FIRST SOLAR

First Solar (Pvt) Ltd

Ref: FS/Correspondence/101/01

The Registrar
National Electric Power Regulatory Authority
NEPRA Tower Attaturk Avenue (East)
Sector G-5/1
Islamabad

Subject: ***Application for a Generation License of 02 MW Solar Power Project***

I, Mirza Nadeem Hafeez, being the duly Authorized representative First Solar Private Limited by virtue of BOARD RESOLUTION dated 13th May, 2014, hereby apply to the National Electric Power Regulatory Authority (NEPRA) and for the Grant of a Generation License of 02 MW Solar Power Project to First Solar Pvt. Ltd pursuant to the 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 provision of National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, and undertake to abide by the terms and provisions of 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]bearing number PO.0302.0015533 in the sum of Rupees 134,728 (One Lakh Thirty Four Thousand Seven Hundred and Forty Eight only) being the non-refundable License application fee calculated in accordance with Schedule-II to National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Date: 30th May, 2014

Signature: _____
Name: Mirza Nadeem Hafeez
Designation: Director

FIRST SOLAR (PVT) LTD

Company Seal

10-B, Street 26, F-8/1
Ph: 051-2255892, 2255052 Fax: 051-2256493

EXECUTIVE SUMMARY

This application is for ***Grant of Generation License*** filed by **First Solar Private Limited**(the "Project Company") for its 02 MW Solar PV Power Project (the "Project") in Kalar Kahar Punjab Pakistan.

First Solar got Letter of Intent (LOI) from Alternative Energy Development Board (AEDB) for the development of 02 MW Solar Power Project under Renewable Policy for Power Generation, 2006.

The Project is located in Kalar Kahar, District Chakwal Punjab Pakistan. The Project facility will generate 02 MW electricity and supply to the national Grid of IESCO.

The Project is sponsored by Monitor Associates (Pvt.) Ltd.

Monitor Associates (Pvt) Ltd. Started as a construction company and was able to earn repute for applying innovative methods and performing precise engineering and management skills in the emerging market. In the year 1999 the third phase of expansion came when the company decided to participate fully to bring in the renewable energy technologies to the country to meet the clean and environmental friendly power needs of our future. Our management and engineers continually research market trends and educate themselves with new changes. Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

The feasibility of the Project was submitted to AEDB in March, 2011 and based on the comments of AEDB, revised feasibility of the Project has been submitted to AEDB in February, 2014. The approval of AEDB is awaited.

Initial Environmental Examination (IEE) of the Project has been completed and NOC has been issued by Environmental Protection Department Punjab.

The Electrical and Grid Interconnection Studies were submitted to Islamabad Electric Supply Company (IESCO) in January, 2013. The approval from IESCO is awaited.

This application document is a package of information as per NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 notified by National Electric Power Regulatory Authority (NEPRA).

The document is comprised of following Annexure:

Annexure-A:	Copy of Board Resolution
Annexure-B:	Certificate of Incorporation
Annexure-C:	Memorandum and Articles of Association
Annexure-D:	Last Filed Annual Return
Annexure-E:	Last Three Years Financial Statement
Annexure-F:	Company Profile of Project Applicant and Project Sponsors
Annexure-G:	CV of Senior Management, Technical and Professional Staff
Annexure-H:	Details of Lender's Facility available for the Project
Annexure-I:	Company Profiles of Sub-Contractors
Annexure-J:	Consent Letters from Sub Contractors
Annexure-K:	Prospectus
Annexure-L:	Project Information in Pursuant to Schedule-III [(Regulation 3(6))] for Generation Facilities
Annexure-M:	Information for Schedule-I of License
Annexure-N	Information for Schedule-II of License
Annexure-O:	Safety Plans and Policies
Annexure-P:	Plant characteristics
Annexure-Q:	Control, metering, instrumentation and protection
Annexure-R:	Training and Development

First Solar (Pvt) Ltd

Extracts of the Minutes of the Meeting of the Board of Directors of M/S First Solar Pvt. Ltd held at 10-B, Street No.26, Sector F-8/1, Islamabad

BOARD RESOLUTION:

The following resolutions were discussed in detail by the Board and approved unanimously.

"RESOLVED THAT First SolarPvt. Ltd (a company incorporated under the laws of Pakistan with its registered office located at **10-B, Street No.26, Sector F-8/1, Islamabad**

(the Company) be and is hereby authorized to file application for the grant of Generation License for submission at National Electric Power Regulatory Authority (NEPRA) in respect of its **02 MW Solar Power Generation Project** to be located **at Kallar Kahar, District Chakwal, Province of Punjab, Pakistan.** (the Project) and in relation thereto, enter into and execute all required documents, make all fillings and pay all applicable fees, in each case, of any nature whatsoever as required."

"FURTHER RESOLVED THAT in respect of application for the grant of Generation License (including any modification to the application for the Grant of Generation License) for submission to National Electric Power Regulatory Authority, **Mr Mirza Nadeem Hafeez** as **Director/ CEO** be and hereby empowered and authorized for and on behalf of the Company to:

(i) review, execute, submit and deliver the Generation License Application (including any modification to the application for the Grant of Generation License) and related documentation required by National Electric Power Regulatory Authority, including any contracts, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements and any other instruments of any nature whatsoever;

(ii) sign and execute necessary documentation, pay the necessary fees, appear before the National Electric Power Regulatory Authority as needed, and do all acts necessary for completion and processing of the Generation License Application (modification to the application for the Grant of Generation License);

(iii) do all such acts, matters and things as may be necessary for carrying out the purposes aftersaid and giving full effect to the above resolutions/resolution".

"AND FURTHER RESOLVED THAT **Mr. Mirza Nadeem Hafeez** as **Director / CEO** be and is hereby authorized to delegate all or any of the above powers in respect of the foregoing to any other officials of the Company as deemed appropriate."

Mirza Nadeem Hafeez
Dated: 13th May, 2014

Mrs. Nadeem Hafeeez

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
ISLAMABAD

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. 0069741

I hereby certify that "FIRST SOLAR (PRIVATE) LIMITED" is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is limited by shares.

Given under my hand at **Islamabad** this **Fifteenth** day **of June, Two Thousand and Nine.**

Fee Rs. 9,000/-

(Muhammad Anas Noman)
Joint Registrar of Companies
Islamabad

CERTIFIED TRUE COPY

DEPUTY REGISTRAR
Company Registration Office
Islamabad

No. ADI 21719
Dated 15/6/11

ANNEXURE-C: MEMORANDUM & ARTICLES OF ASSOCIATION

THE COMPANIES ORDINANCE, 1984

(PRIVATE COMPANY LIMITED BY SHARES)

Memorandum of Association

of

FIRST SOLAR (PRIVATE) LIMITED

I. The name of the Companies is "**FIRST SOLAR (PRIVATE) LIMITED**".

II. The Registered Office of the Company will be situated in the Islamabad Capital Territory, Pakistan.

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

1. To locate, establish, construct, equip, operate, use, manage and maintain thermal power, solar power, hydro power plants and coal fired power plants, power grid station, transforming, switching, conversion, and transmission facilities, grid stations, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plants and equipment for combined heat and power schemes, offices, computer centers, shops, dispensing machines for pre-payment cards and other devices, showrooms, depots, factories, workshops, plants, printing facilities, warehouses and other storage facilities.

2. To carry on the business of oil and petroleum, fabricate, contract, erect, lay, and manufacturers of plants, machinery and apparatus for oil and petroleum, gas and chemical installations and to purchase or otherwise acquire, produce, manufacture refine, treat, purify, blend, reduce, distil, store, transport, market, distribute, supply, sell and otherwise dispose off and generally trade in any and all kinds of petroleum and petroleum products.

3. To carry on the business as petroleum engineers, providing consultancy services, preparation of feasibilities for all sorts of petroleum related industries and to manufacture, buy, sell, import, export and to deal in all sorts of oil field equipments.

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Value Rs. 60/=
Date 10/12/09 S. No. 212
Additional/Joint/Deputy Registrar
CRO, Islamabad

4. To purchase, or establish oil refinery, or otherwise acquire, produce, manufacture, refine, treat, purify, blend, reduce, distil, store, transport, market, distribute, supply, sell and otherwise dispose of and generally trade in any and all kinds of petroleum, and petroleum product, oils, gas, hydrocarbons, petrochemicals, asphalt, bituminous substances and the products and by products which may be derived, produced, repaired, developed, compounded, made or manufactured there from and or acquire and take over the running or likely to be running business of alike nature with or without assets, liabilities, rights, privileges, goodwill, registration, trade mark, import and export registration, or any other facilities.

5. To refine, process, formulate, produce, buy, sell, export, import, indent or otherwise deal in all types of chemicals, petro-chemicals and petroleum industry or any material used or capable of being used in the petrochemical industry, industrial chemicals or any mixtures, derivatives and compounds thereof.

6. To set up, install, erect, establish, run, control, manage and operate an industrial undertaking for the manufacture, production, formulation and blending of liberating oils any where in Pakistan.

7. To own prospect for, explore, acquire by lease, license or otherwise, open work, develop and maintain natural deposits of gas, petroleum and other mineral and chemical substances of all kinds and to carry on and conduct the business of working, obtaining and supplying to other persons such gas, oil, petroleum, and other substances.

8. To buy, import, export, indent, stock, contract, tender, distribute, acquire, secure and grant agency, distribution rights, representations and trade in or deal in any manner in gases of all kinds and gas plant machinery, instruments, implement, appliances equipment, tools, dies, presses and apparatus.

9. To carry on the business of contractors, suppliers and manufacturers of gas regulators and component parts of gas appliances and all other buildings and works, meters, pipes fittings, machinery, apparatus, convenient or necessary for the purposes of the Company.

10. To carry on and undertake trading business of all sorts and to act as indenters, importers, exporters, traders, suppliers, and commission and materials in any form or shape manufactured or supplied by any company, firm, association of person, body, whether incorporated or not, individuals, Government, Semi-Government or any local authority.

11. To apply for, tender, offer, accept, purchase or otherwise acquire any contracts and concessions for or in relation to the projection, execution, carrying out, improvements, management, administration, or control of works and

conveniences and undertake, execute, carry out, dispose of or otherwise turn to account the same.

12. To carry on the business of shipping agents, and clearing and forwarding agents.

13. To apply for tender, purchase or otherwise acquire any contracts, Sub-contracts, licenses and concessions for or in relation to the objects or business herein mentioned or any of them and to undertake, execute, carry out, dispose of or otherwise turn to account the same.

14. To buy, sell, manufacture, refine, make-up, manipulate, import, export, store, warehouse, repair, convert, hire, let out, alter, charter, grow, treat, prepare for the market, exchange and deal, both wholesale and retail, in commodities, substances, apparatus, articles and things of all kinds capable of being used or which can be dealt in by the Company in connection with its objects.

15. To let on hire all or any of the property of the Company whether moveable or immovable, including all and every description of apparatus or appliances and to hold, use, cultivate, work, manage, improve, carry on and develop the undertaking, land, immovable property and assets of any kind of the Company or any part thereof.

16. To run, control, acquire, maintain, own and accompany hand made carpet unit carry on the business of various kinds of wool/silk/cotton and finishing, printing, dyeing, washing, etc.

17. To carry on the business of providing technical services and planning, engineering and architectural design in Pakistan or abroad.

18. To carry on the business as word processors, data processors, computer aided drafting specialists, computer based composers and publishers, consultants, designers, wholesalers, retailers, agents, for the sale of and general merchants, dealers, suppliers, and distributors, hirers, leasers of computer software, hardware, ancillary and allied equipment of every and any description.

19. To carry on the business of computers programmers, advisors of computer language and codes, punch card operators and as consultants and advisors into all aspect of the computer technology and allied industries, and to undertake the business of computer stationery, peripheral equipment of all kinds and to supply of such staff and other personal that may be required by persons having dealings with the Company and to undertake, perform and carry out all services in connection with the computer trade and industries.

20. To invest and deal with money not immediately required for manufacturing and trading business, in such manner as permissible under law but not to act as investment company.

21. To sell, improve, manage, work, develop, lease, mortgage, abandon or otherwise deal with all or any part of the property rights and concessions of the Company.

22. To acquire by concession, grant, purchase, amalgamation barter, lease licenses, allotment or otherwise, either-absolutely or conditionally and either solely or jointly with others, any house, buildings, lands, farms, quarries, water rights, way leaves and other works, privileges, rights and hereditaments, and machinery, plant, utensils, marks and other movable and immovable property of any description.

23. To sell and purchase from time to time and manufacture and deal in all such stock-in-trade, goods, chattels and effects as may be necessary or convenient for any business, for the time being, carried on by the Company and specially machinery and all other material or things necessary for the same.

24. To purchase or otherwise acquire and undertake the whole or any part of the business, property (movable or immovable), assets and liabilities of any person, firm or company carrying on the business of nature of altogether or in part similar to the business which the Company is authorized to carry on or possessed of any property suitable for the purpose of the Company, and to pay for the same and all other property or rights of whatsoever kind acquired by the Company, in cash or in shares, or debenture stock of the Company.

25. To open and establish agencies or branches business connections in any town, city and /or any part of this country or any other country or part of the worlds, for the purchase and sale of goods of all description.

26. To obtain, hold the office of and to act as Advisers, Agents, Selling Agents, Buying Agents, Publicity Agents, Shipper Agents, Carrier's Agents, Clearing and Forwarding Agents, Brokers, Commission Agents, Indenters, Purchasing Agents, Canvassers, Advertisers, Stockists and Distributors for any person, firm and company (including without prejudice to the said generality and in particular of importers, exporters buyers, sellers, merchants, tradesman, builders and property owners booking commission canvassing, distributing and advertising business except managing agency.

27. To enter into any arrangement with the Government of Pakistan or any local Government or with any authorities imperial, supreme, national, municipal, local or otherwise or with any person, in any place where the Company may have interests that may seen conducive to the Company's objects or any of them and to obtain from such Government or authority or other persons any rights, privileges and concessions which the Company may thing it desirable to obtain and to carry out, exercise and company with any such arrangements rights, privileges and concessions.

28. To distribute any of the property of the Company amongst the members in specie or kind but so that no distribution amounting to the reduction of capital be made except with the sanction (if any) for the time being required by law in case of winding up of the Company.

29. To enter into partnership or any arrangement for sharing profits, union of interests, co-operation, joint-venture, reciprocal concession or otherwise deal with any person, firm or company carrying on or proposing to carry on any business which this Company is authorized to carry on or which is capable of being conducted so as directly or indirectly to benefit this Company and to have foreign collaborations and to pay royalties technical fees to collaborators, subject to the provisions of the Companies Ordinance, 1984.

30. To support and subscribe to any charitable or public object including donations to charitable and benevolent foundations and any institution, society, or club or for any purpose which may be for the benefit of the Company or its employees, or may be connected with or for the benefit and welfare of any town or place where the Company carries on business, to give pensions, gratuities or charitable aid to any persons who may have been directors of or may have served the Company, or the wives, children or other relatives or dependents of such persons to make payments towards insurance, and to form and contribute to provident and benevolent funds for the benefit of any such persons, or of their wives, children or other relatives or dependents.

31. To borrow or raise funds by means of loans or other legal arrangements from banks, or other financial institutions, or Directors in such manner as the Company may think fit and in particular by issue of debentures, debenture stock (F.C.S. perpetual or otherwise, convertible into shares of this Company or perpetual annuities and insecurity of any to borrowed, raised or to mortgage, pledge or charge the whole or any part of the property, assets or capital of the Company, present or future, by special assign or otherwise or to transfer or convey the same absolutely or in trust as to give the lender powers of sale and other powers as may seem expedient, and to purchase, redeem or payoff and such securities.

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

33. To enter into joint venture / partnership for Oil and Gas business, including concession, drilling, development, buy and sell trade etc.

34. To buy, lease and make in the purchase and acquisition of land/immovable property to hold and manage such property, and to develop real estate properties

i.e. residential, commercial, warehouse, hotels, resorts, to sell part or maintain, independently or in joint venture.

35. To do and perform all such other acts-and things as are incidental or conductive to the attainment of the above object or any of them.

36. It is further declared that the Company shall obtain the permission from the Board of investment in due course: if required under the law.

37. It is undertaken that the company shall not by advertising, pamphlets, other mean or other negotiation, offer for sale or to take advance money for the further sale of plots, houses, or flats etc. and shall not indulge in any sort of housing finance company business as mentioned in NBFC Rules 2003.

38. It is hereby undertaken that the Company shall not engage in banking business or any business of investment company or non-banking finance company or insurance or leasing business or business of managing agency or in any unlawful business and that nothing contained in the object clauses shall so construed to entitle it to engage in such business directly or indirectly and the Company shall not invite deposits from public through advertisements or otherwise for any schemes and shall not launch or indulge in the business of real estate schemes multi-level marketing (MLM), forex, Pyramid and Ponzi schemes.

39. Notwithstanding any thing stated in any object clause, the Company shall obtain such other approvals or licenses from competent authorities as may be required under any laws for the time being enforced to undertake a particular business.

IV. The liability of the members is limited.

V. The authorized capital of the Company is Rs.5,00,000/- (Rupees Five Hundred Thousands) divided into 50,000 ordinary shares of Rs. 10/- (Rupees Ten) each with power to increase and reduce the capital of the Company for the time being into several classes in accordance with law.

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

Name and Surname (Present & Former) in Full (in Block Letters)	Father Name In Full	Nationality With any Former Nationality	Occupation	Residential Address (in Full)	Number of Shares taken by each subscriber	Signature
1.MIRZA NADEEM HAFEEZ (37405-9090666-3)	MIRZA MUHAMMAD HAFEEZ	PAKISTANI	BUSINESSMAN	H.NO. 20, STREET 10, SECTOR F-8/3, ISLAMABAD	47500	
2.TASNEEM NADEEM (61101-0779135-2)	MIRZA NADEEM HAFEEZ	PAKISTANI	HOUSE PERSON	H.NO. 20, STREET 10, SECTOR F-8/3, ISLAMABAD	2500	
				Total Number of Shares Taken	50,000	

CERTIFIED TO BE TRUE COPY

Dated this .....25th..... day of ..... MAY.....2009

Witness to above Signatures:

Name : SAEED HASAN KHAN
Address: House No.411, STREET NO. 30, I-10/4, ISLAMABAD
CNIC : 61101-8297620-7

DEPUTY REGISTRAR
Company Registration Office
Islamabad
15/5/14

Dated this .....25th..... day of ..... MAY.....2009

OCCUPATION : ACCOUNTANT

Company Registration Office Islamabad

No. ADI
Dated

THE COMPANIES ORDINANCE, 1984

(PRIVATE COMPANY LIMITED BY SHARES)

Memorandum of Association

of

FIRST SOLAR (PRIVATE) LIMITED

1. The regulations contained in Table "A" in the First Schedule to The Companies Ordinance, 1984, shall not apply to the Company except in so far as the same are expressly made applicable by the said Ordinance, or these Articles. The regulation for management of the Company, and for the observance thereof by the members of the Company, and their representatives shall, subject as aforesaid and to any exercise of the statutory power of the Company in reference to the repeal or alternation of or addition to its regulations by Special Resolution as prescribed by the said Ordinance be such as are contained in these Articles.

INTERPRETATION

2. In the interpretation of these Articles the following expressions shall have the following meanings, unless repugnant to or inconsistent with the subject Articles.

2.1: "The Ordinance" means the Companies Ordinance, 1984, or any statutory modification or re-enactment thereof for time being force in Pakistan;

2.2: "Board", means a Board of the Directors, elected by the shareholders, to act on their behalf in the management of the Company affairs;

2.3: "The Company" or "This Company" means **FIRST SOLAR (PRIVATE) LIMITED;**

2.4: "The Directors" means the Directors and Alternate Directors for the time being of the Company, or as the case may be, the Directors and Alternate Directors assembled at a Board;

2.5: "Dividend" includes bonus shares;

2.6: "Month" means a calendar month;

2.7: "The Office" means the Registered Office for the time being of the Company;

2.8: "Persons" includes corporation as well as individuals;

2.9: "The Register" means the Register of members to be kept pursuant to the Ordinance;

2.10: "In Writing" means written or printed or partly written and partly printed or lithographed or typewritten or other substitute for writing;

2.11: Words importing singular number include the plural number and vice versa;

2.12: Words importing masculine gender include the feminine gender;

2.13: Subject as aforesaid any words or expressions defined in the Ordinance; shall except where the subject or context forbids bear the same meaning in these Articles.

PRIVATE COMPANY

3. The Company is "Private Company" within the meaning of sub section 2(1)(28) of the Ordinance and accordingly:

(1) Invitation shall be issued to the public to subscribe for any share of the Company.

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

(3) The right to transfer shares of the Company is restricted in manner and to the extent herein appearing.

BUSINESS

4. The company is entitled to commence business from the date of incorporation. The business of the company shall include all or any of the objects enumerated in the Memorandum of Association. The business of the company shall be carried out at such place or places anywhere in Pakistan or elsewhere as the directors may deem proper or advisable from time to time.

SHARES AND CAPITAL

5. The authorized share capital of the Company is Rs.5,00,000/- (Rupees Five Hundred Thousand only) divide into 50,000 ordinary shares of Rs. 10/- (Rupees Ten only) each with power of the Company to increase or reduce the same and to divide the shares into several classes.

6. The shares shall be under the control of the Board of Directors who may allot or otherwise dispose off the same to such persons, on such terms and conditions and at such times, as the Board of Directors thinks fit. Shares may also be allotted in consideration other than cash.

7. Fully paid shares shall be allotted to all subscribers in the first instance and the Company shall not be bound to recognize any equitable, contingent, future or partial claim to or interest in a share on the part of any person other than the registered share holder, save as herein provided or saves as ordered by some Court of competent jurisdiction.

8. The certificate of title to shares shall be issued under the seal of the Company.

9. Every member shall be entitled to one certificate for the shares registered in his name, or at the discretion of the directors to several certificates, each for one or more of such shares.

10. The Company may increase the capital by the issue of further shares as and when required in accordance with the provisions of the Companies Ordinance, 1984. In this respect every shareholder shall be entitled to make investment in the further capital of the company in the same proportion holds shares in the existing paid up capital of the Company.

TRANSFER AND TRANSMISSION OF SHARES

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

12. The directors may decline to register any transfer of shares to transferee of whom they do not approve and shall be bound to show any reasons for exercising their discretion subject to the provisions of Section 77 and 78 of the Ordinance.

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

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

BORROWING POWERS

15. Subject to the provisions of the Ordinance, the Directors may from time to time at their absolute discretion raise or borrow any sum, or sums of money for the purpose of the company from banks, firms or companies, particularly a person holding the office of the director, and may secure the payment of money in such manner and upon such terms.

and conditions in all respects as they think fit particularly by the issue of debentures of the company or by making, drawing, accepting or endorsing on behalf of the company any promissory note or bills of exchange or giving or issuing any other security of the Company.

16. Debentures and other securities may be made assignable free from any equities between the Company and the persons to whom the same may be issued.

17. Any debentures or other security may be issued at a discount, premium or otherwise and with any special privilege as to redemption, surrender, and drawing, allotment of shares, attending and voting at general meeting of the Company or subject to compliance of the provisions of the Ordinance.

RESERVES

18. The directors may from time to time before recommending any dividend set aside out of the profit of the company such sums as they think fit as a reserve for redemption of debentures or to meet contingencies for equalization of or for special dividends or for rebuilding, repairing, restoring replacing, improving, maintaining or altering any of the property of the Company or for such other purpose as the directors may in their absolute discretion think conducive to the interest of the Company.

GENERAL MEETINGS

19. A General meeting, to be called annual general meeting shall be field, in accordance with the provisions of section 158, within eighteen months from the date of incorporation of the Company and thereafter once at least in every year within a period of four months following the close of its financial year and not more than fifteen months after the holding of its last preceding annual general meeting as may be determined by the directors.

20. The directors may, whenever, they think fit, call an extra ordinary general meeting, and extra ordinary general meetings shall also be called on such requisition, or in default, may be called by such requisitionists, as is provided by section 159 of the Ordinance.

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

22. All business shall be deemed special that is transacted at an extraordinary general meeting, and also all that is transacted at annual general meeting with the exception of declaring dividend, the consideration of the accounts, balance sheet and the reports of the directors and auditors, the election of the directors, the appointment of, and the fixing of the remuneration of, the auditors.

QUORUM

23. 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; save as herein otherwise provided, members having twenty-five percent of the voting power present in person or through proxy and two members personally present will be quorum of the Company's meeting.

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

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

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

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

28. A poll may be demanded only in accordance with the provisions of section 167 of the Ordinance.

29. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in section 168 of the Ordinance and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

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

31. In the case of an equality of votes, whether on a show of hand or on a poll, the Chairman of the meeting at which the show of hands take place, or at which the poll is demanded, shall have and exercise a second or cast vote.

VOTES OF MEMBERS

32. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of Directors in which case, the provisions of section 178 of the Ordinance shall apply. On a poll every member shall have voting rights as laid down in section 160 of the Ordinance.

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

34. On a poll votes may be given either personally or by proxy.

35. (1) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing. A proxy must be a member.

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

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

FIRST SOLAR (PRIVATE) LIMITED

I.....of.....in the district of .....
Being a member the **FIRST SOLAR (PRIVATE)LIMITED** hereby appoint .....of..... As my proxy to vote for me on my behalf at the (annual, extraordinary, as the case may be) general meeting of the company, to be held on the .....day of ..... and at any adjournment thereof.

DIRECTORS

37. The number of directors shall not be less than two. The following persons shall be the first directors of the Company and shall hold the office upto the date of the First Annual General Meeting.

1. MIRZA NADEEM HAFEEZ
2. TASNEEM NADEEM

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

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

40. The qualification of a Director shall be his holding 50 shares of Rs.100/- each in his own name, relaxable in the case of a Director presenting interest holding shares of the requisite value.

POWERS AND DUTIES OF DIRECTORS

41. The business of the company shall be managed by the directors, who may pay all expenses incurred in promoting and registering the company, and may exercise all such powers of the company as are not by the Ordinance or any statutory modification thereof for the time being in force, by these regulations, required to be exercised by the company in general meeting, subject nevertheless to the provisions of the Ordinance or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed by the company in general meeting but not regulations made by the company in general meeting shall invalidate any prior act of the directors which could have been valid if that regulation had not been made.

42. The directors shall appoint a chief executive in accordance with the provisions of sections 198 and 199 of the Ordinance.

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

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

(a) of all appointments of officers made by the directors;
(b) of the names of the directors present at each meeting of the directors and of any committee of the directors;

(c) of all resolutions and proceedings at all meetings of the company and of the directors and of committees of directors.

DISQUALIFICATION OF DIRECTORS

45. No person shall become the director of a company if the suffer from any of the disabilities or disqualifications mentioned in section 187 of Ordinance and, if already a director, shall cease to hold such office from the date he se 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 had 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.

PROCEEDING OF DIRECTORS

46. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit. Questions arising at any meeting shall be decided by a majority of votes. In case of an equality of votes, the chairman shall have and exercise a second or casting vote. A director may and the secretary on the requisition of a director shall, at any time, summon a meeting of directors. \it shall not be necessary to give notice of a meeting of directors to any director for the time being absent from Pakistan.

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

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

FILLING OF VACANCIES

49. 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 178 of the Ordinance for a term of three years.

50. A meeting director shall be eligible for re-election.

51. The directors shall comply with the provisions of sections 174 to 178 and sections 180 and 184 of the Ordinance relating to the election of directors and matters ancillary thereto.

52. 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.

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

DIVIDENDS AND RESERVE

54. The company in general meeting may declare dividends but no dividend shall exceed the amount recommended by the directors. No dividends shall be paid otherwise than out of the profits of the Company.

THE SEAL

55. 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 the presence of at least two directors; and those two directors shall sign every instrument to which the seal of the company is so affixed in their presence.

ACCOUNTS

56. The directors shall cause to be kept proper books of account as required under section 230 of the Ordinance.

57. 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.

58. The directors shall be required by sections 233. and 236 of the Ordinance. cause to be prepared and to be laid before the company in general meeting such profit and loss accounts or income and expenditure accounts and balance sheets duly audited and reports as are referred to in those sections.

AUDIT

59. Once at least in every year the accounts of the Company shall be audited and the correctness of the profit and loss accounts or income and expenditure accounts and balance sheet ascertained by an auditor or auditors and the provisions of the Ordinance in regard to audit and the appointment and qualification of auditors shall be observed.

60. Auditors shall be appointed and their duties regulated in accordance with sections 252 to255 of the Ordinance.

WINDING UP

61. If the company is owned up, whether voluntarily or otherwise the liquidator may with the sanction of a special resolution, divide amongst the contributories in space or kind, the whole or any part of the assets and liabilities of the company subject to the section 421 and other provisions of the Ordinance as may be applicable.

INDEMNITY

62. Every director and other officer or servant of the company shall be indemnified by the company against, and it shall be the duty of the directors to pay out of the funds of the company, all costs, losses and expenses which may such officer or servant may incur or become liable to by reason of any contract entered into or thing done by such officer or servant as such in any way in the discharge of the duties of such officer or servant including traveling expenses.

63. No director or other officer of the company shall be liable for the acts, receipts, neglect or default of any other director or officer or for joining in any receipt or other act for conformity or for any loss or expenses happening to the company through the insufficiency or deficiency of title to any property acquired by order of the directors for or on behalf of the company or for the insufficiency or deficiency of any security or investment in or upon which any of the money of the company shall be invested or for any loss or damage arising from bankruptcy, insolvency or tortuous act of any person with whom any money, securities or effects shall be deposited or for any loss occasioned by any error of judgment or oversight on his part or for any or in other losses, damage or misfortune whatever which shall happen in the execution of his office relation thereto unless the same happens through his dishonesty.

NOTICES

64. (1) A notice may be given by the company to any member either personally or by sending it by post to him to his registered address of (if he has no registered address in Pakistan) to the address, if any, within Pakistan supplied by him to the company for the giving of notices to him.

(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 letters would be delivered in the ordinary course of post.

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

ARBITRATION

66. Whenever any difference arises between the company on the one hand and any of the members, their executors, administrators or assignees on the other hand touching the intent or construction or the incidence or the incidence or consequences of these present, or of the statute or touching any thing then or thereafter done, executed, omitted, or suffered in pursuance of these presents or of the statute or touching breach or alleged breach or otherwise relating to the premises, or to any statute effecting the company, or to any of the affairs of the company, including the fixing of the fair value of the shares of the company, every such difference shall be referred to the decision of an arbitrator to be appointed by the parties in difference or if they cannot agree upon a single arbitrator to the decision of two arbitrators of whom one shall be appointed by each of the parties in difference or any umpire to be appointed by the two arbitrators.

67. Every director, manager, member of the committee, officer, servant, accountant or other person employed in the business of the Company shall if so require by the directors before entering upon his duties, sign a declaration pledging to observe a strict secrecy respecting all transactions of the company with the customers and the state of accounts with individuals, matters relating thereto and shall by such declaration pledge himself not to reveal any of the matters which come to his knowledge in the discharge of his duties except when required to do so by the directors or by a Court of Law and except so far as may be necessary in order to comply with any of the provisions in these present contained.

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

Name and Surname (Present & Former) in Full (in Block Letters)	Father Name In Full	Nationality With any Former Nationality	Occupation	Residential Address (in Full)	Number of Shares taken by each subscriber	Signature
1.MIRZA NADEEM HAFEEZ (37405-9090666-3)	MIRZA MUHAMMAD HAFEEZ	PAKISTANI	BUSINESSMAN	H.NO. 20, STREET 10, SECTOR F-8/3, ISLAMABAD	47500	
2.TASNEEM NADEEM (61101-0779155-2)	MIRZA NADEEM HAFEEZ	PAKISTANI	HOUSE PERSON	H.NO. 20, STREET 10, SECTOR F-8/3, ISLAMABAD	2500	
				Total Number of Shares Taken	50,000	

Dated this ..... 25th ..... day of ..... MAY 2009

Witness to above Signatures:

Name : SAEED HASAN KHAN
Address: House No.411, STREET NO. 30, I-10/4, ISLAMABAD
CNIC : 61101-8297620-7

CERTIFIED TO BE TRUE COPY

Dated this ..... 25th ..... day of ..... MAY 2009

Occupation : Accountant

DEPUTY REGISTRAR
Company Registration Office
Islamabad

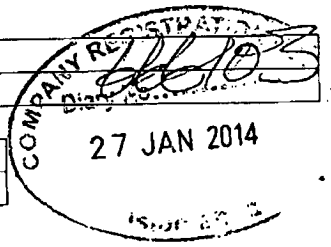
No. ADI
Dated

15/5/14

"THIRD SCHEDULE

(See section 156)

FORM A- ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL



1	Registration No.	0069741			
2	Name of the Company	First Solar (Private) Ltd.			
3	Form A made upto (Day/Month/Year)	31	10	2013	
4	Date of AGM (Day/Month/Year)	31	10	2013	

PART-A

5	Registered office address:	Office No. 201. 2nd Floor, 13-B, Kiran Plaza, F-8 Markaz, Islamabad.
6	Email Address:	
7	Office Tel. No.:	
8	Office Fax No.:	
9	Nature of Business:	Alternate Source of Energy

10 Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares	50.000	500.000/-	10/-

11 Paid up Share Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares	50,000	500,000/-	10/-

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

Mortgages/Charges	N/A

13 **Particulars of the holding company**

Name	N/A	
Registration No.	N/A	% Shares Held

14 **Chief Executive**

Name	Mirza Nadeem Hafeez	NIC	37405-9090666-3
Address	H. No. 20. St-10. F-8/3 Islamabad.		

15 **Chief Accountant**

Name	N/A	NIC	N/A
Address	N/A		

16 **Secretary**

Name		NIC	
Address			

17 **Legal Adviser**

Name	
Address	

18 **Auditors**

Name	Omer Adil & Co, Chartered Accountants
Address	Office No: 401.4th Floor, AL-SAFA Heights II, Plot No#12,F-11/1, Islamabad.

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

Name of Director	Address	Nationality	NIC (Passport No. if foreigner)/Registration No.
1.Mirza Nadeem Hafeez	H. No. 20. St-10. F-8/3 Islamabad.	Pakistani	3 7 4 0 5 9 0 9 0 6 6 6 3
2. Tasneem Nadeem	H. No. 20. St-10. F-8/3 Islamabad.	Pakistani	6 1 1 0 1 0 7 7 9 1 3 5 2

PART-B

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

Folio	Name	Address	Nation-ality	No. of shares	NIC (Passport No. if foreigner)/Registration No.
	Members				
1.	Mirza Nadeem Hafeez	H. No. 20, St-10. F-8/3 Islamabad.	Pakistani	47500	3 7 4 0 5 9 0 9 0 6 6 6 3
2.	Tasneem Nadeem	H. No. 20. St-10. F-8/3 Islamabad.	Pakistani	2500	6 1 1 0 1 0 7 7 9 1 3 5 2
	Debenture holders				

Use separate sheet. if necessary

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

	Name of Transferor	Name of Transferee	Number of shares transferred	Date of registration of transfer
	Members			
		----------	N/A----------	
	Debenture holders			

Use separate sheet, if necessary

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

Date		31	10	2013		Signature	
						Designation (Please tick)	Chief Executive/Secretary

CERTIFIED TRUE COPY

DEPUTY REGISTRAR

No. ADI
Dated 15/5/14

ANNEXURE-H: DETAILS OF LENDER'S FACILITY AVAILABLE FOR THE PROJECT

The Power Policy and State Bank of Pakistan guidelines allow a debt to equity ratio of 80:20 and the same has been assumed for purposes of the tariff. However the same may change based on lenders' requirements. For the purposes of the project tariff and financial model, 80% of the debt is assumed to be provided by local bank.

The proposed financing plan is given below;

Debt: Equity (%)	80:20
Loan tenure	10 years 08 months
Repayment Frequency	Quarterly

Meezan Bank
The Premier Islamic Bank

14-05-2014

FIRST SOLAR (PRIVATE) LIMITED
10-B, Street 26, F-8/1 Islamabad

BANK CERTIFICATE

السلام علیکم ورحمتہ اللہ وبرکاتہ

This is to certify that M/S FIRST SOLAR (PRIVATE) LIMITED bearing NTN # 3909003-5 has been maintaining **PKR CURRENT account # 0302- 0100414485** with Meezan Bank Markaz I-9 Branch Since 07-08-2009.

The certificate is being issued on specific request of our customer without any risk, obligation and responsibility on the part of Meezan Bank Ltd. Pakistan, its authorized signatories or employees.

Suleman Babar
Operations Officer

Noman Fahim
Operations Manager

Meezan Bank Ltd
Markaz I-9 Branch
Plot # 2-A, Markaz I-9 Islamabad - Pakistan
Tel: (92-051) 4859644-7 Fax: (92-051) 4859648 www.meezanbank.com

PROSPECTUS

First Solar got LOI form Alternative Energy Development Board (AEDB). The Project site is located in Kalar Kahar District Chakwal at approx 135 km from Islamabad. The site of 13 acres of flat piece is an agricultural land owned by the Project Company and is perfectly suitable for solar power project installation.

The Project is sponsored by Monitor Associates (Pvt.) Ltd.

Monitor Associates (Pvt) Ltd. Started as a construction company and was able to earn repute for applying innovative methods and performing precise engineering and management skills in the emerging market. In the year 1999 the third phase of expansion came when the company decided to participate fully to bring in the renewable energy technologies to the country to meet the clean and environmental friendly power needs of our future. Our management and engineers continually research market trends and educate themselves with new changes. Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

The feasibility of the Project was submitted to AEDB in March, 2011 and based on the comments AEDB, revised feasibility of the Project has been submitted to AEDB in February, 2014. The approval of AEDB is awaited.

Initial Environmental Examination (IEE) of the Project has been completed and NOC has been issued by Environmental Protection Department Punjab.

The Electrical and Grid Interconnection Studies were submitted to Islamabad Electric Supply Company (IESCO) in January, 2013. The approval from IESCO is awaited.

The Project is now applying for upfront tariff and generation license from NEPRA simultaneously.

ANNEXURE-L: PROJECT INFORMATION IN PURSUANT TO SCHEDULE III [(REGULATION 3(6))] FOR GENERATION FACILITIES

1 PROJECT LOCATION AND SITE MAP

The project site is acquired at Kalar Kahar, District Chakwal, located around 135 kilometers from Rawalpindi and 5 kilometers southwest of Chakwal along motorway.

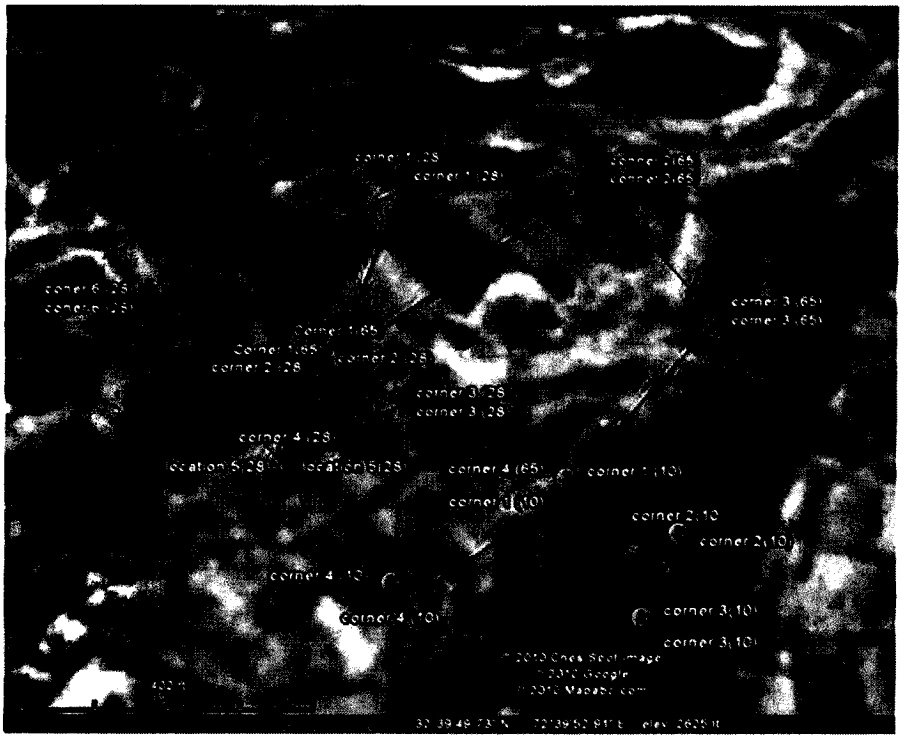
The total land area is 13 acres covering an area well enough for the installation of 2 MW solar power project.

The coordinates of Project Site are given below.

Geographical Coordinates of Project Site

Land Coordinates		
North	East	Attitude
32.66235	72.66026	Alv810meter
32.66325	72.66161	Al815
32.66254	72.66225	Al807
32.66175	72.66142	Al809
32.66175	72.66142	Al809
32.66145	72.66201	Al806
32.66109	72.66182	Al807
32.66124	72.66132	Al809
32.66318	72.66055	Al819
32.66303	72.66077	Al816
32.6621o	72.6604	Al816
32.66184	72.66006	Al816
32.66257	72.65929	Al818

Project Site Overview



Project Site Coordinates

2 LOCATION OF GRID

The nearest substation of IESCO from the Project site of First Solar Power Project is N.P.Sethi 66/11 kV at around 10 km. Upgrading of N.P.Sethi to 132 kV level is under progress and will be completed by the COD of First Solar. Considering the physical proximity of the grid to the Power Plant, it has been decided to evacuate the power at 11 kV by making connections with N.P.Sethi substation at 11 kV to evacuate the maximum of 02 MW of First Solar Project.

The detailed Grid Interconnection Study has been conducted by Power Planners International and copy is provided with this application to NEPRA.

3 PLANT DETAILS

3.1 General Information

Name of Applicant/Company	First Solar Pvt. Ltd
Registered Head Office	10-B, Street No.26, F-8/1 Islamabad
Plant Location	Kalar Kahar Punjab
Type of Generation Facility	Solar PV Power Plant

3.2 Plant System Description

EPC negotiations are at final stage with Nizam Powerway Pakistan and it is expected to finalize by end of July, 2014.

Module Manufacturer/Model	Canadian Solar/ CS6X-330P
Inverter Manufacturer/Model	Huawei/ Huawei-SUN2000-28KTL
Plant Capacity	02 MW
Technology	Solar PV
Unit Size (MW)	300W

Below are given the technical specifications of PV module and inverter offered by the EPC contractor.

PV Module Characteristics	
Module Model	CS6X-330P
Manufacturer	Canadian Solar
Nominal Power [W]	300.00
Efficiency [%]	15.63
Power Tolerance [%]	0/±5
Cell Type	Poly-Crystalline
Open Circuit Voltage [V]	44.6
Short Circuit Current [A]	8.87
Maximum System Voltage	1000V (IEC)600V (UL)
Maximum Series Fuse Rating	15A

Power Coefficient of Temperature [%/C]	-0.50
Nominal Operating Cell Temperature (NOCT) [^{O}C]	42.00±2
Height X Width X Thickness [mm]	1954 X 982 X40

Inverter Characteristics	
Inverter Model	Huawei-SUN2000-28KTL
Manufacturer	Huawei
Max. input voltage	1000 V
Max. DC input	28,200 W
Max. input current	18 A
Min. operating voltage	200 V
Rated input voltage	620 V
AC output power	27,500 W
Rated output voltage	3×277 V/480 V+PE
AC power frequency	50 Hz/60 Hz
Max. output current	33.5 A
Adjustable power factor	0.8 leading ... 0.8 lagging
Dimensions(W/H/D)	520x610x255 mm (20.5 x 24.0 x 10.0 in.)
Operating temperature range	-25ºC to +60ºC (-13ºF to +140ºF)

3.3 Project Commissioning Date (Anticipated)

Project commissioning date (Anticipated)	August, 2015

3.4 Expected Life of the Project

Expected Life of the Project from COD	25 Years

3.5 Plant Characteristics (at Interconnection Point)

Voltage (kV)	± 5%, Normal Operating Conditions ±10% Contingency Conditions
Frequency	50Hz Continuous±1% variation in steady state 49.2 – 50.5 Hz, Short Time
Power Factor	0.8 Lagging;0.9 Leading (for conventional synchronous generators but would not be applicable to solar pp)

4 EXECUTIVE SUMMARY OF ELECTRICAL AND GRID INTERCONNECTION

Executive summary of Electrical and Grid Interconnection Study is attached here for reference. Complete Electrical and Grid Interconnection study is provided to NEPRA along with Generation License Application.

5 EXECUTIVE SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT

Study Methodology:
The study was conducted using standard methodology prescribes by national and international agencies. The IEE comprises of baseline data on existing conditions on physical and biological environment, and social environment together with the anticipated environmental impacts and proposed mitigation measures. Detailed assessment of the social and biological environment of the area was conducted through field survey for the distance up to 10 Km radius of the Project site, however the influence zone of the environmental impacts is considered as 5 Km.

Data was also collected through secondary sources such as published literature and internet to support the findings of the field survey.

The present document reports the finding of IEE carried out to identify potential environmental issues associates with the Project and ensures appropriate mitigation measures to cope with those issues.
The IEE report stands on following strings:

- Relevant Project Information
- Project Alternatives
- Baseline Environmental Conditions
- Possible Impacts
- Mitigation Measures
- Environment Management Plan

Statutory Requirements:
The report fulfils the following regulatory requirements

- Guidelines published by Pakistan Environmental Protection Agency (Pak-EPA),
- Asian Development Bank Polices and Guidelines
- Performance Standards of IFC and World Bank group
- The best practices followed at international level.

Project Overview:
The Project Site is acquired at village called "Mukhayal" in Kalar Kahar, district Chakwal. It is located around 135 kilometers from Rawalpindi and 5 kilometers southwest of Chakwal. The Site is adjacent to the M2 Islamabad – Lahore Motorway. The total land area is 13 acres and is well enough for the installation of 2 MW solar power Project.

Description of Environment:

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, flora and fauna, land use pattern, and socio-economic conditions was undertaken, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors. The environmental and social baseline conditions observed in the Project area are presented in **Section 4** of this report.

The Project is situated in the area where most of the land is used for agriculture. The area can be classified as semi-arid zone because of lack of water (ground and surface). There is no canal, rivers or other water body in that area. Agriculture is the major source of income for most of the people. Wheat, barley, cereals and peanuts are the major crops of the area. The area as whole is virgin environmentally that's why available carrying capacity is not utilized yet.

The area is underdeveloped and it requires development. There are no drainage and water harvesting system, no street lights, no local clinic, no recreational parks nearby, lack of public transport.

This village Mukhyal is less populated area and it is located 6 kilometers from Mianni- Adaa. Most of the people are local and job opportunities are limited. The major source of income is agriculture which is due to lack of rain and deep ground water and no presence of lakes or water bodies nearby. Most of the people travel to other area like other cities or countries for jobs and other business opportunities. According to the survey more than 30 percent people move to other cities and counties.

The area has couple of poultry forms working in 10 to 15 km of the Project area and a windmill project installed by Chinese company. There is no sewage system in that area and no proper water supply system. The local community use bio-fuels like wood as fuels. Road lane is present up to village in good condition and small public transport system developed by local people for their own convenience. There are no railway lines and airport nearby. WAPDA grid station present at a distance of 10 km by road from the village and 7 km from land.

The Project area is semi arid and barren not suitable for agriculture. Coal and salt mines are present at around 30 km from this area.

There is no major source of income. People of the area based upon agriculture in that area. Agriculture production in that area is not up to mark causing financial problems to the local people. There are no industries because of which lack of job opportunities for local people.

There are two hospitals present in 8 to 10 km of Mukhyal village. According to the survey people are satisfied by the services provided by the doctors in that area but ambulance facility in that area is not satisfactory.

Recreational Park is around 25 km away from the local bus stop (miani-adaa).

Stakeholder Consultation:
Stakeholder consultation was carried out as part of IEE study. The main objectives of the consultations were to apprise the stakeholders about the proposed Project activities; obtain their views, concerns and recommendations; and address / incorporate them in the Project design - thus enhancing the environmental and social performance of the Project.

Impact Assessment and Mitigation:
A detailed analysis of Project alternatives are discussed in **Section 5.** During the IEE, the Project potential social and environmental impacts were identified. Each identified environmental and social impact was then characterized with respect to its nature, reversibility, geographical extent, consequence-severity and likelihood. Based upon this characterization, the impacts were then assessed to be of high, medium or low significance. The IEE has recommended appropriate mitigation measures to address the potential environmental and socio-economic impacts. The details of impact assessment and mitigation measures are provided in **Section 6**, which is further supplemented by the Environmental Management Plan (EMP) provided in **Section-7** of this report.

Environmental Management Plan
An Environmental Management Plan (EMP) had been developed to provide an implementation mechanism for the mitigation measures mentioned above and has been updated in the light of the EPA decision circumstances. The EMP provides the organization structure for the environmental and social management system during the Project, and defines the roles and responsibilities of Project players. The EMP includes a mitigation plan, a monitoring plan, the communication and documentation requirements, and training needs, in the context of the environmental and social management of the Project.

Conclusion and Recommendations:
The Project will not cause any significant lasting environmental and social impacts. The environmental disturbance normally associated with construction activities will be minimized through an EMMP, implementation of which will continue during EPC and which includes monitoring arrangements. As solar PV technology is a clean energy source with no significant impacts on the environment with any GHG gas emissions after the construction phase therefore there will be no need for frequent environmental monitoring once the Project is operational. If there will be any major negative environmental impact noticed during operation of the Project, possible mitigation measures will be taken to reduce the impact.

Following annexure are attached to supplement the information in the IEE report;

Annexure-I: Environment management Plan
Annexure-II: Environment Protection Agency (Review of EIA/IEE Regulations 2000)
Annexure-III: National Environmental Quality Standards (NEQs)
Annexure-IV: Fauna of Project Area
Annexure-V: Flora of Project Area
Annexure-VI:-Environment and Social Survey Forms
Annexure-VII:-Snapshots taken during the Site Survey

6 INFRASTRUCTURE: ROADS, RAIL, COLONY AND AMENITIES

Communication Network

There are five ways to enter main city:

- By motorway through Kallarkahar exit, crossing bhaun and entering Chakwal in about 25 minutes.
- By Motorway through Chakwal exit, Balkasar interchange crossing Thoa Bahadur and exntering city in about 30 minutes.
- By GT road taking Mandra exit before Rawat and following chakwal road in about 45 minutes.
- By Jehlum Chakwal Road which exit from GT road at sohawa.
- By Choa Saidan Shah Road Which Came from Khiora and Kallar Kahar and meet chakwal at jehlum road at Choa Chok.

Telecommunication Facilities

Telephone, Internet and Cellular phone services are available in the district.

Basic Infrastructure Facilities

All the basic infrastructure like roads; transport; water; repair and maintenance workshops and technicians; communication facilities like telephone, fax and email; utilities required to run the plant smoothly, office buildings, hostel, medical facilities, security etc., already exists on Project site.

Local Settlement Pattern and Population

According to the 1998 census of Pakistan, the total population is 1,083,725 of which 12.01% only were urban making Chakwal the most rural district in Punjab.

The Project site is vacant with no population within the radius of 1km. There is no major source of income. People of the area based upon agriculture in that area. Agriculture production in that area is not up to mark causing financial problems to the local people. There are no industries because of which lack of job opportunities for local people.

7 PROJECT COST

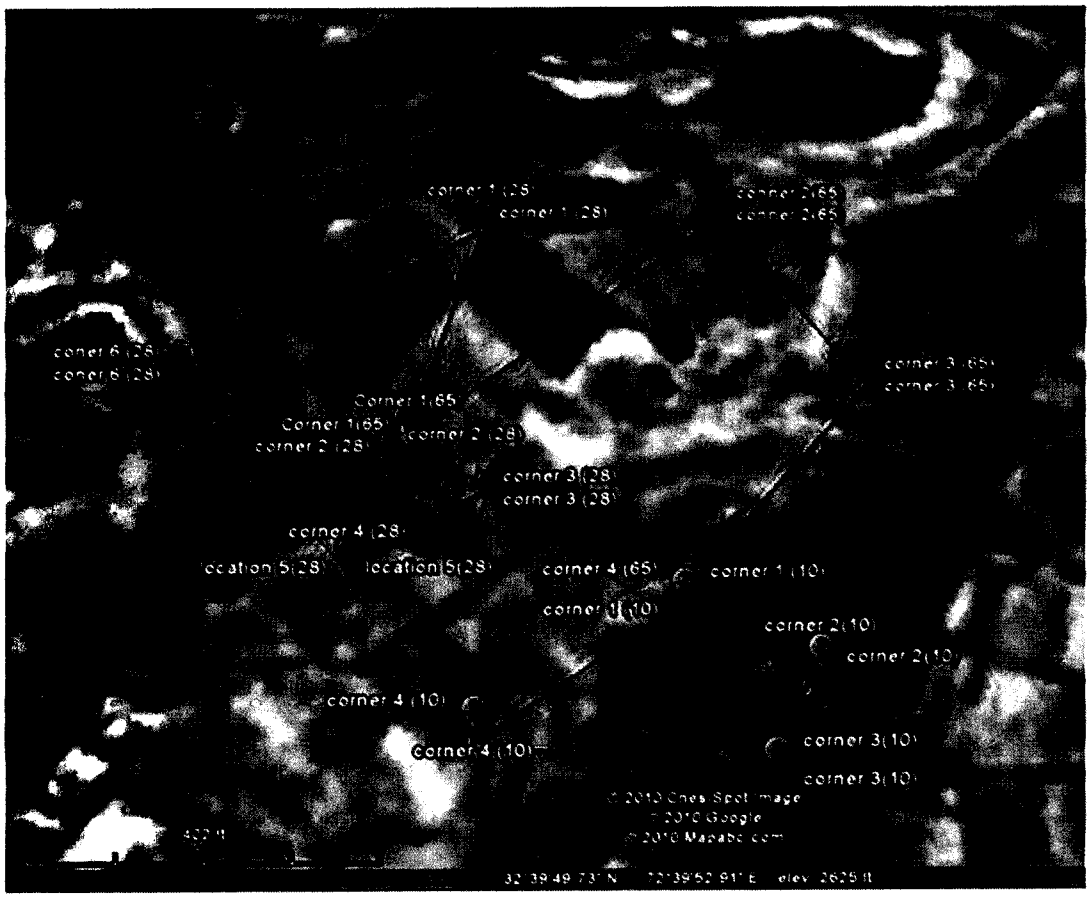
The project cost is approximately 4.0 million USD.

8 PROJECT COMMENCEMENT AND COMPLETION PLAN

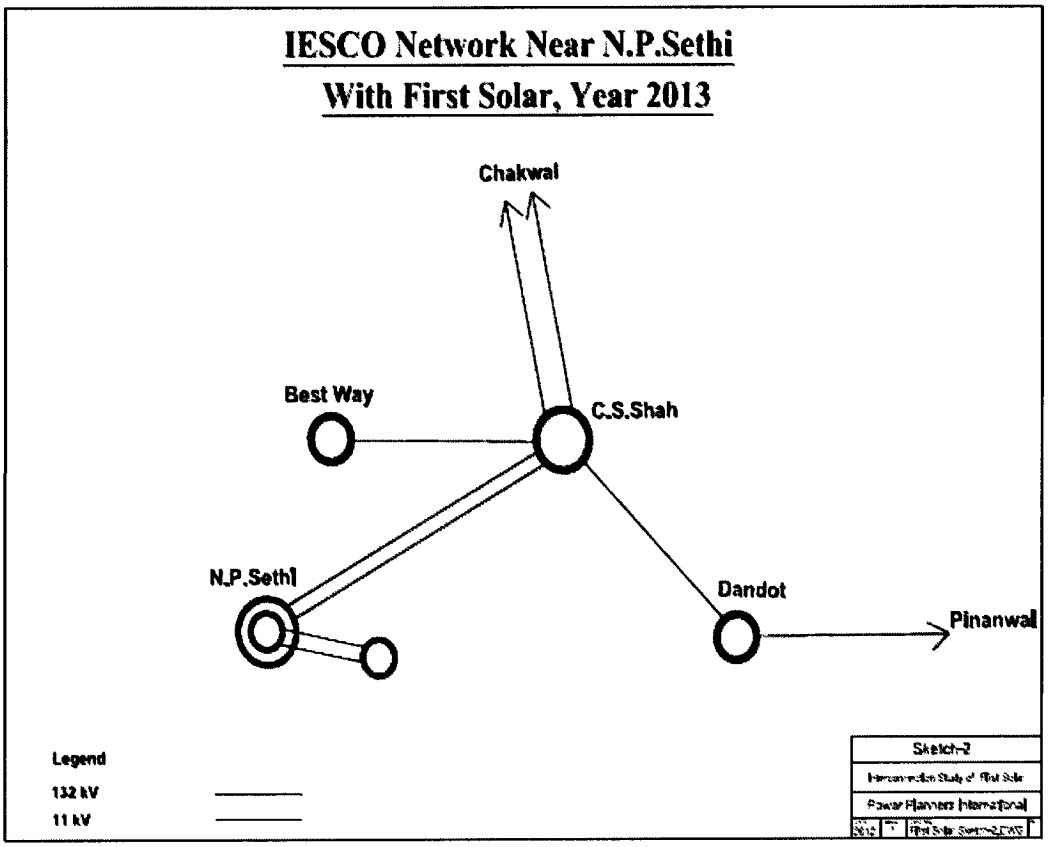
Activity / Milestone	2014				2015			
	1STQTR	2NDQTR	3RDQTR	4THQTR	1STQTR	2NDQTR	3RDQTR	4THQTR
Submission of Feasibility Study								
Approval of Feasibility Study								
Generation License								
Upfront Tariff Approval								
Signing of EPA / IA								
Financial Close								
Project COD								

ANNEXURE-M: INFORMATION FOR SCHEDULE-I OF LICENSE

Project Location Map



Single Line Diagram

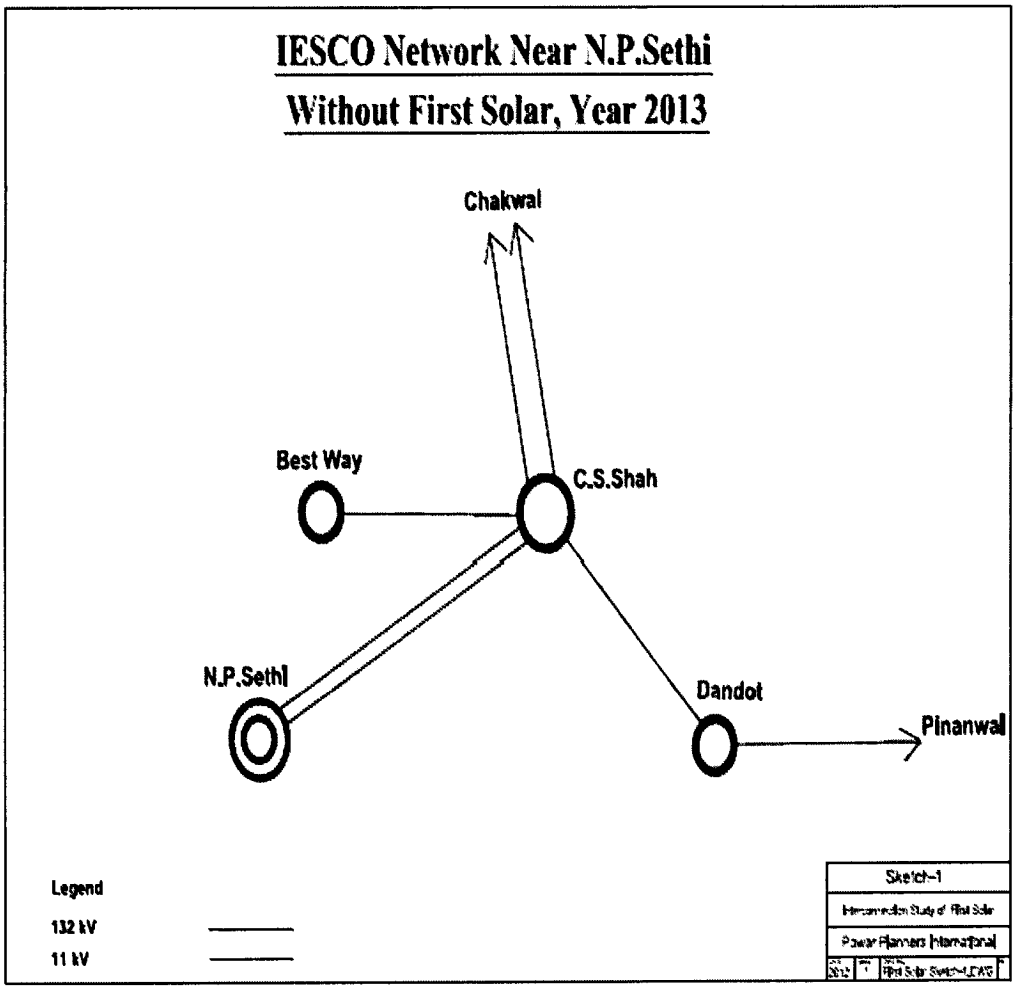


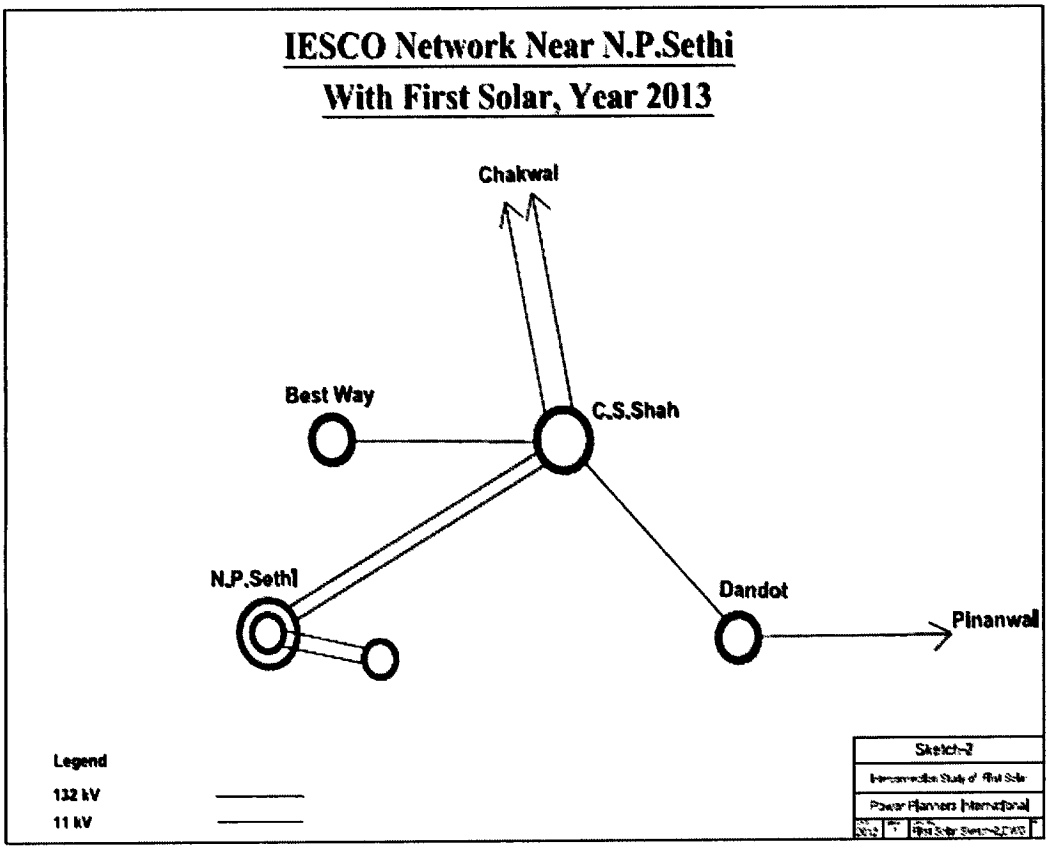
INTERCONNECTION ARRANGEMENT FOR DISPERSAL OF POWER FROM THE PROJECT

The nearest substation of IESCO from the Project site of First Solar Power Project is N.P.Sethi 66/11 kV at around 10 km. Upgrading of N.P.Sethi to 132 kV level is under progress and will be completed by the COD of First Solar. Considering the physical proximity of the grid to the Power Plant, it has been decided to evacuate the power at 11 kV by making connections with N.P.Sethi substation at 11 kV to evacuate the maximum of 02 MW of First Solar Project.

The detailed Grid Interconnection Study has been conducted by Power Planners International and copy is provided with this application to NEPRA.

Schematic Diagram
For Interconnection/Transmission Arrangement for Dispersal of Power from First Solar




IESCO Network Near N.P.Sethi
With First Solar, Year 2013
Chakwal
Best Way
C.S.Shah
N.P.Sethi
Dandot
Pinanwal
Legend
132 kV
11 kV
Sketch-2
Power Planners International

Project Details

(A). General Information

(i)	Name of Applicant/Company	First Solar Pvt. Ltd
(ii)	Registered Office	10-B, Street No.26, F-8/1 Islamabad Tel: +92-51-2255892 Fax: +92-51-2256493
(iii)	Plant Location	Kalar kahar Punjab Pakistan
(iv)	Type of Generation Facility	Solar

(B). Capacity & Configuration

(i)	Plant Size (MW)	02 MW

(C). Plant Details

Module Manufacturer/Model	Canadian Solar/ CS6X-330P
Inverter Manufacturer/Model	Huawei/ Huawei-SUN2000-28KTL
Plant Capacity	02 MW
Technology	Solar PV
Unit Size (MW)	300W

Below are given the technical specifications of PV module and inverter offered by the EPC contractor.

PV Module Characteristics	
Module Model	CS6X-330P
Manufacturer	Canadian Solar
Nominal Power [W]	300.00
Efficiency [%]	15.63
Power Tolerance [%]	0/±5
Cell Type	Poly-Crystalline
Open Circuit Voltage [V]	44.6

Short Circuit Current [A]	8.87
Maximum System Voltage	1000V (IEC)600V (UL)
Maximum Series Fuse Rating	15A
Power Coefficient of Temperature [%/C]	-0.50
Nominal Operating Cell Temperature (NOCT) [^{o}C]	42.00±2
Height X Width X Thickness [mm]	1954 X 982 X40

Inverter Characteristics	
Inverter Model	Huawei-SUN2000-28KTL
Manufacturer	Huawei
Max. input voltage	1000 V
Max. DC input	28,200 W
Max. input current	18 A
Min. operating voltage	200 V
Rated input voltage	620 V
AC output power	27,500 W
Rated output voltage	3×277 V/480 V+PE
AC power frequency	50 Hz/60 Hz
Max. output current	33.5 A
Adjustable power factor	0.8 leading ... 0.8 lagging
Dimensions(W/H/D)	520x610x255 mm (20.5 x 24.0 x 10.0 in.)
Operating temperature range	-25ºC to +60ºC (-13ºF to +140ºF)

(D). <u>Other Details</u>

(i).	Project Commissioning date (Anticipated)	August, 2015
(ii).	Expected Life of the Project from Commercial Operation date (COD)	25 Years

ANNEXURE-O: SAFETY PLANS AND POLICIES

First Solar (Pvt) Ltd

FIRST SOLAR

HEALTH AND SAFETY POLICY OF FIRST SOLAR

Date of Approval : 22nd May, 2012

GENERAL STATEMENT OF POLICY

First Solar acknowledges and accepts its legal responsibilities for securing the health, safety and welfare of its entire staff (employees and sub-contractors working) and all others affected by their activities.

First Solar will provide and maintain safe and healthy working conditions so far as reasonably practicable.

First Solar will encourage all employees to be actively involved in maintaining safe operating conditions and practices.

First Solar will carry out a regular review of this policy to ensure that these standards of health and safety are maintained.

ORGANIZATION

The Management of First Solar has overall responsibility for health and safety, and will: ensure work is planned to take into account health & safety issues

- ensure suitable financial provision is made for health & safety obligations
- provide appropriate information and instruction to employees

At all times staff are responsible for taking reasonable care of themselves and having due regard for the health and safety of others who may be affected by their work activities.

ARRANGEMENTS

First Solar Health and Safety Policy is implemented in the following principal ways;

Communication

The content of this policy and rules specific to a site or job are drawn to the attention of all staff. Staff is encouraged to present their views on health and safety for existing and proposed jobs and to raise immediate concerns with the head of the Company.

Training

Staff is given training appropriate to their responsibilities. Training is specifically provided for use of equipment, use of Personal Protective Equipment and work with any new equipment entering the solar market. Additional training required because of new work activities and the use of new equipment will be provided when needed.

Risk Assessments

Staffs carry out risk assessments are continuously throughout their work. Hazards are considered and work methods established to minimize the risk of injury to themselves and others affected by the work. Where the staff member does not have sufficient knowledge about a specific hazard, such as work in confined spaces, they will take further advice from the Health & Safety adviser if required. The Manager ensure staff are provided with appropriate instruction and training on risk assessments.

Personal Protective Equipment

PPE is provided as appropriate for the work activities. PPE is maintained by the individual staff member and is subject to routine maintenance as appropriate.

Hazardous Substances

In the case of risks to health, Personal Protective Equipment is provided and used by the staff. Unidentified potential hazardous substances, such as asbestos, encountered during the course of a work activity are referred to Health & Safety adviser to advise and take appropriate measures.

Plant characteristics (generation voltage, frequency, power factor, automatic generation control, ramping rate, alternative fuel, auxiliary consumption, time(s) required to synchronize the grid) as required pursuant to Regulation 3(6)(A)(a)(13) of the Regulations

Generation Voltage	
Generator Output voltage	0.69 kV
Voltage at point of interconnection	132 kV
Frequency	
At point of interconnection	50 Hz
Power Factor	
At point of interconnection	0.9 lead – 0.89lag
Automatic Generation Control	
• Connected from generator to grid via full scale power converter. Generation control as per requirement of grid code.	
Ramping Rate	
• As per requirement in grid code	
Alternate Fuel	
• Not applicable	
Auxiliary consumption	
• Approximately Annual energy production 2829 MWh/year	
Time required to synchronize to grid	
• Synchronization of solar array performed through Phase Locked Loop (part of power converter • Less than 1 minute • Synchronization Seller Interconnection facilities to be performed via check synchronism relays. Time required on the order of ms (milliseconds)	

ANNEXURE-R: TRAINING AND DEVELOPMENT

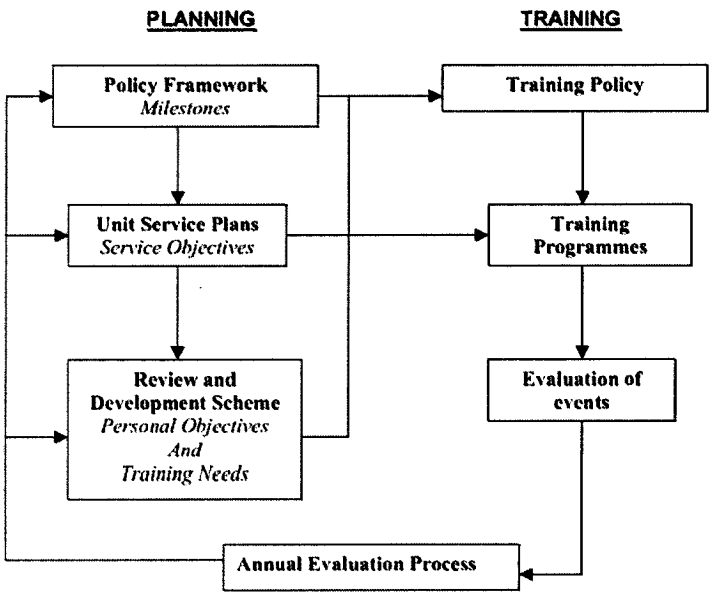
1 Training Policy

1.1 Purpose

The purpose of training is to equip people with the necessary skills, knowledge and attitudes to meet the organization's needs in relation to its objectives. By investing in people through their training we ensure we harness their full potential and focus their energies on the needs of the organization while fulfilling their need for personal development and job satisfaction.

1.2 Training Process

The organization has set up a set process to link the training processes with the planning processes of the organization. The following chart shows this linkage.



The Chart shows that training needs flow out from organizational, service and individual objectives. This ensures training is focused on the needs of the organisation. The system also ensures that training events are evaluated and their contributions to meeting objectives at each level are measured.

1.3 Training Resources

The training process will ensure that the resources required to meet training needs are fully identified, that training is properly focused and that the benefits of the training can be demonstrated.

The organization will always wish to make budgetary decisions about training in the context of overall organization's finances but the Organization has made a public commitment to investing in its people and will ensure wherever possible sufficient funding is made according to the needs identified.

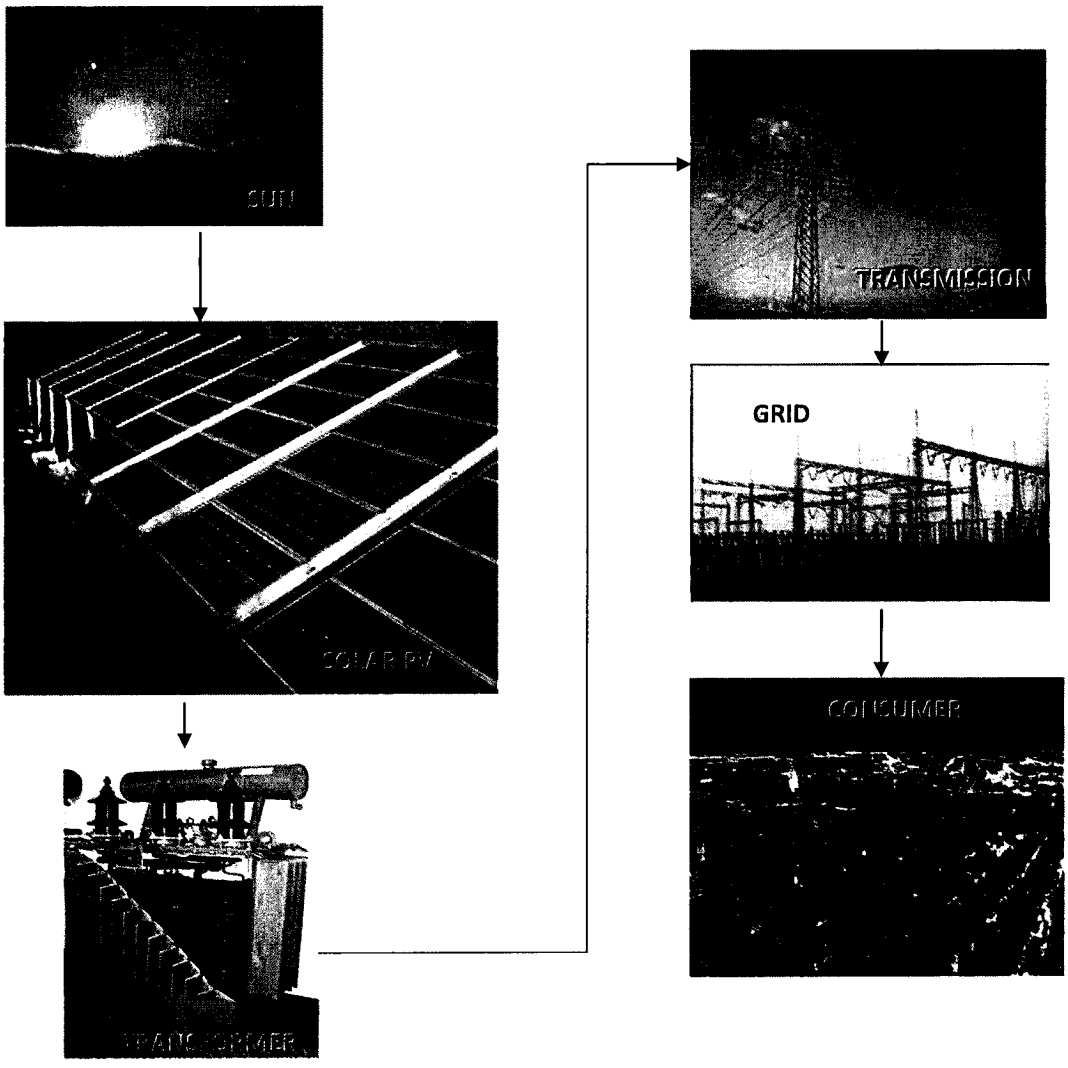
1.4 Areas of Training

All types of training requires a structured training plan, clear objectives and assessment criteria

- Orientation Training
- Councilor Training
- Management Training
- Genereic Training
- Health and Safety Trainings

FEASIBILITY STUDY REPORT

2 MW SOLAR PV POWER PROJECT AT KALAR KAHAR, PUNJAB



PROJECT SPONSORS:

FIRST SOLAR (PVT.) LTD

PROJECT CONSULTANTS:

RENEWABLE RESOURCES (PVT.) LTD

APPROVAL SHEET

TITLE	:	Feasibility Study Report of 2MW Solar PV Power Project in Punjab sponsored by First Solar (Pvt) Ltd
DOCUMENT NUMBER	:	RE2-141-101-001 Issue: 02
CLASSIFICATION	:	**UN CLASSIFIED**

SYNOPSIS

This document is a feasibility study report of a 2MW Solar PV Power Project sponsored by First Solar (Pvt) Ltd. It contains the resource assessment, hardware specifications, power production analysis, electrical interface, civil works design, project cost. It also includes initial environment examination and other site specific information. This report has been prepared by Renewable Resources (Pvt) Ltd of Pakistan.

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LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
CDM	Clean Development Mechanism
CFCs	Chlorofluoro Carbons
Cm	Centimeter
CO_2	Carbon dioxide
CPPA	Central Power Purchasing Agency
DC	Direct Current
DISCOs	Distribution Companies
EE	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
GDP	Gross Domestic Product
GHG	Green House Gas
GIS	Geographic Information System
GoP	Government of Pakistan
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
JI	Joint Implementation
KESC	Karachi Electric Supply Company
Km	Kilometer
kV	Kilovolt

KW	Kilowatt
LOI	Letter of Intent
LPG	Liquefied Petroleum Gas
LOS	Letter of Support
m^2	Meter square
MTDF	Medium Term Development Framework
MW	Megawatt
N_2O	Nitrous Oxide
NCS	National Conservation Strategy
NEPRA	National Electricity Power Regulatory Authority
NEQS	National Environmental Quality Standards
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Management
PEPA	Pakistan Environment Protection Act
PMD	Pakistan Meteorological Department
RE	Renewable Energy
RE2	Renewable Resources (Pvt) Ltd
WAPDA	Water And Power Development Authority

ACKNOWLEDGEMENTS

The management of First Solar is thankful to Ministry of Water and Power and the dedicated team of AEDB for generous support at all stages of project development and looks forward to continue for future milestones.

The management of First Solar also looks forward to the cooperation of Government of Punjab and other Government departments (NEPRA, NTDC, LESCO) which is being extended to the Project.

DISCLAIMERS

This document is intended for use for effective decision making regarding this Project. Reliance on this document for any other purpose would not be suitable.

The Company and the Sponsors are not responsible for any decision made by the intended users for any other purpose. The Company and the Sponsors are also not responsible for any decision made by any other person or party not being an intended user of this document whether related to this project or without written consent of the Company or Sponsors in this regard.

Further, this is not intended to be a business or operational plan for the project.

COPY RIGHT NOTICE

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CONSULTANT CONTACT INFORMATION

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Address	**Islamabad Office:** House# 7, St. 48, F-7/4, Islamabad 44000 **Karachi Office:** GF-1, Unit-1A, Sea view Apartments DHA, Phase V Karachi
Telephone	0092 51 8358591
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DOCUMENT INFORMATION

Purpose and Scope:

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

This document presents the technical, financial and commercial viability of this project within Pakistan's economic and regulatory framework.

Structure of the Document:

This document has been divided into following main parts:

- Part 1: Executive Summary
- Part 2: Country and Industry Overview
- Part 3: Technical Feasibility

Each part is further sub-divided into chapters. Information in the document is supplemented by Annexure.

PART 1

EXECUTIVE SUMMARY

1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, Islamic Republic of Pakistan is largely under the influence of tropical desert climate. The relative shortage of conventional energy resources in Pakistan, when coupled with the hiking energy prices worldwide, leads to a tension in the power supply of the country. It has become a top agenda of Pakistan government to find alternative energies, including solar power.

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

First Solar (Pvt.) Ltd got LOI from AEDB for the development of 2 MW solar power project. The project is located in Punjab province in the area of Kalar Khar. First Solar Pvt. Ltd is owned by Monitor Associates (Pvt) Ltd.

Monitor Associates (Pvt) Ltd. Started as a construction company and was able to earn repute for applying innovative methods and performing precise engineering and management skills in the emerging market. Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

This document is the complete feasibility study of the project including Solar Resource Assessment and Energy Yield Estimates, Initial Environmental report, Electrical and Grid Interconnection studies.

1.1 PROJECT OVERVIEW

The Project Site is acquired at village called "Mukhayal" in Kalar Kahar, district Chakwal. It is located around 135 kilometers from Rawalpindi and 5 kilometers southwest of Chakwal. The Site is adjacent to the M2 Islamabad – Lahore Motorway. The total land area is 13 acres and is well enough for the installation of 2 MW solar power project.

The geographical location of the project is shown in **Figure 1.1**

Figure 1-1: Geographical Location of Project

The project site coordinates are as listed in Table below:

Table 1-1: Project site coordinates

Land Coordinates		
North	**East**	**Attitude**
32.66235	72.66026	Alv810meter
32.66325	72.66161	Al815
32.66254	72.66225	Al807
32.66175	72.66142	Al809
32.66175	72.66142	Al809
32.66145	72.66201	Al806
32.66109	72.66182	Al807
32.66124	72.66132	Al809
32.66318	72.66055	Al819
32.66303	72.66077	Al816
32.6621o	72.6604	Al816
32.66184	72.66006	Al816
32.66257	72.65929	Al818

1.1.1 Project Size

The Project size will be 2MW.

1.1.2 Project Status and Calendar

The complete feasibility study is being submitted. From here onwards, the Project shall pursue approval of feasibility and other project development tasks from the concerned stakeholders. In parallel, the Project shall also pursue determination of tariff and signing of EPA / IA.

Table 1-2: Project Planned Milestones

Activity / Milestone	2013		2014				2015	
	3RD QTR	4TH QTR	1ST QTR	2ND QTR	3RD QTR	4TH QTR	1ST QTR	2ND QTR
Submission of Feasibility Study								
Approval of Feasibility Study								
Tariff Determination								
Approval of Electrical Studies								
Signing of EPA								
Signing of IA								
Financial Close								
Project Construction								
Project COD								

The project construction shall take 6 months from the date of planning till the COD.

Table 1-3: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6
Planning and Preparation						
Import of Hardware and Equipment						
Fabrication of Steel Structures						
Site Civil Works						
Installation of Solar Power Equipment						
Cables and Interconnections						
Grid Connectivity						
Commissioning and Testing						

1.1.3 Geological Conditions

The project site is a rocky, hill top plain. Detailed analysis of the soil conditions, i.e. laboratory testing, shall be performed as part of the EPC works.

1.1.4 Summary of Power Production Estimates

The power production estimates have been calculated in detail based on the regional solar irradiance data, performance characteristics of solar panels and local weather conditions. The summary of power production estimates is given in **Table 1.4.**

Please refer to the Solar Resource Assessment and Energy Yield Estimate report attached as Annex 1.

Table 1-4: Summary of Power Production Estimate

	TBEA SUNOASIS	PHOENIX	NIZAM SOLAR
Equipment			
Module Size [W]	280.0	255.0	245.0
Type	Poly Crystalline	Poly Crystalline	Poly Crystalline
Efficiency [%]	14.4	15.5	15.0
Area of Module [m^2]	1.95	1.65	1.63
Nominal Operating Cell Temperature NOCT [°C]	47.0	45.7	46.0
Temperature Coeff. Of Power [% / °C]	-0.50	-0.40	-0.45
Slope [Degree]	29.0	20.0	30.0
Albedo	0.2	0.2	0.2
Total Number of Modules	7200	7872	8142
Total Area of Modules [m^2]	14,018	12,989	13,300
Plant Capacity [kW]	2016.0	2007.4	1994.8

	TBEA SUNOASIS	PHOENIX	NIZAM SOLAR
Irradiation on horizontal plane [kWh/m²]	1836.28	1836.3	1836.3
Irradiation on inclined plane [kWh/m²]	2061.23	2031.8	2062.1
Gross Production [kWh/yr]	4,116,935	3,930,328	4,045,365
Electrical Losses			
Inverter Losses	2.0%	1.7%	1.7%
DC Line Losses	1.5%	1.5%	1.5%
AC line Losses	1.0%	1.0%	1.0%
Transformer	1.1%	1.1%	1.1%
Sub Total	5.6%	5.3%	5.3%
Other Losses			
Temperature Loss	11.6%	6.8%	9.5%
PV module nameplate DC rating	1.0%	1.0%	1.0%
Tolerance/Mismatch	1.5%	0.0%	0.0%
Horizon Loss	0.0%	0.0%	0.0%
Nearby Shading Loss	2.5%	1.7%	2.5%
Loss due to Irradiance	1.5%	1.5%	1.5%
Soiling	2.0%	2.0%	2.0%
Grid Unavailability	0.0%	0.0%	0.0%

	TBEA SUNOASIS	PHOENIX	NIZAM SOLAR
System Unavailability	1.0%	1.0%	1.0%
Shading	0.0%	0.0%	0.0%
Sun-Tracking	0.0%	0.0%	0.0%
Sub Total			
Overall Loss	24.1%	17.8%	20.8%

Table 1-5: Annual Production during first Year

	TBEA SUNOASIS	PHOENIX	NIZAM SOLAR
Annual energy during First Year	2,742,003	2,792,023	2,829,456
Capacity Factor during First Year	15.5%	15.9%	16.2%

Based on closeness of results between Phoenix Solar and Nizam Solar; negotiations are in progress with both EPC contractors.

1.1.5 EPC Contractor Selection

EPC Offers from multiple EPC contractors are currently under review. Details of the offers are as shown in Table 1-6

Table 1-6: Specifications of Solar Power Equipment

Lead Bidder	Manufacturer	
Solar Phoenix	REC	SMA
TBEA Sunoasis	TBEA Sunoasis	TBEA Sunoasis
Nizam Solar	YingLI Solar	Sungrow

1.1.6 Electrical Grid Interconnection

An Electrical Grid Interconnection Study has been submitted for approval to IESCO. The study is attached as Annexure 2 of this document.

1.1.7 Design of Mechanical Works

Steel Support Structures will be designed and fabricated to install solar panels. The steel structures shall be locally fabricated. The mechanical design shall bear the required level of corrosion and winds / gusts.

1.1.8 Design of Civil Works

The civil works will be required for the following purposes:

- Construction of Foundations for mounting of Solar Arrays.
- Construction of Power House.
- Construction of Office Building.

The design of civil works shall be according to the soil and seismic conditions; and to bear high winds / gusts.

1.1.9 Construction Management

The imported equipment shall come via Karachi Sea Port. The civil work materials shall be arranged from the nearest local markets / dealers. Certain items (steel accessories, local cables, electrical accessories shall come from appropriate cities including Islamabad, Karachi and Lahore.

No heavy machinery is required for construction and erection. There is semi finished road access to the Site, which easily serves for 10 ton trucks with little leveling. The site will be restored to the original landscape in the later phase of construction.

The project company shall hire the services of a professional Renewable Energy consulting firm for construction supervision.

1.1.10 O & M Management

After the completion of its construction, the Project shall be jointly managed with the principle of requiring "few on-duty staff".

The Project Site is separated into the production section and utility area. The production area includes the solar power equipment and accessories including power house. The offices are located in the production section. The location of support staff shall be arranged such that mutual communication and access is easy. The utility section is for daily living, including dormitories, dining rooms and the kitchen.

There will be on Site support for routine maintenance and troubleshoot. For un-expected faults, maintenance resource and procedures shall be laid.

The project company shall hire the services of a professional Renewable Energy consulting firm for O&M supervision.

1.1.11 Environmental Management

A separate environment study has been carried out. There are no hazards. The minor adjustments required during construction phase have been addressed and mitigation plan is provided.

The Initial Environment Examination is attached as Annexure 3

1.1.12 Health and Safety

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

A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and over-haul will be strictly implemented.

A safety and health supervision department will be established, which is to be in charge of the education, training and management of safety and health related issues after the Project is put into operation.

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

1.1.13 CDM Aspect

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the national power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver good environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualifies for the application of CDM projects. NEPRA is allowing almost the same return on equity (RoE) to the thermal and the renewable energy projects. The Sponsors of the Project require CERs to bring the RoE at a level where they can invest in renewable energy projects in Pakistan in future as well. If the Project is approved and registered as a CDM project, CERs can provide extra financial resource for the Project. It will provide favorable conditions for the project financing, improve competitiveness of the project, and reduce investment risk during the project implementation process.

1.1.14 Key Project Figures

Table 1-7: Key Project Figures

No	Item Description	Value
1	Project Capacity	2 MW
2	Annual Power Production (P90)	2,829,456 kWh
3	Total EPC Cost (USD)	3,500,000.00
4	Total Project Cost (USD)	4,344,573.00
5	Average Tariff	US Cents 20.4 / kWh
6	Funding Plan	Debt 70%:Equity 30%
7	Annual Interest Rate	13.04%
8	Return on Equity	18%
9	Loan Period	10 Years
10	Grace Period	01 Years

1.2 RATIONAL FOR SOLAR POWER

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips supply by a considerable amount. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves.

Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would increase Pakistan's reliance on imported fuels with associated foreign exchange effects. This must be considered in the context of rising fuel costs for gas and oil-based fuels as a result of uncertainty over future supply.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind and solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill. As with gas, securing future supplies of coal and hydro-electric power would rely on significant spending on infrastructure. Pakistan has domestic reserves of coal. However, coal currently makes up a very small proportion of total generation, largely the result of most of the reserves being located in one area, the Thar Desert. Exploiting the reserves would require huge and costly upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines before power plant development could commence. Hydro electric power already supplies almost 30% of electricity, and numerous sites for future investment exist, but due to their locations, this would also require significant investment in transmission to meet the expected power needs. Moreover, there are varying political stands on hydro-electric power options.

Looking at how the country's future electricity needs might be met in a way that supports the environmental objectives of the Government of Pakistan; solar power generation has the potential of being a strong contributor.

The development of solar power generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions avoiding thermal power generation.

Solar energy, on the other hand, has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy

Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.meter in a year. It has an average daily global isolation of 19 to 20 MJ/sq.meter per day with annual mean sunshine duration of 8 to 8.5 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m2, 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

Pakistan receives about 15.5x1014 kWh of solar irradiance each year with most regions receiving approximately 8 to 10 sunlight hours per day. The installed capacity of solar photovoltaic power is estimated to be 1600 GW per year, providing approximately 3.5 PWh of electricity (a figure approximately 41 times that of current power generation in the country).

To summarize, the sun shines for 250-300 days per years in Pakistan with an average sun shine hours of 8-10 per day. This gives huge amount of energy to be used for electricity generation by solar photovoltaic and solar thermal power plants.

A quick idea for the potential of solar energy in Pakistan can be obtained from the satellite map of solar radiation released by National Renewable Energy Lab (NREL) of USA

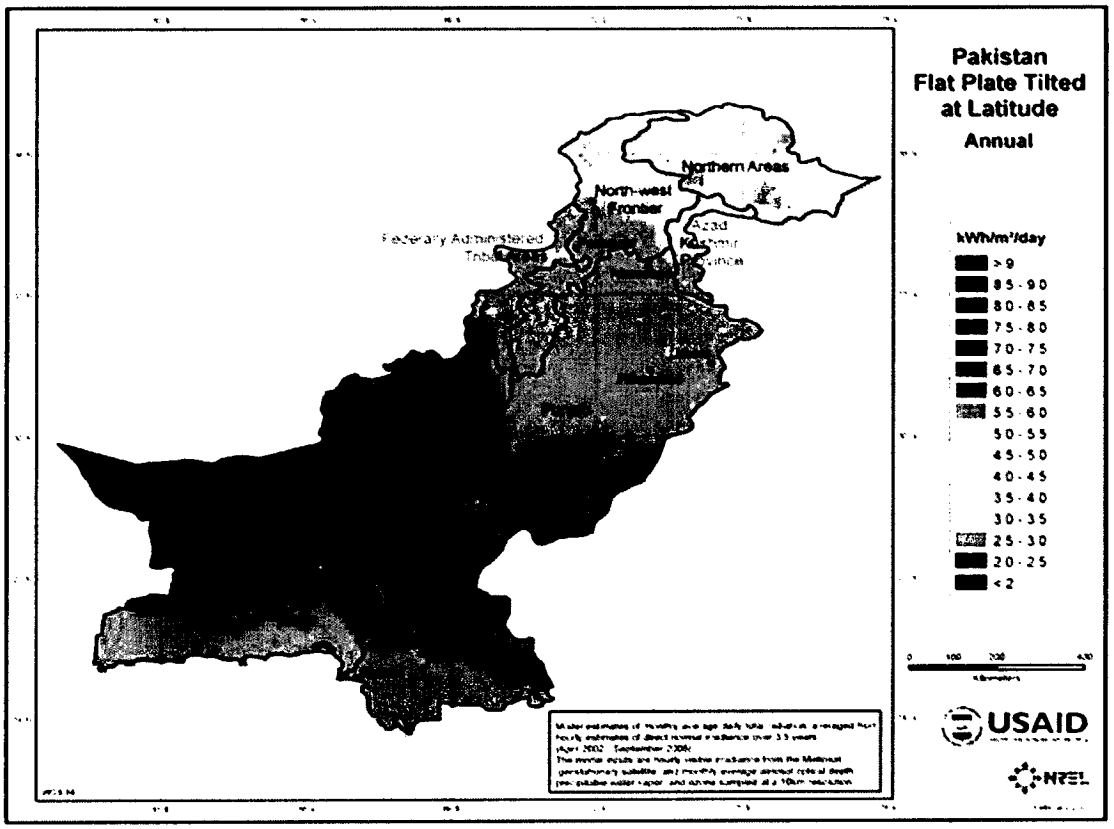


Figure 1-2: NREL Solar Map of Pakistan

1.3 COUNTRY OVERVIEW

Pakistan is located on the western stretch of South Asian Subcontinent with Arabian Sea in the south, China in the north, India on the east, Afghanistan and Iran on the west. It covers an area of 796,000 km^2 and has a coastal line of 980km. Almost $3/5^{th}$ of Pakistan's total area is mountains and hills, deserts spreading along the southern coastal areas, and plateau pastures and fertile agricultural land stretching north. The Indus River, which originates from China, traverses 2300km from north to south into the Arabian Sea.

Pakistan has a tropical climate. It is hot and dry in most of its areas, with relatively high average annual temperature. The southern coastal areas have an average yearly temperature of 26°C. Most areas show temperatures higher than 40°C around noon in June and July.

Some parts of Sindh and Baluchistan even have temperatures higher than 50°C. The yearly precipitation in Pakistan is less than 250mm, with 1/4th of Pakistan having annual rainfall less than 120mm. Pakistan is under great influence of monsoon from Indian Ocean, which brings both precious rain and abundant wind energy resources.

1.4 INDUSTRY OVERVIEW

Every day the sun showers Earth with several thousand times as much energy as we use. Even the small amount that strikes our roof is many times as much as all the energy that comes in through electric wires. With the sun straight overhead, a single acre of land receives some four thousand horsepower, about equivalent to a large railroad locomotive. In less than three days the solar energy reaching Earth more than matches the estimated total of all the fossil fuels on Earth. It's all about converting maximum of it to useful energy. At an average solar power systems amortize themselves within 4 years, meaning after four years they have produced as much energy as it took to manufacture them. The expected lifetime of a system is 25-30 years. The world solar insulation is given in **Figure 1.3**

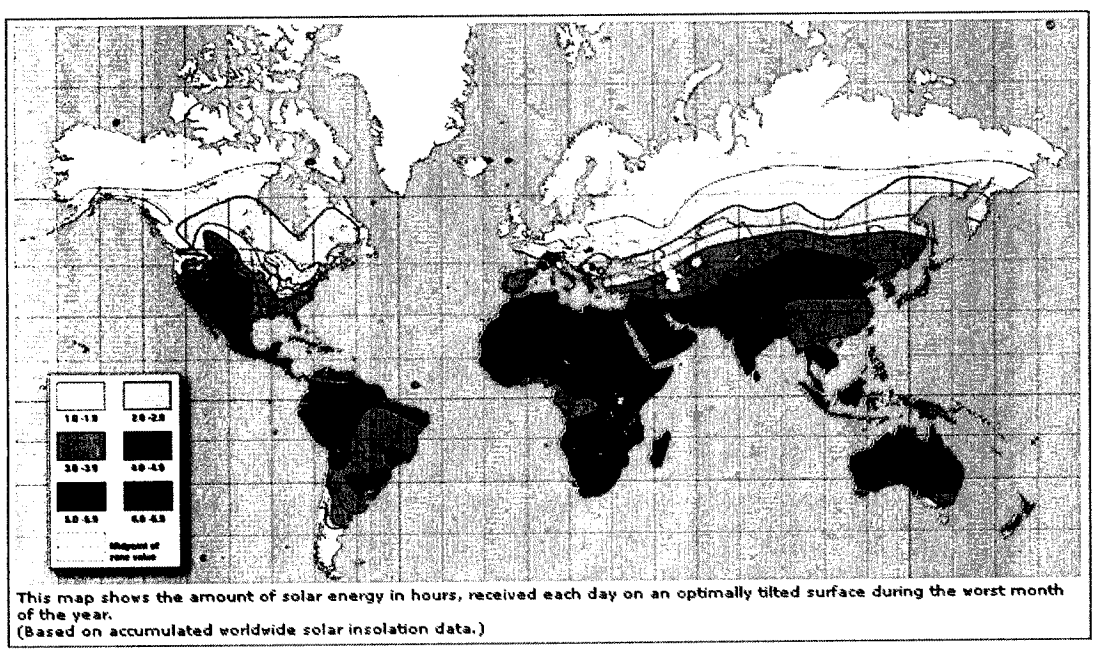


Figure 1-3: World Solar Insulation Values

Top 10 solar power producers in the world are shown in **Table 1.8**

Table 1-8: Specifications of Solar Power Equipment

PV power station	Country	DC peak power(MW)	
Sarnia Photovoltaic Power Plant	Canada	97	Constructed 2009-2010
Montalto di Castro Photovoltaic Power Station	Italy	84.2	Constructed 2009-2010
Finsterwalde Solar Park	Germany	80.7	Phase I completed 2009, phase II and III 2010
Rovigo Photovoltaic Power Plant	Italy	70	Completed November 2010
Olmedilla Photovoltaic Park	Spain	60	Completed September 2008
Strasskirchen Solar Park	Germany	54	
Lieberose Photovoltaic Park	Germany	53	Completed in 2009
Puertollano Photovoltaic Park	Spain	50	231,653 crystalline silicon modules, Suntech and Solaria, opened 2008

1.5 PROJECT TEAM

1.5.1 The Project Company: First Solar (Pvt) Ltd

A special purpose company has been incorporated in accordance with the laws and policies of Pakistan for development, construction and operation of the Project as an independent power producer.

1.5.2 The Sponsor: Monitor Associate (Pvt) Ltd

www.monitorassociate.cn

Establishing in 1990, Monitor Associates (Pvt) Ltd. Started as a construction company and was able to earn repute for applying innovative methods and performing precise engineering and management skills in the emerging market. During its initial years the company developed expertise in civil works and telecommunication services. Later came the expansion phase when the company decided to offer more than engineering services for civil works only.

The company also established its new telecom division to undertake the OFC Network engineering, OFC deployment and erection of communication towers. Beside this the company set up two new departments in 1996 to deal with customization of industrial software, security and surveillance network design and installation. Then in the year 1999 the third phase of expansion came when the company decided to participate fully to bring in the renewable energy technologies to the country to meet the clean and environmental friendly power needs of our future. Our management and engineers continually research market trends and educate themselves with new changes.

Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

1.5.2.1 List of Key Projects by Monitor Associate

Below is given the major projects executed by Monitor Associates Pvt. Ltd.

- Establishing of Satellite network Turnkey basis.
- Mobilink Nation Wide OFC Network
- Mobilink OFC Network on behalf of LT Engineers.
- Azad Jammu &Kashmir area Telecomm uplift Plan
- Deployment and Commissioning of Army DATA Network.
- Installation of Telecomm BTS sites.
- Linking of two army exchanges at Gilgit on Optic Fiber Network
- Solar Lighting System at Defense Housing Authority Lahore.
- Installation of CCTV based surveillance System at GHQ Rawalpindi.
- Installation of CCTV system at Army House for Pakistan Army.
- Construction of Underground exchange building for Pakistan Army.
- Construction of Road project of Azad Jammu & Kashmir Government.
- Construction of Manjhari Tata Pani Road.

1.5.3 Project Consultant: Renewable Resources (Pvt) Ltd

www.renewableresources.com.pk

REnewable REsources (RE2) is the overall Project Consultant and coordinated all the project development activities. The scope of work for RE2 in Project includes the feasibility study, coordination with all project development teams, tariff petition and energy purchase agreement.

RE2 provides consultancy services in the fields of Renewable Energy (RE), Energy Efficiency (EE) and Environment. RE2 offers services for "green" business innovation, customer education, project appraisal, project planning, design and management, development of feasibility studies and environmental studies, as well as client-specific research & surveys. The company has been incorporated as a private limited company in Pakistan under Companies Ordinance 1984.

RE2 provides high quality energy engineering and management consulting services to enable rapid deployment of efficient, cost-effective, reliable, and environment-friendly renewable energy systems. The customized technical solutions and services are dedicated to investment

firms, energy groups, industries, financing institutions and public authorities involved in the development and / or acquisition of renewable and thermal power plants.

In the area of project development, RE2 possesses the entire, necessary expertise including power production analysis, selection of technology / power equipment, comprehensive bankable feasibility, government approvals, overseeing / monitoring the EPC activities etc. For conducting feasibility studies, RE2 has the capabilities to conduct site based investigations like soil analysis, surface contouring, grid evaluation etc. In addition to planning, RE2 also covers the economics, i.e. the project financial model and subsequent generation cost of leading up to tariff in terms of value per kWh.

These services are backed with in-depth grip on technical, financial and administrative aspects at every stage that enables us to employ best practices in project development. This ultimately leads to implementation in accordance with the most efficient planning, which is a vital element in power projects in order to save unnecessary and huge overheads during execution.

The RE2 team also has the expertise to deal with the legal aspects of power projects including Generation License, Tariff Application & justification, Energy Purchase Agreement and Implementation Agreement. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of the complete power projects cycle.

1.5.4 Electrical Consultant: Power Planners International

www.powerplannersint.com

PPI performed the electrical and grid interconnection studies of the project.

PPI has the honor to undertake electrical studies of all the renewable energy power projects in Pakistan. PPI has a team of highly skilled and experienced professionals having worked in WAPDA, Pakistan; and Saudi Electricity Company (SEC or SCECO) in Saudi Arabia in the fields of Power System Analysis, Transmission Planning, Load-Forecasting and Generation Planning. The professional experience spreads over the whole range of operating voltages viz. 765 kV, 500 kV, 380 kV, 220 kV, 132 kV, 110 kV, 66kV and 33kV.

PPI possesses the technical skills to perform Load Flow, Optimal Power Flow, Short Circuit Analysis, Dynamic and Transient Stability Analysis for a grid system of any size.

The professionals of PPI possess thorough hands-on experience on the latest, state-of-the-art tools of power system analysis including PSS/E of Siemens-PTI, PSCAD/EMTDC of EPRI and Manitoba HVDC Research Center.

PART 2

COUNTRY AND INDUSTRY OVERVIEW

2 COUNTRY PROFILE

Area	:	796,096 sq km^2
Population	:	165,000,000 (Approx)

Located in South Asia, Pakistan, officially the Islamic Republic of Pakistan (Urdu:Islami Jumhuriyah Pakistan), shares an Eastern border with India (2,912km), a North-Eastern border with the People's Republic of China (523km), a South Western border with Iran (909km) and a Western and Northern edge with Afghanistan (2,530km). The Arabian Sea is Pakistan's southern boundary with 1,064 km of coastline.

The name "Pakistan" means "Land of the Pure" in Sindhi, Urdu and Persian. It was coined in 1933 by Choudhary Rahmat Ali, who published it in the pamphlet "Now or Never". The name was coined from the names of five territories that were proposed as constituents of a separate country for the Muslims of British India. Officially, the nation was founded as the "Dominion of Pakistan" in 1947, and was renamed as the Islamic Republic of Pakistan in 1956.

The country has a total area of 796,940 km^2 and is nearly four times the size of the United Kingdom. From Gwadar Bay in south-eastern corner, the country extends more than 1,800 km to the Khunjerab Pass on China's border.

3 PAKISTAN ENERGY MARKET

Pakistan's energy requirements are met through Oil, Gas, Hydro Power and Nuclear Power. While Hydro and Nuclear are used only for electricity generation with reference to energy, Oil and Gas are used to supply other areas also. Although Pakistan has one of the largest coal reserves in the world, they remain under-utilized and their share in energy supply is insignificant at the moment.

Production of crude oil per day has increased to 64,948 barrels during 2009-10 from 65,866 barrels per day during the same period last year, showing a decline of 1.36 percent. The overall production of crude oil has decreased to 23.7 million barrels during July-March 2009-10 from 24 million barrels during the corresponding period last year, showing decline of 1.25 percent. On average, the transport sector consumes 30.9% of the petroleum products, followed by power sector (38.5%), domestic (3.9%), other government (2.2%), and agriculture (2.0%) in the year 2010-11.

The average production of natural gas per day stood at 4,032 million cubic feet during July-March, 2010-11, as compared to 4,063 million cubic feet over the same period last year, showing a decrease of 0.7%. The overall production of gas has decreased to 1,471,591million cubic feet during July-March 2010-11 as compared to 1,482,847million cubic feet daily in the same period in 2009-2010, showing decrease of 0.76%. On average, the power sector consumes 27.2% of gas, industrial sector (23.5%), fertilizer (feedstock) (14.2%), domestic (18.7%), commercial sector (3.0%) and cement (0.1%) during period 2010-11. Total installed capacity of electricity (WAPDA, KESC, KANUPP AND IPPs) stood at 22,477 MW during July-March 2010-11, compared to 20,922 MW during July-March 2009-10. Total installed capacity of WAPDA stood at 11,344 MW as of June 2011, of which, hydel accounts for 6,481 MW, thermal accounts for 43.1 percent or 4,900 MW same as compared to year 2009-2010. Therefore, no electricity generation capacity was added by WAPDA in year 2010-2011.

Primary energy supply by sources is shown below:

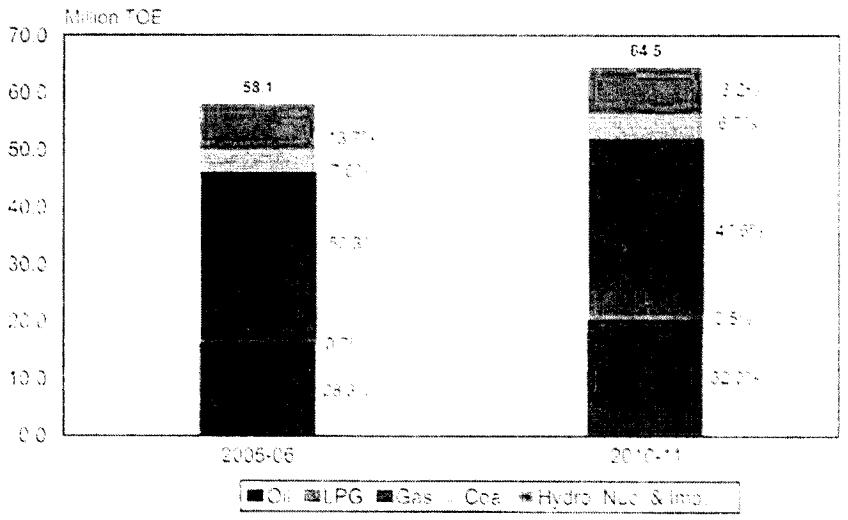


Figure 3-1: Primary Energy Supplies by Sources[1]

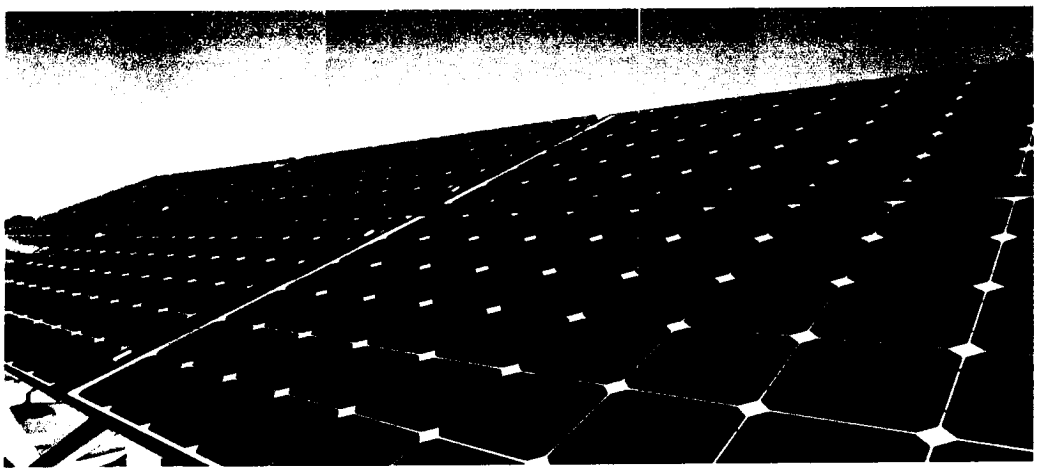
[1] Pakistan Energy Yearbook, 2011

Report No. PPI-53.1-Final-Draft/12

INTERCONNECTION STUDY

For

2 MW Solar PV Power Project by First Solar near Makhial, Punjab



Final Draft Report
(2-11-2012)

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Executive Summary

- The study objective, approach and methodology have been described and the plant's data received from the client First Solar Power is validated.
- The case of September 2013 has been selected to carry out the study assuming the COD by the middle of 2013.
- The IESCO system data as available with PPI for other studies have been used.
- The nearest substation of IESCO from the proposed site of First Solar Power Plant is N.P. Sethi 66/11 kV. Upgrading of N.P. Sethi to 132 kV level is under progress and will be completed by the COD of First Solar. Considering the physical proximity of the grid to the power plant, it has been decided to evacuate the power at 11 kV by making connections with N.P. Sethi Substation at 11 kV to evacuate the maximum power of 2 MW of First Solar power and have been studied in detail.
- The proposed interconnection scheme for First Solar PP has been developed by laying a direct double circuit of 11 kV of length 10 km using Dog conductor from First Solar Power till N.P. Sethi 132/11 kV substation.
- Detailed load flow studies have been carried out for the peak load conditions of September 2013 under normal and N-1 contingency conditions to meet the reliability criteria.
- Steady state analysis by load flow reveals that the proposed scheme is adequate to evacuate the maximum power of 2 MW of the plant under normal and contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at the Solar Power Plant at 11 kV, and the substations of 11 kV and 132 kV in its vicinity. We find that the fault currents for both the proposed scheme are much less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from the Solar Power Plant.
- The maximum short circuit levels of 11 kV bus bar of First Solar Power Plant are 2.96 kA and 2.85 kA for 3-phase and 1-phase faults respectively. Therefore an industry standard switchgear of the short circuit rating of 12.5 kA should be installed at 11 kV switchyard of the Solar Power Plant leaving enough margin to

accommodate fault current contribution from any future reinforcements in that area.

- The dynamic stability analysis of the proposed scheme has been carried out. The stability check for the worst case of three phase fault right on the 11 kV bus bar of the solar power plant substation followed by the final trip of 11 kV circuits emanating from this substation, has been performed. The system is found strong enough to stay stable and recovered with fast damping. The stability of system for far end faults of 3-phase occurring at N.P. Sethi 132 kV bus bar has also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults.
- The proposed scheme of interconnection has no technical constraints or problems, fulfills all the criteria of reliability under steady state load flow, contingency load flows, short circuit currents ratings and dynamic stability analysis. Thus the load flow, short circuit and stability study analyses establish that the proposed scheme of interconnection for First Solar Power Plant is adequate to evacuate the maximum power of the plant under normal and contingency conditions.

Report Contents

1. Introduction

1.1 Background

The site of proposed project is near Makhial in Punjab in the concession area of Islamabad Electricity Supply Company (IESCO). The net output planned to be generated from the site is about 2 MW of electrical power. The electricity generated from this project would be supplied locally to N.P. Sethi 132/11 kV Grid and to the IESCO network through N.P. Sethi 132/11 kV grid located in the vicinity of this project. It is important to note that the existing N.P Sethi 66/11 kV substation is currently being upgraded to 132 kV and this upgrading process will be complete before the COD of First Solar Power Project.

1.2 Objectives

The overall objective of the Study is to evolve an interconnection scheme between First Solar Power Project and IESCO network, for stable and reliable evacuation of 2 MW of electrical power generated from this plant, fulfilling N-1 reliability criteria. The specific objectives are:

1. To develop scheme of interconnections at 11kV for which right of way (ROW) and space at the terminal substations would be available.
2. To determine the performance of interconnection scheme during steady state conditions of system, normal and N-1 contingency, through load-flow analysis.
3. To check if the contribution of fault current from this new plant increases the fault levels at the adjoining substations at 11kV and 132 kV voltage levels to be within the rating of equipment of these substations, and also determine the short circuit ratings of the proposed equipment of the substation at the Solar Power Plant.
4. To check if the interconnection withstands dynamic stability criteria of post fault recovery with good damping after 3-phase faults on the system.

1.3 Planning Criteria

The planning criteria as per Grid Code required to be fulfilled by the proposed interconnection is as follows:

Steady State:

Voltage	± 5 %, Normal Operating Condition
	± 10 %, Contingency Conditions
Frequency	50 Hz, Continuous, ± 1% variation steady state
	49.2 - 50.5 Hz, Short Time
Power Factor	0.80 Lagging; 0.9 Leading (for conventional synchronous generators but would not be applicable to solar PP)

Dynamic/Transient:

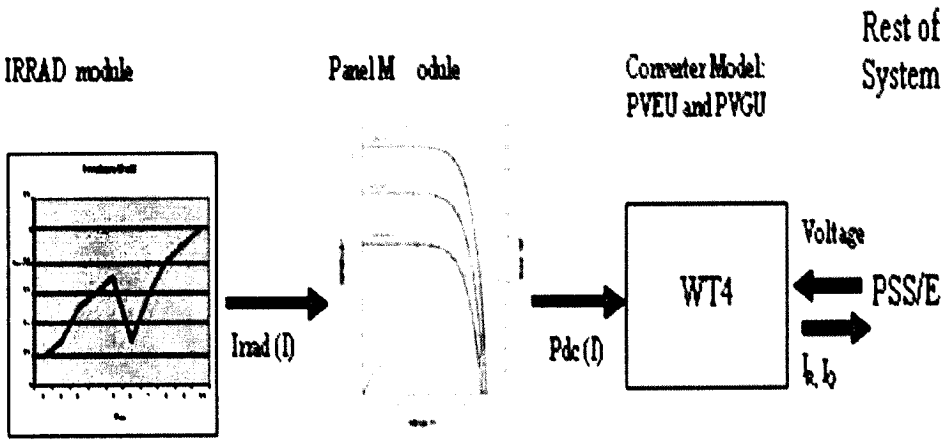
- The system should revert back to normal condition after dying out of transients without losing synchronism with good damping. For 11 kV the total maximum fault clearing time from the instant of initiation of fault current to the complete interruption of current, including the relay time and breaker interruption time to isolate the faulted element, is equal to 200 ms (10 cycles).
- For the systems of 132 kV and above the total normal fault clearing time from the instant of initiation of fault current to the complete interruption of current, including the relay time and breaker interruption time to isolate the faulted element, is equal to 100 ms (5 cycles).

2. Assumptions of Data

The detailed electrical parameters would be designed at the EPC stage. However for the purposes of this study, following assumptions have been made:

2.1 Solar Power Plant data

The Solar Power plant has been modeled according to the following block diagram



The way this works is that the irradiance profile from the sun is used as an input to the panel module which then calculates the DC power at that value of the irradiance. This value is then input to the electrical model of the solar power plant (inverter module) which then goes on to calculate the AC power supplied by the solar power plant.

Due to the presence of the inverter module, from the point of view of the network, the solar power plant is considered a voltage source convertor.

Dynamic Data:

Converter time constant for IQcmd seconds = 0.02 s

Converter time constant for IQcmd seconds = 0.02 s

Voltage sensor for LVACR time constants = 0.02 s

Max Power from PV Plant = 2 MW

Voltage sensor time constant = 1.1 s

2.2 Network data

The 132 and 11 kV network in the area near First Solar Power Project are as shown in Sketches in Appendix-A. The network data of IESCO was available with PPI for other similar studies.

3. Study Approach and Methodology

3.1 Understanding of the Problem

The 2 MW Solar Power Plant by First Solar is going to be a Photovoltaic (PV) based solar project embedded in the 11 kV distribution network of N.P. Sethi. It would run almost all the months of the year though with some variation in its output due to variation in the strength of light in winter and in rainy season.

The existing nearest grid station available for interconnection is N.P Sethi 66/11 kV substation which is currently being upgraded to 132 kV and this upgrading process will be complete before the COD of First Solar. The addition of this source of power generation embedded in local distribution network of this area shall provide relief to the source substations feeding N.P. Sethi from further away. The 11 kV network surrounding N.P. Sethi has significantly load demand. The entire power from the First Solar Power Plant will be utilized locally in meeting the load demand at N.P. Sethi.

The adequacy of IESCO network of 132 kV in and around the proposed site of the Solar Plant would be investigated in this study for absorbing and transmitting this power fulfilling the reliability criteria.

3.2 Approach to the problem

The consultant has applied the following approaches to the problem:

- A base case network model has been prepared for September 2013, which is the completion year of 2 MW Solar PV Plant by First Solar, comprising all 500kV, 220kV and 132 kV system, envisaging the load forecast, the generation additions and transmission expansions for that year particularly.
- Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, have been identified.
- Performed technical system studies for peak load conditions to confirm technical feasibility of the interconnections. The scheme has been subjected to standard analysis like load flow and short circuit, and transient stability study

to check the strength of the plant and the proposed interconnection scheme under disturbed conditions.

- Determine the relevant equipment for the proposed technically feasible scheme.
- Recommend the technically most feasible scheme of interconnection.

4. Development of Scheme of Interconnection

4.1 The Existing Network

The nearest existing IESCO interconnection facilities at the time of commissioning of First Solar Power Project would be as follows:

- N.P. Sethi 66/11 kV Substation which is currently being upgraded to 132 kV and this upgrading process will be complete before the COD of First Solar
- C.S. Shah 132/11 kV Substation

Given the physical proximity of N.P. Sethi to the solar power plant and that fact that the other facilities are at a considerable distance from the plant, the most feasible interconnection of the First Solar Power Plant will be with N.P. Sethi 132/11 kV substation.

The presence of First Solar Plant will provide relief to the source substations of Mangla 132 kV and Mangla 220 kV which are located further away.

4.2 The Scheme of Interconnection of First Solar PV Solar PP :

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of First Solar Power Plant, the interconnection scheme has been developed by laying a direct double circuit of 11 kV of length 10 km using Dog conductor from First Solar Power till N.P. Sethi 132/11 kV substation. This interconnection scheme is shown in Sketch-2 of Appendix-A;

The capacity adequacy will be checked in the load flow analysis.

4.3 Proposed Equipment at First Solar PP 11 kV Substation (Switchyard)

The main equipment at First Solar PP switchyard would consist of;

- Two bus bars of 11 kV with a sectionalizer
- Two breaker panels of 11kV for connection 11 kV circuits to N.P. Sethi

- Breaker panels to connect incoming circuits from inverter collectors at First Solar-PP.
- Breakers to connect auxiliary/station transformers.

4.4 Proposed additions at 11 kV in N.P. Sethi Grid Station

Additional two breaker bays of 11 kV will be required for the interconnection of two 11 kV circuits to be built direct from First Solar to N.P. Sethi Grid.

Total additional 11 kV breaker bays required = 2

5. Detailed Load Flow Studies

5.1 Base Case 2013, Without Solar Power Plant

A base case has been developed for the peak load of 2013 which, using the network data of First Solar Plant and IESCO network.

The results of load flow for this base case are plotted in Exhibit 0.0 of Appendix-B. The system plotted in this Exhibit shows 132 kV network feeding N.P. Sethi connected to its surrounding substations through C.S. Shah, Chakwal etc.

The load flow results show that the power flows on all circuits are within their specified normal current carrying rating. The voltages are also within the permissible limits. We see that the 8.3 MW load demand at N.P. Sethi is met via a 132 kV double circuit from C.S. Shah which carries 4.2 MW/circuit. This power is then distributed on 11 kV level via the 132/11 kV transformer T-1 at N.P. Sethi 132/11 kV substation.

For N-1 contingency conditions we have performed the following cases

Exhibit-0.1	N.P.Sethi to C.S.Shah 132 kV Single Circuit Out
Exhibit-0.2	Chakwal to C.S.Shah 132 kV Single Circuit Out
Exhibit-0.3	Chakwal-New to Chakwal 132 kV Single Circuit Out

In both cases the power flows on all circuits remain within their ratings. Thus we find that there are no capacity constraints in terms of MW or MVA flow in the 11 kV or 132 kV network available in the vicinity of the Solar Power Plant for its connectivity under normal and contingency conditions prior to its connection.

5.2 Load Flow with First Solar Power Plant

We have considered the scenario of September peak 2013 when the 2 MW First Solar Power Project has been completed so that we can judge the maximum impact of the project on the system.

The scheme of interconnection modeled in the load flow for Solar Power Plant is developed by laying a direct double circuit of 11 kV of length 10 km using Dog conductor from First Solar Power till N.P. Sethi 132/11 kV substation.

The results of load flow with the Solar Power Plant interconnected as per proposed scheme are shown in Exhibit 1.0 in Appendix-B. 1 MW/circuit flows from First Solar Power Plant towards N.P. Sethi on the 11 kV double circuit emanating from First Solar Power Plant. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 11 kV or 132 kV circuits under normal conditions i.e. without any outages of circuits.

With part of the load at N.P. Sethi fed by First Solar Plant locally, the flow from C.S. to N.P. Sethi is reduced to 3.2 MW/circuit.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – B as follows;

Exhibit-1.1	First Solar to T-1 11 kV Single Circuit Out
Exhibit-1.2	N.P.Sethi to C.S.Shah 132 kV Single Circuit Out
Exhibit-1.3	Chakwal to C.S.Shah 132 kV Single Circuit Out
Exhibit-1.4	Chakwal-New to Chakwal 132 kV Single Circuit Out

In all the above contingency cases, we find that in the event of outage of any circuit, the intact circuits remain within the rated capacity.
Also the bus bar voltages are well within the rated limits in all the contingency events. Thus there are no constraints in this scheme.

5.4 Conclusion of Load Flow Analysis

From the analysis discussed above, we conclude that the proposed connection of First Solar-PP is adequate to evacuate the power of First Solar-PP under normal as well as contingency conditions.

6. Short Circuit Analysis

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies. .

The maximum fault currents have been calculated with the following assumptions under IEC 909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence
- Desired voltage magnitude at bus bars set equal to 1.10 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydel, thermal and nuclear plants in the system in the year 2013 i.e. all the generating units have been assumed on-bar in fault calculation's simulations.

The assumptions about the generator and the transformers are the same as mentioned in Ch.2 of this report.

6.2 Fault Current Calculations without Solar Power Plant

In order to assess the short circuit strength of the network of 11 kV and 132 kV without the Solar Power Plant for the grid of IESCO in the vicinity of the site of the Plant near N.P. Sethi, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions. These levels will not only give us the idea of the fault levels without the Solar Power Plant and later on how much the contribution of fault current from the Solar Power Plant may add to the existing levels, but also we get a feel of the strength of the proposed node to connect this Power Plant depending on its relative short circuit strength.

The results are attached in Appendix – C.

The short circuit levels have been represented graphically on the bus bars of 11kV and 132 kV along with fault current contributions from the incoming circuits, which are shown in the Exhibit 3.0 attached in Appendix-C.

Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-C for the 11 kV and 132 kV bus bars of our interest i.e. 11 kV and 132 kV circuits lying close to N.P. Sethi. The tabular output is the detailed output showing the contribution to the fault current from the adjoining sources i.e. the lines and transformers connected to that bus. The phase currents, the sequence currents and the sequence impedances are shown in detail for each faulted bus bar.

The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 11 kV and 132 kV substations which normally are 20 kA, 25 kA.

Table-6.1
Maximum Short Circuit Levels without First Solar PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
N.P.Sethi T-1 11kV	5.48	5.12
N.P Sethi 132kV	3.78	2.37
C.S.Shah 132kV	6.14	4.03
Chakwal 132kV	11.27	7.75
Chakwal New 132kV	11.46	8.07

6.3 Fault Current Calculations with Solar Power Plant interconnected

Fault currents have been calculated for both the proposed electrical interconnection schemes. Fault types applied are three phase and single-phase at 11 kV bus bars of Solar Power Plant itself and other bus bars of the 11 kV and 132 kV substations in the electrical vicinity of First Solar Power Plant and N.P. Sethi. The graphic results are indicated in Exhibit 3.1 in Appendix-C.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the

electrical vicinity of Solar Power Plant are placed in Appendix-C. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.2.

Table-6.2
Maximum Short Circuit Levels with First Solar PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
First Solar 11kV	**2.96**	**2.85**
N.P.Sethi T-1 11kV	**5.53**	**5.17**
N.P Sethi 132kV	**3.78**	**2.38**
C.S.Shah 132kV	**6.14**	**4.04**
Chakwal 132kV	**11.28**	**7.76**
Chakwal New 132kV	**11.47**	**8.08**

Comparison of Tables 6.1 with Table 6.2 shows slight increase in short circuit levels for three-phase and single – phase faults due to connection of Solar Power Plant on the 132 kV bus bars in its vicinity. This increase is limited from the point of view of the fact that the Solar Power Plant is a voltage source convertor. We find that even after some increase, these fault levels are much below the rated short circuit values of the equipment installed on these substations. The maximum short circuit levels of 11 kV bus bar of First Solar Power Plant are 2.96 kA and 2.85 kA for 3-phase and 1-phase faults respectively. Therefore an industry standard switchgear of the short circuit rating of 12.5 kA should be installed at 11 kV switchyard of the Solar Power Plant leaving enough margin to accommodate fault current contribution from any future reinforcements taking place in that area

6.4 Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of the Solar Power Plant with the N.P. Sethi 132 kV network, we don't find any problem of violations of short circuit ratings of the already installed equipment on the 132 kV equipment of substations in the vicinity of the Solar Power Plant due to fault current contributions from this plant due to three-phase faults as well as single phase faults.

The maximum short circuit levels of 11 kV bus bar of First Solar Power Plant are 2.96 kA and 2.85 kA for 3-phase and 1-phase faults respectively.. Therefore an industry standard switchgear of the short circuit rating of 12.5 kA should be installed at 11 kV switchyard of the Solar Power Plant leaving enough margin to accommodate fault current contribution from any future reinforcements.

7. Transient Stability Analysis

7.1 Assumptions & Methodology

7.1.1 Stability Models

The assumptions about the generator and its parameters are the same as mentioned in Ch.2 of this report.

We have employed the generic stability models available in the PSS/E model library for dynamic modelling of the PV-Solar power generator, its electrical model and the panel as follows;

Generator	PVGU1
Electrical Model	PVEU1
Solar Panel Model	PANELU1

7.1.2 System Conditions

We have used the system conditions of 2013 as per the COD provided by the client and have kept the output of First Solar PP at full to judge the maximum impact of the plant.

We have tested both the proposed interconnection schemes in and they have been separately modeled in the stability analysis.

All the power plants of WAPDA /NTDC from Tarbela to HubCo have been dynamically represented in the simulation model.

One of the aspects of solar power plants is inverter selection. Although typically inverters did not provide any reactive support to the system, recent advances in inverter technology have allowed inverters not only to provide reactive support to the system but also features like Low Voltage Ride Through (LVRT), Zero Voltage Ride Through (ZVRT) and High Voltage Ride Through (HVRT) which are deemed desirable. We have done studies with an inverter which has reactive support capability of ± 0.95 PF.

7.1.3 Presentation of Results

The plotted results of the simulations runs are placed in Appendix-D. Each simulation is run for its first one second for the steady state conditions of the system prior to fault or disturbance. This is to establish the pre fault/disturbance conditions of the network under study were smooth and steady. Post fault recovery has been

monitored for nine seconds. Usually all the transients due to non-linearity die out within 2-3 seconds after disturbance is cleared in the system.

7.1.4 Worst Fault Cases

Three phase faults are considered as the worst disturbance in the system. We have considered 3-phase fault in the closest vicinity of the Solar Power Plant i.e. right at the 11 kV bus bars of the solar power plant substation, cleared in 10 cycles respectively as well as the faults and stuck breaker case on 132 kV level in which the fault is cleared in 5 and 9 cycles respectively, followed by permanent trip of relevant single circuit emanating from this substation.

7.2 Transient Stability Simulations' Results

7.2.1 Fault at 11 kV Near Solar Power Plant

We applied three-phase fault on the Solar Power Plant 11 kV bus bar, cleared fault in 10 cycles (200 ms) followed by trip of 11 kV circuit between the Solar Power Plant and N.P. Sethi T-1. We monitored different quantities for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – D are discussed as follows;

Fig. 1.1 Bus Voltages

The bus voltages of 11 kV bus bars of First Solar PP, N.P. Sethi T-1 and 132 kV Bus Bars of N.P. Sethi, C.S. Shah and Chakwal-N are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 1.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 1.3 MW/MVAR Output of Solar Power Plant

The pre-fault output of Solar Power Plant was 2 MW and it gets back to the same output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 1.4 Voltage Sensor For LVACR

The value for LVACR is restored to its pre-fault value after the fault clears.

Fig. 1.5 MW /MVAR Flow from First Solar-Solar Power Plant to N.P. Sethi T-1

Followed by clearing of fault, the trip of 11 kV circuit between the power plant and N.P. Sethi T-1 caused the part load of that circuit to flow through the intact 11 kV

circuit between the Solar-PP and N.P. Sethi T-1. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 1.6 Rotor Angles

The rotor angles of the generators of Mangla 220 kV, Mangla 132 kV and Tarbela are plotted relative to machines at Tarbela 132 kV. The results show that the rotor angles get back after the first swing and damps down quickly. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.2 Fault at N.P. Sethi 132 kV – (Far End Fault)

We applied three-phase fault on far-end 132 kV bus bar of N.P. Sethi to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) as standard clearing time for 132 kV systems, followed by trip of a single circuit of 132 kV between N.P. Sethi and C.S. Shah. We monitored different quantities for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – D are discussed as follows;

Fig. 2.1 Bus Voltages

The bus voltages of 11 kV bus bars of First Solar PP, N.P. Sethi T-1 and 132 kV Bus Bars of N.P. Sethi, C.S. Shah and Chakwal-N are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 2.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 2.3 MW/MVAR Output of Solar Power Plant

The pre-fault output of Solar Power Plant was 2 MW and it gets back to the same output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 2.4 Voltage Sensor For LVACR

The value for LVACR is restored to its pre-fault value after the fault clears.

Fig. 2.5 MW /MVAR Flow from N.P. Sethi to C.S. Shah 132 kV

Followed by clearing of fault, the trip of 132 kV circuit between N.P. Sethi and C.S. Shah caused the load of that circuit to flow through the intact 132 kV circuit between

N.P. Sethi and C.S. Shah. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 2.6 Rotor Angles

The rotor angles of the generators of Mangla 220 kV, Mangla 132 kV and Tarbela are plotted relative to machines at Tarbela 132 kV. The results show that the rotor angles get back after the first swing and damps down quickly. The system is strongly stable and very strong in damping the post fault oscillations.

7.3 Conclusion of Dynamic Stability Analysis

The results of dynamic stability show that for the proposed interconnection scheme for First Solar, the system is very strong and stable for the proposed scheme for the severest possible faults of 11 kV and 132 kV systems near to and far of the Solar Power Plant of First Solar. Therefore there is no problem of dynamic stability for interconnection of this Solar Power Plant; it fulfils all the criteria of transient stability. The reactive support from the inverter also helps the system stability.

8. Conclusions

- The study objective, approach and methodology have been described and the plant's data received from the client First Solar Power is validated.
- The case of September 2013 has been selected to carry out the study assuming the COD by the middle of 2013.
- The IESCO system data as available with PPI for other studies have been used.
- The nearest substation of IESCO from the proposed site of First Solar Power Plant is N.P. Sethi 66/11 kV. Upgrading of N.P. Sethi to 132 kV level is under progress and will be completed by the COD of First Solar. Considering the physical proximity of the grid to the power plant, it has been decided to evacuate the power at 11 kV by making connections with N.P. Sethi Substation at 11 kV to evacuate the maximum power of 2 MW of First Solar power and have been studied in detail.
- The proposed interconnection scheme for First Solar PP has been developed by laying a direct double circuit of 11 kV of length 10 km using Dog conductor from First Solar Power till N.P. Sethi 132/11 kV substation.
- Detailed load flow studies have been carried out for the peak load conditions of September 2013 under normal and N-1 contingency conditions to meet the reliability criteria.
- Steady state analysis by load flow reveals that the proposed scheme is adequate to evacuate the maximum power of 2 MW of the plant under normal and contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at the Solar Power Plant at 11 kV, and the substations of 11 kV and 132 kV in its vicinity. We find that the fault currents for both the proposed scheme are much less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from the Solar Power Plant.
- The maximum short circuit levels of 11 kV bus bar of First Solar Power Plant are 2.96 kA and 2.85 kA for 3-phase and 1-phase faults respectively. Therefore an industry standard switchgear of the short circuit rating of 12.5 kA should be installed at 11 kV switchyard of the Solar Power Plant leaving enough margin to

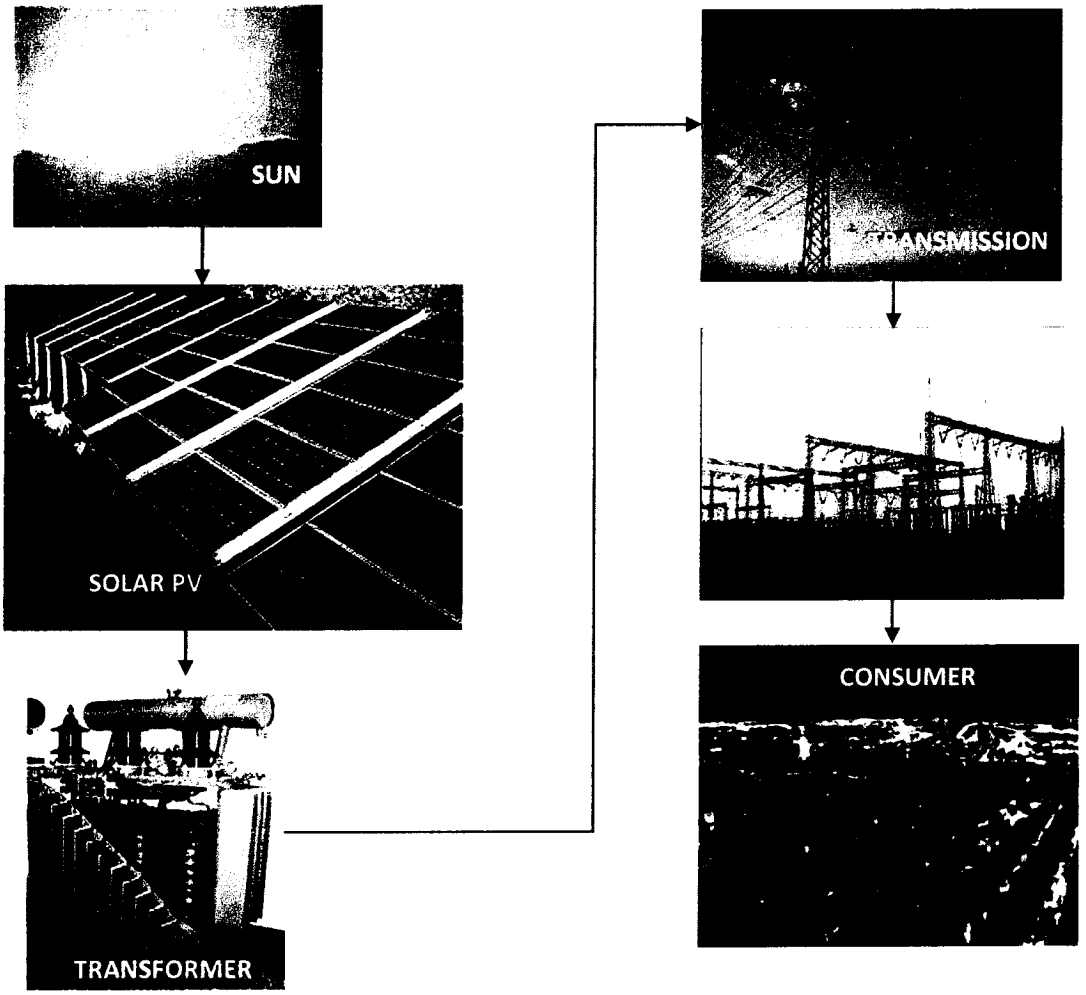
accommodate fault current contribution from any future reinforcements in that area.

- The dynamic stability analysis of the proposed scheme has been carried out. The stability check for the worst case of three phase fault right on the 11 kV bus bar of the solar power plant substation followed by the final trip of 11 kV circuits emanating from this substation, has been performed. The system is found strong enough to stay stable and recovered with fast damping. The stability of system for far end faults of 3-phase occurring at N.P. Sethi 132 kV bus bar has also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults.
- The proposed scheme of interconnection has no technical constraints or problems, fulfills all the criteria of reliability under steady state load flow, contingency load flows, short circuit currents ratings and dynamic stability analysis. Thus the load flow, short circuit and stability study analyses establish that the proposed scheme of interconnection for First Solar Power Plant is adequate to evacuate the maximum power of the plant under normal and contingency conditions.

ORIGINAL

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

2 MW SOLAR PV POWER PROJECT AT KALAR KAHAR, PUNJAB



PROJECT SPONSORS:

FIRST SOLAR (PVT) LTD

PROJECT CONSULTANTS:

RENEWABLE RESOURCES (PVT) LTD; PAKISTAN

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The information contained in the report is meant for the purpose of approval of Project from Environment Protection Agency as per requirement of "Pakistan Environment Protection Act, 1997". Subsequently, Renewable Resources (Pvt.) Ltd (RE2) is not responsible for the contents of the report and any references therein except to the desired purpose of the report. While we have made every attempt to ensure that the information contained in the report has been obtained from reliable and up-to-date sources.

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APPROVAL SHEET

TITLE	:	Initial Environmental Examination (IEE) of 2MW Solar PV Power Project in Punjab sponsored by First Solar (Pvt.) Ltd
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LIST OF ABBREVIATIONS

AEDB	Alternative Energy Development Board
DISCO	Distribution Companies
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
IEE	Initial Environmental Examination
EPA	Energy Purchase agreement
EMMP	Environment Monitoring and Management Plan
GHG	Green house Gas Emissions
IA	Implementation Agreement
LOI	Letter of Intent
MW	Mega Watt
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NGO	Non Governmental Organization
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
PEPA	Pakistan Environment Protection Act
Pak-EPA	Pakistan Environment Protection Agency
RE2	Renewable Resources (Pvt) Ltd
SHEE	Safety Health Environment and Energy
WAPDA	Water And Power Development Authority

COMPANY CONTACT INFORMATION

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PART 1

EXECUTIVE SUMMARY

1 EXECUTIVE SUMMARY

Introduction:

This document is **Initial Environmental Examination (IEE)** of **2MW Solar PV Project** located in Kalarkahar Punjab, Pakistan. The document is prepared for submission to Environment Protection Agency (EPA-Punjab) as per requirement under Pakistan Environment Protection Act (PEPA), 1997. The project company is First Solar Pvt. Ltd. The project sponsor is Monitor Associates Pvt. Ltd which is established in 1990. The company started as a construction company and is providing services in the field of telecommunication, security & surveillance and defense solutions.

Project Consultant

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

The contact details of consultant are given below;

Renewable Resources (Pvt) Ltd	
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Website	www.renewableresources.com.pk
Contact Person	Irfan Afzal Mirza, CEO
Email	Irfanmirza@renewableresources.com.pk

Further information on the qualifications and experience of the Project Sponsors can be found in the body of this Report at **Section 1**.

Project Sponsors:
Monitor Associates Pvt. Ltd is established in year 1990. The company enjoys excellent reputation in the field of telecommunication, security & surveillance and defense. In the year 1999, Monitor Associates decided to participate fully to bring in the renewable energy technologies to the country to meet the clean and environmental friendly power needs of our future.

Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

Further information on the qualification and resources of the underlying shareholders of the Project Sponsors and of their associated professional advisors can be found in the body of this Report at **Section 1**.

Study Methodology:
The study was conducted using standard methodology prescribes by national and international agencies. The IEE comprises of baseline data on existing conditions on physical and biological environment, and social environment together with the anticipated environmental impacts and proposed mitigation measures. Detailed assessment of the social and biological environment of the area was conducted through field survey for the distance up to 10 Km radius of the Project site, however the influence zone of the environmental impacts is considered as 5 Km.

Data was also collected through secondary sources such as published literature and internet to support the findings of the field survey.

The present document reports the finding of IEE carried out to identify potential environmental issues associates with the Project and ensures appropriate mitigation measures to cope with those issues.

The IEE report stands on following strings:

- Relevant Project Information
- Project Alternatives
- Baseline Environmental Conditions
- Possible Impacts
- Mitigation Measures
- Environment Management Plan

Statutory Requirements:
The report fulfils the following regulatory requirements

- Guidelines published by Pakistan Environmental Protection Agency (Pak-EPA),
- Asian Development Bank Polices and Guidelines
- Performance Standards of IFC and World Bank group
- The best practices followed at international level.

Project Overview:
The Project Site is acquired at village called "Mukhayal" in Kalar Kahar, district Chakwal. It is located around 135 kilometers from Rawalpindi and 5 kilometers southwest of Chakwal. The Site is adjacent to the M2 Islamabad – Lahore Motorway. The total land area is 13 acres and is well enough for the installation of 2 MW solar power Project.

Description of Environment:

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, flora and fauna, land use pattern, and socio-economic conditions was undertaken, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors. The environmental and social baseline conditions observed in the Project area are presented in **Section 4** of this report.

The Project is situated in the area where most of the land is used for agriculture. The area can be classified as semi-arid zone because of lack of water (ground and surface). There is no canal, rivers or other water body in that area. Agriculture is the major source of income for most of the people. Wheat, barley, cereals and peanuts are the major crops of the area. The area as whole is virgin environmentally that's why available carrying capacity is not utilized yet.

The area is underdeveloped and it requires development. There are no drainage and water harvesting system, no street lights, no local clinic, no recreational parks nearby, lack of public transport.

This village Mukhyal is less populated area and it is located 6 kilometers from Mianni- Adaa. Most of the people are local and job opportunities are limited. The major source of income is agriculture which is due to lack of rain and deep ground water and no presence of lakes or water bodies nearby. Most of the people travel to other area like other cities or countries for jobs and other business opportunities. According to the survey more than 30 percent people move to other cities and counties.

The area has couple of poultry forms working in 10 to 15 km of the Project area and a windmill project installed by Chinese company. There is no sewage system in that area and no proper water supply system. The local community use bio-fuels like wood as fuels. Road lane is present up to village in good condition and small public transport system developed by local people for their own convenience. There are no railway lines and airport nearby. WAPDA grid station present at a distance of 10 km by road from the village and 7 km from land.

The Project area is semi arid and barren not suitable for agriculture. Coal and salt mines are present at around 30 km from this area.

There is no major source of income. People of the area based upon agriculture in that area. Agriculture production in that area is not up to mark causing financial problems to the local people. There are no industries because of which lack of job opportunities for local people.

There are two hospitals present in 8 to 10 km of Mukhyal village. According to the survey people are satisfied by the services provided by the doctors in that area but ambulance facility in that area is not satisfactory.

Recreational Park is around 25 km away from the local bus stop (miani-adaa).

Stakeholder Consultation:
Stakeholder consultation was carried out as part of IEE study. The main objectives of the consultations were to apprise the stakeholders about the proposed Project activities; obtain their views, concerns and recommendations; and address / incorporate them in the Project design - thus enhancing the environmental and social performance of the Project.

Impact Assessment and Mitigation:
A detailed analysis of Project alternatives are discussed in **Section 5.** During the IEE, the Project potential social and environmental impacts were identified. Each identified environmental and social impact was then characterized with respect to its nature, reversibility, geographical extent, consequence-severity and likelihood. Based upon this characterization, the impacts were then assessed to be of high, medium or low significance. The IEE has recommended appropriate mitigation measures to address the potential environmental and socio-economic impacts. The details of impact assessment and mitigation measures are provided in **Section 6,** which is further supplemented by the Environmental Management Plan (EMP) provided in **Section-7** of this report.

Environmental Management Plan

An Environmental Management Plan (EMP) had been developed to provide an implementation mechanism for the mitigation measures mentioned above and has been updated in the light of the EPA decision circumstances. The EMP provides the organization structure for the environmental and social management system during the Project, and defines the roles and responsibilities of Project players. The EMP includes a mitigation plan, a monitoring plan, the communication and documentation requirements, and training needs, in the context of the environmental and social management of the Project.

Conclusion and Recommendations:

The Project will not cause any significant lasting environmental and social impacts. The environmental disturbance normally associated with construction activities will be minimized through an EMMP, implementation of which will continue during EPC and which includes monitoring arrangements. As solar PV technology is a clean energy source with no significant impacts on the environment with any GHG gas emissions after the construction phase therefore there will be no need for frequent environmental monitoring once the Project is operational. If there will be any major negative environmental impact noticed during operation of the Project, possible mitigatory measures will be taken to reduce the impact.

SECTION 2

INTRODUCTION AND PURPOSE OF STUDY

2 INTRODUCTION AND PURPOSE OF STUDY

2.1 PROJECT PROPONENT

A special purpose company "First Solar Pvt. Ltd" has been incorporated in accordance with the laws and policies of Pakistan for development, construction and operation of the Project as an independent power producer.

The Project is sponsored by Monitor Associates Pvt. Ltd. Establishing in 1990, Monitor Associates (Pvt) Ltd. Started as a construction company and was able to earn repute for applying innovative methods and performing precise engineering and management skills in the emerging market. During its initial years the company developed expertise in civil works and telecommunication services. Later came the expansion phase when the company decided to offer more than engineering services for civil works only.

The company also established its new telecom division to undertake the OFC Network engineering, OFC deployment and erection of communication towers. Beside this the company set up two new departments in 1996 to deal with customization of industrial software, security and surveillance network design and installation. Then in the year 1999 the third phase of expansion came when the company decided to participate fully to bring in the renewable energy technologies to the country to meet the clean and environmental friendly power needs of our future. Our management and engineers continually research market trends and educate themselves with new changes.

Monitor Associates has executed many projects of renewable energy including solar home systems, solar street lights, Solar Part Lights, Solar highway lights at different locations of Pakistan.

Below is given the major projects executed by Monitor Associates Pvt. Ltd;

- Establishing of Satellite network Turnkey basis.
- Mobilink Nation Wide OFC Network
- Mobilink OFC Network on behalf of LT Engineers.
- Azad Jammu &Kashmir area Telecomm uplift Plan
- Deployment and Commissioning of Army DATA Network.
- Installation of Telecomm BTS sites.
- Linking of two army exchanges at Gilgit on Optic Fiber Network
- Solar Lighting System at Defense Housing Authority Lahore.
- Installation of CCTV based surveillance System at GHQ Rawalpindi.
- Installation of CCTV system at Army House for Pakistan Army.
- Construction of Underground exchange building for Pakistan Army.
- Construction of Road project of Azad Jammu & Kashmir Government.
- Construction of Manjhari Tata Pani Road.

2.2 PROJECT BACKGROUND & JUSTIFICATION

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips supply by a considerable amount. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves. Electricity mix of Pakistan (2010-2011) is presented in **Figure 2.1**.

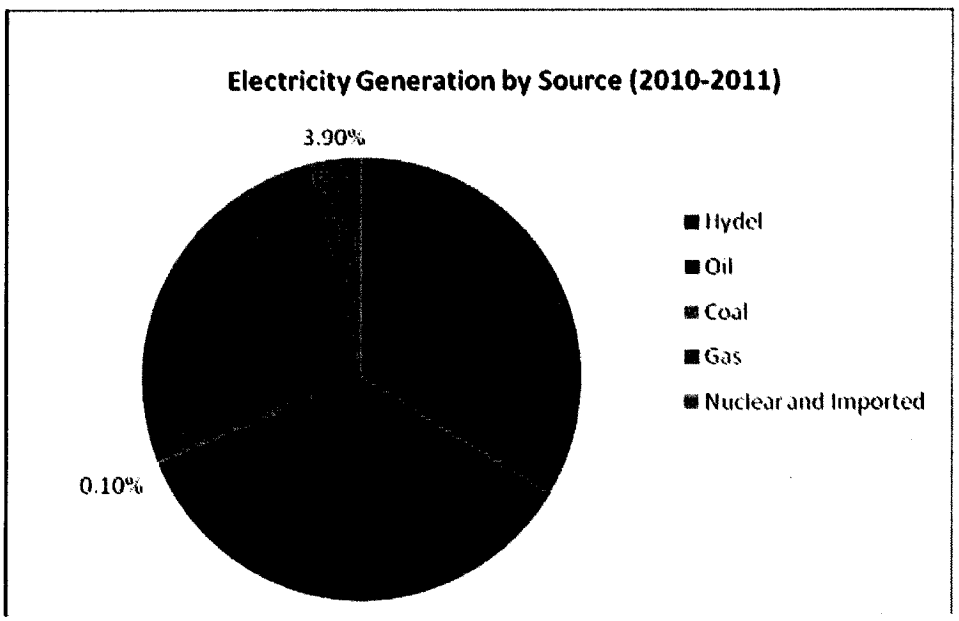

Figure 2.1: Electricity Mix of Pakistan by Source[1]

Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would increase Pakistan's reliance on imported fuels with associated foreign exchange effects. This must be considered in the context of rising fuel costs for gas and oil-based fuels as a result of uncertainty over future supply.

[1] Energy Year Book of Pakistan 2011

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind and solar power.

These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill. As with gas, securing future supplies of coal and hydro-electric power would rely on significant spending on infrastructure. Pakistan has domestic reserves of coal. However, coal currently makes up a very small proportion of total generation, largely the result of most of the reserves being located in one area, the Thar Desert. Exploiting the reserves would require huge and costly upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines before power plant development could commence. Hydro electric power already supplies almost 30% of electricity, and numerous sites for future investment exist, but due to their locations, this would also require significant investment in transmission to meet the expected power needs. Moreover, there are varying political stands on hydro-electric power options.

Looking at how the country's future electricity needs might be met in a way that supports the environmental objectives of the Government of Pakistan; solar power generation has the potential of being a strong contributor. The development of solar power generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions avoiding thermal power generation.

Solar energy, on the other hand, has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy

Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.met in a year. It has an average daily global insolation of 19 to 20 MJ/sq.met per day with annual mean sunshine duration of 8 to 8.5 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m2, 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

To summarize, the sun shines for 250-300 days per years in Pakistan with an average sun shine hours of 8-10 per day. This gives huge amount of energy to be used for electricity generation by solar thermal power plants.

A quick idea for the potential of solar energy in Pakistan can be obtained from the satellite map of solar radiation released by National Renewable Energy Lab (NREL) of USA shown in **Figure2.2.**

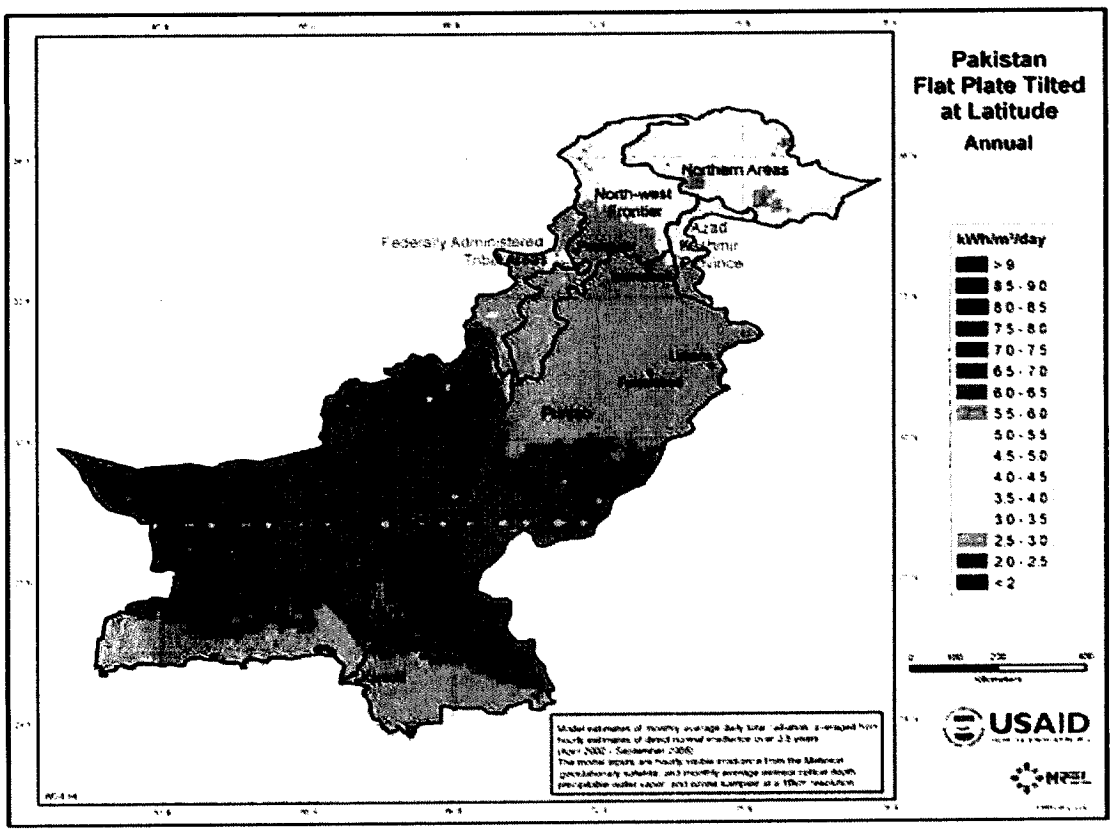

Figure 2.2: NREL Solar Map of Pakistan

2.3 PROJECT OVERVIEW & OBJECTIVES

The Project Site is acquired at village called "Mukhayal" in Kalar Kahar, District Chakwal. It is located around 135 kilometers from Rawalpindi and 05 kilometers southwest of Chakwal. The Site is adjacent to the M2 Islamabad – Lahore Motorway. The total land area is 13 acres and is well enough for the installation of 2 MW solar Power Project.

The objectives of the project are;

i. Contribute to meeting the electricity supply deficit in south west of Pakistan in particular; and country in general.
ii. By using indigenous renewable resources of power generation, avoid depletion of natural resources for future generation and environmental stability.
iii. Contribute to improved electricity supply service delivery to a limited extent specifically having a wide rural outreach.
iv. Improve microeconomic efficiency of the power sector by reducing fossil fuel usage.
v. Reduce greenhouse gas emissions from power generation and contribute to negligible emission, effluent, and solid waste intensity of power generation in the system.
vi. Conserve natural resources including land, forests, minerals, water, and ecosystems.
vii. Develop the local economy and create employment, particularly in rural areas and in a district that is designated a backward area, a priority concern of the Government of Pakistan.

The proposed Project brings in multifold advantages. Not only does it produce clean, pollution free energy, it also has the capacity to provide employment to the people living around the area. It has the capacity of turning the area into clean energy producing hub which will be emulated in other areas of the country.

The brief overview of Project is summarized in **Table 1.1** below;

Table 2.1: Project at a Glance

S. No	Particulars	Description
1	Project Site	Kalarkahar, Province Punjab-Pakistan
2	Land Available for project	13 acres
3	Project Capacity	02 MW
4	Total number of Solar PV modules to be installed	7144 of 280 W
6	Estimated Project Cost	US$7,124,162.81

2.4 OBJECTIVES OF IEE STUDY

Pakistan Environmental Protection Act 1997 (PEPA 1997) requires the proponents of every development project in the country to submit either an Initial Environmental Examination or Environmental Impact Assessment to the concerned environmental protection agency.

The IEE/EIA Regulations 2000 issued under PEPA 1997 provides separate lists for the projects requiring IEE or EIA. Since the total power generation capacity of proposed Project is less than 50 MW, therefore IEE study is performed. Also in various meeting organized by AEDB, EPA, UNEP, it was agreed to follow the same criteria for IEE or EIA as stipulated for thermal and hydro projects.

The purpose of Initial Environmental Examination (IEE) is to identify the reasonably foreseeable environmental effects of the activities that will be conducted under this Project;

This IEE is is prepared to meet the following objectives;

- To highlight existing environmental conditions of the project area along with identification of environmentally sensitive area and concerned stakeholders;
- To Identify the environmental concerns related to development and operational activities of Project execution;
- To assess and address the potential environmental impacts likely to be during the Project activity

- ❖ Describes the illustrative interventions and applicable categorical exclusions;
- ❖ Propose and Recommend additional environmental review and mitigation for certain interventions;
- ❖ Based on the extent of the intervention and impacts, recommends the applicable level of environmental review.

2.5 APPROACH AND METHODOLOGY

The IEE was performed in four main phases, which are described below.

2.5.1 Scoping

The key activities of this phase included:

Project Data Compilation: A generic description of the proposed activities relevant to environmental assessment was compiled with the help of the proponent.

Published Literature Review: Secondary data on weather, soil, water resources, wildlife, and vegetation were reviewed and compiled.

Legislative Review: Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.

Identification of Potential Impacts: The information collected in the previous steps was reviewed and potential environmental issues identified.

Baseline Data Collection: A considerable amount of baseline information on the Project area was available from existing literature and other studies conducted close to the Project area. A field visit was conducted to verify and collect primary data on the site alternatives. A questionnaire was developed and views of local inhabitants were taken about the wind power Project.

2.5.2 Impact Assessment

The environmental, socioeconomic, and Project information collected was used to assess the potential impacts of the proposed activities. The issues studied included potential Project impacts on:

- Geomorphology
- Groundwater and surface water quality, with particular reference to the coast
- Ambient air quality and ambient noise levels
- Ecology of area, including flora and fauna
- Local communities
- Noise impact
- Visual Impact

Wherever possible and applicable, the discussion covers the following aspects:

- The present baseline conditions
- The potential change in environmental parameters likely to be effected by Project related activities
- The identification of potential impacts
- The evaluation of the likelihood and significance of potential impacts
- The defining of mitigation measures to reduce impacts to as low as practicable
- The prediction of any residual impacts, including all long-term and short-term; direct and indirect; beneficial and adverse impacts
- The monitoring of residual impacts

2.5.3 Documentation

This report documenting the IEE process and results is prepared according to the relevant guidelines set by the Pakistan Environment Protection Agency (Pak-EPA).

2.6 METHOD FOR EVALUATING IMPACT

The description of baseline conditions represents the basis for evaluating the impacts of the Project. The description and evaluation of the environmental impacts and proposals for measures to be taken to mitigate and compensate for any determined environmental impacts during construction and operation phase are presented in Environment Management & Monitoring Plan (EMMP) (Annexure-I). In the interest of transparent presentation and evaluation, tabulated evaluation procedures have been applied. On the basis of a point system, the severity of a particular environmental impact together with its general trends i.e. negative or positive is described. The evaluation scale applied is as follows


=High


=Medium


=Low


=No Impact


=Locally Favorable


=Regionally Favorable

For this judgment, international and national standard like those of the World Bank, WHO, etc are used. According to these standards, impacts are evaluated as follows;

High	International and national standards are exceeded.
Medium	Between international and national standards
Low	International and national standards are met