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167,304

The Registrar
National Electric Power Regulatory Authority
G-5/1, Islamabad

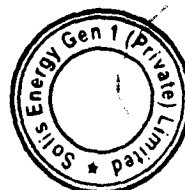
Subject: Application for Generation License

I, Farman Ahmed Khan Lodhi, Chief Executive Officer, being the duly authorized representative of SOLIS ENERGY GEN 1 (PRIVATE) LIMITED by virtue of BOARD RESOLUTION dated March 26th, 2019, hereby apply to National Electric Power Regulatory Authority for the grant of a Generation License to SOLIS ENERGY GEN 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 PAY ORDER in the sum of Rupees 167, 304, being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Date: 08-April-2019



Farman Ahmed Khan Lodhi
Chief Executive Officer

Solis Gen 1 Pvt. Ltd.
C-18, Block-4, Clifton,
Karachi-Pakistan

T +92(21)3587 6531
F +92(21)3587 6621



**Extract of the Board of Directors Resolution
Held on March 26, 2019**


At a meeting of Directors of Solis Energy Gen 1 (Private) Limited held at the Company's registered office at C-18, Block 4, Clifton, Karachi on the March 26, 2019 the Board of Directors, after discussion and with consents of all directors and in compliance of the provision of the Companies Act 2017 the following resolution passed:

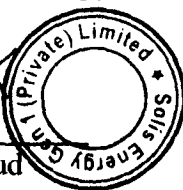
"RESOLVED that the Company shall proceed with all acts necessary to comply with the legal and regulatory requirements in relation to its business objects and activities.

FURTHER RESOLVED that Chief Executive Officer Mr. Farman Ahmed Khan Lodhi has been duly authorized in file; (i) an application for grant of Generation License; (ii) any other clarification submission application petition or document in support thereof; (iii) to make any oral or written representations on behalf of the Company before the National Electric Power Regulatory Authority and any other body, organization, department judicial and quasi-judicial body in relation to the aforesaid filings and to do all other acts, deeds, things and matters as may be deemed expedient in giving effect to the aforesaid resolution.

FURTHER RESOLVED that Chief Executive Officer may further delegate the aforesaid powers, in writing, to one or more persons, as deemed expedient from time to time."

Certified True Copy


Amir Mahmud
Director



Dated: March 26, 2019

A049437



SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

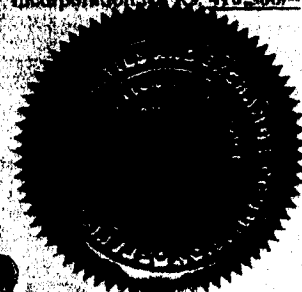
[Under section 16 of the Companies Act, 2017 (XIX of 2017)]

Corporate Universal Identification No. 9129301

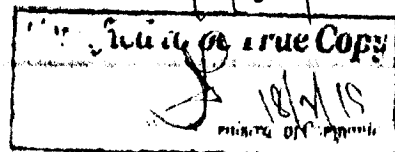
I hereby certify that SOLIS ENERGY GEN 1 (PRIVATE) LIMITED is
this day incorporated under the Companies Act, 2017 (XIX of 2017) and that the
company is limited by shares.

Given under my hand at Karachi this Thirtieth day of January, Two
Thousand and Nineteen

Incorporation fee Rs. 410,500/-



(Muhammad Naeem Khan)
Additional Registrar/Incharge CRO



- (a) engage in any of the business mentioned in sub-clause (3) above or any unlawful operation;
- (b) launch multi-level marketing (MLM), Pyramid and Ponzi Schemes, or other related activities/businesses or any lottery business;
- (c) engage in any of the permissible business unless the requisite approval, permission, consent or licence is obtained from competent authority as may be required under any law for the time being in force.

IV. The liability of the members is limited.

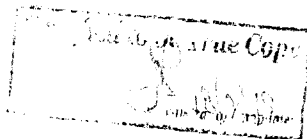
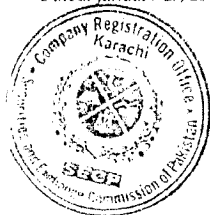
V. The Authorized Capital of the Company is Rs. 100,000,000 (Rupees One Hundred Million only) divided into 10,000,000 (Ten Million) ordinary shares of Rs. 10 (Rupees Ten only) each with powers to increase or reduce the capital, to subdivide or otherwise reorganize the share in the capital or increase into several classes and to attach thereto such preferential, special qualified or deferred rights, privileges or conditions as may be determined by or in accordance with the regulations of the Company and the provision of the Companies Act, 2017 and to vary, modify and abrogate any such rights privileges and conditions.



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

S. No.	Present & Former Name with Father's/Husband's Name in Full & Surname /NIC No. or Passport No. in case of Foreign National	Present/ Former Nationality	Occupation/ Residential Address in Full	No. of Ordinary Shares taken by each subscriber	Signature
01.	MR. ABDUL BASIT TOLA S/o. MR. ABDURRAZZAK TOLA CNIC No. 42301-1106437-9	PAKISTAN	BUSINESS EXECUTIVE PLOT # 508, HAT # 04, MUHAMMAD RESIDENCY, SHIKARPUR COLONY, JAMSHEDPUR ARTHRS, KARACHI	100 (One Hundred Shares Only)	
02.	MS. AMIR MAHMUD S/o. MR. SHAUKAT MAHMUD CNIC No. 42101-1817342-1	PAKISTAN	BUSINESS EXECUTIVE 116-D-1 COMMERCIAL AVENUE, PHASE VI, DHA KARACHI	100 (One Hundred Shares Only)	
03.	MR. FARMAN AHMED KHAN LODHI S/o. MR. MUNIB AHMED KHAN LODHI CNIC No. 42101-7436364-3	PAKISTAN	BUSINESS EXECUTIVE House No. 164-II, Street No. 18, Khayaban-e-Qasim Phase VIII, DHA, Karachi	100 (One Hundred Shares Only)	
Total				300 (Three Hundred Shares Only)	

Dated, January 28, 2019



THE COMPANIES ACT, 2017
(Company Limited by Shares)

ARTICLES OF ASSOCIATION
OF



SOLIS ENERGY GEN 1 (PRIVATE) LIMITED

PRELIMINARY

1. (1) In these regulations-
 - a. "section" means section of the Act;
 - b. "the Act" means the Companies Act, 2017; and
 - c. "the seal" means the common seal or official seal of the company as the case may be.

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

BUSINESS

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

SHARES

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

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

4. The company shall not be bound to issue more than one certificate in respect of a share or shares in the physical form, held jointly by several persons and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery to all.
5. If a share certificate in physical form is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one hundred rupees, and on such terms, if any, as to evidence and indemnity and payment of expenses incurred by the company in investigating title as the directors think fit.

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

TRANSFER AND TRANSMISSION OF SHARES

7. The instrument of transfer of any share in physical form in the company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respect thereof.
8. Shares in physical form in the company shall be transferred in the following form, or in any usual or common form which the directors shall approve: -

Form for Transfer of Shares (First Schedule to the Companies Act, 2017)

I..... s/or/o..... (hereinafter called "the transferor") in consideration of the sum of rupees paid to me by..... s/or/o..... (hereinafter called "the transferee"), do hereby transfer to the said transferee.....the share (or shares) with distinctive numbers fromto.....inclusive, in the SOLIS ENERGY GEN 1 (PRIVATE) LIMITED, to hold unto the said transferee, his executors, administrators and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share (or shares) subject to the conditions aforesaid. As witness our hands this.....day of....., 20....

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

Signature.....
Transferee
Full Name, Father's / Husband's Name
CNIC Number (in case of foreigner,
Passport Number)
Nationality
Occupation and usual Residential Address
Cell number
Landline number, if any
Email address

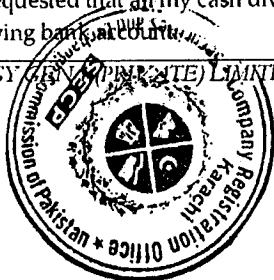
Witness 1:
Signature.....date.....
Name, CNIC Number and Full Address

Witness 2:
Signature.....date.....
Name, CNIC Number and Full Address

Bank Account Details of Transferee for Payment of Cash Dividend (Mandatory in case of a listed company or optional for any other company)

It is requested that all my cash dividend amounts declared by the company, may be credited into the following bank account:

SOLIS ENERGY GEN 1 (PRIVATE) LIMITED



Title of Bank Account	
Bank Account Number	
Bank's Name	
Branch Name and Address	

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

.....
Signature of the Transferee(s)

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

- A fee not exceeding fifty rupees as may be determined by the directors is paid to the company in respect thereof; and
- The duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the directors may reasonably require to show the right of the transferor to make the transfer.

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

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

TRANSMISSION OF SHARES

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



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11. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by lawful award, as the case may be, in favour of the successors to the extent of their interests and their names shall be entered to the register of members.
 12. A person may on acquiring interest in a company as member, represented by shares, at any time after acquisition of such interest deposit with the company a nomination conferring on a person, being the relatives of the member, namely, a spouse, father, mother, brother, sister and son or daughter, the right to protect the interest of the legal heirs in the shares of the deceased in the event of his death, as a trustee and to facilitate the transfer of shares to the legal heirs of the deceased subject to succession to be determined under the Islamic law of inheritance and in case of non-Muslim members, as per their respective law.
 13. The person nominated under regulation 12 shall, after the death of the member, be deemed as a member of company till the shares are transferred to the legal heirs and if the deceased was a director of the company, not being a listed company, the nominee shall also act as director of the company to protect the interest of the legal heirs.
 14. A person to be deemed as a member under regulation 11, 12 and 13 to a share by reason of the death or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share and exercise any right conferred by membership in relation to meetings of the company.

ALTERATION OF CAPITAL

15. The company may, by special resolution-
 - (a) increase its authorized capital by such amount as it thinks expedient;
 - (b) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares;
 - (c) sub-divide its shares, or any of them, into shares of smaller amount than is fixed by the memorandum;
 - (d) Cancel shares which, at the date of the passing of the resolution in that behalf, have not been taken or agreed to be taken by any person, and diminish the amount of its share capital by the amount of the share so cancelled.
16. Subject to the provisions of the Act, all new shares shall at the first instance be offered to such persons as at the date of the offer are entitled to such issue in proportion, as nearly as the circumstances admit, to the amount of the existing shares to which they are entitled. The offer shall be made by letter of offer specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will deem to be declined, and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the directors may dispose of the same in such manner as they think most beneficial to the company. The directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the directors, be conveniently offered under this regulation.
17. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.

SOLIS ENERGY GEN 1 (PRIVATE) LIMITED



18. The company may, by special resolution-

- a. consolidate and divide its share capital into shares of larger amount than its existing shares;
- b. sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the memorandum of association, subject, nevertheless, to the provisions of section 85;
- c. Cancel any shares which, at the date of the passing of the resolution, have not been taken or agreed to be taken by any person.

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

GENERAL MEETINGS

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

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

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

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

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

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

NOTICE AND PROCEEDINGS OF GENERAL MEETINGS

25. Twenty-one days' notice at the least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour



of meeting and, in case of special business, the general nature of that business, shall be given in manner provided by the Act for the general meeting, to such persons as are, under the Act or the regulations of the company, entitled to receive such notice from the company; but the accidental omission to give notice to, or the non-receipt of notice by, any member shall not invalidate the proceedings at any general meeting.

26. All the business transacted at a general meeting shall be deemed special other than the business stated in sub-section (2) of section 134 namely; the consideration of financial statements and the reports of the board and auditors, the declaration of any dividend, the election and appointment of directors in place of those retiring, and the appointment of the auditors and fixing of their remuneration.
27. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business. The quorum of the general meeting shall be two members present personally, or through video-link who represent not less than twenty-five percent of the total voting power, either of their own account or as proxies.
28. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved; in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and, if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than two, shall be a quorum.
29. The chairman of the board of directors, if any, shall preside as chairman at every general meeting of the company, but if there is no such chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as chairman, any one of the directors present may be elected to be chairman, and if none of the directors is present, or willing to act as chairman, the members present shall choose one of their number to be chairman.
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 but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When a meeting is adjourned for fifteen days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.
31. At any general meeting a resolution put to the vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.
32. At any general meeting, the company shall transact such businesses as may be notified by the Commission, only through postal ballot.
33. A poll may be demanded only in accordance with the provisions of section 143.

SOLIS ENERGY GEN I (PRIVATE) LIMITED



34. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in sections 144 and 145 and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.
35. A poll demanded on the election of chairman or on a question of adjournment shall be taken at once.
36. In the case of an equality of votes, whether on a show of hands or on a poll, the chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.
37. Except for the businesses specified under sub-section (2) of section 134 to be conducted in the annual general meeting, the members may pass a resolution (ordinary or special) by circulation signed by all the members for the time being entitled to receive notice of a meeting. The resolution by circulation shall be deemed to be passed on the date of signing by the last of the signatory member to such resolution.

VOTES OF MEMBERS

38. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of directors in which case the provisions of section 159 shall apply. On a poll every member shall have voting rights as laid down in section 134.
39. In case of joint-holders, the vote of the senior who tenders a vote, whether in person or by proxy or through video-link shall be accepted to the exclusion of the votes of the other joint-holders; and for this purpose seniority shall be determined by the order in which the names stand in the register of members.
40. A member of unsound mind, or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on show of hands or on a poll or through video link, by his committee or other legal guardian, and any such committee or guardian may, on a poll, vote by proxy.
41. On a poll votes may be given either personally or through video-link, by proxy or through postal ballot:

Provided that nobody corporate shall vote by proxy as long as a resolution of its directors in accordance with the provisions of section 138 is in force.

42. (1) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorised in writing.
- (2) The instrument appointing a proxy and the power-of-attorney or other authority (if any) under which it is signed, or a notarially certified copy of that power or authority, shall be deposited at the registered office of the company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote and in default of such deposit the instrument of proxy shall not be treated as valid.



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

INDEMNITY

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



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

S. No.	Present & Former Name with Father's/Husband's Name in Full & Surname /NIC No. or Passport No. in case of Foreign National	Present/ Former Nationality	Occupation/ Residential Address in Full	No. of Ordinary Shares taken by each subscriber	Signature
01.	MR. ABDUL BASIT TOLA S/o. MR. ABDUR RAZZAK TOLA CNIC No. 42301-1106437-9	PAKISTAN	BUSINESS EXECUTIVE PLOT # 508. FLAT # G-1. MUHAMMAD RESIDENCY. SHIKARPUR COLONY. JAMSHED QUARTERS. KARACHI	100 (One Hundred Shares Only)	
02.	MS. AMIR MAHMUD S/o. MR. SHAUKAT MAHMUD CNIC No. 42101-1817342-1	PAKISTAN	BUSINESS EXECUTIVE 116-D/I COMMERCIAL AVENUE. PHASE VI. DHA. KARACHI.	100 (One Hundred Shares Only)	
03.	MR. FARMAN AHMED KHAN LODHI S/o. MR. MUNIB AHMED KHAN LODHI CNIC No. 42101-7436364-3	PAKISTAN	BUSINESS EXECUTIVE House No. 164/II. Street No. 18. Khayaban-e-Qasim, Phase VIII. DHA. Karachi	100 (One Hundred Shares Only)	
Total				300 (Three Hundred Shares Only)	



Dated: January 28, 2019

True Copy
18/1/19
Signature of Company

SOLIS GEN 1

PROJECT BRIEF AND PURPOSE OF THE PROJECT

POWER SELLER – SOLIS ENERGY GEN 1 PRIVATE LIMITED

Solis Energy Gen 1 (Private) Limited, a company incorporated under the laws of Pakistan and having its registered office located at C-18, Block 4, Clifton, Karachi, Pakistan (**the Company**). The Company **“Power Seller/Project Owner”** in the renewable energy business and has agreed to install, operate and maintain on the Project Sites of **Zahidjee Textile Mills (the Client)**, each of the Facilities with a collective installed capacity of 5.06 MEGAWATT peak (MWp). The Company shall sell to the Client all the electric energy / Solar Power generated by a Facility under the Take or Pay mechanism in which Client shall take all the Electricity Units delivered by each of the Facilities and pay the Electricity Unit Price to the Company. The electric energy / Solar Power generated by a Facility will be delivered to the Client for **10 years**.

POWER PURCHASER – ZAHIDJEE TEXTILE MILLS

Zahidjee Textile Mills (ZTML), incorporated under the laws of Pakistan and having its registered office located at 2-H, Jail Road, Gulberg II, Lahore, Pakistan (the **Client**). The Client is the owner of the lands, and desirous of engaging the services of **Solis Energy Gen 1 (Private) Limited** for the installation, operation and maintenance of a solar power system on an earmarked location on each of the Land to contribute energy / electricity to its textile production sites. The Client wishes to purchase all of the Electricity Units prior to use of all other power sources including the national grid and its generator.

Zahidjee Textile Mills Limited is engaged in the export of all kinds of value added fabrics and textile made-ups. The Company is also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

They have three different locations which are very much feasible for the installation of Solar PV Plant.

Site Name	Location	Geographical Coordinates
ZTML Unit 1 and 2	Lahore-Faisalabad Road, FSD	31.52 ⁰ N, 73.38 ⁰ E
ZTML Unit 4	Tandlian Wala Road, FSD	31.17 ⁰ N, 73.15 ⁰ E
ZTML Unit 8 and 9	PindiBhattian, FSD	31.65 ⁰ N, 73.20 ⁰ E

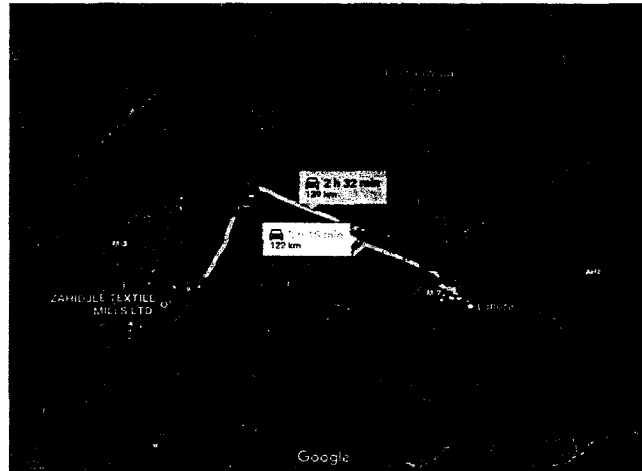
Solis Energy Solution is found to be very much suitable among different EPC contractors technically as well as financially, therefore the owner has awarded the project to Solis Energy Solutions.

- Solar PV Grid tie system with all necessary protection, instrumentation, monitoring, control and synchronizing with Grid as well as existing DG sets.
- Solar based Power Generation System, civil structures and Auxiliaries
- 400 V LV cable for interconnection the system with Distribution Board and control wires for the necessary communication and control system.
- 325 Wp PV Modules of Tier 1 Manufacturer with 16.7% efficiency.
- 50 kW Grid-Tie smart inverter with all necessary protections.
- Dual string DC Isolator/Disconnecter to isolate the DC part when required.
- LV Panel containing Energy Meter, AC Breakers and necessary indications.
- All the electrical installations and wiring for the PV System in accordance with the codes and standard.
- Since the system is neither Off-Grid nor Hybrid, switching over mechanism to backup DG Genset.

Site 1 for the project comprises of Unit 1 and 2 of ZTML. It covers an area of 6.5 acres and is located near Lahore-Faisalabad Road. The Geographical coordinates of the site are 31.52°N and 73.38°E. The site is located approximately 1240 kms from Karachi and 120 kms from Lahore. The area can be approached by Road using National Highway or Lahore-Islamabad Motorway.

SOLIS GEN 1

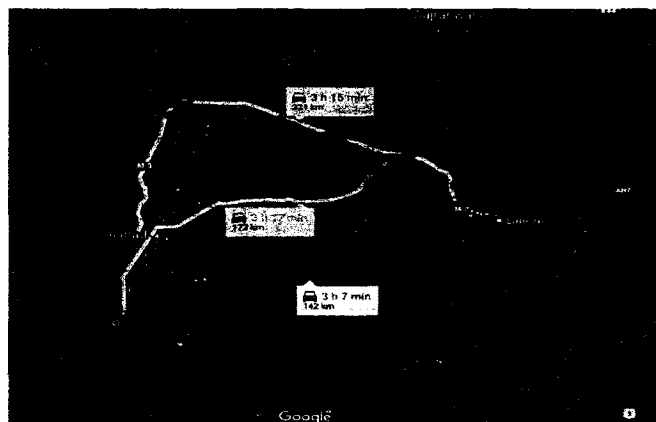
ROUTE MAP: LAHORE TO SITE 1



Site 2

Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located near Tandianwala Road, Faisalabad. The geographical coordinates of the site are 31.17°N and 73.14°E . The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

ROUTE MAP: LAHORE TO SITE 2

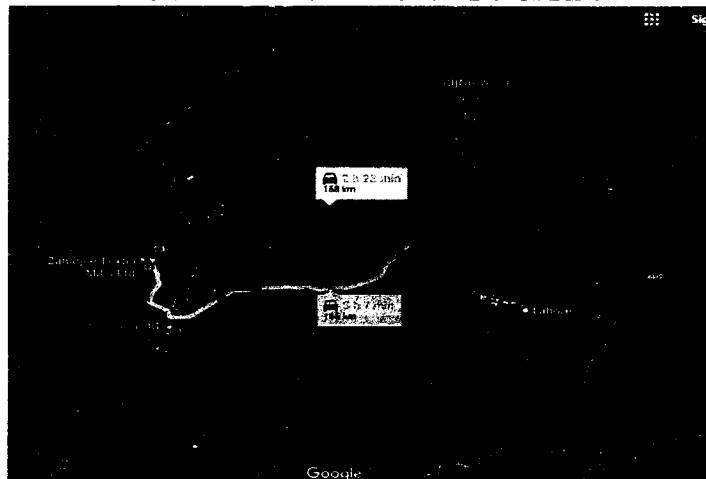


SOLIS GEN 1

Site 3

Site 3 for the Project comprises of Unit 8, 9 of ZTML. It covers an area of 7.25 acres and is located near Tandianwala Road, Faisalabad. The geographical coordinates of the site are 31.65°N and 73.20°E. The site is located approximately 1230 kms from Karachi and 160 kms from Lahore. The area can be approached by using National Highway or Lahore-Islamabad Motorway.

ROUTE MAP: LAHORE TO SITE 3



TECHNICAL DETAILS - SYSTEM COMPONENTS

S.No.	Items	Description	Quantity
Site 1			
1	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	6080
2	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	32
3	DIEF Controller	DG Set and Solar Energy Control System	1
Site 2			
4	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	1900
5	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	10
6	DIEF Controller	DG Set and Solar Energy Control System	1
Site 3			
7	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	7600
8	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	40
9	DIEF Controller	DG Set and Solar Energy Control System	1
Total			
10	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	15580
11	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	82
12	DIEF Controller	DG Set and Solar Energy Control System	3

SYSTEM DESIGN ASSUMPTIONS

- Polycrystalline 325 Wp Solar Modules with efficiency 16.7% are used in the design
- 50 kW grid connected solar inverters, 310-480 V three phase, 98.5% have been considered
- System will be synchronized with 400 V Grid as well as standby DG set.
- DC/AC Ratio of 1.235 for inverters has been considered.
- Maximum AC output of the system is assumed to be (1600 + 500 + 2000) 4100 kW
- Output of the system is based on the instantaneous irradiation value of Solar Energy
- 17 Acres area required for the installation of solar plant

ENERGY GENERATION

S.No.	Efficiency Parameters	
Site 1		
1	Capacity Utilization Factor	15.78%
2	Energy Generation Units	2.73 Million kWh
Site 2		
3	Capacity Utilization Factor	16.01%
4	Energy Generation Units	0.86 Million kWh
Site 3		
5	Capacity Utilization Factor	15.74%
6	Energy Generation Units	3.41 Million kWh
Total		
7	Capacity Utilization Factor	15.79%
8	Energy Generation Units	7 Million kWh

TECHNOLOGY USED

S.No.	Parameters		Qty
1	Technology	Solar Photovoltaic (SPV)	
2	Total System Size	5063.5 kW	
3	Solar Modules	Polycrystalline Solar Modules 325W Tier 1	15580
4	Inverter	50 kW, Grid Tie Solar Inverter	82

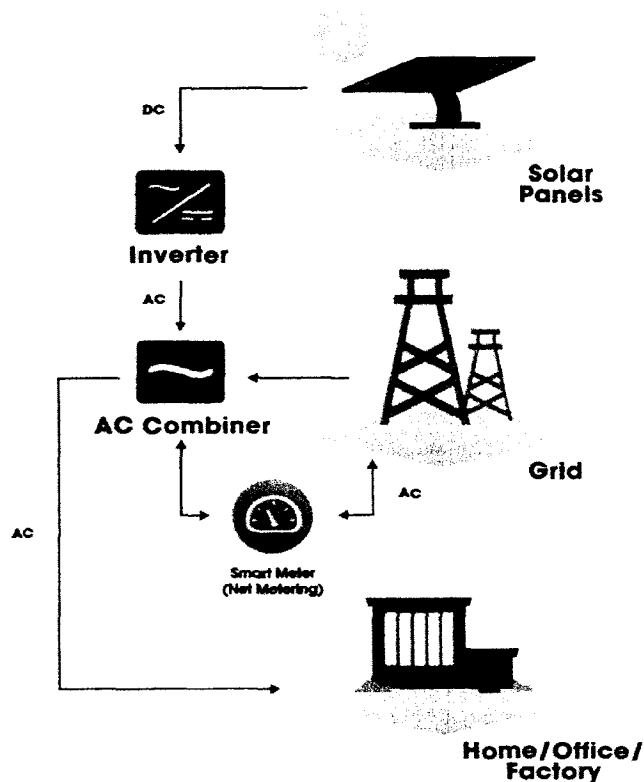
SOLIS GEN 1

POWER FLOW DIAGRAM

Block Diagram



Conceptual Diagram



TYPE, TECHNOLOGY, MODEL, TECHNICAL DETAILS AND DESIGN OF FACILITY

DESIGN DETAILS

- Polycrystalline 325 Wp Solar Modules with efficiency 16.7% are used in the design
- 50 kW grid connected solar inverters, 310-480 V three phase, 98.5% have been considered
- System will be synchronized with 400 V Grid as well as standby DG set.
- DC/AC Ratio of 1.235 for inverters has been considered.
- Maximum AC output of the system is assumed to be (1600 + 500 + 2000) 4100 kW
- Output of the system is based on the instantaneous irradiation value of Solar Energy
- 17 Acres area required for the installation of solar plant

BILL OF MATERIALS (3 SITES)

S.No.	Items	Description	Quantity
Site 1 – 1.98 MW			
1	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	6080
2	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	32
3	DIEF Controller	DG Set and Solar Energy Control System	1
Site 2 – 0.617 MW			
4	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	1900
5	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	10
6	DIEF Controller	DG Set and Solar Energy Control System	1
Site 3 – 2.47 MW			
7	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	7600
8	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	40
9	DIEF Controller	DG Set and Solar Energy Control System	1
Total			
10	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	15580
11	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	82
12	DIEF Controller	DG Set and Solar Energy Control System	3

SOLIS GEN 1

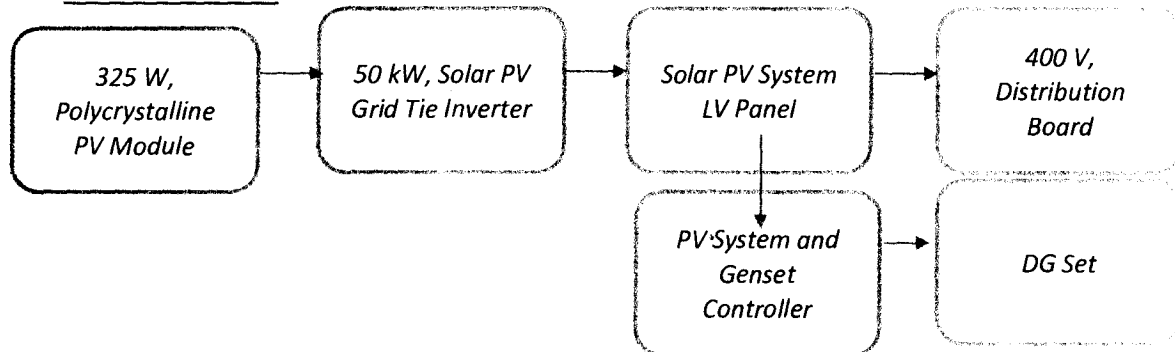
ENERGY GENERATION

S.No.	Efficiency Parameters	
Site 1 – 1.98 MW		
1	Capacity Utilization Factor	15.78%
2	Energy Generation Units	2.73 Million kWh
Site 3 – 2.47 MW		
3	Capacity Utilization Factor	16.01%
4	Energy Generation Units	0.86 Million kWh
Site 3 – 2.47 MW		
5	Capacity Utilization Factor	15.74%
6	Energy Generation Units	3.41 Million kWh
Total		
7	Capacity Utilization Factor	15.79%
8	Energy Generation Units	7 Million kWh

TECHNOLOGY USED

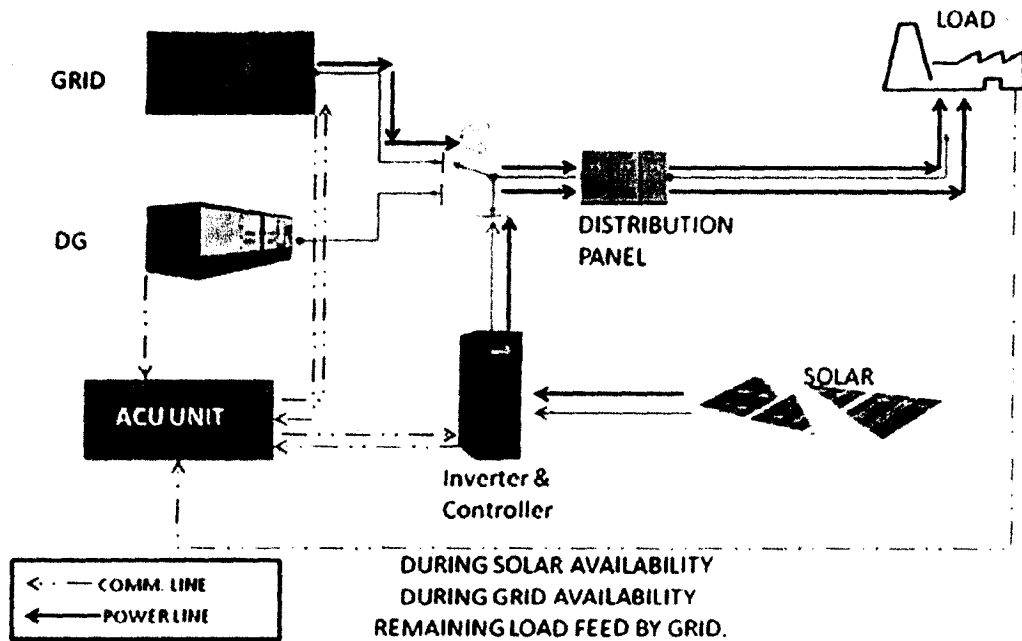
S.No.	Parameters		Qty
1	Technology	Solar Photovoltaic (SPV)	
2	Total System Size	5063.5 kW	
3	Solar Modules	Polycrystalline Solar Modules 325W Tier 1	15580
4	Inverter	50 kW, Grid Tie Solar Inverter	82

BLOCK DIAGRAM



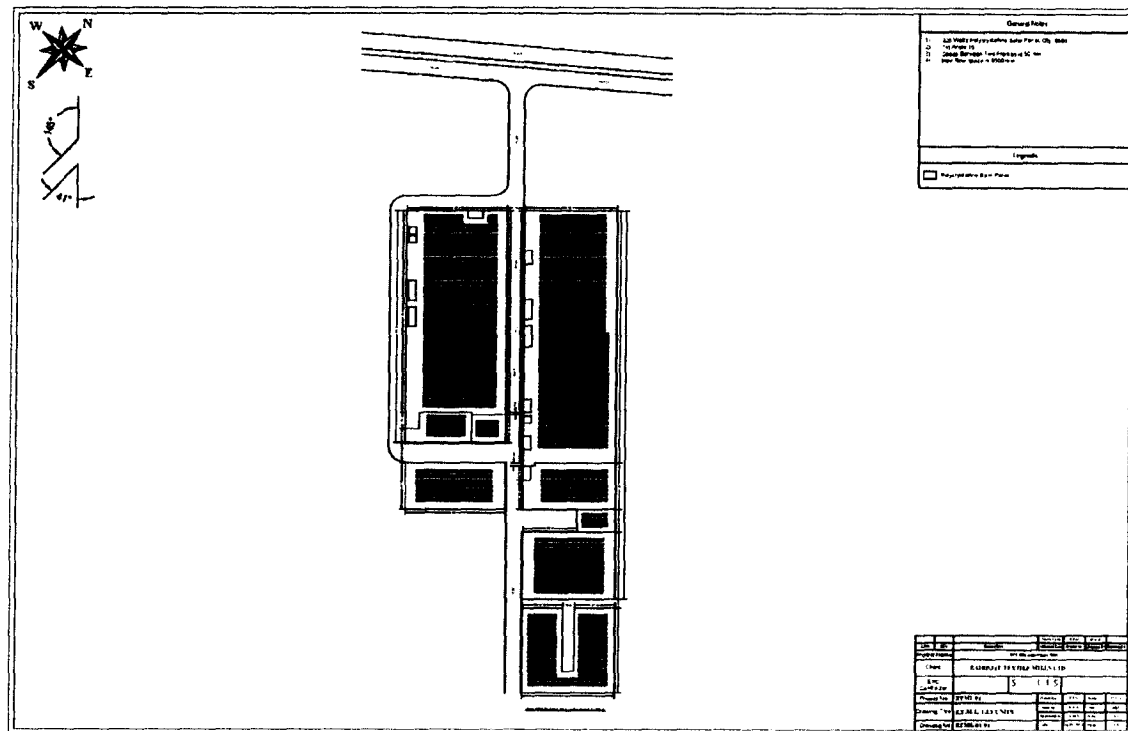
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CONCEPTUAL DESIGN



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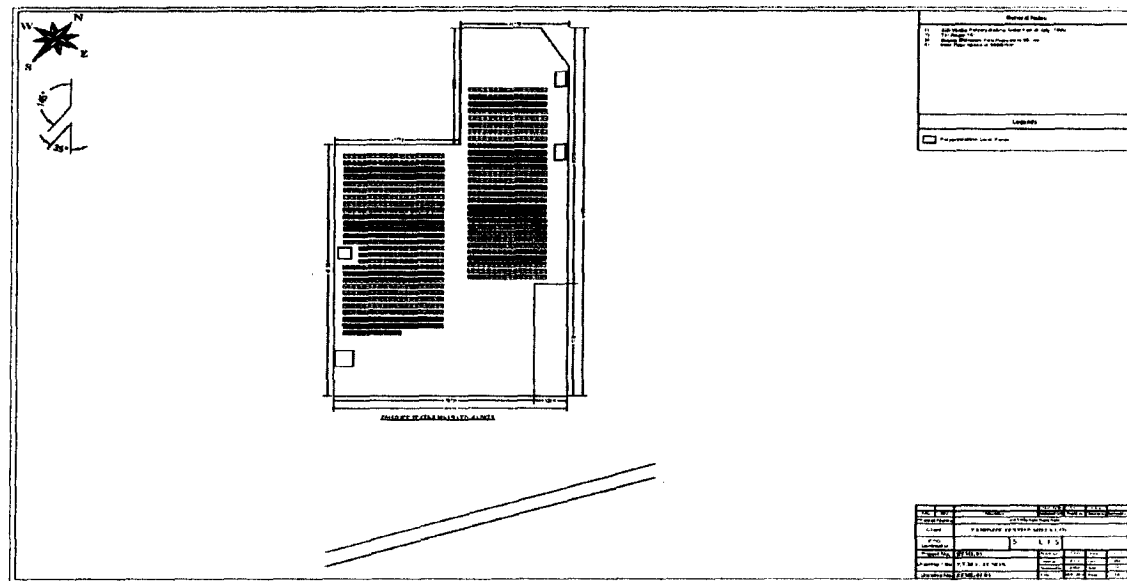
Site 1



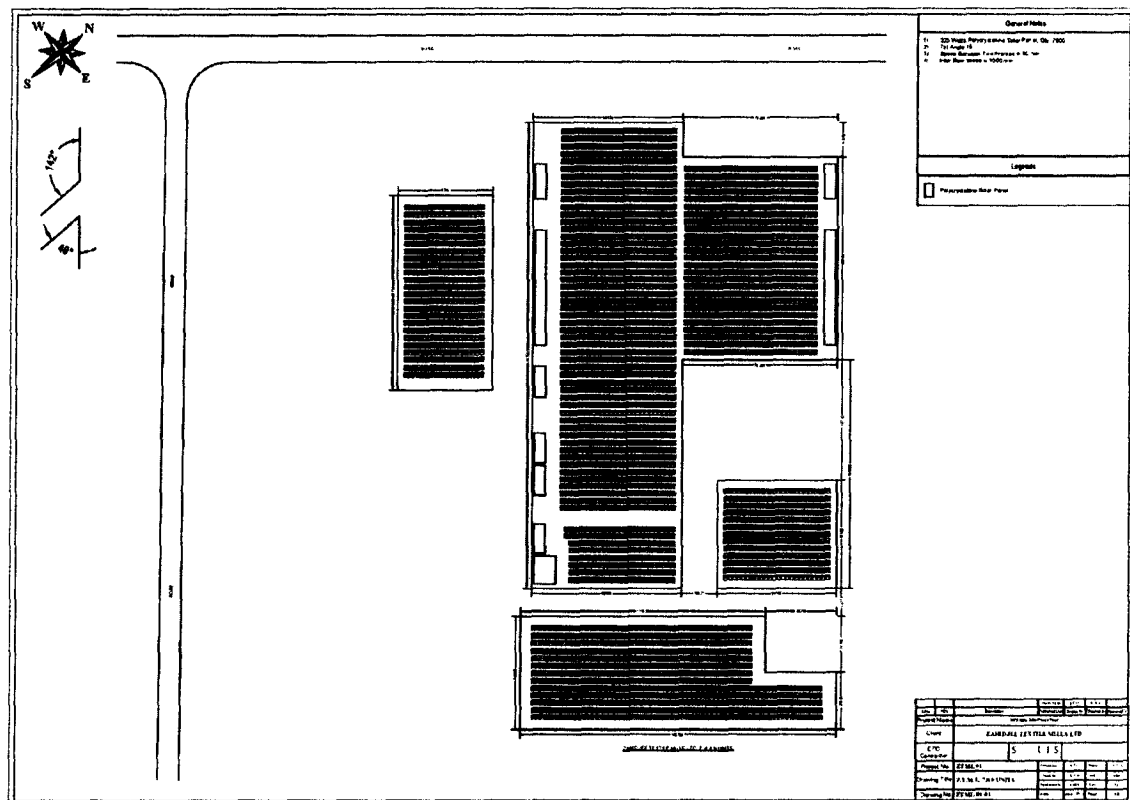
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Site 2



Site 3



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3(5)(h) Feasibility Report

FEASIBILITY REPORT ZTML 5.06 MWp SOLAR PV PLANT

Introduction

This report has the objective to assess the feasibility of this project and is structured as follows:

- Introduction to Solar
- Solar Potential in Pakistan
- Project Overview
- Site Overview
- Conceptual Design
- Environmental Benefits
- Socio Economic Benefits
- Technical Summary

Executive Summary

5.06 MWp Solar PV On-Grid system is to be installed at three different sites of ZTML. The designing of the system is done by considering total available area, minimum and maximum operating load, standby DG set and synchronizing voltage. Main objective of installing solar plant is to minimize the electricity utilization from the grid and revert back the extra generated units from solar to the grid.

Introduction to Solar

Solar is one of the natural source for the generation of electricity, either directly using photovoltaic or indirectly using concentrated solar power.

While generating electricity directly using photovoltaic, the used technologies include On-Grid System, Off-Grid System and Hybrid system (both on-grid and off-grid). As the cost of solar electricity has reduced, many grid-connected solar PV system has been built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from sun. The most important factor influencing the generation is the solar irradiance, which changes throughout the day and it is affected by the land's latitude and climate conditions.

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Solar Potential in Pakistan

Pakistan's per capita electricity consumption is comparatively lower than other countries in a similar development stage. The consumption of electricity mostly depends on Human Development Index (HDI), and the current trend of rising incomes and energy supplies, falling poverty levels. This creates a healthy demand for additional power generation.

Even with the projected surplus in power generation capacity by 2020, there will still be sufficient economic feasibility for small and medium-sized (50-100 MW) renewable energy based power projects in Pakistan. The viability of these projects will be further enhanced by the continued decline in technology prices and the emphasis by the government on indigenous energy resources that also help the country meet its environmental objectives and reduce carbon emissions.

Project Overview

Zahidjee Textile Mills Limited is engaged in the export of all kinds of value added fabrics and textile made-ups. The Company is also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab. They have three different locations which are very much feasible for the installation of Solar PV Plant.

Site Name	Capacity	Location	Geographical Coordinates
ZTML Unit 1 and 2	1.98 MW	32 KM Sheikupura Road, Faisalabad	31.52 ⁰ N, 73.38 ⁰ E
ZTML Unit 4	0.617 MW	CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad.	31.17 ⁰ N, 73.15 ⁰ E
ZTML Unit 8 and 9	2.47 MW	M3, Sahianwala (FIEDMC), Faisalabad	31.65 ⁰ N, 73.20 ⁰ E

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Project Rationale

The Company 'Zahidjee Textile Mills Limited' wants to increase their production for which different electrical machines are required. These electrical machines will consume a huge amount of electrical units from grid, which would not be feasible for them. Under these circumstances, ZMTL has decided to switch the maximum load on Solar PV System that produce the cheaper units than the conventional grid units.

Solis Energy Solution is found to be very much suitable among different EPC contractors technically as well as financially, therefore ZMLT has awarded the project to Solis Energy Solutions.

Technology

- Solar PV Grid tie system with all necessary protection, instrumentation, monitoring, control and synchronizing with Grid as well as existing DG sets.
- Solar based Power Generation System, civil structures and Auxiliaries
- 400 V LV cable for interconnection the system with Distribution Board and control wires for the necessary communication and control system.
- 325 Wp PV Modules of Tier 1 Manufacturer with 16.7% efficiency.
- 50 kW Grid-Tie smart inverter with all necessary protections.
- Dual string DC Isolator/Disconnecter to isolate the DC part when required.
- LV Panel containing Energy Meter, AC Breakers and necessary indications.
- All the electrical installations and wiring for the PV System in accordance with the codes and standard.
- Since the system is neither Off-Grid nor Hybrid, switching over mechanism to backup DG Genset.

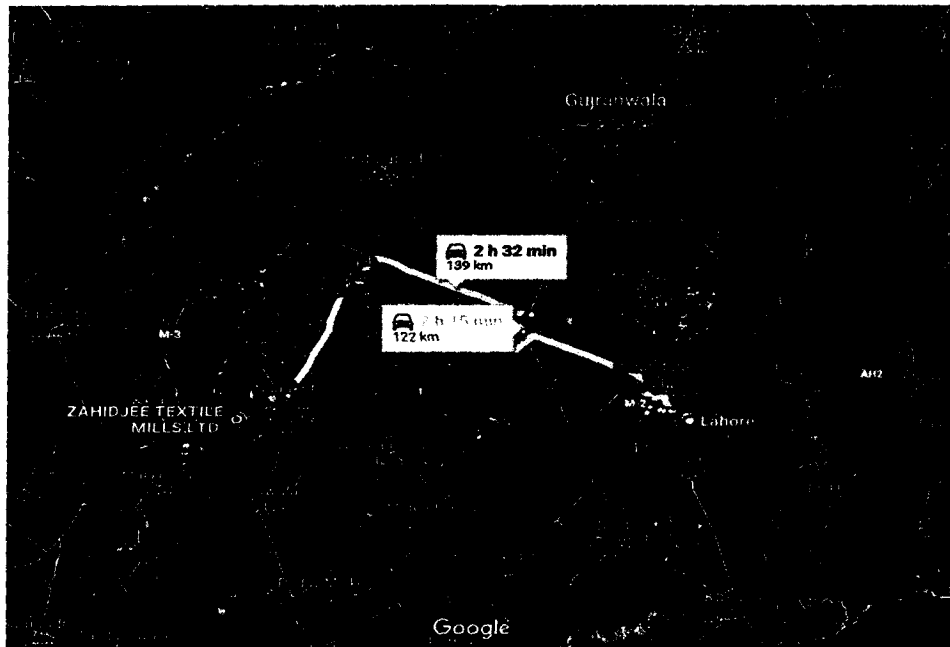
Project Location

Site 1

Site 1 for the project comprises of Unit 1 and 2 of ZTML. It covers an area of 6.5 acres and is located 32 KM Sheikupura Road, Faisalabad. The Geographical coordinates of the site are 31.52°N and 73.38°E. The site is located approximately 1240 kms from Karachi and 120 kms from Lahore. The area can be approached by Road using National Highway or Lahore-Islamabad Motorway.

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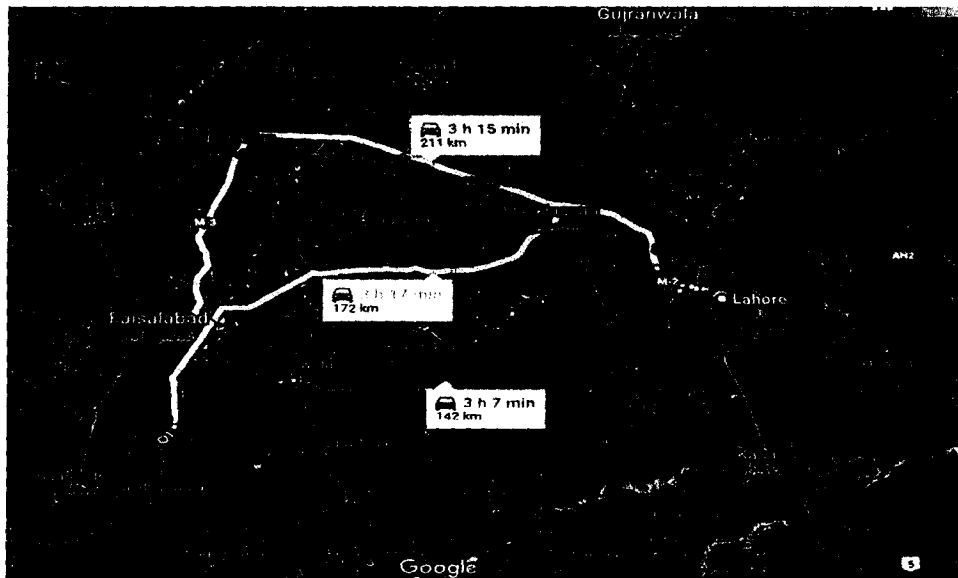
ROUTE MAP: LAHORE TO SITE 1



Site 2

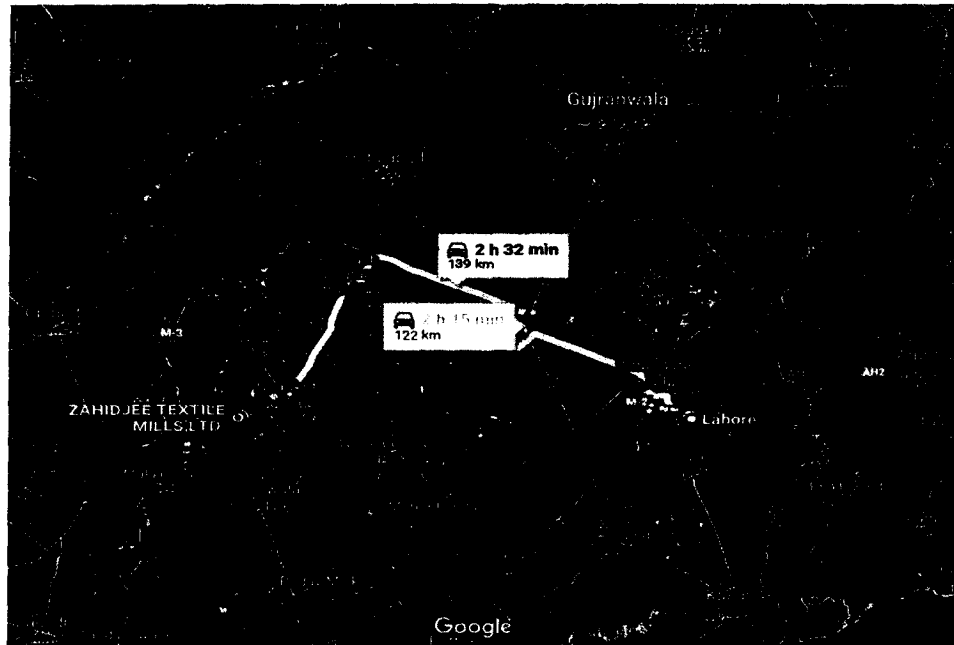
Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad.. The geographical coordinates of the site are 31.17°N and 73.14°E. The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

ROUTE MAP: LAHORE TO SITE 2



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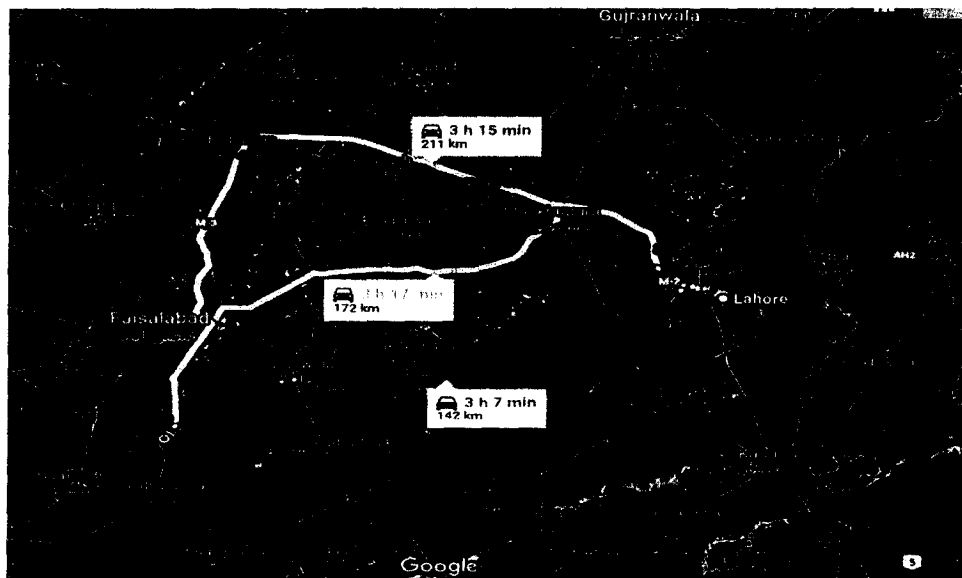
ROUTE MAP: LAHORE TO SITE 1



Site 2

Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad.. The geographical coordinates of the site are 31.17°N and 73.14°E . The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

ROUTE MAP: LAHORE TO SITE 2



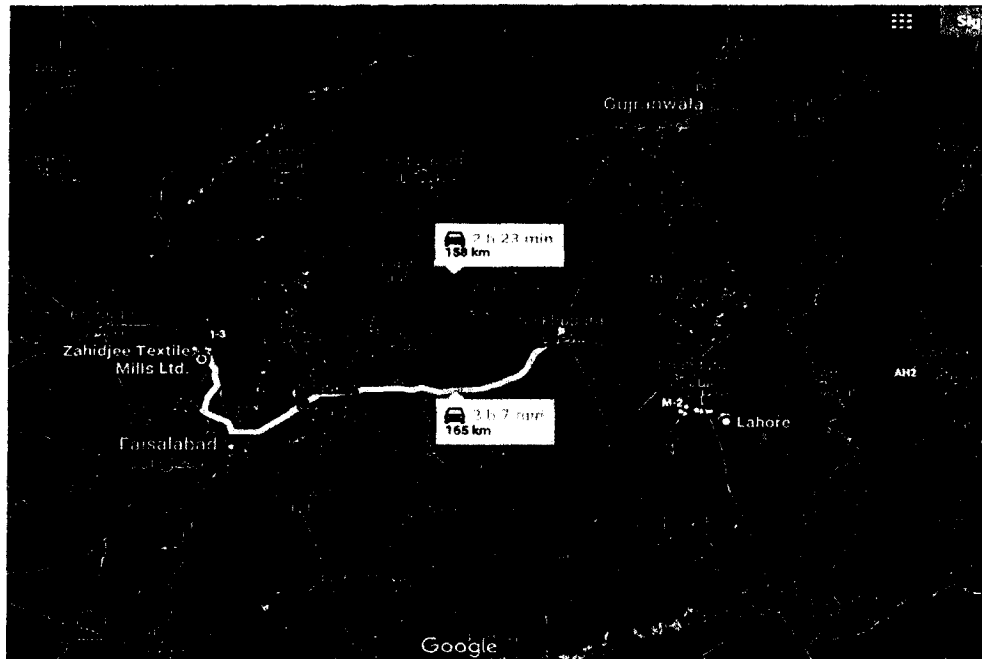
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Site 3

Site 3 for the Project comprises of Unit 8, 9 of ZTML. It covers an area of 7.25 acres and is located M3, Sahianwala (FIEDMC), Faisalabad. The geographical coordinates of the site are 31.65°N and 73.20°E. The site is located approximately 1230 kms from Karachi and 160 kms from Lahore. The area can be approached by using National Highway or Lahore-Islamabad Motorway.

ROUTE MAP: LAHORE TO SITE 3



O & M Costs

The project also includes 24/7 O&M of the complete PV plant including all its relevant system and equipment. This cost will include the following items inclusive of all importation and local charges, duties, taxes, etc.

- Provision of all manpower as duly approved by the company.
- Provision of all consumable material and parts.
- Provision of all routine and preventive maintenance parts.
- Periodic cleaning of PV modules.
- Timely update of inverter's firmware (if necessary).
- Periodic maintenance of Electrical distribution board parts.
- Corrective maintenance of inverter or electrical panels in case of any fault.

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Feasibility & Financing

The project will cost approximately **PKR 412,000,000**.

Project Cost	PKR
EPC	397,452,440
Insurance During Construction	794,905
CAPEX	398,247,345
Financing Fee	3,295,280
Interest During Construction	10,372,551
TOTAL PROJECT COST	411,915,176
Equity	82,387,202
Debt	329,527,973

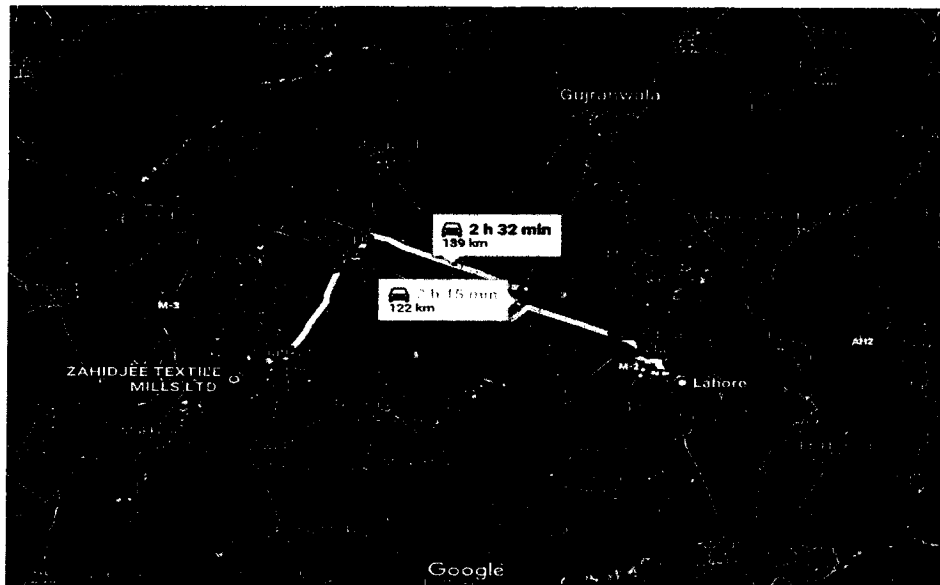
Site Overview

The sites which are proposed for the installation of Solar PV plant are located at Zahidjee Textile Mills Limited, Faisalabad. Solar System will be installed at three different areas.

Site 1

Site 1 for the project comprises of Unit 1 and 2 of ZTML. It covers an area of 6.5 acres and is located 32 KM Sheikupura Road, Faisalabad. The Geographical coordinates of the site are 31.52°N and 73.38°E. The site is located approximately 1240 kms from Karachi and 120 kms from Lahore. The area can be approached by Road using National Highway or Lahore-Islamabad Motorway.

ROUTE MAP: LAHORE TO SITE 1



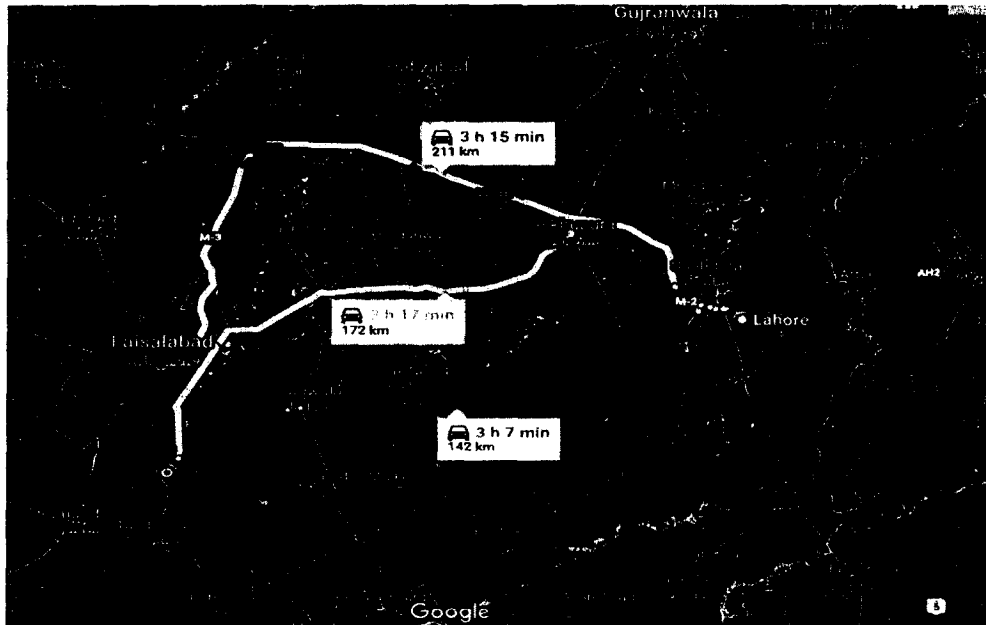
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Site 2

Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad.. The geographical coordinates of the site are 31.17°N and 73.14°E . The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

ROUTE MAP: LAHORE TO SITE 2



Site 3

Site 3 for the Project comprises of Unit 8, 9 of ZTML. It covers an area of 7.25 acres and is located M3, Sahianwala (FIEDMC), Faisalabad. The geographical coordinates of the site are 31.65°N and 73.20°E . The site is located approximately 1230 kms from Karachi and 160 kms from Lahore. The area can be approached by using National Highway or Lahore-Islamabad Motorway.

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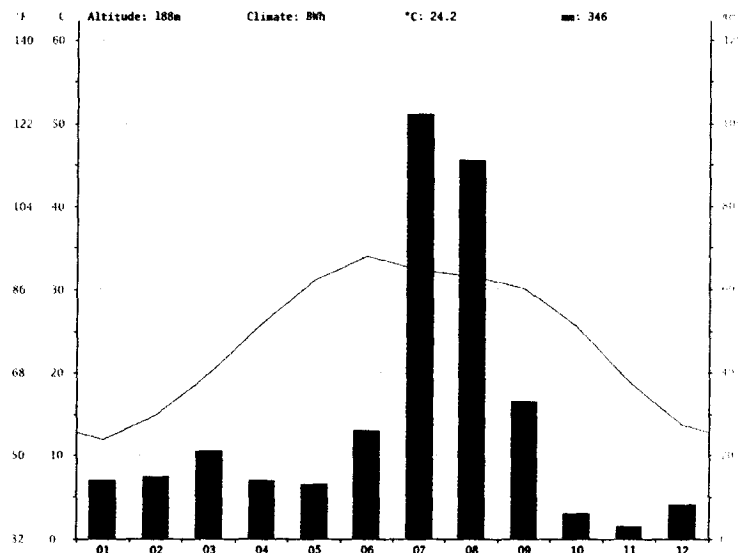
ROUTE MAP: LAHORE TO SITE 3



Climate and Weather in Faisalabad

The climate in Faisalabad is called a desert climate. The climate here is classified as BWh by the Koppen-Geiger System. The average temperature in Faisalabad is 23.57 °C. In a year, the average rainfall is 346 mm.

The graph below shows the climate graph of Faisalabad.



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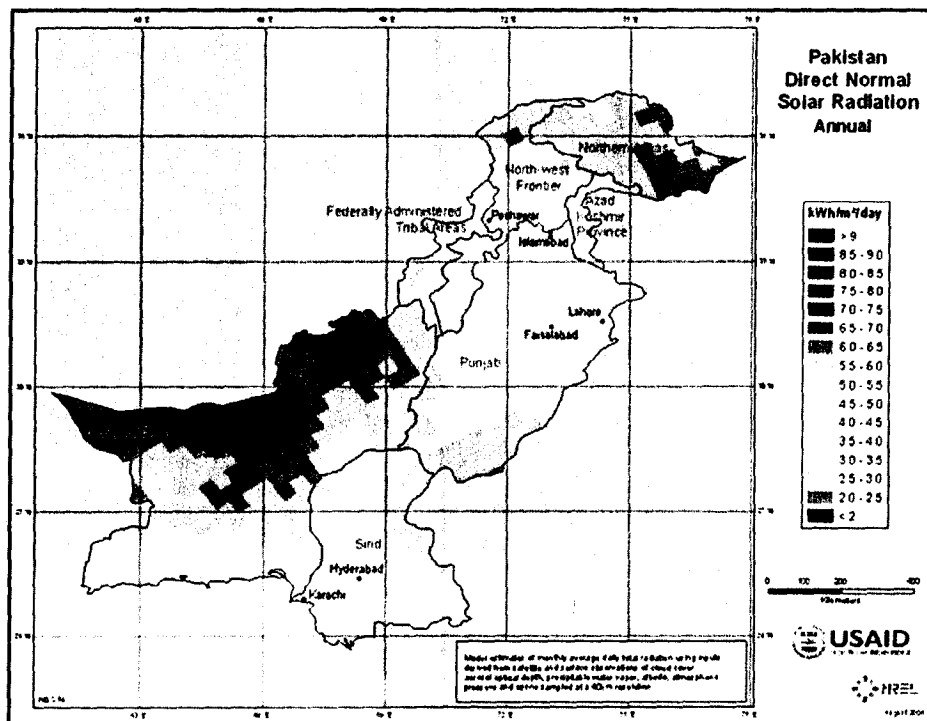
SOLIS GEN 1

With an average of 34°C, June is the warmest month. January is the coldest month, with temperatures averaging 11.9°C.

The precipitation varies 99mm between the driest month and the wettest month. Throughout the year, temperatures vary by 22.1°C.

The Global Horizontal Irradiance (GHI)-kWh/sq.m data for three sites on the basis of meteoronorm 7.1 data is shown below

	Site 1	Site 2	Site 3
Jan	87.1	89.4	87.9
Feb	106.1	106.7	106.9
Mar	147.4	148.0	149.3
Apr	164.9	166.4	165.2
May	186.9	186.4	186.9
Jun	187.0	187.3	187.6
Jul	169.4	171.3	169.6
Aug	167.1	167.1	168.2
Sep	157.6	156.7	158.7
Oct	130.2	131.8	130.0
Nov	98.7	101.7	98.2
Dec	85.0	87.7	85.7
Total	1687.3	1700.4	1694.2



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Environmental Benefits

The solar PV system will substitute the conventional generation such as Diesel, Oil, Coal, hence curtailing the emissions. Annual CO₂ emission reduction is 5,123 metric tonnes per year. This is equivalent to the CO₂ sequestration done by planting 256,150 trees per year. A lifecycle assessment of the CO₂ produced by Solar PV is 40g per kWh as opposed to 700g CO₂ per kWh for diesel fuel.

Socio-Economic Benefits

There are many different benefits which can be achieved from Solar Energy. Some of them are discussed below.

Upgrading power grids to integrate renewables also contributes to broader value creation, while operation and maintenance of renewable energy facilities creates long-term jobs for plant monitoring, equipment inspections and repair services. With the emergence of a local renewable energy industry, numerous opportunities for domestic value creation arise along all segments of the value chain.

The ever increasing cost of fuel and power has become a big issue for many under-developed and developing countries. The socio-economic condition of people living in these areas is not as per the normal standard. Hence, it becomes imperative to provide these people with cheap power and energy. The governments in these areas look for options, like solar energy, to initiate a better and proper distribution of power. This has also helped these people to grow and develop themselves so that they can erase the economic inequality in the country.

The benefits of solar energy are ever increasing with different technologies coming up. The research and development of various solar plants will surely create a sense of equality among different economic groups in the world.

Conceptual Design

Generation Voltage

The Solar PV System will be generating the electricity at 400 V and it will be synchronized on the same voltage level. The standby DG set will also be synchronized with Solar System at 400 V in case of any black down.

Power Factor & Frequency

ZMTL 5 MW Solar PV system is using Grid-Tie inverters of 50 kW each to convert DC power of solar panels to Alternating Power. The Power Factor is adjustable from 0.8 leading to 0.8 lagging and the rated Power Factor at nominal power is 0.99. The range of frequency of the inverter is 45-55 Hz and nominal frequency of generation is 50 Hz.

Automatic Generation Control

Automatic Genset Controller, AGC is a flexible control unit containing all necessary functions for protecting and control of genset. It can be used as a single unit for one genset, or a number of AGCs can be connected in a complete power management system for synchronising projects, islanded or paralleled to the mains.

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By using AGC, the integration of solar power and genset power can be easily possible. The PV plant is considered as a base load power and the genset can provide the extra power if required. The AGC controller only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch the power.

Metering and Protection

The energy which will be generated by Solar System will be locked in the inverters and a separate CT meters will be installed at the site, by which the instantaneous power, daily energy, monthly energy and total energy can be measured.

The inverters with the following protections will be installed at the site.

- DC current reverse connection protection
- AC short circuit protection
- Leakage current protection
- Grid monitoring
- DC fuse and over current protection
- Anti-PID function
- Overvoltage protection

SOLIS GEN 1

Technical Summary

- Polycrystalline 325 Wp Solar Modules with efficiency 16.7% are used in the design
- 50 kW grid connected solar inverters, 310-480 V three phase, 98.5% have been considered
- System will be synchronized with 400 V Grid as well as standby DG set.
- DC/AC Ratio of 1.235 for inverters has been considered.
- Maximum AC output of the system is assumed to be (1600 + 500 + 2000) 4100 kW
- Output of the system is based on the instantaneous irradiation value of Solar Energy
- 17 Acres area required for the installation of solar plant

BILL OF MATERIALS (3 SITES)

S.No.	Items	Description	Quantity
Site 1 – 1.98 MW			
1	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	6080
2	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	32
3	DIEF Controller	DG Set and Solar Energy Control System	1
Site 2 – 0.617 MW			
4	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	1900
5	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	10
6	DIEF Controller	DG Set and Solar Energy Control System	1
Site 3 – 2.47 MW			
7	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	7600
8	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	40
9	DIEF Controller	DG Set and Solar Energy Control System	1
Total			
10	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	15580
11	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	82
12	DIEF Controller	DG Set and Solar Energy Control System	3

SOLIS GEN 1

ENERGY GENERATION

S.No.	Efficiency Parameters	
Site 1 – 1.98 MW		
1	Capacity Utilization Factor	15.78%
2	Energy Generation Units	2.73 Million kWh
Site 3 – 2.47 MW		
3	Capacity Utilization Factor	16.01%
4	Energy Generation Units	0.86 Million kWh
Site 3 – 2.47 MW		
5	Capacity Utilization Factor	15.74%
6	Energy Generation Units	3.41 Million kWh
Total		
7	Capacity Utilization Factor	15.79%
8	Energy Generation Units	7 Million kWh

ANNEXURE – 16

SCHEDULE- III

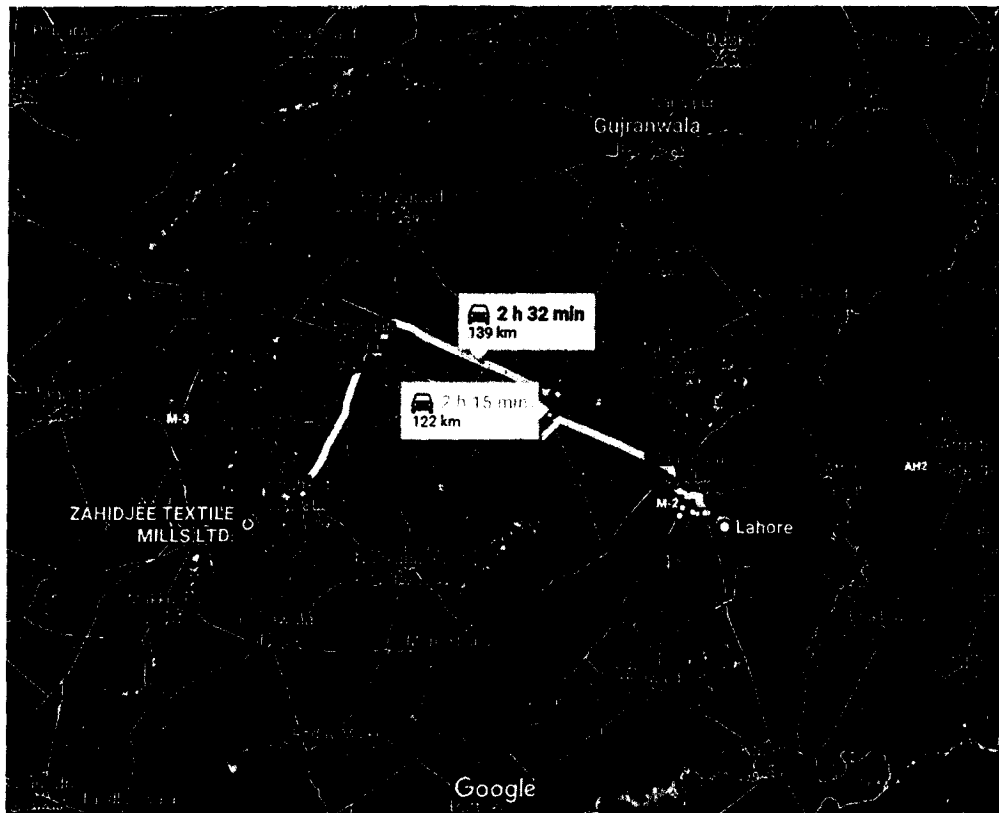
LOCATION MAPS and SITE LAYOUTS

Location Map

Site 1

Site 1 for the project comprises of Unit 1 and 2 of ZTML. It covers an area of 6.5 acres and is located 32 KM Sheikupura Road, Faisalabad. The Geographical coordinates of the site are 31.52°N and 73.38°E . The site is located approximately 1240 kms from Karachi and 120 kms from Lahore. The area can be approached by Road using National Highway or Lahore-Islamabad Motorway.

SITE 1 LOCATION MAP

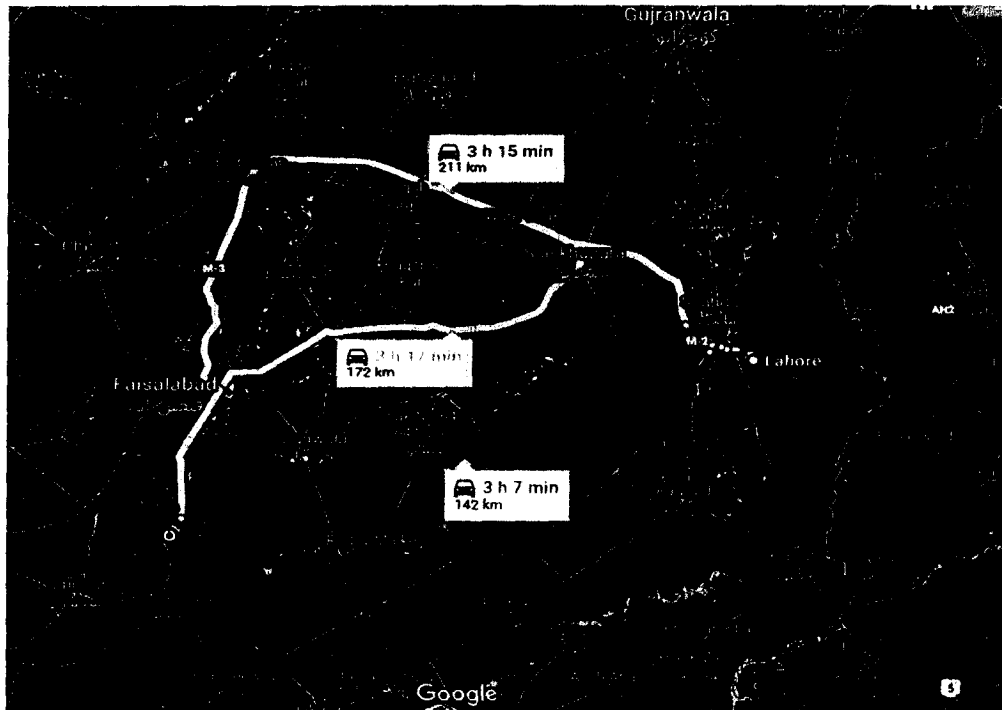


SOLIS GEN 1

Site 2

Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad. The geographical coordinates of the site are 31.17°N and 73.14°E. The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

SITE 2 LOCATION MAP



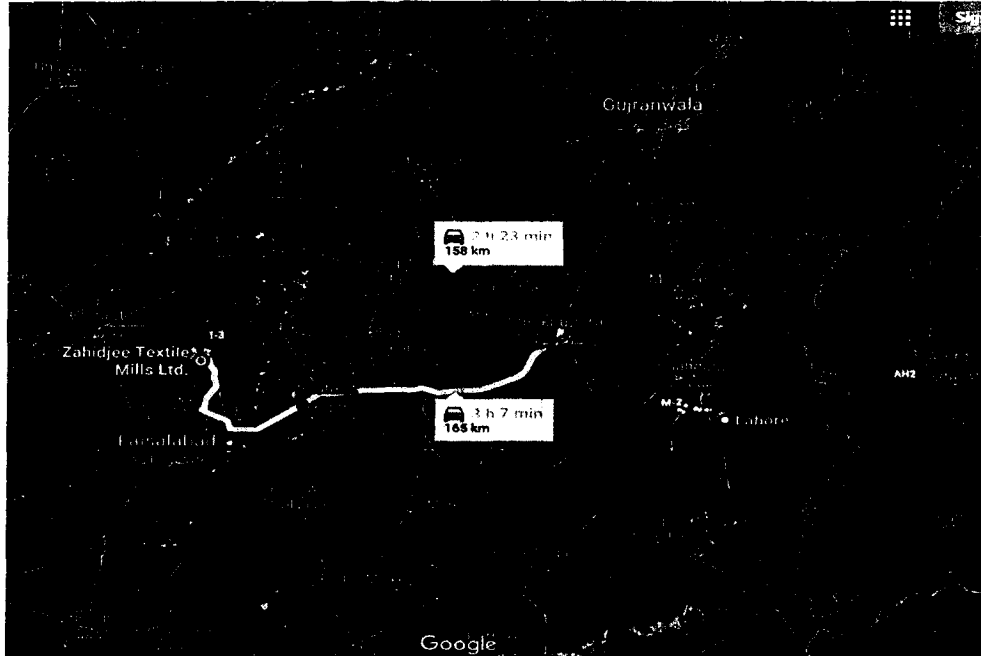
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SOLIS GEN 1

Site 3

Site 3 for the Project comprises of Unit 8, 9 of ZTML. It covers an area of 7.25 acres and is located at M3, Sahianwala (FIEDMC), Faisalabad. The geographical coordinates of the site are 31.65°N and 73.20°E . The site is located approximately 1230 kms from Karachi and 160 kms from Lahore. The area can be approached by using National Highway or Lahore-Islamabad Motorway.

SITE 3 LOCATION MAP

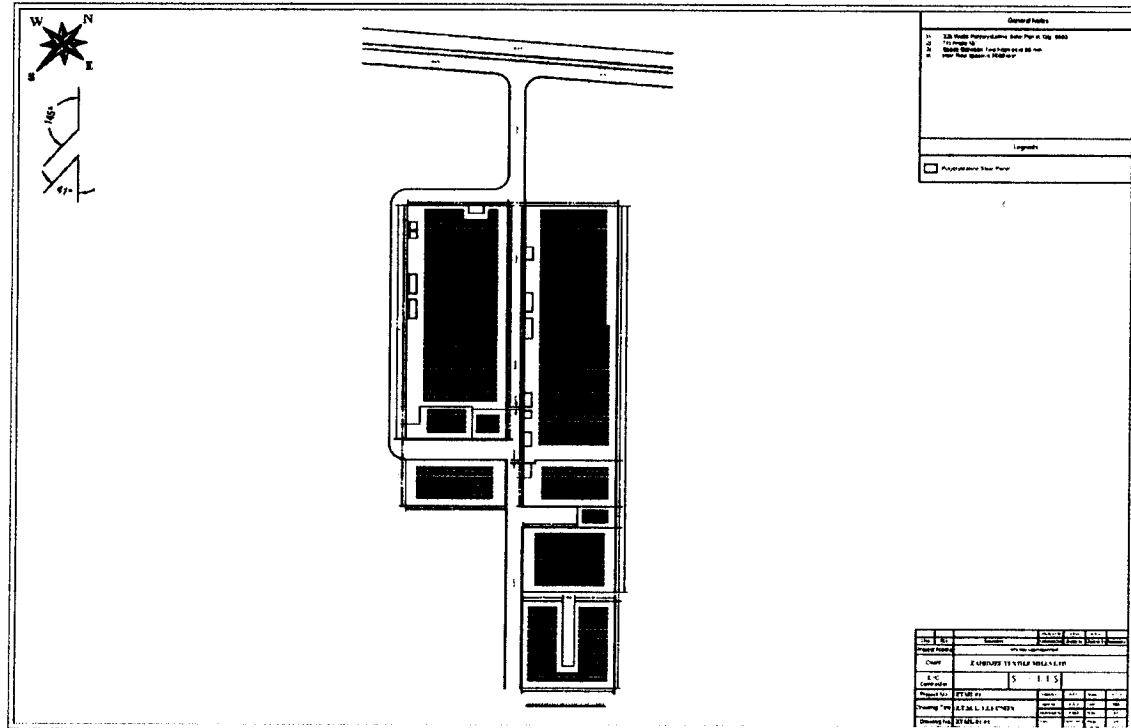


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SITE LAYOUT

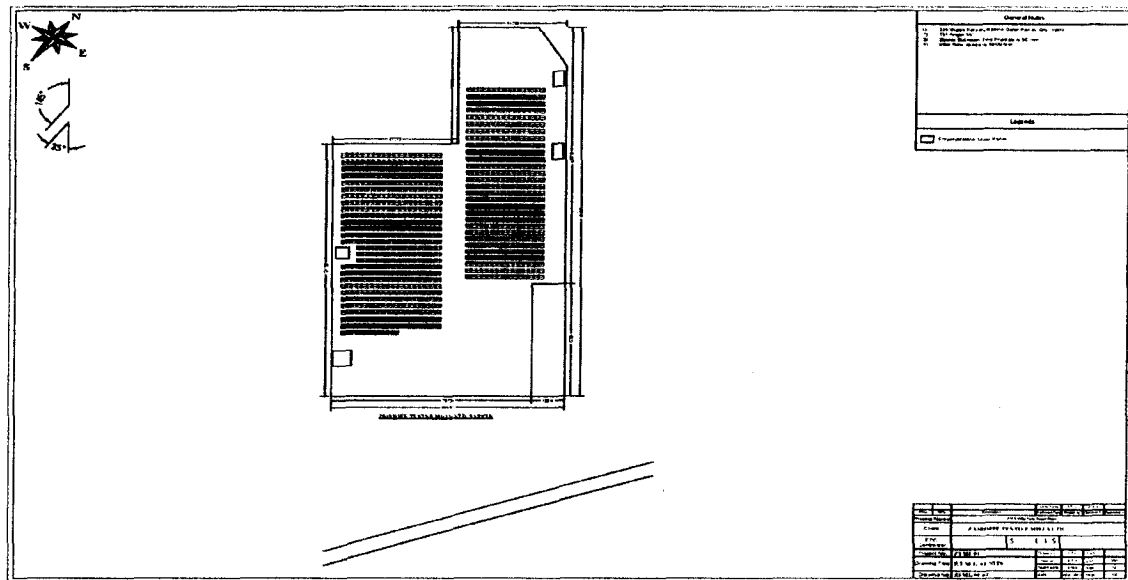
Site 1



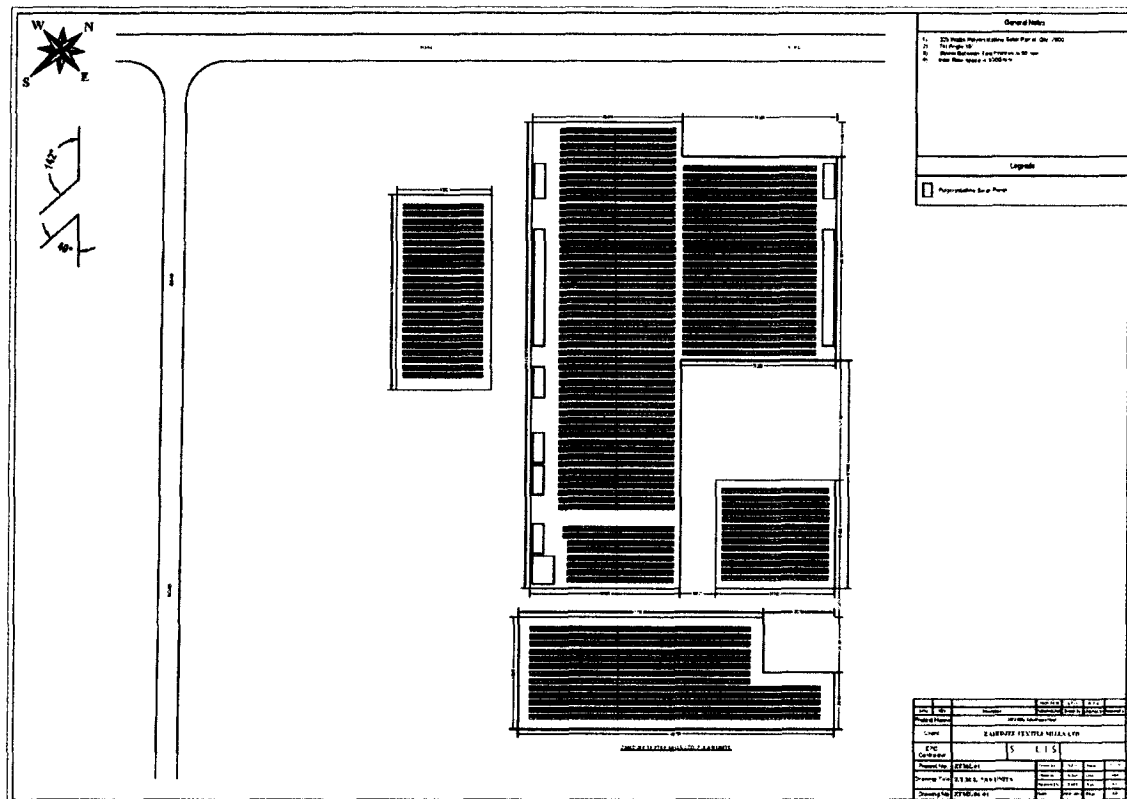
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SOLIS GEN 1

Site 2



Site 3



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TECHNOLOGY, SIZE OF PLANT, NUMBER OF UNITS

SYSTEM COMPONENTS

S.No.	Items	Description	Quantity
Site 1 – 1.98 MW			
1	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	6080
2	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	32
3	DIEF Controller	DG Set and Solar Energy Control System	1
Site 2 – 0.617 MW			
4	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	1900
5	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	10
6	DIEF Controller	DG Set and Solar Energy Control System	1
Site 3 – 2.47 MW			
7	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	7600
8	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	40
9	DIEF Controller	DG Set and Solar Energy Control System	1
Total			
10	PV Modules	325 Wp, Polycrystalline, Tier 1 Manufactured	15580
11	Inverters	Grid-Tie Solar Inverters 50 kW 3 phase	82
12	DIEF Controller	DG Set and Solar Energy Control System	3

SYSTEM DESIGN ASSUMPTIONS

- Polycrystalline 325 Wp Solar Modules with efficiency 16.7% are used in the design
- 50 kW grid connected solar inverters, 310-480 V three phase, 98.5% have been considered
- System will be synchronized with 400 V Grid as well as standby DG set.
- DC/AC Ratio of 1.235 for inverters has been considered.
- Maximum AC output of the system is assumed to be (1600 + 500 + 2000) 4100 kW
- Output of the system is based on the instantaneous irradiation value of Solar Energy
- 17 Acres area required for the installation of solar plant

SOLIS GEN 1

ENERGY GENERATION

S.No.	Efficiency Parameters	
Site 1 – 1.98 MW		
1	Capacity Utilization Factor	15.78%
2	Energy Generation Units	2.73 Million kWh
Site 2 – 0.617 MW		
3	Capacity Utilization Factor	16.01%
4	Energy Generation Units	0.86 Million kWh
Site 3 – 2.47 MW		
5	Capacity Utilization Factor	15.74%
6	Energy Generation Units	3.41 Million kWh
Total		
7	Capacity Utilization Factor	15.79%
8	Energy Generation Units	7 Million kWh

TECHNOLOGY USED

S.No.	Parameters		Qty
1	Technology	Solar Photovoltaic (SPV)	
2	Total System Size	5063.5 kW	
3	Solar Modules	Polycrystalline Solar Modules 325W Tier 1	15580
4	Inverter	50 kW, Grid Tie Solar Inverter	82

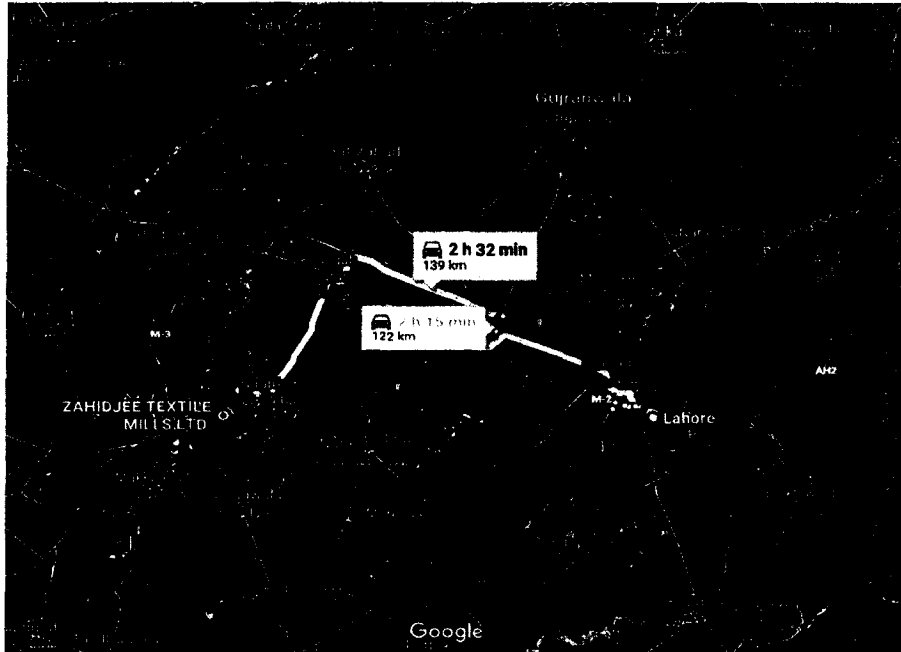
Interconnection with National Grid

Not Applicable. Since, this plant is not connected to the national grid.

Infrastructure

Site 1 for the project comprises of Unit 1 and 2 of ZTML. It covers an area of 6.5 acres and is located 32 KM Sheikupura Road, Faisalabad. The Geographical coordinates of the site are 31.52°N and 73.38°E . The site is located approximately 1240 kms from Karachi and 120 kms from Lahore. The area can be approached by Road using National Highway or Lahore-Islamabad Motorway.

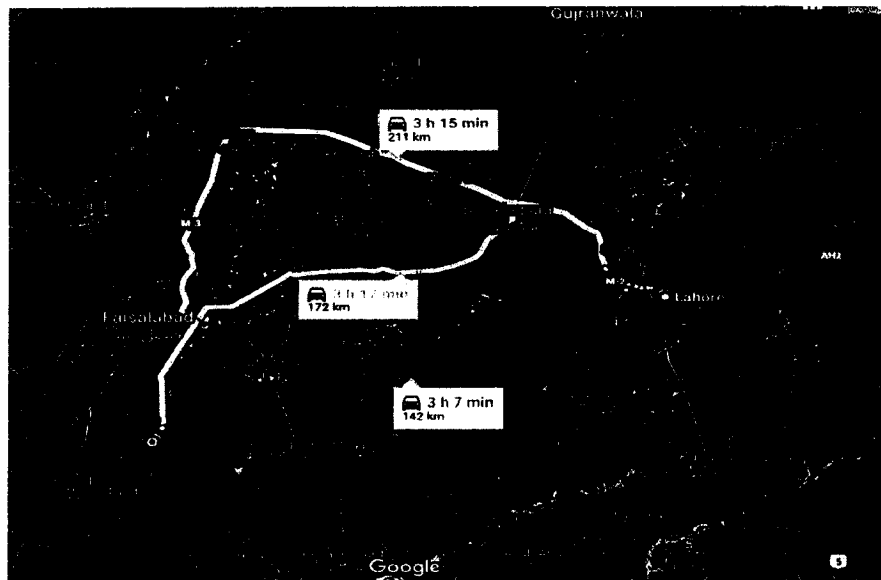
ROUTE MAP: LAHORE TO SITE 1



Site 2 for the Project comprises of Unit 4 of ZTML. It covers an area of 3.5 acres and is located at CK 232 GB, Jaranwala, Tandianwala Road, Faisalabad. The geographical coordinates of the site are 31.17°N and 73.14°E . The site is located approximately 1200 kms from Karachi and 180 kms from Lahore. The area can be approached by using National Highway or Lahore-Faisalabad Road.

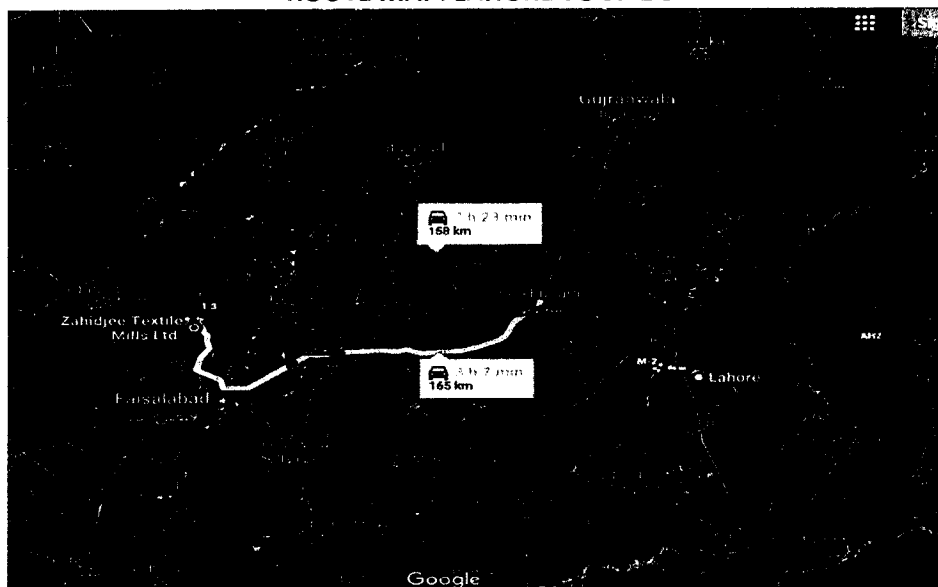
SOLIS GEN 1

ROUTE MAP: LAHORE TO SITE 2



Site 3 for the Project comprises of Unit 8, 9 of ZTML. It covers an area of 7.25 acres and is located at M3, Sahianwala (FIEDMC), Faisalabad. The geographical coordinates of the site are 31.65°N and 73.20°E . The site is located approximately 1230 kms from Karachi and 160 kms from Lahore. The area can be approached by using National Highway or Lahore-Islamabad Motorway.

ROUTE MAP: LAHORE TO SITE 3



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Project cost, information regarding sources and amounts of equity, debt.

Feasibility & Financing:

The project will cost approximately PKR 412,000,000.

Project Cost	PKR
EPC	397,452,440
Insurance During Construction	794,905
CAPEX	398,247,345
Financing Fee	3,295,280
Interest During Construction	10,372,551
TOTAL PROJECT COST	411,915,176
Equity	82,387,202
Debt	329,527,973

Project Commencement & Completion

The project completion time would be 6 months, covering three sites of ZTML. The expected Commercial Operations Date is 31st December, 2019.

Major activities of project involve, Detailed Engineering Design, procurement of Local and Imported Equipment, and Construction involving Civil, Electrical and Mechanical works. Major Milestones are;

S#.	Milestone	Timeline
1.	Detailed Design	Jun, 2019
2.	Equipment's Procurement	Jun, 2019 - Jul, 2019
3.	Project Construction	Aug, 2019 - Nov, 2019
4.	Commissioning	Dec, 2019
5.	Testing	Dec, 2019

ESSA (Environmental and Social Soundness Assessment)

**ENVIRONMENTAL REPORT OF ZAHIDJEE TEXTILE
MILLS LIMITED-FAISALABAD (UNIT 01 & 02)**

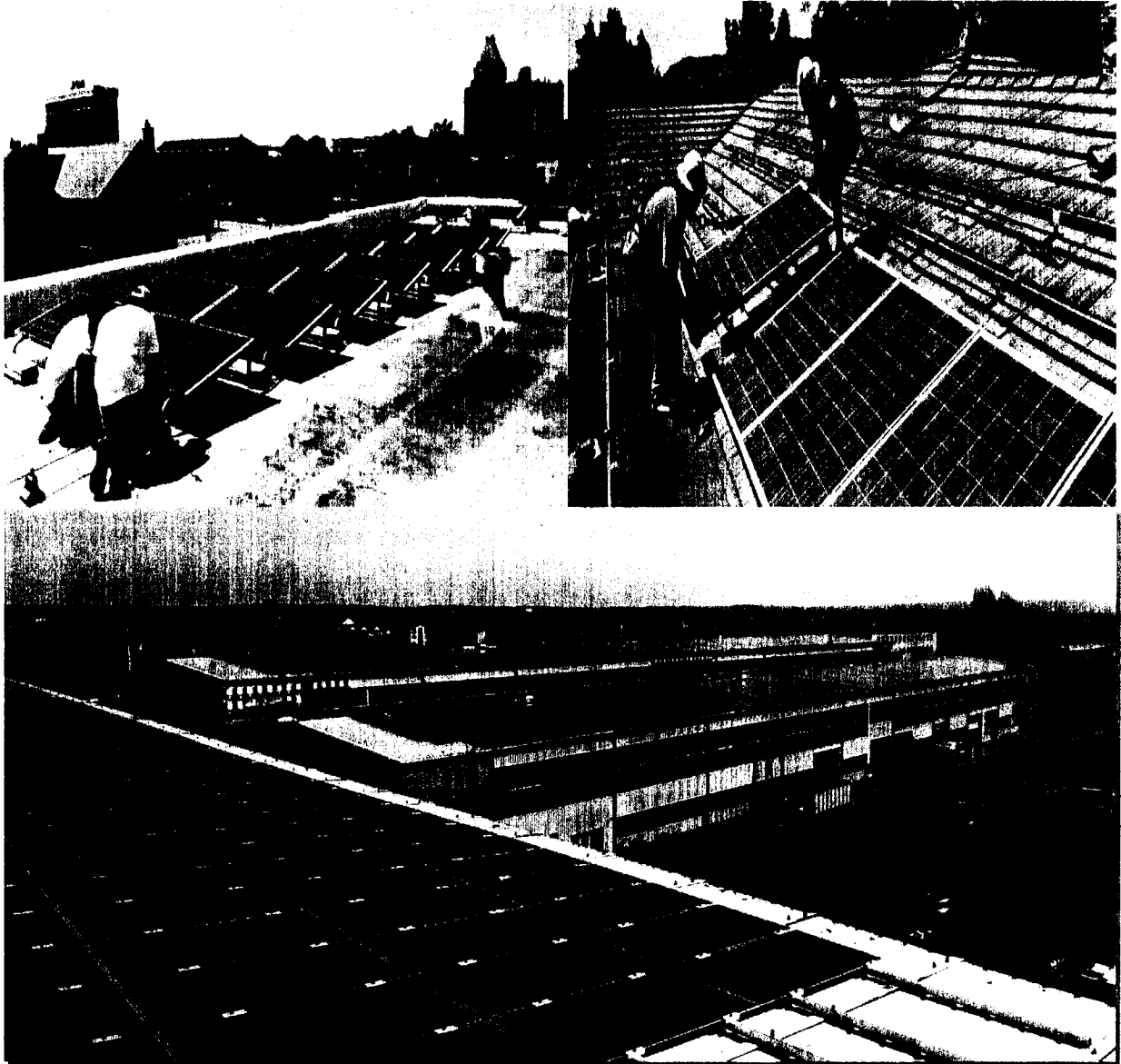


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EXECUTIVE SUMMARY

Zahidjee Textile Mills Limited is interested to installed Solar PV Panels on the rooftop of the factory with capacity of 1.976 MW. Around 6080 polycrystalline PV panels will be installed with power rated of 325 Wp and the capacity factor is approximately 15.78%. the total energy generation will around 2.73 Million kWh.

ZTML is engaged in the export of all kinds of value-added fabrics and textile made-ups. The Company is also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 PROJECT BACKGROUND AND JUSTIFICATION

The project sponsor is Zahidjee Textile Mills Limited. The sponsors of the company will be interested to install the solar PV plant on the rooftop of their factory to generate electricity. It is engaged in the export of all kinds of value-added fabrics and textile made-ups. They also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

1.2 Description of the Project

The project company will be installed 1.976 MW of Solar PV plant in Zahidjee Textiles to produce electricity. The total area of the project is around 6.5 acres for the installation of PV panels. The project area is already a developed area and the solar PV panels will be installed on the rooftop of the factory.

1.3 Project Location

The proposed project site is located near Shahkot in District Faisalabad-Punjab. It is around 25 kilometers away from Faisalabad City. The land area of project site is 6.5 acres located near

Lahore Faisalabad Motorway. The project land is owned by the project company for the installation of 1.976 MW Solar PV plant. The location of site can be viewed in **Figure 1.1** and overview of the project site is shown in **Figure 1.2**.

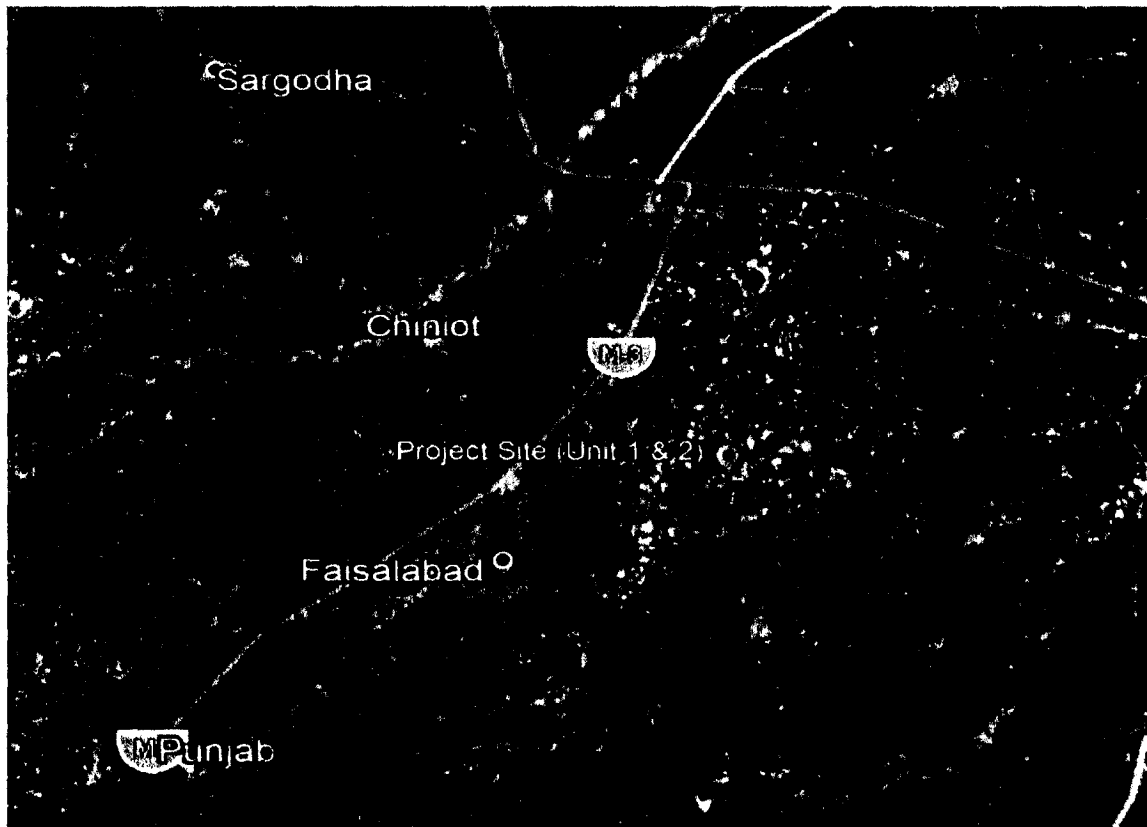


Figure 1.1: Location of Project Site

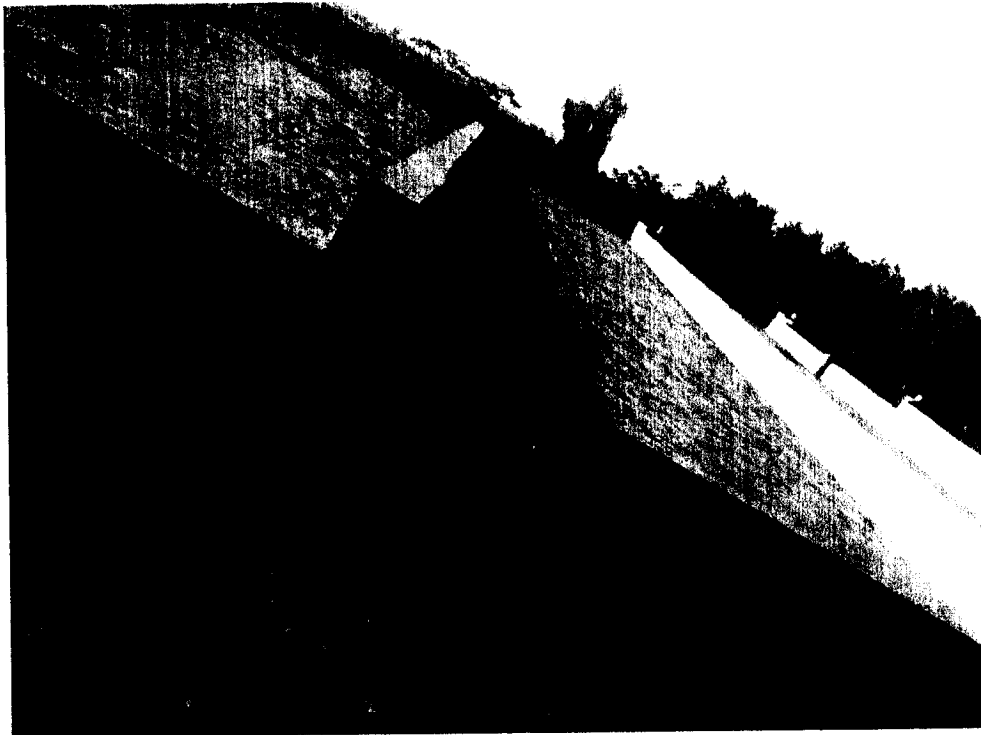


Figure 1.2: Overview of Project Site (Picture-1)

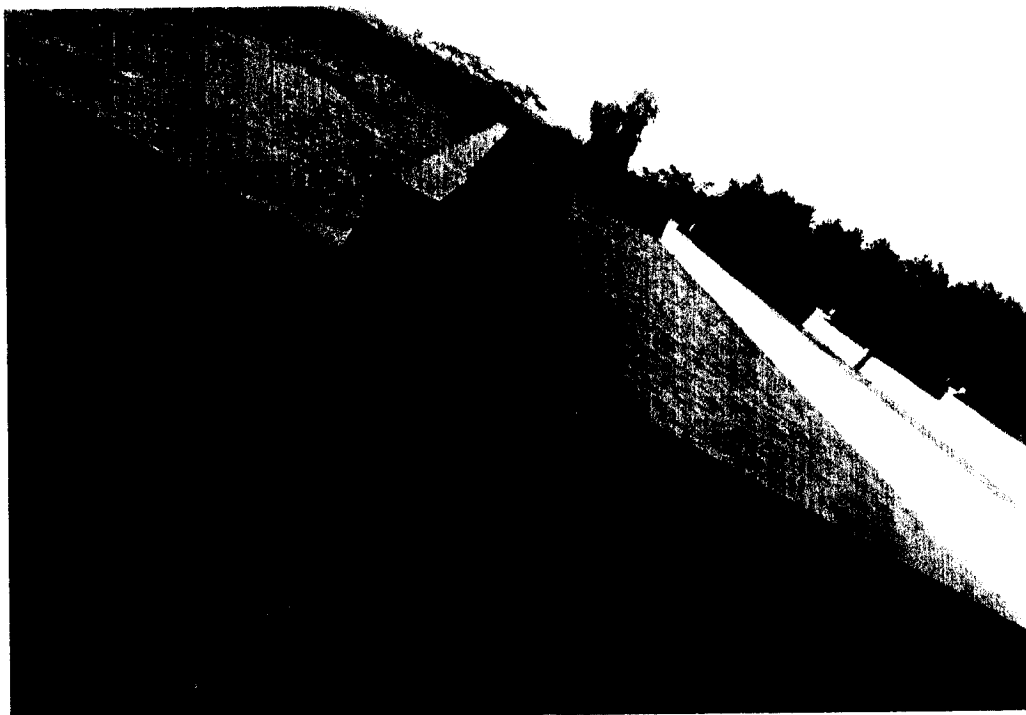


Figure 1.3: Overview of Project Site (Picture-2)

CHAPTER 2

SOLAR ENERGY IN PAKISTAN

2 PROSPECTS OF SOLAR ENERGY IN PAKISTAN

Solar energy has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy. Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.met in a year. It has an average daily global insolation of 19 to 20 MJ/sq.met per day with annual mean sunshine duration of 7 to 8 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m², 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

To summarize, the sun shines for 250-300 days per years in Pakistan with an average sun shine hour of 8-10 per day and in Faisalabad, it's around 6-8 sun shine hours per day. This gives huge amount of energy to be used for electricity generation by solar thermal power plants. A quick idea for the potential of solar energy in Pakistan can be obtained from the satellite map of solar radiation released by National Renewable Energy Lab (NREL) of USA as shown in **Figure 2.1**.

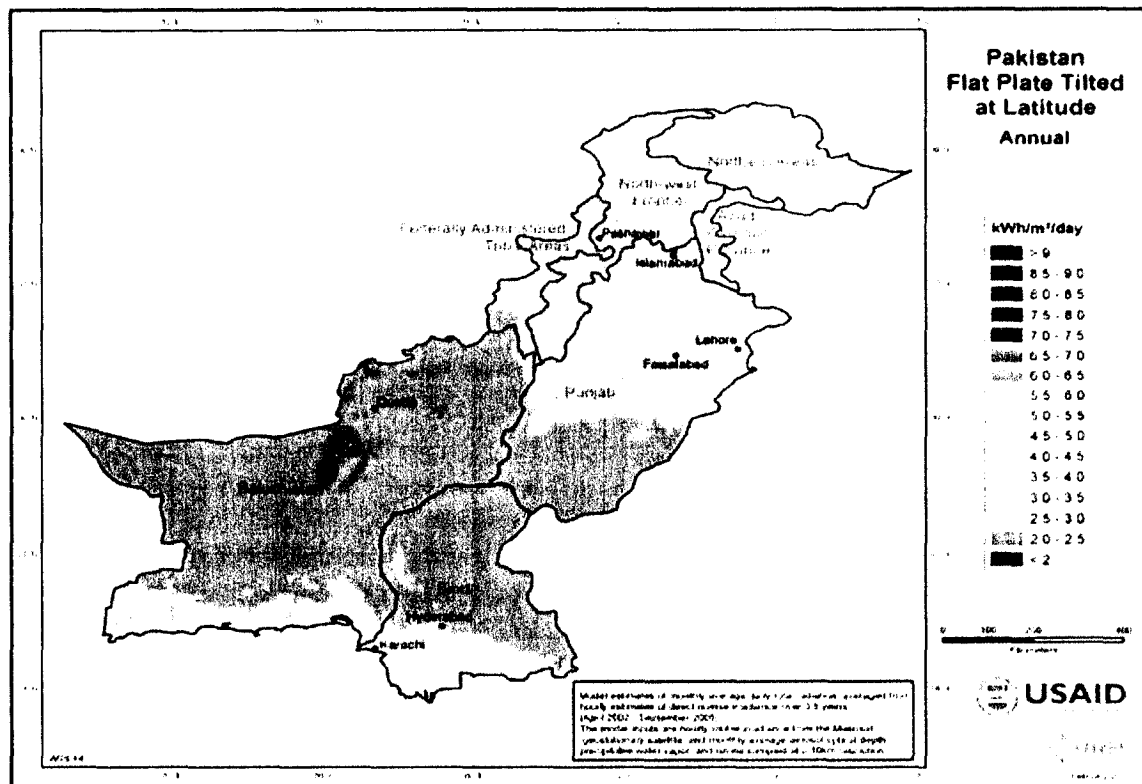


Figure 2.1: NREL Solar Map of Pakistan

2.1 Road Access to the Project Site

The Project site is easily accessible throughout the year. The Lahore-Islamabad motorway (M2) and Pindi Bhattian-Faisalabad Motorway (M3) are the major connecting roads to the Project site, and also the Lahore-Sheikhupura-Faisalabad Road is connected to the project site. The total distance from Lahore to the project site through Sheikhupura road is approximately 123km and from Pindi Bhattian Road is around 182km to the project site as shown in Figure 2.2.

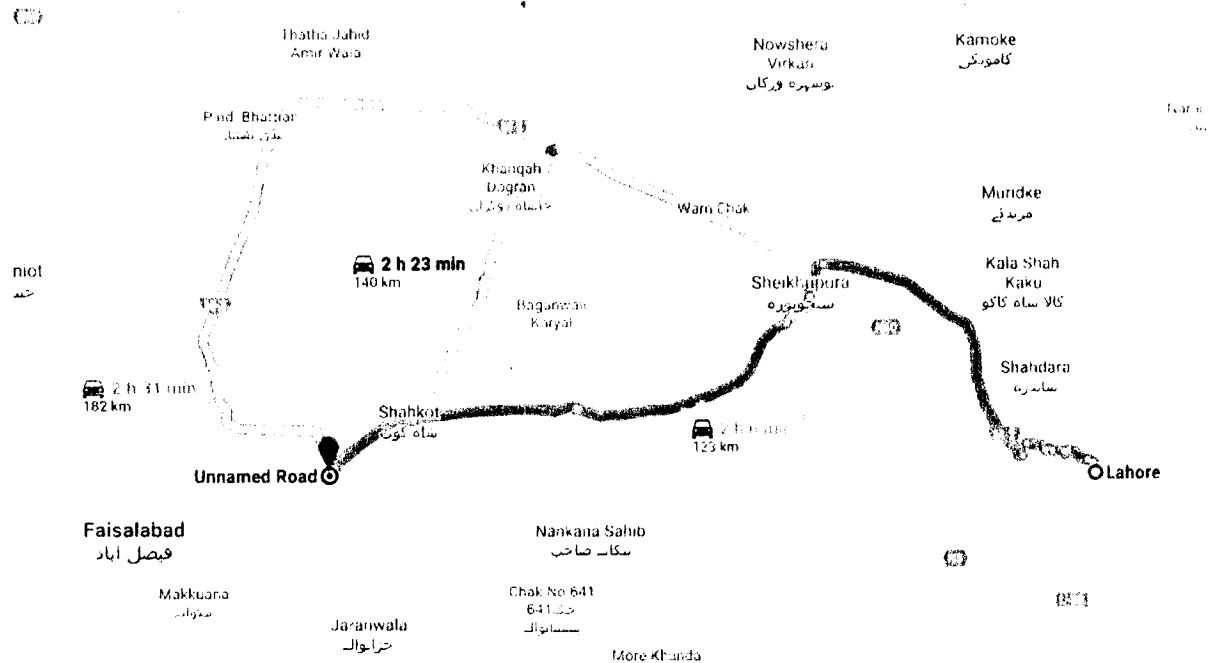


Figure 2.2: Orientation of Project Site from Lahore

The planned movement from Port Qasim to the site will be through the National and Super highways. The major section of the track from Karachi to the site is a multi-lane road, having a relatively flat terrain.

CHAPTER 3

BASELINE CONDITIONS

3 Baseline Conditions

The Baseline condition includes the different parameters which covers under this study are topography, climatic conditions, hydrology, biological conditions, socio-economic environment and seismic hazards.

3.1 Topography

Faisalabad lies in the rolling flat plains of northeast Punjab, at 184 meters (604 ft) above sea level. The city proper comprises approximately 1,230 square.km (470 sq mi) while the district encompasses more than 16,000 square.km (6,200 sq mi). The Chenab River flows about 30 kilometres (19 mi), and the Ravi River meanders 40 km (25 mi) to the southeast. The lower Chenab canal provides water to 80% of cultivated lands making it the main source of irrigation. Faisalabad is bound on the north by Chiniot and Sheikhpura, on the east by Sheikhpura and Sahiwal, on the south by Sahiwal and Toba Tek Singh and on the west by Jhang. The soil consists of young stratified silt loam and very fine sandy loam which makes the subsoil weak in structure with common cankers at only five feet. The water level in this area is higher than in the upland. The upland is flat plains. The general height of the area is from 180 to 192 meters above the sea level. Topographic map of Faisalabad derived from satellite mapping is shown in **Figure 3.1**.

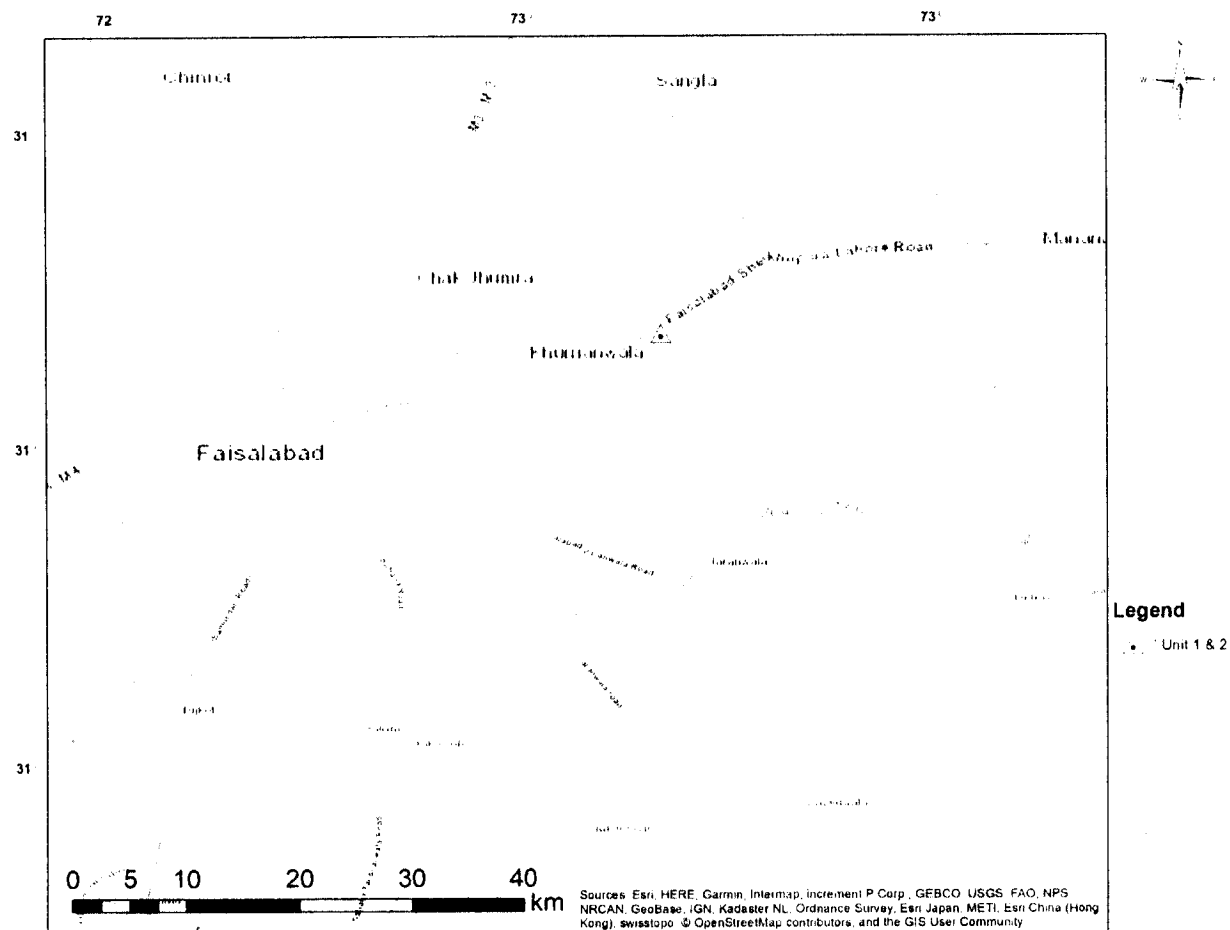


Figure 3.1: Topographic Map of Project Area

3.2 Climatic Conditions

3.2.1 Temperature & Rainfall

The climate of Faisalabad is semi-arid climate with very hot and humid summers and dry cool winters. The summer season lasts from the month of March to October for almost eight months, while the weather is pleasant and cold from November to February. May and June are the hottest months, while July, August and the first half of September can be oppressively humid, except for the days when it rains. June is the hottest month in Faisalabad, when conditions are dry and dust storms are common. The coldest month is January, which is also a dry month with significant foggy days. The fog is particularly dense at night and in early

morning hours. The average temperature in the summer season remains between 30 and 40 degree centigrade, while during winter it is between 08 and 19 degree centigrade.

Spring begins after mid-February and lasts usually until late March, when temperatures begin to rise and conditions become drier and sunnier. The average annual rainfall is only about 375 millimetres (14.8 in), which is highly seasonal since approximately half of the yearly rainfall takes place in July and August during the monsoon season.

Faisalabad has 5-7 hours of sunshine daily on average. As there will be no rise in temperature due to reflections of the panels on the atmosphere because the panels are lined with anti-reflection coating (ARC) on the surface which help to reduce the reflection of the panels to almost zero. Adopted measures during rain and sandstorm are to generate or produce electricity is to be reduced.

The detailed temperature data are given in **Table 3.1** and graphical presentation in given in **Figure 3.2**.

Table 3.1: Temperature Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature(°C)	11.2	15.4	21.1	26.6	32.2	31.8	30.7	30.2	28	24.7	18	13.2

Average Temperature(°C) in Faisalabad (Unit 01 & 02)

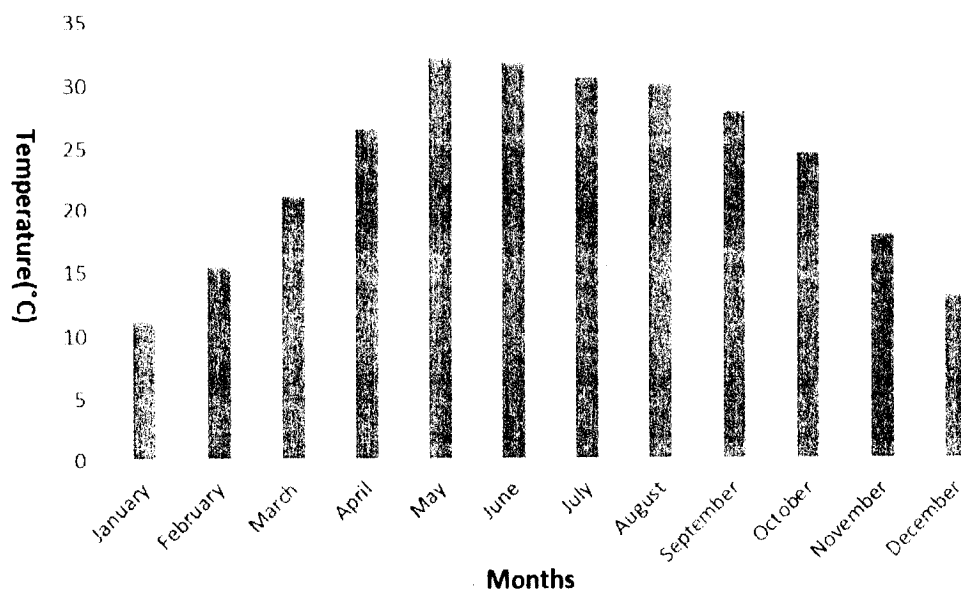


Figure 3.2: Graphical representation of Temperature

The detailed average annual rainfall data are given in **Table 3.2** and graphical presentation is given in **Figure 3.3**.

Table 3.2: Rainfall Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (mm)	0	15.8	19	26.9	23.3	55.4	63.8	30.5	12.4	0.1	0.1	0.2
Days	0	5	9	12	14	15	14	6	3	1	1	2

Average Rainfall Amount (mm) and Rainy Days in Faisalabad

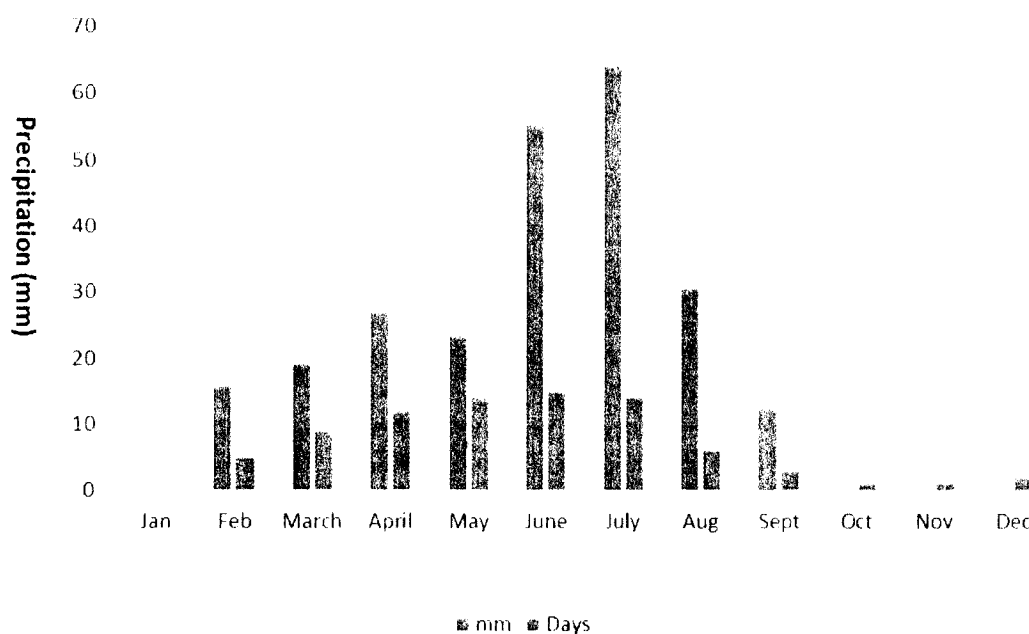


Figure 3.3: Graphical representation of Average Rainfall

Maximum and Minimum Temperature Regime Map of Pakistan is shown in **Figure 3.4**, **Figure 3.5** & **Figure 3.6**.

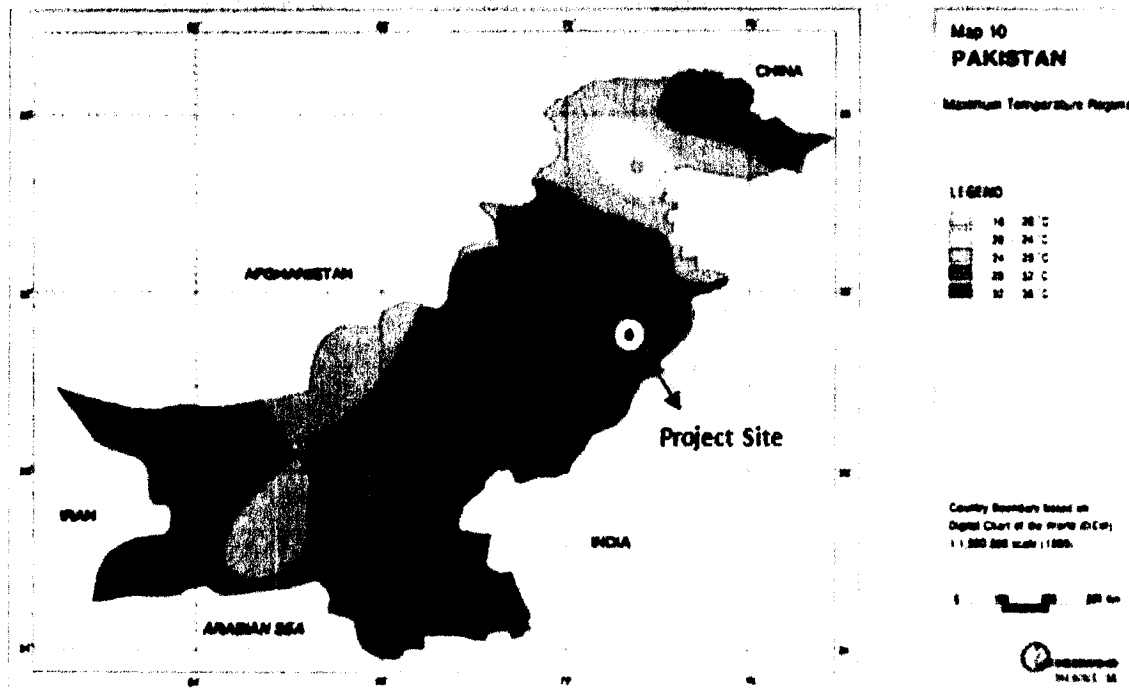


Figure 3.4: Maximum Temperature Regime Map of Pakistan

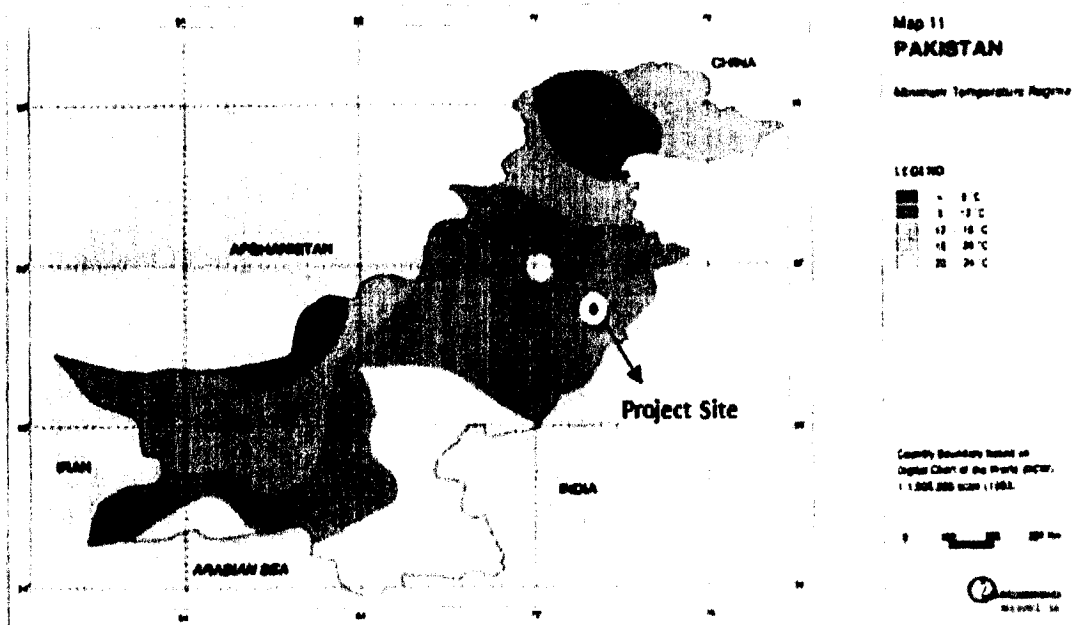


Figure 3.5: Minimum Temperature Regime Map of Pakistan

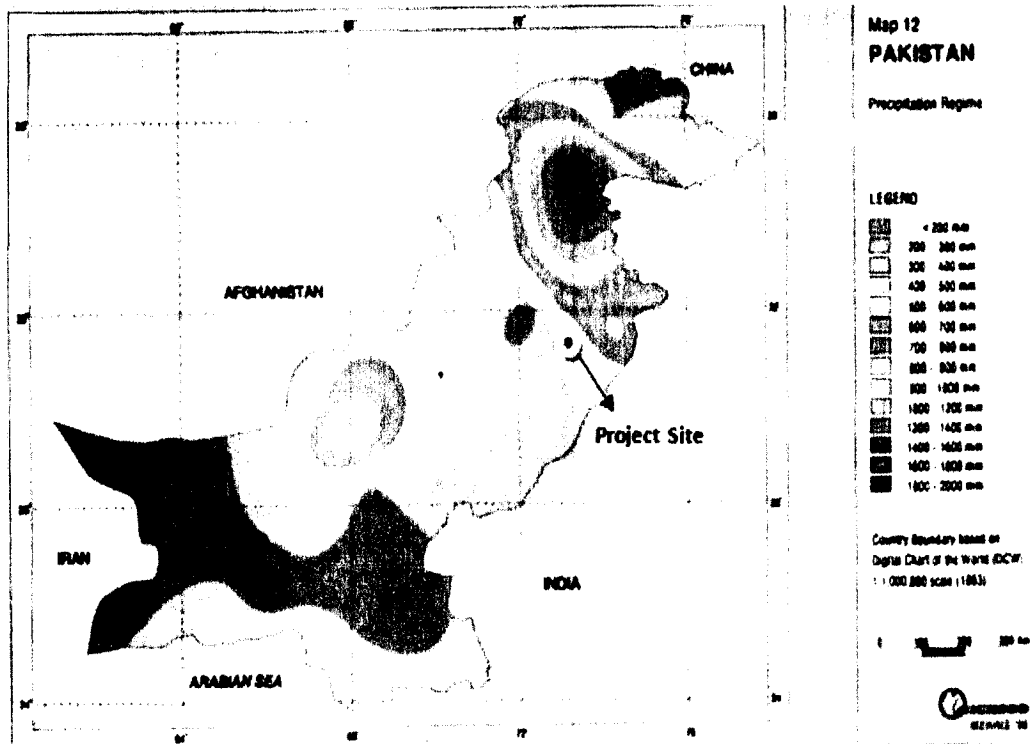


Figure 3.6: Precipitation Map of Pakistan

3.2.2 Wind Speed

The wind in Faisalabad are generally light. The city lies in an area with low wind speeds. Westerly breeze dominates the afternoons, while the nights are calm. South east / easterly winds are common here during the monsoon season. Faisalabad, being in the plains, can experience severe thunderstorms and high wind gusts that can be damaging to its crops.

Wind in Faisalabad is usually **extremely calm**. The windiest month is June, followed by May and July. June's average wind speed of around 4.6 knots (5.3 MPH or 8.5 KPH) is considered "a light breeze." Maximum sustained winds (the highest speed for the day lasting more than a few moments) are at their highest in late May where average top sustained speeds reach 11.3 knots, which is considered a moderate breeze. The average wind speed on yearly basis are given below in **Figure 3.7**.

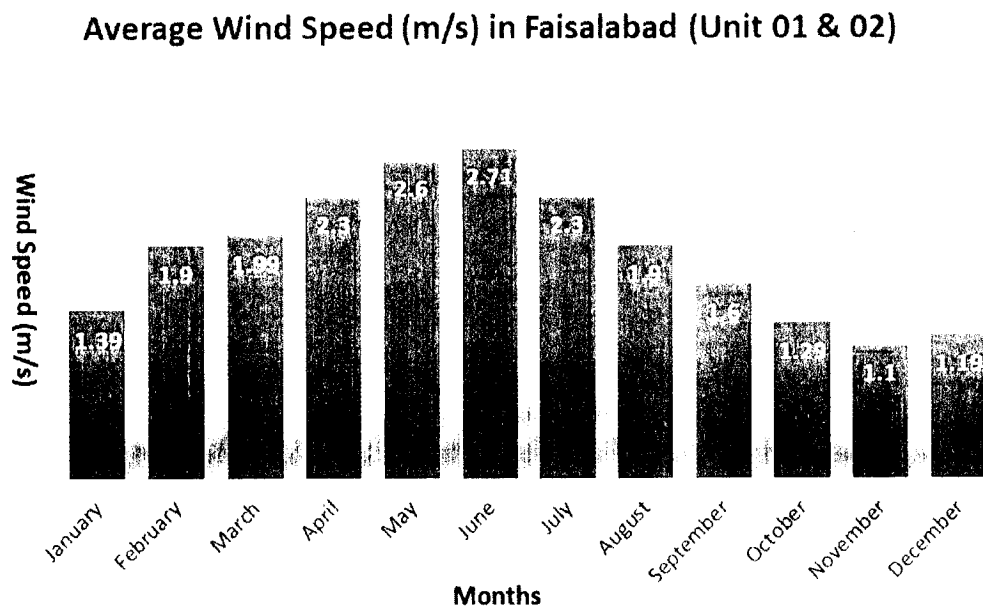


Figure 3.7: Graphical representation of average wind speed in Faisalabad (Unit 01 &02)

3.2.3 Relative Humidity

Faisalabad is semi-arid region; the humidity is high. Faisalabad has some humid months, and dry months in the opposite season. The least humid month is April & May and the most humid month is August (73%). Average annual humidity is given in **Figure 3.8**.

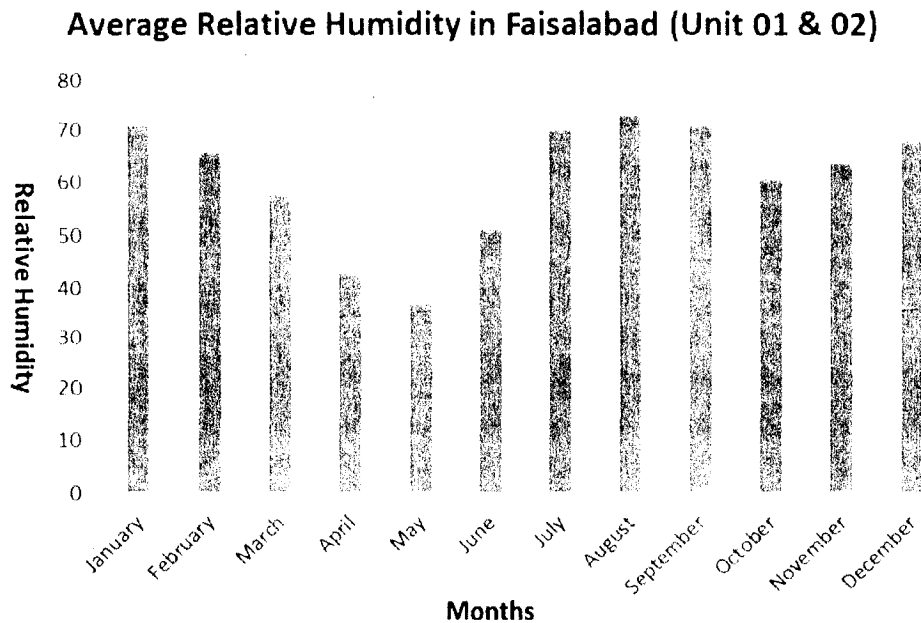


Figure 3.8: Graphical representation of average relative humidity in Faisalabad (Unit 01 & 02)

3.3 Hydrology

Faisalabad is densely populated city and due to tremendous increase in population growth, the demand for water has been increasing every year. Being not the main source for domestic and agriculture usage groundwater is higher in Faisalabad. The situation is different in main city of Faisalabad, where abstracting local groundwater is not the source to fulfill the domestic needs. However, villages are abstracting the local groundwater for drinking and other domestic uses.

The ground water of the city Faisalabad is quite saline, hence, not acceptable for human intake. A limited quantity of potable water is accessible to the citizens from different scarce resources. In the absence of proper sweet water sources, the WASA Faisalabad has to pump and bring the sweet water from the city district (Chiniot) where ample quantity of drinking water is available. At the moment, WASA Faisalabad draws about 56 Million Gallons Per Day (MGD) water mainly from Chiniot Well-Field Area located near Chenab River through 29 tube wells. The aforesaid site is located 27KM from the terminal reservoir. Another sweet water source is positioned at a distance of nearby 13KM from terminal reservoir at Jhang Branch Canal which provides 20 MGD through 25 tube wells installed at Jhang branch Well-Field area. In addition to this, about 8 MGD water is being served to the city through 8 tube wells installed at Rakh Branch Canal which passes through the city. These numerals show that around 88.5 MGD water is produced

by the WASA Faisalabad from different resources for its further provision to the citizen/consumers.

Faisalabad is known as polluted industrial city due to the inadequate treatment facilities. The impact on water resources near Samundri drain in Faisalabad showed that the ground water quality was the worst as 90% of samples were above the WHO limits with respect to TDS, Na, K, Cl, and SO₄. The physicochemical analysis of drinking water was carried out to evaluate drinking water quality of Faisalabad city. The turbidity, hardness, pH, and TDS were found within safe limits of WHO guidelines. The microbial analysis showed that all samples were contaminated with total coliforms and E. coli. The impact of municipal and industrial wastewater on water resources in Faisalabad showed that the physicochemical properties of ground water were beyond the critical values of WHO. However, bottle and supply lines were within critical range.

3.4 Seismic Hazards

According to Seismic Zoning map of Pakistan, Project area falls in Zone 2A which is minor to moderate damage area. There is no earthquake recorded in the history of region above Richter scale 4.5. Also, no damage to the infrastructure and human settlement is reported in the area. Map is shown in **Figure 3.9**.

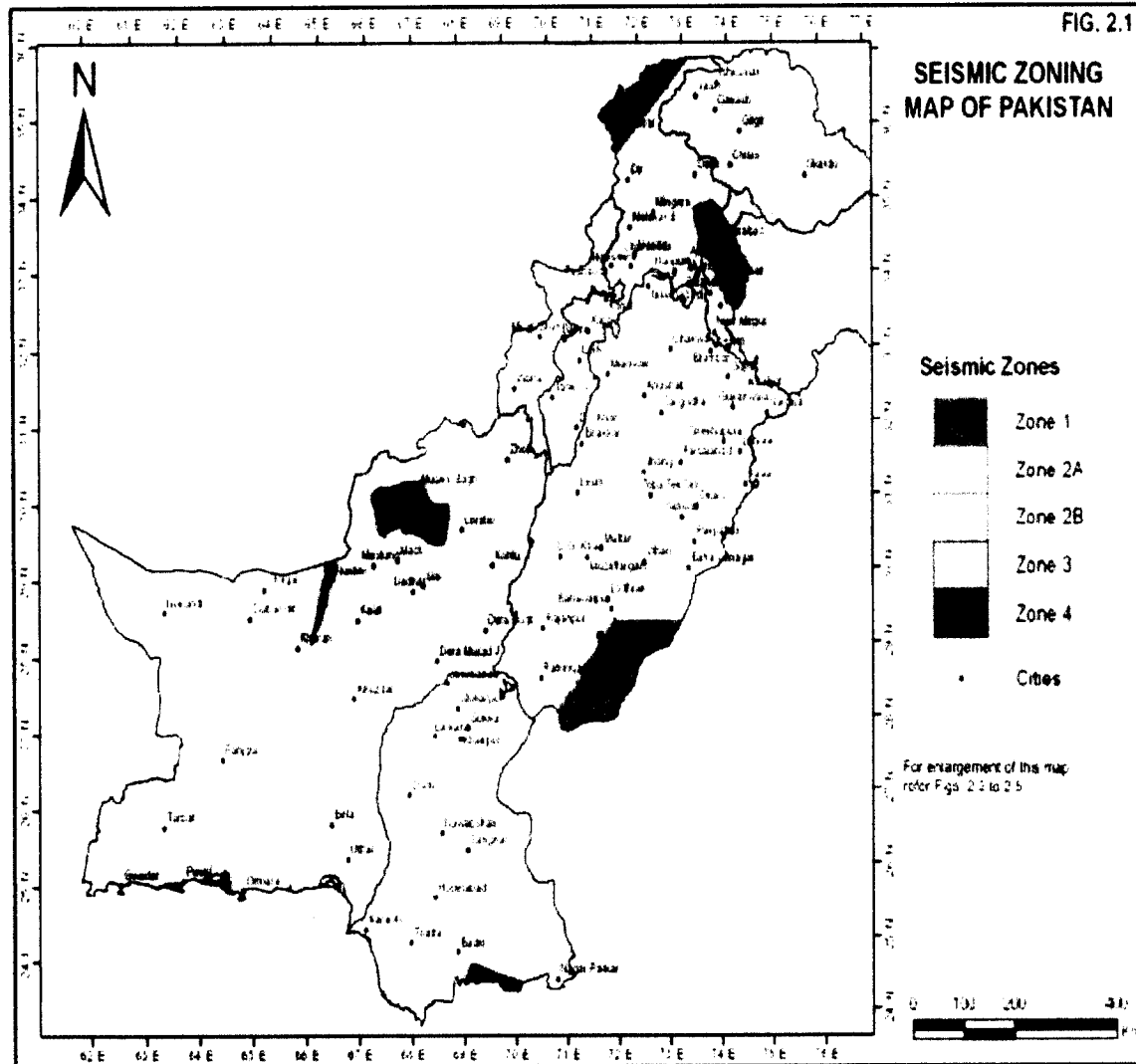


Figure 3.9: Seismic Map of Pakistan

3.5 Socio-Economic Conditions

Faisalabad is a major industrial hub, often referred to as the "Manchester of Pakistan". It contributes around \$20.5 billion to the national GDP. The city is main center of the textile industry, accounting for more than half of Pakistan's total textile shipments. (Punjab Board of Investment and Trade 2016) Faisalabad is the second most populous district in Punjab with a population of 3.55 million. Primarily an agro-industrial district, Faisalabad contributes approximately \$5 billion to the national GDP through its textile exports. Spread across six densely-populated urban, suburban and rural tehsils, Faisalabad has been the site of many development projects in recent years. However, the public infrastructure is still grossly insufficient to cater to the growing demands of Pakistan's third largest metropolis.

16 Ecology

The main crops and fruits of district Faisalabad are wheat, sugarcane, rice, maize, citrus, guava and mangoes. A variety of vegetables are also grown in the district. The wildlife of the district includes foxes, boars, jackals and wild cats. Among the birds there are usually partridges, pigeons, doves, tilliards, lal menas, bias, parrots, quails, pochards, mallards and teals. As the Solar PV panels will be installed on the rooftop of the factory and no Flora and Fauna is going to be disturbed due to execution of this project.

CHAPTER 4

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4 Potential Environmental Impacts and Mitigation Measures

The project may have environmental impact during construction and operation phase of the project. During construction phase, the impacts may be temporary and short term while long term impacts may be observed during the operational phase of the project. The project has positive impacts overall by providing a competitive, pollution free and cost effective. It may also meet the increasing demand of power and reduce the gap between demand and supply of power.

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, construction phase.

4.1 Impact on Air Quality

As the proposed project is Solar PV project, the impact during construction of project is expected to be minimal as a Greenfield Project plant. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly through the movement of vehicles (transportation activities). No excavation and back filling are required because the PV panels will install on rooftop of the factory. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO₂, NO_x, and particulate matter. The impact is reversible, marginal and temporary in nature.

4.2 Impact on Noise Quality

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like; generators, compressors, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A). As noise generated during construction phase of the project is low and within the Limits of NEQ's. As there is no human

settlements and villages near the factory so overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.

4.4 Impact on Water Use and Quality

The construction personnel would be housed in temporary settlements or factory settlements. These settlements would discharge considerable amount of domestic wastewater. Stagnant pools of water would increase breeding of mosquitoes and generally create insanitary conditions. The main pollutants are organic components and microorganisms with the potential to cause contamination of water quality. To address potential impacts on water quality, disinfected washroom (e.g., through regular liming) will be used as main component of the sanitation system. As the PV panels will be installed on rooftop of the factory so no or minor use of water during construction phase of the project and overall no impact on water use and its quality.

4.4 Impact on Groundwater Contamination

There is no harm to the ground water due to construction of PV project because panels will be installed on the rooftop and the project site is already developed due to factory. There is no impact on the Ground water.

Ground water due to plant operation will be drawn during operation phase for any purpose. There shall be minimal discharge of wastewater from cleaning of Solar PV modules. The wastewater emanating from cleaning operations shall be recycled for plantation around the plant. For 01 MW, one vehicle of water is required for the cleaning and duration of the cleaning for 1.976 MW is required approximately 01 or 02 days. For 01 MW, approximately 15000 liters of water is required for washing of panels and on monthly basis, 30,000 liters of water will be required for cleaning of panels and the process will be done on monthly basis.

During the operation & maintenance period, natural underground water can be used for cleaning the modules with manual washing. The water for cleaning the module doesn't include any chemical agents, so the untreated underground water will be used for cleaning. Based on our project circumstances, modules shall be cleaned one in every month. The water supply system will be installed along the solar panel array and will be used by the cleaning staff to use the tap water for manual cleaning.

4.5 Impact on Land Use

The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. The total land available for the Project is 6.5 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 green field, wetland or protected area.

Overall, there will be no impact on the land use because the panels will be installed on the rooftop and only a small chunk of land is required for the space of storage of equipment, construction material and waste handling which have a no or minor impact and will be temporary only in construction phase.

4.6 Impact on Biological Environment

The project site is already developed land and there is no harm to the biological environment for the installation of PV plant. As the PV panels are installed on the rooftop and there will be no impact on flora and fauna of the project area. Thus, the site development works would not lead to any significant loss of important species or ecosystems.

4.7 Impact on Solid Waste

Solid waste during the construction phase consists primarily of rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics etc.) and human waste. During the construction there will be generation of garbage, for which designated practices of solid waste disposal shall be followed.

Solid waste disposal will be done as follows;

- ❖ A waste inventory of various waste generated will be prepared and periodically updated.
- ❖ The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.

- ❖ Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through proper waste handling mechanism.

The complete details of scrap metal details will be given as; scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers as per to manage the solid waste handling team. A separate yard area will be allocated for storing the waste material as per the required industrial practice. Also, approved contractor will be hired for the recycling of waste appropriately during construction phase. Waste handling agency will be hired at the start of project construction to manage the waste generating during the construction and operational phase of the plant and the practices used for handling the waste disposal to manage proper waste management through different mechanisms like, make a proper dumping site for the disposal of waste, handling of waste. The wastes which are recyclable are sold to the external contractors and the non-hazardous waste will be dumped through municipal waste collection system and services. The solid waste will be dumped away from the project site and where nearby no settlements or any other affected environment is present. It may the proper dumping site that is used for local municipality. Although the PV cells will not be disposed but sent back under as warranty is for 25 years.

There are some solid wastes in the project site, including the packing material for the equipment, like the wooden pallets and carton boxes. Solid waste management plan will be followed third party EPA certified contractor will be hired for disposal of solid waste (No Impact).

CHAPTER 5

INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PLAN

5 Institutional Requirement and Environmental Monitoring Plan

During the construction and operation of PV Project, the project company will comply all the rules and regulations of EPA as well as NEQs standards. And implement the environmental mitigation and monitoring plan during construction of the project. Environmental Management and Monitoring Plan provides the mechanism to address the adverse environmental as well as social impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The main purpose of Environmental Monitoring Plan is to provide a detailed 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.

5.1 Preconstruction Phase

During pre-construction phase of the project, a field survey was conducted by the team to identify the potential impacts and address into the monitoring plan to mitigate their affects to the project and the surrounding environment. Define the roles and responsibilities for those who involved in the implementation of the EMP. Also define the implementation mechanism for the mitigation measures identified during the present study.

5.2 Construction Phase

During construction phase of the project, a solid waste will be handled properly as per the standard industrial practices and dumped into the proper waste disposal sites which are already identified. Provide safety trainings to the workers who works during the construction phase. Provide instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact during construction of the project.

5.3 Operational Phase

During operational phase, the environment and social impact will be minimum as there is no dust and any gaseous emission from the plant. Only the waste water that used for the cleaning mechanism of PV panels will be generated and will be handled properly as per the standards. Also provide trainings and awareness sessions rising on the environmental and social issues related to power transmission projects to the project. Ensure the legal compliance properly during O & M phase of the project.

CHAPTER 6

FINDINGS AND RECOMMENDATIONS

6 Findings and Recommendations

The Project will be the replacement of conventional power generation with renewable energy. Solar energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

The project is cost effectively and environmental impacts are likely to be minimum in 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 will 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. As proposal land is already the developed land and PV panels will be installed on the rooftop and there is no harm to the natural environment or any biological habitat.

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

ENVIRONMENTAL REPORT OF ZAHIDJEE TEXTILE MILLS
LIMITED-FAISALABAD (UNIT 04)

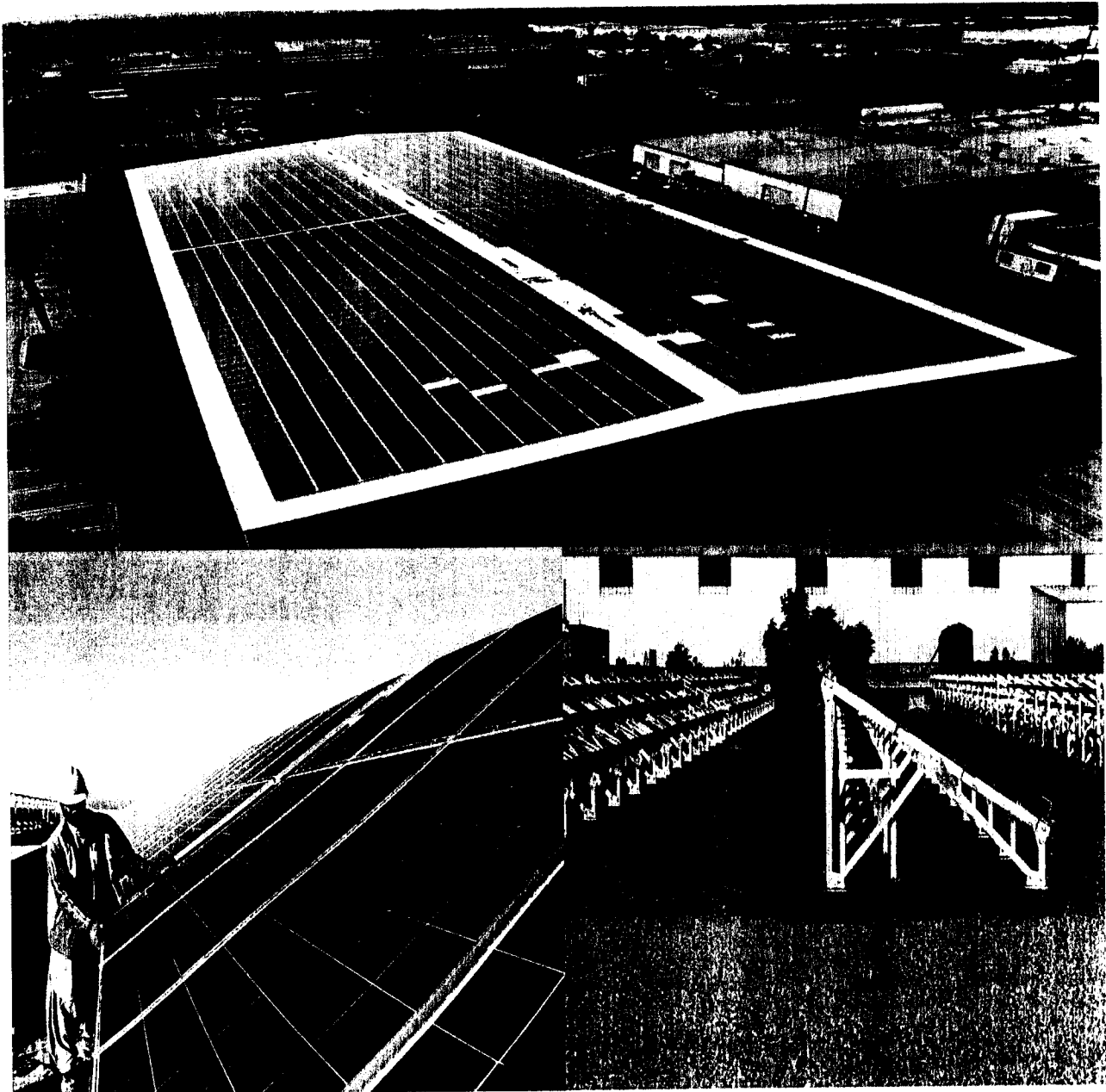


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EXECUTIVE SUMMARY

Zahidjee Textile Mills Limited is interested to installed Solar PV Panels on the rooftop of the factory with capacity of 617.5kW. Total Area for the installation of PV panels are 3.5 acres. Around 1900 polycrystalline PV panels will be installed with power rated of 325 Wp and the capacity factor is approximately 16.01%. the total energy generation will around 0.86 Million kWh.

ZTML is engaged in the export of all kinds of value-added fabrics and textile made-ups. The Company is also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 PROJECT BACKGROUND AND JUSTIFICATION

The project sponsor is Zahidjee Textile Mills Limited. The sponsors of the company will be interested to install the solar PV plant on the rooftop of their factory to generate electricity. It is engaged in the export of all kinds of value-added fabrics and textile made-ups. They also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

1.2 Description of the Project

The project company will be installed 617.5kW of Solar PV plant in Zahidjee Textiles to produce electricity. The total area of the project is around 3.5 acres for the installation of PV panels. The project area is already a developed area and the solar PV panels will be installed on the rooftop of the factory.

1.3 Project Location

The proposed project site is located near Kot Ghulam Muhammad Tandianwala road in District Faisalabad-Punjab. It is around 31 kilometers away from Faisalabad City. The land area of project site is 3.5 acres located near Lahore Faisalabad Motorway. The project land is owned by the project company for the installation of 617.5kW Solar PV plant. The coordinates of the project location are 31°10'27.98"N and 73° 8'45.82"E. The location of site can be viewed in Figure 1.1 and overview of the project site is shown in Figure 1.2.

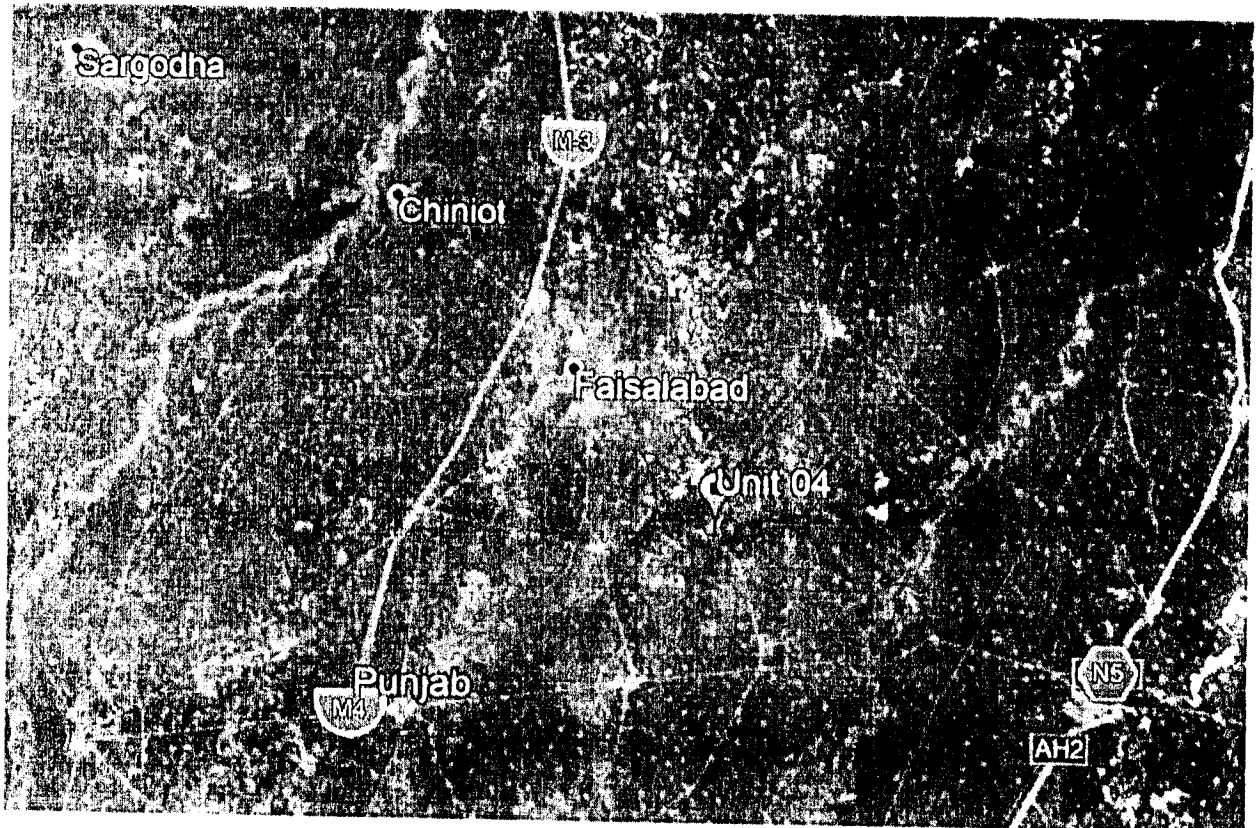


Figure 1.1: Location of Project Site

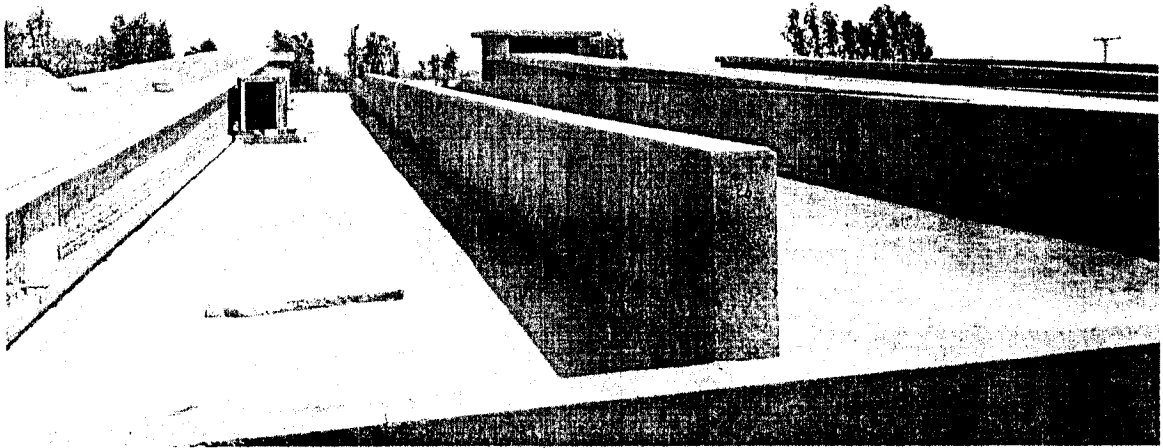


Figure 1.2: Overview of Project Site (Picture-1)

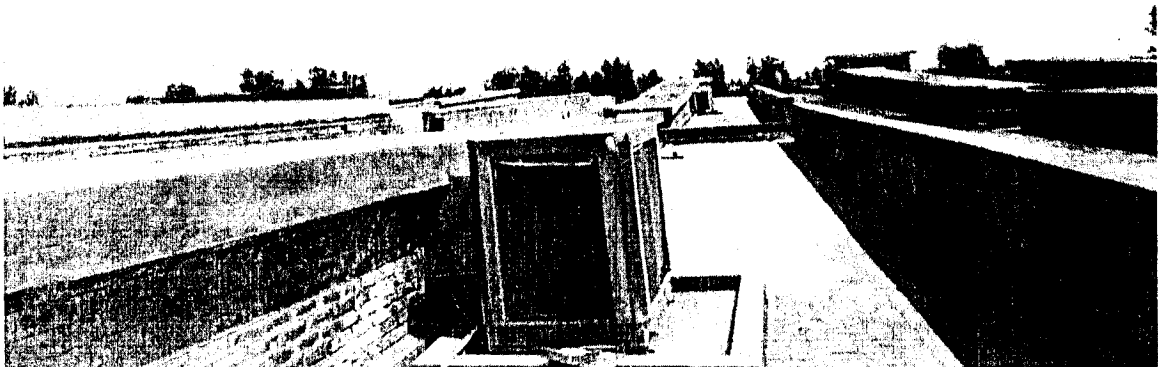


Figure 1.3: Overview of Project Site (Picture-2)

CHAPTER 2

SOLAR ENERGY IN PAKISTAN

2 PROSPECTS OF SOLAR ENERGY IN PAKISTAN

Solar energy has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy. Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.met in a year. It has an average daily global insolation of 19 to 20 MJ/sq.met per day with annual mean sunshine duration of 7 to 8 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m², 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

To summarize, the sun shines for 250-300 days per years in Pakistan with an average sun shine hour of 8-10 per day. In Faisalabad an average sun shine hour is around 6-8 per day. This gives huge amount of energy to be used for electricity generation by solar thermal power plants. A quick idea for the potential of solar energy in Pakistan can be obtained from the satellite map of solar radiation released by National Renewable Energy Lab (NREL) of USA as shown in **Figure 2.1**.

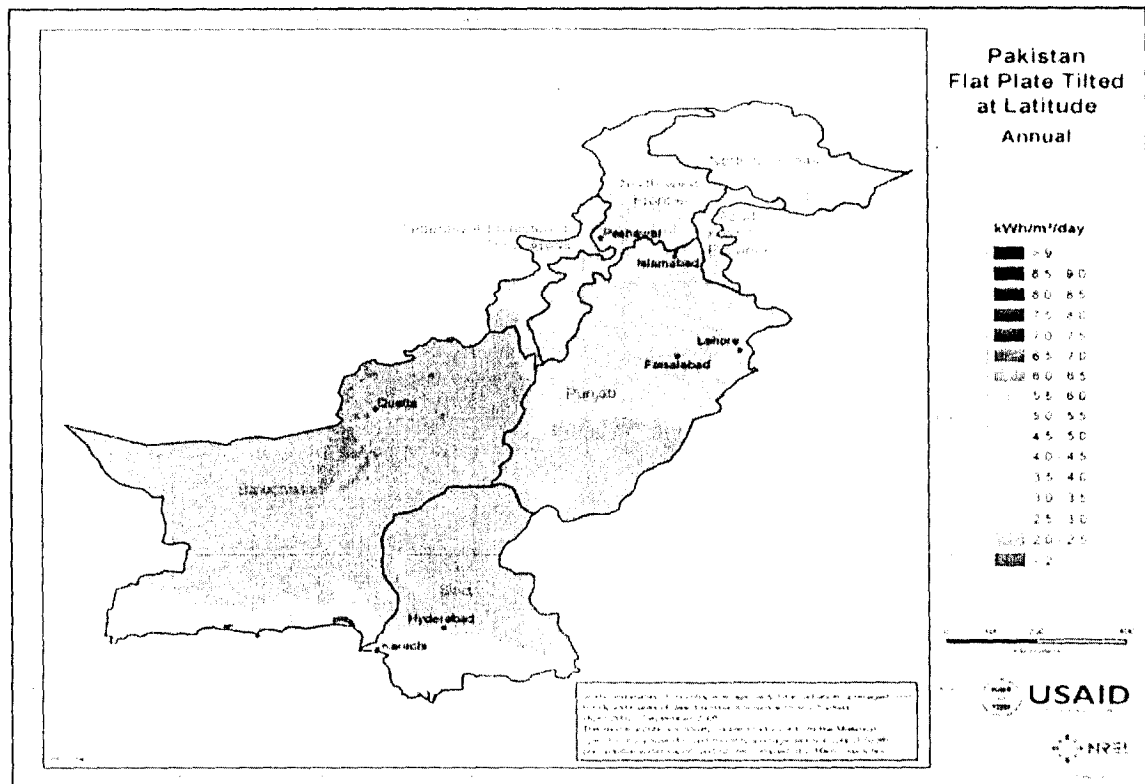


Figure 2.1: NREL Solar Map of Pakistan

2.1 Road Access to the Project Site

The Project site is easily accessible throughout the year. The Lahore-Islamabad motorway (M2) and Pindi Bhattian-Faisalabad Motorway (M3) are the major connecting roads to the Project site, and also the Lahore-Sheikhupura-Faisalabad Road and Satiana-Jaranwala Road is connected to the project site. The total distance from Lahore to the project site through Satiana-Jaranwala road is approximately 143km and from Shakhot Road is around 175km to the project site as shown in Figure 2.2.

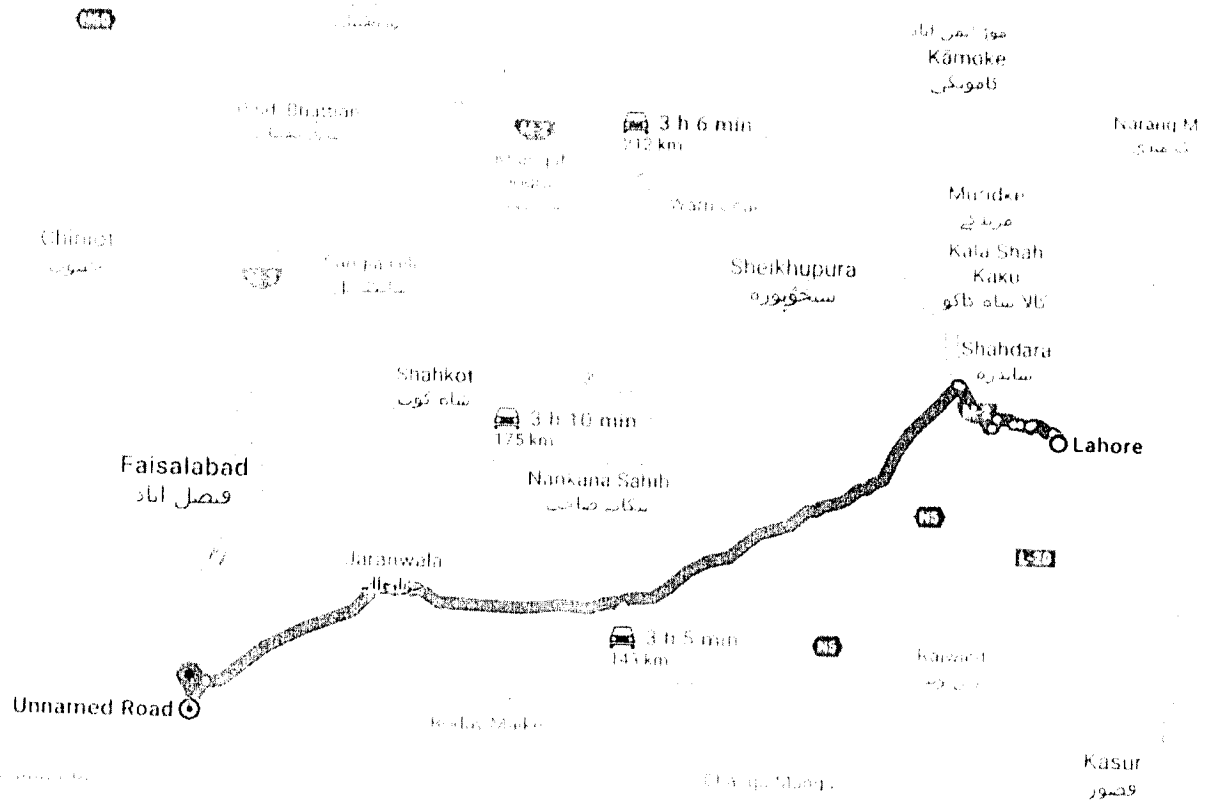


Figure 2.2: Orientation of Project Site from Lahore

The planned movement from Port Qasim to the site will be through the National and Super highways. The major section of the track from Karachi to the site is a multi-lane road, having a relatively flat terrain.

CHAPTER 3

BASELINE CONDITIONS

3 Baseline Conditions

The Baseline condition includes the different parameters which covers under this study are topography, climatic conditions, hydrology, biological conditions, socio-economic environment and seismic hazards.

3.1 Topography

Faisalabad lies in the rolling flat plains of northeast Punjab, at 184 meters (604 ft) above sea level. The city proper comprises approximately 1,230 square.km (470 sq mi) while the district encompasses more than 16,000 square.km (6,200 sq mi). The Chenab River flows about 30 kilometres (19 mi), and the Ravi River meanders 40 km (25 mi) to the southeast. The lower Chenab canal provides water to 80% of cultivated lands making it the main source of irrigation. Faisalabad is bound on the north by Chiniot and Sheikhupura, on the east by Sheikhupura and Sahiwal, on the south by Sahiwal and Toba Tek Singh and on the west by Jhang. The soil consists of young stratified silt loam and very fine sandy loam which makes the subsoil weak in structure with common cankers at only five feet. The water level in this area is higher than in the upland. The upland is flat plains. The general height of the area is from 180 to 192 meters above the sea level. Topographic map of Faisalabad derived from satellite mapping is shown in **Figure 3.1**.

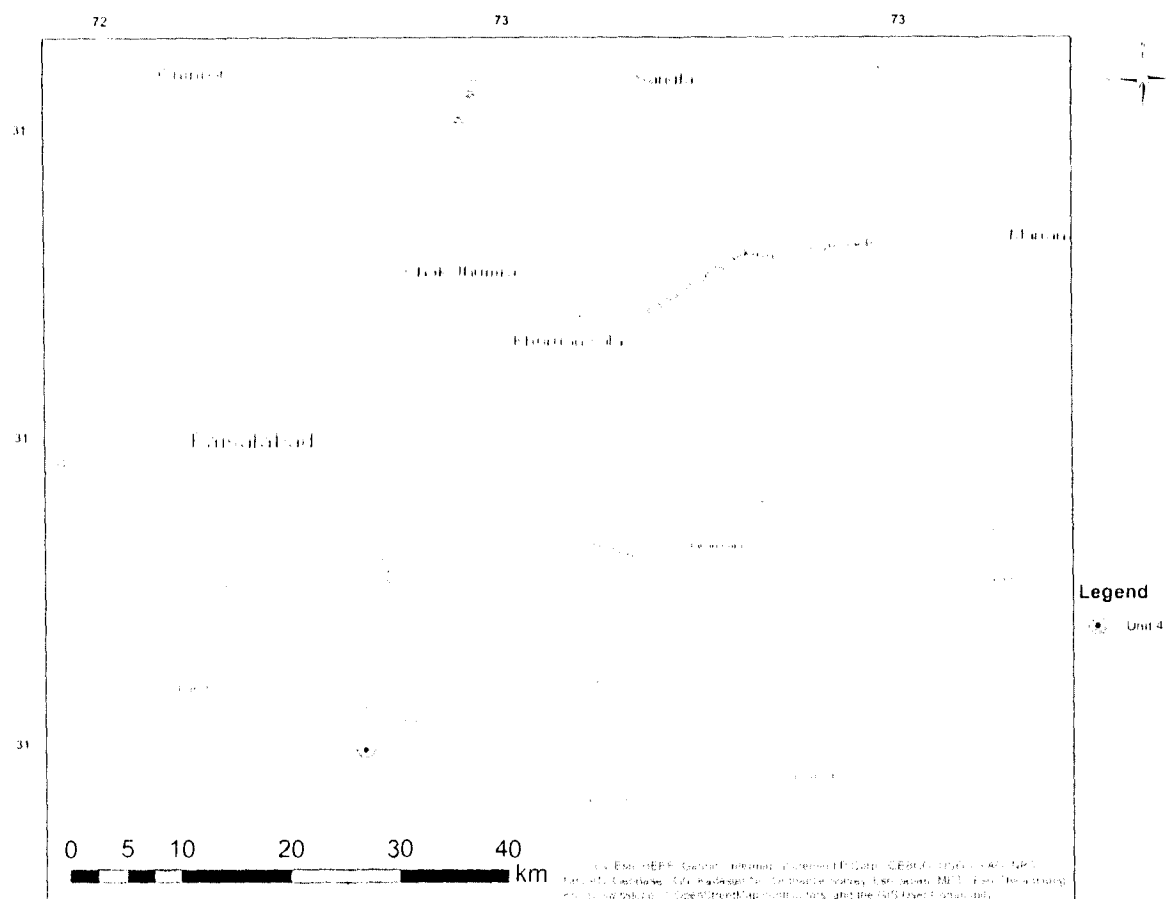


Figure 3.1: Topographic Map of Project Area

3.2 Climatic Conditions

3.2.1 Temperature & Rainfall

The climate of Faisalabad is semi-arid climate with very hot and humid summers and dry cool winters. The summer season lasts from the month of March to October for almost eight months, while the weather is pleasant and cold from November to February. May and June are the hottest months, while July, August and the first half of September can be oppressively humid, except for the days when it rains. June is the hottest month in Faisalabad, when conditions are dry and dust storms are common. The coldest month is January, which is also a dry month with significant foggy days. The fog is particularly dense at night and in early morning hours. The average temperature in the summer season remains between 30 and 40 degree centigrade, while during winter it is between 08 and 19 degree centigrade.

Spring begins after mid-February and lasts usually until late March, when temperatures begin to rise and conditions become drier and sunnier. The average annual rainfall is only about 375 millimetres (14.8 in), which is highly seasonal since approximately half of the yearly rainfall takes place in July and August during the monsoon season.

Faisalabad has 5-7 hours of sunshine daily on average. As there will be no rise in temperature due to reflections of the panels on the atmosphere because the panels are lined with anti-reflection coating (ARC) on the surface which help to reduce the reflection of the panels to almost zero. Adopted measures during rain and sandstorm are to generate or produce electricity is to be reduced.

The detailed temperature data are given in Table 3.1 and graphical presentation in given in Figure 3.2.

Table 3.1: Temperature Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature(°C)	11.3	15.4	21.2	26.6	32.2	31.9	30.8	30.2	28	24.8	18	13.1

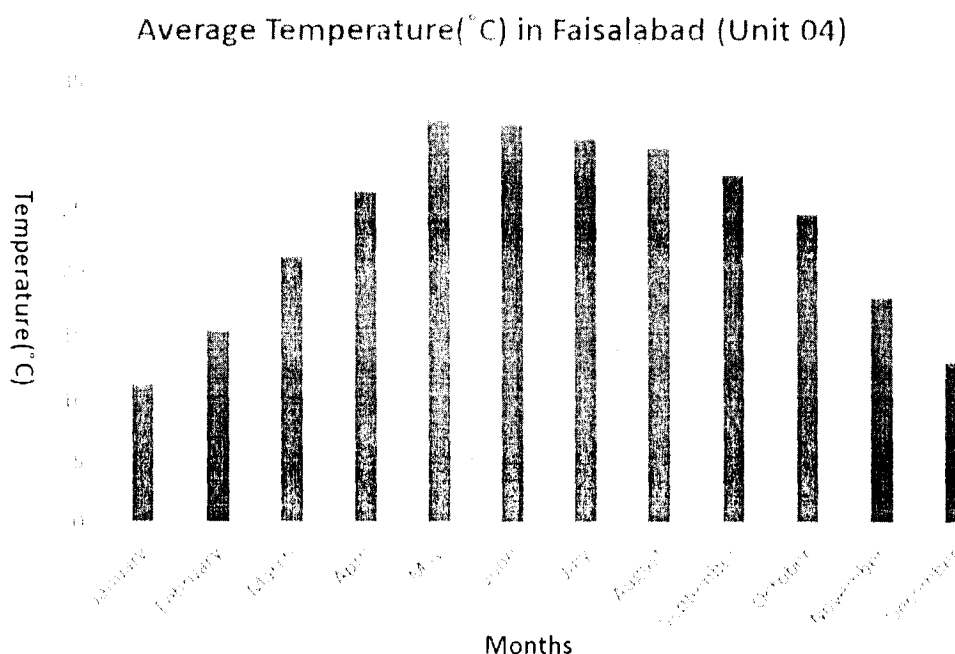


Figure 3.2: Graphical representation of Temperature (Unit 04)

The detailed average annual rainfall data are given in Table 3.2 and graphical presentation in given in Figure 3.3.

Table 3.2: Rainfall Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (mm)	0	15.8	19	26.9	23.3	55.4	63.8	30.5	12.4	0.1	0.1	0.2
Days	0	5	9	12	14	15	14	6	3	1	1	2

Average Rainfall Amount (mm) and Rainy Days in Faisalabad

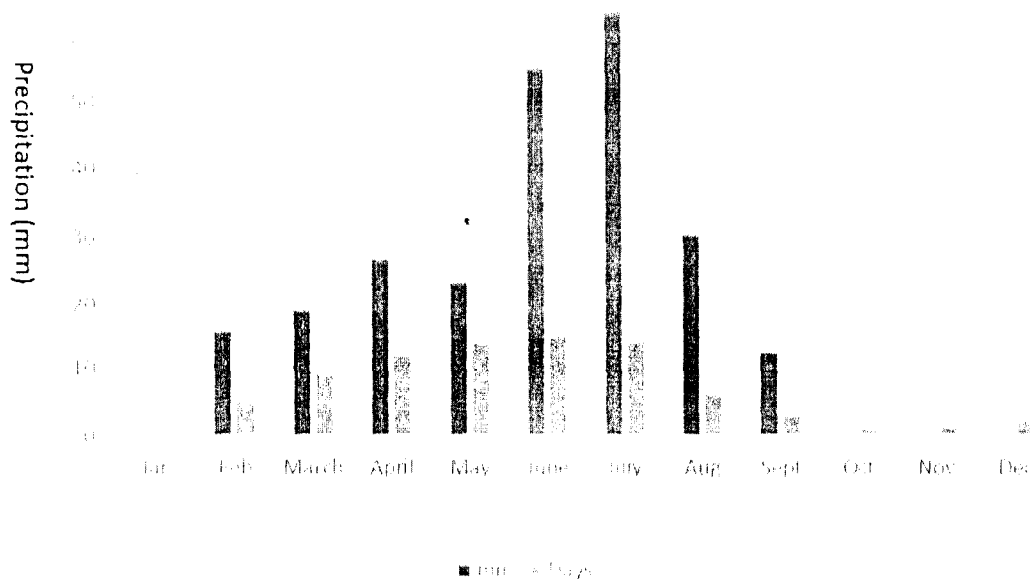


Figure 3.3: Graphical representation of Average Rainfall

Maximum and Minimum Temperature Regime Map of Pakistan is shown in **Figure 3.4**, **Figure 3.5** & **Figure 3.6**.

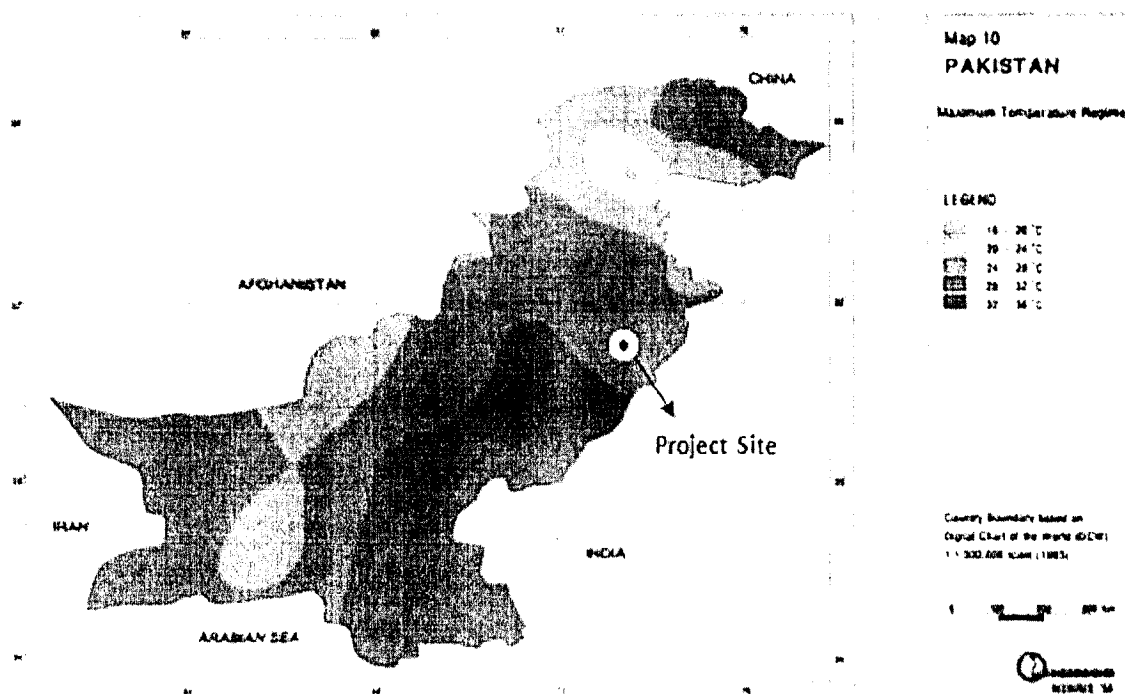


Figure 3.4: Maximum Temperature Regime Map of Pakistan

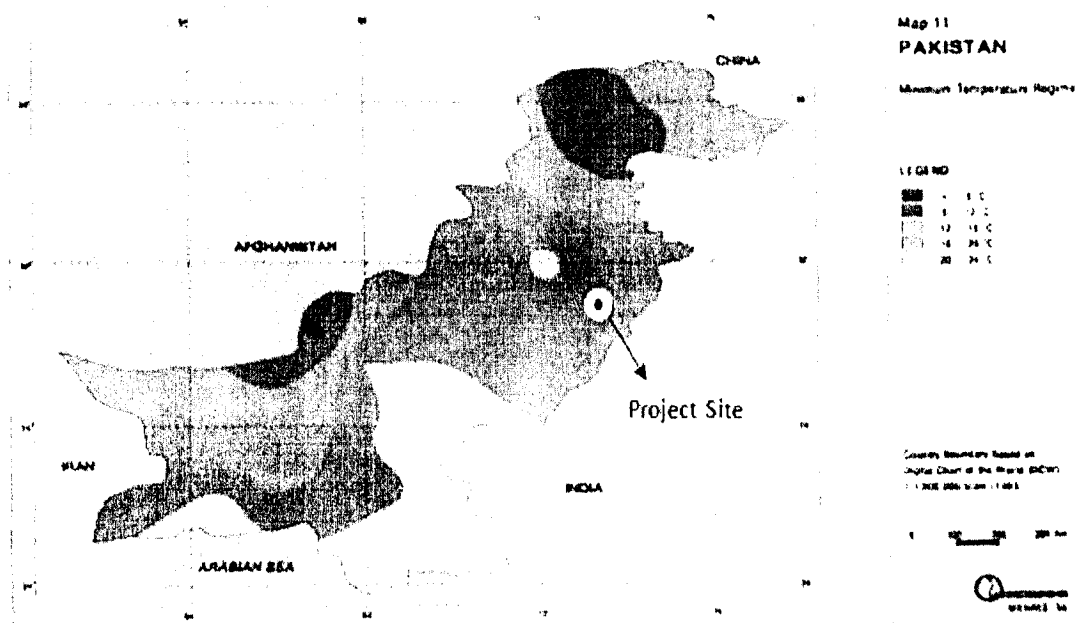


Figure 3.5: Minimum Temperature Regime Map of Pakistan

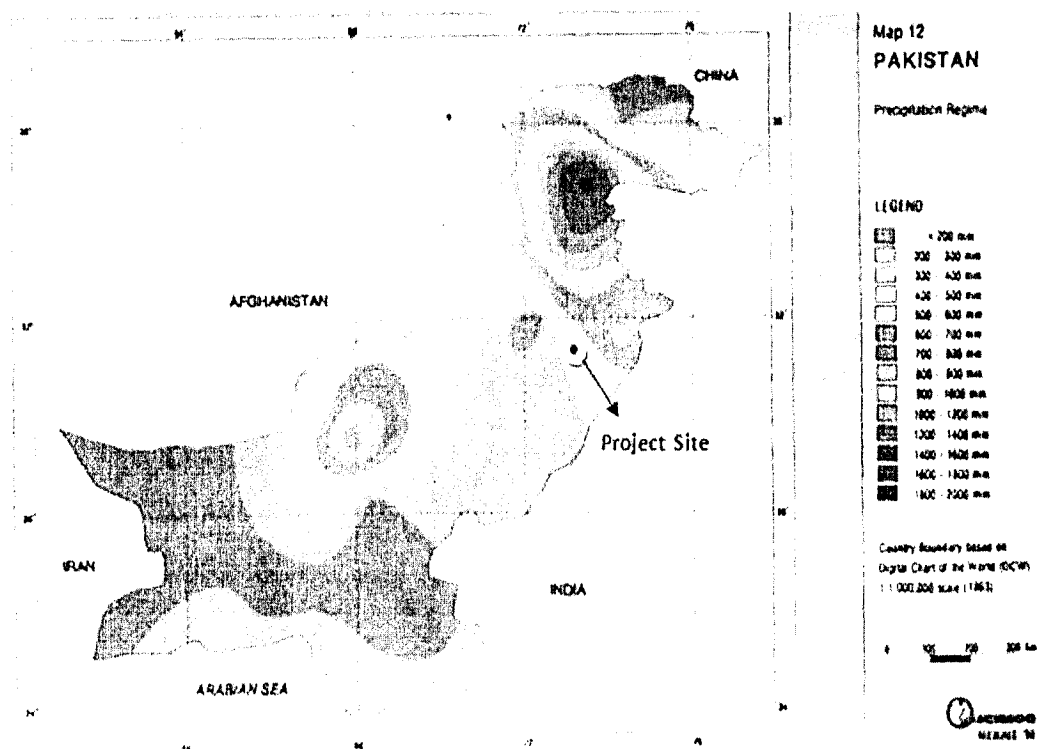


Figure 3.6: Precipitation Map of Pakistan

3.2.2 Wind Speed

The wind in Faisalabad are generally light. The city lies in an area with low wind speeds. Westerly breeze dominates the afternoons, while the nights are calm. South east / easterly winds are common here during the monsoon season. Faisalabad, being in the plains, can experience severe thunderstorms and high wind gusts that can be damaging to its crops.

Wind in Faisalabad is usually **extremely calm**. The windiest month is June, followed by May and July. June's average wind speed of around 4.6 knots (5.3 MPH or 8.5 KPH) is considered "a light breeze." Maximum sustained winds (the highest speed for the day lasting more than a few moments) are at their highest in late May where average top sustained speeds reach 11.3 knots, which is considered a moderate breeze. The average wind speed on yearly basis are given below in **Figure 3.7**.

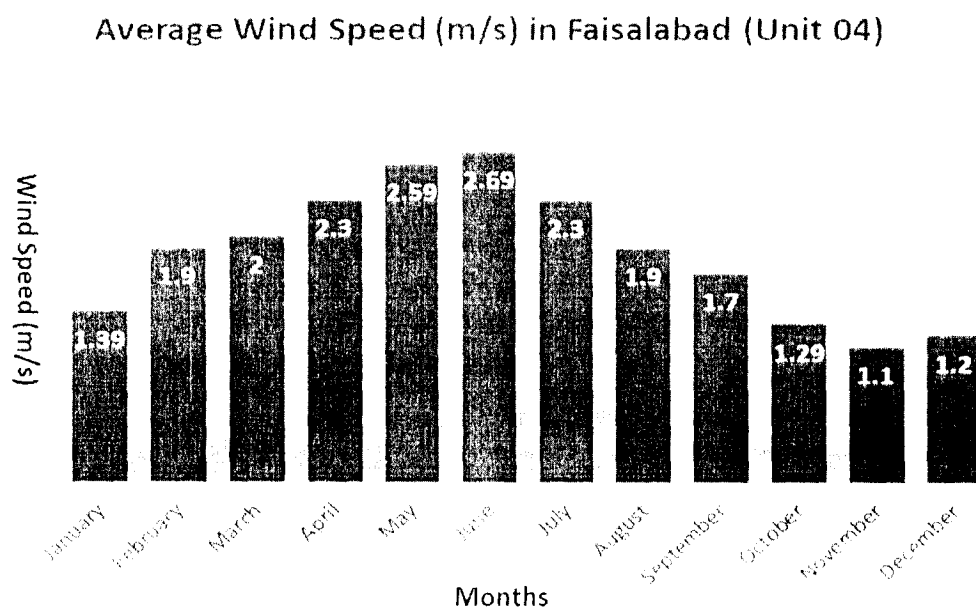


Figure 3.7: Graphical representation of average wind speed in Faisalabad (Unit 04)

3.2.1. Relative Humidity

Faisalabad is semi-arid region; the humidity is high. Faisalabad has some humid months, and dry months in the opposite season. The least humid month is April & May and the most humid month is August (73.3%). Average annual humidity is given in **Figure 3.8**.

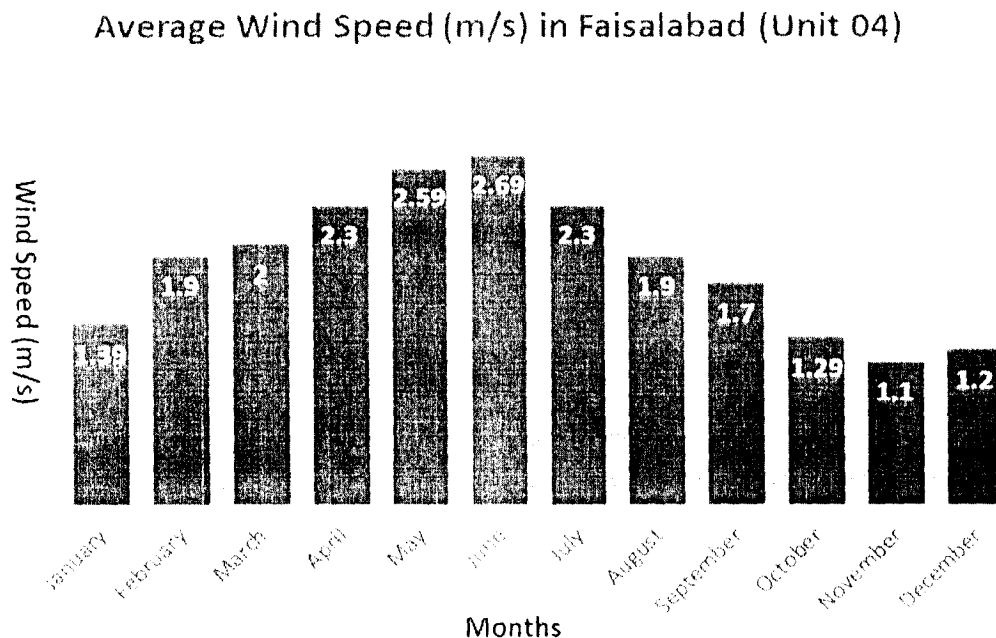


Figure 3.8: Graphical representation of average relative humidity in Faisalabad (Unit 04)

3.3 Hydrology

Faisalabad is densely populated city and due to tremendous increase in population growth, the demand for water has been increasing every year. Being not the main source for domestic and agriculture usage groundwater is higher in Faisalabad. The situation is different in main city of Faisalabad, where abstracting local groundwater is not the source to fulfill the domestic needs. However, villages are abstracting the local groundwater for drinking and other domestic uses.

The ground water of the city Faisalabad is quite saline, hence, not acceptable for human intake. A limited quantity of potable water is accessible to the citizens from different scarce resources. In the absence of proper sweet water sources, the WASA Faisalabad has to pump and bring the sweet water from the city district (Chiniot) where ample quantity of drinking water is available. At the moment, WASA Faisalabad draws about 56 Million Gallons Per Day (MGD) water mainly from Chiniot Well-Field Area located near Chenab River through 29 tube wells. The aforesaid site is located 27KM from the terminal reservoir. Another sweet water source is positioned at a distance of nearby 13KM from terminal reservoir at Jhang Branch Canal which provides 20 MGD through 25 tube wells installed at Jhang branch Well-Field area. In addition to this, about 8 MGD water is being served to the city through 8 tube wells installed at Rakh Branch Canal which passes through the city. These numerals show that around 88.5 MGD water is produced

by the WASA Faisalabad from different resources for its further provision to the citizen/consumers.

Faisalabad is known as polluted industrial city due to the inadequate treatment facilities. The impact on water resources near Samundri drain in Faisalabad showed that the ground water quality was the worst as 90% of samples were above the WHO limits with respect to TDS, Na, K, Cl, and SO₄. The physicochemical analysis of drinking water was carried out to evaluate drinking water quality of Faisalabad city. The turbidity, hardness, pH, and TDS were found within safe limits of WHO guidelines. The microbial analysis showed that all samples were contaminated with total coliforms and E. coli. The impact of municipal and industrial wastewater on water resources in Faisalabad showed that the physicochemical properties of ground water were beyond the critical values of WHO. However, bottle and supply lines were within critical range.

3.4 Seismic Hazards

According to Seismic Zoning map of Pakistan, Project area falls in Zone 2A which is minor to moderate damage area. There is no earthquake recorded in the history of region above Richter scale 4.5. Also, no damage to the infrastructure and human settlement is reported in the area. Map is shown in **Figure 3.9**.

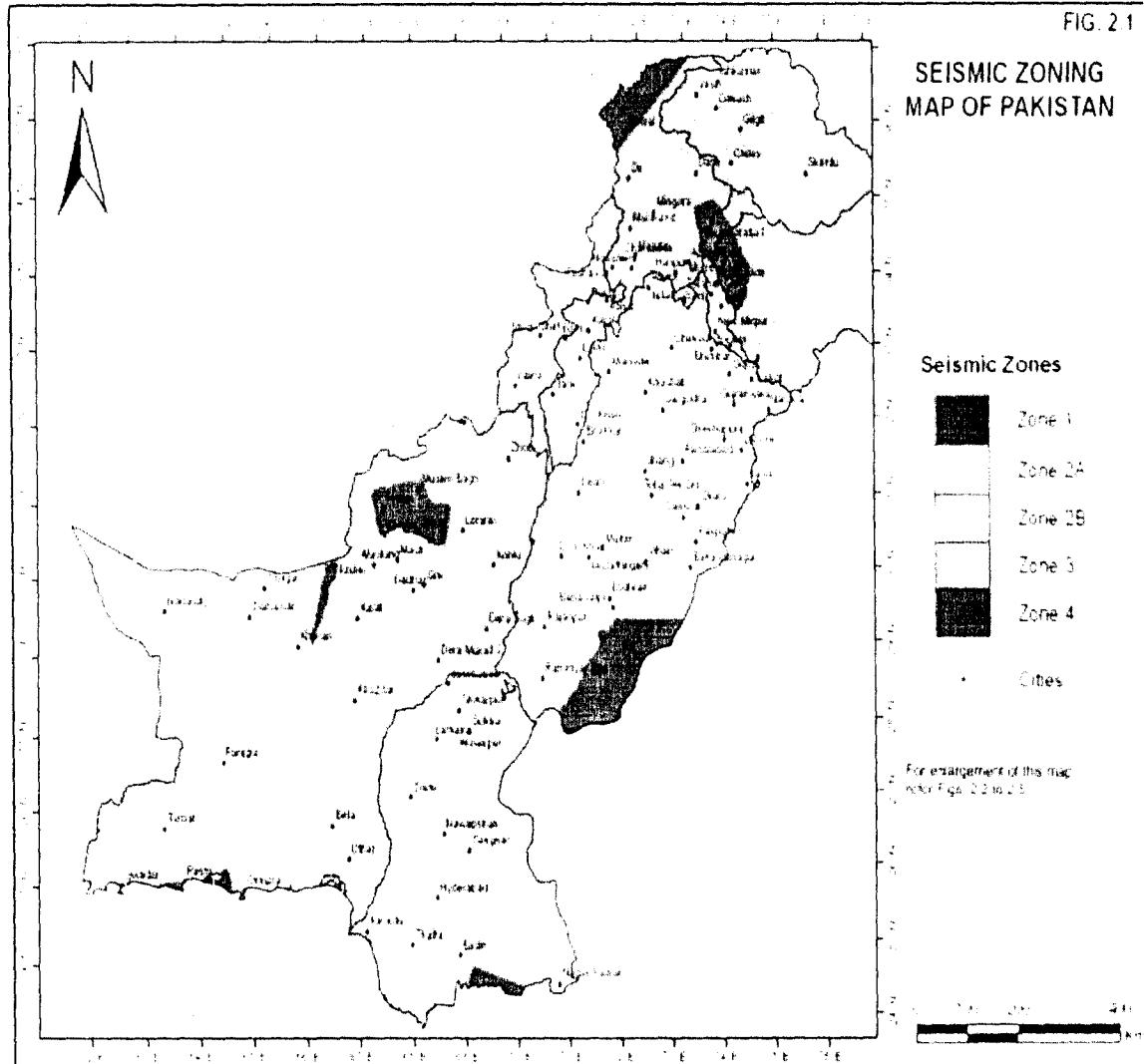


Figure 3.9: Seismic Map of Pakistan

3.5 Socio-Economic Conditions

Faisalabad is a major industrial hub, often referred to as the “Manchester of Pakistan”. It contributes around \$20.5 billion to the national GDP. The city is main center of the textile industry, accounting for more than half of Pakistan’s total textile shipments. (Punjab Board of Investment and Trade 2016) Faisalabad is the second most populous district in Punjab with a population of 3.55 million. Primarily an agro-industrial district, Faisalabad contributes approximately \$5billion to the national GDP through its textile exports. Spread across six densely-populated urban, suburban and rural tehsils, Faisalabad has been the site of many development projects in recent years. However, the public infrastructure is still grossly insufficient to cater to the growing demands of Pakistan's third largest metropolis.

6. Ecology

The main crops and fruits of district Faisalabad are wheat, sugarcane, rice, maize, citrus, guava and mangoes. A variety of vegetables are also grown in the district. The wildlife of the district includes foxes, boars, jackals and wild cats. Among the birds there are usually partridges, pigeons, doves, tilliards, lal menas, bias, parrots, quails, pochards, mallards and teals. As the Solar PV panels will be installed on the rooftop of the factory and no Flora and Fauna is going to be disturbed due to execution of this project.

CHAPTER 4

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4 Potential Environmental Impacts and Mitigation Measures

The project may have environmental impact during construction and operation phase of the project. During construction phase, the impacts may be temporary and short term while long term impacts may be observed during the operational phase of the project. The project has positive impacts overall by providing a competitive, pollution free and cost effective. It may also meet the increasing demand of power and reduce the gap between demand and supply of power.

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, construction phase.

4.1 Impact on Air Quality

As the proposed project is Solar PV project, the impact during construction of project is expected to be minimal as a Greenfield Project plant. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly through the movement of vehicles (transportation activities). No excavation and back filling are required because the PV panels will install on rooftop of the factory. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO₂, NO_x, and particulate matter. The impact is reversible, marginal and temporary in nature.

4.2 Impact on Noise Quality

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like; generators, compressors, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A). As noise generated during construction phase of the project is low and within the Limits of NEQ's. As there is no human settlements and villages near the factory and nearest settlements are around 400-500 meters

away from factory location. So overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.

4.4 Impact on Water Use and Quality

The construction personnel would be housed in temporary settlements or factory settlements. These settlements would discharge considerable amount of domestic wastewater. Stagnant pools of water would increase breeding of mosquitoes and generally create insanitary conditions. The main pollutants are organic components and microorganisms with the potential to cause contamination of water quality. To address potential impacts on water quality, disinfected washroom (e.g., through regular liming) will be used as main component of the sanitation system. As the PV panels will be installed on rooftop of the factory so no or minor use of water during construction phase of the project and overall no impact on water use and its quality.

4.4 Impact on Groundwater Contamination

There is no harm to the ground water due to construction of PV project because panels will be installed on the rooftop and the project site is already developed due to factory. There is no impact on the Ground water.

Ground water due to plant operation will be drawn during operation phase for any purpose. There shall be minimal discharge of wastewater from cleaning of Solar PV modules. The wastewater emanating from cleaning operations shall be recycled for plantation around the plant. For 01 MW, one vehicle of water is required for the cleaning and duration of the cleaning for 617.5kW required approximately 01 day. For 01 MW, approximately 15000 liters of water is required for washing of panels and on monthly basis, 9,000 to 12,000 liters of water will be required for cleaning of panels and the process will be done on monthly basis.

During the operation & maintenance period, natural underground water can be used for cleaning the modules with manual washing. The water for cleaning the module doesn't include any chemical agents, so the untreated underground water will be used for cleaning. Based on our project circumstances, modules shall be cleaned one in every month. The water supply system will be installed along the solar panel array and will be used by the cleaning staff to use the tap water for manual cleaning.

4.5 Impact on Land Use

The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. The total land available for the Project is 3.5 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 green field, wetland or protected area.

Overall, there will be no impact on the land use because the panels will be installed on the rooftop and only a small chunk of land is required for the space of storage of equipment, construction material and waste handling which have a no or minor impact and will be temporary only in construction phase.

4.6 Impact on Biological Environment

The project site is already developed land and there is no harm to the biological environment for the installation of PV plant. As the PV panels are installed on the rooftop and there will be no impact on flora and fauna of the project area. Thus, the site development works would not lead to any significant loss of important species or ecosystems.

4.7 Impact on Solid Waste

Solid waste during the construction phase consists primarily of rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics etc.) and human waste. During the construction there will be generation of garbage, for which designated practices of solid waste disposal shall be followed.

Solid waste disposal will be done as follows;

- ❖ A waste inventory of various waste generated will be prepared and periodically updated.
- ❖ The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.

- ❖ Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through proper waste handling mechanism.

The complete details of scrap metal details will be given as; scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers as per to manage the solid waste handling team. A separate yard area will be allocated for storing the waste material as per the required industrial practice. Also, approved contractor will be hired for the recycling of waste appropriately during construction phase. Waste handling agency will be hired at the start of project construction to manage the waste generating during the construction and operational phase of the plant and the practices used for handling the waste disposal to manage proper waste management through different mechanisms like, make a proper dumping site for the disposal of waste, handling of waste. The wastes which are recyclable are sold to the external contractors and the non-hazardous waste will be dumped through municipal waste collection system and services. The solid waste will be dumped away from the project site and where nearby no settlements or any other affected environment is present. It may the proper dumping site that is used for local municipality. Although the PV cells will not be disposed but sent back under as warranty is for 25 years.

There are some solid wastes in the project site, including the packing material for the equipment, like the wooden pallets and carton boxes. Solid waste management plan will be followed third party EPA certified contractor will be hired for disposal of solid waste (No Impact).

CHAPTER 5

INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PLAN

5 Institutional Requirement and Environmental Monitoring Plan

During the construction and operation of PV Project, the project company will comply all the rules and regulations of EPA as well as NEQs standards. And implement the environmental mitigation and monitoring plan during construction of the project. Environmental Management and Monitoring Plan provides the mechanism to address the adverse environmental as well as social impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The main purpose of Environmental Monitoring Plan is to provide a detailed 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.

5.1 Preconstruction Phase

During pre-construction phase of the project, a field survey was conducted by the team to identify the potential impacts and address into the monitoring plan to mitigate their affects to the project and the surrounding environment. Define the roles and responsibilities for those who involved in the implementation of the EMP. Also define the implementation mechanism for the mitigation measures identified during the present study.

5.2 Construction Phase

During construction phase of the project, a solid waste will be handled properly as per the standard industrial practices and dumped into the proper waste disposal sites which are already identified. Provide safety trainings to the workers who works during the construction phase. Provide instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact during construction of the project.

5.3 Operational Phase

During operational phase, the environment and social impact will be minimum as there is no dust and any gaseous emission from the plant. Only the waste water that used for the cleaning mechanism of PV panels will be generated and will be handled properly as per the standards. Also provide trainings and awareness sessions rising on the environmental and social issues related to power transmission projects to the project. Ensure the legal compliance properly during O & M phase of the project.

CHAPTER 6

FINDINGS AND RECOMMENDATIONS

6 Findings and Recommendations

The Project will be the replacement of conventional power generation with renewable energy. Solar energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

The project is cost effectively and environmental impacts are likely to be minimum in 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 will 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. As proposal land is already the developed land and PV panels will be installed on the rooftop and there is no harm to the natural environment or any biological habitat.

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

ENVIRONMENTAL REPORT OF ZAHIDJEE TEXTILE MILLS
LIMITED-FAISALABAD (UNIT 08 & 09)

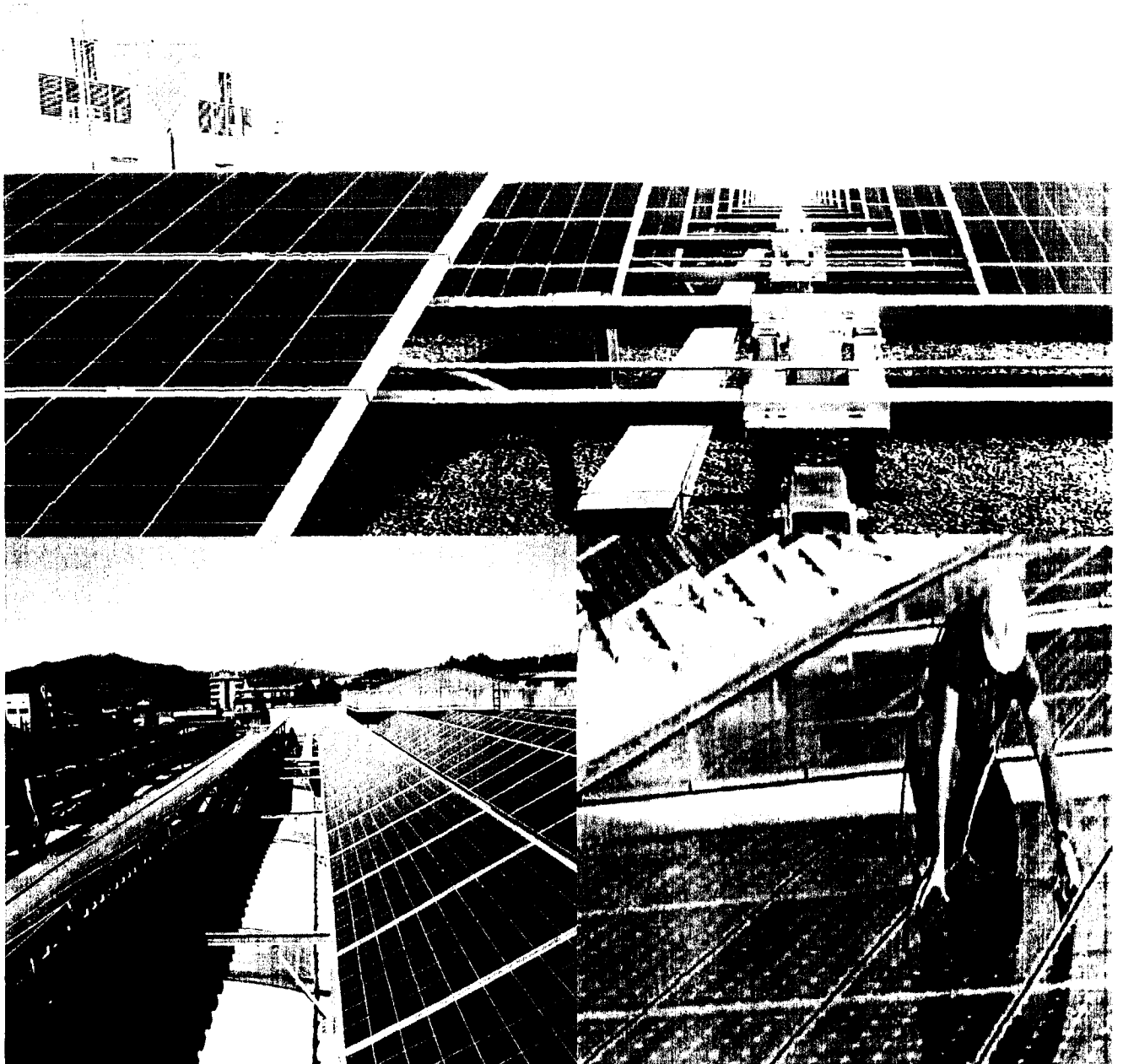


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EXECUTIVE SUMMARY

Zahidjee Textile Mills Limited is interested to installed Solar PV Panels on the rooftop of the factory with capacity of 2.47 MW. Total Area for the installation of PV panels are 7.25 acres. Around 7600 polycrystalline PV panels will be installed with power rated of 325 Wp and the capacity factor is approximately 15.74%. the total energy generation will around 3.41 Million kWh.

ZTML is engaged in the export of all kinds of value-added fabrics and textile made-ups. The Company is also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 PROJECT BACKGROUND AND JUSTIFICATION

The project sponsor is Zahidjee Textile Mills Limited. The sponsors of the company will be interested to install the solar PV plant on the rooftop of their factory to generate electricity. It is engaged in the export of all kinds of value-added fabrics and textile made-ups. They also engaged in the business of manufacturing and sale of yarn. Its product range is divided into three categories: Yarn Manufacturing, Grieg cloth Manufacturing and Export (Grieg/Fabrics/Made ups). It is engaged in manufacturing and export of spinning, weaving, processing and home textile products. It produces Cotton Yarn and Poly Cotton Yarn; Yarn count ranging from Ne 6/S to Ne 40/S carded and combed yarn for knitting and weaving; Slub Yarn (Multi Count/ Multi Twist)/Siro, and double yarn. It has over 280 Shuttle less Sulzer Ruti Looms from which it produces a range of cloth qualities, such as Herringbone, Poly Cotton (PC) Twill, PC Drill, PC/Cotton Perkile and PC/Cotton Sheeting Cloth. The Company's weaving unit is located at Satyana, District Faisalabad and spinning units are located at Tehsil Jaranwala, District Faisalabad, in the province of Punjab.

1.2 Description of the Project

The project company will be installed 2.47MW of Solar PV plant in Zahidjee Textiles to produce electricity. The total area of the project is around 7.25 acres for the installation of PV panels. The project area is already a developed area and the solar PV panels will be installed on the rooftop of the factory.

1.3 Project Location

The proposed project site is located near M3 Industrial City in District Faisalabad-Punjab. It is around 35 kilometers away from Faisalabad City. The land area of project site is 7.25 acres located near Pindi Bhattian-Faisalabad Motorway. The project land is owned by the project company for the installation of 2.47MW Solar PV plant. The coordinates of the project location are 31°39'3.66"N and 73°12'23.62"E. The location of site can be viewed in **Figure 1.1** and overview of the project site is shown in **Figure 1.2**.

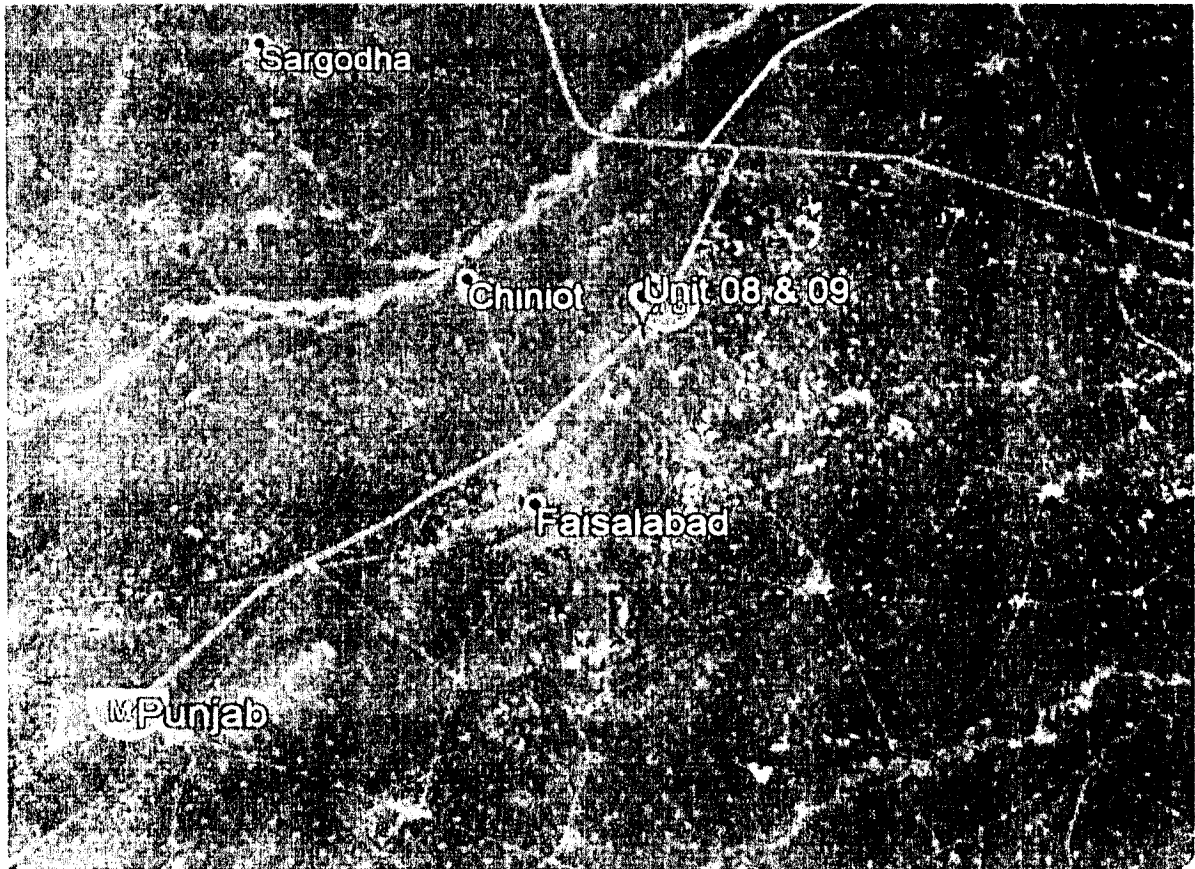


Figure 1.1: Location of Project Site



Figure 1.2: Overview of Project Site (Picture-1)

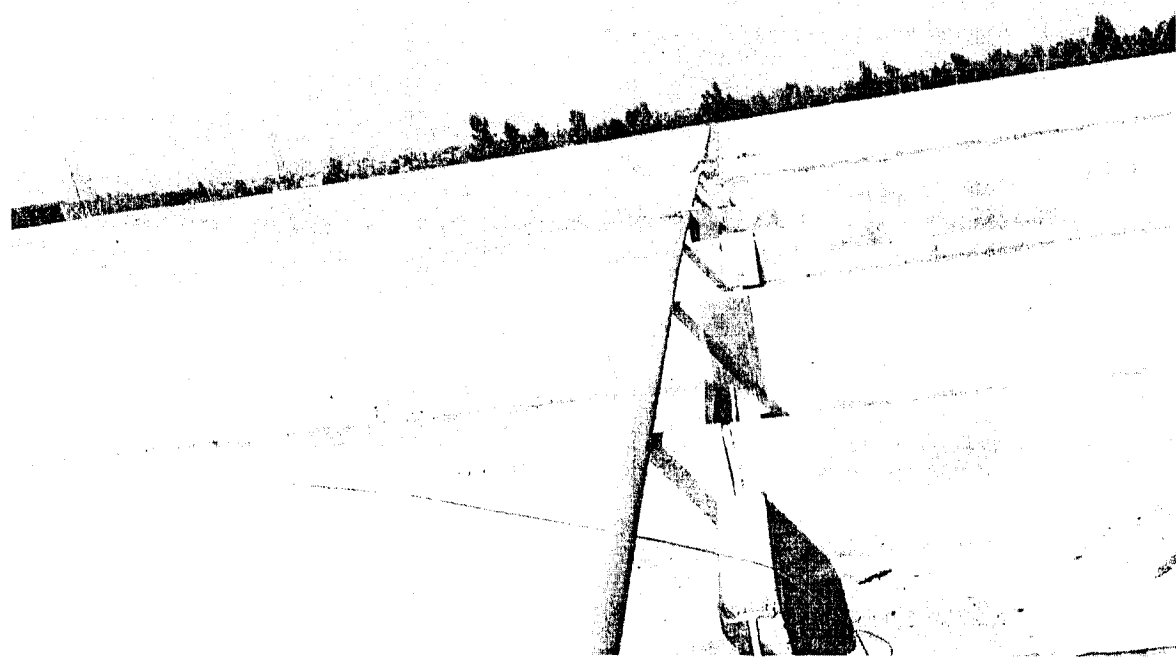


Figure 1.3: Overview of Project Site (Picture-2)

CHAPTER 2

SOLAR ENERGY IN PAKISTAN

2 PROSPECTS OF SOLAR ENERGY IN PAKISTAN

Solar energy has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy. Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.met in a year. It has an average daily global insolation of 19 to 20 MJ/sq.met per day with annual mean sunshine duration of 7 to 8 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m², 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

To summarize, the sun shines for 250-300 days per years in Pakistan with an average sun shine hour of 8-10 per day. In Faisalabad an average sun shine hour is around 6-8 per day. This gives huge amount of energy to be used for electricity generation by solar thermal power plants. A quick idea for the potential of solar energy in Pakistan can be obtained from the satellite map of solar radiation released by National Renewable Energy Lab (NREL) of USA as shown in **Figure 2.1**.

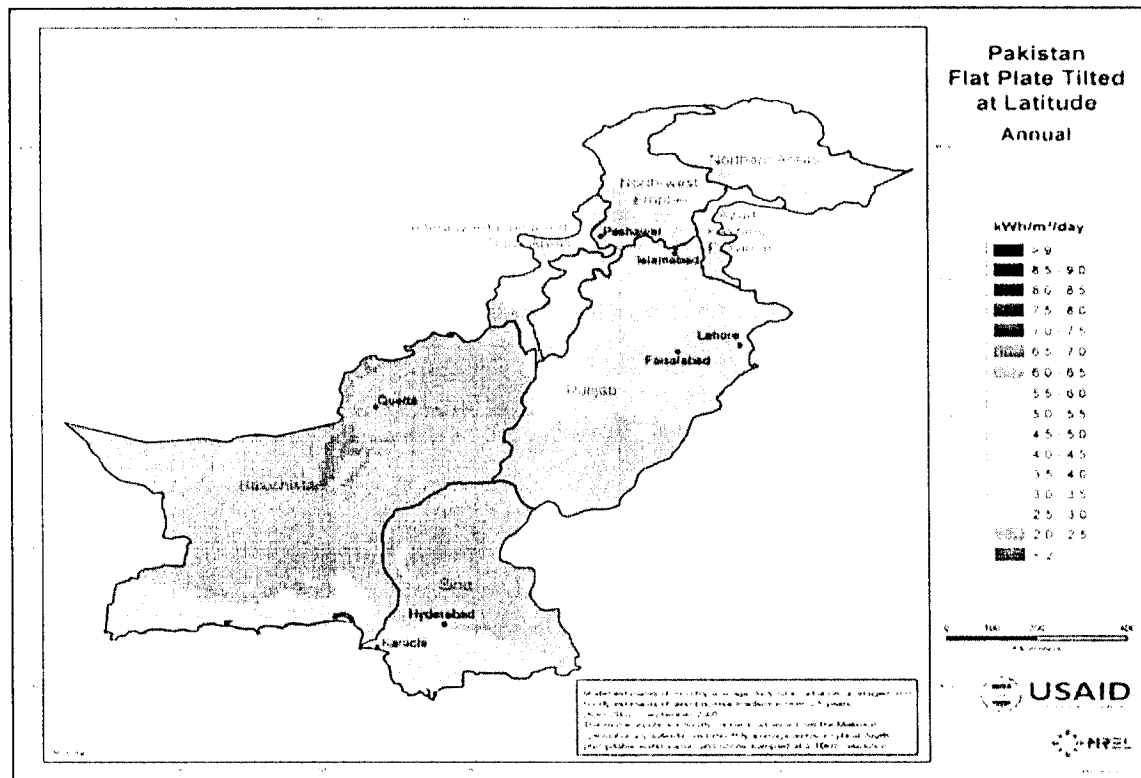


Figure 2.1: NREL Solar Map of Pakistan

2.1 Road Access to the Project Site

The Project site is easily accessible throughout the year. The Lahore-Islamabad motorway (M2), Pindi Bhattian-Faisalabad Motorway (M3) are the major connecting roads to the Project site, and also the Lahore-Sheikhupura-Faisalabad Road and M3 Industrial City Road is connected to the project site. The total distance from Lahore to the project site through Shangle hill road is approximately 152km and from (M3) Pindi Bhattian-Faisalabad Motorway road is around 163km to the project site as shown in **Figure 2.2**.

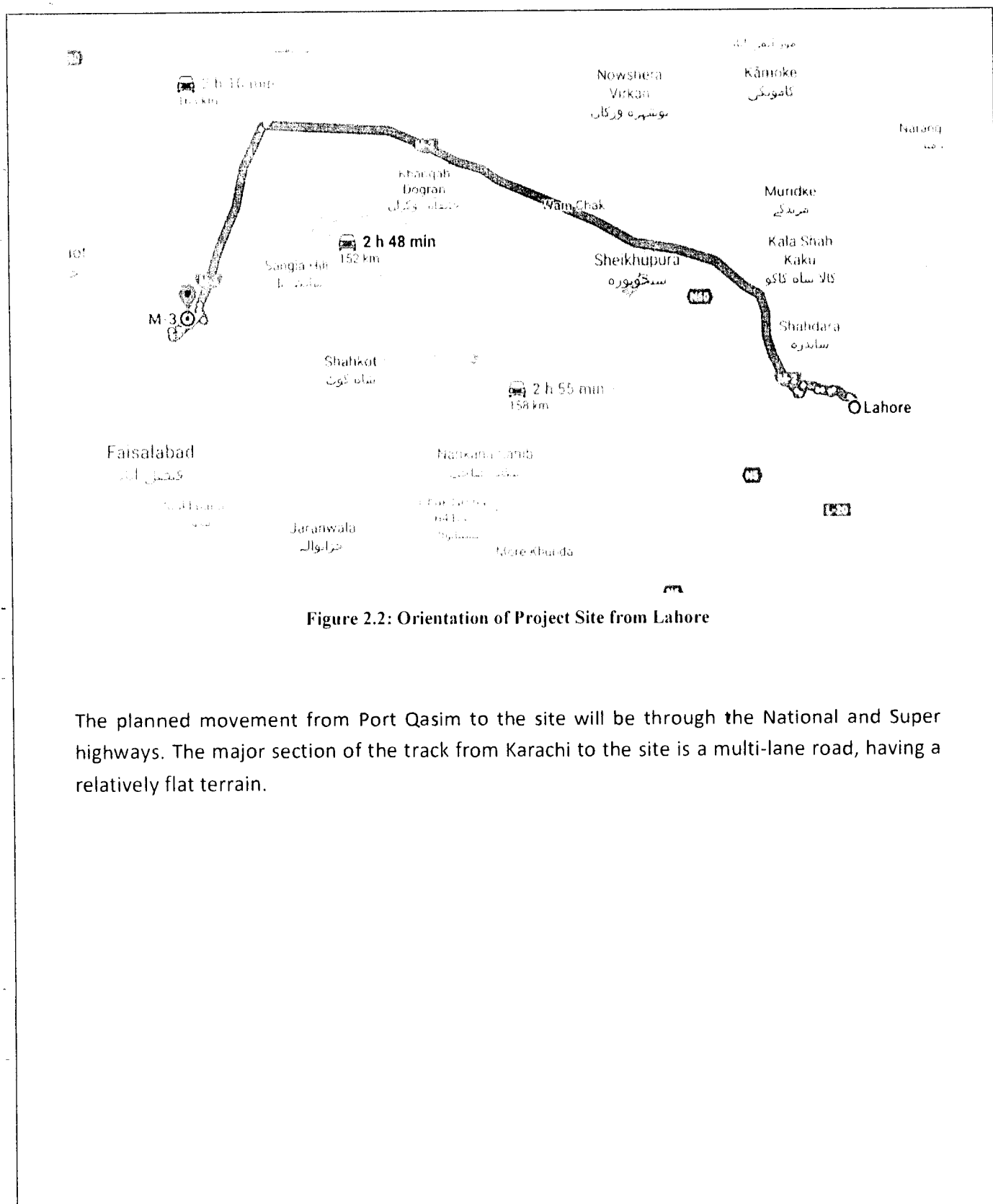


Figure 2.2: Orientation of Project Site from Lahore

The planned movement from Port Qasim to the site will be through the National and Super highways. The major section of the track from Karachi to the site is a multi-lane road, having a relatively flat terrain.

CHAPTER 3

BASELINE CONDITIONS

3 Baseline Conditions

The Baseline condition includes the different parameters which covers under this study are topography, climatic conditions, hydrology, biological conditions, socio-economic environment and seismic hazards.

3.1 Topography

Faisalabad lies in the rolling flat plains of northeast Punjab, at 184 meters (604 ft) above sea level. The city proper comprises approximately 1,230 square.km (470 sq mi) while the district encompasses more than 16,000 square.km (6,200 sq mi). The Chenab River flows about 30 kilometres (19 mi), and the Ravi River meanders 40 km (25 mi) to the southeast. The lower Chenab canal provides water to 80% of cultivated lands making it the main source of irrigation. Faisalabad is bound on the north by Chiniot and Sheikhpura, on the east by Sheikhpura and Sahiwal, on the south by Sahiwal and Toba Tek Singh and on the west by Jhang. The soil consists of young stratified silt loam and very fine sandy loam which makes the subsoil weak in structure with common cankers at only five feet. The water level in this area is higher than in the upland. The upland is flat plains. The general height of the area is from 180 to 192 meters above the sea level. Topographic map of Faisalabad derived from satellite mapping is shown in Figure 3.1.

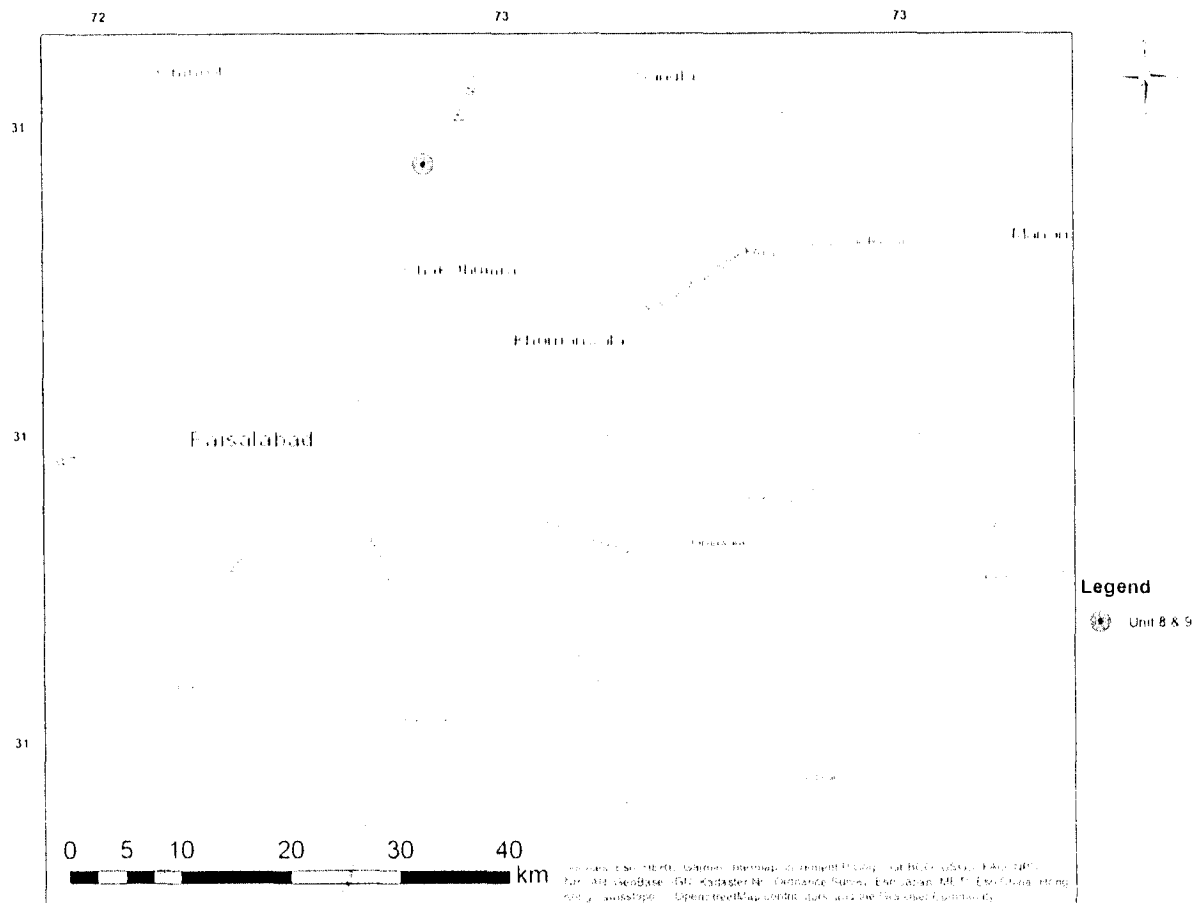


Figure 3.1: Topographic Map of Project Area

3.2 Climatic Conditions

3.2.1 Temperature & Rainfall

The climate of Faisalabad is semi-arid climate with very hot and humid summers and dry cool winters. The summer season lasts from the month of March to October for almost eight months, while the weather is pleasant and cold from November to February. May and June are the hottest months, while July, August and the first half of September can be oppressively humid, except for the days when it rains. June is the hottest month in Faisalabad, when conditions are dry and dust storms are common. The coldest month is January, which is also a dry month with significant foggy days. The fog is particularly dense at night and in early morning hours. The average temperature in the summer season remains between 30 and 40 degree centigrade, while during winter it is between 08 and 19 degree centigrade.

Spring begins after mid-February and lasts usually until late March, when temperatures begin to rise and conditions become drier and sunnier. The average annual rainfall is only about 375 millimetres (14.8 in), which is highly seasonal since approximately half of the yearly rainfall takes place in July and August during the monsoon season.

Faisalabad has 5-7 hours of sunshine daily on average. As there will be no rise in temperature due to reflections of the panels on the atmosphere because the panels are lined with anti-reflection coating (ARC) on the surface which help to reduce the reflection of the panels to almost zero. Adopted measures during rain and sandstorm are to generate or produce electricity is to be reduced.

The detailed temperature data are given in Table 3.1 and graphical presentation in given in Figure 3.2.

Table 3.1: Temperature Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature(°C)	11.2	15.3	21	26.5	32.1	31.8	30.7	30.1	27.9	24.7	18	13.1

Average Temperature(°C) in Faisalabad (Unit 08 & 09)

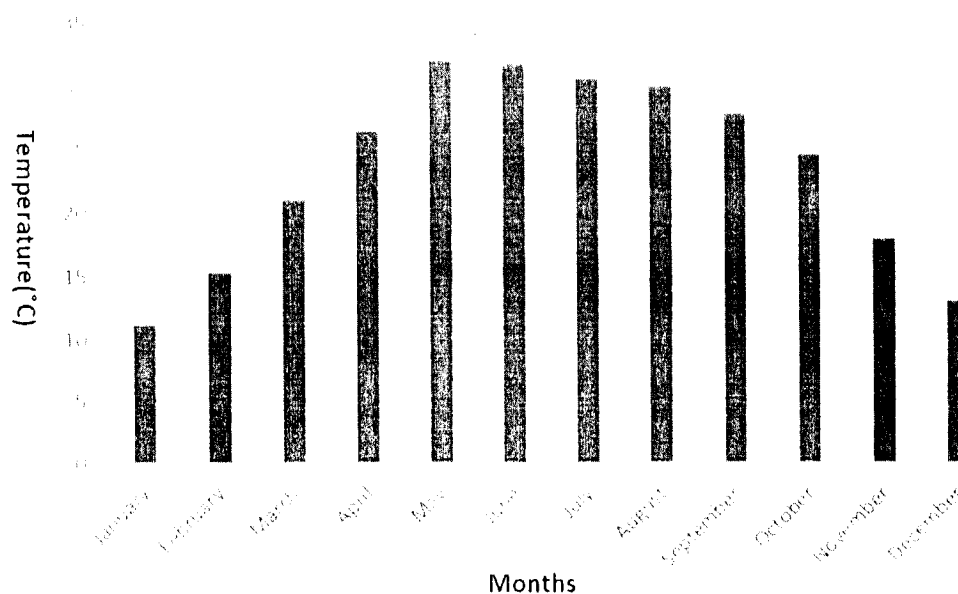


Figure 3.2: Graphical representation of Temperature (Unit 08 & 09)

The detailed average annual rainfall data are given in Table 3.2 and graphical presentation in given in Figure 3.3.

Table 3.2: Rainfall Statistics for Faisalabad District in 2018

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (mm)	0	15.8	19	26.9	23.3	55.4	63.8	30.5	12.4	0.1	0.1	0.2
Days	0	5	9	12	14	15	14	6	3	1	1	2

Average Rainfall Amount (mm) and Rainy Days in Faisalabad

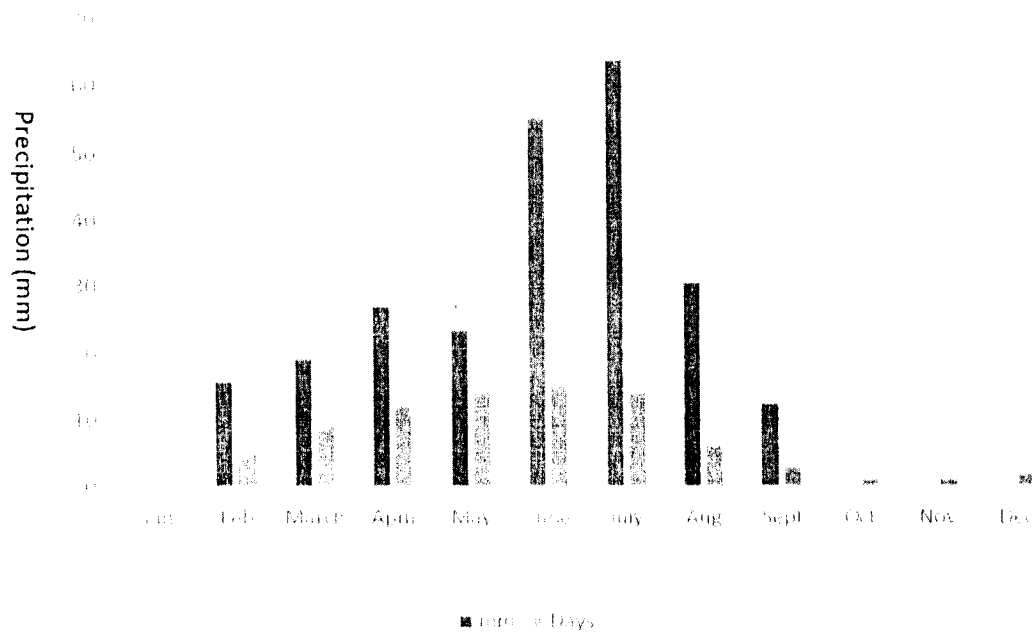


Figure 3.3: Graphical representation of Average Rainfall

Maximum and Minimum Temperature Regime Map of Pakistan is shown in **Figure 3.4**, **Figure 3.5** & **Figure 3.6**.

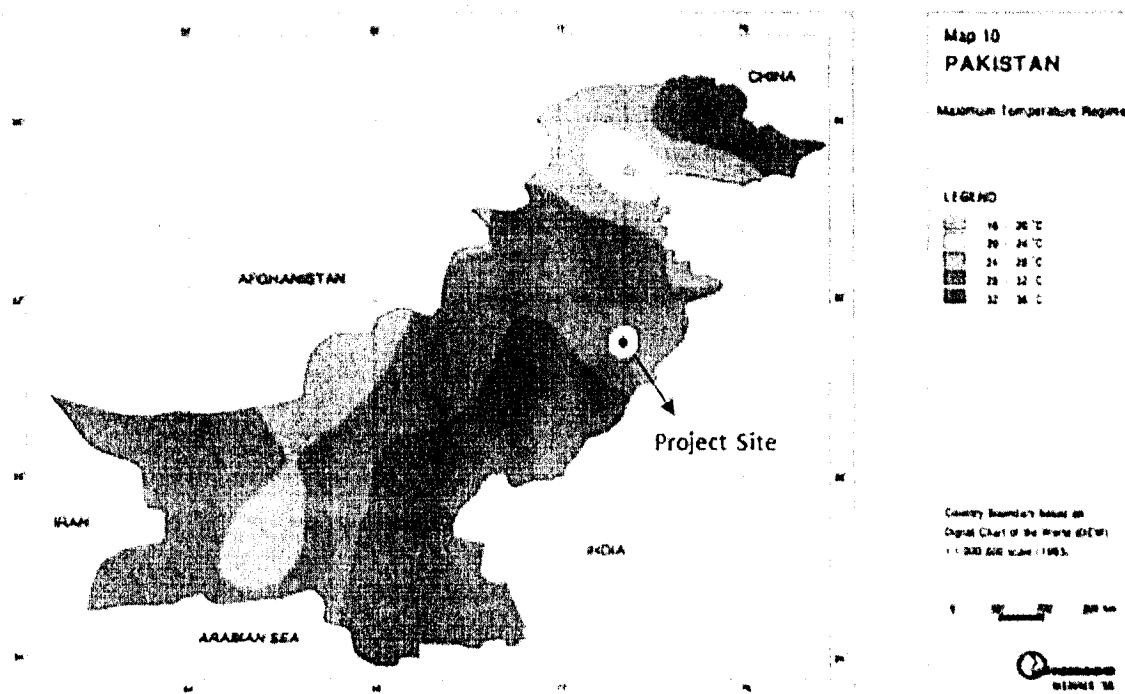


Figure 3.4: Maximum Temperature Regime Map of Pakistan

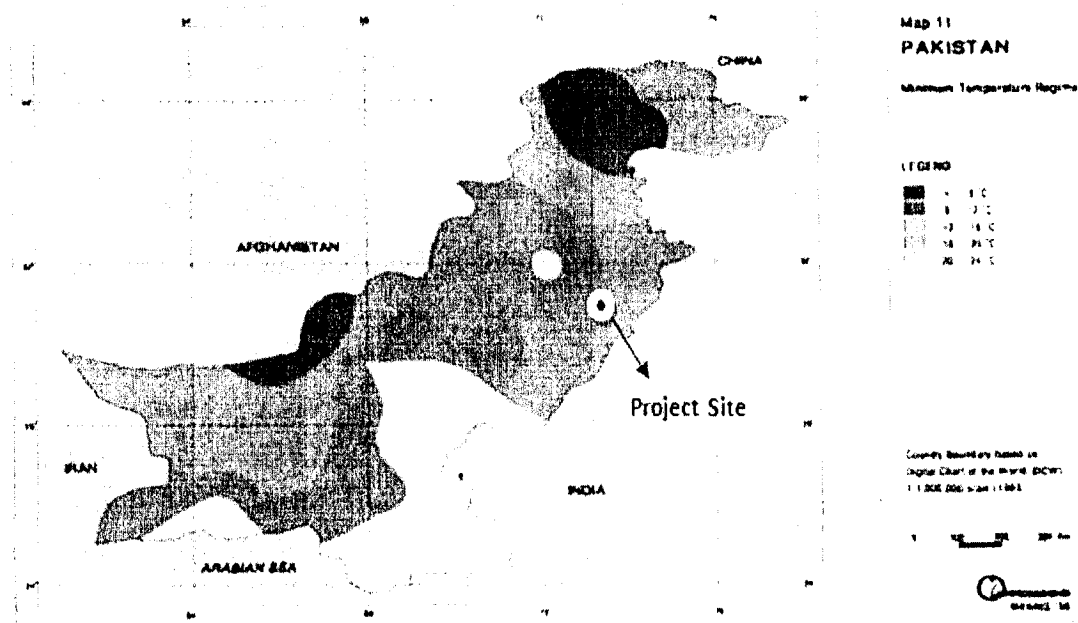


Figure 3.5: Minimum Temperature Regime Map of Pakistan

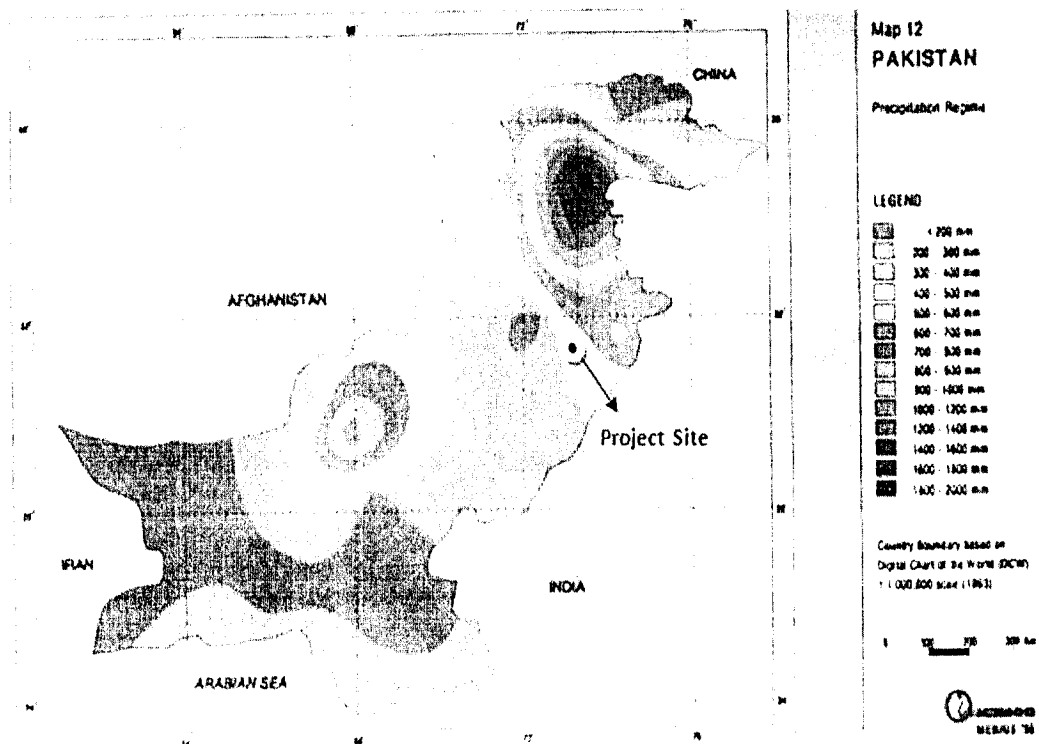


Figure 3.6: Precipitation Map of Pakistan

3.2.2 Wind Speed

The wind in Faisalabad are generally light. The city lies in an area with low wind speeds. Westerly breeze dominates the afternoons, while the nights are calm. South east / easterly winds are common here during the monsoon season. Faisalabad, being in the plains, can experience severe thunderstorms and high wind gusts that can be damaging to its crops.

Wind in Faisalabad is usually **extremely calm**. The windiest month is June, followed by May and July. June's average wind speed of around 4.6 knots (5.3 MPH or 8.5 KPH) is considered "a light breeze." Maximum sustained winds (the highest speed for the day lasting more than a few moments) are at their highest in late May where average top sustained speeds reach 11.3 knots, which is considered a moderate breeze. The average wind speed on yearly basis are given below in **Figure 3.7**.

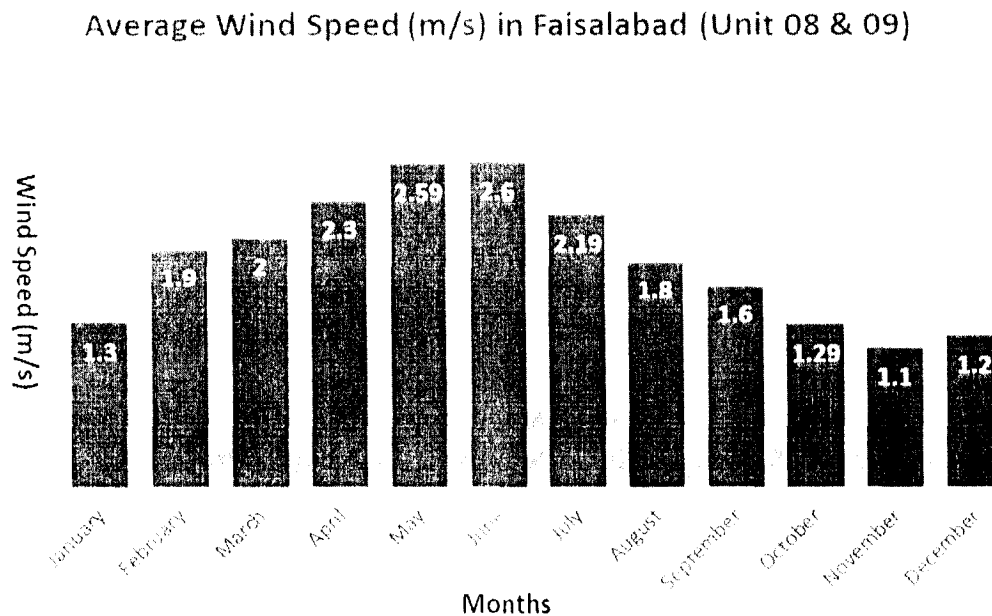


Figure 3.7: Graphical representation of average wind speed in Faisalabad (Unit 08 & 09)

3.2.2 Relative Humidity

Faisalabad is semi-arid region; the humidity is high. Faisalabad has some humid months, and dry months in the opposite season. The least humid month is April & May and the most humid month is August (73.6%). Average annual humidity is given in **Figure 3.8**.

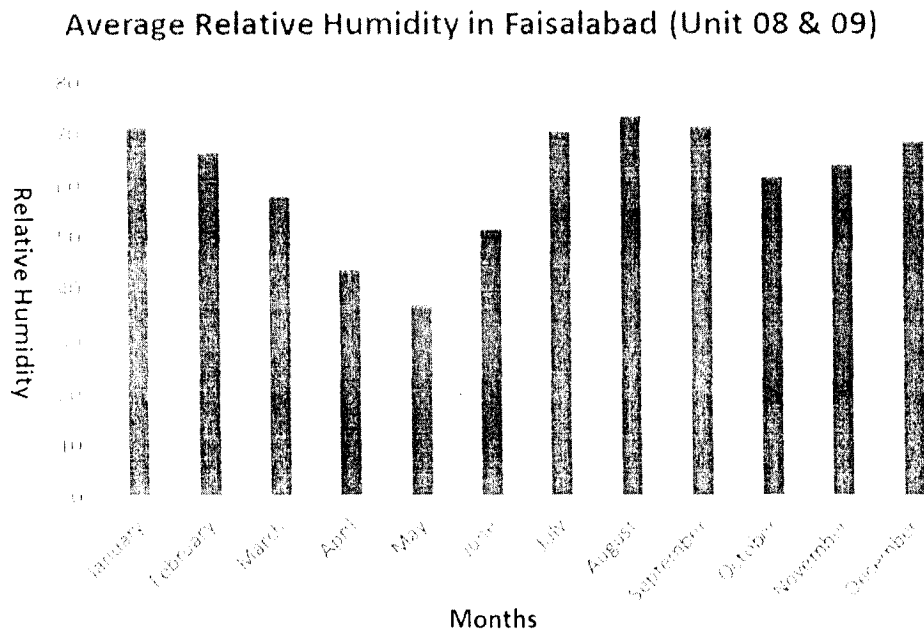


Figure 3.8: Graphical representation of average relative humidity in Faisalabad (Unit 08 & 09)

3.3 Hydrology

Faisalabad is densely populated city and due to tremendous increase in population growth, the demand for water has been increasing every year. Being not the main source for domestic and agriculture usage groundwater is higher in Faisalabad. The situation is different in main city of Faisalabad, where abstracting local groundwater is not the source to fulfill the domestic needs. However, villages are abstracting the local groundwater for drinking and other domestic uses.

The ground water of the city Faisalabad is quite saline, hence, not acceptable for human intake. A limited quantity of potable water is accessible to the citizens from different scarce resources. In the absence of proper sweet water sources, the WASA Faisalabad has to pump and bring the sweet water from the city district (Chiniot) where ample quantity of drinking water is available. At the moment, WASA Faisalabad draws about 56 Million Gallons Per Day (MGD) water mainly from Chiniot Well-Field Area located near Chenab River through 29 tube wells. The aforesaid site is located 27KM from the terminal reservoir. Another sweet water source is positioned at a distance of nearby 13KM from terminal reservoir at Jhang Branch Canal which provides 20 MGD through 25 tube wells installed at Jhang branch Well-Field area. In addition to this, about 8 MGD water is being served to the city through 8 tube wells installed at Rakh Branch Canal which passes through the city. These numerals show that around 88.5 MGD water is produced

by the WASA Faisalabad from different resources for its further provision to the citizen/consumers.

Faisalabad is known as polluted industrial city due to the inadequate treatment facilities. The impact on water resources near Samundri drain in Faisalabad showed that the ground water quality was the worst as 90% of samples were above the WHO limits with respect to TDS, Na, K, Cl, and SO₄. The physicochemical analysis of drinking water was carried out to evaluate drinking water quality of Faisalabad city. The turbidity, hardness, pH, and TDS were found within safe limits of WHO guidelines. The microbial analysis showed that all samples were contaminated with total coliforms and E. coli. The impact of municipal and industrial wastewater on water resources in Faisalabad showed that the physicochemical properties of ground water were beyond the critical values of WHO. However, bottle and supply lines were within critical range.

3.4 Seismic Hazards

According to Seismic Zoning map of Pakistan, Project area falls in Zone 2A which is minor to moderate damage area. There is no earthquake recorded in the history of region above Richter scale 4.5. Also, no damage to the infrastructure and human settlement is reported in the area. Map is shown in **Figure 3.9**.

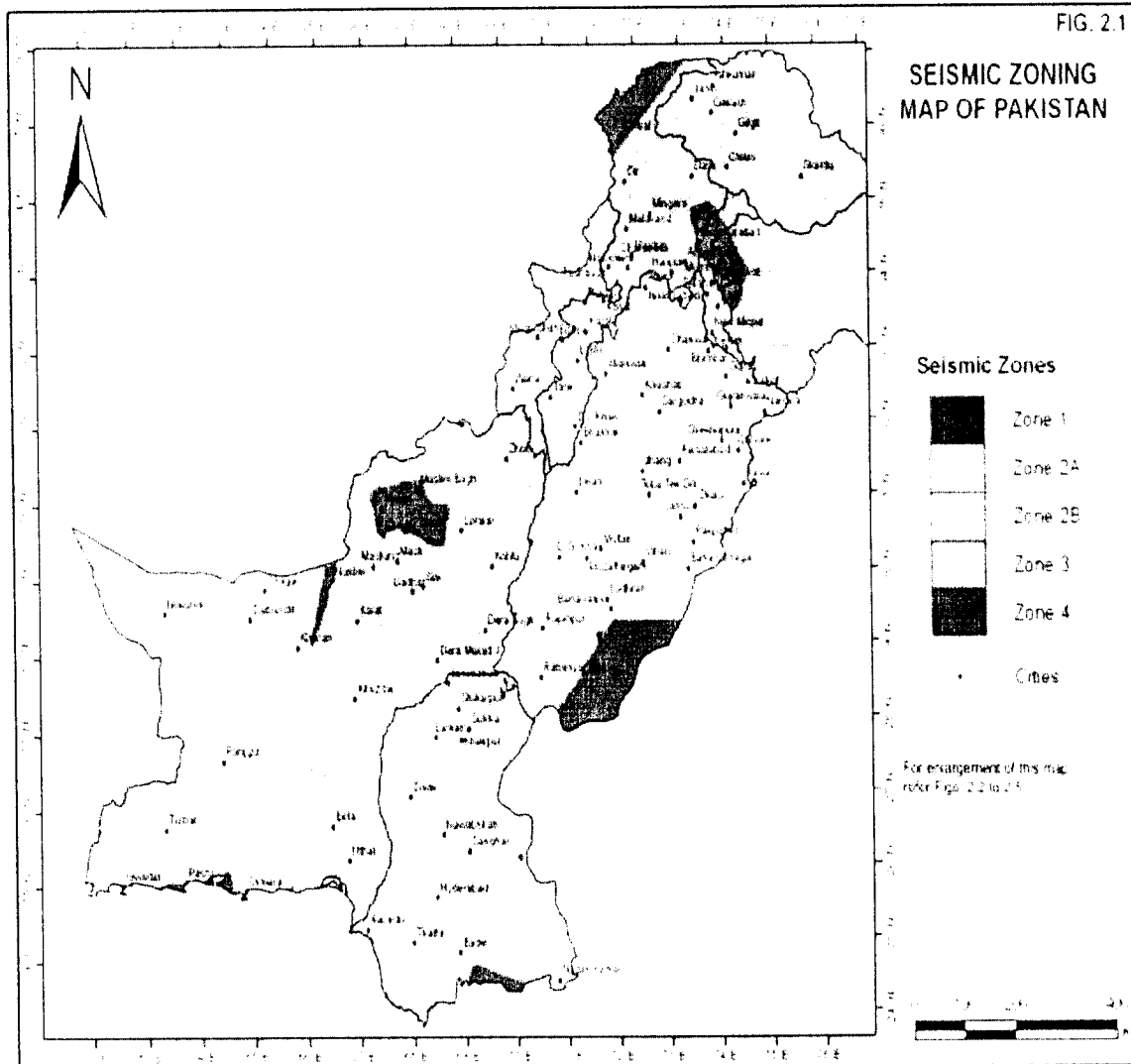


Figure 3.9: Seismic Map of Pakistan

3.5 Socio-Economic Conditions

Faisalabad is a major industrial hub, often referred to as the “Manchester of Pakistan”. It contributes around \$20.5 billion to the national GDP. The city is main center of the textile industry, accounting for more than half of Pakistan’s total textile shipments. (Punjab Board of Investment and Trade 2016) Faisalabad is the second most populous district in Punjab with a population of 3.55 million. Primarily an agro-industrial district, Faisalabad contributes approximately \$5billion to the national GDP through its textile exports. Spread across six densely-populated urban, suburban and rural tehsils, Faisalabad has been the site of many development projects in recent years. However, the public infrastructure is still grossly insufficient to cater to the growing demands of Pakistan's third largest metropolis.

3.6 Ecology

The main crops and fruits of district Faisalabad are wheat, sugarcane, rice, maize, citrus, guava and mangoes. A variety of vegetables are also grown in the district. The wildlife of the district includes foxes, boars, jackals and wild cats. Among the birds there are usually partridges, pigeons, doves, tilliars, lal menas, bias, parrots, quails, pochards, mallards and teals. As the Solar PV panels will be installed on the rooftop of the factory and no Flora and Fauna is going to be disturbed due to execution of this project.

CHAPTER 4

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4 Potential Environmental Impacts and Mitigation Measures

The project may have environmental impact during construction and operation phase of the project. During construction phase, the impacts may be temporary and short term while long term impacts may be observed during the operational phase of the project. The project has positive impacts overall by providing a competitive, pollution free and cost effective. It may also meet the increasing demand of power and reduce the gap between demand and supply of power.

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, construction phase.

4.1 Impact on Air Quality

As the proposed project is Solar PV project, the impact during construction of project is expected to be minimal as a Greenfield Project plant. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly through the movement of vehicles (transportation activities). No excavation and back filling are required because the PV panels will install on rooftop of the factory. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO₂, NO_x, and particulate matter. The impact is reversible, marginal and temporary in nature.

4.2 Impact on Noise Quality

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like; generators, compressors, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A). As noise generated during construction phase of the project is low and within the Limits of NEQ's. As there is no human

settlements and villages near to the factory. So overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.

4.3 Impact on Water Use and Quality

The construction personnel would be housed in temporary settlements or factory settlements. These settlements would discharge considerable amount of domestic wastewater. Stagnant pools of water would increase breeding of mosquitoes and generally create insanitary conditions. The main pollutants are organic components and microorganisms with the potential to cause contamination of water quality. To address potential impacts on water quality, disinfected washroom (e.g., through regular liming) will be used as main component of the sanitation system. As the PV panels will be installed on rooftop of the factory so no or minor use of water during construction phase of the project and overall no impact on water use and its quality.

4.4 Impact on Groundwater Contamination

There is no harm to the ground water due to construction of PV project because panels will be installed on the rooftop and the project site is already developed due to factory. There is no impact on the Ground water.

Ground water due to plant operation will be drawn during operation phase for any purpose. There shall be minimal discharge of wastewater from cleaning of Solar PV modules. The wastewater emanating from cleaning operations shall be recycled for plantation around the plant. For 01 MW, one vehicle of water is required for the cleaning and duration of the cleaning for 2.47MW required approximately 02 days. For 01 MW, approximately 15000 liters of water is required for washing of panels and on monthly basis, 35,000 to 37,000 liters of water will be required for cleaning of panels and the process will be done on monthly basis.

During the operation & maintenance period, natural underground water can be used for cleaning the modules with manual washing. The water for cleaning the module doesn't include any chemical agents, so the untreated underground water will be used for cleaning. Based on our project circumstances, modules shall be cleaned one in every month. The water supply system will be installed along the solar panel array and will be used by the cleaning staff to use the tap water for manual cleaning.

4.6 Impact on Land Use

The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. The total land available for the Project is 7.25 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 green field, wetland or protected area.

Overall, there will be no impact on the land use because the panels will be installed on the rooftop and only a small chunk of land is required for the space of storage of equipment, construction material and waste handling which have a no or minor impact and will be temporary only in construction phase.

4.6 Impact on Biological Environment

The project site is already developed land and there is no harm to the biological environment for the installation of PV plant. As the PV panels are installed on the rooftop and there will be no impact on flora and fauna of the project area. Thus, the site development works would not lead to any significant loss of important species or ecosystems.

4.7 Impact on Solid Waste

Solid waste during the construction phase consists primarily of rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics etc.) and human waste. During the construction there will be generation of garbage, for which designated practices of solid waste disposal shall be followed.

Solid waste disposal will be done as follows;

- ❖ A waste inventory of various waste generated will be prepared and periodically updated.
- ❖ The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.

- ❖ Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through proper waste handling mechanism.

The complete details of scrap metal details will be given as; scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers as per to manage the solid waste handling team. A separate yard area will be allocated for storing the waste material as per the required industrial practice. Also, approved contractor will be hired for the recycling of waste appropriately during construction phase. Waste handling agency will be hired at the start of project construction to manage the waste generating during the construction and operational phase of the plant and the practices used for handling the waste disposal to manage proper waste management through different mechanisms like, make a proper dumping site for the disposal of waste, handling of waste. The wastes which are recyclable are sold to the external contractors and the non-hazardous waste will be dumped through municipal waste collection system and services. The solid waste will be dumped away from the project site and where nearby no settlements or any other affected environment is present. It may the proper dumping site that is used for local municipality. Although the PV cells will not be disposed but sent back under as warranty is for 25 years.

There are some solid wastes in the project site, including the packing material for the equipment, like the wooden pallets and carton boxes. Solid waste management plan will be followed third party EPA certified contractor will be hired for disposal of solid waste (No Impact).

CHAPTER 5

INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PLAN

5 Institutional Requirement and Environmental Monitoring Plan

During the construction and operation of PV Project, the project company will comply all the rules and regulations of EPA as well as NEQs standards. And implement the environmental mitigation and monitoring plan during construction of the project. Environmental Management and Monitoring Plan provides the mechanism to address the adverse environmental as well as social impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The main purpose of Environmental Monitoring Plan is to provide a detailed 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.

5.1 Preconstruction Phase

During pre-construction phase of the project, a field survey was conducted by the team to identify the potential impacts and address into the monitoring plan to mitigate their affects to the project and the surrounding environment. Define the roles and responsibilities for those who involved in the implementation of the EMP. Also define the implementation mechanism for the mitigation measures identified during the present study.

5.2 Construction Phase

During construction phase of the project, a solid waste will be handled properly as per the standard industrial practices and dumped into the proper waste disposal sites which are already identified. Provide safety trainings to the workers who works during the construction phase. Provide instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact during construction of the project.

5.3 Operational Phase

During operational phase, the environment and social impact will be minimum as there is no dust and any gaseous emission from the plant. Only the waste water that used for the cleaning mechanism of PV panels will be generated and will be handled properly as per the standards. Also provide trainings and awareness sessions rising on the environmental and social issues related to power transmission projects to the project. Ensure the legal compliance properly during O & M phase of the project.

CHAPTER 6

FINDINGS AND RECOMMENDATIONS

6 Findings and Recommendations

The Project will be the replacement of conventional power generation with renewable energy. Solar energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

The project is cost effectively and environmental impacts are likely to be minimum in 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 will 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. As proposal land is already the developed land and PV panels will be installed on the rooftop and there is no harm to the natural environment or any biological habitat.

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

SAFETY AND EMERGENCY PLAN

EMERGENCY RESPONSE PLAN (ERP)

PURPOSE

To describe responsibilities in preparation for, response to and recovery from any reasonably foreseeable incident.

PRIORITIES

Secure the Health and Safety of all personnel involved Minimize any impact on the environment. Minimize any impact on property and assets.

ROLES AND RESPONSIBILITIES

EMERGENCY RESPONSE TEAM LEADER (PROJECT MANAGER)

The person is responsible to manage the execution of emergency response. The main responsibilities include

- Lead the team in case of emergency.
- Ensuring that appropriate emergency response teams are defined and prepared for the various emergency responses in different cases.
- Notification to Project Manager of any emergency incident. Emergency should be notify via radio, telephone or messenger.

SITE ENGINEER

Site Engineer is responsible for ensuring at site that provisions are in place for emergency response, including:

- Assembly Points
- Arrangements for conducting head count
- Identification & Mobilization of Fire Team
- Setting up drills and exercise
- Procurement of firefighting equipment

In the event of any emergency, following actions shall be taken by Site Engineer (HSE).

- Analyse the situation and issue direction to the concerned parties and to the Fire Team.
- To make sure that the emergency situation is properly communicated to ERT leader.
- Analyse the intensity of the incident and raise the requirement of any additional equipment if necessary.
- Communicate with site supervisor for withdrawing any permits and for mobilization of any plant and equipment necessary for dealing with emergency.

SOLIS GEN 1

FIRE TEAM

Fire Team will be responsible for:

- Practice the emergency plan exercise on periodic basis.
- Select a member of their team as a leader who will report to Site Engineer (HSE).
- Take part in different training activities.

An electrician shall be included in the fire team who will be responsible for electrical isolation of areas as necessary.

There shall be a periodic check and routine maintenance of firefighting appliances. There will be a sufficient redundancy of appliances to get utilized in case of emergency.

GENERAL CONSIDERATIONS

Emergency drills shall be arranged after periodic intervals. The Site Engineer (HSE) shall be responsible for identifying any remedial actions required.

Communication is a critical factor while dealing with emergency. In case of emergency observed by any person, the emergency alarm will be raised on priority and the assembly point shall be clearly indicated. List of all emergency contacts will be displayed at site. A person will notify about the emergency to the site Engineer as well as on emergency numbers.

Activate the emergency alarm to evacuate the area safely and make sure that all persons leave the site safely. Assign someone to advise security to open the main gate of facility for emergency vehicles.

Plant Characteristics

Generation Voltage

The Solar PV System will be generating the electricity at 400 V and it will be synchronized on the same voltage level. The standby DG set will also be synchronized with Solar System at 400 V in case of any black down.

Power Factor & Frequency

ZMTL 5 MW Solar PV system is using Grid-Tie inverters of 50 kW each to convert DC power of solar panels to Alternating Power. The Power Factor is adjustable from 0.8 leading to 0.8 lagging and the rated Power Factor at nominal power is 0.99. The range of frequency of the inverter is 45-55 Hz and nominal frequency of generation is 50 Hz.

Automatic Generation Control

Automatic Genset Controller, AGC is a flexible control unit containing all necessary functions for protecting and control of genset. It can be used as a single unit for one genset, or a number of AGCs can be connected in a complete power management system for synchronising projects, islanded or paralleled to the mains.

By using AGC, the integration of solar power and genset power can be easily possible. The PV plant is considered as a base load power and the genset can provide the extra power if required. The AGC controller only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch the power.

Metering and Protection

The energy which will be generated by Solar System will be locked in the inverters and a separate CT meters will be installed at the site, by which the instantaneous power, daily energy, monthly energy and total energy can be measured.

The inverters with the following protections will be installed at the site.

- DC current reverse connection protection
- AC short circuit protection
- Leakage current protection
- Grid monitoring
- DC fuse and over current protection
- Anti-PID function
- Overvoltage protection

Training and Development

The most important things to cover in Training & Development include orientation, site induction according to HSE instructions and other professional and management training.

INITIAL HSE ORIENTATION PROGRAM

After completion of successful HSE orientation, a person will be permitted to enter the site. The Site Engineer HSE will be responsible for the initial orientation which will cover the general HSE rules and regulations for working on site including use of PPEs, first aid, incident reporting, emergency response (alarm system, escape route, assembly point) and possible hazards at the site.

This orientation will be also for the workers of sub-contractors working at the site. Site Engineer HSE will be responsible to keep a record of all the workers.

MANAGEMENT EMPLOYEES TRAINING PROGRAM

The management employees training program will be conducted during to make sure that all management employees are trained. Site HSE Engineer will conduct HSE trainings for all staff based on training plan.

TASK SPECIFIC TRAINING PROGRAM

If required, an additional training program shall also be arranged for staff and workers in order to give technical knowledge of solar PV system.