



Nizam Power (Private) Ltd.

EPC & Turnkey Projects

Head Office: G-30/4 KDA Scheme No.5,

Block-8, Clifton Karachi, Pakistan.

Tel : +92-21-3536-0583

Fax : +92-21-3536-0584

The Registrar
National Electric Power Regulatory Authority
2nd Floor, OPF Building, Sector G-5/2
Islamabad.

Subject: Application for Generation License up to 7.72 MW

Dear Sir,

I, Usman Ahmad, Chief Executive Officer, being the duly authorized representative of Nizam Power (Private) Limited by virtue of Board Resolution dated 10th January 2019 by hereby apply to National Electric Power Authority for the Grant of Generation License to Nizam Power (Private) Limited pursuant to section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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

A BANK DRAFT in sum of Rupees 164,960/- being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

The application is filed in triplicate with all annexure appended with each set of the application.

Sincerely,

Usman Ahmad
Chief Executive Officer

Karachi - Head Office
D-64, S.I.T.E., Karachi, Pakistan.
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EXTRACTS OF BOARD RESOLUTION PASSED ON JANUARY 9, 2019

BOARD RESOLUTIONS:

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

"RESOLVED THAT filing of an application with National Electric Power Regulatory Authority for obtaining generation license for setting up 7.72MW Solar power plant by Nizam Power (Private) Limited (a company incorporated under the laws of Pakistan with its registered office located at G-30/4 KDA Scheme No. 5, Block 8 Clifton Karachi, Pakistan (the Company) be and is hereby approved along with all submission of required documents, filings, applicable fees and completion of all necessary formalities".

"FURTHER RESOLVED THAT in respect of submitting an application for the generation license (including any modifications thereto) to National Electric Power Regulatory Authority, MR. USMAN AHMAD, CEO be and is hereby singly empowered and authorized for and on behalf of the Company to:

- (i) review, execute, submit, and deliver the generation license application (including any modifications thereto) for the generation license along with all related documentation required by National Electric Power Regulatory Authority for the grant of the generation license, including any contracts, affidavits, statements, documents, powers of attorney, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements and any other instruments of any nature whatsoever;
- (ii) represent the Company in all negotiations, representations, presentations, hearings, conferences and/or meetings of any nature whatsoever with any entity (including, but in no manner limited to National Electric Power Regulatory Authority, any private parties, companies, partnerships, individuals, governmental and/or semi-governmental authorities and agencies, ministries, boards, departments, regulatory authorities and/or any other entity of any nature whatsoever);

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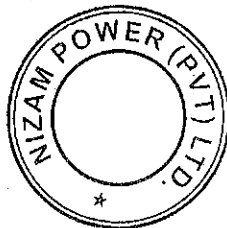
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- (iii) sign and execute the necessary documentation, pay the necessary fees, appear before the National Electric Power Regulatory Authority as needed, and do all acts necessary for completion and processing of the generation license application (including any modifications thereto) and procuring the generation license;
- (iv) appoint or nominate any one or more officers of the Company or any other person or persons, singly or jointly, in their discretion to make communicate with, make presentations to and attend the National Electric Power Regulatory Authority hearings; and
- (vi) do all such acts, matters and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolutions/resolution".

"AND FURTHER RESOLVED THAT Mr. Usman Ahmad, the Chief Executive officer of the Company, 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 by him."

Usman Ahmad
Chief Executive



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1.5.3. Legal Advisor

Mohsin Tayebaly & Co
1st floor, Dime Centre, BC-4 block 9, Kehkashan, Clifton,
Karachi-75600.

The copy of Form — 29 is attached herewith as **Annexure — D**

- 1.6. The list of the directors, senior management, key technical and professional staff of the Applicant Company is provided here under:-

Name	Designation
Usman Ahmad	Chief Executive Officer
Ali Ahmad	Director Finance
Naveed Ahmad	Director
Saad Ahmad	Director Business Development

- 1.7. Brief introduction of the above named officials is as follows:

1.7.1. Usman Ahmad:

Usman Ahmad has a track record of about 13 years and is a pioneer of Solar EPC companies in Pakistan. Usman has done his bachelors in computer information systems from University of Indiana Bloomington, United States of America.

1.7.2. Ali Ahmad

Ali Ahmad has over 17 years of management experience at H. Nizam Din & Sons. He overlooks Nizam's financial Side, Management and Financial Trends of the Solar Market. Ali has Bachelors in Finance from University of Indiana, US.

1.7.3. Naveed Ahmad

Naveed Ahmad brings over 35 years of experience as a specialist in large-scale industry management he has been the man behind renowned tent manufacturer H. Nizam Din & Sons for 30 years now. He did his Bachelors of Science in industrial and operations

engineering from University of Michigan in 1975 and continued on to do his Master's at Michigan as well in the same field.

1.7.4. Saad Ahmad

Saad Ahmad looks after the business development of Nizam Power. With a strong business model, which encourages energy savings for end customers, his role is to identify new customers. Saad has done his bachelors in Marketing from McGill University, Canada.

- 1.8. The curriculum vitae of key personnel are given in **Annexure — E** while the profile showing experience of the Applicant Company, its management staff and its members in the electricity industry is attached as **Annexure - F**.

2. RATIONALE & BUSINESS MODEL

2.1. Rationale

- 2.1.1. It is a common knowledge that availability of electricity in any country has direct effect on its economic and social factors and therefore, in order to measure the affluence of a society, the per capita energy consumption is used as an index to determine its energy sufficiency.
- 2.1.2. Pakistan's per capita energy consumption, 3,894 kWh as against the world average of 17,620 kWh, gives it a ranking of 100 amongst the nations of the world. There is dearth of electricity. As per NEPRA's State of Industry Report 2014, gap between the estimated peak demand and the recorded peak supply of electricity was around 4,406 MW.
- 2.1.3. Generation of electricity in Pakistan is largely on furnace oil whose substantial quantity is imported, prices of the same adversely affect the generation in the country. Although natural gas is a cheaper fuel however its reserves are depleting rapidly. In these circumstances, the use of solar power in Pakistan is quite an attractive alternative mode of generation of electric power. Further, its use does not require refining, transporting and conveying fuels and power over long distances. Moreover, solar

power does not create pollution.

2.1.4. Naturally, Pakistan is located in the Sunny Belt and can take advantage of its ideal situation for utilization of solar energy. The country potential for solar generation is beyond doubt as it has high solar irradiation and enough space for installation of generation system those are ideal for PV and other solar energy applications.

2.1.5. Villages and other areas which are away from grid or distribution system of utilities can also benefit from solar power generation which will also save the extra cost of laying the system and the losses.

2.2. Business Model

2.2.1. The Applicant Company intends to sell electricity to residential, commercial, industrial and agricultural entities (Buyers) through its owned complete on-grid solution of electricity based on solar power (Generating Facilities) under the long term Energy Purchase Agreements (EPAs).

2.2.2. In this regard, the Applicant Company has conducted financial analysis and found this model to be financially workable if there are long term contracts involved. The Company will therefore, plan, design, procure material, construct, install, operate and maintain Generating Facilities at sites of the Buyers.

2.2.3. The Applicant Company shall provide product of the Generation Facilities to the Buyers on terms and conditions as agreed between the Parties so as to recover the cost of investment, working capital, operation and maintenance cost with reasonable rate of return on basis of actual delivery of electricity while taking the risk of shortfall in generation on account of reduction in solar irradiation at its own.

2.2.4. The Applicant Company shall install various Generation Facilities at the sites of the Buyers and understands that the activity of generation and sale of electricity shall take place within the same

premises without crossing any other property or requiring the use of transmission or distribution lines.

2.2.5. The electricity generated through the Generation Facilities of the Applicant Company shall be fed directly into the Distribution Panel of the Buyer and in no case shall be fed or exported to the distribution system of a utility company.

2.2.6. The electricity generated through the Generation Facilities of the Applicant Company shall be less than the total demand of the Buyer hence it will not be a replacement for the relevant utility company but only a partial augmentation.

3. TECHNICAL OVERVIEW

3.1. Technology

- 3.1.1. The electricity shall be generated by use of PV Panels to be installed at the premises of the Buyer and will be supplied directly to the Distribution Panel of the Buyer(s).
- 3.1.2. The Solar PV system will operate in grid interactive / grid tied mode. The grid-tie inverter will be used that will convert direct current **(DC)** electricity into alternating current **(AC)** with built in ability to synchronize with a utility line to supplement the electricity required by the buyer from the distribution company.
- 3.1.3. Grid-tie inverters are also designed to quickly disconnect from the grid if the utility grid will go down and it will ensure that in the event of interruption of electricity from utility, the grid tie inverter will shut down to prevent the energy flow back in the distribution system of the utility. Grid interactive system will supplement utility supplied energy to building or facility.
- 3.1.4. The PV System output will be designed in a manner that it will always be less than the premises load and there will be no export to the utility company's grid.
- 3.1.5. In case the Buyer, subject to NEPRA's permission and agreement with the utility company, opts to export excess electricity to the distribution system through net metering arrangement, then the Applicant Company, on behalf of the Buyer, may provide requisite services.
- 3.1.6. The PV Panels shall convert the solar irradiation into DC electricity and by using inverters; DC supply will be converted into AC supply of 220/400/11KV Volts. In the process, the Applicant will use equipment including:
- PV Modules including structure their installation;
 - Invertors;
 - Surge arrestors;
 - Junction Boxes;
 - PV / AC Electrical Board;
 - Main Distribution Panel;
 - Safety & Protection devices (Automatic with manual override)

- Fuses;
- Wires;
- Breakers;
- Meters;
- Online monitoring devices/ data loggers for
- remote sensing and monitoring;
- Internet access devices/ connects;
- Water taps for panels washing
- Steel Structure,
- Screws, Nuts/Bolts

List of Equipment with Technical details & the Single Line Diagram is attached herewith as **Annexure — G & Annexure — H**

3.1.7. The configuration, technology, model, technical details and design of the Generation Facilities to be acquired, constructed, developed and installed at the premises of Buyers shall be on a standard module but may have slight variations in installation on case to case basis. However, a general overview (on the basis of a model site) has been provided in Annexure G (Equipment and Technical Details) and supplemented by the Annexure H (Single Line Diagram). Grid interconnection and protections required for grid interconnection are in compliance with "NEPRA ARE (Alternative & Renewable Energy) Distributed Generation / Net Metering Rules"

3.1.8. Before the Distribution Panel and after the PV AC Electrical Board there shall be installed the Meter for reading of the actual energy delivered through Generation Facilities of the Applicant Company to the Buyer.

3.2. Capacity

3.2.1. The Applicant shall provide the Generation Facilities of a maximum of up to 7.7MW (per Buyer) at premises of a Buyer which can yield a peak supply of approximately 80% of the same at a point in time.

3.2.2. As there will be multiple sites of varying capacities therefore the overall capacity (Combined Capacity) for the purpose of this Application is 7.7 MW.

3.3. Site(s)

The Generation Facilities to be offered by the Applicant Company shall be at the premises of the Buyer(s) and therefore the Applicant Company does not require purchasing or acquiring a particular site. Moreover, since the electricity generated by the Generation Facilities of the Applicant will not be sold to any electricity utility i.e. DISCO hence it would not require any evacuation by the national grid company (NTDC) therefore the mentioning of a particular site as required under the provisions of NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 is not relevant in this case.

1.4. Interconnection

Since the Generation Facilities of the Applicant Company shall be installed at the site of the Buyer and shall provide electricity to that premises in order to supplement the electricity requirement of the Buyer therefore, the interconnection point shall also be within the premises of the Buyer at the point as identified by the Buyer. The Applicant Company shall deliver electricity to the Buyer's distribution box/panel at 400V level.

1.5. Commissioning & Expected Life

The Generation Facilities by the Applicant shall vary from case to case, as mentioned above therefore the terms as to commissioning shall be as per terms of EPA. However, the average expected life of the Generation Facilities shall be 25 Years.

1.6. Operation & Maintenance

The Applicant Company shall also provide the operation and maintenance, including periodical washing of the PV modules, of the Generation Facilities Installed at the site of the Buyer.

1.7. Environmental

The Generation Facilities by the Applicant, as visualized, will be without emissions and chemical usages; rather, shall be close to natural environment therefore may not involve environmental hazards. The Applicant Company shall use limited quantity of the tap water available at the premises of Buyer for the purposes of washing the PV modules and

shall use the available sewerage for disposal to avoid any negative impact on the environment.

1.8. Monitoring Facilities

The Applicant shall develop, install and maintain a remote monitoring facility at its premises for overall monitoring of the Generation Facilities to be installed at various sites. The Applicant will hire trained staff to carry out maintenance activities on the installed facilities at the Buyer's sites. The Applicant also has a team of qualified engineers to plan and supervise the routine / regular maintenance needs.

1.9. Eligible Sites/Buyers

The Applicant Company requests and proposes that the Authority may kindly allow inclusion of sites and Buyers (the **Eligible Sites/Buyers**) in a schedule, under intimation to NEPRA as and when a Generation Facility is commissioned at any new site, of the generation license to be granted who fulfill the following criteria and parameters:

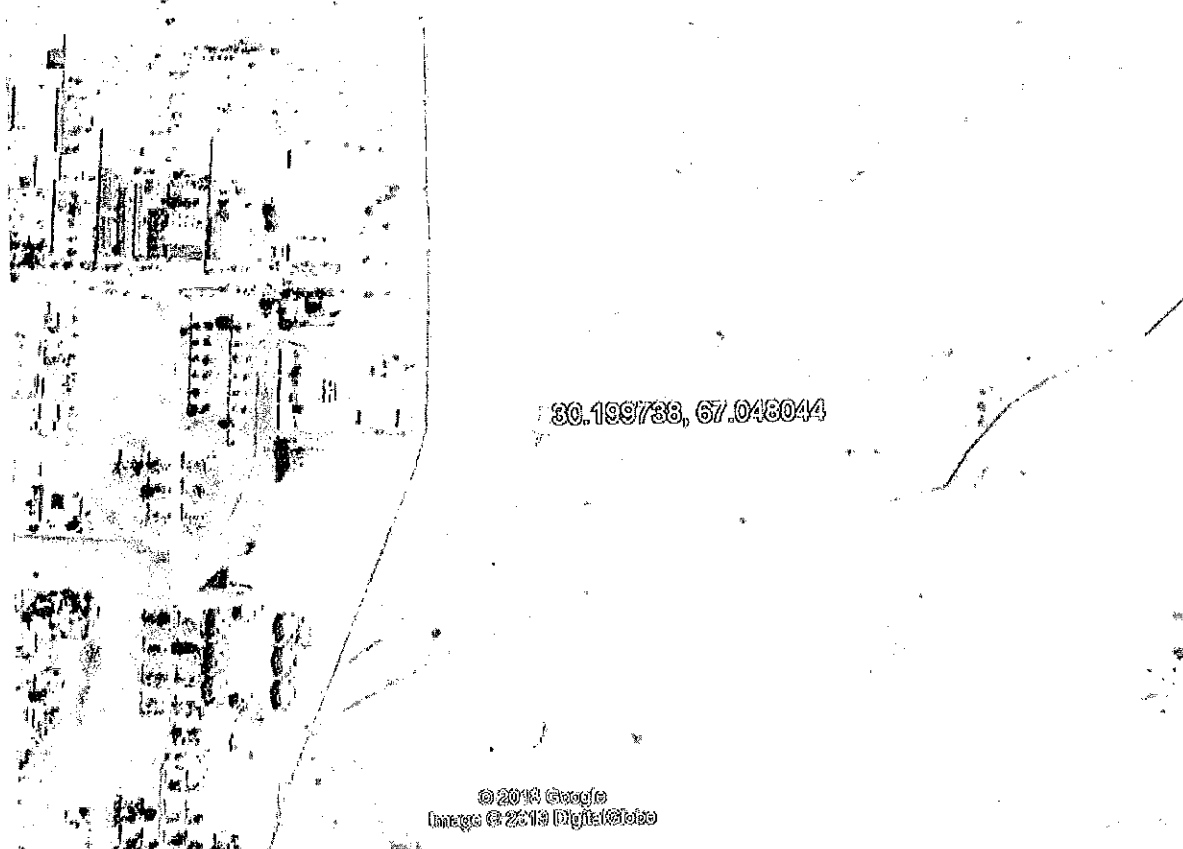
- i. Generation Facility to be setup should be within the site of the buyer;
- ii. Electricity generated through the Generation Facility should not be provided to any premises other than the buyer's premises/site where the Generation Facility is installed;
- iii. Electricity from the Generation Facility should be in addition and supplemental to the electricity being obtained from the electric utility company;
- iv. Capacity of Generation Facility per site should not exceed 7.7MW;
- v. Interconnection point should be within the premises/site where the Generation Facility is installed;
- vi. Generation Facility installed should ensure no back flow of electricity to the distribution system of the utility;
- vii. The delivery of electricity from the PV Modules to the distribution box/panel of the buyer should not require crossing of any public road/area and the distribution network of the electric utility;
- viii. The buyer should not be a defaulter of dues of electricity obtained from electric utility company.

The Applicant Company undertakes to update the record of NEPRA from time to time with reference to increase in the number of Generation Facilities with relevant details of site/buyer as and when the new Generation Facilities are commissioned.

1.10. Model Site Description

1.	Name of Licensee	Nizam Power Pvt. Ltd.
2.	Registered/Business	G-30/4, KDA Scheme No. 5. Block-8, Clifton Karachi
3.	Plant Location	30.199738, 67.048044 30.230636, 67.014436
4.	Type of Generation	Solar Photovoltaic (PV)
5.	Type of Technology	Photovoltaic (PV) Cell
6.	System Type	Grid Tied
7.	Installed Capacity	7.7 mW Peak

1.11. Google image of the site





30.230636, 67.014436

© 2013 Google
Image © 2013 DigitalGlobe

4. FINANCIAL OVERVIEW

4.1. Capital Cost

- 4.1.1. The Capital cost shall include the cost borne by the Applicant Company on feasibility studies, planning, designing, material, construction and installation of the Generation Facilities.
- 4.1.2. The cost of land, step-up transformer, interconnection with distribution system of utility are not required in this case.
- 4.1.3. The expected cost of the project will be PKR 755 Million approximately
- 4.1.4. While making investments in the projects for the Applicant Company would maintain a 75:25 (debt:equity) ratio.

4.2. Source of funding

- 4.2.1. The Applicant shall arrange the required funding through 25% Equity, 75% Debt

5. EXECUTIVE SUMMARY

- 5.1. To supplement the supply of electricity by utilities, the Applicant Company intends to set up small scale solar PV modules (Generation Facilities) at various sites to be provided to multiple buyers for which the Application for grant of Generation License is being submitted before the Authority in terms of Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 read with the relevant Rules and Regulations.
- 5.2. For the reasons mentioned above, it is prayed that Application in hand may please be admitted and a Generation License be granted in name of Nizam Power (Private) Limited for generation of in aggregate of 7.7 MW (gross combined capacity of various Generation Facilities to be installed at the sites of various buyers) through Solar PV Modules, by gradually increasing the number of Generation Facilities at various sites of the prospective buyers who are eligible in terms of the criteria and parameters mentioned above in this application.
- 5.3. It is further prayed that it may also be allowed that the description of sites and buyers shall stand incorporated in the relevant schedule of the

generation license as and when the new site is commissioned. The Applicant Company undertakes to update the Authority, for its official record, any such increase in the number of Generation Facilities with relevant details from time to time.

1. Power Purchaser and Purchase Agreement

Power Purchaser is MES (Military Engineering Services) an Organization Working Under the Umbrella of Armed Forces of Pakistan having its Registered Head Office at GHQ Rawalpindi. MES Will Purchase Power from Nizam Power on a fixed tariff 1 for 15 Years and Tariff 2 for Last 10 Years under a Bilateral Agreement Called Power Purchase Agreement (PPA). Power Purchase Agreement (PPA) will be signed by and between MES And Nizam Power Pvt Ltd.

2. Supply Arrangement

Nizam Power (Private) Limited is developing two separates Photovoltaic (PV) based Solar Farms in Quetta, Baluchistan. The site of proposed project is located in the concession area of Quetta Electric Power Company (QESCO). The combined maximum AC output of the two solar plants will be 6.6MW. The project will start commercial operation by 30th June 2019. The electricity generated from this project would be supplied to the QESCO network through the network developed for evacuation of power. The 6.6MW (AC) Solar Power Plant by Nizam Power will be embedded in the 11 kV distribution network of QESCO. 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 planning criteria as per Grid Code required to be fulfilled by the proposed interconnection is as follows:

Steady State

Voltage $\pm 5\%$, Normal Operating Condition $\pm 10\%$

Contingency Conditions

Frequency 50 Hz, Continuous, $\pm 1\%$ variation steady state 49.2 - 50.5 Hz Short Time

Power Factor ± 0.95 (as per Grid Code Addendum No. 2 for Solar Power Plants)

Site Info

The two distinct sites in Quetta that are available for Solar Power System installation, these are:

1. 95EME
2. Mola Daad

The technical design for both sites is based on following products:

1. Solar Module: 350W (DC Peak), monocrystalline, Tier 1
2. Inverter: Huawei, 100KW (800V, 3 ϕ , 50Hz)
3. Mounting Structure: Hot dip galvanized/Aluminum 2 x 28 (supports 2 rows of 28 modules) at 25° tilt angle. The pitch is kept 6.5m.

2.1. Design Overview

The solar modules produce the DC power by utilizing the solar irradiance and this power is converted into AC by inverters. A peak DC power of 117.6KW is connected on each inverter through a combination of multiple solar modules. 28 modules are connected in series to make up 1 string. 12 such strings are connected on a single inverter. The inverter has 12 built-



in DC switches and built-in DC SPD Type II at each MPPT. The inverter also has built-in AC SPD Type II. The inverter outputs are combined in AC combiner and output from the AC combiner is fed on to the Step-Up transformer, the power is stepped up at 11KV and is transmitted up to the existing substation where it is injected on the relevant feeder.

2.2 Supply Scheme of 95EME

The land required is 13.15 Acres. Proposed DC capacity is 4.0768MWp (11648 x 350W). Total 35 inverters are used. AC power will be 3500KW. 3 AC Combiners are used. 17 inverters are combined in AC Combiner 01, 09 are combined in AC Combiner 2 and 09 are combined in AC Combiner 3.

AC Combiner 01 has: 17 x 100A, 3P, 1150Vac, MCCB & 01 x 1600A, 3P, 1150Vac, MCCB

AC Combiner 02 has: 09 x 100A, 3P, 1150Vac, MCCB & 01 x 1000A, 3P, 1150Vac, MCCB

AC Combiner 03 has: 09 x 100A, 3P, 1150Vac, MCCB & 01 x 1000A, 3P, 1150Vac, MCCB

Power from AC Combiner 01 is fed on to Transformer 01 rated 0.8/11KV, 2000KVA. Power from AC Combiner 02 is fed on to Transformer 02 rated 0.8/11KV, 1250KVA. Power from AC Combiner 03 is fed on to Transformer 03 rated 0.8/11KV, 1250KVA. MV Panels with 630A, 3P VCB are connected at the output of each transformer. Power from transformer 01 is injected on 'Cantt. Feeder' and power output from transformer 02 is injected on 'QESCO Feeder' and power output from transformer 03 is injected on 'Old MES Feeder'. Therefore, 1700KW AC power is injected on 'Cantt. Feeder' (Avg. load: 2000KW), 900KW AC power is injected on 'QESCO Feeder' (Avg. load: 1050KW), and 900KW AC power is injected on 'Old MES Feeder' (Avg. load: 1220KW). The power injection point (Substation) is approximately 950m away from plant electrical room.

2.2. Supply Scheme of Mola Daad

The land required is 10.78 Acres. Proposed DC capacity is 3.645MWp (10416 x 350W). Total 31 inverters are used. AC power will be 3100KW. 2 AC Combiners are used. 17 inverters are combined in AC Combiner 01 and 14 are combined in AC Combiner 2.

AC Combiner 01 has: 17 x 100A, 3P, 1150Vac, MCCB & 01 x 1600A, 3P, 1150Vac, MCCB

AC Combiner 02 has: 14 x 100A, 3P, 1150Vac, MCCB & 01 x 1250A, 3P, 1150Vac, MCCB

Power from AC Combiner 01 is fed on to Transformer 01 rated 0.8/11KV, 1800KVA. Power from AC Combiner 02 is fed on to Transformer 02 rated 0.8/11KV, 1600KVA. MV Panels with 630A, 3P VCB are connected at the output of each transformer. Power from transformer 01 is injected on 'New MES Feeder' and power output from transformer 02 is injected on 'C&SC Feeder'. Therefore, 1700KW AC power is injected on 'New MES Feeder' (load: 1800KW) and 1400KW AC power is injected on 'C&SC Feeder' (load: 1840KW). The power injection point (Substation) is approximately 180m away from plant electrical room.

3 Power Consumption

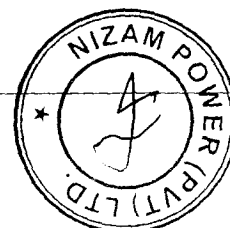
All Generated Electricity will be used by consumed by Premises of MES Quetta. Power Consumption Details are separately mentioned below.

3.1. 95EME

- Cantt. Feeder Load: 2000KW,
- QESCO Feeder Load: 1050KW.
- Old MES Feeder Load: 1220KW.

3.2. Mola Daad

- New MES Feeder load: 1800KW)
- C&SC Feeder load: 1840KW).

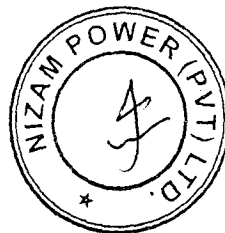


3.3. Reverse Feed in Protection

Grid-tied inverters operate on anti-islanding mode. This feature shuts down the inverter in case of no-grid or load shedding which means the whole solar system is switched off and no power flows into the grid in case of power failure. Secondly, the load at each side is more than the system output. Therefore, all generated electricity will be consumed internally within the premises of MES Quetta. In case, the load becomes less than power being generated then our export control device, using sensors and controllers will limit the generation of solar power to ensure no back feeding into the grid.

4. Grid Interconnection Study

We have Appointed Consultants for Grid Studies, which will be submitted to NEPRA In 6 Weeks.





A001688

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

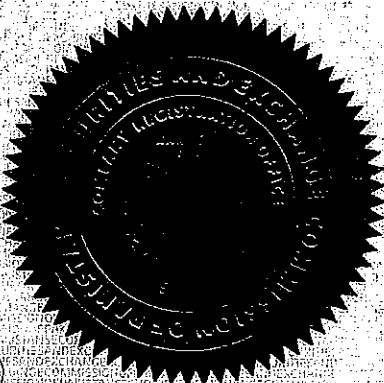
[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. **0088462**

I hereby certify that **NIZAM POWER (PVT.) 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 **Karachi** this **Twenty Third** day of **May**, Two **Thousand** and **Fourteen.**

Incorporation fee Rs. **5,000/=** only




(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE, 1984

[SECTION 205]

FORM 29

1. Incorporation Number: 0088462

2. Name of Company: NIZAM POWER (PVT.) LIMITED

3. Fee Paid (Rs): 900.0

Name and Branch of Bank: KARACHI, MCB - KARACHI, CLIFTON [0074]

4. Receipt No.: E-2014-249489 Date: 06/08/2014

5. Mode of Payment (Indicate): Bank Challan

6. Particulars:

6.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation*** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)
Usman Ahmad	4220167454681	Neveed Ahmad	32 Khayaban e Siamshaer, Phase 5, DHA, Karachi, Pakistan	Chief Executive	Pakistan	Industrialist	01/06/2014	Appointed

6.2. Ceasing of Officer/Retirement/Resignation

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

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

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

Name of Signatory: Usman Ahmad

Designation:

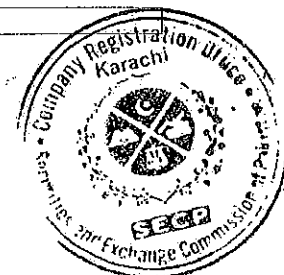
Director

Signature of Chief Executive/Secretary:

Date (DD/MM/YYYY):

06/08/2014

Certified to be true Copy
Amir 13/8/2014
Deputy Registrar of Companies



(Power Generation)

THE COMPANIES ORDINANCE, 1984

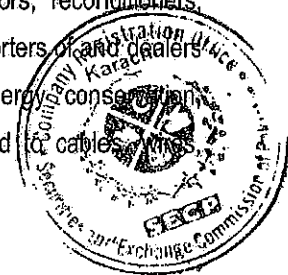
(COMPANY LIMITED BY SHARES)

Memorandum of Association

of

NIZAM POWER (PRIVATE) LIMITED

- I. The name of the Company is "NIZAM POWER (PRIVATE) LIMITED".
- II. The Registered Office of the Company will be situated in the Province of Sindh.
- III. The objects for which the Company is established are all or any of the following:-
 1. To carry on all or any of the businesses of generating, purchasing, importing, transforming, converting, distributing, supplying, exporting and dealing in electricity and all other forms of energy and products or services associated therewith and of promoting the conservation and efficient use of electricity and to perform all other acts which are necessary or incidental to the business of electricity generation, transmission, distribution and supply.
 2. To locate, establish, construct, equip, operate, use, manage and maintain thermal 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, plant and equipment for combined heat and power schemes, offices, computer centres, shops, dispensing machines for pre-payment cards and other devices, showrooms, depots, factories, workshops, plants, printing facilities, warehouses and other storage facilities.
 3. To carry on all or any of the businesses of wholesalers, retailers, traders, importers, exporters, suppliers, distributors, designers, developers, manufacturers, installer, filters, testers, repairers, maintainers, contractors, constructors, operators, users, inspectors, reconditioners, improvers, alterers, protectors, removers, hirers, replacers, importers and exporters of and dealers in, electrical appliances, systems, products and services used for energy conservation equipments, machinery, materials and installations, including but not limited to cables, wires

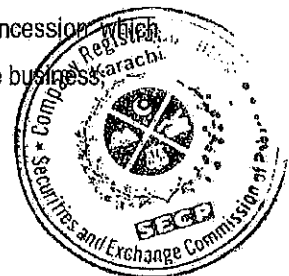


meters, pylons, tracks, rails, pipelines and any other plant, apparatus equipment, systems and things incidental to the efficient generation, procurement, transformation, supply and distribution of electricity.

4. To ascertain the tariff for bulk supply that will secure recovery of operating costs, interest charges and depreciation of assets, redemption at due time of loans other than those covered by depreciation, expansion projects, payment of taxes, and reasonable return on investment, to quote the tariff to bulk purchasers of electrical power, and to prefer petition to the appropriate authority for approval of the schedule of tariff and of adjustments or increases in its bulk supply tariff, where desirable or necessary.

5. For the purposes of achieving the above objects, the company is authorized:-

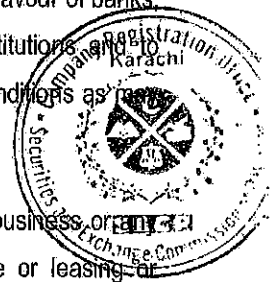
- (1) to purchase/import raw materials and allied items required in connection thereto in any manner the company may think fit;
- (2) to do and perform all other acts and things as are incidental or conducive to the attainment of the objects of the company;
- (3) to own, establish or have and maintain shops, branches and agencies all over Pakistan or elsewhere for sale and distribution of cables, wires, meters, pylons, tracks, rails, pipelines and any other plant, apparatus equipment, systems and things incidental to the efficient generation, procurement, transformation, supply and distribution of electricity;
- (4) to make known and give publicity to the business and products of the company by such means as the company may think fit;
- (5) to purchase, acquire, protect, renew, improve, use and sell, whether in Pakistan or elsewhere any patent, right, invention, license, protection or concession which may appear advantageous or useful to the company for running the business.



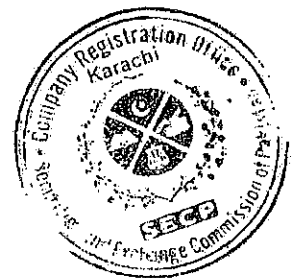
- (6) to pay all costs, charges and expenses, if any, incidental to the promotion, formation, registration and establishment of the company;
- (7) to borrow and arrange the repayment of money from banks/financial institutions or any lawful sources whether in Pakistan or elsewhere and in such manner as the company may think fit, including the issue of debentures, preference shares, bonds, perpetual or otherwise charged upon the whole or any part of the company's property or assets, whether present or future, and to purchase, redeem or payoff such securities;
- (8) to purchase, hold and get redeemed shares, debentures, bonds of any business, company, financial institution or any Government institutions;
- (9) to guarantee the performance of contracts, agreements, obligations or discharge of any debt of the company or on behalf of any company or person in relation to the payment of any financial facility including but not limited to loans, advances, letters of credit or other obligations through creation of any or all types of mortgages, charges, pledges, hypothecations, on execution of the usual banking documents or instruments or otherwise encumbrance on any or all of the movable and immovable properties of the company, either present or future or both and issuance of any other securities or sureties by any other means in favour of banks, Non-Banking Finance Companies (NBFCs) or any financial institutions and to borrow money for purpose of the company on such terms and conditions as may be considered proper.

6. It is, hereby, undertaken that the Company shall not engage in banking business, or business of investment company or non-banking finance company or insurance or leasing or business of managing agency or in any unlawful business and that nothing contained in the object clauses shall be so construed to entitle it to engage in such business directly or indirectly and the Company shall not launch multi-level marketing (MLM), Pyramid and Ponzi schemes.

IV. The liability of the members is limited.



V. The authorized capital of the company is Rs. 100,000/- (Rupees One Hundred Thousand only) divided into 1000 ordinary shares of Rs. 100 each with power to enhance, reduce or consolidate the share capital and to divide the shares of the company into different classes and kinds subject to the provisions of the Companies Ordinance, 1984.



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

Name and surname (Present and Former) in full (In Block Letters) and NIC Number	Father's/ Husband's Name in Full	Nationality with any former Nationality	Occupation	Residential address in Full	No. of Shares	Signature
NAVEED AHMED 42301-6456777-3	S/O. FAIZ AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	400 FOUR HUNDRED	
ALI AHMED 42301-3946602-9	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
USMAN AHMED 42201-5745466-1	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
SAAD AHMED 42301-2143713-3	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
				Total :	1,000 (ONE THOUSAND) ORDINARY SHARES.	

Dated: May 20, 2014

WITNESSED BY:

NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT) LIMITED.

5TH FLOOR, AWT PLAZA, I.I. CHUNDRIGAR ROAD, KARACHI, PAKISTAN.



Certified to be true Copy
Amir
 13/8/2014
Deputy Registrar of Companies

THE COMPANIES ORDINANCE, 1984

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

NIZAM POWER (PRIVATE) LIMITED

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Ordinance, 1984 (the "Ordinance") shall be the regulations of **Nizam Power (Private) Limited** (the "Company") so far as these are applicable to a private company.

PRIVATE COMPANY

2. The Company is a "Private Company" within the meaning of Section 2(1)(28) of the Ordinance and accordingly:

- (1) No invitation shall be made to the public to subscribe for the shares or debentures of the Company.
- (2) The number 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 or 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 the manner and to the extent herein appearing.

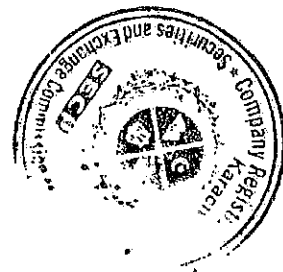
TRANSFER OF SHARES

3. A member desirous to transfer any of his shares shall first offer such shares for sale or gift to the existing members and in case of their refusal to accept the offer, such shares may be transferred to any other person, as proposed by the transferor member, with the approval of the Board of Directors.

DIRECTORS

4. The number of directors shall not be less than two or a higher number as fixed under the provisions of Section 178 of the Ordinance. The following persons shall be the first directors of the Company and shall hold the office upto the date of First Annual General Meeting:

1. Naveed Ahmad
2. Ali Ahmad
3. Usman Ahmad
4. Saad Ahmad



We, the several persons whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of these articles of association, and we respectively agree to take the number of shares in the capital of the company set opposite our respective names.

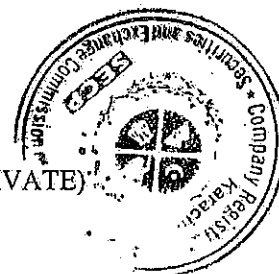
Name and surname (Present and Former) in full (In Block Letters) and NIC Number	Father's/ Husband's Name in Full	Nationality with any former Nationality	Occupation	Residential address in Full	No. of Shares	Signature
NAVEED AHMED 42301-6456777-3	S/O. FAIZ AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	400 FOUR HUNDRED	
ALI AHMED 42301-3946602-9	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
USMAN AHMED 42201-5745466-1	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
SAAD AHMED 42301-2143713-3	S/O. NAVEED AHMED	PAKISTANI	BUSINESS OF ELECTRICITY GENERATION	HOUSE NO. 32, KHAYABAN- E- SHAMSHEER, DHA PHASE- V, KARACHI	200 TWO HUNDRED	
				Total :	1,000 (ONE THOUSAND) ORDINARY SHARES.	

Dated: May 20, 2014

WITNESSED BY:

NATIONAL INSTITUTIONAL FACILITATION TECHNOLOGIES (PVT) LTD.
LIMITED.

5TH FLOOR, AWT PLAZA, I.I. CHUNDRIGAR ROAD, KARACHI, PAKISTAN.



Certified to be true Copy
18/8/2014
Deputy Registrar of Companies

1. O&M Description

The PV power plant is expected to functionally operate for 25 years that operation and maintenance is critical to guarantee power generation. A large PV system is consisting of many components and auxiliary devices, their safety, reliability and effective collaboration are crucial for guarantee the power generation as expected. In this document, it will illustrate what to be maintained and how to maintain the PV power plant in every aspect. The purpose of O&M is to guarantee the performance ratio and safety of the power plant.

2. Types O&M Service

Preventive

General condition

There will be a series of preventive maintenance activities to keep the PV plant in a high performance and a long life. We take systematic and rigorous preventive actions to identified faults. Any faults will be recorded and fixed according to the corrective maintenance and condition-based maintenance.

Normally there are several service activities as below in preventive maintenance:

1. Control of PV modules: Thorough verification of the general status of PV modules. Checked is overall status of the module front and back side, including voltage, current and temperature. Furthermore the modules are random checked hot point.

Material tool: Multimeter, PV tester

2. Control of inverters: Thorough verification of the general status of electrical connections, inverters and State of inverters: cleanliness and cooling condition of the inverter and other electrical appliances of the installation. Possible deviation need to be corrected. We ensure that no dust entered into the inverters housings. Operation of inverters: operation of the internal blower of the inverter should be optimized by removing dust. The status indicators of the inverters need to be checked on correct operation. Also to verify on strange failures, alarms, humming's and overheating. In case detect any failure needs to be corrected according to the

Inverter manual.

Material tool: Multimeter, insulation tape and etc.

3. Cleaning of sensors: Thorough verification of the general status of sensors. Check is the overall status and cleanliness of the sensors.

Material tool: Some washing special tools and calibration tools

Corrective

Normally there are several service activities as below in corrective maintenance:

1. Change of PV modules
2. Change of inverters
3. Change of internal components of electrical devices
4. Restarting the PV installation: When the PV installation has been shutdown from the grid it needs to be re-started as soon as possible. For this situation the shortest reaction is required to minimize the production loss.
5. Restarting the data acquisition system: When the PV installation has been shutdown from the internet, the router and data logger needs to be re-started as soon as possible.

3. O&M General Rules

Components maintenance

3.1 Modules

- a) Module clip must be tightened without any loosening.
- b) Modules panels should not be deformation, twist, burnt or broken.
- c) Cleaning of modules will be done by dry or wet soft cloth material. Corrosive fluid and hard material are forbidden. Frequency of cleaning should refer to **Module cleaning rules**.
- d) In heavy rain, snow and high wind condition, cleaning is forbidden.
- e) Carry out chronic negative test of module to ensure the heavily degraded and disqualified modules are replaced by new one which reduces mismatch loss.
- f) When cleaning modules, water or cleaning liquid should not be flow into the junction box and connection terminals.

- g) The junction box should not be deformation, twist, burnt or broken, also the connection terminals should be well tightened.
- h) In condition of no shading, irradiance above 500W/m², wind speed below 2m/s, temperature differential in one modules surface should below 20oC, measured by tools of infra-red thermograph.
- i) Grounding test (with ground meter) of module to module, module to ground. Ground resistance should below 4Ω.

Module cleaning rules:

- 1. Determine all modules in one specific combiner box as reference for comparison for power loss due to soiling. The reference modules will be cleaned at least 2 times per week.
- 2. When the reference modules power output are 2% higher than nearby modules, the modules in the whole power plant will be considered for cleaning.
- 3. When the reference modules power output are 3% higher than nearby modules, all modules in the power plant must be cleaned.
- 4. All modules must be cleaned at least once per month as mentioned in the maintenance schedule.

3.2 Combiner box

- a) Check of combiner box fixation with respect to loosening.
- b) Check of water leakage, deformation, rust and flag early obsolescence or indistinct. The waterproof lock should be opened and valid.
- c) The combiner box should be stably fixed on foundation.

3.3 Inverter

- a) Check water leakage, rust and flag early obsolescence lost or indistinct.
- b) All connection inside the inverter should be stable including internal control cable, DC and AC cable and monitoring cables.

- c) There should be no strange noise and huge noise during operation, replace the fan if it is faulty.
- d) The module, inductor, transformer and heat dissipation fan should turn and off according to the setting temperature, if the heat dissipation fan produces abnormal noise vibration, the inverter should be turn off for detail check.

3.4 Mounting structure

- a) Check steadiness of the mounting foundation/system and inspect regarding corrosion at substructure.
- b) All of the screw, grounding clamps should be fasten tightly and welding should be intact.
- c) The PV arrays should not be deformed, dislocated or loose.
- d) The screws for fixing the mounting structure should not be loose; mounting structures with foundation bed should be steady, neat and no displacement.

3.5 Cable

- a) Check the PV cables tightness of connection, replace the connector if damage, burnt and water leakage occur.
- b) PV cable behind the panels should be tighten and avoid severe movement.
- c) All cables must be place in tidiness.
- d) Any replacement of cable should be reported and should be relocated at the original position.



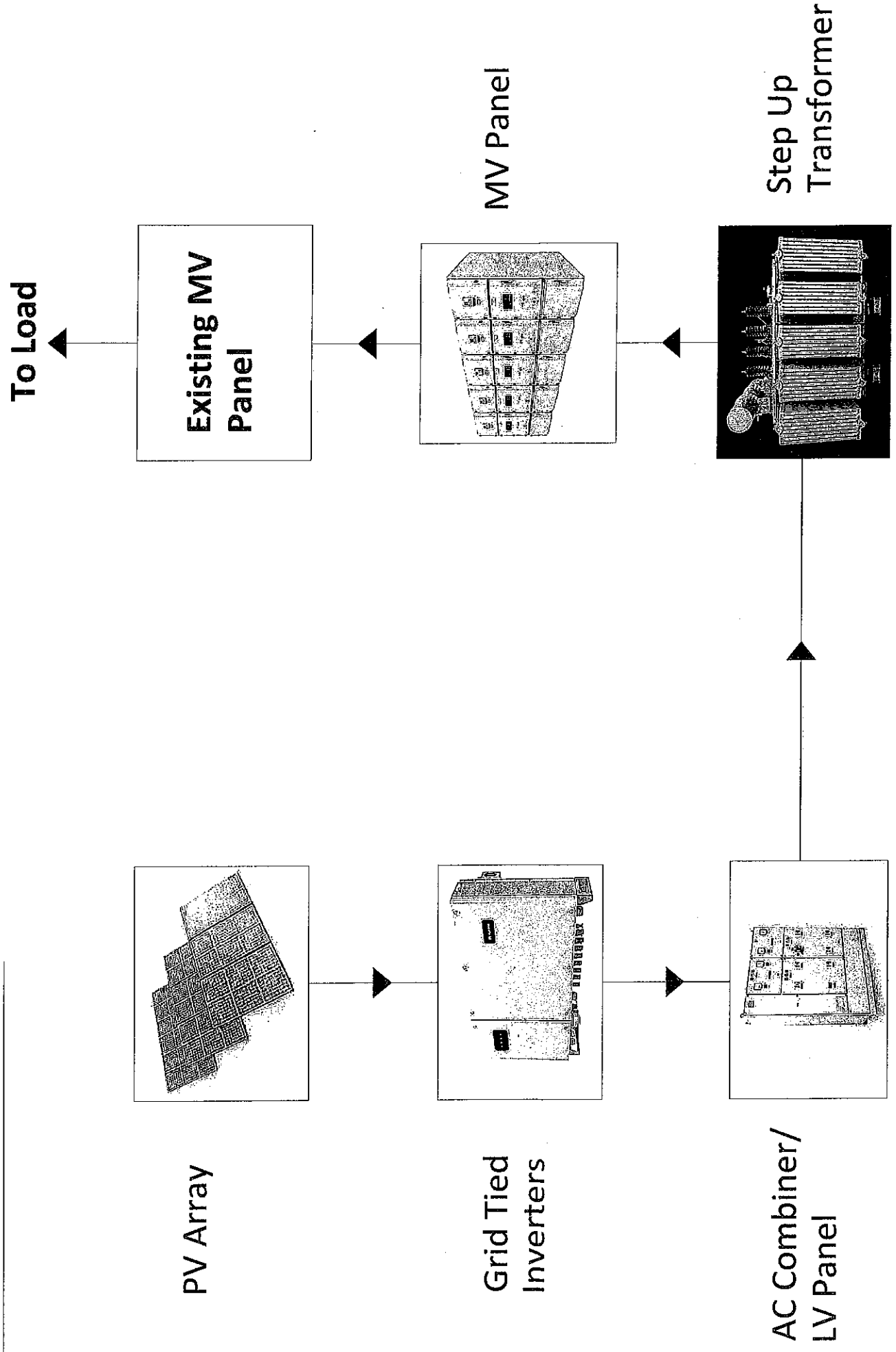
Monthly Check List

Name _____ Address _____
Ph. _____

Physical Check up	For the Month of _____						
Condition of Panels	Breakage	Dust	Rust	Moisture	Fading	connection	Comments
Condition of Inverter	Breakage	Dust	Rust	Moisture	Fading	connection	
Condition of Wiring	Breakage	Dust	Rust	Moisture	Fading	connection	
Condition of D/B	Breakage	Dust	Rust	Moisture	Fading	connection	

Electrical Check up	For the Month of _____						
Panels	Volts	Amps	Temp.	Watts			Comments
Inverter	Volts	Amps	Temp.	Watts			
Wiring	Volts	Amps	Temp.	Watts			
Distribution Box	Volts	Amps	Temp.	Watts			

Conceptual Design



Technical Details and Design of Facility

- Solar modules of 350W (Mono crystalline) are used in the design with 18.1% efficiency
- Huawei inverters are used in the design, where each inverter has a rated AC output power of 100KW at 800V, 3W+PE and 99% efficiency
- PEL/Siemens/Transpower/Equivalent ONAN Step up Transformers of rating 0.8/11kV, 1x 1800kVA, 1x 1600kVA at Mola Dad site and 2x 1250kVA, 1x 2000kVA at 95EME site, are used to step up the voltage to 11KV.
- Vacuum Circuit Breakers of rating 630A, 25kA, 11kV are used for the overall protection of the MV system
- Robust Earthing System will be established including number of earthing pits for DC and AC system to protect the structures, inverters, transformers and other equipment from any kind of faults
- Lightning Arrestors are also incorporated in the design to provide protection from lightning strikes
- Meteorological sensors are used which provide real time data of site's temperature, wind speed and instantaneous irradiation
- AC output of the system is 6600kW (3500kW at 95EME + 3100kW at Mola Dad)
- The maximum land area allocated to install the both systems is 23.93 Acres (13.15 Acres for 95EME Site and 10.78 Acres for Mola Dad site).

Bill of Materials:

BOM 3.645MWp MOLA DAD Site

Sr. No.	Components	Quantity
1	Solar Modules 350W (Mono Crystalline)	10416
2	Huawei 100KW solar inverters	31
3	Step up Transformers 0.8/11kV, 1600kVA	1
4	Step up Transformers 0.8/11kV, 1800kVA	1

**7.722 MWp On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

5	Vacuum Circuit Breakers 630A, 25kA,11kV	4
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BOM 4.076MWp 95EME Site

Sr. No.	Components	Quantity
1	Solar Modules350W (Mono Crystalline)	11648
2	Huawei 100KW solar inverters	35
3	Step up Transformers 0.8/11kV, 2000kVA	1
4	Step up Transformers 0.8/11kV, 1250kVA	2
5	Vacuum Circuit Breakers 630A, 25kA,11kV	6

Combined BOM 7.722MWp (4.076MWp + 3.057 MWp)

Sr. No.	Components	Quantity
1	Solar Modules350W (Mono Crystalline)	22064
2	Huawei 100KW solar inverters	66
3	Step up Transformers 0.8/11kV, 2000kVA	1
4	Step up Transformers 0.8/11kV, 1800kVA	1
5	Step up Transformers 0.8/11kV, 1600kVA	1
6	Step up Transformers 0.8/11kV, 1250kVA	2
7	Vacuum Circuit Breakers 630A, 25kA,11kV	10

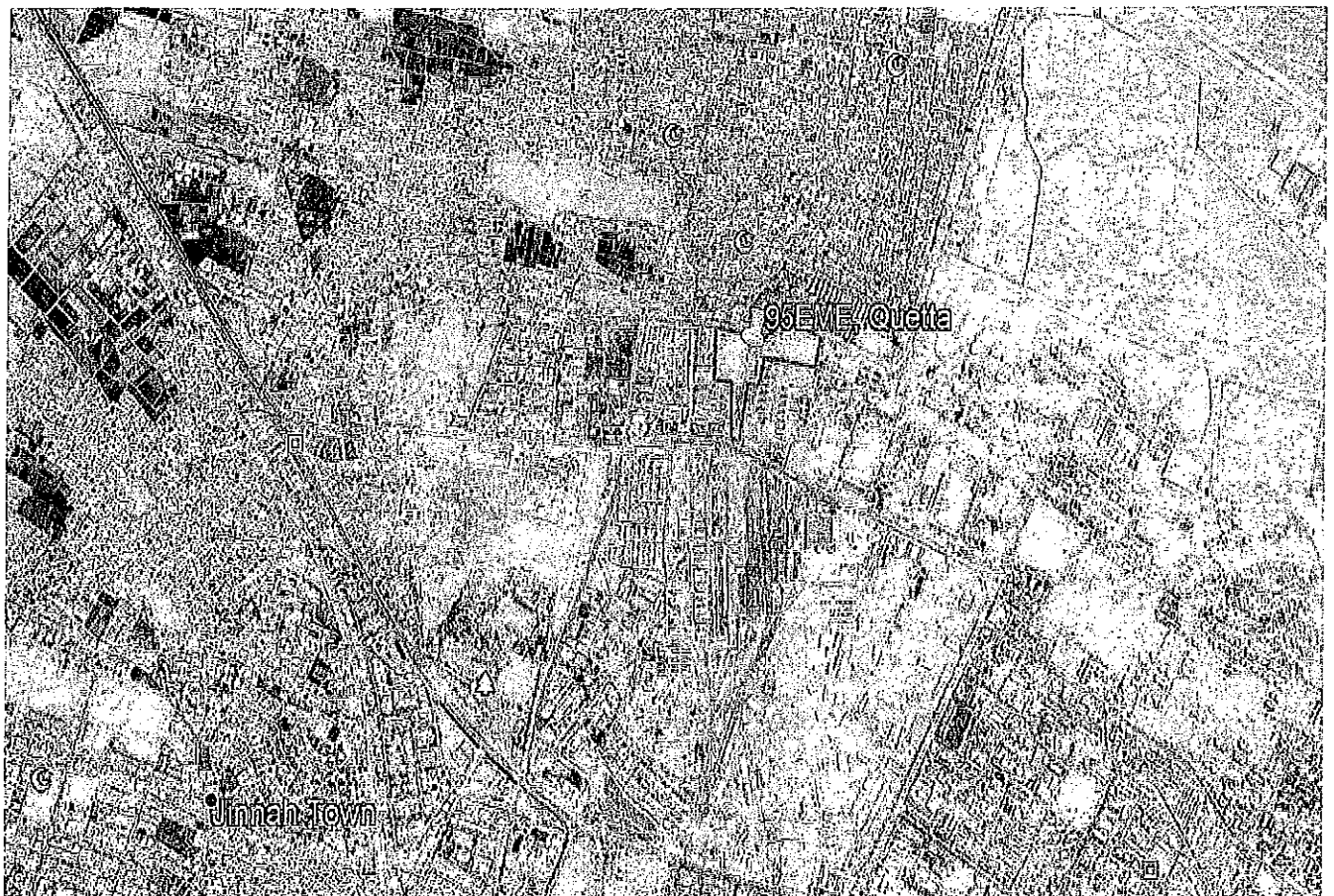
Technology Used:

Sr. No.	Parameters	
1	Technology	Solar Photovoltaic (SPV)
2	Size of Plant	7.722MWp (4.076MWp + 3.645 MWp)
3	Solar Modules	350W Mono Crystalline Solar Modules Tier 1
4	Inverter	100KTL Grid Connected Inverter
5	Transformer	PEL/Siemens/Transfopower/Equivalent 0.8/11kV, 2000kVA, 1800kVA, 1600kVA and 1250kVA ONAN
6	Vacuum Circuit Breaker	630A, 25kA,11kV

Location Maps, Site Maps, Land

i) 95EME, Quetta

4.0768MWp Solar Power Plant will be set up at 95EME, Quetta



ii) Mola Dad, Quetta

3.6456MWp Solar Power Plant will be set up at Mola Dad, Quetta



Efficiency Parameters

Calculation of PR

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

Ratio is defined as:

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

Where,

Z1 = Accumulated electricity generated during testing period (KWh)

Z2 - Total system installed capacity (KWs)

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

1A - Intensity of irradiance under STC condition = 1000W/m²

Calculation of CUF

Capacity Utilization Factor of the plant is calculated using this formula:

$$\text{Capacity Utilization Factor} = \frac{\text{Specific Production } kWh/KWp}{24 \times 365} \times 100$$

**7.722 MW On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

Energy Generation:

Energy Generation at 3.645MWp MOLA DAD Site

Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.00%
2	Capacity Utilization Factor	22.32%
3	Energy Generation Units	7129 MWh/year

Energy Generation at 4.076MWp 95EME Site

Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.07%
2	Capacity Utilization Factor	22.34%
3	Energy Generation Units	7980 MWh/year

Combined Energy Generation at 7.722MWp (4.076MWp + 3.645 MWp) System

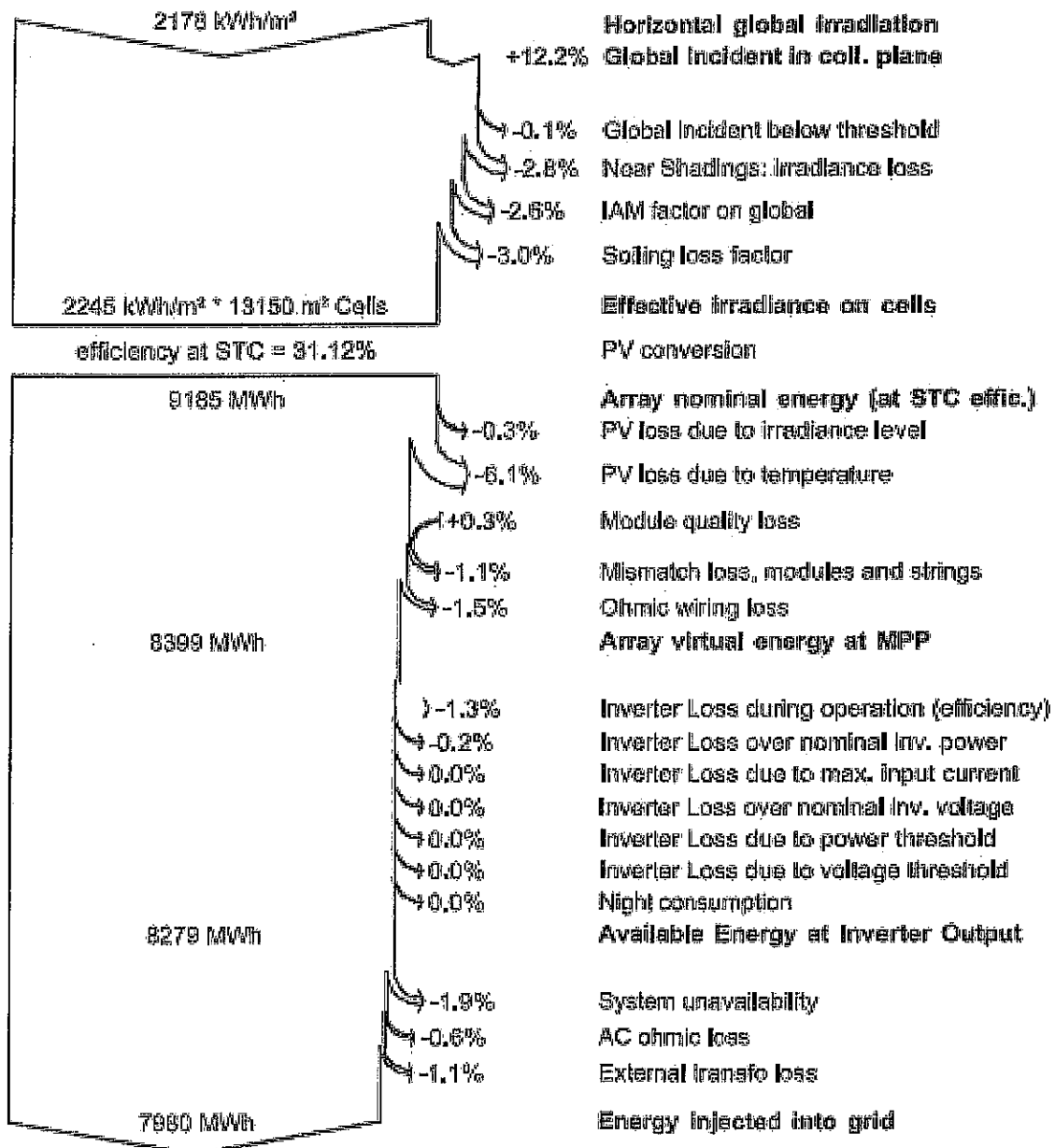
Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.03%
2	Capacity Utilization Factor	22.33%
3	Energy Generation Units	15109 MWh/year

**7.722 MW On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

Loss Diagram for 95EME Solar Plant:

Loss diagram over the whole year

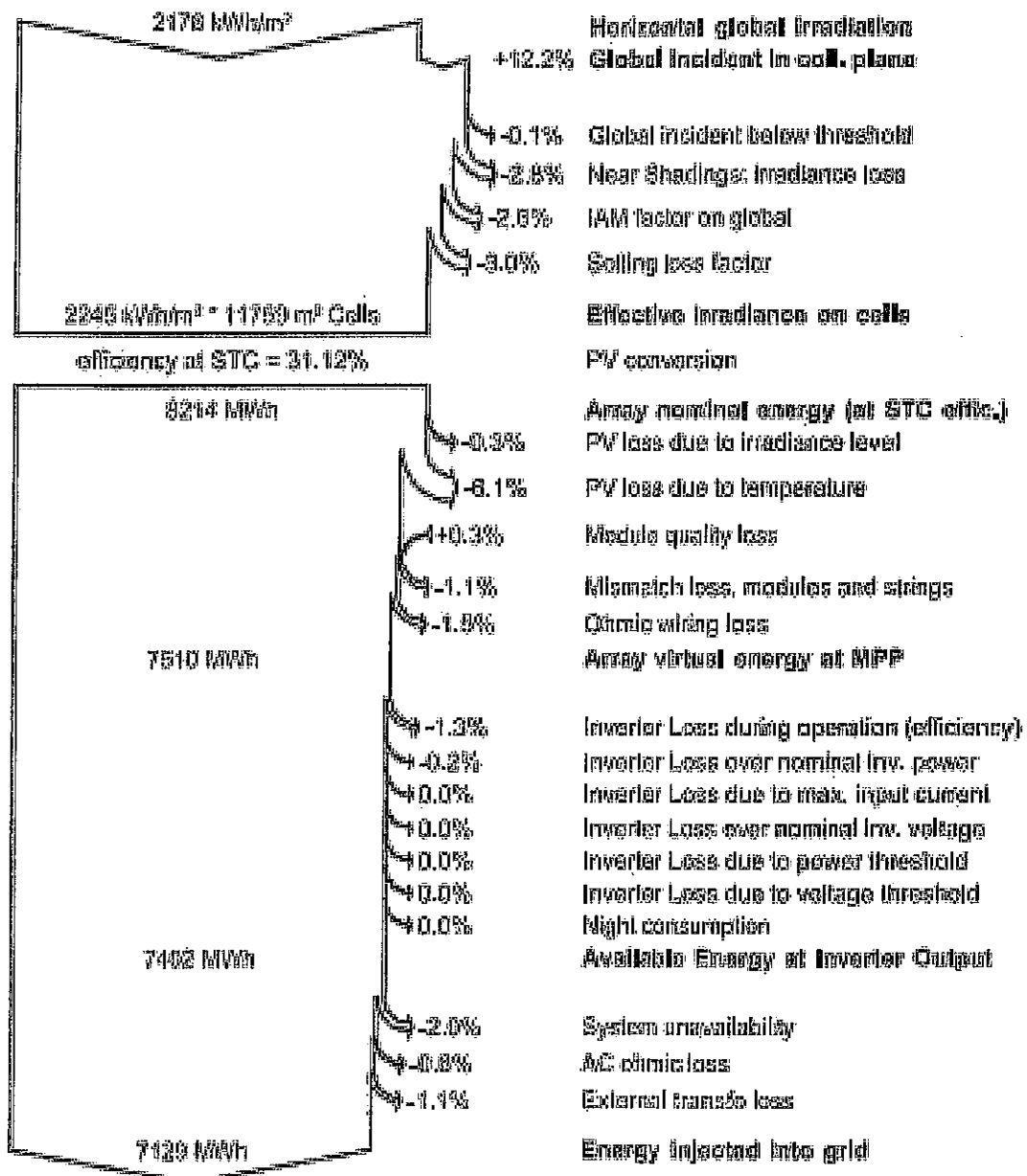


7.722 MW On-Grid Solar PV Plant **Application for Generation License**

**Nizam Power
Private Limited**

Loss Diagram for Mola Dad Solar Plant:

Loss diagram over the whole year



**7.722 MW On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

Control, Metering, Instrumentation and Protection:

Remote Monitoring:

The SUN2000 can connect to the Smart Logger2000 over RS485 or to a PC through the Smart Logger2000 to implement communication. The SUN2000 APP, Smart Logger, embedded Web UI, or the network management software (such as the Net Eco) can be used on the PC to query information about the SUN2000, such as energy yield, alarms, and running status. Remote monitoring enables user to stay updated with regular system status and also alarms, if any incurred. The system status is updated after every 30 minutes whereby the alarms are instantly notified to the administrator.

Weather Sensors:

Weather Sensors will measure temperature, irradiance and wind speed in real time and the data will be displayed on the online portal over the period of time.

Metering and Protection:

The injection point of the system is located approximately 800m from the solar plant at 95EME, and injection point for Mola Dad is located at a distance of approximately 100m from solar plant. Themetering of solar units will be performed at the main 11KVload bus bear. It is designed that all auxiliary loads will be connected before the point ofconnection to get the true reading for energy being evacuated into 11KV grid.

Sensitivity Class for meter is 0.5 M5 with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

This solar plant will have three separate feeders, namely Cantt, QESCO and Old MES at 95EME and havetwo separate feeders, namely, New MES and C&SC at Mola Dad. They will have their respective power load.

The system will have the following protections for the line and load side;

- Over and Under voltage protections (at inverters' end)
- Short Circuit protections

**7.722MWp On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

Environmental Study

INTRODUCTION

As part of this IEE study, an inspection visit was conducted by our team for evaluation of site conditions for technical and environmental study.

Based on the site visit information, publicly available information and from our team's past experience in conducting similar projects, **Nizam Power Pvt. Ltd.** has prepared this study report on Initial Environment Examination (IEE).

This report describes the various features of Initial Environment Examination of the project site in line with local and international standards. The total area concerned piece of state land measuring a **23.93 Acres**, out of which **13.15 Acres will be at 95EME** situated in One (01) KM South West of Nawai Killi Bhattani, Quetta and Nine and Half (9.5) KM North West of Railway Station, Quetta City and **10.78 Acres will be at Mola Dad** situated in Two (02) KM South East of Quetta Cantonment and Ten (10) KM North East of main Quetta City. The leased land is situated in the vicinities of latitude 30°13'51.03"N, longitudes 67° 0'51.66"E (95EME), and latitude 30°11'59.51"N, longitudes 67° 2'53.00"E (Mola Dad) and the lands are allotted on the following terms and conditions:

- This lease will be initially for a period of (25) years extendable for another period.
- The lease shall not assign, sublet mortgage or transfer in any manner the leased land or any part thereof without the express permission of the Government.
- The lease shall utilize the land for any other purpose except with the prior permission of the board of revenue Balochistan.

**7.722MWp On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

Site 01 95EME

S. No Particulars Descriptions

1. Proposed System Capacity:	4076.8kWp Grid Tied System
2. Project Site:	95EME Quetta
3. City:	Quetta
4. Province:	Baluchistan
5. Latitude:	30°13'51.03"N
6. Longitude:	67° 0'51.66"E
7. Road Accessibility:	Asphalt Road
8. Nearest Airport:	15 KM
9. Nearest Town:	Jinnah Town, NawaiKilliBhattani, Quetta Cantonment
10. Nearest City:	Mastung, Pishin, Sibi
11. Land Available:	Open Area, Approximately 13.15 Acres
12. Water Requirement:	Tube Well
13. Daily Global Solar Irradiance	5.96 KWh/m ²
14. Daily Diffuse Solar Irradiance	1.915 KWh/m ²
15. Annual Global Solar Irradiance	2178KWh/m ²
16. Annual Diffuse Solar Irradiance	700KWh/m ²
17. Type of system	Fixed tilt (25 degree)
18. Capacity of Each PV Module	350W
19. Total Number of PV Modules	11648
20. Inverter Model	Sun2000-100KTL-H1
21. Total Number of Inverters	35
22. Annual Electricity Supplied To MES Grid	7979.8MWh

Site 02 Mola Dad

S. No Particulars Descriptions

1. Proposed System Capacity:	3645.6kWp Grid Tied System
2. Project Site:	Mola Dad Quetta
3. City:	Quetta
4. Province:	Baluchistan
5. Latitude:	30°11'59.51"N
6. Longitude:	67° 2'53.00"E
7. Road Accessibility:	Asphalt Road
8. Nearest Airport:	25 KM
9. Nearest Town:	Quetta Cantonment, Mari Abad

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10. Nearest City:	Mastung, Pishin, Sibi
11. Land Available:	Open Area, Approximately 10.78 Acres
12. Water Requirement:	Tube Well
13. Daily Global Solar Irradiance	5.96 KWh/m ²
14. Daily Diffuse Solar Irradiance	1.915 KWh/m ²
15. Annual Global Solar Irradiance	2178KWh/m ²
16. Annual Diffuse Solar Irradiance	700KWh/m ²
17. Type of system	Fixed tilt (25 degree)
18. Capacity of Each PV Module	350W
19. Total Number of PV Modules	10416
20. Inverter Model	Sun2000-100KTL-H1
21. Total Number of Inverters	31
22. Annual Electricity Supplied To MES Grid	7128.6 MWh

Benefits due to Proposed Project

The proposed Project brings in multi fold advantages. Not only does it produce clean, pollution free energy, it also has the capacity to provide employment to the people living in and around that area. It has the capacity of turning Quetta which is a harsh, barren land into a clean energy producing hub which will be emulated by the other Districts of Pakistan.

OBJECTIVE OF THE IEE STUDY

The objective of Initial Environmental Examination (IEE) is to prepare a document based on anticipated Environmental Impact due to setting up of 7.722MWp (4.0768MWp + 3.6456MWp) Solar Power Project and to applicable local and national regulations.

The proposal is for PV based solar power project and there are no potentially significant adverse and irreversible social and environmental impacts. Therefore, according to the findings of the environmental and social impact assessment study conducted with respect to the establishment of the Project and a review of the broad Equator Principles of the project due to limited adverse social or environmental impacts and these are limited to site-specific, largely reversible and readily addressed through mitigation measures.

PROJECT DESCRIPTION

INTRODUCTION

The plot size for the proposed project site is approximately 23.93 acres.

Panoramic view of Project Site

PROJECT STATUS

KEY FEATURES OF SITE

+ Following are key features of proposed 7.722MWp Solar Power Project

- The location falls under the 'Hot and Dry' climatic zone of the area and comprises extreme weather conditions of the hot desert.
- The project location comprises well accessibility as the motorable asphalt road is 10m away from the site.
- There are no shading elements like mountains, large sand dunes, trees available on the site. The entire area is shadow free.
- Nearest Airport is Quetta which is about 25km from the projected location.
- Nearest City (Quetta) to the site is **9.5km**.
- Quetta railway station is the nearest railway station from the location.
- Soil condition at the site is hard sandy and surface is almost flat; hence limited and work is needed to make land flat as per the requirements of solar **PV** power plant.

PROJECT JUSTIFICATION

Pakistan's major electricity sources are a 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 (2013-2014) is presented.

LEGAL POLICIES & INSTITUTIONAL FRAMEWORK

This chapter describes the relevant: national and international policies; legal and administrative framework; Institutional setup, in respect of the environmental and social assessment of the proposed Project.

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Several laws exist in Pakistan containing a number of clauses concerning the protection of the environment. However, the first legislation on environmental protection was issued in 1983. The Pakistan Environment Protection Ordinance, 1983 was the first legislation promulgated for the protection of the environment. Pakistan Environment Protection Agency was established in 1984. No significant environmental policy, guidelines, and regulations were made till the early 1990s. The National Conservation Strategy was developed and approved by the federal cabinet in 1992. Provincial Environment Protection Agencies were also established in 1992-93. National Environmental Quality Standards (NEQS) were established in 1993. Detailed environmental guidelines were issued in 1996. The National Assembly and the Senate conferred Pakistan Environment Protection Act in 1997.

NATIONAL ENVIRONMENTAL LAWS

There are several laws in Pakistan which contain provisions relating to the protection of the environment. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period, and are context specific. The laws relevant to development projects are briefly reviewed below.

POLICY GUIDELINES (www.epa.gov.pk)

National Conservation Strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GOP) on national environmental issues of the country. The Strategy approved by the Federal Cabinet in March 1992 was also recognized by International Financial Institutions, principally the World Bank. The NCS had identified **14** core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage. It had also recommended immediate attention to the stated core areas in order to preserve the environment of Pakistan.

A mid-term review of the NCS in 2000 concluded that achievements under the NCS were primarily awareness raising and institutional building rather than meaningful improvement of

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the environment and natural resources and that the NCS was neither designed nor adequately focused as a national sustainable development strategy (GOP, November 2002). Thus, the need for a more focused National Environmental Action Plan (NEAP) was formulated and approved by the Pakistan Environmental Protection Council in 2001 to practically improve the national environment with emphasis on poverty reduction, and economic as well as sustainable development.

NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that would safeguard public health, promote sustainable livelihoods and enhance the quality of life of the people of Pakistan.

The GOP and United Nations Development Programme (UNDP) have jointly initiated an umbrella support program called the NEAP-Support Programme that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP-Support Programme is environmental sustainability and poverty reduction in the context of economic growth. The objectives of the new policy have total 171 guidelines on sectoral and cross-sectoral issues. The objectives of new policy include assurance of Sustainable development and safeguard of the natural wealth of country. The following are the approved Sectorial Guidelines:

- Water Supply and Management
- Air Quality and Noise
- Waste Management
- Forestry
- Biodiversity and Protected Areas
- Climate Change and Ozone Depletion
- Energy Efficiency and Renewable
- Agriculture and Livestock
- Multilateral Environmental Agreements
- Biodiversity Action Plan

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The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of National Conservation Strategy and in becoming a signatory to and ratifying, the Convention on Biological Diversity (CBD) in 1994.

Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss. This law is applicable for all the project and covers the core 14 points of NCS to sustain the environment for the betterment of future generation.

The Biodiversity Action Plan

The Biodiversity Action Plan (BAP), which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

The Pakistan Environment Protection Act, 1997 is the key legislation empowering the government to frame regulations for the protection of the environment. Detailed rules, regulations, and guidelines required to enforce the Environment Protection Act are still in various stages of development.

ENVIRONMENT INSTITUTIONS AND ADMINISTRATION

The Constitution of Pakistan distributes the legislative powers between the federal and the provincial governments through Federal and Concurrent Lists. The Federal list depicts the areas and subjects on which the Federal government has exclusive powers. The second, concurrent list contains areas and subjects on which both Federal and Provincial governments can enact laws.

The Ministry of Climate Change, Local Government, and Rural Development is responsible for environmental issues at the federal level. The NCS unit within the Ministry ensures implementation of the National Conservation Strategy.

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The Pakistan Environment Protection Agency at the federal level is responsible for administering the provisions of the Environment Protection Act. It is responsible to ensure compliance with the NEQS, develop monitoring and evaluation systems and initiate legislation when necessary.

The provincial Environment Protection Agencies are responsible for environmental planning and development, approval of Initial Environmental Examination (IEE) and Environmental Impact Assessments(EIA) of new projects at the provincial level.

LAWS, REGULATIONS, AND GUIDELINES

Pakistan Environment Protection Act, 1997 is the basic law that empowers the Government of Pakistan to develop policies and guidelines for the protection of the country's natural environment. A brief description of the laws is given below;

PAKISTAN ENVIRONMENTAL PROTECTION ACT, 1997

The PEPA, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, soil, marine, and noise pollution, as well as to the handling of hazardous wastes.

The key features of the law that have a direct bearing on the proposed project relate to the requirement for an initial environmental examination (IEE) and EIA for development projects. Section 12(1) requires that:

"No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Federal Agency approval in respect thereof."

The Pak EPA has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies.

PAKISTAN ENVIRONMENT PROTECTION AGENCY REVIEW OF IEE AND EIA REGULATION, 2000

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The Pakistan Environment Protection Agency Review of IEE and EIA Regulations provide the necessary details for preparation, submission, and review of the IEE and EIA. Categorization of projects of IEE and EIA is one of the main components of the Regulations.

The IEE-EIA Regulations, 2000 also provide the necessary details on the preparation, submission, and review of IEE and EIAs.

The following is a brief step-wise description of the approval process:

- A project is categorized as requiring an IEE or EIA using the two schedules attached to the Regulations.
- An EIA or IEE is conducted as per the requirement and following the Pak-EPA guidelines. The EIA or IEE is submitted to the concerned EPA—provincial EPAs if the project is located in the provinces or the Pak-EPA if it is located in Islamabad.
- A fee, depending on the cost of the project and the type of the report, is submitted along with the document.
- The submittal is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.
- The EPA conducts a preliminary scrutiny and replies within 10 days of the submittal of a report, a) confirming completeness, or b) asking for additional information, if needed, or c) returning the report requiring additional studies, if necessary.
- The EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively, of the issue of confirmation of completeness.
- If the EPAs accord their approval subject to a certain condition, then before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions as per mentioned in Schedule VII.
- Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the EIA.
- An Environment Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.

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- The EPAs are required to issue a confirmation of compliance within 15 days of the receipt of the request and complete documentation.
- The EIA approval is valid for three years from the date of the accord.

A monitoring report is to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operation.

Baluchistan Environmental Protection Agency (BEPA)

Environmental Protection Agency, Balochistan (BEPA) was created on 22nd February, 1992 and under the administrative control of the Urban Planning & Development Department. Balochistan Environmental Protection Agency's role is to serve as main environment regulatory body for Balochistan Province, responsible for implementing National and Provincial Laws, and improving the protection of the Environmental and Natural Resources of Balochistan, developing policies for improvement and sustainable use of natural resources. Functions of Environmental Protection Agency are as follow:

- To protect the environment of Baluchistan with a view to promote and attain pollution free livelihood of both human and natural resource in accordance with the Environmental Laws and National Environmental Quality Standards (NEQS)/check list /guide lines.
- To implement environmental Laws, regulations and National Environmental Quality Standards.
- To promote environmental awareness and conduct research on environmental issues. To integrate the principle and concerns of environmentally sustainable development into provincial development plans and policies. To enforce environmental Laws, regulations and National Environmental Quality Standards with effect from 1st July, 2000.
- To measure and monitor industrial, urban and agriculture pollution discharge in the air, water and soil of Balochistan. To institute Environmental Impact Assessments (EIA)/IEE process for the project formulation by the Government Department /Agencies. To increase the awareness level of policy makers and general public on damage being

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done to the environment and Natural resources. To build the capacity of Environmental Protection Agency, Balochistan, both in terms of human resource development and infrastructure development. To arrange adoption of Pakistan Environmental Protection Act, 1997 through provincial legislation.

EXISTING ENVIRONMENTAL & SOCIAL CONDITION

GENERAL

Quetta is the provincial capital and largest city of Baluchistan, Pakistan. It has a population of 1,001,205 according to the 2017 census. The city is known as the fruit garden of Pakistan, due to the numerous fruit orchards in and around it, and the large variety of fruits and dry fruits produced there. The immediate area has long been one of pastures and mountains, with varied plants and animals relative to the dry plains to the west. Quetta is at an average elevation of 1,680 meters (5,510 feet) above sea level, making it Pakistan's only high-altitude major city. Located in northwestern Baluchistan near the Pakistan-Afghanistan border, Quetta is a trade and communication center between the two countries. The city lies on the Bolan Pass route which was once one of the major gateways from Central Asia to South Asia. Quetta played an important role militarily for the Pakistani Armed Forces in the intermittent Afghanistan conflict.

STUDY AREA:

An area of 2 km around the project can be considered as influence zone and hence it has been taken as a study area to understand even set in the vicinity of the proposed project. However, as the environmental setting is arrived based on secondary data, all available data has been used for the purpose of Environmental understanding.

DATA SOURCE:

SOIL

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The soils of the Arid Zone are generally sandy to sandy-loam in texture. The consistency and depth vary according to the topographical features. The low-lying banns are heavier and may have a hard pan of clay, calcium carbonate (CaCO_3) or gypsum. The pH varies between 7 and 9.5. The soils improve in fertility from west and northwest to east and northeast. Desert soils are Regosols of windblown sand and sandy fluvial deposits, derived from the disintegration of rock in the subjacent areas and blown in from the coastal region and the Indus Valley.

LAND USE

There are few shrub thickets near the project site. There are no settlements near the project site. Within the 2 Km survey area, there are some houses, some temporary huts and agricultural fields as shown there. The soil is sandy which is porously comprising of more of gravel and less silt and clay content. There are some sand dunes in the small area. Overall the area is plain with a gentle slope.

ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

The proposed project may have an impact on the environment during construction & operation phases. During the construction phase, the impacts may be regarded as temporary or short-term; while long term impacts may be observed during the operation stage. Spatially the impacts have been assessed over the study area of 2 km radius of the project site.

The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever increasing Demand of Power and to bridge the Gap between Demand and Supply of Power.

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

Introduction

Environmental & Social Management Plan is an implementation plan to mitigate and offset the potential adverse environmental & social impacts of the project and enhance the positive impacts. Based on the environmental baseline conditions, planned project activities and

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impacts assessed earlier, this section enumerates the set of measures to be adopted to minimize the adverse impacts. The process of implementing mitigation and compensatory measures, execution, agencies responsible for their implementation and indicative costs is discussed in this chapter.

The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever increasing Demand of Power and to bridge the Gap between Demand and Supply of Power.

ENVIRONMENTAL & SOCIAL MANAGEMENT PROCESS

The ESMP has been designed within the framework of the requirement under Pakistan legislation Baluchistan legislations, and ADB's SPS on environmental and socio-economic aspects.

The mitigation measures to be adopted for the implementation of the proposed project include the following:

- Environmental Management Plan;
- Rainwater Harvesting
- Clean Development Mechanism;
- Occupational Health and Safety;
- Labor Working Conditions;
- Construction Labor Management;
- Environmental Action and Monitoring Plan;
- Community Development Plan;
- Public Consultation and Information Disclosure Plan;
- Grievance Redressal Mechanism;
- Disaster Management Plan

CONSULTATION, PARTICIPATION, AND DISCLOSURE

Introduction

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The need for public consultation and disclosure arises from the universal belief that transparency and accountability are fundamental to fulfilling any development mandate and in strengthening public involvement in the decision making process. For all Categories, "A" and "B" projects the project proponent or third party experts must have consulted with project affected communities in a structured and culturally appropriate manner. The public consultation should involve affected communities; the process must ensure their free, prior and informed consultation (FPIC) and facilitate their informed participation.

CONCLUSION AND RECOMMENDATION

Impacts are manageable and can be managed cost effectively - Environmental impacts are likely to result from the proposed transmission system development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as a correction in work practices at the construction sites, or through the careful selection of sites and access routes.

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

Significantly improvement in the economic activities in the surrounding areas due to the generation of direct and indirect employment opportunities.

There is the negligible removal of trees for the proposed project, which is the main positive impact to the proposed project area. Compensatory afforestation will take place where tree removal is unavoidable.

Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to the proposed project.

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

CONCLUSIONS

An environment and social analysis have been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community, and employee health and safety etc. The impact analysis found that due to careful consideration of environmental and social aspects during route and site selection by the proponent, no major adverse impacts are expected. There is no adverse impact on the migration of habitat, any natural existing land resources, and effect in the regular life of people. The environment and social impact associated with transmission line project is limited to the extent of the construction phase and can be mitigated through a set of recommended measures and adequate provision for the environment and social impacts which cover monitoring, measuring and mitigation.

EMP has been prepared. Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor was carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils. From this perspective, the project is expected to have a small "environmental footprint". No endangered or protected species of flora or fauna are reported at any of the subproject sites. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs.

Feasibility Report 7.722MW Solar Power Plant

Executive Summary:

In an effort to provide cleaner and cheaper power, MES took initiative to invite registered EPC firms to install solar power plants on power purchase agreement (PPA) all over Pakistan. Therefore, Nizam Power (Private) Limited will develop "7.722MW Grid Tied Solar System", out of which, 4.076MWp PV system will be installed at 95EME site and 3.645MWp PV system will be installed at Mola Dad site, Quetta, Baluchistan (South Zone 1). The plant will provide electricity to MES for 25 years. After thorough site study, critical analysis on current and future load was performed which determined the installed DC capacity of the plant.

Key highlights of the project are:

- | | |
|------------------------------------|---------------------------------|
| • Customer | Military Engineering Services |
| • Project Model | BOT |
| • System Type | Grid Tied, Ground Mounted |
| • System Size | 7.722MWp
(4.076MWp+3.645MWp) |
| • Annual CO ₂ Reduction | 6,421.33tonnes per annum |
| • Solar PV Type | MonoCrystalline |

Introduction:

The objective of this report is to access the feasibility of this project and is organized as follows:

- Introduction to Solar
- Solar Potential in Pakistan
- Project Overview
- Conceptual Design

- Technical Summary

Introduction to Solar:

Solar power is energy from the sun that is converted into thermal or electrical energy. The solar cell is the basic component of a solar panel. Also called photovoltaic cells or PV cells they generate electricity as they absorb sunlight. Solar cells are made of semiconductor materials, the most common of which is crystalline silicon. A solar module, or PV module, is made of connected solar cells. The total number of cells in a module will vary, as will the module's effectiveness. Since, a single solar module can only produce so much electricity, multiple modules are often interconnected to create a larger solar panel: the backbone of a solar PV system.

Solar photovoltaic cells consist of a positive and a negative film of silicon placed under a thin slice of glass. As the photons of the sunlight beat down upon these cells, they knock the electrons off the silicon. The negatively-charged free electrons are preferentially attracted to one side of the silicon cell, which creates an electric voltage that can be collected and channeled. This current is gathered by wiring the individual solar panels together in series to form a solar photovoltaic array. Depending on the size of the installation, multiple strings of solar photovoltaic array cables terminate in one electrical box, called a fused array combiner. Contained within the combiner box are fuses designed to protect the individual module cables, as well as the connections that deliver power to the inverter. The electricity produced at this stage is DC (direct current) and must be converted to AC (alternating current) suitable for use. The inverter turns the DC electricity generated by the solar panels into AC power that can be put to immediate use by connecting the inverter directly to a dedicated circuit breaker in the electrical panel.

Solar energy is the cleanest and most abundant renewable energy source available. The solar power is becoming an increasingly popular form of alternative energy around the world. As an alternative to the burning of fossil fuels, solar panels rank alongside wind and hydropower as essential energy options for the future of the planet, and offer the additional benefit of being easier to integrate into the home.

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Solar technologies can harness this energy for a variety of uses, including generating electricity, providing light or a comfortable interior environment, and heating water for domestic, commercial, or industrial use.

Solar Potential in Pakistan:

In view of the growing needs of energy in Pakistan, the efficient use and development of renewable energy sources has become a major issue in the country. Fortunately, Pakistan is among those countries in which sun warms the surface throughout the year and therefore has a strong potential for solar power generation. With eight to nine hours of sunshine per day the climatic conditions in Pakistan are ideal for solar power generation. According to studies, Pakistan has 2.9 million megawatts of solar energy potential besides photovoltaic opportunities.

The lowest solar radiation intensity 76.49 W/m^2 observed at Cherat during December and highest 339.25 W/m^2 at Gilgit. The average monthly solar radiation intensity remains 136.05 to 287.36 W/m^2 in the country. The results indicate that the values of solar radiation intensity greater than 200 W/m^2 were observed in the months: February to October in Sindh, March to October in almost all regions of Baluchistan, April to September in NWFP, Northern Areas and Kashmir regions while March to October in Punjab. For 10 h a day, average solar radiation intensity ranges from $1500 \text{ W/m}^2/\text{day}$ to $2750 \text{ W/m}^2/\text{day}$ in Pakistan especially in southern Punjab, Sindh and Baluchistan regions throughout the year. In an area of 100 m^2 , 45 MW to 83 MW power per month may be generated in the above-mentioned regions.

Project Overview:

Introduction:

In an effort to provide cleaner and cheaper power, MES took initiative to invite registered EPC firms to install solar power plants on power purchase agreement (PPA) all over Pakistan. Therefore, Nizam Power (Private) Limited will develop "7.722MW Grid Tied Solar System", out of which, 4.076MWp PV system will be installed at 95EME site and 3.645MWp PV system will be installed at Mola Dad site, Quetta, Baluchistan (South Zone 1). Nizam power (Private) Limited will provide EPC and O&M services for the said plant. The project will provide electricity to MES for 25 years. After rigorous site study, critical analysis on current and future load was performed which determined the installed DC capacity of the plant.

Project Rationale:

Military Engineer Services is organized on inter-services basis and consists of the following: -

- The office of the Engineer-in-Chief
- Four MES Wings, one each for Army, Navy, PAF and Defence Production Division of Ministry of Defence, each wing is headed by a DW&CE who is of the rank of Brigadier/ Commodore/ Air Commodore /Chief Engineer.

MES as a department deals with designing, construction and maintenance of buildings, road, airfields, bridges, electricity, water supply, sewerage, Sui gas, drainage, furniture and stores etc. To handle all these services, MES has different cadres like Building and Roads (B&R), Electrical and Mechanical (E&M), Furniture and Stores (F&S), which are considered to be specialists in their respective fields. It is an inter-services organization responsible for such services for Army, Navy, Air Force and DP Division.

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To obtain cheaper and cleaner means of power, MES aims to develop grid connected solar PV plants with aggregated power of up to 50MW at various places in Pakistan, on power purchase agreement for 25 years. Therefore, the 7.722MWp (4.076MWp+3.645MWp) power plant will provide the following benefits to the customers and wider stake holders:

- It will meet the load requirement of the local garrison
- Since most of the load will be met by the solar plant, the usage of grid will be reduced
- The plant is completely installed in house which will generate captive power
- Capex free deployment under power purchase agreement for 25 years

Technology:

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

Environmental Benefits

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The annual reduction in CO₂ emissions by the proposed PV system will be 6421.33 tonnes per year. A life cycle assessment of the CO₂ produced by solar PV is 48g per kWh as opposed to 2620g CO₂ per kWh for diesel fuel/grid sources.

Conceptual Design:

Generation Voltage:

AC power will be generated by the solar power plant at a low voltage level of 800V 3W+PE system. Transformers will be used to step up the low voltage level to 11KV which will be in synch with the Electrical Network.

Power Factor and Frequency:

Solar Grid connected string inverter of Huawei 100KTL will be installed in solar power plant to convert the DC Power of solar panels to alternating power. Grid connected inverters are functioned to adapt the power factor of existing diesel genset grid. The range of power factor provided by the inverter is 0.8 leading – 0.8 lagging, which makes it suitable for the delivering and absorbing of the reactive power. The rated frequency of the inverter is 50Hz

Remote Monitoring:

The SUN2000 can connect to the Smart Logger2000 over RS485 or to a PC through the Smart Logger2000 to implement communication. The SUN2000 APP, Smart Logger, embedded Web UI, or the network management software (such as the Net Eco) can be used on the PC to query information about the SUN2000, such as energy yield, alarms, and running status. Remote monitoring enables user to stay updated with regular system status and also alarms, if any incurred. The system status is updated after every 30 minutes whereby the alarms are instantly notified to the administrator.

Metering and Protection:

Metering of solar units will be performed at the main 11KV load bus bar. The meter has a sensitivity class of 0.5s with bidirectional 4 quadrant calculations algorithm. Features include:

- Total import and export units can be extracted over the period
- TODcalculations
- MDI
- Active and Reactive power calculations

Technical Details and Design of Facility

- Solar modules of 350W (Mono crystalline) are used in the design with 18.1% efficiency
- Huawei inverters are used in the design, where each inverter has a rated AC output power of 100KW at 800V, 3W+PE and 99% efficiency
- PEL/Siemens/Transfopower/Equivalent ONAN Step up Transformers of rating 0.8/11kV, 1x 1800kVA, 1x 1600kVA at Mola Dad site and 2x 1250kVA, 1x 2000kVA at 95EME site, are used to step up the voltage to 11KV.
- Vacuum Circuit Breakers of rating 630A, 25kA,11kV are used for the overall protection of the MV system
- Robust Earthing System will be established including number of earthing pits for DC and AC system to protect the structures, inverters, transformers and other equipment from any kind of faults
- Lightning Arrestors are also incorporated in the design to provide protection from lightning strikes
- Meteorological sensors are used which provide real time data of site's temperature, wind speed and instantaneous irradiation
- AC output of the system is 6600kW (3500kW at 95EME + 3100kW at Mola Dad)
- The maximum land area allocated to install the both systems is 23.93 Acres (13.15 Acres for 95EME Site and 10.78 Acres for Mola Dad site).

Bill of Materials:

**7.722 MW On-Grid Solar PV Plant
Application for Generation License**

**Nizam Power
Private Limited**

BOM 3.645MWp MOLA DAD Site

Sr. No.	Components	Quantity
1	Solar Modules350W (Mono Crystalline)	10416
2	Huawei 100KW solar inverters	31
3	Step up Transformers 0.8/11kV, 1600kVA	1
4	Step up Transformers 0.8/11kV, 1800kVA	1
5	Vacuum Circuit Breakers 630A, 25kA,11kV	4

BOM 4.076MWp 95EME Site

Sr. No.	Components	Quantity
1	Solar Modules350W (Mono Crystalline)	11648
2	Huawei 100KW solar inverters	35
3	Step up Transformers 0.8/11kV, 2000kVA	1
4	Step up Transformers 0.8/11kV, 1250kVA	2
5	Vacuum Circuit Breakers 630A, 25kA,11kV	6

Combined BOM 7.722MWp (4.076MWp + 3.645MWp)

Sr. No.	Components	Quantity
1	Solar Modules350W (Mono Crystalline)	22064
2	Huawei 100KW solar inverters	66
3	Step up Transformers 0.8/11kV, 2000kVA	1
4	Step up Transformers 0.8/11kV, 1800kVA	1
5	Step up Transformers 0.8/11kV, 1600kVA	1
6	Step up Transformers 0.8/11kV, 1250kVA	2
7	Vacuum Circuit Breakers 630A, 25kA,11kV	10

Energy Generation:

Energy Generation at 3.645MWp MOLA DAD Site

Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.00%
2	Capacity Utilization Factor	22.32%
3	Energy Generation Units	7129MWh/year

Energy Generation at 4.076MWp 95EME Site

Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.07%
2	Capacity Utilization Factor	22.34%

**7.722 MW On-Grid Solar PV Plant
Application for Generation License**

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Private Limited**

3	Energy Generation Units	7980MWh/year
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Combined Energy Generation at 7.722MWp (4.076MWp + 3.645MWp) System

Sr. No.	Efficiency Parameters	Quantity
1	Performance Ratio of the System	80.03%
2	Capacity Utilization Factor	22.33%
3	Energy Generation Units	15109MWh/year

Interconnection with NationalGrid

The power generated from the system will be interconnected to the grid.

Inter Connection at National Grid at 95EME Site:

There are three separate existing feeders, namely Cantt, QESCO and Old MES. They will have their respective power load; however, all three feeders will be coupled together.

Inter Connection at National Grid at Mola Dad Site:

There are two separate existing feeders, namely New MES and C&SC. They will have their respective power load; however, all two feeders will be coupled together.

Infrastructure

The location of 95EME solar plant is MES Cantt, Quetta which is 9.5km away from the Quetta city. This location is accessible by all means of transportation. Whereas, the location of Mola Dad solar plant is towards North West of main Quetta city, which is 10km away from the Quetta city. This location is accessible by all means of transportation

System Studies:

The power output from the system will be divided onto three feeders which are coupled together. Different sizes of busbars are incorporated in the system to distribute the power. These multiple configurations usually depend upon:

- Current carrying capacity in Normal and Fault conditions
- No of outputs
- Fault Isolation
- Connection method used

This solar plant requires one transformer of 2000kVA and two of 1250kVA for 95EME Site, and one transformer of 1600kVA and one of 1800kVA for Mola Dad site, which are terminated on a PV Bus through individual separate MV panels. The neutral cables and frames of all the transformers will be grounded for safety purpose. There will be three separate feeders, namely Cantt, QESCO and Old MES for 95EME Site, and two separate feeders for Mola Dad Site, namely as New MES and C&SC. They will have their respective power load; however, all three feeders on both sites will be coupled together.

Vacuum Circuit Breakers of rating 630A are used at MV Side which can withstand 25kA of shortcircuit. The normal operating current for Cantt Feeder is calculated to be around 89.22A. The breaker will be adjusted to 112A of overcurrent tripping using relays. The normal operating current for QESCO and Old MES feeders is calculated to be around 47.2A. The breaker will be adjusted to 59A of overcurrent tripping using relays. The normal operating current for C&SC is calculated to be around 73.5A. The breaker will be adjusted to 100A of overcurrent tripping using relays. The normal operating current for New MES is calculated to be around 89.23A. The breaker will be adjusted to 120A of overcurrent tripping

using relays. The short circuit current from Solar Panels is not expected to exceed 120A due to the nature of the solar panels used. All inverters will have twelve built in DC Switches. Each MV panel will have an earth connection (along with an earth fault relay) to isolate the faults (if they occur). The connection of the solar system to the load is by single busbar topology.

Plant Characteristics:

Generation Voltage:

AC power will be generated by the solar power plant at a low voltage level of 800V 3W+PE system. Transformers will be used to step up the low voltage level to 11KV which will be in synch with the Electrical Network.

Power Factor and Frequency:

Solar Grid connected string inverter of Huawei 100KTL will be installed in solar power plant to convert the DC Power of solar panels to alternating power. Grid connected inverters are functioned to adapt the power factor of existing diesel genset grid. The range of power factor provided by the inverter is 0.8 leading – 0.8 lagging, which makes it suitable for the delivering and absorbing of the reactive power. The rated frequency of the inverter is 50Hz

Remote Monitoring:

The SUN2000 can connect to the Smart Logger2000 over RS485 or to a PC through the Smart Logger2000 to implement communication. The SUN2000 APP, Smart Logger, embedded Web UI, or the network management software (such as the Net Eco) can be used on the PC to query information about the SUN2000, such as energy yield, alarms, and running status. Remote monitoring enables user to stay updated with regular system status and also alarms, if any incurred. The system status is updated after every 30 minutes whereby the alarms are instantly notified to the administrator.

Metering and Protection:

Metering of solar units will be performed at the main 11KV load bus bar. The meter has a sensitivity class of 0.5s with bidirectional 4 quadrant calculations algorithm.

7.722 MW On-Grid Solar PV Plant Application for Generation License

**Nizam Power
Private Limited**

Features include:

- Total import and export units can be extracted over the period
 - TOD calculations
 - MDI
 - Active and Reactive power calculations
-
- Earth Fault detection
 - Over current protection
 - Emergency system shutdown

Operations and Maintenance Costs

The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 25 years

(300 Months).

1. Provision of all manpower as duly approved by the Company.
2. Provision of all consumable material and parts.
3. Provision of all routine and preventive maintenance parts.
4. Full costs relating to any repairs and replacements due to defects in the or breakdown of the equipment and systems strictly in accordance with OEMs requirements. The cost shall also include all dismantling, handling, shipment, etc.
5. Provision of all lubricating oils, greases, coolants, rust inhibitors, and any other items as recommended by the original equipment manufacturers (OEMs).
6. Provision of all emergency spare parts as per the recommendations of the OEMs or as directed by the Company.

**7.722 MW On-Grid Solar PV Plant
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7. Capital and Operational spares for 02 years to be kept in the inventory which will be handed over to Company at the end of the Project.

It's specifically pointed out that the O&M shall also be inclusive of following as incurred throughout the O&M contract period.

1. Vehicles and their drivers for travel within and outside the Project site, including purchase, insurance, taxes, etc. relating to vehicles, their O&M and safety.
2. All return travel costs of company's personnel coming from abroad (if required).
3. Medical expenses, insurance, etc. as required on company's personnel.
4. Regular monitoring of requirements of all necessary items for O&M and arrangements for their timely availability at site.
5. Reporting on all aspects of Power Plant operation and performance.

General Layout

MES - 3645.6kWp - Mola Dad - Quetta

Nizam Power Pvt. Ltd.

2 x 28 Structure

MV Trench

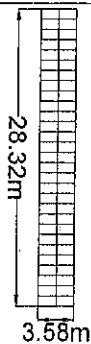
LV Trench

Road

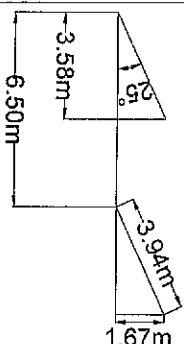
Boundary

Obstacles

Top View



Side View



Azimuth Angle: 0°

Total Installed Capacity: 3,645.6kWp

Nominal Module Power: 350Wp

Total Number of Modules: 10416

Tilt Angle: 25°

Designed by: Salman Qayyum

Checked by: Daaraab Fasih

Verified by: Muhammad Waheed

Project No.: NEL-1119-4H36456M

Drawing No.: NEL-1119-4H36456M-GL

Project: Procurement of Grid Connected Solar PV Plants Aggregate upto 50MW at Various Places in Pakistan on PPA Basis

Title: General Layout

Nizam Power Pvt. Ltd.



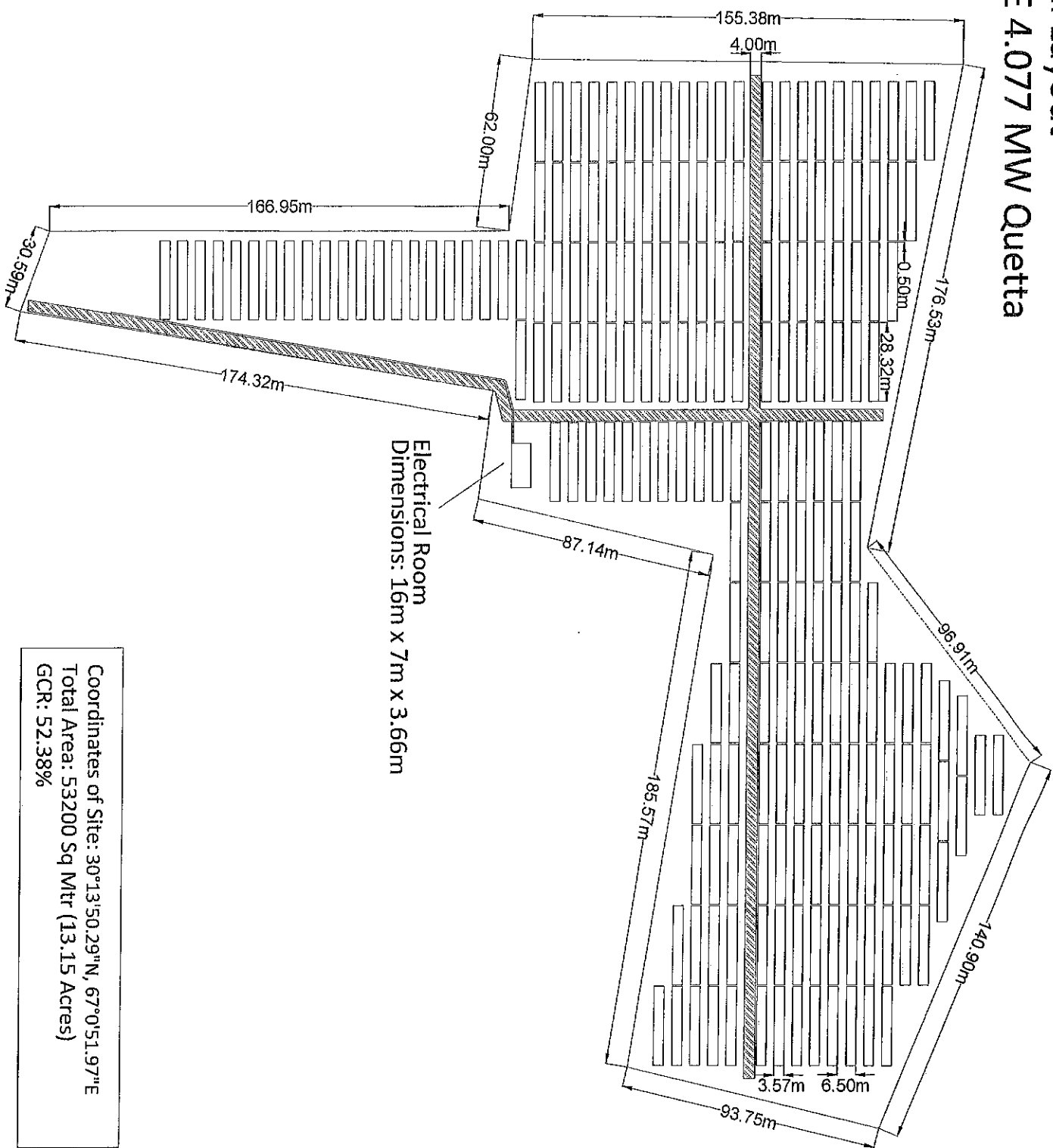
Injection Point
MV Trench Length = 170m

Electrical Room

Dimension: 12m x 7m x 3.66m

Total Area: 4360054 Mtr (10.78 Acres)
MV Trench Length = 170m, GCR = 57.1%

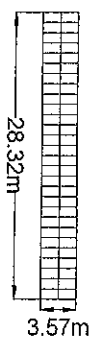
General Layout
95 EME 4.077 MW Quetta



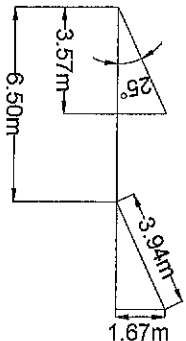
Coordinates of Site: 30°13'50.29"N, 67°0'51.97"E
Total Area: 53200 Sq Mtr (13.15 Acres)
GCR: 52.38%

	2 x 28 Structure
	MV Trench
	Road
	Boundary

Top View



Side View

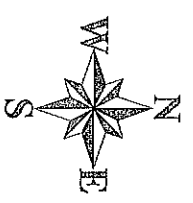
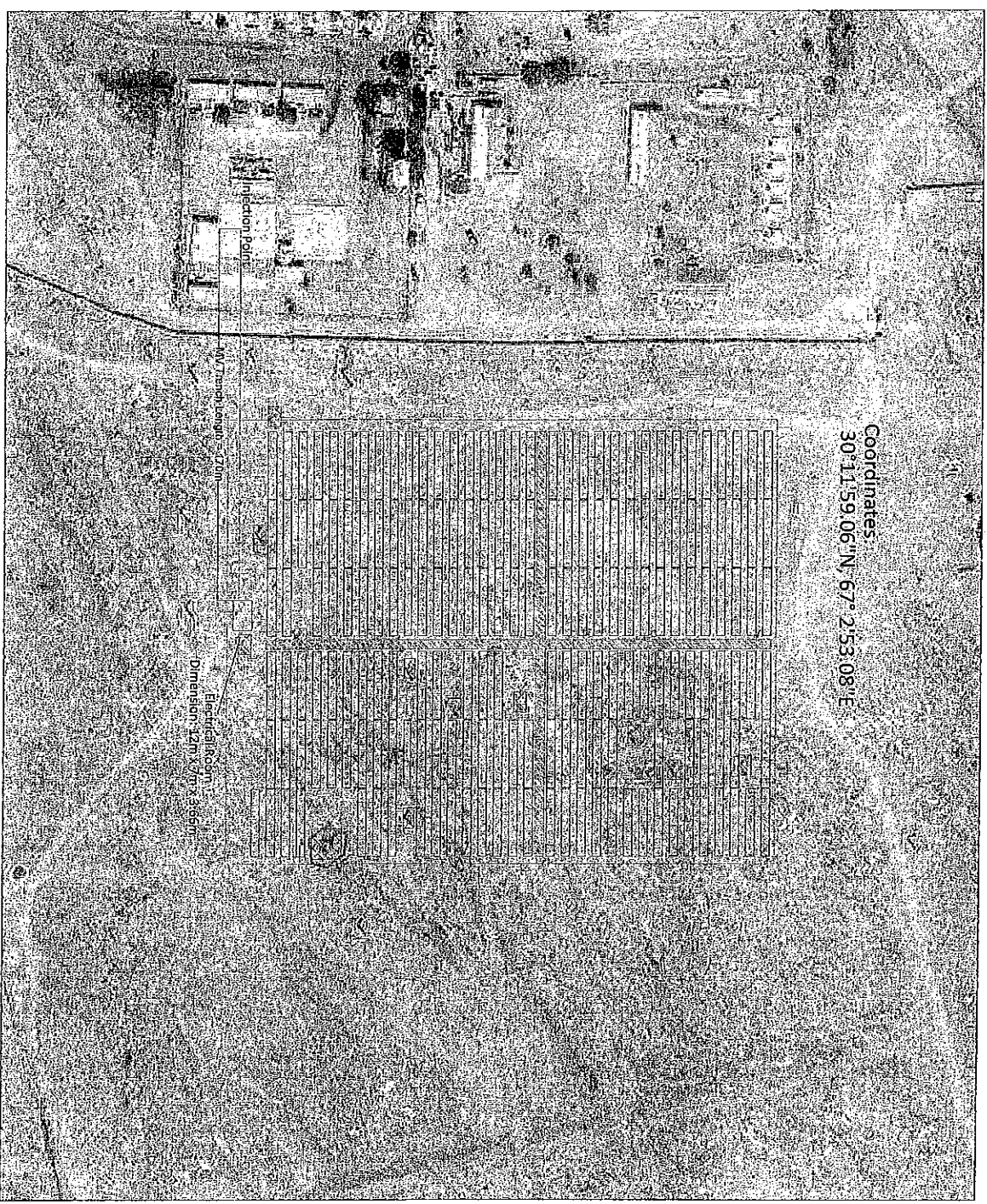


Azimuth Angle	0°
Total Installed Capacity	4.077MWp
Nominal Module Power	350Wp
Total Number of Modules	11648
Tilt Angle	25°
Designed by	Zainab Ali
Checked by	Daaraab Fashhi
Verified by	Muhammad Walid
Project No.	NEI-1119-11949776M
Drawing No.	NEI-1119-11949776M-01
Project	Procurement of Grid Connected Solar PV Plants Aggregate upto 50MW at Various Places in Pakistan on PPA basis
Title	General Layout
	Nizam Power Pvt. Ltd.

PV Placement Layout

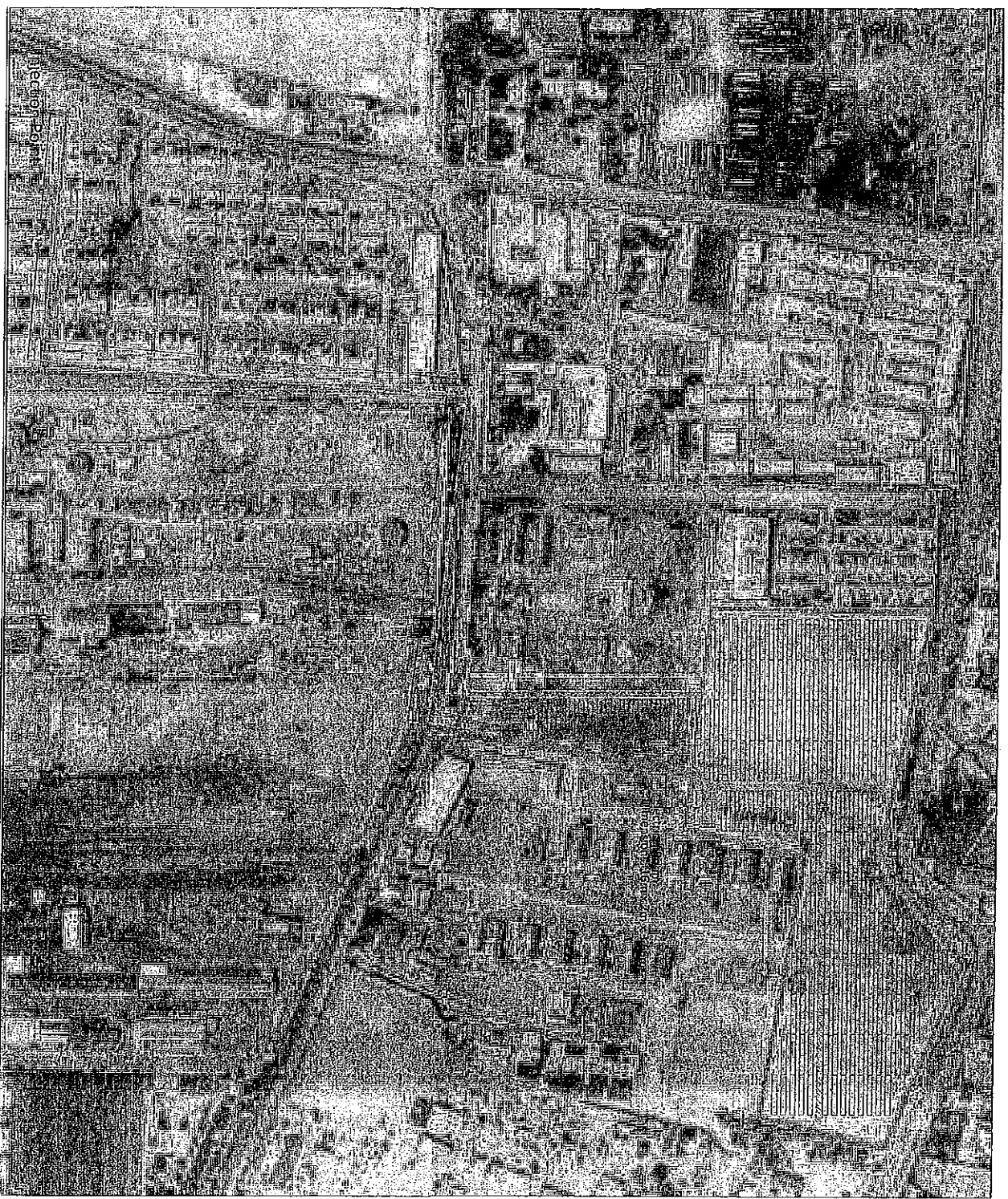
MES - 3645.6kWp - Mola Dad - Quetta

Nizam Power Pvt. Ltd.	
	2x28 Structure
	Obstacles
	MV Trench



Total Area: 43600Sq Mtr (10.78 Acres)
MV Trench Length = 270m, GCR = 57.1%

PV Placement Layout 95 EME 4.077 MW Quetta



Nizam Power Pvt. Ltd.	
	2 x 28 Structure
	Roads
	Over Head Lines
	MV Trench
	Boundary

Coordinates of Site: 30°13'50.29"N
67°0'51.97"E
Total Area: 53200 Sq Mtr (13.15 Acres)
Length of MV Trench: 172.55m
Length of Over Head Line: 770.90m