GRID EDGE (PRIVATE) LIMITED

To:
Mr. Syed Safeer Hussain
Registrar Office, NEPRA
NEPRA Tower, Ataturk Avenue (East) G-5/1, Islamabad

February 8th, 2021

Subject: **APPLICATION OF GRID EDGE (PRIVATE LIMITED) FOR GRANT OF GENERATION LICENSE IN RESPECT OF 3.4 MW SOLAR POWER PROJECT, FAISALABAD, PUNJAB**

I, Mujtaba Haider Khan, Chief Executive Officer, being the duly authorized representative of GRID EDGE (PRIVATE) LIMITED by virtue of BOARD RESOLUTION, hereby apply to National Electric Power Regulatory Authority for the grant of a Generation License to GRID EDGE (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 186,944 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.

I hope this meets all the requirements. Feel free to contact me for any further queries.

Mujtaba Haider Khan
Chief Executive Officer
ID EDGE (Private) Limited
3rd Floor, Dawood Centre,
MT Khan Road, Karachi

GRID EDGE (PRIVATE) LIMITED * KARACHI * Grid Edge

GRID EDGE (PRIVATE) LIMITED

Extract of the Board of Directors Resolution
Passed on December 8, 2020

I, Imran Chagani, Company Secretary of Grid Edge (Private) Limited, hereby certify that the following Resolution was passed by the Board of Directors on December 8, 2020.

"**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 Mr. Mujtaba Haider Khan, Chief Executive Officer has been duly authorized to file (i) an application for Generation License for its project at Crescent Textile Mills, (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 Mr. Mujtaba Haider Khan may further delegate the aforesaid powers, in writing, to one or more persons, as deemed expedient from time to time."

Certified True Copy

Imran Chagani
Company Secretary

Dated: December 15, 2020

GRID EDGE (PRIVATE) LIMITED * KARACHI * Grid Edge

Dawood Centre, M.T. Khan Road, Karachi-75950, Pakistan
Telephone No.: 021-35632200 Fax No.: 021-35633970

A044063

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

SECP

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. **0122474**

I hereby certify that **GRID EDGE (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 **Eighth** day of **August, Two Thousand** and **Eighteen**

Incorporation Fee Rs. 7000/= only

(Kashif Mahmood)
Additional Joint Registrar

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

Certified to be True Copy

Deputy Registrar of Companies

GRID EDGE (PRIVATE) LIMITED ★ KARACHI ★ Grid Edge

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM

OF

ASSOCIATION

OF

GRID EDGE (PRIVATE) LIMITED

1. The name of the Company is Grid Edge (Private) Limited.

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

3. (i) The principal line of business of the Company shall be to generate, accumulate, transmit, distribute, purchase, sell and supply electric power or any other energy and power generated by any source, from conventional or non-conventional energy by bio-mass, hydro, thermal, gas, air, diesel oil, or solar, hydrocarbon fuel or any other form, kind or description or through renewable energy sources, wind mill or another means/ source on a commercial basis and to construct, lay down, establish, operate and maintain power/energy generating stations, including buildings, structures, works, machineries, equipments, cables, wires, lines, accumulators, lamps, and works and to undertake or to carry on the business of managing, owning, controlling, erecting, commissioning, operating, running, leasing or transferringpower plants and plants based on conventional or non-conventional energy source, thermalpowerplants, solar energy plants, wind energyplants, mechanical, electrical, hydel, civil engineering works, boiler houses, steam turbines, switch yards, transformer yards, sub stations, transmission lines, accumulators, workshopsand to do all such other things and acts as may appear to be incidental or conducive to the attainment of the above objects and to have full power to exercise all powers to achieve or to endeavour to achieve the above objects.

(ii) Except for the businesses mentioned in sub-clause (iii) hereunder, the company may engage in all the lawful businesses and shall be authorized to take all necessary steps to do all such other things and acts in connection therewith and ancillary thereto as may appear to be incidental or conducive to the attainment of the above objects.

(iii) Notwithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), insurance Business, *Modaraba* management company, Stock Brokerage business, forex, real estate

GRID EDGE (PRIVATE) LIMITED * Grid Edge * KARACHI

business, managing agency, business of providing the services of security guards or any other business restricted under any law for the time being in force or as may be specified by the Commission.

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

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

(b) launch multi-level marketing (MLM), Pyramid and Ponzi Schemes, commodity, future contract or share trading business locally or internationally or other related activities/businesses or any lottery business as restricted under the law or any unlawful operation;

(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.

4. The liability of the members is limited.

5. The authorized capital of the Company is Rs. 50,000,000/- (Rupees Fifty Million only) divided into 5,000,000 (Five Million) Ordinary Shares of Rs. 10/- (Rupees Ten only) each. The Company shall have powers to increase, reduce or re-organize the capital of the Company or increase or reduce the nominal value of the shares and divide shares in the capital for the time being into several classes to the extent permissible by law in accordance with the provisions of the Companies Act, 2017 or any statutory modifications thereof.

GRID EDGE (PRIVATE) LIMITED Grid Edge KARACHI

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

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of Shares taken by each subscriber (in figures and words)	Signatures
ENI International B.V Through Nominee Kamran Ajmal Mian	33264964 42101-3402641-3	Subscriber Ajmal Mian	Netherlands Pakistan	Services	Strawinskylaan 1725, 1077 XX Amsterdam, the Netherlands. House no 9-B, 1 East Street, Phase 1 DHA Clifton Cantt Karachi South	48,000(Forty Eight Thousand Shares Only)	
Mujtaba Haider Khan	42201-0492212-1	Ansar Haider Khan	Pakistan	Services	Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	1 (One Share Only)	
Inam ur Rahman	35201-1378474-9	Fazal Rahmaan	Paksitan	Services	House no 3/300, Sarwar Road, Lahore Cantt	1 (One Share Only)	

Certified to be True Copy

Deputy Registrar of Compa...

GRID EDGE (PRIVATE) LIMITED * KARACHI * Grid Edge

Reon Energy Limited Thorugh Nominee Mujtaba Haider Khan	0089881 42201-0492212-1	Subscriber Ansar Haider Khan	Pakistan Pakistan	 Services	Dawood Centre, M.T. Khan Road, Karachi Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	71,998 (Seventy One Thousand Nine Hundred and Ninety Eight Shares Only	
		Total number of shares taken (in figures and words)				120,000 (One Hundred and Twenty Thousand Shares Only)	

Dated the 5th day of July, 2018.

GRID EDGE (PRIVATE) LIMITED Grid Edge KARACHI

THE COMPANIES ACT, 2017 (XIX of 2017)

(Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

GRID EDGE (PRIVATE) LIMITED

PRELIMINARY

1. (1) The Regulations in Table A in the First Schedule to the Companies Act 2017, shall not apply to the Company except in so far as they are repeated or contained in these Articles.

(2) Inthese Articles-

"REON" means Reon Energy Limited, a company incorporated and existing under the laws of Pakistan, being the holder of 60% shareholding in the Company;

"ENI" means ENI International BV, a company incorporated and existing under the laws of the Netherlands, being the holder of 40% shareholding in the Company;

"section" means section of the Act;

"the Act" means the Companies Act, 2017; and

"the Company" means Grid Edge (Private) Limited;

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

"these Articles" means these Articles of Association as originally framed or as from time to time altered by Special Resolution.

(3) Unless the context otherwise requires, words or expressions contained in these Articles shall have the same meaning as in the 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.

REGISTERED OFFICE

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

BUSINESS

3. The directors shall have regard to the restrictionson the commencement of business imposed by section19 if, and so far as, those restrictions are binding upon the Company.

SHARES

4. 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, been titled 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 there on. 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.

5. 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.

6. 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.

7. 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

8. The instrument of transfer of any share in physical form in the Company shall be executed both by the transfer or 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 there of.Shares in physical form in the Company shall be transferred in the form attached as Annexure A or in any usual or common form which the directors shall approve.

9. (1) Subject to the restrictions contained in Articles 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. a fee not exceeding fifty rupees as may be determined by the directors is paid to the Company in respect thereof; and

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

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

TRANSMISSION OF SHARES

10. The certificates of title to shares shall be issues under the Seal of the Company and signed by two (2) directors. Every certificate of shares shall bear the following legend thereon:

> "Any disposition, transfer, charge, sale, pledge, hypothecation, assignment of or dealing in any other manner in the Shares represented by this certificate is restricted by a Shareholders Agreement to be signed between REON and ENI. Copies of such Agreements are available in the custody of the Company."

The executors, administrators, legal successors, 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.

GRID EDGE (PRIVATE) LIMITED * KARACHI *

11. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by law ful 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.

ALTERATION OF CAPITAL

12. The Company may, by special resolution, passed at a shareholders meeting-

(a) increase its authorised capital by such amount as it thinks expedient, provided that the nominal value of shares is PKR10/- each;

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

(c) Any capital raised by the creation of new shares shall be considered part of the authorized capital and the new shares be subject to provisions herein contained with reference to transfer, transmission, voting an otherwise.

13. Subject to the provisions of the Companies Act, 2017 all new shares, before issue, shall at the first instance be offered to the Shareholders of the Company strictly in proportion to the number of existing shares held by such shareholder.The offer shall be made, following the unanimous approval of the issuance of new shares, 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/she declines to accept the shares offered, the directors under Section 83 of the Companies Act. 2017, may dispose of the same in such manner as they think most beneficial to the Company. The directors may like wise 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 Article.

14. 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.

15. The Company may, by special resolution, passed by the Shareholders of the Company reduce its share capital in any manner and with, and subject to any incidental authorisation and consent required, by law.

16. Subject to provisions of Section 85 of the Companies Act, 2017 the Company may, by special resolution, passed by the Shareholders of the Company at unanimity, alter the conditions of the Memorandum so as to cancel any shares which at the date of passing of the resolution in that respect have not been taken or agreed to be taken by any person, any diminish the amount of its authorized share capital by the amount of shares so cancelled.

GENERAL MEETINGS

17. The Statutory General Meeting of the Company shall be held within a period of one hundred and eighty days from the date on which the Company is entitled to commence business or nine months from the date of incorporation, which ever is earlier, as required by Section131 of the Companies Act, 2017.

18. An Annual General Meeting, shall be held, in accordance with the provisions of section 132 of the Companies Act, 2017,within sixteen months from the date of incorporation of the Company and there after once atleast in every year within a period of one hundred and twenty days following the close of its financial year. All such General Meetings will be called 'Annual General Meetings' and all other General Meetings will be called 'Extraordinary General Meetings'.

19. Subject to provision of Section 133 the directors may, when ever they thinkfit, call an Extra ordinary General Meeting of the Company which require approval of the Shareholders in a General Meeting and shall, on requisition of Shareholders representing not less than 10% of the voting power on the date of deposit of such requisition, forthwith proceed to call an Extraordinary General meeting. Any director of the Company may call an Extra ordinary

GRID EDGE (PRIVATE) LIMITED * Grid Edge * KARACHI

General Meeting as long as the quorum is complete.

20. Twenty one (21) day notice at the least specifying the agenda, place, the day and the hour of meeting and, in case of special busines, the general nature of the business, shall be given in the manner provided by Section 134(4) of the Act to such persons as prescribed for under the Act and who are entitled to receive such notices. In the event of an emergency affecting the business of the Company, the Board may in accordance with Companies Act, 2017, make application to the Registrar for a shorter notice period, and, if the Registrar authorizes a shorter notice, then an Extraordinary General Meeting may be convened upon such shorter notice.

21. Chairman of Board will also be Chairman of Extraordinary General Meeting, but if there is no such Chairman, or the Chairman is not present within thirty (30) minutes after the meeting commences, the Shareholders present may choose one of the directors appointed by Reon and present at the meeting to be the Chairman.

22. The Company may provide video-link facility to its members for attending General Meetings at places other than the town in which General Meeting is taking place after considering the geographical dispersal of its members.

23. Minutes shall be made in books provided by the Board pursuant to Section 151 of the Act for the purposes of all resolutions and proceedings at General Meetings, and any such Minutes is signed by the Chairman of the General Meeting or of the next following General Meeting and approved by the Shareholders shall constitute sufficient evidence of the facts therein stated without further proof.

24. 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.

25. 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 of the Company shall be two members present personally, or through video-link who jointly represent not less than seventy-five percent of the total voting power, representatives or nominees from REON and ENI to be present, either of their own account or as proxies.

VOTES OF MEMBERS

26. Except as to voting for the election of directors under Section 159 of the Act, every Shareholder entitiled to vote, either in person or by proxy, and upon a poll every Shareholder entitled to vote and present in person or by proxy shall have one (1) vote for every share conferring voting rights as aforesaid held by him.

27. A member of unsound mind, or inrespect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on showof 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.

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

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

29. (1) The instrument appointing a proxy shall be inwriting 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 an otarially certified copy of that power or authority, shall be deposited at the registered office of the Company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote and in default the instrument of proxy shall not be treated as valid.

30. An instrument appointing a proxy may be in the form attached as Annexure B, or a form as near there to as

GRID EDGE (PRIVATE) LIMITED * KARACHI * Grid Edge

may be.

31. A vote given in accordance with the terms of an instrument of proxy shall be valid not with standing the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the share inrespect of which the proxy is given, provided that no intimation inwriting of such death, insanity, revocation or transfer as a fore said shall have been received by the Company at the office before the commencement of the meeting or adjourned meeting at which the proxy isused.

DIRECTORS

32. Unless otherwise agreed by the Shareholders in General Meeting, the Company shall have at least three (3) directors the majority of which being resident in Pakistan, with REON appointing two (2) directors and ENI appointing one (1) director. The following shall be the first directors of the Company, so, however, that the number of directors shall not in any case be less than that specified in section 154 of the Act and they shall hold office until the election of directors in the first Annual General Meeting:

1. Mujtaba Haider Khan
2. Inam ur Rahman
3. Kamran Ajmal Mian

33. The Board shall fix the number of directors thirty-five (35) days before convening the General Meeting at which the directors are to be elected, and the number so fixed shall not be changed except with the prior approval by special resolution of the Company in a General Meeting. It is clarified that in no event shall the number of directors increase beyond three (3) until the same has been so approved by all the Shareholders in a General Meeting.

34. The directors shall appoint a nominee director from REON as the Chairman of the Company. The Board may remove Chairman at any time by unanimous vote (except the vote of the Chairman to be removed) and appoint a new Chairman and such Chairman shall be appointed from amongst the nominee directors of REON on the Board. The term of the Chairman shall be co-terminous with the term of the Board. A retiring Chairman shall be eligible for reappointment and shall preside over the General Meeting at which an election of directos shall be held.

35. An elected director shall hold office for a period of three (3) years. Election of directors to be held every three years.

36. The Company may by resolution in a General Meeting remove a director in accordance with Companies Act, 2017.

37. If any director resigns or becomes disqualified or ceases for whatever reason prior to the expiry of the three year term, the Board shall appoint any person to be a director to fill such vacancy within ninety (90) days of the vacancy. Any director so appointed shall complete remainder of the term of the director in whose place hes appointed.

38. The remuneration of the directors shall from time to time be determined by the Board, provided that unless otherwise agreed the nominee directors of REON and ENI shall not be entitled to any remuneration, directors may be reimbursed all reasonable travelling, hotel and other expenses properly incurred by him/ her in attending and returning from meetings of directors or General Meetings of the Company or in connection with the discharge of their duties as directors of the Company.

39. Save as provided in section 153 of the Act, no person shall be appointed as a director unless he is a member of the Company or the only nominee of a corporate Shareholder.

GRID EDGE (PRIVATE) LIMITED * KARACHI * Grid Edge

POWERS AND DUTIES OF DIRECTORS

40. The Board shall be responsible for the overall direction, supervision and management of the Company. The Board may pay all expenses incurred in promoting and registering the Company, and may exercise all such powers of the Company as are not by the Act or by these articles or by the Shareholder Agreement or by a special resolution required to be exercised by the Company in General Meetings, subject nevertheless to the provisions of the Act or to any of the Articles, or to any such regulations as may be prescribed by the Company in General Meeting but no regulations made by the Company in General Meeting shall invalidate any prior act of the directors which would have been valid if such regulations had not been made.

41. The Board shall appoint a director nominated by REON as the chief executive in accordance with the provisions of sections 186 and 187 of the Act, or if he ceases to be a director for any cause, appoint another director as Chief Executive from REON.

42. Subject to approval by the Board, any director not permanenetly resident in Pakistan or any director so resident but intending to be absent from Pakistan for a periof of not less than three (3) months may appoint any person acceptable to the Board to be an alternate director of the Company to act for him. Every such appointment shall be made by notice to the Board in writing under the hand of the director making the appointment (with a copy to the Shareholders). An alternate director will be an acting director, entitled to receive notice of all meetings, and to attend and vote as a director. An appointee director shall cease to be the director if his appointer for any reason is diqualified or ceases to be a Director or if his appointer returns to Pakistan or if the appointee is removed from office by notice in writing under the hand of the appointer.

43. The amount for the time being remaining undischarged of moneys borrowed or raised by the directors for the purposes of the Company (otherwise than by the issue of sharecapital) shall not at anytime, without the sanction of the Company in General Meeting, exceed the issued share capital of the Company.

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

MINUTE BOOKS

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

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

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

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

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

THE SEAL

46. The directors shall provide for the safe custody of the seal and the seal shall not be affixed to any instrument except by the authority of a resolution of the board of directors or by a committee of directors authorized in that behalf by the directors and in the presence of at least two directors and of the secretary or such other person as the directors may appoint for the purpose; and those two directors and secretary or other person as a fore said shall sign every

instrument to which the seal of the Company is so affixed in their presence.

DISQUALIFICATION OF DIRECTORS

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

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

PROCEEDINGS OF DIRECTORS

48. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit; provided that the directors shall meet at least once in each quarter of a calendar year.A director may, and the secretary on the requisition of a director shall, at anytime, summon a meeting of directors. Notice sent to a direct or throug he mail whether such director is in Pakistan or outside Pakistan shall be avalid notice.

49. The directors shall from among the directors appointed by REON, elect a chairman of the Board of directors and determine the period for which he is to hold office. If at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the directors present may choose one of their number to be chairman of the meeting.

50. Atleast two (2) directors of whom at least one nominated by each Shareholder, for the time being of the Company. present personally or through video-link, shall constitute a quorum.

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

52. Other questions as listed in the Shareholder Agreement, at meetings of the Board shall be determined by unanimity of votes of the director from each Shareholder present.

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

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

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

55. All acts done by any meeting of the directors or of a committee of directors, or by any person acting as a director, shall, not with standing that it be afterwards discovered that there was some defect in the appointment of any such directors or persons acting as a foresaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be a director.

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

57. A resolution in writing signed by all the directors – signatures being in the same document or severally – shall

GRID EDGE PRIVATE LIMITED Grid Edge KARACHI

the time being entitled to receive notice of a meeting of the directors shall be as valid and effectual as if it had been passed at a meeting of the directors duly convened and held.

FILLING OF VACANCIES

58. At the first Annual General Meeting of the Company, all the directors shall stand retired from office, and directors shall be elected in their place in accordance with section 159 for a term of three years.

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

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

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

62. The General Meeting may remove a director but only in accordance with the provisions of the Act.

DIVIDENDS AND RESERVE

63. The Company in General Meeting shall declare dividends by unanimous decision of the Shareholders.

64. The directors may from time to time pay to the members such interim dividends as appear to the directors to be justified by the profits of the Company, if approved by unanimous decision of the Shareholders.

65. Any dividend may be paid by the Company either in cash or in kind only outo fits profits.The payment of dividend in kind shall only be in the shape of shares of listed company held by the distributing company.

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

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

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

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

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

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

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

70. The dividend shall be paid within the period laid down under the Act.

GRID EDGE (PRIVATE) LIMITED * Grid Edge * KARACHI

ACCOUNTS

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

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

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

74. The directors shall as required by sections 223 and 226 of the Act cause to be prepared and to be laid before the company in General Meeting the financial statements duly audited and reports as are referred to in those sections.

75. The financial statements and other reports referred to in Article 79 shall be made out in every year and laid before the Company in the annual General Meeting in accordance with sections132 and 223.

76. A copy of the financial statements and reports of directors and auditors shall, atleast twenty-one days preceding the meeting, be sent to the persons entitled to receive notices of General Meetings in the manner in which notices are to be given here under.

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

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

NOTICES

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

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

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

81. A notice may be given by the company to the person entitled to a share inconsequence of the death or insolvency of a member in the manner provided under Article 84 addressed to them by name, or by the title or representatives of the deceased, or assignees of the insolvent, or by any like description, at the address, supplied for the purpose by the person claiming to be so entitled.

82. Notice of every General Meeting shall be given in the manner here in before authorised to (a) every member of the Company and also to (b) every person entitled to a share inconsequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the Company for the time being and every person who is entitled to receive notice of General Meetings.

WINDING UP

83. (1)In the case of members' voluntary windingup, with the sanction of a special resolution of the Company, and. in the case of creditors' voluntary windingup, of a meeting of the creditors, the liquidator shall exercise any of the powers given by sub-section (1) of section 337 of the Act to a liquidator in a windingup by the Court including *inter-alia* divide amongst the members, in specie or kind, the whole or any part of the assets of the Company, whether

GRID EDGE (PRIVATE) LIMITED Grid Edge KARACHI

they consist of property of the same kind or not.

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

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

INDEMNITY

84. 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 reliefis granted to him by the Court.

GRID EDGE (PRIVATE) LIMITED ★ KARACHI ★ Grid Edge

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a Company, inpursuance of these articles of association, and we respectively agree to take th enumber of shares in the capital of the Company set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of Shares taken by each subscriber (in figures and words)	Signatures
ENI International B.V Through Nominee Kamran Ajmal Mian	33264964 42101-3402641-3	Subscriber Ajmal Mian	Netherlands Pakistan	Services	Strawinskylaan 1725, 1077 XX Amsterdam, the Netherlands. House no 9-B, 1 East Street, Phase 1 DHA Clifton Cantt Karachi South	48,000 (Forty eight Thousand Shares Only)	
Mujtaba Haider Khan	42201-0492212-1	Ansar Haider Khan	Pakistan	Services	Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	1 (One Share Only)	
Inam ur Rahman	35201-1378474-9	Fazal Rahmaan	Paksitan	Services	House no 3/300, Sarwar Road, Lahore Cantt	1 (One Share Only)	
Reon Energy Limited Thorugh Nominee Mujtaba Haider Khan	0089881 42201-0492212-1	Subscriber Ansar Haider Khan	Pakistan Pakistan	Services	Dawood Centre, M.T. Khan Road, Karachi Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	71,998 (Seventy One Thousand Nine Hundred and Ninety Eight Shares Only	
		Total number of shares taken (in figures and words)				120,000 (One Hundred and Twenty Thousand Shares Only)	

Dated the 7th day of July, 2018

Certified to be True Copy

Deputy Registrar of Companies

Annexure A

Form for Transfer of Shares

(First Schedule to the Companies Act, 2017)

GRID EDGE (PRIVATE) LIMITED Grid Edge KARACHI

I……...s/o..... r/o.....(here in after called "the transferor") in consideration of the sum of rupees..... paid to me by.....s/o ..... r/o..... (here in after called "the transferee"), do here by transfer to the said transferee.....the share (or shares) with distinctive numbers from ……...to.....inclusive,in the **GRID EDGE (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 here by agree to take the said share(or shares) subject to the conditions afore said.

As witness our hands this.....dayof.....,20.....

Signature……	Signature……
Transferor	**Transferee**
FullName,Father's/Husband'sName	FullName,Father's/Husband'sName
CNIC Number(in case of foreigner,	CNIC Number(in case of foreigner,
Passport Number)	Passport Number)
Nationality	Nationality
Occupation and usual Residential Address	Occupation and usual Residential Address
	Cell number
	Land line number,if any
	Email address
Witness 1:	**Witness 2:**
Signature……..date……	Signature……..date……
Name,CNIC Number and Full Address	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:

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

I 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.

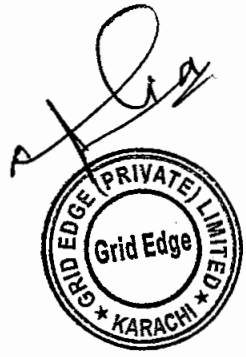
……
Signature of the Transferee(s)

GRID EDGE (PRIVATE) LIMITED Grid Edge KARACHI

Annexure B

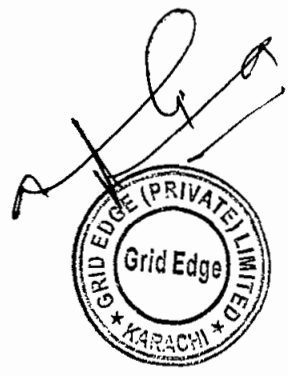
INSTRUMENT OF PROXY
XXXXXX (Private) Limited

"I……..s/o.....r/o..... ..... being a member of the **GRID EDGE (PRIVATE) LIMITED,** hereby appoint ……s/o.....r/o..... as my proxy to attend and vote on my behalf at the (statutory, annual, extraordinary, as the case may be)General Meeting of the Company to be held on the……..day of……..,20……and at any adjournment thereof."



ANNEXURE – 6

3(5)(b) Profile of experience of the applicant its management, staff and its members in power sector.



Grid Edge Private Limited

The applicant Grid Edge Private Limited is power purchase agreement arm of Reon Energy Limited.

The electricity market is changing fast. Technology advancements, evolving consumer preferences, and new policies are leading to a surge of adoption of solar, energy storage, microgrids, electric vehicles, and other new energy technologies. These distributed energy resources are forcing new models to rethink how the energy market works, consequently, new models for customer energy management, grid infrastructure and electricity market design are arising to address these changes.

The Company, has been incorporated to bring innovation in the energy market by providing power purchase agreements via renewable technologies to private sector and public-sector customers in Pakistan by setting up Solar PV plants on the site of the customer by offering hybrid or grid tied solutions.

This allows savings on transmission infrastructures to the government of Pakistan and allows customers to take advantage of cheaper renewable power without having to undertake expensive capex on its own accord as asking clients to undertake expensive capex on technology, which has capacity risk, has inhibited the growth of this industry in Pakistan even with all the great effort of NEPRA and Ministry of Water and Power to unlock the value of Solar in Pakistan.

Accordingly, the company has decided to apply for a generation license for its proposed project with Crescent Textile Limited.

GRID EDGE (PRIVATE) LIMITED
Grid Edge
KARACHI

REON Energy Limited

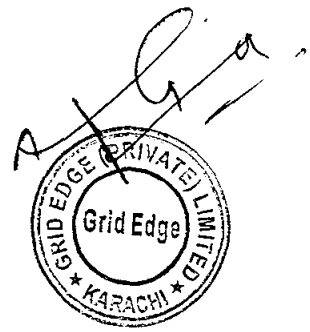
Reon Energy Limited, a wholly owned subsidiary of Dawood Lawrencepur Limited is renewable solar energy arm of Dawood Group looking after the solar energy business for the Group and is in the process of crafting the best possible business portfolio within the solar energy realm for better long term shareholder returns.

REON is the largest solar national leading EPC (Engineering, Procurement and Construction) solution providers in Pakistan. These solutions include designing of system, procurement of material from distinct manufacturers and construction of complete PV System (on-grid and hybrid) to deliver cost effective & trustworthy solutions.

Projects have been delivered at various sites with projects greater than 1MW for a variety of customers, including Servis Industries, Kohinoor Textiles and Nobel Energy - a part of the Wah Nobel Group. The Company with an installed distributed captive capacity of over 50MW in the C&I sector with further 50 MW underway, is now recognized as the leader in high quality installations whilst providing customers with clean energy and minimizing their energy price risk. Key projects executed recently include 12.5MW solar installation at Fauji Cement Limited and 10 MW ENI Pakistan.

Since inception, REON has focused on supply chain management and engineering collaborations to bring in efficiencies, which have ultimately benefited customers. The Company is now directing all focus to the high-growth areas in the solar energy space. Solar energy solutions help provide energy security and minimize energy costs for businesses. In addition, renewable energy addresses environmental concerns regarding carbon emissions and greenhouse gases. These factors together with declining prices of solar generation equipment indicate a huge potential in the market.

Reon Energy believes in adhering to the highest levels of safety for all stakeholders; customers, staff, contractors. Company safety policies and procedures are strictly complied with and zero tolerance is exercised for misdemeanors. As a step towards reaffirming its safety commitment, the Company successfully obtained ISO 14001 Certification.



Profile of Experience of Applicant (Grid Edge Pvt Ltd)

Mujtaba Haider Khan

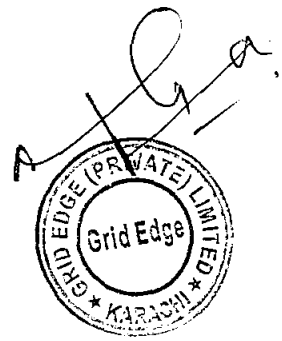
Chief Executive Officer

Mujtaba is CEO of Reon Energy Limited since 2016 and has also served as the Head of Strategy for Dawood Hercules Corporation Limited. Before that, he worked as the Head of Strategy and Transformation for BT Fleet, a wholly owned subsidiary of British Telecom in London. Mujtaba has led BT in a range of commercial and transformation roles including as Project Director in Global Services Division and as the Head of Procurement for the UK wide fiber rollout program. Mujtaba holds his BS in Computer Systems Engineering and an MBA from Cranfield School of Management. His area of expertise includes Growth Strategy, Start-up, and Cost Transformation.

Inam-ur Rehman

Director

Inam ur Rahman is currently the Chief Executive Officer of Dawood Hercules Corporation. In the recent past, he has led the renewable businesses of the group as CEO of Reon Energy Limited and has set up a 50MW wind power plant Tenaga Generasi Limited. With more than 25 years of professional experience Mr. Rahman has expertise across a spectrum of industries including renewable energy, foods, textiles, fashion & apparel, lifestyle, and business consulting. His present portfolio of directorships includes Engro Corporation Limited and Cyan Limited. He has earlier also served as a director on the Boards of Sui Northern Gas Pipelines Limited, Dawood Lawrencepur Limited, Sind Engro Coal Mining Company, Laraib Energy Limited, SACH International Limited, and Pebbles Private Limited.



3(5)(i) Prospectus

(i) INTRODUCTION

Grid Edge Private Limited

The applicant Grid Edge Private Limited is power purchase agreement arm of Reon Energy Limited.

The electricity market is changing fast. Technology advancements, evolving consumer preferences, and new policies are leading to a surge of adoption of solar, energy storage, microgrids, electric vehicles, and other new energy technologies. These distributed energy resources are forcing new models to rethink how the energy market works, consequently, new models for customer energy management, grid infrastructure and electricity market design are arising to address these changes.

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Applicant's Senior Management and Technical Professionals

Mujtaba Haider Khan

Chief Executive Officer

Mujtaba is CEO of Reon Energy Limited since 2016 and has also served as the Head of Strategy for Dawood Hercules Corporation Limited. Before that, he worked as the Head of Strategy and Transformation for BT Fleet, a wholly owned subsidiary of British Telecom in London. Mujtaba has led BT in a range of commercial and transformation roles including as Project Director in Global Services Division and as the Head of Procurement for the UK wide fiber rollout program. Mujtaba holds his BS in Computer Systems Engineering and an MBA from Cranfield School of Management. His area of expertise includes Growth Strategy, Start-up, and Cost Transformation.

Sulaiman ur Rehman

Vice President - Sales and Commercial

Sulaiman look after sales and commercial division and steering corporate PPA development for Reon. He has over a decade of experience as global strategist, portfolio manager and business head. Sulaiman has expertise in global capital strategy and allocation, and portfolio analysis. He has previously worked with Privatization Commission of Pakistan and Citi Group – Global Corporate and Investment Bank. Sulaiman holds a Bachelor of Science in Economics from University of London, UK.

Osman Maud

Project Director

Osman Maud a Registered Electrical Engineer with over 10 years of Professional experience in Project Development, Asset Management and EPC business. Osman has been part of teams that have worked on Coal, Wind, Hydel, Combined Cycle Gas Power Stations and Solar Power Projects in top companies of Pakistan. Osman has successfully developed and lead Engineering and Projects section at Reon and has recently delivered 12.5MW solar plant at Fauji Cement Limited. Osman has a bachelor's in engineering from NUST Pakistan.

(ii) SALIENT FEATURES

Grid Edge (Private) Limited intends to setup 3.45 MW captive Solar Power Plant (DC) at Crescent Textile Mills premises (Faisalabad, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site. Main objective of this Solar plant is to provide clean energy from solar plant to partially meet energy needs in an affordable and environment friendly way.

Key highlights of the project are as follows:

Customer	Crescent Textile
Project Model	BOT
System Type	Roof Mounted, On Grid
System Size	3.45 MWp
Solar PV Type	Mono-crystalline

Project Overview:

Introduction:

Grid Edge (Private) Limited intends to setup 3.45 MW captive Solar Power Plant (DC) at Crescent Textiles premises (near, Faisalabad, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site.

Project Rationale:

- On site affordable energy production from solar plant to partially meet energy needs
- Sustainable energy source in line with triple bottom line impact for client
- Capex free deployment under power purchase agreement for 15 years
- Reliance on localized energy sources and hedge for the term of the contract for 15 years

Technology:

- Solar based Power Generation System, civil structures, and auxiliaries.
- Complete Solar Based Power Generating Panels with their protection, instrumentation, monitoring, control and synchronizing panels with existing power sources
- All technical parameters covered including but limited to Net Efficiency, Net Output, Power Plant Availability, Construction of Power Plant Building including all facilities as well as all related sub-systems such as:

  - Plant Ventilation and air-conditioning in office and similar areas,
  - Electrification and lighting systems
  - Emergency Lighting System, etc.
  - Fire Protection System
- The installed system shall meet applicable codes and standards. Safety signage and labelling should be mounted on the system as required
- All Solar Panels shall be made of Crystalline Silicon solar cells
- All the electrical installations and wiring for the PV system in accordance with codes and standards

Project Location:

The Solar Plant will be located within the Crescent Textile factory in Faisalabad

Operations and Maintenance:

The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 15 years (180 Months) and shall include but not be limited to the following items and their related costs, 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. (Bidders are required to provide a priced list).
- Full costs relating to any repairs and replacements due to defects in the or break down of the equipment and systems strictly in accordance with OEMs requirements. The cost shall also include all dismantling, handling, shipment, etc.
- Provision of all emergency spare parts as per the recommendations of the OEMs or as directed by the Company. (Bidders are required to provide a priced list).

(iii) Proposed Investment and Timelines

Feasibility & Financing:

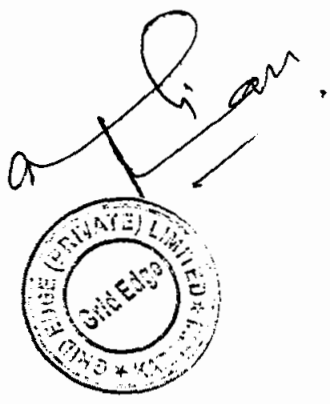
The Project will cost approximately PKR 240 Million funded through 25% equity and 75% debt through SBP Green Financing

This project will be completed in a period of 6 months after issuance of Generation License. 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. No.	Major Milestone	Timeline
1	Detailed Engineering Design	1.0 month
2	Procurement	1.5 months
3	Construction	2.5 months
4	Commissioning and Testing	1.0 month

ANNEXURE – 15

3(5)(h) Feasibility Report



FEASIBILITY REPORT

Crescent Textile 3.45 MW Solar Power Plant

Executive Summary:

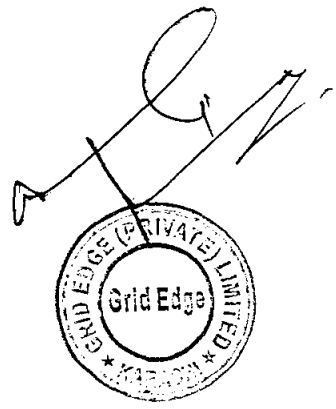
Grid Edge (Private) Limited intends to setup 3.45 MW captive Solar Power Plant (DC) at Crescent Textile Mills premises (Faisalabad, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site. Main objective of this Solar plant is to provide clean energy from solar plant to partially meet energy needs in an affordable and environment friendly way.

Key highlights of the project are as follows:

Customer	Crescent Textile
Project Model	BOT
System Type	Roof Mounted, On Grid
System Size	3.45 MWp
Solar PV Type	Mono-crystalline

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
- Conceptual Design
- Technical Summary



Introduction to Solar:

Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect.

Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system.

As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun.

The productivity of solar power in a region depends on solar irradiance, which varies through the day and is influenced by latitude and climate.

The locations with highest annual solar irradiance lie in the arid tropics and subtropics. Deserts lying in low latitudes usually have few clouds and can receive sunshine for more than ten hours a day. These hot deserts form the Global Sun Belt circling the world. This belt consists of extensive swathes of land in Northern Africa, Southern Africa, Southwest Asia, Middle East, and Australia, as well as the much smaller deserts of North and South America.

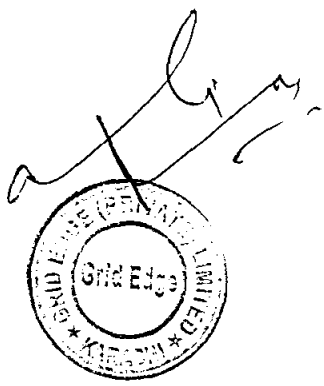
GRID EDGE (PRIVATE) LIMITED
Grid Edge
KARACHI

Solar Potential in Pakistan:

There is an increasing demand for power in the domestic, commercial, and industrial sectors as Pakistan's population and its economy continue to expand. Currently, electricity consumption is severely suppressed by increasing tariffs, supply shortfalls and infrequent load shedding, and there also exist significant levels of latent demand in the country as rising income levels allow more people to switch to electricity from using traditional fuels or captive power.

Pakistan's per capita electricity consumption is currently significantly lower in comparison to other countries in a similar development stage, and much below that of OECD countries. Per capita electricity consumption is strongly correlated with the human development index (HDI), and the current trends of rising incomes and energy supplies, falling poverty levels, and increasing economic activity are predicted to lead to rapid increases in per capita consumption rates in Pakistan, creating a healthy demand for additional power generation.

Even with the projected surplus in power generation capacity by 2025, there will still be sufficient economic feasibility for small and medium-sized (1-50 MW) renewable energy-based power projects in the Pakistan, especially those located near remote and isolated load centers and extremities of the grid network or based on bilateral bulk contracts or for augmenting peak supplies on the grid. The viability of such 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:

Introduction:

Grid Edge (Private) Limited intends to setup 3.45 MW captive Solar Power Plant (DC) at Crescent Textiles premises (near, Faisalabad, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site.

Project Rationale:

- On site affordable energy production from solar plant to partially meet energy needs
- Sustainable energy source in line with triple bottom line impact for client
- Capex free deployment under power purchase agreement for 15 years
- Reliance on localized energy sources and hedge for the term of the contract for 15 years

Technology:

- Solar based Power Generation System, civil structures, and auxiliaries.
- Complete Solar Based Power Generating Panels with their protection, instrumentation, monitoring, control and synchronizing panels with existing power sources
- All technical parameters covered including but limited to Net Efficiency, Net Output, Power Plant Availability, Construction of Power Plant Building including all facilities as well as all related sub-systems such as:
    - Plant Ventilation and air-conditioning in office and similar areas,
    - Electrification and lighting systems
    - Emergency Lighting System, etc.
    - Fire Protection System
- The installed system shall meet applicable codes and standards. Safety signage and labelling should be mounted on the system as required
- All Solar Panels shall be made of Crystalline Silicon solar cells
- All the electrical installations and wiring for the PV system in accordance with codes and standards

Project Location:

The Solar Plant will be located within the Crescent Textile factory in Faisalabad

Operations and Maintenance:

The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 15 years (180 Months) and shall include but not be limited to the following items and their related costs, 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. (Bidders are required to provide a priced list).
- Full costs relating to any repairs and replacements due to defects in the or break down of the equipment and systems strictly in accordance with OEMs requirements. The cost shall also include all dismantling, handling, shipment, etc.
- Provision of all emergency spare parts as per the recommendations of the OEMs or as directed by the Company. (Bidders are required to provide a priced list).

Feasibility & Financing:

The Project will cost approximately cost PKR 240 Million funded through 25% equity and 75% debt through SBP Green Financing

Environmental Benefits:

This system will help curtailing CO_2 emissions by 2,500 tonnes a year. A life cycle assesment of the CO2 produced by solar PV is 40g per kWh as opposed to 700g CO_2 per kWh for diesel fuel/grid sources

Conceptual Design:

Generation Voltage:

Solar Power plant will be generating AC power at Low voltage levels of 400V 4W+PE system and to be synced with existing generator/FESCO at Low voltage level.

Power Factor & Frequency

CTL solar power plant is using solar grid connected string Inverters of 110KW each to covert DC power of solar panels to Alternating Power. Grid connected inverters have the functionality to adapt the power factor of existing diesel genset and grid. The range of Power Factor can be set from 0 – 1 leading /lagging, making it suitable for absorbing or delivering reactive power. The nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

Automatic Generation Control & Ramp Rate:

The Automatic Sustainable Controller (DEIF ASC-4) is a controller designed to serve as a link between sustainable power plant (Solar) and genset plants, combining them so they work as one common hybrid system. The concept of the ASC-4 is to maximize sustainable power penetration, depending on the total load demand to the hybrid without compromising constraints such as minimum genset load demand.
The ASC-4 Solar is the variant designed for PV control, and it enables integration of PV power and genset power. The PV plant is handled as a base loading power- and reactive power provider, not as a voltage- and frequency provider. Therefore, the ASC-4 only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch power.

Ramp rate of inverters is the function of MPPT algorithm. Normally solar power is set to ramp up or ramp down the generation within the period of 5-10 seconds from 0 – 100 percent. Ramp rate can be adjusted according to the behavior of gensets over loading and unloading due to Solar power variations.

Metering and Protection:

The solar will be terminated at LT against each respective building. The Solar Panels are installed on the roof of factory building and are terminated at the 415V busbar.

Sensitivity Class for meter is 0.5s with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

The following Over and Under voltage protections are present in the system.

- Short Circuit protections
- Earth Fault detection
- Over current protection
- Emergency system shutdown protection.

GRID EDGE (PRIVATE) LIMITED
Grid Edge

Technical Summary:

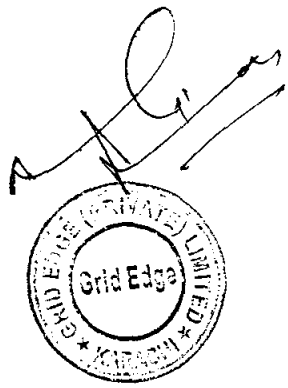
- Monocrystalline 530W Solar Modules with efficiency 20.75% are used in the design
- 110 KW grid connected solar inverters, 480V three phase, 98.7% have been considered
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2600 KW
- 10 Acre Rooftop space required for Solar installation
- Output of the system is based on instantaneous Irradiation values of Solar Energy

Bill of Materials:

S. No.	Components	Qty (No.)
1	Monocrystalline Solar Modules 530W	6512
2	Grid Connected Solar Inverters 110KW 3 Phase	26
3	LV Panel IP42 MCCB	5

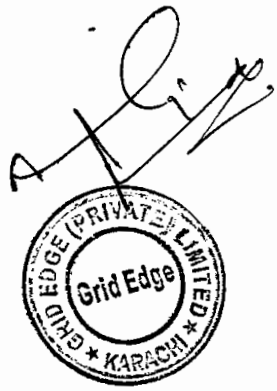
Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	82.3%
2	Capacity Utilization Factor	15.9%
3	Energy Generation Units	4.7 Million KwH



ANNEXURE - 16

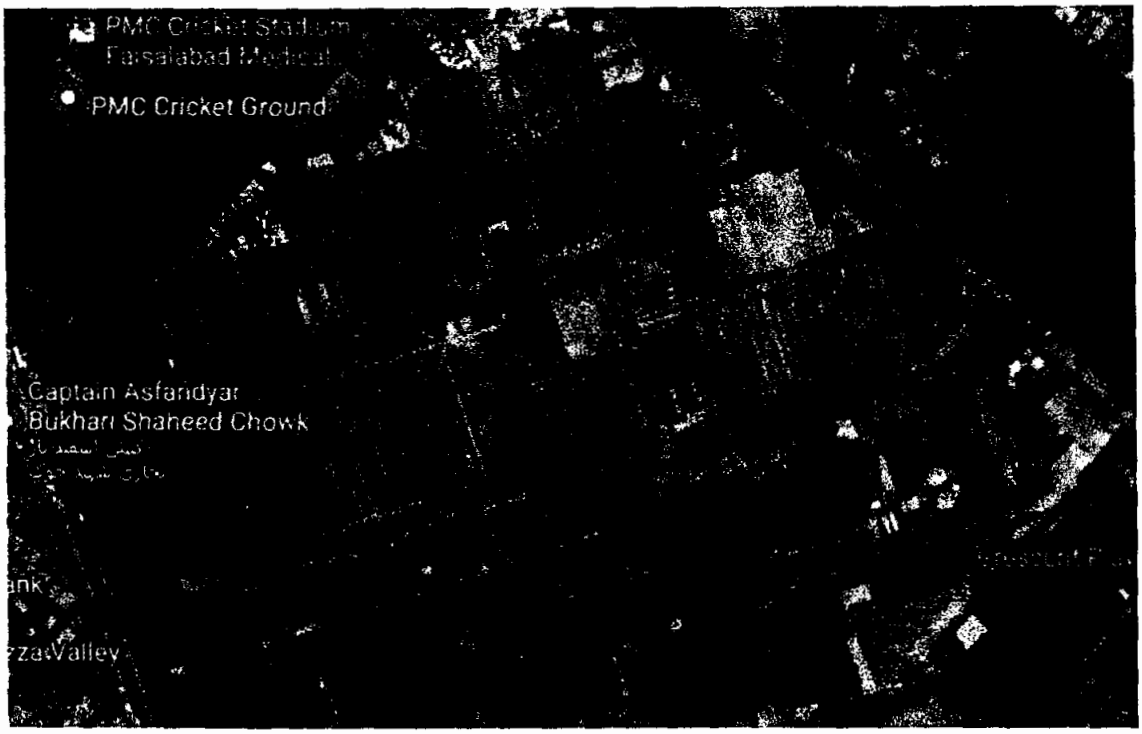
SCHEDULE – III



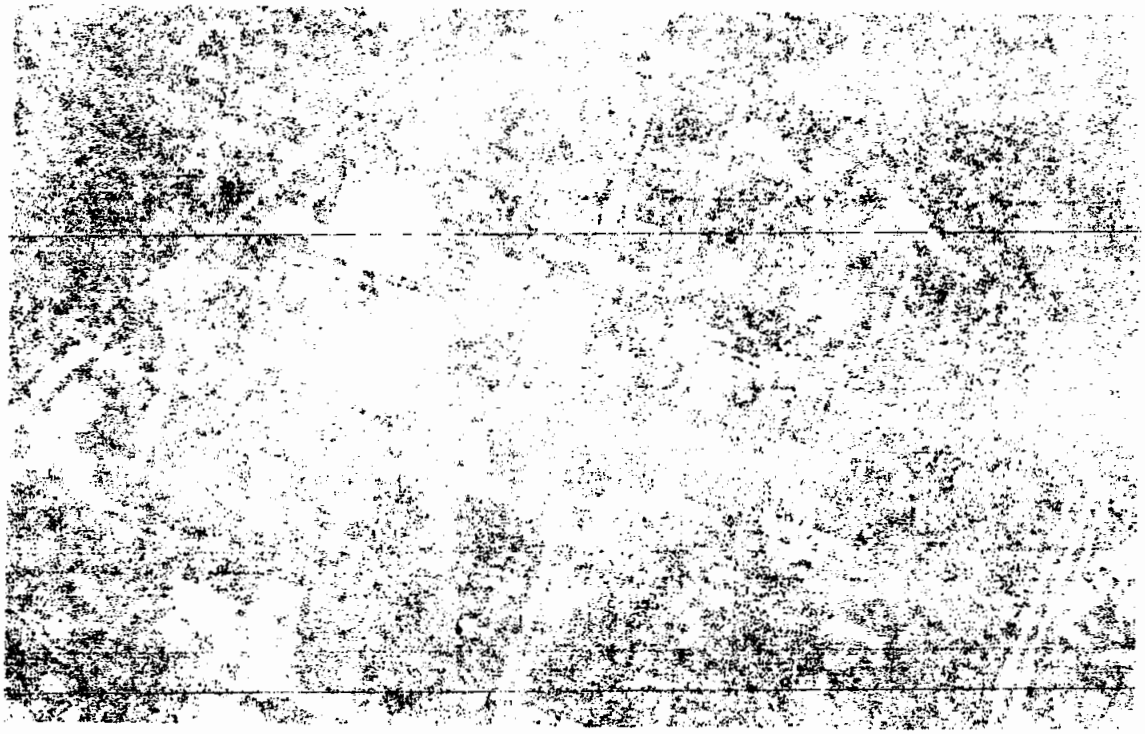
LOCATION MAPS, SITE MAPS, LAND

Location Map:

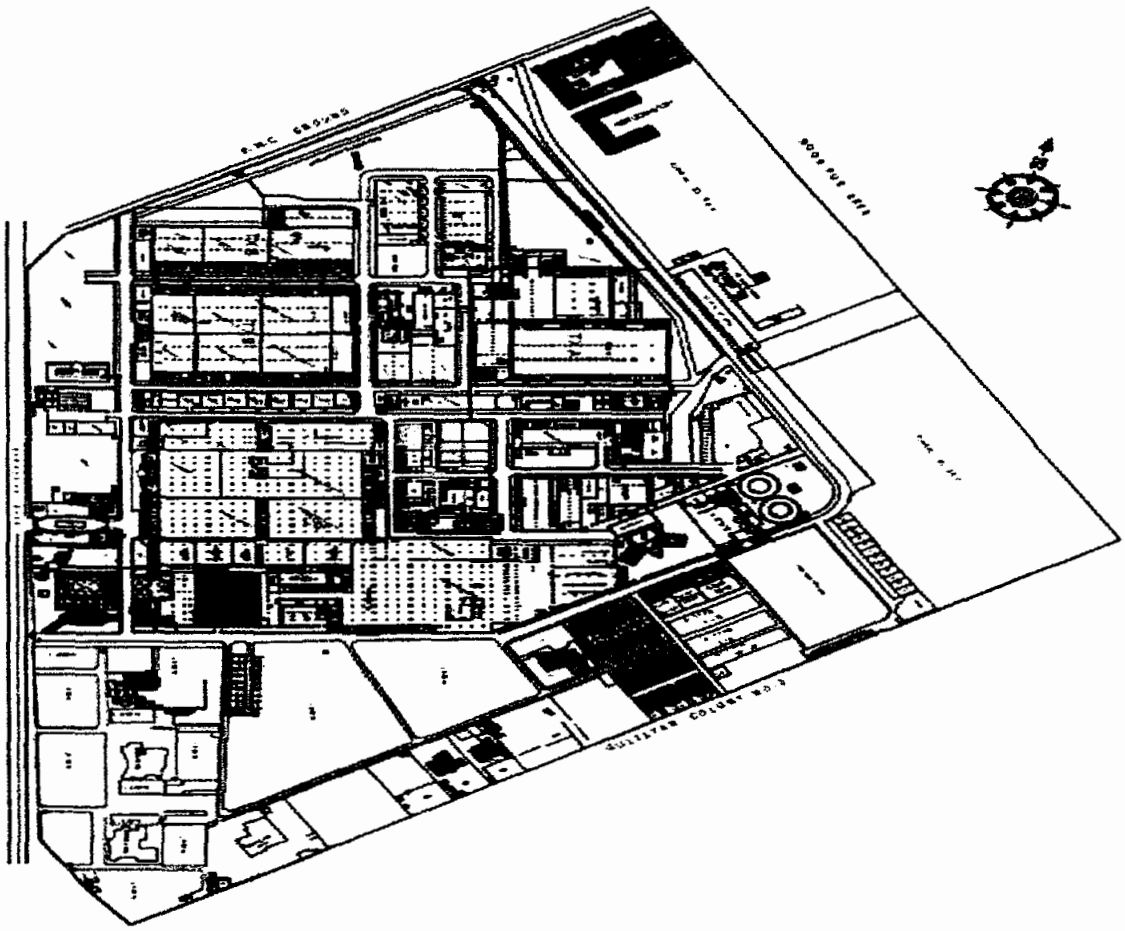
The Solar Plant will be located at Crescent Textile Mills, Sargodha Road, District Faisalabad, Punjab, Pakistan



Crescent Textile mills



Site Location and Layout:



Grid Edge (Private) Limited

TECHNOLOGY, SIZE OF PLANT, NUMBER OF UNITS

Technical Summary:

- Monocrystalline 530W Solar Modules with efficiency 20.75% are used in the design
- 110 KW grid connected solar inverters, 480V three phase, 98.7% have been considered
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2600 KW
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Bill of Materials:

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Energy Generation:

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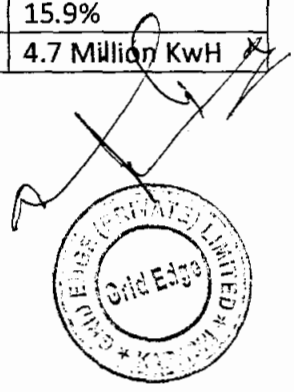
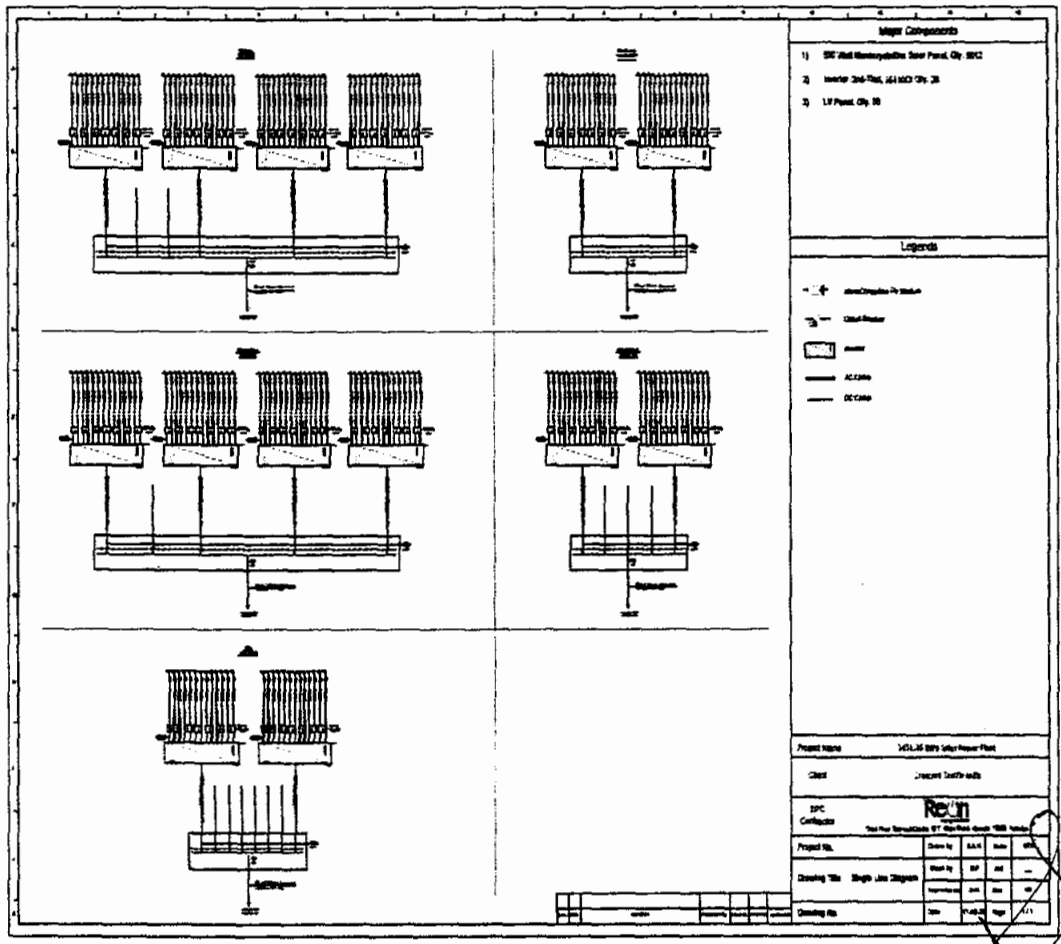


Technology & Number of Units:

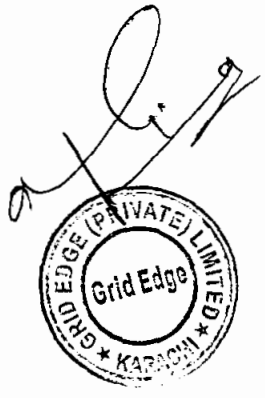
S.No.	Parameters	
1	Technology	Solar Photovoltaic (SPV)
2	Size of Plant	3.45 MW
3	Solar Modules	Monocrystalline Solar Modules 530W Tier 1
4	Inverter	110kW Grid Connected Inverter
5	LV Panel	IP42- 400,1000,1200,1600A MCCB
6		

Single Line Diagram:



Infrastructure

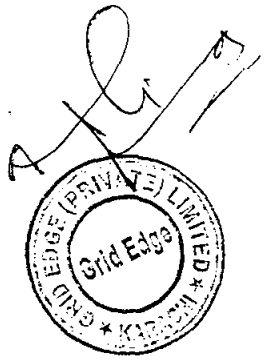
- The location is within the premises of existing unit of Crescent Textile Mills, Faisalabad to produce green energy by using solar panels and is easily accessible by all traffic. All utilities (electricity, water, boarding lodging and fuel) is readily available on site.



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

Feasibility & Financing:

The Project will cost approximately PKR 240 Million funded through 25% equity and 75% debt through SBP Green Financing



GOVERNMENT OF THE PUNJAB
ENVIRONMENTAL PROTECTION AGENCY
National Hockey Stadium, Gate No. 10
Ferozepur Road, Lahore
000217

NO. DD (EIA)/EPA/F-107(IEE)/2020/ 300
Dated: 24 /08/ 2020

To.

Mr. Muhammad Manzoor
Proponent
M/S Crescent Textile Mills Limited
Crescent Textile Mills Limited Head Office, Sargodha Road.
District Faisalabad.

Subject: **DECISION OF EPA PUNJAB FOR ENVIRONMENTAL APPROVAL UNDER SECTION 12 OF PEPA 1997, REGARDING PROJECT "INSTALLATION OF SOLAR PANEL SYSTEM OF 03 MW BY M/S CRESCENT TEXTILE MILLS LIMITED, AT SARGODHA ROAD, NOORPUR, DISTRICT FAISALABAD"**

1. Description of Project: Installation of solar penal system of 03 MW by M/S Crescent Textile Mills Limited over an area of 14 Acres.
2. Location of Project: Crescent Textile Mills, Sargodha Road, Noorpur, Faisalabad.
3. Date of receiving of IEE 02.03.2020
4. After careful review of Initial Environmental Examination (IEE) report, EPA Punjab has considered Site Inspection Report received from Deputy Director (Environment), Faisalabad vide his letter No. 14/DD/EPA/FSD, dated 13-05-2020. EPA Punjab has also considered the recommendations of **Committee of Experts** (Meeting dated 07.07.2020), and other relevant record to take the lawful decision.
5. **Environmental Protection Agency, Punjab accords Environmental Approval under Section 12 of Punjab Environment Protection Act 1997 for construction of your aforesaid Project subject to the following conditions:**

i. The Proponent shall ensure compliance of Punjab Environmental Quality Standards (PEQS).
ii. Mitigation Measures suggested in the Environmental report and Environmental Management Plan (EMP) shall be strictly adhered to minimize any negative impacts on soil, ground water, air and biological resources of the Project area.
iii. The Proponent shall maintain record of the auditable measures taken for implementation of Environmental Management Plan for verification by EPA, Punjab.
iv. Monitoring shall be carried out during the entire period of the Project activities. Monitoring reports shall be submitted to EPA Field office on quarterly basis.
v. The Proponent shall ensure that energy consumption shall be reduced by incorporating green energy sources along with regular power supply.
vi. The Proponent shall redress the objection / concerns of neighbors / stakeholder on priority basis (if any at any stage).
vii. The Proponent shall obtain No Objection Certificates/ clearance of all other concerned departments before commencement of work and will not start operations without obtaining necessary NOCs/Approvals.
viii. The proponent shall submit copies of all necessary NOCs/Approval from other departments along with application for operational phase under Regulation 14 of IEE/EIA regulation 2000.
ix. The Proponent shall plant 5000 trees of 6-7 feet height of indigenous species in the district in consultation with Directorate of (EDH) / Deputy Director (Environment), Faisalabad, within six months. The Proponent shall also take measures for protection and maintenance of these trees and maintain their proper record for verification by EPA.
x. The proponent shall follow building by-[illegible]

xii. Compensation shall be provided to the inhabitants in case of loss of agricultural land, crop, property, etc. in accordance with the rates that are agreed upon. All conflicting issues regarding compensation, etc. should be settled amicably before the start of the Project activities.

xiii. The Proponent shall do landscaping and restore the environment after completion of the construction work.

xiv. Arrangement shall be made for disposal of sanitary and solid waste. The solid waste shall be retained within the unit boundary/premises and will be disposed off in an environment friendly way at a suitable disposal facility. Toilet/washroom will be maintained in an orderly and hygienic manner for public use.

xv. The proponent shall dispose of domestic wastewater after treatment.

xvi. The Proponent shall follow the SOPs regarding dengue larvae eradication and shall ensure removal of stagnant water on daily basis.

6. The Proponent shall, before commencing construction of the Project, acknowledge acceptance of the stipulated conditions by executing an Undertaking in the form prescribed in Schedule VII of Review of IEE/EIA Regulations 2000.

7. The Proponent shall be liable for correctness and validity of information supplied to this department by Proponent / Environmental consultant. If any information/Document supplied is found incorrect/false, the approval will be deemed cancelled and strict Legal action will be taken against the proponent and consultant.

8. The Proponent shall be liable for compliance of Regulations 13, 14, 17 and 18 of IEE/EIA Regulations, 2000, regarding approval, confirmation of compliance, entry, inspections and monitoring.

9. This approval is accorded only for the construction phase of the Project. The Proponent shall obtain approval for operational phase of the Project in accordance with Regulation 13(2) (b) and Regulation 14 of the IEE/EIA Regulations, 2000.

10. Any change in the approved Project shall be communicated to EPA, Punjab and will be commenced after obtaining the approval.

11. This approval shall be treated as null and void if any of the condition mentioned above, is not complied with. This approval does not absolve the Proponent of the duty to obtain any other approval or consent that may be required under any law in force and is subjudice to legal proceedings in any legal forum / court.

12. The proponent shall apply for confirmation of compliance (Operational phase) as per Regulation 14 of IEE/EIA Regulations, 2000, only after complying all conditions mention in this approval.

13. This approval shall be valid (for commencement of construction) for a period of **three** years from the date of issue under Regulation 16 of IEE / EIA Regulations, 2000.

14. This approval can be withdrawn at any time without any prior notice if deemed necessary in the public / national interest.

15. This decision is issued with the approval of Director General, EPA Punjab.

ASSISTANT DIRECTOR (EIA)

NO. & DATE EVEN.

A copy is forwarded to from Deputy Director (Environment), Faisalabad vide his letter No. 14/DD/EPA/FSD, dated 13-05-2020. He is requested to:

i. Obtain undertaking from the Project Proponent mentioned at para 6 for the record of EPA Headquarter and Field Office.

ii Ensure compliance of the conditions mentioned in the Environmental Approval and maintain the file / record of correspondence with the Project Proponent properly.

iii. Ensure monitoring of the project at every stage and inform any violations to the authority so that strict action can be taken as per law.

EXECUTIVE SUMMARY

Title of the Project: Installation of Solar Panel System of 3MW by M/s Crescent Textile Mills Limited.

Location of the Project: Crescent Textile Mills, Sargodha Road, Noorpur, District Faisalabad.

Project Proponent	Project Consultant
Crescent Textile Mills Limited Sargodha Road, Noorpur, District Faisalabad. Contact# +92-41-111-105-105 Email: manzoorm@ctm.com.pk	**Ecogreen Company (Pvt.) Ltd.** Plot # 2-A, Commercial Zone Gate#1, Canal View Society, Lahore. Contact# +92-42-35294297 Email: info@ecogreen.com.pk

Introduction

Crescent Textile Mills (Crestex) was founded in 1950 that is vertically integrated composite textile unit. M/s Crescent Textile Mills intends to install a solar panel system of 3MW within the premises of existing textile unit at Sargodha Road, Noorpur, District Faisalabad. The main objective of proposed project is to produce cheap, emission-free electricity without causing undue environmental damage.

Screening

As per Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2000 the proposed project has been falls under ***"Schedule I"*** *(Projects involving potentially insignificant impacts requiring IEE)* ***Category J - Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of regulation 5.***

Legal Framework

The project will comply with all the national environmental legislations in Pakistan. The national environmental legislations in order to obtain the required regulatory clearances are as under:

- The Pakistan National Conservation Strategy (NCS) which outlines the country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources.
- Pakistan Environmental Protection (Amendment) Act, 2012 which empowers the Pak-EPA to delegate powers to the Provincial EPAs, identifies categories of projects to which the IEE/EIA provisions will apply, develop guidelines for conducting IEE and EIAs and procedures for their submission, review and approval, develop environmental emission standards for parameters i.e. air, water and noise etc.
- The National Environmental Quality Standards (NEQS), 2010 specify the maximum allowable concentrations of pollutants in municipal and liquid industrial effluents, maximum allowable concentration of pollutants in gaseous emissions from industrial sources, etc.
- The other provincial and departmental applicable laws and regulations include Land Acquisition Act 1894, Forest Act 1927; Pakistan Penal Code 1860, Antiquities Act 1975, Punjab Local Government Ordinance 2001 and The Punjab Wildlife Protection Act 1974.

Project Objectives

The project objectives are to:

- Utilize clean energy.
- Effectively convert solar energy into electricity.
- Reduce environmental pollution.
- Produce cheap, emission-free electricity without causing undue environmental damage.

Project Description

The proposed project involves the installation of solar panel system of 3MW by M/s Crescent Textile Mills Ltd. within the premises of existing unit of Crescent Textile Mills at Sargodha Road, Noorpur, District Faisalabad to produce green energy by using solar panels. Solar panels will be installed on roof top over an area of 14 Acre. For this project proponent has planned to contract with "Reon Energy, a part of Dawood Hercules as preferred EPC (Engineering, Procurement and Construction) partner" for installation of solar panel system.

Salient Features of Project

The salient features of the project are present in the table below:

Proponent name	Muhammad Manzoor *(Sr. Manager Electrical)*
Contact no.	0316-9997081
Postal address	Mills & Head Office, CTM, Sargodha Road, District Faisalabad
Project title	Installation of Solar Panel System of 3MW by M/s Crescent Textile Mills Limited
Project location	Crescent Textile Mills Limited, Sargodha Road, Noorpur, District Faisalabad
Coordinates	31°27'06.6" N and 73°05'23.3" E
Total area for installation of solar panels	14 Acre
No. of solar panels to be installed	6,819
Project Capacity	3 MW
Nature of land	Within premises of CTM
Cost of project	PKR 246 Million
Tree plantation	Trees will be planted in all open spaces and boundary of the project area
Forest Area/ National Park	None
Historically important Site	None within the 10 km radius
Source of water	Ground Water Supply

The detailed description of this project and environmental baseline studies of the project are given in chapter 2 and 3.

Anticipated Major Impacts and Recommended Mitigation Measures

Assessment of the Impacts during Construction

While the project's construction poses certain environmental risks, these are short term and easily reversed. The major effects expected during the construction phase include: dust, air and noise pollution as well as minimal level soil pollution. There is also expected to be an increase solid waste.

Mitigation Measures

- All loose material to be kept on site for the shortest possible time and provided with suitable covering.
- Ambient air quality within the premises of the project site to be monitored.
- Implement good working practices to minimize noise and also reduce its impacts on human health (ear muffs, safe distances, enclosures).
- Acoustic mufflers/enclosures to be provided.
- All solid waste to be appropriately disposed off.
- No untreated discharge to be leaked to surface water, groundwater or soil.
- Implement waste management plan that identifies and characterizes every waste product associated with project activities and that identifies the procedures for collection, handling and disposal of each type of waste.

Assessment of the Impacts during Operation

- Solar cells do not emit any pollutants during their operations.
- Installation of solar panel system will not harm the natural resources
- Solar cells do not make a noise during operation
- Solar cells do not emit any substances to the air during operation
- During operation there will no significant amount of wastewater solid waste generated

Mitigation Measures

No specific mitigatory measures required.

The impacts of the project activities on environment during all the phases (design, construction and operation) have been considered and their detailed mitigation measures have been suggested in **Chapter-4**.

Environmental Management & Monitoring Plans

During construction phase, ambient air quality for dust level in particular, vehicle and equipment exhaust, noise level (tests), solid waste management and soil contamination, community and workers' safety (visual) will be monitored. During operational phase, solid waste management and water supply will be monitored. The plan has been included in **Chapter-5.**

Conclusion

The Initial Environmental Examination contains a detailed description of the project, environmental baseline, potential environmental impacts and suggested mitigation measures. An implementation mechanism for mitigation measures in the form of an Environmental Management Plan for both construction and operational phase has also been included in this study. Appropriate mitigation measures as explained in the environmental study shall reduce, if not eliminate these impacts so that these can be within acceptable limits. It is further concluded that all potential environmental concerns associated with the proposed project have been adequately addressed and no further study is required in this context.

CHAPTER 1: INTRODUCTION

1.1 GENERAL

This report deals with the studies conducted for Initial Environmental Examination (IEE) for the installation of solar panel system of 3MW by M/s Crescent Textile Mills Ltd. within the premises of existing unit of Crescent Textile Mills at Sargodha Road, Noorpur, District Faisalabad. The proponent has engaged environmental consultants, **M/s Ecogreen Company (Pvt.) Ltd.** to carry out the Initial Environmental Examination (IEE) for the proposed project development.

1.2 PURPOSE OF THE REPORT

The main purpose of this Initial Environmental Examination (IEE) report is to identify the baseline environmental, biophysical and socio-economic conditions to examine proposed project alternatives including alternate sites and to study the potential impacts along with formulation of suitable mitigation measures for an environment friendly implementation of the proposed project site and around the proposed project area.

1.3 NEED FOR INITIAL ENVIRONMENTAL EXAMINATION (IEE)

As per Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2000 the proposed project has been falls under ***"Schedule I"*** *(Projects involving potentially insignificant impacts requiring IEE)* ***Category J - Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of regulation 5.***

1.4 IDENTIFICATION OF THE PROPONENT AND PROJECT

1.4.1 THE PROPONENT

a. **Proponent:** Muhammad Manzoor ***(Sr. Manager Electrical)***
b. **Postal Address:** Mills & Head Office, CTM, Sargodha Road, District Faisalabad
c. **Contact Number:** 0316-9997081

1.4.2 THE PROJECT

The proposed project is installation of solar panel system of 3MW by M/s Crescent Textile Mills Ltd. Its salient features will be explained in Chapter 2 and briefly described in Executive Summary of IEE.

1.4.2.1 Nature of project

The proposed project is associated with the Installation of Solar Panel System.

1.4.2.2 Capacity of project

The capacity of project is 3 MW.

1.4.2.3 Location of project

The location of proposed project is within the premises of existing unit of Crescent Textile Mills at Sargodha Road, Noorpur, District Faisalabad.

1.4.2.4 Current status of project

The project is proposed yet.

Figure 1: Current Status of Project

1.5 SCOPE OF STUDY

For achieving the above objectives the study is mainly divided into the following sub tasks:

- Identification of various legal/ statutory requirements as set forth by the Pakistan Environmental Protection Act, 1997 and the guidelines for preparation of IEE reports and review of existing regulatory framework in the country with reference to the development projects.
- Collection of data related to physical, ecological and socio-economic resources of the project area.
- Identification and evaluation of salient environmental impacts.
- Identification of necessary mitigation measures to minimize the adverse impacts.
- Preparation of an Environmental Management Plan (EMP).

1.6 CONSULTANTS PERFORMING IEE STUDY

The services of environmental consultants **M/s Ecogreen Company (Pvt.) Ltd.** have been taken by the proponent for the formation of the Initial Environmental Examination (IEE) report.

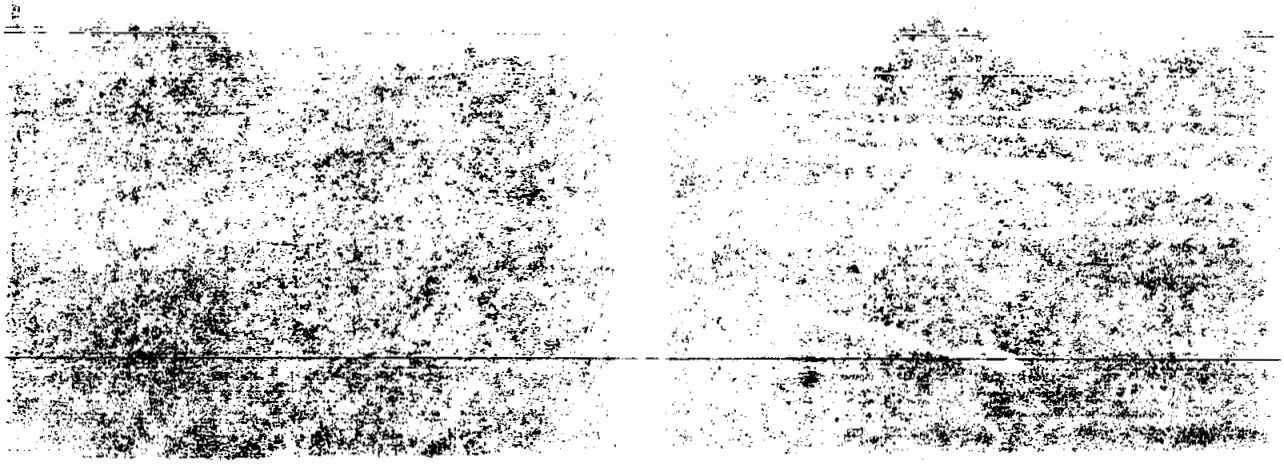


Table 1: Consultant Details

Consultant	Ecogreen Company (Pvt.) Ltd.
Address	Plot#2-A, Mini Commercial Zone Gate#1, Canal View Society, Lahore.
Contact No.	+92-42-35294297

1.7 TEAM MEMBERS

The team which conducted the IEE studies consists of Environmentalists and Environmental Engineers who studied the project and prepared the report. The details of the team members are given in the table below:

Table 2: List of Team Members

Sr. #	Name	Qualification
Team Leader		
1	**Ms. Zahra Anwar**	**M.Phil Environmental Sciences**
Environmental Scientist		
2	Dr. Ambreen Lateef	Ph.D. Environmental Sciences
3	Ms. Foqia Khalid	Ph.D. (Scholar) Environmental Sciences
4	Ms. Leenah Maqbool	M.Phil Environmental Sciences
5	Mr. Adnan Naeem	MS Env. Science & M.Sc. Analytical Chemistry
6	Mr. Danial Zaib	BS Environmental Sciences
Environmental Engineers		
7	Engr. M. Usman	B.Sc. Environmental Engineering
8	Engr. Taha Rahim	B.Sc. Environmental Engineering
9	Engr. M. Ali	B.Sc. Environmental Engineering

1.8 STRUCTURE OF REPORT

- Chapter 1 **"Introduction"**- Briefly presents the proposed project introduction, objectives and need of the IEE study.
- Chapter 2 **"Project Description"**- Presents detailed account of specifications and major components of the proposed project.
- Chapter 3 **"Environmental Baseline Profile"**- Establishes baseline conditions for physical, biological and socio-economic conditions of the proposed project area.
- Chapter 4 **"Potential Environmental Impacts and Mitigation Measures"**- Deals with the potential environmental impacts and mitigation measures which have been proposed to mitigate the environmental impacts of proposed project.

- Chapter 5 **"Environmental Management and Monitoring Plans"**- Outlines training needs of the staff for the implementation of the proposed Environmental Management Plan and monitoring requirements.
- Chapter 6 **"Conclusion and Recommendations"**- This chapter concludes the whole report and provide recommendations.

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CHAPTER 2: PROJECT DESCRIPTION

2.1 GENERAL

This section covers the proposed project comprehensively and contains salient features i.e. location, project site layout, objectives, alternatives, cost and magnitude of operation and different phases of proposed project.

2.2 CATEGORIZATION OF THE PROJECT

As per Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2000 the proposed project has been falls under ***"Schedule I"*** *(Projects involving potentially insignificant impacts requiring IEE)* ***Category J - Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of regulation 5.***

2.3 OBJECTIVES OF THE PROJECT

The project objectives are to:

- Utilize clean energy.
- Effectively convert solar energy into electricity.
- Reduce environmental pollution.
- Produce cheap, emission-free electricity without causing undue environmental damage.

2.4 PROJECT ALTERNATIVES

2.4.1 No Project Option (NPO)

The development and implementation of renewable energy is unavoidable. Renewable energy resources are unlimited, widely available and should be exploited. One of those renewable energy resources is concentrated solar power which presents the greatest potential for commercial use because it can be stored in the form of thermal energy and can hybridized. Solar-powered electrical generating systems help to reduce impact on the environment and save money at the same time. From the analysis above, it becomes apparent that the No Project Option is no alternative to the proponent.

2.4.2 Site Alternatives

No alternative for the site is analyzed because the site selected for the installation of solar panel system of 3MW is present within the premises of Crescent Textile Mills. This will benefit the existing textile unit by providing sustainable renewable power supply. The selected site also has no ecologically sensitive area and status of current Environment is satisfactory, so, it is best suited for the proposed project activities.

2.5 PROJECT SITE LOCATION AND LAYOUT MAP

2.5.1 Site Layout Map

The layout map of project is attached in Annexure III.

2.5.2 Location Map

The project site is located within the premises of Crescent Textile Mills Limited at Sargodha Road, Noorpur, District Faisalabad.

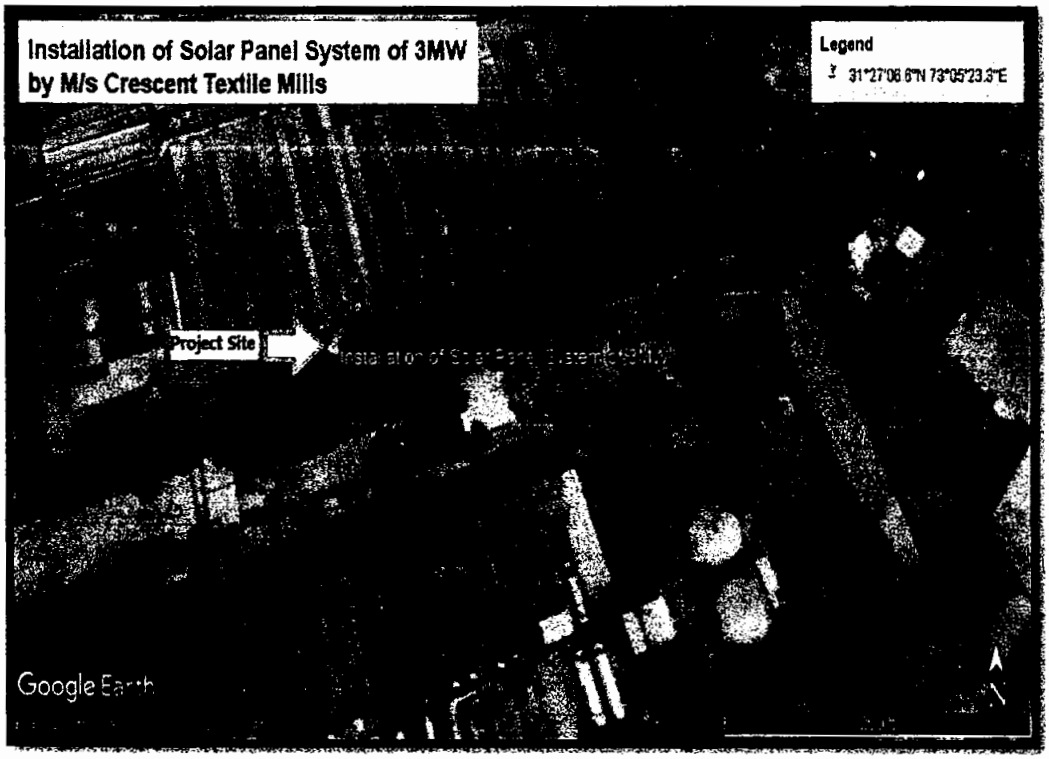


Figure 2: Site Layout Map

2.6 NATURE OF AREA

Area for the project site is industrial in nature.

2.7 LAND USE ON SITE

The site is present within the premises of CTM and will be used for the installation of solar panel system. There is no settlement, surface water body, grassland or preserved area in the proximity of the project area that could be damaged or dismantled.

2.8 LAND OWNERSHIP

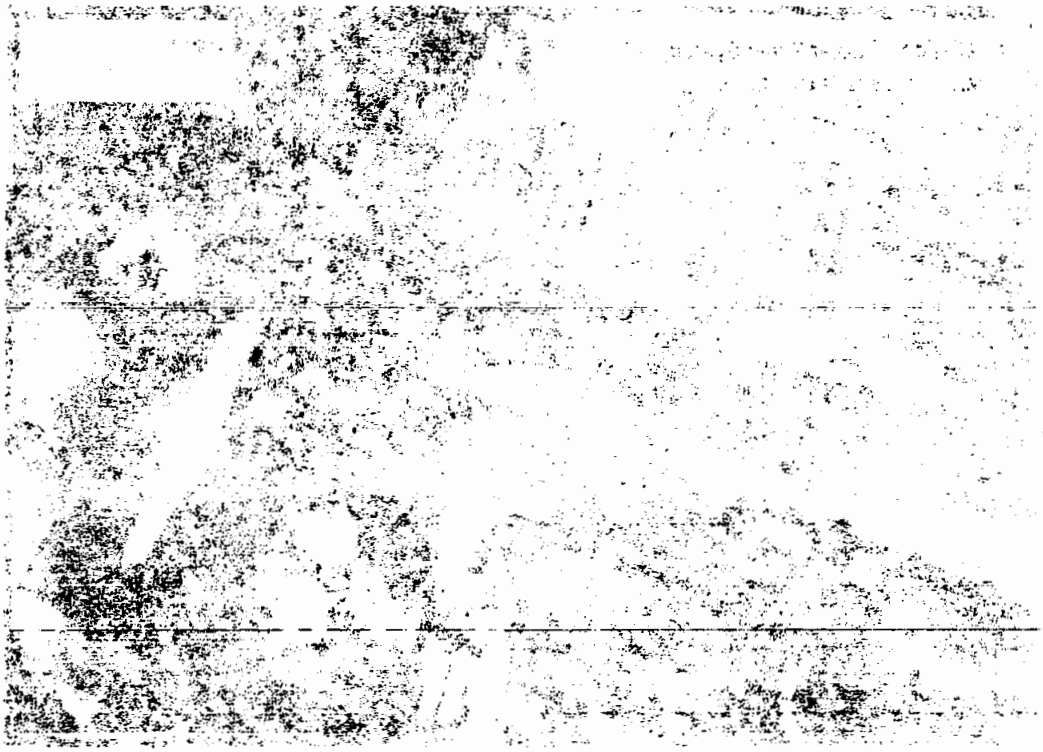
Land of the site selected for the location of the project is under undisputed ownership of the proponent. The property ownership documents are attached in Annexure II.

2.9 VEGETATION FEATURES OF THE SITE

Project site has no vegetation cover and within CTM vicinity so no major tree cutting is involved.

2.10 ROAD ACCESS

The project site is easily accessible through different roads. Road Network along project site is shown below in figure 2.



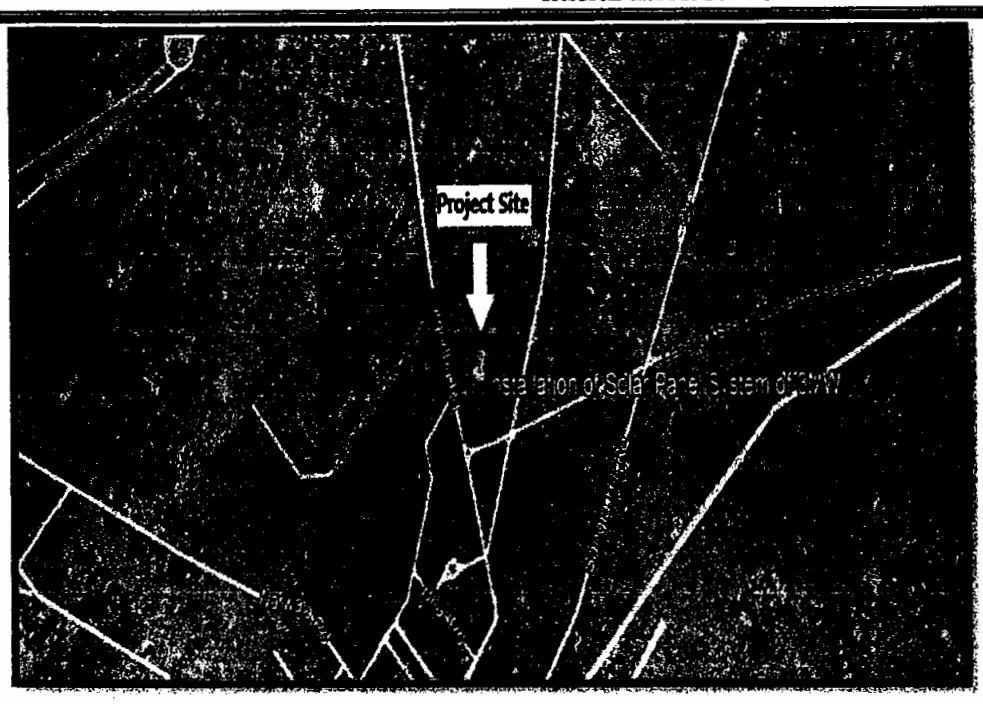


Figure 3: Road Access Map

2.12 RESTORATION AND REHABILITATION PLAN

No human population resides within the project area. There is no need for the relocation or dismantling of any significant structure. Moreover, all activities will be carried out in accordance with prevailing environmental management laws and controls so as to avoid any damage to any segment of environment or human health around the project site.

2.13 DESCRIPTION OF THE PROJECT

Solar energy components that make up a complete solar power system are the roof system, solar panels, invertors and net meters. In most solar systems, solar panels are placed on the roof. Solar panels, also known as modules, contain photovoltaic cells made from silicon that transform incoming sunlight into electricity rather than heat. ("Photovoltaic" means electricity from light - photo = light, voltaic = electricity.) Solar photovoltaic cells consist of a positive and a negative film of silicon placed under a thin slice of glass. As the photons of the sunlight beat down upon these cells, they knock the electrons off the silicon. The negatively-charged free electrons are preferentially attracted to one side of the silicon cell, which creates an electric voltage that can be collected and channeled. This current is gathered by wiring the individual solar panels together in series to form a solar photovoltaic array. Depending on the size of the installation, multiple strings of solar photovoltaic array cables terminate in one electrical box, called a fused array combiner. Contained within the combiner box are fuses designed to protect the individual module cables, as well as the connections that deliver power to the inverter. The electricity produced at this stage is DC (direct current) and must be converted to AC (alternating current) suitable for use in homes or business.

The inverter is typically located in an accessible location, as close as practical to the modules. The inverter turns the DC electricity generated by the solar panels into 120volt AC that can be put to immediate use by connecting the inverter directly to a dedicated circuit breaker in the electrical panel. In a solar electric system that is also tied to the utility grid, the DC power from the solar array is converted into 120/240 volt AC power and fed directly into the utility power distribution system of the building. The power is "net metered," which means it reduces demand for power from the utility when the solar array is generating electricity - thus lowering the utility bill.

2.13.1 Solar Panel Operating Principle

Figure 4 shows the conceptual design of solar panel operating principle.

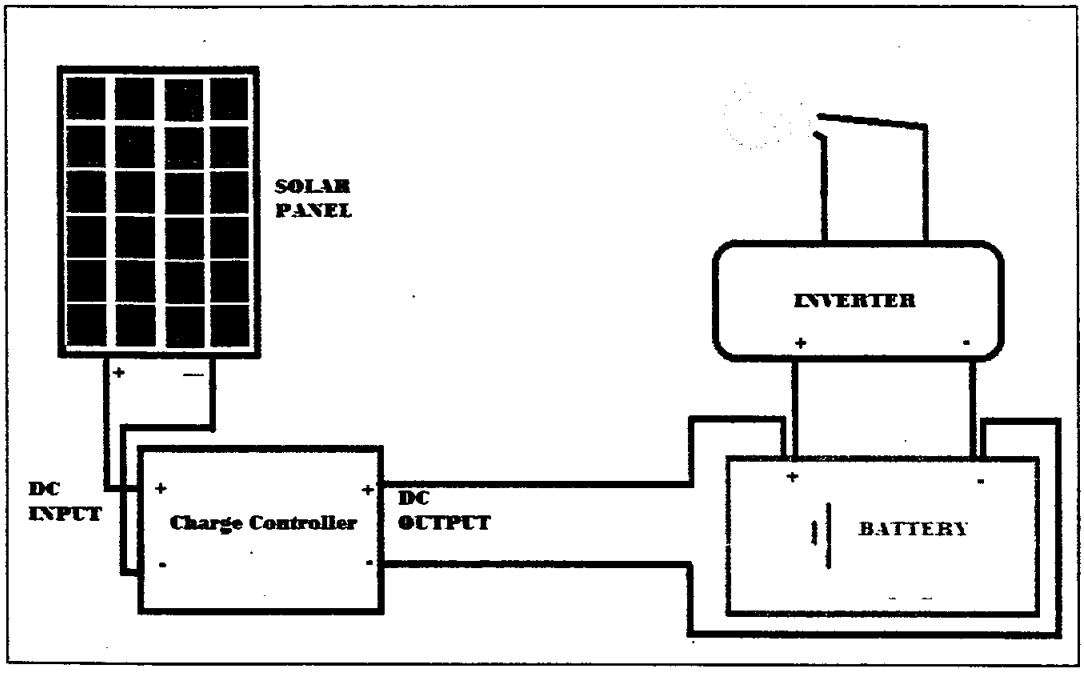


Figure 4: Conceptual Design of Solar Panel Operating Principle

2.13.2 List of Equipments

Equipments used for this project will be solar panels, inventors, data logger and cables etc. List of equipments is given below in Table 3.

TABLE 3: List of Equipments

Sr.#	Items	Brand	Description	Quantity
Solar System (Imported)				
1	Solar Panels	Tier 1	440 W Monocrystalline	6,819
2	Inverters	Sungrow	Sungrow 110 kW	21
3	Data logger	Sungrow	Logger 1000	1
4	Quantum	Reon	Spark APP	1
5	Reon's EMS	Campbell Science, Fronius, Seneca	Module Temperature, Ambient Temperature, Wind Sensor, etc	1

Local Items			
6	Mounting Structure & Installation	Local	Hot-Dipped Galvanized for Inverter Beams & Flat rooftop
7	DC & AC Cable	PAK/Fast Cables/Equiv.	As per system requirements
8	All miscellaneous including Grounding, Earthing, CTS, LV Panels and standard accessories for safe installation	-	Cable ties, nuts/bolts, screws, MC4 nails, tape, PVC, lugs, bare conductor, PVC pipe, MC4 connector etc.

2.14 SOLAR PANELS

Tier 1-monocrystalline solar panels generally considered as premium solar products are selected for the said project. The main advantages of monocrystalline panels are their higher efficiencies and sleeker aesthetics. To make solar cells for monocrystalline solar panels, silicon is formed into bars and cut into wafers. These types of panels are called "monocrystalline" to indicate that the silicon used is single-crystal silicon. Because the cell is composed of a single crystal, the electrons that generate a flow of electricity have more room to move. As a result, monocrystalline panels are more efficient than their polycrystalline counterparts.

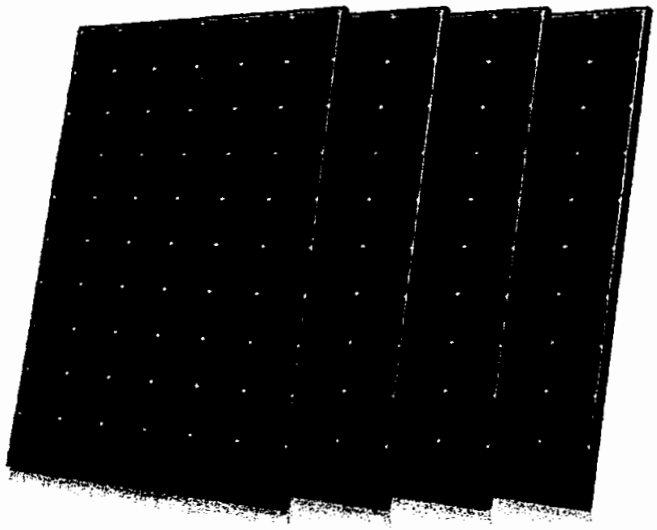


Figure 5: Solar Panels

2.15 SOLAR INVERTER

Sungrow string inverters having IV curve scan and fuseless design equipped with 9 Maximum Power Point Tracker (MPPTs) that react to changes in light intensity by choosing the optimal load for the cells to achieve the most usable power output will be installed. Inverters will have

i. active cooling for maximum reliability,

ii. protection level of IP66 and an anti-corrosion grade of C5 for enabling high efficiency even though in the shade and making it resilient in harsh conditions inorder to achieve up to 99% efficiency.

2.16 LOGGER 1000

The Logger1000 is a device used for data collection, power control and protocol conversion for inverters and other PV equipment in the PV systems. The device is also integrated with communication gateway and O&M function.

The Logger1000 is featured as flexible networking, auxiliary maintenance and easy operation.

2.17 QUANTUM

Reon's SPARK app will allow proponent to monitor performance of solar panel system and will also highlight areas of optimization.

2.18 SUPPLIES/ AMENITIES

2.18.1 Water supply

During construction works source of water would be ground water available at the depth of 300 ft. which will be used for watering the construction sites, as well as for ensuring proper conditions for workers.

2.18.2 Man power

65 workers will be hired for installation phase and 5 workers will be hired for operational phase.

2.18.3 Fire fighting

The facility will have a comprehensive fire fighting system covering all areas of facility. This ensures that any fire within the unit will be quickly surpassed and extinguished.

2.19 WASTEWATER GENERATION

In this project no process wastewater will be generated.

2.20 SOLID WASTE GENERATION

Solid waste generated from installation phase would include mostly construction material. Waste will be collected within the site until transfer to the waste disposal site. Reusable material will be recovered from the waste as much as possible. During operational phase there will no significant amount of solid waste generated from operational activities.

2.21 NOISE

Solar cells do not make noise during operation.

2.22 EMERGENCY RESPONSE PLAN

Emergency response will be determined in corresponding instructions.

- There would be an evacuation plan, technical means/equipment necessary for handling small-scale emergency situations, protective and communication means (phone, fax machine) for personnel to protect themselves and call for corresponding emergency services (fire-fighting).
- Every accident must be registered and its causes must be investigated. If necessary, remediation will also be ensured.

2.23 SCHEDULE OF IMPLEMENTATION

The proponent aims to complete project in a period of 12 months after getting Environmental Approval from Environmental Protection Agency (EPA), Punjab.

Table 4: Schedule Implementation

Sr. No.	Activities	6 Months			6 Months		
		2M	2M	2M	2M	2M	2M
1	Detailed designing						
2	Mobilization of contractors						
3	Obtaining of approvals						
5	Solar Panel System Installation						
6	Restoration and plantation						
M= MONTHS							

2.24 COST AND MAGNITUDE OF OPERATION

The total cost of the proposed project is estimated at PKR 246 Million. However, budget will be allocated for purchase and maintenance of standardized PPEs for workers, tree plantation, fire-fighting equipment maintenance & management and environmental monitoring. BOQ is attached with IEE report as Annexure VIII.

2.25 GOVERNMENT APPROVAL

The environmental approval according to the Section-12 of Punjab Environmental Protection Act, 1997, as amended in 2012 is the mandatory requirement of the project.

CHAPTER 3: ENVIRONMENTAL BASELINE PROFILE

3.1 GENERAL

For any project the prevailing environmental conditions need to be assessed prior to the preliminary stages of planning, designing, execution and operation. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures. The existing environmental conditions of the proposed project have been considered with respect to physical, biological and socio-economic aspects. Information has been collected from various sources, including published literature, field observations and surveys conducted for evaluation of associated or related impacts.

3.2 PHYSICAL RESOURCES

Following is a brief description of various physical resources of the proposed project site.

3.2.1 Topography

The proposed project site is within the premises of existing unit of Crescent Textile Mills at Sargodha Road, Noorpur, District Faisalabad.

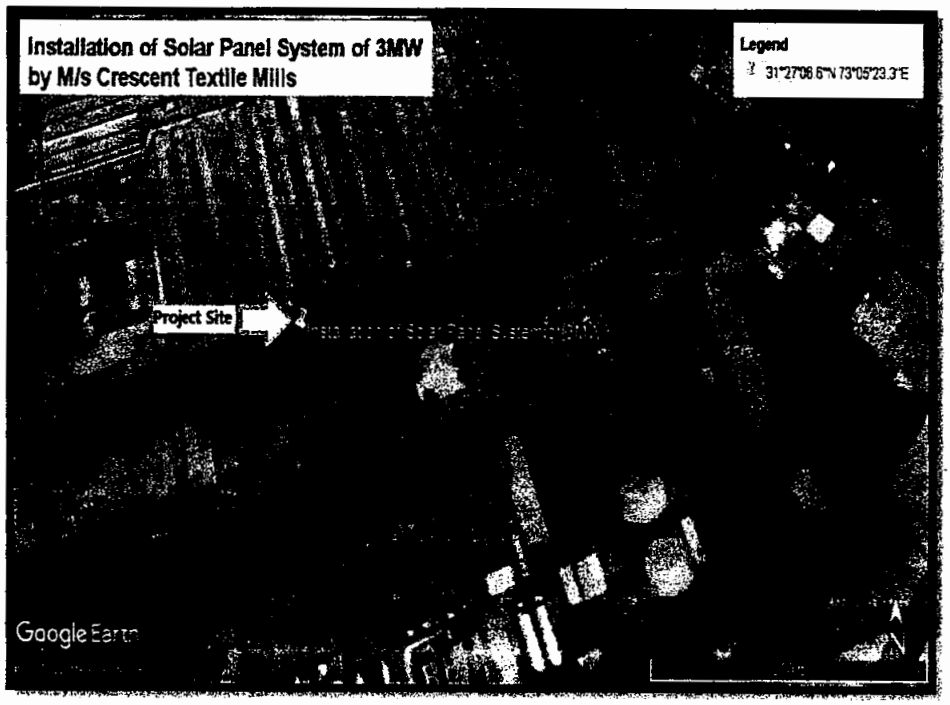


Figure 6: Location of Proposed Project

3.2.2 Geology

The project area (District Faisalabad) is located on the "Bar Upland" which is relatively older alluvium deposit. The soil in the surroundings of the project site is fertile, thereby supports cultivation. There is no presence of rocks in the vicinity of the project area.

3.2.3 Surface Hydrology

The sub soils and sub strata encountered in the area have been formed by alluvial deposits transported by ancient streams of the Indus River System. The unconsolidated sediments are to a depth of about 900 feet. The groundwater recharge is mainly derived from the seepage of unlined canals, watercourses and from irrigation practices. Recharge directly from rainfall is small. Also, some recharge takes place from ponds, water supply and sewerage systems. Groundwater is the major source of water in the study area, which is extracted with the help of pumps and motors. The groundwater extracted is used to fulfill various domestic, irrigation and industrial needs.

Project Site

No fresh water body is present near site. Groundwater will be used for drinking and other purpose.

3.2.4 Seismology

The area where the proposed project is situated falls in Zone "2A" according to Seismic Zoning Map of Pakistan. According to the seismic map of Pakistan this zone is associated with unknown geologic conditions and the earthquake damage is "moderate". However, earthquakes of magnitude up to five on the Richter scale which generate ground acceleration up to 0.1g have been reported for this zone.

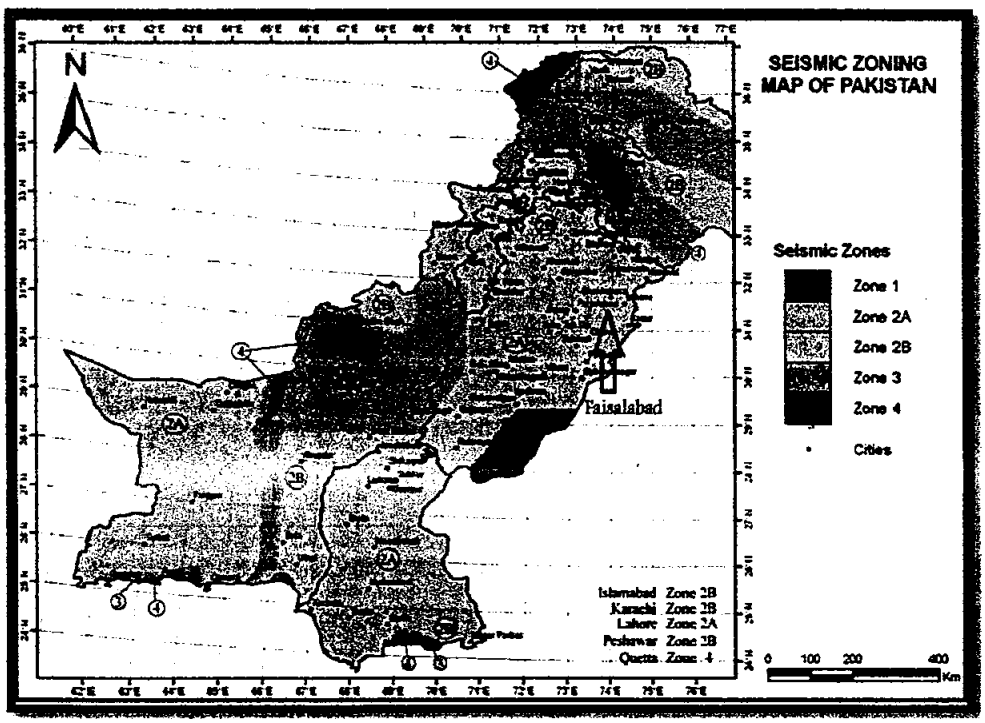


Figure 7: Seismic Zoning Map of Pakistan

3.2.5 Climatic condition and Seasons

The climate of Faisalabad features a semi-arid climate with very hot and humid summers and dry cool winters. The average maximum and minimum temperatures in June are 40.5 °C (104.9 °F) and 26.9 °C (80.4 °F). In January the average minimum and maximum are 19.4 °C (66.9 °F) and 4.1 °C (39.4 °F)[1].

The summer season starts in mid April and continues until late October. 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 winter season starts in November and continues until early February[2]. 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 millimeters (14.8 in) which is highly seasonal since approximately half of the yearly rainfall takes place in July and August during the monsoon season.

Climate data for Faisalabad

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)													
Average high °C (°F)													
Average low °C (°F)	4.3 (40.9)	7.6 (45.7)									10.4 (50.7)	6.1 (43.0)	
Record low °C (°F)	−4 (25)	−2 (28)	1 (34)	7 (45)						9 (48)	2 (36)	−1.3 (29.7)	−4 (25)
Average Precipitation mm (inches)	16 (0.6)	18 (0.7)	23 (0.9)	14 (0.6)	9 (0.4)	29 (1.1)			20 (0.8)	5 (0.2)	2 (0.1)	5 (0.2)	346 (13.6)

Figure 8: All year climatic condition of the city

3.2.6 Ground Water

The ground water is available at 350 to 400 feet depth and can be used for drinking and other purposes. The sub soils and strata encountered in the area have been formed by alluvial deposits

[1] Faisalabad: it's Pakistan Archived 2010-11-01 at the Wayback Machine.
[2] Data Archived *from* the original *on June 13, 2010.*Retrieved January 18, 2011.

transported by ancient streams of the Indus River System. At the project site groundwater is the major source of water which is extracted with the help of pumps and motors.

3.3 ENVIRONMENTAL CONDITIONS

3.3.1 Ambient Air Quality

The proposed project site is located in agricultural area however the ambient air quality of the proposed project area is neat and clean due to agricultural fields and rural settings. For the analysis of different environmental parameters of proposed site, EPA certified lab was hired.

3.3.2 Noise Level

Noise levels at the project site and around the project area was monitored using digital sound level meter and was within the limits prescribed in the PEQS.

3.3.3 Water Quality

Water Quality of the proposed project site was monitored and values was within the limits prescribed in the WHO guidelines.

3.4 BIOLOGICAL RESOURCES

3.4.1 Flora

Site is situated within urban area. No forest or any type of worthy flora is present at the proposed project site. The most common plant and tree species in the district are Karir, Aak, Kana, Khabbal, Lamb, Gorkha, Shisham, Kikar, Eucalyptus, Jaman, Dharek, Mulberry, Beri and Khajoor[3].

3.4.2 Fauna

With an increase in the rate of urbanization, the ecology of Faisalabad has been considerably affected but there is no threatened or endangered found in the project site. No wildlife was present there. Only cats, dogs, sparrows and crows passed by temporarily. No permanent habitat of any fauna was found.

3.4.3 Fishery and Aquatic Biology

There is no source of fishery in the project area. There are no fish farms around the proposed project site. There is no river, canal and other water body flowing in the proximity of the proposed project area. So, there is no aquatic biology in the context of the project area.

3.4.4 Forestry

There is no forest present in the area where the proposed project is located.

[3] Thesis submitted on "Environmental Impact Assessment of Faisalabad- Khanewal Motorway (M-4) by Lamia Islam Khan

3.5 SOCIO ECONOMIC ASSESMENT

3.5.1 Nearby Residential Areas

The proposed project site is located within the premises of existing unit of Crescent Textile Mills at Sargodha Road, Noorpur, District Faisalabad. Scattered cluster of residential zones exist around project site are shown in Figure 9.

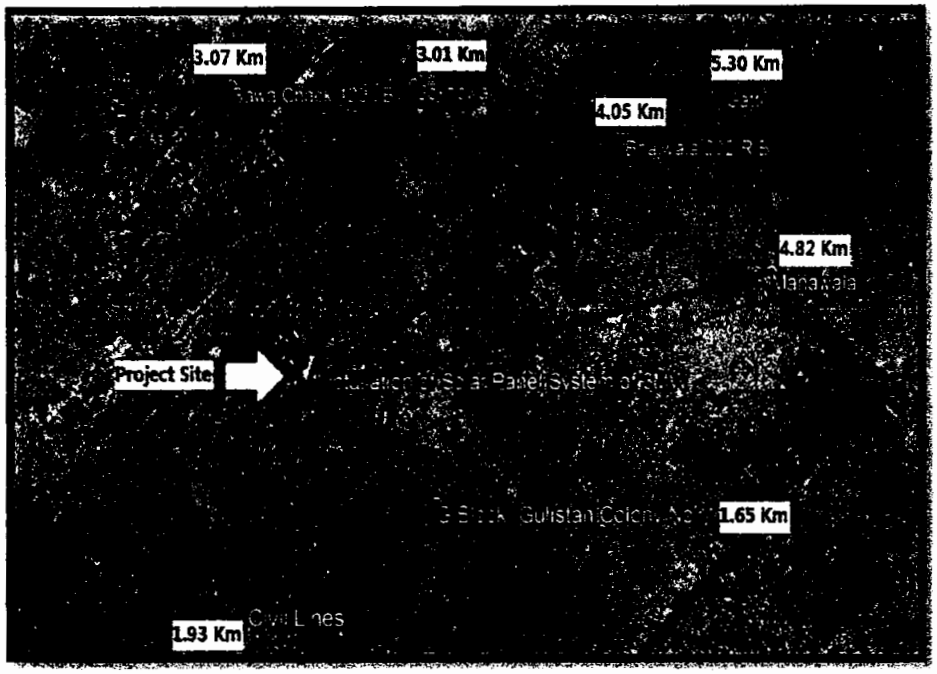


Figure 9: Nearby residential areas from proposed project site

3.5.2 Health Facilities

Nearby hospitals from the proposed project site are shown in Figure-10.

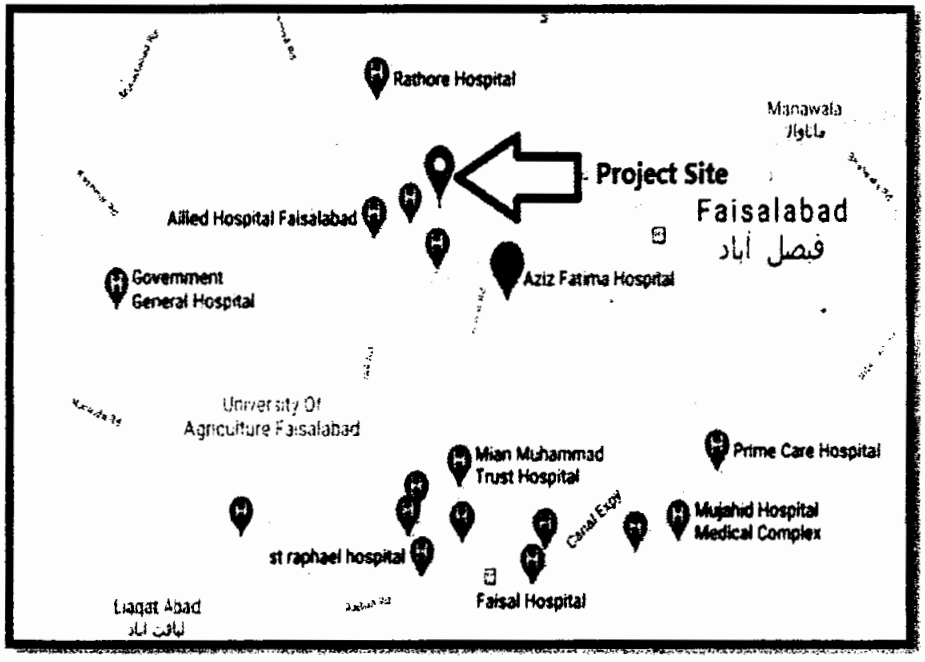


Figure 10: Nearby hospitals from proposed project site

3.5.3 Institutions

Nearby institutions from the proposed project site are shown in Figure-11.

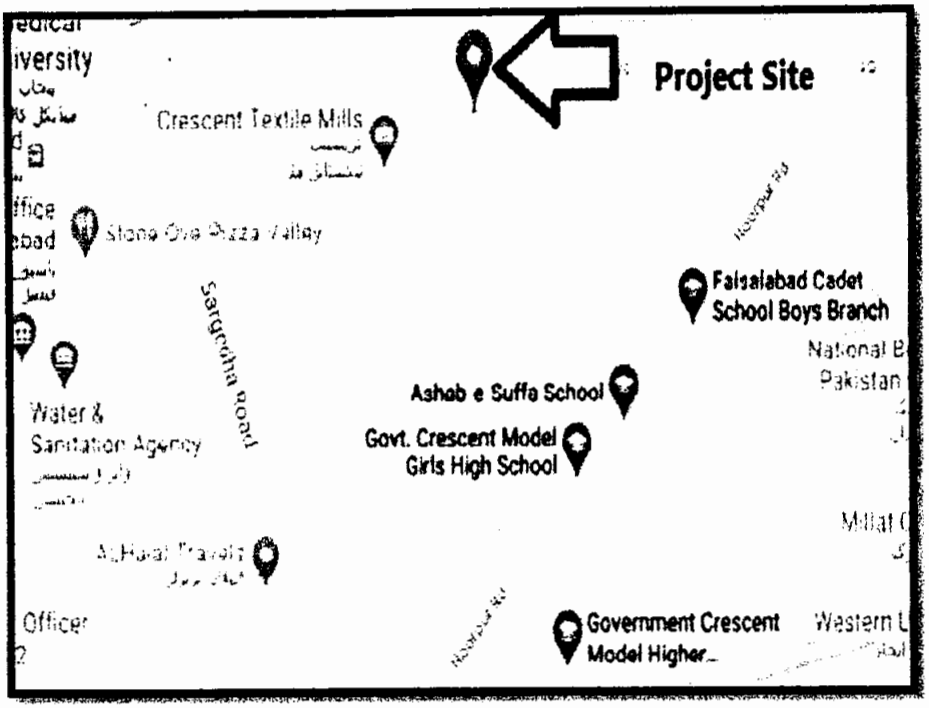


Figure 11: Nearby Institutions from proposed project site

3.6 SOCIO ECONOMIC SURVEY

The socio-economic aspects were studied and analyzed by conducting socio-economic survey in the community residing in the project vicinity. Public participation was a key component in order to get information for incorporation. The local people were interviewed. The positive and negative views of the perceived affected locals were sought. The exercise was conducted by a team of experts via administration of structured questionnaires as well as interviews surrounding the proposed project site. During the detailed field survey, consultations were made with local community/ general public. The basic purpose of these meetings/ focus group discussions was to:

- ✓ Share information with stakeholders about the expected impacts of proposed development works on the physical, biological and socioeconomic environment;
- ✓ Understand stakeholders' concerns regarding various aspects of the project, including the existing conditions and the potential impacts either positive or negative of the proposed project.

The following methodologies were used for carrying out public consultation:

- ✓ Local communities, individuals affected and owners and employees who will be directly or indirectly affected were given priority while conducting public consultation.
- ✓ Walk-through informal group consultations in the proposed project area.

- ✓ The local communities had been informed through public consultation with a briefing on project interventions including its benefits.

Figure 12: Survey from the nearby residents of area

3.7 QUALITY OF LIFE VALUES

3.7.1 Settlement Patterns

The field surveys have shown that the settlement pattern of the project area and its vicinity is mostly urban.

3.7.2 Demographic Characteristics of Population

The demographic features include the information on the household's profile, gender composition, occupations, and literacy status of the population residing in the proposed project area. The information relating to the demographic profile of the people in the project area are described below.

Individuals and workers from nearby areas were interviewed. Most of the people have sound earning sources. Most of the people were reluctant in providing a figure of their total family income. The diseases prevalent in the community were stomach disorders, fatigue, headache etc.

3.7.3 Family Size

Based on the field survey of the local population the average family size computed to be 4.

3.7.4 Age Groups

Ages of the consulted population were also recorded. The people interviewed for the socio-economic assessment belongs to different age groups i.e. 20-35 years, 36-45 years, 46-55 years, and 56 years and above.

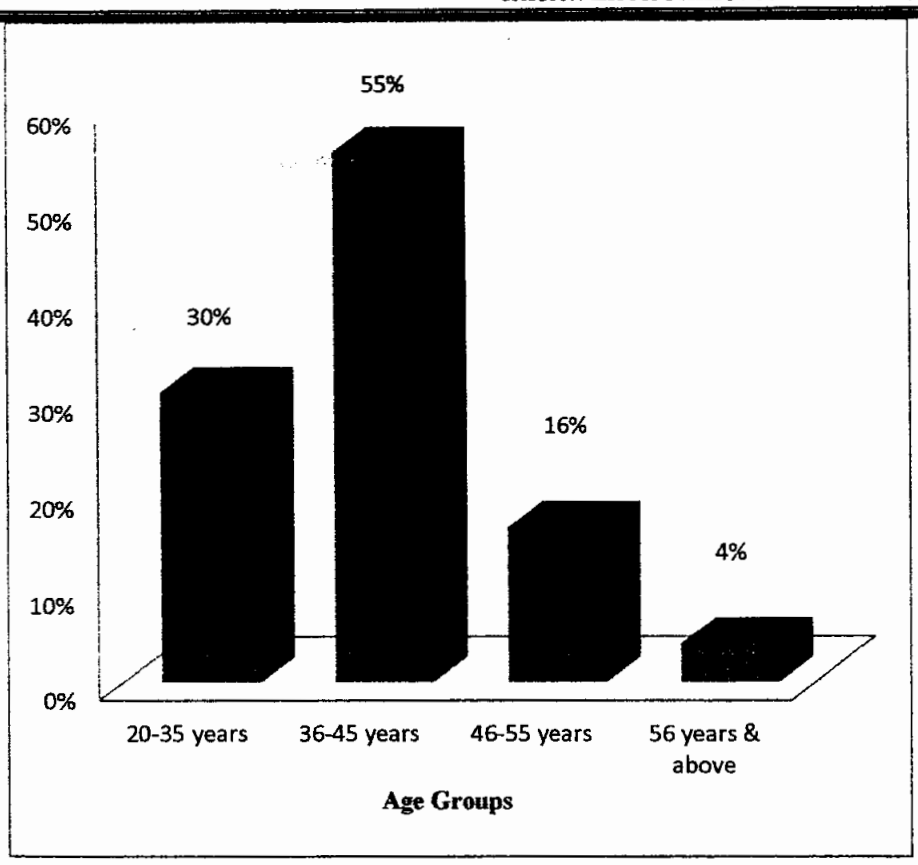


Figure 13: Percentages of age groups

3.7.5 Status of Education

Among respondents the percentage of educational status is shown in figure 14.

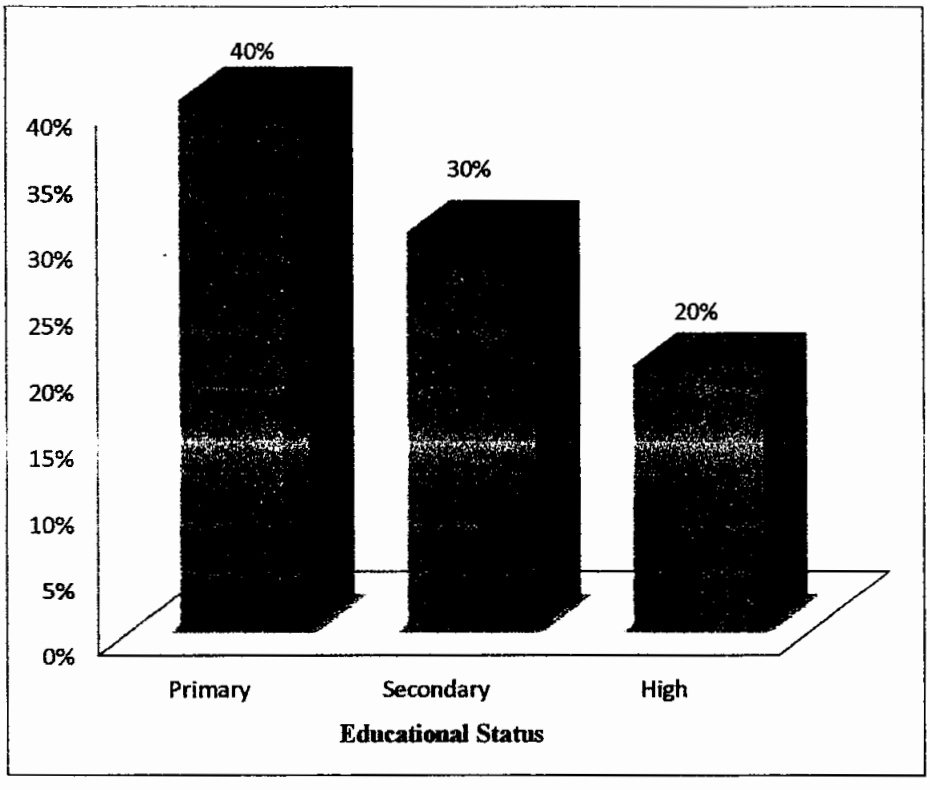


Figure 14: Educational status of area

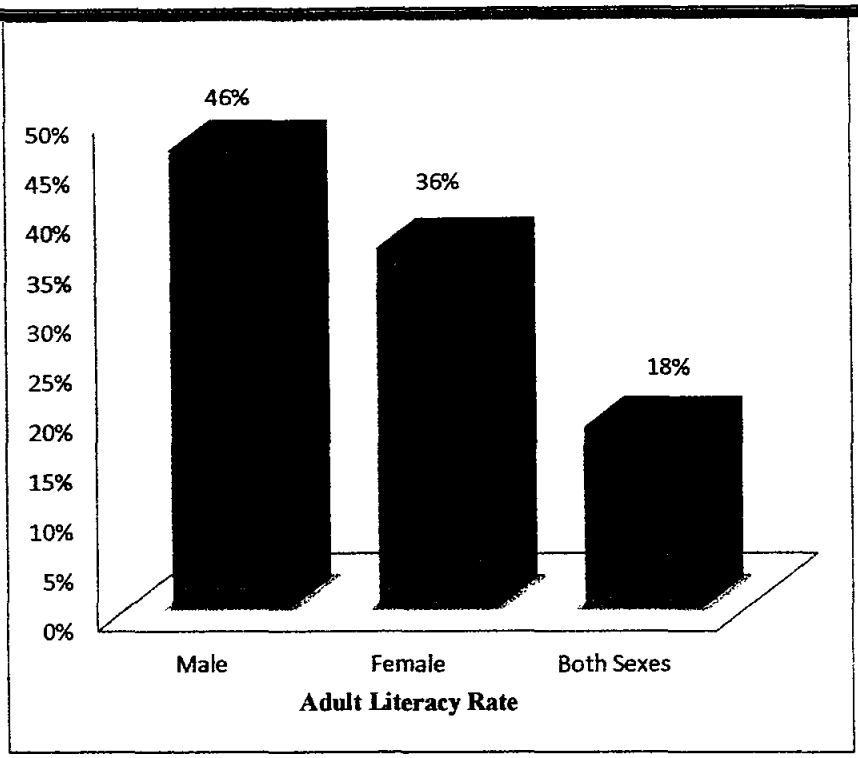


Figure 15: Adult literacy rate

3.7.6 Employment Status

On the basis of field survey, the employment status has been shown in the following graph. Most of the female respondents were unemployed. The assessment of annual household income is one of the important indicators to measure the well-being/ livelihood of the household. The average family income was calculated to be PKR 35,000.

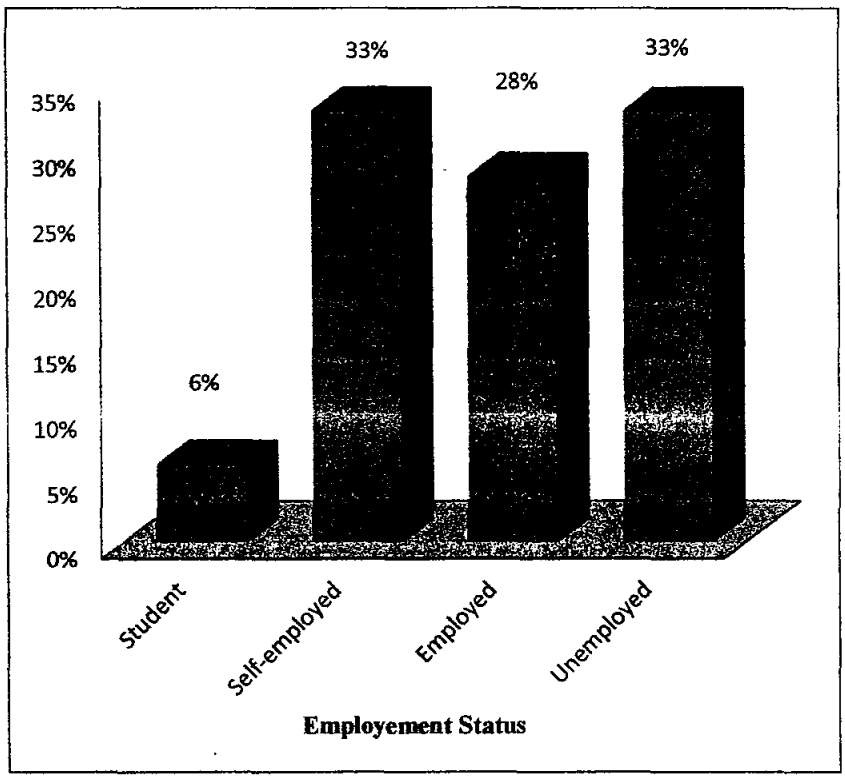


Figure 16: Employment status of area

3.7.7 Occupation

In the vicinity of the project area, the sample population is involved in different occupations in order to meet their living expenditure. Out of the total sample population, 41 percent were involved in self-business like shops/stores while 55 percent were employed in various services.

Table 5: Percentage of different occupations

Business	Services	Other
41	55	4

3.7.8 Project Response

In opinion of the respondents that around 97% are in favor of the project. In their opinion, construction of the project will create labor opportunities for locals and it will help to improve economic and social conditions of area. The respondents also provided the mitigation measures like certified contractor must be hired, proper plantation should be done, proper procedures should be followed etc. They said, if mitigation measures will be implemented they would have no objection.

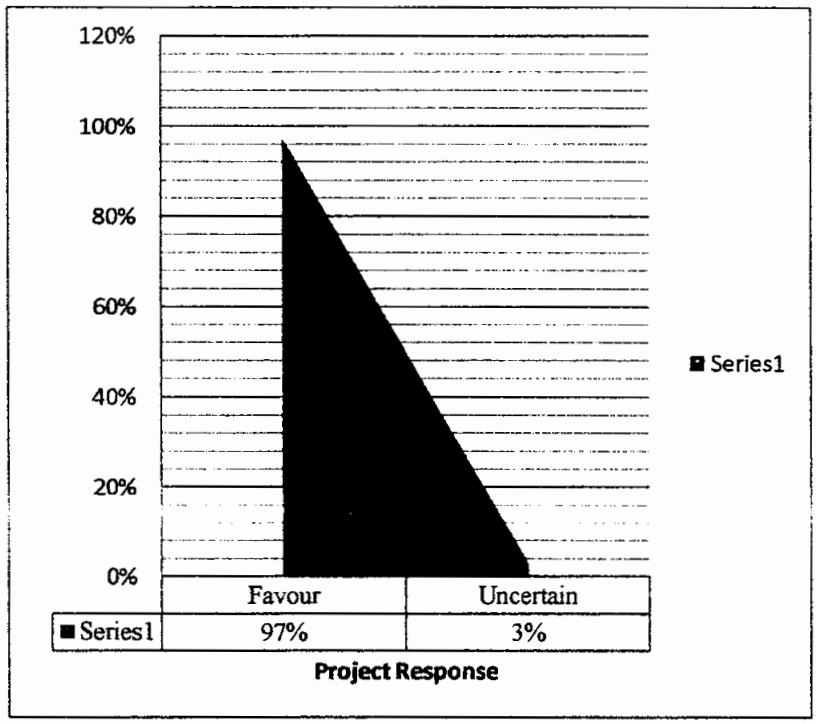


Figure 17: Percentage of people in favor and against of project

CHAPTER4: POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

1.1 GENERAL

The development of any project could necessarily bring changes in the local environment in terms of physical, biological and socio-economic aspects. The impacts generated are both beneficial as well as negative impacts. Based on the analysis of environmental baseline information and activities that are to be performed by the project, the possible environmental impacts are identified. Most of the identified impacts have been quantified to the extent possible on the value judgment. Each of the environmental issues has been examined in terms of their current condition, likely impacts during construction and subsequent operational phases. The impacts have been predicted in terms of the environmental impact and business impact of the proposed project activities.

4.2 OBJECTIVES

The objective of screening is identification of the adverse as well as beneficial impacts and then mitigating the effect of adverse impacts up to acceptable limits or within PEQS. Following are the objectives of screening out all significant environmental and social impacts:

- To find different alternatives and ways of carrying out the project activities which may cause adverse impacts
- To enhance the environmental and social benefits of project
- To avoid, minimize and remediate adverse impacts
- To ensure that residual adverse impacts are kept within acceptable limits

In the sub-sections below the impacts assessment methodology for the proposed project has been defined. It includes the magnitude, the extent of the impact and the nature of the anticipated impact.

4.3 METHODOLOGY

This section discusses the project's potential environmental impact on the area's geomorphology, soil, water resources, air resource, biological resources, socioeconomic condition and where applicable, identifies mitigation measures that will reduce, if not eliminate, its adverse impact. The assessment carried out in the sub-sections below is based on potential impacts on overall environmental receptors within the project area. Impacts are evaluated on the basis of magnitude, immediacy and sustainability. Evaluation criteria are as follows:

4.3.1 Magnitude

The magnitude of the impacts associated with the proposed project include the type of impact project commencement will cause to its immediate environment and social structure. It could be direct, indirect and cumulative.

4.3.2 Immediacy

Immediacy of the impact focus on the following parameters:

- Temporal Extent (during construction and operation)
- Spatial Extent (local or widespread)

4.3.3 Sustainability and Reversibility

Sustainability and reversibility of the impact focused on the following parameters:

- Mitigability (Fully/Partially)
- Monitoring (Fully/Partially)

4.4 Purpose of Mitigation Measure

The basic purpose of mitigation measures is to reduce the impacts of the installation of solar panel system on the socio-environment up to the maximum possible extent. The mitigation measures are suggested based on the following parameters:

4.4.1 What is the problem?

The proposed project is the installation of solar panel system. The study area is within the premises of existing textile unit at Sargodha Road, Noorpur, District Faisalabad. In addition, to the noise and fugitive dust emissions during the development phase solid waste also requires proper management. The major impact associated with the operational phase includes health and safety of workers, fire-fighting arrangements and housekeeping.

4.4.2 When problem will occur and when it should be addressed?

The impacts from the installation of solar panel system will occur during the construction and operation due to the civil work involved and the people residing in the project area. These issues included; noise generation, fugitive dust emissions, solid waste management, top-soil removal, health and safety issues and change in the geographic features of the area. These all problems should be addressed on-site where they are being generated, to avoid the residual or adverse impacts.

4.4.3 Where problem should be addressed?

The problem will be generated from site development of the solar panel system. So, it should be addressed on source i.e. at site within the same timeframe.

4.4.4 How the problem should be addressed?

Proper mitigations measures will be provided according to the nature of the impacts/problems.

4.5 Ways of Achieving Mitigation Measures

Following ways will be adopted to reduce the impacts of the proposed development:

4.5.1 Changing in Planning Design

Proposed design is developed considering environmental risk and hazards. Moreover, there is no endangered and threatened species present in the project area. Any human settlement or infra-structure will not be dislocated or dismantled due to the proposed project development. Hence, there is no need to change the design of project.

4.5.2 Improved Management and Monitoring Practices

The anticipated impacts had been reduced significantly by adopting better management activities, as it will be carried out for betterment of the society. Following practices that need to be adopted to reduce the impact significantly:

4.5.2.1 Compensation in Money Terms

Due to the installation of proposed project, geography/landscape of the area will be changed on the permanent basis; however, there is no protected or environmentally sensitive area present within 10.0 km vicinity of the project that could be impacted. Hence, no compensation in the monetary terms will be required.

4.5.2.2 Replacement/Relocation/Rehabilitation

The proposed project site is reserved for the installation of solar panel system. No replacement, relocation and rehabilitation will required for the commencement of the aforesaid project.

4.6 Impact Significance

Evaluation of impacts signifies the potential impacts in terms of its likelihood nature as per the following criteria:

- The impacts are further classified based on their spatial distribution, i.e. local, when impacting an area of approximately 1 km radius from the project area, moderate spread, when impacting an area of 1 to 2 km radius and regional beyond 2 km.
- The impacts are classified as short term, moderate term and long term in terms of their existence in temporal scale. Impacts-less than 1 year existence as short term, while those with 1 to 3 years as moderate term and more than 3 years as long term.
- The negative impacts are termed as adverse impacts while positive impacts as beneficial.

The significance of environmental impacts of various involved activities has been evaluated based on the criteria outlined in Table 6.

Table 6: Impact Significance Criteria

Impact	Criteria
	When the impact is of high intensity with high spread and high duration.
	When the impact is of moderate intensity with high-moderate spread and high-moderate duration.
Short term	When the impact is of low intensity but with moderate spread and moderate duration or of moderate intensity.
Insignificant	When the impact is of low intensity, low spread and low duration.
	When the impacts are positive.

Based on the above-specified criteria, Matrix method has been used to describe potential environmental impacts due to proposed project as shown in Table 7 and 8. It is important to note that one activity may have varying impacts on different receptors i.e. different components of the environment. To avoid repetitions, this section describes various activities, which may have wide impacts on many receptors.

Table 7: Impact Assessment (Construction Phase)

ENVIRONMENTAL STANDARDS						ECOLOGICAL IMPORTANCE		SOCIAL IMPORTANCE			
Surface and Ground Water Quality	Air Quality	Noise	Solid Waste	Smell & Smoke	Fire Hazards	Destruction of Habitat / Vegetation	Disturbance to local fauna	Disturbance to Other Services	Urban Congestion	Employment Opportunities	Public Health & Safety
1	1	-1	-1	0	1	0	0	0	0	+1	0

Table 8: Impact Assessment (Operational Phase)

ENVIRONMENTAL STANDARDS						ECOLOGICAL IMPORTANCE		SOCIAL IMPORTANCE			
Surface and Ground Water Quality	Air Quality	Noise	Solid Waste	Smell & Smoke	Fire Hazards	Destruction of Habitat / Vegetation	Disturbance to local fauna	Disturbance to Other Services	Urban Congestion	Employment Opportunities	Public Health & Safety
0	0	0	0	0	0	0	0	0	0	+2	1

Key: 1 = Minor Impacts are defined as Less significant adverse impacts that may be easily prevented or mitigated

2 = Moderate Impacts are considered as likely to have adverse environmental impacts

3 = Major Impacts are defined as significant, or irreversible adverse impact

0 = This category serves no impacts from project

4.7 IMPACTS DUE TO PROJECT LOCATION

The development will have both socio-economic and environmental implications as discussed in the sub-sections below.

4.7.1 Relocation of People

Currently, there are no infringements on the project site that may be affected therefore relocation exercises are not required.

4.7.2 Loss of Vegetation

Considering the scale of the project and commonly found flora and fauna within the project influence area, no significant adverse effects are envisaged on the ecology of the area. The site has no vegetative cover.

4.7.3 Shifting of Utilities

There will not be any shifting of existing utilities such as water supply pipelines, sewers, electrical lines, etc. due to the proposed project.

4.7.4 Impact on Archaeological/Cultural Property

Within the project influence area there are no significant archaeological properties, hence no impact in this area is anticipated.

4.8 IMPACTS DUE TO PROJECT LOCATION

Environmental problems related to location of the project are mostly in the areas of physical setting, socioeconomic setting, ecological setting and special areas. Field survey revealed that the impacts of the project due to its location are mostly insignificant in nature. Location of this solar panel system is the existing textile unit of Crescent Textile Mills Limited at Sargodha Road, Noorpur, District Faisalabad.

4.9 IMPACTS DUE TO PROJECT DESIGN

Solar energy systems provide significant environmental benefits in comparison to the conventional energy sources. The design, if maintained and operated in sustainable manner will cast positive impacts on the environment as there will be

- no depletion of the exhausted natural resources
- absence of any air emissions or waste products during operation
- reduction of the emissions of the greenhouse gases (mainly $C0_2$,NOx) and prevention of toxic gas emissions ($S0_2$,particulates)
- reduction of the required transmission lines of the electricity grids; and
- improvement of the quality of water resources

4.10 IMPACTS DUE TO PROJECT CONSTRUCTION

Installation of 3MW solar panel system at existing premises of textile unit does not required any construction because the unit is already constructed and the project is about installation of solar panel system at the roof top of unit. Impacts anticipated during installation phase are short-term and of low magnitude which are easily managed.

4.10.1 Impact on Air Quality

The project will not have a significant impact on the air quality during the installation stage.

Mitigation measures

No mitigation required.

4.10.2 Soil Erosion

It is anticipated that the project will not have any soil erosion impact.

Mitigation measures

No mitigation required.

4.10.3 Noise Pollution

Due to the installation activities there will be short-term noise impacts in the immediate vicinity of the project site. The noise levels are not expected to exceed occupational limits; therefore no adverse effects on employees should result.

Mitigation measures

Workers should be provided with noise related PPE's such as earmuffs etc.

4.10.4 Solid Waste

Installation activities will lead to the generation of solid waste mainly in the form of packaging waste and empty bags etc.

Mitigation measures

All solid waste should be appropriately disposed off.

4.10.8 Ecological Impact

The project site is present within the vicinity of CTM, Faisalabad and has no wildlife habitat. There is no threatened or endangered biodiversity (flora and fauna) species and protected areas known to exist within the project site. For these reasons it is expected that any activities for vegetation removal, ground excavations and leveling are likely to cause minimal or no biodiversity impacts in the project site.

Mitigation Measures

Measures taken to control loss of biodiversity will include:

- Strict instructions will be given to all personnel working in project area to refrain from killing, capturing or disturbing any species of bird, reptile or mammal encountered during project activities, except in self-defense.

- No removal of vegetation should be done at the project site.

4.10.9 Impact on Water Quality

The project will not have a significant impact on the air quality during the installation stage.

Mitigation measures

No mitigation required.

4.10 IMPACTS DUE TO PROJECT OPERATION

4.10.1 Discharge of Pollutants

Solar cells do not emit any pollutants during their operations.

Mitigation measures

No mitigation required.

4.10.2 Impacts on Natural Resources

Installation of solar panel system will not harm the natural resources

Mitigation measures

No mitigation required.

4.10.3 Air Pollution

Solar cells do not emit any substances to the air during operation.

Mitigation measures

No mitigation required.

4.10.4 Water Pollution

Solar reduces water pollution. This one is a little less obvious, but certainly one of the biggest environmental advantage of solar. With solar energy, there's almost no risk to local water resources, nor does their operation strain local supplies by competing with agriculture, drinking systems, and other vital water needs.

Mitigation measures

No mitigation required.

4.10.5 Noise

Intrusion Solar cells do not make a noise during operation.

Mitigation measures

No mitigation required.

4.10.5 Solid Waste

During operation there will no significant amount of solid waste generated.

Mitigation measures

No mitigation required.

4.10.6 Potential Positive Impacts

a) Employment opportunities

The proposed project will create employment opportunities at the installation, operation and maintenance phase. There will be job opportunities for the contractor, suppliers, transporters and maintenance personnel.

b) Business Opportunities

The proposed project will create business opportunities between the proponent, various suppliers and contractors.

4.11 ENVIRONMENTAL ENHANCEMENT MEASURES

Indigenous trees will be planted outside boundary of project. Grasses, median plants and median shrubs will also be grown. Aesthetic and beauty plants including roses and jasmine will be planted. Trees height will be between 3-7 ft. Spacing between plants will be 6-8m. Tree plantation will be done in open spaces and along boundary of project site.

CHAPTER 5: ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

5.1 GENERAL

Environmental planning and management as a concept seek to improve and protect environmental quality for both the project site and the neighborhood through segregation of activities that are not compatible with the environment. Environmental Management Plan (EMP) for development projects such as proposed Liquid Petroleum Gas filling and storage plant is aimed at providing a logical framework within which identifies negative environmental impacts can be mitigated and monitored. In addition, EMP assigns responsibilities for action to various factors and provides a time frame within which mitigation measures can be done. EMP provides a checklist for project monitoring and evaluation.

5.2 ENVIRONMENTAL MANAGEMENT PLAN

This EMP describes the mitigation and management measures to address the environmental issues during construction and operational phases of the proposed project.

5.3 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN

The objectives of the EMP are as follow:

- To outline functions and responsibilities of responsible persons.
- To state standards and guidelines, which are required to be achieved in term of environmental legislation
- To outline mitigation measures and environmental specifications which are required to be implementation for all phase of the project in order to minimize the extent of environmental impacts and to manage environmental impact associated with the proposed project.
- To prevent long term or permanent environmental degradation
- To identify training requirement at various levels

5.4 INSTITUTIONAL CAPACITY

Implementation of EMP is the responsibility of proponent and contractor. This section provides institutional arrangements for environmental management during the proposed activity and defines the roles and responsibility of the various organizations/departments. The responsibilities of different organizations/departments are summarized below:

5.4.1 Proponent

Responsibility of Proponent includes the following:

- Must take ownership of the process to ensure that its responsibilities are met.

- Supervising construction works.
- Schedule preparation and resource forecasting for engineering and other technical activities relating to the project.

5.4.2 Contractor

The contractor of construction activities will be responsible for:

- Develop and review work instructions and procedures.
- Review and improve method statements for environmental aspects prior to work starting.
- Monitor construction activities to ensure that control measures are effective and ensure compliance with the EMP.
- Coordinate with construction teams to ensure that environmental risks are identified and appropriate controls are developed.
- Coordinate environmental training for site personnel and subcontractors.
- Liaison with the project's environmental manager, and project public liaison officer.
- Ensure correct procedures are followed in the event of an environmental incident.
- Maintain training register, identify training needs and provide training where required.

5.4.3 EIA/IEE Expert

EIA/IEE Expert (Environmental Specialist) is the member of the supervising consultant's team. The responsibilities of EIA/IEE Expert include:

- Work with proponent to ensure all statutory environmental submissions under PEPA 1997 (Amended 2012) and other environmentally related legislation are thoroughly implemented.
- Work with proponent to ensure all environmental requirements and mitigation measures from the environmental assessment of the proposed project are included in the contract prequalification and bidding documents.
- Work with proponent to execute any additional IEE requirements needed due to fine tuning of the proposed project and that environmental performance targets are included in the contracts prior to project commencement.

5.4.4 Training Schedule

Proponent will be responsible for providing health and safety training, and briefing environmental requirement of the project to workers and its staff before the commencement of work.

5.5 ENVIRONMENT MANAGEMENT

It lists all the mitigation measures identified in the IEE and the associated environmental or social aspect, during construction and operation phase with the administrative framework

involving all the responsible implementing authorities required to take the planned actions/measures. It enhances project benefits by reducing its impacts and making it environment-friendly as in Table 9.

Table 9: EMP for Construction and Operational Phase

SR.#	TYPE OF IMPACT	TARGETS TO BE ACHIEVED	MITIGATION MEASURES	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
CONSTRUCTION PHASE					
1	Land Use	Land acquisition	• Development of the project and installing the panels only on the specified rooftops area, no installation of any panels besides the facilities' premise • There is no direct land use associated with the project; the solar panels will be installed on the rooftop of CTM. Thus, there is no "Community displacement" and "land acquisition"	Contractor/ Proponent	Proponent
2	Air Quality	Compliance with prescribed PEQs to control air pollution	• Installing construction sheets on the site to prevent dust propagation where it may occur • Maintenance and management of all the construction machinery and vehicles • Waste burning will not be allowed	Contractor/ Proponent	Proponent
3	Water Quality	Control of groundwater or surface water pollution from construction activities	• Use of spill prevention trays and impermeable sheets to avoid contamination of the groundwater/surface water • The contractor will repair /replace / compensate for any damages caused by the construction activities to the drinking water sources.	Contractor/ Proponent	Proponent
4	Solid Waste	Proper & safe handling and disposal of construction related waste	• Ensure prevention of inappropriate disposal of waste material.	Contractor/ Proponent	Proponent

5	Noise	Compliance with prescribed PEQs to control noise pollution	• Provision of acoustic enclosures (hood and shrouds) on generator • Proper maintenance of construction equipment. • Minimize/avoid unnecessary use of pneumatic drills and other noisy machinery.	Contractor/ Proponent	Proponent
6	Workers Health & Safety	Prevention of any possibility of work site accident/ impact on worker's health	• Provision of first aid box at work site to cope with emergency situation • Safety training to the workers • Adequate safety signs on site • Provide training regarding proper handling and use of chemicals/ paints • Install fire extinguishers at fire handling places	Contractor/ Proponent	Proponent
			OPERATIONAL PHASE		
1	Solid Waste Generation	Handling and proper disposal of solid waste	• Solar panel system do not cause any solid waste during operation	-	-
2	Air Quality	Ambient air quality (PEQs) standards	• Solar Panel system do not cause carbon dioxide gas emission or emission of other GHGs • Solar panels have positive impacts on air quality • PV material are usually encased in glass or plastic and do not release particles into air	-	-
3	Wastewater	Handling and proper disposal of solid waste	• Solar panel system do not cause any wastewater during operation	-	-
4	Health and Safety	Prevention measures against labor accidents and health problems	• Explanatory and preventive signs must be available around the solar panels; barriers for sites that are only to be entered by authorized and skilled workers should be implemented. • Workers shall be given orientation regarding the works they are to be indulged in. • The Emergency Response Plan is a part of the OHS	EHS Officer	Proponent

			procedures		
5	Biodiversity	Prevention measures against biodiversity accidents and problems	• There are no registered protected or rare animal species in the project area. Moreover, there are no bird migration activities or any habitats around project site. • As the panels are located on the roof top monitoring activities need to be implemented to record avian species fatalities and injuries. If the numbers are high, then mitigation measures need to be carried out such as habitat restoration in nearby area	EHS Officer	Proponent

- Define monitoring mechanism and identify monitoring parameters.
- Evaluate the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggest improvements in the management plan, if required,
- Identify training requirement at various levels.

An environmental monitoring plan is suggested to monitor environmental parameters during survey, construction and post construction phase of the project.

Following environmental record should be maintained:

- Periodic inspection reports of the site
- Audit reports
- Incident record of all moderate and major spills and other incidents and accidents. The record will include:
  - ✓ Location of spill or battery limit of the accident
  - ✓ Estimated quantity or the amount of injury (as may be reported in LTI or LWI)
  - ✓ Spilled material or nature of injury or loss (temporary or permanent)
  - ✓ Restoration measures
  - ✓ Photographs
- Description of any damage to vegetation, water resource, or community asset.
- Corrective measures are taken, if any
- Waste Tracking Register that will hold records of waste generated during the Construction period. This will include quantities of waste disposed of, recycled, or reused.
- Survey reports, in particular, the following:
  - ✓ Vehicle and equipment noise.
  - ✓ Ambient noise survey reports.

- ✓ Environmental and social training records.

5.7 EQUIPMENT MAINTENANCE DETAIL

Equipment should only be inspected, tested and maintained by qualified trained personnel. If any equipment is not in good operating condition, it should be repaired immediately. Authorized dealers will be responsible for maintenance of equipments. Equipment procedures and maintenance guidelines should be kept in a central location for quick reference when needed.

5.8 ENVIRONMENTAL BUDGET

Although installation of solar panel system project itself is an eco-friendly project however instead of project eco friendly development, separate environmental management cost also added in project. The total cost for the environmental management is estimated as 100,000 PKR per annum.

negative environmental impacts are having low to moderate intense ratings or temporary. No depletion, deterioration or exploitation of local natural resources is expected to be caused by the proposed project.

It is accordingly recommended that the Environmental Approval for the project may be issued by the Punjab Environmental Protection Agency subjected to the payment of requisite scrutiny fee by the proponent of the project.

6.2 RECOMMENDATIONS

The Initial Environmental Examination (IEE) as well as survey results are finally evaluated to recommend the following:

- Adherence to the Environmental Management Plan (EMP) as proposed in this report is mandatory.
- During the construction phase of this project all the required PPEs should be provided to the workers.
- Proper housekeeping in and around the site must be given consideration.
- Proper plantation must be done as corporate social responsibility (CSR).
- The fire safeties precautions must be considered to prevent or reduce the likelihood of fire.
- Proper maintenance of solar panel system.
- Placing and maintaining fire extinguishers at easily accessible points.
- Proper safety and information sign boards must be placed at required places.
- Adequate training of workers must be done to deal with the situations.

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

Roles and Responsibilities

(For events deemed to be major, CUSTOMER may be obliged, by its responsibilities under its agreements with the Government, to assume control of emergency response activities. In these circumstances the CUSTOMER Representative shall clearly advise REON that CUSTOMER is assuming control and the REON Project Manager will work under CUSTOMER instruction).

For emergency response activities managed by REON, key roles and responsibilities are detailed below.

Emergency Response Team Leader (Project Manager)

The ERT Leader shall carry overall responsibility for REON emergency response execution. Key responsibilities shall include:

- Providing leadership and direction in the event of an emergency.
- Ensuring that emergency response planning, preparedness and execution is consistent with the requirements of CUSTOMER.
- Ensuring that appropriate emergency response teams are defined and prepared for the various emergency response scenarios identified in this plan.
- Notification to CUSTOMER Project Manager of any emergency incident. This is a mandatory requirement for all emergencies. Notification of an emergency incident should be made via radio, telephone, or messenger to CUSTOMER Operations CCR as soon as practicable upon receiving advice of same.
- Following initial notification, liaison with CUSTOMER Project Manager during the execution of any emergency response.

Mobilization of additional resources, third party assistance etc. Liaison with management.

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the following actions:

- Shall attend the site of the incident, assess the situation and issue direction to the concerned parties and to the Fire Team.
- Ensure that messages have been communicated to The Emergency Response Team Leader.
- Evaluate the scale of the incident and decide whether additional resources are required to adequately deal with it.
- Liaise with site supervision for withdrawing any permits.
- Liaise with site supervision for the mobilization of any plant and equipment necessary for dealing with the emergency.
- Limit access to the area with barriers or other means to prevent unauthorized access.
- Co-ordinate the reinstatement measures following stabilization of incident.
- Prepare a full report.

Fire Team

- The fire team will be selected and trained appropriately.
- The Site Engineer HSE shall appoint a Fire Team Leader (and his substitute) who will direct personnel under his control.
- The fire team leader will have had training and preferably previous experience in emergency response actions.
- All the members of the fire team shall report to the Fire Team Leader.
- Appropriate training shall be provided to members of the fire team.
- An electrician or instrument specialist will be included in the fire team. His responsibility the electrical isolation of areas as necessary.

Firefighting appliances shall be maintained in accordance with their specifications. Sufficient redundancy shall be incorporated into the facilities to allow for periodic unavailability during maintenance. A designated member of the HSE Team shall regularly confirm that fire extinguisher and other appliances are recharged and maintained as appropriate.

Raising the alarm and plan activation

Activate the alarm and notify the ERT Leader.

Provide the following details:

- Location of the Incident.
- Natures of incident e.g. fire, number of injuries, etc.
- If it is a fire, state type - oil, gas, electric or other and state wind direction and strength.
- Identify yourself giving your name and telephone number or radio channel.

Alarm and Communication

Communication is a critical factor in handling an emergency. To control the situation by the earliest possible action, any employee must be able to act and raise an emergency alarm.

The assembly points shall be clearly indicated.

- On hearing an alarm all personnel shall vacate the workplace. Before leaving, each person shall ensure that the area is as safe as possible by switching off all power tools, running machines etc.
- All personnel shall muster at the assembly point as per the plan. The designated members of the HSE team shall provide guidance and assistance for mustering at the correct assembly point.
- The subcontractor's HSE team members shall take directions from the Site HSE co-ordinator.

Emergency Contacts List

List of all emergency services contacts will be displayed at site, including contact numbers of ERT and key persons (Project Manager REON, subcontractor Manager, Site HSE Engineer)

Incident response

Emergency situations occurring at the work site have the potential to cause serious injury, loss of life and property damage.

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In an emergency, or on hearing the "Stop Work Alarm", every supervisor shall ensure the following:

- All work is stopped at once.
- All equipment is shut down and put in a safe place.
- All men are evacuated to a pre-determined assembly point in an orderly manner.
- Arrange best possible interim medical arrangements for patient or injured person during transfer to hospital or while attendance by doctor is being arranged.
- Ensure the presence of ambulance 24 hours with driver.
- Anti-Snake Venom must be present at site.
- A roll call is taken, and every man is accounted for, awaiting further instructions
- Keep the zone affected by the emergency clear and remove any vehicles that could cause a restriction to the emergency team

Evacuation

Activate the emergency alarm to evacuate the area safely and ensure that unnecessary personnel leave the site by a safe route. Assign someone to advise security to open the Facility main gate for emergency vehicles.

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System Studies:

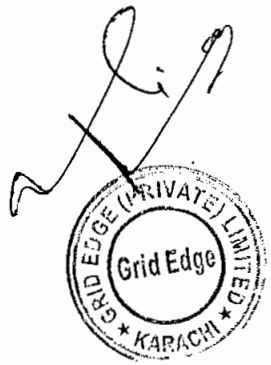
Not Applicable (MV scope excluded)

functionality to adapt the power factor of existing diesel genset and grid. The range of Power Factor can be set from 0 – 1 leading /lagging, making it suitable for absorbing or delivering reactive power. The nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

Automatic Generation Control & Ramp Rate:

The Automatic Sustainable Controller (DEIF ASC-4) is a controller designed to serve as a link between sustainable power plant (Solar) and genset plants, combining them so they work as one common hybrid system. The concept of the ASC-4 is to maximize sustainable power penetration, depending on the total load demand to the hybrid without compromising constraints such as minimum genset load demand.
The ASC-4 Solar is the variant designed for PV control, and it enables integration of PV power and genset power. The PV plant is handled as a base loading power- and reactive power provider, not as a voltage- and frequency provider. Therefore, the ASC-4 only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch power.

Ramp rate of inverters is the function of MPPT algorithm. Normally solar power is set to ramp up or ramp down the generation within the period of 5-10 seconds from 0 – 100 percent. Ramp rate can be adjusted according to the behavior of gensets over loading and unloading due to Solar power variations.



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The ASC-4 Solar is the variant designed for PV control, and it enables integration of PV power and genset power. The PV plant is handled as a base loading power- and reactive power provider, not as a voltage- and frequency provider. Therefore, the ASC-4 only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch power.

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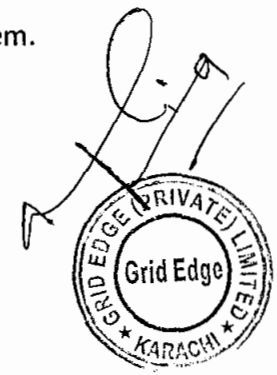
Metering and Protection:

The solar will be terminated at LT against each respective building. The Solar Panels are installed on the roof of factory building and are terminated at the 415V busbar.

Sensitivity Class for meter is 0.5s with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

The following Over and Under voltage protections are present in the system.

- Short Circuit protections
- Earth Fault detection
- Over current protection
- Emergency system shutdown protection.



REON Site Engineer HSE with the help of CUSTOMER HSE personnel shall perform the initial orientation based on but not limited to the following:

- Explaining REON HSE Policy and organizations of REON site and CUSTOMER.
- General HSE rules and regulations for working on site including use of Personal Protective Equipment, incident reporting, getting first aid, emergency response (alarm system, escape route, assembly point), HSE inspection, housekeeping, etc.
- Hazards at construction site
- Environmental hazards

Note:

This Initial HSE Orientation would also be given to all the workers of the sub-contractors working at site.

Site Engineer HSE will keep a record of staff having completed induction.

Specific Induction for Workers (On Job)

After the general induction first line supervisor shall conduct a specific orientation for new staff, which would comprise:

- Introduction of the workers on the nature of their jobs.
- Explaining to the workers the work environment of a particular location and specific job hazards

Permit to Work System Course

- It is mandatory for all work permit recipient and signatories to attend a permit to work course held by CUSTOMER. Work permits will often be required prior to commencement of work.
- Refresher courses will be arranged by REON HSE.

Toolbox Talk by Line Supervisors

All supervisors will be trained to deliver daily toolbox talk in their respective areas.

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Task Specific Training Courses (Whenever Required)

In addition to the above, specific training courses shall also be provided for staff and workers Subjects for the training courses will be identified in the training plan as advised by the CUSTOMER.

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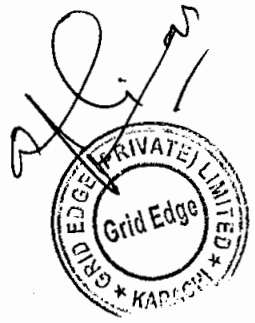
Key highlights of the project are as follows:

Customer	Crescent Textile
Project Model	BOT
System Type	Roof Mounted, On Grid
System Size	3.45 MWp
Solar PV Type	Mono-crystalline

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
- Conceptual Design
- Technical Summary



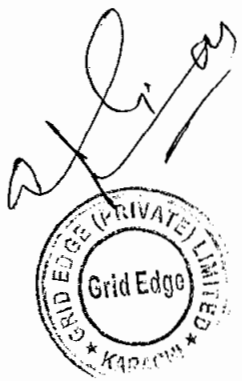
As the cost of solar electricity has fallen, the number of grid-connected [illegible] grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun.

The productivity of solar power in a region depends on solar irradiance, which varies through the day and is influenced by latitude and climate.

The locations with highest annual solar irradiance lie in the arid tropics and subtropics. Deserts lying in low latitudes usually have few clouds and can receive sunshine for more than ten hours a day. These hot deserts form the Global Sun Belt circling the world. This belt consists of extensive swathes of land in Northern Africa, Southern Africa, Southwest Asia, Middle East, and Australia, as well as the much smaller deserts of North and South America.

(HDI), and the current trends of rising incomes and energy supplies, falling poverty levels, and increasing economic activity are predicted to lead to rapid increases in per capita consumption rates in Pakistan, creating a healthy demand for additional power generation.

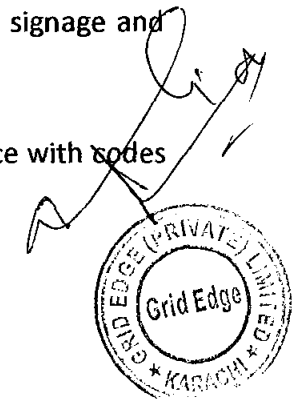
Even with the projected surplus in power generation capacity by 2025, there will still be sufficient economic feasibility for small and medium-sized (1-50 MW) renewable energy-based power projects in the Pakistan, especially those located near remote and isolated load centers and extremities of the grid network or based on bilateral bulk contracts or for augmenting peak supplies on the grid. The viability of such 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.



- Capex free deployment under power purchase agreement for 15 years
- Reliance on localized energy sources and hedge for the term of the contract for 15 years

Technology:

- Solar based Power Generation System, civil structures, and auxiliaries.
- Complete Solar Based Power Generating Panels with their protection, instrumentation, monitoring, control and synchronizing panels with existing power sources
- All technical parameters covered including but limited to Net Efficiency, Net Output, Power Plant Availability, Construction of Power Plant Building including all facilities as well as all related sub-systems such as:
    - Plant Ventilation and air-conditioning in office and similar areas,
    - Electrification and lighting systems
    - Emergency Lighting System, etc.
    - Fire Protection System
- The installed system shall meet applicable codes and standards. Safety signage and labelling should be mounted on the system as required
- All Solar Panels shall be made of Crystalline Silicon solar cells
- All the electrical installations and wiring for the PV system in accordance with codes and standards



Project Location:

The Solar Plant will be located within the Crescent Textile factory in Faisalabad

Operations and Maintenance:

The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 15 years (180 Months) and shall include but not be limited to the following items and their related costs, inclusive of all importation and local charges, duties, taxes, etc.

Feasibility & Financing:

The Project will cost approximately cost PKR 240 Million funded through 25% equity and 75% debt through SBP Green Financing

Environmental Benefits:

This system will help curtailing CO_2 emissions by 2,500 tonnes a year. A life cycle assesment of the CO2 produced by solar PV is 40g per kWh as opposed to 700g CO_2 per kWh for diesel fuel/grid sources

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reactive power. The nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

Automatic Generation Control & Ramp Rate:

The Automatic Sustainable Controller (DEIF ASC-4) is a controller designed to serve as a link between sustainable power plant (Solar) and genset plants, combining them so they work as one common hybrid system. The concept of the ASC-4 is to maximize sustainable power penetration, depending on the total load demand to the hybrid without compromising constraints such as minimum genset load demand.
The ASC-4 Solar is the variant designed for PV control, and it enables integration of PV power and genset power. The PV plant is handled as a base loading power- and reactive power provider, not as a voltage- and frequency provider. Therefore, the ASC-4 only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch power.

Ramp rate of inverters is the function of MPPT algorithm. Normally solar power is set to ramp up or ramp down the generation within the period of 5-10 seconds from 0 – 100 percent. Ramp rate can be adjusted according to the behavior of gensets over loading and unloading due to Solar power variations.

Metering and Protection:

The solar will be terminated at LT against each respective building. The Solar Panels are installed on the roof of factory building and are terminated at the 415V busbar.

Sensitivity Class for meter is 0.5s with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

The following Over and Under voltage protections are present in the system.

- Short Circuit protections
- Earth Fault detection
- Over current protection
- Emergency system shutdown protection.

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Technical Summary:

- Monocrystalline 530W Solar Modules with efficiency 20.75% are used in the design
- 110 KW grid connected solar inverters, 480V three phase, 98.7% have been considered
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2600 KW
- 10 Acre Rooftop space required for Solar installation
- Output of the system is based on instantaneous Irradiation values of Solar Energy

Bill of Materials:

S. No.	Components	Qty (No.)
1	Monocrystalline Solar Modules 530W	6512
2	Grid Connected Solar Inverters 110KW 3 Phase	26
3	LV Panel IP42 MCCB	5

Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	82.3%
2	Capacity Utilization Factor	15.9%
3	Energy Generation Units	4.7 Million kWh

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Efficiency Parameters

PV power plant efficiency can be judged per its performance ratio, expressed as a percentage. This ratio compares a plant's actual energy production to its theoretical energy-generating potential and describes how efficient a PV power plant is in converting sunlight incident on the PV array into AC energy delivered to the utility grid. AS per IEC definition, Performance Ratio defines as.

$$Performance\ Ratio = \frac{Z1}{Z2} \div \frac{Z3}{Z4}$$

Where,

Z1 = Accumulated electricity generated during testing period (kWh)

Z2 = Total system installed capacity (kWp)

Z3 = Accumulated irradiation during testing period (Wh/m2)

Z4 = Intensity of irradiance under STC condition = 1,000W/m2

Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	82.3%
2	Capacity Utilization Factor	15.9%
3	Energy Generation Units	4.7 Million kWh

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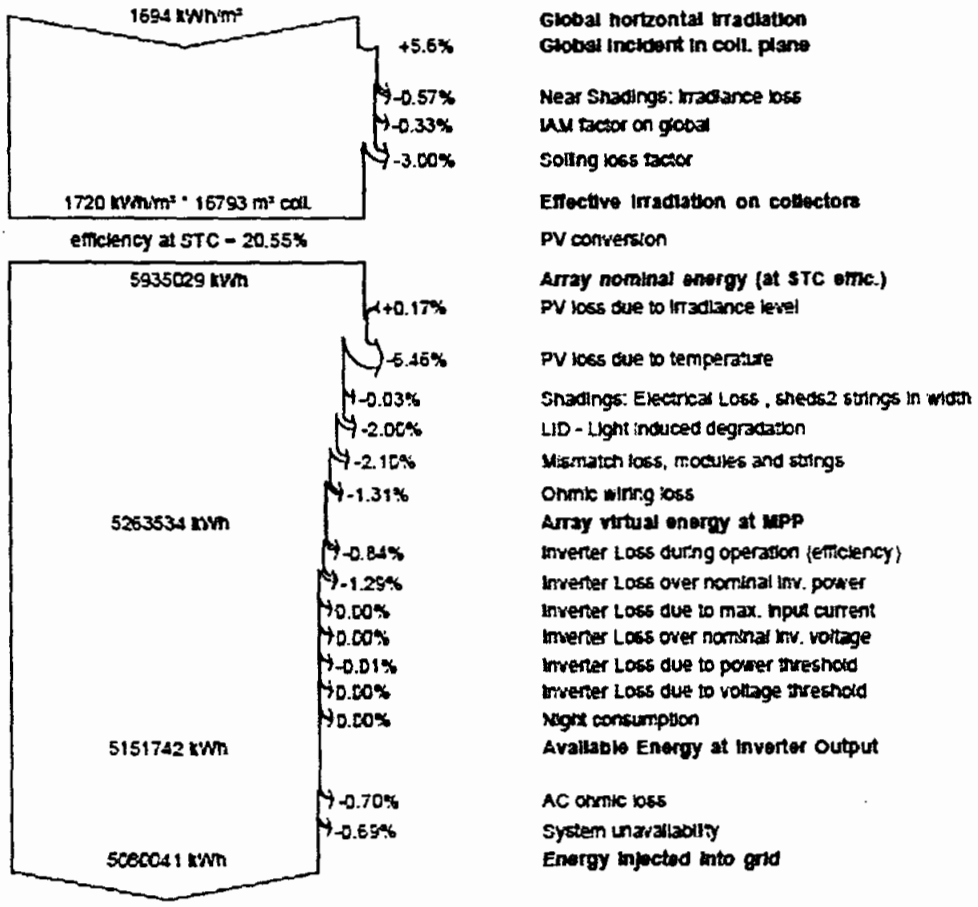
Loss diagram over the whole year



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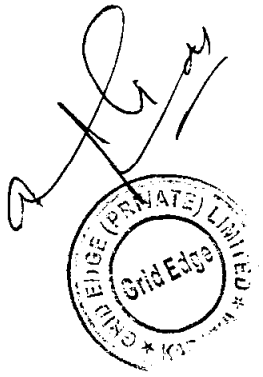
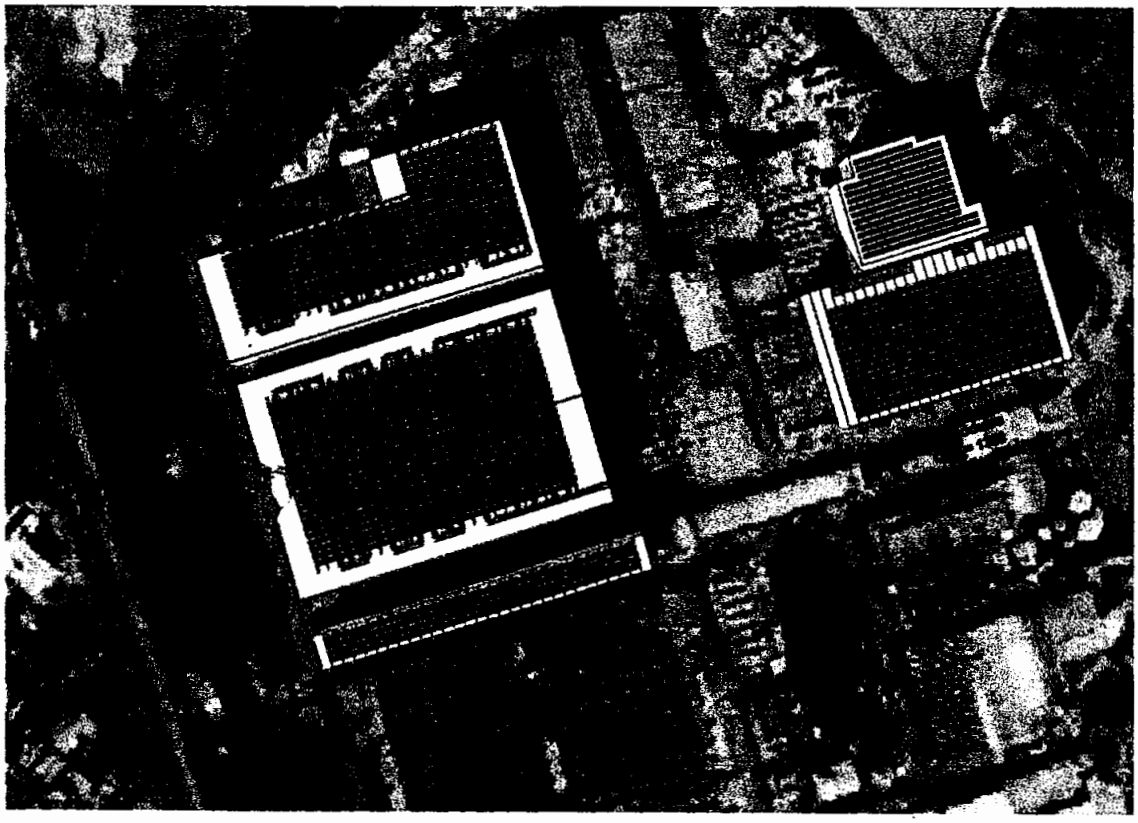
SCHEDULE-I

The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/ Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule



Location of the Generation Facility/Solar Power Plant/Solar Farm of the Licensee



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Land Coordinates of the Generation Facility/Solar Power Plant/Solar Farm of the Licensee

Coordinates	
31.4513208	73.0885344

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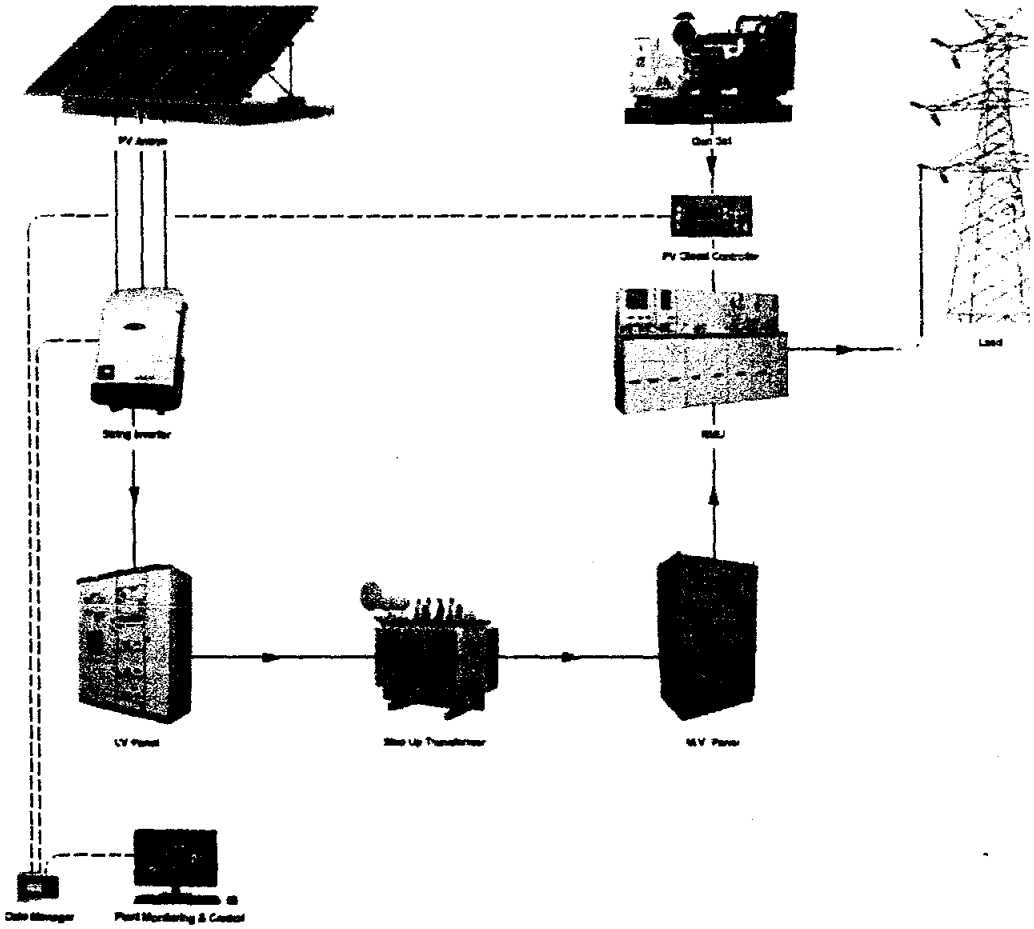
Process Flow Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensees



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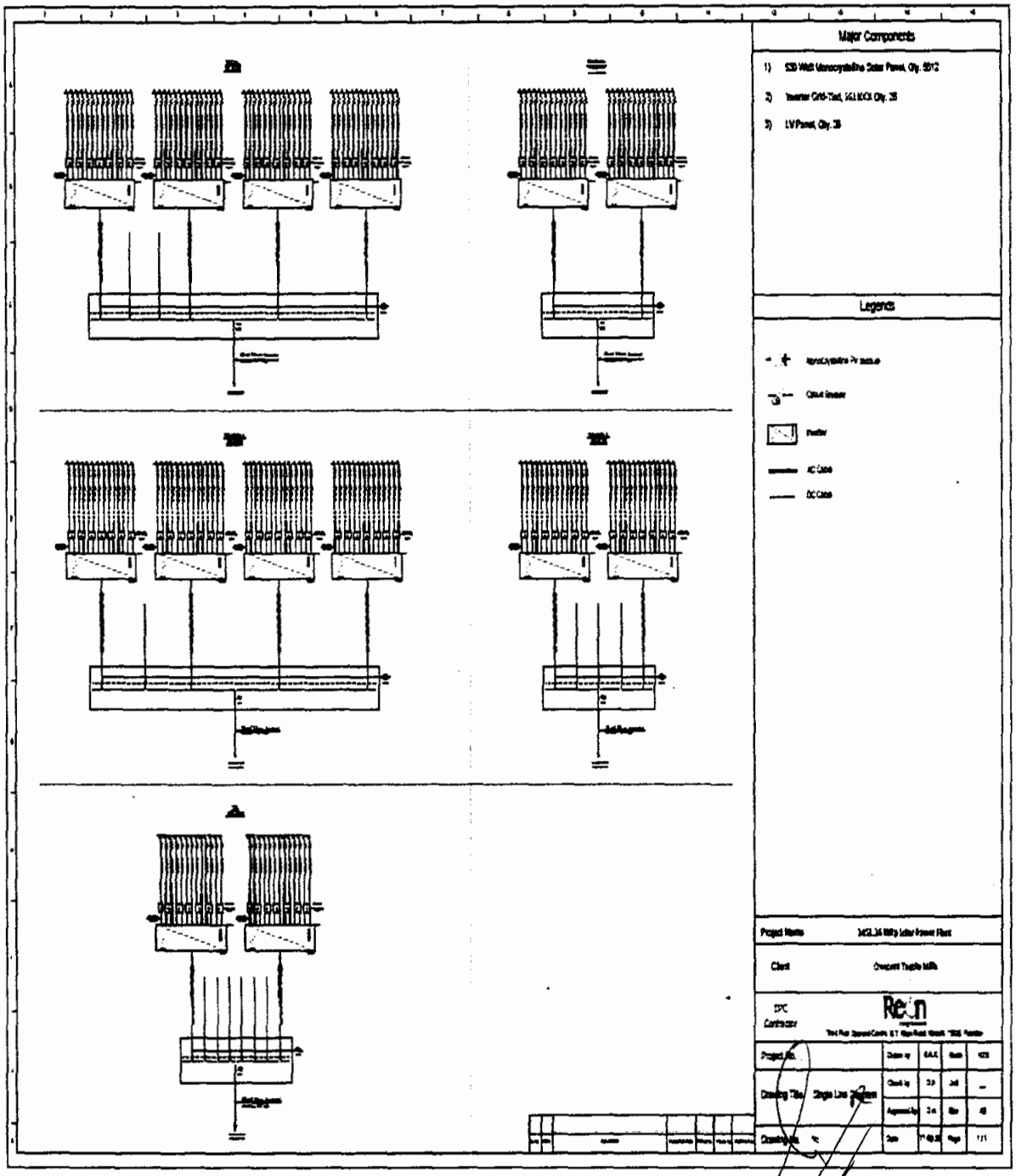
Single Line Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensee



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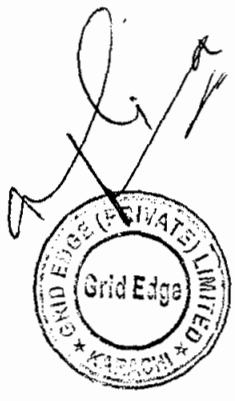
Interconnection Arrangement/Transmission Facilities for Dispersal of Power from the Generation Facility/Solar Power Plant/Solar Farm of the Licensee

The electric power generated from the generation facility/Solar Power Plant/Solar Farm of the Licensee/Grid Edge Pvt. Ltd. will be delivered/supplied to a Bulk Power Consumer (BPC) in the name of Crescent Textile Limited (CTL) located in Faisalabad, in the province of Punjab.

The Solar Facility is located within the premises of the Power Purchaser (CTL) and does not require any transmission line to be installed on public land. All power generated will be consumed by CTL facility.



Details of Generation Facility/Solar Power Plant/ Solar Farm

(A). General Information

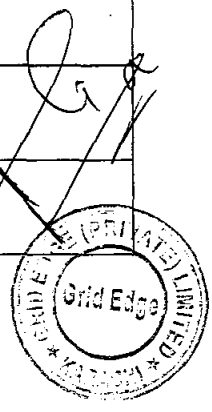
(i).	Name of the Company/Licensee	Grid Edge Pvt. Limited
(ii).	Registered/ Business office of the Company/Licensee	3rd Floor, Dawood Center, M T Khan Road, Karachi
(iii).	Location of the generation facility Solar Power Plant/ Solar Farm	Crescent Textile Plant, in Faisalabad
(iv).	Type of the generation facility/ Solar Power Plant/ Solar Farm	Solar Photovoltaic (PV)

(B). Solar Power Generation Technology & Capacity

(i).	Type of Technology	Photovoltaic (PV) Cell
(ii).	System Type	Off Grid
(iii).	Installed Capacity of the generation facility Solar Power Plant/ Solar Farm (MW)	3.451

(C). Technical Details of Equipment

(a).	**Solar Panels – PV Modules**	
(i).	Type of Module	Monocrystalline Silicon Solar Modules 530W
(ii).	Type of Cell	Monocrystalline
(iii).	Dimension of each Module	2206×1122×35mm
(iv).	No. of Panel/Modules	6,512



(v).	Total Module Area	2.475 m^2 per module
(vi).	Frame of Panel	Anodized Aluminium Frame
(vii).	Weight of one Module	28.2 kg
(viii).	No of Solar Cells in each module	144
(ix).	Efficiency of module	20.75%
(x).	Maximum Power (Pmax)	530
(xi).	Voltage @ Pmax	40.16 V
(xii).	Current @ Pmax	13.20 A
(xiii).	Open circuit voltage (Voc)	49.09 V
(xiv).	Short circuit current (Isc)	14.10 A
(xv).	Maximum system open Circuit Voltage	1500 V
(b).	**PV Array**	
(i).	Nos. of Strings	356
(ii).	Modules in a string	18 each
(c).	**Inverters**	
(i).	Capacity of each unit	110 kW
(ii).	Manufacturer	Sungrow SG110CX
(iii).	Input Operating Voltage Range	200-1100 V

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(iv).	Number of Inverters	26	
(v).	Efficiency of inverter	98.7%	
(vi).	Max. Allowable Input voltage	1100 V DC	
(vii).	Max. Current	158.8 A	
(viii).	Max. Power Point Tracking Range	550-850 V	
(ix).	Output electrical system	3 phases, 4 wires	
(x).	Rated Output Voltage	480 V	
(xi).	Power Factor (adjustable)	> 0.99; 0-1 adjustable	
(xii).	Power control	MPP tracker	
(xiii).	Rated Frequency	50/60 Hz	
(xiv).	Environmental Enclosures	Relative Humidity	0-100%, condensing
		Audible Noise	68 dB(A) @ 1m
		Operating Elevation	4000 m
		Operating temperature	-30 to +60°C
(xv).	Grid Operating protection	A	DC circuit breaker
		B	AC circuit breaker
		C	DC overload protection (Type 2)

		D	Overheat protection
		E	Grid monitoring
		F	Insulation monitoring
		G	Ground fault monitoring
(d).	**Data Collecting System**		
(i).	System Data	Continuous online logging with data logging software to portal.	
(e).	**Unit Transformer**		
(i).	Rating	N/A	
(ii).	Type of transformer	N/A	
(iii).	Purpose of transformer	N/A	
(iv).	Output Voltage	N/A	

(D). Other Details

(i).	Expected COD of the generation facility Solar Power Plant/ Solar Farm	August 2021 (Subject to GL Issuance)
(ii).	Expected useful Life of the generation facility Solar Power Plant/ Solar Farm from the COD	25 years

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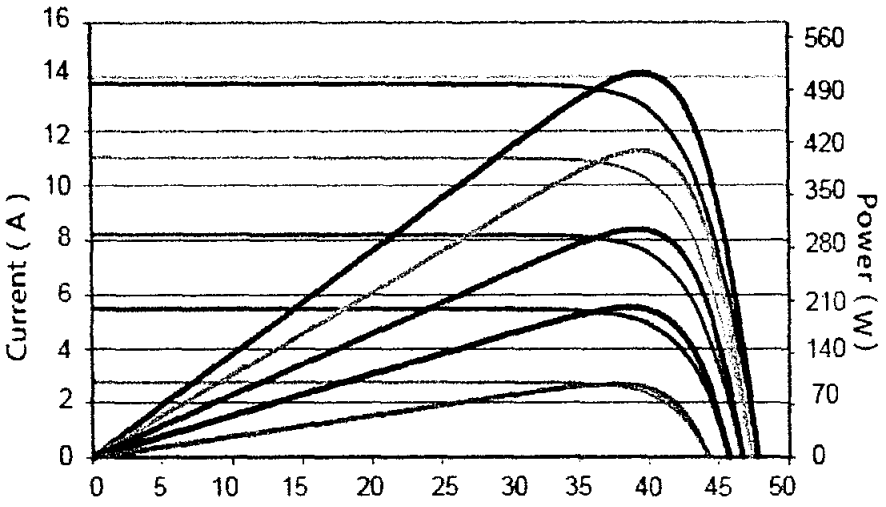
V-I Curve
of Solar Cell of Generation Facility/Solar Power Plant/ Solar Farm



Information
Regarding Bulk Power Consumer(s)/BPC(s) i.e. CTL

(i).	No. of Consumers	One (01)
(ii).	Location of consumers (distance and/or identity of premises)	Within premises
(iii).	Contracted Capacity and Load Factor for consumer	NA
(iv).	Specify Whether	

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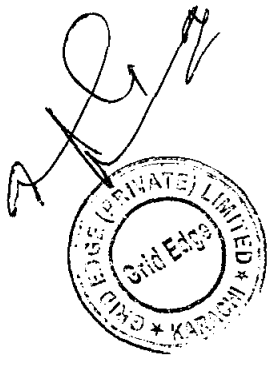
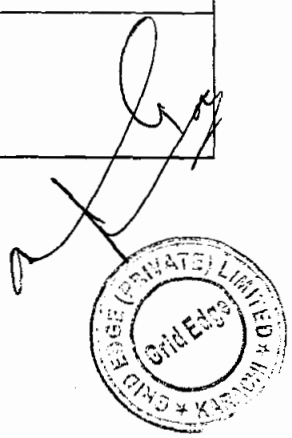
	(a).	The consumer is an Associate undertaking of the Grid Edge -If yes, specify percentage ownership of equity;	No
	(b).	There are common directorships:	No
	(c).	Either can exercise influence or control over the other.	No
(v).	Specify nature of contractual Relationship		
	(a).	Between each consumer and Grid Edge.	Power Purchase Agreement (PPA)
	(b).	Consumer and DISCO.	Industrial Consumer
(vi)	Any other network information deemed relevant for disclosure to or consideration of the Authority.		N/A



Information
Regarding Distribution Network for Supply of Electric Power to BPC in the name of CTL

(i).	No. of Feeders		One (01)
(ii).	Length of Each Feeder (Meter)		NA
(iii).	Length of Each Feeder to each Consumer		NA
(iv).	In respect of all the Feeders, describe the property (streets, farms, Agri land, etc.) through, under or over which they pass right up to the premises of customer, whether they cross-over.		Solar Field is located inside the premises of CTL
(v).	Whether owned by CTL, Consumer or DISCO- (deal with each Feeder Separately)		
	(a).	If owned by DISCO, particulars of contractual arrangement	NA
	(b).	Operation and maintenance responsibility for each feeder	NA
(vi).	Whether connection with network of DISCO exists (whether active or not)- If yes, provide details of connection arrangements (both technical and contractual)		Yes
(vii).	Any other network information deemed relevant for disclosure to or consideration of the Authority.		NA



SCHEDULE-II

The Total Installed Gross ISO Capacity of the Generation Facility/Power Plant/Solar Plant (MW), Total Annual Full Load (Hours), Average Sun Availability, Total Gross Generation of the Generation Facility/Solar Farm (in kWh), Annual Energy Generation (25 years Equivalent Net Annual Production-AEP) KWh and Net Capacity Factor of the Generation Facility/Solar Farm of Licensee are given in this Schedule.

SCHEDULE-II

(1).	Total Installed Capacity of the Generation Facility/Solar Power Plant/Solar Farm	3.451 MW
(2).	Average Sun Hour Availability/Day (Irradiation on Inclined Surface)	8 to 8.5 Hours
(3).	No. of days per year	365
(4).	Annual generating capacity of Generation Facility/Solar Power Plant/Solar Farm (As Per Simulation)	4794 MWh (this is p90 value)
(5).	Total expected generation of the Generation Facility/Solar Power Plant/Solar Farm during twenty five (25) years term of this license	113,197 MWh
(6).	Annual generation of Generation Facility/Solar Power Plant/Solar Farm based on 24 hours working	28,764 MWh
(7).	Net Capacity Factor of Generation Facility/Solar Power Plant/Solar Farm	15.9% (as per P90 Value)

Note

All the above figures are indicative as provided by the Licensee. The Net Delivered Energy available to Power Purchaser for dispatch will be determined through procedures contained in the Energy Purchase Agreement (EPA) or the Applicable Document(s).