frequency are to carried out according to the requirement of Pakistan Environment Protection (Amendment) Act, 2012, under Category-A "Guidelines for Self-Monitoring and Reporting by Industry (SMART). Monitoring should be carried out biannually, at least preferably by a third party.

Public consultations were also held with the stake holders to know their views about the project. On the overall basis the participants of the public consultation were strongly in the favor of the project to be accomplished as soon as possible

1.8 Conclusions

The project embarks upon self-generation of electric power by installing of 40 MW bagasse based co-generation power plant. The project estimated cost is Rs. 1.3 million/USD Dollars and the area required for the project is approx. 50 acres.

With this mentioned capacity the project falls under category of the projects requiring IEE*. At the end of the preparation of this IEE Report it is concluded that:

1- There are no sensitive elements /segments of environment around the project site.

2- The project is based on production of electric power by waste the sugar mill.

3- Effluent will be treated and reused at the project site, while oily waste water will be treated/purified and recycled and the oil recovered will be sold in the market for its reuse.

4- EMP and EMtP as recommended in this IEE Report are to be put in place during operations of the project.

5- Biannual monitoring of all out environmental monitoring by a third party also certifies that the project will run in accordance with legal requirements.

6- Availability of water for the project is ensured from the tube-wells to be installed for the regular project operations.

7- On the basis of the facts summarized as above, the project merits for issuing Environmental Approval by the Environmental Protection Agency, Government of Punjab, Lahore.

2.0 INTRODUCTION

2.0 INTRODUCTION

Considering the strong correlation between economic growth and energy demand growth, there is an imperative need for sustained increases 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. Per capita energy consumption in Pakistan currently stands at 14 MBtu as compared to 92 MBtu in Malaysia and 34 MBtu in China.

Since 1999-2000 Pakistan's economy was undergoing significant structural changes. The economy had been growing at an average rate of 7.6 % over the past three years ending June 2007. The target of economic growth was fixed at 7-8 percent growth per annum. This object will need a commensurate rise in energy use.

The demand and supply of electricity was balanced in 1997 with the commissioning of private sector Independent Power Projects (IPPs) established under the Private Power Policy, 1994. Generation capacity has increased since 1997, and it was expected that demand and supply would remain in equilibrium by 2020. However, faster economic activity, rising disposable income, higher availability of consumer finance, double-digit growth of large-scale manufacturing, and higher agricultural production have all resulted in higher demand for power. From June 2005 to the end of 2013, there is big supply-demand gap. As peak demand growth approached 4.7% per mean year during 2000 to 2013.

Highly expensive generation of electricity due to an increased dependence on expensive thermal fuel sources (44% of total generation). RFO, HSD, and Mixed are the biggest sources of thermal electricity generation in Pakistan and range in price from Rs. 12 per unit for mixed, to Rs. 17 per unit for RFO, and a tremendously expensive Rs. 23 per unit for HSD. Dependence on such expensive fuel sources has forced Pakistan to create electricity at rates that are not affordable to the nation and its populace.

A terribly inefficient power transmission and distribution system increase cost, which currently records losses of 23-25% due to poor infrastructure, mismanagement, and theft of electricity.

Electricity Power Balance:

The following tables 2.1 & 2.2 indicated balance of demand and supply from 2003 to 2019.

Table 2.1 Power Balance of Demand and Supply from 2003 to 2014 (MW)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Demand	11,598	12,595	13,847	15,838	17,398	17,852	18,467	18,521	18,940	18,827	22,140	23,242
Supply	13,166	13,816	13,796	14,085	14,092	13,912	13,445	14,451	14,465	14,600	17,574	19,155

Source NTDC.

Table 2.2 Power Balance Forecast of Demand and Supply from 2015 to2019 (MW)

	2015	2016	2017	2018	2019
Demand	24,361	25,521	26,755	28,058	29,423
Supply	19,534	20,304	24,259	26,588	29,895

Source: NTDC.

Power Development Plan

To sustain growth, Pakistan needs an integrated National Energy Plan. The Government of Pakistan 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 not only investments in power production sector from local resources, but also foreign investments are pouring in large amounts. The government has encouraged the private and public sector meet this additional demand and have a plan to reform power structure and reducing delivery cost.

Pakistan has set key targets in terms of the demand-supply gap, affordability, efficiency, financial viability and governance of the system. The Government of Pakistan has initiated the following targets for electricity sector.

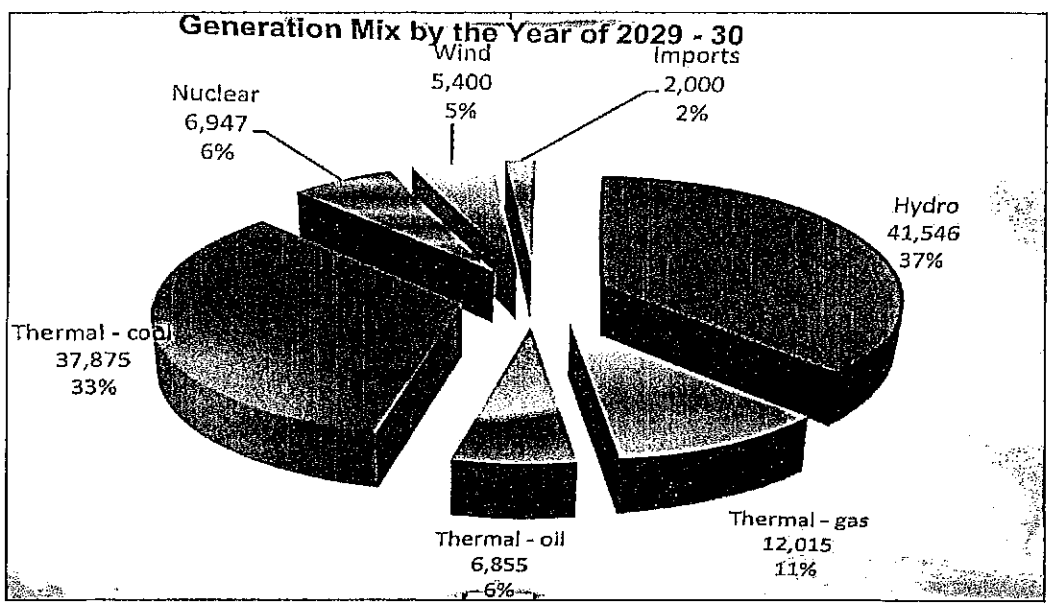
- Decrease supply demand gap from present 4,200 MW to 0;

- Decrease transmission and distribution losses from 23-25% to 16%
- Decrease decision making processing time at the Ministry, related departments and regulators from long to short durations

Table - 2.3 Power Generation Addition Plan (MW, by 2020)

Producer Name	Installed Capacity	Percent Share
Hydel WAPDA	6,138	23.6%
Gencos	2,372	9.1%
Thermal IPP	9,524	36.6%
Hydel IPP	2,577	9.9%
Nuclear	1,780	6.8%
Wind	1,650	6.3%
Import	1,000	3.8%
Solar	1,000	3.8%
Total	**26,041**	**100%**

Source: NTDC, Project Feasibility Study



Source: Project Feasibility Study – NTDC

Figure - 2.1 Illustrates the Power Generation Mix Plan by the Year 2029 – 30.

The predominance of fossil fuels in the energy mix is highlighted by the preponderance of gas at 11%, oil at 6%, and coal at 33% with hydro electricity at 37%.

Where the optimal utilization of the country's hydroelectric potential is accorded priority in the future power development strategy, there use of coal is also a priority sector. Pakistan has an estimated coal reserves amounting to between 175 to 185.5 billion tons.

Due to high cost energy resources, Pakistan Government has decided to enhance the share of coal in the overall energy mix to 33 percent by 2029-30. Presently, around 80 percent of cement industry has switched over to indigenous coal from furnace oil. In view of further anticipated shortfall of electricity and other energy resources during the next about 10 years the maximum utilization of local coal would be required in power generation and gasification.

The province of Punjab consumes around 68% of the of the total energy generation. In view of the situation the Govt. of the Punjab has allowed to utilize even imported coal.

For development of projects on fast track basis in public sector, the Govt. of Punjab has established Punjab Power Development Company Limited (PPDCL).

2.1 Purpose of the report:

Kashmir Sugar Mills Limited was incorporated on 1996 – 97 as a Public Limited Company. This organization is a part of Al-Shafi group of companies. The mill is located at Shorkot city, district Jhang in the Province of Punjab. It went into commercial production in December 1997. KSML has adopted defection remelts carbonation/sulphonation process for the production of white sugar. The mill is situated in Shorkot city. The area of mill is about 107 acres which is enclosed by the boundary wall having the main factory building, cane yards, workshops, main stores, auto repairing shops, sugar goodown, school and officers "residence colony". The project also acquires 2,250 acres that named as Kashmir sugar mills research farms. The land is meant for developing can seed of better cane varieties for our growers and serves to secure can supply from integral sources for at least a month' time.

Present crushing capacity of mills is 10,000 tones sugarcane per day. KSML is a member of Pakistan Sugar Mills Association (PSMA).

The operating pattern of the sugar mill is as follows:

- **Milling season:** it traditionally runs from the start of November to the beginning of April. During this period, mature sugarcane is harvested and transported to the mill, where it is crushed to extract sugar juice. The juice is then processed to produce white sugar.

- **Off-milling season:** it starts immediately after the milling season (i.e., from the beginning of April to the start of November). During this period, the sugar mill is shut down for maintenance activities.

Kashmir Sugar Mills Limited (KSML) is a medium sized sugar manufacturing unit with crushing capacity of 8500 tons /day the crushing capacity will enhance to 1000 tons/day. Bagasse generated through crushing is used as a fuel for steam generation which subsequently produces power as well. KSML is currently producing heat and power through topping cycle cogeneration at low pressure around 24 bars. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures.

It is with this background that M/S Kashmir Sugar Mills Limited (KSML) is in the process of installing a 40 MW Bio Mass (Bagasse) based Co-generation power plant for the generation of electricity. Bagasse based co-generation power plant under the name "Kashmir Power Private Limited ("KPPL"). The plant is to be installed at Shorkot, district Jhang, punjab from where Bagasse is already available.

Before the commencement of work, according to the Punjab Environmental Protection (Amendment) Act 2012, Section 12 Initial Environmental Examination and Environmental Impact Assessment. "No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental

effects an environmental impact assessment, and has obtained from the Government Agency approval in respect thereof."

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) regulation, 2000 the project falls in Schedule "I". Therefore, this IEE report has been prepared according to the Guidelines for the preparation and review of environmental reports (1997/2000).

This Initial Environmental Examination (IEE) report is being submitted to the Environmental Protection Agency (EPA)), Government of the Punjab, Lahore for getting No Objection Certificate (NOC) /EA (Environmental Approval).

The project is being run on fast track so as to make it operational as per energy policy frame work of power cogeneration 20 months from the financial close. Major part of this electric power generated will be exported to the national grid, after fulfilling its own needs.

2.2 Identification of the project & the proponent:

The project proponent Kashmir Sugar Mills Limited has an existing low pressure (LP, 24 bar) cogeneration plant consisting of 2 boilers and 2 back pressure steam turbines. The overall steam generation capacity of the existing cogeneration plant is 160 tones per hour and the power production capacity is 8.0 MW.

The existing LP system generates enough heat (low-pressure process steam) and electricity to meet the energy requirement of the sugar mill during the milling season. During off-milling season, the electricity is either purchased from the grid or generated through diesel engines to meet the power requirements of offices, employee's residence, etc.

The increase in cost of Electricity resulted in ever swelling of import bills, which state is not affordable for a poor country like Pakistan with fragile economy. Therefore, to meet present day requirements of the fuels and to fulfill the future increased demand, Government of Pakistan has started encouraging the use of Renewable biomass as fuel to produce electric power.

It is with this background that Kashmir Sugar Mills Limited has decided to install a 40 MW co-generation power plant (Bagasse) Based Co-Generation power plant at KSML.

The proposed Power Plant aims at installing Kashmir sugar mill power plant with new High Pressure Boilers and Extraction cum Condensing Turbo Generators. The surplus power will be supplied to National Grid and house requirements of KSML. This will also add to its own share to reduce the power shortage at the National Level although not so big quantity.

Alternative Energy Development Board (AEDB), Government of Pakistan, issued letter of intent vides its No. B/3/21/2016/Bagasse-Biomass/KPPL dated 09/11/2016 to M/S Kashmir Sugar Mills Limited for 40 MW Bagasse/Biomass Based High Pressure Co-Generation Power Plant Punjab Province.

2.2.1 Identification of the proponent

Ahsan-ul-Haq abid
Kashmir Power Private Limited
Full address: 40 BII Gulberg III Lahore
Phone:0300-4000121
Email:ahsan_ggmf@kashmirsteel.com

2.2.2 Contact Person:

Mr. Hafiz Muhammad Kashif Munir
Kashmir Power Private Limited
Full address: 40 BII Gulberg III Lahore
Phone:0322 4612833
Email:kashiif.muneer@gmail.com

2.3 Consultants who prepared the report:

ECTECH–Environment Consultants,
Suite No. 4, 2nd Floor, Link Arcade,
Model Town Link Road, Lahore-Pakistan
Phone: +92 42 35887517, 35925693, 35841688
Fax: +92 42 35855508
E-mail: ectech_ectech@yahoo.com.

2.4 Brief description of nature, size and location of the project:

2.4.1 Nature and size of the plant:

Kashmir Sugar Mills Limited is planning to install a bagasse based co-generation plant upto 40 MW capacity within the premises of industry. The proposed power plant will

cover a total area of 50 acres. The total estimated cost of the power plant is 1.3 Million USD/ MW (Approx).

KSML is currently producing heat and power through topping cycle cogeneration at medium pressure around 24 bars. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures.

2.4.2 Location of the project:

This power plant will be installed within the premises of Kashmir sugar mills limited, 3 km off Shorkot cant. Road, Shortkot City, District Jhang. The location of the proposed project is given hereunder;

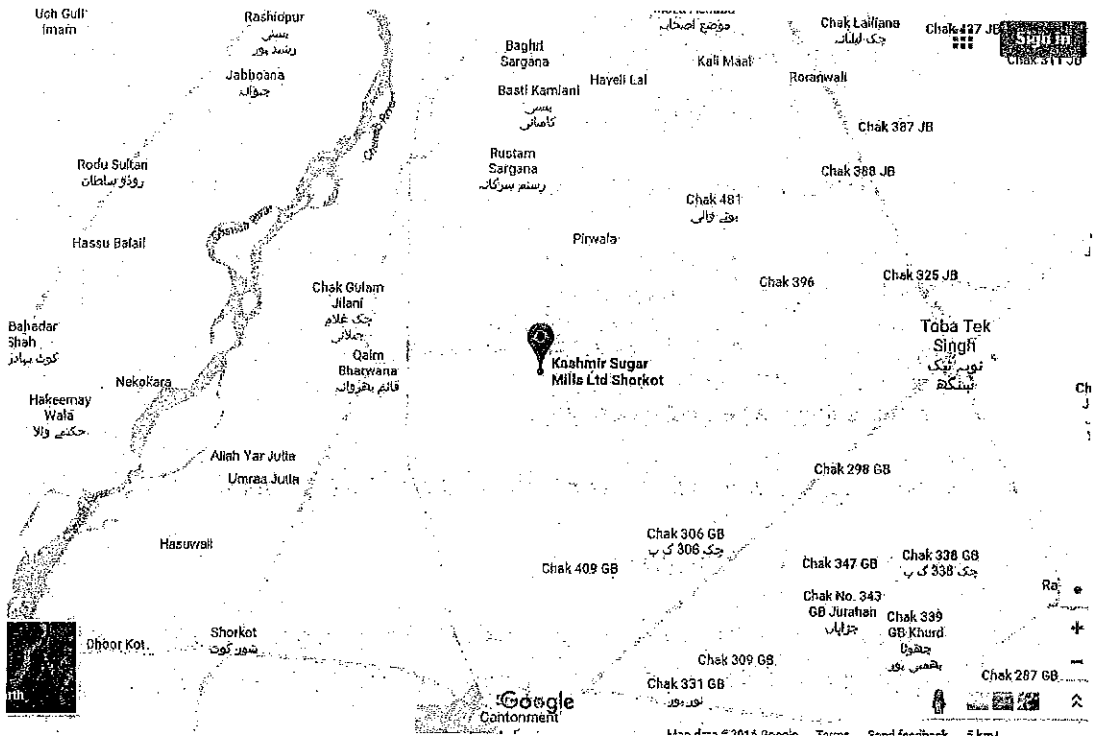


Figure: 2.2 Location of the Project **Courtesy: Google**

3.0 DESCRIPTION OF THE PROJECT

3.0 DESCRIPTION OF THE PROJECT

3.1 Type and category of the project:

Pakistan is an energy deficit country. Fossil fuels are already in short supply, and their local availability is fast depleting along with price hike taking place during very short intervals of time. Import bills of the fossil fuels are swelling at a very fast rate due to their fast increasing demand in the country. Pakistan's fragile economy cannot afford to continue with the present situation. Consequently, the present state demands to explore other cheaper fuels which could fully or partially replace the fossil fuels presently in use.

The Power Plant is proposed within premises of Kashmir sugar Mills Ltd. at Shorkot, District Jhang, Province of Punjab. KSML is planning to install Bagasse based Co-generation power plant upto the 40 MW capacity, proposed power plant will cover a total area of 50 acers. The total estimated cost of the power plant is 1.3 Million USD/ MW (Approx).

KSML is currently producing heat and power through topping cycle cogeneration at medium pressure around 24 bars. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures

Bagasse is the matted cellulose fiber residue from sugarcane generated in a sugar mill. The efficient use of Bagasse as fuel for the production of low cost power is one of the main objectives of the cogeneration power plant. So far, the tendency to consider Bagasse as surplus commodity has recently been changed to its being a cheaper fuel especially for cogeneration of cheaper electric power and steam, to increase its contribution to the country's energy supply. It is worth mentioning here that KSML already using Bagasse in low pressure boilers going to replace with high pressure boilers.

The plant site is situated within the legal jurisdiction of the Environmental Protection Agency, Government of the Punjab, Lahore. Therefore, this IEE report will be submitted to this EPA for getting Environmental Approval/No Objection Certificate as required

under the Punjab Environment Protection (Amendment 2012) Act, Section-12 to fulfill the mandatory legal condition.

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) regulation, 2000 the project falls in Schedule "I". Therefore, this IEE report has been prepared according to the Guidelines for the preparation and review of environmental reports (1997/2000).

3.2 Objectives of the project:

The main objective of the project is to reduce per unit generation cost of electricity without affecting the environmental conditions of the surrounding area and to extend the life of power plant. This will benefit the common man by reducing per unit cost of electricity due to cheap fuel and extended life of power plant. Other broader objectives are as follows

Pakistan is passing through the phase of acute shortage of electric supply verses the generation. The total installed power generation capacity of Pakistan in 2010-11 was 23,412 MW, with 16,070 MW from thermal sources (69 percent), 6,555 MW hydroelectric (28 percent) and 787 MW nuclear (3 percent). The growth in energy supply continued lagging much behind increasing demand in its supply. Resultantly, the power shortage as of today stands at over 6,000MW with further increase in the demand in all sectors of life. Consequently, Pakistan currently faces severe power shortages, which results in frequent and long drawn out load shedding. The frequency of the load shedding is fast on the increase.

The "Energy Security Action Plan" developed by the Planning Commission of Pakistan, (2005) planned the increase in electric generation capacity. Planed electricity generation & installed capacity are presented in the following table:

Table 3.1: Planed Electricity Generation & Installed Capacity MW

Year	Nuclear	Hydro Power	Coal	Renewable	Gas + Oil	Total
2005	400	6,460	160	180	12,340	19,540
2010	0	1,260	900	700	5,020	7,880
2015	900	7,570	3,000	800	7,850	20,120
2020	1,500	4,700	4,200	1,470	12,860	24,730
2025	2,000	5,600	5,400	2,700	22,790	38,490
2030	4,000	7,070	6,250	3,850	30,660	51,830
TOTAL	8,800	32,660	19,910	9,700	91,520	162,590

According to the Planning Department, Government of Pakistan (daily Jang, Lahore, Janaury18, 2013),"it will not be possible to end load shedding during the planned year even if all power projects are completed on schedule". It looks very difficult to bridge the shortage gap between production and demand of electricity for a longer time to come and load shedding will remain a constant feature in the country.

The Government being aware of its responsibilities, according to the advice of The Prime Minister of Pakistan, has already formed a working group comprising expertise, planners, administrators etc. All members of the group agree to give first preference to the short term and medium term projects along side work will also be carried out on Long Term Projects.

For renewables projects Alternative Energy Development Board (AEDB) is the sole representing agency of the Federal Government that was established in May 2003 with the main objective to facilitate, promote and encourage development of Renewable Energy in Pakistan and with a mission to introduce Alternative and Renewable Energies (AREs) at an accelerated rate15. Small hydro projects under 50 MW are also come under the scope of AEDB. The Federal Government established AEDB as a statutory

organization by announcing and promulgating the AEDB Act in May 201016. The Act bestowed upon AEDB the authorities and the responsibilities for the promotion and development of AREs. The Government of Pakistan has tasked the AEDB to ensure 5% of total national power generation capacity to be generated through renewable energy technologies by the year 2030.

Purpose of the Working Group

Purpose of the Working Group is to:

i- Ensure action on the Five Year Plan and Vision 2025

ii- Reduce difference between supply and demand of electricity

iii- Search for cheaper sources of electricity

iv- Prepare proposals for the already under construction projects

v- Monitor the projects working in the country

vi- Prepare recommendations for the projects whose feasibility studies are already available and those operational projects whose feasibility studies have not been prepared

The mandate of the Working Group is not restricted only to the projects relating to Water and Power but also extends to the projects relating to petroleum and natural resources.

In view of the prevalent status of the big gap between electric power generation and supply, every day price hikes in power tariff, uncertainty in supply resulting in long drawn out load shedding with ever increase in their frequency; Kashmir Sugar Mills Ltd. has planned to install its own power generation facility using Bagasse a fuel cheaper than all fossil fuels.

Bagasse based Cogeneration Power production facility in sugar industry, provides a lot of advantages both to the sugar industry as well as to the country at very less cost as compared to the use of fossil fuels, though for a shorter time period per year due to its limited availability. Some of the advantages using Bagasse as fuel are highlighted as below:

i- Reduces, at very low cost, gap between demand and supply in the power sector with Bagasse as fuel available at very low cost

ii- The Bagasse based cogeneration is environment friendly

iii- Cutting upon foreign exchange bills outflow from the country for the purchase of the fossil fuels

iv- Improving financial status of sugar sector and its downstream products, by the use of Bagasse as fuel for power production, which can also be called value addition

v- Bagasse storage does not require cost storage, maintenance, repair and equipment besides, involve no danger of high losses in case of fire,

vi- Bagasse based Cogeneration is extensively used in India, installed generation capacity close to 1800 MW, while more plants are at various stages of implementation. The other countries like Mauritius (around 250 MW), Reunion Island (around 220 MW), and Brazil etc are also using Bagasse as fuel for cogeneration of electricity.

It will be worth mentioning here that even with the existing crushing capacity of KSML there is surplus Bagasse available to run the new cogeneration power plant during crushing as well off season of the sugar mills.

The gross power generation, during the season, after the implementation of the Cogeneration program will be 40 MW (Operational) with having installed capacity of 40 MW and sugar mill power consumption is 8 MW.

Table 3.2: Total load on industry during on and off seasons

Parameters	Value
Power house Auxiliary load	3600 KW
Sugar mill consumption during season	6085 kW
Sugar mill consumption during off season	500 KW
Total load during season	3600+6085 KW
Total load during off season	3600+500 KW

Thus exportable power provided to the national Grid will be 30.31 MW during season and 35.9 MW during off season.

3.3 Alternatives considered for Site Selection:

Hereunder, alternatives considered for the site selection for installation of the cogeneration power plant are highlighted.

a- Availability of Land for the Power Plant:

A lot of land, within the premises of KSML is available at the site selected for the project. Presently, 50 Acers are required for the project. Therefore, the present site is quite suited which is within the premises of KSML.

b- Availability of Bagasse as Fuel from In Sourcing:

The Kashmir Sugar Mills plant generates 337466.88 MT bagasse/season during crushing period. Out of this 40127.58/ MT bagasse will be saved for off season and 297339.30/ MT bagasse will be used during the season. 40,000/ tons bagasse will be purchase from the third party.

Bagasse from KSML will be available for Co generation plant within the premises of KSML. As sugar factory also belongs to the proponents of the Cogeneration Power Plant. This will further reduce the cost of power production, resulting in advantages to all the downstream users of the project.

c- Availability of Bagasse/bio mass from Out Sourcing.

The area around the project site is extensively under agriculture use from which the other bio masses like sugar cane trash, cotton straw, wheat straw, rice husk, mustard straw, etc. can be purchased during off season further Bagasse from other factories who have not installed their power plant can be used.

d- Basic infrastructure:

Basic Infrastructure like roads, plentifully availability of underground water of good quality, cheap labor, telephone, Internet, transportation etc. are available and well developed.

e- Interconnection with Grid

It is proposed to step up the generation voltage of 11 kV to 132 kV and injected to the National grid at 132 kV level. The 132 kV transmission lines from the Cogeneration plant shall be connected to the NTDC, the nearest distance of 132 KV transmission line is 1 km.

f- Transportation cost of Bagasse as raw material:

To meet the requirement of steam for power generation at Kashmir Sugar Mill Power Plant, 40 MW High Pressure Cogeneration project, the site is located within the premises of KSML and this will drastically cut the cost of the transportation of the Bagasse from its source of production to the power plant. Therefore, the project site has been selected adjacent to the Bagasse yard of the Kashmir Sugar Mills, 3 km Shorkot City, Dist. Jhang, Punjab.

g- Environment

Environmental consideration for industrial sitting is of utmost importance. The plant is to operate according to the Environment Management Plan (EMP) as provided under section 6. Under this EMP necessary safeguards have been provided to minimize all type of pollutants to the level as required under the National Environment Quality Standards (NEQS), National Environmental Quality Standards for Ambient Air (NEQSAA) effective 12 August 2016 and National Environmental Quality Standards for Noise (NEQSN) effective 12 August 2016.

The present site for installation of the power plant is not situated within or near to any sensitive environment around. Accordingly, the site selected for the power plant is quite suitable.

h- Waste water disposal facility:

Approximately all the effluent generated from the power plant will be used within the boundary walls of the project. After water treatment process and passing through skimmers for the collection of oil and grease the water will be used for irrigation of the grassy plots, plants, trees and sprinkling of the road sides and open spaces to suppress fugitive dust. Thus virtually all treated water will be consumed within the four boundary walls of the project

i- Labor availability:

All categories of the labor required for the project operation are available conveniently and plentifully at affordable cost at the project site. This factor too supports siting of the project at the present site.

Estimated 100-150 labour will be engaged during construction phase while 50 persons in three (03) shifts during regular operation of the power plant.

On the basis of the above facts, the selected site for the new cogeneration power plant project is the most suitable.

3.4 Location and site layout of the project (May be annexed at the end of report)

The plant layout is attached as Annexure-I. While relevant details of the project are given here under.

- **Layout of the Steam Generating Unit**

The steam generators will be laid out, along the North to East direction, with the steam generator front facing the North. The steam generator is of semi-outdoor design, with a canopy over the furnace area and the bagasse storage silo.

The Deaerator, Coal bunker, bagasse storage silos along with the feeders, chutes and the distributors will be kept in front of the steam generator. The steam generator feeder operating floor level will be approximately at 8.5 meters.

The economizer and the air pre-heater are to be arranged in a single vertical pass behind the steam generator. The air pre-heater will be laid out in such that the tube replacement could be done easily. The fans and Electro Static Precipitator shall be arranged as shown in the layout drawing.

Adequate platforms and stairways, as required for convenient operation and maintenance of the steam generator shall be provided.

The steam generator feed water pumps shall be located on the ground floor below the deaerator structure. The deaerator will be located on the front side of the steam generator in between the TG building and the steam generator. The feed water control station shall be located on the steam generator operating floor.

A RCC Chimney is to be located downstream of the Electrostatic Precipitator, on to the Southern side. Concrete paving will be provided in the steam generator area with necessary drains and trenches for cables and pipes.

The steam generator gets its fuel mainly from the sugar plant's milling section. The bagasse will be fed through a system of belt and slat chain conveyors and the surplus bagasse will be taken back to the storage yard through a set of conveyors. Belt conveyors will be used for stacking the bagasse into the covered storage yard and also for reclaiming the bagasse from the storage yard to the boiler.

- **Turbo Generator Building Layout**

The turbo generator building, to be located on the Southern side of the steam generator will be of size 86.4 m x 27.7 m, and sized to accommodate the Turbo-generator and its main auxiliary equipment. The turbo generator operating floor shall be at 9.0 m elevation. The building superstructure will be of RCC with brick wall and RCC floor slabs.

The building roof will be of steel tresses and Galvalume steel sheets. The transformers & DG sets will be located on the Southern side of the TG building.

The turbine and generator foundation will be of reinforced concrete, isolated from the building foundation and the superstructure. The turbo-generator will be laid out with its axis in the East-west direction perpendicular to the steam generator axis, at the 9.0 m elevation. The oil system console and other auxiliaries will be located within the building

One Electric Overhead Travelling (EOT) crane, with a span of 13.5 m, capable of serving the entire length of the building shall be provided in the turbo-generator building. An opening of 15 m x 8 m provided on the turbine operating floor at the western end which serves to take out the turbo-generator components for maintenance.

Road access is provided for this maintenance bay for the easy transportation of the material and equipment into the TG building or from the TG building.

The steam inlet piping and the extraction steam piping will be run below the operating floor, and a bay is reserved for routing of all these pipes.

- **Control and Electrical Rooms**

The Ten and half meter wide bay on Southern side of the TG bay (B-C) houses the electrical panels & control room for the complete cogeneration plant. The electrical panel room will be located on the Southern side of the TG building at 3.5 M elevation. Con roll room for the entire plant will be located on the Northern side of the TG at 9.0 M level. There will be false flooring for the control room, to facilitate cable routing to the various panels and the DCS systems.

3.5 Land use in the project area:

The project site is within Kashmir Sugar Mills, shorkot, district jhang, Punjab. Most of the area around the project is in agricultural use. Sugarcane is one among the major cash crop of the project area.

3.6 Road access

Project is at shorkot cant road, 3 km off, shorkot city, district jhang. TT Singh and Jhang Districts are connected to the other main cities of the country through a well-established road network of provincial highways and railways. The district TT Singh and District Jhang have 1855 Km and 4096 Km long metal roads network. The Districts headquarters are connected with their Tehsil Headquarters and adjoining Districts of Faisalabad, Khanewal, Sargodha, Sahiwal through provincial highways network and with rural centers with district council roads network. Major mode of transportation in the Project area includes intercity buses, minibuses (for local passengers), cars, vans, tractor trolleys, and trucks. Out of all these transportation modes, mainly, minibuses, cars and vans are used to travel to the settlements along proposed Motorway.

Distance from city Shorkot to 25 biggest cities of country: Pakistan

Distance (Km)	
Shorkot - Karachi	666 km
Shorkot - Lahore	379 km
Shorkot - Faisalabad	275 km
Shorkot - Rawalpindi	474 km
Shorkot - Multan	70 km
Shorkot - Hyderabad	549 km
Shorkot - Gujranwala	406 km
Shorkot - Peshawar	480 km
Shorkot - Quetta	389 km
Shorkot - Islamabad	488 km
Shorkot - Bahawalpur	75 km
Shorkot - Sargodha	307 km
Shorkot - Sialkot	456 km
Shorkot - Sukkur	306 km
Shorkot - Larkana	363 km
Shorkot - Shekhupura	361 km
Shorkot - Jhang Sadr	214 km
Shorkot - Gujrat	432 km
Shorkot - Mardan	508 km
Shorkot - Kasur	365 km
Shorkot - Wah	481 km
Shorkot - Dera Ghazi Khan	51 km
Shorkot - Sahiwal	228 km
Shorkot - Nawabshah	462 km
Shorkot - Mingaora	578 km

3.7 Vegetation features of the site:

The area around the project site is vegetated and cultivation is done in the area which mostly depends upon rain, canals and the water obtained from tube wells. Wheat, sugarcane and corn are the main crops and almost all the vegetables are grown. Fruit orchards are numerous and the main fruit are orange and lokat, guava.

The fauna and flora of the area include: Kikar, Piple, Bohar, Eucalyptus, Popular and Sharin. There is very little of wild life in the area. Karil (Capparis aphylla) is commonly met with but is no-where bigger than shrub. Jand a much prized tree for its firewood and charcoal is becoming a Varity. Shisham Kikar along canal banks has developed into fine

big trees. There is no locality without a rich growth of trees mainly Piple, Bohar, Eucalyptus, Popular and Sharin.

Table 3.3: Major crops/cropping pattern in the project area

	Tehsil	Cropping Pattern	
		Rabbi	Kharif
1	Faisalabad	Wheat, Fodder	Sugarcane, Fodder, Rice. Potato
2	Goira	Wheat, Vegetables	Sugarcane, Potato, Cotton, Fodder
3	Toba Tek Singh	Wheat, Fodder	Sugarcane, Cotton, Fodder
4	Shorkot	Wheat, Fodder	Sugarcane, Cotton, Rice
5	Kabirwala	Wheat, Gram	Rice, Cotton, Fodder, Vegetable
6	Khanewal	Wheat, Gram	Cotton, Rice, Sugarcane, Maize

Source: Agriculture Department

3.8 Cost and magnitude of the operation

As above mentioned 40 MW Co-generation power plant using Bagasse as fuel is going to be installed at Kashmir sugar mills limited, Shorkot, District Jhang. The estimated cost of the project is 1.3 Million USD/MW. The total area required for the project is 50 Acers. There will not any other activity except the generation of power.

3.9 Schedule of Implementation:

The project, provided everything goes according to the planning, will be completed within 20 months from the Zero date. Time line chart is attached as Annexure-II.

Project Implementation stages (tentative):

This schedule envisages the project commissioning and synchronization in Twenty (20) months from the date of ordering of the boilers and turbo generators. The proposed COD is November 2018. With the completion of the detailed project report by November, the preparation of the procurement specifications for the boilers and turbo Generators will be taken up. It is expected that the tendering, evaluation and order finalization will take about three months time. The boiler and the Turbo Generators will be ordered by December 2016.

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For the major packages, the schedule includes the following applicable activities. The time period requirement for these activities has been included in the periods shown against each package.

3.10 Description of the Project (process flow charts/ steps)

Kashmir Sugar Mills Limited (KSML) is a medium sized sugar manufacturing unit with crushing capacity of 10,000 tons /day. Bagasse generated through crushing is used as a fuel for steam generation which subsequently produces power as well. KSML is currently producing heat and power through topping cycle cogeneration at low pressure around 25 bars. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures.

Bagasse based Cogeneration power plant, offers a number of advantages both to the sugar industry and to the country. Besides reducing gap between the demand and the supply in the power sector, Bagasse based fuel power cogeneration provides environmentally friendly solution for additional power generation, reduces dependence on fossil fuels, saves on hard earned foreign exchange from its outflow from the country for import of fossil fuels and gives sugar industry financial gains in the form of cheaper energy while using Bagasse as fuel.

In Pakistan almost all sugar mills are in the process of using Bagasse as fuel for production of cheaper and environmental & cleaner energy. The Bagasse based Cogeneration of electric power is also being extensively used in India, with already the installed generation capacity is close to 1800 MW with more plants coming up.

The cultivable area surrounding the purposed power plant site is approximately (**80,000**) acres where major crop is sugarcane hence a surplus amount of Bagasse will be available for the power plant. Ground water availability is about 60-70 ft and it is very good and quality is quite suitable for meeting all water needs of the project.

The purposed new Bagasse based power plant will be in a position to run for about 120 days during season and 29 days offseason using Bagasse saved during operational phase from KSML.

3.10.1 Energy demand and supply characteristics of the sugar mill

KSML has an existing low pressure (LP, 24 bars) cogeneration plant consisting of 2 boilers and 2 back pressure steam turbines. The overall steam generation capacity of the existing cogeneration plant is 160 tones per hour and the power production capacity is 8.0 MW.

The existing LP system generates enough heat (low-pressure process steam) and electricity to meet the energy requirements of the sugar mill during the milling season. During off-milling season, the electricity is either purchased from the grid or generated through diesel engines to meet the power requirements of offices, employee's residence, etc.

It is proposed to adopt High Pressure of 110 bar / 540°C for the new cogeneration plant. High pressure boiler at 110 bar along with Extraction Condensing Steam Turbine is suggested. The boiler capacity is around 200 tons per hour with turbo generator of 40 MW. The efficiency of the proposed water tube boiler is 71.5% and isentropic efficiency of the turbine is 71%. The heat rate of power plant is estimated to 21.36% with availability of 29.77%. The total investment of the project will be around 1.3 Million USD. The environmental impact of the project is the annual reduction of 26,442 tons of CO2.

3.10.2 Raw Materials

The Major raw material for this project is Bagasse, which is a by-product of the sugar production process. The Co-generation power plant will use Bagasse produced in-house by KSML. The quantity of the Bagasse to be used for the co generation plant is detailed as below.

3.10.2.1 Bagasse Characteristics

Bagasse is a by-product/waste of sugarcane in KSML. Bagasse is a fuel of varying composition and heating value. These characteristics depend on the climate, type of soil upon which the cane is grown, variety of cane, harvesting method, amount of cane washing, and the efficiency of the milling plant.

Table 3.4: Bagasse Characteristics Bagasse:

Characteristics	Unit	Average Value	Range
Carbon	wt.%	*47.82	-
Hydrogen	wt.%	*5.85	-
Oxygen	wt.%	*42.66	-
Sulfur	wt.%	*0.3	0 – 0.3
Nitrogen	wt.%	*0.14	
Ash	wt.%	*3.23	1 - 4
Moisture Contents	wt.%	50.3	50 - 54
Low Calorific Value (LCV)	kJ/kg	7,295	6,590 - 7,790
Gross Calorific Value (GCV)	kJ/kg	9,503	8,536 - 9,723
Density	kg/m^3	150	130 - 170

Source: Consultant's Experience of Local sugar mill

* Dry Basis

Table 3.5: Ultimate ash analysis of design Bagasse:

Carbon	23.96 %
Hydrogen	2.93 %
Oxygen	21.36 %
Moisture	50 %
Nitrogen	0.07 %
Ash	1.55 %
Sulphur	0.15 %
Total	100 %
HHV	**3** kcal/kg

Table 3.6: Typical bagasse ash analysis:

ASH ANALYSIS Constituents	Design	Minimum	Maximum
Fe_2O_3	18.10	15	21
MnO	1.04	0.5	1.5
Cr_2O_3	0.13	0.05	0.20
V_2O_5	0.13	0.05	0.20
TiO_2	0.65	0.03	1.0
CaO	2.87	1.50	3.50

K_2O	3.26	2.00	12.00
P_2O_5	1.83	1.00	2.50
SiO_2	54.80	45	75
Al_2O_3	7.80	5.00	10.00
MgO	9.10	7.00	15.00
Na_2O	0.10	0.1	1.0
Cl	0.02	0.01	0.05
S	0.01	0.01	0.05

Table 3.7: Ash fusion temperature

ASH FUSION TEMPERATURES (°C)	
Reducing & Oxidizing Conditions	
Deformation	1110
Softening	1222
Hemispherical	1250
Flow	1322

3.10.2.2 Water:

All requirements of water are given as:

The site will require make up and cooling water for the operation. The water requirement of the proposed power plant is to be met from tube-wells. The ground water availability is good and reliable. However, there is plenty of surface water available from nearby irrigation canal system. Water from the canal could be utilized in case of emergency.

Due to plentiful availability of water, it has been decided to go with water cooled condensing system for the cogeneration plant. The raw water supply has been planned to be provided by tube-wells installed within the proposed plant boundary. The raw water will be used as a source for make up water for the losses in the process steam, boiler blow down, cooling tower blow down, service water, etc. It has been proposed to provide totally independent raw water and treated water system for the proposed cogeneration

project. The new system will include the storage reservoir, clarifier, reverse osmosis and de-mineralization system and storage tanks. The proposed plant will be located in the area which is being fed by an elaborate irrigation canal system; with the result that ground water aquifer is being regularly replenished. Shortage of ground water is not expected.

Cooling Tower

The capacity of the cooling tower for 40 MW plant shall be a minimum of 4350 m3 /hr, and there shall be a minimum of three (3) Cells.

Reverse Osmosis (RO) Plant

The RO plant shall be designed to have two streams of 33 m3. each. Adequately sized neutralizing pit shall be provided near the RO plant for collecting the discharges from the RO plant and effectively neutralizing the same before pumping the waste to the sugar plant's effluent treatment system.

The water requirement for different processes during construction and operation phase

are fulfill by underground water.

Demineralized (DM)

Water Plant DM water plant will be installed for complete demineralization of raw water for use as boilers makeup water. Regeneration effluents after neutralization will be sent to the wastewater treatment plant.

WASTEWATER TREATMENT PLANT

Liquid effluents from all sources including sewage to be generated in the power plant will be treated according to required levels of the National Environmental Quality Standards as well as those by the World Bank, before discharging into the nearby water canal, after due permission from the competent authority incharge of the canal. The process for getting permission has already been initiated. It is estimated that 50 to 60% of the liquid effluents will be recycled thus reducing the requirement of raw makeup water by 40 to 50%. Thus there is no possibility of any damage to the agriculture crops in the least.

a. Boiler feed water total requirement 200 Ton/h

In which:

I) Re-circulation of condensate from sugar plant 90%

II) From the treated raw water, 10%

b. The raw water will be made available from the deep 3 Well turbine pumps. 2 turbines are reserved if there is probl em in any one. The capacity of each turbine is 1.2 cusec. Cooling water for extraction / condensing turbine total requirement is 14400 m^3/h. All the water will be re-circulated. Drift Losses 0.005 % will be met from underground water. Evaporation loss 1.56 %. All cooling water requirement will be met through cooling tower.

Cooling water for extraction / condensing turbine

Total requirement: 8,400 m^3/h

Drift Losses 0.005 %

- Water requirements during construction phase =100 – 150 cum/day
- Water requirements during operational phase (during season) =5400 cum/day
- Water requirements during operation phase (during off season) = 7200 cum/day
- Coolant water requirement = 14400 cum/hr

3.11 Technology Review & Selection

3.11.1 Major Equipment:

The following are major items / equipment of the plant:

- HP boiler
- HP STG set
- DCS & Instrumentation
- Fuel & ash handling system

- Cooling towers
- Switchyard and Transformers
- Water Treatment Plant
- Low voltage package
- VFDs and Drives
- Plant Piping & accessories
- Ventilation & Air Conditioning System
- Fire Fighting System
- EOT crane
- Panels, Cables and other electrical accessories

3.11.2 Plant Technology Suppliers

- China Wuxi/ HTC / Siemens / PEL/ ABB will be finalized by financial and technical proposal

Ash handling system –

- INFRATECH INDIA TEKNIK PLANT & MACHINERY MANUFACTURING COMPANY METHODS (INDIA) PVT, LTD.

Water treatment plant –

- WEMS / KONTEL TECHNOLOGIES PAKISTAN CHEMICALS

Cooling towers –

- LIANG CHL INDUSTRY PVT LTD, THAILAND
- ADK ENTERPRISES PAKISTAN
- GEA POLACEL COOLING TOWERS

- SPIG PAKISTAN
- INDUSTRIAL DEVELOPMENT & ENGINEERING ASSCOSIATE PAKISTAN
- True Water cooling towers malasiya
- Capacity: 14400 Cu. Mtr. /hr.

Drives/Motors/Instrumentation –

- ABB
- SIEMENS
- YOKOGAWA
- EMERSON SUPCON

3.12 Details of restoration and rehabilitation at the end of the project life:

The co-generation power plant is expected to have a project life of about 30 years. Once the useful life of the new plant will be over, it will be refurbished completely. A comprehensive mechanical, electrical and civil structural overhaul will be carried out. To bring the plant to-date with the then technology available, all necessary equipment replacements will also be done. In this way, the plant will be revived for another term of its useful life. The redundant parts and equipment will be sold in the market for recycling.

In fact the replacement / up gradation of damage / obsolete components of all the major equipments will be carried out as and when needed. However, if the restoration/ rehabilitation of any component/ equipment will be deemed imperative and that will be carried out with the most modern technology available at that time.

This all will be done conforming to the environmental management and controls so as to avoid any damage to any segment of environment or human health. Good part of the civil works, specially the digging of the soil, has already been completed therefore for restoration and rehabilitation of the site at the end of the project shall be one month.

3.13 Government approvals and leases required by the project:

No objection certificate (**NOC**)/Environmental Approval (**EA**) from the EPA, Punjab, Lahore is the major requirement to start work on the project.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.0 DESCRIPTION OF THE ENVIRONMENT

(AREA AFFECTED BY THE PROJECT)

4.1 Spatial and temporal boundaries adopted for the various aspects of the study

While carrying out the present study, factors including present environmental settings and likely future trends around the project site were taken into consideration. Availability of basic infrastructure, water, raw materials, and markets for the product, labor, transport and electricity were the major among other factors considered in the project area. Socio-economic conditions were also considered during the course of the study.

4.2 Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions should the project not go ahead.

Canals and tube wells provides water for the irrigation in the project area. The major crops in the area are sugar cane, wheat, rice and Corn. Even though the sugar cane is considered as a predominant crop in the command area, it still forms only 60% of the agricultural production in the area.

Many people rear especially cows and buffalos for producing milk even on semi commercial scale. It will not be out of place to say that the area is one among the other food baskets of the Punjab province.

The awareness about the importance of education is now developing in the area. Some people of the area are playing an important role in the politics of the country even at higher levels. Fairly reasonable proportion of the people in cities is educated. While in villages, like in other parts of the Punjab province, % of educated people is low. Modern means of communication including television, radio, telephone, fax, e-mail and newspapers are within the reach of majority of the people especially in the cities. The socio-economic values are subject to change in cities specifically under the influence of media especially television.

4.3 Environmentally sensitive areas of special or unique value

Topography and geology; Soils and Climate; water; Ecological resources: Fisheries and aquatic biology, Biodiversity, Forestry, Wildlife, scientific institutions, Socio-economic and Cultural and other heritage,

4.3.1 Physical Resources of the Project Area:

The physical resources of the project area are described below

- **Topography and Geology:**

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.

Of the six Physiographic Divisions of Upper Indus Plain namely:

i- Bari Doab- 2.9 million hectares,

ii- Rechna Doab-2.8 million hectares,

iii- The Chaj Doab- 1.3 million hectares,

iv- The Sindh Sagar Doab/Thal Desert, 3.2 million hectares,

v- The Derajat/Suleman Piedmont, 2 million hectares.

Topography of the project is totally flat with mild slope from north to south (Pakistan Geological Survey). The area is 500 meters above sea level. "the soil of whole district is fertile and is rich alluvial loam" (Punjab agricultural department). The sand is abundant in Ravi and Chenab river bed and this sand is good as building material

- **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

soils; 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 organics. 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 project site falls in the unit of areas between Old River terraces and flood plains of the rivers. The nature of sediments, their surface configuration and deposition pattern are similar to the areas called "bar" areas. From age point of view, they are much younger having been deposited during the sub recent times. This age difference is mainly responsible for weaker development in the soils. The soils are developed in to moderate depth and locally they are known as Bangar Soils.

4.4 Physical environment

4.4.1 Meteorology

The area has the climate with two extremes

Hot summer and mild winter. The summer season starts from April and continue till October. After that the temperature starts to fall especially with cooler nights. June and July are the hottest months in the year. The onset of winters can be marked with November which continues till March.

- Cold Weather Season---December to February.
- Hot Weather Season—march to July.
- Monsoon Season -- August to September
- Post Monsoon Season—October & November.

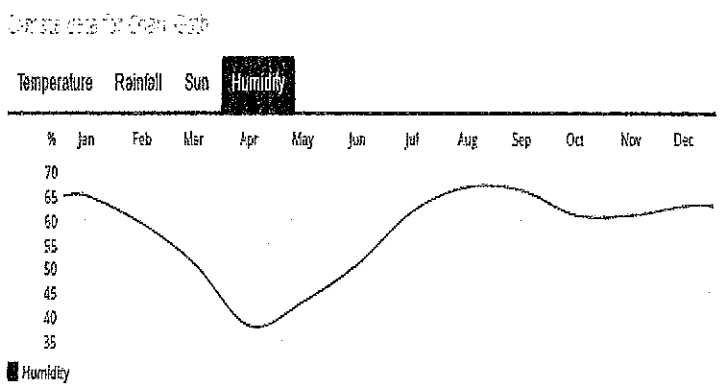
This district has a moderate climate, hot in summer and cold in winter. During the peak of summer the temperature may rise to 55°C during the day, but in the winter months the minimum temperature may fall below 12°C. Average temperature in summer is 33c and 18c in winter. Rainfall is very scarce and scanty. The average rainfall is 20 to 25 cm annually

Table 4.1: showing temperature, precipitation profile of city

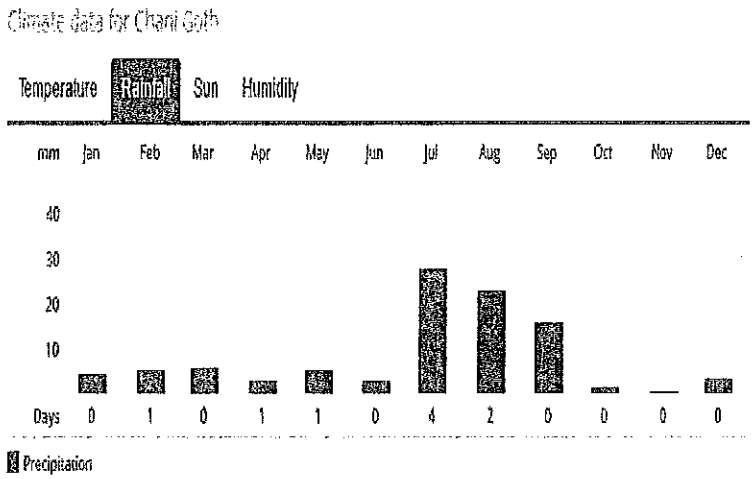
Month	Mean Temperature (°C)		Precipitation (millimeters)	Relative Humidity (%)
	Maximum	Minimum		
January	19.4	4.1	11.5	66.0
February	21.9	7.1	20.1	61.2
March	26.7	12.3	25.7	58.2
April	33.5	18.0	16.9	46.5
May	38.4	22.7	16.1	37.5
June	41.5	31.8	27.9	41.7
July	40.1	32.4	115.0	61.5
August	38.1	26.6	89.8	65.9
September	35.7	23.7	28.6	59.9
October	33.0	17.1	3.8	54.7
November	27.2	10.3	3.0	62.7
December	21.4	5.1	8.6	66.5
Annual (Average)	31.2	17.6	372.3	56.6

Source: Data Processing Centre, Pakistan Meteorological Department.

Humidity

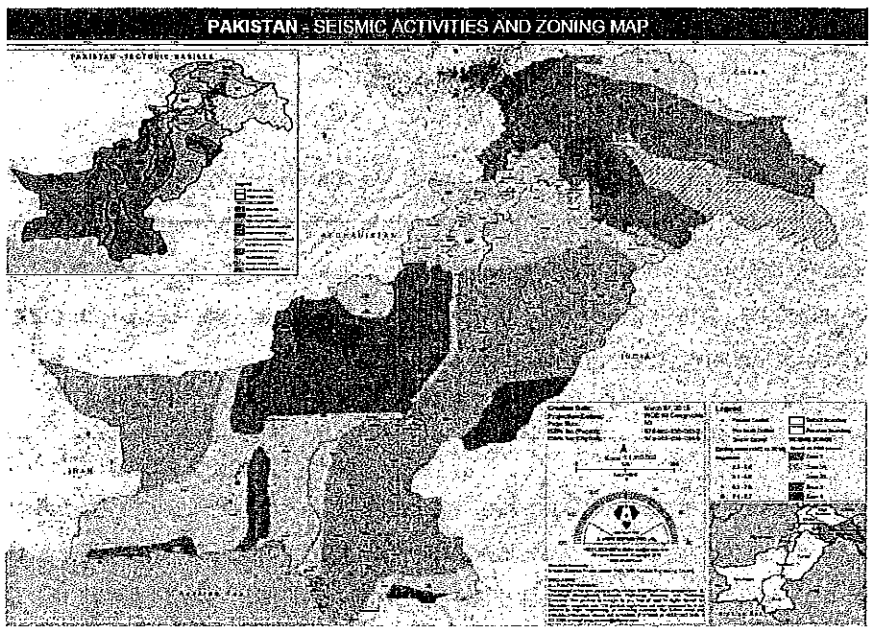


Rainfall



4.4.2 Seismicity

According to seismic zoning of Pakistan, the project area lies in zone 1 of modified mericalli scale and represents minor damages. Distant earthquakes may cause damage to structures with fundamental period greater that 1.0 seconds, corresponds to intercity V and VI of the M.M Scale (National disaster management authority)



4.4.3 Surface and ground water resources

The main sources of water in the project area are river ravi and river Chenab. The canals and water courses system from these two sources is the main irrigation system in the project area. The jhang branch is major irrigation system in that area.

Underground water of good quality is available in large quantities will be used for the entire needs of the project. Extraction of water for project needs will not be at the cost of its availability for irrigation or other uses. The water table of the area 60-70 ft.

4.5 Ecological Resources fisheries, aquatic biology, wildlife, forests, rare or endangered species:

Naturally the project area was vegetated by tropical thorn forest, however the natural vegetation have long ago been replaced completely by agricultural crops.

Crops

Major crops grown and cultivated in this area vary seasonally. In winter season wheat and fodder are grown and during summer sugarcane, rice cotton and maize are grown.

Trees

Citrus and guava orchards are common towards the north eastern side and mango orchards toward south western end. Tree plantation is also found along the field borders and along the water channels. Among trees shisham and kikar are the main species. Other species growing in this area are eucalyptus, semul, bakin/dharek, jaman, sukhchain, mulberry, beri, and khajoor.

Natural vegetation

Natural vegetation includes karir, aak, kana, khabbal, lamb, gorkha which are present in graveyards or in the open area along the roads and also along some canals. Koondar grows along water ponds and wet places (Pakistan wildlife department).

A detailed description is given hereunder;

Local name	Botanical name	Local name	Botanical name
Kikar	Acacia Arabia	Nim	Azadirachta indica
Dates			
Phulahi	Acacia modesta	JAam	Mangifera indca
Shisham tali	Dalbergia sisso	Jal or Wan	Salvadora oleodes
Jaman	Eugenia jambolana	**SHRUBS:**	
Pipal	Ficus retusa	Babri	Acacia jacquemontii
Barh	Fecus bengalenisis	Jawanh	Alhaji-camelorum
Poplar	Populus spp	Aak	Alotropis procera
Jand	Prosopis spicigera	Khar	Haloxilon recurvum
Mesquite	Prosopis glandulosa		
GRASSES:		**GRASSES:**	
Khabbal	Cynodon dactylon	Siriala	Hetropogon contortus
Khowi	Cymbopogon jwaraucusa	Kana	Saccharum munja
Dabb	Eragrostic cynosuriodes	Kundar	Typha angusti-folia

- **Wildlife:**

There is no adequate habitat for wild life in these areas. However, among the main species of wildlife sparsely found in the area especially in the cultivable lands include snakes, wild rats, goh and lizards, foxes, (very few), jackals (very few), wild pigeons, sparrows, crows, owls and doves.

- **Fauna:**

Habitat for accommodation of any fauna of special mention in the area. Rearing of buffalos and cows is done for milk both for own use and for commercial purpose. Goats and sheep are also kept in abundance for meat and milk. Horses and donkeys are also reared for transport of goods especially in villages for carriage of fodder from fields to the farm houses or "dairas", sugar cane to sugar factories and cotton to ginning factories besides other uses. Moreover Dogs (kutay), Cats (Bilian), Hens (murgean), Rabbits (khargosh), Pigeons (kabutar), Fishes (informs), Ducks (batkhain) etc are included in major fauna of District Ahmad Pur Sharqiya.

4.6 Socio-Economic

Demographic Profile

According to the District Census Report1998, total population of the Project affected Tehsils is as follows:

Shorkot: Total population of Shorkot Tehsil of District Jhang is 670,255 with a growth rate of 2.23% and urban and rural distribution of population is 15% and 85% respectively. The women/men ratio is 108:100 and average household size is 6.9. Overall literacy rate for both sexes is 54.29 and male to female as well as urban to rural literacy ratio is given in table 3.1 below:

District	Area	1998		
		Male	Female	Overall
Toba Tek Singh	Rural	59.1	35.3	47.5
	Urban	70.7	55.2	63.2
	Total	**64.92**	**43.29**	**54.29**
Gojra	Rural	61.19	39.81	50.74
	Urban	70.66	56.55	63.83
	Total	**63.48**	**43.8**	**53.88**
Shorkot	Rural	49.49	14.89	32.84
	Urban	70.61	45.31	58.44
	Total	**52.65**	**19.43**	**36.66**

Caste and Ethnic Groups and language

Project Area lies in center of Punjab province wherein each village has a mix of population from different castes and ethnic groups. The rural population of Jhang district relates to Sayyed, Jatt, Arain, Malik, Rajput, Kathia and Noon castes and ethnic groups. According to the findings of the sample survey, Punjabi is the predominant language of the project corridor and is spoken by 100% population. Other languages spoken include Urdu which is widely used among the educated segment of the local population.

Religion

The predominant religion in Jhang is Islam, with 97% and 98% of the population respectively. A negligible proportion of the population belongs to other religions, including Christianity and Qadiani / Ahmadi.

Family Life

Mostly people live with parents and brothers in joint families. Families live in a shared house and share all productive resources such as land, crops, trees and cattle. The internal domestic management and arrangements are in the hands of the oldest men and women of the family. The external matters are dealt by the male head of the household. However the nuclear family trend is emerging in the area.

Settlement Pattern

Majority of the population in project area resides together in the form of compact blocks of houses established as such in each revenue estate locally known as village. However, some families prefer to reside in their agricultural farms to watch and ward their belongings. The villages are connected with the each other and nearest towns mainly with paved roads. Most of the construction of houses is made of bricks and mud mortar and kacha/semi-pacca house are common. Although the population of the villages falling in project corridor relates to different castes but culture is homogeneous throughout project corridor as the languages being spoken, traditions and rituals are common.

Conflicts Resolution Mechanism and Laws

The project area is a "settled area" where provincial and federal statutory laws apply. Under this law, the cases are registered at police stations, if laws of the country are violated. Once a case is registered the legal course takes place through normal courts starting from civil court, District and Session court. Punchayat system is also effective in the area especially in matters of dispute among different caste groups. Under Punchayat system, the family/village heads and locally influential persons play a vital role in arbitration between conflicting parties to resolve their grievances. The decision of Punchayat is binding on the parties and it has a legal acceptance as well in local judicial system of the Province under law of country.

Industry

There are seven large scale industries in the district Jhang. The Government Woolen Centre, Jhang City manufactures blankets for supply to Pakistan Army. Carpets and Durries are also produced for sale among government departments and the public. There is a number of Hand Looms and Power Looms at Jhang and Chiniot. The Wood Carving and masonry of Chiniot is very famous.

5.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Baseline/ Zero Environmental Monitored Data:

In order to assess the existing status of the environment as baseline, on site environmental monitoring was carried out. Results of this monitored data are shown in the Annexures-(III, IV, V, VI)

5.2 Environmental problems during construction and mitigation measures:

i- Environmental problems due to project location

The project aims at installation of new Cogeneration Power Plant under the name "Kashmir Sugar Mill Power Plant, 31.2 MW High Pressure Cogeneration Power Plant" using Bagasse as fuel. The power plant will be installed near the Bagasse storage facility of KSML to reduce cost of its transport to the power plant that is within the premises of the ISM. Surplus quantity of Bagasse required to run the power plant will be available from the project site around where it is available in abundance.

Environmental Management Plan (EMP) as described hereunder is to be followed covering all activities during construction phase; therefore no environmental problems are envisaged due to the project location.

ii- Environmental problems related to design

The plant is to be designed in away that it complies with the required limiting values as set under the NEQS, NEQSAA (effective from 1st January 2013) & NEQSN (effective from 1st July, 2012).

Under the conditions no environmental problem worth mentioning relating to design are envisaged.

Iii- Third party quarterly monitoring

Third party quarterly monitoring will further ensure compliance with the required standards.

Iv- Environmental problems resulting from construction:

The most likely environmental problems to occur during construction phase could due to:

- Construction machinery,
- Compaction of soil activity,
- leveling of land,
- moving vehicles,
- Construction of building and associated civil work.

The pollution from these activities could be in the form of the following emissions from the exhaust of vehicles and from fuel burning in the operation of machines to be used for several of construction activities:

- Gaseous emission of SO_2, NO_x and CO, hydrocarbons etc.
- Particulate Matter (PM).
- Noise.
- Effluent.

In the first place, construction activity is going to be on very limited scale and for short duration, therefore, magnitude of emissions/pollutants will not be very big.

Secondly, the scheduled traffic plan of vehicles visiting plant regularly will further ensure that the environmental pollution does not adversely affect the people and environment.

The scale of erection and commissioning will also be small, thus the potential contribution of noise and dust as pollutants will also be very small and will be curtailed within the plant boundaries.

And lastly, a dedicated Environmental Management Plan (EMP) to be operational during construction will further ensure that environmental problems to accrue during construction are well managed within the required limits of the NEQS Pakistan.

v- Environmental problems resulting from project operations:

The technology suppliers/designers and fabricators enjoy international reputation. The boiler/s will be designed in a way that all sort of emissions from them meet the required levels of the NEQS Pakistan.

➢ Noise levels:

Since most of the machinery will be placed within the built up area thus ensuring noise level compliance with the required standards. Wherever necessary, double housing to the rattling parts of the machinery, is to be provided for reduction of noise levels. This is to be incorporated at the design stage of the plant. The maximum noise levels will not increase from 75 dB (A) during day time and 65 dB (A) during night time at the plant boundary thus will remain in compliance with the limits of the NEQSN Pakistan limits.

State of the art technology (if and wherever required) to reduce CO, NO_x and SO_2 and Particulate Matter (PM) emissions will be used. Hereunder, more details are given.

➢ Boiler Stack Emissions

Boiler stack emissions of concern are primarily nitrogen oxides (NO_x), carbon monoxide (CO) and particulate matter (PM) and sulphur dioxide (SO_2).

Since CO emissions are a function of plant operations such as the level of excess air and maintenance of combustion temperature and residence time, therefore, its concentrations can be easily controlled while controlling these factors.

➢ Ash Handling

The ash handling system envisaged for the cogeneration plant is of two types and shall be provided for two boilers individually:

- Sub-merged scrapper conveyor system for grate ash
- Dense phase handling system for fly ash

The fly ash from Electrostatic precipitator (EP) (Fly Ash Arrestor) will be dry and powdery in nature and occasionally with hot solids. Since the fly ash is to be collected though EP, therefore for the fly ash from the stack gas emission will be trapped in the system up to 99.9%. This ensures that the main emission of PM will be conveniently controlled to the desired levels as set by the NEQSAA.

The fly ash will be collected in storage yard having a suitable capacity & will be disposed-off by trucks / trailers suitably covered to avid any spillage on the way. This ash may be dispose off according to any one of the following methods, individually of collected:

- Supply to cement factory. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- Land fills. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- For making bricks for face lifting,
- Used as manure in field,
- making bricks for paving
- Supply of the fly ash to agriculture use as rich source of Potassium, (K) being cheaper substitute of costly potassium fertilizer. It is to remember that since the ash comes from Bagasse an agree product therefore it will not harm to soil.

➢ **Bottom ash**

The furnace bottom ash is collected by water impounded scrapper conveyers, and as the quantity of ash discharge is less, the same is collected in trolleys parked near the scraper conveyor. This ash can be disposed of in variety of methods like:

- In cement as aggregate
- Manufacturing of tiles for face lifting of buildings, flooring of paths etc.
- Landfill

➢ **Quantity & Quality of the effluents from the 40 MW Cogeneration Plant**

The figures given below are for the normal operation of the plant during the seasonal with Bagasse as the fuel.

➢ **Gaseous pollutants from the Cogeneration Plant during Bagasse firing.**

Flue gases from the stack	284,780 kg/hr
Temperature of the gas leaving stack	160°C (max)
CO	378 mg/Nm^3
SO_2	13.3 mg/Nm^3
NO_x	19.8 mg/Nm^3
PM through flue gases	65. mg/Nm^3

➢ **Solid Wastes from the Plant during Bagasse firing**

Dry fly Ash	0.92 MT/h
Wet bottom ash from Grate	0.63 MT/h

➢ **Liquid Effluents**

a)	Boiler Blow down Water	:	4.15 TPH
	Total Dissolved Solids		: 80-100 ppm (Max)
	pH @ 25 Deg.C	:	9.8to 10.3
b)	Cooling Tower Blow down	:	1 – 2.5 Cu.Mtr./Hr
	Total Dissolved solids	:	650 – 700 ppm
	pH @ 25 Deg.C	:	9.8 to 10.6
	Chlorine	:	N A
c)	Waste Water from water treatment		12 TPH (average) Neutralizing pit

Total Dissolved solids	:	500 ppm (Max.)
pH @ 25 Deg.C	:	7.81

The figures given below are for the normal operation of the plant during the off-season operation.

Gases Effluents from the cogeneration plant during bagasse firing

Flue Gases from the stack from the boilers	210,780 kg /Hr
Temperature of the gases leaving the stack	160 Deg .C (max)
SO2 emission	11.3 mg/Nm^3
NOx emission	less then 80 ppm
PM	50 mg/nm^3

- **SO_2 emissions**

After the plant startup, SO_2 emissions will be 11.3 mg/Nm^3as the sulphur content in the fuel is very less.

- **NOx emissions**

After the plant startup, NOx emissions will be 149.8 mg/Nm^3 due to the very low level of nitrogen content in Bagasse. The maximum stack emissions of SO_2 and NOx will not exceed the permissible limits of the NEQS Pakistan.

- **Particulate Matter (PM) emissions:**

Particulate matter emissions will be approximately 50.0 mg/Nm^3 and will be controlled with Electrostatic Precipitator (EP) to remain within the prescribed limits of the National Environmental Quality Standards (NEQS)-Pakistan limits.

- **Effluents:**

The Effluent generated from Co-generation power plant lagoon treatment process will be used as effluent will be neutralized and will be let into the proposed effluent treatment plant. The treated water from the power plant, ETP will be used for

agriculture purpose and for sprinkling inside the plant boundary wall. As already KSML using lagoon treatment process and all waste water after treatment is used within boundary fields of KSML.

5.3 Environment Management Plan /Mitigation / Compensation Measures during Construction Phase

Potential	Mitigation/ Compensation Measures Impact
Air Quality	1. Vehicles transporting loose construction material to be Covered with tarpaulins.
	2. Limit on speed and movement of vehicles, where considered appropriate speed-breakers should be installed
	3. Use low emissions trucks/vehicles for material transport where possible.
	4. Routine service and maintenance of vehicles and machines to reduce engine emissions.
	5. During periods with abnormal wind speeds, in particular during dry weather conditions, workers on the construction site should be provided with adequate inhalation and eyes protection gears. In case particulates in air hamper a clear view over the site completely, so that safety is impaired, the construction should be interrupted until weather conditions improve.
	6. To reduce generation of dust in the construction process, onsite roads and parking areas, as far as possible, would be constructed with asphalt over a compacted sub base.
	7. Spraying exposed soil with water to reduce PM emissions. Water to be applied at a rate to maintain a moist surface, but not create surface water runoff or erosion conditions.
	8. Provide wheel washers to remove particulate matter that would otherwise be carried offsite by vehicles that would

	decrease deposition of particulate matter on area roads and subsequent entrainment from those roads. 9. Routing and scheduling construction trucks to reduce delays to traffic during peak travel times would reduce secondary air quality impacts caused by a reduction in traffic speeds while waiting for construction trucks. 10. As far as possible planting vegetative cover (matching the local climate), as soon as possible after grading, would reduce windblown particulate matter in the area.
Water Supply	1. During construction, non-potable water would be supplied by Trucks to provide dust control. 2. Potable drinking water for construction workers would be provided by a water service to be contracted by the site contractor.
Ground Water	1. Any liquid material and lubricants (e.g. hydrostatic Testing) Water and wastewater) that accumulate during the construction phase should not infiltrate into the soil that have a direct contact to the ground water. Septic tanks shall be used for any waste water collection. Each tank, when filled and closed, should be brought to the closest wastewater treatment plant for further treatment. 2. Closed tanks should be removed from the site as soon as possible and should not be allowed to remain on the construction site as an interim storage until the end of the construction phase.

3. Monitoring of the characteristic of waste water collected in the septic or other tanks should be carried out on routine basis.

4. Maintenance and washing of all mobile machinery & vehicles should be carried out at adequate service stations. Good and regular maintenance of all vehicles and machines used on site is mandatory.

5. Maintenance and re-fueling (if necessary) of any construction equipment shall be done at a decent distance from the excavation area and only be undertaken on sealed area. Any re-fuelling must be handled carefully taking particular attention to not spilling any fuel.

6. On site storage of fuel, engine oil and lubricants (if any) shall be in locked tanks, sealed and shadow-roofed area.

7. On site storage of fuel, engine oil and lubricants that might be stored shall be collected at the end of construction phase and brought to either a disposal point as hazardous waste or be brought back for re-use to the place it was rented for the purpose of this construction.

Solid Waste

1. All solid wastes shall be disposed off according to a

   set Procedure and record of sales will be kept to track at any time when it is required.

2. The contractors to whom any waste is to be sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse / handling of such wastes in environmentally sustainable way.

Soil	1. Construction activities must be limited to the designated areas. 2. Refilling of excavated soil should be done as far as possible. Where possible reuse of excavated soil should be done. 3. Prevention measures should be developed in the event of an accident or threat (e.g. massive, uncontrolled leakage of waste water into unsealed soil on-site).
Fauna and flora	1. Planting of indigenous grass, trees and bushes between the edge of the site and the adjacent un-utilized area should be carried out. If not earlier practical, such measures should be implemented after the completion of all construction activities 2. Develop green strips of suitable vegetation, along the access road to improve the landscape shape.
Noise	1. Power mechanical equipment like bulldozers, air compressors, Concrete pumps, excavators, concrete mixers etc. shall only be used with low sound power, whenever possible. 2. Optimize transportation management to avoid needless truck trips; avoidance of truck movements in residential areas at least during night time. 3. The building machinery equipment shall be well-maintained and serviced regularly during construction phase.

4. Silencers or mufflers on construction equipment shall be used.

5. Whenever possible, mass construction material and excavated soil shall be stored in direction of the nearest habitat as noise barrier.

6. Construction activities shall be scheduled in such a way that noise intensive operations side by side with an increased net noise level will be avoided.

7. Workers on the construction site should be equipped with ear protection in particular those directly exposed to higher noise levels.

5.4 Environment Management Plan /Mitigation / Compensation Measures During Operation Phase

Potential	Mitigation /Compensation measures Impact
Landscape	1. To the extent possible, develop a green belt along the Facilities boundary area and other open spaces, to create to some extent a natural landscape. The flora to be used for such green belt should be tolerant to the local climate.
Ambient Air Quality	2. Continuous monitoring of ambient air for SO_2, NOx, and PM to be carried. National Ambient Air Quality Standards (NAAQS) -2010 will also be applicable Standards.
Surface Water	3. Waste water treatment, as described in this report,

	to be carried out continuously and monitored.
Ground Water	4. Regular inspection of facilities for intercepting leaking and spilled liquids. Hazardous chemicals shall be handled only in appropriate segregated, sealed and bundled areas at site.
Solid Waste	1. All solid wastes shall be disposed off according to a set procedure and record of sales will be kept to track at any time when it is required. 2. The contractors to whom any waste is to be Sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse/handling of such wastes in environmentally sustainable way.
Noise	1. Equipment will be acoustically shielded and /or lagged as far as possible. 2. A noise measurement campaign during full operation at operation start should be implemented to verify the real noise levels are in line with NEQSN-Pakistan. 3. Workers should be obliged to use ear protection in areas within the plant and for specific work that exceed the tolerable maximum noise limits.

	4- Double housing of the rattling parts will be incorporated at the design stage in the area wherever necessary to ensure noise level reduction to the NEQSN Pakistan.
Ash handling	1. Bottom Ash and fly ash generated by burning Bagasse in the boiler will be used as manure / Fertilizer and disposed to the farmers and also made available to other growers in the region. The ash will be stored in enclosed silos on site. Transportation of the ash from the site will be done through trucks to be completely covered with tarpaulin to avoid any ash being spread on the roads during transportation.

With all these arrangements in place Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMtP), as recommended in this report will also be operational as legal requirement under the Punjab Environmental Protection (amendment 2012) Act . This will further ensure the power plant operation in environmentally sustainable fashion.

Besides the concrete measures to be adopted as described above, the quality of environment will further be enhanced through the running of project in complete accordance with the 5RS Principles- Reducing, Recycling, Reusing, Refurbishing and Retrofitting. Good house keeping will be the order of the day. Tree plantation on the project site and its vicinity will be carried out.

5.5 Potential Environmental enhancement measures

Besides the concrete measures to be adopted as described above, the quality of environment will further be enhanced through the running of project in complete accordance with the 5RS Principles- Reduce, Reuse, Recycle, Refurbish and Retrofit.

Good house keeping will be the order of the day. Tree plantation on the project site, the quarries and on roads in the project vicinity will be carried out.

As a part of the Kashmir Sugar Mill Limited as its mother project, already a lot of environmental enhancement measures including also tree plantation over a vast stretch of the project area boundary wall have been adopted.

During construction and regular operation of the project activity large number of the persons will be employed. Local people will be preferred for employment as per employment policy of Kashmir Sugar Mill Limited. It is estimated that about 300 people of all categories will get employment during construction phase of the project while 50 regular employees are required for the smooth running of the plant.

5.6 Occupational Health and Safety Management

The HSE management system will be implemented and attach as Annexure-VII

5.7 Disaster Management Plan

Emergency prevention through good design, operation, maintenance and inspection are essential to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such Emergency and restoration of normalcy at the earliest. The overall objective of a disaster management plan is to make use of the combined resources at the site and outside services to achieve the following:

1. To localize the emergency and if possible eliminate it.
2. To minimize the effects of the accident on people and property.
3. Effect the rescue and medical treatment of casualties.
4. Safeguard other people.
5. Evacuate people to safe areas.
6. Informing and collaborating with statutory authorities.

7. Provide authoritative information to news media.
8. Initially contain and ultimately bring the incident under control.
9. Preserve relevant records and equipment for the subsequent enquiry into the Cause and circumstances of the emergency.
10. Investigating and taking steps to prevent reoccurrence.

6.0 ENVIRONMENTAL MONITORING PROGRAM AND INSTITUTIONAL REQUIREMENTS

6.0 ENVIRONMENTAL MONITORING PROGRAM AND INSTITUTIONAL REQUIREMENTS

The project aims at installation of 40 MW Bagasse based Cogeneration power plant using Bagasse as fuel at Shorkot, Dist Jhang, Punjab. Environmental Management Plan (EMP) and Environmental Monitoring Programme (EMtP) as recommended for the project will ensure that all type of pollutants from the projects remain within the prescribed limiting values of the NEQS, NEQSAA and NEQSN- Pakistan.

6.1 Assigning responsibility for implementation (by name or position)

6.1.1 Institutional capacity

The project will be implemented and monitored by the Project Proponent that will be executed as Implementing Agency (KSML), which will be supported by Design and Supervision Consultant (Engineer). Kashmir sugar Mill Limited (KSML) will be the Implementing Agency.

KSML shall be responsible for ensuring compliance to environmental requirements as well as central/ state governments. An Environmental Management Plan (EMP) will be a part of contract with the civil works contractors engaged for execution of the works. The supervision and implementation of EMP shall be the responsibility of contractors and Engineers with KSML as implementing agency (with assistance of HSE Inspector).

For effective environment management, responsibilities are set for each operation as follows:

Official concerned	Responsibility
1-General Manager/Plant Incharge/ RD	i- Over all in-charge of all the Environmental Management Plan (EMP) and EMtP. ii- He will be responsible to ensure smooth functioning of the EMP and EMtP/ system iii- Daily progress on the state of the environmental status will be reported to him in writing by his junior responsible staff. iv- All other Environmental Management and Monitoring matters , issues and problems will be reported to him for rectification. v- He will work as bridge between the Government concerned authorities and the inside E.M. vi- He will be answerable to the higher management in all matters relating to E.M.
2- Shift Engineer/ In Charge	i- During his shift timings, he will be responsible to look into smooth functioning of the process in environmentally sustainable fashion. ii- He will be responsible to rectify any problem regarding environmental matters. iii- He will directly report all matters regarding E.M. to the G.M.

3- Plant Operator	i- He will record emissions behavior on hourly basis and will report to the Shift Engineer.
4- Laboratory Chemist	i- He will be responsible to carry out all tests regarding environmental monitoring which includes Gaseous emissions monitoring, particulates monitoring, sound levels monitoring etc. according to the monitoring scheduled and will report to the Shift Engineer/In Charge.

6.2 Monitoring program to assess performance:

According to "Guidelines for Self- Monitoring and Reporting by Industry (SMART)," Final Report, March 1998, approved by Pakistan Environmental Protection Council (PEPC), in August 1999, Power Plant falls under "Category B" regarding monitoring of gaseous emissions.

All out environmental monitoring of the power plant should be carried out according to the schedule as recommended in the SMART.

After the plant start up, once a comprehensive monitoring report for all NEQS parameters for normal plant operations should be carried out. This is to establish that the plant does meet the environmental commitments made in this IEE Report. This monitoring should be carried out by a third party. Thereafter, subsequent regular monitoring will be restricted to priority parameters as suggested in the SMART. Reporting will be done according to the format as approved in the SMART.

Even though all effluent generated through the entire project activities along with sewage will be treated in the designed waste water treatment plant and all relevant data regarding generation, treatment and disposal mode of the effluent will be duly recorded.

A track record of all solid wastes and their disposal shall also be regularly maintained for its use as and when required.

All monitoring data should be reviewed and analyzed regularly in comparison with the NEQS limiting values. In case of any deviation/violation of the required standards, immediate necessary corrective actions should be taken. All the monitored data should be reported to the EPA Punjab.

6.3 Reporting and reviewing procedures

Monitoring schedule, as explained above will be adhered to and all the data to be monitored will be scrutinized at the level of Shift Engineer/ In Charge and on monthly basis at the G.M. level. The data will be documented according to appropriate format. Discrepancies will be duly addressed to. For presentation of the data to the Government Agencies, approved data recording to the SMART format.

6.4 Training Schedules

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 effluents treatment 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.

6.5 Environmental Monitoring

Environmental monitoring will be carried out by the staff to be engaged for the purpose.

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 Environment quality monitoring laboratory

The existing laboratory will be upgraded and furbished with required equipment to also act as environmental monitoring laboratory.

6.7 Summary of Impacts and mitigation measures

The most significant pollutant emitted by Bagasse-fired boilers is **Ash**. As KSML is already using High pressure boilers and ash is in very little quantity, the high pressure boilers will produce minor quantity of ash which will be controlled by the use of Electrostatic Precipitator separator (fly as arrestor) to meet the permitted dust concentration as required by NEQS Pakistan. Both of these technologies have the ability to remove 99.9% of ash (PM) in stack exhausts.

Gaseous Emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are lower than conventional fossil fuels due to the characteristically very low levels of sulfur and nitrogen associated with Bagasse, therefore, they will remain within the prescribed limiting values of the of the NEQS Pakistan.

The noise levels of 75 dB (A) and 65 dB (A) indicated are at the plant boundary, as the maximum noise level shall be 85dB (A) at 3.0 m from the equipment.

Bottom ash

- Supply to cement factory. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- Land fills. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- For making bricks for face lifting,
- Used as manure in field,
- making bricks for paving
- Supply of the fly ash to agriculture use as rich source of Potassium, (K) being cheaper substitute of costly potassium fertilizer. It is to remember that since

the ash comes from Bagasse an agree product therefore it will not harm to soil.

The furnace bottom ash is collected by water impounded scrapper conveyers, and as the quantity of ash discharge is less, the same is collected in trolleys parked near the scraper conveyor. The bottom ash of ash during transportation. This ash can be disposed of in variety of methods like:

- In cement as aggregate
- Manufacturing of tiles for face lifting of buildings, flooring of paths etc.
- Landfill

6.8 Equipment maintenance details

Predictive maintenance and preventive maintenance will be managed as per recommendation of OEM.

6.9 Environmental budget

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. 1 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. After that, monitoring program will be revised in consultation with EPA and cost will be revised accordingly.

KASHMIR POWER PRIVATE LIMITED

7.0 GRIEVANCE REDRESSING MECHANISM-FORMAL AND INFORMAL CHANNELS

7.0 GRIEVANCE REDRESSING MECHANISM-FORMAL AND INFORMAL CHANNELS

7.1 Formal Channel

The formal channel under PEPA (Amendment 2012) is as per law. It is immaterial whether it is produced in the IEE report for our cogeneration plant or not. As and when any issue may arise the law will take its own course.

7.1.1 Environmental Legislation

The Punjab Environmental Protection (Amendment 2012) Act (PEPA) provides a complete code of conduct for addressing grievances stemming from damages to any sector of the environment from the project activities.

The project is required to operate at least 95 % of its operational period in strict compliance with the required emission standards of Pakistan as provided in the (Punjab Environmental Protection (Amendment 2012) Act and the National Environmental Quality Standards. This ensures that the project proponent is legally bound to observe all legal requirements to avoid damaging the environment around the project.

7.1.2 Punjab Environmental Protection (Amendment 2012) Act and Environmental Management

The Punjab Environmental Protection (Amendment 2012) Act covers aspects related to the protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development. Being the prime environmental law, Punjab Environmental Protection (Amendment 2012) Act establishes complete regulatory and monitoring bodies, policies, rules, regulations and national environmental quality standards. To ensure enforcement, the act establishes regulating bodies i.e. Punjab Environmental Protection Council (PEPC) and responsible bodies i.e. Pakistan Environmental Protection Agency (Pak-EPA) at Federal level and Environment Protection Agencies at Provincial level. The act extends to the whole of Punjab province.

Punjab-EPA has the power to arrest without warrant any person against whom reasonable suspicion exists of his having been involved in an offence under the PEPA-2011, and enter, inspect and search without warrant any premises, vehicle or vessel. It also provides for seizing any plant, machinery, equipment, vehicle or substance, record

or document. Punjab Environmental Protection (Amendment 2012) Act also provides the power to summon and enforce the attendance of any person and issuance of Environmental Protection Order, PO 16, an Environmental Protection Order (EPO), in relation to a person who is contravening a provision of the PEPA-2012.

7.1.3 Enforcement of PEPA and Liability

The Government of Punjab is bound to protect the environment in accordance with its international commitments under various conventions and treaties it has signed or ratified. The PEPA-2012 translates these commitments into a compliance programme for the industrial establishments. Non-compliance to these commitments may results in loss of credibility, popularity and even financial aid from the international forums.

With the eights in the Constitution of Pakistan, the Punjab EPA is responsible for implementation of all Rules and Regulations within the province. Punjab EPA is responsible to ensure under the PEPA- 2012 requires:

- That no person (including companies) under its purview will discharge or emit any effluent or noise in contravention of the National Environmental Quality Standards.
- That no proponent of a project shall commence construction or operation unless he has filed with the Punjab-EPA, an Environmental Assessment report according to the sensitivity of the project or where the project is likely to cause an adverse environmental impact.
- That no person may dispose of waste on public land or on highway on or a land owned or administrated by a local council, unless done in accordance with the provisions of the Punjab Environmental Protection (Amendment 2012) Act.

The following section of this act further clarifies the mechanism of Environmental Management and Grievance Redress Mechanism.

Section 11:

"Prohibition of certain discharges or emissions. — (1) Subject to the provisions of this Act and the rules and regulations no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount,

concentration or level which is in excess of the National Environmental Quality Standards or, where applicable, the standards established under sub-clause (I) of clause (g) of sub-section (1) of section 6."

"(2) The Federal Government may levy a pollution charge on any person who contravenes or fails to comply with the provisions of sub-section (1), to be calculated at such rate, and collected in accordance with such procedure as may be prescribed."

Section 12:

"Initial environmental examination and environmental impact assessment.—(1) No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact Assessment, and has obtained from the Government Agency approval in respect thereof".

Section 16:

"Environmental protection order.---(1) Where the Federal Agency or a Provincial Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act, rules or regulations or of the conditions of a license, and is likely to cause, or is causing or has caused an adverse environmental effect, the Federal Agency or, as the case may be, the Provincial Agency may, after giving the person responsible for such discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures that the Federal Agency or Provincial Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include;

(a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;

(b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;

(c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances; and

(d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Federal Agency or, Provincial Agency."

Section 17:

"Penalties.—(1) Whoever contravenes or fails to comply with the provisions of sections 11, 12, 13 or section 16 or any order issued there under shall be punishable with fine which may extend to one million rupees, and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

Provided that if contravention of the provisions of section 11 also constitutes contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2) only.

(2) Whoever contravenes or fails to comply with the provisions of section 14 or 15 or any rule or regulation or conditions of any license, any order or direction, issued by the Council or the Federal Agency or Provincial Agency, shall be punishable with fine which may extend to one hundred thousand rupees, and in case of continuing contravention or failure with an additional fine which extend to one thousand rupees for every day during which such contravention or failure continues.

Contraventions of the provisions of the PEPA-2012 is punishable with imprisonments extending up to five years, or with fine extending up to one million or with both. Where an offence is committed by a company every Chief Executive officer (CEO) and the company shall be deem guilty of the offence. Action can even be taken against Government Agencies and Local Authorities.

Government may also constitute an Environmental Tribunal to hear cases relating to the PEPA-2012. The tribunal may only hear cases when the complaint is made in writing by Pak-EPA, or Local Council or any aggrieved person who has given at least thirty days notice to Pak-EPA of the offence and of his intension to make a complaint to the Tribunal. The Tribunal may also hear appeals from the Agencies. Appeals from the tribunal shall go to the High Court.

In order to resolve the disputes relating to the environment issues, Environmental Tribunal Rules 1999 have been promulgated. In trying the offences, the tribunal has to follow the Code of Criminal Procedures 1898. The tribunal shall send the copies of his orders to the parties concerned and the Director General of the Federal EPA and Provincial EPAs. The Tribunal shall dispose of its proceedings within 60 days. An appeal to the Tribunal, accompanying a copy of the impugned order, copies of the documents relied and prescribed fees, shall be sent to the Registrar by the appellant. Generally the proceedings of the Tribunal shall be open. "

7.2 Grievance Redress Mechanism- Informal

In the PEPA Act or in any other law, to the best of our information, the informal channel to settle any dispute or issue has not been provided. Its status is like an agreement in between two parties. To settle any dispute or issue which may arise in between them it is not binding on any of the parties to settle it through informed channel, rather as and when an issue or dispute may arise, they will be free to opt for it and if any party do not wish to opt for it, the channel efficacy will be of no avail. To our mind its status is like "The Arbitration" option available in the Management – CBA negotiations process. If any of the parties do not wish to enter into arbitration, the arbitration provision will not bind the parties must enter into arbitration.

7.2.1 Compensation for Environmental Damages

As described under Section 17- Penalties, Subsection-(5), (f) of the Punjab Environmental Protection (Amendment 2012) Act, the likely damages to be caused to any sector of the environment or property or else will be paid to the affected parties.

Secondly, under the PEPA -2012, the EPA Punjab and the Environment Tribunal can legally prosecute the project proponent for the damages to occur from the pollution generation from the project.

There is complete legal cover to address issues related to compensation for any environmental damage arising out of project activity. However, to address any such issues more expeditiously, the project administration will have a local committee as an Informal Mechanism.

This informal mechanism will provide convenient, quick and cost effective decisions for compensation against any environmental damages that occur from the project activity. This informal mechanism will also build confidence between the project administration and public and safeguard the interests of both the project and the public at large.

The project administration, therefore, proposes the following committee at the local level for amicable and speedy resolution of cases pertaining to any environmental damages that likely occur from the project activity. The decision of the committee will be executed in letter and spirit.

7.2.2 Constitution of the Committee:

- Chief Executive of the Company or his nominee: Chairman/Chief Executive of the committee
- Head of the District Local Self Government — Ex- Member
- A dignitary of the project area (enjoying confidence of the people of the project area) — Member
- Head EHS Department of the project — Member
- Representative of the NGO the project area. — Member
- Representative of the aggrieved person — Member
- Environmentalist — Member

7.2.3 Time Schedule for Redressing the Grievance

- The committee will be under obligation to decide the grievance within three weeks of the complaint by the aggrieved party.

- Compensation as decided by the committee will be paid in full to the aggrieved party within two weeks from the date of decision of the committee.
- The decision of the committee will be binding on both parties, i.e. the project proponent as well as the aggrieved party.

8.0 PUBLIC CONSULTATIONS

8.0 PUBLIC CONSULTATIONS

Public consultations were held with the people from the project area. They are very much in favor of the project installation for the reasons and advantages to accrue to them directly as well as indirectly as described below.

Written comments/views of the public consultations are attached as Annexure- VIII

Community Awareness and Perception about the Project:

- By and large, a large proportion of the people of the project area are aware of the planned project implementation.
- Among the people consulted as a part of the Public Consultations, virtually all of them welcome the project.
- The people have clear perception that there will at least some addition to the shortfall of power.
- People foresee all out positive impacts like employment opportunities, business development, operating small hotels/tea stalls, tires and tubes repairing shops along with other vending services for the vehicles.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of installation of the power plant. Therefore, their attitude towards the project installation is quite positive.
- As far as the Social Impact Assessment (SIA) is concerned, positive social impacts are dominant over hardly conceived any negative social impacts observed during the study.
- They correlate their positive attitude towards the plant with many socio-economic opportunities and benefits to restart.
- The people believe that installation of the plant in the area will not only help to restart earning opportunities but also, it will open up vast employment new 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, some reasonable number of the local people will get employment and business from the installation of the plant e.g.: shop keepers, traders, suppliers, contractors, transporters, technicians etc.

- They feel that the plant and its related activities will provide a strong base for positive financial and social change.

- They foresee improvement in the quality of life of the people.

From the above facts one can conclude that many positive economic and social impacts will reappear in the quality of the lives of the people of the Study Area due to the plant installation.

9.0 CONCLUSIONS

9.0 CONCLUSIONS

Kashmir Sugar Millis in the process of installing a 40 MW Bio Mass (Bagasse) based Co-generation power plant for the generation of electricity. Bagasse based co-generation power plant under the name "Kashmir Power Private Limited". The plant is to be installed at Shorkot, Dist Jhang, Punjab.

Bagasse based Cogeneration is being considered by many countries as an environment friendly way of augmenting the generation capacity. The Government of Pakistan has estimated a potential of 3000 MW of Cogeneration power from the existing sugar mills. The Government of Pakistan is treating these projects on "fast track basis". The present project of KSML to generate 40 MW with the Bagasse to be generated for a period of about 120+29 days.

The proposed new Cogeneration plant, on commissioning will export a substantial quantum of power to the national grid. The proposed Cogeneration cycle is already proven and implementation of this project will benefit the sugar mill and the project in itself and the country.

According to the "Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000" the project falls in category "I". Accordingly, this IEE has been prepared for issuance of NOC/EA by the EPA, Government of the Punjab, Lahore before initiation of the project on ground.

It has been found that the project has inbuilt mechanism to:

- Treat the effluents, control stack gases emissions and PM, control Noise to the prescribed limits of the NEQS, NEQSAA and NEQSN- Pakistan.
- Solid wastes disposal will be done according to the environmentally sustainable order.
- EMP and EMtP as recommended in this IEE Report are to be put in place during operations of the project.
- Biannual monitoring of all out environmental monitoring by a third party also certifies that the project will run in accordance with legal requirements.

On the basis of the major facts summarized as above, the project merits for issuing No Objection Certificate (**NOC**)/Environmental Approval (**EA**) by the Environmental Protection Agency, Government of Punjab, Lahore.

RECOMMENDATION:

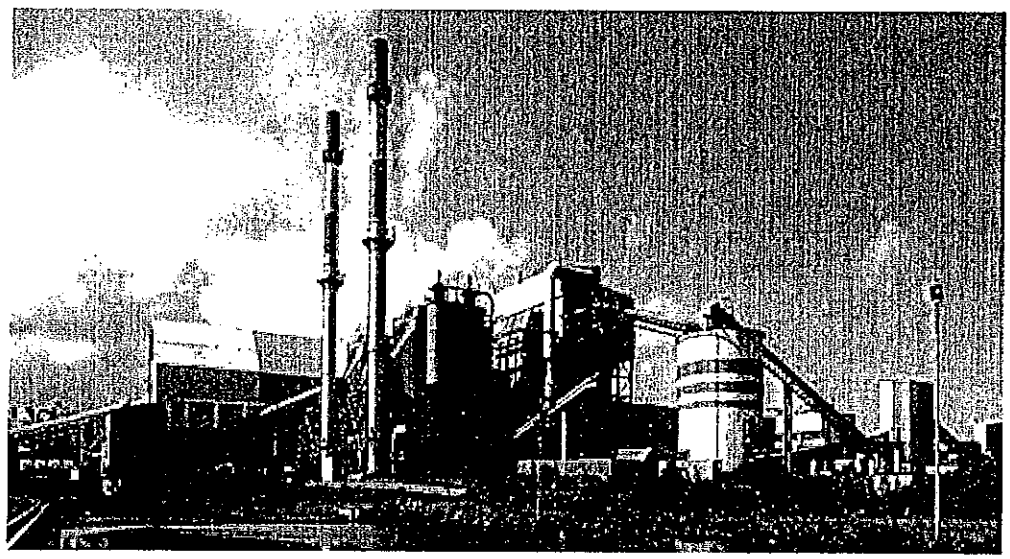
On the basis of the facts summarized as above, the project merits for issuing Environmental Approval by the Environmental Protection Agency, Government of Punjab, Lahore

Report No. PPI-228.1-Draft/16

INTERCONNECTION STUDY

For

40 MW CO-GENERATION POWER PROJECT BY KASHMIR SUGAR MILLS



Draft Report
(November 2016)

Power Planners International

UK Office:
3-Sylvester Road,
Sudbury Town, Middlesex,
HA0 3AQ, UK
Phone & Fax:+44-(0)208-9223219

Pakistan Office:
64-F/1, Wapda Town,
Lahore 54770, Pakistan
Phone: +92-42-35182835;
Fax: + 92-42-35183166

Email: info@powerplannersint.com
www.powerplannersint.com

Executive Summary

- The Draft Report of 40 MW Power Project by Kashmir Sugar Mills, referred to as Kashmir PP, is submitted herewith. The installed capacity of the plant would comprise of one unit of 40 MW which would deliver maximum net power of 35.8 MW to the grid.
- It would like to go for high pressure cogeneration in the sugar mill with the aim of exporting power nearly 29.6 MW to the national grid during the crushing season, from November to March. During the Non-crushing season Kashmir PP will supply 35.8 MW power to the national grid, the operational period will depend on the availability of bagasse.
- The latest generation, transmission plan and load forecast provided by NTDC has been used for the study, attached in Appendix – A, vide data permission letter no. GMPP/CEMP/TRP-333/4483-86 dated 26-10-2016.
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The nearest grid facility is the 132 kV substations of Shorkot City. It lies at about 7.5 km from the site of Kashmir PP.
- Due to the location of Kashmir PP, the most feasible interconnection scheme would be looping in-out one of the 132 kV single circuit between Shorkot City to Shorkot Road passes about 1.5 km from the proposed Kashmir PP on Lynx conductor. The up-coming chapters discuss in detail the location and interconnection of the Kashmir PP. A few approximate sketches are shown in Appendix-B.
- The proposed scheme will require two breaker bays of 132 kV at Kashmir PP to connect with the 132 kV circuits each from Shorkot City to Shorkot Road respectively.
- In view of planned COD, of the Kashmir PP in November 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 January 2019 for maximum thermal power dispatches in the grid during winter which is the crushing season.

- Steady state analysis by load flows, short circuit and stability criterion reveals that proposed scheme is adequate to export 35.8 MW output of the plant under normal and contingency conditions.
- Since the plant operates during summer as well, its detail analysis has also been carried out for September 2019.
- In an extended term scenario, September 2021 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. Along with it, short circuit and dynamic stability analysis have been carried out for a complete check of the system.
- The short circuit level of the Kashmir Power Plant 132 kV is 7.97 kA and 8.02 kA for 3-phase and 1-phase faults respectively for the year 2021. Therefore industry standard switchgear of the short circuit rating of 40 kA would be fine to be installed at 132 kV switchyard of Kashmir Power Plant taking care of any future generation additions and system reinforcements in its electrical vicinity and also fulfill the NEPRA Grid Code requirements specified for 132 kV switchgears. There are no violations of exceeding the rating of the equipment in the vicinity of Kashmir PP due to contribution of fault current from it.
- 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 Kashmir PP 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 for single phase fault. The stability of system for far end faults of 3-phase occurring at Shorkot Road 132 kV and Shorkot City 132 kV bus bar has also been checked.

Contents

Appendices

Appendix –A: Generation, Transmission Plan and Load Forecast for Chapter – 4

Appendix –B: Map & Sketches for Chapter – 4

Appendix –C: Plotted Results of Load Flow for Chapter – 5

Appendix –D: Plotted Results of Short Circuit for Chapter – 6

Appendix –E: Plotted Results of Stability Analysis for Chapter – 7

Appendix –F: Generator, Transformer and Dynamic Data

1. INTRODUCTION

1.1 Background

Kashmir Power Plant is a Cogeneration plant near Shorkot City in District Jhang embedded in the distribution network of FESCO. The electricity generated from this project would be supplied to the grid system of FESCO through 132 kV grids available in the vicinity of this project. A general idea of the location of plant and grid stations in its vicinity can be viewed in sketch-1 attached in Appendix - B.

Kashmir PP aims to install 40 MW and go for high pressure cogeneration in the sugar mill with the aim of exporting 29.6 MW power to the grid during the crushing season and 35.8 MW after it, depending on the availability of bagasse. The project is expected to start commercial operation by November 2018. The electricity generated from this project would be supplied to the grid system of FESCO through 132 kV grids, as that of Shorkot City and Shorkot Road, available in the vicinity of this project. The location of Kashmir PP 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 Kashmir Power Plant and FESCO network, for stable and reliable evacuation of 40 MW of electrical power generated from this plant, fulfilling 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 would be 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 contribution of fault current from the plant unit increases the fault levels at the adjoining substations at 132 kV voltage levels to be within the rating of equipment of these substations, and also determine the short circuit ratings of the proposed equipment of the substation at Kashmir 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
	49.4 - 50.5Hz, Min/Max Contingency Freq. Band
Power Factor	0.8 Lagging; 0.9 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 dying out of transients 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 9 cycles after fault initiation.

2. ASSUMPTIONS OF DATA

The number of new generating units at Kashmir PP will be two. As per the data provided by the client following data has been modeled:

2.1 Kashmir-PP Data

Installed capacity of power plant	= 1x 40 = 40 MW
Net Capacity of power plant	= 40 MW
Power factor	= 0.80 lagging, 0.85 leading
MVA capacity	= 50 MVA
Inertia Constant	= 1.1522 MW-sec/MVA
Generating Voltage	= 11 kV
Transformer Rating	= 40 MVA

2.2 Network data

The 132 kV network in the area near Kashmir Power Project are as shown in Sketches in Appendix-B. The latest Generation Expansion Plan and Load Forecast of NTDC as per data permission letter no. GMPP/CEMP/TRP-333/4483-86 dated 26-10-2016.has been used as shown in Appendix-A. The network of FESCO in the vicinity of Kashmir PP was verified during a visit held on 17th October 2016 by PPI engineers.

3. STUDY APPROACH AND METHODOLOGY

3.1 Understanding of the Problem

Kashmir Power Plant would like to go for high pressure cogeneration with the aim of exporting a maximum of 35.8 MW supply to the grid during the Off-Season and 29.6 MW in Crushing Season. The site of proposed project is located at a distance of about 1.5 km from the 132 kV single circuit from Shorkot City 132 kV G/S to Shorkot Road 132 kV G/S. The proposed Power Project is going to be embedded in the transmission network of FESCO through this nearest available 132 kV network.

The adequacy of FESCO network of 132 kV in and around the proposed site of Kashmir PP has been investigated in this study for absorbing and transmitting this power fulfilling the reliability criteria.

3.2 Approach to the problem

The following approach has been applied to the problem:

- 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, November 2018, of Kashmir PP. 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.
- The month of September 2019, has also been completely analyzed for the system, considering maximum hydel dispatches.
- Load flow and short circuit studies have also been performed for September 2021 to see 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.
- Perform technical system studies for peak load conditions to confirm technical feasibility of the interconnections. The scheme will be subjected to standard analysis 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 technically most feasible scheme of interconnection.

4.DEVELOPMENT OF SCHEME OF INTERCONNECTION

4.1 The Existing and Ongoing Network

The network around the proposed location of Kashmir-PP is shown in Sketch-1 in Appendix-B. Kashmir PP is in District Jhang embedded in the distribution network of FESCO. Network is being fed from the sources substation of T.T. Singh-New 220/132 kV and Samundri 220/132 kV.

These are multiple feeding points in the vicinity which provides reliability and voltage support to the system. All these substations provide a strong 220 kV and 500 kV network around the proposed plant. A strong system helps in stable operation of a power plant.

4.2 The Scheme of Interconnection of Kashmir-PP

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of the Kashmir PP, the most feasible interconnection scheme would be looping in-out the Shorkot City to Shorkot Road 132 kV single circuit at the proposed 132 kV Kashmir PP grid station. The looping distance would be 1.5 km long using Lynx Conductor as shown in Sketch-2 in Appendix-B. The network around Kashmir PP has been modeled at 132 kV and 11 kV.

5. DETAILED LOAD FLOW STUDIES

The base cases have been developed for the peak conditions of January 2019 using the network data of NTDC and FESCO available with PPI. The peak loads of the year 2019 for FESCO have been modeled as per the latest PMS Demand forecast as provided by NTDC. Detailed load flow studies have been carried out for January 2019, September 2019 and future case September 2021.

5.1 Peak Load Case January 2019

The peak load case in January 2019 has been studied in detail for the conditions of without and with Kashmir PP.

5.1.1 Without Kashmir-Power Plant

The results of load flow analysis without Kashmir PP 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	Shorkot City to Shorkot Road 132kV Single Circuit Out
Exhibit 0.2	T.T. Singh to Shorkot City 132kV Single Circuit Out
Exhibit 0.3	T.T. Singh-New to T.T.Singh 132kV Single Circuit Out
Exhibit 0.4	Head Sidhnai to Shorkot City 132kV Single Circuit Out
Exhibit 0.5	T.T. Singh-New to Pir Mehal 132kV Single Circuit Out
Exhibit 0.6	T.T. Singh-New to Jhang 132kV Single Circuit Out
Exhibit 0.7	Jhang to Gojra 132kV Single Circuit Out

5.1.2 With Kashmir-Power Plant

The scenario of Kashmir PP after the COD of the plant when it starts exporting 29.6 MW during crushing season to the FESCO network has been studied. The results of

load flows with Kashmir PP 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	Kashmir Sugar Mills to Shorkot City 132kV Single Circuit Out
Exhibit 1.2	Kashmir Sugar Mills to Shorkot Road 132kV Single Circuit Out
Exhibit 1.3	T.T.Singh to Shorkot City 132kV Single Circuit Out
Exhibit 1.4	T.T.Singh-New to T.T.Singh 132kV Single Circuit Out
Exhibit 1.5	Head Sidhnai to Shorkot City 132kV Single Circuit Out
Exhibit 1.6	T.T.Singh-New to Pir Mehal 132kV Single Circuit Out
Exhibit 1.7	T.T.Singh-New to Jhang 132kV Single Circuit Out
Exhibit 1.8	Jhang to Gojra 132kV 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.

5.2 Peak Load Case 2019: Summer Scenario

The scenario of Kashmir PP during the summer season, for the month of September with maximum hydel dispatches, has been studied. The results of load flows with Kashmir PP 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	Kashmir Sugar Mills to Shorkot City 132kV Single Circuit Out
Exhibit 2.2	Kashmir Sugar Mills to Shorkot Road 132kV Single Circuit Out
Exhibit 2.3	T.T.Singh to Shorkot City 132kV Single Circuit Out
Exhibit 2.4	T.T.Singh-New to T.T.Singh 132kV Single Circuit Out
Exhibit 2.5	Shorkot City to Head Sidhnai 132kV Single Circuit Out
Exhibit 2.6	T.T.Singh-New to Pir Mehal 132kV Single Circuit Out
Exhibit 2.7	T.T.Singh-New to Jhang 132kV Single Circuit Out
Exhibit 2.8	Jhang to Gojra 132kV 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.

5.3 Peak Load Case 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 as per NTDC requirement.

Exhibit 3.0 shows the normal case of 2021 of the region with Kashmir PP. The total 35.8 MW of electrical power will be supplied to the national grid from Kashmir PP.

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 3.1	Kashmir Sugar Mills to Shorkot City 132kV Single Circuit Out
Exhibit 3.2	Kashmir Sugar Mills to Shorkot Road 132kV Single Circuit Out
Exhibit 3.3	T.T.Singh to Shorkot City 132kV Single Circuit Out

Exhibit 3.4	T.T.Singh-New to T.T.Singh 132kV Single Circuit Out
Exhibit 3.5	Shorkot City to Head Sidhnai 132kV Single Circuit Out
Exhibit 3.6	T.T.Singh-New to Pir Mehal 132kV Single Circuit Out
Exhibit 3.7	T.T.Singh-New to Jhang 132kV Single Circuit Out
Exhibit 3.8	Jhang to Gojra 132kV Single Circuit Out

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 ± 10 % off the nominal for contingency conditions' criteria.

We find that there are no capacity constraints in the proposed connectivity scheme even in the up-coming years i.e. 2021.

5.4 Conclusion of Load Flow Analysis

From the analysis discussed above, we conclude that the proposed interconnection scheme of looping in-out one of the Shorkot City – Shorkot Road 132 kV single circuit at Kashmir-PP is adequate to evacuate the maximum 35.8 MW spillover power of Kashmir PP under normal and contingency conditions.

It was found that in 2019 all the contingency cases 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 September 2019 and 2021 was also evaluated and found to be stable under normal and contingency cases.

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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 2021 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 Kashmir PP Year 2019

In order to assess the short circuit strength of the network of 132 kV without Kashmir PP for FESCO in the vicinity of the site of the Plant near Shorkot City and Shorkot Road, 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 Kashmir PP and later on how much the contribution of fault current from Kashmir 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 4.0 attached in Appendix-D. Both 3-phase and 1-phase fault currents

are indicated in the Exhibit 4.0 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 25 kA or 31.5 kA for older substations and 40 kA for new substations.

Table-6.1
Maximum Short Circuit Levels without Kashmir PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Shorkot City 132kV	6.60	5.62
Shorkot Road 132kV	5.32	4.81
Pir Mehal 132kV	5.09	5.13
T.T.Singh 132kV	8.18	7.53
T.T.Singh-New 132kV	24.53	23.72
Head Sidhnai 132kV	4.61	4.40
Jhang 132kV	10.23	11.92
Gojra 132kV	21.86	21.24

6.3 Fault Current Calculations with Kashmir PP 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 Kashmir-PP itself and other bus bars of the 132 kV substations in the electrical vicinity of Kashmir-PP. The graphic results are shown in Exhibit 4.1.

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 Kashmir-PP and the 132 kV bus bars of Kashmir-PP itself 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 Kashmir PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
KSML 132kV	6.96	7.12
Shorkot City 132kV	7.49	7.04
Shorkot Road 132kV	5.94	5.72
Pir Mehal 132kV	5.45	5.50
T.T.Singh 132kV	8.71	7.89
T.T.Singh-New 132kV	25.22	24.18
Head Sidhnai 132kV	4.73	4.52
Jhang 132kV	10.33	12.01
Gojra 132kV	22.34	21.56

6.4 Fault Current Calculations with Kashmir-PP Year 2021

Fault currents have been evaluated for the peak case of 2021 in order to observe the maximum fault current on Kashmir PP and the bus bars in its vicinity considering the future additions in the system. Fault types applied are three phase and single-phase at 132 kV bus bars of Kashmir PP itself and other bus bars of the 132 kV substations in the electrical vicinity of Kashmir-PP. The graphic results showing maximum 3-phase and 1-phase fault levels are indicated in Exhibit 4.2. Both 3-phase and 1-phase fault currents are indicated in the Exhibit 4.2 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 Kashmir-PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.3

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Table-6.3
Maximum Short Circuit Levels with Kashmir PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
KSML 132kV	7.97	8.02
Shorkot City 132kV	9.08	8.83
Shorkot Road 132kV	7.63	7.26
Pir Mehal 132kV	6.61	6.40
T.T.Singh 132kV	13.75	13.16
T.T.Singh-New 132kV	25.74	25.42
Head Sidhnai 132kV	4.80	4.76
Jhang 132kV	13.36	14.01
Gojra 132kV	22.72	22.08

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 Kashmir-PP on the 132 kV bus bars in its vicinity; and a rise on Shorkot City 132 kV bus bars because of direct connection with Kashmir-PP. 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 Kashmir PP 132 kV standard size switchgear of short circuit rating of 40 kA has been proposed. 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 Kashmir-PP with Shorkot City 132 kV and Shorkot Road 132 kV Substation, 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 Kashmir-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 Kashmir-PP 132 kV is 7.97 kA and 8.02 kA for 3-phase and 1-phase faults respectively in the year 2021. Therefore industry standard switchgear of the short circuit rating of 40 kA would serve the purpose 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	EXST1
Speed Governing System	TGOV1
Inertia Constant	H = 1.1522 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 with the maximum thermal dispatch after the COD of Kashmir Power Plant and thus the loading on the lines in the vicinity of Kashmir-PP will be maximum allowing us to judge the full impact of the plant.

The proposed Kashmir-PP has been modeled in the dynamic simulation as per data provided by client.

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 Kashmir-PP i.e. right at the 132 kV bus bar of Kashmir-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. Also to fulfil the Grid Code criteria case of stuck breaker (breaker failure) single phase fault has also been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms.

7.2 Dynamic Stability Simulations' Results with Kashmir-PP interconnected - January 2019

7.2.1 Fault at 132 kV KSML-PP

We applied three-phase fault on KSML 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132 kV single circuit between KSML and Shorkot Road 132 kV substation. We monitored different quantities for one second pre-fault and nine seconds 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 132 kV bus bars of KSML, Kashmir-PP, Shorkot City, Shorkot Road, Pir Mehal and T.T. Singh are plotted. The results show quick recovery of the voltages after fault clearance.

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 Kashmir-PP

The MW/MVAR output of Kashmir-PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

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Fig. 1.4 Speed and mechanical power of Generators at Kashmir-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 Flow on KSML to Shorkot City 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from KSML to Shorkot City causes the entire output of Kashmir-PP to flow on the intact 132 kV circuit between KSML and Shorkot City 132kV circuit. This causes significant loading on the KSML to Shorkot City 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 Kashmir-PP, Jinnah, Chashma, Hunza-PP and Liberty-P 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Kashmir-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 KSML (Stuck Breaker)

We applied single-phase fault on KSML 132 kV bus bar, cleared fault in 9 cycles (180 ms), to simulate a stuck breaker case, followed by trip of a 132 kV single circuit between KSML and Shorkot Road 132 kV substation. We monitored different quantities for one second pre-fault and nine seconds 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 132 kV bus bars of KSML, Kashmir-PP, Shorkot city, Shorkot Road, Pir Mehal and T.T. Singh are plotted. The results show quick recovery of the voltages after fault clearance.

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 Kashmir-PP

The MW/MVAR output of Kashmir-PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 2.4 Speed and mechanical power of Generators at Kashmir-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 Flow on KSML to Shorkot City 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from KSML to Shorkot Road causes the entire output of Kashmir-PP to flow on the intact 132 kV circuit between KSML and Shorkot City 132kV circuit. This causes significant loading on the KSML to Shorkot City 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 Kashmir-PP, Jinnah, Chashma, Hunza-PP and Liberty-P 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Kashmir-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 Shorkot Road 132 kV

We applied Single-phase fault on far 132 kV bus bar of Shorkot Road 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 KSML and Shorkot Road. We monitored different quantities for one second pre-fault and

nine seconds 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 132 kV bus bars of KSML, Kashmir-PP, Shorkot City, Shorkot Road, Pir Mehal and T.T. Singh are plotted. The results show quick recovery of the voltages after fault clearance.

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 Kashmir-PP

The MW/MVAR output of Kashmir-PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 3.4 Speed and mechanical power of Generators at Kashmir-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 Flow on Shorkot Road to Pir Mehal 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from KSML to Shorkot Road, we have monitored the flow from Shorkot Road to Pir Mehal. 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 Kashmir-PP, Jinnah, Chashma, Hunza-PP and Liberty-P 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Kashmir-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.

7.2.4 Fault at Shorkot City 132 kV

We applied three-phase fault on far 132 kV bus bar of Shorkot City 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 Shorkot City and KSML. We monitored different quantities for one second pre-fault and nine seconds 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 132 kV bus bars of KSML, Kashmir-PP, Shorkot City, Shorkot Road, Pir Mehal and T.T. Singh are plotted. The results show quick recovery of the voltages after fault clearance.

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 Kashmir-PP

The MW/MVAR output of Kashmir-PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 4.4 Speed and mechanical power of Generators at Kashmir-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 Flow on KSML to Shorkot City 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Shorkot City to KSML, we have monitored the flow from KSML to Shorkot City. 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 Kashmir-PP, Jinnah, Chashma, Hunza-PP and Liberty-P 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Kashmir-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 Conclusion of Dynamic Stability Analysis

The results of dynamic stability carried out for January 2019 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 Kashmir PP under all events of disturbances. Therefore there is no problem of dynamic stability for interconnection of Kashmir PP; it fulfills all the criteria of dynamic stability.

8.CONCLUSIONS

- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The nearest grid facility is the 132 kV substations of Shorkot City. It lies at about 7.5 km from the site of Kashmir PP.
- Due to the location of Kashmir PP, the most feasible interconnection scheme would be looping in-out one of the 132 kV single circuit between Shorkot City to Shorkot Road passes about 1.5 km from the proposed Kashmir PP on Lynx conductor. The up-coming chapters discuss in detail the location and interconnection of the Kashmir PP. A few approximate sketches are shown in Appendix-B.
- The proposed scheme will require two breaker bays of 132 kV at Kashmir PP to connect with the 132 kV circuits each from Shorkot City to Shorkot Road respectively.
- In view of planned COD, of the Kashmir PP in November 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 January 2019 for maximum thermal power dispatches in the grid during winter which is the crushing season.
- Steady state analysis by load flows, short circuit and stability criterion reveals that proposed scheme is adequate to export 35.8 MW output of the plant under normal and contingency conditions.
- Since the plant operates during summer as well, its detail analysis has also been carried out for September 2019.
- In an extended term scenario, September 2021 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. Along with it, short circuit and dynamic stability analysis have been carried out for a complete check of the system.
- The short circuit level of the Kashmir Power Plant 132 kV is 7.97 kA and 8.02 kA for 3-phase and 1-phase faults respectively for the year 2021. Therefore industry

standard switchgear of the short circuit rating of 40 kA would be fine to be installed at 132 kV switchyard of Kashmir Power Plant taking care of any future generation additions and system reinforcements in its electrical vicinity and also fulfill the NEPRA Grid Code requirements specified for 132 kV switchgears. There are no violations of exceeding the rating of the equipment in the vicinity of Kashmir PP due to contribution of fault current from it.

- 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 Kashmir PP 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 for single phase fault. The stability of system for far end faults of 3-phase occurring at Shorkot Road 132 kV and Shorkot City 132 kV bus bar has also been checked.