FARAN POWER LIMITED

Date: January 27, 2017

Ref: FPL/001/01-17

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, **Ahmed Ali Bawany**, Chief Executive, being the duly authorized representative of **Faran Power Limited (FPL)** by virtue of Resolution of Board of Directors dated 2nd January 2017, hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation License to FPL 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. **17163687** dated 16-01-2017 drawn on HBL, Foreign Exchange Branch, Karachi, in the sum of Rupees **292,384/-** only (PKR Two Hundred Ninety Two Thousand Three Hundred Eighty Four Only), being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Thanking you,

Ahmed Ali Bawany
Chief Executive

FARAN POWER LIMITED KARACHI

3RD FLOOR, BANK HOUSE NO. 1, HABIB SQUARE, M.A. JINNAH RAOD, KARACHI. PAKISTAN - 74000
PHONE: (+92-21) 111 BAWANY (22 92 69) FAX: +92-21-32421010

FARAN POWER LIMITED

EXTRACTS OF THE RESOLUTIONS OF BOARD OF DIRECTORS OF FARAN POWER LIMITED PASSED IN THEIR MEETING HELD ON JANUARY 2, 2017 AT 3rd FLOOR, BANK HOUSE NO. 1, HABIB SQUARE, M.A. JINNAH ROAD, KARACHI

The Board of Directors of FARAN POWER LIMITED a public company duly formed and registered in the Islamic Republic of Pakistan having incorporation no. 0104213 (the **Company**) and having its registered office at 3rd Floor, Bank House No. 1, Habib Square, M.A. Jinnah Road, Karachi, in their meeting held on January 2, 2017, 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. Ahmed Ali Bawany, *Chief Executive*, Mr. Muhammad Omar Bawany, *Director*, Mr. Bilal Omar Bawany, *Director* and Mr. Muhammad Ayub, *Company Secretary* of the Company be and are hereby singly authorized to do any or all of the following acts, deeds and things, on behalf of the Company, in connection with this application to be filed with NEPRA under the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 and the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999:

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

Muhammad Ayub
Company Secretary

Ahmed Ali Bawany
Chief Executive

FARAN POWER LIMITED KARACHI

R568074

100 Rupees

M. KALEEM M. ALI KHAN STAMP VENDOR
Licence # 22, Shop # 64, New Ruby Centre,
Talpur Road, Bolitan Market, Karachi.
SR. NO. 068638 DATE 28 JAN 2017
ISSUED TO WITH ADDRESS MR.
THROUGH WITH ADDRESS MR. Muhammad Khalid Khan (Advocate)
KBA No. 1739
PURPOSE
VALUE RS. ATTACHED
STAMP VENDOR SIGNATURE
"Not Use For Free Will & Diverse Purpose"

SYED NASIR HUSSAIN
OATH COMMISSIONER

BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I, **Ahmed Ali Bawany** S/o **Muhammad Amin Ahmed Bawany** having CNIC No. 42000-0409904-3, Chief Executive of Faran Power Limited hereby solemnly affirm and declare that the contents of the accompanying 'Application for Generation License' including all supporting documents are true and correct to the best of my knowledge and belief and that nothing has been concealed.

DEPONENT
Ahmed Ali Bawany
(Chief Executive)
(CNIC# 42000-0409904-3)

Verified on 28/01/2017 that the information stated above is true and correct

SOLEMNLY AFFIRMED BEFORE ME
28 JAN 2017
Syed Nasir Hussain
Advocate & Oath Commissioner
Karachi Pakistan

A025211

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 16 (5) of the Companies Ordinance, 2016 (VI of 2016)]

Corporate Universal Identification No. **0104213**

I hereby certify that **FARAN POWER LIMITED** is this day incorporated under the Companies Ordinance, 2016 (VI of 2016) and that the company is **limited by shares.**

Given under my hand at **Karachi** this **Fourteenth** day of **December, Two Thousand** and **Sixteen**.

Incorporation fee Rs. **210,500/=** only

(Kashif Mahmood)
Deputy Registrar of Companies
Karachi

FREE OF COST COPY
Certified to be True Copy
15/12/2016
Deputy Registrar of Companies

FARAN POWER LIMITED KARACHI

THE COMPANIES ORDINANCE 2016
(A Company Limited By Shares)

MEMORANDUM OF ASSOCIATION OF FARAN POWER LIMITED

1. The name of the Company is **"FARAN POWER LIMITED."**

2. The Registered office of the Company will be situated in the Province of Sindh.

3. **(i)** The Principle line of business of the company shall be to establish, erect, setup, construct, equip, operate use, manage, maintain and run electric power generating projects and transmission systems for generating power by using wind, fuel, nuclear, thermal, geothermal power station, solar, hydro, coal, steam, and bio-mass or any other alternative, renewable energy sources and bio-energy to generate electricity and in this regard establish power grid station, switching, conversion, and transmission facilities, grid stations, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plant and equipment, transmission towers, buildings, workshops and other facilities as may from time to time be necessary for the attainment of the objects of the company.

   (ii) Except for the businesses mentioned in sub-clause (3) hereunder, the company shall engage in all the lawful business and shall be authorized to take all necessary steps and action in connection therewith and ancillary thereto.

   (iii) Nowithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), Insurance Business, Modaraba management company, Stock Brokerage business, forex, real estate business, managing agency, business of providing the services of security guards or any other business restricted under any law for the time being in force or may be specified by the Commission.

   (iv) It is hereby undertaken that the company shall not:

   a) Engage in any of the business mentioned in sub-clause (3) above or any unlawful operation;

   b) Launch multi-level marketing (MLM), Pyramid and Ponzi Schemes or other related activities/businesses or any lottery business;

   c) Engage in any of the permissible business unless the requisite approval, permission, consent or licence is obtained from competent authority as may be required under any law for the time being in force.

FARAN POWER LIMITED KARACHI

4. The liability of the members is limited.

5. The Authorized Share Capital of the Company is **Rs. 50,000,000/-**, **(Rupees Fifty Million Only)** divided into **5,000,000 (Five Million Only)** shares of **Rs.10/- (Rupees Ten)**,each, comprising of such classes and kinds as my be permissible under the Companies Ordinance, 2016 or any other statutory enactment or modification thereof or instrument as may for the time being be applicable to the Company.

We, the several persons, whose names and addresses are given 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 set apposite our respective names.

Names & Surname In full block Letters	Father's/ Husband's Name in Full	Nationality	Occupation	Residential Address in Full	No. of shares Taken by each Subscriber	Signature
Faran Sugar Mills Limited (Through Mr. Ahmed Ali Bawany) (42000-0409904-3)	Muhammad Amin Ahmed Bawany	Pakistani	Business	3rd Floor Bank House No. 1, Habib Square M.A. Jinnah Road, Karachi	9997 . (Nine Thousand Nine Hundred and Ninety Seven Only)	
Mr. Muhammad Omar Bawany (42000-0369567-9)	Muhammad Amin Bawany	Pakistani	Business	3rd Floor Bank House No. 1, Habib Square M.A. Jinnah Road, Karachi	1 (One Only)	
Mr. Ahmed Ali Bawany) (42000-0409904-3)	Muhammad Amin Ahmed Bawany	Pakistani	Business	3rd Floor Bank House No. 1, Habib Square M.A. Jinnah Road, Karachi	1 (One Only)	
Mr. Bilal Omar Bawany (42000-0469097-5)	Muhammad Omar	Pakistani	Business	3rd Floor Bank House No. 1, Habib Square M.A. Jinnah Road, Karachi	1 (One Only)	
			Total (Ten Thousand Only)		**10000**	

DATED: NOVEMBER 28, 2016

WITNESS NAME: NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT.) LIMITED

ADDRESS: 5TH FLOOR AWT PLAZA, I.I CHUNDRIGAR ROAD, KARACHI

FARAN POWER LIMITED KARACHI

THE COMPANIES ORDINANCE, 2016
(A COMPANY LIMITED BY SHARES)

ARTICLES OF ASSOCIATION OF FARAN POWER LIMITED

PRELIMINARY

1. (1) In these regulations-

   a. "section" means section of the Ordinance;

   b. "the Ordinance" means the Companies Ordinance, 2016; and

   c. "the seal" means the common seal or official seal of the company as the case may be.

   (2) Unless the context otherwise requires, words or expressions contained in these regulations shall have the same meaning as in the Ordinance; and words importing the singular shall include the plural, and *vice versa,* and words importing the masculine gender shall include feminine, and words importing persons shall include bodies corporate.

BUSINESS

2. The directors shall have regard to the restrictions on the commencement of business imposed by section 19 if, and so far as, those restrictions are binding upon the company.

SHARES

3. In case of shares in the physical form, every person whose name is entered as a member in the register of members shall, without payment, be entitled to receive, within thirty days after allotment or within fifteen days of the application for registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid up thereon:

   Provided that if the shares are in book entry form or in case of conversion of physical shares and other transferable securities into book-entry form, the company shall, within ten days after an application is made for the registration of the transfer of any shares or other securities to a central depository, register such transfer in the name of the central depository.

4. The company shall not be bound to issue more than one certificate in respect of a share or shares in the physical form, held jointly by several persons and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery to all.

FARAN POWER LIMITED KARACHI

5. If a share certificate in physical form is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one hundred rupees, and on such terms, if any, as to evidence and indemnity and payment of expenses incurred by the company in investigating title as the directors think fit.

6. Except to the extent and in the manner allowed by section 86, no part of the funds of the company shall be employed in the purchase of, or in loans upon the security of, the company's shares.

TRANSFER AND TRANSMISSION OF SHARES

7. The instrument of transfer of any share in physical form in the company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respect thereof.

8. Shares in physical form in the company shall be transferred in the following form, or in any usual or common form which the directors shall approve:-

Form for Transfer of Shares[1]
(1st Schedule to the Companies Ordinance, 2016)

I..... s/o .....r/o.....(herein after called "the transferor") in consideration of the sum of rupees..... paid to me by..... ...../..... s/o.....r/o.....(hereinafter called "the transferee"), do hereby transfer to the said transferee .....the share (or shares) with distinctive numbers from .....to .....inclusive, in the..... .....Limited, to hold unto the said transferee, his executors, administrators and assigns, subject to the several conditions on which I held the We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of these articles of association, and we respectively agree to take the number of shares in the capital of the company set opposite our respective names:

same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share (or shares) subject to the conditions aforesaid.

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

Signature	Signature.....
Transferor	**Transferee**
Full Name, Father's / Husband's Name	Full Name, Father's / Husband's Name
CNIC Number (in case of foreigner, Passport Number)	CNIC Number (in case of foreigner, Passport Number)
Nationality	Nationality
Occupation and usual Residential Address	Occupation and usual Residential Address

Company Registration Office * Karachi * Securities and Exchange Commission of Pakistan

FAZAN POWER LIMITED KARACHI

Cell number	Cell number
Landline number, if any	Landline number, if any
Email address	Email address
Witness 1:	**Witness 2:**
Signature .....date	Signature .....date
Name, CNIC Number and Full Address	Name, CNIC Number and Full Address

9. (1) Subject to the restrictions contained in regulation 10 and 11, the directors shall not refuse to transfer any share unless the transfer deed is defective or invalid. The directors may also suspend the registration of transfers during the ten days immediately preceding a general meeting or prior to the determination of entitlement or rights of the shareholders by giving seven days' previous notice in the manner provided in the Ordinance. The directors may, in case of shares in physical form, decline to recognise any instrument of transfer unless-

   a. a fee not exceeding fifty rupees as may be determined by the directors is paid to the company in respect thereof; and

   b. the duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the directors may reasonably require to show the right of the transferor to make the transfer.

   (2) If the directors refuse to register a transfer of shares, they shall within fifteen days after the date on which the transfer deed was lodged with the company send to the transferee and the transferor notice of the refusal indicating the defect or invalidity to the transferee, who shall, after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the company.

   Provided that the company shall, where the transferee is a central depository the refusal shall be conveyed within five days from the date on which the instrument of transfer was lodged with it notify the defect or invalidity to the transferee who shall, after the removal of such defect or invalidity, be entitled to re-lodge the transfer deed with the company.

CAPITAL

10. The authorized capital of the Company is **Rs. 50,000,000/-, (Rupees Fifty Million Only)** divided into **5,000,000 (Five Million Only)** shares of **Rs.10/- (Rupees Ten)**, each. The **"minimum subscription"** within the meaning of the Ordinance shall be **Rs. 100,000/-.**

TRANSMISSION OF SHARES

11. The executors, administrators, heirs, or nominees, as the case may be, of a deceased sole holder of a share shall be the only persons recognised by the company to deal with the share in accordance with the law. In the case of a share registered in the names of two or more holders, the survivors or survivor, or the executors or administrators of the deceased survivor, shall be the only persons recognised by the company to deal with the share in accordance with the law.

12. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by lawful award, as the case may be, in favour of the successors to the extent of their interests and their names shall be entered to the register of members.

13. A person may on acquiring interest in a company as member, represented by shares, at any time after acquisition of such interest deposit with the company a nomination conferring on a person, being the relatives of the member, namely, a spouse, father, mother; brother, sister and son or daughter, the right to protect the interest of the legal heirs in the shares of the deceased in the event of his death, as a trustee and to facilitate the transfer of shares to the legal heirs of the deceased subject to succession to be determined under the Islamic law of inheritance and in case of non-Muslim members, as per their respective law.

14. The person nominated under regulation 12 shall, after the death of the member, be deemed as a member of company till the shares are transferred to the legal heirs and if the deceased was a director of the company, not being a listed company, the nominee shall also act as director of the company to protect the interest of the legal heirs.

15. A person to be deemed as a member under regulation 11, 12 and 13 to a share by reason of the death or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share and exercise any right conferred by membership in relation to meetings of the company.

ALTERATION OF CAPITAL

16. The company may, by special resolution-

    (e) increase its authorised capital by such amount as it thinks expedient;

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

    (g) sub-divide its shares, or any of them, into shares of smaller amount than is fixed by the memorandum;

    (h) cancel shares which, at the date of the passing of the resolution in that behalf, have not been taken or agreed to be taken by any person, and diminish the

FAUJI POWER LIMITED KARACHI

Company Registration Office, Karachi, Securities and Exchange Commission of Pakistan

amount of its share capital by the amount of the share so cancelled.

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

18. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.

19. The company may, by special resolution-

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

    (b) sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the memorandum of association, subject, nevertheless, to the provisions of section 85;

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

20. The company may, by special resolution, reduce its share capital in any manner and with, and subject to confirmation by the Court and any incident authorised and consent required, by law

GENERAL MEETINGS

21. The statutory general meeting of the company shall be held within the period required by section 131.

22. A general meeting, to be called annual general meeting, shall be held, in accordance with the provisions of section 132, within sixteen months from the date of incorporation of the company and thereafter once at least in every year within a period of four months following the close of its financial year.

23. All general meetings of a company other than the statutory meeting or an annual general meeting mentioned in sections 131 and 132 respectively shall be called extraordinary general meetings.

24. The directors may, whenever they think fit, call an extraordinary general meeting,

and extraordinary general meetings shall also be called on such requisition, or in default, may be called by such requisitionists, as provided by section 133. If at any time there are not within Pakistan sufficient directors capable of acting to form a quorum, any director of the company may call an extraordinary general meeting in the same manner as nearly as possible as that in which meetings may be called by the directors.

25. The company may provide video-link facility to its members for attending general meeting at places other than the town in which general meeting is taking place after considering the geographical dispersal of its members:

Provided that in case of listed companies if the members holding ten percent of the total paid up capital or such other percentage of the paid up capital as may be specified, are resident in any other city, the company shall provide the facility of video-link to such members for attending annual general meeting of the company, if so required by such members in writing to the company at least seven days before the date of the meeting.

NOTICE AND PROCEEDINGS OF GENERAL MEETINGS

26. Twenty-one days' notice at the least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of meeting and, in case of special business, the general nature of that business, shall be given in manner provided by the Ordinance for the general meeting, to such persons as are, under the Ordinance or the regulations of the company, entitled to receive such notice from the company; but the accidental omission to give notice to, or the non-receipt of notice by, any member shall not invalidate the proceedings at any general meeting.

27. All the business transacted at a general meeting shall be deemed special other than the business stated in sub-section (2) of section 134 namely; the consideration of financial statements and the reports of the board and auditors, the declaration of any dividend, the election and appointment of directors in place of those retiring, and the appointment of the auditors and fixing of their remuneration.

28. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business. The quorum of the general meeting shall be-

(d) in the case of a public listed company, not less than ten members present personally, or through video-link who represent not less than twenty-five percent of the total voting power, either of their own account or as proxies;

(e) in the case of any other company having share capital, two members present personally, or through video-link who represent not less than twenty-five percent of the total voting power, either of their own account or as proxies.

FARAN POWER LIMITED KARACHI

Company Registration Office Karachi Securities and Exchange Commission of Pakistan

29. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved; in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and, if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than two, shall be a quorum.

30. The chairman of the board of directors, if any, shall preside as chairman at every general meeting of the company, but if there is no such chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as chairman, any one of the directors present may be elected to be chairman, and if none of the directors is present, or willing to act as chairman, the members present shall choose one of their number to be chairman.

31. The chairman may, with the consent of any meeting at which a quorum is present (and shall if so directed by the meeting), adjourn the meeting from time to time but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When a meeting is adjourned for fifteen days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.

32. (1) At any general meeting a resolution put to the vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.

(2) At any general meeting, the company shall transact such businesses as may be notified by the Commission, only through postal ballot.

33. A poll may be demanded only in accordance with the provisions of section 143.

34. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in sections 144 and 145 and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

35. A poll demanded on the election of chairman or on a question of adjournment shall be taken at once.

36. In the case of an equality of votes, whether on a show of hands or on a poll, the chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.

37. Except for the businesses specified under sub-section (2) of section 134 to be conducted in the annual general meeting, the members of a private company [illegible]

FARAN POWER LIMITED KARACHI

public unlisted company (having not more than fifty members), may pass a resolution (ordinary or special) by circulation signed by all the members for the time being entitled to receive notice of a meeting. The resolution by circulation shall be deemed to be passed on the date of signing by the last of the signatory member to such resolution.

VOTES OF MEMBERS

38. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of directors in which case the provisions of section 159 shall apply. On a poll every member shall have voting rights as laid down in section 134.

39. In case of joint-holders, the vote of the senior who tenders a vote, whether in person or by proxy or through video-link shall be accepted to the exclusion of the votes of the other joint-holders; and for this purpose seniority shall be determined by the order in which the names stand in the register of members.

40. A member of unsound mind, or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on show of hands or on a poll or through video link, by his committee or other legal guardian, and any such committee or guardian may, on a poll, vote by proxy.

41. On a poll votes may be given either personally or through video-link, by proxy or through postal ballot:

Provided that no body corporate shall vote by proxy as long as a resolution of its directors in accordance with the provisions of section 138 is in force.

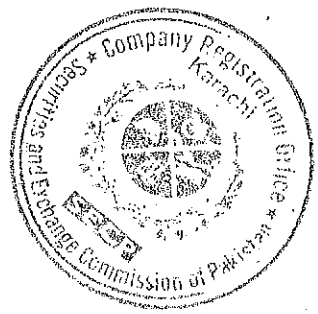
42. (1) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorised in writing.

(2) The instrument appointing a proxy and the power-of-attorney or other authority (if any) under which it is signed, or a notarially certified copy of that power or authority, shall be deposited at the 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 shall not be treated as valid.

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

FARAN POWER LIMITED KARACHI

Company Registration Office Karachi Securities and Exchange Commission of Pakistan



INSTRUMENT OF PROXY

Faran Power Limited

"I ..... s/o ..... r/o ..... being a member of the ..... Limited, hereby appoint ..... s/o ..... r/o ..... as my proxy to attend and vote on my behalf at the (statutory, annual, extraordinary, as the case may be) general meeting of the company to be held on the ..... day of ....., 20 ..... and at any adjournment thereof."

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

DIRECTORS

45. The following subscribers of the memorandum of association shall be the first directors of the company, so, however, that the number of directors shall not in any case be less than that specified in section 154 and they shall hold office until the election of directors in the first annual general meeting:

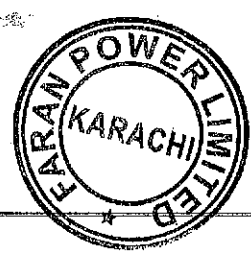
1. Muhammad Omar Bawany
2. Ahmed Ali Bawany
3. Bilal Omar Bawany

46. The remuneration of the directors shall from time to time be determined by the company in general meeting subject to the provisions of the Ordinance.

47. Save as provided in section 153, no person shall be appointed as a director unless he is a member of the company.

POWERS AND DUTIES OF DIRECTORS

48. The business of the company shall be managed by the directors, who may pay all expenses incurred in promoting and registering the company, and may exercise all such powers of the company as are not by the Ordinance or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the company in general meeting, subject nevertheless to the provisions of the Ordinance or to any of these regulations, and such regulations



being not inconsistent with the aforesaid provisions, as may be prescribed by the company in general meeting but no regulation made by the company in general meeting shall invalidate any prior act of the directors which would have been valid if that regulation had not been made.

49. The directors shall appoint a chief executive in accordance with the provisions of sections 186 and 187.

50. The amount for the time being remaining undercharged of moneys borrowed or raised by the directors for the purposes of the company (otherwise than by the issue of share capital) shall not at any time, without the sanction of the company in general meeting, exceed the issued share capital of the company.

51. The directors shall duly comply with the provisions of the Ordinance, or any statutory modification thereof for the time being in force, and in particular with the provisions in regard to the registration of the particulars of mortgages, charges and pledge affecting the property of the company or created by it, to the keeping of a register of the directors, and to the sending to the registrar of an annual list of members, and a summary of particulars relating thereto and notice of any consolidation or increase of share capital, or sub-division of shares, and copies of special resolutions and a copy of the register of directors and notifications of any changes therein.

MINUTE BOOKS

52. The directors shall cause records to be kept and minutes to be made in book or books with regard to-

(a) all resolutions and proceedings of general meeting(s) and the meeting(s) of directors and Committee(s) of directors, and every member present at any general meeting and every director present at any meeting of directors or Committee of directors shall put his signature in a book to be kept for that purpose;

(b) recording the names of the persons present at each meeting of the directors and of any committee of the directors, and the general meeting; and

(c) all orders made by the directors and Committee(s) of directors:

Provided that all records related to proceedings through video-link shall be maintained in accordance with the relevant regulations specified by the Commission which shall be appropriately rendered into writing as part of the minute books according to the said regulations.

THE SEAL

53. The directors shall provide for the safe custody of the seal and the seal shall not be affixed to any instrument except by the authority of a resolution of the board of directors or by a committee of directors authorized in that behalf by the directors

FARAN POWER LIMITED KARACHI

Company Registration Office Karachi Securities and Exchange Commission of Pakistan

and in the presence of at least two directors and of the secretary or such other person as the directors may appoint for the purpose; and those two directors and secretary or other person as aforesaid shall sign every instrument to which the seal of the company is so affixed in their presence.

DISQUALIFICATION OF DIRECTORS

54. No person shall become the director of a company if he suffers from any of the disabilities or disqualifications mentioned in section 153 or disqualified or debarred from holding such office under any of the provisions of the Ordinance as the case may be and, if already a director, shall cease to hold such office from the date he so becomes disqualified or disabled:

Provided, however, that no director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for, the company of which he is director, but such director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not be counted.

PROCEEDINGS OF DIRECTORS

55. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit. A director may, and the secretary on the requisition of a director shall, at any time, summon a meeting of directors. Notice sent to a director through email whether such director is in Pakistan or outside Pakistan shall be a valid notice.

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

57. At least one-third (1/3rd) of the total number of directors or two (2) directors whichever is higher, for the time being of the company, present personally or through video-link, shall constitute a quorum.

58. Save as otherwise expressly provided in the Ordinance, every question at meetings of the board shall be determined by a majority of votes of the directors present in person or through video-link, each director having one vote. In case of an equality of votes or tie, the chairman shall have a casting vote in addition to his original vote as a director.

59. The directors may delegate any of their powers not required to be exercised in their meeting to committees consisting of such member or members of their body as they think fit; any committee so formed shall, in the exercise of the powers so delegated, conform to any restrictions that may be imposed on them by the directors.

60. (1) A committee may elect a chairman of its meetings; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the members present may choose one of their number to be chairman of the meeting.

(2) A committee may meet and adjourn as it thinks proper. Questions arising at any meeting shall be determined by a majority of votes of the members present. In case of an equality of votes, the chairman shall have and exercise a second or casting vote.

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

62. A copy of the draft minutes of meeting of the board of directors shall be furnished to every director within seven working days of the date of meeting

63. A resolution in writing signed by all the directors for the time being entitled to receive notice of a meeting of the directors shall be as valid and effectual as if it had been passed at a meeting of the directors duly convened and held.

FILLING OF VACANCIES

64. At the first annual general meeting of the company, all the directors shall stand retired from office, and directors shall be elected in their place in accordance with section 159 for a term of three years .

65. A retiring director shall be eligible for re-election.

66. The directors shall comply with the provisions of sections 154 to 159 and sections 161, 162 and 167 relating to the election of directors and matters ancillary thereto.

67. Any casual vacancy occurring on the board of directors may be filled up by the directors, but the person so chosen shall be subject to retirement at the same time as if he had become a director on the day on which the director in whose place he is chosen was last elected as director.

68. The company may remove a director but only in accordance with the provisions of the Ordinance.

DIVIDENDS AND RESERVE

69. The company in general meeting may declare dividends but no dividend shall exceed the amount recommended by the directors.

FARAN POWER LIMITED KARACHI

Company Registration Office * Ministry of Finance * Securities and Exchange Commission

70. The directors may from time to time pay to the members such interim dividends as appear to the directors to be justified by the profits of the company.

71. Any dividend may be paid by a company either in cash or in kind only out of its profits. The payment of dividend in kind shall only be in the shape of shares of listed company held by the distributing company.

72. Dividend shall not be paid out of unrealized gain on investment property credited to profit and loss account.

73. Subject to the rights of persons (if any) entitled to shares with special rights as to dividends; all dividends shall be declared and paid according to the amounts paid on the shares.

74. (1) The directors may, before recommending any dividend, set aside out of the profits of the company such sums as they think proper as a reserve or reserves which shall, at the discretion of the directors, be applicable for meeting contingencies, or for equalizing dividends, or for any other purpose to which the profits of the company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of company or be invested in such investments (other than shares of the company) as the directors may, subject to the provisions of the Ordinance, from time to time think fit.

(2) The directors may carry forward any profits which they may think prudent not to distribute, without setting them aside as a reserve.

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

76. (1) Notice of any dividend that may have been declared shall be given in manner hereinafter mentioned to the persons entitled to share therein but, in the case of a public company, the company may give such notice by advertisement in a newspaper circulating in the Province in which the registered office of the company is situate.

(2) Any dividend declared by the company shall be paid to its registered shareholders or to their order. The dividend payable in cash may be paid by cheque or warrant or in any electronic mode to the shareholders entitled to the payment of the dividend, as per their direction.

(3) In case of a listed company, any dividend payable in cash shall only be paid through electronic mode directly into the bank account designated by the entitled shareholders.

77. The dividend shall be paid within the period laid down under the Ordinance.

ACCOUNTS

78. The directors shall cause to be kept proper books of account as required under section 220.

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

80. The directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account and book or papers of the company except as conferred by law_ or authorised by the directors or by the company in general meeting.

81. The directors shall as required by sections 223 and 226 cause to be prepared and to be laid before the company in general meeting the financial statements duly audited and reports as are referred to in those sections.

82. The financial statements and other reports referred to in regulation 80 shall be made out in every year and laid before the company in the annual general meeting in accordance with sections 132 and 223.

83. A copy of the financial statements and reports of directors and auditors shall, at least twenty-one days preceding the meeting, be sent to the persons entitled to receive notices of general meetings in the manner in which notices are to be given hereunder.

84. The directors shall in all respect comply with the provisions of sections 220 to 227.

85. Auditors shall be appointed and their duties regulated in accordance with sections 246 to 249.

NOTICES

86. (1) A notice may be given by the company to any member to his registered address or if he has no registered address in Pakistan to the address, if any, supplied by him to the company for the giving of notices to him against an acknowledgement or by post or courier service or through electronic means or in any other manner as may be specified by the Commission.

(2) Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter will be delivered in the ordinary course of post.

87. A notice may be given by the company to the joint-holders of a share by giving the notice to the joint-holder named first in the register in respect of the share.

FARAN POWER LIMITED KARACHI

Company Registration Office * Government of Pakistan * Securities and

88. A notice may be given by the company to the person entitled to a share in consequence of the death or insolvency of a member in the manner provided under regulation 85 addressed to them by name, or by the title or representatives of the deceased, or assignees of the insolvent, or by any like description, at the address, supplied for the purpose by the person claiming to be so entitled.

89. Notice of every general meeting shall be given in the manner hereinbefore authorised to (a) every member of the company and also to (b) every person entitled to a share in consequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the company for the time being and every person who is entitled to receive notice of general meetings.

WINDING UP

90. (1) In the case of members' voluntary winding up, with the sanction of a special resolution of the company, and, in the case of creditors' voluntary winding up, of a meeting of the creditors, the liquidator shall exercise any of the powers given by sub-section (1) of section 337 of the Ordinance to a liquidator in a winding up by the Court including inter-alia divide amongst the members, in specie or kind, the whole or any part of the assets of the company, whether they consist of property of the same kind or not.

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

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

DISPUTE RESOLUTION

91. In the event that a dispute, claim or controversy arises between the Company, its management or its shareholders, or between the shareholders inter-se, or the directors inter-se, all steps shall 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

92. Whenever any difference arises between the Company on the one hand, and any of the members, their executors, administrators, or assigns on the other hand, touching the true intent or construction, or the incidents or consequences of these presents, or of the statutes, or touching anything then or thereafter done, executed, omitted or suffered in

alleged breach of these presents, or any claim on account of any such breach or alleged breach, or otherwise relating to the premises, or to these presents, or to any statute affecting the Company, or to any of the affairs of the Company, every such difference shall be referred under the Arbitration Act 1940, to the decision of an arbitrator to be appointed by the parties in differences, or if they cannot agree upon a single arbitrator, to the decision of two arbitrators, of whom one shall be appointed by each of the parties in difference, or an umpire to be appointed by the two arbitrators. The cost of, and incident to, any such reference and award shall be in the discretion of the arbitrators, or umpire respectively, who may determine the amount thereof, or direct the same to be taxed as between attorney and client or otherwise, and may award by whom, and to whom, and in what manner the same shall be borne and paid.

INDEMNITY

93. Every officer or agent for the time being of the company may be indemnified out of the assets of the company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the company, except those brought by the company against him, in which judgment is given in his favour or in which he is acquitted, or in connection with any application under section 492 in which relief is granted to him by the Court.

MISCELLANEOUS

94. If the provisions of these Articles are in any way inconsistent with the provisions of the Companies Ordinance, 2016 or any other law for the time being in force, the provisions of that Ordinance, or that other law shall prevail, and these Articles shall be read subject to that Ordinance or that other Law

FARAN POWER LIMITED KARACHI

Company Registration Office * Karachi * Securities and Exchange Commission of Pakistan

We, the several persons, whose names and addresses are given 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 set apposite our respective names.

Names & Surname In full block Letters	Father's/ Husband's Name in Full	Nationality	Occupation	Residential Address in Full	No. of shares Taken by each Subscriber	Signature
Faran Sugar Mills Limited (Through Mr. Ahmed Ali Bawany) (42000-0409904-3)	Muhammad Amin Ahmed Bawany	Pakistani	Business	3rd Floor Bank House No. 1, Habib Square M.A. Jinnah Road, Karachi	9997 (Nine Thousand Nine Hundred and Ninety Seven Only)	
Mr. Muhammad Omar Bawany (42000-0369567-9)	Muhammad Amin Bawany	Pakistani	Business	Memon Coperative Housing Society, House No 161, Block 7/8, Karachi	1 (One Only)	
Mr. Ahmed Ali Bawany) (42000-0409904-3)	Muhammad Amin Ahmed Bawany	Pakistani	Business	Memon Coperative Housing Society, House No 161, Block 7/8, Karachi	1 (One Only)	
Mr. Bilal Omar Bawany (42000-0469097-5)	Muhammad Omar	Pakistani	Business	Memon Coperative Housing Society, House No 161, Block 7/8, Karachi	1 (One Only)	
				Total (Ten Thousand Only)	**10000**	

DATED: NOVEMBER 28, 2016

WITNESS NAME: NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT.) LIMITED

ADDRESS: 5TH FLOOR AWT PLAZA, I.I CHUNDRIGAR ROAD, KARACHI

FREE OF COST COPY

Certified to be True Copy

Deputy Registrar of Companies

FARAN POWER LIMITED KARACHI

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

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

October 28, 2016

Mr. Ahmed Ali Bawany
Chief Executive Officer,
M/s Faran Power Limited,
Faran Sugar Mills Limited,
3R Floor, Bank House No. 1,
Habib Square, M.A. Jinnah Road,
Karachi.
Tel: 021-111786878
Fax: 021-32421010

Subject: **LETTER OF INTENT (LOI) TO M/S FARAN POWER LIMITED FOR DEVELOPMENT OF A 26.50MW (GROSS) BAGASSE BASED HIGH PRESSURE COGENERATION POWER PROJECT AT M/S FARAN SUGAR MILLS LIMITED, DEH CHANO KATIAR, TANDO EBRAHIM, SHAIKH BHIRKIO, TANDO MUHAMMAD KHAN, SINDH UNDER THE PROVISION OF FRAMEWORK FOR POWER COGENERATION 2013 (BAGASSE /BIOMASS)**

Reference: Your revised request received through letter No. PP/795/08-16 dated August 12, 2016 on the subject cited above.

Alternative Energy Development Board ("AEDB") hereby confirms its interest in your proposal for establishing a 26.50 MW (Gross) Bagasse based High Pressure Co-generation Power Plant under "SPV" i.e. M/s Faran Power Limited at M/s Faran Sugar Mills Limited, Deh Chano Katiar, Tando Ebrahim Shaikh Bhirkio, Tando Muhammad Khan, Sindh, ("Project") under the Framework for Power Co-Generation 2013 Bagasse/Biomass. AEDB acknowledges receipt of the Bank Guarantee No. 5001/17/2016 furnished by the Sponsor(s) dated October 14, 2016 to the tune of US$ 13,500/- with validity period up to April 13, 2018.

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

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

4. The validity of this LOI is 12 calendar months from the date of its issue, where after it will automatically lapse immediately (unless extended pursuant to clauses 5 or 6), being the **October 27, 2017** (the "Expiry Date"). Issuance of this LOI or the lapsing of its validity, cannot form the basis of any claim for compensation or damages by the Sponsor(s) or the project company or any party claiming through or under them against the Government of Pakistan, the Provincial Government, AEDB or any of their

FARAN POWER LIMITED KARACHI

ngencies, employees or consultants on any grounds whatsoever, during or after the expiry of the validity of the LOI.

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

6. The Sponsor(s) shall apply to NEPRA for award of Upfront tariff within the period of validity of this LOI. Upon Upfront tariff being given, the Sponsor(s) shall forthwith submit a new Performance Guarantee in the sum of US$ 67,500/- (US Dollars Sixty Seven Thousands and Five Hundreds Only) and obtain the Letter of Support ("LOS") from AEDB within the validity period of this LOI, provided, if the award of the Upfront tariff is delayed beyond the initial validity of the LOI, the Sponsor(s) shall extend the bank guarantee for a further period of 06 months and the Expiry Date shall be extended *ipso facto* for a further period of 03 months, and the Sponsor(s) shall obtain the LOS and submit the Performance Guarantee within the extended period afore-said

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

8. M/s Faran Sugar Mills Limited (Faran Power Ltd) and its majority shareholders as of the date of this LOI shall be the Main Sponsors of the Project.

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

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

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

(Mr. Ahmed Ali Bawany)
Chief Executive Officer
M/s Faran Power Limited
Faran Sugar Mills Limited

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

FARAN POWER LIMITED KARACHI

Annex

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

TARAN POWER LIMITED KARACHI

DRAFT

"THIRD SCHEDULE

(See section 156)

FORM A- ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL

1	Registration No.	0104213
2	Name of the Company	FARAN POWER LIMITED

3	Form A made upto (Day/Month/Year)			
4	Date of AGM (Day/Month/Year)			

PART-A

5	Registered office address:	3RD Floor Bank House No 1 Habib Square M.A.Jinnah Road Karachi.
6	Email Address:	violin @cyber.net.pk
7	Office Tel. No.:	32418050
8	Office Fax No.:	32421010
9	Nature of Business:	POWER GENERATION.

10 Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares	5,000,000	50,000,000	RS. 10/= each

11 Paid up Share Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares	10,000	100,000	RS. 10/= each

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

13 **Particulars of the holding company**

Name	
Registration No.	% Shares Held

14 **Chief Executive**

Name	Ahmed Ali Bawany	NIC	42000-0409904-3
Address	2nd Floor Bank House No.1 Habib Square M.A.Jinnah Road Karachi..		

15 **Chief Accountant – CFO**

POWER LIMITED KARACHI

Name		NIC	
Address			

16 **Secretary**

Name	Muhammad Ayub	NIC	42101-7447145-7
Address	3rd Floor Bank House No 1 Habib Sq M.A.Jinnah Road Karachi		

17 **Legal Adviser**

Name
Address

18 **Auditors**

Name	HAROON ZAKARIA & CO
Address	Beamount Road PIDC Karachi.

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

	Name of Director	Address	Nationality	NIC (Passport No. if foreigner)												
1.	MUHAMMAD OMAR BAWANY	MUHAMMAD AMIN	PAKISTAN	4	2	0	0	0	0	3	6	9	5	6	7	9
2.	AHMED ALI BAWANY	MUHAMMAD AMIN	PAKISTAN	4	2	0	0	0	0	4	0	9	9	0	4	3
3.	BILAL OMAR BAWANY	MUHAMMAD OMAR	PAKISTAN	4	2	0	0	0	0	4	6	9	0	9	7	5

PART-B

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

Folio	Name	Address	Nation-ality	No. of shares	NIC (Passport No. if foreigner)											
	Members															
1	FARAN SUGAR MILLS LIMITED	3rd Floor Bank House No.1 Habib Square M.A.Jinnah Road Karachi		99,970												
1	MUHAMMAD OMAR BAWANY	2nd Floor Bank House No.1 Habib Square M.A.Jinnah Road Karachi	Pakistani	1	4	2	0	0	0	0	3	6	9	5	6	7	9
2	AHMED ALI BAWANY	2nd Floor Bank House No.1 Habib Square M.A.Jinnah Road Karachi	Pakistani	1	4	2	0	0	0	0	4	0	9	9	0	4	3
3	BILAL OMAR	2nd Floor	Pakistani	1	4	2	0	0	0	0	4	6	9	0	9	7	5

FARAN POWER LIMITED KARACHI

	BAWANY	Bank House No.1 Habib Square M.A.Jinnah Road															
	Debenture holders																

Use separate sheet, if necessary

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

	Name of Transferor	Name of Transferee	Number of shares transferred	Date of registration of transfer
	Members			
	Debenture holders			

Use separate sheet, if necessary

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

Date		Day	Month	Year		Signature	
						Designation (Please tick)	CompanySecretary

INSTRUCTIONS FOR FILLING FORM-A

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

KAPCO POWER LIMITED KARACHI

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

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

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

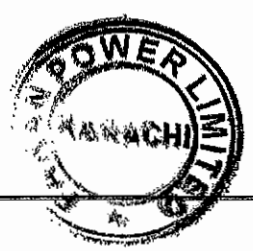
5. If the space provided in the Form is insufficient, the required particulars should be listed in a separate statement attached to this return which should be similarly certified and signed.

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

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

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

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



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, 2016 **FORM 29**

[SECTION 197]

1. Incorporation Number
2. Name of Company: FARAN POWER LIMITED
3. Fee Paid (Rs.): 500.0 Name and Branch of Bank: KARACHI, MCB - PIDC (0915)
4. Receipt No.: E-2016-514271 08/12/2016
5. Mode of Payment (Indicate): Bank Challan

6. Particulars*:

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)
Mr. Ahmed Ali Bawany	42000-0409904-3	S/O Muhammad Amin Ahmed Bawany	3rd Floor Bank House No 1 Habib Square M.A.Jinnah Road Karachi Karachi Sindh Pakistan 74800	Director	Pakistan	Business	Since Incorporation.	
Mr. Bilal Omar Bawany	42000-0469097-5	S/O Muhammad Omar	3rd Floor Bank House No 1 Habib Square M.A.Jinnah Road Karachi Karachi Sindh Pakistan 74800	Director	Pakistan	Business	Since Incorporation.	
Mr. Muhammad Omar Bawany	42000-0369567-9	S/O Muhammad Amin Bawany	3rd Floor Bank House No 1 Habib Square M.A.Jinnah Road Karachi Karachi Sindh Pakistan 74800	Director	Pakistan	Business	Since Incorporation.	

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)

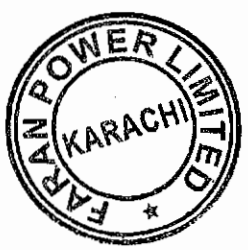
6.3. Any other change in particulars relating to columns (a) to (g) above

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

	National (b)	Name (c)			(if any) (g)	or Change (h)	other remarks (i)

Name of Signatory	Mr. Anmed Ali Bawany	Designation	Director
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	08/12/2016

date on which such person became a partner



Sponsor Profile

Faran Sugar Mills Limited, the main sponsor of Faran Power Limited ("the Project"), is part of Amin Bawany Group which is a leading business group having interest in diversified businesses such as sugar, insurance, modaraba, particle board, ethanol production, trading, construction and other important business sectors of Pakistan. The following companies are managed by Amin Bawany Group:

- Faran Sugar Mills Limited
- Sind Particle Board Mills Limited
- Reliance Insurance Company Limited
- BF Modaraba
- Unicol Limited
- Unienergy Limited

Faran Sugar Mills Limited was incorporated in 1981 and the principal business of the company is manufacture and sale of white refined sugar. The sugar mill is located at Tando Ebrahim Bawany, Sheikh Bhirkio, District Tando Muhammad Khan. The area is considered as a suitable sugarcane growing area and ensures ample and uninterrupted supply of adequate quantity/quality of cane during the crushing season. The sugar mill started commercial production in 1983 with installed cane crushing capacity of 2,000 TCD extendable to 2,700 TCD, which has now been enhanced to 10,000 TCD.

Faran Sugar is ranked amongst top sugar mills operating in the province of Sindh in terms of production. The diversified portfolio of its customers includes the manufacturers of cereals, confectionaries, syrups, beverages, ice creams, and biscuits.

The company has made long-term investment in a distillery unit namely, Unicol Limited, where entire molasses of the company is used to produce premium quality ENA grade ethanol. Unicol was formed in accordance with the terms of a Joint Venture agreement concluded amongst three leading sugar mills of Sindh.

Board of Directors – Faran Power Limited

Ahmed Ali Bawany – Chief Executive

Mr. Ahmed Ali Bawany is the Chief Executive Officer of Faran Power Limited. He got his initial schooling from Springfield School Karachi and St. Patrick's High School Karachi and did his O-Levels from CAS, Karachi. For pursing further education, he went to USA and got degree in Business Entrepreneurship from University of Southern California. Besides Faran Power Limited, he is the Chief Executive of Faran Sugar Mills Limited since April 2007. He is actively involved in Unicol Limited. He is also on the board of Reliance Insurance and is the Chairman of B.F Modaraba. Mr. Ahmed Ali Bawany has an extensive experience in dealing with industry, trade and government bodies.

FARAN POWER LIMITED KARACHI

Muhammad Omar Amin Bawany – Director

Mr. Muhammad Omar Amin Bawany acquired his education from Karachi American School and then went to American College, Switzerland and obtained an Associate Degree in Business Administration. Under his wise management, Annoor Textile Mills operated successfully. He is the Chairman of Faran Power Limited. He is on the Board of Directors of Faran Sugar Mills, B.F Modarba, Reliance Insurance Company and Unicol Limited. Moreover, he is working in the capacity of Vice Chairman of Faran Sugar Mills Limited and the Chief Executive of B.F Modaraba.

Bilal Omar Bawany – Director

Mr. Bilal Bawany completed his primary schooling from CAS school and did his A-levels from Karachi Grammar School. He then went on to pursue Bachelors in Electrical Engineering from the American University of Sharjah, graduating with honors and holds an MBA from Institute of Business Administration. He has worked with leading companies in Abu Dhabi, Scotland and Pakistan including Baker Hughes and Avanceon. He is on the Board of Directors of Faran Power Limited, Faran Sugar Mills Limited and UniEnergy Limited.

Sponsor's Experience in Power Sector

At present, FSML is running and maintaining a 13 MW captive power plant based on a low pressure system. Details of the boilers and turbo alternators currently run by FSML are given in the tables below:

Boilers

Sr. No	Description	Ratings	Make
01	Boiler # 1	40 TPH	FCB
02	Boiler # 2	40 TPH	FCB
03	Boiler # 3	50 TPH	Yoshimine
04	Boiler # 4	90 TPH	Takuma
Total		**220 TPH**	

Turbo-Alternators

Sr. No	Description	Ratings	Make
01	T.A. Set # 1	1.5 MW	FCB
02	T.A. Set # 2	1.5 MW	FCB
03	T.A. Set # 3	4.0 MW	PBH
04	T.A. Set # 4	6.0 MW	SKODA
Total		**13 MW**	

The management team has sufficient experience in executing cogeneration power projects and carrying out the operations and maintenance of power plants. Moreover, the group has entered into a JV project for development of a 50 MW wind power project in Jhimpir, Sindh by the name of UniEnergy Limited.

FARAN POWER LIMITED KARACHI

Technology, Type and Model

1.1 General Design

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 will be 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 FSML. During the crushing season, FSML needs steam and electricity to crush the sugar cane and produce sugar. Steam for FSML will be supplied from the controlled extraction of the steam turbine which is at approximately 3 bar pressure. The expected steam demand for FSML is 88 TPH from the HP system. The electricity demand of FSML during the crushing season is 8.35 MW. During the off-season, the electricity demand is 0.5 MW.

1.2 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 FPL, 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 many 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 FPL proposes 1x135 TPH capacity boilers and 1 x 26.5 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.

2 Design and Specifications of the Plant

2.1 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 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.

Design Parameters:

- Bagasse Fired Boiler; 135 TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar(a)
- Steam temperature at the Main steam stop valve outlet at MCR: 540 ± 5 ^{0}C
- Boiler feed water temperature at the inlet to the Deareator; 105 ^{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: 85 dB(A)

The Bagasse through drum feeders, screw feeders and pneumatic spreaders will be fed 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 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.

Thereafter, the Fly Ash Arrestor installed at the outlet of the Air Preheater. From Fly Ash Arrestor most of the fly ash will be separated from the flue gases.

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.

Demineralized (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 415V 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.

2.2 Steam Turbine and Auxiliaries

2.2.1 Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with 2 number of uncontrolled extractions and 1 number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.075 bar (a) pressure during off-season operation.
The low pressure steam at 3 bar (a), 133.5^{0}C will be supplied to the sugar plant for juice heating in the evaporator station. The medium pressure steam at 5 bar (a), 155^{0}C will supplied for centrifugal washing. 90% condensate of the supplied LP steam will be returned from the sugar mill. There will be no condensate return of medium pressures steam.

2.2.2 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 5 seconds.

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

2.2.3 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

2.2.4 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

2.3 AC Generator

Generator shall be supplied in line with the following specifications:

Table 7: Generator Specifications

Description	Parameters
Rating & Count	26.5 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

Generator electrical output rating shall be as follow:

- 33.125 MVA rated capacity at 50°C ambient.
- 11 ± 10% KV
- 50 ± 5% Hz
- 3 Phase

2.3.1 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

2.4 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

2.5 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

2.6 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)

2.7 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:

2.7.1 Main Cooling Water Pumps

Three (3) Main Cooling Water Pumps (two working and one standby) each of capacity approximately 2600 m^3/hr shall be provided. Pumps will be horizontal centrifugal type, driven by electric motors.

2.7.2 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.

2.7.3 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 6600 m^3/hr and is combined and common for the whole cogeneration power plant.
- There shall be 2 cells each having a capacity of approximately 3300m^3/hr.
- The cooling tower will be designed for a cooling range of 10°C, and an approach of 4°C while operating under the atmospheric wet bulb temperature of about 30°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 34°C and 44°C respectively.

2.8 Raw Water System

Raw water system consists off the following components:

2.8.1 Cooling Water Makeup Pump

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

2.8.2 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.

2.9 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.

2.10 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.

2.11 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.

2.11.1 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.

2.11.2 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.

2.12 Water Treatment System

The Cogeneration power plant make up water requirements will be met from the canal water supply / 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.

High Rate Solid Contact Clarifier (HRSCC) → Multi-grade Filter → Ultra-filtration → Two Stage Reverse Osmosis system → Electro De Ionization system with standby mixed bed. The capacity of water treatment plant is 30m3/hr. DM water is collected in two DM water tanks each having a capacity of 1000 m3. Water will be distributed from DM tanks through pumps to different users i.e. Deaerator, Condenser etc.

2.13 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:

2.13.1 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.

2.13.2 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.

2.13.3 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.

2.13.4 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.

2.13.5 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.

2.14 Effluent Handling System

Effluent handling system consists of the following main components:

2.14.1 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.

2.14.2 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.

2.14.3 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.

2.14.4 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 200 m^3/hr.

2.15 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.

2.16 Electric Overhead Travelling (EOT) Cranes

EOT cranes shall be provided in the following buildings:

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 70 extendable 25 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.

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.

3 Electrical Design

3.1 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 Two (2) numbers of step-up power transformer (one working + one standby) to meet N-1 condition of NTDC.

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 Two (2) numbers of 6.5MVA, 11/5.5kV interconnecting transformers which shall be inter connected with 11kV cogen switchboard through HT cable.

3.1.1 Ambient Conditions for Electrical Equipment.

Ambient conditions and design temperatures for electrical equipment are given in Table 8 below:

Table 8: Ambient Conditions for Electrical Equipment

	Deg C
Maximum Temperature	44
Minimum Temperature	9
Plant Design Temperature	50
Indoor Equipment Design	50
Outdoor Equipment Design	50

3.2 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 9 below:

Table 9: Plant Operating Voltage

Generation (TG) system	11 kV
Power evacuation system	132 kV
Non-AC VSD / auxiliaries of cogeneration plant	415 V
AC VSD / auxiliaries of co-generation plant	415 V
DC system of co-generation plant	110 V
UPS system of co-generation plant	230 V

3.3 Basic Electrical Design Parameters

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

Table 10: Basic Electrical Design Parameters

Power Factor (lagging)	0.8
Generation Voltage (kV)	11 kV, 3 phase
Parallel operation with Grid	Required with 132 kV 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	40 kA
400 V	50 kA
Fault Level & Withstand Duration	
132kV Switchgear	40 kA for 1 sec
For 11 kV Switchgear	40 kA for 3 sec
For 400 V Switchgear	50 kA for 1 sec
400V Lighting System	10 kA for 1 sec
11kV Isolated Phase Bus Ducts	40 kA for 3 sec
110VDC	25 kA for 1 sec
48VDC	10 kA for 1 sec
230VAC	10 kA for 1 sec
Transformer and all accessories	All transformers and its accessories shall be capable of withstanding for 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

3.4 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 11: 132kV Switchyard Specifications

Voltage Level	132 kV
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	3150 Amp 40 kA 1 sec
Isolator (Centre break, motor operated with copper alloy blades)	2,000 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)	25
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

3.5 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 12: Insolated Phase Bus Duct Specifications

Application	Steam Generator Connection to 11kV Panel
Power Frequency Withstand Voltage	28kV
BIL	75kVp
Enclosure	Minimum thick of 3mm Al
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 40kA, whichever is higher

3.6 11kV Switchboard

11 kV switchgear shall be of indoor, metal clad, fully draw out truck type with vacuum circuit breaker. The switchgear shall be suitable for maximum system voltage of 12 kV. The power frequency voltage of the board shall be 28kV and BIL of the panel shall be 75kV (peak). The circuit breakers and switchgear assembly shall withstand the rated short circuit current for not less than three seconds. The breakers shall also be rated for peak asymmetrical current with a rating of 2.5 times symmetrical rated current. The switchboard shall have Incomer, Tie, Bus coupler and outgoing feeders of rating 3,150A / 2,000A / 1,250A for distribution of power to co-gen and sugar plant and power export.

3.7 400 V Switchboard

All the cogeneration plant auxiliary loads shall be segregated into 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 one (1) of 11/0.415/0.415kV AC VSD transformer and non-VSD loads shall be connected to one (1) of 11/0.415kV AC VSD transformer. Both the VSD and non-VSD switchboards shall be interconnected through tie ACB feeders. DG incomer shall be provided in the non – VSD switchboard to meet the plant startup / emergency loads. These switchboards shall be designed for 50 kA for 1 sec. The busbar material of the panel shall be of copper.

3.8 Transformers

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

Table 13: Specifications of Transformers

Description	Parameters
Generator transformer (GT) / Power Transformer	Min. 28/35 MVA 132/11 kV YNd1
VSD transformers [Three winding transformer for co-generation plant	3.15 MVA 11/0.415/0.415 kV, Dyn11Dzn0
Interconnection transformer at sugar plant	6.5MVA, 11/5.5kV, Dyn11
Lighting Transformer	150kVA, 415V/400V, 50Hz, Dyn11, dry type, Three Phase, Two Windings
Neutral Grounding Transformer	Zn0 windings, 50A for 10Sec & 500A for 3 sec, 11KV, ONAN

3.9 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 14: AC & DC UPS Specifications

Description	Parameters
110VDC for TG System	1x100% Dual FCBC with Battery Bank [VRLA Type]
110VDC for Switchyard	2 sets of Battery banks SMF type 2V Cell batteries, suitable for 110V DC system along with FCBC.
230VAC UPS	2x100% Dual Redundant UPS with Dedicated Battery Bank [SMF type: Sealed Maintenance Free]
230VAC Emergency Lighting inverter	Minimum 16kVA inverter with battery backup

3.10 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.

3.11 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.

3.12 RTDs & Thermistors

Thermistors shall be installed on motors rated between 22 to 75kW. RTD shall be made available for motors more than 90kW. BTDs shall be made available for motors rated from 110 kW. All RTDs shall be hooked up with relays in Motor Relays in respective MCC.

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

TG system shall be grounded through Neutral Grounding Resistor (NGR) panel to limit the earth fault current to 50 A to suit the system requirement, through the 11kV neutral point of TG. The 11kV system shall be provided with 11kV 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.

LV system 415V system shall be solidly grounded through transformer neutral. Neutral busbars shall be made available in 415 V PCCs, and all MCCs.

415V 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.

3.14 Cable Installation

Cables shall be installed in cable trays on cable racks. All outdoor cables shall be laid on overhead cable trays. No cables shall be buried, except for outdoor lighting cables. Outdoor cable racks shall have clearance of minimum 6 m between the ground level and the lowest point of the cable racks.

3.15 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.

3.16 Lighting & Small Power

Plant lighting loads shall be fed through one (1) No. of 415/400V, Dyn11 connected dry [illegible] lighting transformer of minimum rating of [150] kVA.

Emergency Lighting Distribution Board (ELDB) shall be fed through inverter of minimum [16] 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.

3.17 Plant Communication System

Plant communication shall be provided with following facility:

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

3.18 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)
Segregated Phase Bus ducts	IP54 (indoor) IP55 (outdoor)

3.19 Plant Startup

The co-generation plant shall be started with two (2) numbers of 415V Black start DG sets. These DG sets shall be connected to DG panel, which shall be planned with two incoming DG set feeder and two outgoing feeders.

Plant startup can also be managed either from Grid supply or Black start DG sets.

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

3.20 Instrumentation and Control (I&C) Systems

I&C System will ensure control and monitoring of operations of both the technological and electrical part of Cogen 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 Cogen 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

3.21 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.

3.22 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.

Faran Power Limited

26.5 MW Bagasse-based Cogeneration Power Project

Tando Muhammad Khan, Sindh

Feasibility Report

Table of Contents

FARAN POWER LIMITED KARACHI

1 Project Background

Faran Sugar Mills Limited ("FSML") through a wholly subsidiary Faran Power Limited ("FPL") intends to set up a green field 26.50 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 within the premises of FSML at Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan, Sindh.

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 partially meet the steam and power requirements of FSML during the crushing season. The Project will enable FSML to establish a sustainable market for its by-product, bagasse, and will also allow the sponsors of FSML to take an exposure in the power sector through incentives offered by the Government of Pakistan ("GoP") under the Framework and RE Policy.

The objective of this financial feasibility report ("Feasibility") is to assist FSML 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 the 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.

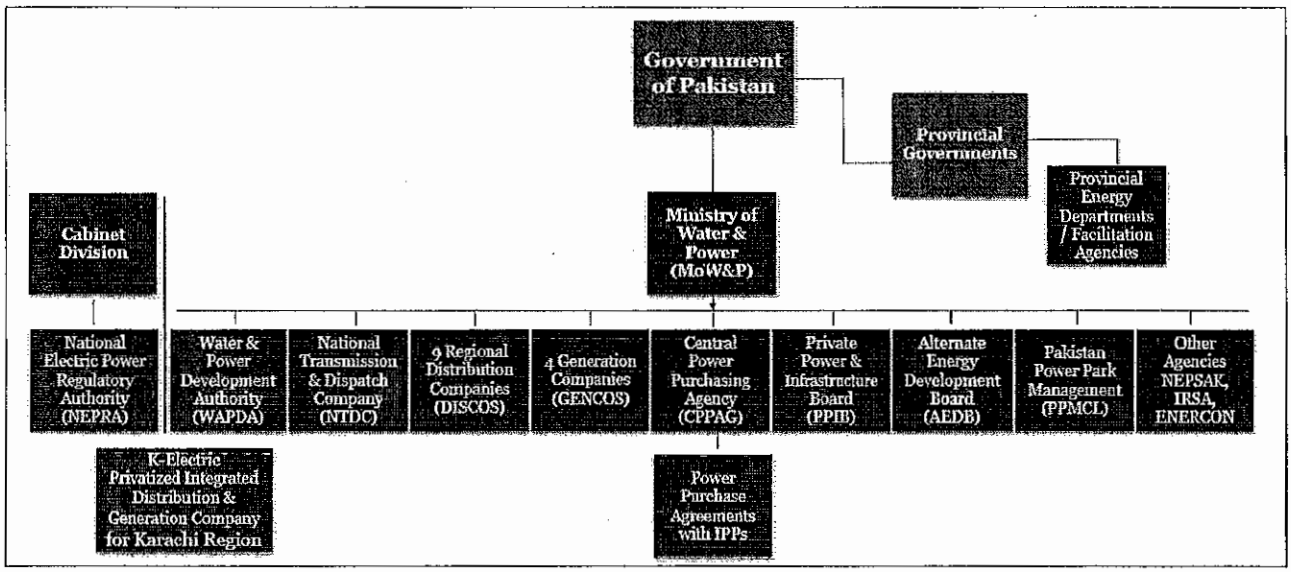
Table 1: Pakistan Power Generation Capacity

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 legal, independent body acting as a central counterparty to power purchase transactions. The present form of the power structure in Pakistan is presented below:

Table 2: 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 3: Pakistan Energy Generation by Source

As on 30th June	2010-11	2011-12	2012-13	2013-14	2013-14
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, 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. Thermal generation breakdown in the country in recent years is given in the table below:

Table 4: 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 19,132 MW, while the maximum peak demand reached 24,757 MW, resulting in a 5,625 MW gap between supply and demand. Projections by government agencies depict that this shortfall is not going to end till 2018. The tables below show the actual and projected surplus/deficit in demand during system peak hours:

Table 5: 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 6: 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 by not only causing social disruption, but also affecting 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 by adding 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 is required to, as far as reasonably possible, protect the interests of consumers and companies providing electric power services in accordance with the 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 ("**IA**"), assists the power purchaser, fuel supplier, government authorities in the negotiations, execution and administration of the EPA, fuel 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 [illegible] EPA

FARAN POWER LIMITED KARACHI

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-G purchases power 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 EPA in this regard.

2.4.5 Hyderabad Electric Supply Company ("HESCO")

HESCO was formed to take over/acquire all the properties, assets and liabilities of Hyderabad Area Electricity Board owned by WAPDA. The company was incorporated on 23rd April 1998 and certificate for commencement of business was obtained on 1st July 1998 from NEPRA. HESCO serves 975,346 consumers and has administratively divided 12 districts of Sindh Province into 4 operation Circles: Hyderabad, Laar, Nawabshah and Mirpurkhas.

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 FSML/FPL seeking an LOI from AEDB for the Project (which the company has already been issued). In May 2013, NEPRA 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 pre-requisites apply to NEPRA for the same.

Upon receipt of the Upfront Tariff approval from NEPRA the Project Company shall seek an 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, after submission of an approved grid interconnection study from HESCO and an environmental study from 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. Cogeneration 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.

FARAN POWER LIMITED KARACHI

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 water in the juice 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

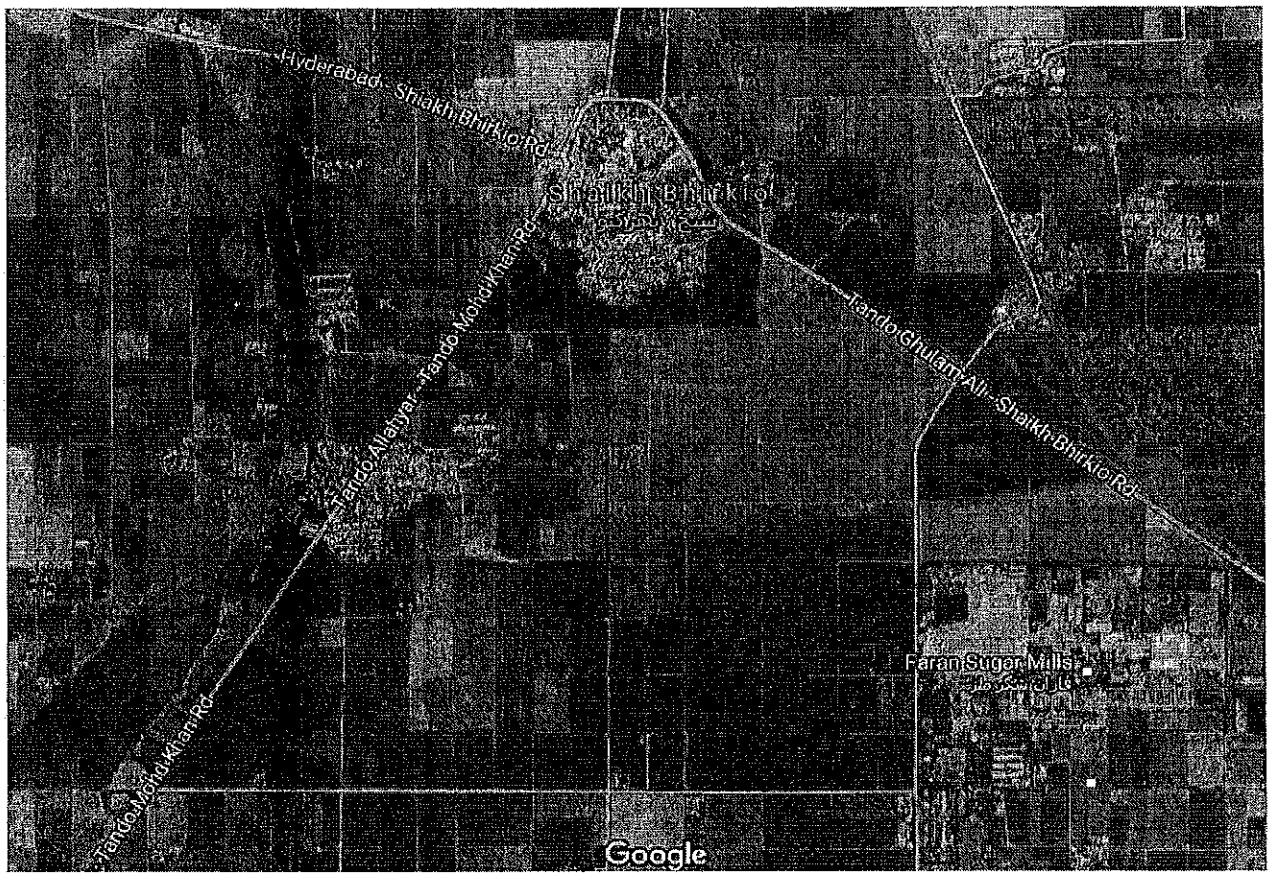
The 26.50 MW Co-generation Project envisages a 1+1 configuration power plant comprising of a high pressure (110 bar) traveling grate boiler having a steam capacity 135 tons per hour, a 26.50 MW condensing/extraction steam turbine generators and balance of plant **("Plant")**. It is planned that, **during the crushing period,** steam and power for FSML operations will be provided from the existing Low Pressure **("LP")** system and the balance steam/power requirement of FSML will be met through the High Pressure **("HP")** system of the Plant. During the crushing period, bagasse from FSML will be utilized both in the HP and LP Systems to generate steam and power. During the non-crushing period only the HP system shall operate, which will use un-utilized bagasse available with FSML as fuel. Detailed workings regarding the fuel availability and generation mix are provided in the following sections.

5.1 Project Site and Location

The Project Site will be located within the premises of FSML located at Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan, Sindh. The total area of the sugar mill and its premises is 158.24 acres and of that, approximately 17 acres will be allocated to the construction of the power plant.

A map of the Project site is given below and a detailed plant layout has been attached as Annexure 1:

FARAN POWER LIMITED KARACHI



6 Plant Type and Technology

6.1 General Design

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 will be 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 FSML. During the crushing season, FSML needs steam and electricity to crush the sugar cane and produce sugar. Steam for FSML will be supplied from the controlled extraction of the steam turbine which is at approximately 3 bar pressure. The expected steam demand for FSML is 88 TPH from HP

system. The electricity demand of FSML during the crushing season is 8.35 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 FPL, 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 many 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 FPL proposes 1x135 TPH capacity boilers and 1 x 26.5 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 Design and Specifications of the Plant

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 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.

Design Parameters:

- Bagasse Fired Boiler; 135 TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar(a)
- Steam temperature at the Main steam stop valve outlet at MCR: 540 ± 5 ^{0}C
- Boiler feed water temperature at the inlet to the Deareator: 105 ^{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: 85 dB(A)

The Bagasse through drum feeders, screw feeders and pneumatic spreaders will be fed 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 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.

Thereafter, the Fly Ash Arrestor installed at the outlet of the Air Preheater. From Fly Ash Arrestor most of the fly ash will be separated from the flue gases.

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.

Demineralized (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 415V 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.

7.2 Steam Turbine and Auxiliaries

7.2.1 Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with 2 number of uncontrolled extractions and 1 number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.075 bar (a) pressure during off-season operation.
The low pressure steam at 3 bar (a), 133.5^{0}C will be supplied to the sugar plant for juice heating in the evaporator station. The medium pressure steam at 5 bar (a), 155^{0}C will supplied for

centrifugal washing. 90% condensate of the supplied LP steam will be returned from the sugar mill. There will be no condensate return of medium pressures steam.

7.2.2 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 5 seconds.

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

7.2.3 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

7.2.4 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

7.3 AC Generator

Generator shall be supplied in line with the following specifications:

Table 7: Generator Specifications

Description	Parameters
Rating & Count	26.5 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

Generator electrical output rating shall be as follow:

- 33.125 MVA rated capacity at 50˚C ambient.
- 11 ± 10% KV
- 50 ± 5% Hz
- 3 Phase

7.3.1 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

7.4 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

7.5 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

7.6 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)

7.7 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:

7.7.1 Main Cooling Water Pumps

Three (3) Main Cooling Water Pumps (two working and one standby) each of capacity approximately 2600 m^3/hr shall be provided. Pumps will be horizontal centrifugal type, driven by electric motors.

7.7.2 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.

7.7.3 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 6600 m^3/hr and is combined and common for the whole cogeneration power plant.
- There shall be 2 cells each having a capacity of approximately 3300m^3/hr.
- The cooling tower will be designed for a cooling range of 10°C, and an approach of 4°C while operating under the atmospheric wet bulb temperature of about 30°C.
- Each cell of cooling tower gear box will be equipped with vibration switches, oil temperature and oil level controls.

FARAN POWER LIMITED KARACHI

- The source of cooling water will be Bore Well Water.
- Cooling water supply and return temperature is 34˚C and 44˚C respectively.

7.8 Raw Water System

Raw water system consists off the following components:

7.8.1 Cooling Water Makeup Pump

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

7.8.2 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.

7.9 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.

7.10 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.

7.11 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.

7.11.1 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.

7.11.2 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.

7.12 Water Treatment System

The Cogeneration power plant make up water requirements will be met from the canal water supply / 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.

High Rate Solid Contact Clarifier (HRSCC) → Multi-grade Filter → Ultra-filtration → Two Stage Reverse Osmosis system → Electro De Ionization system with standby mixed bed. The capacity of water treatment plant is 30m3/hr. DM water is collected in two DM water tanks each having a capacity of 1000 m3. Water will be distributed from DM tanks through pumps to different users i.e. Deaerator, Condenser etc.

7.13 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:

7.13.1 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.

7.13.2 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.

7.13.3 Portable Fire Extinguishers:

FARAN POWER LIMITED KARACHI

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

7.13.4 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.

7.13.5 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.

7.14 Effluent Handling System

Effluent handling system consists of the following main components:

7.14.1 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.

7.14.2 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.

7.14.3 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.

7.14.4 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 200 m^3/hr.

7.15 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.

7.16 Electric Overhead Travelling (EOT) Cranes

EOT cranes shall be provided in the following buildings:

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 70 extendable 25 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.

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 Two (2) numbers of step-up power transformer (one working + one standby) to meet N-1 condition of NTDC.

FARAN POWER LIMITED KARACHI

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 Two (2) numbers of 6.5MVA, 11/5.5kV interconnecting transformers which shall be inter connected with 11kV cogen switchboard through HT cable.

8.1.1 Ambient Conditions for Electrical Equipment.

Ambient conditions and design temperatures for electrical equipment are given in Table 8 below:

Table 8: Ambient Conditions for Electrical Equipment

	Deg C
Maximum Temperature	44
Minimum Temperature	9
Plant Design Temperature	50
Indoor Equipment Design	50
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 9 below:

Table 9: Plant Operating Voltage

Generation (TG) system	11 kV
Power evacuation system	132 kV
Non-AC VSD / auxiliaries of cogeneration plant	415 V
AC VSD / auxiliaries of co-generation plant	415 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 10: Basic Electrical Design Parameters

Power Factor (lagging)	0.8
Generation Voltage (kV)	11 kV, 3 phase
Parallel operation with Grid	Required with 132 kV 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	40 kA
400 V	50 kA
Fault Level & Withstand Duration	
132kV Switchgear	40 kA for 1 sec
For 11 kV Switchgear	40 kA for 3 sec
For 400 V Switchgear	50 kA for 1 sec
400V Lighting System	10 kA for 1 sec
11kV Isolated Phase Bus Ducts	40 kA for 3 sec
110VDC	25 kA for 1 sec
48VDC	10 kA for 1 sec
230VAC	10 kA for 1 sec
Transformer and all accessories	All transformers and its accessories shall be capable of withstanding for 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 11: 132kV Switchyard Specifications

Voltage Level	132 kV
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	3150 Amp 40 kA 1 sec
Isolator (Centre break, motor operated with copper alloy blades)	2,000 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)	25
Instrument Transformers	Hermetically sealed, dead tank design rating as

FARAN POWER LIMITED KARACHI

	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 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 12: Insolated Phase Bus Duct Specifications

Application	Steam Generator Connection to 11kV Panel
Power Frequency Withstand Voltage	28kV
BIL	75kVp
Enclosure	Minimum thick of 3mm Al
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 40kA, whichever is higher

8.6 11kV Switchboard

11 kV switchgear shall be of indoor, metal clad, fully draw out truck type with vacuum circuit breaker. The switchgear shall be suitable for maximum system voltage of 12 kV. The power frequency voltage of the board shall be 28kV and BIL of the panel shall be 75kV (peak). The circuit breakers and switchgear assembly shall withstand the rated short circuit current for not less than three seconds. The breakers shall also be rated for peak asymmetrical current with a rating of 2.5 times symmetrical rated current. The switchboard shall have Incomer, Tie, Bus coupler and outgoing feeders of rating 3,150A / 2,000A / 1,250A for distribution of power to co-gen and sugar plant and power export.

8.7 400 V Switchboard

All the cogeneration plant auxiliary loads shall be segregated into 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 one (1) of 11/0.415/0.415kV AC VSD transformer and non-VSD loads shall be connected to one (1) of 11/0.415kV AC VSD transformer. Both the VSD and non-VSD switchboards shall be interconnected through tie ACB feeders. DG incomer shall be provided in the non-

switchboard to meet the plant startup / emergency loads. These switchboards shall be designed for 50 kA for 1 sec. The busbar material of the panel shall be of copper.

8.8 Transformers

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

Table 13: Specifications of Transformers

Description	Parameters
Generator transformer (GT) / Power Transformer	Min. 28/35 MVA 132/11 kV YNd1
VSD transformers [Three winding transformer for co-generation plant	3.15 MVA 11/0.415/0.415 kV, Dyn11Dzn0
Interconnection transformer at sugar plant	6.5MVA, 11/5.5kV, Dyn11
Lighting Transformer	150kVA, 415V/400V, 50Hz, Dyn11, dry type, Three Phase, Two Windings
Neutral Grounding Transformer	Zn0 windings, 50A for 10Sec & 500A for 3 sec, 11KV, ONAN

8.9 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 14: AC & DC UPS Specifications

Description	Parameters
110VDC for TG System	1x100% Dual FCBC with Battery Bank [VRLA Type]
110VDC for Switchyard	2 sets of Battery banks SMF type 2V Cell batteries, suitable for 110V DC system along with FCBC.
230VAC UPS	2x100% Dual Redundant UPS with Dedicated Battery Bank [SMF type: Sealed Maintenance Free]
230VAC Emergency Lighting inverter	Minimum 16kVA inverter with battery backup

8.10 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.

8.11 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.

FARAN POWER LIMITED KARACHI

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.

8.12 RTDs & Thermistors

Thermistors shall be installed on motors rated between 22 to 75kW. RTD shall be made available for motors more than 90kW. BTDs shall be made available for motors rated from 110 kW. All RTDs shall be hooked up with relays in Motor Relays in respective MCC.

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

TG system shall be grounded through Neutral Grounding Resistor (NGR) panel to limit the earth fault current to 50 A to suit the system requirement, through the 11kV neutral point of TG. The 11kV system shall be provided with 11kV 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.

LV system 415V system shall be solidly grounded through transformer neutral. Neutral busbars shall be made available in 415 V PCCs, and all MCCs.

415V 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.

8.14 Cable Installation

Cables shall be installed in cable trays on cable racks. All outdoor cables shall be laid on overhead cable trays. No cables shall be buried, except for outdoor lighting cables. Outdoor cable racks shall have clearance of minimum 6 m between the ground level and the lowest point of the cable racks.

FARAN POWER LIMITED KARACHI

8.15 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.

8.16 Lighting & Small Power

Plant lighting loads shall be fed through one (1) No. of 415/400V, Dyn11 connected dry type lighting transformer of minimum rating of [150] kVA.

Emergency Lighting Distribution Board (ELDB) shall be fed through inverter of minimum [16] 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.

8.17 Plant Communication System

Plant communication shall be provided with following facility:

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

8.18 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)
Segregated Phase Bus ducts	IP54 (indoor) IP55 (outdoor)

FARAN POWER LIMITED KARACHI

8.19 Plant Startup

The co-generation plant shall be started with two (2) numbers of 415V Black start DG sets. These DG sets shall be connected to DG panel, which shall be planned with two incoming DG set feeder and two outgoing feeders.

Plant startup can also be managed either from Grid supply or Black start DG sets.

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

8.20 Instrumentation and Control (I&C) Systems

I&C System will ensure control and monitoring of operations of both the technological and electrical part of Cogen 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 Cogen 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

8.21 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.

8.22 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.

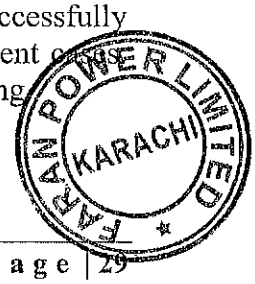
All field-mounted instruments will be equipped with sufficient isolation device such as a block and bleed valves assembly, and vent and drain valves so as to permit safe maintenance, removal, testing and calibration of instruments during plant operation.

9 Grid Interconnection

A detailed grid interconnection study for the Project has been carried out by Power Planners International and has been submitted to HESCO for approval. Key findings of the report are summarized below:

- The network around FPL at 132 kV and 11 kV has been modeled as shown in Annexure-2 (Sketch-1).
- The nearest HESCO grid facility available for interconnection to FPL are Chamber 132 kV Grid Station and Shaikh Bhirkio 132 kV Grid Station.
- Keeping in view the location of Power Project, it is proposed to connect FPL via looping In-Out of the existing Transmission Line from 132 kV Chamber Grid Station to Shaikh Bhirkio 132 kV grid station. The looping distance as confirmed from site visit would be 2 km and the conductor used would be Lynx. Moreover, it is suggested that stringing of the second circuit from 132 kV Chamber Grid Station to Shaikh Bhirkio 132 kV Grid Station should be carried out on the already available STG tower to fulfill the N-1 criteria. The scheme is shown in Sketch-2 attached as Annexure-3.

- FPL would generate power at 11 kV voltage level from where it is stepped-up to 132 kV using two 132/11 kV transformers with rating of 31.5/40 MVA.
- The proposed scheme would require two 132 kV line bays at the 132 kV substation of FPL for the connection to 132 kV Chamber grid station and Shaikh Bhirkio 132 kV Grid Station. Furthermore, it would also require two transformer bays for the connection of two 132/11 kV transformers with rating of 31.5/40 MVA.
- In view of planned COD of the FPL in October 2018, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of
  - January 2019 for maximum thermal power dispatches in the grid during the crushing Season for FPL.
  - September 2019 for maximum hydropower dispatches in the grid during the off-season of FPL.
- The system conditions of normal and N-1 contingency have been studied to meet the reliability criteria of NEPRA Grid Code.
- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2021 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover of up to 23.12 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at FPL and the substations of 132 kV in its vicinity. We find that the fault currents for the proposed scheme are within the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from FPL.
- The maximum short circuit levels of Faran PP 132 kV is 4.56 kA and 4.60 kA for 3-phase and 1-phase faults respectively for the Year 2019 and 4.73 kA and 5.01 kA for 3-phase and 1-phase faults respectively for the Year 2021. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out for January 2019. The stability check for the worst case of three phase fault right on the 132 kV bus bar of FPL substation followed by the final trip of one 132 kV circuit emanating from this substation, has been performed for fault clearing of 5 (100 ms) and 9 cycles (180 ms), in case of stuck breaker, as understood to be the normal fault clearing time of 132 kV protection system. The stability of system for far end faults of 3-phase occurring at 132 kV bus bar have also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults for the most stringent case. The system is found strong enough to stay stable and recovered with fast damping.



- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.

10 Initial Environmental Examination

FPL has commissioned an Initial Environmental Examination ("IEE") in compliance with the requirements of Sind Environmental Protection Act (SEPA) 2014, and Sindh Environmental Protection Agency (Review of EIA/IEE) Regulations. As per the IEE report, this project activity has excellent contribution towards sustainable development and addresses the key issues:

Environmental well-being

- Substituting the electricity requirement from grid by co-fired plant there by eliminating the generation of equivalent quantum of electricity using conventional fuel feeding the national grid.
- Conserving fossil fuel and other non-renewable natural resource.
- Mitigating the emission of GHG (CO2).

Socio- economic well being

- Contributing to a small increase in the local employment by employing skilled and unskilled personnel for operation and maintenance of the equipment.
- Adopting an advanced and sustainable technology for long term benefits.
- Helping to bridge the gap of electricity demand and supply at local level.

The project is expected to have the following significant potential impacts:

Impact	Description
Air quality	Emissions of greenhouse gases and other emissions
Emissions from traffic movements;	Dust levels during construction;
Flood risk	Identification of any mitigation works which may be needed during the development stage of the project;
Ecology	Direct and indirect impacts on statutory and non-statutory designated sites; Scope for biodiversity enhancements;
Transport	Increase in road movements during construction and operation; Inter-action with other proposed transport schemes
Noise	Temporary noise increases during construction; Noise during operation
Landscape and Visual	Visual aspects of the proposed plant; Building design
Socio-economic	Potential for job creation during construction; Potential employment at the Blackburn Meadows Renewable Energy Plant
Energy/sustainability	Contribution to the City's sustainable energy strategy

FARAN POWER LIMITED KARACHI

11 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.

FARAN POWER LIMITED KARACHI

11.1 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 less than 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.

12 Key Operating Assumptions

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

- Plant Generation
- General & Timeline
- Project Cost
- Financing Assumptions
- Project Tariff & Revenue

12.1 Plant Generation Parameters

As discussed earlier, 26.50 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 FSML to the extent these are not met by the LP boiler. To meet the steam requirements of the MSML process, the current LP boiler along with a 1.65 MW (Gross) 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 16: Plant Generation

	Crushing Period	Non-Crushing Period
Extracting & Condensing Turbine Capacity	26.50 MW	26.50 MW
Auxiliary Consumption of Turbine	2.28 MW	2.87 MW
Net Capacity from HP System	24.22 MW	23.63 MW
Gross Capacity of Backpressure Turbo generator	1.65 MW	n/a
Auxiliary Consumption of Backpressure Turbo generator	0.60 MW	n/a
Net Capacity of LP System	1.05 MW	n/a
Sugar Mill Requirement	9.40 MW	0.50 MW
Net Exportable to Sugar Mill from HP System	8.35 MW	0.50 MW
Net Exportable to Grid from HP System	15.87 MW	23.13 MW
Exportable Units	38,107 MWh	37,536 MWh

12.2 Project Timeline

As per discussions with the Sponsors a 20-month construction time following financial close has been assumed for the Project. Financial Close is targeted in end-July 2017 with a target Project commercial operations date **("COD")** of mid-March 2019. This would enable the Project to smooth any teething issues that may arise during the crushing period. A schedule of activities and key milestones is provided in Table 17 below:

Table 17: Indicative Project Schedule

Activity	Duration	Start Date	End Date
Issuance of LOI			28-Oct-16
EPC Activities	120	28-Oct-16	25-Feb-17
Grid Study, Approvals & CPPA-G Consent	120	28-Oct-16	25-Feb-17
Generation License Application and Approval from NEPRA	60	23-Jan-17	24-Mar-17
Tariff Application and Approval from NEPRA	30	25-Feb-17	27-Mar-17
Issuance of LOS	15	27-Mar-17	11-Apr-17
Signing of IA and EPA	60	11-Apr-17	10-Jun-17
Financial Close Activities	120	27-Mar-17	25-Jul-17
Construction Activities	600	25-Jul-17	17-Mar-19
Commercial Operations Date			17-Mar-19

12.3 Project Life

As per the standard energy purchase agreement ("EPA") the Project life and EPA term has been assumed as 30 years from COD and all equipment is being procured corresponding to the same.

12.4 Project Cost

The break-down of the estimated Project Cost is provided below in Table 18. The Engineering, Procurement & Construction Cost accounts for 80% of the total Project Cost. The project cost is based on an average PKR/USD exchange rate of PKR 109.19/USD. 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.

Table 18: Estimated Project Cost

Estimated Project Cost*	USD million	PKR million
EPC Cost	26.50	2,893.59
Non-EPC Cost	0.98	107.32
Project Development Costs	2.28	248.88
Insurance during Construction	0.20	21.70
Financing Fee & Charges	0.95	104.22
Interest during Construction (IDC)	2.20	240.41
Total	**33.12**	**3,616.12**
EPC Cost per MW (USD million)	*1.00*	
Project Cost per MW (USD million)	*1.25*	

**Project cost is based on preliminary estimates and will be firmed up when EPC contract is finalized*

- **EPC Cost** at USD 1.00 per kW has been based on applicable costs in precedent transactions with an adjustment for smaller plant size. The Company is in the process of finalizing the equipment for the Project. The Project may opt for EPC or multiple vendor package and this shall be updated in due course.
- **Non-EPC** costs include costs related to:
  - Land & Development cost estimated at 0.50 million
  - Non-reimbursable fuel during testing at USD 0.48 million based on an estimated bagasse consumption of 15,000 MT.
- **Project Development** costs include costs related to technical studies, owners' engineer, construction manager as well as legal and other advisors estimated at USD 1.12 million; fees related to NEPRA, AEDB, SECP as well guarantee costs estimated at USD 0.16 million; and Company overheads during the construction period estimated at USD 1.0 million.
- **Construction Insurance** has been budgeted at 0.75% of EPC cost.
- **Financing Fees & Charges** have been estimated in line with precedent transactions and have been budgeted in the range of 3.5% of total debt.
- **Interest during Construction** has been calculated over a 20-month construction period, an 80:20 debt to equity ratio and a lending rate of 3-month KIBOR plus 3.0%. Disbursement over the 20-month period is based on an advance payment of 15.0%; final acceptance payment of 5% and an equal distribution over the remaining 18 months. The payment profile shall be firmed at the time of finalization of the EPC contract(s).

12.5 Project Financing

The Project financing will be based on a debt to equity ratio of 80:20. 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.

Key parameters of the Project funding are provided in Table 19 below:

Table 19: Project Funding

Project Cost	PKR 3,616.12 million
Debt	PKR 2,892.89 million
Equity	PKR 723.22 million
Lending Rate	9.44% *(3-month KIBOR + 3.0%)*
Repayment Period	10 years
Repayment Frequency	Quarterly
Annual Installment	PKR 450.17 million

12.6 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 1.00 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%

FARAN POWER LIMITED KARACHI

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: 7.99%)

Respective tariff components along with relevant indexations are provided in Table 20 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	Reference 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
Return on Equity	1.0345	1.0345	After onetime adjustment at COD, annual changes in PKR/USD parity
Debt Servicing Component	3.6658		After onetime adjustment at COD, quarterly changes in 3-M KIBOR
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.

12.7 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 FSML. 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 FSML
- Sale of steam to FSML

12.8 General

The base case financial projections show that the Project is expected to generate a positive earnings before interest, taxes and depreciation (EBITDA) and net profits throughout the life of the Project.

12.9 Projected Financial Statements

Projected financial statements and key financial ratios based on the base case assumptions discussed in Section 12 are provided in the following sections. Financial Statements presented below are limited to the 10-year debt period.

12.10 Projected Income Statement

PKR million	1	2	3	4	5	6	7	8	9	10
REVENUE										
Power to Sugar Mill	260	260	260	260	260	260	260	260	260	260
Power to CPPA-G	942	942	942	942	942	942	942	942	942	942
Steam for Sugar Mill	97	97	97	97	97	97	97	97	97	97
Total Revenue	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**	**1,298**
Bagasse Cost	641	641	641	641	641	641	641	641	641	641
Local Variable O&M	13	13	13	13	13	13	13	13	13	13
Foreign Variable O&M	43	43	43	43	43	43	43	43	43	43
Local Fixed O&M Cost	34	34	34	34	34	34	34	34	34	34
Total O&M Cost	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**
Insurance Cost	31	31	31	31	31	31	31	31	31	31
Depreciation	121	121	121	121	121	121	121	121	121	121
EBIT	**417**	**417**	**417**	**417**	**417**	**417**	**417**	**417**	**417**	**417**
Working Capital Cost	20	20	20	20	20	20	20	20	20	20
Interest on LT Loan	267	249	229	207	184	158	129	98	63	25
Net Income	**130**	**148**	**168**	**190**	**213**	**239**	**268**	**299**	**334**	**372**

FARAN POWER LIMITED KARACHI

12.11 Projected Balance Sheet

PKR millions	1	2	3	4	5	6	7	8	9	10
Fixed Assets	3,496	3,375	3,255	3,134	3,013	2,893	2,772	2,652	2,531	2,411
Advance	-	-	-	-	-	-	-	-	-	-
Accounts Receivable	-	-	-	-	-	-	-	-	-	-
Debt Reserves	-	-	-	-	-	-	-	-	-	-
Cash	-	-	-	-	-	-	-	-	-	-
Total Current Assets	-	-	-	-	-	-	-	-	-	-
Total Assets	**3,496**	**3,375**	**3,255**	**3,134**	**3,013**	**2,893**	**2,772**	**2,652**	**2,531**	**2,411**
Accounts Payable	-	-	-	-	-	-	-	-	-	-
Working Capital	-	-	-	-	-	-	-	-	-	-
Debt Current Portion	201	221	243	266	292	321	352	387	425	-
Current Liabilities	**201**	**221**	**243**	**266**	**292**	**321**	**352**	**387**	**425**	-
Long-term Debt	2,508	2,287	2,044	1,778	1,485	1,164	812	425	-	-
Total Liabilities	**2,709**	**2,508**	**2,287**	**2,044**	**1,778**	**1,485**	**1,164**	**812**	**425**	-
Paid-up Capital	723	723	723	723	723	723	723	723	723	723
Retained Earnings	63	144	244	366	512	684	885	1,117	1,383	1,688
Total Equity	**786**	**867**	**968**	**1,090**	**1,236**	**1,408**	**1,608**	**1,840**	**2,106**	**2,411**
Equity & Liabilities	**3,496**	**3,375**	**3,255**	**3,134**	**3,013**	**2,893**	**2,772**	**2,652**	**2,531**	**2,411**

FARAN POWER LIMITED KARACHI

12.12 Projected Cash Flows

PKR millions	1	2	3	4	5	6	7	8	9	10
Earnings after tax	130	148	168	190	213	239	268	299	334	372
Add: Depreciation	121	121	121	121	121	121	121	121	121	121
Change in Advances	-	-	-	-	-	-	-	-	-	-
Change in A/C Receivable	-	-	-	-	-	-	-	-	-	-
Change in A/C Payable	-	-	-	-	-	-	-	-	-	-
Cash Flow from Operations	**251**	**269**	**288**	**310**	**334**	**360**	**388**	**420**	**454**	**492**
Cash Flow from Investment	-	-	-	-	-	-	-	-	-	-
Repayment of LT Debt	(183)	(201)	(221)	(243)	(266)	(292)	(321)	(352)	(387)	(425)
Repayment of WC Loan	-	-	-	-	-	-	-	-	-	-
Disbursement of Equity	-	-	-	-	-	-	-	-	-	-
Cash Flow from Financing	**(183)**	**(201)**	**(221)**	**(243)**	**(266)**	**(292)**	**(321)**	**(352)**	**(387)**	**(425)**
Net Cash Flow	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**

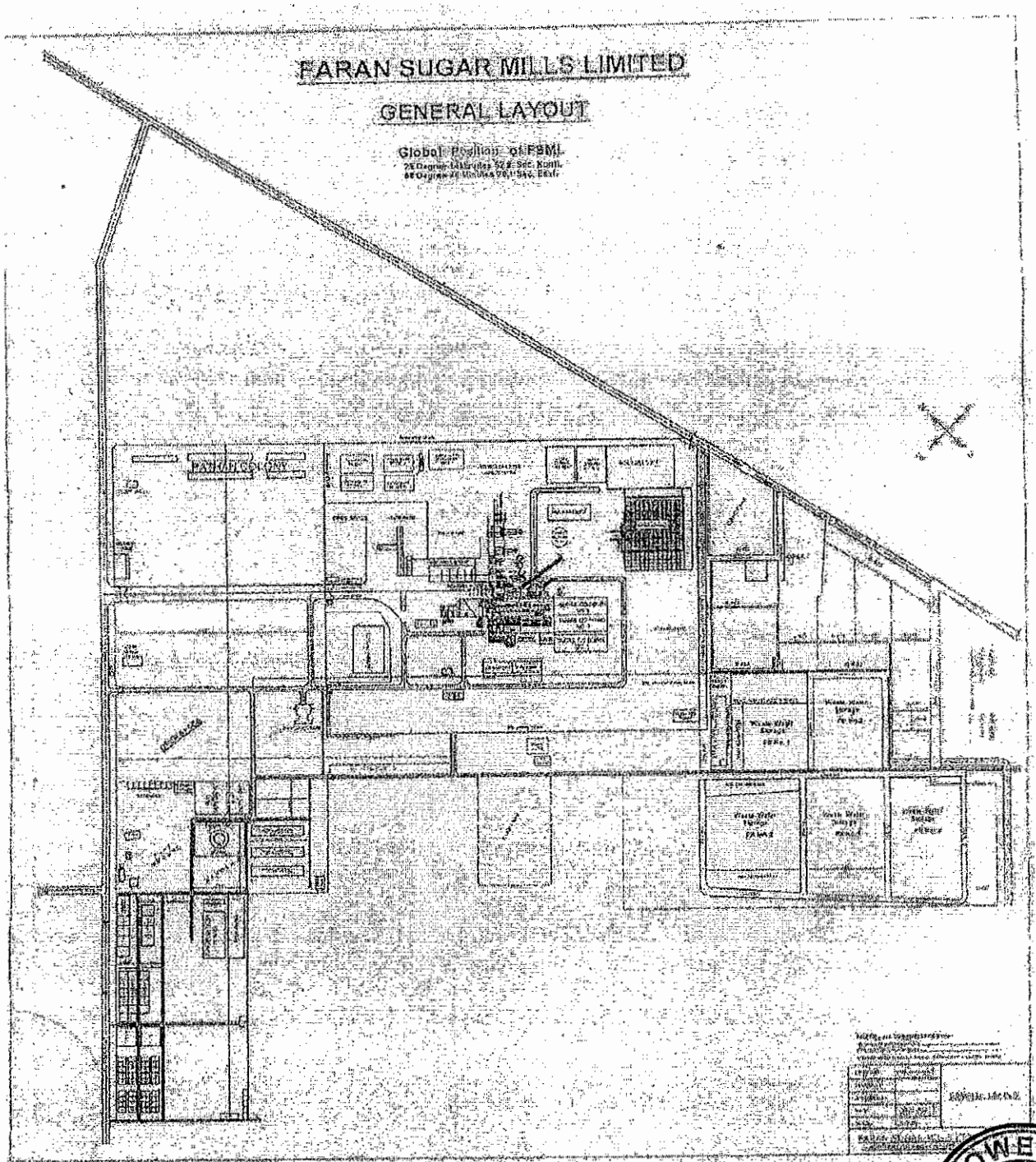
FARAN POWER LIMITED KARACHI

13 Financial Summary

	Min.	1	2	3	4	5	6	7	8	9	10
Revenue	**1,298**	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298
EBITDA	**537**	537	537	537	537	537	537	537	537	537	537
Net Income	**130**	130	148	168	190	213	239	268	299	334	372
Dividends	**67**	67	67	67	67	67	67	67	67	67	67
Annual Interest	**45**	286	268	249	227	203	177	149	117	83	45
Debt Servicing	**470**	470	470	470	470	470	470	470	470	470	470
Debt to Equity	-	3.45	2.89	2.36	1.88	1.44	1.06	0.72	0.44	0.20	-
Times Interest	**1.88**	1.88	2.00	2.16	2.37	2.64	3.03	3.61	4.58	6.49	11.94
DSCR	**1.14**	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Loan Life Cover Ratio	**1.10**	1.10	1.10	1.10	1.11	1.11	1.12	1.12	1.13	1.13	1.14

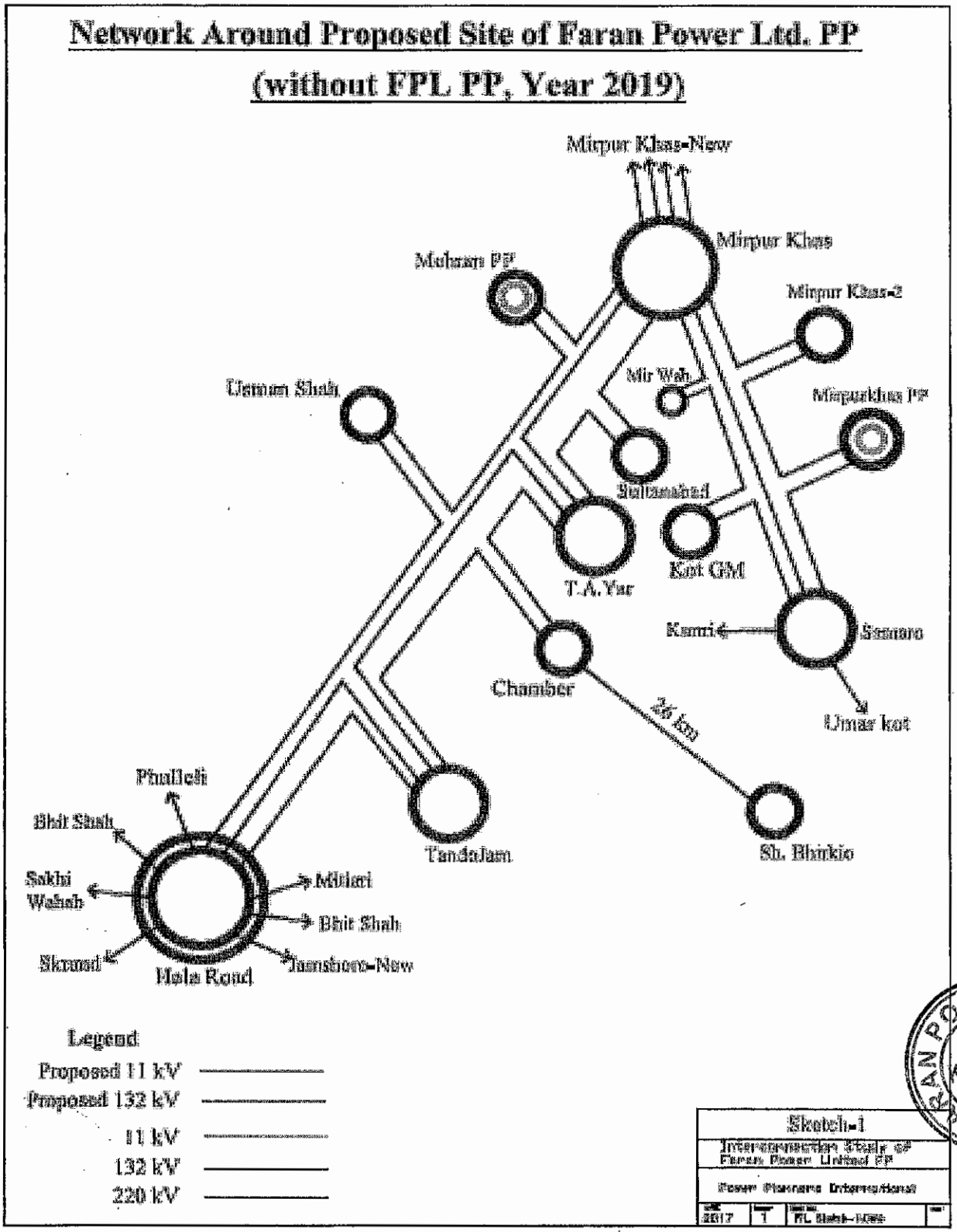
FARAN POWER LIMITED KARACHI

14 Annexure 1 – Plant Layout

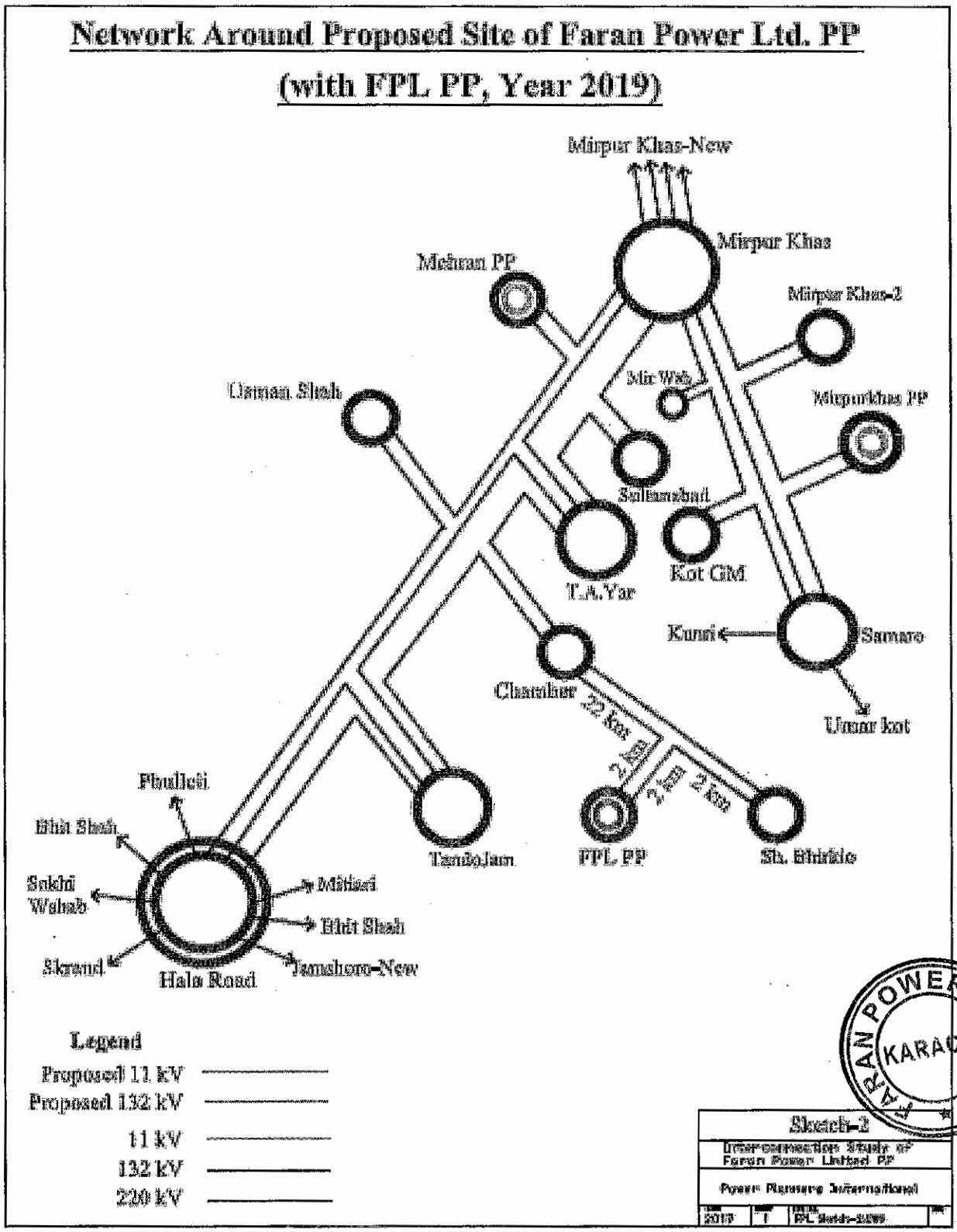


FARAN POWER LIMITED KARACHI

15 Annexure 2 – Sketch 1



16 Annexure 3 – Sketch 2



Prospectus

Introduction of Applicant

Faran Sugar Mills Limited ("FSML") through a wholly owned subsidiary Faran Power Limited intends to set up a green field 26.50 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 FSML located at Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan, Sindh.

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 Agreement as well as partially meet the steam and power requirements of FSML during the crushing season. The Project will enable FSML to establish a sustainable market for its by-product, bagasse, and will also allow the sponsors of FSML 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	26.50 MW (Gross)
Project Location	Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan.
Land Area	17 Acre
Construction Period	20 months
Technology	Bagasse/Bio-Mass.
Power Purchaser	Central Power Purchasing Agency Guarantee Limited
Steam Turbines	1 X 26.50 M.W extraction cum condensing
Boilers	1 X 135 TPH, 110 Bar 540°C
Upfront Levelized Tariff	US Cents 10.62 per kWh

FARAN POWER LIMITED KARACHI

Proposed Investment

The total cost for the project is approximated PKR 3,616.12 Million (USD 33.12 million), which is expected to be financed in a debt to equity ratio of 80:20.

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 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.

Schedule III

General Information

(i)	Applicant's Name	Faran Power Limited
(ii)	Registered Office	3rd Floor, Bank House No.1, Habib Square, M.A Jinnah Road, Karachi
(iii)	Plant Location	Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan
(iv)	Type of Generation Facility	Bagasse fired Cogeneration Power Plant
(v)	Commissioning/Commercial Operation Date	Within 20 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

FARAN POWER LIMITED KARACHI

1. Location maps, site maps and land

- Plant Layout attached as Annex-1
- The Project Site will be located within the premises of Faran Sugar Mills Limited located at Tando Ebrahim Bawany, Shaikh Bhirkio, District Tando Muhammad Khan, Sindh. The total area of the sugar mill and its premises is 158.24 acres and of that, approximately 17 acres will be allocated to the construction of the power plant.

2. Technology, Size of Plant and Number of Units

(i)	Type of Technology	Cogeneration Power Plant with high pressure boilers and Turbo-Generators
(ii)	Installed Plant Capacity (Gross)	26.50 MW (Gross)
(iii)	Number of Units	One (01)
(iv)	Unit make, model & year of manufacture	New Boiler, turbo generator, switch gear and BOP
(vi)	Available Capacity	Power Generation: 26.50 MW (Season operation) 26.50 MW (Off-season operation)
(v)	Auxiliary Consumption	Approximately 9.0 %

3. Fuel: Type, Imported/Indigenous, Supplier, Logistics

(i)	Primary Fuel	Bagasse
(ii)	Alternate Fuel	NIL
(iii)	Fuel Source (Imported/Indigenous)	Indigenous
(iv)	Fuel Supplier	Faran Sugar Mills
(v)	Supply Arrangement	Through conveyor belts/loading trucks/tractor trolleys etc.,
(vi)	Sugarcane Crushing Capacity	416.66 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

4. Emission Values

		Primary Fuel
(i)	SOx (mg/Nm^3)	8.46
(ii)	NOx (mg/Nm^3)	131
(iii)	CO^2	6.83
(iv)	CO (mg/Nm^3)	58
(v)	PM10(mg/Nm^3)	163

5. Cooling Water Source

(i)	Cooling Water Source/Cycle	RCC Counter Flow Cooling Tower + Canal Water + R.O (Treated Water)

FARAN POWER LIMITED KARACHI

6. Interconnection

(i)	Name of Nearest Grid	Chamber and Shaikh Bhirkio Grid Station
(ii)	Distance of Grid from Project Site	22 and 5 km
(iii)	Voltage Level	132 kV
(iv)	Single Line Diagram	Attached as Annex-2

7. Infrastructure

(i)	Road	FPL is located at a distance of 2 KM away from Shaikh Bherkio on Falkara road. It has an approach from Falkara Road and is also connected with Tando Ghulam Ali Hyderabad Road which is further connected to Shaikh Bhirkio to Tando Mohammad Khan Road and Shaikh Bherkio to Tando Allhayar Road.
(ii)	Rail	Hyderabad to Tando Adam (then up/down-country) double railway track is passing 35 KM away from FPL. Nearest railway stations is Hyderabad 40 KM away from the Plant and

		Hyderabad station is connected to the national railway network.
(iii)	Staff Colony	Fran sugar Mills has a large staff colony over an area of 30 acres which includes guest houses, bungalows, quarters and hostels for the staff. Colony has all basic amenities available. The staff colony maybe utilized by staff of FPL.
(iv)	Amenities	Dispensary: A well-equipped dispensary with qualified Doctors and paramedical staff are available 24 hrs to meet any emergency to workers and staff. Ambulance: An ambulance with ready staff is also available for 24 hours. School: Faran Abadghar Ebrahim Bawany memorial School for children of colony and surrounding area is also available. Fair price Shop: Fair price shop for staff and colony is also available. Water filter plant: Water filter plant and RO plant are also available to provide clean water to houses and plant. Pick and Drop Service: Buses are available for staff to provide pic and drop services from Hyderabad, Matli, Talhar, Tando Allahyar and Tando Ghulam Ali cities.

FAUJI POWER LIMITED KARACHI

8. Project Cost and Financing

Estimated Project Cost*	**PKR million**
EPC Cost	2,893.59
Non-EPC Cost	107.32
Project Development Costs	248.88
Insurance during Construction	21.70
Financing Fee & Charges	104.22
Interest during Construction (IDC)	240.41
Total	**3,616.12**
Debt	2,892.89
Equity	723.22

*Estimated projected cost is based on an average PKR/USD exchange rate of 109.19.

9. Project Commencement and Completion Schedule

Activity	Duration	Start Date	End Date
Issuance of LOI			28-Oct-16
EPC Activities	120	28-Oct-16	25-Feb-17
Grid Study, Approvals & CPPA-G Consent	120	28-Oct-16	25-Feb-17
Generation License Application &Approval from NEPRA	60	23-Jan-17	24-Mar-17
Tariff Application and Approval from NEPRA	30	25-Feb-17	27-Mar-17
Issuance of LOS	15	27-Mar-17	11-Apr-17
Signing of IA and EPA	60	11-Apr-17	10-Jun-17
Financial Close Activities	120	27-Mar-17	25-Jul-17
Construction Activities	600	25-Jul-17	17-Mar-19
(Commercial Operations Date			17-Mar-19

10. Environment and Social Soundness Assessment

Report attached as Annex-3

11. Safety and Emergency Plans

Attached as Annex-4

12. System Studies, Load flow, Short circuit etc.

Detailed Interconnection and Grid Study has been submitted to HESCO for approval, attached as Annex-5.

FAUJI POWER LIMITED KARACHI

13. Plant Characteristics

(i)	Generation Voltage	11 kV	
(ii)	Frequency	50 Hz	
(iii)	Power Factor	0.8 (lag)	
(iv)	Automatic Generation Control (AFG)	Through Woodward Governor	
(v)	Ramping Rate	300 rpm/min	
(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

14. Control, Metering, Instrumentation and Protection

Attached as Annex-6.

15. Training and Development

The training and development program has been given due recognition so that safe and reliable operation and maintenance of the plant can be ensured. Training and Development programs have been devised to properly use various tools for training.

Apprenticeship Programs: One graduate and one skilled person will be absorbed in the plant for a period of one and half years in each of operation, electrical, instrumental and control, and mechanical department. He will be attached with assistant executive engineer level person. For skilled apprentice, the attachment will be with Foreman level person. Through such program the Plant will be serving the community as well as a database for company referral, when needed.

Training at Plant: Section wise training at plant on quarterly basis. The training to be imparted by senior plant management as well as by industry expert. The training to be imparted on two-tier basis; for lower management and middle management.

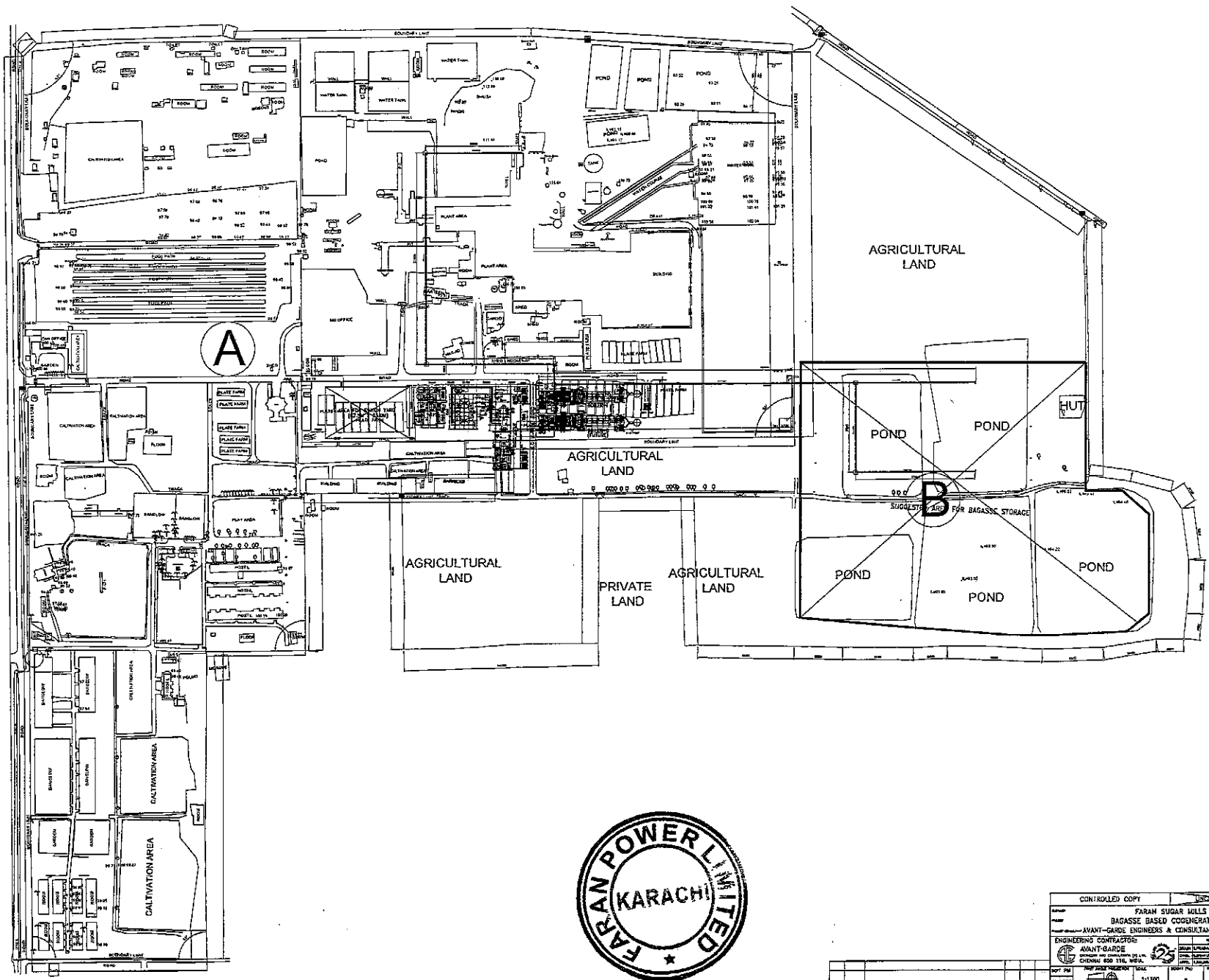
Training and Development abroad: The top tier to undertake management training and refresher on a six-monthly basis and to undergo foreign career development training every three months.

Operation and Maintenance Manuals: Referral to these manuals is a very good self-training and development tool. They are made by the experts of equipment and systems and are focused towards safe operation and corrective maintenance. They are very useful when consulted before and after the undertaking the work.

Visits and Trainings at Manufacturers' Works: Visits and trainings at outsourced maintenance firms is often a very good training source.

Working together with EPC Contractor: Each plant has certain unique features therefore the EPC contractor is often in the best position to operate and maintain. Entering into O&M agreement for an initial period of one or two years following project completion is a rich source of training and development of plant personnel.

Training and Development is an ongoing activity and the project Sponsors will devise the programs such that the benefits of various types of training are best attained.



FARAN POWER LIMITED KARACHI

CONTROLLED COPY

UNCONTROLLED COPY

FARAN SUGAR MILLS LTD

BAGASSE BASED COGENERATION PLANT

AVANT-GARDE ENGINEERS & CONSULTANTS (FZC), SHARJAH, UAE

ENGINEERING CONTRACTOR:

AVANT-GARDE

CHENNAI 600 116, INDIA.

02	12.11.15	GENERALLY REVISED	BP	SSK	SSK
01	24.08.15	REVISED AS PER SITE MEETING ON 20.08.15	BP	SSK	SSK
REV	DATE	DESCRIPTION	DRN BY	CHKD BY	APPD BY

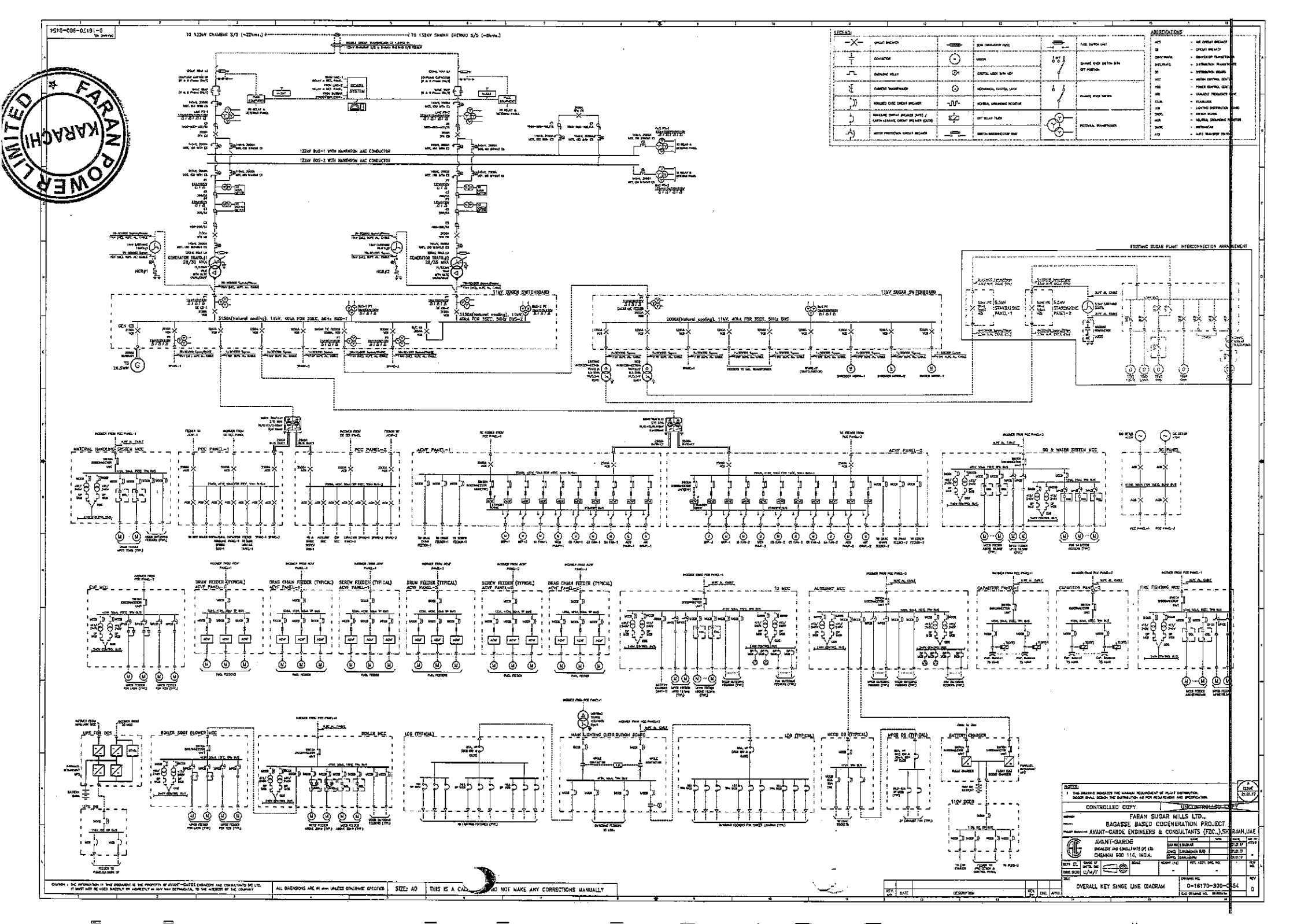
SCALE	1:1300
TITLE	OVERALL PLANT LAYOUT
DRAWING NO.	0-18170-E00-0003
REV	02

CAUTION : THE INFORMATION IN THIS DOCUMENT IS THE PROPERTY OF AVANT-GARDE ENGINEERS AND CONSULTANTS (P) LTD. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED

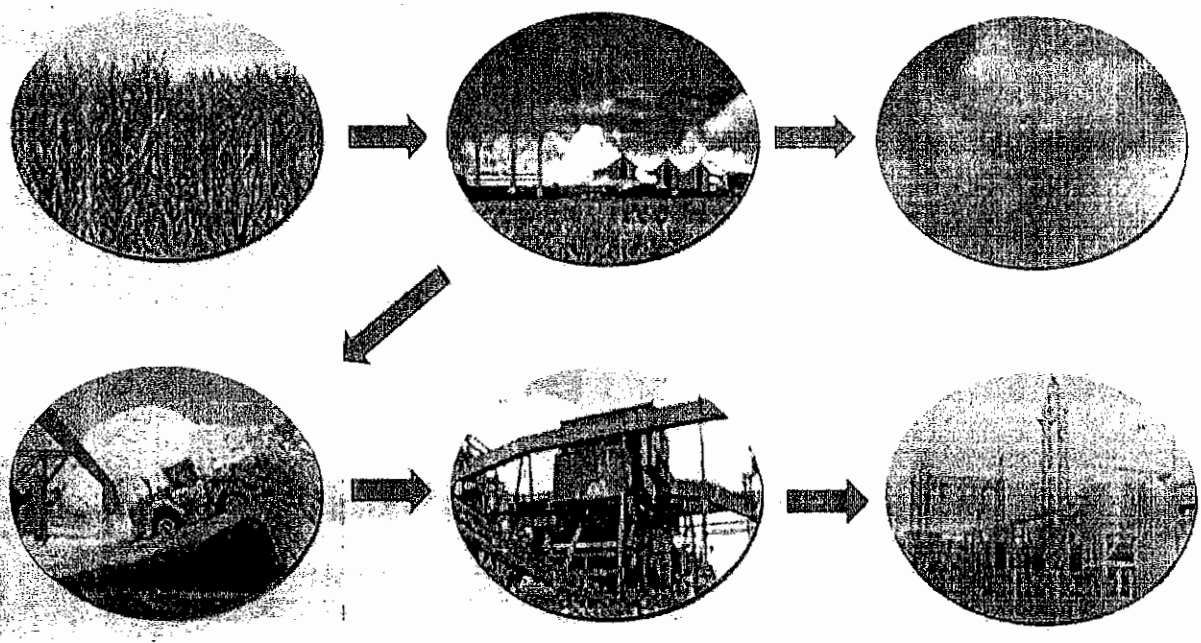
SIZE: A0

THIS IS A CAD FILE – DO NOT MAKE ANY CORRECTIONS MANUALLY


FARAN POWER LIMITED KARACHI
D-16170-900-0454
LEGEND:
ABBREVIATIONS
TO 132kV CHAMBAR S/S (~22kms.)
TO 132kV SHAKH SHEKHU S/S (~8kms.)
SCADA SYSTEM
132kV BUS-1 WITH HAWTHRON AAC CONDUCTOR
132kV BUS-2 WITH HAWTHRON AAC CONDUCTOR
GENERATOR 1(6/10.5 MVA 22/33 kV)
GENERATOR 2(6/10.5 MVA 22/33 kV)
11kV SCREEN SWITCHBOARD
3150A(Natural cooling), 11kV, 40kA FOR 2SEC, 50Hz BUS-1
3150A(Natural cooling), 11kV, 40kA FOR 2SEC, 50Hz BUS-2
11kV SUGAR SWITCHBOARD
2000A(Natural cooling), 11kV, 40kA FOR 3SEC, 50Hz BUS
EXISTING SUGAR PLANT INTERCONNECTION ARRANGEMENT
MATERIAL HANDLING SYSTEM MCC
PCC PANEL-1
PCC PANEL-2
ACVF PANEL-1
ACVF PANEL-2
BG & WATER SYSTEM MCC
DG PANEL
ESP MCC
DRUM FEEDER (TYPICAL) ACVF PANEL-1
DRAG CHAIN FEEDER (TYPICAL) ACVF PANEL-1
SCREW FEEDER (TYPICAL) ACVF PANEL-1
DRUM FEEDER (TYPICAL) ACVF PANEL-2
SCREW FEEDER (TYPICAL) ACVF PANEL-2
DRAG CHAIN FEEDER (TYPICAL) ACVF PANEL-2
TO MCC
AUXILIARY MCC
CAPACITOR PANEL-1
CAPACITOR PANEL-2
FIRE FIGHTING MCC
UPS FOR DCS
BOILER SOOT BLOWER MCC
BOILER MCC
LDB (TYPICAL)
MAIN LIGHTING DISTRIBUTION BOARD
MCCB DB (TYPICAL)
MPCB DB (TYPICAL)
BATTERY CHARGER
110V BOARD
NOTES:
CONTROLLED COPY
UNCONTROLLED COPY
FARAN SUGAR MILLS LTD.,
BAGASSE BASED COGENERATION PROJECT
AVANT-GARDE ENGINEERS & CONSULTANTS (PVT.)LTD.,KARACHI,UAE
AVANT-GARDE
ENGINEERS AND CONSULTANTS (P) LTD
CHENNAI 600 116, INDIA.
OVERALL KEY SINGE LINE DIAGRAM
D-16170-900-0454
CAUTION : THE INFORMATION IN THIS DRAWING IS THE PROPERTY OF AVANT-GARDE ENGINEERS AND CONSULTANTS (P) LTD.
ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED
SIZE: A0
THIS IS A CAD DRAWING DO NOT MAKE ANY CORRECTIONS MANUALLY

FARAN SUGAR MILLS LTD.

FARAN POWER LIMITED



Cogeneration Power Plant

INITIAL ENVIRONMENTAL EXAMINATION - 2016

Environmental Total Solutions

FARAN POWER LIMITED KARACHI

INITIAL ENVIRONMENTAL EXAMINATION 2016-17

Faran Power Limited

Tando Ebrahim Bawany, Shaikh Bhirkio,
District Tando Muhammad Khan

Developed by:

Environmental Total Solutions

Office No. 1, Aqsa Tower, Gulshan-e-Iqbal, Main
Rashid Minhas Rd., Karachi.
Email: etspak1@gmail.com
Contact: 0333-2277350

FARAN POWER LIMITED
KARACHI

EXECUTIVE SUMMARY

With the policy of privatization of the power industry and liberalized -schemes formulated by the Govt. of Pakistan for setting up bio mass power plant by private enterprises and in view of the Energy policy as announced by State Govt. project proponent has decided to set up 26.5MW (installed capacity) bagasse based cogeneration power plant at Faran Power Limited, located at Shaikh Bhirkio, Taluka Tando Muhammad Khan, District Tando Mohammad Khan, Sindh. This report presents the findings of Initial Environment Examination (IEE) study carried out by Environmental Total Solutions (ETS) for proposed Cogeneration Power Plant.

The IEE has been prepared in compliance with the requirements of Sind Environmental Protection Act (SEPA) 2014, and Sindh Environmental Protection Agency (Review of EIA/IEE) Regulations. The project contribution to sustainable development. This project activity has excellent contribution towards sustainable development and addresses the key issues:

Environmental well-being

- Substituting the electricity requirement from grid by co-fired plant there by eliminating the generation of equivalent quantum of electricity using conventional fuel feeding the national grid.
- Conserving fossil fuel and other non-renewable natural resource.
- Mitigating the emission of GHG (CO_2).

Socio- economic well being

- Contributing to a small increase in the local employment by employing skilled and unskilled personnel for operation and maintenance of the equipment.
- Adopting an advanced and sustainable technology for long term benefits.
- Helping to bridge the gap of electricity demand and supply at local level.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Objective

The objective of the project is to satisfy the ever increasing demand for electricity in Pakistan with a clean alternative to the more fossil-fuel based electricity component of the Pakistan national grid. The project will generate 26.5 MW of electricity and will export 23.13MW and 15.87MW during off-season and crushing season respectively to the national grid.

Categorization of the project

The project would be placed in category B, Schedule I, requiring an IEE study due to:

- Low sensitivity of the micro environment in which the 26.5 MW power plant is being sited.
- Impact of different activities including construction, installation, commissioning and operation being confined to and localized into the microenvironment of Shaikh Bhirkio. Taluka Tando Muhammad Khan, District Tando Mohammad Khan Sindh

SUMMARY

As a result of the production of this Initial Environmental Examination Scoping Statement, the following significant potential impacts of the Renewable Energy Plant (Bagasse based) have been indicated. Other effects will also occur which will be investigated, but these are considered the most significant.

Air quality	Emissions of greenhouse gases and other emissions:
Emissions from traffic movements;	Dust levels during construction;
Flood risk	Identification of any mitigation works which may be needed during the development stage of the project;
Ecology	Direct and indirect impacts on statutory and non-statutory designated sites; Scope for biodiversity enhancements;
Transport	Increase in road movements during construction and operation; Inter-action with other proposed transport schemes;
Noise	Temporary noise increases during construction: Noise during operation;

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Landscape and Visual	Visual aspects of the proposed plant; Building design;
Socio-economic	Potential for job creation during construction: Potential employment at the Blackburn Meadows Renewable Energy Plant;
Energy/sustainability	Contribution to the City's sustainable energy strategy;

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

LIST OF ABBREVIATIONS

AAQM	Ambient Air Quality Monitoring
ACW	Auxiliary Cooling Water
ADP	Asian Development Bank
ARE	Alternative/Renewable Energy
BFB	Boiler Feed Pump
BA	Bottom Ash
BOD	Biological Oxygen Demand
CCPP	Captive Co-generation Power Plant
CCS	Carbon Capture & Storage
CDM	Clean Development Mechanism
CFBC	Circulating Fluidized Bed Combustion
CHP	Combined Heat & Power
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Cycle of Concentration
COD	Chemical Oxygen Demand
CMI	Census of Manufacturing Industries
CPCB	Central Pollution Control Board
CRE	Combustible Renewable Energy
CSO	Clarified Slurry Oil
CSR	Corporate Social Responsibility'

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

CW	Cooling Water
DO	Dissolved Oxygen
DM	De-mineralized
DMC	Developing Member Countries
EBM	Environmental Best Management
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
EPA	Environmental Protection Act
ESP	Electro-Static Precipitator
ETS	Environmental Total Solution
FA	Fly ash
GBEP	Global Bio-energy Partnership
GDP	Gross Domestic Product
GHG	Green House Gasses
GLC	Ground Level Concentration
HESCO	Hyderabad Electric Supply Company
HSE	Health, Safety and Environmental
HWMHTM	Hazardous Waste (Management, Handling and Tran's boundary Movement) Rules
HP	High Pressure
IEA	International Energy Agency
IEE	Initial Environmental Examination
IPCC	International Panel on Climate Change

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

IMD	Indian Meteorological Department
LBOD	Left Bank out Fall Drainage
N	North
NE	North East
NEQS	National Environmental Quality Standards
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
OECD	Organization for Economic Co-operation &Development
PEPA	Pakistan Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PM	Particulate Matter
$PM_{2.5}$	Particles less than 2.5Micrometer
PM_{10}	Particles less than 10 Micrometer
PPE	Personnel Protective Equipment
RCC	Reinforced Cement Concrete
RBOD	Right Bank out Fall Drainage
SEPA	Sindh Environmental Protection Agency
SITE	Sindh Industrial Trading Estate
SG	Steam Generator
SPL	Sound Pressure Level
SPM	Suspended Particulate Matter
SO_2	Sulfur dioxide
STG	Steam Turbine Generator

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

SW	South West
TDS	Total Dissolved Solid
TOR	Terms of Reference
WHRB	Waste Heat Recovery Boilers
UNDP	United Nations Development Program
UNFCCC	United Nations Frame Work Convention on Climate Change
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNESCAP	United Nations Economic & Social Commission for Asia & Pacific

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

UNITS

^{o}C	Degree Celsius
Exajoule	One Billion joule
^{o}F	Degree Fahrenheit
ha	Hectare
dB(A)	Decibel (A-rated)
GW	Giga Watt
ha	Hectare
Kw	Kilowatt
KWh	Kilowatt-hour
Nm^3/h	Normal cubic meter per hour
mg/Nm^3	Micro gram per normal cubic meter
mg/l	Mille gram per liter
mm	Mille meter
MW	Megawatt
mW	Milliwatt
Wh	Watt-hour
µm	micrometer

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Technical Terms Used in Power Generation

Alternative fuel:

- Methanol, denatured ethanol, etc, separately or in blends of at least 10 percent by volume with gasoline or other fuels
- Compressed natural gas
- Liquefied natural gas
- Liquefied propane gas
- Hydrogen
- Coal derived liquid fuels
- Fuels other than alcohols derived from biological materials
- Electricity
- Biodiesel
- Any other fuel determined to be substantially not petroleum and yielding potential energy security benefits and substantial environmental benefits.

Background level

The average amount of a substance presents in the environment that originally referring to naturally occurring phenomena. Used in toxic substance monitoring.

Backup rate

Backup rate is a utility charge for providing occasional electricity service to replace on-site generation.

Backup electricity, backup services

Power or services needed occasionally; for example, when on-site generation equipment fails.

Baffle chamber

In incinerator design, a chamber designed to settle fly ash and coarse particulate matter by changing the direction and reducing the velocity of the combustion gases.

Bag house

A chamber containing fabric filter bags that remove particles from furnace stack exhaust gases. A bag house is used to eliminate particles greater than 20 microns in diameter

Base load capacity

The power output that generating equipment can continuously produce.

Base load demand

The minimum demand experienced by an electric utility, usually 30-40% of the utility's peak demand

Best available control measures

The most effective measure for controlling small or dispersed particulates such as soot and ash from woodstoves and open burning of brush, timber, grasslands, or trash is at sources.

Best available control technology (BACT)

That combination of production processes, methods, systems, and techniques that will result in the lowest achievable level of emissions of air pollutants from a given facility. BACT is an emission limitation that the permitting authority determines on a case-by-case basis, taking into account energy, environmental, economic and other costs of control. BACT may include fuel cleaning or treatment or innovative fuel combustion techniques.

Best management practices (BMP)

A practice or combination of practices that a designated agency determines to be the most effective, practical means of reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals

Boiler horsepower

A measure of the maximum rate of heat energy output of a steam generator. One boiler horsepower equals 33,480 Btu/hr output in steam

Boiler

Any device used to burn biomass fuel to heat water for generating steam

Bottom ash

Noncombustible ash that is left after solid fuel has been burned.

British thermal unit (BTU)

A unit of heat energy equal to the heat needed to raise the temperature of one pound of water one degree Fahrenheit at one atmosphere pressure (sea level)

Capacity Factor

The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full-power operation during the same period.

Combined Heat and Power (Cogeneration)

Combined heat and power (CHP), also known as cogeneration, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. CHP is not a specific technology but an application of technologies to meet an energy user's needs. CHP systems achieve typical effective electric efficiencies of 50 to 80 percent — a dramatic improvement over the average

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

efficiency of separate heat and power. Since CHP is highly efficient, it reduces traditional air pollutants and carbon dioxide, the leading greenhouse gas associated with climate change

Emissions

Anthropogenic releases of gases to the atmosphere. In the context of global climate change, they consist of radioactively important greenhouse gases (e.g., the release of carbon dioxide during fuel combustion).

Energy Efficiency

Energy efficiency refers to products or systems using less energy to do the same or better job than conventional products or systems. Energy efficiency saves energy, saves money on utility bills, and helps protect the environment by reducing the amount of electricity that needs to be generated. When buying or replacing products or appliances for your home, look for the ENERGY STAR® label — the national symbol for energy efficiency.

Fossil Fuels

Fossil fuels are the nation's principal source of electricity. The popularity of these fuels is largely due to their low costs. Fossil fuels come in three major forms-coal, oil, and natural gas. Because fossil fuels are a finite resource and cannot be replenished once they are extracted and burned, they are not considered renewable.

Generation (Electricity)

The process of producing electric energy from other forms of energy; also, the amount of electric energy produced, expressed in watt-hours (Wh)

Generation (Gross)

The total amount of electric energy produced by the generating units at a generating station or stations, measured at the generator terminals

Generation (Net)

Gross generation less the electric energy consumed at the generating station for station's use

Grid

The layout of an electrical distribution system

Kilowatt (kW):

One thousand watts of electricity

Kilowatt-hour (kWh):

One thousand watt-hours

Megawatt (MW):

One million watts of electricity

Renewable Energy:

The term renewable energy generally refers to electricity supplied from renewable energy sources, such as wind and solar power, geothermal, hydropower, and various forms of biomass. These energy sources are considered renewable sources because they are continuously replenished on the Earth

Transmission System (Electric):

An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Turbine

Turbine is a machine that is used for generating rotary mechanical power from the energy of a stream of fluid (such as water, steam, or hot gas). Turbines convert the kinetic energy of fluids to mechanical energy through the principles of impulse and reaction, or a mixture of the two

Watt (Electric)

Watt is the electrical unit of power. The rate of energy transfer equivalent to 1 ampere of electric current flowing under a pressure of 1 volt at unity power factor.

Watt (Thermal)

A unit of power in the metric system, expressed in terms of energy per second, equal to the work done at a rate of 1 joule per second.

Watt-Hour (Wh)

Watt-Hour (Wh) is termed as the electrical energy unit of measure equal to 1 watt of power supplied to, or taken from an electric circuit steadily for 1 hour.

TABLE OF CONTENTS

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

ANNEXURES	
Annexure-1	89
Annexure-2	90
Annexure-3	92
Annexure-4	93
Annexure-5	95
Annexure-6	96
Annexure-7	98
Annexure-8	100
Annexure-9	102
Annexure-10	103

Chapter

One INTRODUCTION

1.1 BACKGROUND

The importance of energy generation cannot be underestimated due to its pivotal share in the industrialization process of the country. During the fiscal year 2011-12, the total power generated in the country was 98,664 GWh of which the share of thermal electricity generation was 66% hydel power plants contributed 29% and nuclear power plants added 5% to the bulk.

The Government has formulated a new energy policy which envisages recommending an energy mix as a way forward where energy mix would mean regime change under which focus from thermal power will be shifted to cheaper energy production like bagasse-based power generation. It also proposed phasing out subsidy on the power sector but also recommending subsidy protection for consumers using 300 or below units of electricity per month.

The country has many alternatives available which can be utilized to deal with the electricity shortfall. After analyzing different alternatives, we have come up with a conclusion that a multi-pronged strategy is required and several projects accompanied by strict scrutiny and administrative measures are the need of the day. Pakistan should strive to expand the use of renewable energy to help bridge the gap of energy deficiency in the country. The country is blessed with natural resources that can be utilized to create electricity.

Renewable resources that are technologically viable and have prospects to be exploited commercially in Pakistan include wind energy, solar energy, micro-hydel, bio-energy, and emerging technologies like fuel cell. Pakistan can benefit from these resources and can supplement existing energy resources as well as can use as primary energy source when no other option is available.

1.2 NON-CONVENTIONAL RENEWABLE ENERGY SOURCES

The ever growing energy demand & the steep depletion of fossil fuels have forced to explore the possibility of developing other sources of energy particularly from non-conventional renewable energy sources, which is also environmental friendly. Further, it is an undisputed fact that the present level of generation of power from Hydel, Thermal and nuclear sources could not meet the increasing

demand due to various problems. In order to reduce the Green House Gas Emission. the Non-Conventional Energy is to be utilized for the generation of electricity. One of the Non-Conventional renewable Energy source is Bagasse

1.3 COGENERATION

To meet growing requirement of power, use of biomass for generation of power is receiving great deal of attention as source of energy. Co-generation the combined generation of steam and electricity is an efficient and cost effective means to save energy and reduce pollution. The mill wet bagasse having heat value of around 2250 kcal/kg save 35% fuel which is equivalent to 2 barrel of oil

Where power is consumed, heat is often required as well. The processing industries use thermal energy for heating and drying or to produce steam.. Producing both power and useful heat at the same time is the most cost-efficient way to cover these requirements: By making use of the hot exhausts normally emitted as waste, Combined Heat and Power (CHP) generation significantly reduces fuel consumption compared to conventional power plants and additional boiler equipment to produce heat. Thanks to this, the same electrical and thermal outputs can be achieved at much lower costs, while emissions to the environment are kept to a minimum

As concerns grow about environmental protection, global warming, and steadily rising energy prices, public interest is focusing more on energy efficiency. Countries promoting and subsidizing efforts to expand the use of renewable energy, better building insulation, and cogeneration to make power and heat supply systems more energy-efficient

1.4 POTENTIAL OF BAGASSE -FIRED POWER GENERATION IN PAKISTAN

Bagasse is the Crushed Residue of sugar cane. It is termed as a Captive Biomass that is fibrous in nature. It has a calorific value of 2250 kcal / kg. Bagasse is an excellent Raw Material for power generation. It provides a suitable and reliable source of steam and electricity to feed the sugar industry. Pakistan sugar industry that is one of the biggest industries in the region comprises 81 sugar mills with an annual capacity of about six million tons sugar. The industry crushes about 30 - 40 million tons of sugar cane that yields about 12 million tons of bagasse as an industrial waste that has a potential of generating 3000 MW electricity. Almost all 81 sugar mills have in-house bagasse based cogeneration power plants mostly to meet their own requirements. Only a few sugar mills have surplus electricity to sell to the power utility companies. The surplus power generated by the sugar industry can be synchronized with the National Grid or local grid.

Bagasse based cogeneration has the following advantages.

- Since the fuel (bagasse) is available virtually at no cost
- Fuel is available at site and the infrastructure for fuel transportation is not required
- Transmission losses are very less as the bagasse co-generation power plants is in the centre of Load.
- Net emission of carbon dioxide is very negligible.
- The sugar industry has decades of experience of related technology.
- It does not increase any foreign exchange outflow
- Bagasse based cogeneration provides employment to rural areas.
- Cogeneration reduces the Green House Gas emission. This will reduce the global warming.

Power Generation Process

Conventionally, the sugar mills use low pressure boilers (24 bara) for generating power and process steam. The steam passes through turbine and generates required power for the sugar plant. The exhaust steam from the turbine is used in the processing of sugar. This process of utilization of steam for generating power and for processing of sugar is called cogeneration. The proposed project will install High Pressure Boilers (110 bara) and steam Turbines. Using the same quantity of bagasse, the proposed power plant will be able to generate additional power for export besides meeting the power and steam requirement of the sugar mill. The additional power will be fed to the National Grid system.

1.5 PROJECT DESCRIPTION

The" National Policy for power co-generation by sugar industry "was notified in January 2006. This policy offers attractive incentive to the sugar mills as available to the IPPs under power policy in vogue. It includes guaranties for power purchase and payment, income tax, concessional duties on import of machinery, guaranteed rate of return on investment and etc. Amendments to the policy were made to favour the sponsors.

To respond to this policy, initiative was taken by the Faran Power Limited (FPL), having their head office at 3rd Floor, Bank House No.1, Habib Square, M. A Jinnah Road, Karachi. , Pakistan is proposed to install co-generation power plant, using bagasse as fuel in one of the major sugarcane and sugar-producing district of Sindh, Pakistan. In project site sugarcane is being cultivated in large areas since many decades for manufacture of white refined sugar. Sugar industry is a major livelihood provider to millions of agricultural families and their dependents particularly in rural areas.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

The plant is ideally located from the stand point of availability of bagasse (Fuel) from the adjacent sugar plant. The electricity produced will be sold to HESCO through 132 KV circuits.

The project will generate net 26.5MW electricity during the sugar production season and off season and 15.87MW and 23.13 MW respectively for export to the national electricity grid of Hyderabad Electric Supply Company (HESCO). Bagasse from FSML will be used as fuel for approximately 168 days of the power plant operation. Total quantity of bagasse available for steam and power generation is around 255,000 tones. The proposed Project brings in multifold advantages. Not only does it produce clean, pollution free energy, it also has the capacity to provide employment to the people living in and around that area.

Company Goal

True success in individuals or in company requires more than just achieving economical goals. In a competitive global market, to be environmentally and socially responsible is challenging. Though challenging it is necessary especially in a growing economy like Pakistan. Hence, Faran Power Limited is organized and funded to be:

- Economically sustainable;
- Maintain high quality standards;
- Socially engaged in community and;
- Environmentally responsible.

1.6 NEED OF THE PROJECT

The need to the power project is spelled out by the statement of the Chief Executive Officer of the HESCO who held the following as being mainly responsible for fluctuation and tripping in the power generation system:

- Old power supply system in project area
- Distribution losses.

The position with regard to availability of power has deteriorated and has compelled HESCO to go for forced load-shedding

Project Objectives

The project aims to produce electricity for supply to HESCO through national grid thus reducing the supply and demand imbalance. The proposed power plant is a standalone power producing unit based on Bagasse fired Boilers along:

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

- Respond to the urgent need to close the widening gap between power generation and demand at Shaikh Bhirkio, District Tando Muhammad Khan, Sindh.
- Ensure stable power supply to HESCO
- Provide employment to the local people;
- Respond to the need of improvement in quality of life through sustainable power production systems.

Social Infrastructure

Further improvements in infrastructural facilities ultimately result in development of area which will automatically enhance the social status of the area as well as native's standard of livings. Ancillary business establishments will be helpful for further growth in market, trading and business centers leading to regional development. Interaction & understanding between different souls, families, communities, societies, regions, culture, traditions, social traits etc. beneficial for reducing differences leads towards unity & prosperity

The Need for Environmental Assessment

Economic, social and environmental change is inherent to development. While development aims to bring about positive change it can lead to conflicts. The promotion of economic growth as the motto for increased well being was the main development thrust with little sensitivity to adverse social or environmental impacts. The need to avoid adverse impacts and to ensure long term benefits led to the concept of sustainability. This is accepted as an essential feature of development if the aim of increased well being and greater equity in fulfilling basic needs is to be met for existing and future generations. In order to predict environmental impacts of any development activity, to provide an opportunity to mitigate against negative impacts and enhance positive impacts, environmental impact assessment is carried out.

Pakistan's efforts to protect the environment by using Environmental Impact Assessment in project planning can be said to be based on the Penal Code of 1860 which considered fouling of water and air as punishable offences. Promulgation of an Ordinance in 1983 followed by the Pakistan Environmental Protection Act, 1997 and Sindh Environmental Protection Act 2014 provides the Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA) a legal requirement

According to clause 17(I) part-vi dealing Environmental Examinations and Assessments of Sindh Environmental Protection Act 2014:

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

"No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof"

1.7 SCOPE OF IEE STUDY

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

The ultimate goal of this IEE report is to produce an Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMP) for the Construction and Operation Stages of the proposed project. Compliance with the guidance contained in these plans will ensure the implementation of this project in an environmentally sustainable manner both at Construction as well as Operation stages of the Project.

The IEE report ensures compliance to all national and local regulations enforced in Pakistan. This IEE report is developed in a manner that it is socially responsible and reflects sound environmental management practices.

This IEE report also discusses the legal and administrative framework within which the IEE is prepared. A brief project description is included together with a description of the baseline environmental conditions and the actual environmental situation at the proposed site for the project.

The technical section of the report and the environmental baseline situation form the basis for the detailed impact assessment during the construction and operation phases of the project. Based on the findings of this report, an environmental management system has been devised, outlining necessary mitigation and compensation measures together with monitoring practices.

1.8 OBJECTIVE OF THE IEE STUDY

The objective of Initial Environmental Examination (IEE) is to prepare a document based on anticipated Environmental Impact due to setting up of bagasse based cogeneration Power Project and to applicable provincial and SEPA regulations.

Approach and Methodology

This IEE report regarding the Bagasse Based Cogeneration Faran Power Limited, District Tando Mohammed Khan; Pakistan) has been accomplished after carrying out thorough reconnaissance to identify the following Environmental and Social areas of concern:

- To achieve the desired environmental compliance standards under the Sindh Environmental Protection Act 2014 Guidelines as applicable to the project.
- Plans and activities to remedy/mitigate any potential adverse impacts and the gaps that could probably remain after implementation
- Any other points/steps to be taken which could be beneficial to mitigate environmental adverse impacts that may accrue both during construction and regular operation of the power plant.

In addition to the evaluation and review of the available records, data and the facts for the project feasibility study, detailed discussions were held with the concerned members of the project management.

Notes and proposals for measures to be taken to mitigate and compensate for any determined/detrimental environmental impacts are contained in the Environmental Management Plan (EMP) as well as a Monitoring Plan, including all parameters that need to be measured, and the frequency of monitoring actions (Section – 7).

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

Reporting

In the end, all activities / steps performed during IEE study were documented in shape of IEE report; it was compiled in the format / guideline given by Pakistan Environmental Protection Agency (PEPA) in Pakistan Environmental Assessment Procedures, 1997.

1.9 CONTENTS OF THE REPORT

The report has been divided into eight chapters and presented as follows:

Chapter 1: Introduction

Chapter one provides purpose of the report, background information of the expansion project, brief description of nature, size and location of project, and scope of the study.

Chapter 2: Legislative & Regulatory Aspect

The key environmental legislation and the standard relevant to the project and the methodology adopted in preparation of the report have also been described in this chapter.

Chapter 3: Description of the Environment

This chapter presents the methodology and findings of field studies undertaken to establish the environmental baseline conditions, which is also supplemented by secondary published literature.

Chapter 4: Project Description

Chapter four deals with the layout of the plan, location, process, and details of the expansion project, other technical and design information and sources of anticipated pollution

Chapter 5: Analysis of Alternatives (Technology and Site)

The technology and project site alternatives are discussed in the chapter five.

Chapter 6: Anticipated Environmental Impacts and Mitigation Measures

This chapter deals with the details and the inferences drew from the anticipated Environmental Impacts of the project during various stages of project advancement, such as design, location of project, construction and regular operations. The chapter also provides recommendations/Environmental Management Plan (EMP) including mitigation measures for minimizing the negative environmental impacts of the project and enhancing the positive impacts.

Chapter 7: Environmental Management Plan

This chapter describes the institutional arrangements for environment protection and Conservation during the operational stage of the Project and the management strategy for the project. Environmental monitoring requirements for effective implementation of mitigatory measures during expansion and operational phase have been also delineated in this chapter.

Chapter 8: Summary and Conclusion

The summary of the IEE report has been given in this chapter along with conclusions.

Salient Features of the Project Site

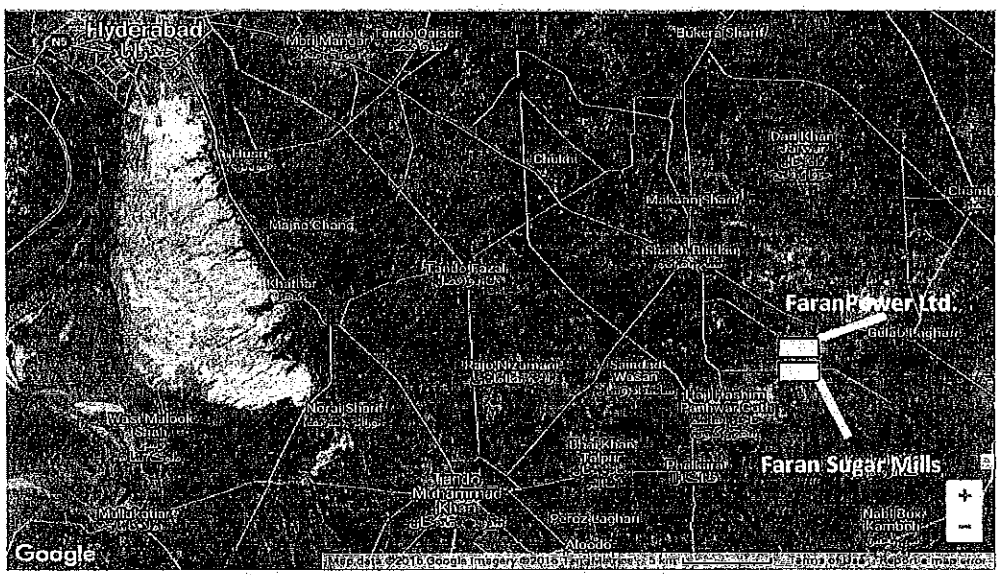
Feature	Particular
Project Name	Faran Power Limited
Location	Faran Power Limited, Shaikh Bhirkio, TalukaTando Muhammad Khan, District Tando Mohammad

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

	Khan Sindh
Installation Capacity	26.5 MW
Net generation output	24.5MW
Latitude / Longitude	25.13° North latitude, 68.53° East longitude
Average altitude above mean MSL	12 meters elevation above the sea level
Temperature in °C	Maximum and minimum temperatures of 48.5° and 11.1°C respectively
Average Relative Humidity	**54%**
Total annual Rainfall in mm	172.4
Average Wind Velocity	**3.5m/Sec**
Soil Type	Fine sandy loam to silty clay loams
Railway Station	Tando Mohammed Khan
Nearest Town	Tando Mohammed Khan
Nearest Water Body	Rohri canal (Khachar Distributory).
Sensitive locations like protected forests, monuments, national park, zoos etc	No sensitive location within 10 km radius

LOCATION MAP OF FARAN POWER LTD., SHAIKH BHIRKIO, SINDH, PAKISTAN



FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Chapter

Two LEGISLATIVE & REGULATORY ASPECT

2.1 PREFACE

Legal and Institutional Framework in Pakistan, the history of legislation drafted specifically to protect the environment dates back to 1980s. This section provides a brief historical and constitutional context followed by a detailed discussion of relevant laws.

Historical and Constitutional Context

The development of statutory and other instruments for environmental management has steadily gained priority in Pakistan since the late 1970s. The Pakistan Environmental Protection Ordinance, 1983 was the first piece of legislation designed specifically for the protection of the environment. The promulgation of this ordinance was followed, in 1984, by the establishment of the Pakistan Environmental Protection Agency (Pak-EPA), the primary government institution at that time dealing with environmental issues. Significant work on developing environmental policy was carried out in the late 1980s, which culminated in the drafting of the Pakistan National Conservation Strategy. Provincial environmental protection agencies were also established at about the same time. The National Environmental Quality Standards (NEQS) were established in 1993. In 1997, the Pakistan Environmental Protection Act (PEPA) 1997 was enacted to replace the 1983 Ordinance. PEPA conferred broad-based enforcement powers to the environmental protection agencies. This was followed by the publication of the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations 2000 which provided the necessary details on the preparation, submission, and review of initial environmental examinations (IEE) and environmental impact assessments (EIA) reports.

Prior to the 18th Amendment to the Constitution of Pakistan in 2010, the legislative powers were distributed between the federal and provincial governments through two 'lists' attached to the Constitution as Schedules. The Federal list covered the subjects over which the federal government had exclusive legislative power, while the 'Concurrent List' contained subjects regarding which both the federal and provincial governments could enact laws. The subject of 'environmental pollution and

ecology' was included in the Concurrent List and hence allowed both the national and provincial governments to enact laws on the subject. However, as a result of the 18th Amendment this subject is now in the exclusive domain of the provincial government. The main consequences of this change were as follows:

- The Ministry of Environment at the federal level was abolished. Its functions related to the national environmental management were transferred to the provinces. To manage the international obligations in the context of environment, a new ministry—the Ministry of Climate Change—was created at the federal level.
- The PEPA 1997 was technically no longer applicable to the provinces. The provinces were required to enact their own legislation for environmental protection. However, to ensure legal continuity PEPA 1997 continued to be the legal instrument for environmental protection in the provinces till enactment of provincial law.

All provinces have now enacted their own environmental protection laws. These provincial laws are largely based on PEPA 1997 and, hence, provide the same level of environmental protection as the parent law. The provincial assembly of Sindh passed the Sindh Environmental Protection Act 2014 (the 'Sindh Act 2014') in March 2014.

Between 1993 and 2010, the Pak-EPA promulgated several rules, regulations, standards, and guidelines to implement the provisions of the PEPA 1997. It is understood that these instruments remain applicable in Sindh, unless they are superseded by a new instrument. In Sindh two such instruments have been promulgated, as will be discussed later in this chapter.

The discussion on regulatory requirements applicable to this project is, therefore, based on the Sindh law, the Sindh Environmental Protection Act 2014 and the rules, regulations, standards, and guidelines developed under the PEPA 1997 and the two instruments promulgated by the Government of Sindh.

2.2 ENVIRONMENTAL LAWS

The Sindh Environmental Protection Act 2014 (Sindh Act 2014) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, industrial liquid effluent, marine, and noise pollution, as well as to the handling of hazardous wastes. The sections of Sindh Act 2014 that

have a direct bearing on the proposed Project are listed below. The details are discussed in the following sections.

- Section 11 that deals with the Sindh Environmental Quality Standards (SEQS) and its application
- Section 13 that deals with hazardous substances
- Section 14 that prohibits various acts detrimental to the environment
- Section 15 that relates to vehicular pollution
- Section 17 that establishes the requirement for environmental impact assessment

Implementation of the provisions of the Sindh Act 2014 is made through several rules and regulations. The relevant rules and regulations are:

- National Environmental Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2001
- Environmental Samples Rules, 2001
- The Pollution Charge for Industry (Calculation and Collection) Rules, 2001
- Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014
- (IEE-EIA Regulations 2014) Guidelines are issued by the Pak-EPA for preparation of environmental assessment.

2.3 REQUIREMENTS FOR IEE/EIA

The articles of Sindh Act 2014 that have a direct bearing on the environmental assessment of the proposed Project are:

- Article 17(1): 'No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or an environmental impact assessment, and has obtained from the Agency approval in respect thereof.'
- Article 17(3): 'Every review of an environmental impact assessment shall be carried out with public participation…'

The IEE-EIA Regulations 2014 provides the necessary details on the preparation, submission, and review of the IEE and the EIA. Categorization of projects for IEE and EIA is one of the main components of the IEE-EIA Regulations 2014. Projects have been classified on the basis of expected degree of adverse environmental impact. Project types included in Schedule II of the regulations those

that are likely to have potentially significant impact on the environment and thus an EIA is required for such projects, whereas those included in Schedule I as having potentially less adverse effects and therefore require an IEE.

The word 'project' as defined in the Sindh Act 2014 includes new developments as well as modifications, expansions and rehabilitations of the existing projects. The proposed Project is considered a new development and not a modification to the existing Project because it will have its own separate staff, resources, financing, accounting, utilities, and administrative control. None of these items will be shared. Hence the existing project is not the subject of this EIA.

Regulation 9 of the IEE-EIA Regulations 2014 requires that:

Ten paper copies and two electronic copies of an IEE or EIA shall be filed with the Federal Agency; Every IEE and EIA shall be accompanied by:

a. An application, in the form set out in Schedule V;
b. Copy of receipt showing payment of the review fee;
c. No objection certificates from the relevant departments in case of EIA shall be the part of reports; and
d. The environmental check list as per its guidelines.

The prescribed procedure for review of IEE/EIA by the EPA is described in Regulations 10–17. The key features are:

- On acceptance of the IEE/EIA for review, EPA will place a public notice in national English and Urdu newspapers and in local language newspaper informing the public about the project and where it's IEE/EIA can be accessed. It will also set a date for public hearing which shall be at least 30 days after the publication of the notice
- If it considers necessary, the EPA can form a Committee of Experts to assist the EPA in the review of the IEE/EIA. The EPA may also decide to inspect the project site
- Article 17(4) of SEPA Act 2014 binds the SEPA to 'communicate its approval or otherwise … within a period of four months from the date the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which … the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations'.

Regulation 7 of the IEE-EIA Regulations 2014 pertains to the guidelines. It states that:

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

1. The Agency may issue guidelines for preparation of an IEE or EIA or an environmental checklist, including guidelines of general applicability and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to a particular sector.
2. Where guidelines have been issued under sub-regulation (1), an IEE or EIA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify in the IEE or EIA or in environmental checklist any departure there from.' The relevant guidelines are the follows

Policy and Procedures for the filling, review, and approval of environmental assessments sets out the key policy and procedural requirement. It contains a brief policy statement on the purpose of environmental assessment and the goal of sustainable development and also states that environmental assessment be integrated with feasibility studies.

Guidelines for the preparation and review of environmental reports which cover the following:

- Scoping, alternatives, site selection, and format of environmental reports;
- Identification, analysis and prediction, baseline data, and significance of impacts;
- Mitigation and impact management and preparing an environmental management plan;
- Reporting;
- Review and decision making;
- Monitoring and auditing;
- Project management.

Guidelines for sensitive areas which identifies the sensitive areas

Sectoral Guidelines for Environmental Reports-Thermal Power Stations deal with major thermal power plants which will be defined as those producing electrical energy from fossil fuels (coal, gas, oil). The guideline is prepared to assist project proponents to identify the key environmental parameters those are required to be addressed to develop mitigation measures and alternatives that need to be considered in the actual IEE.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Hazardous Substances

Article 13 of the Sindh Act 2014 states that 'Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except—(a) under a license issued by the Agency; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.'

Hazardous substance is defined in Article 2(xxv) of the Sindh Act 2014 as "(a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and (b) any substance which may be prescribed as a hazardous substance

To date, SEPA has not prescribed any substance as hazardous nor has it defined the procedure for licensing. As and when, the procedure is defined and a license for any particular substance being used at the power plant is required, license will be obtained by the project Proponent. However, best industry practice and internationally acceptable guidelines for hazardous substances would be used for the proposed project.

2.4 ENVIRONMENTAL STANDARDS

Article 11(1) of the Sindh Act 2014 states that: '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, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in Section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards...'. Between 1993 and 2010, the Pak-EPA promulgated several standards, the NEQS, which were applicable to the entire country. These include:

- Ambient air quality (9 parameters)
- Drinking water (32 parameters)
- Ambient noise
- Industrial effluents (32 parameters)
- Industrial gaseous emissions (18 parameters)

Following the promulgation of Sindh Act 2014, Sindh has notified its own ambient air quality standard. It is understood that the NEQS issued prior to Sindh Act 2014 remain in force in Sindh unless they are expressly amended, as is the case with the ambient air quality standards. As the Sindh Act 2014, does not have the provision for a national standard and PEPA 1997 is no longer applicable in Sindh, the term 'Sindh Environmental Quality Standards' is understood to include the NEQS (except ambient air quality standards) issued under PEPA 1997. However, the term NEQS is still used in this document where reference is made to older standards. The complete set of SEQS is included as Appendix 1.

All industrial standards (ambient air quality, gaseous emission, ambient noise, and industrial effluent) are applicable to the proposed Plant. These are further discussed in Section 3.10

Under the National Environmental Quality Standards, Self-Monitoring and Reporting (SMART) by Industry Rules 2001, industrial units are responsible for monitoring their gaseous and liquid discharges and reporting them to the relevant environmental protection agency. As fuel and coal fired thermal power plant falls under the Schedule II Category (Category A) of industrial categorization and reporting procedure for SMART, environmental monitoring reports required to be submitted in monthly basis to the relevant authorities. The project proponents will report their emission and effluent to the SEPA in accordance with the rules.

Other Laws

The scope of environmental law implied by the legal definition of „environment" given in PEPA 1997 results in numerous laws enacted since the nineteenth century being classified as environmental laws. These include laws pertaining to forests, water resources, wildlife, land, agriculture, health and town planning. Laws that may have relevance to environment with a brief scope of the law and their applicability are listed in Exhibit 2.1.

Water Law

Most of the law on water allocations and use in Pakistan is not relevant to the Project because it applies to water needed for irrigation. In the last decade, water law in Pakistan has been under review with a National Water Policy published in 2003, which identifies the following needs for the regulation of industrial use of water:

- Make available and reserve sufficient supplies of water for industry on priority basis to promote industrial development and economic growth; and Enact legislation to formally allow and define the use of water abstraction licenses and water rates for industrial use.

- Although specific regulations have been developed for sharing of irrigation water in Sindh, these are not applicable to non-irrigated areas such as Thar.

Exhibit 2.1: Key Environmental Laws in Sindh

Legal Instrument	Scope and Applicability	Relevance
The Antiquities Act 1975 and Sindh Cultural Heritage Act 1994	Preservation and protection of antiquities (any object more than 75 years old). Empowers the government to declare any antiquity as protected	There is no protected antiquity at the proposed site of power plant or its surroundings. Will apply to any chance find of archaeological resource during excavation
Boiler Act 1923 and Boilers Act (Sindh Amendment) Ordinance 1971	Regulation including safety of boilers (any closed vessel exceeding 23 liters in volume) used for generating steam	Will apply to boilers in the power plant
Canal and Drainage Act 1873 and Sindh Irrigation Act 1879	Regulates all surface water bodies (both natural and constructed using public resources).	Not applicable since there are no perennial surface water bodies in the project area of influence
Electricity Act 1910 and Electricity Rules 1937	Regulates production, transmission, distribution, and use of electricity	Applicable to the Project including sections relating to safety.
Forest Act 1927	Regulates forest resources. Empowers the government to declare any forest area reserved or protected.	No relevance as there are no reserve or protected forest in the project area of influence
Land Acquisition Act 1894	Empowers the government to acquire private land for projects of national importance and lays down the acquisition procedure	Not in the scope of the project
Petroleum Act 1934	Regulates import, transportation, storage,	Storage of petroleum products at the power plant site will be

	production, refining and blending of petroleum products and other flammable substances	governed by this law
Sindh Wildlife Protection Ordinance 1974	Empowers the government to take measures for protection of wildlife in the province by declaring setting aside certain areas as national park, wildlife sanctuary, and game reserve, and by declaring certain species as protected.	There are no protected areas in the project area of influence. The Rann of Kutch Wildlife Sanctuary is at least 5 km from the site.
Sindh Water Management Ordinance 2002	"To provide for the establishment on long term, sustainable and participatory basis, of public systems for the distribution and delivery of irrigation water, the removal of drainage water and the management of flood waters"	No relevance to the Project
Mines Act 1923	Regulates mines	Not relevant to the power plant

2.5 LABOR, HEALTH AND SAFETY LEGISLATION

The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular:

- Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;
- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and
- Article 37(e) makes provision for securing just and humane conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

- Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. There are various laws containing health and safety requirements including: Mines Act 1923; Factories Act 1934; Factories Rules; Hazardous Occupations Rules 1963; Provincial Employees Social Security Ordinance 1965; and Workmen's Compensation Act 1923. No single comprehensive piece of legislation deals with occupational or community safety and health.

2.6 FEDERAL LAWS

Pakistan Environmental Protection Act, 1997

The Act was promulgated on December 06, 1997 by repealing the Pakistan Environmental Protection Ordinance of 1983. Section 12 of the Act provides for environmental assessment study: Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) prior to commencement of construction or operation of a project.

Project Implementation and Resettlement of Affected Persons Ordinance (draft) In order to provide legislative support to National Resettlement Policy; Government of Pakistan has also drafted Project Implementation and Resettlement of Affected Persons Ordinance but has not yet promulgated. The provisions of this draft ordinance are consistent with the requirements of the World Bank's OP 4.12 on involuntary resettlement. After becoming law, these provisions will apply when addressing the resettlement issues that arise in the project.

Cutting of Trees (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department

The Antiquities Act, 1975

Archaeological sites and monuments are specifically protected by this Act.

Land Acquisition Act, 1894

The Land Acquisition Act (1894) deals with the acquisition of private properties for public purposes including large development projects like major roads. There are 55 sections in this Act mainly dealing with area notifications, surveys, acquisition, compensation, apportionment awards, disputes resolution, penalties and exemptions

Canal and Drainage Act, 1873

This Act entails provisions for the prevention of pollution of natural or man-made water bodies.

Pakistan Penal Code, 1860

This Act defines the penalties for violations concerning pollution of air, water bodies and land. viii).

Explosives Act, 1884

Under the Explosives Act, 1884, the project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting, and other purposes.

Highways Safety Ordinance, 2000

This ordinance includes provisions for the licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control, offences, penalties and procedures; and the establishment of a police force for motorways and national highways charged with regulating and controlling traffic on the national highways, and keeping the highways clear of encroachments.

Hazardous Substance Rules, 2003

(Draft) Section 14 of the PEPA 1997 requires that "no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except

a. Under a license issued by the Federal Agency and in such manner as may be prescribed; or
b. In accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party." Pak-EPA has drafted the Hazardous Substance Rules to implement the licensing requirement. The rules are still in their draft form and are pending notification.

Environmental Standards and Guidelines Applicable to the Projects

The proposed project is legally required to comply with the SEQS for gaseous emission, and liquid effluent, and SEQS for ambient air quality.

The environmental standards applicable in Sindh are SEQS as developed by Sindh Environmental Protection Agency after 18th Amendment. In addition to Sindh Environmental Protection Agency has separately notified the ambient air quality standards.

Chapter

Three DESCRIPTION OF THE ENVIRONMENT

3.1 GENERAL

Baseline Quality of the Environment

Environmental baseline survey presents the existing environmental scenario and the results from the assessment and evaluation aspects emerging during the operation of the factory. Screening of potential environmental aspects, the assessed and evaluated impacts requiring necessary mitigation measures are suggested in the report.On the basis of the findings, programs of environmental improvement is suggested and followed by training and campaigning in order to enhance awareness and care at all levels of personnel. Procedures are documented to direct the implementation of the programs in the field.

Environmental Baseline Monitoring (EBM) is a very important. EBM during the operational phase helps in judging the success of mitigation measures in protecting the environment. Mitigation measures, in turn are used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes.

Description of the existing environment should include natural, cultural, socio-economic systems and their interrelationships. The intention is not to describe all baseline conditions, but to focus the collection and description of baseline data on those VECs that are important and are likely to be affected by the proposed Sugar industrial activity.

Objective of EBM in IEE/EIA Context

EBM studies are carried out to:

- Identify environmental conditions which might influence project ;
- Identify sensitive issues or areas requiring mitigation or compensation;
- Provide input data to analytical models used for predicting effects;
- Provide baseline data against which the results of future monitoring programs can be compared.

3.2 BACKGROUND

This document describes the scope of the study plan for comprehensive characterization of baseline environmental and social conditions existing in and around the proposed project.

Specific Objectives

By implementing an Environmental Management System (EMS) in accordance with the PEPA Standards, the objectives include:

- To define, describe and characterize the existing baseline conditions
- To ensure that this study will provide a sound technical bases for ongoing evaluation of environmental effects during operations
- To identify the methods and approach for data gathering and analysis for reviews of others
- To identify the specific potential impact of each step of the process

Secondary Objectives

- Reducing environmental liability and risk,
- Helping to maintain consistent compliance with legislative and regulatory requirements,
- Preventing pollution and reducing waste,
- Pollution-incident coverage is issued,
- Identifying areas for reduction in energy and other resource consumption,
- And demonstrating commitment to high quality.

3.3 METHODOLOGY OF ENVIRONMENTAL BASELINE SURVEY

The environmental assessment (examination and evaluation) is primarily based on simple comparative evaluation approach. Initially the baseline or profile of the projected area is developed by the site visits, collecting data, records and information on physical and ecological environment. The same data is then projected (exploited) as baseline information with respect to environment for the evaluation, identification assessment of significant impact either in qualitative or quantitative manner is carried out for which appropriate mitigation measure are proposed.

Site Visits/ Survey

The environmental assessment team comprising of group of experts made a number of facts finding and sample collection visits to the factory to collect baseline data in extent to environmental aspects.

Scope

- Consultation with clients;
- Preliminary survey of the site has done in which general environmental issues and sensitivity of the factory area have assessed;
- All possible archives and published literature is consulted in addition to previous baseline studies on Sugar factories.

3.4 DESCRIPTION OF THE ENVIRONMENT

The description of the environment of the project requires baseline data on the following:

- Physical Environment
- Biological Environment
- Social Environment

Geography

Tando Muhammad Khan District is a district in the southern part of Sindh province in Pakistan.It is bordered by Hyderabad and Tando Allahyar districts to the north, to the south and east Badin district and to the west Thatta district. The Indus River flows through Northwest. Tando Muhammad Khan district comprises three talukas viz. Tando Muhammad Khan (also the biggest town in the district), Bulri Shah Karim and Tando Ghulam Hyder. Tando Muhammad Khān is situated at 25.13° North latitude, 68.53° East longitude and 12 meters elevation above the sea level. Tando Muhammad Khān is a town in Pakistan, having about 72,659 inhabitants.

Geology

The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karonjhar mountains, which is famous for Nagar Parkar Granite. In the north Sindh is enquired by rocks of Laki range extending to Suleiman range and its southern most part is encircled by the Arabian Sea. The rocks exposed in this area belong to upper Cretaceus which are recent in age.

The sub-surface rocks are about 20,000 feet thick and belong to Cretaceous and Pre-Cretaceous periods. Mostly the rocks are of sedimentary origin of clastic and non-clastic nature and belong to marine, partly marine and fluviatile depositional environments. Basin wise Sindh lies in the lower Indus Basin and its main tectonic features are the platform and fore deep areas.

Thick sequences of Pab sandstone of Upper Cretaceous, Ranikot Group (Khadro, Bara, Lakhra) of Paleocene, Laki, Tiyon, andKhirthar of Eocene age, Nari Formation of Oligocene, Gaj Formation of Lower to 3 Middle Miocene, Manchar of Upper Miocene to Pliocene, Dada Conglomerate of Pleistocene are present in various areas of Sindh. Limestone and sandstones are the most dominant sedimentary rocks in the area. Structurally Sindh generally contains gently folded anticlinal features trending in north-south direction. The major active faults in province are as under:

Surjani Fault: N-S Trending.

This fault located west of Larkana. It cuts Quaternary deposits. The maximum magnitude of the earthquake associated with the fault is of the order M=6.1 on Ritcher Scale.

Jhimpir Fault: N-W Trending.

A number of epicenters are located on the fault. The fault has produced an earthquake of M=5.6 on Ritcher Scale.

Pab Fault: NN-W Trending.

It passes through the eastern part of Pab range. The maximum magnitude of the earthquake associated with fault is of the order M=7.0 on Ritcher Scale.

Rann of Kutch: E-W Trending

The fault has produced an earthquake of the order M=7.6 on Ritcher Scale. Recent studies have revealed that this fault traverses the Karachi Metropolitan Area.

3.5 HYDROLOGY

Sindh province is mostly irrigated through the Indus river system (canals and tributaries) and large aquifer sources of groundwater underline the Indus basin. They form an important source of water supply throughout the Project Area with many tube wells, motorized pumps and hand pumps. Groundwater in the Indus Basin is, however, of variable quality and tends to be non-saline only near the surface. Aquifers are recharged by means of seepage during flood season. The depth of the groundwater table varies from 3 meters to 25 meters along the route. Tando Muhammad Khan district is irrigated by the canals from the Sukkur and Kotri barrage and by rain water. However, other modes of land irrigation such as river water and tube wells are also used. The area being fed by Kotri is further divided in perennial and non-perennial system of irrigation. The irrigation network is mainly

comprises Guni Canal, Akramwah and Nasir canal. There are two major canals, three minor canals. These water sources are the major source of drinking water as well as water for irrigation

Seismicity

According to the seismic zone map of Pakistan, the Project Area lies in a zone where minor to moderate damage can occur.

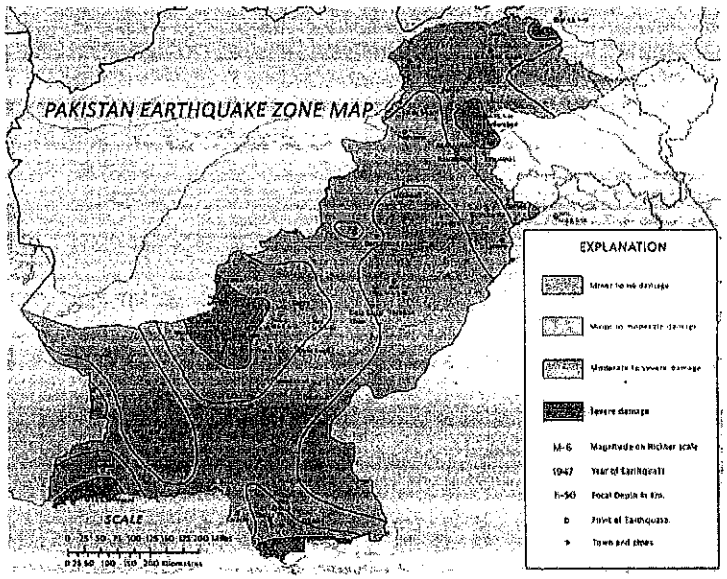


Figure 4 Pakistan Earth Quake Zones

3.6 GROUNDWATER AND WATER SUPPLY

More than 80% of lands in Sindh are underlain by the saline groundwater unfit for irrigation that is a major constraint in irrigated agriculture. The shortage of irrigation water coupled with recent drought conditions in Sindh has increased the importance of exploitation of groundwater even in areas with marginal water quality. The fresh groundwater is found mostly in a strip parallel to the left bank of Indus River and some pockets in other areas. The aquifer found at shallow depths highly Trans missive. Number of tube wells has been installed in private and public sector to pump water for use in agriculture. Such development of groundwater could lead to increasing secondary soil salinity due to use of groundwater of marginal quality and intrusion of saline water into fresh water aquifer.

Irrigation is largely dependent on canals, but tube wells have also been sunk in areas where water is fit for irrigation. Ground water is generally brackish, but potable water is available in the belts along the

Indus and canals. The strata in the subproject area are water bearing and alluvial deposits and giving groundwater potential throughout the project area.

The local population is generally reliant on supply from hand pumps. Piped water is available to 42% housing units of the Province which is 74% in urban areas and 17% in rural areas.

Groundwater

Groundwater sources exist in the area and potable water is available. The local population is generally reliant on supply from the hand pumps in rural areas while in urban areas population is using drinking water from piped water supply scheme

Surface water

The sources of surface water are Sukkur, Kotri barrages and rainy water. The area being fed by Kotri is further divided in perennial and non-perennial system of irrigation. The irrigation network mainly comprises Guni canal, Phuleli canal, Akramwah and Nasir canal.

Soils

The soils of the Project area are of recent alluvial origin and are basically suitable for irrigated agriculture. Although, stratification is complex, the majority of soils are within the range of fine sandy loam to silty clay loams with the latter being most common. Sandy soil can be found in the desert and sand mixed clay loam 3 -5 m in depth laid over sandy soils in the Nara and Jamrao Canal command area. All soils contain calcium carbonate and most contain gypsum. Salinity is wide spread but generally ephemeral: with adequate water and drainage, most soils can be reclaimed by simple leaching.

The alluvial deposits date back to the time when Hakro River (Eastern Nara) flowed through this area during the Sama and Soomra period 1298-1520 CE2 in Sindh.

Land Use

The existing project area is generally on flat land.

3.7 CLIMATE

The climate of Tando Mohammad Khan District is moderate. However, the summer months - April, May and June - are very hot during the day. The mean minimum and maximum temperatures during this period are 21.1° and 48.5°C respectively. December and January are the coldest months with maximum and minimum temperatures of 48.5° and 11.1°C respectively. The temperature falls abruptly at night. The climate is tempered by the west and south air breeze, which blows for eight

months from March to October, making the hot weather tolerable. The autumn starts in September and lasts for about two months. The maximum-recorded humidity at Tando Mohammad Khan is 55 percent. Rainfall is highly erratic with an average of about 172.4 mm. The monsoon dominates from July to September.

The minimum and maximum mean monthly temperature, precipitation and relative humidity are given in Table recorded at the nearest monitoring station i.e. at Hyderabad, sindh.

CLIMATE DATA

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	33.3 (91.9)	38.2 (100.8)	43.4 (110.1)	46.0 (114.8)	48.4 (119.1)	48.5 (119.3)	45.5 (113.9)	43.9 (111.0)	43.0 (109.4)	44.0 (111.2)	41.0 (105.8)	36.0 (96.8)	48.5 (119.3)
Average high °C (°F)	24.7 (76.5)	28.1 (82.6)	33.8 (92.8)	38.8 (101.8)	41.4 (106.5)	40.1 (104.2)	37.3 (99.1)	36.0 (96.8)	36.3 (97.7)	36.9 (98.4)	31.0 (87.8)	26.0 (78.8)	34.2 (93.6)
Average low °C (°F)	11.1 (52.0)	13.8 (56.8)	18.6 (65.5)	22.9 (73.2)	26.1 (79.0)	28.0 (82.4)	27.7 (81.9)	26.6 (79.9)	25.3 (77.5)	22.4 (72.3)	17.3 (63.1)	12.8 (55.0)	21.1 (70.0)
Record low °C (°F)	3.3 (37.9)	4.0 (39.2)	9.0 (48.2)	12.0 (53.6)	19.0 (66.2)	20.0 (68.0)	21.4 (70.5)	22.8 (73.0)	20.6 (69.1)	15.0 (59.0)	6.0 (42.8)	3.0 (37.4)	3.3 (37.9)
Rainfall mm (inches)	1.5 (0.059)	5.4 (0.213)	4.8 (0.189)	6.0 (0.236)	3.6 (0.142)	9.6 (0.378)	53.0 (2.087)	62.3 (2.453)	19.4 (0.764)	4.2 (0.165)	1.9 (0.075)	2.5 (0.098)	174.2 (6.858)
Mean monthly sunshine hours	272.8	257.1	288.3	288.0	313.1	279.0	235.6	251.1	285.0	306.9	279.0	272.8	3,328.7

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Humidity

Humidity is variable; it is highest on the whole at the end of August and much less in May when the air is uncomfortably dry. During summer, the wind blows in the south-west and in winter north-west direction. During the months of May and June, hot winds laden with dust blow constantly south-west direction. The district lies in the rain shadow area, and heavily laden south-west monsoon clouds rising from the Arabian Sea pass over this area without any showers. In winter, the district gets some rain from the cyclonic winds, blowing from the Persian Gulf. The average daily relative humidity for April is around 40%.

Wind

The average daily wind speed in April has been around 19 km/h, that's the equivalent to about 12 mph, or 11 knots. In recent years the maximum sustained wind speed has reached 83 km/h, that's the equivalent of around 52 mph, or 45 knots

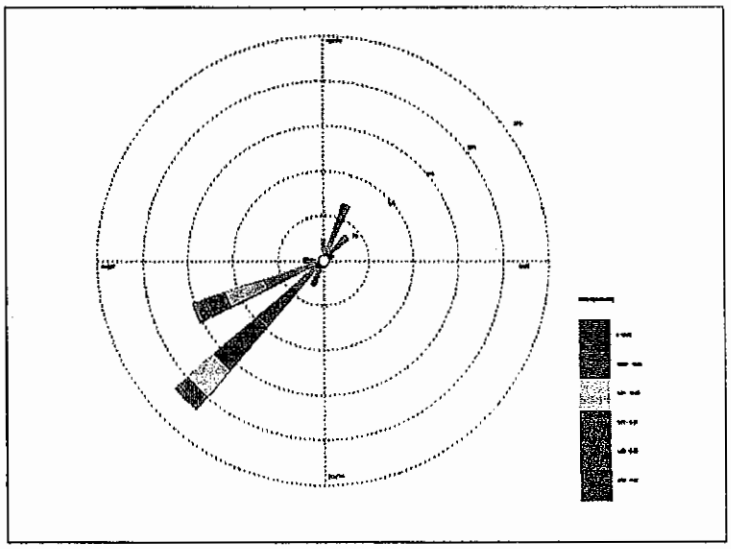
Table 3.3: Average Wind Speed at 10m, 30m and 50m height in Hyderabad

Height	Data	Jan	Feb	Mar	April	May	June	Jul	Aug	Sep	Oct	Nov	Dec
10m	AWS	2.2	2.3	2.1	4.0	5.7	6.7	6.5	5.8	5.2	1.9	1.8	1.9
30m	AWS	3.6	3.6	3.6	5.6	7.8	8.8	8.8	7.5	3.2	6.9	3.2	3.2
50m	AWS	4.4	4.4	4.3	6.5	8.9	10.0	9.9	8.5	7.8	3.9	3.9	4.8

Courtesy: Pakistan Meteorological Department (PMD)

Wind Roses

Most of the wind blows from south-southwest to west-southwest direction in Sindh region. However during summer season, a heat low exists over Baluchistan and adjoining areas. Its trough usually extended southeastward causing most frequent wind direction found west-northwest at Kati Bandar.



3.8 AIR QUALITY AND NOISE

The project site is located in a rural area and human activity is primarily related to agriculture, although there is one sugar mills also. The major air quality issue is total suspended particulate matter (TPS) and NO_2. The TPS level can exceed acceptable levels due to the presence heavy dust. Human activity such as from sugar mills and cultivation of the fields aggravates the situation. Some dust is generated when vehicles overtake on unpaved shoulders.Air quality and traffic noise monitoring data is available from studies relating to the construction of cogen power plant. The sampling points for these studies are located along the project road.

Ambient Air Quality at One Station– in the close vicinity of the proposed project

Parameter	Units	Sampling location	SEQS, 24h Avg.
Total suspended particulates	mg/m3	1.09	0.50
Oxides of sulfur (SOx)	mg/m3	0.0685	0.120
Oxides of nitrogen	mg/m3	0.0480	0.040
Carbon dioxide	mg/m3	0.782	5.00

Existing traffic volume is relatively low and the adjacent land use is primarily agricultural. Both road and other ambient noise levels increase when the road enters a town. Existing noise levels (Table 4)

were recorded from previous studies and reflect the expected low noise conditions. The noise levels were within the acceptable limits of commercial area SEQS Standard in day time and acceptable range for transport corridors as defined in Pakistan.

Noise intensity nearby village of the project site

Location	Noise intensity Dba			SEQS limits (Commercial Zone/Residential Zone)	
	High	Medium	Low	Day	Night
	63.14	46.21	34.35	65/55	55/45

Cultural Heritage and Community Structure

There are no official heritage sites or historic, religious or archeologically important sites located in the project area. There is no major historic or archaeological feature of note but there a few places of worship e.g. Mosques within 500m radius of proposed sites of the project.

3.9 BIOLOGICAL ENVIRONMENT

Aquatic Biology

The dominant vegetation of the province is indicative of its hot and dry climate, which is composed of open communities of deciduous and xerophytic trees and shrubs. Sindh soil and climate are suitable for plants which grow well in Africa, Arabia, and Iran, etc. Someone has said that it is certain that anything can grow in the Indus loam.Due to the high intensity of human settlement, land cultivation and industry, undisturbed natural habitats are very limited. There is nevertheless still significant plant and animal diversity.

Flora

The Project Area falls within the Tropical Thorn Forest ecosystem, however much of the natural vegetation has been replaced by agricultural crops, mainly rice, sugarcane, cotton, maize, mong, mash, millet and sorghum sown in April-June and harvested during October-December; and wheat, gram, lentil, tobacco, canola, barley and mustard, planted in October-December and harvested in April-May. 61. The dominant trees in lower Sindh are babul (Populuseuphrafica), ber

(Zizypuhsnumularia) and several verities of Tamarix such asplai(Tamarixgallica) and jhao (Tamarixdiocia), talhi (Dalbergiasisoo), kri (Tamarixgallica), karir (Copparisaphylla). 62. Of more concern would be damage to old plantations of Azadirachtaindica (Neem), Albizialebbek (Shrin), Ficusreligiosa (Peepal), Acacia nilotica (Babul), Cordiamyxa (Lasura) and Ficusbenghalensis (Borh), and recent plantation of Cornucopias. These trees have significant medicinal value or are important culturally. 63. Among the grasses; Lumb (Arislidadepressa), Chemmer (Eleusinecompressa), Gorkha(lasiurussindicus) and Kana (Saccharumbengalensis) are found in the Project Area. Koondeor Dib (Typhaaugustata) is found along the water ponds scattered on both sides of the road.

Fauna

Mammals

Many decades ago, the project area was rich in wildlife but these have been depleted due to conversion of habitat to agricultural lands. Jackal, squirrel, fox, rats; mongoose and several species of bats are still found in the area. 65. Domestic animals including goats, sheep, camel, cows, donkey and buffalo are the dominant users of the land and have severely degraded wildlife habitat.

Reptiles

Reptiles include snakes such as cobra (Najanaja), rattlesnakes (Crotalushorridus) and rat eater snakes (several varieties). Small and medium sized lizardsare also a common sight in the area. These include monitor lizard (Varanu ssp.), spiny tailed lizard(Uromatixhardwickii) and fringed toed lizard (Acanthodactyluscontoris). Turtles are also present in the area especially in the vicinity of moist lands, ponds, canals and during rainy seasons.

Birds

Important bird species found in the project area are the common crow (Corvusbrachyrhynchos), common mynah (Acridotherestristis), house sparrow (Passer domesticus) and common teal (Anascrecca). These birds are frequently visible along the roadside. Grey and black partridges (Perdixperdix and Melanoperdixniger), though present in the area, have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian roller (Coraciasbenghalensis), crested lark (Galeridacristata), vultures (several varieties) and quail. White heron (Ardeaalba) and black heron (Egrettaardesiaca) are also plentiful and inhabit the ponds located on both sides of project roads. Water birds, including white stork (Ciconiaciconia), white pelican (Pelecanusonocrotalus), little brown dove (Spilopeliasenegalensis) and white throated king fisher(Halcyon smyrnensis) are most often found using the roadside ponds as feeding areas.

Ecosystems

Ecosystems include protected areas such as wildlife sanctuaries, national parks and game reserves,but none near or within the proposed project area.

3.10 SOCIO-ECONOMIC ENVIRONMENT

Industrial and Commercial Activities

There is no heavy industry in the project area. There are a number of secondary industries within the district that support the agricultural economy such as rice husking, a sugar refinery, and cotton ginning and flour mills. There are also some brick kilns

Employment and Income Sources in Project Area

Nearly all employment in the project area is in the agriculture or agriculture product processing sector. Most common jobs involve harvesting, picking, threshing, animal rearing transport driving and guarding. Local laborers commonly gain employment during the sugarcane harvesting season for crop harvest, loading and transport. Sugar mills in the surrounding area also employ skilled and unskilled labor.Sugar mills and cotton gins create employment and continue to contribute significantly to the local economy.

Agricultural lands are owned by landlords and farmers work for a share of the sale of the crop. They live in the fields in small houses made from wet soil, cow dung and palm leaves, graze a few cattle and grow vegetables for food.

Market places are typically located adjacent to the main roads where economic activity is highest. The grain and cattle markets are open every day except Fridays. Shops in the market places are mostly grocery shops and small hotels and are typically owned by local people. Smiths, workshops, hardware commodities and other house-hold items are available from stores in these markets. Those not employed in agriculture include cobblers, carpenters, blacksmiths and barbers with lower incomes. Their daily wage is between Rs. 400 and 500, however, economic opportunities are limited and people face difficulties finding employment other than irregular temporary work. They are usually uneducated.

Agriculture is the most widespread source of income in the project area (65% of all income). Thirty percent of the population earns income as shopkeepers, small business, and as laborers in the sugar,

cotton and rice industry and 5% have government jobs in departments such as the agriculture department, forest department, post office, police, transport and the Pakistan army.

3.11 DEMOGRAPHY

The project road is located in the Tando Muhammad Khan district, and the demography is diverse.

Table: Demography of the Subproject road Tando Muhammad Khan

Factor	Tando Muhammad Khan
Area km2	1733.99
Population (Person) Male Female	547,215 284,552(52%) 262,663 (48%)
Sex ratio (M:F)	110 : 110
Population Density Urban Population	257per km2 147,748 (27%)
Rural Population	399,467 (73%)
Avg Household size	6
Literacy ratio 10+ Male Female	36.00% 49.00% 23.00%

Tribal people include Halapotra, Hingora, Syed, Almaani, Dars, Jamali, Mahendo, Khoso, Kolhi. Junejo, Leghari, Memon, Malik, Lashari, and Solangi. Sindhi language is commonly spoken in the majority of the communities in the project area. However, SariakiBalochi,, Urdu and Punjabi languages are also spoken and understood.

Archaeological, Cultural and Historical Resources

There are no archaeological, cultural or historical resources in this corridor and none will be impacted by any of the work activities.

Chapter
Four

PROJECT DESCRIPTION AND MAGNITUDE OF OPERATIONS

4.1 INTRODUCTION

The objective of the project is to satisfy the ever increasing demand for electricity in Pakistan with a clean alternative to the more fossil-fuel based electricity component of the Pakistan national grid. The project aims to generate net 26.5 MW of electricity to export to the national grid. The project is to be located at Shaikh Bhirkio, Taluka Tando Muhammad Khan, District Tando Mohammad Khan, Sindh, in the close vicinity of Faran Sugar Mills.

Faran Power Cogeneration Project, is a power capacity expansion project involving the generation of electricity using sugarcane bagasse on site and consisting of the following activities.

4.2 CO-GENERATION PLANT

The high pressure cogeneration plant is selected to utilize bagasse as non conventional fuel. The boiler capacity is designed for 135 TPH at 110 bara, 540^{0}C. The high pressure TG is selected as 26.5MW extraction Condensing (Dual Mode). This will also meet the process steam requirement of the Sugar Plant. It is expected that Co-generation Plant will fulfill the energy requirement of the Sugar Plant and net power of 15,870 KW can be exported to the National Grid. Surplus and purchased bagasse from other sugar mills from other mills shall be used during off Season.

The power generation mill will be 11 KV and exportable power will be stepped up to 132 KV and will be supplied through national grid. Being an operating Sugar Plant, infrastructure facilities like housing colony, guest houses, administrative building are available outside the sugar factory premises. The space is available for the plant to erect.

The topography and geological aspect (soil bearing capacity) are favorable. All equipment for the cogeneration unit shall be designed for satisfactory operation for a life time of minimum 30 years under specified site conditions. All equipment shall be suitable for rated voltage of +10% and frequency of 50 Hz with +5% variation and 10% (absolute sum) combined voltage and frequency

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

variation. The generator shall be of synchronous type with brushless excitation system, and shall be designed for rated voltage & frequency of 11 kV & 50 Hz, with corresponding variations of +10% and +5%. The generator shall have closed circuit air cooled system with external water circuit (CACW cooling) and the windings shall have class 'F' insulation, with temperature rise limited to class 'B' insulation limits, under specified cooling water & ambient air temperatures. All the auxiliaries of the cogeneration unit and shall be connected at 415V level.

For sugar mill drives, Two (2) No of converter transformers shall be provided. Surplus power from the high pressure 26.5 MW cogeneration TG unit, after feeding the in house loads, shall be exported to national grid by stepping-up the power to 132 kV, through transformer. All the equipment including switchyard and the transmission system shall be designed to have provision for future expansion with additional cogeneration unit. All equipment for cogeneration unit shall be designed for satisfactory operation for a life time of minimum 30 years under specified site conditions.

All required protections and metering for generator transformer shall be provided switchyard relay along with tariff metering equipment. All equipment shall be designed for future expansion with additional cogeneration unit.

Cogeneration Scheme

The proposed cogeneration scheme for the Faran Power Ltd, consist of a single boiler of 135 TPH capacity with steam outlet pressure of 110 bara, 540^{0}C and one 26.5 MW extraction Condensing (Dual Mode) turbo generator providing process steam from the extractions of the TG. The proposed system is capable of operating during sugar season with in-house bagasse and in Off-Season on Condensing Mode.

The cogeneration scheme is configured to optimize the power generation by using most of the bagasse generated in the factory during cane crushing season. The cogeneration plant consisting of the boiler, extraction condensing Dual Mode turbo generator, auxiliary system, switchyard, etc

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

4.3 PROJECT DESIGN AND TECHNOLOGY

The cogeneration project activity is based on conventional steam power cycle involving direct combustion of biomass (bagasse) in a boiler to raise steam, which is then expanded through a turbo alternator to generate electricity. The plant comprises of a new 135 t/hr at 110 bara and 540 °C. The new turbo alternator will be in the region of 26.5MW. The steam extracted from the turbo alternator is used in the sugar plant processes and the power generated is both used in-house and excess is exported to the National grid via high tension line.

Specification of HP Steam Turbine

The HP Steam Turbine is a single-casing turbine, geared for generator drive. It has a compact and flexible design with a high degree of standardization. Used for power generation applications

Technical data

- Power output 26.5MW
- Inlet pressure 110bara/1,1562 psi
- Inlet temperature 540°C/1,004°F
- Rotational speed up to 12,000rpm
- Controlled extraction up to 21bar/298psi and up to 350°C/662°F
- Bleed up to 60bar/870psi
- Exhaust pressure (back pressure) up to 2.5bara/35.5psi
- Exhaust pressure (condensing) up to 0.3bar/4.4psi
- Exhaust area 0.28–1.6m2/ 3.0 –17. 2 sq. ft.

Typical dimensions

- Length: 12m/39ft.
- Width: 4 m /13.1ft
- Height: 5m/16.4ft.

Features

- Condensing Extraction Dual Mode Turbine
- Pre-engineered turbine modules, modular peripherals
- Two controlled extractions
- Radial/axial exhaust
- Package unit design
- Customized steam path

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

The steam cycle plant will be located within the factory where the exhaust from the steam turbine is recovered and used for meeting industrial process steam and heat needs. The technology combines heat and power (cogeneration) systems with greater levels of energy services per unit of biomass (bagasse) consumed than systems that generate power only.

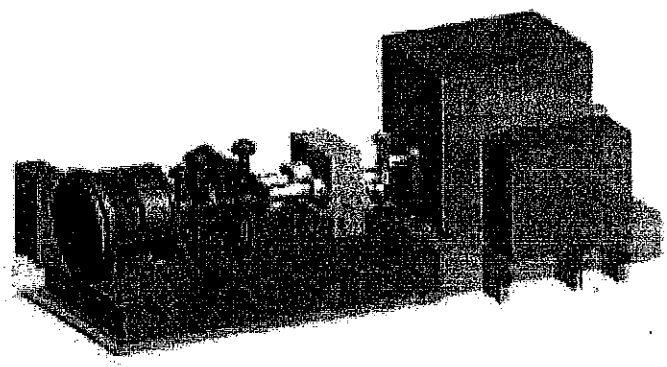


Fig: HP Steam Turbine

The project is aimed at utilizing excess bagasse which is not utilized (dumped in the nucleus estate) at the moment, and boiler efficiency improvement to generate electricity which will be exported to the national electricity grid. The project will result in a net decrease of 30 to 40 t/hr in steam demand but with a two fold increase in electricity generation.

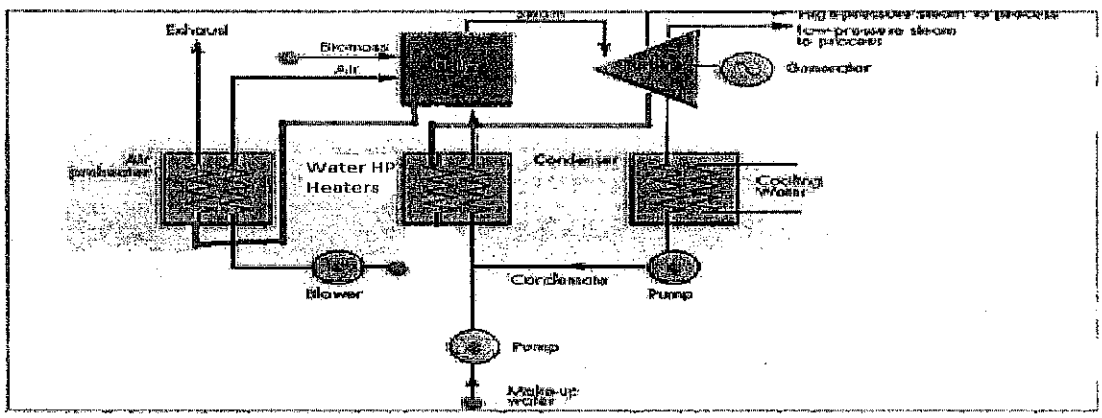


Fig 4.1: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing extraction steam turbine

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

The technology involves generation of high pressure steam from pressurized water, with the resulting steam expanding to drive a turbo-generator, and then condensing back to water for partial or full recycling to the boiler. A heat exchanger is used to recover heat from flue gases to preheat combustion air, and a deaerator is used to remove dissolved oxygen from water before it enters the boiler. An electrostatic precipitator is installed to remove the particulate matter in the boiler flue gases while a dry ash extraction system is used to remove the ash generated from the combustion. This is an improvement from the current wet ash system which results in some of the carbon and other compounds in the ash being discharged into the surface water. The technology used is safe, environmentally friendly and proven.

4.4 PROCESS DESCRIPTION

Bagasse will be received from the sugar cane milling process via a conveyor and fed directly to the boilers to produce steam. The new boiler will produce 135 t/hr of steam at 110 bara and 540 ^{0}C temperatures while the old retained boiler will generate 65 t/hr of steam at 24 bara pressures and 350°C temperature. The high pressure steam will be used to drive the 26.5 MW turbo generators to produce electricity and exhaust steam and condensate.

The exhaust steam and condensate will be passed through a deaerator to remove dissolved oxygen before being recycled back into the boiler drum. The low pressure steam will be used directly in the mill for drives and sugar processing. Other than the steam used directly in the milling process, all the steam will be recycled and only little make up will be required once the system is operational and stable.

Flue gases will pass up the boiler stack which will be fitted with a precipitator to remove any particulate matter in the gases. A heat exchanger is used to recover heat from flue gases to preheat combustion air. The ash will be collected under the boiler using a dry system from where it will be accumulated awaiting use for soil conditioning or pH correction in the plantations.

The electricity generated will be metered at various locations to determine the quantity used internally or exported to the grid.

Table 4.1: FPL Plant Description

(i)	Plant size installed capacity	26.5 MW Gross
(ii)	Type of Technology	Cogeneration plant with high pressure boiler 110 bar, 540 °C class; turbo generator with Extraction Condensing Dual Mode Steam Turbine, cooling tower and balance of plant.
(iii)	Number of Units/Size (MW)	1 x 26.5 MW.
(iv)	Fuel	Bagasse.
(v)	Unit Make/ Model & Year of Manufacture	New Boiler, turbo generator, switch gear and BOP.
(vi)	Commissioning/Commercial Operation date of each Unit of the Generation Facility	Within 20 months from financial close.
(vii)	Expected Useful Life of the each Unit of the Generation Facility from its Commercial Operation/ Commissioning Date	**30 Years**
(viii)	Expected Remaining useful Life of each Unit of the Generation Facility (at the time of grant of (Generation License)	**30 Years**
(ix)	Generation Voltage	**11 KV**
(x)	Frequency	**50 Hz**
(xi)	Power Factor	**0.8**
(xii)	Automatic Generation Control (AGC)	**Yes**
(xiii)	Ramping Rate	**300 rpm/min**
(xiv)	Time required to Synchronize to Grid	**150 Minutes from Cold Start**

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Table 4.2: Technical Details of Proposed Co-generation power plant

Description	Season	Off-Season
Days	100	68
Gross Capacity (MW)	26.5	26.5
Auxiliary Consumption (MW)	2.28	3.37
Net Installed Capacity (MW)	24.22	23.13
Sugar Mills Consumption (MW)	8.35	0.5 (Incorporated in Auxiliary consumption)
Exportable Capacity to Grid	15.87	23.13
Total Bagasse Generated	M.T	255,000
Total Bagasse Consumed	M.T	255,000
Off-Season Steam Generation	M.T	169,728

Table 4.3: Fuel Raw Material Details

(i)	Primary Fuel	Bagasse	
(ii)	Alternate / Backup Fuel	Nil	
(iii)	Fuel Source (Imported / Indigenous)	Indigenous	
(iv)	Fuel Supplier	From Sugar Mill	
	Supply Arrangement	Through Conveyor Belts/Loading Trucks/Tractor Trolleys etc.	
(v)	Sugarcane Crushing Capacity	10,000 TCD	
(vi)	Bagasse Generation Capacity	255,000 Tons at 0.85 factor:	
(vii)	Fuel Storage facilities	**Primary Fuel**	**Alternate Fuel**
		Bagasse yard	----
(viii)	Capacity of Storage Facilities	**Primary Fuel**	**Alternate Fuel**
		70,000 Tons	-----
(ix)	Gross Storage Capacity	Primary Fuel	**Alternate Fuel**
		80,000 Tons	-----

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Table 4.4: Emission Values

S;No.	Description	Primary Fuel
(i)	SOx (mg/Nm3)	8.46
(ii)	NOx (mg/Nm3)	131
(iii)	CO_2	6.83
(iv)	CO (mg/Nm3)	58
(v)	PM10 (mg/Nm3)	163

Table 4.5: Cooling System

(i)	Cooling Water Source / Cycle	RCC Counter Flow Cooling Tower + Canal Water + R.O (Treated Water)

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Chapter

Five ANALYSIS OF ALTERNATIVES

5.1 ALTERNATIVES

It is the requirement of the best practice that the IEE/EIA should consider project alternatives and their relative potential impact on the environment. Alternatives must, however, be both practical and reasonable, within the overall constraints of the proposed project development.

No Action (Zero Option)

This option requires the IEE/EIA to consider the potential positive and negative impacts that may arise if the project did not go ahead. The "zero option" would result primarily in negative impacts.

The project will be using available quantity of bagasse (renewable energy source) along with other biomass for generation 8.35MW electricity for their Sugar Mill unit 100 days of Season and 68 day of Off Season (Total 168 days) in a year. And additional would be to supply much needed power to national grid. The use of biomass will also result in a net reduction in CO_2 emissions so contributing to the control of climate change. Additionally the existing ecological habitats will not be disturbed as transmission line to Grid Station is in close vicinity of the project area.

5.2 PROPOSED POWER PLANT SITE

When the need for additional power generation capacity was confirmed, Faran Power Limited had reviewed a number of siting options prior to the selection of the final proposed location. Selection of site for installation of a cogeneration power plant is based on following criteria:

- Availability of land;
- Availability of fuel;

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

Available Infrastructure

Available Infrastructure considerations in the selection of a site are as detailed below:

- Availability of infrastructure facilities such as main road access to the proposed project site for ease of transportation of workforce, consumables, plant equipments and fuel etc.,
- Facility for interconnection with transmission and distribution systems for evacuation of power, transportation of sugarcane & sugar also.
- Availability of facilities like medical, education, civic amenities and railway station within a reasonable distance from the site.

Environmental Consideration

Environmental considerations critical to the selection of a site are listed below:

a. Avoiding the use of forest land
b. Minimum use of cultivable land
c. Away from thickly populated town
d. Minimum requirement of cutting of trees
e. No displacement of people
f. Away from critically polluted area
g. Away from national park and wildlife sanctuaries
h. Away from tiger reserve/Elephant reserve/turtle nestling grounds.
i. Away from core zone of biosphere reserve.

j. Away from Archeological sites.

k. Away from defense installations.

As per above site selection criteria the proposed site is most suitable for set-up the plant.

5.3 ANALYSIS OF CO-GENERATION

Cogeneration has been adopted as standard means of energy generation since long by the sugar industry. With the use of efficient processing and energy management systems, energy from bagasse, over and above the sugar factory needs, is available and can be exported conveniently in the form of electric power. Application of sugar cogeneration will replace a part of fossil-based electricity generation leading to a more sustainable mix in power generation. Cogeneration with power export will assist in reducing greenhouse gases (GHGs) emissions. In order to continue reliable, efficient and safe operation, the existing steam and power generation system will be closed down and replaced with the more efficient system in proposed power plant.

5.4 ANALYSIS OF ALTERNATIVE

Technology The only option to use the bagasse effectively is the combustion route, where the bagasse is combusted in a boiler to generate steam. However, because of the nature of and characteristics of bagasse, both atmospheric & circulating fluidized bed technologies (AFBC and CFBC) and the pulverized fuel (PF) combustion technologies are not suitable for the stand-alone combustion of bagasse. Some attempts had been made to integrate the traveling grate or pinhole grate technology with a PF technology, but the applicability of this design for use of standalone bagasse firing, the cost and efficiency are questionable. So, for all practical purposes, the traveling grate technology will be the best suited for this specific application. The traveling grate technology may not be the best for coal, as other technologies like CFBC and PF are best suited for coal, but however, with two totally different types of fuels and with other technologies not suitable for bagasse, a compromise has been made to settle for the travelling grate operating on the Rankine Cycle, with a traveling grate fired boiler and with a turbine which is designed to supply the process steam from its extraction points.

The selection of pressure and temperature, at which high pressure steam is generated, will have a significant influence on the amount of power generation. At higher pressure and temperature the boiler efficiency improves' and the same quantity of fuel generates the high pressure and temperature,

containing additional thermal energy. It therefore follows, that the highest practical steam pressure and temperature should be selected, taking into consideration the limitations imposed by expensive materials of construction for boiler, turbine and piping, as well as the limitations of quality and treatment of boiler feed water. At the same time, the capital and operating costs also impact the selection of steam pressure and temperature parameters.

Analysis of Boiler Technology

The proposed project has envisaged 110 kg/cm² pressure and 540°C temperature parameters for steam, which will give optimum efficiency and power generation, when extracted through a matching turbo generator set. The capacity of the boiler and turbine will be 135 TPH and 26.5MW respectively. The design philosophy will be to generate optimum levels of power from high pressure steam, supply steam and power requirements of the sugar complex and auxiliaries, and export optimum level of power to nearby substation.

For bagasse firing, traveling grate or dumping grate boilers are utilized. In traveling grate the ash discharge is by grate movement and automatic. In dumping grate the ash has to be removed manually with opening of furnace bottom doors which is not recommended in high pressure boilers. Hence the selection of traveling grates

Analysis of Fuel

Fossil energy resources consist primarily of natural gas and furnace oil. Domestic oil supply is considered negligible and natural gas resources are becoming scarce in Pakistan. Moreover, domestic coal is very high in sulfur and ash content, which will lead to severe environmental hazards. The project's proposal for using bagasse is the best option for environmental and economic reasons. In the absence of any cheaper fuel, bagasse utilization is of prime importance

5.5 RENEWABLE ENERGY ALTERNATIVES

Renewable resources such as wind power, micro hydro, and solar photovoltaic are not feasible options at the current time, but are subject to future consideration, particularly with respect to the price of fuel.

With availability of biomass and coal locally the option of using other renewable energy sources will be highly cost ineffective.

Moreover, high wind speed is only apparent for short periods of time in the project site area and hydro potential does not exist. Therefore, none of the currently available other renewable energy sources, at the utility level, will be able to meet the current needs.

Chapter

Six

ASSESSMENT OF THE POTENTIAL IMPACTS AND MITIGATION MEASURES

6.1 METHODOLOGY FOR ANTICIPATING ENVIRONMENTAL IMPACTS

Baseline data and conditions form the basis for evaluation of the environmental impacts of the proposed power project. A tabulated evaluation procedure has been used for the purpose of the presentation. The severity of the impact is presented on point scale. The evaluation scale used for the IEE study is given below:-

Scale: Extent of Impact

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

For evaluation rating, the National Environmental Quality Standards (NEQS) and International guidelines are used as reference guide. Various parameters of extent of environmental impacts are described below

Evaluation of Impacts - Criteria

Extent of Environmental Impact	Description
- High	International and National Standards are exceeded
- Medium	Between International and National Standards
- Low	International and National Standards are met

6.2 ENVIRONMENTAL IMPACTS ASSESSMENT DURING CONSTRUCTION PHASE

This section discusses the potential impacts from the installation of the proposed power plant and associated facilities on the natural resources and environment of the site and vicinity.

Land Acquisition

Land requirement for the proposed project will be met from the land (which was under industrial use) already available. No resettlement activities and no expropriation measures are required for realization of the proposed project.

The land required for the proposed project does not represent land of specific ecological importance. The area was assessed as being without any features that are out of the ordinary. No specific mitigation or compensation measures are required.

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

Erosion/Sedimentation

- The proposed project does not require land clearing and site preparation for installation of the power block and associated facilities.
- No wetlands are present within the project boundaries. The proposed construction area is not anticipated to significantly impact the land on site. No trees removal will be required in any area where construction conflicts exist.

General site preparation and construction activities associated with the overall development of the Project site include the following:

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

Site preparation will consist of clearing and grubbing, followed by grading and leveling. Site preparation and construction activities will not require any explosives. The plant site is in level condition, rough grading, excavation, and backfill activities will be performed to prepare the site for underground utilities, concrete foundations, and surface drainage. Structural backfill materials may be imported to the site for constructing concrete foundations and to raise grade site elevation to achieve proper drainage.

After construction of the power plant project is essentially complete, any remaining areas that do not have an impervious surface will be vegetated with native plant materials.

Soils excavated for the major equipment foundations may be used as general fill or structural fill, if appropriate. Fill may be required to raise portions of the site to grade. Since the site is in a flat area, the fill should not cause adverse impacts to site topographic conditions. Very little, if any, runoff flows onto the proposed site. Therefore, the fill will not impede existing drainage patterns. Added fill, with compaction, will shift areas of percolation within the site. Runoff will be managed with the storm water management system to mimic pre-construction conditions. During construction, erosion at the site will be managed according to an erosion control plan.

After construction, areas will be planted predominantly with native vegetation to control erosion.

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

6.3 AIR QUALITY

Major sources of dust emissions during construction include:

- Excavation.
- Earthwork.
- Ground leveling.
- Vehicles movement.
- Emissions from vehicles and machinery.

Dust generation from construction activities is an important concern during construction phase. Dust particles generally larger than 10 μm will settle down close to the construction sites, resulting in visible deposition close to the construction activities. Fugitive dust emissions will be greater during land clearing and site preparation phases. Fugitive dust emissions will also be greater during the more active construction periods as a result of increased vehicle traffic on the site. The dust to be generated during construction activities is mostly inorganic and of a nontoxic nature. Quantum dust generation will depend on weather conditions, wind velocity, precipitation rate, and type of construction activities. Dust and grit are expected to be present during the construction phase in dry months. This will end when the major civil works finish. Some dampening of the exposed areas, by employing dust control methods, may therefore be necessary during periods of dry weather in order to reduce the risk of dust entrainment in the ambient air. Peak dust generation, if construction activities coincide, will be during the drier months and this dust will tend to become dispersed within the ambient air as a result of vehicle movements. It will therefore be necessary to ensure that loads are covered to prevent fine dust blowing from open-top trucks. In dry periods, it may also be necessary employ dust control measures.

There will be an overall increase in traffic and heavy machinery movement during peak construction phase for limited period leading to a rise in emission level. These emissions together with exhaust emissions from equipment/machinery deployed during the construction phase are likely to result in marginal increases in the levels of sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), and un-burnt hydrocarbons. However, due to limited duration of the construction period and the use of the equipment at different intervals, the impact on air quality can be considered as low.

Potential minor sources of volatile organic compounds include evaporative losses from onsite painting, refueling of construction equipment and the application of adhesives and waterproofing chemicals.

The background levels of these pollutants are considered to be virtually low based upon the low frequency of traffic use proximal to the site. However, even with the predicted increase in construction related traffic and associated site activities, any increase in these pollutants is considered to be almost insignificant.

Fugitive dust emissions from the construction site will be minimized using appropriate dust suppression control methods. These standard control methods will include paving or placement of gravel on roads, applying dust suppressing chemicals or water to roads and other exposed surfaces, or other methods, as needed. The existing public road on exiting site is already paved.

Spilled and tracked dirt (or other materials) will be removed from the road in a timely manner. Of course, all construction related fugitive dust emissions, on the overall basis, will be temporary and will cease to exist once construction is completed. Emissions from open burning will be limited by removing materials whose burning would produce excessive smoke e.g., green vegetative materials.

During construction there will be some impacts on air quality. However, the proposed mitigation measures will reduce the impacts to an acceptable level, especially as they are limited to the construction phase. The overall construction period is expected to have duration of about 6 months. The quantity of any emissions to be released during the construction process will generally be very low, but will vary on an hourly and daily basis as construction progresses.

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

6.4 IMPACT ON SURFACE AND GROUND WATER

Surface Water

The nearest surface water is the irrigation canal. The existing surface water will not be affected by any construction activities. By avoiding uncontrolled discharges of liquids and waste, implementing adequate waste management and instigating appropriate organizational measures and mitigation actions, impacts on surface water can be reduced to a low level and will be limited to the construction period.

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

Groundwater

The proposed power plant site is located within the aquifer that serves the surrounding communities. Based upon the importance and sensitivity of this aquifer, as well as good construction practices, all precautions necessary will be required to reduce the potential for site impacts to a minimum.

While the proposed site preparation and facility construction activities for the power project are not anticipated to cause any short-term or long-term groundwater impacts to the site, Best Management Practices (BMP) will be employed during construction to ensure impacts (if any) are minimal and are properly mitigated.

Fluctuations in groundwater levels are expected to occur throughout the year due to rainfall, by surface percolation and infiltration through the canal system. As a result, minor dewatering systems may be required and maintained during certain phases of construction (e.g., during engine foundation installation). After excavation, backfill, compaction, construction of the permanent plant drainage system and certain concrete construction activities are complete, the dewatering system, if required, will be removed. Any restoration needed for affected areas will follow after the dewatering equipment is removed. The implementation of appropriate erosion and sedimentation controls will also minimize adverse water quality impacts during site preparation.

Spills of fuel oil can have a potential adverse impact on soil, groundwater and particularly surface water during both the construction and operational phases of the project. During construction, all fueling will be conducted in a manner consistent with the spill prevention and response plan to be prepared by the construction contractor.

During construction, fuel oil will be dispensed from tanks/drums to be located onsite to construction vehicles. Fuel for construction activities will be delivered to the site by fuel truck drivers, who will be required to receive spill plan training prior to beginning work. The trucks will be equipped with oil spill response materials. Each transfer will be documented. Implementing management controls should minimize the potential for adverse impacts due to spills during site construction.

During construction all contractors, technicians and laborers will be required to implement practices to minimize the potential for spills of fuels or chemicals. Maintenance will be performed only in designated areas. In the unlikely event that spills do occur, they will be managed in accordance with the project's Environmental Management Plan (EMP).

To further minimize potential environmental impacts it is recommended that full-time environmental monitoring is conducted during construction, particularly during all refueling operations to minimize potential concern. The environmental monitoring could be under the environmental safety department or a member of the safety department with the authority of "stopping the job" in the event that noncompliance of environmental regulation is being observed. The proposed project includes the installation of supply tube-wells. The actual depths of the supply will be based upon the results of the geotechnical study and will take into account the occurrence of the local aquifer.

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

6.5 SOLID WASTE

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

- Bricks waste
- Waste from Quality Control

- Paper bags
- Used oil/lubricants
- Metal/wooden waste
- Empty drums or containers
- Cotton rags

Miscellaneous waste: Miscellaneous solid wastes include a host of items like batteries, tires, tubes, filters, belts, nylon strips, scrap wood, steel scrap, house hold articles etc., which will be sold in the market through scrap dealers.

During the site clearance stage, it is anticipated that relatively large quantities of solid waste would be generated consisting of top-soil and sub-soil. The generation and disposal of site wastes is not considered to be a problem. Part of the excavated material would be used for leveling and grading and the balance would be stockpiled at designated locations on the site.

During trenching any construction waste not utilized as fill material during trenching activities should be removed from the route and properly disposed. The trenching route should be restored to its original condition, prior to alteration by the project. In addition, all solid waste and surplus materials should be removed from the project site and properly disposed.

However, while disposing any waste material, all environmental aspects/impacts of such wastes should be communicated clearly to the concerned contractor. Record of all such sales should be maintained for later use if and when required.

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

6.6 NOISE IMPACT

Construction of the proposed project is expected to take place for about 6 months, with varying degrees of activity occurring during different phases of construction. Construction phases are expected to include excavation, concrete pouring, steel erection, mechanical/electrical installation and cleanup.

Noise is generated by operation of heavy equipment and increased frequency of vehicular traffic in the area during construction activities. Vibration levels will also increase due to these activities. However, these impacts are short term, intermittent and temporary in nature and are not likely to be felt outside the boundary of the proposed project. The exact noise levels are a complex function of variables such as the actual noise levels emitted from each major noise emitting equipment, their location and orientation within the construction area, and their operation and load.The adjoining localities are likely outside the range of impact of noise emissions due to construction activities. It is assumed that the relevant National and International standards will be met.

Overall, the impact of noise generated during construction on the environment is temporary and mainly confined to daylight hours. It is anticipated that it will be possible to reduce noise impacts during construction to an acceptable minimum.

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

Fire Risk

Fire and explosion hazard impacts are not expected during the construction phase due to the limited quantities of flammable and combustible materials to be imported to the site. The availability and use of portable extinguishing systems would limit the impacts of small fires, and personnel will receive training on the proper use and locations of this equipment. During construction, any waste disposal burning will be conducted in a cleared and dedicated area under controlled conditions, on those days when ambient air conditions will not permit embers to drift into the surroundings

6.7 ECOLOGICAL IMPACTS

Terrestrial Systems

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

Fauna and Flora

Site preparation for the plant does not require any clearing of vegetation but ground excavation will be necessary. The construction area is not perceived as including sensitive habitats. Under normal dry weather conditions, a significant amount of dust will be thrown up by excavating activities. Hence, vegetation and animal habitats in the vicinity of the site and roads will be affected by wind-blown dust and its deposition. The contribution to the natural dust concentration in the air will only be of significance at the beginning of the construction phase, during the main excavation activities. During this period, dust can be expected to settle on plant leaves and aerial roots, which could hinder air exchange and assimilation by the plants.

The temporarily increased vehicular traffic coupled with high noise levels due to various construction activities may also have some negative impacts on animals. Especially birds and other acoustically orientated animals living in the vicinity of the site and the roads used can be disturbed by noise. Disturbances during the period of construction could drive noise sensitive bird species from their habitats, but these are expected to return after construction has finished. No endangered species were found in the construction area. During the visual inspections of the site no nests or nesting was observed. No birds or wild animals were discerned in the site vicinity. Accordingly, during the construction phase of the project, birds would likely relocate to undisturbed areas.

The influence of dust is unavoidable but mainly restricted to the first period of the construction phase. No major impacts by dust and noise on the flora and fauna in the vicinity of the site and the used roads are to be expected. The construction related impacts on offshore fauna and flora may be considered to be low.

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

6.8 IMPACTS ON HUMAN POPULATION

Construction related noise is not anticipated to be a significant concern to the nearest receptor outside the project site boundaries. The construction activity will normally occur during daylight hours and will run one shift per day. In addition, any excessive noise generated by construction related activities will be short term and short duration, and will generally not exceed the World Bank noise guidelines.

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

Traffic Impact

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

6.9 SOCIO-ECONOMIC IMPACTS

Most of construction workers are anticipated to be hired from the nearby where the project site is located. In addition, general contractors/vendors, consultants and engineers from within the province/country will provide technical and specialized services. The construction impacts on the local employment opportunities are beneficial, although relatively short term. Indirect employment in the local area will also occur primarily in retail, eating and drinking establishments. During construction of the plant employment opportunities will be created both for skilled and unskilled local workers.

Extent of Socio-Economic Impact = ▼▼ (locally favorable)

Public Services and Facilities

Construction related impacts to public services and facilities, such as police, fire, and medical services and water, wastewater and solid waste disposal are not expected to be significant. With minimal relocations to the project area expected, existing facilities and services will be adequate to meet the

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

demands on these services. The selected general contractor will be responsible for removing and disposing of construction related debris.

Cultural Resource Impacts

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

Table 6.1: Checklist of Action Affecting Environment and Significance of their Impact

Actions Affecting Environment Resources & Values	Damage to Environment	Recommended Mitigation Measures	Significance of Impact
A. Environmental Problems due to Project Location			
1. Changes in hydrology affecting existing property values of land	1. Damages to land due to erosion and/or accretion	1. Careful design and planning to minimize / offset problem	O
2. Changes in drainage pattern	2. Damages due to changes in flooding / accretion, erosion hazards	2. Careful design to minimize / offset problem	▲
2a. Stream Flow Obstruction	2a. Conflicts with other beneficial water uses	2a. Appropriate sharing of water rights	O
3. Changes in land uses	3. Possible loss in overall regional welfare	3. Careful planning	O
4. Encroachment into precious ecological zones	4. Loss of precious ecology	4. Careful planning	O
5. Displacement of population / Resettlement	5. Social inequities / compensation	5. Adequate attention to problem	O

6. Historical / monuments / cultural values	6. Loss of precious values	6. Careful planning to minimize / offset problem	O
7. Environmental aesthetics	7. Loss of environmental aesthetics	7. Careful planning and monitoring	O
Actions Affecting Environment Resources and Values	**Damage to Environment**	**Recommended Mitigation Measures**	**Significance of Impact**
B. Environmental Problems due to Inadequate Design			
1. Unrealistic assumptions on available O & M skills	1. Unnecessary damages because O & M requirements too high	1. Realistic O & M assumptions	O
2. Pollution Control Equipment Selection	2. Assumed pollution removals not realized	2. Appropriate equipments selection	O
3. Environmental pollution control operations	3. Possible loss in overall regional welfare	3. Careful planning / designing / monitoring and use of appropriate standards	O
3a. Surface water (fresh / Canal)	3a. Impairment of downstream beneficial water uses	3a. Careful planning & monitoring	O
3b. Groundwater (Tube well)	3b. Impairment of beneficial water uses	3b. Careful planning & monitoring	O
3c. Air	3c. Impairment of air quality	3c. Careful planning & monitoring	▲
3d. Noise	3d. Environmental Degrading & Health Hazard	3d. Careful planning & monitoring	▲
4. Impacts on adjacent land economic users including recreation / tourism	4. Impairment of land uses	4. Careful Planning / O & M	▲

5. Occupational Health & Safety Hazards	5. Hazards to workers health and safety	5. Careful planning to offset problem	▲
6. Hazards due to Spills / fires / explosions	6. Hazards to workers health and safety	6. Careful planning and management of pollution control	▲
7. Area Sanitation	7. Sanitation / Disease hazards	7. Careful planning / design	▲
8. Handling routes in/out areas	8. Traffic congestion and nuisances along access routes	8. Careful planning & monitoring	O
Actions Affecting Environment Resources & Values	**Damage to Environment**	**Recommended Mitigation Measures**	**Significance of impact**
C. Environmental Problems During Construction stage			
1. Problems due to uncontrolled construction practices e.g. scarring	1. Problems of Environmental Degradation	1. Careful planning and Implementation	▲
a) Run off erosion	(a) Problems of Environmental Degradation	a) Careful Planning and Implementation	▲
b) Workers accidents	b) Problems of Environmental Degradation	b) Careful planning and Implementation	▲
c) Sanitation disease hazards	c) Problems of Environmental Degradation	c) Careful planning and implementation	▲
d) Insect vector disease hazards	(d) Problems of Environmental Degradation	d) Careful Planning and Implementation	▲
e) Hazardous material handling	e) Problems of Environmental	e) Careful planning and implementation	▲

	Degradation		
f) Dust/odors/fume	f) Problems of Environmental Degradation	f) Careful planning and implementation	▲
g) Explosion / fire hazards / hazardous materials spills	g) Problems of Environmental Degradation	g) Careful Planning and implementation and Monitoring	▲
h) Noise / Vibration hazards	h) Problems of Environmental Degradation	h) Careful Planning and Implementation	▲
i) Trenching / quarrying / blasting hazards	i) Problems of Environmental Degradation and Trapping of Wildlife	i) Careful Planning implementation and Monitoring	▲
j) Machinery & Equipment Mobilization	j) Problems of Environmental Degradation	j) Careful planning and implementation	▲
k) Water pollution hazards	k) Problems of Environmental Degradation	k) Careful Planning of passage and Implementation	X
l) Blockage of wildlife passageways	l) Problems of Environmental Degradation	l) Careful planning and Implementation	O
2. Uncovered cut and fill tranches / areas	2. Soil erosion, consequent damage to properties and environment, besides trapping of wildlife	2. Careful planning and implementation	▲
2. Inadequate construction monitoring	2. Encourages poor construction practices	2. Adequate monitoring during construction	▲

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

Action Affecting Environment Resources and Values	Damage to Environment	Recommended Mitigation Measures	Significances of Impact
D. Environment Hazards Relating to Operations			
1. Inadequate O & M	1. Variety of environmental degradation similar to items B.1 to 8	1. Adequate O & M	▲
2. Inadequate operations phase / environmental monitoring	2. Opportunity loss for feedback connections to project design and O & M	2. Adequate monitoring	▲
3. Occupational Health & Safety Programmes including accidents	3. Hazards to workers health and Safety	3. Careful O & M including readiness for emergency	▲
4. Nuisance from handling and Transportation of fuels on access roads	4. Oil drips, spills, dust and noise hazards	4. Careful O & M including safe driving and Monitoring	▲
5. Surface run off from site/campsite	5. Leakage of fuel on ground & oil drips	5. Adequate O & M / Monitoring	▲
Actions Affecting Environment Resources & Values	**Damage to Environment**	**Recommended Mitigation Measures**	**Significance of Impact**
E. Critical Environmental Review Criteria			
1. Loss of irreplaceable resources	1. Long-term national environmental and economic Losses	1. Planning required to be consistent with government policies	▲

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

2. Accelerated use of resources for short term gain	2. Long-term national environmental and economic losses	2. Planning required to be consistent with policies	▲
3. Endangering of Species	3. Long-term environmental losses	3. Planning to be consistent with policies	O
4. Promoting undesirable rural-urban mitigation	4. Intensification of national economic problems	4. Planning to be consistent with policies	O
5. Increase in affluence/poor income gap	5. Intensification of national socioeconomic imbalances	5. Planning to be consistent with policies	O
Actions Affecting Environment Resources & Values	**Damage to Environment**	**Recommended Mitigation Measures**	**Significance of Impact**
F. Potential Environmental Problems During Operation			
1. Removal or damage to vegetative growth	1. Problem at preparation of site & during operation	1. Careful implementation of EMP	▲
2. Land Use Changes	2. Problem at Preparation of site, construction, commissioning & during operation	2. Careful implementation of EMP	▲
3. Micro level changes in the human settlements	3. Problem at siting & Operation stage	3. Careful implementation of EMP	O
4. Industrial & Transportation Activities	4. Problem at Operation Stage	4. Careful implementation of EMP including Traffic Management	▲
5. Emergence of Slums & Wayside Commercial	5. Problem at Construction &	5. Careful implementation of EMP	O

Activity	Operation Stage		
Actions Affecting Environment Resources and Values	**Damage to Environment**	**Recommended Mitigation Measures**	**Significance of Impact**
G. Impacts from Operation of RPPs			
1. Environment health hazard due to Operation Activities	1. Unnecessary exposure of workers to environmental hazards	1. Careful planning, training of workers	▲
2. Depreciation of environmental aesthetics	2. Loss of values	2. Careful planning and implementation	▲
3. Encroachment on ecosystem	3. Loss of precious ecology	3. Careful planning	▲
Overall Significance of Impact of Different Activities			▲

Chapter
Seven

ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

Chapter 6 has identified a number of impacts that are likely to arise. Where adverse impacts have been identified, the IEE has examined the extent to which these impacts would be mitigated through the adoption of industry standard practice and guidelines and following legislative requirements of the Sindh Environmental Protection Act (SEPA). The Environmental Management Plan (EMP) describes both generic good practice measures and site specific measures, the implementation of which is aimed at mitigating potential impacts associated with the proposed activities.

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. A project may have identified proper mitigation measures but without a management plan to execute it, the desired results may not be obtained. The present chapter on Environment Management Plan envisages proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities

The following issues have been addressed in this EMP:

- Mitigation measures for abatement of the undesirable impacts caused during construction and operation stages
- Details of management plans
- Institutional set up for implementation of the EMP commissioning of the project
- Expenditures for environmental protection measures.

EMP included four major elements:

1. **Commitment and Policy:** The project will strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, land and water.
2. **Planning:** This includes identification of environmental impacts, legal requirements, and setting environmental objectives.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

3. **Implementation:** This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.
4. **Measurement and evaluation:** This includes monitoring, corrective actions, and record keeping.

The EMP's that will be put into place consist of those during construction and operating stages of the project and includes the following elements:

- Water Management,
- Hazardous and Solid Waste Management,
- Air Pollution Control and Management
- Noise Control and Management,
- Storm Water Management,
- Land Management and plantation
- Occupational, Safety and Health Issues,
- Best Management Practices,,
- Environmental Monitoring,
- Emergency Response Plans for Emergency Scenarios,
- Environmental Management System.

7.2 IDENTIFICATION OF IMPLEMENTING AUTHORITY

The responsibility for the implementation of the EMP will be with the Promoter and Contractor (P & C).An environmental management cell (EMC) will be established by the Promoter and Contractor (P & C) for implementing the mitigation measures.

In addition, an Environmental Officer will be appointed by project authorities for management of the project with the objective of reviewing and assessing the progress made by the concession company in implementing the suggested mitigation measures.

Implementation of Recommended Mitigation Measures

The mitigation measure for the impact is made a part of proposed activities. The major instruments of environmental management will be monitoring performance of the construction by the EMC. The conditions, which must fulfilled documents, are suggested below:

- All necessary measures and precautions will be cited so that the execution of the works and all associated operations on site or off-site are carried out in conformity with statutory and regulatory environmental requirements.
- Necessary measures and precautions to avoid nuisance or disturbance arising from the execution of the works will be included, preferably at the source itself.
- Wastes such as spoil or debris or silt from the sites will be immediately removed and the affected areas will be restored to their original state.

Objective

Environmental management and monitoring is an activity to be undertaken by the administration over the entire cycle showing its commitment towards meeting environmental regulations/standards and good housekeeping practices as well as maintaining health and safety standards. The environmental management and monitoring programs are implemented from the very early stages of planning and execution phases. Infect the authorization of the company is the point of initiation of environmental management plan. The monitoring data, observations recorded and test results/analysis are vital and formulate legal documents to be kept in safe custody and may be provided to competent authority as and when required in accordance to Sindh Environmental Protection Act (SEPA) 2014.

The primary objective of this EMP is to establish and implement the Environment, Health & Safety Protection Procedure in its best spirit through the company staff at operational level. Faran Power Ltd (the proponent) has committed for developing and implementing a comprehensive EMP to help ensure a high level of environmental protection throughout this undertaking. This EMP provides the procedures and mitigation matrix for the production of Fiber.

Purpose

Outline environmental protection measures to be followed during operation:

- Ensure that commitments to minimize environmental impacts are met;
- Document environmental concerns and appropriate protection measures;
- Provide concise and clear instructions to company personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact;

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

- Provide a reference document for personnel when planning and/or conducting specific activities;
- Provides contingency plans for accidental events;
- Communicate changes in the program through the revision process; and
- Post implementation phase monitoring.

Scope and outlines

To ensure a holistic framework for the management of the environmental impacts, during the planning, design and construction phases of the Faran Power Ltd. project, the EMP initially sets out general environmental requirements, which are applicable to these phases of the project.

The EMP also contains a series of project environmental specifications designed to avoid, minimize and ultimately manage the potential environmental impacts of the Faran Power Ltd. project during the planning, design and construction phases of the project.

Environmental impacts anticipated during the operational and maintenance phase of the project will be managed in terms of an Environmental Management System (EMS), which the Concessionaire is required to implement. This EMP does not cover decommissioning and closure environmental requirements since the commission period will span approximately 30 years and it is expected that a further period may be negotiated thereafter. Given the expected lifespan of such an investment and facility, decommissioning or closure cannot be envisaged for a long time to come.

This is the main step to identify the areas for environmental management and priorities to be given based on the risk involved. Following criterions will be used to determine priorities for attention:

- Impact on physical and biological environment of the area;
- Contribution to innovation and definition of best environment practice;
- Compliance with statutory requirements and other environmental commitments;
- Availability of resources (for environmental management).

EMP acknowledges the social and cultural dimensions of responsible environmental management alongside the biological and physical aspects reflecting a holistic view as a "human ecosystem".

The Scope of EMP includes the following functional areas:

7.3 CONSTRUCTION PHASE

Environment impacts during construction phase involve site preparation, transportation of construction materials and equipment and construction of the infrastructure. However, this is not a long-term impact as this is a temporary phase.

From the above activity, it is envisaged that there will be some effect on the existing environment. To minimize these impacts, the proponent will undertake all preventive and remedial measures, which are outlined hereunder. Following control measures are recommended to mitigate the probable adverse impacts.

Site Management Plan

During the construction phase, as soon as construction is over, the construction waste will be disposed through authorized contractor.

Air Quality Management

During construction period, there is likelihood of generation of dust and NOx emissions. This can be attributed to leveling activity and vehicular movement. The transport vehicles should be properly maintained to minimize smoke in the exhaust.

Water sprinkling is suggested to address this issue. Since there is likelihood of fugitive dust from the construction activity, material handling and from the truck movement in the premises, following are the measures to be taken during construction phase.

Sprinkling of water shall be done. Construction equipment shall be maintained and serviced regularly such that the gaseous emissions from this equipment are maintained within the design specifications; and Construction activities shall be restricted to daytime only as much as possible to minimize disturbance during nighttime.

Water Quality Management

The raw water for the various purposes will be supply from site water supply. Proper Construction methodologies will be adopted in order to avoid any nuisance.

FARAN POWER LIMITED KARACHI

Environmental Total Solutions

- To maintain balanced, holistic approach to the solution of concerned issues in accordance with the compliance to the legislative requirements;
- To provide professional guidance on questions relating to the environment management and issues raised by contractors/ relevant personals;

To progress of the EMP process through development towards implementation.

Hierarchy of prevention

Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (also known as the Framework Directive), is a European Union directive that sets out general principles for protection of workers' Occupational safety and health. It provides the enabling framework for a number of other individual directives concerned with specific aspects of health and safety.

Personal Protective Equipments

Protection for	Equipment Protection	Against
HEAD	Safety Helmet Electric resistance helmet. Welder's leather cap	Fall of objects/hitting against objects During maintenance, etc. Electric shock. Splashing of liquid etc.
EYE	Panorama goggles with clear plastic Vision. Spectacle-type goggles with blue lens	Oil & paint splashes, dust, chips High temperature flame during furnace work
EAR	Ear plugs or muffs	High noise level
NOSE	Dust mask, fumes mask, oxygen mask & air mask.	Fine dust particles, fumes and gas.
FACE	Welding helmet and	Welding fumes, sparks and UV rays.

	shield	
BODY	Apron	Falling of hot chips, slag, etc.
	Safety belt	Falling of persons from height
	Hand gloves	Heat radiation
	Electric resistance gloves	Electric shocks
	Canvas gloves	Contact with oil, grease, etc.
LEG	Safety shoes	Striking by objects, fall of objects and stepping on sharp or on hot objects.

The general principles of prevention set out in Article 6(2) of Council Directive 89/391/EEC) are specified in the following schedule:

- Avoiding risks;
- Evaluating the risks which cannot be avoided;
- Combating the risks at source;
- Adapting the work to the individual, especially as regards the design of workplaces, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health;
- Adapting to technical progress;
- Replacing the dangerous by the non-dangerous or the less dangerous;
- Developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors relating to the working environment;
- Giving collective protective measures priority over individual protective measures; and
- Giving appropriate instructions to employees.

For making this brochure aiming the reduction of chemicals exposure in woodworking industries, the following general safety guidelines were always taken into account: hazard prevention and hazard control.

7.9 HAZARD PREVENTION

Three methods are used to control the impact of hazards. The first, and preferred, is to prevent the hazard at the design stage. The second is to identify and eliminate existing hazards. The third is to reduce the likelihood and severity of mishaps from hazards that cannot be eliminated.

Hazards may be prevented through appropriate actions during the design process, when operating procedures are developed, and when equipment is purchased. The hazard would never exist if we anticipated problems and eliminated them before they reached the worker.

Hazard control

When hazard prevention is not possible, one must control their effects by reducing the severity of the hazards. Several methods to control hazard possibilities exist. These methods are developed into benchmarks in the following order:

- Reduction through engineering &warnings;
- Reduction through practices at organizational level, and
- Reduction through protective equipment.

Chapter

Eight SUMMARY AND CONCLUSION

8.1 GENERAL

An Initial Environmental Examination report has been prepared for cogeneration power plant based on existing baseline environmental quality data, Identification and prediction of significant environmental impacts due to the proposed activity followed by delineation of appropriate impact mitigation measures and suggestion for implementing this measure by preparing an Environmental Management Plan (EMP).

8.2 PROLOGUE

- The land is acquired from the existing area of Faran Sugar Mills Ltd. Proposed project will be in existing available area; therefore issues related to land acquisition, displacement of people etc do not arise.
- Use of latest technology and modernization will lead to energy saving, cost effective and efficient process.
- Cogeneration plant using biomass will solve problem of baggasse disposal.
- Recycle and reuse of bagasse in boiler have added advantage of pollution control as ash and sulfur content is very low.
- Water requirements of the plant will be met form the existing tube well facility
- Energy produce from cogeneration plant will be supplied to national grid

During the environmental examination study, all possible environmental aspects have been adequately addressed and necessary control measures have been suggested to meet with statutory requirements.

The proposed project will contribute to economic growth in indirect way and may help in meeting the increasing demands of power if proved to be economically beneficial for future production.

Environmental setting Base line data for environmental aspects like air, water, soil, land use land cover was collected from the plant location. Ecological conditions were studied in within 10km radius there is no reserve forest, natural park or wildlife sanctuary in this area. The area is flat and no recorded sites of archaeological importance exist. Socio economic study was carried out through primary survey and secondary information from census report. Meteorological data was obtained and Wind rose was drawn and according to wind condition.

Ambient air quality was measured from the project area. All parameter values were within SEQS limits. Similarly noise measured from project location in the study area was within prescribed regulation.

Environmental Assessment

Environmental Assessment has been carried out component wise. Mitigation measures are described in detail for each environmental aspect. The proposed Project brings in multifold advantages. Not only does it produce clean, pollution free energy, by adopting environmental friendly and latest technology. Design criteria for power plant are arrived at with best available alternative. Project also has the capacity to provide employment to the people living in and around that area.

Environmental & Management Monitoring Program

Environment monitoring program has been delineated to confirm all the compliances as per the statutory requirement and minimize environmental risk and to identify unexpected changes in the operation of the plant. The post project monitoring program is suggested to keep all the environmental parameters under control throughout the operation of various processes. Cost for environmental monitoring plan has also been computed.

8.3 CONCLUDING REMARKS

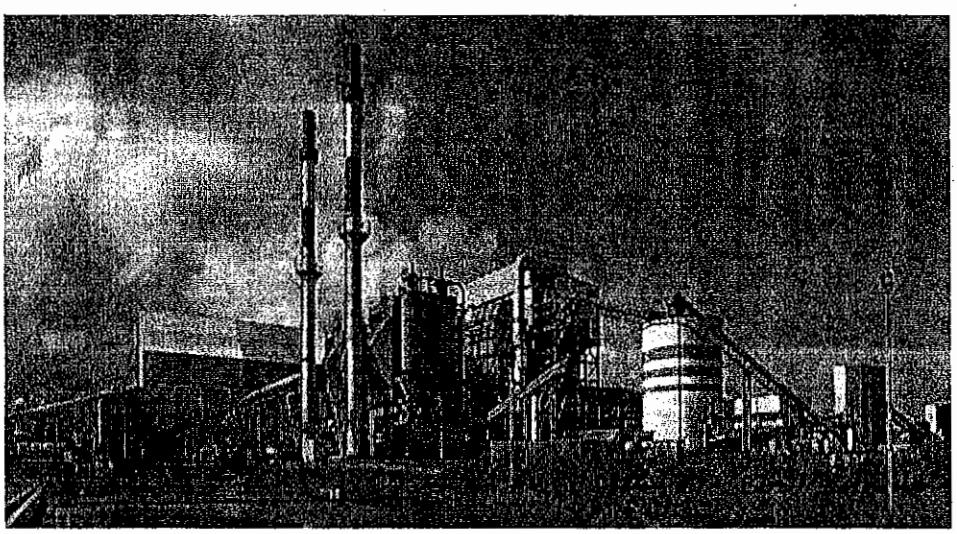
Occupational, safety, health and environmental protection policy has been given to have safe operations in the plant. Green belt development, provision of rain water harvesting structure, corporate social responsibility and occupational health surveillance program has been emphasized to have better environmental statues in and around the plant premises. Environmental Management Plan has been described to facilitate effective management to control mitigation measures during operation storage handling and transportation of materials and products. Manpower requirement has been identified to control all environmental and legislative issues related to the industry.

Report No. PPI-227.2-Final/17

INTERCONNECTION STUDY

For

26.5 MW Faran Power Limited at Faran Sugar Mills, Shaikh Bhirkio, District Tando Muhammad Khan, Sindh



Final Report
(January 2017)

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, Pakistan
Phone: +92-42-35182834-35;
Fax: + 92-42-35183166

Email: info@powerplannersint.com
www.powerplannersint.com

FARAN POWER LIMITED KARACHI

Executive Summary

- The Final Report for interconnection of 26.5 MW Faran Power Limited (FPL) Bagasse Cogeneration Power Plant at Faran Sugar Mills with HESCO grid system is submitted herewith.
- Faran Power Limited would like to go for high pressure cogeneration with the aim of exporting a maximum of 23.12 MW electrical power to the national grid.
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated. The network around Faran Power Limited (referred to as FPL in the remainder of the report) at 132 kV and 11 kV has been modeled as shown in Appendix-B (Sketch-1).
- The nearest HESCO grid facilities available for interconnection to FPL are Chamber 132 kV Grid Station and Shaikh Bhirkio 132 kV Grid Station.
- Keeping in view the location of Power Project, it is proposed to connect Faran Power Limited via looping In-Out of the existing Transmission Line from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station. The looping distance as confirmed from site visit would be 2 km and the conductor used would be Lynx. Moreover, it is also suggested that stringing of the second circuit from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station should also be carried out on the already available double STG tower to fulfill the N-1 criteria. The scheme is shown in Sketch-2 in Appendix-B.
- FPL would generate power at 11 kV voltage level from where it is stepped-up to 132 kV using two 132/11 kV transformers with rating of 31.5/40 MVA.
- The proposed scheme would require two 132 kV line bays at the 132 kV substation of FPL for the connection to 132 kV Chamber grid station and Shaikh Bhirkio 132 kV grid station. Furthermore it would also require two transformer bays for the connection of two 132/11 kV transformers with rating of 31.5/40 MVA.
- With the gross capacity of 26.5 MW, the spillover from FPL would be 23.12 MW in Off-Season and 15.87 MW in the Crushing Season.
- In view of planned COD of FPL in October 2018, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of

- January 2019 for maximum thermal power dispatches in the grid during the Crushing Season for FPL.
- September 2019 for maximum hydropower dispatches in the grid during the off-season for FPL.

The system conditions of normal and N-1 contingency have been studied to meet the reliability criteria of NEPRA Grid Code.

- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2021 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover of up to 23.12 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at FPL and the substations of 132 kV in its vicinity. We find that the fault currents for the proposed scheme are within the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from FPL.
- The maximum short circuit levels of FPL 132 kV is 4.56 kA and 4.60 kA for 3-phase and 1-phase faults respectively for the Year 2019 and 4.73 kA and 5.01 kA for 3-phase and 1-phase faults respectively for the Year 2021. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out for January 2019. The stability check for the worst case of three phase fault right on the 132 kV bus bar of FPL substation followed by the final trip of one 132 kV circuit emanating from this substation, has been performed for fault clearing of 5 (100 ms) and 9 cycles (180 ms), in case of stuck breaker, as understood to be the normal fault clearing time of 132 kV protection system. The stability of system for far end faults of 3-phase occurring at 132 kV bus bar have also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults for the most stringent cases. The system is found strong enough to stay stable and recovered with fast damping.

- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.

Report Contents

1. Introduction

1.1 Background

Faran Power Limited at Faran Sugar Mills would like to go for high pressure cogeneration with the aim of exporting spillover power to the National Grid. The electricity generated from this project would be supplied to the grid system of HESCO through 132 kV grids available in the vicinity of this project. The nearest grid facility is Chamber 132 kV Grid Station and Shaikh Bhirkio 132 kV Grid Station as shown in Sketch-1 in Appendix-B.

1.2 Objectives

The overall objective of the Study is to evolve an interconnection scheme between FPL and HESCO network, for stable and reliable evacuation of the electrical power generated from this plant, fulfilling N-1 reliability criteria. The specific objectives of this report are:

1. To develop scheme of interconnections at 132 kV for which right of way (ROW) and space at the terminal substations would be available.
2. To determine the performance of interconnection scheme during steady state conditions of system, normal and N-1 contingency, through load-flow analysis.
3. To check if the contribution of fault current from this new plant 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 FPL.
4. 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

Short Circuit:

Substation Equipment Rating for 132 kV should be 31.5 kA or 40 kA.

Dynamic/Transient:

The system should revert back to normal condition after dying out of transients without loosing synchronism with good damping after 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.

In case of failure of primary protection (stuck breaker case), the total fault clearing time from the instant of initiation of fault current to the complete interruption of current to isolate the faulted element, including the primary protection plus the backup protection to operate and isolate the fault, is equal to 180 ms (9 cycles) for 132 kV and higher voltage levels.

2. Technical Data

The number of generating units at FPL is one. The following data have been provided by the Client:

2.1 FPL data

Generator data:

Gross capacity of power plant	= 1x26.5 = 26.5 MW
Lump sum MVA capacity	= 1x33.125 = 33.125 MVA
Generating Voltage	= 11 kV
Power factor	= 0.80 lagging
Crushing Season:	
Load + Auxiliary Consumption	= 10.63 MW
Spillover to the Grid	= 15.87 MW
Off-Season:	
Load + Auxiliary Consumption	= 3.37 MW
Spillover to the Grid	= 23.12 MW
GSU Transformer	= 31.5/40 MVA (x2)
GSU Transformer reactance	= 12.5 %

2.2 Network data

The latest Generation Expansion Plan and Load Forecast has been used as provided by NTDC and is shown in Appendix-A.

The 132 kV network in the area near FPL are as shown in Sketches in Appendix-B.

The system data of HESCO has been used as already available with PPI.

3. Study Approach and Methodology

3.1 Understanding of the Problem

Faran Power Limited at Faran Sugar Mills would like to go for high pressure cogeneration with the aim of exporting a maximum of 23.12 MW supply to the grid during the Off-Season and 15.87 MW in Crushing Season. The proposed Power Project is going to be embedded in the transmission network of HESCO through this nearest available 132 kV network.

The adequacy of HESCO network of 132 kV in and around the proposed site of FPL has been investigated in this study for absorbing and transmitting this power fulfilling the reliability criteria.

3.2 Approach to the problem

The consultant has applied the following approaches to the problem:

- A base case network model has been prepared for January 2019 (Crushing Season) and September 2019 (Off-Season) after the commissioning of FPL in October 2018, comprising all 500 kV, 220 kV and 132 kV system, envisaging the load forecast, the generation additions and transmission expansions for that year particularly in HESCO.
- Month of January 2019 and September 2019, while representing Crushing Season and Off-Season respectively, also represent low water and high water conditions respectively in the grid system. Thus both the high water and low water flow patterns can be observed allowing us to judge the maximum impact of the plant on the transmission system in its vicinity. In addition, case for extended term scenario of the year 2021 has also been studied.
- 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

Faran Power Limited at Faran Sugar Mills is located near Shaikh Bhirkio, District Tando Muhammad Khan embedded in the distribution network of HESCO. The existing 132 kV network available around FPL is shown in Sketch-1 in Appendix-B. The nearest interconnection facilities of HESCO at time of commissioning of FPL would be as follows:

- 132 kV Chamber Grid Station
- 132 kV Shaikh Bhirkio Grid Station

The system around FPL has another co-generation power plant in the vicinity i.e. Mehran Sugar Mills PP. There is a strong 220 kV network in the vicinity connecting Hala Road 220/132 kV grid station with Jamshoro 220 kV, T.M.Khan 220 kV and Mirpur Khas 220 kV substations. A strong system helps in stable operation of a power plant.

4.2 The Scheme of Interconnection of FPL

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of the FPL, the interconnection scheme for FPL has been developed. According to the new scheme, it is proposed to connect Faran Power Limited via looping In-Out of the existing Transmission Line from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station. The looping distance as confirmed from site visit would be 2 km and the conductor used would be Lynx. Moreover, it is also suggested that stringing of the second circuit from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station should also be carried out on the already available double STG tower to fulfill the N-1 criteria. The scheme is shown in Sketch-2 in Appendix-B. The network of FPL has been modeled at 132 kV and 11 kV.

5. Detailed Load Flow Studies

5.1 Peak Case Load Flow January 2019, without FPL

A base case has been developed for the peak load of January 2019 using the network data of NTDC and HESCO available with PPI, after updating with latest load forecast and expansion plan of NTDC and HESCO. The peak load of the year 2018-19 for HESCO has been modeled as per the latest PMS Demand forecast obtained from NTDC.

The results of load flow for this base case are plotted in Exhibit 0.0 of Appendix-C. The system plotted in this Exhibit comprises of 132 kV network feeding Hala Road, Tando Jam, Tando Allah Yar, Chamber, Mirpur Khas and the surrounding areas.

The load flow results show that the power flows on all the circuits are within their normal rating. The voltage profile of these surrounding substations is also within normal limits.

For N-1 contingency conditions we have performed the following cases

Exhibit 0.1	Trip Chamber to T.A.Yar 132 kV Single Circuit
Exhibit 0.2	Trip Tando Jam to Chamber 132 kV Single Circuit
Exhibit 0.3	Trip Tando Jam to T.A.Yar 132 kV Single Circuit
Exhibit 0.4	Trip Hala Road to Tando Jam 132 kV Single Circuit
Exhibit 0.5	Trip T.A.Yar to Mirpur Khas 132 kV Single Circuit

We see that in all the cases the power flows on all circuits remain within their rated limit. Also the bus voltages are within the acceptable operating range.

5.2 Peak Case Load Flow January 2019, with FPL in Crushing Season

The scheme of interconnection modeled in the load flow for FPL is as described in Chapter-4.

Load flow studies have been carried out for January 2019 because it represents the maximum thermal power dispatch conditions in the grid during the Crushing Season condition for FPL. Thus the loading on the lines in the vicinity of FPL will be

maximum, allowing us to judge the maximum impact of the plant on the transmission system in its vicinity. The results of load flow with FPL interconnected as per proposed scheme are shown in Appendix-C.

The results of Normal case of Peak January 2019 are plotted in Exhibit 1.0. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

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.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows;

Exhibit 1.1	Trip Faran 132/11 kV Single Transformer
Exhibit 1.2	Trip Faran to Chamber 132 kV Single Circuit
Exhibit 1.3	Trip Faran to Shaikh Bhirkio 132 kV Single Circuit
Exhibit 1.4	Trip Shaikh Bhirkio to Chamber 132 kV Single Circuit
Exhibit 1.5	Trip Chamber to T.A.Yar 132 kV Single Circuit
Exhibit 1.6	Trip Tando Jam to T.A.Yar 132 kV Single Circuit
Exhibit 1.7	Trip Hala Road-1 to Tando Jam 132 kV Single Circuit
Exhibit 1.8	Trip T.A.Yar to Mirpur Khas 132 kV Single Circuit

We see that in all the contingency cases, in the event of outage of any circuit, the intact circuits remain within the rated capacity.

Also the bus bar voltages are well within the permissible limits in all the contingency events.

5.3 Peak Case Load Flow September 2019, with FPL in Off-Season

The scheme of interconnection modeled in the load flow for FPL is as described in Chapter-4.

Load flow studies have been carried out for September because it represents the maximum hydropower dispatch conditions in the grid during the Off-Season for FPL. The results of load flow with FPL interconnected as per proposed scheme are shown in Appendix-C.

The results of Normal case of Peak September 2019 are plotted in Exhibit 2.0. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

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.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows;

Exhibit 2.1	Trip Faran 132/11 kV Single Transformer
Exhibit 2.2	Trip Faran to Chamber 132 kV Single Circuit
Exhibit 2.3	Trip Faran to Shaikh Bhirkio 132 kV Single Circuit
Exhibit 2.4	Trip Shaikh Bhirkio to Chamber 132 kV Single Circuit
Exhibit 2.5	Trip Chamber to T.A.Yar 132 kV Single Circuit
Exhibit 2.6	Trip Tando Jam to T.A.Yar 132 kV Single Circuit
Exhibit 2.7	Trip Hala Road-1 to Tando Jam 132 kV Single Circuit
Exhibit 2.8	Trip T.A.Yar to Mirpur Khas 132 kV Single Circuit

We see that in all the contingency cases, in the event of outage of any circuit, the intact circuits remain within the rated capacity.

Also the bus bar voltages are well within the permissible limits in all the contingency events.

5.4 Peak Load Case 2021: Extended Term Scenario

We have also studied the future scenario of Year 2021 to assess the impact of the plant in the extended term.

The results of Normal case of Peak 2021 are plotted in Exhibit 3.0. 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	Trip Faran 132/11 kV Single Transformer
Exhibit 3.2	Trip Faran to Chamber 132 kV Single Circuit
Exhibit 3.3	Trip Faran to Shaikh Bhirkio 132 kV Single Circuit
Exhibit 3.4	Trip Shaikh Bhirkio to Chamber 132 kV Single Circuit
Exhibit 3.5	Trip Chamber to T.A.Yar 132 kV Single Circuit
Exhibit 3.6	Trip Tando Jam to T.A.Yar 132 kV Single Circuit
Exhibit 3.7	Trip Hala Road-1 to Tando Jam 132 kV Single Circuit
Exhibit 3.8	Trip T.A.Yar to Mirpur Khas 132 kV Single Circuit

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 of FPL.

5.5 Conclusion of Load Flow Analysis

The proposed interconnection scheme of FPL is adequate to evacuate the spillover electrical power from FPL under normal and contingency conditions tested for peak load conditions of January 2019, September 2019 and extended term scenario of the Year 2021. In all the normal and contingency cases, we find that the loading on the circuits remain within the rated capacity. Also the bus bar voltages are well within the permissible limits in all the normal and contingency events. Hence the proposed interconnection scheme of FPL has no constraints according to the Load Flow Analysis.

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 year 2019 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 Ch.2 of this report.

6.2 Fault Current Calculations without FPL – Year 2019

In order to assess the short circuit strength of the network of 132 kV without FPL for the grid of HESCO in the vicinity of the site of the Plant, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions. These levels will give us the idea of the fault levels without FPL and later on how much the contribution of fault current from FPL 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 i.e. Hala Road, Tando Jam, Tando Allah Yar, Chamber, Mirpur Khas and surrounding bus bars 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 which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-D for the 132 kV bus bars of our interest. The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 132 kV substations which normally are 20 kA, 25 kA or 31.5 kA for older substations and 40 kA for new substations.

Table-6.1
Maximum Short Circuit Levels without FPL - Year 2019

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
Chamber 132 kV	5.48	4.74
Shaikh Bhirkio 132 kV	3.17	2.64
Tandojam 132 kV	10.40	9.73
T. A. Yar 132 kV	9.34	9.13
Sultanabad 132 kV	11.72	11.38
Mirpurkhas 132 kV	14.15	15.33
Mirpurkhas-2 132 kV	9.84	10.16
Mirpurkhas PP 132 kV	8.98	9.18
Mir Wah Gurchani 132	6.54	5.94
Kot GM 132 kV	5.42	5.16
Usman Shah Huri 132 kV	6.28	5.65
Mehran 132 kV	6.94	6.82
Samaro 132 kV	6.14	6.43
Hala Road 132 kV	22.86	23.38
Hala Road-1 132 kV	15.98	16.34

6.3 Fault Current Calculations with FPL – Year 2019

Fault currents have been calculated for the electrical interconnection of proposed scheme. Fault types applied are three phase and single-phase at 132 kV bus bars of FPL itself and other bus bars of the 132 kV substations in the electrical vicinity of Hala Road, Tando Jam, Tando Allah Yar, Chamber and Mirpur Khas. The graphic results showing maximum 3-phase and 1-phase fault levels are indicated in Exhibit 4.1. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The 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 FPL 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 FPL – Year 2019

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
Faran 132 KV	4.66	4.95
Chamber 132 kV	6.16	5.91
Shaikh Bhirkio 132 kV	4.56	4.60
Tandojam 132 kV	10.82	10.08
T. A. Yar 132 kV	9.82	9.59
Sultanabad 132 kV	11.97	11.54
Mirpurkhas 132 kV	14.45	15.58
Mirpurkhas-2 132 kV	9.97	10.25
Mirpurkhas PP	9.08	9.25
Mir Wah Gurchani 132 kV	6.59	5.97
Kot GM 132 kV	5.45	5.18
Usman Shah Huri 132 kV	6.30	5.66
Mehran 132 kV	6.97	6.84
Samaro 132 kV	6.18	6.45
Hala Road 132 kV	22.92	23.42
Hala Road-1 132 kV	16.31	16.59

Comparison of Tables 6.1 and 6.2 show slight increase in short circuit levels for three-phase and single – phase faults due to connection of FPL on the 132 kV bus bars in its vicinity. We find that even after some increase, these fault levels are below the rated short circuit values of the equipment installed on these substations. The maximum short circuit level of FPL 132 kV is 4.56 kA and 4.60 kA for 3-phase and 1-phase faults respectively.

6.4 Fault Current Calculations with FPL – Year 2021

Fault currents have been calculated for the electrical interconnection of proposed scheme in the year 2021. Fault types applied are three phase and single-phase 132 kV bus bars of FPL itself and other bus bars of the 132 kV substations in the electrical vicinity of Hala Road, Tando Jam, Tando Allah Yar, Chamber and Mirpur Khas. 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 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 FPL are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.3

Table-6.3
Maximum Short Circuit Levels with FPL – Year 2021

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
Faran 132 KV	4.73	5.01
Chamber 132 kV	6.28	6.00
Shaikh Bhirkio 132 kV	4.63	4.66
Tandojam 132 kV	11.07	10.28
T. A. Yar 132 kV	10.14	9.84
Sultanabad 132 kV	12.67	12.10
Mirpurkhas 132 kV	15.50	16.62
Mirpurkhas-2 132 kV	10.45	10.64
Mirpurkhas PP 132 kV	9.48	9.56
Mir Wah Gurchani 132 kV	6.81	6.11
Kot GM 132 kV	5.58	5.28
Usman Shah Huri 132 kV	6.39	5.73
Mehran 132 kV	7.11	6.95
Samaro 132 kV	6.32	6.57
Hala Road 132 kV	22.59	23.29
Hala Road-1 132 kV	16.72	16.94

We find that the short circuit levels have increase a little more in the future scenario but are still below the rated short circuit values of the equipment installed on these substations. The maximum short circuit level of FPL 132 kV is 4.73 kA and 5.01 kA for 3-phase and 1-phase faults respectively. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.

6.5 Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of FPL there is no problem of violations of short circuit ratings of the already installed equipment on the 132 kV equipment of substations in the vicinity of FPL 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 FPL 132 kV is 4.56 kA and 4.60 kA for 3-phase and 1-phase faults respectively for the year 2019. The same values for the year 2021 are 4.73 kA and 5.01 kA. Therefore industry standard switchgear of the short circuit rating of 40 kA would be fine to be installed at 132 kV switchyard of FPL 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 Switchgear.

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 Ch.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 = 2.819 MW-sec/MVA

7.1.2 System Conditions

The proposed scheme as described in Chapter-4 has been modeled in the dynamic simulation.

All the power plants of WAPDA/NTDCL and IPPs 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 3-4 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 FPL i.e. right at the 132 kV bus bar of FPL substation, cleared in 5 cycles, as normal clearing time for 132 kV i.e.100 ms, followed by a permanent trip of single 132 kV circuit emanating from this substation.

7.2 Dynamic Stability Simulations' Results with FPL in Crushing Season

Three-phase faults were applied on 132 kV bus bars, followed by clearing of fault in 5 cycles (100 ms) or 9 cycles (180 ms) and then tripping of a circuit between the faulted bus and a nearby grid station. Different quantities were monitored for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and the results are plotted in Appendix – E. These fault locations and monitored quantities are discussed one by one as follows;

7.2.1

Fault Location: Three Phase Fault at FPL 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: FPL to Shaikh Bhirkio 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Faran 132 kV 2. Shaikh Bhirkio 132 kV 3. Chamber 132 kV 4. Tando Jam 132 kV 5. Hala Road-1 132 kV 6. Sultanabad 132 kV	The voltages of all the bus bars recover after fault clearance	1.1
Frequency	FPL 132 kV	Recovers after fault clearance	1.2
MW/MVAR Output of the Plant	FPL 11 kV	Recovers after damping down oscillations	1.3
Speed and $P_{mechanical}$ of the Plant	FPL 11 kV	Recovers after damping down oscillations	1.4
Line Flows (MW/MVAR)	FPL to Chamber 132 kV single circuit	Attains steady state value after damping of oscillations	1.5
Rotor Angles	1. FPL 11 kV 2. MEL PP 11 kV 3. Mir Wah 11 kV 4. MPKEL PP 11 kV 5. Jamshoro 220 kV 6. Hub 500 kV (reference angle)	Damps down and attain a steady state value	1.6

7.2.2

Fault Location: Single Phase Fault at FPL 132 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: FPL to Shaikh Bhirkio 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Faran 132 kV 2. Shaikh Bhirkio 132 kV 3. Chamber 132 kV 4. Tando Jam 132 kV 5. Hala Road-1 132 kV 6. Sultanabad 132 kV	The voltages of all the bus bars recover after fault clearance	2.1
Frequency	FPL 132 kV	Recovers after fault clearance	2.2
MW/MVAR Output of the Plant	FPL 11 kV	Recovers after damping down oscillations	2.3
Speed and $P_{mechanical}$ of the Plant	FPL 11 kV	Recovers after damping down oscillations	2.4
Line Flows (MW/MVAR)	FPL to Chamber 132 kV single circuit	Attains steady state value after damping of oscillations	2.5
Rotor Angles	1. FPL 11 kV 2. MEL PP 11 kV 3. Mir Wah 11 kV 4. MPKEL PP 11 kV 5. Jamshoro 220 kV 6. Hub 500 kV (reference angle)	Damps down and attain a steady state value	2.6

7.2.3

Fault Location: Three Phase Fault at Chamber 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Chamber to Tando Allah Yar 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Faran 132 kV 2. Shaikh Bhirkio 132 kV 3. Chamber 132 kV 4. Tando Jam 132 kV 5. Hala Road-1 132 kV 6. Sultanabad 132 kV	The voltages of all the bus bars recover after fault clearance	3.1
Frequency	FPL 132 kV	Recovers after	3.2

		fault clearance	
MW/MVAR Output of the Plant	FPL 11 kV	Recovers after damping down oscillations	3.3
Speed and $P_{mechanical}$ of the Plant	FPL 11 kV	Recovers after damping down oscillations	3.4
Line Flows (MW/MVAR)	Chamber to Tando Jam 132 kV intact single circuit	Attains steady state value after damping of oscillations	3.5
Rotor Angles	1. FPL 11 kV 2. MEL PP 11 kV 3. Mir Wah 11 kV 4. MPKEL PP 11 kV 5. Jamshoro 220 kV 6. Hub 500 kV (reference angle)	Damps down and attain a steady state value	3.6

7.3 Conclusion of Dynamic Stability Analysis

The results of dynamic stability 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 FPL. Therefore there is no problem of dynamic stability for interconnection of FPL; it fulfills all the criteria of dynamic stability.

8. Conclusions

- Grid Interconnection Study for 26.5 MW (Gross Capacity) Faran Power Limited at Faran Sugar Mills is carried out which is located near Shaikh Bhirkio, District Tando Muhammad Khan. The nearest HESCO grid facility available for interconnection to FPL is Chamber 132 kV Grid Station and Shaikh Bhirkio 132 kV Grid Station.
- Keeping in view the location of Power Project, it is proposed to connect Faran Power Limited via looping In-Out of the existing Transmission Line from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station. The looping distance as confirmed from site visit would be 2 km and the conductor used would be Lynx. Moreover, it is also suggested that stringing of the second circuit from 132 kV Chamber grid station to Shaikh Bhirkio 132 kV grid station should also be carried out on the already available double STG tower to fulfill the N-1 criteria. The scheme is shown in Sketch-2 in Appendix-B.
- FPL would generate power at 11 kV voltage level from where it is stepped-up to 132 kV using two 132/11 kV transformers with rating of 31.5/40 MVA.
- The proposed scheme would require two 132 kV line bays at the 132 kV substation of FPL for the connection to 132 kV Chamber grid station and Shaikh Bhirkio 132 kV grid station. Furthermore it would also require two transformer bays for the connection of two 132/11 kV transformers with rating of 31.5/40 MVA.
- With the gross capacity of 26.5 MW, the spillover from FPL would be 23.12 MW in Off-Season and 15.87 MW in the Crushing Season.
- In view of planned COD of FPL in October 2018, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of
    - January 2019 for maximum thermal power dispatches in the grid during the Crushing Season for FPL.
    - September 2019 for maximum hydropower dispatches in the grid during the off-season for FPL.

  The system conditions of normal and N-1 contingency have been studied to meet the reliability criteria of NEPRA Grid Code.

- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2021 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover of up to 23.12 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at FPL and the substations of 132 kV in its vicinity. We find that the fault currents for the proposed scheme are within the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from FPL.
- The maximum short circuit levels of FPL 132 kV is 4.56 kA and 4.60 kA for 3-phase and 1-phase faults respectively for the Year 2019 and 4.73 kA and 5.01 kA for 3-phase and 1-phase faults respectively for the Year 2021. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out for January 2019. The stability check for the worst case of three phase fault right on the 132 kV bus bar of FPL substation followed by the final trip of one 132 kV circuit emanating from this substation, has been performed for fault clearing of 5 (100 ms) and 9 cycles (180 ms), in case of stuck breaker, as understood to be the normal fault clearing time of 132 kV protection system. The stability of system for far end faults of 3-phase occurring at 132 kV bus bar have also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults for the most stringent cases. The system is found strong enough to stay stable and recovered with fast damping.
- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.