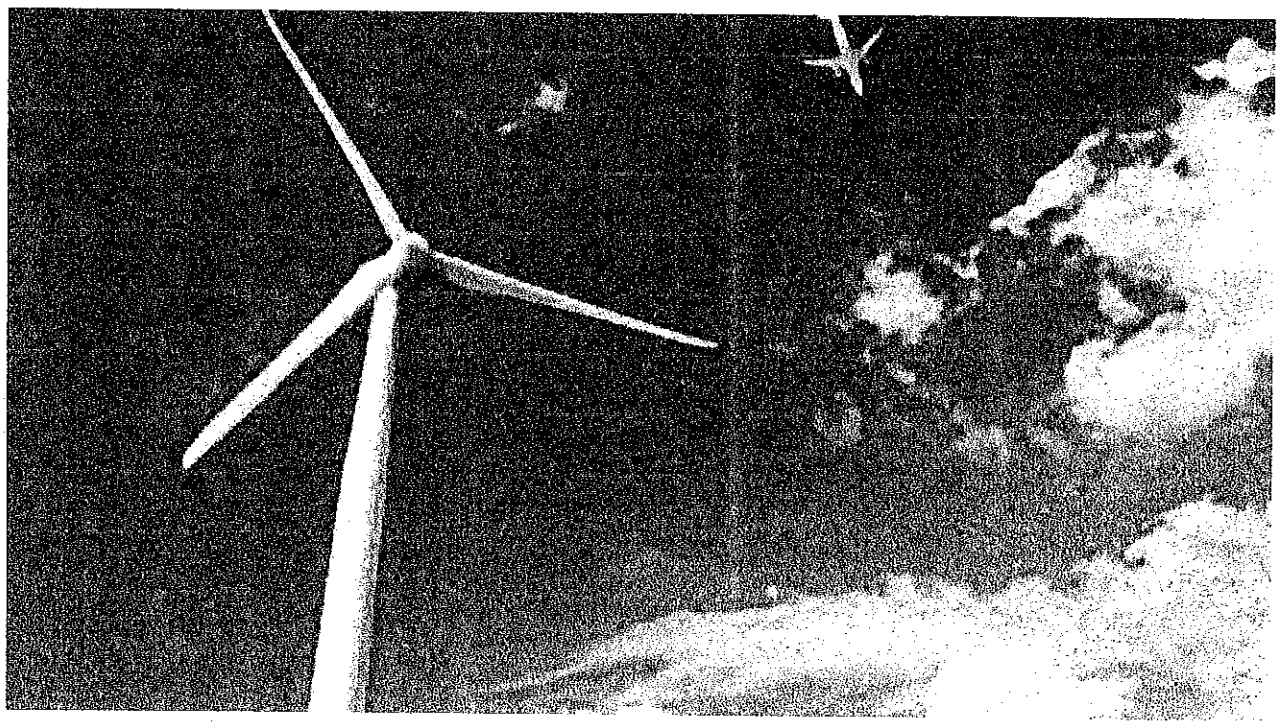
GENERATION LICENSE APPLICATION FOR 50 MW SHAHEEN RENEWABLE ENERGY 1, WIND POWER PROJECT AT BHOLARI, SINDH



PROJECT COMPANY:

SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED.

PROJECT TECHNICAL CONSULTANT:

RENEWABLE RESOURCES (PVT) LIMITED.

SHAHEEN FOUNDATION PAF

SHAHEEN FOUNDATION PA

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16 January, 2017

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

Dear Sir,

RE: APPLICATION FOR A GENERATION LICENSE – 50 MW WIND POWER PROJECT

I, Brig Dr. Gulfam Alam (Retd), being the duly authorized representative of Shaheen Renewable Energy 1 (Private) Limited by virtue of Board Resolution dated 11-01-2017, hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation Licence to SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED pursuant to section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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

A Bank Draft in the sum of PKR 294,384/- (Rupees Two Hundred and Ninety-Four Thousand Three Hundred and Eighty Four Only), being the non-refundable licence 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.

(DR. GULFAM ALAM)
Brigadier (Retd)
C.E.O SRE-1
Shaheen Foundation, PAF

SHAHEEN FOUNDATION PAF ISLAMABAD
Company Seal

SHAHEEN FOUNDATION PAF

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11 January, 2017

RESOLUTIONS OF THE BOARD OF DIRECTORS OF SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED BY CIRCULATION

RESOLVED THAT:

Shaheen Renewable Energy 1 (Private) Limited ("**Company**") be and is hereby authorized to file an application for Generation License (including any modifications, motions, applications, review motions or re-filings of generation license application) (the "**Application**") for the Company's proposed 50MW wind power project in Jhimpir, Sindh, Pakistan the "**Project**").

Brig Dr. Gulfam Alam (Retd), Chief Executive Officer of the Company, be and is hereby authorized by and for and on behalf of the Company to do all actions and take all measures as may be necessary or appropriate in connection with the filing, presentation and pursuit of the Application, including, without limitation:

i. to sign, file, amend or withdraw the Application, affidavits, powers-of-attorney, statements forms, applications, deeds, certificates, interrogatories, correspondence, replies to information directions, interrogatories, discovery directions or any other documents and instruments as may be necessary or appropriate;

ii. make all filings and pay all applicable fees in connection with the Application;

iii. to appoint and remove consultants, attorneys and advisers;

iv. represent the Company in person or through attorneys, advocates or representatives in all negotiations, representations, presentations, hearings, conferences or meetings of any nature whatsoever with any entity (including, but not limited to NEPRA, private parties, companies, partnerships, individuals, governmental or statutory authorities and agencies, ministries, boards and departments, regulatory authorities or any other entity of any nature whatsoever); and

v. do all acts, matters, things and take all actions as may be required in connection with the Application until the award of the Generation Licence in respect of the Project and further also for any revisions or modifications to the tariff awarded by NEPRA at any stage whatsoever as may be considered fit and appropriate by him in his estimation.

The above resolution was duly passed by circulation by the Board of Directors in accordance with the Articles of Association of the Company.

Directors and person Authorized to sign Name in full (In CAPITAL Letters)	Official position	Specimen Signature
Air Marshal MUHAMMAD JAMSHED KHAN (Retd)	Chairman/Director	
Air Vice Marshal SYED RAZI NAWAB (Retd)	Director	
Brig Dr. GULFAM ALAM (Retd)	C.E.O/Director	
Mr. AAMIR SHAHZAD MUGHAL	Director	

We further certify that the specimen signatures recorded above are correct.

(UMER SADIQ)
Company Secretary
Shaheen Renewable Energy 1 (Private) Limited

EXPERIENCE

Shaheen Renewable Energy 1 (Private) Limited project team comprises of experienced professionals having a combined average project management experience of more than 25 years.

Following are key team members for the development of Wind Project:

1. Brig. Dr. Gulfam Alam (Retd)
2. Mr. Aamir Shehzad Mughal
3. Mr. Muhammad Ali Shaukat

1. Brig. Dr. Gulfam Alam (Retd)

He was commissioned in Pakistan Army Corps of Engineers in 1978 and during his tenure of service he was employed on numerous important assignments including Director Planning and Works at Engineer-in-Chief branch, GHQ, Deputy Group Command in Frontier Works Organization and teaching assignment at NUST. For his notable services for the Country, he was decorated with Sitara-e-Imtiaz (Military). He holds Doctorate of Philosophy (PhD) degree in Civil Engineering (Structures) from University of Illinois at Urbana – Champaign (United States of America - 1994) and has more than 25 years of diversified domestic as well as international exposure in the construction field. His working experience can be broadly categorized into policy formulation, evaluation, planning / development, implementation /monitoring and collaboration with donor agencies.

He has been part of the Faculty of engineering at National University of Science and Technology (NUST) and taught for 10 years.

He has 15 years of experience in the field of project construction, development, execution and monitoring.

He was the Director (Planning and Development) in Fauji Foundation and Project Director of Foundation Wind Power Company Limited (2 x 50 wind power projects i.e. FWEL-I & FWEL-II). During his tenure with Fauji Foundation he was on the Board of Fauji Group's associated companies in the sectors of fertilizers, cement, oil and gas, terminal operations, power generation and education. Brigadier Dr Gulfam Alam has also served as Technical Member to Pakistan Commission for Indus Water.

Currently, he is associated with Shaheen Foundation, PAF holding the appointment of Chief Executive Officer (CEO) of the 50MW Shaheen Renewable Energy -1 (Private) Limited wind power project.

2. Mr. Aamir Shehzad Mughal

Mr. Aamir is the Chartered Accountant by profession and working as Director Finance of Shaheen Foundation PAF. Mr. Aamir is experienced member of team having experience more than 16 years. Mr. Aamir is responsible for overall financial management of the Foundation and its associated companies. Responsibilities include finance, accounts, budget, taxation and performance evaluation of the projects and companies. On behalf of the Foundation, he is also acting as board member of Shaheen Insurance Company Limited, Air Eagle (Pvt.) Ltd and Ensign Communiqué (Pvt.) Ltd. He shall be looking after all the financial matters of the project as well as arrangement of equity and debt for the project.

2. Mr. Muhamamd Ali Shaukat

Mr. Muhammad Ali Shaukat is MBA (Finance) and a financial/energy management professional with 10 years' experience in corporate financial management, project financial modeling, operational business planning, and transaction investment & origination. For more than 7 years, he has been involved with project development and management of Renewable Energy Projects especially Wind Power Projects from raw site stage to commercial operations. He was also associated with Fauji Foundation Planning & Development Division (2009-2015) as a core member of the project development team looking after the techno-commercial, legal and financial aspects of project development. He was also the Country Manager-Sales Pakistan for the Vestas Wind Technology Limited (the largest wind turbine manufacturing company in the world). He is currently working as Manager-Project Development with Shaheen Foundation for development of 50MW Shaheen Renewable Eneergy-1 (Private) Limited wind power project.

A021806

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
Company Registration Office
1st Floor SLIC Building No.7, Blue Area,
Islamabad

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. **0100463**

I hereby certify that **SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is **limited by shares.**

Given under my hand at **Islamabad** this **Twenty Eighth** day of **June,** Two Thousand and **Sixteen.**

Fee Rs. **97000/-**

(Faisal Lateef Khawaja)
Joint Registrar of Companies

CERTIFIED TO BE TRUE COPY

Assistant Registrar
Company Registration Office Islamabad

No. ADI 14675

Dated 28/6/16

Annexure-3:

Memorandum of Association

THE COMPANIES ORDINANCE, 1984
(Private Company Limited by Shares)

Memorandum of Association

Of

Shaheen Renewable Energy 1 (Private) Limited

I. NAME

The name of the Company is "Shaheen Renewable Energy 1 (Private) Limited" (hereinafter referred to as the "Company").

II. REGISTERED OFFICE

The Registered office of the Company will be situated at capital territory Islamabad.

III. OBJECTS

The objects for which the Company is established are to undertake any or all of the following subject to approval from concerned authorities / NEPRA:

1. To carry on the business of establishing and operating and managing electric power and generating projects and transmission systems for generating and supplying electric power, in any manner that may be deemed necessary and expedient by the Company, including but not restricted to setting up of thermal power plants, wind farms, hydro electric power plants, other renewable energy plants and to manufacture, assemble, acquire and supply all necessary power stations, transmission systems, control systems, cables, wires, lines, accumulators, lamps and works to generate, accumulate, distribute and supply electricity to customers, both public and private, including but not limited to villages, cities, towns, streets, docks, markets, theatres, buildings, industries, plants, utilities, and places, both public and private, and for all other purposes for which energy can be utilized or is required.

2. To enter into any arrangements with the Government of Pakistan, Government of Sindh, the Alternative Energy Development Board or its successors-in-interest, if any, or any other provincial or local government or with any supreme, national, municipal or local

authority, autonomous region if any, or with any person, and at any place where the Company may have interest that may seem conducive to the Company's objects, or, any of them in any mode and to obtain from such government or authority, or other persons any right, privilege and concession which the Company may think is desirable to obtain and to carry out, exercise and comply with any such arrangement, right, privilege and concession.,

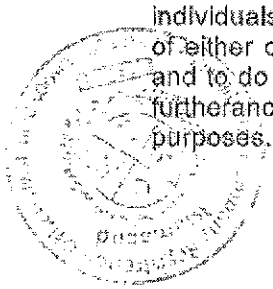
3. To purchase or otherwise acquire, generate, sell, supply, market, distribute, and transmit electric energy and perform services and operations related thereto and so far as may be conducive to the attainment of the said objects or convenient or advantageous in connection therewith.

4. To construct, own, purchase, acquire, lease, build, erect, install, establish, operate, manage and maintain plants, laboratories, equipment, apparatus and other facilities for the generation, transmission, sale, and distribution of electrical energy.

5. To purchase or otherwise acquire, become interested in, deal in and with, invest in, hold, sell, mortgage, pledge or otherwise dispose of, turn to account or realize upon, all forms of securities, including stocks, bonds, debentures, notes, evidences of indebtedness, securities of any nature or form convertible into all exchangeable for other securities of any nature or forms, certificates of interest, participation certificates, voting trust certificates and certificates evidencing shares of or interest in trusts and trusts estates or associations, certificates of trust of beneficial interests in trust, mortgages and other instruments, securities and rights.

6. To acquire by purchase or otherwise, own, hold, buy, sell, convey, lease, mortgage or encumber real estate and other property, personal or mixed and to survey, subdivide, plant, improve and develop lands for purposes of sale or otherwise, and to do and perform all things needful and lawful for the development and improvement of the same for residents, trade or business.

7. To supply any transmission and distribution companies, governmental or autonomous bodies, cities, towns, villages, communities and the inhabitants thereof, corporations, partnerships, individuals, places of amusement or exhibitions, or any two or more of either or same with water, light, heat, gas and/or electric power and to do any and all things incidental, necessary, and/or proper in furtherance of and/or in connection with the foregoing objects and purposes.



8. To buy, lease, sell, exchange or otherwise acquire and to construct, lay, maintain and operate facilities and other conveyers for the transportation/ supply of electric power and other substances.

9. To buy, sell, manufacture, store, repair, alter, improve, exchange, hire, import, export and deal in all factories, works, plant machinery, tools, utensils, aircrafts, vehicles, appliances, apparatus, products, materials, substances, articles and things capable of being used in any business which this Company is competent to carry on or required by any customers of or persons dealing with the Company or commonly dealt with by persons engaged in any such business or which may seem capable of being profitably dealt with in connection therewith and to manufacture, experiment with, render marketable and deal in all products of residue and by-products incidental to or obtained in any of the businesses carried on by the Company.

10. To purchase, take on lease or tenancy or in exchange, hire, take options over or otherwise acquire for any estate or interest whatsoever and to hold, develop, work, cultivate, deal with, dispose of and turn to account concession, grants, decrees, licenses, privileges, claims, options, leases, property (movable or immovable), or rights or powers of any kind which may appear to be necessary or convenient for any business of the Company or for purposes of investment or re-investment and to purchase, charter, hire, build or otherwise acquire vehicles of any or every sort or description and to use the same for carriage of merchandise or passengers of all kinds and to carry on the business of owners of trucks, lorries, motor-cars and aircraft in all or any of their respective branches.

11. To construct and provide or otherwise acquire, whether by purchase, lease or otherwise, residential accommodation for persons engaged in the business of the Company.

12. To aid any government or state, or any municipal or other body politic or corporate or company or association or individuals with capital, credits, means or resources for the prosecution of any works, undertakings, projects or enterprises.

13. To provide the industrial classes with commodious and healthy lodgings and dwellings.

14. To manage, improve, farm, cultivate, maintain or otherwise deal with any part of the lands and buildings or other real property of the Company not required for the purposes of the Company.

15. To appropriate any part or parts of the property of the Company for the purposes of, and to build offices and other places of business.

16. To promote and form other companies for undertaking any business in accordance with the law and to take or otherwise acquire, hold shares, debentures or other securities of any such company, and to subsidize or otherwise assist any such company.

17. To obtain all powers and authorities necessary to carry out or extend any of the objects herein.

18. To take or otherwise acquire and hold shares, stock, debentures, debenture stock and/or to acquire and undertake the whole or any part of the business, property or liabilities of any other company having objects altogether or in part similar to those of this Company or carrying on any business capable of being conducted so as directly or indirectly to benefit this Company.

19. To enter into any agreement or any arrangement for sharing profits, union of interest, co-operation, joint-ventures, reciprocal concessions, or otherwise with any individual, firm co-operative or other security, company, association, corporate body, research and education institutions, affiliates, Government or local authority or other legal entity whether national or not, as may be necessary or expedient for the purpose of carrying on any business of the Company.

20. To open, close and operate banking accounts of the Company with any bank or banks and to draw, make, accept, endorse, discount, execute and issue promissory notes, bills of exchange, bills of lading, warrants, debentures and other negotiable or transferable instruments.

21. To borrow money and to receive the proceeds of loans and to secure payment of money in such manner as the Company may decide is necessary for realization of the purposes mentioned above, and in particular by:

    i. the issue of perpetual or redeemable and convertible or non-convertible PTCs, TFCs, sukuks and other Islamic modes of financing instruments, debentures or debenture stock (perpetual or otherwise), bonds, promissory notes, bills of exchange and such other securities;

    ii. furnishing undertakings and guaranteeing the performance by the Company or associated company of any obligation

undertaken by the Company or associated company as the case may be, depositing securities, shares and documents of title;

iii. hypothecating, charging and mortgaging all or any of the properties and assets (both present and future, movable and immovable) of the Company and creating pledge, liens etc. on such properties on the condition that such transactions shall not affect the performance of the Company; and

iv. appointing attorneys, counsels and giving them powers and authority for executing documents, registering documents, selling and managing the properties, undertaking any business of the Company and furnishing and creating such other securities as may be considered expedient; and for the purposes aforesaid, or otherwise, execute, complete and deliver agreements and such other documents as may be required;

22. To guarantee the payment of money and the performance of contracts of engagement of the Company and to secure the payment of money and the performance of any contracts or engagements entered into by the Company and to discharge any debt or any obligations of or binding upon the Company by a mortgage or charge upon all or any part of the undertaking, property and rights of the Company (either present or future or both), or by the creation or issue of bonds debentures stocks, pledges, liens or any other securities or by any other means.

23. To guarantee the payment of money unsecured or secured by or payable under or in respect of promissory notes, bonds, debentures, debenture stock (perpetual or otherwise), contracts, mortgages, charges, obligations, instruments and securities of the Company and generally to guarantee or become sureties for the performance of any contracts or obligations concerning the business of this Company.

24. To draw, make, accept, endorse, seal, execute, negotiate, purchase, hold and dispose of cheques, promissory notes, bills of exchange, drafts, charter parties, bills of lading, warrants and other negotiable documents and contracts, deeds and other instruments and to cancel and vary such instruments, relating to the business of the Company.

25. To apply for purchase or otherwise acquire and protect and renew in any part of the world any patent, patent rights, brevets d'invention trade marks, designs, licenses, concessions, and the like, conferring any exclusive or non-exclusive or limited right to their use, or any secret or other information as to any invention which may seem capable of being used for any of the purposes of the Company, or

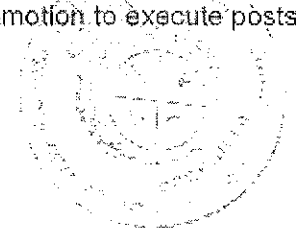
the acquisition of which may seem calculated directly or indirectly to benefit the Company, and to use, exercise or develop in respect of, or otherwise turn to account the property, rights or information so acquired, and to expend money in experimenting upon, testing or improving such patents, inventions or rights; and to sell any patent rights or privileges belonging to the Company, or which may be acquired by it, or any interest in the same for the use and practice of the same or any of them and to let or allow to be used or to otherwise deal with any inventions, patents or privileges in which the Company may be interested, and to do all such acts and things as may be deemed expedient for turning to account any inventions, patents and privileges in which the Company may be interested.

26. To employ and remunerate Directors, officials, agents, employees, trainees and servants of the Company and any person, firm or body corporate rendering services to the Company either by cash payment or by allotment to him or her or them, as the case may be, of shares or securities of the Company and benefit employees and ex-employees of the Company, and to grant pension, gratuities and allowances and to provide houses, amenities and conveniences of all kinds, and for the purpose of this paragraph the words "employees" and "ex-employees" shall include respectively, present and former Directors and other officials, agents, employees, trainees and servants.

27. To establish and operate provident funds for the employees and to establish and support or aid any schools and any educational, scientific, literary, religious or charitable institutions or trade societies whether such societies be solely connected with the trade carried on by the Company or not, and any club or other establishment calculated to advance the interests of the Company or its employees.

28. To subscribe or grant money for any national, charitable, benevolent, public, general or useful object or for any exhibition.

29. To provide openings for the fullest possible employment of Pakistani Nationals in the administrative and technical departments of the Company and to accept Pakistani Nationals as apprentices for training and to establish, provide, maintain and conduct, schools, training colleges, laboratories, workshops and other institutions for the education, training and instruction of Pakistani Nationals whom the Company may be able to take into service who may desire to avail themselves of the same and thereby to fit themselves for promotion to execute posts in the service of the Company.



30. To accept stock or shares in, or the debentures, mortgage-debentures or other securities of any other company in payment or part payment for any services rendered or for any sale made to or debt owing from any such company.

31. To improve, develop, sell, exchange, take on lease, mortgage, pledge, hypothecate, assign, transfer, dispose of, turn to account or otherwise deal with all or any part of the present and future property and assets, immovable and movable, corporeal or incorporeal, tangible or intangible, and any right, title and interest therein of the Company, including rights, licence, privileges, concessions, easements and franchises as may seem expedient.

32. To payout of the funds of the Company all expenses of and incidental to the formation, registration, advertisement of the Company and the issue and subscription of the share or loan capital including brokerage and/or commission for obtaining applications for or placing or guaranteeing the placing of shares or any debentures, debenture stock and other securities of the Company and also all expenses relating to the issue of any circular or notice and the printing, stamping and circulating of proxies and forms to be filled up by the members of the Company.

33. To pay for rights or property acquired by the Company and to remunerate any person or company whether by cash payment or by the allotment of shares, debentures or other securities of the Company as fully paid up.

34. To adopt such means of making known the business, services and products of the Company as may seem expedient and in particular by undertaking seminars, training and demonstration programs and by advertising in the press, media and internet by circulars and by purchase and exhibition of works of art or interests, by publication of books and periodicals and by granting prizes, rewards and donations.

35. To establish and maintain or procure the establishment and maintenance of any contributory or non-contributory pension or superannuation funds for the benefit of, and give or procure the giving of donations, gratuities, pensions, allowances or emoluments to any persons who are or were at any time in the employment or service of the Company, and also to establish and subsidize and subscribe to any institutions, associations, clubs or funds calculated to be for the benefit of or to advance the interests and well being of the Company or of any such other company as aforesaid and do any

of the matters aforesaid, either alone or in conjunction with any such other company as aforesaid.

36. To open branches, liaison offices, register the Company and to undertake all or any of the business of the Company in any part of the world and to become a member of various associations and trade bodies whether in Pakistan or abroad.

37. To apply for and obtain necessary consents, permissions and licences from any Government, State, Local and other national or international authorities for enabling the Company to carry any of its objects into effect or for extending any of the powers of the Company or for effecting any modification of the constitution of the Company or for any other purpose which may seem expedient, and to oppose any proceedings or applications which may seem cancelled, directly or indirectly to prejudice the interests of the Company, and to enter into arrangements with any Government or authorities, central, provincial, municipal, local or otherwise, public or quasi-public bodies or with any natural persons and legal entities, in any place where the Company may have interests that may seem conductive to the objects of the Company or any of them or to obtain from such Government, authorities or persons, any rights, privileges and concessions which the Company may think fit to obtain, and to carry out, exercise and comply therewith for the purposes of the Company.

38. To get insure the property, assets and employees of the Company in any manner deemed fit by the Company, and to create any reserve fund, sinking fund, insurance fund, or any other special fund whether for depreciation or for repairing, insuring, improving, extending or maintaining any of the property of the Company or for any other purpose conductive to the interests of the Company.

39. To invest the surplus monies of the Company not immediately required in any manner but not to act as an investment company.

40. To advance money or give credit to such persons or companies and on such terms as may seem expedient, in particular to customers and others having dealings with the Company.

41. To import, export, buy, sell, own, install and/or rent machinery and other equipment, goods, materials, raw materials and spare parts required for or in connection with the business of the Company.

42. To enter into partnership or other joint venture or co-operation with any person or company or other legal entity, local or foreign, carrying on or engaged in any business or transaction which this company is

authorized to carry on or engage in, or otherwise assist any such person or company or legal entity.

43. To receive, declare and distribute profits and to capitalize such portion of the profits of the Company as are not distributed among shareholders of the Company, in the form of dividends, and as the Company may think fit, and to issue bonus shares, as fully paid up in favor of the shareholders of the Company.

44. To file or register any documents required to be filed or registered under law, and to pay any fees, charges, expenses, rents, taxes, duties and other dues payable in connection with the business or operation of the Company.

45. To amalgamate, consolidate, or merge, with a view to effecting a union of interests, either in whole or in part, with or into any other companies, associations, firms or persons carrying on any trade or business of a similar nature to that which the Company is authorized to carry on.

46. To make rules or regulations not inconsistent with this Memorandum, to provide for all matters for which provision is necessary or expedient for the purpose of giving effect to the provisions of this Memorandum and the efficient conduct of the affairs of the Company.

47. To improve, manage, develop, grant rights or privileges in respect of, or otherwise deal with, all or any part of the property and rights of the Company and to establish laboratories, research and development centers to perform such research and development as the Company may deem advisable or feasible, and to expend money or experimenting upon and testing and improving or securing any processes, patent or protecting any invention or inventions which the Company may acquire or propose to acquire or deal with.

48. To accept, buy, sell, market, supply, transfer (including transfer of actionable claims) or deliver any and every kind of moveable property for such price and subject to such terms, conditions and warranties as the Company may think fit.

49. To sell, improve, manage, develop exchange, lease, mortgage, enfranchise, dispose of, turn to account, or otherwise deal with, all or any part of the property, assets or undertaking of the Company for

such consideration as the Company may think fit, and in particular for shares, debentures, or other securities of any other company whether or not having objects altogether or in part similar to those of this Company, and to distribute among the members in specie any property of the Company.

50. To accept or give security, including but not limited to promissory notes, indemnity bonds, guarantees assignments, receipts, bailments, pledges, hypothecations, liens, mortgages and charges against the credit extended or moneys borrowed in connection with the business of the Company.

51. To settle disputes by negotiation, conciliation, mediation, arbitration, litigation or other means and to enter into compromise with creditors, members and any other persons in respect of any difference or dispute with them.

52. To develop and/or transfer technology and to acquire or pass on technical know-how.

53. To train personnel and workers, both in Pakistan and abroad, to obtain technical proficiency in various specialties connected with the business of the Company.

54. To vest any real or personal property, rights or interests acquired by or belonging to the Company in any person or company on behalf of or for the benefit of the Company, and with or without any declared trust in favor of the Company, and to undertake or execute any trust the undertaking whereof may seem desirable, and either gratuitously or otherwise.

55. To pay underwriting commission and brokerage on any shares or securities issued by the Company.

56. To provide aid, pecuniary or otherwise, to any association, body or movement having for an object the solution, settlement, or surmounting of industrial or labour problems or troubles or the promotion of industry or trade.

57. To distribute among the shareholders of the Company, in specie, any property of the Company, or any proceeds of sale or disposal of any property of the Company, but so that no distribution amounting to a reduction of capital be made except with the sanction (if any) for the time being required by law.

58. To generate and sell carbon credits and enter into arrangements for the same.

59. The Company shall not engage in banking business or business of an investment company, insurance company or leasing company or in any unlawful business.

60. The liability of the Company enumerated above may be subject to unanimous decision of the shareholders.

61. To do all or any of the things herein in any part of the world either as principals, agents, trustees, contractors or otherwise, and either alone or in conjunction with others.

62. To do all and everything necessary, suitable or proper or incidental or conducive to the accomplishment of any of the purposes or the attainment of any of the objects or furtherance of any of the powers herein before set forth, either alone or in association with other corporate bodies, firms or individuals and to do every other act or thing incidental or appertinent to or arising out of or connected with the business or powers of the Company or part thereof, provided the same be lawful.

63. It is hereby declared that:

(a) the objects specified in each of the paragraphs of this clause shall be regarded as independent objects, and accordingly shall in no way be limited or restricted (except where otherwise expressed in such paragraphs) by reference to or inference from the terms of any other paragraph or the name of the Company, but may be carried out in as full and ample manner and construed in as wide a sense as if each of the said paragraphs defined the objects of a separate and distinct company;

(b) Notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association, nothing herein shall be construed as empowering the Company to undertake or indulge in the business of banking finance, investment or insurance directly or indirectly, as restricted under law or any unlawful operations.

64. It is declared that notwithstanding anything contained in the forgoing object clauses of this Memorandum of Association nothing contained therein shall be constructed as empowering the Company to undertake or to indulge in business of security services, payment systems, electronic funds transfer in and outside Pakistan, deposit taking from general public, network marketing, referral marketing & direct selling banking company, leasing investment, managing agency, insurance business, any of the NBFC business, multi-level marketing (MLM), Pyramid or Ponzi Scheme, commodity, future contract or shares trading business locally or internationally, directly or indirectly as restricted under the law or any unlawful operation.

IV. LIABILITY

The Liability of the members is limited.

V. SHARE CAPITAL

The authorized capital of the Company is Pak Rupees twenty five million only (PKR 25,000,000) divided into two and a half million (2,500,000) shares of Pak Rupees ten only (PKR 10.00) each. The Company shall have power to increase, reduce or reorganize the Capital of the Company, subdivide the Share Capital of the Company into different classes in accordance with the provisions of the Companies Ordinance, 1984.

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

Name	Father's/ Husband's Name in full	Nationality	Occupation	Residential Address	Number of shares taken by each subscriber	Signature
Committee of Administration / Shaheen Foundation - PAF through Air Marshal Muhammad Jamshed Khan (Retd) CNIC # 36302-6039047-1	Muhammad Bashir Khan	Pakistani	Managing Director, Shaheen Foundation	PAF Complex, E-9, Islamabad	2,499,996 (Two Million Four Hundred Ninety-Nine Thousand Nine Hundred Ninety-Six)	
Air Marshal Muhammad Jamshed Khan (Retd) Nominee Shaheen Foundation CNIC # 36302-6039047-1	Muhammad Bashir Khan	Pakistani	Managing Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
Air Vice Marshal Razi Ul Hassan Nawab (Retd.) Nominee Shaheen Foundation CNIC # 37405-0628856-7	Syed Akbar Nawab	Pakistani	Deputy Managing Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
Group Captain Ehsan-ur-Rauf Sheikh (Retd) Nominee Shaheen Foundation CNIC # 61101-2643759-5	Abdul Aziz Sheikh	Pakistani	Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
Mr. Aamir Shahzad Mughal Nominee Shaheen Foundation CNIC # 37102-5805273-3	Fazal Karim Mughal	Pakistani	Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
				Total number of share taken	2,500,000 (Two Million Five Hundred Thousand)	

Dated this 2nd day of June, 2016

Witness:

Full Name: NIFT (Pvt.) Ltd.
Full Address: AWT Plaza, I. I. Chundrigar Road, Karachi

CERTIFIED TO BE TRUE COPY

Assistant Registrar
Company Registration Office Islamabad

Annexure-9

Articles of Association

THE COMPANIES ORDINANCE, 1984

(COMPANY LIMITED BY SHARES)

ARTICLES OF ASSOCIATION

OF

SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED

PRELIMINARY

The regulations contained in Table 'A' of the First Schedule to the Companies Ordinance, 1984 shall apply to this Company (so far as these regulations are applicable to private companies except as the same are modified, altered, repeated or added to by these Articles.

DEFINITIONS AND INTERPRETATIONS

1. In these presents unless there be something in the subject or context inconsistent therewith, words signifying the singular number only, shall include the plural and the vice versa and words signifying males only shall extend to and include females and word signifying persons, shall apply mutatis mutandis to bodies corporate.

(i) "The Company" means "SHAHEEN RENEWABLE ENERGY 1 (PRIVATE) LIMITED"

(ii) "The Office" means the registered office of the company.

(iii) "Ordinance" means the Companies Ordinance, 1984.

(iv) "Section" means the section of the ordinance.

(v) "The Commission" means the Securities and Exchange Commission of Pakistan established under section 3 of the Securities and Exchange Commission of Pakistan Act, 1997.

(vi) "Month and Year" shall mean the English calendar month and English calendar year respectively.

(vii) "The register" means the register of members to be kept pursuant to Section 147 of the Companies Ordinance, 1984.

(viii) "In writing or written" includes printed, lithographed and type written or other modes of representing words in visible and legible form.

(ix) "Dividend" includes bonus.

(x) "Capital" shall mean the capital of the Company for the time being raised or authorized to be raised for the purpose of Company.

(xi) 'Shares" shall mean the share in the capital of the Company.

(xii) "These presents" shall mean the Memorandum of Association of the Company and these Articles and all supplementary, substituted or amended Articles for the time being in force.

(xiii) "The Seal" in relation to a company means the Common Seal of the Company.

PRIVATE LIMITED COMPANY

2. The Company is a private limited company within the meanings of Section 2(1) clauses 28 of the Companies Ordinance, 1984 and accordingly :

   i. No invitation shall be issued to the public to subscribe for any shares, debenture or debentures stock of the Company.

   ii. The number of members of the Company (exclusive of the persons in employment of the Company) shall be limited to fifty provided that for the purpose of this provision where two or more persons hold one or more shares jointly they shall be treated as single member, and

   iii. The right to transfer shares in the Company is restricted.

REGISTERED OFFICE

3. The registered office of the Company shall be situated in the Islamabad, Capital Territory.

BUSINESS

4. The business of the Company includes all or any of the objects enumerated in the Memorandum of Association and shall be commenced soon after the incorporation of the Company.

CAPITAL

5. The authorized capital of the Company is Rs. 25,000,000/- (Rupees Twenty five Million only) divided into 2,500,000 ordinary shares of Rs. 10/- each with power to increase, reduce, consolidate, sub- divide, re-organize or to divide the share capital of the Company into several classes in accordance with the provisions of the Ordinance.

SHARES

6 Subject to the Provision of the Ordinance, the share shall be under control of the Board of Directors who may allot or otherwise dispose of the same to such persons, firm or Subject of the provision of the Ordinance, the shares shall be under the control of the Board of Directors who may allot or otherwise dispose off the same to such persons, firm or corporations, on such terms and condition and for such consideration and at such times as may be through fit.

7. The share in the capital of the Company may be allotted or issued in payment or part payment of any land, building, machinery or goods supplied or any services rendered to the Company

In promotion and establishment thereof or in conduct of its business. Any share so allotted may be issued as fully paid up and not otherwise.

8. If a share certificate is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding ten rupees, and on such term, if any, as to evidence and indemnity and payment of expenses incurred by the Company in investigating title as the director think fit.

9. Where at any time the Board decides to increase the issued capital of the Company by issuing any further shares, then subject to provisions of Section 86 of the Companies Ordinance 1984, all new shares shall be offered to the Members in proportion to the existing shares held by each member, and such offer shall be made by notice under registered post or circular specifying the number of shares to which the member is entitled, and limiting a time with in which the offer , if not accepted, will be deemed to be declined; and after the expiration of such time, or on receipt of information from the member to whom such notice is given that he declines to accept the shares offered, the Board may dispose of the same in such manner as it may consider most beneficial to the Company.

TRANSFER OF SHARES

10. The instruments of transfer of any share in the Company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register members in respect thereof.

11. Shares in the Company shall be transferred in the Form prescribed by Table 'A' in first Schedule or in any usual or common form which the directors shall approve.

12. a. The directors shall not refuse to transfer any fully paid shares unless the transfer deed is defective or invalid. The director may also suspend the registration of transfer 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 director may decline to recognize any instrument of transfer unless.

    i. A fee not exceeding two rupees as may be determined by the directors is paid to the Company in respect thereof :

    ii. 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.

    b. If the directors refuse to register a transfer a shares, they shall within one month 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 defeat 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.

TRANSMISSION OF SHARES

13. The executors, administrators, heirs, no nominees, as the case may be, a deceased sole harder of a share shall be the only persons recognized by the Company as having any title to the shares. In the case of a share registered in the name of two or more holders, the survivors or survivor, or the executors or administrators of the deceased survivors shall be the only person recognized by the Company as having any title to the share.

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

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

ALTERATION OF CAPITAL

16. The Company may, from time to time, by special resolution increase the share capital by such sum, to be divided into shares of such amount, as the resolution shall prescribe.
17. Subject to the provision of the Ordinance, all new shares shall, before issue, be offered to such persons as at the date of the offer are entitled to receive notice from the Company of general meeting in proportion, as nearly as the circumstances admit, to the amount of the existing share to which they are entitled. The offer shall be made by notice specifying the number of shares offered and limiting a time within which the offer if not accepted, will be deemed to be declined and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the directors may dispose of the same in such manner as they like 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 person entitled to an offer of the new-share) cannot in the opinion of the Directors, be conveniently offered under this regulation.
18. The new share shall be subject to the same provision with reference to transfer, transmission and otherwise as the shares in the original share capital.
19. The Company may, by special resolution :

    i. consolidate and divide its share capital into shares of larger amount than its existing shares;

    ii. sub-divide its existing shares or any of them into shares of similar amount that is fixed by the Memorandum of Association subject, nevertheless, to the provision of clause (d) of sub-section (1)of section 92;

iii. 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 the special resolution, reduce its share capital in any manner and with, and subject to, any incident authorized and consent required by law.

GENERAL MEETING

21. The general meeting to be called annual general meeting, shall be held, within 18 months from the date of its incorporation in accordance with provisions of section 158 and thereafter once at least in every year and within a period of six months following the close of its financial year and not more than fifteen months after the holding of its last preceding annual meeting as may determine by directors.

22. All general meetings of the company other than the annual General Meeting mentioned in section 158 shall be called extraordinary general meetings.

23. The directors may, whenever they think fit, call an extraordinary general meeting and extraordinary general meetings shall also be called on such requisition, or in default, may be called by such requisitionists, as is provided by section 159. If at any time there are not with in 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 meeting may be called by the directors.

PROCEEDING AT GENERAL MEETINGS

24. Subject to the provisions of sub-section (3) of section 158 of the Companies Ordinance, 1984, at least 21 days' notice (exclusive of the day on which notice is given) specifying the place, the date and the hour of meeting and in case of special business, the general nature of that business shall be given to such person as are under the Companies Ordinance, 1984 or the regulation of the Company, entitled to receive such notice from the Company but the accidental omission to give such notice to or non-receipt of such notice by any member shall not invalidate the proceedings at any General Meeting.

    Provided that in case of an emergency affecting the business of company a shorter notice may, as authorized by register, be sent.

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

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

27. If within half an hour from the time appointed from the meeting a quorum is not present, the meeting, if called upon the requisition of members shall be dissolved, in any other case it will

stand adjourned to the same day in the next week at the same time and same place and if at adjourned meeting, quorum is not present within half an hour, the members present being not less than Two shall be a quorum.

28. The Chairman of the Company shall preside as Chairman at every General Meeting of the Company.

29. If there is no such Chairman or if at any meeting he is not present within fifteen minutes at the time appointed for holding the meeting or is unwilling to act as Chairman, any one of the director present may be elected to be chairman, and if none of the director is present or is unwilling to act as chairman, the members present shall choose one of their number to be the Chairman.

30. 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 and from place to place, but no business shall be transacted at the adjourned meeting other than the business left unfinished of the meeting from which the adjournment took place. When a meeting is adjourned for ten (10) days or more, notice of the adjournment shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give of any adjournment of the business to be transacted at an adjourned meeting.

31. At any General Meeting, a resolution put to the vote of the meeting shall be declared on a show of hands unless a poll (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 the resolution has on show of hands been carried or carried unanimously or by a particular majority or lost and an entry to that effect in the books of the proceedings of the Company shall be conclusive evidence of that fact, without proof of the number of proportion of the votes recorded in favor of, or against that resolution.

32. If a poll is demanded as aforesaid, it shall be taken in the manner as it provided under section 167 and 168 of Ordinance.

33. In the case of an equality of votes whether on show of hands or on poll, the Chairman of the meeting at which the show of hand takes places or at which the poll is demanded, shall be entitled to have and exercise a second or casting votes.

34. A poll demanded on the election of a Chairman or on a question of adjournment Shall be taken forthwith

VOTES OF MEMBERS

35. On show of hands every member present in person shall have one vote except for election of directors in which case the provision of Section 178 shall apply. On a poll every member shall have voting rights as laid down in Section 160.

36. In case of joint holders, the vote of the seniors who tender a vote, whether in person or by proxy shall be accepted to the exclusion of the votes of the other joint holder; and for the purpose seniority shall be determined by the order in which the names stand in the registered of members. In case of minor the guardian shall be entitled to vote for him.

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

38. On a poll, votes may be given either personally or by proxy provided that nobody corporate shall vote by proxy as long as a resolution of its Directors in accordance with the provisions of Section 162 of the Companies Ordinance, 1984 is in force.

39. The instrument appointing a proxy shall be in writing under the hand of the appointer or by his attorney duly authorized in writing, if the appointer is a corporation, either under the common seal, or under the hand of an officer or attorney so authorized. No person shall act as a proxy unless he is a member of the Company.

40. 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 will not be treated as valid.

41. An instrument appointing a proxy may be in the following form or in any other form near thereto as may be approved by the Company.

SHAHEEN RENEWABLE ENERGY 1(PRIVATE) LIMITED

PROXY FORM

I/We _____ of _____ being a Member of _____ and holders of _____ Ordinary shares as per Registered Folio No. _____ do hereby appoint _____ of _____ or _____ who is also a member of the Company _____ Registered Folio No. _____ to attend and vote for me/us and on my/our behalf at the Annual General Meeting/Extra-Ordinary General Meeting of the Company to be held on _____, at _____ and at any adjournment thereof.

Signed by :_____

Witness: _____

Date: _____

Affix Revenue Stamp

Note:

1. A member entitled to attend and vote at the meeting may appoint in writing another member as his/her proxy to attend and vote instead of him/her at the meeting. If the member is a corporation, its common seal should be affixed on the instrument.

2. This form of proxy in order to be effective must be deposited duly completed, at the Registered Office of the Company not less than 48 hours before the time of holding of the meeting.

3. A proxy must be a member of the Company. Signature should agree with the specimen registered with the Company.

42. 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 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

43. The Directors of the Company shall subject to Article clause 44 hereof, fix the number of elected directors of the Company not later than 35 days before convening of the general meeting at which directors are to be elected and the number so fixed shall not be changed except with the prior approval of the general meeting of the Company.

44. Unless otherwise determined by the company in general meeting in the manner provided under Article clause 43, the number of directors shall not be less than two. The following are first Directors of the Company who shall hold office till first annual general meeting.

1	**Air Marshal Muhammad Jamshed Khan (Retd.)**	**Director**
2	**Air Vice Marshal Syed Razi Ul Hassan Nawab (Retd.)**	**Director**
3	**Group Captain Ehsan ur Rauf Sheikh (Retd.)**	**Director**
4	**Mr. Aamir Shahzad Mughal**	**Director**

45. The directors of the company shall, unless the number of persons who offer themselves to be elected is not more than the number of directors fixed under Article clauses 43 and 44 be elected by the members of the company in general meeting in the following manner namely:-

    i. A member shall have such number of votes as is equal to the products of the number of voting shares or securities held by him and the number of directors to be elected;

    ii. A member may give all his votes to a single candidate or divided them between more than one of the candidates in such manner as he may choose; and

    iii. The candidate who gets the highest number of votes shall be declared elected as director and then the candidate who gets next highest number of votes shall be so declared and so on until the total number of directors to be elected has been so elected.

46. All elected Directors shall retire from office at General Meeting held after every third year. A Director retiring at a meeting shall retain office until the election of Directors in that meeting.

47. Subject to the provisions of Section 181 of the Companies Ordinance, the company may by resolution in general meeting remove a Director appointed under Article clause 53 or elected in the manner for in Article clause 45 hereof.

48. In addition to the Directors elected or deemed to have been elected by shareholders, the company may have directors nominated by the Company's creditors or other special interest holders by virtue of contractual arrangements.

49. Save as provided in Section 187, no person shall be appointed as a Director unless he is member of the Company.

50. The directors of the company elected under Article clause 45 shall hold office for three years except the director appointed casual vacancy who shall be subject to retirement in term of Article 53 hereof.

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

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

53. 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.

REMUNERATION

54. Each Director other than regularly paid Chief Executive and full time working Director shall receive out of the funds of the Company a sum, as may be fixed by the directors, not exceeding Rs. 5000/- for each meeting attended by him plus other expenses incurred by him in connection with attending of Board's meeting.

55. Subject to the provisions of the Companies Ordinance, the remuneration of Directors including Chief Executive shall from time to time be determined by the Company's Board of Directors.

56. The Directors may also sanction the payment of such additional sum, as they may think fit to any Directors for the performance of extra services he may render to the Company subject to the approval of the shareholders at a general meeting in accordance with the provisions of the Companies Ordinance, 1984.

57. The Director who resides out of station shall also be entitled to be paid such travelling and other expenses as may be fixed by the Directors from time to time.

58. The Directors may from time to time appoint any one of them to the office of the Director-in-charge, General Manager or Manager for such terms and at such remuneration as they may thing fit.

QUORUM

59. The quorum necessary for the meeting of Board of Directors shall be fixed by the Directors and unless so fixed shall be two Directors present in person.

60. Subject to the provisions of the ordinance, a resolution in writing signed by all the Directors, without a meeting of Directors shall be effective for all purposes as a resolution passed at the meeting of Directors duly held, called and constituted.

DISQUALIFICATION OF DIRECTORS

61. No person shall become a director of the company if he suffers from any of the disabilities of disqualification mentioned in section 187 and if, already a director shall cease to hold such office from the date he so becomes disqualified or disabled.

62. All acts done by any meeting of Directors or by a Committee of Directors or by any person acting as a director shall, notwithstanding that it shall afterwards be discovered that there was some defect in the appointment of such Director, or person acting as aforesaid, or 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.

POWERS AND DUTIES OF DIRECTORS

63. 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 the 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 the 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 regulations had not been made.

64. 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 mortgage charges effecting 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 resolution and a copy of the register of directors and notifications of any changes therein.

65. The directors shall cause minutes to be made in books provided for the purpose:

    i. of all appointments of officers made by the directors;

    ii. of the names of the directors present at each meeting of the directors and of any committee of the directors;

    iii. of all the resolutions and proceedings at all meetings of the Company and of the directors and of committee of directors;

    and every director present at any meeting of directors or committee of directors shall sign his name in a book kept for the purposes.

NOMINEE DIRECTOR

66. In addition to the directors elected by shareholders, company may have directors nominated by Shaheen Foundation – PAF

    Nothing in section 178, section 180or section 181shall apply to nominee director.

CHAIRMAN

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

CHIEF EXECUTIVE

68. The Directors shall appoint a person as Chief Executive of the Company In the manner provided for in sections 198 and 199 of the Ordinance.

69. The Chief Executive appointed as aforesaid shall, unless he earlier resigns or otherwise ceases to hold office, holds office for a period not exceeding three years or if a shorter period is fixed by the Directors at the time of his appointment, for such period.

70. The Company shall appoint a person who is not ineligible to become a Director of the Company under section 187, to be a Chief Executive.

POWER OF CHIEF EXECUTIVE

71. The whole business of the Company shall be carried on by the Chief Executive who shall have all powers, authorities and discretions as are given to or vested in by the Companies Ordinance, 1984 or may be entrusted by these presents.

72. Unless otherwise decided by the board of directors the Chief Executive shall exercise, during the period of his office, the following powers, subject to the control and supervision of the board of directors:-

    i. To engagement and dismissal of managers, secretaries and all other employees of the Company on such terms and remuneration as he may decide;

    ii. To execute and sign all contracts and to draw, sign, accept, endorse and negotiate on behalf of the Company all bills of exchange, promissory notes, cheques and other such financial documents;

    iii. To open and operate all bank accounts of the Company;

iv. To appoint and terminate the services of lawyers, attorneys, consultants, for such purposes and with such powers and for such period and subject to such conditions as he may think fit and issue such powers of attorney in their favor as may be necessary;

v. To cause accounts to be maintained properly and generally to provide for compliance of all statutory requirements;

vi. To delegate all or any of his powers to one or more directors, employees or any other person as he may deem fit;

vii. To issue order for the common seal of the Company to be affixed on any instrument provided that it is signed by him personally in the presence of at least one director and the secretary or any other person as the directors may appoint for the purpose who should also sign along with him. He may further authorize the fixation of the seal by any two directors in the presence of the secretary or any other person as aforesaid who should also sign every instrument to which the seal of the Company is so affixed in their presence. Instruments so signed shall be binding on the Company;

viii. To institute, prosecute, compromise, withdraw, or abandon any legal proceedings by or against the Company or its officers or otherwise concerning the affairs of the Company; and

ix. To provide for the welfare of the employees or ex-employees of the Company, or their wives, widows of families or the dependents or connection of such persons in such manner as may be thought fit.

x. To insure the movable and immovable property of the Company.

BORROWING POWERS

73. Subject to the provisions of the Ordinance, the Board of Directors shall have the powers to raise or borrow any sums of money for and on behalf of the Company from the members or other persons, companies, commercial banks, or financing institutions, or the directors may themselves advance money to the company upon such terms and conditions as they may approve from time to time.

74. The Directors may from time to time secure the payment of such money in such manner and upon such terms and conditions in all respects as they may think fit and in particular by the issue of debentures or bonds of the company or by mortgage or charge of all or nay part of the property of the company.

ACCOUNTS

75. The Directors shall cause to be kept proper books of accounts as required by section 230 of the Companies Ordinance with respect to :-

i. All sums of money received and expended by the Company and the matter in respect of which the receipts and expenditure take place;

ii. All sales and purchases of goods by the Company;

iii. All assets of the Company;

iv. All liabilities of the Company;

v. All other matters required by the Commission from time to time.

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

AUDIT

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

THE SEAL

78. 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 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.

INDEMNITY

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

SECRECY

80. No member shall be entitled to visit and inspect the works of the Company without the permission of the Chief Executive/Board of Directors or to require discover or any matter which is or may be in nature of trade secret, or secret process which may relate to the conduct of the Company's business and which in the opinion of Chief Executive/Board of Directors, will be not in the interest of the members of the Company to communicate to the public.

ARBITRATION

81. Whenever any difference arises between the Company on the one hand and the members, their executors, administrator or assignee on the other hand, touching the true intent of construction or the incident or consequence of these presents or of the statutes or touching anything thereafter done, executed, omitted or suffered in pursuance of these presents or otherwise relating to these presents or to any statute affecting the Company or to any of the Company's arbitrators or the Company, every such difference shall be referred for the decision of the arbitrator or umpire under the Arbitration Act. 1940 (as amended).

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

WINDING UP

83. If the Company is wound up, the liquidator may with the sanction of a special resolution of the Company and any other sanction required by the Ordinance divide amongst the members in specie or kind, the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.

    i. 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 class of members.

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

DISPUTE RESOLUTION

84. 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 and accredited mediator before taking recourse to formal dispute resolution such as arbitration or litigation.

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

Name and Surname (Present & Former) in Full (in Block Letters)	Father's / Husband's Name in Full	Nationality with any former Nationality	Occupation	Residential Address (in Full)	Number of shares taken by each subscriber	Signature
1. Committee of Administration / Shaheen Foundation, PAF through Air Marshal Muhammad Jamshed Khan (Retd.) CNIC # 36302-6039047-1	Muhammad Bashir Khan	Pakistani	Managing Director, Shaheen Foundation	PAF Complex, E-9, Islamabad	2,499,996 (Two Million Four Hundred Ninety-Nine Thousand Nine Hundred Ninety-Six)	
2. Air Marshal Muhammad Jamshed Khan(Retd.) Nominee Shaheen Foundation CNIC # 36302-6039047-1	Muhammad Bashir Khan	Pakistani	Managing Director, Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
3. Air Vice Marshal Razi Ul Hassan Nawab (Retd.) Nominee Shaheen Foundation CNIC # 37405-0628856-7	Syed Akbar Nawab	Pakistani	Deputy Managing Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
4. Group Captain Ehsan-ur-Rauf Sheikh (Retd.) Nominee Shaheen Foundation CNIC # 61101-2643759-5	Abdul Aziz Sheikh	Pakistani	Director Shaheen Foundation	PAF Complex, E-9, Islamabad	1 (One)	
5. Mr. Aamir Shahzad Mughal Nominee Shaheen Foundation CNIC # 37102-5805273-3	Fazal Karim Mughal	Pakistani	Director Shaheen Foundation	H # 838, Muhallah Masjid Nurani, Fateh Jang, Distt Attock	1 (One)	
				Total Number of Shares taken	2,500,000 (Two Million Five Hundred Thousand)	

Dated this 2nd Day of June 2016

Witness:

Full Name: **NIFT (Pvt.) Ltd.**

Full Address: AWT Plaza, I. I. Chundrigar Road, Karachi

CERTIFIED TO BE TRUE COPY

Assistant Registrar
Company Registration Office Islamabad

Annexure 15

Type, Technology and Technical details of the facility

General Electric – The WTG manufacturer

GE has long been known as one of the most innovative companies on the planet. Product evolution is one of our core competencies and GE is continuing this tradition by developing the next generation of wind energy. GE wind turbines are another chapter in storied power generation history, which spans over a century. With proven performance, reliability, and availability, GE offers increased value to the customers.

GE Renewable Energy is one of the world's leading wind turbine suppliers. GE's current product portfolio includes turbines with rated capacities from 1.5 MW to 3.2 MW. Additionally, GE offers support services that cover everything from development assistance to operations and maintenance. The 1.7 MW platform selected for the project has more than 20,000 installed units in the world, which is a remarkable market size.

Today, GE continues to lead the global wind industry with mature manufacturing capabilities and innovative product line. The specifications of 1.7 MW **GE 1.7 103** turbine are as follows:
The brief details of Generation Facility/Wind Power Plant are as follows:

Wind Farm Capacity & Configuration:

(i).	Wind Turbine Type, Make & Model	General Electric (G.E.) 1.7-103
(ii).	Installed Capacity of Wind Farm (MW)	49.3 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	29 x 1.70 MW

Wind Turbine Details:

(a).	**Rotor**	
(i).	Number of blades	3
(ii).	Rotor diameter	103 m
(iii).	Swept area	8,332 m^2
(iv).	Power regulation	Combination of blade pitch angle adjustment, and generator / converter torque control.
(v).	Cut-in wind speed	3 m/s
(vi).	Cut-out wind speed	20 m/s
(vii)	Survival wind speed	20 m/s (10-minute average), resp. 23/25 m/s (30/3 second average)

(viii)	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
(b).	**Blades**	
(i).	Blade length	50.2 m
(c).	**Gearbox**	
(i).	Type	Multi-stage planetary/helical gear design
(ii).	Gear ratio	1 : 107 (50 Hz)
(d).	**Generator**	
(i).	Power	1,700 kW
(ii).	Voltage	690 V
(iii).	Type	Three–phase double-fed asynchronous generator connected to the grid with partial converter
(iv).	Enclosure class	IP 54
(v).	Coupling	Flexible coupling
(vi).	Power factor	+0.95 to -0.95
(e).	**Control System**	
(i).	Type	Automatic or manually controlled.
(ii).	Scope of monitoring	Remote monitoring of different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.
(iii).	Recording	Production data, event list, long and short-term trends
(f).	**Brake**	
(i).	Design	Three independent systems, fail safe (individual pitch)
(ii).	Operational brake	Aerodynamic brake achieved by feathering blades.
(iii).	Secondary brake	Mechanical brake on (high speed) shaft of gearbox.
(g).	**Tower**	
(i).	Type	Tubular steel tower
(ii).	Hub heights	79.7 m

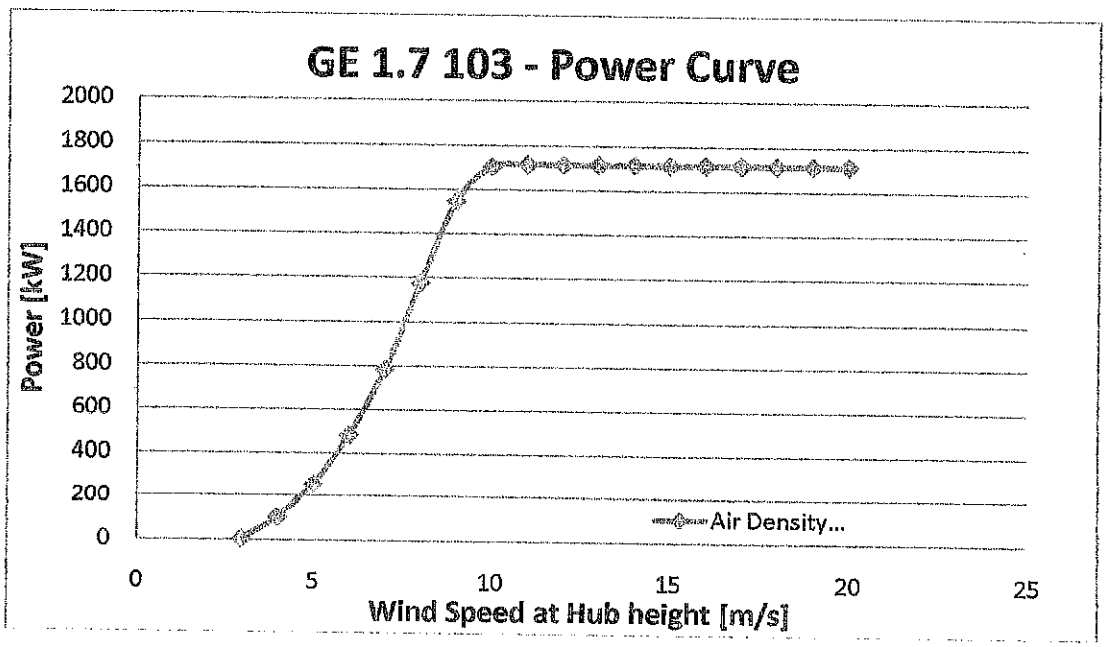
Other Details:

(i).	Project Commissioning date	2019
(ii).	Expected Life of the Project from Commercial Operation date (COD)	20 Years

Power Curve of GE 1.7 103

The power curve in table and graph is shown below:

Wind Speed (m/s)	Power (kW)
3	3
4	105
5	259
6	485
7	782
8	1175
9	1548
10	1703
11	1715
12	1715
13	1715
14	1715
15	1715
16	1715
17	1715
18	1715
19	1715
20	1715



Energy Yield of the Wind Farm

The energy yield details of SRE 1 Wind Farm are given in Table below:

1	Total Installed/Gross ISO Capacity (MW)	49.3
2	Total Annual Full Load Hours	3066
3	Average Wind Turbine Generator(WTG) Availability	97%
4	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	173.74
5	Array & Miscellaneous Losses (GWh)	13.90
6	Availability Losses(GWh)	5.21
7	Balance of Plant Losses (GWh)	3.47
8	Annual Energy Generation (20 year equivalent Net AEP) GWh	151.15
9	Net Capacity Factor	35%

EPC Contractor

The details of selected candidate for the EPC Contractor are as follows:

HYDROCHINA CORPORATION, affiliated to POWERCHINA Huadong Engineering Corporation Limited (HDEC) which is one of the world's top 500 enterprises and a comprehensive construction group with diversified industrial structures, is a large consultation enterprise for development of water resource and renewable energy, and serves as an important institution for undertaking and implementation of oversea business in the POWERCHINA group. As a sub-brand of POWERCHINA, HYDROCHINA is focused on providing services in development of hydropower, wind power and solar power, involving resources survey, planning, investigation, design, consultation, financing, procurement, EPC contracting, safety appraisal, construction supervision, construction inspection and final acceptance, and operation maintenance for renewable energy projects, and offers its clients valuable solutions by taking full advantage in advanced technology. Otherwise, on behalf of POWERCHINA, HYDROCHINA expands its business scope to the sectors of transmission and transformation, thermal power, power grid construction, environment protection, municipal construction, port and navigation and oil underground structure.

Over the years, HYDROCHINA has developed three core business sectors, design and consultation, EPC contract and investment, and set up overseas representative offices or branches for providing high quality services abroad. Moreover, it has been always looking on environment protection as important as the corporation's development, and voluntarily takes developing clean energy and benefiting the whole society as its duty. Sticking to the philosophy "to have our heart with clients, to pursue excellence", HYDROCHINA, with a positive and aggressive attitude, keeps reaching for a higher level of technology, does its best endeavors to assure the quality of each project and has completed numerous world famous projects.

Now, HYDROCHINA has ranked No.1 in the 60 China engineering design enterprises ENR, 15th in the Global top 150 engineering design companies and 59th of 225 international engineering design companies.

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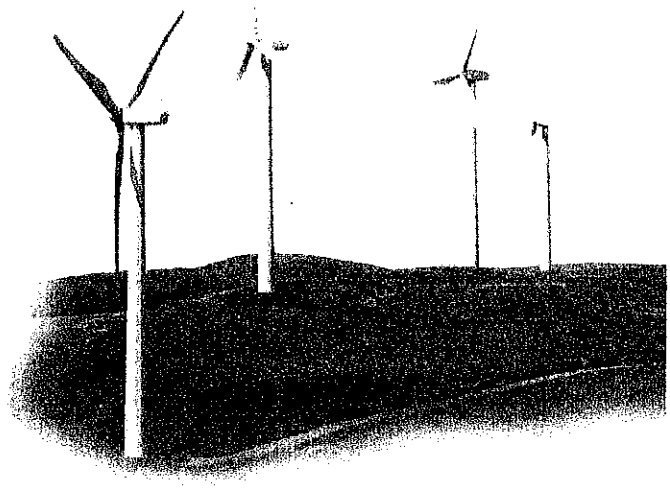
Technical Documentation Wind Turbine Generator Systems 1.7-103 - 50 Hz and 60 Hz



Technical Description and Data

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Introduction

This document summarizes the technical description and specifications of the GE Energy (GE) 1.7-103 wind turbine generator system.

Technical Description of the Wind Turbine and Major Components

The wind turbine is a three bladed, upwind, horizontal-axis wind turbine with a rotor diameter of 103 m. The turbine rotor and nacelle are mounted on top of a tubular tower giving a hub height of 80 m. The machine employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system.

The wind turbine features a distributed drive train design wherein the major drive train components including main shaft bearings, gearbox, generator, yaw drives, and control panel are attached to a bedplate (see Figure 1).

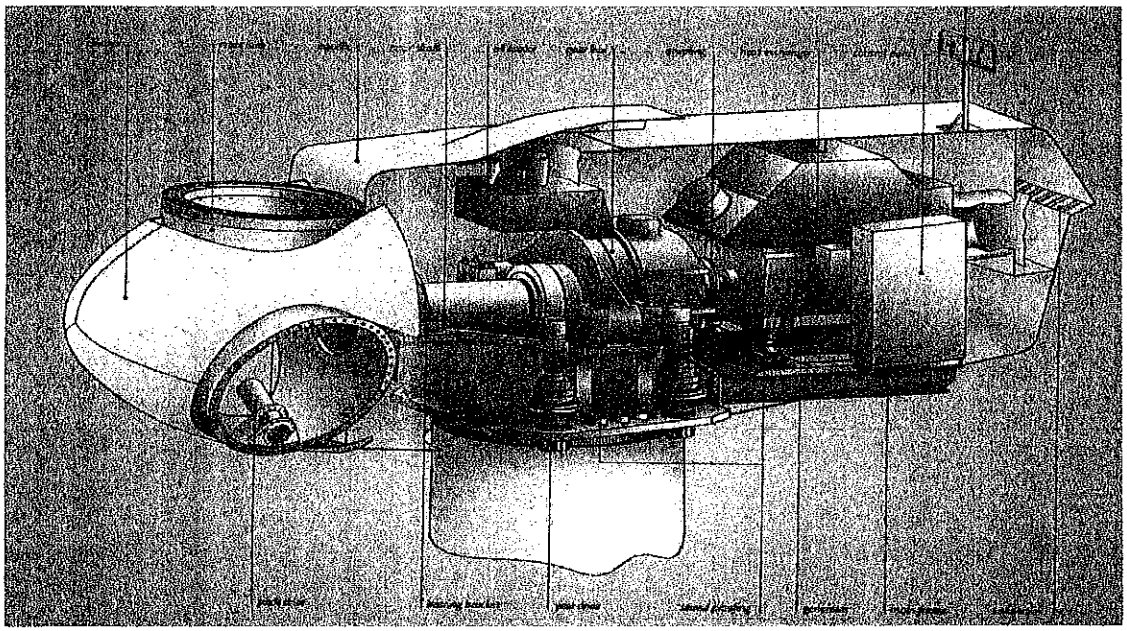

Figure 1: GE Energy 1.7-103 wind turbine nacelle layout

Rotor

The rotor diameter is 103 m, resulting in a swept area of 8,332 m^2, and is designed to operate between 10 and 17.14 revolutions per minute (rpm). Rotor speed is regulated by a combination of blade pitch angle adjustment and generator/converter torque control. The rotor spins in a clock-wise direction under normal operating conditions when viewed from an upwind location.

Full blade pitch angle range is approximately 90°, with the 0°-position being with the airfoil chord line flat to the prevailing wind. The blades being pitched to a full feather pitch angle of approximately 90° accomplishes aerodynamic braking of the rotor; whereby the blades "spill" the wind thus limiting rotor speed.

Blades

There are three rotor blades used on each wind turbine. The airfoils transition along the blade span with the thicker airfoils being located in-board towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

Vortex Generators (VGs) are attached to the suction side of the blades to increase turbine performance. These are molded plastic vanes that create vortices, attached to the blade in rows on the inner 1/3rd of the blade. VGs increase the amount of attached flow over the blade and increase its efficiency.

Blade Pitch Control System

The rotor utilizes three (one for each blade) independent electric pitch motors and controllers to provide adjustment of the blade pitch angle during operation. Blade pitch angle is adjusted by an electric drive that is mounted inside the rotor hub and is coupled to a ring gear mounted to the inner race of the blade pitch bearing (see Figure 1).

GE's active-pitch controller enables the wind turbine rotor to regulate speed, when above rated wind speed, by allowing the blade to "spill" excess aerodynamic lift. Energy from wind gusts below rated wind speed is captured by allowing the rotor to speed up, transforming this gust energy into kinetic which may then be extracted from the rotor.

Three independent back-up units are provided to power each individual blade pitch system to feather the blades and shut down the machine in the event of a grid line outage or other fault. By having all three blades outfitted with independent pitch systems, redundancy of individual blade aerodynamic braking capability is provided.

Hub

The hub is used to connect the three rotor blades to the turbine main shaft. The hub also houses the three electric blade pitch systems and is mounted directly to the main shaft. Access to the inside of the hub is provided through a hatch.

Gearbox

The gearbox in the wind turbine is designed to transmit power between the low-rpm turbine rotor and high-rpm electric generator. The gearbox is a multi-stage planetary/helical gear design. The gearbox is mounted to the machine bedplate. The gearing is designed to transfer torsional power from the wind turbine rotor to the electric generator. A parking brake is mounted on the high-speed shaft of the gearbox.

Bearings

The blade pitch bearing is designed to allow the blade to pitch about a span-wise pitch axis. The inner race of the blade pitch bearing is outfitted with a blade drive gear that enables the blade to be driven in pitch by an electric gear-driven motor/controller.

The main shaft bearing is a roller bearing mounted in a pillow-block housing arrangement.

The bearings used inside the gearbox are of the cylindrical, ball and tapered roller type. These bearings are designed to provide bearing and alignment of the internal gearing shafts and accommodate radial and axial loads.

Brake System

The electrically actuated individual blade pitch systems act as the main braking system for the wind turbine. Braking under normal operating conditions is accomplished by feathering the blades out of the wind. Any single feathered rotor blade is designed to slow the rotor, and each rotor blade has its own back-up to provide power to the electric drive in the event of a grid line loss.

The turbine is also equipped with a mechanical brake located at the output (high-speed) shaft of the gearbox. This brake is only applied as an auxiliary brake to the main aerodynamic brake and to prevent rotation of the machinery as required by certain service activities.

Generator

The generator is a doubly-fed induction type. The generator meets protection class requirements of the International Standard IP 54 (totally enclosed). The generator is mounted to the bedplate and the mounting is designed so as to reduce vibration and noise transfer to the bedplate.

Flexible Coupling

Designed to protect the drive train from excessive torque loads, a flexible coupling is provided between the generator and gearbox output shaft. This coupling is equipped with a torque-limiting device sized to keep the maximum allowable torque below the maximum design limit of the drive train.

Yaw System

A roller bearing attached between the nacelle and tower facilitates yaw motion. Planetary yaw drives (with brakes that engage when the drive is disabled) mesh with the outside gear of the yaw bearing and steer the machine to track the wind in yaw. The automatic yaw brakes engage in order to prevent the yaw drives from seeing peak loads from any turbulent wind.

The controller activates the yaw drives to align the nacelle to the average wind direction based on the wind vane sensor mounted on top of the nacelle.

A cable twist sensor provides a record of nacelle yaw position and cable twisting. After the sensor detects excessive rotation in one direction, the controller automatically brings the rotor to a complete stop, untwists the cable by counter yawing of the nacelle, and restarts the wind turbine.

Tower

The wind turbine is mounted on top of a tubular tower. The tubular tower is manufactured in sections from steel plate. Access to the turbine is through a lockable steel door at the base of the tower. Service platforms are provided. Access to the nacelle is provided by a ladder and a fall arresting safety system is included. Interior lights are installed at critical points from the base of the tower to the tower top.

Nacelle

The nacelle houses the main components of the wind turbine generator. Access from the tower into the nacelle is through the bottom of the nacelle. The nacelle is ventilated. It is illuminated with electric light. A hatch at the front end of the nacelle provides access to the blades and hub. The rotor can be secured in place with a rotor lock.

Anemometer, Wind Vane and Lightning Rod

An anemometer, wind vane and lightning rod are mounted on top of the nacelle housing. Access to these sensors is accomplished through a hatch in the nacelle roof.

Lightning Protection

The rotor blades are equipped with a lightning receptors mounted in the blade. The turbine is grounded and shielded to protect against lightning, however, lightning is an unpredictable force of nature, and it is possible that a lightning strike could damage various components notwithstanding the lightning protection deployed in the machine.

Wind Turbine Control System

The wind turbine machine can be controlled automatically or manually from either an interface located inside the nacelle or from a control box at the bottom of the tower. Control signals can also be sent from a remote computer via a Supervisory Control and Data Acquisition System (SCADA), with local lockout capability provided at the turbine controller.

Service switches at the tower top prevent service personnel at the bottom of the tower from operating certain systems of the turbine while service personnel are in the nacelle. To override any machine operation, Emergency-stop buttons located in the tower base and in the nacelle can be activated to stop the turbine in the event of an emergency.

Power Converter

The wind turbine uses a power converter system that consists of a converter on the rotor side, a DC intermediate circuit, and a power inverter on the grid side.

The converter system consists of a power module and the associated electrical equipment. Variable output frequency of the converter allows operation of the generator.

Technical Data for the 1.7-103

Rotor

Diameter	103 m
Number of blades	3
Swept area	8,332 m²
Rotor speed range	10 to 17.14 rpm
Rotational direction	Clockwise looking downwind
Maximum tip speed	84.8 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering

Pitch System

Principle	Independent blade pitch control
Actuation	Individual electric drive

Yaw System

Yaw rate	0.5 degree/s

Corrosion Protection

Atmospheric corrosion protection (corrosion categories as defined by ISO 12944-2:1998)				
50 & 60 Hz	Standard		Enhanced (Option)	
Recommended Climate	Dry, arid, inland, non-industrial areas		Humid, coastal, industrial areas	
Component	Internal	External	Internal	External
Blades	C-4	C-5	C-4	C-5
Tower shell coating	C-2	C-3	C-4	C-5M
Tower internal fasteners, tower stair fasteners	C-4	C-4	C-4	C-5
Hub, bedplate, generator frame, mainshaft, pillowblock, gearbox, generator	C-4	C-4	C-4	C-4
Nacelle, hub fasteners	C-4	C-4	C-4	C-5
Automatic lubrication system (option for 1.x)	C-3	C-3	C-5	C-5

Operational Limits

Height above sea level	Maximum 2500 m. See notes in section maximum standard ambient temperature below.
Minimum temperature (standard) operational / survival	Standard weather: -15°C / -20°C Cold weather package: -30° C / -40° C Switching on takes place at a hysteresis of 5K (-10°C resp. -25°C)
Maximum standard ambient temperature (operation / survival)	+40°C / +50°C The turbine has a feature reducing the maximum output, resulting in minimized turbine revolutions once the component temperatures approach predefined thresholds. This feature operates best at higher altitudes, as the heat transfer properties of air diminish with decreasing density. Please note that the units are not de-rated in respect to site conditions. The units' reactions related to this feature are based solely on sensor temperatures.
Wind conditions according to IEC 61400	**50 Hz/60 Hz: (IEC S)** $V_{average}$ = 7 m/s , T_I = 16 % @ 15 m/s
Maximum extreme gust (10 min) cording to IEC 61400	**50 Hz/60 Hz:** Standard weather package: 37.5 m/s Cold weather package: 37.5 m/s

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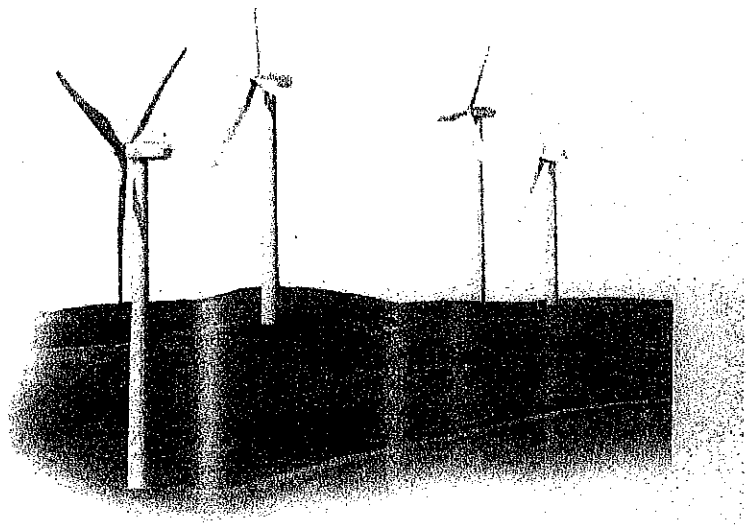
Technical Documentation Wind Turbine Generator Systems 1.7-103 - 50 Hz and 60 Hz



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The wind turbine features a distributed drive train design wherein the major drive train components including main shaft bearings, gearbox, generator, yaw drives, and control panel are attached to a bedplate (see Figure 1).

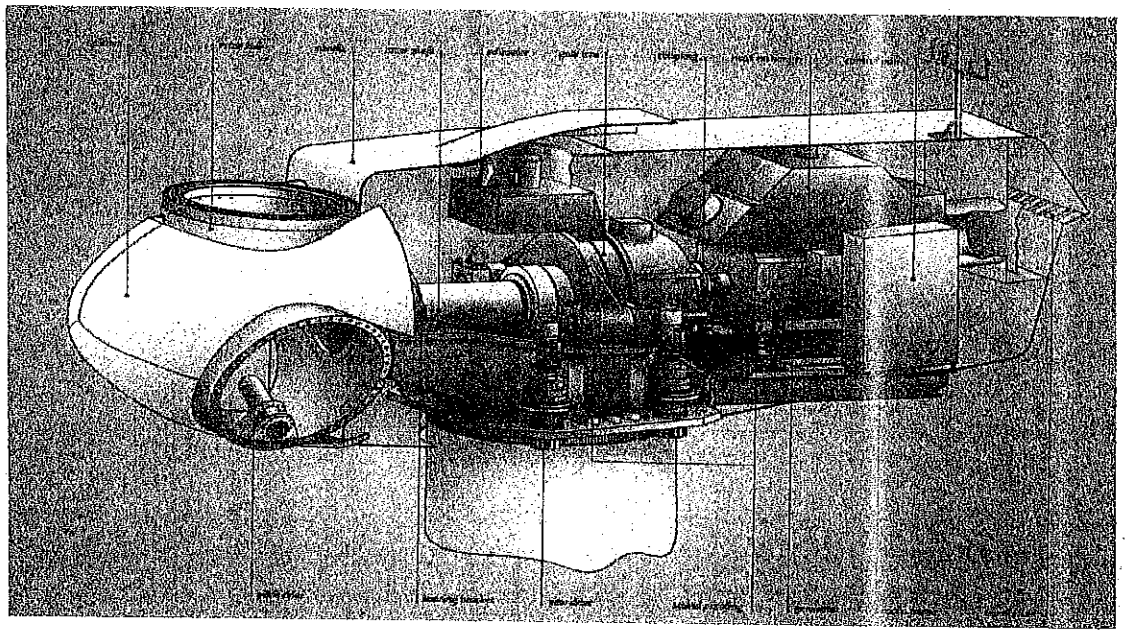

Figure 1: GE Energy 1.7-103 wind turbine nacelle layout

Rotor

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Full blade pitch angle range is approximately 90°, with the 0°-position being with the airfoil chord line flat to the prevailing wind. The blades being pitched to a full feather pitch angle of approximately 90° accomplishes aerodynamic braking of the rotor; whereby the blades "spill" the wind thus limiting rotor speed.

Blades

There are three rotor blades used on each wind turbine. The airfoils transition along the blade span with the thicker airfoils being located in-board towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

Vortex Generators (VGs) are attached to the suction side of the blades to increase turbine performance. These are molded plastic vanes that create vortices, attached to the blade in rows on the inner 1/3rd of the blade. VGs increase the amount of attached flow over the blade and increase its efficiency.

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Three independent back-up units are provided to power each individual blade pitch system to feather the blades and shut down the machine in the event of a grid line outage or other fault. By having all three blades outfitted with independent pitch systems, redundancy of individual blade aerodynamic braking capability is provided.

Hub

The hub is used to connect the three rotor blades to the turbine main shaft. The hub also houses the three electric blade pitch systems and is mounted directly to the main shaft. Access to the inside of the hub is provided through a hatch.

Gearbox

The gearbox in the wind turbine is designed to transmit power between the low-rpm turbine rotor and high-rpm electric generator. The gearbox is a multi-stage planetary/helical gear design. The gearbox is mounted to the machine bedplate. The gearing is designed to transfer torsional power from the wind turbine rotor to the electric generator. A parking brake is mounted on the high-speed shaft of the gearbox.

Bearings

The blade pitch bearing is designed to allow the blade to pitch about a span-wise pitch axis. The inner race of the blade pitch bearing is outfitted with a blade drive gear that enables the blade to be driven in pitch by an electric gear-driven motor/controller.

The main shaft bearing is a roller bearing mounted in a pillow-block housing arrangement.

The bearings used inside the gearbox are of the cylindrical, ball and tapered roller type. These bearings are designed to provide bearing and alignment of the internal gearing shafts and accommodate radial and axial loads.

Brake System

The electrically actuated individual blade pitch systems act as the main braking system for the wind turbine. Braking under normal operating conditions is accomplished by feathering the blades out of the wind. Any single feathered rotor blade is designed to slow the rotor, and each rotor blade has its own back-up to provide power to the electric drive in the event of a grid line loss.

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Flexible Coupling

Designed to protect the drive train from excessive torque loads, a flexible coupling is provided between the generator and gearbox output shaft. This coupling is equipped with a torque-limiting device sized to keep the maximum allowable torque below the maximum design limit of the drive train.

Yaw System

A roller bearing attached between the nacelle and tower facilitates yaw motion. Planetary yaw drives (with brakes that engage when the drive is disabled) mesh with the outside gear of the yaw bearing and steer the machine to track the wind in yaw. The automatic yaw brakes engage in order to prevent the yaw drives from seeing peak loads from any turbulent wind.

The controller activates the yaw drives to align the nacelle to the average wind direction based on the wind vane sensor mounted on top of the nacelle.

A cable twist sensor provides a record of nacelle yaw position and cable twisting. After the sensor detects excessive rotation in one direction, the controller automatically brings the rotor to a complete stop, untwists the cable by counter yawing of the nacelle, and restarts the wind turbine.

Tower

The wind turbine is mounted on top of a tubular tower. The tubular tower is manufactured in sections from steel plate. Access to the turbine is through a lockable steel door at the base of the tower. Service platforms are provided. Access to the nacelle is provided by a ladder and a fall arresting safety system is included. Interior lights are installed at critical points from the base of the tower to the tower top.

Nacelle

The nacelle houses the main components of the wind turbine generator. Access from the tower into the nacelle is through the bottom of the nacelle. The nacelle is ventilated. It is illuminated with electric light. A hatch at the front end of the nacelle provides access to the blades and hub. The rotor can be secured in place with a rotor lock.

Anemometer, Wind Vane and Lightning Rod

An anemometer, wind vane and lightning rod are mounted on top of the nacelle housing. Access to these sensors is accomplished through a hatch in the nacelle roof.

Lightning Protection

The rotor blades are equipped with a lightning receptors mounted in the blade. The turbine is grounded and shielded to protect against lightning, however, lightning is an unpredictable force of nature, and it is possible that a lightning strike could damage various components notwithstanding the lightning protection deployed in the machine.

Wind Turbine Control System

The wind turbine machine can be controlled automatically or manually from either an interface located inside the nacelle or from a control box at the bottom of the tower. Control signals can also be sent from a remote computer via a Supervisory Control and Data Acquisition System (SCADA), with local lockout capability provided at the turbine controller.

Service switches at the tower top prevent service personnel at the bottom of the tower from operating certain systems of the turbine while service personnel are in the nacelle. To override any machine operation, Emergency-stop buttons located in the tower base and in the nacelle can be activated to stop the turbine in the event of an emergency.

Power Converter

The wind turbine uses a power converter system that consists of a converter on the rotor side, a DC intermediate circuit, and a power inverter on the grid side.

The converter system consists of a power module and the associated electrical equipment. Variable output frequency of the converter allows operation of the generator.

Technical Data for the 1.7-103

Rotor

Diameter	103 m
Number of blades	3
Swept area	8,332 m²
Rotor speed range	10 to 17.14 rpm
Rotational direction	Clockwise looking downwind
Maximum tip speed	84.8 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering

Pitch System

Principle	Independent blade pitch control
Actuation	Individual electric drive

Yaw System

Yaw rate	0.5 degree/s

Corrosion Protection

Atmospheric corrosion protection (corrosion categories as defined by ISO 12944-2:1998)				
50 & 60 Hz	Standard		Enhanced (Option)	
Recommended Climate	Dry, arid, inland, non-industrial areas		Humid, coastal, industrial areas	
Component	Internal	External	Internal	External
Blades	C-4	C-5	C-4	C-5
Tower shell coating	C-2	C-3	C-4	C-5M
Tower internal fasteners, tower stair fasteners	C-4	C-4	C-4	C-5
Hub, bedplate, generator frame, mainshaft, pillowblock, gearbox, generator	C-4	C-4	C-4	C-4
Nacelle, hub fasteners	C-4	C-4	C-4	C-5
Automatic lubrication system (option for 1.x)	C-3	C-3	C-5	C-5

Operational Limits

Height above sea level	Maximum 2500 m. See notes in section maximum standard ambient temperature below.
Minimum temperature (standard) operational / survival	Standard weather: -15°C / -20°C Cold weather package: -30° C / -40° C Switching on takes place at a hysteresis of 5K (-10°C resp. -25°C)
Maximum standard ambient temperature (operation / survival)	+40°C / +50°C The turbine has a feature reducing the maximum output, resulting in minimized turbine revolutions once the component temperatures approach predefined thresholds. This feature operates best at higher altitudes, as the heat transfer properties of air diminish with decreasing density. Please note that the units are not de-rated in respect to site conditions. The units' reactions related to this feature are based solely on sensor temperatures.
Wind conditions according to IEC 61400	**50 Hz/60 Hz: (IEC S)** $V_{average}$ = 7 m/s , T_I = 16 % @ 15 m/s
Maximum extreme gust (10 min) according to IEC 61400	**50 Hz/60 Hz:** Standard weather package: 37.5 m/s Cold weather package: 37.5 m/s

Annexure 16

Location, Site map and Land details

Project Site

The site proposed for the implementation of the Project has been selected by considering

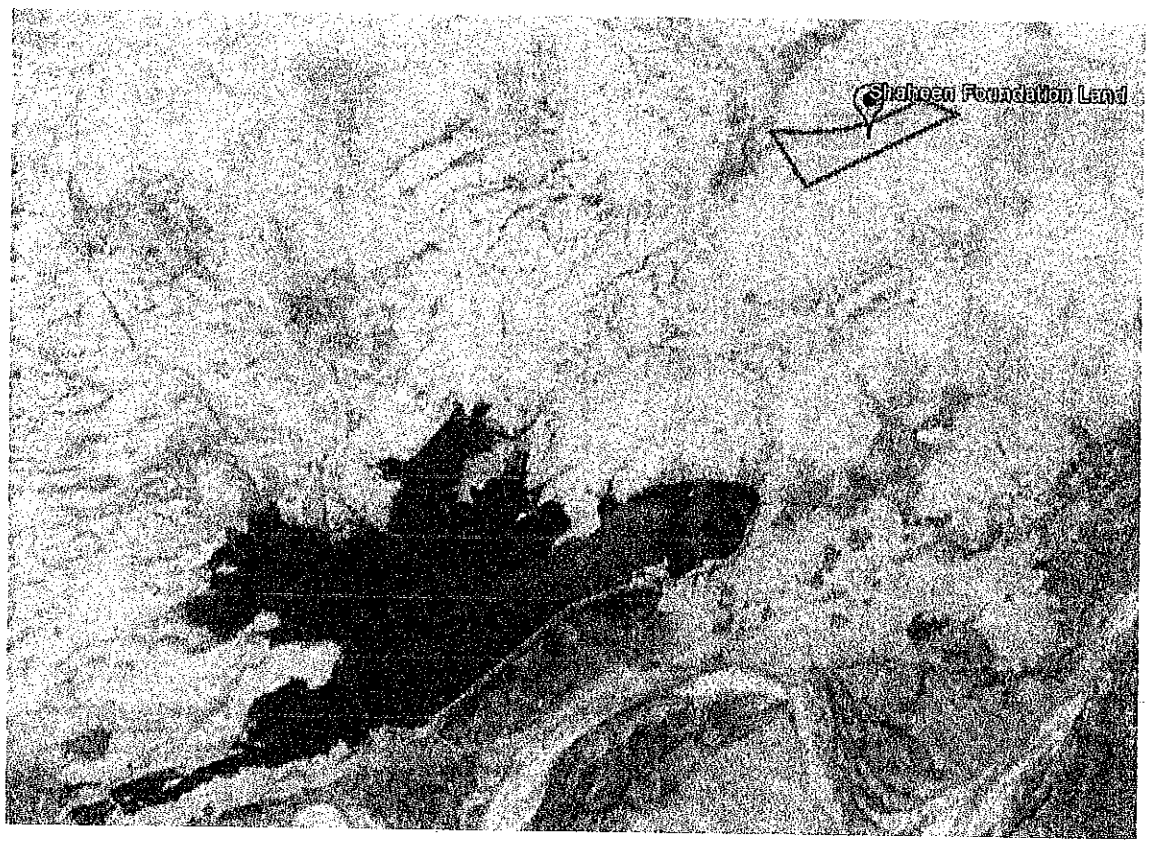
I. Location in the wind corridor
II. Wind conditions at the site
III. Topographic conditions
IV. Site accessibility
V. Location of the grid with reference to the site for interconnection-

The site is located within the wind corridor identified by AEDB and the land is owned by the project sponsors.

The site is located in Bholari District Thatta, Sindh, which is one of the most promising areas where wind power projects can be viably installed. Shaheen Renewable Energy 1 (Private) Limited wind farm site is located 125-130 km from Port Qasim Karachi with easy road access.

Land Description of the Project Site

Shaheen Renewable Energy 1 (Private) Limited is the Project Company for a 50 MW Wind Power Project to be located in Bholari District Thatta, Sindh that is towards the East of Karachi. The National Highway and Superhighway are the major connecting roads to the Project site, having a distance of approximately 120-125 km from Port Qasim. The wind farm Project is located in Bholari, which is located approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of approximately 2880 [redacted] acres of land, which is owned by the project company. The Jhimpir wind corridor is identified as a potential area for the development of wind power projects. The overview of the project site is shown in Figure below



The Project site is exposed to strong south westerly winds; wind data analysis of the area suggests that 80% wind blows from the south west direction. The terrain of the area is flat with small change in altitude. The proposed site lies under roughness class 1.5 as there is low vegetation. The site is easily accessible through metallic roads. The ground is hard and rocky; the subsurface soil also includes clay and silt.

The proposed wind farms lie on a flat inland area with hard and rocky ground conditions. The site would be categorized as inland wind development as opposed to offshore/coastal wind project development (which is more difficult to develop due to tides and soft subsoil clay). The general terrain at the site can be described as simple and flat terrain. Internal access roads are the roads connecting the single wind turbine locations with each other and the external access roads and grid station would be constructed during the civil works of the wind farm.

The proposed site area lies in an arid zone with very little annual precipitation. The result is that there is sparse vegetation in the area. Some hardy tree species are visible scattered far and wide in the area. The area is rocky with some rock outcrops towards the Super Highway. The terrain at the site and surrounding area is generally flat with elevations varying between 55 m in the southwest corner of the site to 100 m in the northeast corner.

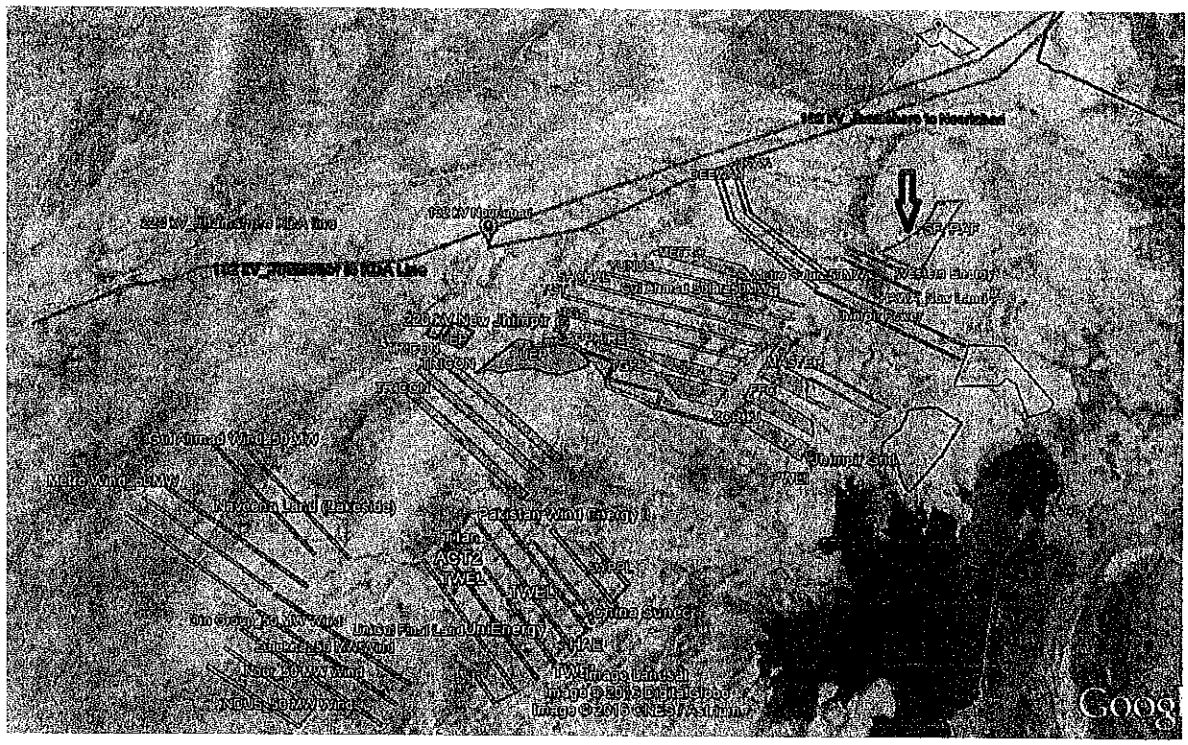
The proposed site is located about 120-125 km from Port Qasim, Karachi. Karachi borders on the Arabian Sea and the weather belongs to tropical monsoon climate. Rainfall is scarce with about 200 mm for a whole year and most of this is concentrated in July and August. The temperature in winter from November to February is temperate, but it is hot with high temperature in summer from April to August as the highest temperature has reached 44.02°C. The coordinates of Wind farm are given in Table below:

50 MW SRE 1, PAF

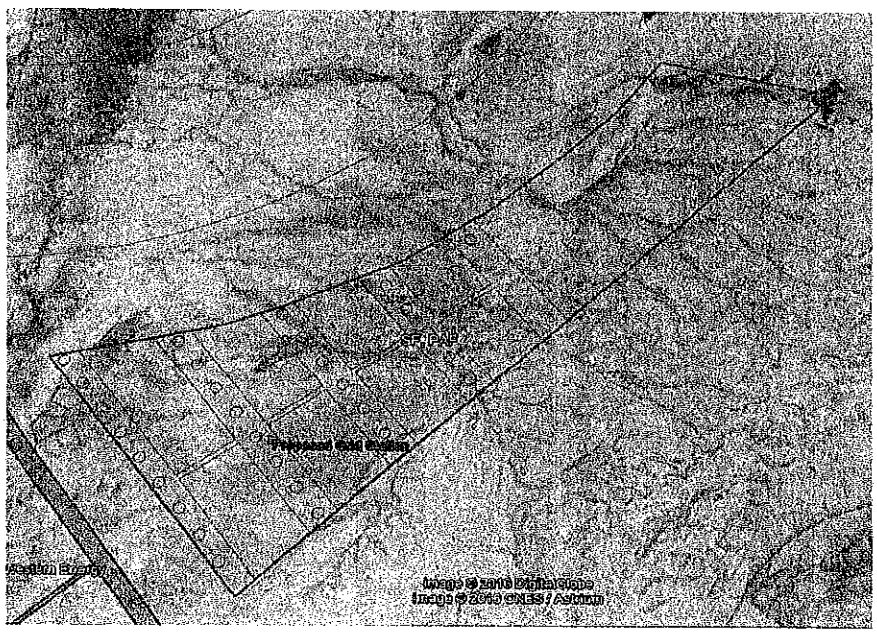
S. No.	Latitude	Longitude
1	25°10'55.80"N	68° 3'48.00"E
2	25° 13'26.40"N	68° 6'28.80"E
3	25° 13'29.19"N	68° 7'28.97"E
4	25° 10'2.80"N	68° 5'15.10"E

Wind Farms Layout at Project Site

The overview of wind farm of Shaheen Renewable Energy 1 (Private) Limited and neighboring wind farms are shown in Figure below:



The micrositing of the Shaheen Renewable Energy 1 (Private) Limited Project with 29 Turbines is shown in Figure below:



The coordinates of WTGs are given in Table below:

Coordinates (UTM z42 WGS84)		
Turbine No.	Easting [m]	Northing [m]
SF_T01	405766.0228	2785448.387
SF_T02	406020.8929	2785273.681
SF_T03	406275.763	2785098.974
SF_T04	406530.633	2784924.268
SF_T05	406680.309	2785914.948
SF_T06	406785.5031	2784749.562
SF_T07	406935.1601	2785740.215
SF_T08	407040.3732	2784574.856
SF_T09	407190.0113	2785565.481
SF_T10	407295.2433	2784400.15
SF_T11	407444.8624	2785390.747
SF_T12	407505.129	2786436.409
SF_T13	407550.1134	2784225.444
SF_T14	407699.7135	2785216.013
SF_T15	407759.9011	2786261.56
SF_T16	407804.9834	2784050.737
SF_T17	407954.5646	2785041.279
SF_T18	408014.6732	2786086.711
SF_T19	408209.4157	2784866.545
SF_T20	408269.4453	2785911.862
SF_T21	408321.1712	2786973.601
SF_T22	408464.2669	2784691.812
SF_T23	408524.2175	2785737.013
SF_T24	408576.0843	2786798.958
SF_T25	408778.9896	2785562.164
SF_T26	408830.9975	2786624.315
SF_T27	408930.3784	2787649.801
SF_T28	409085.9106	2786449.672
SF_T29	409340.8238	2786275.028

Topographical and Geological Conditions at Project Site

Topographical conditions

The Project site is on a plain area at an elevation of 55-100 m, which is generally flat, but a bit higher on the east and lower on the west. The landform at wind farm sites is mainly of pediment and the vegetation there is less developed.

Geological conditions

The planned wind farm sites are covered mainly by marine alluvium of Holocene and recent weathered deposit, and underlain mainly by Tertiary limestone. The bedrock in the site is generally outcropped. As the WTG is a high-rise structure, it has a high gravity center and should sustain high loads, large horizontal wind force and overturning moments. WTGs are designed to withstand these forces.

Hydrology

According to the regional hydrological data available, the Project site is in a dry area, where the water table is deeply underground, and the surface water and water in the shallow surface layers is weakly to slightly corrosive to the concrete and is corrosive to the rebars in the concrete which has been submerged in water for a long-time or alternatively in wet and dry conditions. Corrosion prevention measures will be adopted in the design and implementation of the wind farm.

Annexure 17

Technology, Size and No. of Units

Technology	Wind Power
Size	49.3
No. of Units	**29**

Annexure 18

Grid Interconnection Details

Name of Grid	Jhimpir-1
Distance from Nearest Grid	30KM
Grid Voltage	132KV

Annexure 19

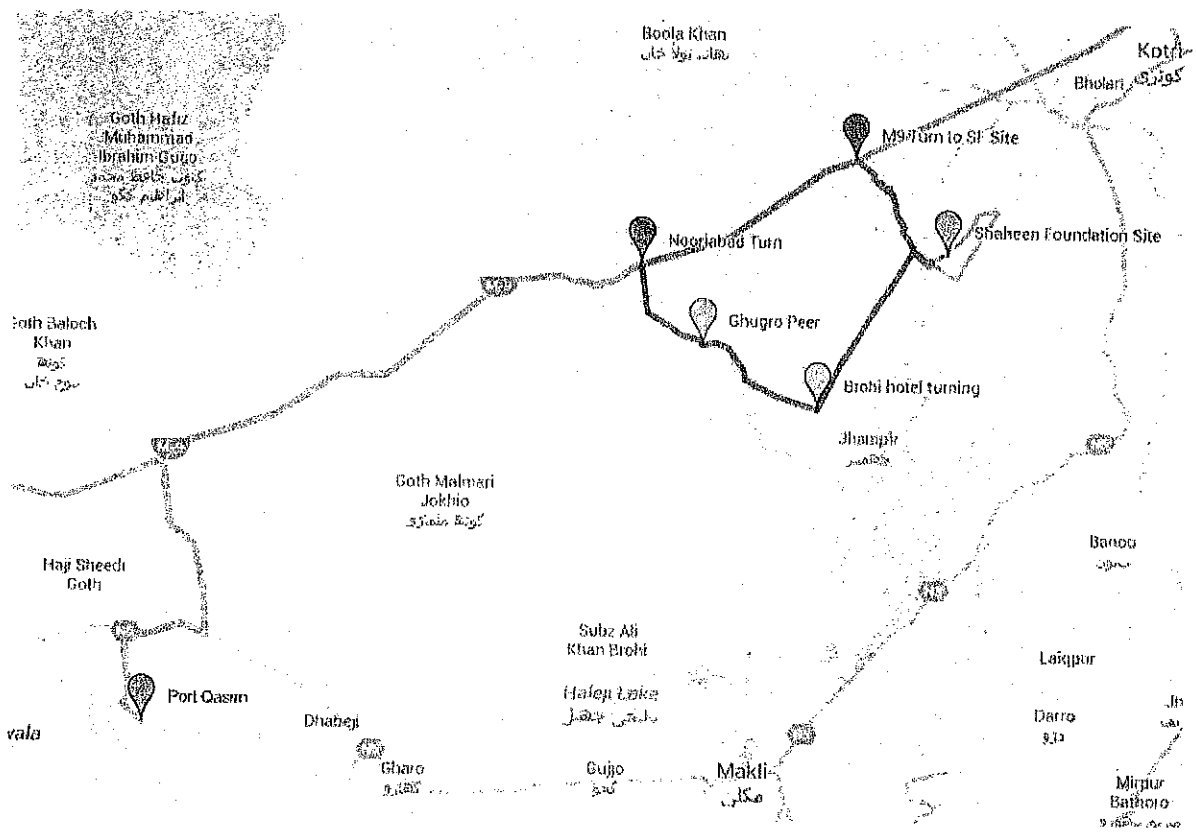
Site Infrastructure

Site Accessibility

The major section of track from Karachi to the site is via the National and Super highway. The track is a multi-lane road. It has a flat terrain, and long and heavy vehicles can easily navigate through this road. Generally, minor track settlement is required from Nooriabad onwards to reach site area. The total distance from Karachi to the site is approximately 130km.

There are number of neighboring wind farms in the surrounding area of Thatta. The site is located in Bholari-Thatta, Sindh that is towards the East of Karachi and within the same corridor as many other wind power projects. The project site is towards the north of the FFC Wind Project, Zorlu Wind project, Three Gorgeous Wind Project, Hawa Wind Project, and JPL Power Project.

The overview of the track from Bin Qasim Port to the Project site through the National and Super Highway is shown in Figure below:



Telecommunication at project site

Close to the site, there is wire based telecommunication available in the nearby towns. Cellular phone suppliers Mobilink, Telenor, Warid, Ufone and Zong have coverage on the site area.

For the SCADA system of the wind farm, a wire based telecommunication infrastructure has to be installed. Land line network will be arranged from the nearby towns once civil work starts at the site.

Availability of Semi-Skilled and Skilled Labor

There is a dearth of wind project specific skilled labor in the area, however the Project will be a source of employment for these individuals.

Annexure 20

Project Cost, Debt/Equity

Project Cost

The estimated project cost is **110 Million USD**.

Debt to Equity Ratio
82.5 Million USD (75%) : 27.5 Million USD (25%)

Annexure 21

Project Commencement and Completion Schedule

Award of Tariff	July 30, 2017
Financial Close	July 30, 2018
Commercial Operation Date	30 Nov 2019

Annexure 22

Safety and Emergency Plans

Safety & Emergency Plans for Project

Fire Protection

The fire prevention design of 132kV boost substation in this project implements the principle of "Giving priority to prevention, combining prevention with elimination". Focusing on the actual situation of the project, advanced fire prevention technology is actively adopted to protect the safety, with convenient use, reasonable economy.
Because the boost substation is near the town, no fire agency is set, but one full-time firefighter needs to be equipped with. During the initial stage of fire, it is fought by the control center. If the event of a major disaster happens, the fire should be put out together with the support of the local fire brigade.

Fire hydrant, sand box, portable fire extinguisher and so on are set in the boost substation, and configured in every places of the boost substation. The width of roads inside and outside of the station is greater than 4m, which can also be used as fire lanes. Each main buildings should have safe exits which are opened to outside. Power supply for fire prevention adopts independent double loop, both of which are respectively connected through the 33kV busbar. Water supply for fire prevention adopts water tank, which is equipped with two pumps.

The fire prevention monitoring system would be set, and the fire prevention planning would be made during the construction period.

Labor Safety

During the project construction and operation, adhere to the principle of "safety first, prevention crucial" to realize a full, whole-process, and all-around management and supervision and ensure the safe and economic operation of various types of equipments and the personal safety of the staff.

The hygiene and safety management institution should be set up in the wind farm, which is responsible for the education, training and management on aspects of health and safety after the project is put into operation. A part time safety management personnel should be determined in production department, who is responsible for labor safety and industrial hygiene daily.

Tour inspection regulation, operation monitoring regulation, and maintenance regulation should be established, and daily safety maintenance on the relevant apparatus, instrument and equipment for production should be done.
According to the features of the project, the hygiene and safety management institution should be configured monitoring equipments such as sound level meter, and the necessary safety propaganda apparatus.

The main contents of labor safety and industrial hygiene design are to analyze the hazard factors which may exist during the operation period ,such as fire and explosion protection, electrical injury, mechanical injury, and electromagnetic radiation, and risk factors which are possibly existing in high-altitude operations, excavation, lightning and electrical protection and other work during the construction period, to formulate

the corresponding measures, establish the corresponding institution and emergency plan, and put forward a special investment and implementation plan. Through calculation, the special investment budget is 126,200 dollars.

Accident Emergency Rescue Preplan

The enterprise managing and operating the wind farm shall conscientiously implement relevant national laws and regulations for production safety, perfect the rules and regulations, put into effect layer upon layer the production safety responsibility system, enhance the current management of production safety and on-site safety inspection, and organize production and operating activities strictly as per relevant regulations. The enterprise shall search out in time any hidden dangers, rectify and reform the hidden dangers conscientiously, work out safety countermeasures, assure labor resources material resources and registered capital required for the production safety, improve the safety education training of employees, and prevent new accident potential from occurring. The wind farm shall establish accident emergency rescue system, work out accident treatment preplans (including salvage preplans and technological preparation preplans) in view of potentially affected areas, study out operable responding measures, and designedly organize actual training exercises so as to grasp the preplans, find out the errors and detects of the emergency preplans in process of training exercises, hereby work out analysis reports on training exercises, set forth corrective measures, and finish the improvement of emergency preplans.

The wind farm shall establish an early-warning mechanism, emergency treatment capacity and accident emergency rescue action project against sudden major accidents. Corresponding emergency preplans shall be worked out for typical accidents related to wind prevention and moisture protection etc., and more detailed, normative and complete accident emergency preplans shall be worked out for potential major accidents such as typhoon, fire, explosion, electric-power secondary system accidents, and construction-period major artificial accident prevention.

Annexure 23

Grid Study and Approval

21A

NATIONAL TRANSMISSION & DESPATCH COMPANY LTD

No. 8800 /GM/GSC/NTDC

GENERAL MANAGER (GSC)

Date: 01/12/2016

CERTIFICATE

Subject: **APPROVAL OF SYSTEM STUDIES OF 50 MW OF M/S SHAHEEN RENEWABLE ENERGY 1 (PVT) LTD (SHAHEEN FOUNDATION) WIND POWER PROJECT.**

NTDC hereby accords its approval in respect of system studies submitted by M/s Shaheen Renewable Energy 1 (Pvt) Ltd (Shaheen Foundation) in respect of 50 MW Wind Power Project at Jhimpir Sindh. NTDC further certifies that the power to be generated by M/s Shaheen Renewable Energy 1 (Pvt) Ltd (Shaheen Foundation) will be evacuated by July, 2019 and the power injected through the above mentioned project will not have any adverse affect on the National Grid as required under the Grid Code.

Signature:

Name: WAJAHAT SAEED RANA

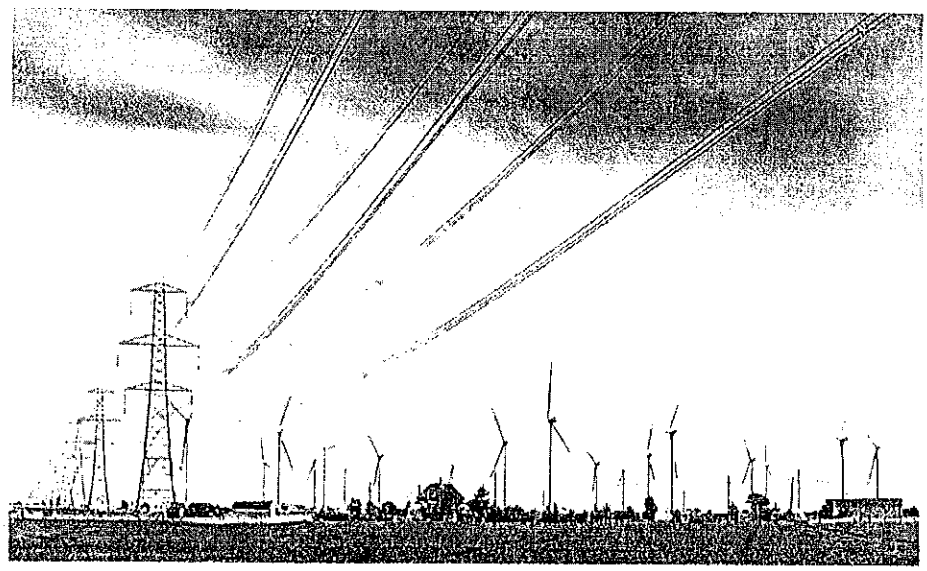
Designation: General Manager (GSC)
413-WAPDA House, Lahore.

Int -

413-WAPDA House, Lahore, Pakistan Tel: +92 42 99202699, Fax: +92 42 99202150, gmgsc@ntdc.com.pk

National Transmission and Despatch Company Limited (NTDCL)

Grid Interconnection Study for Evacuation of Power from 49.3 MW Shaheen Foundation (PAF) Wind Power Project to the National Grid



Planning (Power) Department
4th Floor, PIA Tower, Egerton Road, Lahore.

May 2016

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Appendices

Appendix-1: Shaheen Foundation WPP Data Received from Project Sponsor

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Appendix-3: Load Flow Study Exhibits

Appendix-4: Short Circuit Study Exhibits

Appendix-5: Dynamic Data of Shaheen Foundation WPP for Stability Analysis

Appendix-6: Transient Stability Study Exhibits.

Executive Summary

1. Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh. The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the selected 10 WPPs was communicated to CPPA-G and NTDCL for information and further action at their ends.

2. The sponsor of Shaheen Foundation WPP, i.e., M/s Shaheen Foundation PAF, has engaged Planning Power department of NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

3. The project sponsor of Shaheen Foundation WPP, as per requirements of NTDCL Planning Power, provided the project site location/coordinates, and other necessary technical data/information of Shaheen Foundation WPP, i.e., No., generation capacity, voltage, p.f. & type of WTGs, collector group configuration, gross & net output capacity of the plant, No. & rating of transformers, switchyard voltage levels, single line diagram & equipment rating etc.

4. As per information provided by the project sponsor, Shaheen Foundation WPP comprises of 29 No. WTGs and each WTG is of General Electric make, Type-3 with 1.7 MW gross capacity. The total gross generation capacity of Shaheen Foundation WPP is 49.3 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.2 MW.

5. This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from Shaheen Foundatin WPP in integration with other WPPs in its vicinity. In this report, he

results of load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from Shaheen Foundation WPP to the National Grid in the light of NEPRA Grid Code.

6. Considering the capacity, locations, existing/planned system network in the area, the following integrated interconnection scheme of the 3 WPPs lying in northern part of Jhimpir including Shaheen Foundation, Norinco, and Western Energy, has been proposed for their reliable power evacuation to the grid:

   i) 132 kV double circuit (D/C) transmission line, approx. 30 km long on Greeley conductor for connecting all the 3 WPPs including Shaheen Foundation WPP with 132 kV single circuit from Master WPP to the under construction Jhimpir New (Jhimpir-1). In this scheme, the interconnection of Shaheen Foundation WPP includes 132 kV D/C transmission line, approx. 8 km long, on Greeley conductor for looping In/Out on the 132 kV single circuit from Western WPP to Norinco WPP.

   ii) Addition of 4th 220/132 kV transformer at the under construction Jhimpir New (Jhimpir-1) 220/132 kV substation.

   The following interconnection schemes/network reinforcement proposed with the other 7 WPPs lying in southern part of Jhimpir, will also be required for the reliable power evacuation of 3 WPPs including Shaheen Foundation WPP to the grid:

   iii) 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.

   iv) 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.

7. The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed

interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

8. Detailed load flow studies have been carried out for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the above proposed interconnection schemes of the 10 WPPs including Shaheen Foundation WPP for their reliable power evacuation to the grid.

9. The proposed interconnection scheme for Shaheen Foundation WPP has been found adequate after performing the load flow studies to assess the steady state system performance under normal and N-1 contingency conditions. The voltage profile, line loading, frequency and active/reactive power flow etc. from the Shaheen Foundation WPP and on the grid are within the NEPRA Grid Code criteria. It has been found on the basis of the study results that the power from Shaheen Foundation WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints.

10. The short circuit studies have been carried out with proposed interconnection of Shaheen Foundation WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Shaheen Foundation WPP and other substations in its vicinity. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Shaheen Foundation WPP for various number of WTGs in operation and reduced generation in its vicinity. It is found that the induction of Shaheen Foundation WPP with the proposed interconnection scheme has no adverse impact on the existing and proposed substations in its vicinity.

11. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Shaheen Foundation WPP are 8.14 kA and 5.42 kA respectively in the year 2021-22 but these are expected to rise due to future grid system

expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Shaheen Foundation WPP.

12. Transient stability analysis has been carried out for Shaheen Foundation WPP with the proposed interconnection scheme. The stability of the Shaheen Foundation WPP and the power system has been checked with application of different disturbances on the wind farm and at the substations in its vicinity. It has been found that the Shaheen Foundation WPP and the power system remain stable with no adverse effects after subjected to faults as per Grid Code requirement.

13. The LVRT requirements for Shaheen Foundation WPP have been tested against contingency conditions of 100 ms (5 cycles) under normal clearing time and 180 ms (9 cycles) for delayed fault clearing. The stability simulations have proved that Shaheen Foundation WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

14. The impact of induction of Shaheen Foundation WPP on power quality has also been analyzed. The study results indicate that the power quality indices including flicker and voltage unbalance, remain within the permissible limits as mentioned in the IEC and other international standards. It is clearly mentioned that it is the responsibility of developer of the Shaheen Foundation WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

15. It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Shaheen Foundation WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary modifications in the equipment/substation of Shaheen Foundation WPP, if any, in this regard.

16. It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Shaheen Foundation WPP to the National Grid.

1 Introduction

There is huge potential of wind power at Jhimpir, Gharo and in their surrounding areas in Southern Part of Pakistan. At present, about 308 MW of Wind Power Projects (WPPs) in operation, whereas, some WPPs are in testing/commission phase and many other WPPs are at different stages of implementation. In 2013, a PC-1 was prepared to propose evacuation scheme of 1756 MW of WPPs, located at Jhimpir, Gharo and near Jamshoro, to the National Grid. Out this wind capacity, a total of 500 MW WPPs located near Jamshoro was planned to be inducted by two companies, i.e., 250 MW each by M/s NBT Wind Power Pakistan-II (Pvt.) Ltd. and NBT Wind Power Pakistan-III (Pvt.) Ltd. The LOIs of these two WPPs were cancelled later due to non-achievement of the required milestones.

Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh.

The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the 10 WPPs was communicated to NTDCL through CPPA-G Ltd. for their information and further action at their ends.

The sponsor of Shaheen Foundation WPP, i.e., M/s Shaheen Foundation, has engaged NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

The site location/coordinates and other necessary technical data/information of the Shaheen Foundation WPP, i.e., number, generation capacity, voltage, p.f. & type of WTGs; collector group configuration; gross & net output capacity of the plant; number & rating of transformers; single line diagram; switchyard voltage levels &

equipment rating etc., have been provided by its sponsor and is attached in Appendix-1.

As per information provided by the project sponsor, Shaheen Foundation WPP comprises of 29 No. WTGs and each WTG is of General Electric make, Type-3 with 1.7 MW gross capacity. The total gross generation capacity of Shaheen Foundation WPP is 49.3 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.2 MW.

This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from Shaheen Foundation WPP in integration with other WPPs in its vicinity. In this report, he results of load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from Shaheen Foundation WPP to the National Grid in the light of NEPRA Grid Code.

2 Technical Data of Shaheen Foundation WPP

The project sponsor has provided the location/site coordinates, micro-siting arrangements of WTGs, proposed sketch of the WPP and detailed technical data/parameters of WTG and switchyard equipment etc. for Shaheen Foundation WPP which is attached in Appendix-1. The salient parameters of Shaheen Foundation WPP are given as under:

a) **WTG Generator Data**:

- Number of WTGs = 29
- Manufacturer/Model = General Electric GE1.7-103
- Gross capacity = 1.7 MW
- Type = 3
- Voltage = 0.69 kV
- Power factor = 0.95 (Lagging/Leading)

b) **WTG Arrangement in Wind Farm**

- No. of collector groups = 4
- No. of WTGs in one collector group = 3 X 7 WTGs + 1 x 8 WTGs
- Length of each collector group with the switchyard = 3 km

c) **Total Wind Farm Capacity:**

- Total gross capacity= 49.3 MW
- EBOP Losses = 1.35 MW
- Auxiliary Consumption = 0.8 MW
- Total net output capacity that will flow to the Grid = 47.2 MW

d) **Generator Step-up Transformer Data:**

- No. of step-up transformers = 29
- Voltage ratio = 0.69/33 kV
- MVA rating = 1.9 MVA
- Percentage Impedance = 6.5%

e) Proposed Switchyard of Wind Power Project:

- High Voltage (HV) Level = 132 kV
- Medium Voltage (MV) Level = 33 kV
- Bus Bar Scheme = Double bus single breaker
- Power (HV/MV) transformer:
  - No. of transformers = 2
  - Voltage ratio = 132/33 kV
  - MVA rating = 31.5/40/50 MVA
  - Percentage Impedance = 10-12%
- Switchgear data, single line diagram and layout of switchyard attached in Appendix-1.

f) Proposed Reactive Power Compensation

2x10 MVAR Capacitor bank or SVC (to be decided in detailed design stage)

The other technical data/information about switchyard equipment is attached in Appendix-1.

3 Study Objectives, Assumptions and Criteria

3.1 Study Objectives

The objectives of the interconnection study are given as under:

- To propose the transmission scheme for reliable dispersal of power from M/s Shaheen Foundation WPP to the National Grid under normal and N-1 contingency conditions.
- To evaluate adequacy of the proposed interconnection scheme and to assess the impact of Shaheen Foundation WPP on the grid system and vice versa through load flow, short circuit, transient stability studies and power quality analyses.

3.2 Study Assumptions

The system studies are based on the following assumptions:

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs, especially HESCO.
- Export of power from NTDC to K-Electric is assumed as 650 MW.
- Interconnected transmission system has been assumed, however, split bus has been assumed at 132 kV bus bars of Hala Road and T.M. Khan Road 220/132 kV substations as per system requirements.
- The existing, under-construction and already planned WPPs at Jhimpir and Gharo clusters with their interconnection arrangements. The under-construction 220/132 kV substations, i.e., Jhimpir New (Jhimpir-1) and Gharo New, with their allied transmission lines are assumed to be commissioned.
- As per information provided by project sponsor, the total gross & net capacity of Shaheen Foundation WPP have been assumed as 49.3 MW & 47.2 MW

respectively. The modeling of Shaheen Foundation WPP in PSS/E software has been made as under:

- There are a total number of 29 WTGs and four collector groups in the wind farm with each WTG having gross capacity of 49.3 MW and generating power at 0.69 kV which has been stepped up to 33 kV through 1.7 MVA transformer.
- Out of four collector group , three collector groups comprising of 7 WTGs have been modeled with 1.7 x 7 = 11.9 MW capacity each and equivalent 0.69/33 kV transformers and one collector group comprising of 6 WTGs has been modeled with 1.7 x 8 = 13.6 MW capacity and equivalent 0.69/33 kV transformer.
- Each of the four collector groups have been connected through individual 33 kV cables with 33 kV bus bar of the 132/33 kV substation.
- The 20 MVAR switched shunt has been assumed at 33 kV bus bar.
- At 132/33 kV substation, the 2 No. 132/33 kV transformers have been modeled separately. The percentage impedance of 132/33 kV transformer has been assumed as 12% each.

- Other WPPs in the vicinity of Sheheen have also been modeled according to their own WTG capacities and collector group configuration.
- This interconnection study report is based on the information supplied by M/s M/s Shaheen Foundation and NTDCL is not responsible for the study results on account of any deficiency and/or inaccuracy of the supplied information.

3.3 Study Criteria

The interconnection studies have been carried out keeping in view of the following system operating criteria/limits in accordance with NEPRA Grid Code:

Voltage Limits ±5% under normal and ±10% under contingency conditions. However, voltages at some generation buses and some substations may be kept upto

	+8% under normal operating conditions as per network configuration and/or system requirements.
Transmission Line Loading Limits	80% under normal and 100% under N-1 contingency conditions.
Transformer Loading Limits	80% under normal and 110% under N-1 contingency conditions.
Frequency Limits	49.8 – 50.2 Hz under normal condition and 49.4 – 50.5 Hz under N-1 condition.
Stability Criteria	System stability must be maintained after subjected to the following disturbances • 3-phase fault at bus bar cleared in 5-cycles/ 100 ms (normal clearing condition) and tripping of the associated circuit. • 3-phase fault at bus bar cleared in 9 cycles/180 ms (delayed clearing or stuck breaker condition) and tripping of the associated circuit.
Low Voltage Ride Through (LVRT) Requirements	• A wind power plant must withstand a voltage dip down to 30% of retained voltage for a duration of at least 100 ms for a normal clearing case, and at least 180 ms in the case of stuck breaker contingency event. • The wind power plant shall manage active power restoration, after the voltage recovery, at a rate of at least 20% of nominal output power per second, subject to availability of adequate wind speed at site.

4 Proposed Interconnection Scheme

Considering the capacity, locations, existing/planned system network in the area, the following integrated interconnection scheme of the 3 WPPs lying in northern part of Jhimpir including Shaheen Foundation, Norinco, and Western Energy, has been proposed for their reliable power evacuation to the grid:

i) 132 kV D/C transmission line, approx. 30 km long on Greeley conductor for connecting all the 3 WPPs including Shaheen Foundation WPP with 132 kV single circuit from Master WPP to the under construction Jhimpir New (Jhimpir-1). In this scheme, the interconnection of Shaheen Foundation WPP includes 132 kV D/C transmission line, approx. 8 km long, on Greeley conductor for looping In/Out on the 132 kV single circuit from Western WPP to Norinco WPP.

ii) Addition of 4th 220/132 kV transformer at the under construction Jhimpir New (Jhimpir-1) 220/132 kV substation.

The following interconnection schemes/network reinforcement proposed with the other 7 WPPs lying in southern part of Jhimpir, will also be required for the reliable power evacuation of 3 WPPs including Shaheen Foundation WPP to the grid:

iii) 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.

iv) 220 kV D/C transmission line, approx. 07 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.

It is intimated that lengths of the above mentioned lines are approximate and will be finalized after route survey.

The geographical diagram showing above proposed interconnection scheme for power dispersal of Shaheen Foundation WPP is attached as Figure #1 (Appendix-2).

The google earth diagram indicating the locations/layout of the WPPs in Jhimpir area including Shaheen Foundation WPP is also attached in Appendix-2.

5 Load Flow Studies

The detailed load flow studies have been carried out with the proposed interconnection scheme for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the proposed interconnection scheme for Shaheen Foundation WPP for its reliable power evacuation to the National Grid. In this regard, system scenarios for peak load conditions in years 2019 and 2021 have been simulated to evaluate the adequacy of the proposed interconnection scheme and performance of Shaheen Foundation WPP on the system under normal and N-1 contingency conditions. In addition, the load flow studies have also been carried out for off-peak load condition in 2019 to analyze the impact of the Shaheen Foundation WPP on the system.

It is to be noted that all the load flow study Exhibits referred in the following sections are attached in Appendix-3. The results of the load flow studies for dispersal of power from Shaheen Foundation WPP to the National Grid are described as under:

5.1 Peak Load 2019 Scenario

Load flow study for the peak load scenario in 2019 under normal system condition has been carried out with net output of 47.2 MW from Shaheen Foundation WPP and is attached as Exhibit #1.0 & 1.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Shaheen Foundation WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Western-E WPP – Shaheen-F WPP 132 kV S/C	21.2
Shaheen-F WPP – Jhimpir-1 WPP 132 kV S/C	68.4
Western-E WPP – Norinco WPP 132 kV S/C	26.9

Transmission Line/Transformers	Power Flow (MW)
Jhimpir-1 – T.M. Khan 132 kV D/C	227.2
Jhimpir-1 – Jhimpir-2 220 kV S/C	167.5
Gharo New – Jhimpir-1 220 kV S/C	23.2
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.2
4x250 MVA, 220/132 kV transformers at Jhimpir-1	648.4

The active and reactive power flows from Shaheen Foundation WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions during peak load scenario of 2019. The results of contingency studies are attached as Exhibit# 1.1 to 1.10 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
1.1	Shaheen-F WPP – Western-E WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
1.2	Shaheen-F WPP – Jhimpir-1 132 kV S/C out	-do-
1.3	1x50 MVA, 132/33 kV transformer at Shaheen-F WPP out	-do-
1.4	One collector group (8 WTGs) at Shaheen-F WPP out	-do-
1.5	Master WPP – Jhimpir-1132 kV S/C	-do-

Exhibit #	Contingency Conditions	Remarks
	out	
1.6	1x250 MVA, 220/132 kV transformer at Jhimpir-1 out	-do-
1.7	Jhimpir-1 – T.M. Khan 132 kV S/C out	-do-
1.8	Jhimpir-1 – T.M. Khan Road 220 kV S/C out	-do-
1.9	Jhimpir-1 – Jhimpir-2 220 kV S/C out	-do-
1.10	Jhimpir-1 – Gharo New 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers at/in the vicinity of Shaheen Foundation WPP are well within their capacities. In general, the study depicts that the voltage profile of the system and at the switchyard of Shaheen Foundation WPP is within limits and there would be no transmission system constraints in the flow of power from Shaheen Foundation WPP to the system under normal and N-1 contingency conditions.

5.2 Off-peak Load 2019 Scenario

Load flow study for the off-peak load scenario in 2019 under normal system condition has been carried out with net output of 47.2 MW from Shaheen Foundation WPP and is attached as Exhibit #2.0 & 2.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Shaheen Foundation WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Western-E WPP – Shaheen-F WPP 132 kV S/C	21.2
Shaheen-F WPP – Jhimpir-1 WPP 132 kV S/C	68.4
Western-E WPP – Norinco WPP 132 kV S/C	26.9
Jhimpir-1 – T.M. Khan 132 kV D/C	206.2
Jhimpir-1 – Jhimpir-2 220 kV S/C	183.9
Gharo New – Jhimpir-1 220 kV S/C	19.4
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.8
4x250 MVA, 220/132 kV transformers at Jhimpir-1	669.2

It is evident from the above table that the power flows on the 132 kV interconnection circuits of 3 WPPs including Shaheen Foundation WPP remain the same, however, the power flows on the 220 kV circuits and on other part of the system has varied mainly due to lower demand during off-peak load condition in 2019. The active and reactive power flows from Shaheen Foundation WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions during off-peak load scenario in 2019. The results of contingency studies are attached as Exhibit #2.1 to 2.10 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
2.1	Shaheen-F WPP – Western-E WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the

Exhibit #	Contingency Conditions	Remarks
		system remain within limits.
2.2	Shaheen-F WPP – Jhimpir-1 132kV S/C out	-do-
2.3	1x50 MVA, 132/33 kV transformer at Shaheen-F WPP out	-do-
2.4	One collector group (8 WTGs) at Shaheen-F WPP out	-do-
2.5	Master WPP – Jhimpir-1 132 kV S/C out	-do-
2.6	1x250 MVA, 220/132 kV transformer at Jhimpir-1 out	-do-
2.7	Jhimpir-1 – T.M. Khan 132 kV S/C out	-do-
2.8	Jhimpir-1 – T.M. Khan Road 220kV S/C out	-do-
2.9	Jhimpir-1 – Jhimpir-2 220 kV S/C out	-do-
2.10	Jhimpir-1 – Gharo New 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers in the vicinity of proposed Shaheen Foundation WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of power from the

proposed Shaheen Foundation WPP to the system under normal and N-1 contingency conditions.

5.3 Peak Load 2021 Scenario

Load flow study for the peak load condition in 2021 under normal system condition has been carried out with net output of 47.2 MW from Shaheen Foundation WPP and is attached as Exhibit #3.0 & 3.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Shaheen Foundation WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Western-E WPP – Shaheen-F WPP 132 kV S/C	21.2
Shaheen-F WPP – Jhimpir-1 WPP 132 kV S/C	68.4
Western-E WPP – Norinco WPP 132 kV S/C	26.9
Jhimpir-1 – T.M. Khan 132 kV D/C	267
Jhimpir-1 – Jhimpir-2 220 kV S/C	111.4
Gharo New – Jhimpir-1 220 kV S/C	36.2
Jhimpir-1 – T.M. Khan Road 220 kV D/C	533.4
4x250 MVA, 220/132 kV transformers at Jhimpir-1	608.8

The active and reactive power flows from Shaheen Foundation WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions for peak load condition in 2021. The results of contingency studies are attached as Exhibit #3.1 to 3.10 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
3.1	Shaheen-F WPP – Western-E WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
3.2	Shaheen-F WPP – Jhimpir-1 132 kV S/C out	-do-
3.3	1x50 MVA, 132/33 kV transformer at Shaheen-F WPP out	-do-
3.4	One collector group (8 WTGs) at Shaheen-F WPP out	-do-
3.5	Master WPP – Jhimpir-1 132 kV S/C out	-do-
3.6	1x250 MVA, 220/132 kV transformer at Jhimpir-1 out	-do-
3.7	Jhimpir-1 – T.M. Khan 132 kV S/C out	-do-
3.8	Jhimpir-1 – T.M. Khan Road 220 kV S/C out	-do-
3.9	Jhimpir-1 – Jhimpir-2 220 kV S/C out	-do-
3.10	Jhimpir-1 – Gharo New 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study results, the power flows on transmission lines and transformers in the vicinity of proposed Shaheen Foundation WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of

power from Shaheen Foundation WPP to the system under normal and N-1 contingency conditions.

5.4 Conclusions of Load Flow Analysis

The proposed interconnection scheme for evacuation of power from 49.3 MW Shaheen Foundation WPP to the National Grid has been found reliable in various operating scenarios under normal and N-1 contingency conditions with no transmission system constraints.

6 Short Circuit Studies

The short circuit studies have been carried out with proposed Interconnection scheme of Shaheen Foundation WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Shaheen Foundation WPP and substations in its vicinity. The studies have been carried out with all the existing and planned generation in operation and with interconnected transmission system. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Shaheen Foundation WPP for various number of WTGs in operation and reduced generation in its vicinity.

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in short circuit analysis for which provision is available in the PSS/E software used for these studies. The maximum and minimum short circuit currents have been calculated with the following assumptions under IEC 909 standard:

- Set tap ratios to unity
- Set line charging to Zero
- Set shunt to zero in positive sequence
- The voltage magnitude at bus bars set equal to 1.10 p.u for maximum short circuit analysis and 0.9 p.u for minimum short circuit analysis.

In the short circuit analysis, the parameters of generator and step-up transformer for Shaheen Foundation WPP, have been assumed as per information provided by its sponsor, attached in Appendix-1. The results of maximum and minimum short circuit studies with necessary details are presented in Appendix-4.

6.2 Short Circuit Study Results

The short circuit studies have been carried out with proposed Interconnection scheme and by using the above parameters for generator and step-up transformer to compute the maximum three phase and single phase short circuit levels at the

switchyard of Shaheen Foundation WPP and other substations in its vicinity. The studies have been carried out for the year 2021-22 with all the existing and planned generation in operation and with interconnected transmission system except 132 kV split buses at 220/132 kV substations of Hala Road and T.M. Khan Road. The results of maximum short circuit studies for the year 2021-22 are summarized as under:

Maximum Short Circuit Levels

Name of Faulted Bus Bars	Maximum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
Shaheen Foundation WPP 132 kV	8.14	5.42
Western Energy WPP 132 kV	8.14	5.40
Norinco WPP 132 kV	9.48	5.56
Jhimpir-2 220 kV	18.96	11.47
Jhimpir-2 132 kV	15.48	12.01
Jhimpir-1 220 kV	19.89	11.66
Jhimpir-1 132 kV	27.59	13.56

The minimum three phase and single phase short circuit levels have also been computed for system scenario of 2019 at the 132 kV switchyard of Shaheen Foundation WPP with all WTGs and one WTG in operation; and with reduced generation in operation in its vicinity. The minimum short circuit levels at the 132 kV switchyard of Shaheen Foundation WPP are tabulated as under:

Minimum Short Circuit Levels at Shaheen Foundation 132 kV Bus

WTGs in Operation at Shaheen Foundation WPP	Minimum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
All WTGs	6.49	4.23
One WTG	5.87	3.41

6.3 Conclusions of Short Circuit Analysis

It is evident from the short circuit analysis that the induction of Shaheen Foundation WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Shaheen Foundation WPP are 8.14 kA and 5.42 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Shaheen Foundation WPP.

7. Transient Stability Studies

Transient stability studies have been carried out with the proposed interconnection scheme to evaluate the dynamic response of generators and the power system after occurrences of faults. The transient stability simulations are used to check in time domain whether the generators at and in the vicinity of Shaheen Foundation WPP as well as the power system remain stable after subjected to severe disturbances as per Grid Code requirement.

7.1 Study Methodology

The dynamic simulation model of the entire network has been developed in PSS/E software. The dynamic model parameters of WTG Type-3 used for Shaheen Foundation WPP, in the studies are attached in Appendix-5. On the other hand, the dynamic models/parameters of generators, exciters and governors of all the other power plants, already available in Planning (Power) NTDCL, have been used in the studies.

Two worst types of disturbances have been simulated to assess the stability of the Shaheen Foundation WPP and the power system as per NEPRA grid code criteria which are given as under:

- 3-phase fault at bus bar cleared in 5-cycles (100 ms) and tripping of the associated circuit.
- 3-phase fault at bus bar cleared in 9 cycles (180 ms) (delayed clearing or stuck breaker condition) and tripping of the associated circuit.

The simulations have been run in the time domain in the following sequence:

- Running simulation for initial one second for pre-fault steady state condition.
- Fault application at 1.0 second and running the simulation upto 1.1 second for 5 cycle fault (up to 1.18 second for 9 cycle fault).
- Fault clearance at 1.1 second for 5 cycle fault (1.18 second for 9 cycle fault) and tripping of the associated circuit.

- Running simulation up to 10 seconds after fault clearance.

The following generator and network parameters are monitored in the simulations and have been presented in the report through the following stability plots for each type of disturbance:

i. Bus frequency and voltage
ii. WTG (Pmechanical, Generator & Turbine Rotor speed deviation, Pitch, Aero Dynamic Torque, Paero, active and reactive power output etc.)
iii. Line power flows, i.e., P (MW) & Q (MVAR)
iv. Conventional thermal generator rotor angle

In order to interpret the stability plots, the bus numbers assigned to the bus bars and the voltage levels, are given as under:

Bus Number	Bus Name / Voltage
81120	Shaheen-F/132 kV
811201	Shaheen-F MV/33 kV
811206, 811207, 811208 & 811209	Shaheen-F LV-1 to LV-4 / 0.69kV
81119	Western-E/132 kV
9428	Jhimpir-1 / 132 kV
9429	Jhimpir-1 / 220kV
811	Jhimpir-2 / 220kV
800	Jamshoro / 220 kV
900	KDA / 220 kV
530	M.Garh / 220 kV
90	Hub / 500 kV

7.2 Transient Stability Analysis Results

The transient stability analysis for Shaheen Foundation WPP with the proposed interconnection scheme has been carried out for peak load 2019 scenario. The stability of the Shaheen Foundation WPP and the power system has been tested with application of different disturbances on the wind farm and at the substations in its vicinity. The plotted results of the stability simulations are attached in Appendix-6 and described as under:

(i) For Normal Clearing Time (100 ms)

The transient stability studies for faults with normal clearing time of 100 ms corresponding to 5 cycles, have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Shaheen Foundation WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Shaheen-F WPP 132kV Bus	Shaheen-F WPP – Jhimpr-1 132kV S/C	1.1	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.2	Bus Voltage	
			1.3	WTG Collector Group Output (P&Q)	
			1.4	Pmechanical & Speed of WTG	
			1.5	Pitch & Aero Dynamic Torque of WTG	
			1.6	Paero on Rotor Blade & Shaft Twist Angle	
			1.7	Turbine Rotor Speed Deviation & Gen. Speed Deviation	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			1.8	Pitch Compensation & Pitch Control	
			1.9	Line Power Flows (P&Q)	
			1.10	Rotor Angle	
2	Shaheen-F WPP 132 kV Bus	Shaheen-F WPP – Western-E WPP 132kV S/C	1.11	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.12	Bus Voltage	
			1.13	WTG collector group Output (P&Q)	
			1.14	Pmechanical & Speed	
			1.15	Pitch & Aero Dynamic Torque of WTG	
			1.16	Paero on Rotor Blade & Shaft Twist Angle	
			1.17	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.18	Pitch Compensation & Pitch Control	
			1.19	Line Power Flows (P&Q)	
			1.20	Rotor Angle	
3	Shaheen-F WPP 132 kV Bus	One 132/33 kV T/F at Shaheen-F WPP	1.21	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.22	Bus Voltage	
			1.23	WTG collector group Output (P&Q)	
			1.24	Pmechanical & Speed	
			1.25	Pitch & Aero Dynamic Torque	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
				of WTG	
			1.26	Paero on Rotor Blade & Shaft Twist Angle	
			1.27	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.28	Pitch Compensation & Pitch Control	
			1.29	Line Power Flows (P&Q)	
			1.30	Rotor Angle	
4	Shaheen-F WPP 33 kV MV Bus	One Collector Group comprising of 8 WTGs at Shaheen-F WPP	1.31	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.32	Bus Voltage	
			1.33	WTG collector group Output (P&Q)	
			1.34	Pmechanical & Speed	
			1.35	Pitch & Aero Dynamic Torque of WTG	
			1.36	Paero on Rotor Blade & Shaft Twist Angle	
			1.37	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.38	Pitch Compensation & Pitch Control	
			1.39	Line Power Flows (P&Q)	
			1.40	Rotor Angle	
5	Jhimpir-1 220 kV Bus	Jhimpir-1 – T.M.Khan Road	1.41	Bus Frequency	Shaheen Foundation
			1.42	Bus Voltage	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
		220 kV S/C	1.43	Power Flow (P & Q)	WPP and NTDCL system remain stable.
			1.44	Rotor Angle	
			1.45	WTG collector group Output (P&Q)	
6	Jhimpir-1 220 kV Bus	Jhimpir-1 – Jhimpir-2 220 kV S/C	1.46	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.47	Bus Voltage	
			1.48	Power Flow (P & Q)	
			1.49	Rotor Angle	
			1.50	WTG collector group Output (P&Q)	
7	Jhimpir-1 220 kV Bus	Jhimpir-1 – Gharo New 220kV S/C	1.51	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			1.52	Bus Voltage	
			1.53	Power Flow (P & Q)	
			1.54	Rotor Angle	
			1.55	WTG collector group Output (P&Q)	

It is evident from the above stability Exhibits that Shaheen Foundation WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

(ii) For Delayed Clearing Time (180 ms)

The transient stability studies for faults with delayed clearing time of 180 ms corresponding to 9-cycle fault (stuck breaker condition) have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Shaheen Foundation WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Shaheen-F WPP 132kV Bus	Shaheen-F WPP – Jhimpr-1 132kV S/C	2.1	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			2.2	Bus Voltage	
			2.3	WTG collector group Output (P&Q)	
			2.4	Pmechanical & Speed	
			2.5	Pitch & Aero Dynamic Torque of WTG	
			2.6	Paero on Rotor Blade & Shaft Twist Angle	
			2.7	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.8	Pitch Compensation & Pitch Control	
			2.9	Line Power Flows (P&Q)	
			2.10	Rotor Angle	
2	Shaheen-F WPP 132 kV Bus	Shaheen-F WPP – Western-E WPP 132kV S/C	2.11	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			2.12	Bus Voltage	
			2.13	WTG collector group Output (P&Q)	
			2.14	Pmechanical & Speed	
			2.15	Pitch & Aero Dynamic Torque of WTG	
			2.16	Paero on Rotor Blade & Shaft Twist Angle	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			2.17	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.18	Pitch Compensation & Pitch Control	
			2.19	Line Power Flows (P&Q)	
			2.20	Rotor Angle	
3	Shaheen-F WPP 132 kV Bus	One 132/33 kV T/F at Shaheen-F WPP	2.21	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			2.22	Bus Voltage	
			2.23	WTG collector group Output (P&Q)	
			2.24	Pmechanical & Speed	
			2.25	Pitch & Aero Dynamic Torque of WTG	
			2.26	Paero on Rotor Blade & Shaft Twist Angle	
			2.27	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.28	Pitch Compensation & Pitch Control	
			2.29	Line Power Flows (P&Q)	
			2.30	Rotor Angle	
4	Shaheen-F WPP 33 kV	One Collector Group comprising of 8	2.31	Bus Frequency	Shaheen Foundation
			2.32	Bus Voltage	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
	MV Bus	WTGs at Shaheen-F WPP	2.33	WTG collector group Output (P&Q)	WPP and NTDCL system remain stable.
			2.34	Pmechanical & Speed	
			2.35	Pitch & Aero Dynamic Torque of WTG	
			2.36	Paero on Rotor Blade & Shaft Twist Angle	
			2.37	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.38	Pitch Compensation & Pitch Control	
			2.39	Line Power Flows (P&Q)	
			2.40	Rotor Angle	
5	Jhimpir-1 220 kV Bus	Jhimpir-1 – T.M.Khan Road 220 kV S/C	2.41	Bus Frequency	Shaheen Foundation WPP and NTDCL system remain stable.
			2.42	Bus Voltage	
			2.43	Power Flow (P & Q)	
			2.44	Rotor Angle	
			2.45	WTG collector group Output (P&Q)	

It is evident from the above stability Exhibits that Shaheen Foundation WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

7.3 Conclusions of Transient Stability Analysis

The results of transient stability analysis indicate that Shaheen Foundation WPP and

other generators in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Shaheen Foundation WPP or at the other substations in its vicinity. The stability simulations also proved that the Shaheen Foundation WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

8 Power Quality Analysis

The power quality analysis is very important for a wind power plant that may cause flicker and distortions in the power supply. These issues become more significant for weak power systems having low short circuit strength. Therefore, power quality analysis including flicker and voltage unbalance, has been carried out with the proposed interconnection scheme of 49.3 MW Shaheen Foundation WPP for the worst case scenario of minimum system short circuit levels in 2019.

8.1 Flicker

IEC61400-21 standard have been used for the calculation of flicker levels for steady-state continuous operation. The probability of 99th percentile flicker emission from a single inverter during continuous operation for short time $P_{st\Sigma}$ and long time flicker level $P_{lt\Sigma}$ are assumed same and calculated by the following formula:

$$P_{st\Sigma} = P_{lt\Sigma} = \frac{1}{S_k} \cdot \sqrt{\sum_{i=1}^{N_{wt}} (c_i(\psi_k, \upsilon_a) \cdot S_{n,i})^2} \qquad (A)$$

Where

S_n is the rated apparent power of the WTG

S_k is the short-circuit apparent power at PCC

N_{wt} is the number of WTGs connected to the PCC

The value of c (φ_k) may not be greater than 1, therefore for the present analysis, the value of 1 for the worst case has been assumed. PCC is the point of common coupling which is 132 kV bus of the switchyard of 49.3 MW Shaheen Foundation WPP.

For the minimum short circuit case, the system network in the vicinity of 49.3 MW Shaheen Foundation WPP has been modeled with minimum generation in operation. The short circuit calculations have been done at 0.9 p.u. voltage. The values used in the calculation of flicker are as below:

S_n = 1.789 MVA

N_{WT} = 29

S_k = 1485.59 MVA

Using the above data in Equation (A), we get

$$P_{St\Sigma} = P_{lt\Sigma} = 0.006485 = 0.65\ \%$$

Whereas, the acceptable value in IEC Standard is less than 4%. Therefore, the flicker level is far less than the maximum permissible limit which implies that the inverters at 49.3 MW Shaheen Foundation WPP would not cause any flicker problem during steady state operation even in the weakest system conditions.

8.2 Voltage Unbalance

(i) Voltage Step-Change

The voltage step-change occurs when only a single WTG is energized. The value of voltage change depends on the impedance of the network from the connection point to Point of Common Coupling (PCC). The PCC is 132 kV bus of Shaheen Foundation WPP. The Voltage step-change should be less than or equal to 3% and this condition is evaluated by using the following formula:

$$\Delta V = \sum Swka\ [\left(\frac{1}{Ske}\right) - \left(\frac{1}{Skss}\right)] \leq 3\% \qquad \text{(B)}$$

Where

$\mathbf{S_{wka}}$ is the MVA rating of the inverter

$\mathbf{S_{ke}}$ is the Short Circuit MVA at connection point

$\mathbf{S_{kss}}$ is the Short circuit MVA at PCC

The values used in the calculation of voltage step-change are as below:

S_{wka} = 1.789 MVA

S_{ke} = 466 MVA

S_{kss} = 1343.09 MVA

Using the above data in Equation (B), we get

$\Delta V = 0.002507 = 0.25\ \%$

The voltage step-change is less than the maximum permissible limit of 3% which implies that the WTG would not cause any voltage step-change problem.

(ii) Voltage Fluctuation

The voltage fluctuation has been calculated assuming only one WTG in operation, using the following equation and it is found to be within permissible limits.

$$Volatge\ Fluctuation = \sqrt{\sum(\frac{Pwka}{Ske})^2} \quad \leq 1/25 \text{ or } 4\% \qquad (C)$$

Where

P_{wka} is the MW rating of WTG

S_{ke} is the Short Circuit MVA at connection point

The values used in the calculation of voltage fluctuation are as below:

P_{wka} = 1.7 MW

S_{ke} = 466 MVA

Using the above data in Equation (C), we get

Voltage Fluctuation = 0.003648 = 0.36%

The value of voltage fluctuation is less than the maximum permissible limit of 4% which implies that the WTG would not cause any voltage step-change problem.

8.3 Conclusions of Power Quality Analysis

The important power quality indices like flicker and voltage unbalance have been computed with Shaheen Foundation WPP and compared with limits given in IEC and other international standards. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits, with the interconnection of subject WPP.

It is added that it is the responsibility of developer of the Shaheen Foundation WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

9 Overall Conclusions and Recommendations

i) On the basis of detailed interconnection studies, the following integrated interconnection scheme of the 3 WPPs lying in Northern part of Jhimpir including Shaheen Foundation WPP, has been found reliable for power evacuation to the National Grid:

- 132 kV D/C transmission line, approx. 30 km long on Greeley conductor for connecting all the 3 WPPs including Shaheen Foundation WPP with 132 kV single circuit from Master WPP to the under construction Jhimpir New (Jhimpir-1). In this scheme, the interconnection of Shaheen Foundation WPP includes 132 kV D/C transmission line, approx. 8km long, on Greeley conductor for looping In/Out on the 132 kV single circuit from Western WPP to Norinco WPP.
- Addition of 4th 220/132 kV transformer at the under construction Jhimpir New (Jhimpir-1) 220/132 kV substation.

The following interconnection schemes/network reinforcement proposed with the other 7 WPPs lying in southern part of Jhimpir, will also be required for the reliable power evacuation of 3 WPPs including Shaheen Foundation WPP to the grid:

- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.

ii) The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation in

completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

iii) The results of detailed load flow studies for various operating scenarios indicate that the power from Shaheen Foundation WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints. The voltage profile, line loading, frequency and active/reactive power flow etc. from Shaheen Foundation WPP and on the grid are within the NEPRA Grid Code criteria.

iv) The bus bar rating and normal rated current for switchgear equipment in the 132 kV switchyard of Shaheen Foundation WPP are recommended as 2500 Amperes.

v) The results of short circuit studies indicate that Shaheen Foundation WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Shaheen Foundation WPP are 8.14 kA and 5.42kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Shaheen Foundation WPP.

vi) The results of transient stability analysis indicate that Shaheen Foundation WPP & other power plants in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Shaheen Foundation WPP or at the other substations in its vicinity. The stability simulations also prove that Shaheen Foundation WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

vii) The important power quality indices like flicker and voltage unbalance have been computed with Shaheen Foundation WPP. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits as mentioned in the IEC and other international standards, with the proposed interconnection of Shaheen Foundation WPP. It is clearly mentioned that it will be the responsibility of developer of the Shaheen Foundation WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

viii) It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Shaheen Foundation WPP to the National Grid.

ix) It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Shaheen Foundation WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Shaheen Foundation WPP, if any, in this regard.

x) In view of the huge wind potential at Jhimpir & in its surrounding areas, the power system network around Shaheen Foundation WPP will be developed in future. Therefore, there may be possibility of modification in the interconnection arrangement of Shaheen Foundation WPP in future, if needed necessary as per system requirements.

Annexure 24

Plant Characteristics

Plant Characteristics

The plant characteristics are given in table below:

S. No.		
1	Generation Voltage	690 V
2	Frequency	50 Hz
3	Power Factor	0.95 leading - lagging
4	Automatic Generation Control	Pitch controlled
5	Ramping rate	As per grid code
6	Alternative Fuel	NA
7	Aux. consumption	800 kW
8	Time required to synchronize to the grid	As per grid code

Annexure 25

Control Metering Instrumentation and Protection

Control, Metering, Instrumentation and Protection

Operation control of the wind turbine

The main task of the operation control is to ensure an automatic and safe operation of the wind turbine in all situations by monitoring and constantly keeping the parameters within the set range as stored in the control computer of the wind turbine.

To achieve this, a real time control system is used, which queries relevant data and processes it further. The parameters are provided by WTG Manufacturer and are adapted to the respective site. The objective is a safe and automatic operation of the wind turbine in all situations.

When the wind speed is lower than the cut-in wind speed, the wind turbine remains at a standstill (energy save modus), i.e. only the computer remains in operation capturing (weather) data. All other systems are switched on only if required and thus do not consume energy. Exceptions are the safety-related functions, e.g. the brake system (hydraulic pump). The rotor is idling. When the cut-in wind speed is reached, the wind turbine will change to 'Ready for operation' mode. Now all systems are tested and the nacelle aligns to the wind direction. If the wind increases, the rotor accelerates. When a certain speed is reached, the generator is connected to the grid and the wind turbine starts producing electricity. During operation, the nacelle follows the wind direction.

If the set point for tower cable untwists is exceeded the wind turbine shuts down and the nacelle turns back automatically, i.e. the tower cables are untwisted. Afterwards the wind turbine starts again automatically. At low wind speeds the wind turbine operates in part-load operation. The rotor blades remain fully turned into the wind. In this way, the rotor blades are always in the best aerodynamic position and operate at optimum efficiency. The rotor speed remains below nominal speed. The power produced by the WT now depends on the wind speed. When the nominal wind speed is reached, the wind turbine switches over to the nominal load range. If the wind speed increases the control system will adjust the angle of the rotor blades in such a way that the rotor speed is kept at nominal speed as far as possible. Thus the wind turbine constantly generates nominal power. Once the cut-out wind speed is exceeded, the wind turbine shuts down, i.e. the blades turn by approx. 90Â° into feathered position. The rotor slows down and idles until the wind decreases below the cut-in wind speed. In this way, the loads acting on the wind turbine in stormy weather can be significantly reduced.

Sensors are installed in all systems and many components of the wind turbine. They report the current state to the controls. There are set points given for each measuring point. They must be kept. If the value deviates from the set point, the control system reacts respectively. Upon exceeding a certain temperature limit, at first e.g. the pump of the cooling circuit is switched on. If the temperature falls below the set point again, the pump is switched off. If another set point is exceeded, a warning message is sent to the WTG remote surveillance being run from the substation. The WTG remote surveillance decides what to do by processing all current operating data. If the

temperature falls again below a temperature limit value, the warning message disappears. When exceeding a third temperature limit value, the wind turbine is switched off immediately. This third value is selected such that any damage to the wind turbine can be prevented.

All in all, six parameters belong to one temperature measuring point, three high and three low temperature limit values. When exceeding certain parameters regarding the safe operation, the wind turbine is switched off immediately, e.g. values above cut-out wind speed or pressure drop at the hydraulic system. A soft braking procedure is triggered in case of external disturbances, e.g. too high wind speed or grid failure. In case of safety critical disturbances an emergency stop is triggered to ensure that the rotor slows down as fast as possible. Using the wind data, the control system calculates 3 second average values. These values are then used to create a 30 second average value and in turn a 10 minute average value. These values are used to control the wind turbine. In the case of the wind speed, the control system applies the 10 minute average value, because otherwise the wind turbine would shut down too early or too frequently due to the turbulences of the wind. To prevent damage caused by short but strong gusts, which become lost in average value, the 3 second average value is also taken into account. Consequently, the wind turbine is shut down when the 10 minute average value exceeds 20 m/s or when the 3 second average value exceeds 26 m/s. This gives the wind turbine comprehensive protection against storms. For safety reasons, a certain delay must be kept after every shut down before the wind turbine starts again. At low temperatures, the wind turbine will only restart once the individual components have reached their relevant start-up temperature. The duration of this warm-up phase varies depending on the temperature of the components before the warm-up phase begins. The less the single components have cooled down, the shorter the warm-up phase. A temperature-controlled startup procedure reduces the stress on the components during turbine start-up until the optimum operating temperature is reached.

All relevant turbine components possess maximum operating temperatures which are monitored. Before one of these temperature limits is reached, the wind turbine will reduce its power output and can continue to operate.

Control of Wind Farms

The propriety wind farm monitoring software will be used for Wind Farm. It offers comprehensive options to monitor and control a wind farm. The two essential tasks of a wind farm controller are:

- The optimum fulfillment of the grid operator feed-in regulations
- Ensuring output of the maximum possible power from the wind farm in case of error (internal or external)

The above tasks can, among other things, be realized by:

- Starting and stopping the individual wind turbines in a staggered sequence
- Active power limitation.

- Reactive power management.
- Intelligent set point distribution, i.e., the set point specified for active power limitation, for example, is distributed among all wind turbines depending on the available power of the wind turbines according to defined rules.

Metering

Independent current transformers of accuracy class 0.2 s and voltage transformers of accuracy class 0.2 shall be installed at the substation for providing input to the Energy Meters. A separate air-conditioned room in the Complex's Substation shall be provided. All cabling between the Meters and associated Current Transformers and Voltage Transformers shall be laid as per prudent engineering practices.

The metering points to record the MwH and MVAR exchange between the Complex and the Purchaser's Grid System shall be at the HV Side (132kV) of the Power Transformer of the Complex. The project will provide a dedicated set of current and Voltage transformers (0.2FS5 & 0.2 accuracy class respectively), to feed the main metering system.

The Project's interconnection facility shall be equipped with required protective devices as per prudent engineering practices. Protective relays, duly approved by the Power Purchaser, shall be in accordance with applicable IEC standards.

Facility Protection

The Project shall provide a suitable protection system to cope with the faults contributed by the wind farm, substation and the grid for safe operation as per requirement of NTDC. For protection of lines from Complex to the substations, line differential relays shall be installed with distance protection feature.

As a back up to the above, the following shall be installed:

- line over current/earth fault relay
- bus bar differential
- transformer differential
- line over current/earth fault protection on transformer bay

The current and voltage transformers shall be sized with respect to their ratios and burdens as per the requirements of NTDC Protection department.

Annexure 26

Training and Development Plan

Training and Development of Staff

The Operations & Management (O&M) of the Project shall be managed by the EPC Contractor for initial 2 years post-COD as Warranty Period O&M under the EPC Contract. The O&M for years 3 – 8 shall be carried out by the same contractor under the O&M Contract. Throughout the O&M period, the Contractor shall be responsible for On Job Training (OJT) of the local team, which shall remain part of the O&M and gradually take over after completion of O&M tenure.

The EPC and O&M Contracts shall mention in detail the training requirements for the operation of the wind farm and the Project Company's personnel. As per the Contracts, the Contractors shall be required to provide details of how training will be carried out, including the number of days of training outside Pakistan, and the number of people who will be trained under their offer. The Contractor will ensure that the personnel working on the wind farm during the construction and the operation period are correctly trained and qualified for the roles that they are performing and that a record of their training is maintained.

The Contractors shall be required to provide special emphasis to the Health & Safety (H&S) aspects of the Project construction and operations, for which specific training will be provided by the Contractors to all of the operations and maintenance personnel, including the regulatory requirements for the use of any special safety equipment required for the undertaking of such functions. Such training will be in addition to any other training provided and will continue, for each individual, until each said individual can be certified by the Contractors as having attended the full H&S training, thus gaining sufficient appreciation of the H&S requirements to operate the Project.

Although the content of training modules will be finalized between the Contractors and the Project Company prior to COD, some specific training needs that will be covered include the following:

a) Procedures for operation and maintenance of the wind farm and its associated equipment.
b) Awareness and application of safe systems of work and responsibilities of all staff involved in operations and maintenance duties.
c) Fire control and prevention (including equipment maintenance and management and 'emergency plan').
d) First-aid provision (including 'emergency plan').
e) Working at heights (including 'emergency plan').
f) Working on, at or near rotating plant.
g) Working on, at or near high and low voltage AC and DC apparatus (HV & LV) and the differences between live, not live and dead circuits.
h) Working on, at or near energized systems (such as pressure vessels, accumulators, springs, gearing, torque arms, unearthed electrical systems and dampers).
i) Working on, at or near hazardous substances (oils, chemicals, insulators and gases).
j) Confined space works and requirements therein.

The Contractors shall provide or procure the provision of these training needs for all O&M personnel in order that the O&M services may be performed in accordance with the Project Agreements and Prudent Industry Practice.

شاہین
SHAHEEN
FOUNDATION
PAF

May, 2016

APPROVAL SHEET

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SYNOPSIS

This document is a feasibility study report of the 50MW Wind Power Project being developed by Shaheen Foundation, PAF. It contains the hardware specifications, energy yield estimates, electrical interface, civil works design and the project cost. It also includes the initial environmental examination, soil investigations, site topography, grid interconnection studies and the project management information. This report has been prepared by Renewable Resources (Pvt.) Ltd, Pakistan.

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LIST OF ABBREVIATIONS

AEDB	Alternative Energy Development Board
ADB	Asian Development Bank
AREs	Alternative and Renewable Energies
ASL	Associated Surveyors (Pvt.) Ltd
C.R	Core Recovery
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CFCs	Chlorofluoro Carbons
CH_4	Methane
CO_2	Carbon dioxide
COD	Commercial Operation Date
CoP	Conference of the Parties
CPPA-GL	Central Power Purchasing Agency Guarantee Limited
CT	Continuous Transmission
CVT	Continuously Variable Transmission
DAE GoS	Directorate of Alternative Energy, Government of Sindh
DC	Direct Current
DISCOs	Distribution Companies
EE	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
EU	European Union
GoP	Government of Pakistan

GSU	General Step Up (transformers)
GRM	Grievance Redress Mechanism
GW	Gold Wind
HESCO	Hyderabad Electric Supply Corporation
HFCs	Hydro fluorocarbons
HV	High Voltage
IE	Independent Engineer
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
IRR	Internal Rate of Return
JI	Joint Implementation
KESC	Karachi Electric Supply Company
km	Kilometer
kV	Kilovolt
KIBOR	Karachi Inter Bank Offer Rate
LIBOR	London Inter Bank Offer Rate
LOI	Letter of Intent
LOS	Letter of Support
MVA	Mega Volt-Ampere
MV	Medium Voltage
MW	Megawatt
N_2O	Nitrous Oxide
NEPRA	National Electricity Power Regulatory Authority
NPMV	Non Project Missed Volume
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Despatch Company

O & M	Operation & Management
OC	Operating Committee
OECD	Organization for Economic Cooperation and Development
OHL	Overhead Lines
OJT	On Job Trainings
OP	Operating Procedures
PPI	Power Planners International
PFCs	Per fluorocarbons
RE	Renewable Energy
RE2	Renewable Resources (Pvt.) Ltd
RQD	Rock Quality Designation
RMU	Ring Main Units
SEC/SCECO	Saudi Electricity Company
SF_6	Sulfur Hexafluoride
SPT	Standard Penetration Test
SF, PAF	Shaheen Foundation, Pakistan Air Force
VT	Variable Transmission
WAPDA	Water And Power Development Authority
WTG	Wind Turbine Generator
WRA	Wind Resource Assessment

ACKNOWLEDGEMENTS

The management of Shaheen Foundation, PAF is thankful to the Ministry of Water and Power and the dedicated team of Alternative Energy Development Board (AEDB) for generous support at all stages of project development and looks forward to their continued support in the future.

The management of Shaheen Foundation also looks forward to the cooperation of Government of Sindh and other Government departments (NEPRA, NTDC, HESCO) which is being extended to the Project.

DISCLAIMERS

This report is prepared for the benefit of Shaheen Foundation, PAF (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the Client's prior written consent in each specific case. The information contained in this report is intended to be used by the Client for such other purpose as may be necessary for the development and implementation of the Project.

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DOCUMENT INFORMATION

Purpose and Scope:

The purpose of this report is to provide information required for the relevant agencies to make an informed decision regarding the implementation and execution of this project.

1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, The Islamic Republic of Pakistan is largely under the influence of a tropical desert climate. The thermal depression of South Asia and the monsoon winds shape up Pakistan's southern coastal areas and northern mountain areas into a land rich in wind energy resources. The costal wind-energy-rich areas are normally referred to as Southern Sindh and the vast plateau to the east and the northeast of Karachi city. The relative shortage of conventional energy resources in Pakistan and the hiking of fuel prices worldwide spurred the Pakistan Government to find alternative sources, including wind power.

Government of Sindh has formulated a policy to encourage the participation of private sector in the development and application of renewable energies. A Government organization called the Directorate of Alternative Energy, Sindh (DAE, Sindh) has been established to facilitate the implementation of renewable energy projects.

At present, six (06) wind power projects of approx. 50 MW capacity each are in operation. A total of eight projects (six of 50 MW each, one of 99 MW and one of 30 MW) have achieved financial close and entered construction.

Shaheen Foundation, a trust of the Pakistan Air Force, was established in 1977 under the Charitable Endowment Act 1890. The foundation was created to promote welfare activities for the benefit of serving and retired PAF personnel including civilians and their dependents, and to this end, generates fund through industrial and commercial enterprises.

Shaheen Foundation carries out different sorts of welfare activities, which are mainly focused on two main aspects i.e to provide rehabilitation jobs to PAF retired personnel and educational scholarships to their talented wards. The rehabilitation jobs are provided inland and abroad. The provisioning of these facilities from Shaheen Foundation fairly enables retired PAF Officer/Airman/Civilian to support their families in civil environment and get their children educated in professional colleges and universities.

Shaheen Foundation is interested in setting up a Wind Power Project of 50 MW capacity in Bholari, Sindh, Pakistan.

Renewable Resources (Pvt) Limited (RE2) is the consultant for Shaheen Foundation for developing this project.

SF, PAF has vast land available; having area of approximately 2880 acres and preliminary site assessment of this area has been carried out.

1.1 PROJECT OVERVIEW AND SITE

Shaheen Foundation is the Project Company for a 50 MW Wind Power Project to be located in Bholari District Thatta, Sindh that is towards the East of Karachi. The National Highway and Superhighway are the major connecting roads to the Project site, having a distance of approximately 120-125km from Port Qasim. The wind farm Project is located in Bholari, which is located approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of approximately 2880 acres of land, which is owned by the project company. The Jhimpir wind corridor is identified as a potential area for the development of wind power projects. The overview of the project site is shown in **Figure 1-1.**

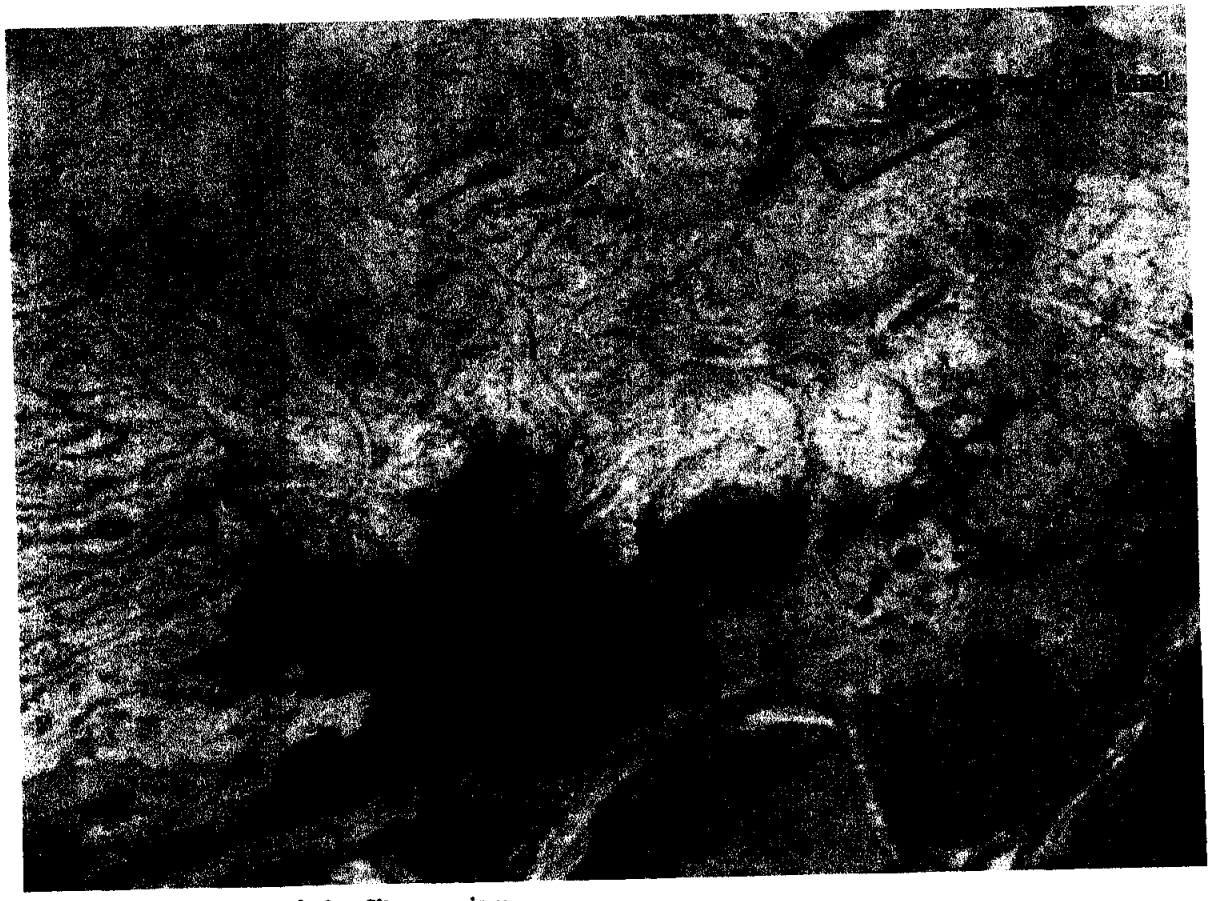

Figure 1-1: Shaheen Foundation Site overview

The Project Site has a relatively flat terrain with sparse vegetation, consisting of small shrubby bushes. The satellite map of Project Site is shown in **Figure 1-2** below.

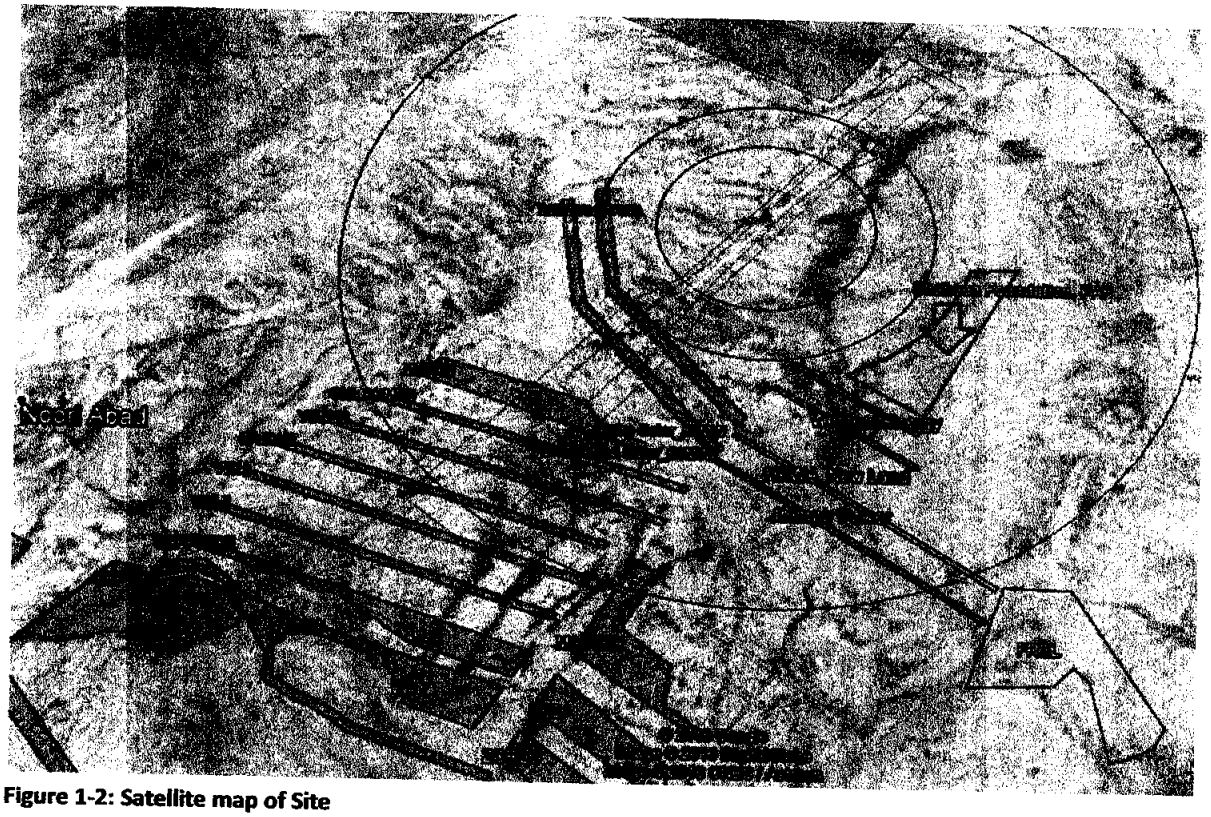

Figure 1-2: Satellite map of Site

Further details of Site are given in Section 07 and the Site Transportation and Access Study are attached as Annex II.

1.1.1 Project Size

The Project site consists of 2880 acres of land and the Project shall have an installed capacity of 50 MW.

1.1.2 Project Status and Calendar

The project calendar is given on the next page:

Table 1-1: Project Planned Milestones

Activity / Milestone	2015	2016				2017				2018	
	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR
Time consumed in Land arrangement and Grid Data.											
Preparation of Feasibility											
Submission of Feasibility Study											
Approval of Feasibility Study											
Generation License											
Upfront Tariff											
Signing of EPA											
Signing of IA											
Financial Close											
Project Construction											
Start of Operations											

The project construction shall take 18 months from the date of planning till the COD.

Table 1-2: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Engineering and Mobilization																		
Construction of Temporary Establishment																		
Civil Works of WTGs and Substation																		
Construction of Substation																		
Supply of WTGs and Towers																		
Cables and Interconnection																		
Erection and Installation																		
Testing and Commissioning of EBOP																		
Testing and Commissioning of WTGs																		
EPA Tests and Reliability Run Test																		

1.1.3 Wind Resource Assessment (WRA)

A separate study has been carried out for the WRA including complete analysis of wind data and long term correlation.

1.1.4 Energy Yield Estimates

The energy yield estimates have been generated including development of wind farm layouts, determination of energy yields and uncertainty assessments.

1.1.5 Geological Conditions

The Project area has a wide range of soil types due to its diverse land forms, which include sandy, deltaic, alluvial, gravel, coastal, and mountainous.

The information related to geological conditions is given in Section 11. The detailed Geotechnical Investigation Report is attached as Annex IV.

1.1.6 Design of Civil Works

Information related to the civil works is given in Section 12.

1.1.7 Design of Electrical Works

Information related to the electrical works is given in Section 13.

The Project has an installed capacity of 50 MW, using wind turbine generators (WTG), each with a capacity in the range of 1.7 – 2.0 MW and an output voltage of 0.69 kV. A substation consisting of step up transformer and other BOP equipment will connect the farm to the 132 kV power lines. The power from the turbine will be stepped up to Medium Voltage (MV) through a generator step up transformer which will be housed in a separate compartment in close proximity to the wind turbine tower. Power from all the WTGs in the plant will be delivered to the substation, and onwards to the grid via the step up transformers and HV switchgear, built within the boundaries of the wind power plant. The switchgear gantries will be the point of metering and connection to the 132 kV power lines.

Grid interconnection point and required reactive power compensation, if any, for the project shall be as per the findings of the grid interconnection study.

Please refer to the Grid Interconnection Study attached as Annex V.

1.1.8 Construction Management

Information related to the construction management is given in Section 14.

1.1.9 O & M Management

The O&M shall be managed by the O&M Contractor for initial 2 years of Warranty Period followed by a complete Field Service Agreement till end of ten years of operations. The local team shall remain part of the O&M and shall gradually take over after having On Job Trainings (OJT).

O&M management will be established with the principle of requiring "few on-duty staff". After entering the electrical equipment and machinery to their stable operation mode, the wind turbine and associated apparatus shall be managed with "no on-call staff and few on-guard staff".

The production area includes facilities such as generators, transformers, and the substation. There shall be buildings for protection and control, telecommunication, DC power supply and for administrative purposes.

1.1.10 Environmental Management

Information related to the environmental management works is given in Section 15.

A separate environment study has been carried out; The Initial Environmental Examination (IEE) report is attached as Annex VI.

There are no significant hazards. The minor adjustments required during construction phase have been addressed and mitigation plan provided. A data collection survey was also done that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern, and socioeconomic conditions.

1.1.11 Health and Safety

During the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

A safety and health supervision department will be established on the wind farm, which is to be in charge of the education, training and management of safety and health related issues after the project is put into operation. There will be safety personnel in the production section, and a part-time worker for the routine safety and health work.

The systems of patrol inspection, operation guardianship, maintenance and over-haul will be established for the daily maintenance of production equipment, instruments and apparatus. The safety and health supervision department will provide sound meter and other appropriate inspection equipment, as well as necessary public education service for production safety.

A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and over-haul will be strictly implemented. The Safety Regulation of the wind farm will also be carefully observed to minimize accidents.

1.1.12 CDM Aspect

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver substantial environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects.

The Project Company intends to develop a CDM project according to the provisions of the prevailing Policy.

1.2 LIST OF ANNEXURE

ANNEX – I: Pakistan Energy Profile and Global Wind Energy Stats

ANNEX – II: Transportation and Access Study Report

ANNEX – III: Wind Resource and Energy Yield Assessment Report

ANNEX – IV: Geo Technical Investigation Report

ANNEX – V: Electrical Grid Interconnection Study Report

ANNEX – VI: Initial Environmental Examination (IEE) Report

Presently, the Project plans to opt for upcoming upfront tariff. Therefore Annex III, being not required for an upfront tariff, is only meant for controlled circulation.

1.3 PROJECT TEAM

1.3.1 Shaheen Foundation, PAF

Shaheen Foundation, a trust of the Pakistan Air Force, was established in 1977 under the Charitable Endowment Act 1890. The foundation was created to promote welfare activities for the benefit of serving and retired PAF personnel including civilians and their dependents, and to this end, generates fund through industrial and commercial enterprises.

Shaheen Foundation extends its welfare services in the sectors of employment, education, health, Engineering Services, Production, Construction works, Advertising & Housing etc. It has more than three thousand employees on its strength out of which seven hundred are ex-PAF personnel. The foundation facilitates retired PAF personnel in seeking jobs in civil sector within the country as well as abroad. Shaheen Foundation provides different scholarships and fellowships at Graduates and Masters Level to the talented children of Ex-PAF personnel. Moreover, all serving PAF persons are member of Medical Welfare Scheme through which they are compensated for death or permanent disability during service. Additionally PAF personnel are provided financial and medical grants at the time of such need.

The policies of the Shaheen Foundation are framed and governed by the "Committee of Administration" and are implemented by the Managing Director of the Foundation. The Chief of the Air Staff is the Chairman of the Committee of Administration. Besides, the committee comprises of Principal Staff Officers of the Pakistan Air Force. The Foundation is represented in the committee by its Managing Director.

The Shaheen Foundation has its Headquarters in Islamabad and it various subsidiaries are located throughout the length and breadth of Pakistan. Shaheen Foundation has grown into a reputed business group. The Foundation has total assets close to Rs. 1500 million. It has been always the endeavor of the Shaheen Foundation to identify and make long term investments in profitable ventures of national importance. As such, Shaheen Foundation, PAF is interested in setting up a Wind Power Project of 50 MW capacity in Bholari, Sindh, Pakistan.

1.3.2 Renewable Resources (Pvt.) Ltd – Project Consultant

www.renewableresources.com.pk

Renewable Resources (RE2) is the professional technical advisor for the Project. RE2 is a consulting company specialized in Renewable Energy (RE), Energy Efficiency (EE) and Environment (Env) Projects. The company is owned by group of professionals who have been intimately involved in the renewable energy program of Pakistan, and have a fundamental understanding of issues relating to power project development, which include but are not limited to feasibility studies, regulatory approvals, concession and security documents, and applicable policies.

RE2 is capable of conducting full feasibility package featuring power production estimates, grid interconnection and tariff model. RE2 also has the expertise to deal with all technical aspects regarding the legal documents of power projects. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of RE power Projects and its work output meets international standards. RE2 is presently a consultant for various power Projects in Pakistan sponsored by local and international investors, with international banks.

2 COUNTRY AND INDUSTRY OVERVIEW

The detailed stats and situation of energy in Pakistan, specific information and prospects of wind and international trends in wind power sector is given in Annex I.

At this juncture, we are encountering the worst electricity crises of the history of Pakistan resulting in extended load shedding to an extent which virtually suspends social life. The situation has further forced Government of Pakistan to again take decisions like early market shutdown, power cutoff to industry, and two holidays per week thus affecting all business activities.

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. Oil import is a significant burden on the national exchequer. Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would still be an imported product.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro or other renewable sources, such as wind / solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill.

Looking at how the country's future electricity needs might be met, wind has the potential of being a strong contributor in future because of being an indigenous resource and available in huge quantities in the country.

3 REGULATORY REGIME

Power sector Pakistan has a ministry overlooking the electricity business in the country and a regulatory authority, independent of the ministry, to control the business practices in the market. There are a number of stakeholders involved in the cycle:

- Ministry of Water and Power
- National Electric Power Regulatory Authority (NEPRA)
- National Transmission and Despatch Company (NTDC)
- Central Power Purchasing Agency Guarantee Ltd. (CPPA-GL)
- Directorate of Alternative Energy, Sindh (DAE-GoS)
- Alternative Energy Development Board (AEDB)

3.1 MINISTRY OF WATER AND POWER

The Federal Ministry of Water and Power is the GoPs executive arm for all issues relating to electricity generation, transmission and distribution, pricing, regulation, and consumption. It exercises these functions through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

3.2 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

NEPRA has been created to introduce transparent and judicious economic regulation, based on sound commercial principles, in the electric power sector of Pakistan. NEPRA regulates the electric power sector to promote a competitive structure for the industry and to ensure the coordinated, reliable and adequate supply of electric power in the future. By law, NEPRA is mandated to ensure that the interests of the investor and the customer are protected through judicious decisions based on transparent commercial principles.

NEPRA remains to be the same platform for federal as well as provincial projects.

3.3 NATIONAL TRANSMISSION AND DESPATCH COMPANY (NTDC)

NTDC shall be the power purchaser. National Transmission & Despatch Company (NTDC) Limited was incorporated on 3rd August 1998 and commenced commercial operation on 1st March 1999. It was organized to take over all the properties, rights and assets obligations and liabilities of 220kV and 500kV Grid Stations and Transmission Lines/Network owned by Pakistan

Water and Power Development Authority (WAPDA). The NTDC operates and maintains nine 500kV Grid Stations, 4,160km of 500kV transmission line and 4,000km of 220kV transmission line in Pakistan.

For low voltage power such as 11 kV, the autonomous distribution companies (commonly called as DISCOS) are the power purchasers. Functionally, DISCOS fall at a step lower than NTDC and are looking after low voltage assets.

3.4 CENTRAL POWER PURCHASING AGENCY GUARANTEE LIMITED (CPPA-GL)

CPPA-GL is an agency to purchase power from solar power plants on behalf of NTDC. CPPA-GL acts as a one window for all affairs related to NTDC for the Project including signing of the Energy Purchase Agreement (EPA), establishment of Operating Committee (OC), development of Operating Procedures (OP), appointment of Independent Engineer (IE) and testing of the Project leading to declaration of commercial operations. CPPA-GL also handles payments to the Project against sale of electricity and all sort of Non Project Missed Volume (NPMV) under the EPA.

3.5 DEPARTMENT OF ALTERNATE ENERGY GOVT. OF SINDH (DAE GoS)

Energy Department, Government of Sindh is to solve matters relating to development, generation, supply and distribution of hydro and thermal power. It also determines of rates of supply to consumers in bulk and otherwise and may prescribe tariffs within the province except where entrusted to WAPDA. Energy Department is also responsible for perspective planning, policy formulation, processing of power projects and enactment of legislation with regard to thermal and hydro power generation and distribution.

3.6 DEPARTMENT OF ALTERNATE ENERGY GOVT. OF SINDH (DAE GoS)

Alternative Energy Development Board (AEDB) is the sole representing agency of the Federal Government that was established in May 2003 with the main objective to facilitate, promote and encourage development of Renewable Energy in Pakistan and with a mission to introduce Alternative and Renewable Energies (AREs) at an accelerated rate as to achieve sustainable economic growth. The administrative control of AEDB was transferred to Ministry of Water and Power in 2006. The Government of Pakistan has inter alia mandated AEDB to implement policies, programs and projects through private sector in the field of ARE and Undertake ARE projects on commercial scale (AEDB Act 2010).The Federal Government established AEDB as a statutory organization by announcing and promulgating the AEDB Act in May 2010.

4 CARBON CREDITS

The Kyoto Protocol to the United Nations Framework Convention on Climate Change will strengthen the international response to climate change. Adopted by consensus at the third session of the Conference of the Parties (COP) in December 1997, it contains legally binding emissions targets for Annex I (industrialized) countries. By arresting and reversing the upward trend in greenhouse gas emissions that started in these countries 150 years ago, the Protocol promises to move the international community one step closer to achieving the Convention's ultimate objective of preventing dangerous anthropogenic [man-made] interference with the climate system.

The developed countries are to reduce their collective emissions of six key greenhouse gases by at least 5%. This group target will be achieved through cuts of 8% by Switzerland, most Central and East European states, and the European Union (the EU will meet its group target by distributing different rates among its member states); 7% by the US; and 6% by Canada, Hungary, Japan, and Poland. Russia, New Zealand, and Ukraine are to stabilize their emissions, while Norway may increase emissions by up to 1%, Australia by up to 8%, and Iceland 10%. The six gases are to be combined in a "basket", with reductions in individual gases translated into "CO2 equivalents" that are then added up to produce a single figure.

Each country's emissions target must be achieved by the period 2008 - 2012. It will be calculated as an average over the five years. "Demonstrable progress" must be made by 2005. Cuts in the three most important gases carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) will be measured against a base year of 1990 (with exceptions for some countries with economies in transition). Cuts in three long-lived industrial gases – hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF6) - can be measured against either a 1990 or 1995 baseline. A major group of industrial gases, chlorofluorocarbons, or CFCs, are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

Actual emission reductions will be much larger than 5%. Compared to emissions levels projected for the year 2000, the richest industrialized countries (OECD members) will need to reduce their collective output by about 10%. This is because many of these countries will not succeed in meeting their earlier non-binding aim of returning emissions to 1990 levels by the year 2000, and their emissions have in fact risen since 1990. While the countries with economies in transition have experienced falling emissions since 1990, this trend is now reversing. Therefore, for the developed countries as a whole, the 5% Protocol target represents an actual cut of around 20% when compared to the emissions levels that are projected for 2010 if no emissions-control measures are adopted.

The Kyoto Protocol provides that nations can redeem a part of their climate protection commitments by implementing projects aimed at reducing emissions in other countries. These projects are primarily to be carried out by the private sector.

These investment projects can financially benefit from generating additional emissions reductions as compared to a business as usual case.

4.1 EMISSION REDUCTION MECHANISMS

There are three methods in Kyoto Protocol which permits the acquisition of emissions credits by means of project-based investment abroad.

4.1.1 Emissions Trading

Emission trading or Carbon Trading involves trading carbon emission credits within nations. Allowances are created, thereby making emissions a commodity that can be traded between industries etc. The Kyoto Protocol says that it is ok to trade in emissions, but that it should not be the major means to achieve one's commitments. Some European countries and corporations have started implementing such programs to get a head start and to see how well it will work.

4.1.2 Clean Development Mechanism (CDM)

Clean Development Mechanism (CDM) allows richer countries to offset their CO_2 emission against the emissions prevented when technology that cuts down on greenhouse gas emissions is deployed in poor countries.

4.1.3 Joint Implementation (JI)

Joint Implementation (also known as Activities Implemented Jointly) is where developed countries invest in emission-reducing activities in other industrialized countries, and gaining reduction units as a result.

4.2 ROLE OF CDM IN THE SHAHEEN FOUNDATION PROJECT

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver significant environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects. If the project is approved and registered as a CDM project, CERs can provide extra financial resource for the project. It will provide favorable conditions for the project financing, improve competitiveness of the project, and reduce investment risk during the project implementation process. The CDM benefits in the Project (if incurred) shall be availed according to the provision in the Policy.

5 WIND INDUSTRY IN PAKISTAN

5.1 CURRENT STATUS OF WIND IPPs IN PAKISTAN

The wind energy sector of Pakistan has matured in the last few years. The major impediments delaying the development of wind power projects have been removed. Wind data of almost 10 years is available for two locations, i.e. Gharo and Jhimpir. All the stakeholders are now at the same frequency and are fully motivated to facilitate the development of wind power in the country.

Initially very few suppliers wanted to come to new market like Pakistan. But now most of the suppliers are keen for the Pakistani market. One factor could be the Pakistani market getting matured. Now General Electric, Gamesa, Nordex, Vestas and Goldwind are all active in the market.

5.1.1 Letter of Intent (LOI)

The total number of LOIs issued by AEDB and DAE Sindh for various projects till date is in the range of 100.

5.1.2 Land Allocation by AEDB / GOS

AEDB and DAE-GoS have got approx. 31,000 acres of land from GOS and further allocated land to twenty six (26) wind IPPs.

5.1.3 Projects in Operations Phase

Total of six (06) different projects with capacity of more than 300 MW have achieved their CODs. Following projects have started their commercial operations:

No.	Company	Capacity (MW)	COD
	FFC Energy Ltd	49.5	1st Quarter 2013
	Zorlu Energy	56.4	2nd Quarter 2013
	Foundation Wind Energy I	50.0	1st Quarter 2015
	Foundation Wind Energy II	50.0	4th Quarter 2014
	Three Gorges First Wind Farm Pakistan (Pvt) Ltd.	49.5	4th Quarter 2014
	Sapphire Wind Energy Ltd	52.8	4th Quarter 2015

5.1.4 Projects in Construction Phase

Following projects have achieved financial close during 2014-15 and are currently under construction:

No.	Company	Capacity (MW)
	Yunus Energy Ltd	50.0
	Metro Power Company Ltd	50.0
	Gul Ahmed Wind Energy Ltd	50.0
	UEP Wind (Pvt) Ltd	99.0
	Master Wind Energy Ltd	52.8
	Tapal Wind (Pvt) Ltd	30.0
	HydroChina Dawood	49.5
	Tenega Genarsi	49.5
	Sachal	49.5

5.1.5 Projects at Advanced Development Stages

Following projects have reached the Generation License / Tariff stage:

No.	Company	Capacity (MW)
	Hawa Energy (Pvt) Ltd	49.3
	Jhimpir Power Ltd	49.3
	Hartford Energy (Pvt) Ltd	49.3
	Tricon Boston 1	49.3
	Tricon Boston 2	49.3
	Tricon Boston 3	49.3
	Three Gorges Second Wind Farm Ltd	49.5
	Three Gorges Third Wind Farm Ltd	49.5

5.1.6 Projects at Initial Development Stages

During 2015, various projects got their LOIs and lands from GOS. Most of these projects have completed their feasibility study and are at the EPC bidding stage. There is generally a readiness amongst the projects to obtain Generation License and Tariff. However, the grid allocation for the projects is in process. These include:

No.	Company	Capacity (MW)
	Master Green Energy Ltd	100.0
	Metro Wind Power Ltd	60.0
	Gul Ahmed Electric Ltd	50.0
	ACT2 Wind (Pvt) Ltd	50.0
	Artistic Wind Power (Pvt) Ltd	50.0
	Uni Energy Ltd	50.0
	Zulaikha Energy (Pvt.) Ltd.	50.0
	Noor Solar Energy (Pvt.) Ltd	50.0
	Lakeside Energy (Pvt.) Ltd	50.0
	NASDA Green Energy (Pvt.) Ltd	50.0
	Din Energy Limited	50.0
	Indus Wind Energy Limited	50.0

In addition to above, there are two projects, which were in the development stage prior to land allocations of above. However, these have some issues related to land and grid, and thus fall in the same category of development. These are China Sunec and Western Energy Limited.

5.2 TARIFF REGIME IN PAKISTAN

5.2.1 Negotiated Tariff for Wind IPPs

The initial regime was of a negotiated tariff, which is still applicable. The Project Company justifies all expenses and financial position to NEPRA through a petition. The NEPRA in return determines the project tariff on a "cost plus" basis. The Project Company is allowed 17% IRR on the equity. There are six projects so far at cost plus tariff. Five of these are in operation phase and one is in construction phase.

5.2.2 Upfront Tariff for Wind IPPs

NEPRA has announced a few upfront tariffs from time to time during past. The wind risk lies with the project company for upfront tariff. In lieu of it, the project companies can create cost efficiencies and draw maximum benefits from this "take and pay" basis. The indexations such as LIBOR / KIBOR, US$ and inflation are available.

The current upfront tariff allows full payment till an annual capacity factor of 35% is achieved. Afterwards, the tariff decreases to 75% from 35% till 36%. Then the tariff starts rising reaching 80% from 36% till 37%. Thereafter, the tariff regains its 100% value. This scheme is to intensify the high efficiency WTGs.

Most of the projects now prefer upfront tariff. SF, PAF wants to opt for the upfront tariff.

6 PROJECT IN TERMS OF POLICY FRAMEWORK

6.1 LETTER OF INTENT (LOI)

First step was to obtain Letter of Intent from AEDB, which was issued on 28th April, 2016. This letter entitled the Project Company to start working on wind power project at official level and get support from DAE GoS and other government departments in the preparation of feasibility study for the project.

6.2 ACQUISITION OF LAND

The land is owned by the Project sponsors; SF, PAF.

6.3 FEASIBILITY STUDY

The feasibility study of the Project is being finalized in this document.

6.4 GENERATION LICENSE

Rights to produce and sell electricity in Pakistan are granted by NEPRA through "Generation License". Project Company will file an application to NEPRA for Generation License which authorizes a company to produce and sell electricity in the country.

6.5 TARIFF DETERMINATION

A separate application shall be prepared for approval of upfront tariff.

6.6 LETTER OF SUPPORT (LOS)

Once the tariff is approved, the Project Company is required to move for arrangement of financing. AEDB will issue a Letter of Support for the Project Company giving government guarantees until EPA and IA are fully effective to ensure sponsors and lender of the full government support. A bank guarantee of US$ 2,500 / MW shall be required to be submitted by the Project Company before issuance of LOS.

6.7 ENERGY PURCHASE AGREEMENT (EPA)

Agreement between the Power Purchaser and the Project Company is called Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two companies. As soon as the feasibility study is submitted and upfront tariff is filed, the Project Company shall enter into the discussions of EPA. This is going to be a significant step in development of the project.

6.8 IMPLEMENTATION AGREEMENT (IA)

The Implementation Agreement (IA) provides security to the sponsors and lenders against the performance of the power purchases through guarantees from Government of Pakistan. Its discussions shall start alongside the EPA.

6.9 FINANCIAL CLOSE

Upon approval of feasibility study, grant of generation license, determination of tariff and the signing of project documents (EPA and IA); the Project Company shall move forward to complete the financial close. However, the discussions with lenders have already been started.

7 PROJECT SITE

7.1 WIND CORRIDOR OF PAKISTAN

Pakistan has 1046 km long coastal line with very encouraging wind regime. According to a study carried out by NREL and the wind masts installed in the Gharo and Keti Bandar wind corridor, the average wind speed in the region is 7.4 m/s making a regional potential of more than 50,000 MW. Wind Map of Pakistan by NREL is shown in **Figure 7-1**.

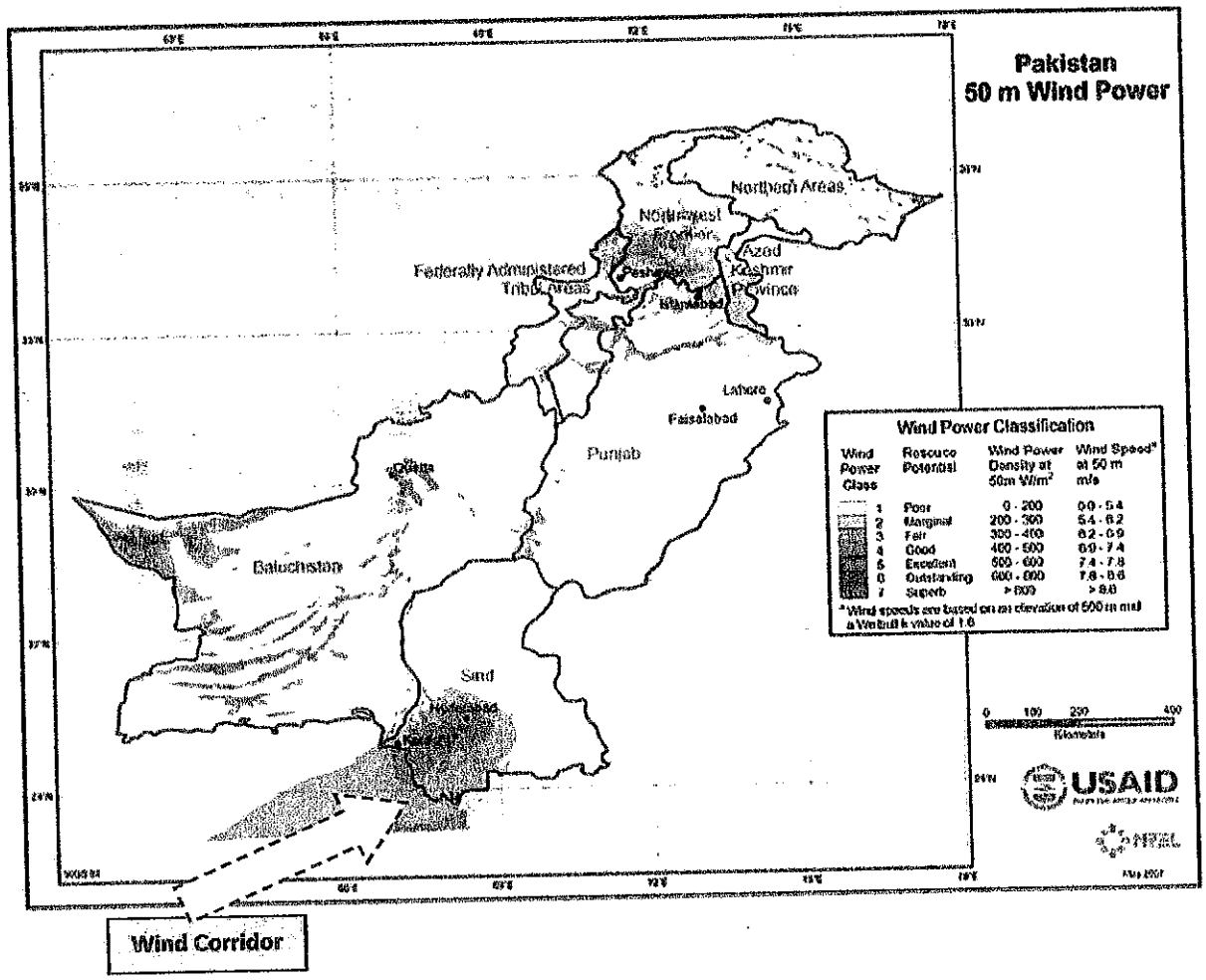

Figure 7-1: Wind Map of Pakistan by NREL

Based on the wind potential, Government of Pakistan initiated the wind power projects and facilitated land to the potential investors. The lands were allocated in Gharo, Bhambore and Jhimpir, where different wind power developers have taken the land. Later, GOS started facilitating the developers with land as well. The lands in this case belong to SF, PAF.

An overview of project sites allocated in Bholari region is shown in **Figure 7-2:**

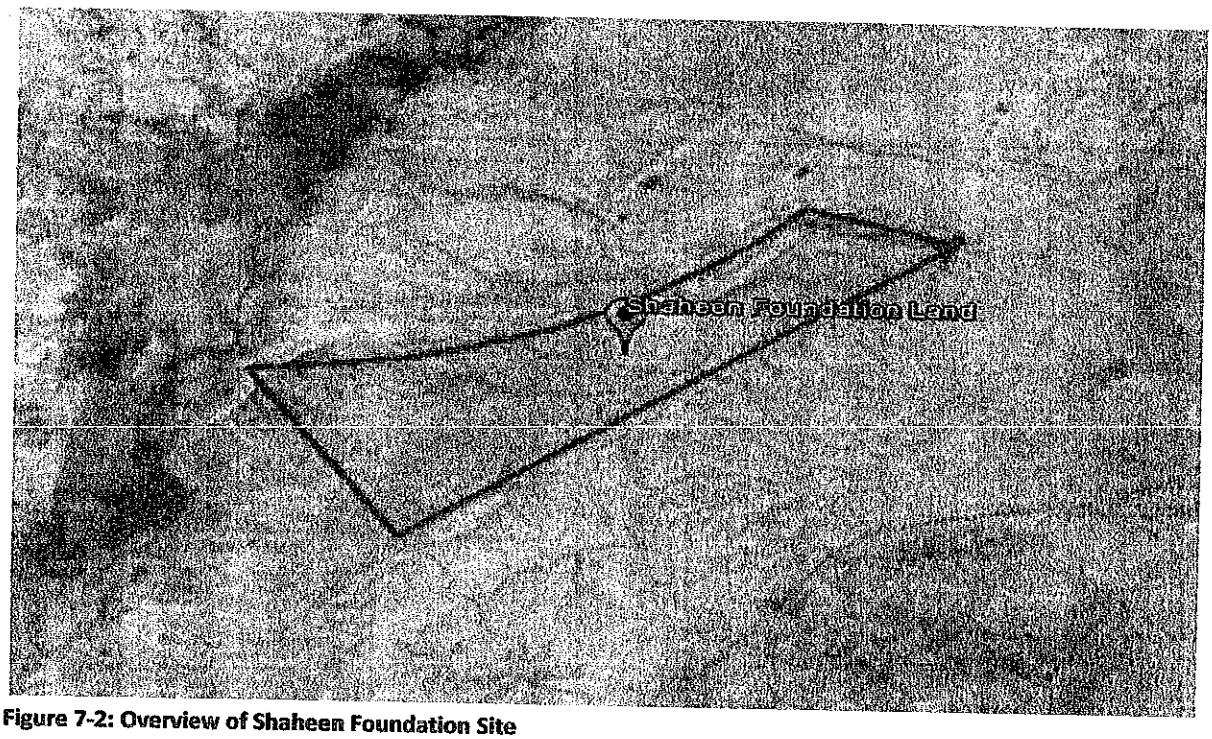

Figure 7-2: Overview of Shaheen Foundation Site

7.2 SITE DETAILS

The site is located in Bholari, Sindh which is towards the North East of Karachi as shown in **Figure 7-3.**

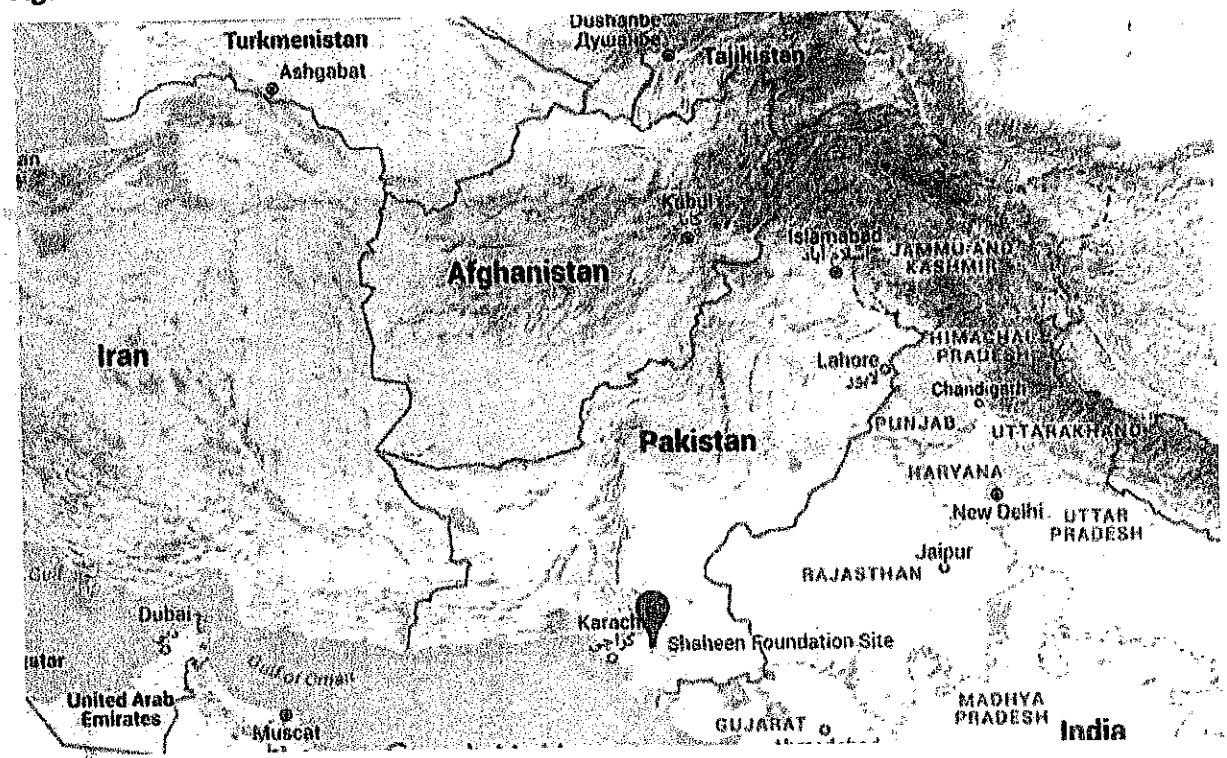

Figure 7-3: Shaheen Foundation Site Location

The electrical network within the vicinity of the site of the plant comprises of LV (11 kV) and HV (132 kV and 220 kV) lines.

Hyderabad Electrical Supply Company 132/11 kV grid station is DISCO in Jhimpir. Nearest Grid is Jhimpir Grid. The distance of the grid station from the Project site is approximately 19 kilometers.

A separate electrical and grid interconnection study will be conducted for the project including Power Quality, Load Flow, Short Circuit and Power Evacuation.

The site is nearly flat with the surroundings having same characteristics. View of Shaheen Foundation Site is given in **Figure 7-4.**

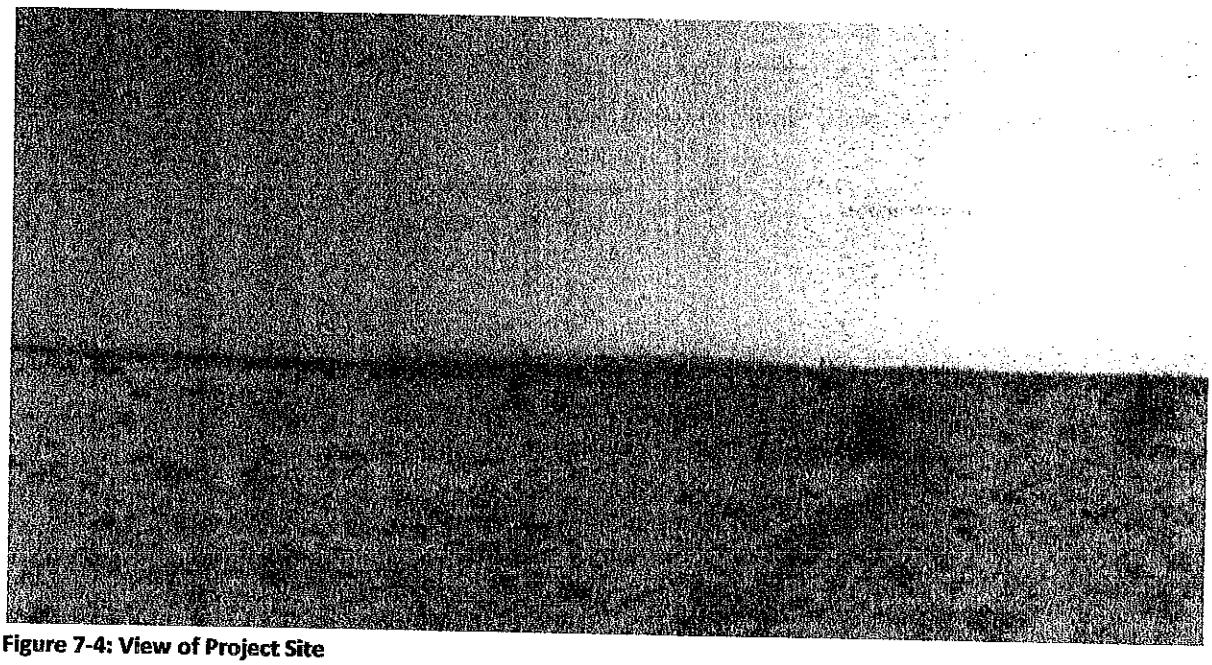

Figure 7-4: View of Project Site

7.3 TRANSPORTATION AND ACCESS NETWORK

A Transportation and Access Study has been carried out and is attached as Annex II.

The major section of track from Karachi to the site is via the National and Super high-way. The track is a multi-lane road. It has a flat terrain, and long and heavy vehicles can easily navigate through this road. Generally, minor track settlement is required from Nooriabad onwards to reach site area. The total distance from Karachi to the site is approximately 130km.

There are number of neighboring wind farms in the surrounding area of Thatta. The site is located in Bholari-Thatta, Sindh that is towards the East of Karachi and within the same corridor as many other wind power projects. The project site is towards the southwest of the FFC Wind Project, Zorlu Wind project, Three Gorgeous Wind Project, Hawa Wind Project, and JPL Power Project.

The satellite overview of the track from Bin Qasim Port to the Project site through the National and Super Highway is shown in **Figure 7-5**.

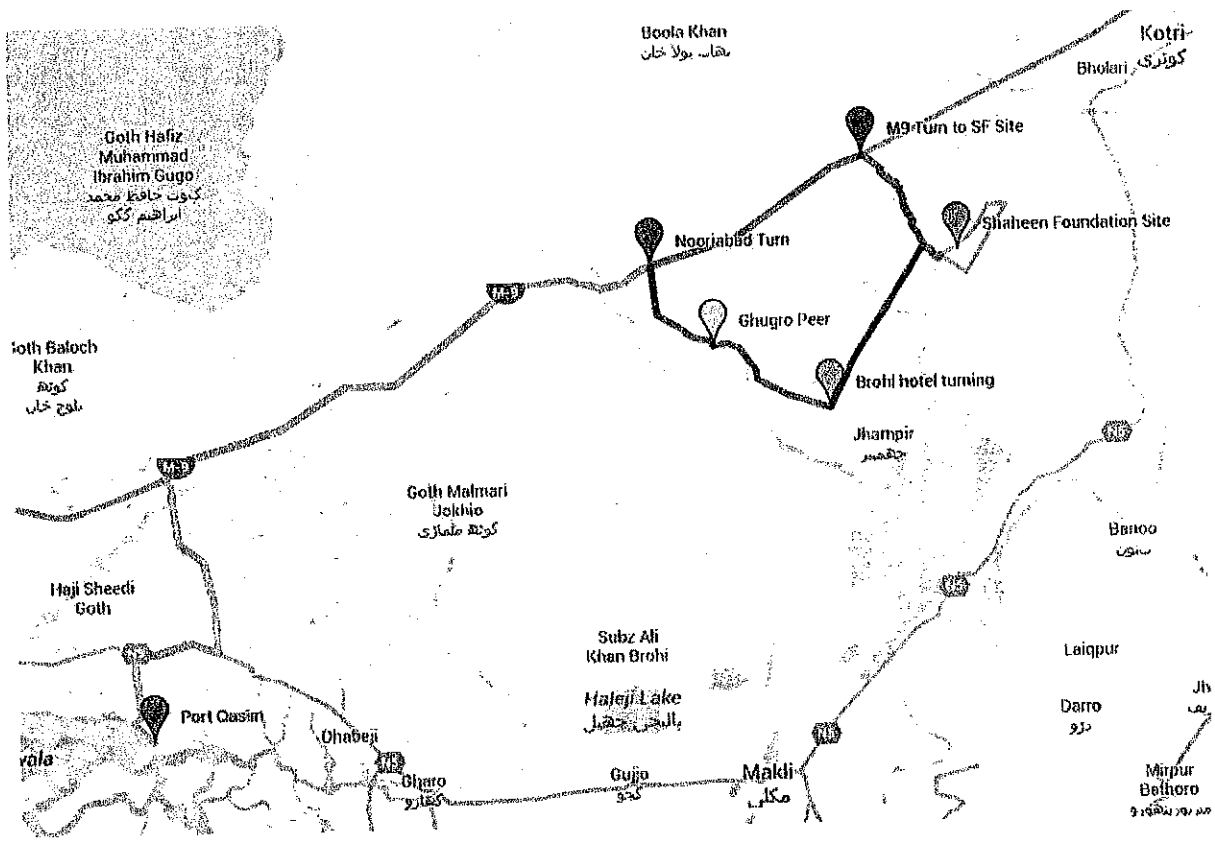

Figure 7-5: Access to the site

The Bin Qasim port, which is one of the major ports of Pakistan, is the point of delivery of equipment for the proposed wind power project. It is located towards South-West of the site as shown in **Figure 7-6**, having an aerial distance of approximately 91 km.

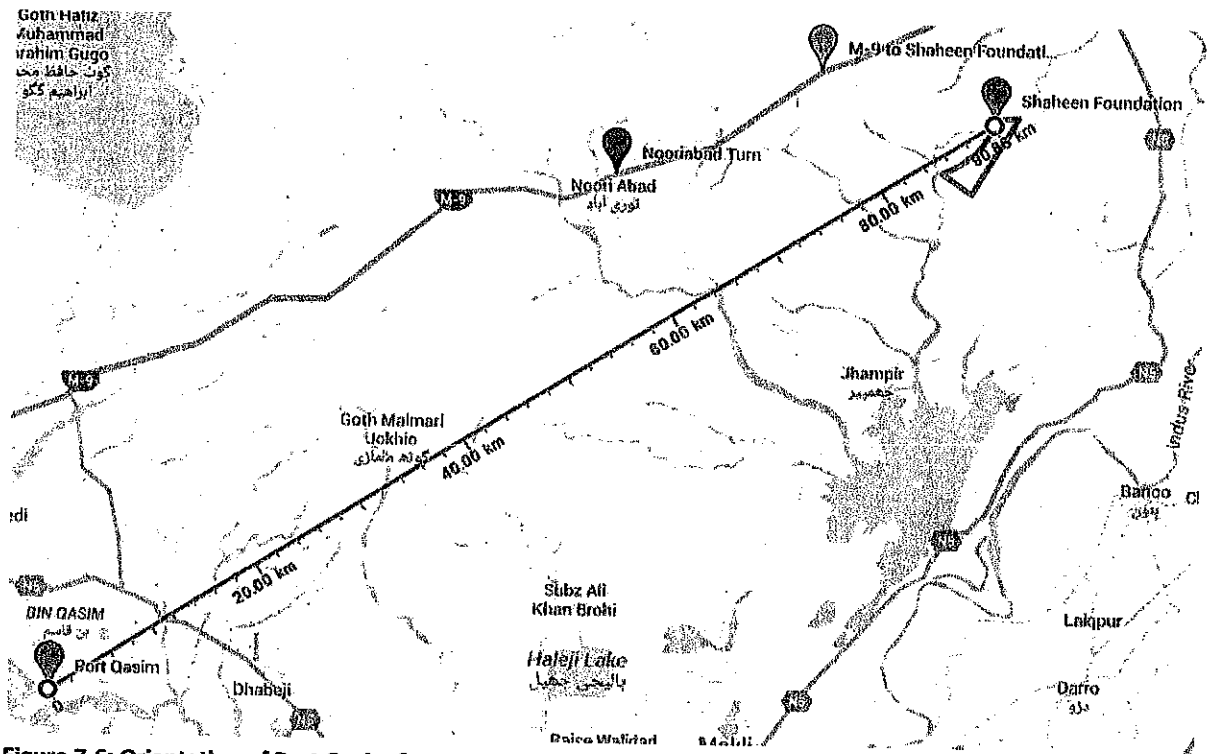

Figure 7-6: Orientation of Port Qasim from Site 1 (Ariel View)

7.4 CLIMATIC CONDITIONS

The climate of the southern parts of Sindh is characterized by fluctuating temperatures and sparse rainfall. The summers are hot and humid with average temperature ranging between 33°C to 40°C. The temperature in summers may reach up to 50°C. The winters are pleasant with average temperature in the range of 15°C to 25°C. Climate information of Karachi, which lies near to the site, is shown in table below:

Table 7-1: Maximum & Minimum Temperatures in Jhimpir Region[1]

S. No.	Month	Mean (°C)	Median (°C)	Min (°C)	Max (°C)	Std. Dev. (°C)
1	Jan	20.6	20	10.3	34.5	5.7
2	Feb	22.9	22.3	12.9	33.3	4.8
3	Mar	26.7	25.9	14.7	42.6	5
4	Apr	29.8	28.9	20.4	41.9	4.8
5	May	31.6	30.2	25.2	42.8	4.3
6	Jun	31.1	30.3	25.9	38.2	2.8
7	Jul	29.4	28.7	25.7	35.8	2.2
8	Aug	28.5	27.8	24.7	34.6	2.1
9	Sep	28.6	27.8	23.6	38.5	3.5
10	Oct	28.9	28.4	21.6	38.5	4
11	Nov	25.8	25	17.9	35.9	4.4
12	Dec	21.8	21.6	9.9	34.8	5.7

Table 7-2: Average Precipitation and Rainfall Days in Jhimpir Region[2]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	16mm
2	1	0	1	0	1	3	4	1	0	0	1

[1] Long term Temperature Data from nearby met mast
[2] Meteorological Department of Pakistan

7.5 TELECOMMUNICATION

PTCL telephone service is not available but mobile carriers have coverage on the site area.

7.6 EARTHQUAKES

According to the seismic zoning map of Pakistan, the Bholari region falls in ZONE II-B with moderate to severe damage area probability. This has been separately covered in the Geo Technical Study and the Initial Environmental Examination.

8 WIND RESOURCE ASSESSMENT AND ENERGY YIELD ESTIMATES

Presently, the Project plans to opt for upcoming upfront tariff. Therefore Annex III being not required for an upfront tariff is only meant for controlled circulation. If for any reason, the Project is not able to opt for the upfront tariff, then the cost plus option will be opted for and the wind studies will be submitted to relevant departments.

9 SELECTION OF WTG AND EPC CONTRACTOR

SF, PAF is currently working on the selection of following WTG suppliers and EPC Contractors. The details of EPC Contractors and WTGs offered by them are as follows:

EPC Contractor	Turbines offering	Capacity of Turbine
DESCON	• General Electric GE 1.7-103 • Gold Wind GW 121-2.5	• 1.7 MW • 2.5 MW
Power China	• General Electric GE 1.7-103 • Gold Wind GW 121-2.5 • Gamesa G114-2.0	• 1.7 MW • 2.5 MW • 2.0 MW

Turnkey EPC proposals have been invited through a bidding process, which will be evaluated on merit and then initial meetings shall take place with all bidders. Following this, detailed negotiations will be done with the two better prospective options to make a final selection.

The main aspects to select the WTG and EPC Contractor are as follows:

a) The quality of WTG and Type Certification according to site suitability
b) The quality and certifications of EBOP equipment
c) The ultimate energy yield potential at P90 for the Project
d) The total EPC cost and resultant tariff / IRR
e) Technical guarantees, warrantees and obligations
f) Time for Completion
g) The commercial and legal terms of the EPC package

At the moment, the entire feasibility is based on all WTGs mentioned in this section. The Project plans to make a final selection of the WTG and EPC Contractor by the time the stage for Generation License and Tariff of the Project will reach.

10 GEOLOGICAL CONDITIONS

In order to collect detailed regional geological information, SF, PAF hired professional services of M/s Bore and Bore (Pvt.) Ltd, a Pakistani local prospecting agency to conduct field exploration and drilling, of ten (10) bore holes. The drilling depth of seven (07) boreholes is 20m and for the other three (03) it is 10m. The complete Geotechnical Investigation Report is report is attached as Annex-IV.

10.1 OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 10 boreholes, at the site of each proposed turbine location, 7x20m & 3x10m in depth.
- To execute field and laboratory geotechnical testing.
- To investigate the surface and sub-surface soil condition, to evaluate foundation design parameters.
- To provide shallow and deep foundation recommendations.

10.2 GEOLOGY OF KARACHI REGION AND SURROUNDINGS

Geologically Karachi trough is located on the southern extension of the Kirther folded structures. It carries marine terrigenous and calcareous terrigenous Oligocene and Neogene sediments. Geological structure map of Karachi is shown in figure above.

The folds in the Palaeogene and Mesozoic sediments are overlain by the Oligocene-Neogene sediments of Karachi embayment.

The Karachi trough is delineated by the north-trending severely deformed mountain ranges namely Mor Range, Pab Range and Belaophiolite/mélange zone to the west. It is surrounded by Kirther Range to the north and to the east, and by the Indus delta and the Arabian Sea Creeks to the south-east and south. In the south, the Karachi structural embayment opens to the Arabian Sea. The trough is somewhat an asymmetrical Synclinorium.

The eastern limb of this trough is wider and comparatively greater than the western limb. The prominent strikes of the folds of the trough are sub-meridional north-south changing into southwestern direction in the south. The trough may be sub-divided into three principal regions named below:

- Northern Relatively Uplifted Region
- Southern Sub Merged Region
- Western Monocline

The tectonic map of Pakistan, Geological and Sub Surface details of Bholari are shown in **Figure 10-1 & Figure 10-2.**

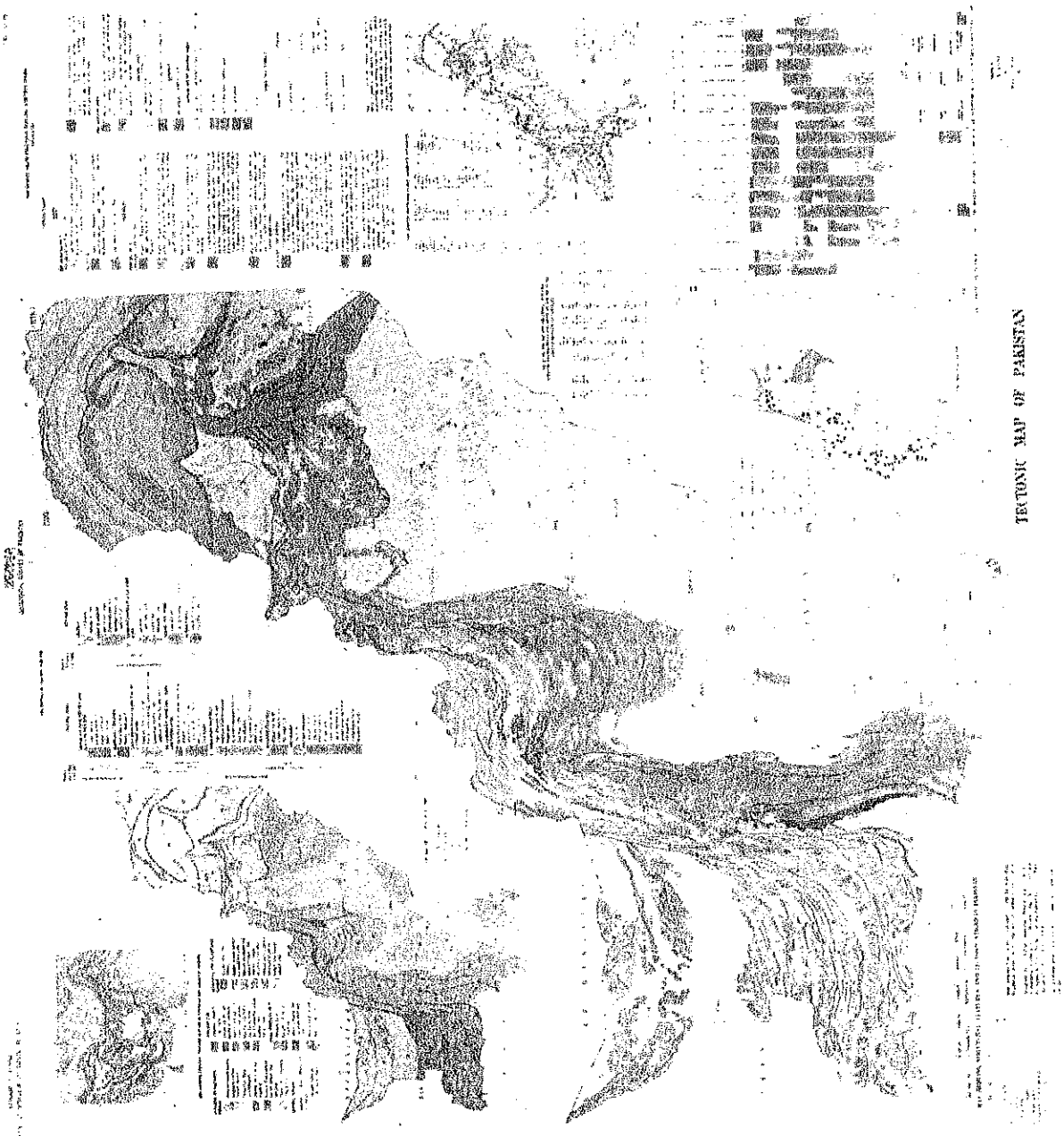

Figure 10-1: Tectonic Map of Pakistan

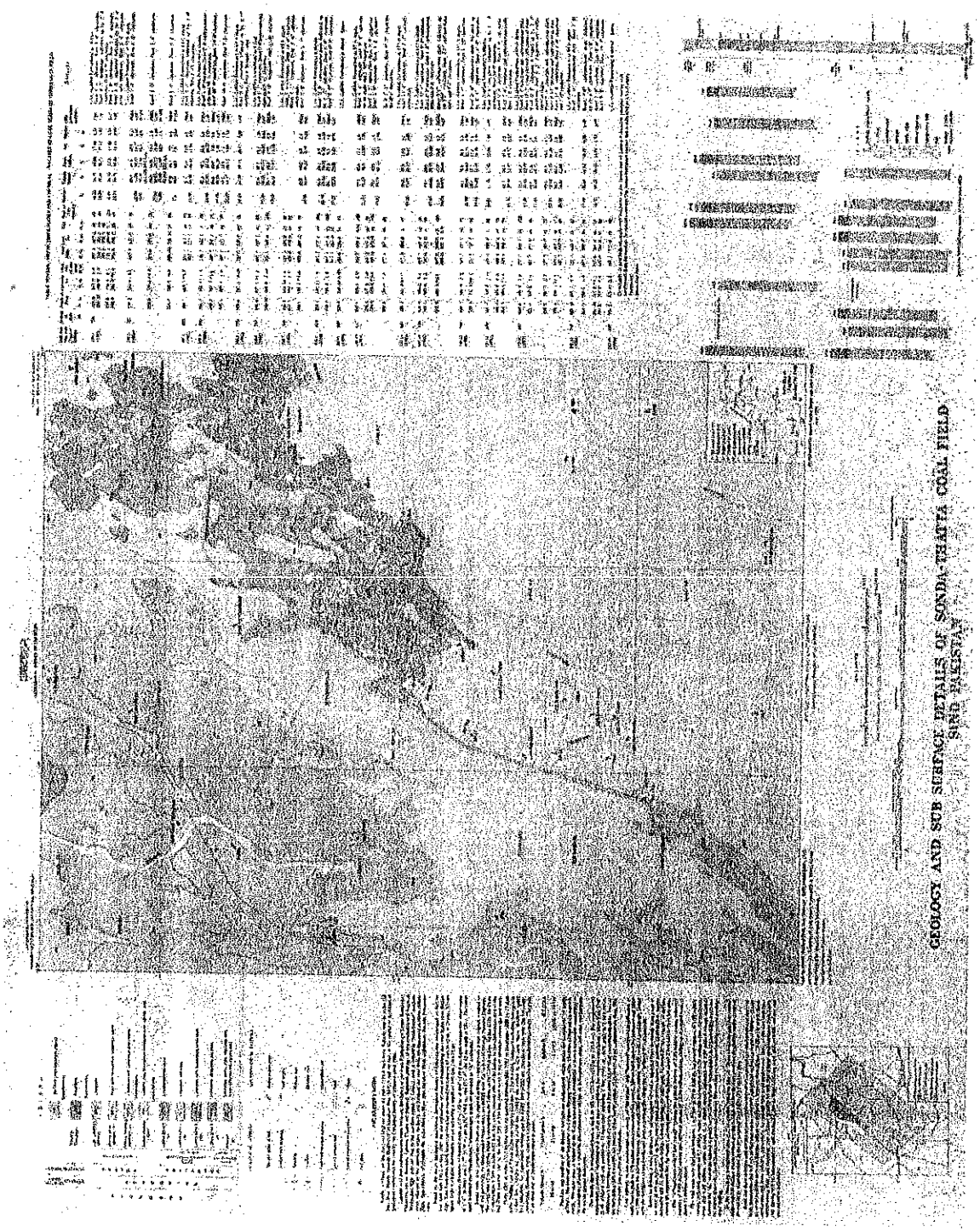

Figure 10-2: Geological and Sub Surface details of Bholari

10.3 SEISMOLOGY OF KARACHI REGION

The region is surrounded by some active fault lines; namely Pab Fault, Ornach Nal Fault and Runn of Kuch Fault. The history of earthquakes in Karachi is given in table below:

Table 10-1: Earthquake Records around Karachi

Year	Longitude	Latitude	Depth (km)	Richter Scale	Modified Mercalli Intensity	Location
1962	24.70	66.00	0	4.50	——	Karachi
1965	25.03	66.76	40	4.50	——	Karachi
1966	25.00	68.00	——	5.00	VI-VII	Jhimpir
1968	24.61	66.42	19	4.10	——	Karachi
1970	25.28	66.65	33	4.90	V	Karachi
1971	25.00	68.00	——	4.50	V	Jhimpir
1972	25.35	66.71	33	4.50	V	Karachi
1973	25.00	68.00	——	5.00	VI	Jhimpir
1973	25.48	66.33	57	4.90	V	Karachi
1975	25.50	66.80	——	4.50	V	Gadani
1975	25.22	66.59	33	4.70	V	Karachi
1976	24.96	70.38	14	4.70	V	Karachi
1984	25.86	66.41	33	5.00	VI	Karachi
1985	24.90	67.39	33	5.00	VI	Karachi
1986	25.34	66.60	33	4.60	V	Karachi
1992	25.25	67.76	33	3.60	IV	Karachi
1996	25.06	66.76	33	——	——	Karachi
1998	25.69	66.46	33	4.40	V	Karachi
1998	24.85	66.35	33	4.50	V	Karachi

The seismic parameters of Karachi region are given in the table below along with the map in *Figure 10-3*.

Table 10-2: Seismic Parameters of Karachi

Seismic Parameters	Value
UBC Zone	2B
Max Peak Ground Acceleration	16% - 20% of 'g' ($g = 9.8\ m/s^2$)
Seismic Hazard	Upper Moderate
Magnitude (Richter Scale)	5.5 to 6.5
Intensity (MM Scale)	VI – VII

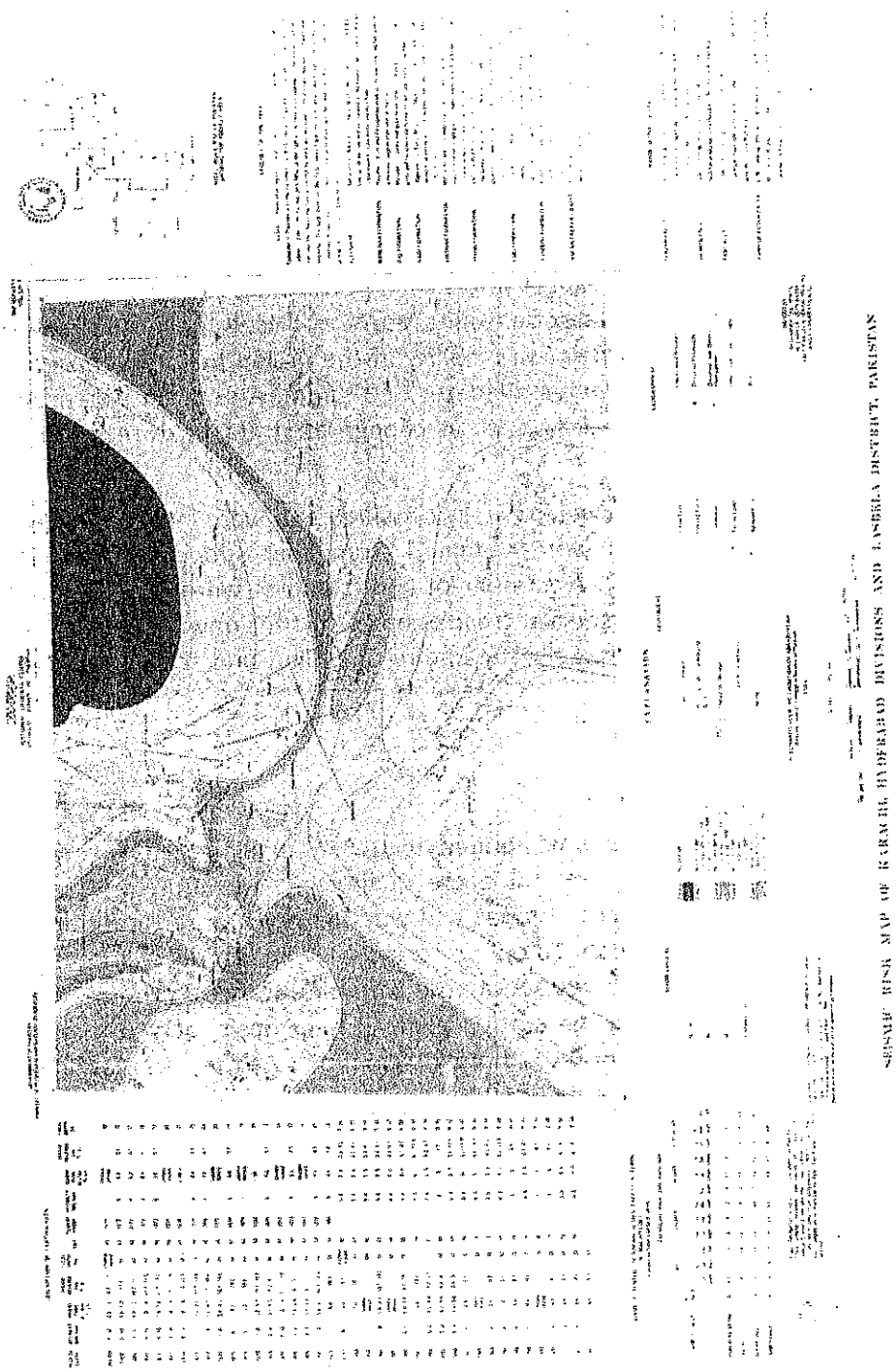

Figure 10-3: Seismic Map of Pakistan

10.4 FIELD WORK

10.4.1 Borehole Drilling

The drilling and sampling work has been performed using the standards, procedures and equipment's recommended for engineering site investigation. All borings were advanced through soil between sampling intervals by rotary wash methods, using rotary drilling machines of hydraulic feed. These machines are most suitable to the site conditions with all accessories for extending the bore to required depths, taking samples and performing the necessary onsite tests. Minimum drilling fluid consisting of water bentonite slurry was used for flushing out the cutting to provide a positive head and to maintain stability of the drilled hole. The boreholes were also stabilized using casing with a nominal diameter of 130mm. A drag bit was used to advance the boring. Observations during drilling such as change of strata, texture, color and drilling difficulties were noted.

The soil layers encountered in the borehole were visually classified and were later upgraded as per laboratory test results. Few samples were obtained from split spoon sampler after performing standard penetration test (SPT). A number of core samples were preserved. The samples were cleaned, labeled and put in especially made core-boxes for onward transmission to the laboratory for testing. Special care was taken during handling and transportation of samples.

10.4.2 Rock Core Drilling

Rock core drilling relates to the procedure in which underlying rock is investigated by coring so as to obtain samples for classification, to determine the quality of rock, and to check for possible detrimental properties such as cracks, fissures and weathering or other deterioration that could affect the strength of the formation. To obtain rock core samples, NX diameter core barrels with special bits were used. Under rotary action, the core bit advances into the rock. A circulating supply of water was provided in the cutting edge to help flush rock cuttings and dissipate heat. "Core Runs" were made to drill the hole in segments. At the completion of a core run, the barrel and rock sample were brought to the surface, the depth of recovery was properly recorded for further evaluation in the laboratory. Based on the length of the rock core recovered from each run, core recovery (C.R.) and rock quality designation (RQD) were calculated for a general evaluation of rock quality encountered. Suitable core samples were preserved for shear strength characteristics.

10.4.3 Location of Boreholes

Table 10-3: Location of Boreholes during Geo Technical Investigations (UTM zone 42R)

S.No	Easting	Northing	Depth(m)
B1	68° 4'16.38"	25°10'42.67"	20
B2	68° 5'3.04"	25°10'14.15"	20
B3	68° 5'6.71"	25°10'46.58"	20
B4	68° 5'1.10"	25°11'26.00"	20
B5	68° 5'27.18"	25°11'7.21"	20
B6	68° 5'27.97"	25°11'43.75"	20
B7	68° 5'49.96"	25°12'3.93"	20
B8	68° 4'37.35"	25°11'1.23"	10
B9	68° 5'46.54"	25°11'33.08"	10
B10	68° 6'4.76"	25°11'53.65"	10

10.4.4 List of Field and Lab Tests

Geotechnical laboratory testing was carried out on retrieved disturbed soil samples. The following are the relevant tests carried out on selected samples as required for determining the subsurface conditions and correlating with the information obtained from field testing and sampling:

- Grain Size Analysis
- Liquid and Plastic limits
- Natural Moisture Contents
- Density
- Specific Gravity
- Direct Shear Test
- Unconfined Compressive Strength of Rocks
- Chemical Test

10.5 CONCLUSIONS OF GEOTECHNICAL STUDIES

The Geo technical Investigation for Shaheen Foundation, PAF Wind Power Project in Bholari, Sindh was carried out in May, 2016. Scope of work included drilling of (07) bore holes up to 20.0 meters depth and three (03) boreholes of up to 10 meters depth. Soil Electrical Resistivity testing was also conducted at thirty (30) location across the site. Soil and rock samples were also collected during the field investigation. Laboratory testing of the soil and rock samples has been carried out in M/s Bore and Bore (Pvt.) Ltd lab which includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc. Chemical characteristics of the soil and ground water samples have also been assessed through determination of total dissolved solids, sulphate content, chloride content and pH. Keeping in view, the results from field, and laboratory tests and the expected loads being transferred to the founding stratum, allowable bearing pressures for shallow foundations at depth of 1.5meters. Exposure to chloride and sulphate salts is 'negligible' for soil; therefore, Ordinary Portland Cement (OPC) should be used for underground concreting.

11 CIVIL ENGINEERING DESIGN

The civil engineering design mainly includes following structures:

- Foundation of WTG Towers
- Foundation of substation and grid interconnection apparatus, i.e. transformer, switchgear.
- Construction of permanent buildings (residence and offices) of O&M staff.

The design activity of the civil works shall be carried out as part of the EPC contract during early phase of construction. However, the geo technical risk shall lie under contractor's responsibility as per the terms of the EPC Contract.

12 ELECTRICAL ENGINEERING DESIGN

The basic electrical design of the wind farm is discussed in this chapter. The overall electrical system has been designed considering the data from HESCO/NTDC and requirements of the grid code addendum for wind energy approved by NEPRA. As part of the grid interconnection study (**attached as Annex V**), complete modeling of the wind farm has been performed. Load Flow Studies, Short Circuit Analysis, and Transient Stability Analysis along with the Power Quality Analysis have also been performed on the existing and future planned HESCO/NTDC network as part of the report.

The dispatch voltage shall be 132 kV. There will be a two-stage step voltage, one step up to MV level at each WTG level through individual GSUs, and the other at the substation. The MV level shall be at either 22 kV or 33 kV. The Wind Farm shall have two 132 kV outgoing lines to keep the N-1 grid connectivity criteria. The termination points of the lines on the two remote ends have been identified, which will be firmed up during the construction phase by NTDC considering the network scenario at that time. The protection and telecommunication scheme will be accordingly finalized at that time.

The Wind Farm shall be divided into collector groups, each having approx. five (05) WTGs. Every WTG shall be equipped with own step-up transformer and shall be connected with the successive WTG by means of Ring Main Units (RMU) and vacuum breaker in configuration in/out. The connection of the RMUs to the main MV Switchgear shall be achieved by under-ground XLPE insulated single core aluminum conductor. The MV Switch gear shall have two bus sections with bus-coupler device, each feeding half of the WTG groups. It will also feed auxiliary transformer and capacitor bank to meet the power factor requirements of the national grid code (0.95 lagging).

The 132 kV substation shall consist of two bus sections of a single bus bar with a coupler and two breaker bays to connect main transformers with the 132 kV double circuit overhead lines (OHL). The Main Transformers shall meet the N-1 grid code criteria and thus may be two (02) in number (31.5/40/50 MVA each). The instrumentation transformers (CTs, VTs and CVTs) for all purposes shall be sized according to requirement. The 132 kV OHLs from the Wind farm substation to the 132 kV to far end connection points (whether adjacent grid stations or neighboring project substations) are out of the scope of the contractor and shall be installed and connected by NTDC. The HV/MV switchgear, main power transformer and other protection equipment shall be of reputable manufacturers, confirming to the requirements to be spelled in detail in the EPC Contract and in the EPA. Further, the detailed electrical design will be subject to approval of both SF, PAF and NTDC as per the requirements of EPC Contract and EPA.

In this regard, the concept mentioned in this section serves as guidelines and firm design will be prepared during construction phase, which may be somewhat different from predicted here.

13 CONSTRUCTION MANAGEMENT

Like all wind power projects in Pakistan, the structure of EPC contract is on a "turnkey" basis. Everything shall be managed from one platform (one window) of the EPC contractor. The partners of EPC contractor shall be underneath that platform through "subcontracting" or "joint and several arrangements". In this way, the role of Shaheen Foundation shall become to supervise and monitor everything.

Shaheen Foundation personnel will supervise construction activities right from the beginning. The Shaheen Foundation team will monitor the construction schedule, owner's engineers and the EPC contractor to complete the project within given time frame and in-line with HSE guidelines.

Shaheen Foundation requires careful management for construction. To achieve this, Shaheen Foundation, PAF will prepare a Construction Management Master Plan taking into account all relevant aspects. The master plan shall be regularly reviewed, updated and shared with all project stakeholders.

Construction Management Plan depends on the nature of work, likelihood of disruptions, impact on local amenity, dangers or risks involved and any other relevant issue required to be addressed under the planning permit.

In order to manage all the above operations correctly, Shaheen Foundation shall have a consultant as a "Construction Supervisor" who shall supervise the quality and progress of all contractors and give approvals of the milestones.

The project construction shall take 18 months from the date of planning till the COD. The activity structure and timelines are given in table below:

Table 13-1: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Engineering and Mobilization																		
Construction of Temporary Establishment																		
Civil Works of WTGs and Substation																		
Construction of Substation																		
Supply of WTGs and Towers																		
Cables and Interconnection																		
Erection and Installation																		
Testing and Commissioning of EBOP																		
Testing and Commissioning of WTGs																		
EPA Tests and Reliability Run Test																		

14 Initial Environment Examination (IEE)

The Initial Environment Examination (IEE) has been carried out as per the Pakistan Environmental Protection Act, 1997, according to the requirements of Environmental Protection Agency, Government of Sindh and has already been submitted. **The report is attached as Annex VI.**

A data collection survey, which included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern and socioeconomic conditions, was undertaken based on the available secondary information or through data collected in the field. The primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. The secondary data was collected for land, ecology, climate, and socioeconomic factors.

According to the study conducted, the prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

The impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage and are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes. Since proposed land is covered with shrubs, thus there is no need for removal of any significant vegetation for the construction of the wind power Project.

The proposed Project will have a number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significant improvement in economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- There is negligible removal of trees for the Project, which is the main positive impact to the proposed Project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed Project with mitigations being properly taken care.

Proper GRM will have to be implemented by Shaheen Foundation, PAF to overcome the public inconvenience during the proposed Project activities.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made by Shaheen Foundation to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by Shaheen Foundation, no major adverse impacts are expected. There is no adverse impact of migration on the habitat, any natural existing land resources and there is no effect on the regular life of people.

The environment and social impact associated with the project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most of the impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the project is expected to have a lesser "environmental footprint". No endangered or protected species of flora or fauna are reported near the project sites.

The stakeholder from the Government and Non-Government sector has also appreciated the project activities, raised concerns related to the social and environment areas which shall be addressed through effective planning and management.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed project has limited adverse environmental and social impacts, which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The potential cumulative and residual impacts of the Project as a whole indicate that the project is classified as a category "B", in accordance with ADB's Safeguards Policy Statement 2009. The Project is not considered highly sensitive or complex. The mitigation measures related to construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed project has limited adverse environmental and social impact, which can be mitigated following the EMP and shall be a pollution free renewable source of power generation with small environmental foot prints.

In view of the aforementioned details, it is concluded that development of the 50 MW wind power project by Shaheen Foundation will have no adverse environmental impact and the project can be regarded as an Environmental Friendly Green Project.

15 CONCLUSIONS OF FEASIBILITY STUDY

The detailed feasibility of the project has been conducted which covers all aspects required for developing the Project.

The wind climate observed on the site indicates good annual average wind speed. Thus the annual energy estimates are also good and it is feasible to develop the project based on General Electric GE 1.7-103 (1.7 MW) and Gamesa G114-2.0 (2.0 MW) turbines. The Project IRR as currently being assessed is suitable.

The project site is feasible for the wind farm with easy access for the transportation of equipment. The climatic conditions at the project site are moderate and there is no significant impact of seismic hazards foreseen in the area. The telecommunication and transportation facilities are adequate.

The Project shall not have negative environmental impact during its life cycle. Instead, the project will bring positive development and improve the socio-economic conditions of the area through generation of employment opportunities and contribute in environmental sustainability of the area.

The negotiations of the EPC contract and price shall play a vital role in the final selection.

The project site is conveniently located close to the grid of HESCO and NTDC. However, the remaining Grid Interconnection study will tell which grid to be selected for the connection.

From here onwards, the project may enter into getting licenses and permits and into negotiation of security documents. The next steps after approval of feasibility study would be to apply for the Generation License and Tariff, and to begin negotiations for EPA and IA. The Project may also enter into discussions with lenders at some stage.

It is expected that the Project will achieve financial close by second quarter of year 2017. It is anticipated that the Shaheen Foundation Project would be a valuable addition to the National Grid for generating electricity and contribute to overcome the current energy crises of the Pakistan.

Reference No: EPA/2016/05/18/IEE/150

ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF SINDH

Plot # ST-2/1, Sector 23, KIA, Karachi-74900
Ph: 5065950, 5065598, 5065637
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Date: 16-08-2016

SUBJECT:-DECISION ON INITIAL ENVIRONMENTAL EXAMINATION (IEE).

1.	**Name & Address of Proponent:**	Mr. Muhammad Jamshed Khan, Air Marshal (Retd) Managing Director M/s. Shaheen Foundation PAF P.O. Box 2225, E 9/1, PAF Complex, Islamabad Pakistan
2.	**Description of Project:**	Construction of 50 MW Wind power project
3.	**Location of Project:**	Bholari , District Thatta Sindh
4.	**Date of Filing of IEE:**	11-05-2016

5. After careful review of the Initial Environmental Examination (IEE) report, the Environmental Protection Agency (EPA), Sindh accord its approval subject to the following conditions:

i. The mitigation measures provided in the IEE report and implementation of Environmental Management Plan shall strictly be followed by the proponent to minimize or reduce the impacts on physical and biological environment. As for this, cost of EMP shall separate be allocated and be part of the tender document.

ii. The project proponent makes ensure to treat effluent generated from sewerage & waste water generated from the project activities and reduced its concentration at permissible level for compliance of National/Provincial Environmental Quality Standards (NEQS/SEQS) prior to discharge. However, the discharge should be planned away from environmental sensitive areas, with special attention to high water tables, vulnerable aquifers, and wetlands, community receptors, including water wells, water intakes and high value agriculture land.

iii. The gaseous emissions (SO_2, NOx, & CO) and particulate matters released from all construction and utilities machineries shall conform/meet to the National/ Provincial Environmental Quality Standards (NEQS/SEQS) all the time at no time, the discharge/emission levels shall go higher than stipulated standards of this office.

iv. The machinery used for construction or other project activities shall meet the NEQS/SEQS positively. However, proponent shall possess environmental and safety fitness certificate prior to use of the machinery equipment.

v. The impact on Water, Air, Soil and noise shall be minimized by adopting adequate precautionary measures as stipulated in current national and international guidelines (Pak-EPA, IFC, World Bank)

vi. All the types of adversely affect of wind project on local environment shall be reduced by means of mitigation efforts that should be completed during the design, construction, and operation phase of wind warm by proponent in order to avoid damages to vulnerable ecological systems.

vii. The project proponent shall bound to adopt effective mitigation measures with respect to environmental issues posed by wind turbines that includes wildlife safety, bio-safety disturbance, noise, visual pollution, electromagnetic inferences and local climate change.

viii. The project proponent shall follow current national and international guidelines with respect to wind energy such as OPIC & (IFC) during construction, operation & decommissioning of the project activities.

ix. The Wind Energy induced environmental impacts on birds, bats, and other physico-chemical parameters i.e. temperature, ambient air, water, and noise quality should be minimized & monitored by independent Monitoring Consultant (IMC) having expertise in carrying out Environmental & Social Impact monitoring. In addition, the IMC will monitor the implementation of the Environmental Management Plan, HSE Management System, CSR Plan Implementation and commitments made in IEE report same will be submitted to EPA on quarterly basis. The proponent shall identify and report HSE and CSR performance in monitoring reports including near misses, accidents, lost time incidents (LTI).

x. The vegetation of the disturbed project area should be replanted soon as after completion of construction work in order to overcome or reduced the impact of soil erosion.

xi. The waste generated from project activity shall confirm to dispose as environment friendly manner as non-hazardous waste shall be disposed at designated and approved waste disposal site and hazardous waste shall be transferred/disposed off only in a manner as prescribed in Waste Management Rules 2014 of Sindh EPA

xii. The Project proponent shall prepare on-site & off-site emergency plans for fires-safety, spillage control, human accidents ect; as disaster risk management and other as per extent rules in this regard

xiii. A complete Occupational, Health, Safety and Environment (HSE) commissioning management system shall be developed, implemented and monitored for compliance as per national if available or international guidelines. For this purpose, HSE setup should be supervised by a designated HSE officer at the senior level with sufficient administrative and technical authority to perform the designated functions. And proponent shall make sure that the operating instructions and emergency actions are made available to every worker/labor at the site. Moreover, proponent shall place all required resources and take necessary safety measures to prevent any incident and accident to human during project activity.

xiv. The project activity shall not be carried out at any protected area as notified in gazette notification of Government of Sindh.

xv. The proponent shall ensure that no unfortunate HSE incident(s) are caused due to construction and operation of project. The cost of damage to the environment, property and life of the people workers shall lie on the proponent.

xvi. If project proponent is storing bulk diesel/ furnace oil then project proponent bound to obtain necessary approval from Department of Explosive.

xvii. The project proponent shall have secondary containment equivalent to 110% of storage capacity for safety measures and prevent from soil contamination. However, chemicals of any forms (solid, liquid, gases) shall be handled by wearing personal protective equipments (PPEs) and care shall be taken to prevent any spillage.

xviii. The proponent shall ensure that emissions/effluents from project activity do not pose an unacceptable risk to human health or become nuisance to the neighborhood.

xix. For all engineering designs, NFPA (National Fire Protection Authority) codes will be followed. Standard fire and smoke detection and protection devices such as alarms, sprinklers, fire hoses and hydrants will be provided at all critical locations.

xx. This approval is accorded only for the construction of project activity and proponent shall submit separate EIA or IEE as required under EIA/IEE regulation 2014 o SEP ACT, for any enhancement or change in the design of project.

xxi. Under the CSR policy, community development scheme should be initiated after assessment of needs of community in terms of formal social assessment and CSR implementation plan.

xxii. The proponent shall ensure that maximum unskilled and skilled workforce employment be made locally preferably near/around project area and in compliance with all the applicable laws with respect to employment, working hours, compensation and benefits etc respectively.

xxiii. Proponent shall facilitate EPA Officer(s)/Official(s) as and when required for inspection of compliance status under provisions of Sindh Environmental Protection Act, 2014, rules and regulations framed there under and the conditions laid down in this approval.

xxiv. The Department reserves the right to stipulate additional conditions, if found necessary and the company/ project proponent in a time bound manner will have to implement those conditions.

xxv. No violation of any regulations, rules, instruction and provision of SEP Act, 2014, shall be made and in case of any such violation of the rules/laws in the approval shall stand cancelled without any further notice.

6. All the environmental conditions of this approval shall be incorporated in the terms and conditions of Engineering, Procurement, Construction (EPC) & Operational & maintenance (O & M) tender document of the project for commitment and compliance.

7. The proponent shall be liable for compliance of SEP Act 2014 & EIA/IEE Regulations 2014, in force relating to conditions for approval, confirmation of compliance, entry, inspection and monitoring

8. The proponent shall be liable for compliance of EIA/IEE Regulation 2014 of SEP ACT 2014, which direct for conditions for approval, confirmation of compliance, entry, inspection and monitoring.

9. This approval is issued only for construction phase however, the validity for this approval is three years with effect from date of issuance

10. This approval shall be treated as null and void if all or any of the conditions mentioned above, is are not complied with. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force.

Waris Ali Gabol
(Deputy Director Tech)

ORIGINAL

INITIAL ENVIRONMENTAL EXAMINATION (IEE) OF 50 MW WIND POWER PROJECT IN BHOLARI, SINDH, PAKISTAN

May, 2016

PROJECT COMPANY

Shaheen Foundation, PAF

PROJECT CONSULTANTS

Renewable Resources (Pvt.) Ltd

Disclaimer Notice

This report has been prepared for the benefit of (SF, PAF) Shaheen Foundation, PAF (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the Client's prior written consent in each specific case. The information contained in this report is intended for purposes of seeking an approval from the Environment Protection Agency in accordance with the requirements of the Pakistan Environment Protection Act, 1997, and may be used by the Client for such other purpose as may be necessary for the development and implementation of the Project.

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Prepared in May, 2016

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APPROVAL SHEET

TITLE	:	Initial Environmental Examination (IEE) of 50MW Wind Power Project in Bholari, Sindh Pakistan
DOCUMENT NUMBER	:	RE2/04/154/000/04 Issue: 01
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SYNOPSIS	:	This document is a report on Initial Environmental Examination (IEE) of 50 MW Wind Power Project in Bholari Sindh, Pakistan. Project is owned by Shaheen Foundation, PAF (SF, PAF). The report is Prepared by Renewable Resources (Pvt.) Ltd.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AEDB	Alternative Energy Development Board
CBD	Convention on Biological Diversity
CITES	Convention on Trade of Endangered Species
CLs	Core Labor Standards
Db	Decibel
DMC	Developing Member Countries
EIA	Environmental Impact Assessment
EHS	Environment Health and Safety
EMP	Environment Management Plan
ESMC	Environmental and Social Management Cell
EPA	Energy Purchase Agreement
EMMP	Environment Monitoring and Management Plan
GAD	Gender and Development
GHG	Greenhouse Gas Emissions
GRM	Grievance Redressal Mechanism
IEE	Initial Environmental Examination
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
Km	Kilometers
LAA	Land Acquisition Act
LOS	Law of Seas
MEA	Multilateral Environmental Agreements
MW	Mega Watt
MWh	Mega Watt Hour

NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NGO	Non-Government Organization
Nox	Nitrate Oxides
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation and Maintenance
OPIC	Overseas Private Investment Corporation
PEPA	Pakistan Environment Protection Act
POPs	Persistent Organic Pollutants
Pak-EPA	Pakistan Environment Protection Agency
SEPA	Sindh Environment Protection Agency
PV	Photo Voltaic
RE2	Renewable Resources (Pvt.) Ltd
SCR	Social Complaint Register
SHEE	Safety Health Environment and Energy
Sox	Sulfur Oxides
SF, PAF	Shaheen Foundation, Pakistan Air Force
WWF	World Wildlife Foundation

EXECUTIVE SUMMARY

Introduction

This document is an ***Initial Environmental Examination*** IEE of a ***50 MW Wind Power Project*** (Project) being developed by Shaheen Foundation, PAF (SF, PAF) in Bholari, Sindh Pakistan.

The sponsor of the Project is **Shaheen Foundation, Pakistan Air Force**.

SHAHEEN FOUNDATION, a trust of the Pakistan Air Force, was established in 1977 under the Charitable Endowment Act 1890. The foundation was created to promote welfare activities for the benefit of serving and retired PAF personnel including civilians and their dependents, and to this end-generates fund through industrial and commercial enterprises.

Shaheen Foundation is interested to setup a Wind Power Project of 50 MW Capacity in Bholari, Sindh, Pakistan.

Consultant

Renewable Resources is the Project consultant engaged for Project development including the Initial Environmental examination (IEE) of the Project.

The contact details of consultant are given below;

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Project Sponsors

The Project Sponsors are the limited liability company incorporated under the laws of Pakistan, called (SF, PAF). Contact details are as follows;

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Study Methodology

The study was conducted using standard methodology prescribed by national and international agencies to facilitate the review of identified environmental issues. This entailed an understanding and description of the environment within the activities which will occur or potentially have influence on the social and biological environment. The IEE study was conducted in four phases.

- Phase-I involved the definition and categorization of the Project components, collection of baseline data and information of the defined Project area through physical survey and consultation with the local inhabitants near the Project area.
- Phase-II involved the laboratory analysis of the different environmental parameters which includes (Ambient Air Monitoring, Ambient Noise, and Water quality analysis of the project area.
- Phase-III involved assessment of potential impact assessment of the pre-construction, construction, operation and Decommission phase of the Project.
- Phase-IV involved the mitigation measures, formulation and monitoring of an Environmental Management Plan (EMP) to minimize the environmental impacts of the Project during construction and operation phase.

The approach of IEE study includes the following steps:

- Describing the Project and details of Project Proponents
- Review of applicable Statutory Requirements and compliances
- Establishing environmental baseline conditions through survey and consultation with the local stakeholders
- Scoping the issues and establishing the boundaries of the assessment
- Review of Project Alternatives
- Assessing the potential environmental effects of the Project, including residual and cumulative effects
- Identifying potential mitigation measures to eliminate or minimize the potential adverse environmental impacts
- Environmental Management & Monitoring Plan and follow-up programs

Statutory Requirements

The report fulfills the following regulatory requirements:

- Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000 with reference to Pakistan Environmental Protection Act, 1997,
- Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014 with reference to Sindh Environmental Protection Act, 2014
- Performance Standards of IFC and World Bank group

The details of the statutory requirements and compliances of this IEE report to the national and international regulations or guidelines are explained in **Section 2** of this report.

Project Overview

The wind farm Project of 50 MW of Shaheen Foundation SF, PAF is located in Bholari, District Thatta Sindh. The land has been privately owned by Shaheen Foundation, Pakistan Air Force. The Karachi Hyderabad Motorway (Super Highway) is connecting road to the SF Shaheen Foundation, PAF site. The total land area of the Project is 2880 acres.

Subject to finalization of the EPC, the Project will install 29 units of General Electric-103 turbine generators (WTGs), each with rated output of 1.7MW. However, the exact configuration will be determined upon finalisation of the EPC. The other options of wind turbine generators (WTGs) are also available like, Gamesa G114 wind turbine generators (WTGs) rated output of 2.0 MW total 25 WTGs.

Further details about the Project and its location are given in **Section3** of this report.

Description of Environment

A data collection survey was undertaken that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern, and socio-economic conditions, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, climate, and socioeconomic factors.

The physical survey of the site was conducted by Mr. Umair Ali Khilji and Mr. Asad Ali Sahito of Renewable Resources Pvt. Ltd. The environmental and social baseline conditions observed in the Project area are presented in **Section 4** of this report.

Impact Assessment and Mitigation

A detailed analysis of Project alternatives are discussed in **Section 5.** During the IEE, the Project potential social and environmental impacts were identified. Each identified environmental and social impact was then characterized with respect to its nature, reversibility, geographical extent, consequence-severity and likelihood. Based upon this characterization, the impacts were then assessed to be of high, medium or low significance. The IEE has recommended appropriate mitigation measures to address the potential environmental and socio-economic impacts. The details of impact assessment and mitigation measures are provided in **Section 6,** which is further supplemented by the Environmental Management Plan (EMP) provided in **Section-8** of this report.

Stakeholder Consultation

Stakeholder consultation was carried out as part of IEE study. The details of the consultation are documented in **Section-8** of the report.

Finding and Recommendations

- Wind Power Project is a green energy Project and, therefore, there is no major long lasting social or environment impact foreseen.
- Air quality of the area may be slightly disturbed only during construction phase of the Project.
- The Project Area does not fall under any sensitive, protected area.

- No threatened / Near-Threatened species of wildlife was recorded in the Project Area.
- There are four settlements near the project area; only two are permanent settlements and other two were seasonal/temporary settlements. These settlements are outside from the project land area at distance of 3.39 Kilometers therefore no disturbance to the inhabitants is foreseen.
- Regarding bird mortality due to collision, it is found that birds landing area is around 25 km away from the wind farm and the migratory birds are not seen in the wind farm area and there are minimal to zero chance of bird collision from these wind turbines.
- Noise impacts will be less than 70 DB (A) which is within the range as per National Environmental Quality Standards (NEQs) of Pakistan.
- The environmental disturbance normally associated with construction activities will be minimized through an Environment Management Plan (EMP), implementation of which will continue during Project operation and which includes monitoring arrangements.
- The Project will bring a positive development in the area and improve the socio-economic conditions through generation of employment opportunities and opening of avenues for the development of this area. Power project constructed and then operated in the area will cause development of good infrastructure, which will be benefited by the local population.
- The Project will also help promote renewable energy in Pakistan and will contribute positively by meeting the energy supply demand of the country.
- This IEE study concludes that the proposed Wind project will not lead to significant adverse environmental and social impacts of such nature or magnitude that would require a more detailed report in the form of an EIA. Additionally careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.

The project has been discussed with local people, government officials and NGO (like Wildlife department, Forest department, SEPA, WWF and IUCN). The consultations elicited general support for the project. There were no serious environmental issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust and bird mortality.

In the view of all above, 50 MW wind power Project of Shaheen Foundation, PAF can be regarded as **Environmental Friendly Green Project.** The details of IEE findings and recommendations are discussed in **Section-9** of this report.

The following Annexures are attached with the report in order to support the results and findings of the report.

Annexure-I: Environmental Management and Monitoring Plan
Annexure-II: EMP Implementation Cost Estimates
Annexure-III: Pakistan Environmental Protection Agency Act 1997 and (Review of IEE and EIA) Regulations, 2000
Annexure-IV: Sindh Environmental Protection Agency Act 2014 and (Review of IEE and EIA) Regulations, 2014
Annexure-V: Pakistan National Environmental Quality Standards
Annexure-VI: IFC HSE Guidelines for Wind Energy Sector
Annexure-VII: Laboratory Analysis Reports of Ambient Air Quality, Noise and Drinking Water Quality
Annexure-VIII: List of Flora and Fauna Recorded in Project Area
Annexure-IX: Snapshots of Biological Environment
Annexure-X: Social Survey Forms
Annexure –XI: Snapshots of Community Consultation
Annexure –XII: Snapshots of Stakeholders Consultation
Annexure – XIII: NOC of Sindh Wildlife Department

SECTION 1

INTRODUCTION AND PURPOSE OF STUDY

1 INTRODUCTION AND PURPOSE OF STUDY

1.1 PROJECT PROPONENT

The sponsor of the Project is **Shaheen Foundation, Pakistan Air Force**.

SHAHEEN FOUNDATION, a trust of the Pakistan Air Force, was established in 1977 under the Charitable Endowment Act 1890. The foundation was created to promote welfare activities for the benefit of serving and retired PAF personnel including civilians and their dependents, and to this end-generates fund through industrial and commercial enterprises.

Shaheen Foundation is interested to setup a Wind Power Project of 50 MW Capacity in Bholari, Sindh, Pakistan.

Renewable Resources (Pvt) Limited (RE2) is the consultant to develop the Project of Shaheen foundation.

Shaheen Foundation SF, PAF has land available having area of approximately 2880 Acres. In order to identify the land for the wind farm within the same area, preliminary site assessment has been carried out.

1.2 THE PROFESSIONAL ADVISORS

Renewable Resources (Pvt.) Ltd is the professional technical advisor for the Project. Renewable Resources is a consulting company specialized in Renewable Energy (RE), Energy Efficiency (EE) and Environment (Env) Projects. The company is owned by group of professionals who have been intimately involved in the renewable energy program of Pakistan, and have a fundamental understanding of issues relating to power project development, which include but are not Ltd to feasibility studies, regulatory approvals, concession and security documents, and applicable policies.

RE2 is capable of conducting full feasibility package featuring power production estimates, grid interconnection and tariff model. RE2 also has the expertise to deal with all technical aspects regarding the legal documents of power projects. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of RE power Projects and its work output meets international standards. RE2 is presently a consultant for various power Projects in Pakistan sponsored by local and international investors, with international banks.

RE2 has gained significant experience in conducting Environmental and Social Impact Assessments (ESIA) and Initial Environmental Examinations (IEE) of renewable energy projects in accordance with national and international laws and standards. These studies cover all baseline environmental conditions and anticipated environmental impacts of projects and provide comprehensive Environmental Management Plans.

To date, RE2 has conducted fifteen (15) environmental studies of renewable energy projects, which have all been approved by the relevant Environmental Protection Agencies.

1.3 PROJECT BACKGROUND & JUSTIFICATION

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips domestic supply by a considerable margin. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves. Electricity mix of Pakistan (2013-2014) is presented in the figure below:

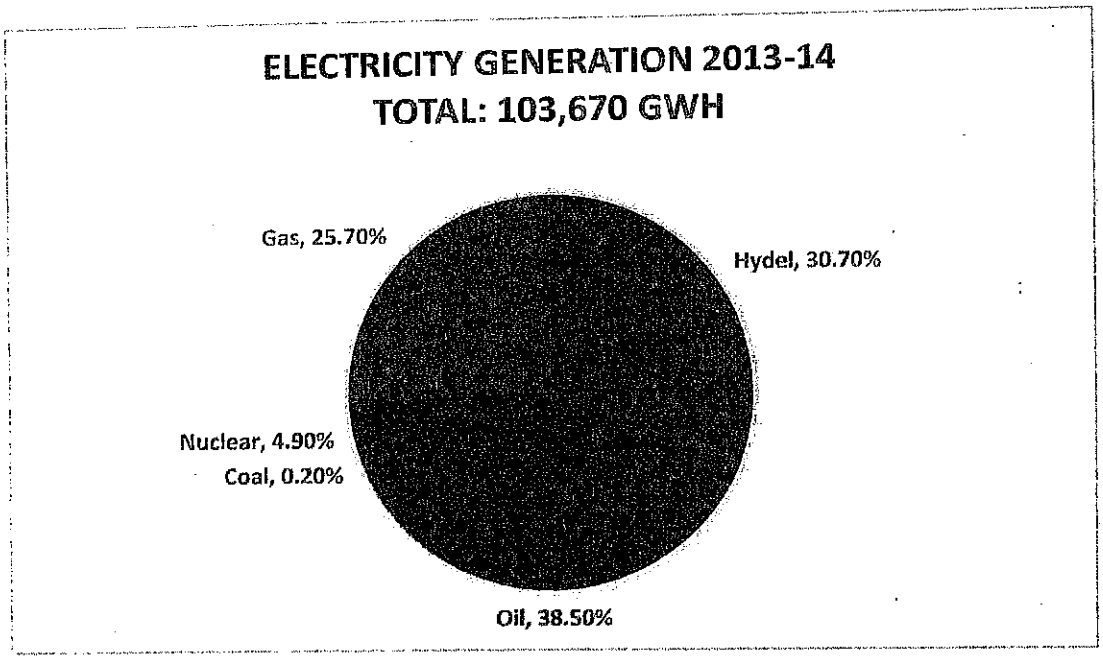


Figure 1.1: Electricity Mix of Pakistan by Source[1]

[1] Energy Year Book of Pakistan 2014

Import of gas could be seen as a viable option to overcome the depleting domestic reserves. However, gas import has significant challenges, such as the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would increase Pakistan's reliance on imported fuels with associated foreign exchange burdens. This must be considered in the context of rising costs for gas and oil-based fuels as a result of uncertainty over future supply.

Alternatives to further fuel imports for electricity generation are the production of domestic coal, generation from hydro-electric power, or other renewable sources, such as wind and solar power. These options will assist in reducing Pakistan's reliance on imported oil and protect against resulting vulnerability to changes in global oil prices, which will in turn also have a positive effect on the current trade deficit and inflating import bill.

As with gas, securing future supplies of domestic coal and hydro-electric power would require significant spending on infrastructure. While Pakistan has domestic reserves of coal, it currently makes up a very small proportion of the country's total power generation. This is due, in part, to the fact that most of the reserves are located in the remote Thar Desert region. Exploiting the coal reserves would require significant upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines, as a pre-requisite to any power plant development. Hydro-electric power already supplies almost 30% of the domestic electricity that is generated, and numerous sites for future investment exist. However, due to their locations, this would also require significant investment in transmission and other infrastructure. Moreover, there are various political issues relating to the development of hydro-electric and coal generation power plants, which remain to be resolved.

In light of the prevailing circumstances, wind generation appears to be a viable and environmentally friendly alternative for meeting Pakistan's urgent electricity demands. The development of wind generation projects could reduce dependence on oil-based thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions, all of which will contribute towards projecting a positive image of Pakistan within the international community. Also the per kWh tariff for wind power projects are now comparatively lower than that of furnace oil projects, particularly the Rental Power Projects, which were previously inducted to meet the urgent needs of electricity shortfalls.

1.4 PROSPECTS OF WIND ENERGY IN PAKISTAN

Pakistan has considerable potential for wind energy in the coastal belt of its southern provinces Sindh and Balochistan, as well as in the central desert areas of Punjab and Northern Sindh. This potential source of renewable energy has however, not been properly realized thus far. According to a study conducted by NREL, and data collected from the wind masts installed in the Gharo and Keti Bandar wind corridor, the average wind speed in this wind corridor is 7.4 m/s making a regional potential of more than 50,000 MW. The Wind Map of Pakistan as comprised by NREL is shown in Figure 1.2 below.

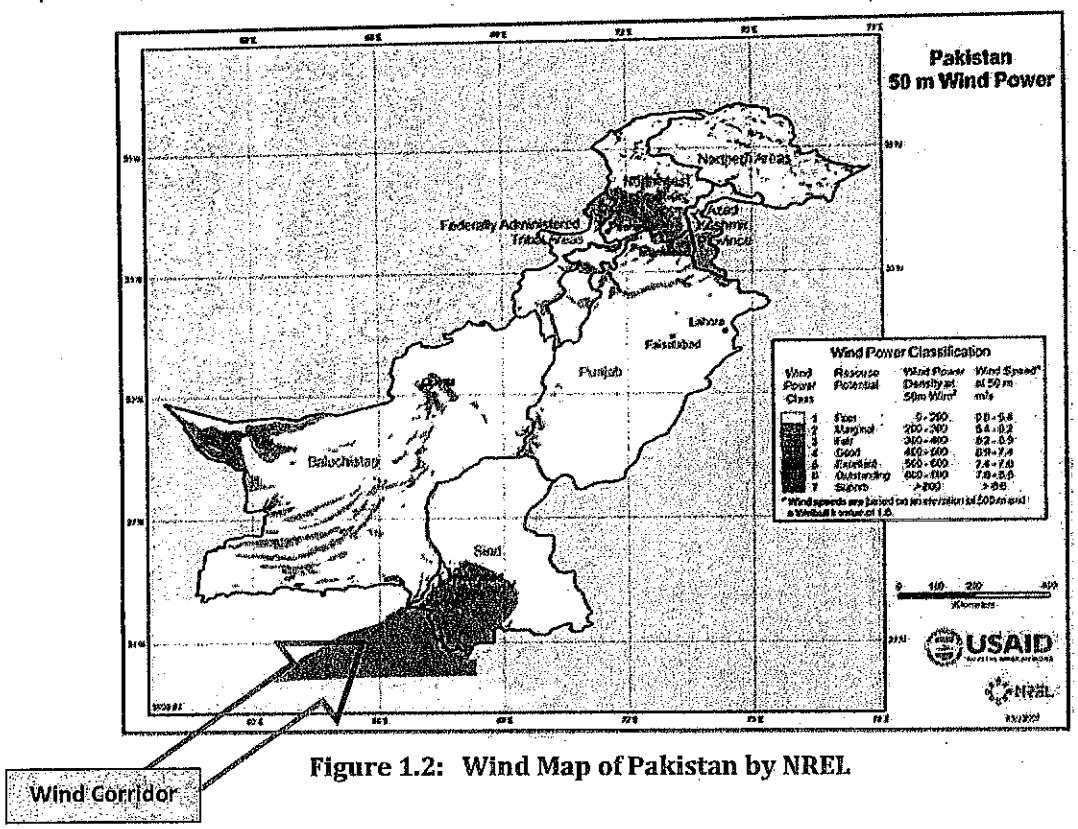


Figure 1.2: Wind Map of Pakistan by NREL

The Government of Pakistan (GOP) is diversifying its energy mix on a fast track basis to ensure Energy Security, Sustainable Development, Social Equity and Environmental Protection. Given its overall economics, wind energy is envisaged as an important ingredient of Pakistan's future energy mix.

Keeping in view the anticipated future energy needs and the significant potential for renewable energy, the GOP has set a target of at least 5% of the total national power generation capacity to be generated through renewable energy technologies, especially through wind energy by the year 2030.

1.5 PROJECT OVERVIEW & OBJECTIVES

The Wind Farm Project is located in Jhimpir, which is approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city.The Project site consists of 2880 acres of land, which has been privately owned by the Shaheen Foundation, PAF. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site.

The brief overview of Project is summarized in **Table 1.1** below.

Table 1-1: Project at a Glance

S. No	Particulars	Description
1.	Project Site	Bholari, Province of Sindh, Pakistan
2.	Project Area	2880 Acres
3.	Project Capacity	50MW
4.	Estimated Project Cost	105 million US $

The Project is being developed with the following objectives:

i. Contribute to meeting the electricity supply deficit in south west of Pakistan in particular; and country in general;

ii. Provide electricity to stimulate and support the expansion of local industry and service businesses;

iii. By using indigenous renewable resources of power generation, avoid depletion of natural resources for future generation and environmental stability;

iv. Create employment during construction and operations and provide opportunities for developing ecotourism;

v. Improve microeconomic efficiency of the power sector by reducing fossil fuel usage;

vi. Reduce greenhouse gas emissions from power generation and contribute to negligible emission, effluent, and solid waste intensity of power generation in the system;

vii. Conserve natural resources including land, forests, minerals, water, and ecosystems; and

viii. Improve local physical infrastructure such as access roads and transmission network in the Project area.

1.6 NEED AND OBJECTIVES OF IEE STUDY

Pakistan Environmental Protection Act 1997 (PEPA 1997) requires the proponents of every development project in the country to submit either an Initial Environmental Examination or Environmental Impact Assessment to the concerned environmental protection agency.

Sindh Environment Protection Agency Act 2014 (SEPA 2014)

Sindh Assembly has passed the Sindh Environmental Protection Act 2014; Environmental protection became the provincial subject; SEPA have developed Act, regulations and sectorial guidelines to develop its own Act and regulation and guidelines.

The IEE/EIA Regulations 2000 issued under PEPA 1997 and IEE /EIA regulations issued under SEPA Act 2014

Both guidelines provide separate lists for the projects requiring IEE or EIA. This Initial Environmental Examination (IEE) report has been prepared in accordance with the provisions in the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000. According to these regulations, an IEE is required for projects falling in any category listed in Schedule-I of the regulations, and an EIA is required for projects listed in Schedule-II of the regulations.

1.7 BASIS PROJECT CATEGORIZATION OF EIA STUDY

Section 12 of Pakistan Environmental Protection Act 1997 and other regulatory documents such as Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000 requires that every new development project in Pakistan has to be preceded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the magnitude of the project and severity of impacts anticipated at the time of commissioning of the project.

PEPA (Review of IEE/EIA) Regulations 2000 categorize projects into two separate schedules depending on whether a project requires an IEE (Schedule-I) or an EIA (Schedule-II). The

Regulations also require that all projects located in environmentally sensitive areas need submission of an EIA.

Section 17 of Sindh Environment Protection Agency 2014 and Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014 requires wind project to conduct the IEE under schedule I,

Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulation, 2014, the list of projects requiring an EIA includes wind energy projects if it falls under any sensitive, protected area. It defines "Environmental Sensitive Areas" as the area which falls under sensitive sites like protected areas, or the sites which may have crucial and growing importance. The Project Area does not fall under the said category accordingly IEE report has been prepared.

Accordingly an IEE Study has been conducted, and the same will be submitted to seek approval prior to project initiation.

This report conforms to the requirements of the IEE report addressed in **IFC and World Bank group performance standards**.

In the context of the scope of the Project, the IEE report has addressed the following objectives, where applicable:

- Category of the Project consistent with Pakistan Environmental Protection Act, 1997, Sind Environment Protection Act 2014 and IFC's and World Bank group performance standards.
- Highlight baseline environmental and social conditions of the Project area along with identification of environmentally sensitive area and concerned stakeholders
- Relevant host country laws, regulations, applicable treaties and agreements
- Protection of human health, cultural properties and biodiversity including endangered species and sensitive ecosystems.
- Major hazards; occupational health and safety; fire prevention and life safety
- Socio-economic impacts; land use: land acquisition; involuntary resettlement
- Impacts on indigenous peoples and communities, if applicable

- Cumulative impacts of existing, proposed, and anticipated future projects
- Efficient production, delivery, and use of energy .
- Pollution prevention and waste minimization, pollution controls (liquid effluent and air emissions), and solid and chemical waste management.

1.8 Scope of IEE Study

This IEE study is focused at developing the environmental profile of the project area so as to evaluate the existing physical, biological and socioeconomic aspects leading to respective impacts due to construction and operations at the Wind Farm.

The main purpose of the IEE study is to ensure that:

- Any major adverse impact on the environment (physical, ecological and social) during different phases of projects viz. siting, design, construction and operation are identified.
- Adverse impacts are appropriately addressed and adequate mitigation measures are incorporated in the siting, design, construction and operation phases of project.

Socioeconomic aspects are identified, and mitigation measure has been suggested.

- Alternatives to achieve the objectives are analyzed.
- Environmental Management Plan (EMP) for sustainable development and operation of the project is developed for implementation and monitoring of the project activities.
- The present IEE report has identified the significant environmental aspects and screened the potential aspects to ensure that the likely impacts due to proposed activities during construction, installation of masts and WTGs and operation of the proposed project, and the residual impact on adoption of mitigation measures have been critically assessed with respect to compliance with the Pakistan Environmental Protection Act 1997, Sindh Environment Protection Act 2014 and World Bank, IFC.

1.9 Methodology for Initial Environmental Examination Study

The environmental assessment (examination and evaluation) is primarily based on simple comparative evaluation approach. Initially the baseline or the profile of the project area is developed by site surveys, collecting data, records and information on physical, ecological /biological as well as socioeconomic environment. The data so compiled is then projected

or modeled for different phases of projects, i.e. design, construction, and operations. The likely changes in the critical environmental aspects or significant changes in the ambient environmental parameters are identified. Identification, assessment and evaluation of significant impact either in qualitative or quantitative terms is carried out for which appropriate mitigation measures are proposed.

Project Team of environmentalists and sociologists held consultation based on the detailed contents of the Project with main stakeholders. Environmental and social considerations being an essential component of the implementation phase of this project, the following points were underscored for implementing the IEE recommendations:

Identifying the need, if any, for involuntary resettlement and for land acquisition and to prepare an appropriate Involuntary Resettlement Program.

Reducing the impact on the living environment during the construction period, selecting appropriate construction methods and construction schedule.

Accordingly the IEE study has:

- Conducted public consultation at the early stage
- Held stakeholders meetings during the study.
- Understood in detail the concerns of Persons resident in the villages that are outside the SF, PAF land area.
- In consideration of:
- Agreement between AEDB and SF Shaheen Foundation, PAF allowing SF land for installation of Wind Power Generation will require no payment for land acquisition,
- Consultation Meetings with the residents of one village located within the SF project boundary and one on the outside of the land area, have confirmed the issue that establishment of the Wind Farm on SF land will not require land acquisition or involuntary resettlement, and insignificant impact on the ecology and living environment, It is implicit that there would be no need for involuntary resettlement or acquisition of land.
- This IEE report presents the existing environmental scenario and the results from the assessment and evaluation of the environmental aspects emerging during the installation and operation phases of wind turbines. Following screening of potential environmental aspects, the assessed and evaluated impacts requiring necessary mitigation measures are suggested in the report. The report also includes the Environmental Management and Monitoring Program that will be implemented during siting, construction operation phases and decommission phase.

The methodology specifically adopted for conducting the IEE of The Project may be summarized as follows;

1.9.1 Scoping

The key activities of this phase include:

Project Data Compilation: A generic description of the proposed activities relevant to environmental assessment was compiled with the help of the proponent.

Published Literature Review: Secondary data on weather, soil, water resources, wildlife, and vegetation were reviewed and compiled.

Legislative Review: Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.

Identification of Potential Impacts: The information collected in the previous steps was reviewed and potential environmental issues identified.

Baseline Data Collection:

Primary Data Primary data for Environmental Monitoring including Ambient Air, Ambient noise, ground water and surface water was developed through EPA Certified Laboratory (SGS), in addition to that Birdlife and wildlife survey was also conducted during this study and previous studies conducted by the Project team. A field visit was conducted to verify and collect primary data on the site alternatives. A questionnaire was developed and views of local inhabitants were taken about the wind power Project.

Secondary Data reasonable data of baseline information on the Project area was available from existing literature and other studies conducted close to the Project area have also been referred in this study.

1.9.2 Impact Assessment

The environmental, socioeconomic, and Project information collected was used to assess the potential impact of the proposed activities. The issues studied included potential Project impact on:

- Geomorphology
- Groundwater and surface water quality,
- Ambient air quality and ambient noise levels
- Ecology of area, including flora and fauna especially with reference of migratory and local birds
- Local communities
- Noise impact
- Shadow impact

Wherever possible and applicable, the discussion covers the following aspects:

- The present baseline conditions
- The potential change in environmental parameters likely to be effected by Project related activities
- The identification of potential impacts
- The evaluation of the likelihood and significance of potential impacts
- The definition of mitigation measures to reduce impacts to as low as practicable
- The prediction of any residual impacts, including all long-term and short-term, direct and indirect, beneficial and adverse impacts
- The monitoring of residual impacts

1.9.3 Documentation

This report documenting the IEE process and results is prepared in accordance with the relevant guidelines set by the Pakistan Environment Protection Agency (Pak-EPA) in general and Sindh Environmental Protection Agency in specific.

1.10 METHOD FOR EVALUATING IMPACT

The description of baseline conditions represents the basis for evaluating the Project's impact. The description and evaluation of the environmental impact, and proposals for measures to be taken to mitigate and compensate for any determined environmental impact during construction and operation phase, are presented in the Environment Management Plan (EMP) (Annexure-I). In the interest of transparent presentation and evaluation, tabulated evaluation procedures have been applied. The severity of a particular environmental impact together with its general trends (i.e. negative or positive) is described on the basis of a point system. The evaluation scale applied is as follows:

=High

=Medium

=Low

=No Impact

=Locally Favorable

=Regionally Favorable

Both national and international standards, such as those of the World Bank and WHO, are used as a basis for this judgment. According to these standards, impacts are evaluated as follows;

High	International and national standards are exceeded
Medium	Between international and national standards
Low	International and national standards are met

SECTION 2

LEGASLATIVE REQUIREMENTS

2 LEGISLATIVE REQUIREMENTS

This chapter describes the relevant: (i) national and international policies; (ii) legal and administrative framework; and (iii) institutional setup, in respect of the environmental and social assessment of the proposed Project.

2.1 NATIONAL ENVIRONMENTAL LAWS

There are several laws in Pakistan which contain provisions relating to the protection of the environment. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context specific. The laws relevant to development projects are briefly reviewed below.

2.2 POLICY GUIDELINES

2.2.1 National Conservation strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GOP) on national environmental issues. The Strategy approved by the Federal Cabinet in March 1992 was also recognized by International Financial Institutions, principally the World Bank. The NCS had identified 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage. It had also recommended immediate attention to the stated core areas in order to preserve the environment of Pakistan.

A mid-term review of the NCS in 2000 concluded that achievements under the NCS were primarily awareness raising and institutional building rather than meaningful improvement of the environment and natural resources and that the NCS was neither designed nor adequately focused as a national sustainable development strategy (GoP, November 2002). Thus the need for a more focused National Environmental Action Plan (NEAP) was formulated and approved by the Pakistan Environmental Protection Council in 2001 to practically improve the national

environment with emphasis on poverty reduction, and economic as well as sustainable development.

NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that would safeguard public health, promote sustainable livelihoods and enhance the quality of life of the people of Pakistan.

The GOP and United Nations Development Programme (UNDP) have jointly initiated an umbrella support programme called the NEAP-Support Programme that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP-Support Programme is environmental sustainability and poverty reduction in the context of economic growth. The objectives of new policy has total 171 guidelines on sectorial and cross sectorial issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country. The following are the approved Sectorial Guidelines:

- Water Supply and Management
- Air Quality and Noise
- Waste Management
- Forestry
- Biodiversity and Protected Areas
- Climate Change and Ozone Depletion
- Energy Efficiency and Renewable
- Agriculture and Livestock
- Multilateral Environmental Agreements
- Biodiversity Action Plan

The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of National Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss.

2.2.2 The Biodiversity Action Plan

The Biodiversity Action Plan (BAP), which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

The BAP recognizes that an IEE is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an IEE needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

2.3 ENVIRONMENT INSTITUTIONS AND ADMINISTRATION

The Constitution of Pakistan distributes the legislative powers between the federal and the provincial governments through Federal and Concurrent Lists. The Federal list depicts the areas and subjects on which the Federal government has exclusive powers. The Concurrent list contains areas and subjects on which both Federal and Provincial governments can enact laws.

The Ministry of Climate Change, Local Government and Rural Development are responsible for environmental issues at the federal level. The NCS unit within the Ministry ensures implementation of the National Conservation Strategy.

The Pakistan Environment Protection Agency is the federal body responsible for administering the provisions of the Pakistan Environment Protection Act. It is responsible for ensuring compliance with the NEQs, developing monitoring and evaluation systems and initiating legislation when necessary.

The provincial Environment Protection Agencies, i.e. the Environment Protection Department in Sindh, are responsible for environmental planning and development and approval of Initial Environmental Examination (IEE) and Environmental Impact Assessments (EIA) of new Projects at the provincial level.

2.4 LAWS, REGULATIONS, AND GUIDELINES

The Pakistan Environment Protection Act, 1997, is the basic law that empowers the Government of Pakistan to develop policies and guidelines for the protection of the country's natural environment. A brief description of the laws is given below.

2.5 PAKISTAN ENVIRONMENTAL PROTECTION ACT, 1997

The PEPA, 1997, 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, soil, marine, and noise pollution, as well as to the handling of hazardous wastes.

The key features of the law that have a direct bearing on the proposed Project relate to the requirements for an initial environmental examination (IEE) and EIA for development Projects. Section 12(1) requires that: "No proponent of a Project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the Project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Federal Agency approval in respect thereof." Pak-EPA has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies. As the proposed Project will be located near Karachi, it falls under the jurisdiction of the EPA Sindh.

2.6 SINDH ENVIRONMENTAL PROTECTION ACT, 2014

The Sindh Environmental Protection Act, 2014 (SEPA) is the basic legislative tool empowering the provincial government to frame regulations for the protection, conservation, rehabilitation and improvement of the environment. The SEPA 2014 is broadly applicable to air, water, soil, hazardous waste, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint. Sindh Environmental Protection Act, 2014 (SEPA) attached as Annexure.

- It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards.
- Under section 17 of SEPA, "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 Agency approval in respect thereof. "

- SEPA shall review the IEE & EIA and accord approval subject to such terms and conditions as it may prescribe or require. The agency shall communicate within sixty

days it approval or otherwise from the date IEE is filed failing which the IEE shall deemed to have been approved.

2.7 PAKISTAN ENVIRONMENT PROTECTION AGENCY REVIEW OF IEE AND EIA REGULATION, 2000

The Pakistan Environment Protection Agency Review of IEE and EIA Regulations provide the necessary details in respect of the preparation, submission, and review of the IEE and EIA. Categorization of Projects of IEE and EIA is one of the main components of the Regulations.

The following is a brief step-wise description of the approval process:

- A project is categorized as requiring an IEE or EIA using the two schedules attached to the Regulations.
- An EIA or IEE is conducted as per the requirements of the EPA guidelines.
- The EIA or IEE is submitted to the concerned EPA—provincial EPAs if the project is located in the provinces, or the Pak-EPA if it is located in Islamabad.
- A fee, depending on the cost of the project and the type of the report, is submitted along with the document.
- The submittal is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.
- EPA conducts a preliminary scrutiny and replies within 10 days of the submittal of a report by:(a) confirming completeness;(b) asking for additional information, if needed; or (c) returning the report requiring additional studies, if necessary.
- EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively, upon confirmation of completeness.
- If the EPAs accord their approval subject to certain conditions, then before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions as per mentioned in schedule vii.
- Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.
- An Environment Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.
- The EPAs are required to issue confirmation of compliance within 15 days of the receipt of request and complete documentation.
- The IEE approval is valid for three years from the date of accord.

A monitoring report is to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operation.

Complete guidelines of Preparation of EIA/IEE along with details of other concerned laws and regulations outlined in the Pakistan Environment Protection Act 1997 are provided in Annexure- III for reference

2.8 SINDH ENVIRONMENT PROTECTION AGENCY REVIEW OF IEE AND EIA REGULATION, 2014

The SEPA review of IEE and EIA regulations, 2014 (the 'regulations'), prepared by the SEPA under the powers conferred by section of Sindh Environmental Protection Act, 2014provide the necessary details on the preparation, submission and review of the IEE, EIA and environmental checklist of the project

These regulations classify projects on the basis of expected degree of severity of environmental impacts and list them in three separate schedules. Schedule-I lists projects that may not have significant environmental impacts and require an IEE. Schedule-II lists projects of potentially significant environmental impacts requiring preparation of an EIA. Schedule-III list projects of screening and requiring preparation of environmental checklist. The Regulations also require under the schedule-II Clause-A6: Wind energy projects if falls under any sensitive, protected area and under the Clause-J: that all projects located in environmentally sensitive areas require preparation of an EIA. SEPA (Review of IEE /EIA regulations) 2014 has been provided in the report . The Project Area does not fall under the protected area; accordingly IEE report has been prepared. Wind Projects, transmission lines less than 11KV and grid station falls in Schedule I - lists of projects requiring an IEE while the wind energy projects if fall under any sensitive, protected areas and transmission lines (11KV and above) and distribution projects fall in Schedule II - lists of projects require an EIA.

Complete guidelines of Preparation of EIA/IEE along with details of other concerned laws and regulations outlined in the Sindh Environment Protection Act are provided in Annexure- IV for reference

2.9 SECTORAL GUIDELINES FOR ENVIRONMENTAL REPORTS-WIND POWER PROJECTS

The wind power sectorial guidelines form part of a package of regulations and guidelines, to be read in conjunction with the overall EIA /IEE guidelines package. These guidelines have been prepared by the Federal EPA in collaboration with other key stakeholders, which include: the provincial EPAs; the Federal and Provincial Planning Development Divisions; NGOs; representatives of chambers of commerce and industry; and other consultants.

These guidelines consist of comprehensive guidelines and procedures for the environmental assessment of wind power projects in Pakistan. It is emphasized that the various guidelines should be read as a package; reliance on the sectorial guidelines alone is inadequate.

2.10 POLICY FOR DEVELOPMENT OF POWER GENERATION PROJECTS, 2006

The Alternative Energy Development Board was established as an autonomous body attached to the Cabinet Division on 12th May 2003. The AEDB was established to act as a central agency for the development, promotion, and facilitation of renewable energy technologies; the formulation of plans and policies; and the development of a technological base for manufacturing of renewable energy equipment in Pakistan. In February 2006, the administrative control of the AEDB was shifted from the Cabinet Division to the Ministry of Water & Power. The AEDB has developed the national policy for promoting renewable energy sources in the medium and long term, which is known as the Policy for Development of Renewable Energy for Power Generation, 2006 (Power Policy). AEDB is also responsible for procuring land leases from the Revenue department for wind farm projects.

The current Project is developed under provisions of the Policy for Development of Renewable Energy for Power Generation, 2006.

2.11 PROJECT DEVELOPMENT IN TERMS OF POLICY FRAMEWORK

The following paragraphs describe the progress of the Project in terms of the Power Policy:

2.11.1 Letter Of Intent (LOI)

The first step for the development of a project pursuant to the Policy is to register with the AEDB and obtain a Letter of Intent. The sponsors of the Project successfully filed their application and obtained their LOI from the AEDB on April, 28th, 2016 after depositing their bank guarantee. The LOI is the official mandate for the Project Company to commence working on the Project, with the support of the AEDB and other government departments. The LOI heralds the commencement of activities leading to the preparation of a feasibility study and acquisition of land for the Project.

2.11.2 Acquisition of Land

The land is being allocated by the Pakistan Air Force Bholari area, Sindh, Pakistan. Land measures 2880 acres of area.

2.11.3 Submission of Feasibility Study

The Project Company is required to submit a detailed feasibility study, including Technical Feasibility, Electrical Grid Studies, and Environmental Studies, to the AEDB for their approval.

2.11.4 Generation License

In order to produce and sell electricity in Pakistan, a project is required to obtain a "Generation License" from the regulator, NEPRA. The Project Company is therefore required to make an application to NEPRA for its Generation License.

An application for the generation license along with necessary documents will be submitted to NEPRA after submission of Feasibility Study to AEDB.

2.11.5 Tariff Determination

A separate application will be submitted by the Project Company to NEPRA for approval of its power tariff. This application will be submitted simultaneously with the application of Generation License.

2.11.6 Letter of Support (LOS)

Once the tariff has been approved, the Project Company can engage with its lenders to finalize its financing terms and conditions. At this stage, AEDB will issue a Letter of Support to the Project Company as soon as the Project Company submits a bank guarantee in respect of its obligation to achieve Financial Close. The amount of the Bank Guarantee is calculated at US$2,500 per MW.

The Letter of Support provides the Project Company with a continued mandate to develop the Project, and provides certain assurances of support from governmental entities and departments. The Letter of Support remains valid until the effectiveness of the EPA and IA.

2.11.7 Energy Purchase Agreement (EPA)

The agreement between the Power Purchaser and the Project Company is called the Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two parties. Discussions relating to the EPA normally commence as soon as the feasibility study is submitted and the tariff petition is filed with NEPRA.

2.11.8 Implementation Agreement (IA)

The Implementation Agreement (IA) is an agreement between the Project Company and the GOP, where in the GOP mandates the Project Company to develop the power project, and provides certain assurances and concessions to the Project, its lenders, shareholders and contractors. Importantly, the IA provides certain guarantees in respect of the performance of the power purchaser. The IA also assures the project of compensation in case of any termination resulting from a default or force majeure. These discussions normally commence alongside the EPA.

2.11.9 Financial Close

Upon approval of feasibility study, grant of generation license, approval of tariff, and the signing of Project documents (EPA and IA); the Project Company shall move forward to financial close.

2.12 NATIONAL AND INTERNATIONAL ENVIRONMENTAL STANDARDS

2.12.1 National Environmental Quality Standards

The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were last revised in 2010. The NEQS specify the standards for industrial and municipal effluents, gaseous emissions, ambient air requirements, vehicular emissions, noise levels and water quality standards.

The National Environmental Quality Standards (NEQS) specify the following standards:

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources
- Maximum permissible limits for motor vehicle exhaust and noise
- For power plants operating on oil and coal:
  - Maximum allowable emission of sulfur dioxide
  - Maximum allowable increment in concentration of sulfur dioxide in ambient air
  - Maximum allowable concentration of nitrogen oxides in ambient air
  - Maximum allowable emission of nitrogen oxide for steam generators a function of heat input
  - Maximum allowable concentration of effluent pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers)

Selected NEQS for liquid effluents discharged to inland waters, gaseous emission from industrial sources, emissions from motor vehicles, noise, ambient air quality and water quality standards are provided in Annexure-V

2.12.2 National Environmental Policy, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council in its 10th meeting in 27th December 2004 under the chairmanship of the Prime Minister of Pakistan and there after approved by the Cabinet on 29th June 2005. NEP is the primary policy of the Government of Pakistan that addresses the environmental issues of the country.

The broad Goal of NEP is, "{to protect, conserve and restore Pakistan's} environment in order to improve the quality of life of the citizens through sustainable development." The NEP identifies

the following set of sectorial and cross-sectorial guidelines to achieve its Goal of sustainable development.

a. Sectorial Guidelines:

Water and sanitation; air quality and noise; waste management; forestry; biodiversity and protected areas; climate change and ozone depletion; energy efficiency and renewable; agriculture and livestock; and multilateral environmental agreements.

b. Cross Sectorial Guidelines

Poverty; population; gender; health; trade and environment; environment and local governance; and natural disaster management. The NEP suggests the following policy instruments to overcome the environmental problems throughout the country:

- Integration of environment into development planning
- Legislation and regulatory framework
- Capacity development
- Economic and market based instrument
- Public awareness and education
- Public private civil society partnership

Even though NEP is a policy document that does not apply to the Project directly, development projects, such as wind power generation projects, are not expected to negatively impact the environmental issues identified by NEP. In any event, mitigation measures would be adopted to minimize or avoid any negative impact. Furthermore, renewable sources of energy, such as wind power projects, provide an environmentally positive means for increasing power production and development.

2.12.3 Land Acquisition Act, 1984

The Land Acquisition Act (LAA) of 1894, amended from time to time, has been the de-fact o policy governing land acquisition and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys, acquisition, compensation and apportionment awards and dispute resolution, penalties and exemptions.

For the proposed Project, the proponents have leased land from the Government of Sindh and no settlement or structure exists at the site. The LAA is therefore not applicable to the acquisition of land for the proposed Project.

2.12.4 Telegraph Act, 1985

This law was enacted to define the authority and responsibility of the Telegraph authority. The law covers, among other activities, installation and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payment of compensation associated with the installation of these lines and posts.

Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Compensation is paid to the owner for any structure, crop or tree that exists on the land; cost of the land is not paid to the owner.

2.12.5 The Sindh Wildlife Protection Ordinance, 1972

The Sindh Wildlife Protection Ordinance, 1972 empowers the government to declare certain areas reserved for the protection of wildlife and control activities within these areas. It also provides protection to endangered species of wildlife. As no Project activities are planned in declared protected areas, provision of this law is not applicable to the proposed Project.

2.12.6 The Sindh Fisheries Ordinance, 1972

The Sindh Fisheries Ordinance, 1980 regulates fishing in public waters, including the coastal areas of Sindh. It empowers the Government of Sindh to issue licenses for fishing in public waters, place restrictions on the type of equipment that can be used for fishing, restrict fishing in certain areas or of certain species of fish, regulate the onshore trade of fish catch, and regulate the fish processing industry. Article 8 of the Ordinance prohibits the discharge of wastewater to public waters without the consent of the Director Fisheries.

As no activities are planned for this Project which can breach this Ordinance, provision of this law is not applicable to the proposed Project.

2.12.7 The Forest Act 1927

The Forest Act, 1927 empowers the government to declare certain areas as reserved forest areas. As no reserved forest exists in the vicinity of the proposed Project, the provisions of this law are not applicable to the proposed Project.

2.12.8 Canal and Drainage Act, 1873

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction and O&M works to be carried out during the proposed Project.

2.12.9 The Antiquities Act, 1975& the Sindh Cultural Heritage (Preservation) Act, 1994

The Antiquities Act of 1975 ensures the protection of Pakistan's cultural resources. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export.

The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance.

Under the Act, the Project proponents are obligated to ensure that no activity is undertaken within 61m (200 ft.) of a protected antiquity, and to report to the Department of Archaeology, Government of Pakistan any archaeological discovery made during the course of the Project. The Sindh Cultural Heritage (Preservation) Act, 1994, is the provincial law for the protection of cultural heritage. Its objectives are similar to those of the Antiquity Act, 1975. No antiquity protected under these two laws was identified in the vicinity of the proposed Project.

2.12.10 Factories Act, 1934

The clauses relevant to the proposed Project are those that address the health, safety and welfare of the workers, disposal of solid waste and effluents, and damage to private and public property. The Act also provides regulations for handling and disposing toxic and hazardous substances. The Pakistan Environmental Protection Act of 1997 (discussed above), supersedes parts of this Act pertaining to environment and environmental degradation.

2.12.11 Employment of Child Act, 1991

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA

defines a child to mean a person who has not completed his/her fourteenth year of age. The ECA states that no child shall be employed or permitted to work in any of the occupations set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, bidi (kind of a cigarette) making, cement manufacturing, textile, construction and others. United Energy and its contractors will be bound by the ECA to prohibit any child labor at the Project sites or campsites.

2.12.12 Civil Aviation Rules, 1994

These rules apply to flight operations within Pakistan by aircrafts other than military aircrafts and, except where otherwise prescribed, to flight operations by air crafts registered, acquired or operating under these rules, wherever they may be. The rules with relevant significance to the power Project:

- No person shall erect any temporary or permanent structure, nor position a vehicle or other mobile object on or in the vicinity of an aerodrome (airport), that will be within the clearance area, or will protrude through an obstacle limitation surface, at that aerodrome.
- No person shall operate a light in the vicinity of an aerodrome which because of its glare is liable to dazzle pilots of aircraft taking off from or landing at that aerodrome; or which can be mistaken for an aeronautical ground light. If such a light is operated it shall be extinguished or satisfactorily screened immediately upon notice being given to the person or persons operating the light, by the Director-General or by the Manager or by a person authorized by him.
- No person or persons shall operate a radio station or electrical equipment in the vicinity of an aerodrome or of a radio aid to navigation serving an airway or an air route in Pakistan which is liable to cause interference with radio communications between aircraft and an Air Traffic Services Unit, or which is liable to disturb the signal from a navigational radio aid.
- A captive balloon or a kite shall not be flown at a height above 200ft within 6kmofan aerodrome, and a free balloon shall not be flown at any place, except with the express permission of the Director-General and in compliance with the conditions attached to such permission
- An aircraft shall not be flown over congested areas of cities, towns, or settlements or over an open air assembly of persons, except by permission of the Director-General, unless it is at such height as will permit, in the event of an emergency, a landing to be made without undue hazard to persons on the ground, and except when it is taking off

or landing, shall not be flown closer than500ft to any person, vessel, vehicle or structure.

- As there is no airport in close proximity to the Project area, it is highly unlikely that the aforementioned rules would apply to the Project's construction and operation activities. However, it is often recommended for projects to seek the relevant permission from Civil Aviation Authority for the installation of wind turbines. The blade tips of wind turbines will be marked in red to make the structure more visible from a distance to aircrafts.

2.12.13 Pakistan Penal Code, 1860

The Code deals with offences where public or private property or human lives area affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents. Most of the environmental aspects of the Code have been superseded by the Pakistan Environmental Protection Act, 1997.

2.12.14 National Resettlement Policy / Ordinance

The Ministry of Climate Change, Local Government and Rural Development formulated a draft policy in 2004 on involuntary resettlement with technical assistance from ADB. The policy aims to compensate for the loss of income to those who suffer loss of communal property including common assets, productive assets, structures, other fixed assets, income and employment, loss of community networks and services, pasture, water rights, public infrastructure like mosques, shrines, schools and graveyards.

The government has also developed a document entitled "Project Implementation and Resettlement of the Affected Persons Ordinance, 2002", later referred to as the "Resettlement Ordinance", for enactment by provincial and local governments, after incorporating local requirements. The Ordinance, being a new law, shall be supplementary to the LAA as well as other laws of Pakistan, and wherever applicable under this policy. However, if necessary, appropriate amendments to the LAA 1894 will also be proposed to facilitate the application of the Resettlement Ordinance.

There has not been much progress on the enactment of the Resettlement Ordinance; hence this is not relevant for the proposed project.

2.12.15 Sindh Local Government Ordinances, 2001

These ordinances were issued under the devolution process and define the roles of the district governments. These ordinances also address the land use, conservation of natural vegetation, air, water and land pollution, disposal of solid waste and wastewater effluents, as well as matters relating to public health.

2.12.16 The IUCN Red List

Some animal species are already extinct in Pakistan, and many are internationally threatened. The 1996 IUCN Red List of Threatened Animals classifies 37 species and 14 sub-species of mammals that occur in Pakistan as internationally threatened or near-threatened.

The Red List is based on field data that is more than 10 to 15 years old and needs to be re-assessed. The country also provides critical habitat to 25 internationally threatened bird species and 10 internationally threatened reptiles.

According to the National Avian Research Centre in Abu Dhabi, with Houbara's birth rate of 5 per cent a year and if number of Houbara keeps decreasing at the same rate with more than 6,000 being bagged by hunting parties and more than 4000 smuggled out of country, the worst scenario are that the Houbara bustard would disappear as the species by 2015.

There are a number of organizations that were formed to protest the illegal hunting and preserve the wildlife. This includes National Council for Conservation of Wildlife (NCCW), established in 1974 and supported by the UN, which breaks into three groups: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Wetland of International Importance Especially as Waterfowl Habitat (RAMSAR) and Convention on the Conservation of Migratory Species of Wild Animals (CMS).

2.12.17 Motor Vehicles Ordinance, 1965, and Rules, 1969

The Motor Vehicles Ordinance, 1965, was extended in 1978, to the whole of Pakistan. The ordinance deals with the powers of motor vehicle licensing authorities and empowers the Road Transport Corporation to regulate traffic rules, vehicle speed and weight limits, and vehicle use; to erect traffic signs; and to identify the specific duties of drivers in the case of accidents. It also describes the powers of police officers to check and penalize traffic offenders at the provincial level. At the same time, the ordinance also empowers the Regional Transport Authority to

The World Bank Guidelines for noise are provided in Table 2-1

Table 2-1 World bank Guidelines for Noise levels			
No.	Receptor	Day (07:00-22:00)	Night (22:00-07:00)
1.	Residential & Institutional educational	55	45
2.	Industrial & Commercial	70	70
Source: Pollution Prevention and Abatement Handbook World Bank Group (1998) **Notes: Maximum allowable log equivalent (hourly measurements) in dB(A)**			

2.14 Equator Principles

The Equator Principles are a set of guidelines, promoted by the International Finance Corporation (IFC) that address the environmental and social issues associated with major development projects worldwide. They provide a common baseline and framework for the implementation of internal environmental and social procedures and standards for project financing activities across all industries.

Principle 1: Review and Categorization (of projects)
Principle 2: Social and Environmental Assessment
Principle 3: Applicable Social and Environmental Standards
Principle 4: Action Plan and Management System
Principle 5: Consultation and Disclosure
Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: EPFI Reporting

Review and categorization

An EPFI will categorize a project, based on the magnitude of the potential social or environmental impacts and risks of that project, in accordance with IFC classification criteria.

These categories are:

Category A: Projects with potential significant adverse social or environmental impacts that is diverse, irreversible or unprecedented.

operate as a quasi-judicial body at the district level to monitor road transport, licensing requirements, and compensations for death or injury to passengers on public carriers.

2.12.18 Cutting of Trees (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department. During the site survey conducted by the team of environmentalist and socialist, there is no tree on the site. Hence this law is not relevant to the proposed project.

2.13 WORLD BANK GUIDELINES ON ENVIRONMENT

The principal World Bank publications that contain environmental guidelines are listed below.

- Environmental Assessment Operational Policy 4.01.Washington, DC, USA. World Bank 1999.Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross Sectorial Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.Environmental Health and Safety (EHS) guidelines, International Finance Corporation (IFC) World Bank Group, 2007.
- The first two publications listed here provide general guidelines for the conduct of an IEE, and address the IEE practitioners themselves as well as project designers. While the Sourcebook in particular has been designed with Bank projects in mind, and is especially relevant for the impact assessment of large-scale infrastructure projects, contains a wealth of information which is useful to environmentalists and project proponents.
- The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested. The Sourcebook also highlights concerns in social impact assessment, and emphasizes the need to incorporate socio-economic issues in IEE exercises.

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background d and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, operation, and decommissioning phase of project or facility.

Category B: Projects with limited adverse social or environmental impacts that is few in number, generally site specific, largely reversible and readily addressed through mitigation measures.
Category C: Projects with minimal or no social or environmental impacts.
Wind Energy projects, by their nature; tend to fall into Categories B or C, being medium or low risk. Certain EPFIs as a matter of policy for example treat every wind turbine project as
Category D: The Equator Principles apply to projects over 10 million US dollars. The Principles state that adopting financial institutions will provide loans directly to projects only under the following circumstances:
This IEE study has adequately addressed the Equator Principles applicable to risky projects as stated hereunder:

Principle 1 (Review and Categorization): The study has reviewed the National and International Laws and Guidelines on different environmental aspects and has categorized the SF, PAF Wind Power Project in Category C (Low Hazard).

Principle 2 (Social and Environmental Assessment): The Study has been prepared to respond to the National and International requirements and to satisfactorily address the key environmental and social issues.

Principle 3 (Applicable Social and Environmental Standards): For the purpose of this IEE Study, primary data on the baseline environmental and social conditions have been generated wherever necessary to address the requirements of National laws and regulations; applicable International Treaties and Agreements; sustainable development and use of renewable natural resources; protection of human health, cultural properties, and biodiversity and other physical, ecological and socioeconomic issues required to be addressed under this Principle.

Principle 4 (Action Plan and Management System): Section-6 of this study screens the potential environmental impacts and proposes/provides Mitigation Measures to reduce the severity of impact. The study also includes the Environmental Monitoring and Management Plan.

Principle 5 (Consultation and Disclosure): Being a project of Category C, the public consultation is limited to the scoping sessions with stakeholders and an extensive socio economic survey of the villages/hamlets that are all outside the boundary of the Project area. The surveys and consultation meetings have established that no major resettlement or temporary relocation or acquisition of land is involved.

Principle 6 (Grievance Mechanism): This Principle will not apply since 'no' resettlement or temporary relocation or acquisition of land is involved.

Principle 7 (Independent Review): Being placed in Category C, an independent review is not required.

Principle 8 (Covenants): The IEE study has incorporated Covenants linked to compliance. Moreover, No Objection Certificates are issued to Proponents of Project under conditions of compliance with the Mitigation and Performance Monitoring Plan. Needless to say that if the proponent does not comply with the agreed terms, Sindh EPA is authorized to take corrective and even coercive action.

Principle 9 (Independent Monitoring and Reporting): This Principle will be not be applicable to the SF Wind Power Project since it falls in category of projects requiring an IEE .

Principle 10 (EPFI Reporting): The concerned EPFI may safely commit to report publicly at least annually about its Equator Principles implementation processes and experience.

2.15 IFC Performance Standards on Social and Environmental Sustainability

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards are also applied to the projects in emerging markets. Together, the eight Performance Standards establish standards that the Proponent is to meet throughout the project.

The objectives of Performance standards are given below:

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities , and the environment
- To promote improved social and environment performance of companies through the effective use of management systems.

Performance Standard-1: Social & Environmental Assessment and Management System

This Performance Standard seeks to:

- ❖ Identify and assess social and environment impacts in the project's area of influence;
- ❖ Avoid, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- ❖ Ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- ❖ Promote improved social and environment performance of the project through the effective use of management systems.

Under this Standard, the project is required to establish and maintain a social and environmental management system appropriate to the nature and scale of the project and in accordance with the level of social and environmental risks and impacts. The management system is required to incorporate the following elements:

- Social and Environmental Assessment;
- Management program;
- Organizational capacity;
- Training;
- Community engagement;
- Monitoring; and
- Reporting

This IEE study has been conducted to respond to requirements of national legislation and international Guidelines as well fulfills the above requirements of the IFC Performance Standards PS1.

Performance Standard-2: Labor and Working Conditions

This PS seeks to establish, maintain and improve the worker-management relationship; promote fair treatment, non-discrimination and equal opportunity for workers, and compliance with national labor and employment laws; protect the workforce by addressing child labor and forced labor issues; and promote safe and healthy working conditions, and to protect and promote the health of workers.

The Sponsors of proposed project and their contractors will be required to adhere to this PS, in particular with regard to compliance with national labor and employment laws; employment of

child labor, and promoting safe and healthy working conditions, besides protecting and promoting the health of workers.

Performance Standard-3: Pollution Prevention and Abatement

The PS 3 seeks to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, and to promote the reduction of emissions that contribute to climate change. The Standard requires the project to consider during its entire lifecycle ambient conditions and apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.

PS 3 will be applicable to all stages of the SF Wind Power Project. Various aspects of pollution prevention and abatement of the proposed project are discussed separately in this report.

Performance Standard-4: Community Health, Safety and Security

The PS 4 seeks to avoid or minimize risks and impacts on the health and safety of local community during the project lifecycle from both routine and non-routine circumstances, and to ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. The PS requires the project to evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and establish preventive measures to address them in a manner commensurate with the identified risks and impacts.

The present assessment addresses the requirement of PS 4 for the proposed project, and has evaluated the impacts of sitting the project on health, safety and security of the community in the microenvironment as well as the macro-environment. The Environmental Management Plan also addresses company community aspects.

Performance Standard-5: Land Acquisition and Involuntary Resettlement

This PS aims to address the adverse impacts associated with land acquisition and involuntary resettlement caused by the project. The PS seeks to:

- ❖ Avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs.
- ❖ Mitigate adverse social and economic impacts from land acquisition or restrictions on affected person's use of land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- ❖ Improve or at least restore the livelihoods and standards of living of displaced persons.
- ❖ Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

  The project site is the property of SF, PAF. Moreover there is no permanent settlement or hamlet within the designated area. Project Land has been privately owned by Shaheen Foundation, PAF.

Performance Standard-6: Biodiversity Conservation and Sustainable Natural Resource Management

The PS 6 seeks to protect and conserve biodiversity, and promote sustainable management and use of natural resources through adoption of practices that integrate conservation needs and development priorities.

The present environmental assessment addresses the potential impacts of the proposed project on the biodiversity. This IEE has recommended measures for the conservation of flora, fauna and other natural resources.

Performance Standard-7: Indigenous Peoples

The PS 7 seeks to address the impacts of the project on the indigenous people. Specifically, the objectives of the PS are to:

- ❖ Ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples.
- ❖ Avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not feasible, to minimize, mitigate, or compensate for such impacts, and to provide opportunities for development benefits, in a culturally appropriate manner.

- ❖ Establish and maintain an ongoing relationship with the Indigenous Peoples affected by a project throughout the life of the project.
- ❖ Foster good faith negotiation with and informed participation of Indigenous Peoples when projects are to be located on traditional or customary lands under use by the Indigenous Peoples.
- ❖ Respect and preserve the culture, knowledge and practices of Indigenous Peoples

  No indigenous people - with a social and cultural identity distinct from the existing dominant society that makes them vulnerable to being disadvantaged in the development process of the proposed project are known to exist in and around the proposed site. No such people were found in the area during the present study either. Therefore, this PS is not applicable for the proposed project.

Performance Standard-8: Cultural Heritage objectives have been set in the IFC performance standards to achieve sustainable development.

The objectives of this PS-8 are to protect cultural heritage from the adverse impacts of project activities and support its preservation, and to promote the equitable sharing of benefits from the use of cultural heritage in project activities.

No sites of cultural heritage are known to exist at or in the immediate vicinity of the project location. There are also no indications of any old settlement in the area, nor is there any site covered under the listing of cultural heritage sites. This PS will therefore not be applicable to the Project.

2.16 IFC- Environmental, Health, and Safety Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). For Wind Energy the EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities.

Construction activities for wind energy projects typically include land clearing for site preparation and access routes; excavation, and filling; transportation of supply materials and

fuels; construction of foundations involving excavations and placement of concrete; operating cranes for unloading and installation of equipment; and commissioning of new equipment. Decommissioning activities may include removal of project infrastructure and site rehabilitation.

Environmental issues associated with the construction and decommissioning activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity, including habitat alteration and impacts to wildlife. Due to the typically remote location of wind energy conversion facilities, the transport of equipment and materials during construction and decommissioning may present logistical challenges.

Environmental issues specific to the operation of wind energy projects and facilities include the following:

- Visual impacts
- Noise
- Species mortality or injury and disturbance
- Light and illumination issues
- Habitat alteration
- Water quality
- Electric Power Transmission and Distribution

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fuelling activities. Environmental issues during the construction phase of power transmission and distribution projects specific to this industry sector include the following:
- Terrestrial habitat alteration.
- Aquatic habitat alteration.

- Electric and magnetic fields.
- Hazardous materials

IFC Guidelines for Environment Health Safety specific to Wind Power Project are attached as Annexure VI

2.17 INSTITUTIONAL SETUP FOR ENVIRONMENTAL MANAGEMENT

The apex environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided by the Prime Minister (referred to as the "Chief Executive") of the Country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and environmental tribunals. The EPAs were first established under the 1983 Environmental Protection Ordinance (PEPO, 1983); PEPA 1997further strengthened their powers. The EPAs have been empowered to receive and review the environmental assessment reports (IEEs and EIAs) of the proposed projects, and provide their approval (or otherwise). The proposed Project would be located in the Sindh Province, hence this IEE report will be sent to the Sindh-EPA for review.

2.18 OBLIGATION UNDER INTERNATIONAL TREATIES

Pakistan is signatory of several Multilateral Environmental Agreements (MEAs), including:

- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal
- Convention on Biological Diversity (CBD)
- Convention on Wetlands (Ramsar)
- Convention on International Trade in Endangered Species (CITES)
- UN Framework Convention on Climate Change (UNFCCC)
- Kyoto Protocol
- Montreal Protocol on substances that deplete the ozone layer
- UN Convention to Combat Desertification
- Convention for the Prevention of Pollution from Ships (MARPOL)
- UN Convention on the Law of Seas (LOS)
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Cartina Protocol

These MEAs impose requirements and restrictions of varying degrees upon the member countries. However, the implementation mechanism for most of these MEAs is weak in Pakistan, and administrative/institutional setup is practically on existent. Although almost all of the above MEAs would apply to the Project in one way or the other, the ones which have direct relevance for the proposed Project include the Basel Convention, Montreal Protocol, Stockholm Convention, UNFCCC, and Kyoto Protocol.

SECTION 3

DESCRIPTION OF PROJECT

3 DESCRIPTION OF PROJECT

3.1 PROJECT LOCATION

The wind farm Project is located in Bholari, which is located approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 2880 acres of land, which has been acquired by the project company. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects.

The Project site has very sparse vegetation consisting of small shrubby bushes and flat terrain area Location of the Project is shown in Figure 3.1.

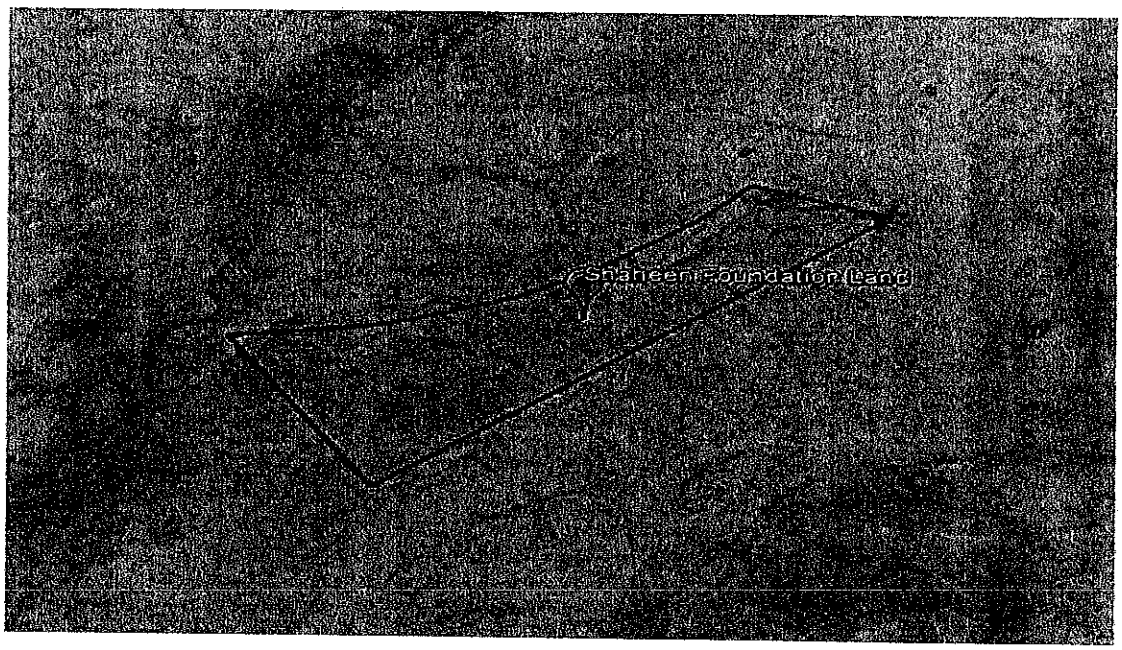


Figure 3.1: SF Project Site Layout

Table 3-1: Land Coordinates

Sr. No.	Latitude	Longitude
P-1	25°10'55.80"N	68° 3'48.00"E
P-2	25°13'26.40"N	68° 6'28.80"E
P-3	25°13'29.19"N	68° 7'28.97"E
P-4	25°10'2.80"N	68° 5'15.10"E

The Project area is open and can be seen from images below in Figure 3.2;

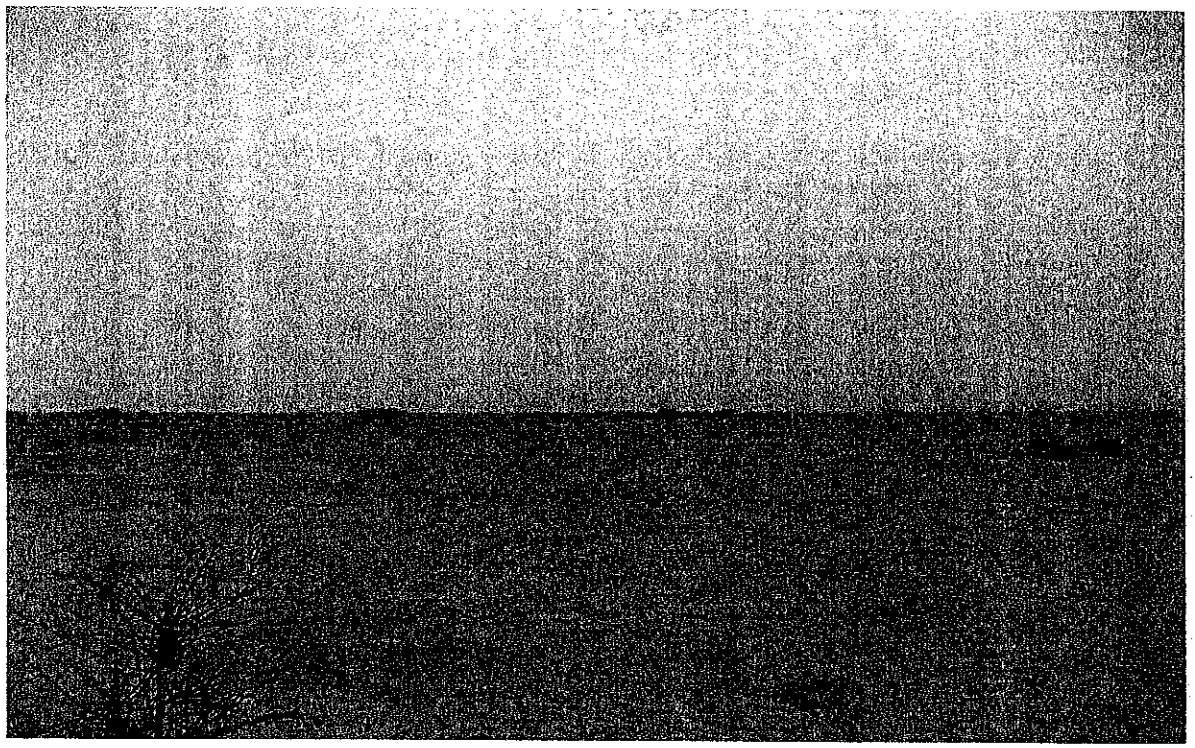


Figure 3.2: A View of Project Site

3.2 ROAD ACCESS

The Project site is easily accessible throughout the year.

The major track from Karachi to Nooriabad is via the Karachi-Hyderabad Motorway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Nooriabad to the site is a single track with semi metaled road named "Thatta Thano Bula Road", which turns toward the site. However, the terrain is flat and long and heavy vehicles can easily navigate through this road. There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 130 km.

The satellite overview of the track from Karachi to the Project site through Karachi-Hyderabad Motorway is shown in Figure 3.3.

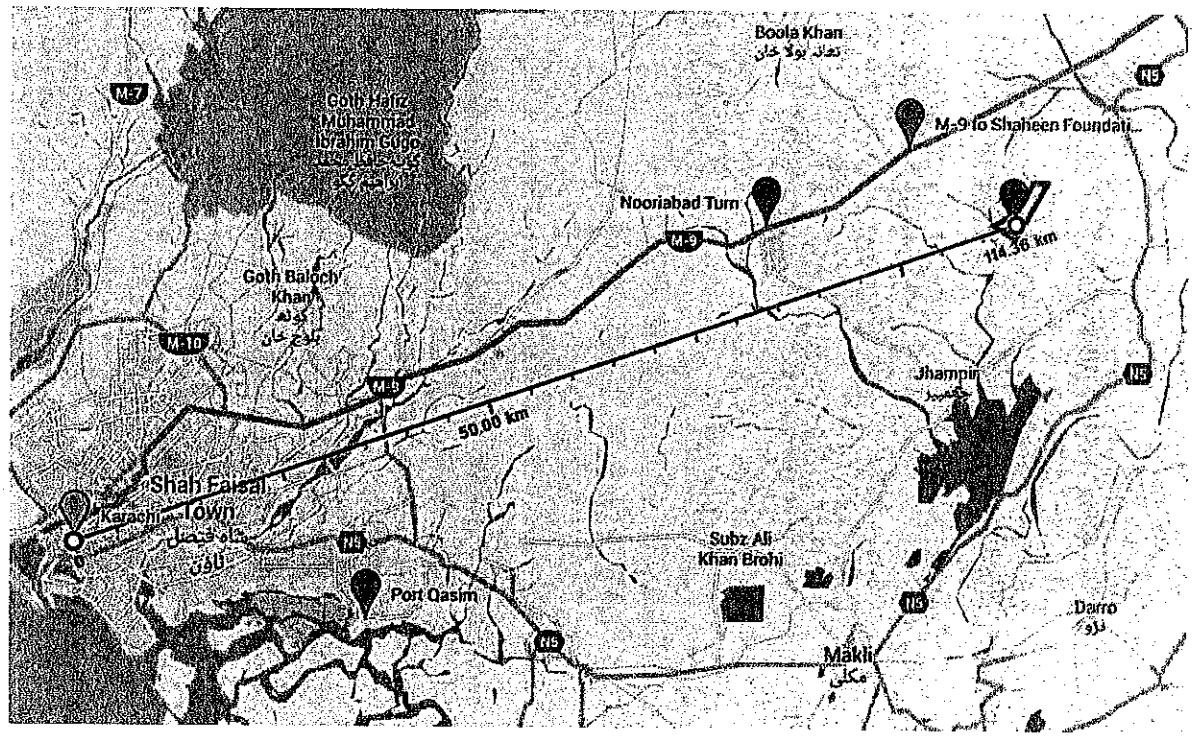


Figure 3.3: Ariel View of Complete Track (Through Karachi-Hyderabad Motorway)

The major track from Karachi to site is two-way road. The Port Qasim is the one of the major port of Pakistan and is the point of delivery of equipment for the proposed wind power project. It is located towards east of the site as shown in Figure 3.4.

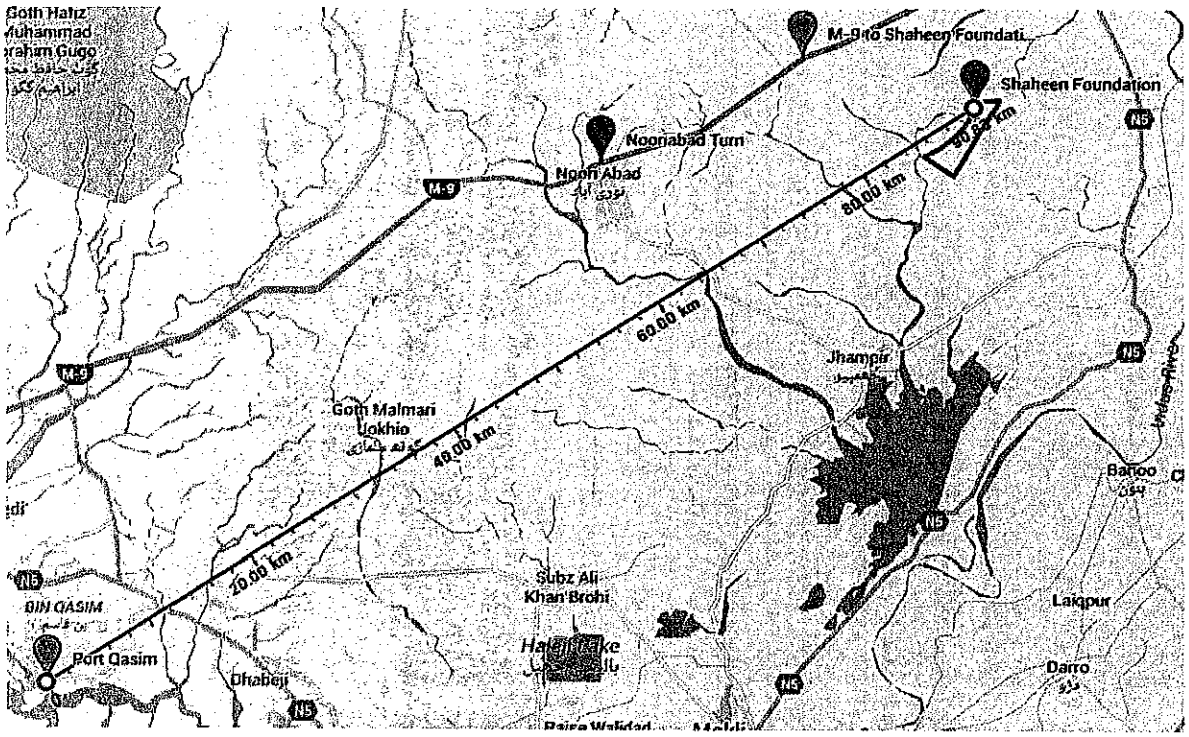


Figure 3.4: Orientation of Site from Port Qasim (Aerial View)

Aerial distance between the Port to the site is 91 km. The track starts from Port Qasim, where it joins the National Highway. Passing from the link road between National highway and Super highway, the track then joins the Superhighway, which stretches until the Nooriabad Industrial site. The track, then from the Nooriabad, splits into 2 possible options.

Track Option 1 (Green) continues on the M-9 for another 22 km till 'Ali Hotel' landmark, it then continues off M-9 to till the project site. Option 2 (Purple) goes through the Nooriabad Industrial Site. The track length from the Nooriabad Industrial site to the project site is approximately 44 km. Total track lengths are close to 120 km (Option 1) and 130 km (Option 2) respectively from Port Qasim. Detail access to site is shown in Figure 3.5.

The track from Port to the Nooriabad Super Highway is good but site access Road that turns to the site needs minor development.

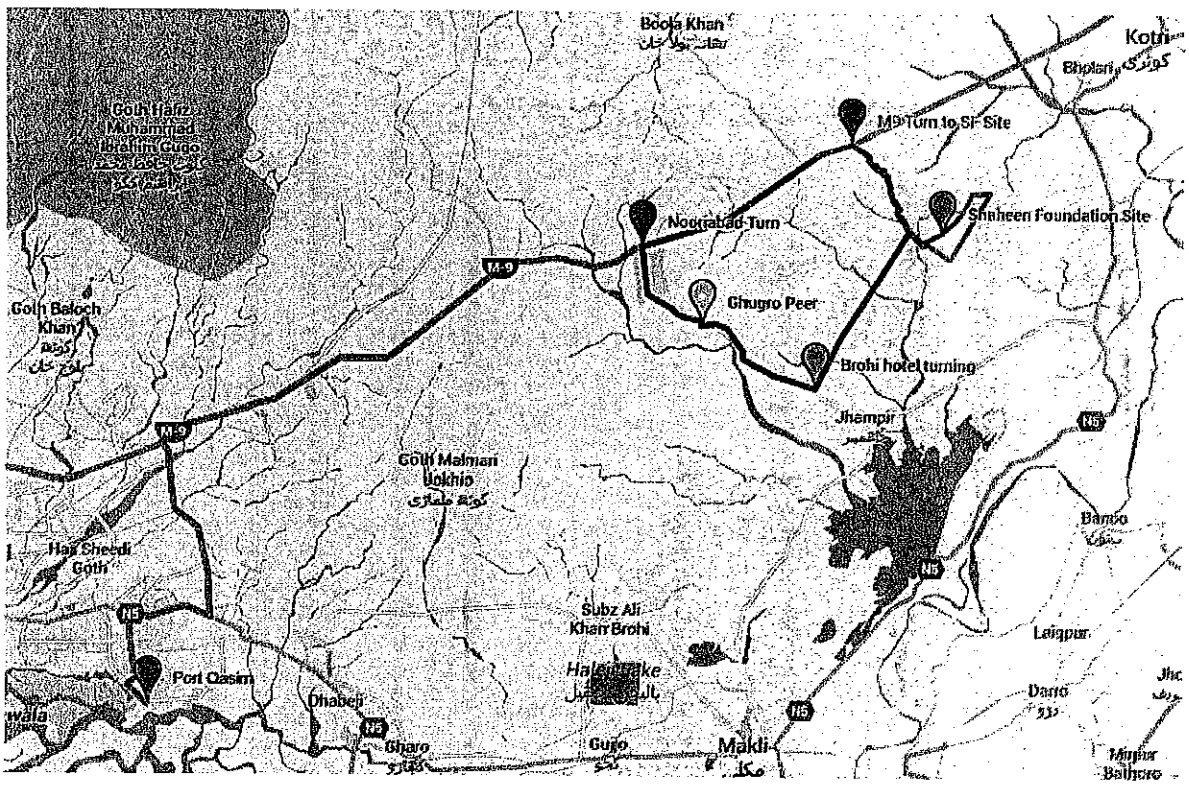


Figure 3.5: Detailed Access from Port Qasim to the Site

There is a number of neighboring wind farms under various stages of development in the Jhimpir region of various capacities ranging from 05 MW to 250 MW. The view of different tracks of land allocated to the wind farm project developers in Jhimpir is shown in Figure 3.6.

Figure 3.6: SF Site with Respect to Neighbouring Wind Farms in Jhimpir

3.3 PROJECT SIZE AND COMPONENTS

The Project is of 50 MW capacities. Following WTGs will be installed:

- General Electric GE 1.7-103 – Total 29 WTGs
- Gamesa G114-2.0 – Total 25 WTGs

The Project can be divided into four major phases:

- Pre-Construction Phase
- Construction Phase
- Operation and Maintenance Phase
- Decommissioning Phase

3.3.1 Preconstruction Phase

Pre-construction phase consists of:

- Land Procurement
- Soil and topographic Survey
- Installation of wind measuring mast
- Wind Resource Assessment and Micrositing
- Approvals from Government Departments (discussed in section 2.9)

3.3.2 Construction Phase

Construction Phase of the Project will be awarded to an EPC firm selected through a competitive bidding process. It is estimated that direct manpower required during the Construction phase will be approximately 500 persons, with unskilled jobs being offered mainly to local inhabitants, particularly during the Construction Phase.

Construction activities will be comprised mainly of:

- Construction of site roads and crane pads at each wind turbine site
- Construction of turbine foundation and transformer pads
- Installation of electrical systems, underground and some overhead lines

- Assembly and erection of the wind turbines
- Construction and installation of substation
- Commissioning and Testing

All supplies both for construction and for the camp will be transported by trucks from Karachi. This will include all fuels and oils, drilling equipment, spare parts for construction machinery, and food supplies for construction camps.

3.3.3 Operation and Maintenance Phase

In order to maintain a high level of performance, a maximum staff of 10 persons per shift will be maintained for the wind farms, in addition to the security staff.

3.3.4 Decommissioning Phase

The Project's wind power generation systems, if operated prudently, should maintain certain residual value upon decommissioning, following the estimated 20 year life-cycle of the Project, as agreed in the EPA. Its continued performance would demand up-gradation rather than decommissioning of the plant. The tower and turbine may need replacement while the old ones may be sold as scrap to be appropriately disposed-off.

However, if the site is to be decommissioned prior to the designated plant life, it will be initiated by dismantling the turbines, supporting towers and substation, and transporting them out of the Project area. The activity will take approximately six (06) months and will require 400-500 truck- loads to transport the material. The turbine material and the tower will be sold as scrap, and concrete will be broken and moved to the landfill site. The site will be leveled to make it available for regular use.

3.4 PROJECT SCHEDULE

The Project is presently preparing its feasibility study, which is expected to be completed within the 2nd Quarter of 2016. It is expected that the Tariff would be applied soon after completion of the feasibility study. This would be followed by the execution of the EPA, and thereafter the financial closing of the project by the 1st Quarter of 2017. The planned COD is the 2nd Quarter of 2018.

The EPC contract would be locked with tariff approval, which is expected to be available by September, 2016.

No	Milestone	Anticipated Date
1	Submission of Feasibility Study	2nd QTR of 2016
2	Tariff Application	2nd QTR of 2016
4	EPC Contract Signing	3rd QTR of 2016
5	Tariff Approval	3rd QTR of 2016
6	EPA/IA	4th QTR of 2016
7	Financial Close	1st QTR of 2017
8	Project COD	2nd QTR of 2018

3.5 LOCATION OF GRID

The Project is planned to be built in the Jhimpir region. The electrical network within the vicinity of the site of the plant comprises of LV (11 kV) and HV (132 kV and 220 kV) lines. For projects with installed capacity in excess of 10 MW, connection must be made with HV lines.

Hyderabad Electrical Supply Company 132/11 kV grid station is in Jhimpir. The distance of the grid station from the Project site is approximately seventeen (17) Kilometers.

Figure 3.7: Nearest HESCO grid station

3.6 INFRASTRUCTURE DETAILS

Under the project following supporting infrastructure and facilities will also be constructed; their design details are still in planning stage;

- Administration Building
- Switch yard Building
- Dormitories Building
- Maintenance Building
- Internal Connecting roads
- Green belts

SECTION 4

BASELINE ENVIRONMENTAL CONDITIONS

4 BASELINE ENVIRONMENTAL CONDITIONS

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, flora and fauna, land use pattern, and socioeconomic conditions was undertaken, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors.

4.1 CLIMATIC CONDITIONS

The climate of the Project area can be broadly classified as arid, moderate, hot and humid. The mild winter is restricted to the November-February period. The summer extends from May to September, which overlaps the short spells of the main rainy season during July-August. The weather tends to be very humid during June, July, and September and is pleasant during March and April.

The climate of this area is characterized by fluctuating temperatures and sparse rainfall. The summer seasons are hot and humid with average temperatures ranging between 33ºC to 37ºC. The temperature in summer seasons may reach up to 45ºC. The winters are pleasant with average temperature in the range of 15ºC to 25ºC. The months of July and August generally observe the annual monsoon rainfalls. The meteorological stations of Badin and Hyderabad are located within the wind corridor. However, the meteorological data from Karachi station is also representative of the prevailing climatic conditions of coastal areas in the wind corridor. The climate information of Jhimpir is shown in Table 4.1.

The climatic conditions of Thatta and Badin districts may be taken as moderate as a whole. The climate is tempered by the cool sea breeze which blows for eight months of the year from March to October. During the monsoon season the sky is overcast but there is very little precipitation. The climate in summer is generally moist and humid. The cold weather in the districts start from the beginning of November when a sudden change from the moist sea breeze to the dry and cold north-east wind brings about as a natural consequence, an immediate fall in temperature. The annual average of maximum and minimum temperatures of Jhimpir is given in Table 4.1 and presented in Figure 4.1.

Table 4-1: Average Maximum and Minimum Temperatures in Jhimpir Region (°C)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
24	28	33	38	41	40	37	35	36	36	31	26
12	15	19	23	26	28	27	26	25	23	19	14

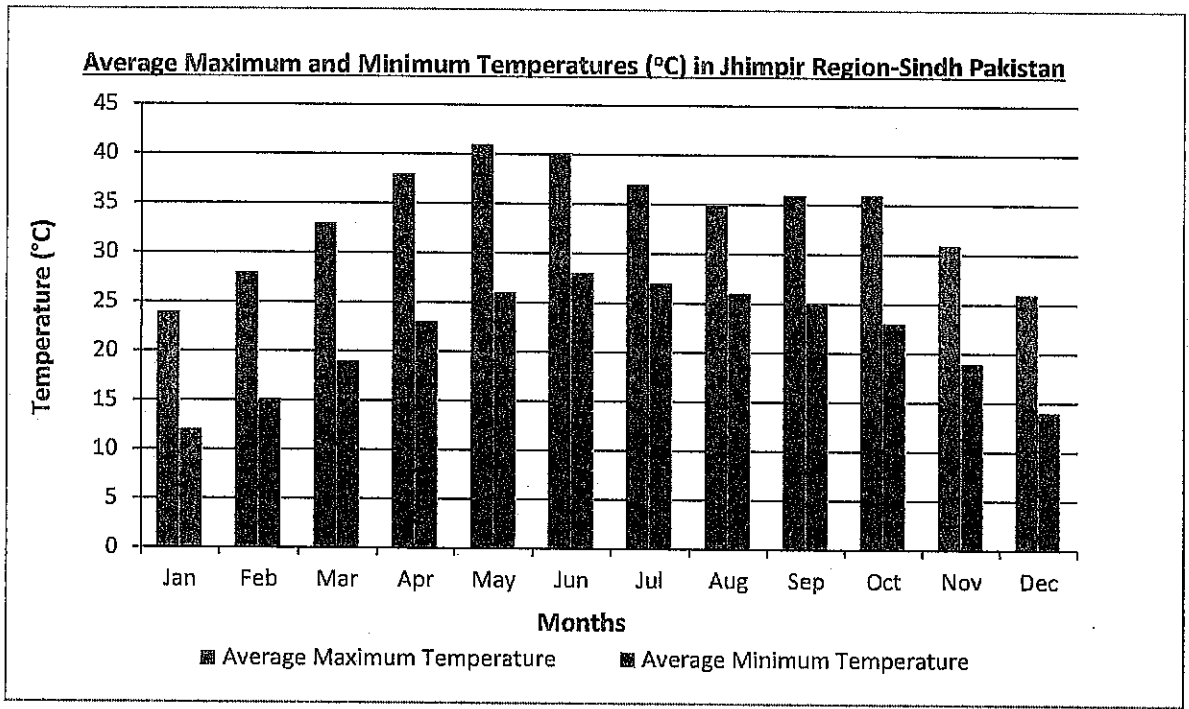


Figure 4.1: Graph of Average Maximum and Minimum Temerature (°C)

The annual precipitation takes place mainly during summer. It is unevenly distributed. Average rainfall as per meteorological record is given in Table 4.2, most of which occurs in monsoon season, from April to September.

Table 4-2: Average Precipitation and Rainfall Days in Jhimpir Region

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	16mm
2	1	0	1	0	1	3	4	1	0	0	1

4.2 SURFACE AND GROUND WATER HYDROLOGY AND DRAINAGE

Major water reserve of the area is Keenjhar Lake, also known as Kalri Lake. The lake is located approximately 17 km from the Project site. It is 24 km long and 6 km wide and has an area of 14000 ha (35,583 acres). The lake is fed by the Kalri Bagar feeder canal from the North-West as well as by small seasonal streams entering into it from the North and the West. The feeder is also the conduit for the industrial wastes of Kotri town. Keenjhar is a wild life sanctuary and a Ramsar site. Keenjhar Lake which is shown in Figure 4.3.

Figure 4.2: Satellite View of Keenjhar/Kalri Lake near Project Site

The only perennial water channel in the area is the KalriBaghar (KB) Upper Feeder which feeds Keenjhar Lake with Indus water from Kotri Barrage. The KB Feeder is approximately 20km away from the Jhimpir wind farm sites and lies on its eastern side. The KB feeder is about 61km long and its design discharge is about 258 cubic meters per second (cumecs). Kinjhar Lake is also being fed by hill torrents during floods from the western side. The catchment area of these hill torrents are about 1664 sqkm and have their outfall into the Kinjhar Lake. These hill torrents include RodhNai and LiariNai. BaranNai, which is the principal source of flood drops into the River Indus downstream of Kotri barrage.

Figure 4.3: View of Kinjhar/Kalri Lake near Project Site

Kinjhar Lake is the main source of fresh water for drinking and irrigation for the areas downstream of Jhimpir including the city of Karachi. Kinjhar Lake is an artificial water storage reservoir located in District Thatta. It came into existence as a consequence of implementation of the Kotri Barrage canals Irrigation Project. This artificial reservoir has been formed out of natural depressions of Sonheri and Kinjhar Dhands. The gaps between the surrounding hills of the dhands were closed with the construction of earthen embankments having an average height of about 7.6m. Apart from KB Feeder, hill torrents and Kinjhar Lake there is no other source of surface water available in the area. The quantity of water in Kinjhar Lake is ample to fulfill the requirements of the downstream areas for irrigation and drinking purposes.

Regular Surveys have not been carried out to assess the availability and quality of Ground water in the Province of Sindh. Various sources estimate that the volume is 3-5 MAF scattered in 28% of the geographical area of Sindh. This water is found mainly along the Indus water channels and in a few underground streams. In recent years, drought has caused excessive extraction of groundwater to make up for the lack of irrigation water. This, in turn, has resulted in rapid depletion of the groundwater and filling up of the underground freshwater channels and reservoirs with brackish water.

During social survey, it is learned that the availability of drinking water is the major problem of the area. The water of shallow wells present in the expansion areas contains higher values of TDS and mostly saline in nature therefore is not suitable for human consumption. The results are also attached in **annexures VII**.

The depth of water table is also depleting over the period. Due to increased number of private tube wells being installed in the location of sub project, the ground water is depleting. Recharge from surface /rain water is helping in reduction of depth of sub soil water table. During dry periods, the situation sometimes becomes quite serious.

The project activities will not disturb the water bodies located nearby. As there is no water discharges from the Wind turbines during operations and during construction wastewaters will not be disposed in any water body. However, water from domestic activities like Labor camps will be treated through septic tank / soaking pits.

The area is very poor in terms of the indicator in respect to piped water, which is available to only about 14% of the housing units. About 13% of rural households have hand pumps inside the housing units, while 16% use outside ponds for fetching water, and 6% of housing units use dug wells. The ground water level of the site is 115 meters.

The drainage system in the area is not developed. The booster pumping station for the water supply pipeline is established to supply water from Keenjhar Lake to Nooriabad Industrial State. Nooriabad Industrial state is located at a distance of approximately 28.5 km from Keenjhar Lake.

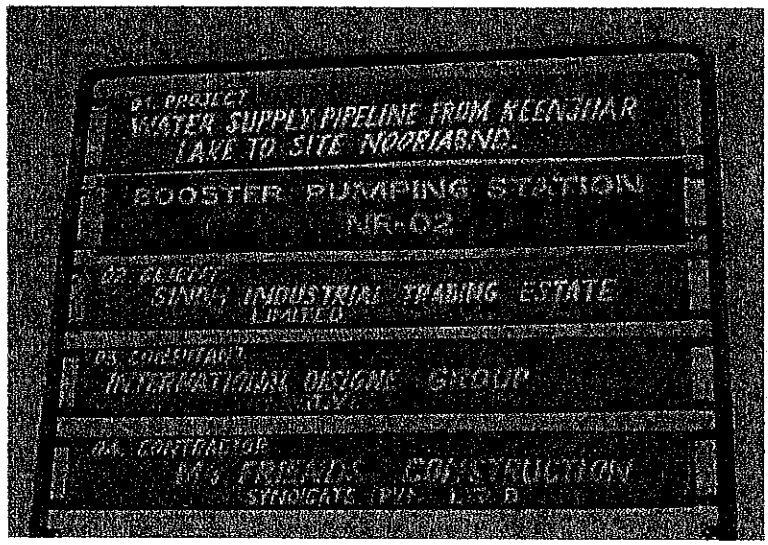


Figure 4.4: Booster Pumping Station from Kinjhar Lake to Nooriabad IndustriaL Estate

4.3 AMBIENT AIR QUALITY

The area in and around the Project site is underdeveloped with no industrial development nearby, but the area is likely to develop into a modern city after development of wind power projects in the area. The primary sources of air pollution include traffic near Karachi Hyderabad Motorway. The impact of exhaust emissions from vehicular traffic operating on Highway N5 is Ltd to the microenvironment of the highway. No sources of anthropogenic sources of air pollution exist in the immediate vicinity of the site; therefore the ambient air of the area is likely to be free from the key pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO2) and particulate matter (PM). But in very minor quantities. In general, the air quality of the area is high with no significant air pollutants (PM). Ambient air quality recorded by the EPA Certified Laboratory during this study. It may be seen that the average level of each parameter in ambient air is on lower side in comparison with National Environmental Quality Standards (NEQS). The results are attached in **annexure VII**.

4.4 NOISE QUALITY

There is no continuous source of noise emission within or around the proposed project wind farm site.

The Noise level recorded at the unpolluted site in ranges between 37.5 dB (A) and 45 dB (A) with the average at 44.0 dB (A), which is characteristic of wilderness and well within 75 dB (A) the level suggested by NEQS.

There is very minor human settlement near the Project area. Traffic near the Project site is consequently very low. Industrialization is also very low, thus baseline noise levels are low.

4.5 SEISMIC HAZARDS

According to the seismic zoning map of Pakistan, the Jhimpir region falls in **ZONE II-B** with moderate to severe damage area probability with G Factor of g=0.1-0.3, as shown in the map in Figure 4.5.Earthquake records indicate that this region has experienced several earthquake tremors in the past, as well as recently. The region has some major tectonic features, including the Runn Kutch-Karachi fault, Pab fault, Ornach-Nal fault, Surjan fault, and Jhimpir fault.

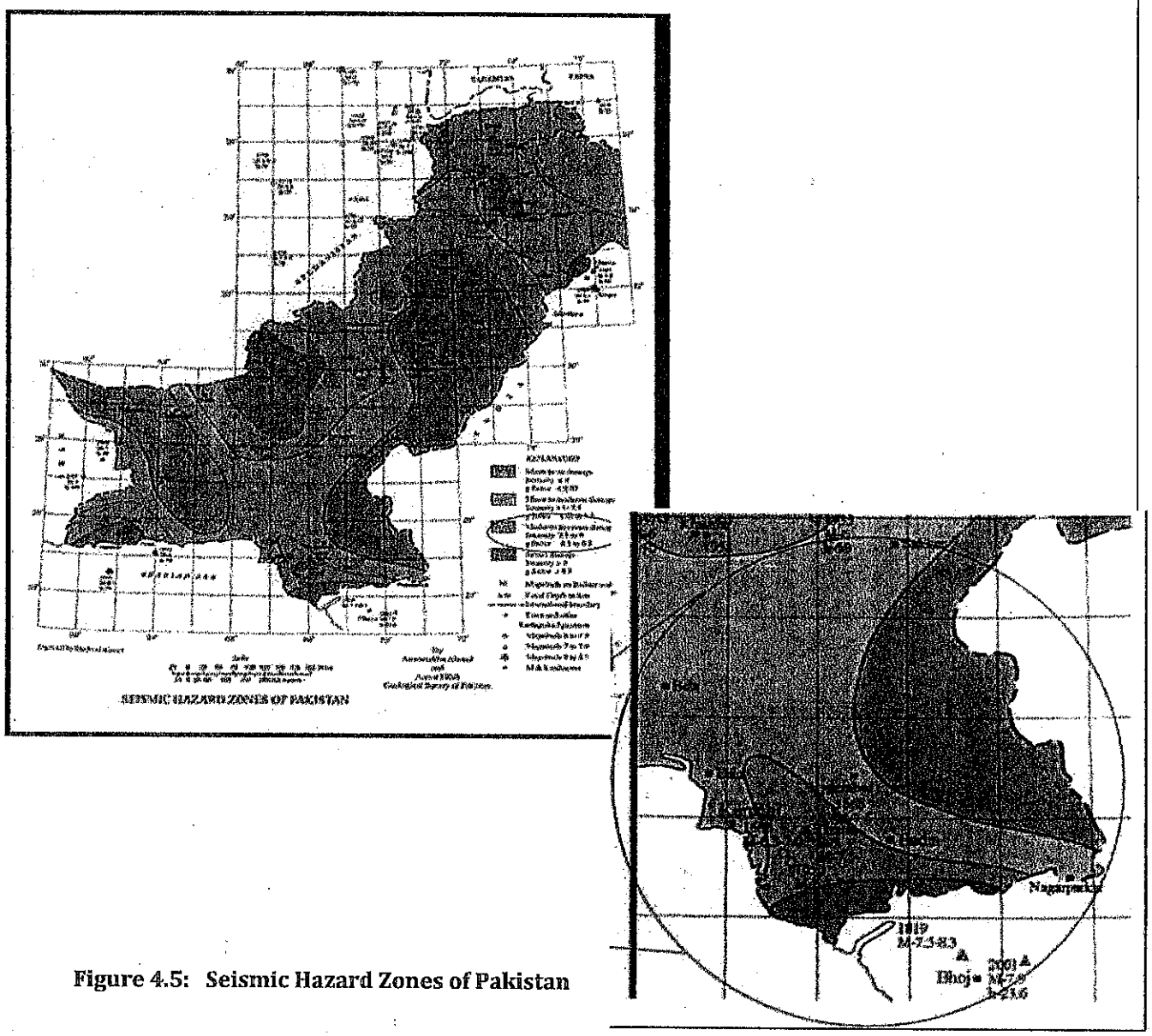


Figure 4.5: Seismic Hazard Zones of Pakistan

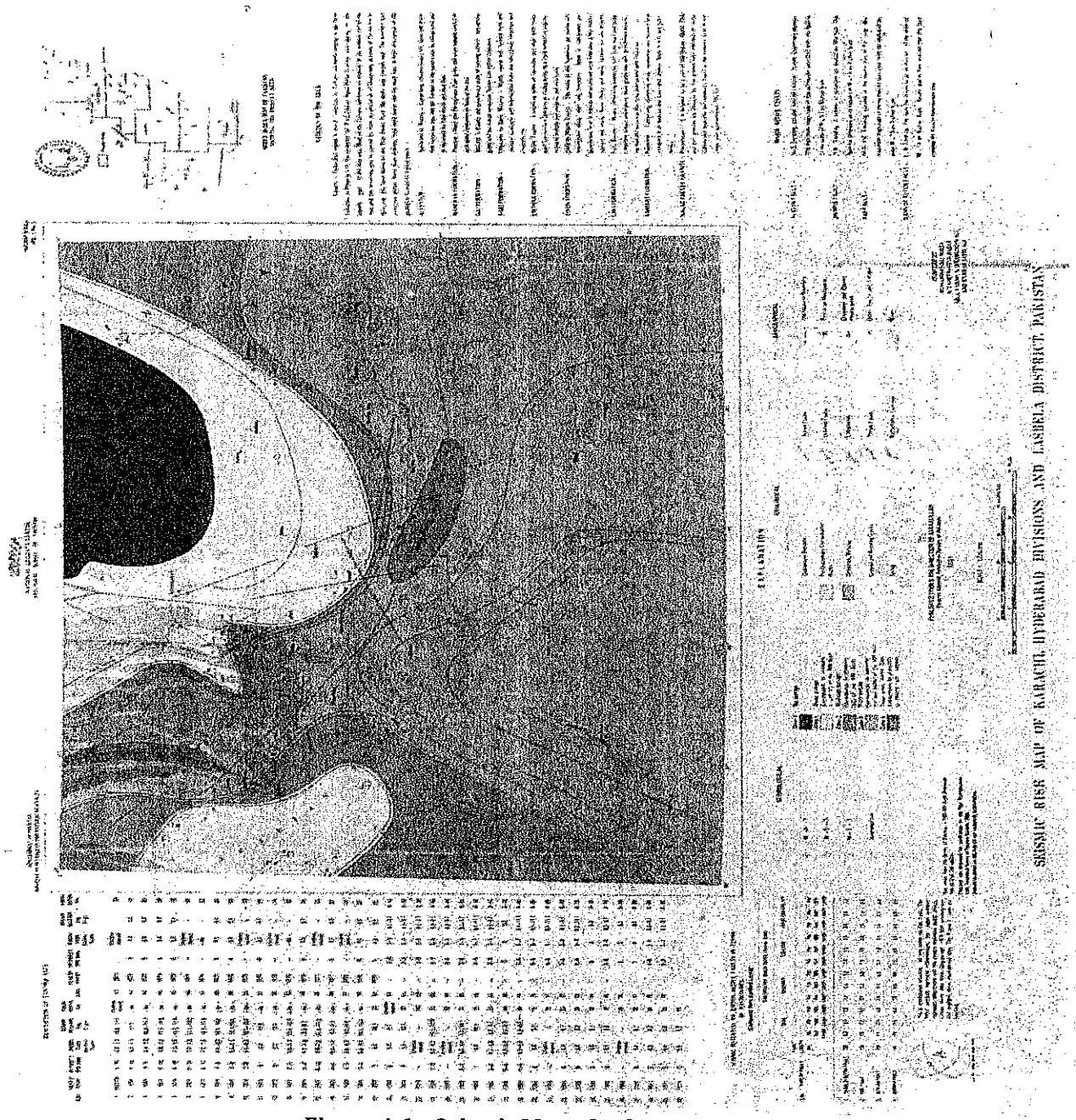


Figure 4.6: Seismic Map of Pakistan

4.6 FLOODS

Sindh province has two sources of flooding. The Riverine flood is more predictable and allows ample time to react, whereas the torrential floods leave almost no time to respond. Torrential floods have lesser frequency and duration but very high intensity; therefore, impact is often severe. These floods normally occur in monsoon months of July and August when the catchment areas in Balochistan receive heavy rains. The Western boundary of Sindh is connected with Balochistan through the Khirthar hills.

In 2011, torrential floods devastated more than 11,000 villages in Kacha and the surrounding areas of Sindh, displacing more than 213,000 households from their villages along with 1,065,000 numbers of livestock. District Thatta was the worst affected in Sindh because it was the last district on the Indus River where the flood remained for around two months. Official data reveals that approximately one million people were directly hit in this district of the province.

According to the flood map of Pakistan, Sindh province falls under a moderate to heavy flooding zone.

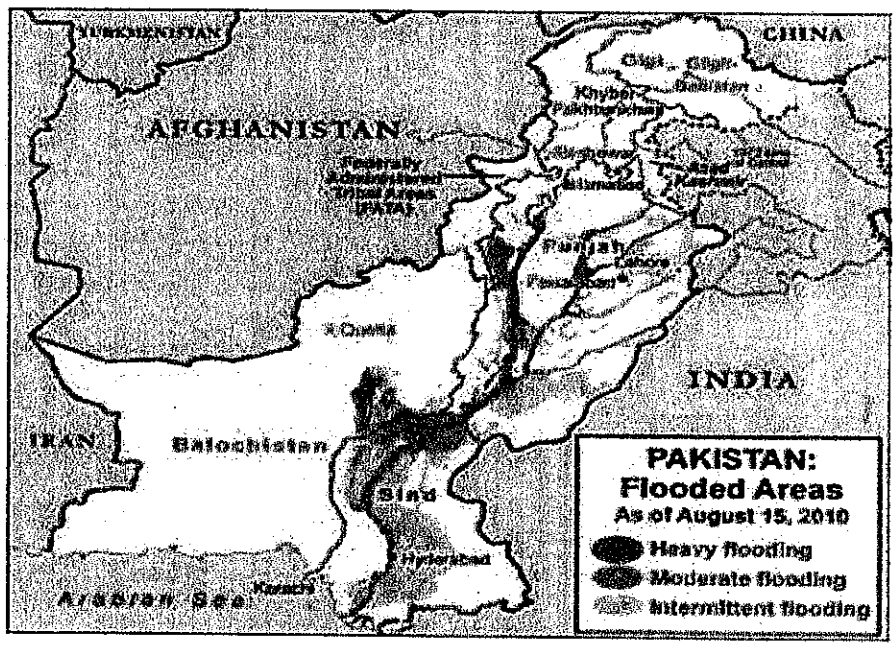


Figure 4.7: Flood Map of Pakistan

4.7 GEOLOGICAL SETTINGS

The Project area has a wide range of soil types due to its diverse land forms, which include sandy, deltaic, alluvial, gravel, coastal, and mountainous.

The Prevailing geologic conditions in the region are the results of extensive sedimentation, coastal movements, and erosion over a long period of time in the geological ages. The geology of the region is closely related to the formation process of Himalayan Ranges. This has resulted in intense deformation with complex folding, high angel strike-slip faults, and crust thickening expressed in a series of thrust faults. The important tectonic changes which have had so much influence in the region are freely visible, particularly in the Indus plain. Ultimately, it is only by considering the geology on a broader regional scale, as well as in site specific detailed, that the effect can be appreciated.

The hilly region of western Sindh consists almost entirely of rocks belonging to the tertiary system of geological nomenclature. It is only along the Laki range and in its neighborhood that there is some exposure of rocks belonging to the next older system; the cretatious with the exceptions of some volcanic beds associated with these cretatious strata, all the rocks formation of western Sindh are the sedimentary origin. All of the more important hills messes consist of limestone. A vast majority of this limestone deposit is from the nummultic period and is largely built up of the accumulated shells of foraminifera; principally those belonging to the genus nummulties.

Table 4-3: Geologocal Formations covered in the Wind Corridor of Jhimpir

Geological Symbol	Description	Percentage (%) of Total Area
Q	Unconsolidated surface deposits of silt and gravel of recent period	32.57
Te	Eocene Sedimentary Rocks (Mostly Limestone) of Tertiary Ages	67.43

4.8 SOIL CLASSIFICATION

The texture of soils in the wind corridor ranges from loamy saline, silty, and clayey in the coastal areas to gravely, mainly loamy, and clayey soils in the in land areas.

The loamy soils in the coastal areas are strongly saline (hence devoid of any agriculture), moderately alkaline (pH of 7.9 to 8.4) and strongly calcareous ($CaCO_3$ content greater than 15%). The soil in the inland areas, especially those areas covered under the lower Indus basin, consists mainly of loamy and clayey soils. These soils have little or no salinity (0 to 4dSm-1) and are moderately alkaline (pH of 7.9 to 8.4). The soils are generally non-saline, non-sodic except local saline patches in inter-dual valleys and some parts of the alluvial plain.

The soil of Jhimpir is classified as mainly loamy saline and part gravely. The soil is similar in nature to the soil of Gharo area. However the soils in some patches may be different with a slight salinity (between 4dSm-1 to 8dSm-1). This type of soil is usually neutral (with a pH of 6.6to 7.3), and moderately calcareous (with $CaCO_3$ content in the range of 3% to15%). Properties of soil in some patches of the wind farm may be different to the ones stated above with moderately alkaline (pH of 7.9 to 8.4), strongly calcareous (with $CaCO_3$ content of greater than 15%) with little or no salinity (between 0dSm-1 to 4dSm-1). This type of soil is usually neutral (with a pH of 6.6 to 7.3), and moderately calcareous (with $CaCO_3$ content in the range of 3% to 15%).

4.9 LAND USE CAPABILITY

The land area of the Project consists of a complex of agriculturally unproductive (rock) land and some poor grazing (gravely land) (Class VIII, VII). This area constitutes about 38.3% of the total wind farm area and is also incapable of agriculture as the soil underneath mainly consists of rock and gravel. The remaining portion (about 61.7%) of the land is a complex of poor torrent-watered crop land and poor (loamy) grazing land. Some part of this land is capable of agriculture being fed by torrent water whereas the remaining portion comprises of grazing area (capable of growing grass and shrubs).

Table 4-4: Land Use Capability Class in Jhimpir

Classification No	Soil (Class)	Capability	Percentage (%) of Total Area
7	IV, VII	Complex of poor torrent-watered cropland and poor (loamy) grazing land	61.68
10	VIII,VII	Agriculturally un-productive(rock) land and some poor grazing (gravely) land	38.32

The Project site consists of areas that have variable land use. The rocky and gravely soil formation devoid the major land area for any agricultural use. However the land area is also influenced by perennial grazing consisting of short grasses shrubs and scrubs. This area is dependent on residual moisture from torrent overflows. The major bushes found in the area include Devi, Chali, Damral, and Darathi (local names). No medicinal value is associated with these plant species found in the area.

4.10 SOCIO ECONOMIC FEATURES

4.10.1 Local Settlement Pattern and Population

Jhimpir, being in the administrative control of District Thatta, is unique in terms of population sensibility and characteristic. The total area of Thatta is 17,355 sq/km, the total population consists of 1,113,194 persons scattered in several *goths/paras*. Gender distribution shows a figure of 589,341 males and 523,853 females. The population density of Thatta is 64.1 per sq/ km, and the percentage of the total population residing in an urban area is 11.2 %. The average household size is approximately 5 persons. The average growth rate of the population has remained at 2.26% from 1981-98.

Table 4-5 List of Settlements and Population details

S.No	Name of Settlement/Goth	Coordinates	Distance from Project Site (km)	Population	Status /Type
1.	Chhachar Bubar	25°8'44.77"N 68°7'50.88"E	5.14km	400	Permanent
2.	Jakhro goth	25°11'15.02"N 68°5'3.37'E	1.45km	150	Seasonal/Temporary
3.	Shah Bukhari Tomb	25°9'40.44"N 68°7'20.91"E	3.41km		Permanent
4.	Meting Railway Station	25°9'38.35"N 68°7'18.86"E	3.39km		Permanent

Average household size is 5; houses built in nearby villages are single room houses, made of mud and bushes; there are four settlements found in the proximity of the proposed project area nearest settlement are found at the distance of 3.39 kilometer. Shah Bukhari Tomb and Meting Railway Station are the only permanent settlements and Chhachar Bubar and Jakhro Goth are seasonal /temporary settlements near the project site having 70 - 80 houses and 400-500 persons. The population of the settlements varies from 30 – 300+ inhabitants and houses from 5 – 50. Table shows the GPS coordinates of the settlements observed during the survey. During Micrositing study of the towers, due consideration will be given to avoid any disturbance to locals.

4.10.2 Health and Education Facilities

The health infrastructure in District Thatta is scant. Three out of the six coastal Talukas do not have any Rural Health Centre or any Veterinary Dispensary. A particular problem of access to health services is the scattered nature of the population. Thus, many people have no access to health services within a convenient location from their homes. Serious ailments have to be treated at Thatta, Hyderabad, or Karachi. Many of the diseases occurring in the area are water-borne and are due to lack of sanitation facilities. A basic health care centre is present in the area with minimum facilities and staff.

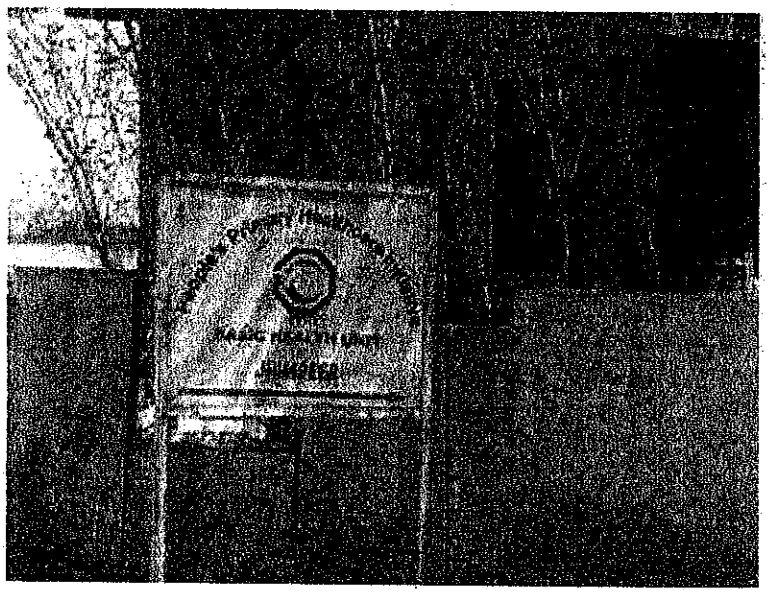


Figure 4.8 A Basic Health Unit in Jhimpir

The literacy rate in District Thatta was reported to be 22% in 1998. The male literacy rate was three times higher at 32% compared to the female literacy rate of only 11%.The literacy rate in urban areas was much higher at 46% compared to only about 19% in rural areas. A single primary school is located in the area.

Government primary school has been observed in the vicinity, which is not functional. The peoples of these goths are demanding the teachers as well as the middle schools. Private school is observed which is far and located at Bachal Jhakro Goth. There is dire need of high school and to make primary school functional.

Figure 4.9: A View of School nearby Project Area

4.10.3 NGOs Working in the Area

Different national and international NGOs are working in District Thatta with the help of their local partners. Their scope of work ranges from relief operations in the coastal areas of Thatta to social welfare and livelihood improvement initiatives. Certain NGOs are working on CPI (Community Physical Infrastructure) projects, and others have found their way in providing microfinance to local communities through social collateral. A few of these NGOs are also working on awareness and advocacy. NGOs and institutions working in the area includes NRSP (National Rural Support Program), Aga Khan Planning and Building Services (AKPBS), PPAF (Pakistan Poverty Alleviation Fund), IUCN, WWF, and Pakistan Fisher Folk Forum.

4.10.4 Income Source

The area does not offer opportunities for employment and the population is primarily engaged as cheap unskilled labor force either in Nooriabad, Thatta, Hyderabad or Karachi. Skilled labor from this area mainly comprise of vehicle drivers, agriculture activities, Shepherd, welders,

plumbers, and electricians. Government service is relatively rare; few locals are working in the Pakistan Steel Mill Dolomite Project and the Pakistan Railway Station in Jhimpir. During the social assessment visit it was observed that peoples are barely meeting their dietary needs. This in a way is exciting for the local population because the SF project is expected to bring job opportunities and raise the living standard of locals.

4.10.5 Infrastructure and Industry

The district is linked by road with other districts. The National Highway from Karachi to Peshawar passes through Thatta for a length of approximately 200 km.

The main railway line from Karachi to Peshawar also connects the district. The nearest railway station is Jhimpir.

Electricity is only available in 21% for the rural housing units, while kerosene oil is still used in 77% of the rural dwellings. Firewood is used as the main cooking fuel in about 91% of rural households and 77% of urban households.

The district is also equipped with digital and non-digital telecommunication systems, besides postal service and telegraph service.

From an industrial point of view, The Thatta district has progressed considerably. There are about 30 industrial units established in the district.

Nearest industrial hub is Nooriabad at the distance of approximately 26 kilometers, Nooriabad has different type and size of industries; which includes Textile, Power, Cement, etc.

4.11 ECOLOGY

RE2 project team (Flora and fauna experts) done by Dr. Syed Ali Ghalib have conducted the field survey for the study following were the methodology.

A. Methodology

Data in respect of fauna and flora were gathered both from primary and secondary sources. The sampling locations were randomly selected, ensuring that representative locations are sampled for each habitat and the maximum possible number of species belonging to each habitat is recorded.

Prior to the start of actual field work, there is a need to collect a sift of information to form a general overview on the wildlife populations on the site (and nearby areas) and their likely sensitivity.

This is largely a secondary data collection exercise during which information is sought and collected on:

(i) Mammals, birds, reptiles, amphibians and plants:

(ii) Habitats:

(iii) Designated / protected / sensitive sites in the vicinity of the proposed development

After having made a general overview of the likely animal populations on the site, their likely sensitivity and the proximity of the designated / protected sites forms the main objective of the field survey programme. This allows the selection of target / key species1 and their principal habitats in the Area.

Data in respect of fauna and flora were gathered from both primary and secondary sources. The sampling locations were randomly selected, ensuring that representative locations are sampled for each habitat and the maximum possible number of species belonging to each habitat is recorded.

Secondary data were collected through literature search including the studies conducted within and in the surroundings of the Project Area and information collected from the local communities and from the Sindh Wildlife Department.

The vegetation surveys were carried out by laying 20 x 20m quadrates within the study area. The plant communities were determined within the habitat.

Field Surveys were undertaken in the project area to collect data about the fauna of the area. Standard direct and indirect methods were applied to record the occurrence, distribution and population of various animal species in the area, which included point count surveys, roadside or track counts, line transect method and tracks/signs counts.

Survey Methods

There are two main survey types involved in such studies.

Distribution and status surveys: These are meant to record the occurrence, distribution and population / seasonal status of the various species using the site as breeding, wintering or staging site.

Vantage Point Surveys: These surveys comprise a series of observations from a certain fixed chosen location to quantity the flight activities of the birds at a proposed development site, which provides data to estimate the collision risk of the birds (particularly the migratory ones) against the blades of the turbine.

The survey area must adequately cover the entire development area. This includes access tracks; borrow pits, nearby villages, forested area, water points, farmland, vegetative area and wastelands.

Habitat loss and displacement may affect animals out with the project site. Therefore, surveys are also made in the area extending at least 500m beyond the project area boundary on either side.

Snap shots of Biological Environment survey are attached as Annexure IX.

B. Principal Habitats

The Project Area is mostly a wasteland comprising of the following main habitats.

- Sandy Plain Area
- Rocky Plain Area
- Rocky Area
- Scrubland
- Small patches of barani agriculture land
- Small villages
- Coal pits/mines

4.11.1 Flora

Flora survey conducted by Project team experts revealed that, during the fieldwork in the Project Area, 24 plant species belonging to 15 families were identified. Out of these, 17 species are perennial, 05 are annual and 02 are herbs. The quantitative analysis of the floral

composition was made and four distinct plant communities were identified based on life forms of the identified species. The dominant vegetation includes Zizyphus nummularia, Prosopis cineraria, Capparis decidua and Acacia milotica. There is also ploughed Barani agriculture land and also some vegetated area. Sueda fruticosa is the key species of the site area.

Project Area has 24 plant species belonging to 15 families were identified sampled in the main locations within the project Area. Out of these, 17 species were perennial, 5 were annual and 02 were herbs the. The quantitative analysis of the floral composition was made and four distinct plant communities were identified based on life forms of the identified species. Summary of Floral composition found in project area is shown in table 4-6;

Table 4-6 Floral Composition found in Project Area

S. No	Life Form	Number
1	Trees	06 species
2	Shrubs	11 species
3	Herbs	05 species
4	Grasses	02 species

No endemic or rare plant species (expect commiphora wightii) was recorded during the survey.

The following Table provides the list of floral species observed in the three main habitats viz. Flat Plains, Streambeds and hillocks/ foothills in quadrates measuring 20 x 20 m and 2 x2 m.

4.11.2 Fauna

The wildlife in the area has been affected by colonization of the area, and many wild life species have either diminished or vanished. No threatened wildlife species has been reported from the Project Area. Faunal attributes recorded during the study period is given below in table 4-7

Table 4-7 Faunal Attributes in the Project Area

Attributes	Numbers
Mammals	10 species
Birds	38 species
Reptiles	08 species
Plants	24 species

A. Mammals

During the present survey, 10 species were recorded and shown in table 4-7. The area has very thin population of mammals. Only solitary individuals of big mammals such as Indian Jackal could be sighted. Small mammals such as Five Striped Palm Squirrel, Indian and Desert Gerbils, House mouse were less common. Desert Hedgehog and Desert Hare were scarce.

B. Birds

38 species were recorded from the area (Table 4-7). The area supports Grey Partridge, Pigeon, Doves, Mynah, Grey Shrike, Bulbul, Indian Robin, Purple Sunbird, Black Kite, Brahminy Kite. House Sparrow, House Crow and Sind Jungle Sparrow were quite common near the villages or near the water points.

C. Reptiles

As regards the Reptiles, 08 species were recorded during the present survey (Table 4-7). Snakes such as Saw-scaled Viper, Indian Cobra, Indian Sand Boa, Plain Racer have been reported from the area. Indian Desert Monitor was found to be scarce, while Indian Garden Lizard and Indian Spiny tailed Lizard were common in the area.

List of Flora and Fauna found in the Project area is attached as Annexure X

D. Protected Areas

There is no Wildlife Protected Area in the close vicinity of the site. Keenjhar Wildlife Sanctuary is more than 10.9 miles away from the site. No Protected / Reserve Forest or any Rangeland lie in the vicinity of the Project Area. Two Ramsar Sites are located within this wind corridor viz. Haleji Lake, and Keenjhar Lake.

4.12 NATURAL MINERAL RESOURCES

The area near the Project site area is very rich in natural resources. Coal reserves of approximately 28 million tones covering an area of 350 sq.miles are present in the area of Jhimpir.

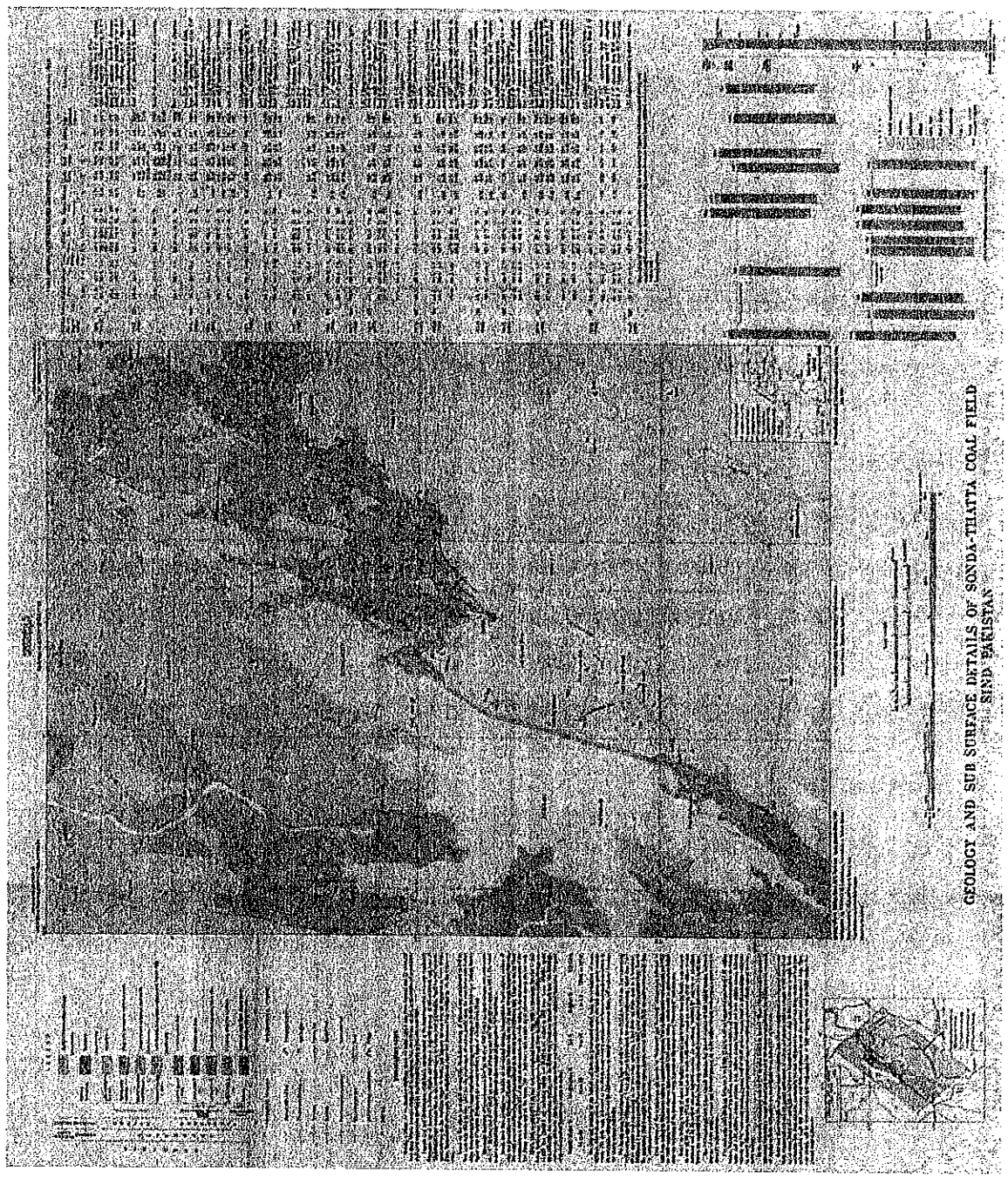


Figure 4.9: Geological and Sub Surface Details of Jhimpir

SECTION 5

ANALYSIS OF PROJECT ALTERNATIVES

5 ANALYSIS OF PROJECT ALTERNATIVES

Setting up of a wind power project involves selection of environmentally and techno economically suitable site, land characteristics, meteorology, infrastructure, grid availability, water availability, rail and road connectivity, accessibility and shading aspects etc. This chapter elaborates analysis of project alternatives, which can be considered in the project area.

5.1 WITH OR WITHOUT PROJECT

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips supply by a considerable amount. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind and solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill. As with gas, securing future supplies of coal and hydro-electric power would rely on significant spending on infrastructure. Pakistan has domestic reserves of coal. However, coal currently makes up a very small proportion of total generation, largely the result of most of the reserves being located in one area, the Thar Desert. Exploiting the reserves would require huge and costly upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines before power plant development could commence. Hydroelectric power already supplies almost 30% of electricity, and numerous sites for future investment exist, but due to their locations, this would also require significant investment in transmission to meet the expected power needs. Moreover, there are varying political stands on hydro-electric power options.

Looking at how the country's future electricity needs might be met in a way that supports the environmental objectives of the Government of Pakistan; wind power generation has the potential of being a strong contributor. The development of wind power generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions avoiding thermal power generation. The project will also add to the power generation from Renewable energy resources and help in meeting target of Government to achieve 5 % power generation from RE by 2015.

In view of the above, the "Without Project" option is not a preferred alternative.

5.2 ALTERNATIVE FUEL

The only viable generating options for energy production to meet the supply-demand gap in project region are fossil fuel energy. Pakistan is already facing huge short fall in fulfilling the coal requirement for already existing thermal power plant. The quality of coal is also low to medium in the region resulting in fly ash, carbon footprints and sulphur fume emission when it's burnt.

Coal power generation cause serious environmental threats including air pollution, coal dust, contamination of ground water, emissions of heavy metal pollutants which in turn can cause serious health issues.
So, it is imperative to look for alternatives to fossil fuel based power generation to achieve long term power solution of the country.

5.3 Location Alternative

The area where the project is located is the identified wind corridor of Jhimpir. The location of the project is selected on the base of suitable terrain and wind speed availability in the area.

Jhimpir Wind Corridor is also considered as most suitable land for wind power project other than Gharo. Also there are number of wind farms already in the development stage in this area. Therefore the infrastructure for the development of wind power generation in this area is already in development phase. The availability of land in this area is also a major reason for the selection of land in this area. As there are number for wind masts already installed in the area, therefore it's easier to use reference wind data of the neighbouring wind masts for the feasibility study which is more reliable and actual site based.

The major reasons for the selection of this site are;

- Adequate wind resource that allows for the operation of utility-scale wind turbines;
- Proximity and sufficient access to an adequate electric transmission/Grid;
- Contiguous areas of available land resource;
- Compatible land use;
- Ltd sensitive ecological issues;
- Sufficient distance from major population centers; and
- Compliance with Provincial, and Federal laws and regulations.

SECTION 6
POTENTIAL ENVIRONMENTALIMPACTS AND MITIGATION MEASURES

6 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 LAND USE

The total land allocated for the Project is 2880 acres. At the Project site, there has been an absence of the following since the past few decades:

- Any agricultural activity on the land
- Any commercial activity on the land to support the livelihood of local residents nearby
- Any green field, wetland or protected area

There are four settlements/Goths near the project area, which are located 3.39 kilometer away from the project site. Out of four only one Goth having population of 400 persons and 50 houses is located near the project boundaries which is seasonal/temporary and will not be affected due to construction and operation activities.

Therefore, there is no threat to the existing land use or degradation, and there is no net impact on the land use.

Extent of displacement of existing land use or other environmental resources	Low Impact

◇◇◇ =High
◇◇ =Medium
◇ =Low
○ =No impact
☆ =Locally Favorable
☆☆ =Regionally Favorable

6.2 AIR QUALITY

The Project involves power generation using wind energy—a clean source of energy (i.e., no fuels are used).Air pollution will increase during construction due to truck/vehicle traffic to the Project site, minor construction required to erect the WTG, earthwork, development of access roads, vehicle traffic on un-metaled road, etc. Also, the use of construction vehicles and equipment and idling of vehicles carrying construction raw materials will add to the emissions during the construction period.

However, the increase in air pollution is temporary. Also, the nearest major human habitat is approximately 3.39 km away from the project site. Thus, the impact of the construction activity on air pollution will be low and temporary. Construction emissions will be higher than emissions from Project operation activities, but still limited in volume. Emissions will be monitored and controlled through effective implementation of EMP.

Impact on Air Quality	Low

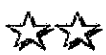

=High


=Medium


=Low


=No Impact


=Locally Favorable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6.3 NOISE QUALITY

Project construction involves a variety of noise generating activities that include the use of grading, excavating/drilling/, concrete batching, tower erection, the construction of ancillary structures, concreting, material movement, site cleanup, etc.

Noise levels generated by construction equipment vary significantly depending on the type and condition of equipment, the operation method and schedule and the site of the activity.

Construction activities at site are expected to produce noise levels in the range of 75–85 dB (A), with most works carried out during daytime.

The noise levels produced during construction will not have a significant impact on existing ambient noise levels at receiving sites, as noise generating activities are dispersed and most construction activities will occur during the day when higher noise levels are tolerated due to higher background noise levels. In addition, the constructions phase will be restricted to a few months, therefore the intermittent impact from construction noise is deemed to be negligible.

During Project operation, noise will be generated from rotor movement through the air, turbine operation, vehicle movements, and machinery operation around the site for maintenance and repair purposes. Blades moving through the air produce an aerodynamic noise. This noise is detectable when it is greater than the background noise, generally at wind speeds between the turbine cut-in wind speed (when the turbine starts to generate power) and up to 8-9 m/s (before the background noise starts to mask the noise from the blades and turbine). In addition, the operating turbine may produce a tonal noise.

The modern tubular towers contribute towards minimizing the noise emissions.

Impact on Noise Quality during Construction		Low
Impact on Noise Quality during Operation		Low

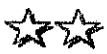
 =High

 =Medium

 =Low

 =No Impact

 =Locally Favorable

 =Regionally Favorable

6.4 NOISE FROM WIND TURBINES

No landscape is ever completely quiet. The modern tubular towers contribute toward minimizing the noise emissions. Birds and human activities emit sound, and at wind speeds around 4-7 m/s and up to the noise from the wind in leaves, shrubs, trees, masts etc. will gradually mask (drown out) any potential sound - from wind turbines. This makes it extremely difficult to measure sound from wind turbines accurately. At wind speeds around 8m/s and above, it generally becomes a quite abstruse issue to discuss sound emissions from modern wind turbines, since background noise will generally mask any turbine noise completely.

The sound power level from a single wind turbine is usually between 90 and 105 dB(A) This creates a sound pressure level of 50-60 dB (A) at a distance of 40 meters from the turbine, i.e. about the same level as conversational speech.

Figure 6.1 is released by GE, which shows the comparison of various common sounds with respect to the sound generated from Wind turbines. The research explains that a large wind turbine isn't very loud from an objective standpoint. According to this data, at a distance of 300 meters, a turbine will be somewhere between an air conditioner (50 decibels) and a refrigerator (40 decibels). At about 500 meters, the levels drop to about 38 decibels, which is well below the typical 40-45 decibels of background noise in a populated area.

Therefore, wind turbines are not any louder than what an average person is already used to.

The quality of wind farm noise is one factor. Researchers are looking at whether the low-frequency sound of blades has a different psycho-social impact than noise from highways or airports. It's very common that people living close to turbines call the sound "penetrating." Of course, different people handle the sound in different ways. Many residents are unfazed by turbines at close distances.

However, noise analysis have been done to make the baseline data which ranges between 36-44 dB (A), close noise monitoring will be performed during construction and operation phases to keep in permissible limits.

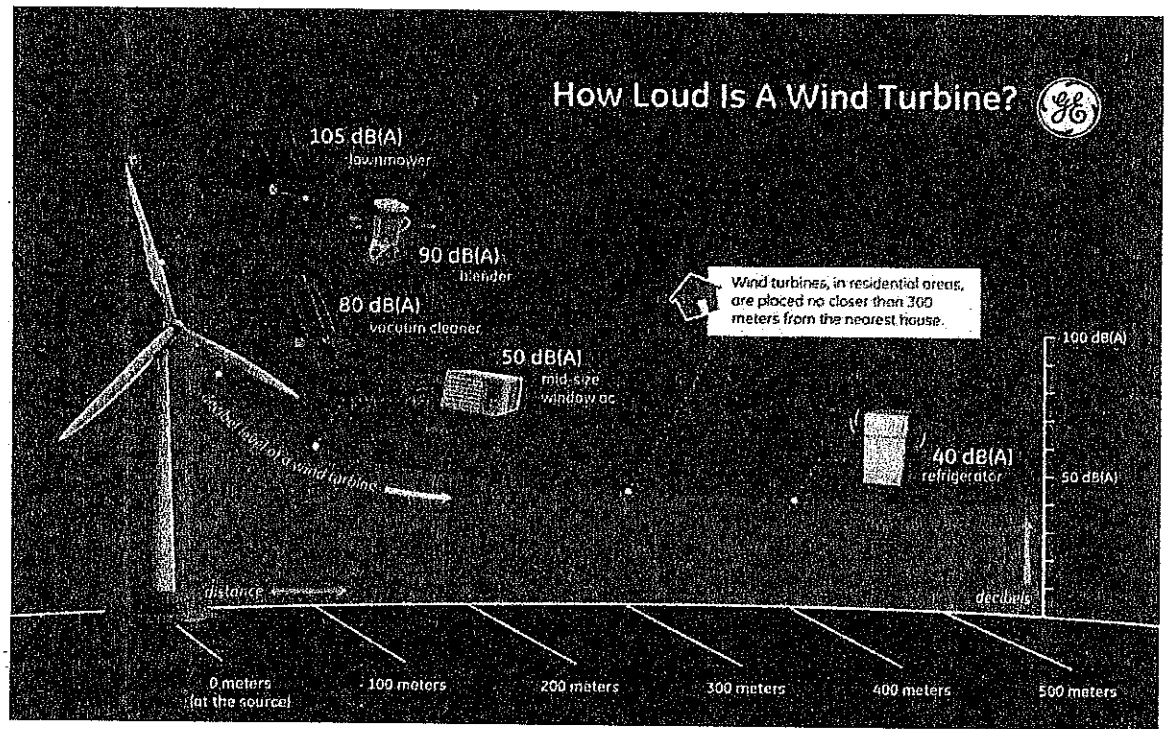


Figure 6.1: Noise Generating from Wind Turbine[2]

The Project will use modern wind turbine models, which have advanced technology that includes upwind rotors, tubular towers and sound proof nacelles to reduce mechanical noise. Noise from wind turbines varies with wind speed, but is generally comparable to the background sound in a typical household at 40 to 60 dB. The noise from wind turbines is usually measured in relation to ambient noise. If the wind is at higher speeds, the ambient noise level will be higher. Most new wind turbines will have noise levels at or close to ambient level. Distances of 100 feet are usually sufficient to keep noise levels below 60 dB, which has been suggested as a reasonable regulatory limit. Nearest communities are located at 3-6 kilometers.

[2] GE Global Research; National Institute of Deafness and other Communication Disorders (NIDCD part of NIH)

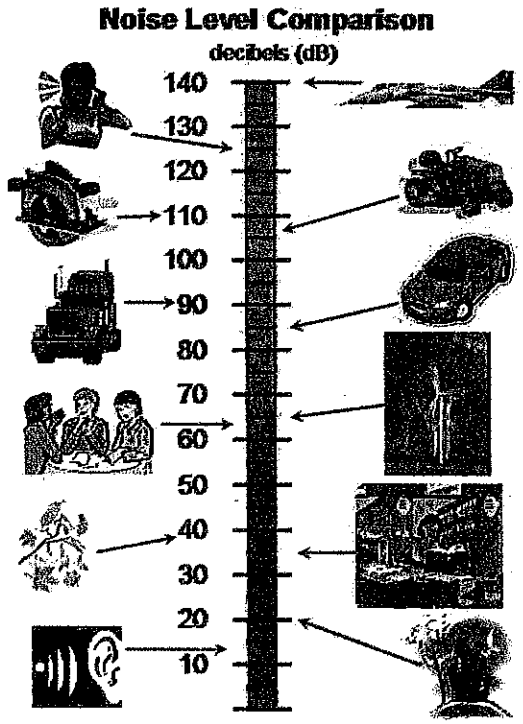


Figure 6.2: Noise Generating from Wind Turbine[3]

Impact of Noise Generated from Turbine	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

[3] GE Global Research; National Institute of Deafness and other Communication Disorders (NIDCD part of NIH)

6.5 SHADOW FORECASTING

Wind turbines, like other tall structures, will cast a shadow on the neighboring area when the sun is visible. For a community living very close to the wind turbine, it may be annoying if the rotor blades chop the sunlight, causing a flickering (blinking) effect while the rotor is in motion.

The probability of when and for how long there may be a flicker effect may be predicted. It might not be known in advance whether there is wind, or what the wind direction is, but using astronomy and trigonometry a likely, or a "worst case" scenario can be predicted.

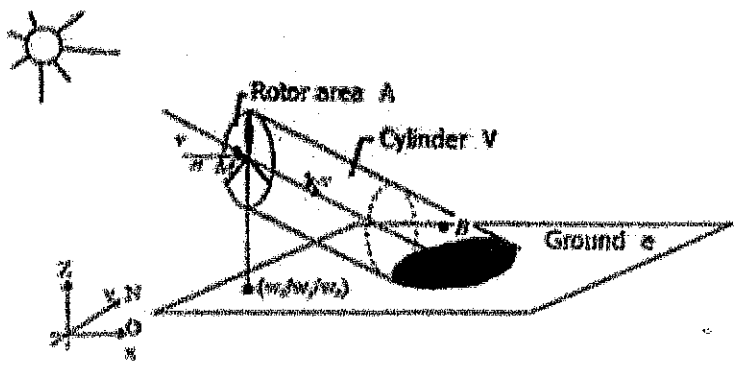


Figure 6.3: Shadow Flicker of Wind Turbine

In a study conducted by the Department of Energy and Climate Change, UK, the data of wind turbines of 18 countries were selected to study the shadow flicker impact. The study concluded that the so-called "shadow flicker" caused by wind turbines does not pose a significant risk to health of the nearby residents. There is no case reported about any significant impact of shadow flicker in any of the wind farms in the countries included in the study.[4]

[4] http://www.decc.gov.uk

At distances of greater than 1,000 feet between wind turbines and receptors, shadow flicker usually only occurs at sunrise or sunset when the cast shadows are sufficiently long. Moreover, in Pakistan, there is a common trend for people to build homes in shady areas.

Impact of Shadow flicker	Low

	=High
	=Medium
	=Low
	=No Impact
	=Locally Favorable
	=Regionally Favorable

6.6 WATER USE AND QUALITY

The volume of water used during Project construction and operation is low. i.e, approximately 1500 to 2000 gallons per day water is required during construction of the project. Water required for plant civil works, will be sourced from ground water, RO Plant will be installed to make water free from any contamination. Water is available and quantities required are negligible than requirement.

Once the wind farm is operational, water is only required for the domestic use of Project staff at the site.

Water Use & Quality	Low

	=High
	=Medium
	=Low
	=No Impact
	=Locally Favorable
	=Regionally Favorable

6.7 GROUNDWATER CONTAMINATION

Groundwater contamination can occur if chemicals or any other waste materials are not properly handled or are incorrectly disposed of and leach into the water table or if wastewater from plant activities is not properly disposed of.

All the waste material will be handled and disposed of in accordance with accepted safe practices, with no harmful substances released by the Project. Therefore, there will be no effect on surface water quality or ground water contamination.

Ground Water Contamination	= No Impact

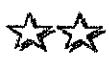

=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.8 Solid Waste Generation

Solid waste generated on site may spread over or create hazard for community and employees of the project.

Two type of solid waste will be generated during construction and operation phases; it is estimated that average 200kg/day domestic (non-hazardous waste) will be generated, which will be disposed at TMA identified waste disposal point at Jhimpir city.

All the hazardous waste material will be handled and disposed of through EPA certified waste disposal contractors (like, Petro waste, KMC). Therefore, there will be no effect on general sites condition and cleanliness of project boundaries.

Solid Waste Generation	= No Impact
◇◇◇	=High
◇◇	=Medium
◇	=Low
○	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

6.9 Wastewater Generation

Wastewater will be generated on site from domestic activities; and from construction activities; Wastewater from camp (Black water) will be stored in the septic tanks this must be transferred through tankers to the nearby located TMA disposal point (if hazardous wastewater is present). The effluent water will be transported to the evaporating pond that will be constructed temporarily within project premises. The effluent water will then be evaporated naturally. The protected fence and all other precautionary measures will be taken in place. It will be ensure that wastewater from site shall not enter into the water body.

Wastewater from construction activities must be stored in the settling tanks after settling of the particles it can be re-used for the sprinkling at the connecting roads for dust supersession.

Wastewater Generation	= Low Impact
◇◇◇	=High
◇◇	=Medium
◇	=Low
○	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

6.10 BIOLOGICAL ENVIRONMENT

6.10.1 Wetland and Wildlife Sanctuaries

Around 1967, an exploration sponsored by WWF—UK revealed that wildlife and wetlands resources in Pakistan were severely threatened and, in most areas, declining in condition. The expedition report prepared by Mountfort (1967) recommended that a range of wetland sites be declared Protected Areas. The Convention on Wetlands came into force for Pakistan on 23 November 1976. Pakistan presently has 19 sites designated as Wetlands of International Importance, with a surface area of 1,343,627 hectares.

The wetlands of Pakistan are shown in Figure 6.4.

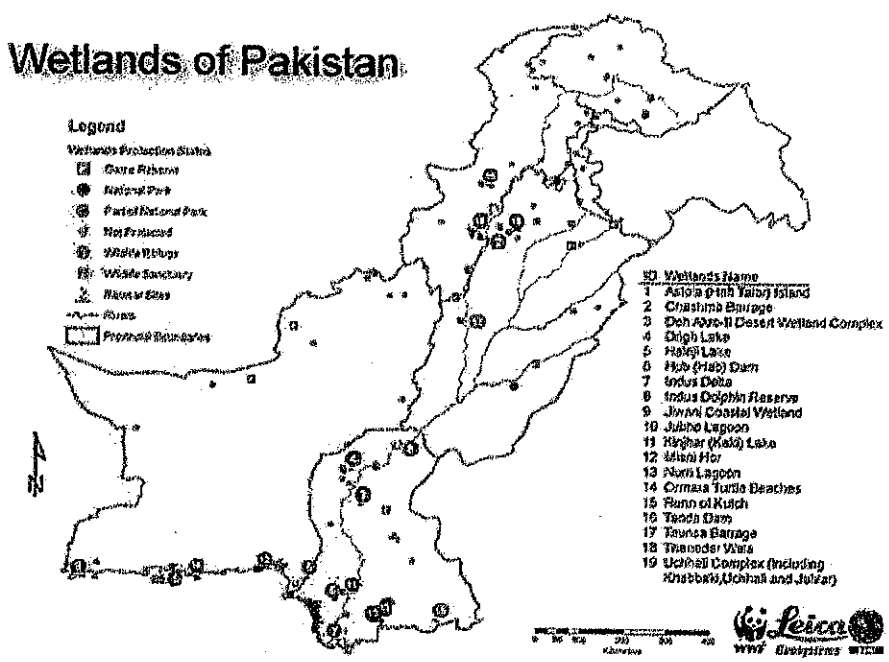


Figure 6.4: Wetlands of Pakistan[5]

[5] www.pakistanwetland.org

Out of 19 Ramsar sites, 10 sites are located in the province of Sindh, which are shown in Figure 6.5.

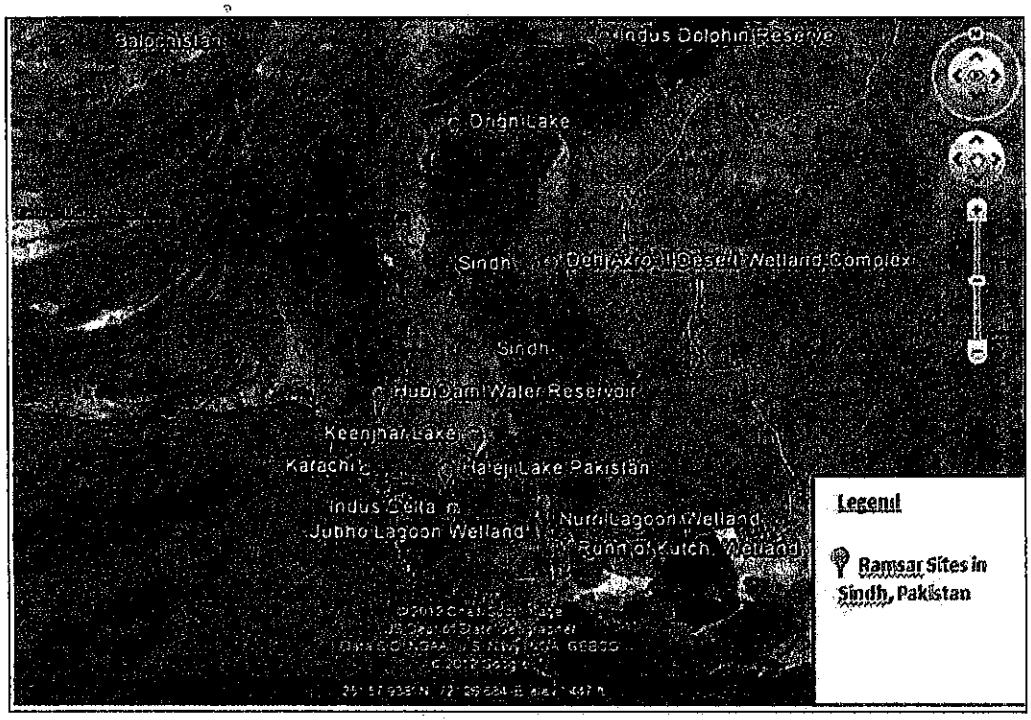


Figure 6.5: Wetland located in Sindh

Keenjhar Lake is the declared wildlife sanctuary, and the Ramsar site is located at a distance of 10.9 miles Approx. from the Project site. It is the largest fresh water lake in Pakistan. It is an important source that provides drinking water to Thatta District and Karachi city. The area is favored as a habitat for winter migratory birds like ducks, geese, flamingos, cormorants, shorebirds, herons, egrets, ibises, terns, coots, and gulls. It has been observed that it is the breeding area of the night heron, cotton teal, purple moorehen, and pheasant tailed jacana. The natural vegetation of the surrounding area is tropical thorn forest. The lake is rich in fish and fauna, and supports the livelihood of about 50,000 local people. Main activities at this Ramsar site are commercial fishing, nature conservation, and public recreation.

6.10.2 The Indus Flyway

Pakistan is one of the principal wintering grounds for water birds in South Asia. The lakes in the Indus Valley are major refuge for the migratory water birds which breed in Northern Eurasia. Pakistan forms part of their "Indus River Green Route". When the climate in their breeding grounds in Russia becomes too rigorous and the food gets scarce, then the birds leave the place and disperse to their winter resorts further south along the following distinct flyways.

1. Northern Europe Scandinavia-North Sea.
2. Central and Southern Europe-Black Sea-Mediterranean.
3. West Siberia-Caspian Sea-Nile.
4. Siberian-Kazakhstan-Pakistan/Central Asian Flyway.
5. East Siberia- Tibet-Ganges/ East Asian- Australian Flyway.
6. Far East- Kamchatka –China / Japan. West Pacific Flyway.
7. North East Siberia- Chokotka- California / Pacific Flyway.

Most of the sub-continent's visitors come through Pakistan route to India and Sri Lanka or Africa. Majority of winter visitors to the sub-continent enter via Indus Plain. Some come down the Indus River Valley and its far northern tributaries as well as the Chenab and Jhelum rivers further east. A very significant number enter from further west coming over the Peiwar Pass and following down the Kurram River. Some of these autumn migrants fan out eastwards into Northern India and thus avoid the Rajasthan Desert to the South, while other follow the Indus River down to the Indus Delta.[6]

[6] Roberts, T.J. 1991. The Birds of Pakistan. Volume 1. Oxford University Press, Karachi

Table 6-1: Migratory and Local Birds of Keenjhar Lake[7]

List of Migratory Birds of Keenjhar Lake	List of Local Birds of Keenjhar Lake
White pelican	Marsh Harriers
Dalmatian pelican	Ospreys
Large cormorant	Cuckoos
Grey heron	Swifts
Large egret	Swallows
Black bittern	Pigeons
Yellow bittern	Doves
Spoonbill	Parrots
Flamingo	Sandgrouses
Pintail	Mynas
Common teal	Shrikes
Mallard	Larks
Gadwall	Grebes
Wigeon	Pelicans
Garganey	Carmorants
Shoveller	Flamingos
Common pochard	Herons and Bitterns
White eyed Pochard	Ibises and Spoonbills
Tufted duck	Ducks
Common coot	Morhens/Waterhens
Grey plover	Coots
Dunlin	Waders
Little stint	Gulls and Terns
Avocet	Babblers
Ruff	Sunbirds
Herring gull	Bushchats
Blackheaded gull	Bee-eaters
Whiskered tern	Drongos
	Crows
	Prinias
	Warblers
	Wagtails
	Sparrows
	Weaverbirds

[7] www.wwfpak.org

6.10.3 Birds/Avian Collision

Birds can be affected by wind farm development through loss of habitat, disturbance to their breeding and foraging areas, and by collisions caused by the rotating turbine blades. Pakistan receives a large number of migratory birds from Europe and Central Asian States every year. These birds spend the winter seasons in Pakistan and go back to their native habitats in the summer. The route these birds take from Siberia to Pakistan is known as International Migratory Birds Route Number 4. It is also called the Green Route or Indus Flyway. Out of seven flyways of the world, the Indus Flyway is one of the busiest routes. Birds begin their journey in November. February is the peak time, and by March they start flying back.

At present there is no atlas available for bird migratory routes within Pakistan. However, extensive research has been done based on the literature available on bird migratory flyways and the wetlands map developed by Pakistan Wetland Organization. A map of Indus flyway also known as Green Route or Migratory Route No 4 is shown in Figure 6.6. The Indus flyway route is marked with arrows in red.

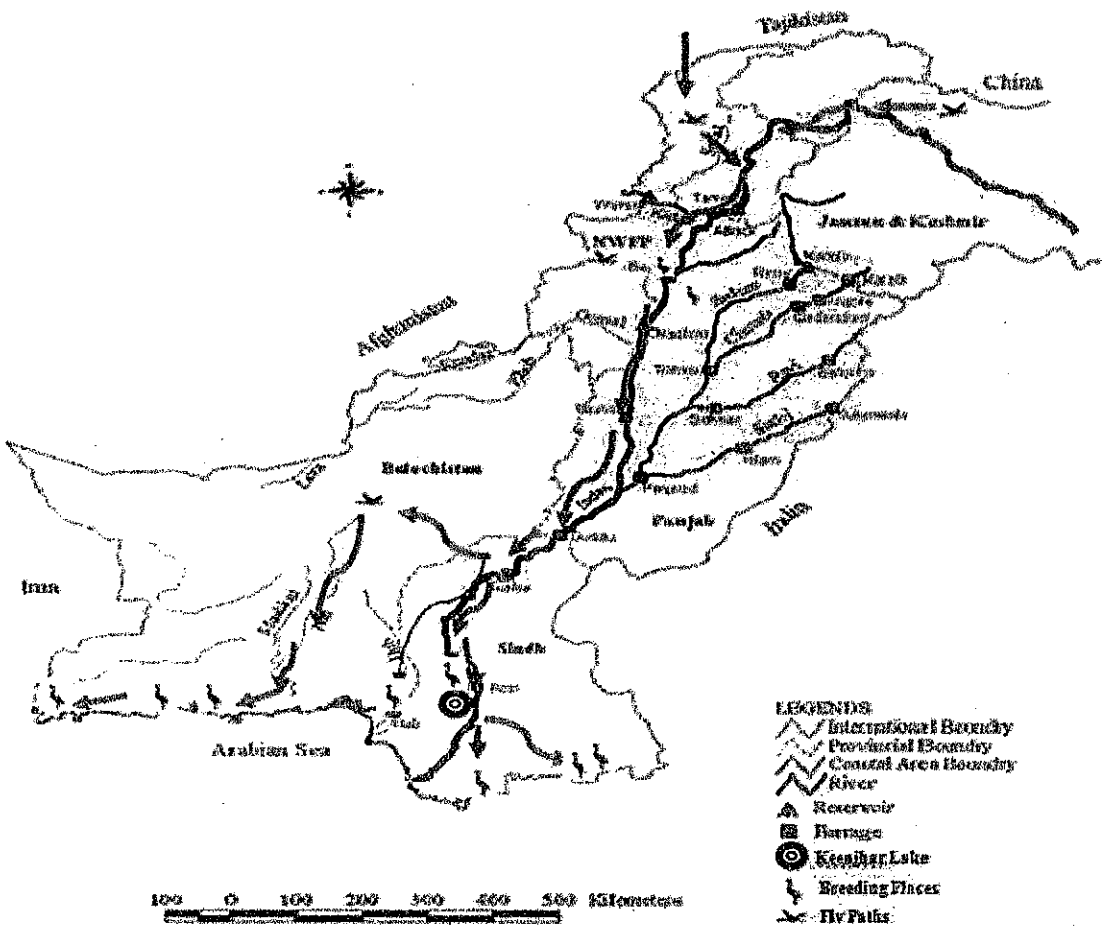


Figure 6.6: Indus Flyway for Migratory Birds/Green Route No.04

The main migrants to South during the winter season are the Water birds, Raptors, Houbara Bustard and the Passerines (Warblers, Pipits, Wagtails and Buntings).

The water birds migrate fairly large number in winter. They are very diverse group of species comprising mostly of Pelicans, Flamingo, Cormorants, Darter, Herons, Egrets, Bitterns, Storks, Ibises, Spoonbill, Ducks, Cranes, Water Cock, Rails, Crakes, Coot, Waders, Gulls and Terns.

The wintering birds of Prey include: Eurasian Griffon, and Cinereous Vulture, Marsh Harrier, Montagu's Harrier, Common Buzzard, Long legged Buzzard, Booted Eagle, Greater Spotted Eagle, Steppe Eagle, Common Kestrel, Merlin and Eurasian Hobby.

A list of 236 species of birds is available, both resident and migratory, whose range of occurrence covers the most important wetland of the surrounding area of the Wind Farms in the Jhimpir Wind Corridor viz. Keenjhar Lake. The list is quite comprehensive and is based mainly on the experience gained during the water bird surveys undertaken during the last ten years. It gives an overall idea about the resident and migratory birds, many of which may be expected to be observed on their migration / local movement to and from the lake and the surrounding areas.

From the review of literature and interviews with local residents of the area, it was observed that migratory birds come and land on the Eastern side of the Keenjhar Lake, which is towards the river Indus. Whereas all the wind farm sites are located towards the West and Northwest direction of the Keenjhar Lake. The detailed view and description of the bird's living areas in Keenjhar Lake is described in Figure6.7. It is found from the study that there is very little probability of bird hit from the wind farms as the Project is located approximately 15 km away from eastern side of Keenjhar Lake, and birds usually do not land and stay in the western part of Keenjhar Lake.

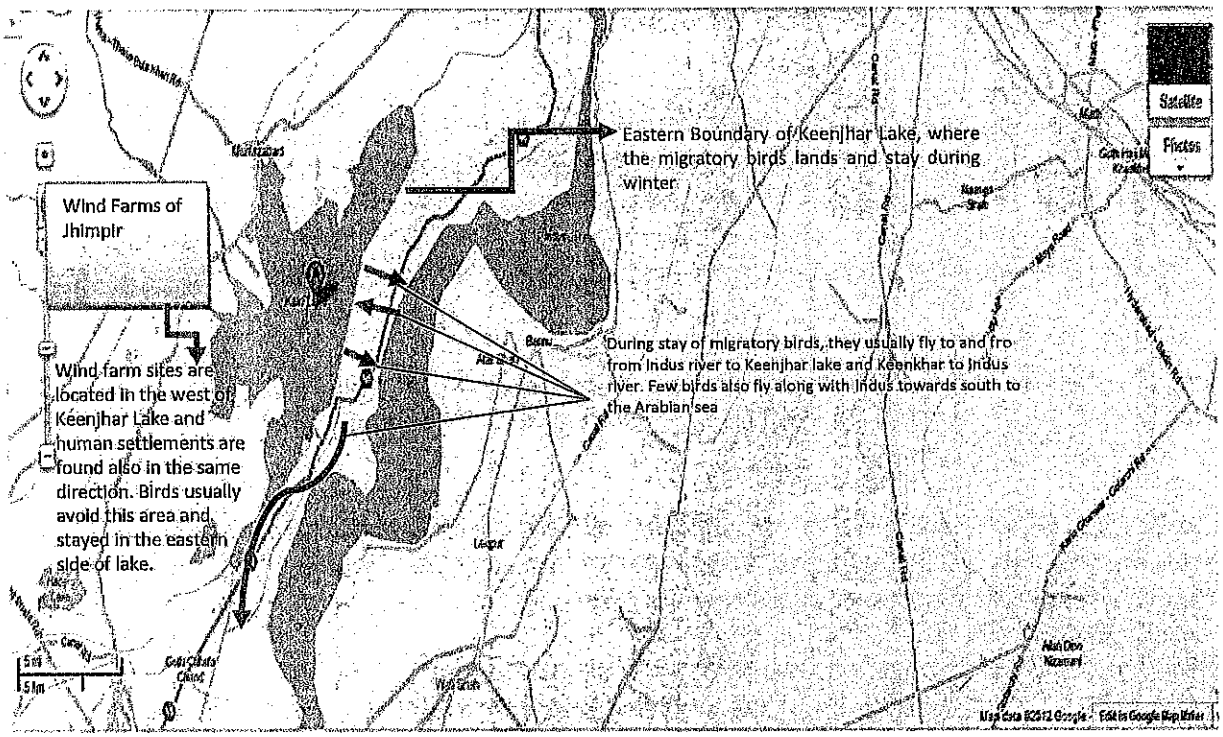


Figure 6.7: Birds Flying and Staying Patterns on Keenjhar Lake with Respect to Wind Farms

Compared to other causes of mortality among birds, the effect of wind power is relatively minor. Non-collision impacts on birds such as site avoidance and disruption of migratory behavior could also be significant. However, according to a survey conducted by WWF in 2009, the number of birds in and around Keenjhar Lake has reduced drastically in recent years. Furthermore, these birds have a tendency to fly at an altitude of 400 to 500 meters, thereby negating any chance of collision with wind towers at this specific Project site.

As a general rule, birds notice new structures and learn to avoid them in movements, thereby sustaining their ability to continue feeding and breeding in the location. Wind farm technology is new to Pakistan, but this technology has now been used in western and developed countries for over a decade. A study report (Sept. 2005) by the U.S Government Accountability Office (GAO) on the effects of wind energy development on wildlife determined that fewer birds fly into wind turbines than is generally thought.

Although several hundred utility-scale wind farms currently operate across the United States, such problems appear to be limited to two project areas, according to the report. In the context

of other sources of avian mortality, it does not appear that wind power is responsible for a significant number of deaths, the report states in its conclusion[8].

The impact of wind energy development on bird populations came to prominence due to the high number of mortalities associated with one of the world's largest wind farm developments in California's Altamont Pass.[9]This wind farm had up to 5,600 wind turbines in operation and is located in a year-round, high activity, area for raptors. Additional factors included prey abundance; high-speed rotor blades; lattice tower structures, which provided horizontal cross-bars for perching; rapid blade movement; and the close proximity of turbines.

Another research cited by the European Wind Energy Association shows that the risk of bird deaths through collision with wind turbines is low. For example, it is estimated that 33,000 birds are killed annually by wind turbines operating in the U.S., an average of 2.2 fatalities for each of the 15,000 turbines.

In Spain, a study showed 0.13 dead birds per year per turbine. Furthermore, in the U.S., over 100 million birds are estimated to die each year from colliding with vehicles, buildings, power lines, and other structures, with wind power responsible for just 1 out of every 5,000 – 10,000 avian fatalities.

There seems no threatened or endangered bird species found at the site. Any development of the wind farm will have no impact on the existing bird life. Also, an emission-free power generation is clearly beneficial to all fauna.

However, due to the minimal expected impact of bird's collision with the wind turbines, the following mitigation measures are proposed:[10]

The wind towers to be erected minimum at a distance of 300 meters to avoid the avian collision and to give the birds a wider corridor for access in the Project area

- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds monitoring the birds during the migratory season be undertaken to record their distribution and migratory pattern and use of the area during the season.
- Hunting, feeding or harassment of wildlife is strictly prohibited during the entire course of construction and operation phases.

[8] http://www.gao.gov/new.items/d05906.pdf

[9] American Wind Energy Association: Facts about Wind Energy & Birds, 5pp.-Internet Article

10 Ghalib, S.A., Khan, M.Z., Ahmed, S.M., Begum, A., Hussain, B. and Ahmed, W. 2014. Study of the Wildlife of Jhimpir Wind Corridor, district Thatta, Sindh and Development of Bird Monitoring Strategy in the Area. African Journal of Science and Research. 6(3) : 01-09.

- Food wastes not to be disposed of in the open. Food wastes collected in waste segregation unit is disposed of according to waste disposal procedure on a regular and strict basis.
- Night work during construction be prohibited, night travelling not be allowed unless absolutely necessary.
- Operation camp is located 500m away from perennial water bodies.
- Shaheen Foundation will work with the local WWF located in Thatta and remain involved in the conservation efforts of threatened species.

Impact on Migratory Birds	=No Impact
Impact on Local Birds	=Low


=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.10.4 Flora and Vegetation

As there is no dense vegetation or forestation in the Project site area, there will be no damage to any kind of vegetation or forests. However, there will be a requirement for minimal vegetation clearing or deforestation during the Project. It is anticipated that once the Project is operational, new plants shall be re-planted in the empty spaces around wind turbines. Enough space will be allocated for green belts.

Impact on Flora and vegetation	= No Impact

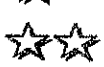

=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11 SOCIO ECONOMIC ENVIRONMENT

6.11.1 Archeological Sites

No archaeological sites are present near the Project site.

Archeological Sites	 =Regionally Favorable

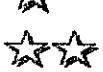

=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11.2 Re-Settlement

Project is located on privately owned land. The most of the settlement are located outside of project boundary; there are some seasonal houses located inside the project boundary which will not be affected, and no resettlements are required. However, any involuntary resettlements, if required, will be done as per IFC performance standard PS-5.

Resettlement	= Low Impact


=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11.3 Visual Impact on Landscape

The addition of the Project to the local landscape will have a significant visual impact, as it would be the first such structure in Pakistan. In European countries, wind turbines are considered to give insignificant visual impact due to the fact that wind power technology is very common there and large numbers of wind turbines are installed. But as far as Pakistan is concerned, wind power is an emerging technology for local inhabitants, and it would give a noteworthy positive visual impact.

Visual Impact on Landscape	=Regionally Favorable


=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11.4 Aviation Hazard

No aviation hazard will be created by the Project as it is located 98 km from the nearest airport at Karachi. In addition, the blades are marked with red bands to make the structure more visible.

Aviation Hazard	= No Impact


=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11.5 Traffic Management

The impact on traffic will be minimal and due to trucks carrying construction material and WTG components as well as vehicles to carry personnel. Traffic will need to be planned and managed effectively to avoid inconvenience for the local population and/or endanger public safety.

Traffic Management	= Low

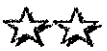

=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

6.11.6 Labor Welfare and Safety

Large amounts of labor will be deployed during construction. The labor camps need to provide proper water supply and sanitation facilities (toilets with septic tanks).Otherwise insects may proliferate and lead to public health hazard. The safety aspects to be covered include proper handling of electrical devices, tools, equipment, and construction materials to prevent accidents to personnel. Local will be preferred for the unskilled jobs. Overall impact will be low.

Labor Welfare & Safety	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.7 Seismic Hazards

The damage zone classification of the region where the site is located is ZONE II-B (moderate to severe damage). The foundation design of the wind turbine generator (WTG) will take account of this seismic factor.

Seismic Hazards	 =Low

 =High

 =Medium

 =Low

 =No Impact

 =Locally Favorable

 =Regionally Favorable

SECTION 7

PUBLIC CONSULTATION

7 PUBLIC CONSULTATION

This section provides the details of the consultation meetings held with stakeholders as part of the environmental and social soundness assessment process requiring information disclosure and sharing. For this purpose consultation meetings were held at the outset for the scoping process of IEE study, followed by a series of meetings at the proletarian level. Dr. Syed Ali Ghalib and our team member Mr. Farooq Ali Khan (RE2) have performed the consultations with different departments and officials. These stakeholders are the different government officials and NGOs like IUCN Pakistan, WWF department, Karachi (Senior Director, Mr. Rabnawaz), SEPA representative (Dr. Aashiq Hussain Langah), Sindh Wildlife department Hyderabad office (Mr. Ghulam Muhammad Gadani, Deputy Conservator wildlife), Sindh Forest department, Karachi (Divisional Forest officer), Archeological department, Karachi.

7.1 Objectives of Public Consultation

The overall objectives of the consultation process were as follows:

- To inform all interested people on the likely positive and negative effects of the wind power proposed project and encourage feedback from stakeholders on IEE findings, principally the impacts and proposed mitigation measures;
- To gain a consensus on the impacts identified, their importance and the relevance and effectiveness of the mitigation measures proposed;
- To provide confidence that all relevant issues and mitigation measures have been identified, agreement that the mitigation measures are adequate, and that nothing significant has been missed;
- To enable incorporation of stakeholder views and concerns in the IEE.

7.2 Consultation Process

7.2.1 Scope

The social survey team conducted meetings and interviews with local communities. During these meetings a description of the project was given along with an overview of the projects likely social and environmental impact.

7.2.2 Community Consultation

Community consultations consisted of formal and informal meetings at Jhimpir residential area, and project vicinity. The consultation exercise was conducted in both Sindhi and Urdu languages. A non-technical oral description of the project was given providing an overview of all likely positive and negative impacts. Following which, an open discussion was held so that the participants could voice their concerns and opinions. All participants were encouraged to voice their concerns and opinions. Participants were also asked to suggest alternatives where they had particular concerns.

Feedback obtained from the stakeholders was documented, and all issues and suggestions raised were recorded in survey forms. Both social and environmental issues were raised.

The people interviewed (Table 7-2) had worries /concerns related to basic needs and generally agreed that most of the effects would be temporary only during construction. Some common concerns regarding the lack of educational facility, shortage of clean drinking water, lack of basic health unit, lack of waste disposal, lack of electricity, poor roads condition and minimal employment opportunities issues were raised. None of these issues related specifically to proposed wind power project but were general complaints. Most of the participants appreciated the project and said that it would boost the local employment opportunities, while some said that business and economic situation in the area will also improve.

A matrix of concerns by community members was prepared as given in Table 7-1. The register of attendance is provided as Table 7-2. A pictorial record of the meetings is included as **Annexure XI.**

Table 7-1: Summary of Concerns Raised during Stakeholder Consultation

Issues	Concerns raised by community	Remarks
Health Care Facilities	Healthcare centers particularly for women and children Schools	Basic health unit is available in the Jhimpir with very little facilities, A dispensary may be provided.
Employment	Provision of semi-skilled and unskilled jobs for local labor in the project construction period.	Unskilled jobs will be given to locals people where possible. Training will be provided.
Safety of Community	Comply with the traffic management rules.	Proper traffic management will be resorted to during the construction period.
Drinking water	Community member rated Safe drinking water at highest priority during our survey.	As part of the Social development program SF, PAF shall provide the safe drinking water through RO filter plant to nearby communities
Educational Facility	Unavailability of Teachers, and School (Primary and Secondary) Vocational training	NGO working in social sector and proponent shall provide the required facilities for the local peoples.
Other issues	Black top link roads	Linking roads will be developed as part of the project component will benefit the local residents as well.

Table 7-2 General Public Interviewed during Public Consultation at Jhimpir

S.NO	NAME	OCCUPATION	LOCATION
1	Din Muhammad	Guard	Chhachar Bubar
2	Murad	Labour	Chhachar Bubar
3	Kaim Khan	Shepherd	Chhachar Bubar
4	Nabi Baksh	Unemployed	Chhachar Bubar
5	Sado Jhakro	Unemployed	Sahi Makan
6	Mir Mohammad	Labour	Matti Goth

7	Abdul Kareem	Labour	Goth Jhakro
8	Anwar Ali	Labour	Goth Jhakro
9	Sorab Jhakro	Labour	Jhakro Goth
10	Bachayo Khaskheli	Labour	Goth Jummah Khaskheli
11	Mangilado Khaskheli	Cooli	Goth Jummah Khaskheli
12	Karim	Coal Mine labour	Goth Jummah Khaskheli
13	Raise Khaskheli	Labour	Goth Jummah Khaskheli
14	Mehmood Khaskheli	Coal Mine Labour	Goth Jummah Khaskheli
15	Rasool Baksh	Unemployed	Goth Jummah Khaskheli
16	Karam Khan	Coal Miner	Goth Arbab Bhai Khan
17	Allah Dimna	Labour	Goth Arbab Bhai Khan
18	Muhammad Yousaf	Labour	Goth Arbab Bhai Khan
19	Mir Muhammad	Coal Miner	Goth Dhani baksh Brohi
20	Raja Brohi	Labour	Goth Dhani baksh Brohi
21	Allah Buksh	Hotel Waiter	Goth Dhani baksh Brohi
22	Mir Hassan Brohi	Coal Miner	Goth Dhani baksh Brohi

7.2.3 Government Agencies

Stakeholders including provincial government officials, international NGOs, and related stakeholders were consulted at their offices. All the stakeholders were given maximum project information and were shown a detailed map of the area. Their concerns and suggestions are reproduced below. Attendance lists of the stakeholders consulted in the proposed project was collated and reproduced in Table 7-3. Pictures of the meetings are provided in **Annexure- XII.**

a) Environmental Protection Agency (Karachi Head Office) (Director Technical EIA/IEE)

The Karachi head office of EPA is responsible for general environment protection in the project area. A meeting was held on January, 28, 2016 with the Mr. Aashiq Hussain Langah (Director EIA) and Mr. Waris Gabool (Deputy Director Technical). The project team provided information about the proposed project site with the help of the project area map and briefed about the salient features of the project and requested that the officers express their views /suggestion and concerns of the Department. Their views concerns / suggestions are re-produced as follows;

- The social survey conducted by the social expert must have Livelihood matrix, group discussion, Priorities of locals, pear wise ranking and questionnaire. Only a questionnaire is not enough for the social survey.

- Analyse Cumulative effect on community
- Attach the following documents with IEE report
- Land Lease Document
- LOI Copy
- Laboratory test for air, noise, surface and ground water must be attached with IEE report.
- Flora and Fauna survey report must be attached with IEE report.
- Drinking water availability shall be ensured by the proponent throughout the project period.
- Project activities will support the area at large, and activities will not cause any harm.
- Removal of vegetation must be avoided, as far as possible. A planting programme should be developed in the Project Area taking care to avoid the introduction of invasive species.
- A certificate must be obtained from the sindh wildlife department to the effect that the proposed WPP area does not fall within the limits of any Protected Area notified by the Department.

b) Sindh Wild Life Department (Conservator)

A consultation meeting was held on February 02, 2016 with Mr. Ghulam Muhammad Gadani Deputy Conservator Wildlife Department at his Karachi office along with his team. The project team provided information about the proposed project site with the help of the project area map and requested the officers to identify any protected wildlife sanctuary or other concerns of the Department. A set questionnaire was also filled. During the meeting the Conservator expressed his views regarding the project and overall appreciated project activities. Their views and concerns / suggestions are re-produced as follows;

- Mr. Ghulam Muhammad Gaddani along his team identified the Keenjhar Lake as the Wildlife sanctuary and Ramsar site as nearest protected area which is located approx. 17 kilometers and he briefed about its importance and patterns of the birds during the different seasons.
- He also suggested that the Project provide the basic facilitates to the communities like School, clean drinking water and sanitation etc.

c) Sindh Forest Department (Karachi Office)

A consultation meeting was held on January 26, 2016 with Divisional Forest Officer Mr. Shahzad Sadiq Gill, Range Forest Officer Mr. Tahir Latif, Range Forest Officer Mr. Raja Karim and Sub.Division Forest Officer Mr. Rab Dino Khatti at his Karachi office along with his team. The project team provided information about the proposed project site with the help of the project area map and requested the officers to identify any protected wildlife sanctuary or

other concerns of the Department. During the meeting the forest officers expressed his views regarding the project and overall appreciated project activities. They do not have any issue / objection with the project in Jhimpir. As they know that this is the barren land and there is very sparse vegetation their only the concern was, the fact that the Euphorbia (Tree species) is very common in that area, and the Project should minimize its removal. The Department has created some water conservation ponds in the area. These get filled with water during heavy rains and are used by the local people and the livestock for drinking purposes. These should be safeguarded during the Project activities.

7.2.4 Non-Governmental Organizations

A number of NGO's, who are highly involved in the protection of wildlife and nature conservation, were consulted concerning the proposed Project.

a) International Union for Conservation Nature IUCN

A consultation meeting was held on January 28, 2016 with Mr. Muhammad Tahir Qureshi Senior Coastal Ecosystem Advisor and Mr. Kamran Ahmad Naqvi Urban Specialist Technical at IUCN Karachi Office. RE2 team provided information about the proposed project site with the help of the project area map and requested the experts to share their views or other concerns of the IUCN as expert. A set of questionnaires was also completed. During the meeting Mr. Qureshi and Mr. Kamran expressed their reservation regarding the project. Their views and concerns / suggestions are re-produced as follows;

- Raised concern about mortality of birds and said that project is located near birds flying route.
- Raised concern about the noise pollution by wind turbines and were concerned that it may affect local norms and modify the bird's habitats in that area. They seemed reassured when informed that a detailed study for noise pollution has already been conducted and incorporated in our IEE report.
- Employment opportunities should be provided and locals must be given preference.
- Mr. Qureshi said that sustainable development of the area should be a goal.

b) WWF (World Wide Fund)

A consultation meeting was held on January 22, 2016 with Senior Director WWF-Pakistan Mr. Rab Nawaz and Technical Advisor WWF and Ex. DG Marine Fisheries department Mr.

Mohammad Moazzam Khan. RE2 team provided information about the proposed project site with the help of the project area map and requested the experts to share their views / concerns /suggestions as the expert conservationist. Mr. Rab Nawaz and his team supported and appreciated the project activities; they do not have any objections / issues and are well satisfied with the green energy project and appreciated the fact that (RE2) consulted with all the concerned environmental departments.

c) List of Public and NGO Sector Stakeholder Consulted

A number of stakeholders in addition to the general public, were also consulted (Table- 7-3)

Table 7-2 List of Public and NGO Sector Stakeholders

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Aashiq Hussain Langah	Sindh EPA	Director (EIA)
Mr. Waris Gabool	Sindh EPA	Deputy Director Technical
Mr. Ghulam Muhammad Gadani	Sindh Wildlife Department	Deputy Conservator Wildlife
Mr. Tahir Qureshi	IUCN	Senior Coastal Ecosystem Advisor
Mr. Kamran Ahmad Naqvi	IUCN	Urban Specialist
Muhammad Moazzam Khan	WWF	Technical Advisor and Ex. DG Marine Fisheries department
Mr. Rab Nawaz	WWF	Senior Director
Mr. Shahzad Sadiq Gill	Sindh Forest department	Divisional Forest Officer
Mr. Tahir Latif	Sindh Forest department	Range Forest Officer
Mr. Raja Karim	Sindh Forest department	Range Forest Officer
Mr. Rab Dino Khatti	Sindh Forest department	Sub. Division Forest Officer

Mitigation Measures:

The following mitigation measures have been suggested.

1. Disturbance to the habitat of the Indian spiny tailed Lizard be minimized controlled.
2. As far as possible, the burrows/ holes of the lizard be safeguarded against any developmental activity. The animals be specially protected during the construction phase.
3. Hunting, feeding or harassment of wildlife be strictly prohibited during the entire course of operation.
4. Vegetation clears and land uptake during the operation be minimized.
5. Development of new access tracks during operations be minimized.
6. Routes involving minimum clearing of vegetation be selected.
7. Operation must avoid disturbing live bird nests and small mammal and reptile holes.
8. Food wastes not to be disposed off in the open. Food wastes collected in waste segregation unit be disposed off according to waste disposal procedure on a regular and strict basis.
9. Night work during construction be prohibited; night travelling not be allowed unless absolutely necessary.
10. All mitigations related to minimizing noise be adhered to.
11. Construction work near areas which show small mammal and reptile populations should commence after a soft start up and be randomly monitored.
12. Vehicle speeds on access road be controlled to avoid incidental mortalities of reptiles. Any such incident be reported and vehicle speeds be randomly checked.
13. Movement of all project personnel be restricted to work areas.
14. Movement of project vehicles be restricted only to the project access road or to routes approved.

Conclusion

It is assessed that the impacts due to construction and operation activities of the project will be moderate. The species or their habitats will not be affected significantly, as there are no critical wildlife habitats in the Project Area. Moreover, the movement and behavior of migratory birds will not be much affected, as the site in not located on the main water birds flyway.

SECTION 8

ENVIRONMENT MANAGEMENT PLAN

8 ENVIRONMENT MANAGEMENT PLAN

8.1 PURPOSE AND OBJECTIVE OF EMP

The purpose of Environmental Management Plan (EMP) is to provide a summary of the predicted impacts associated, mitigating measures and monitoring actions so as to minimize potential negative impacts and enhance positive impacts from the Project. The EMP will provide a guide (almost checklist) for the main stakeholders, namely the owner, contractor and operator of the Wind Power Project, on what mitigating actions need to be taken and where and when they are needed. It will thus help to improve the likelihood that adverse impacts are mitigated, project benefits are showcased, and an environmentally beneficial standards of best practice is provided to all those involved. In particular, the EMP:

- Defines roles and responsibilities for those involved in the implementation of the EMP and identifies areas where these roles and responsibilities can be shared with other stakeholders
- Define the implementation mechanism for the mitigation measures identified during the present study.
- Provides concise instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact, making these legally binding through their inclusion in contract specifications
- Defines the requirements for communication, documentation, training, management and implementation of the mitigating measures; and,
- Specifies actions required to assess compliance with and effectiveness of the mitigation measures through compliance and effects monitoring mechanism, defined in the EMP's two action tables.

8.2 COMPONENT OF EMP

The EMP consists of the following:

- Institutional Arrangements
- Mitigation and Monitoring plan
- Grievance Redressing Mechanism
- Reports and Documentation
- Environmental and social trainings
- Public disclosure requirements
- Budgetary estimates for EMP implementation

All the components of EMP are discussed from Sections 8.3 to 8.9

8.3 INSTITUTIONAL ARRANGEMENT

8.3.1 PROJECT DEVELOPER

The Project Developer (i.e. SF) is the 'owner' of the project and as such is responsible for ensuring that the conditions of the environmental authorization issued in terms of Sindh Environmental Protection Act, 2014 (should the project receive such authorization) are fully satisfied, as well as ensuring that another necessary permits or licenses are obtained and complied with. It is expected that the Project Developer will appoint the contractor, and the consultant.

Shaheen Foundation, Pakistan Air Force (SF, PAF) will establish an Environment & Social Management Cell (ESMC) at Corporate and site level, headed by a Project Director to be responsible for day-to-day implementation of the Project. Shaheen Foundation, PAF is responsible for undertaking the Project in accordance with the Environmental Impact Assessment (EIA) and implementing the Environmental and Social Management Plan, which will be consistent with the standards set by IFC and World Bank Group.

The ESMC is responsible for coordinating and implementing all environmental and social activities. During Project implementation, the ESMC will be responsible for reflecting the occurrence of new and significant impacts resulting from Project activities and integrating sound mitigation measures into the EMP. The ESMC includes a safeguard specialist and supporting staff, together forming the Environmental and Social Unit, appointed by SF to look after environmental, social and safety issues. The ESMC will be empowered to implement safeguard planning and monitor implementation.

The safeguard specialist provides guidance to the Project Manager and his staff to adopt environmental good practices while implementing the Project. The safeguard specialist is

responsible for implementing safeguard issues associated with the Project through a site team composed of Shaheen Foundation PAF (SF, PAF) site staff and the contractor's staff, to be assigned by the ESMC as necessary.

The duties of the Environmental and Social Unit of the ESMC at the corporate level are to:

- Monitor the implementation of mitigation measures during construction and operation phases of the Project.
- Prepare suitable environmental management reports at various sites.
- Advise and coordinate field unit activity towards effective environment management.
- Prepare environment health and safety manual for the operation of transmission lines/substations.
- Advise during Project planning/design and cells on environmental and social issues while route selection of the alignment at the planning/design stage to avoid negative environmental impact.
- Provide training and awareness on environmental and social issues related to power transmission Projects to the Project/contract staff.

The duties of the Environmental and Social Unit at the site level are to:

- Implement the environment policy guidelines and environmental best practices at the sites.
- Advise and coordinate the contractor(s) activity towards effective environment management.
- Implement environment and safety manual.
- Carry out environmental and social survey in conjunction with the Project planning cell while route selection of the alignment at the planning stage to avoid negative environmental impact.
- Make the contractor staff aware of environmental and social issues so that EMP could be managed effectively.

8.3.2 Supervision Consultant (RE)

The supervision consultant / Project Monitoring Consultant (PMC) (RE) has qualified environment health and safety staff on board to which will be responsible for overseeing the implementation of the EMP during the construction.

8.3.3 Lead Contractor

The contractor will be responsible for the following:

- **Overall construction program, project delivery and quality control for the construction for the wind project.**
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction.
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment.
- Ensuring that each subcontractor employ an Environmental Officer to monitor and report on the daily activities on-site during the construction period
- Ensuring that safe, environmentally acceptable working methods and best practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely.
- Meeting on site with the Environmental Officer prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Ensuring that all appointed contractors and sub-contractors are aware of this
- Environmental Management Plan and their responsibilities in relation to the plan;
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the Environmental Management Plan, to the satisfaction of the Environmental Officer.

At the time of preparing this draft EMP, the appointment of a lead contractor has not been made and will depend on the project proceeding to the construction phase.

The Framework of Environment and Social Management Cell are shown in **Figure8.1** and Key responsibilities of ESMC are summarized in **Table7.1.**

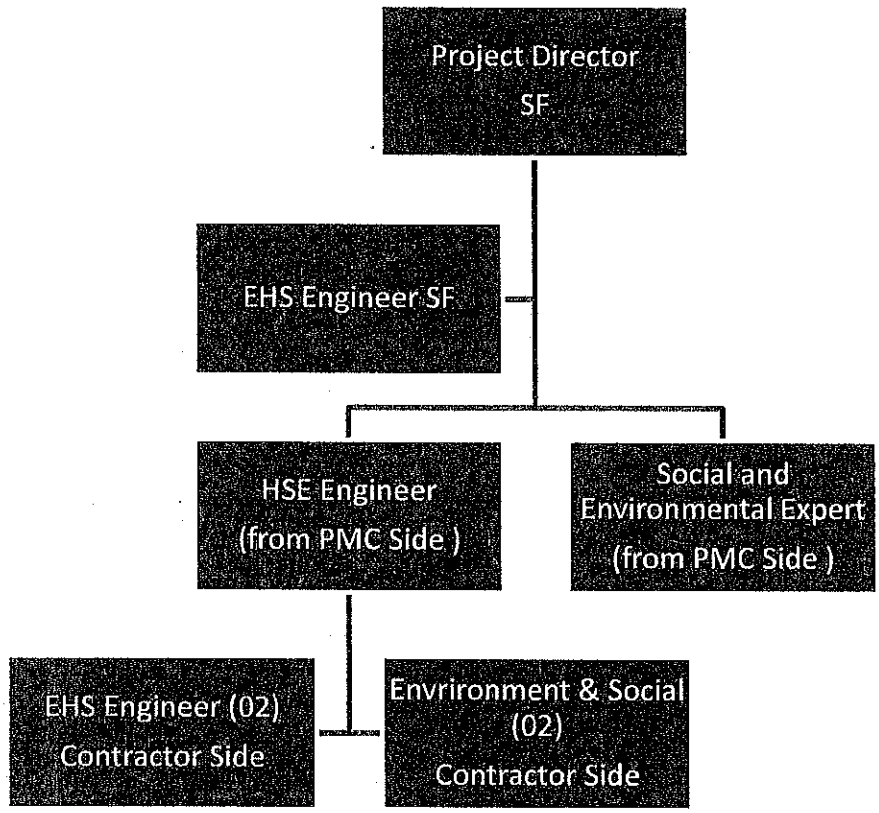


Figure 8.1: Environment and Social Management Cell (ESMC)

8.4 MITIGATION & MONITORING PLAN

The mitigation plan is a key component of the EMP. It lists all the potential effects of each activity of the Project and their associated mitigation measures identified in the IEE.

For each Project activity, the following information is presented in the plan:

- A listing of the potential impact associated with that Project activity
- A comprehensive listing of mitigation measures (actions)
- The person(s) responsible for ensuring the full implementation of the action
- The person(s) responsible for monitoring the action
- The timing of the implementation of the action to ensure that the objectives of mitigation are fully met
- It should be emphasized that the mitigation measures will have to be translated into environmental as well as social requirements and specifications to be made part of the contracts for the construction activities, with legal binding.

The objective of the environmental and social monitoring during the various phases of the proposed Project will be as follows:

- Ensuring that the mitigation measures included in the IEE are being implemented completely
- Ensuring the effectiveness of the mitigation measures in minimizing the Project's impacts on social and environmental resources

To achieve these objectives, the Environmental Management and Monitoring Plan (EMMP) for construction and operation phase is given in Annexure-I.

8.5 GRIEVANCE REDRESSAL MECHANISM

Environmental and social grievances will be handled in accordance to the Project Grievance Redress Mechanism. Open and transparent dialogue will be maintained with Project affected persons as and when needed, in accordance with ADB safeguard policy requirements. The Grievance Redress Mechanism (GRM) for the Project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism will remain active throughout the life-cycle of the Project.

Shaheen Foundation shall have a standard mechanism to:

i. inform the affected people (AP) about GRM and its functions;
ii. set the procedures and mechanisms adopted for making the complaints;
iii. support the complainants in communicating their grievance and attending the GRM meetings; and
iv. Implement compliance with a GRMs' decision, its monitoring and communication to the people.

Under the GRM, the ESMC will maintain the Social Complaint Register (SCR) at the sites to document all complaints received from the local communities or any other stakeholder. The information recorded in the Register will include the date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

As soon as a complaint is received, the ESMC will determine the remedial action. If required, consultations will also be undertaken with the contractor's site manager. Once the remedial action is decided, implementation responsibility as well as schedule will be determined.

The proposed remedial action will be documented in the SCR, with complete details (by whom and by when). The proposed remedial action will be shared with the complainant. Similarly, the actual action taken will also be documented in a register and shared with the complainant. The complainant's views on the remedial action taken will also be documented in the register.

The SCR will be reviewed during the fortnightly meetings at the site during the Project, and the action items discussed. The progress on the remedial actions will also be reviewed during the meetings.

8.6 REPORTS AND DOCUMENTATION

The ESMC will produce periodic reports based on the information collected. These will include reports for:

- Project initiation meetings with each contractor
- Non-compliances
- Effects monitoring
- Summary of SCR under GRM

The reports will also be made available for review, to the external monitoring teams, and to any other stakeholders who visit the site. In addition, the Social and Environmental Monitoring expert will prepare reports for each monitoring visit.

At the end of the Construction Phase, a final report will also be prepared.

8.7 ENVIRONMENTAL AND SOCIAL TRAININGS

Environmental and social trainings will help to ensure that the requirements of the EIA and EMP are clearly understood and followed by all Project personnel throughout the Project period. The primary responsibility for providing training to all Project personnel will be that of the ESMC.

The environmental and social training program will be finalized before the commencement of the Project, during the detailed design phase. The training will be provided to the SF staff, the construction contractors, and other staff engaged for the Project. Training will cover all staff levels, ranging from the management and supervisory to the skilled and unskilled personnel. The scope of the trainings will cover general environmental awareness and the requirements of the EIA and the EMP, with special emphasis on sensitizing the Project staff to the environmental and social aspects of the area.

During the O&M phase of the Project, these trainings will continue to be conducted by ESMC for all relevant staff of the Company.

8.8 PUBLIC DISCLOSURE REQUIREMENTS

Shaheen Foundation will disclose this IEE and EMP to all the stakeholders before the commencement of the proposed Project. The EIA report will be made available to the stakeholders at the sites designated by the EPA, in accordance with the national legislation (PEPA 1997) and Sindh EPA Act 2014. In addition, the executive summary of the IEE will be translated into the local (Urdu / Sindhi) languages (if necessary), and made available to the affected communities (and also kept at the Project site). This will ensure that the local communities are aware of the Project, its key impacts, the mitigation measures and the implementation mechanism. In addition, the Executive Summary will be disclosed through the SF official website.

8.9 COST ESTIMATES FOR EMP IMPLEMENTATION

The cost of implementation of the environmental safeguards includes both the direct cost of the mitigation measures and the costs of monitoring the execution of the EMP such as laboratory costs and monitoring visits, training costs, etc. Contractor cost to be included in the BOQ items, while SF cost shows the environmental monitoring / training cost that will be borne by the SF through the EMSC. Detailed cost is shown in Annexure –II.

SECTION 9

INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

9 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

The field studies were conducted for preliminary scoping, survey, and assessment activities and in order to coordinate the field survey and analysis.

A questionnaire was developed to assess the general concerns of the local residents of nearby villages in respect of this Project. Mr. Umair Ali Khilji of Pakistan Alternative Energy Services himself filled the questionnaires after directing the questions to the native people. Snapshots of consultative meetings are also attached in **Annexure-XI.**

During the construction phase, residents of the local areas selected representatives, local councilors, and informal community leaders, including members of NGOs, will be asked to state their current perceptions of priorities for improvements to the urban environmental infrastructure in their areas and the likely impacts of the Project during construction and operation phases.

The stakeholder consultation is a continuous process, and should be maintained throughout the Project. The consultations carried out during the present IEE and reported in this Chapter are essentially a first step in this process.

During the present IEE, the stakeholder analysis was carried out to identify relevant stakeholders on the basis of their ability to influence the Project or their vulnerability to be negatively impacted from it. This approach ensured that no relevant groups were excluded from the consultations, and appropriate engagement strategies were developed for each stakeholder.

During the stakeholder consultations carried out in the communities near the proposed site, the participants were first provided the salient information about the proposed Project.

Since the Project would not directly affect them, the villagers generally did not have any apprehension or reservation about the Project. On the contrary, they expected that the Project would bring employment and small business/trade opportunities for the local population.

SECTION 10

CONCLUSION AND RECOMMENDATION

10 FINDING AND RECOMMENDATION

Prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes. Since proposed land is covered with shrubs, thus there is no need for removal of any significant vegetation for the construction of the wind power Project.

The proposed Project will have number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significant improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- The Project Area does not fall under any sensitive, protected area.
- No threatened / Near-Threatened species of wildlife was recorded in the Project Area.

- There is negligible removal of trees for the Project, which is the main positive impact to the proposed Project area.

- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed Project with mitigations being properly taken care.

Proper GRM will have to be implemented by Shaheen foundation to overcome public inconvenience during the proposed Project activities.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs. Adequate provisions are being made by Shaheen Foundation (SF) to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by Shaheen Foundation (SF), no major adverse impacts are expected. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people. At least, one year bird monitoring is recommended to compile substantive data about the impacts of wind power plants on the birds and other important wildlife of the area.

The environment and social impact associated with the Project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main Project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the Project is expected to have a less "environmental footprint". No endangered or protected species of flora or fauna are reported near Project sites.

The project has been discussed with local people, government officials and NGO. The consultations elicited general support for the project. There were no serious environmental

issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust and bird mortality.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed Project has Ltd adverse environmental and social impact which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

This IEE study concludes that the proposed Wind project will not lead to significant adverse environmental and social impacts of such nature or magnitude that would require a more detailed report in the form of an EIA. Additionally careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.