National Electric Power Regulatory Authority
Islamic Republic of Pakistan

NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

Registrar

No. NEPRA/R/LAG-415/26654-661

December 06, 2019

Mr. Musaddiq Rahim
Company Secretary,
Gharo Solar Limited
Formerly Gharo Solar (Private) Limited,
1485/C-2A, Asad Jan Road, Lahore Cantt

Subject: **Modification Generation Licence No. SPGL/25/2018 (Modification-I)**
Licence Application No. LAG-415
Gharo Solar Limited, (GSL) Formerly Gharo Solar (Private) Limited

Reference: GSL's LPM submitted vide letter No. GSPL/NEPRA/LPM/19-01 dated 17.06.2019

It is intimated that the Authority has approved Modification in Generation Licence No. SPGL/25/2018 dated July 17, 2018 in respect of Ghar Solar Limited (GSL), formerly Gharo Solar (Private) Limited pursuant to Regulation 10(11) of the NEPRA Licensing (Application and Modification Procedure) Regulation 1999.

2. Enclosed please find herewith determination of the Authority in the matter of Licensee Proposed Modification of GSL alongwith Modification-I in the Generation Licence No. SPGL/25/2018, approved by the Authority.

Enclosure: **As Above**

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

06 12 19

(Syed Safeer Hussain)

Copy to:

1. Secretary, Power Division, Ministry of Energy, 'A' Block, Pak Secretariat, Islamabad
2. Chief Executive Officer, Alternative Energy Development Board (AEDB), 2nd Floor, OPF Building, G-5/2, Islamabad
3. Managing Director, NTDC, 414 WAPDA House, Lahore
4. Chief Executive Officer, CPPA(G), Ground Floor, Enercon Building, G-5/2, Islamabad
5. Chief Executive Officer, K-Electric Limited, KE House, 39-B, Sunset Boulevard, Phase-II, DHA Karachi
6. Chief Executive Officer, Hyderabad Electric Supply Company, WAPDA Offices Complex, Hussainabad, Hyderabad
7. Director General, Environmental Protection Agency, Government of Sindh Plot No. ST/2/1, Sector 23 Korangi Industrial Area, Karachi

National Electric Power Regulatory Authority (NEPRA)

Determination of the Authority in the Matter of Licensee Proposed Modification in the Generation Licence of Gharo Solar (Private) Limited

December 06, 2019
Case No. LAG-415

(A). Background

(i). In terms of Section-14B (previously Section-15) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act"), the Authority granted a generation licence (No. SPGL/25/2018, dated July 17, 2018) to Gharo Solar (Private) Limited (GSPL).

(ii). The above mentioned licence envisaged setting up a 50.123 MW Photo Voltaic (PV) cell based generation facility/Solar Farm/solar power plant at Deh Ghairabad, Mirpur Sakro, District Thatta in the province of Sindh, using single glass poly-crystalline PV modules.

(B). Communication of Modification

(i). GSPL in accordance with Regulation-10(2) of the NEPRA Licensing (Application & Modification Procedure) Regulations, 1999 (the "Licensing Regulations"), communicated a Licensee Proposed Modification (LPM) in its existing generation licence on June 18, 2019.

(ii). In the "text of the proposed modification", GSPL submitted that the status of the company has changed from a Private Limited to Public Limited. The Installed Capacity of the generation facility has been finalized to 50.00 MWp on the basis of final plant design and technical specifications. On account of the detailed design and selected equipment for the project, there are changes in Schedule-I & II of the existing Generation Licence.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(iii). Regarding the "statement of the reasons in support of the modification", GSPL submitted that as per requirements under the financing documents of the project, the Special Purpose Vehicle (SPV) executing the project was required to be converted to a Public Limited company and the necessary formalities in this regard have been completed in March 2019. The site of the proposed generation facility is close to the coastal area and in this regard, the sponsors of the project carried out a detailed study pertaining to corrosion. The study concluded the site environment as very highly corrosive and humid of category Class-C5, requiring selection of equipment that can withstand the corrosive environment during the control period of the project. Accordingly, robust type of inverters and allied equipment have been selected to sustain the C5 corrosion level. In view of the said, the conventional single glass poly-crystalline modules have been substituted with double glass modules. The proposed modification will enable the company to be closer to the achievement of the unprecedented plant factor of 22.21% determined by the Authority in the tariff and achieve higher quality of service and performance.

(iv). About the "statement of impact on the tariff, quality of service and the performance by the licensee of its obligations under the licence", GSPL submitted that there will be no impact on the tariff as the Company is not claiming any cost increase. Further, it was submitted that the company anticipates that the proposed changes will not only result in improvement in quality of service but also the performance shall be improved as it shall be better positioned to provide the much needed affordable energy to the Power Purchaser. The modification is expected to increase the quality of the plant that can withstand the very corrosive and aggressive environment for the term of the Generation License and shall enable the Company to meet its performance benchmark.

(C). Processing of Modification

(i). After completion of all the required information as stipulated under the Regulation-10(2) and 10(3) of the Licensing Regulations, by GSPL, the Registrar published the communicated LPM on June 29, 2019, in one (01) Urdu

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(Daily Express) and one (01) English (the News) newspaper, informing the general public about the communicated LPM and inviting their comments within a period of fourteen (14) days from the date of the said publication.

(ii). Apart from the above, separate letters were also sent to other stakeholders including Government Ministries and their attached departments, various representative organization, individual experts and others on July 02, 2019. Through the said letters, the stakeholders were informed about the communicated LPM and publication of its notice in the press. Further, the said entities were invited to submit their views and comments in the matter, for assistance of the Authority.

(D). Comments of Stakeholders

(i). In reply to the above, the Authority received comments from K-Electric Limited (KEL) only. The comments offered by KEL are summarized in the following paragraph:-

(a). KEL submitted that company has selected equipment and supplier consistent with the list of options noted under Section-11 of the tariff decision the Authority has issued dated January 25, 2018. Additionally, the Energy Purchase Agreement (EPA) has been finalized on the tariff decision approved by the Authority dated Jan 11, 2019. It is clarified that the equipment selected is acceptable to the Power Purchaser and shall enable the company to meet the specified reliability and output benchmark over the term of the EPA.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(ii). The Authority considered the above comments and found the same favourable and accordingly considered it appropriate to proceed further as stipulated in the NEPRA Licensing (Generation) Rules, 2000 (the "Generation

Rules") and the Licensing Regulations.

(E). Evaluation/Findings

(i). The Authority examined the entire case in detail including the already granted licence, communicated LPM, comments of stakeholder and rejoinder from the Licensee. In this regard, the Authority observed that a Generation Licence (No. SPGL/25/2018, dated July 17, 2018) was granted to GSPL through its determination No. NEPRA/R/DL/LAG-415/11491-96, dated July 17, 2018 for setting up a Photovoltaic Cell (PV) based generation facility/Solar Power Plant/Solar Farm with a cumulative installed capacity of 50.123 MW_P.

(ii). The Authority has observed that the main features of the LPM communicated by the company/Licensee/GSPL are (a). change of status of the company from private limited to public limited; (b). change in the type of equipment to bear with the extreme environmental conditions during the life of the project; (c). changes in the schedule-I & II of the existing generation licence to reflect the changes in the equipment and other related characteristics, etc.; and (d). change in the Installed capacity of the generation facility.

(iii). In this regard, the Authority in terms of Section-26 of the NEPRA Act read with Regulation-10(5) of the Licensing Regulations, is empowered to modify an existing licence of a licensee subject to and in accordance with such further changes as it may deem fit, if in the opinion of the Authority such modification (a). does not adversely affect the performance by the licensee of its obligations; (b). does not cause the Authority to act or acquiesce in any act or omission of the licensee in a manner contrary to the provisions of the NEPRA Act or the rules or regulations made pursuant to it; (c). is or is likely to be beneficial to the consumers; (d). is reasonably necessary for the licensee to effectively and efficiently perform its obligations under the licence; and (e).is reasonably necessary to ensure the continuous, safe and reliable supply of electric power to the consumers keeping in view the financial and technical viability of the licensee.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(iv). In consideration of the above, the Authority observes that (a). LPM will not be affecting adversely the performance by the Licensee of its obligations but will enable the Licensee to have better performance as the new equipment will be more durable and reliable in terms of performance at site; (b). the LPM will not cause it to act or acquiesce in any act or omission of the licensee in a manner contrary to the provisions of the NEPRA Act or the rules or regulations made pursuant to it; (c). the proposed LPM will be beneficial to the consumers due to selection of more robust equipment which will result in better capacity factor; (d). the LPM is reasonably necessary for the licensee to effectively and efficiently perform its obligations under the licence; (e). it is reasonably necessary for the Licensee to have this LPM to ensure the continuous, safe and reliable supply of electric power to the utility/consumers keeping in view its financial and technical viability.

(v). As explained in the preceding paragraphs, GSPL initially submitted application for the grant of Generation Licence and petition for determination of tariff based on standard polycrystalline PV modules. In its tariff petition, GSPL had claimed the net plant Capacity Factor (CF) of 20.50%. However, the Authority determined that tariff of GSPL based on CF of 22.21% duly considering the energy estimates of other projects which were based on dual glass poly-crystalline PV modules.

(vi). In order to achieve the higher CF as determined by the Authority, GSPL has now decided to opt bifacial mono crystalline PV modules. The Authority considers that the bifacial technology is relatively expensive and a higher cost would have been allowed to GSPL had it filed a petition based on these modules. However, GSPL has decided not to claim any additional cost in this regard.

(vii). The Authority encourages the installation of the robust and efficient technology by any company including GSPL. The Authority has already acknowledged the said changes in specifications of the module while approving

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

the Energy Purchase Agreement executed between GSPL and KEL vide its decision No NEPRA/R/TRF-403/GSPL-2017/523-24 dated January 11, 2019. However, the Authority considers that extra yield may arise from the use of bifacial modules being proposed by GSPL and the same should also benefit the consumers.

(viii). In view of the above, the Authority decides to change the sharing mechanism given at Para 44(c) of the determination of the tariff of GSPL dated January 25, 2018. The Authority revises the sharing mechanism such that the CF shall remain at 22.21% but 100% benefit of any additional energy produced above this capacity factor up to 23.21% shall be to the benefit of the power purchaser/end-consumer and the existing sharing percentages given in the determination of the tariff of GSPL shall apply after 23.21%, as summarized below: -

Net annual plant Capacity Factor/CF	% of the prevalent tariff allowed to Licensee/GSPL
Up to 22.21%	100%
Above 22.21% to 23.21%	0%
Above 23.21% to 24.21%	80%
Above 24.21% to 25.21%	90%
Above 25.21%	100%

(ix). The petitioner is hereby directed to file the modification petition to get the aforesaid changes incorporated in its tariff determination.

(F). Approval of LPM

(i). In view of the above, the Authority is satisfied that the Licensee has complied with all the requirements of the Licensing Regulations pertaining to the modification. Therefore, the Authority in terms Section-26 of the NEPRA Act read with Regulation-10(11) of the Licensing Regulations approves the communicated LPM without any changes.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(ii). Accordingly, the Generation Licence (No. SPGL/25/2018, dated July 17, 2018) of GSPL is hereby modified. The changes made in the said licence are attached as annexure to this determination. The approval is subject to the provisions contained in the NEPRA Act, relevant rules, regulations, terms & conditions of the generation licence and other applicable documents.

Authority

Rafique Ahmed Shaikh
(Member)

29/11/19

Rehmatullah Baloch
(Member)

29/11/19

Saif Ullah Chattha
(Member)

2.12.2019

Engr. Bahadur Shah
(Member/Vice Chairman)

Tauseef H. Farooqi
(Chairman)

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

06 12 19

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE
No. SPGL/25/2018

In exercise of the Powers conferred under Section-26 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, the Authority hereby modifies the Generation Licence (No. SPGL/25/2018, dated July 17, 2018 granted to Ghao Solar (Private) Limited, to the extent of changes mentioned hereunder:

(a). The name of the company/Licensee appearing on the face sheet is changed to Gharo Solar Limited;

(b). The Installed Capacity mentioned on the face sheet may be read as 50.00MW$_P$ instead of 50.123 MW$_P$;

(c). The expiry date of the Licence mentioned on the face sheet may be read as 29th day of November 2044;

(d). The Changes made in Articles of the Generation Licence are attached as Revised/Modified Articles of Generation Licence;

(e). Changes made in Schedule-I of the Generation Licence are attached as Revised/Modified Schedule-I.

(f). Changes made in Schedule-II of the Generation Licence are attached as Revised/Modified Schedule-II.

This **Modification-I** is given under my hand on this 6th **day** of **December Two Thousand & Nineteen**

Registrar 06 12 19

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-1
Definitions

1.1 In this licence

(a). "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 as amended or replaced from time to time;

(b). "Applicable Documents" mean the Act, the rules and regulations framed by the Authority under the Act, any documents or instruments issued or determinations made by the Authority under any of the foregoing or pursuant to the exercise of its powers under the Act, the Grid Code, the applicable Distribution Code, the Commercial Code if any, or the documents or instruments made by the Licensee pursuant to its generation licence, in each case of a binding nature applicable to the Licensee or, where applicable, to its affiliates and to which the Licensee or any of its affiliates may be subject;

(c). "Applicable Law" means all the Applicable Documents;

(d). "Authority" means the National Electric Power Regulatory Authority constituted under Section-3 of the Act;

(e). "Bus Bar" means a system of conductors in the generation facility/Solar Power Plant/Solar Farm of the Licensee on which the electric power from all the photovoltaic cells is collected for supplying to the Power Purchaser;

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(f). "Carbon Credits" mean the amount of Carbon Dioxide (CO_2) and other greenhouse gases not produced as a result of generation of electric energy by the generation facility/Solar Power Plant/Solar Farm and other environmental air quality credits and related emissions reduction credits or benefits (economic or otherwise) related to the generation of electric energy by the generation facility/Solar Power Plant/Solar Farm, which are available or can be

obtained in relation to the generation facility/Solar Power Plant/Solar Farm after the COD;

(g). "Commercial Code" means the National Electric Power Regulatory Authority (Market Operator, Registration, Standards and Procedure) Rules, 2015 as amended or replaced from time to time;

(h). "Commercial Operations Date (COD)" means the day immediately following the date on which the generation facility/Solar Power Plant/Solar Farm of the Licensee is commissioned;

(i). "Commissioned" means the successful completion of commissioning of the generation facility/Solar Power Plant/Solar Farm for continuous operation and despatch to the Power Purchaser;

(j). "Commissioning" means the undertaking of the Commissioning Tests of the generation facility/Solar Power Plant/Solar Farm as stipulated in the EPA;

(k). "Commissioning Tests" means the tests to be carried out pursuant to provisions of EPA;

(l). "Distribution Code" means the distribution code prepared by the concerned distribution company i.e. KEL and approved by the Authority, as it may be revised from time to time with necessary approval of the Authority;

(m). "Energy Purchase Agreement (EPA)" means the energy purchase agreement, entered or to be entered into by and between the Power Purchaser and the Licensee, for the purchase and sale of electric energy generated by the generation facility/Solar Power Plant/Solar Farm, as may be amended by the parties thereto from time to time;

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

(n). "Generation Rules" mean the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000 as amended or replaced from time to time;

(o). "Grid Code" means the grid code prepared by NTDC and approved by the Authority, as it may be revised from time to time by NTDC with necessary approval by the Authority;

(p). "IEC" means the International Electrotechnical Commission or its successors or permitted assigns;

(q). "IEEE" means the Institute of Electrical and Electronics Engineers or its successors or permitted assigns;

(r). "Licence" means this licence granted to the Licensee for its generation facility/Solar Power Plant/Solar Farm;

(s). "Licensee" means Gharo Solar Limited or its successors or permitted assigns;

(t). "Licensing Regulations" mean the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations, 1999 as amended or replaced from time to time;

(u). "KEL" means K-Electric Limited or its successors or permitted assigns as a Power Purchaser;

(v). "Net Delivered Energy" means the net electric energy expressed in kWh generated by the generation facility/Solar Power Plant/Solar Farm of the Licensee at its outgoing Bus Bar and delivered to the Power Purchaser;

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

(w). "NTDC" means National Transmission and Despatch Company Limited or its successors or permitted assigns;

(x). "Policy" means the Policy for Development of Renewable Energy for Power Generation, 2006 of GoP as amended or replaced from time to time;

(y). "Power Purchaser" means KEL which will be purchasing electric energy from the Licensee, pursuant to the EPA for procurement of electric energy;

(z). "SCADA System" means the Supervisory Control and Data acquisition system for gathering of data in real time from remote locations to control equipment and conditions;

(aa). "Solar Power Plant/Solar Farm" means a cluster of photovoltaic cells in the same location used for production of electric power;

1.2 The words and expressions used but not defined herein bear the meaning given thereto in the Act or Generation Rules and Licensing Regulations issued under the Act.

Article-2
Applicability of Law

This licence is issued subject to the provisions of the Applicable Law, as amended from time to time.

Article-3
Generation Facilities

3.1 The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facility/Solar Power Plant/Solar Farm of the Licensee are set out in Schedule-I of this licence.

3.2 The net capacity/Net Delivered Energy of the generation facility/Solar Power Plant/Solar Farm of the Licensee is set out in Schedule-II of this licence. The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its generation facility/Solar Power Plant/Solar Farm before its COD.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-4
Term of Licence

4.1 This licence is effective from the original date of its issuance i.e. July 17, 2018 and has the term of twenty-five (25) years from the COD of the generation facility/Solar Power Plant/Solar Farm of the Licensee subject to Section 14-B of the Act.

4.2 Unless suspended or revoked or Licence ceases to have effect, the Licensee may apply for renewal of this Licence ninety (90) days prior to the expiry of the above term as stipulated in the Generation Rules read with the Licensing Regulations.

Article-5
Licence fee

The Licensee shall pay to the Authority the licence fee as stipulated in the National Electric Power Regulatory Authority (Fees) Rules, 2002 as amended or replaced from time to time.

Article-6
Tariff

The Licensee shall charge only such tariff from the Power Purchaser which has been determined, approved or specified by the Authority.

Article-7
Competitive Trading Arrangement

7.1 The Licensee shall participate in such manner as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement.

7.2 The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority. Provided that any such participation shall

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

be subject to any contract entered into between the Licensee and another party with the approval of the Authority.

7.3 Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties thereto and such terms and conditions as may be approved by the Authority.

Article-8
Maintenance of Records

For the purpose of sub-rule(1) of Rule-19 of the Generation Rules, copies of records and data shall be retained in standard and electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.

Article-9
Compliance with Performance Standards

The Licensee shall comply with the relevant provisions of the National Electric Power Regulatory Authority Performance Standards (Generation) Rules 2009 as amended or replaced from time to time.

Article-10
Compliance with Environmental & Safety Standards

10.1 The generation facility/Solar Power Plant/Solar Farm of the Licensee shall comply with the environmental and safety standards as may be prescribed by the relevant competent authority from time to time.

10.2 The Licensee shall provide a certificate on a bi-annual basis, confirming that the operation of its generation facility/Solar Power Plant/Solar Farm is in conformity with required environmental standards as prescribed by the relevant competent authority.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-11
Power off take Point and Voltage

The Licensee shall deliver the electric energy to the Power Purchaser at the outgoing Bus Bar of its generation facility/Solar Power Plant/Solar Farm. The Licensee shall be responsible for the up-gradation (step up) of generation voltage up to the required dispersal voltage level.

Article-12
Performance Data

12.1 The Licensee shall install properly calibrated automatic computerized solar radiation recording device(s) at its generation facility/Solar Power Plant/Solar Farm for recording of data.

12.2 The Licensee shall install SCADA System or compatible communication system at its generation facility/Solar Power Plant/Solar Farm as well as at the side of the Power Purchaser.

12.3 The Licensee shall transmit the solar radiation data and power output data of its generation facility/Solar Power Plant/Solar Farm to the control room of the Power Purchaser.

Article-13
Provision of Information

In accordance with provisions of Section-44 of the Act, the Licensee shall be obligated to provide the required information in any form as desired by the Authority without any exception.

Article-14
Emissions Trading /Carbon Credits

The Licensee shall process and obtain expeditiously the Carbon Credits admissible to the generation facility/Solar Power Plant/Solar Farm. The Licensee shall share the said proceeds with the Power Purchaser as per the Policy.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-15
Design & Manufacturing Standards

The photovoltaic cells and other associated equipment of the generation facility/Solar Power Plant/Solar Farm shall be designed, manufactured and tested according to the latest IEC, IEEE standards or any other equivalent standard in the matter. All the plant and equipment of generation facility/Solar Power Plant/Solar Farm shall be unused and brand new.

Article-16
Power Curve

The power curve for the individual photovoltaic cell provided by the manufacturer and as mentioned in Schedule-I of this generation licence, shall form the basis in determining the cumulative power curve of the generation facility/Solar Power Plant/Solar Farm.

Article-17
Compliance with Applicable Law

The Licensee shall comply with the provisions of the Applicable Law, guidelines, directions and prohibitory orders of the Authority as issued from time to time.

Article-18
Corporate Social Responsibility

The Licensee shall provide the descriptive as well as monetary disclosure of its activities pertaining to corporate social responsibility (CSR) on an annual basis.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

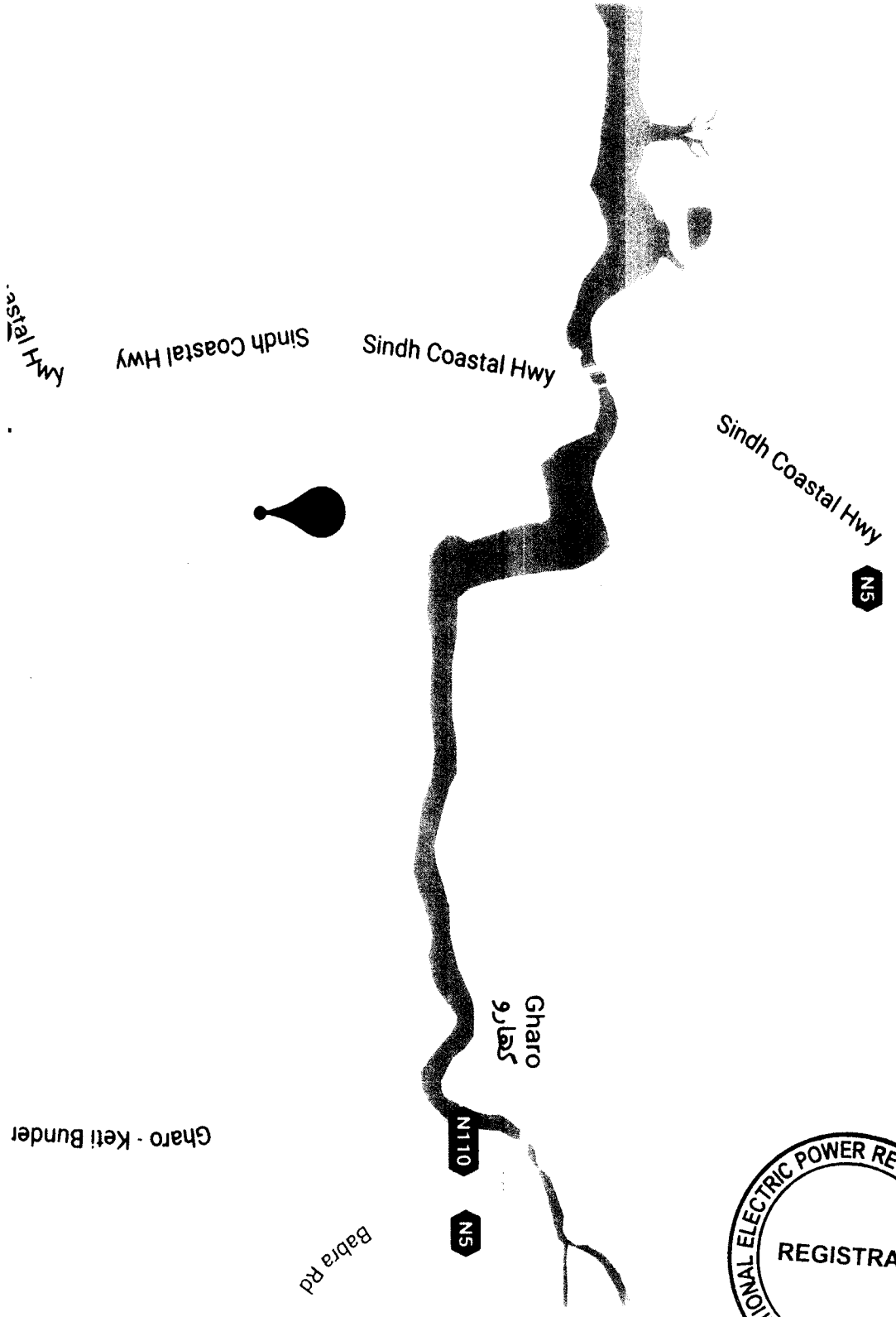
SCHEDULE-I

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

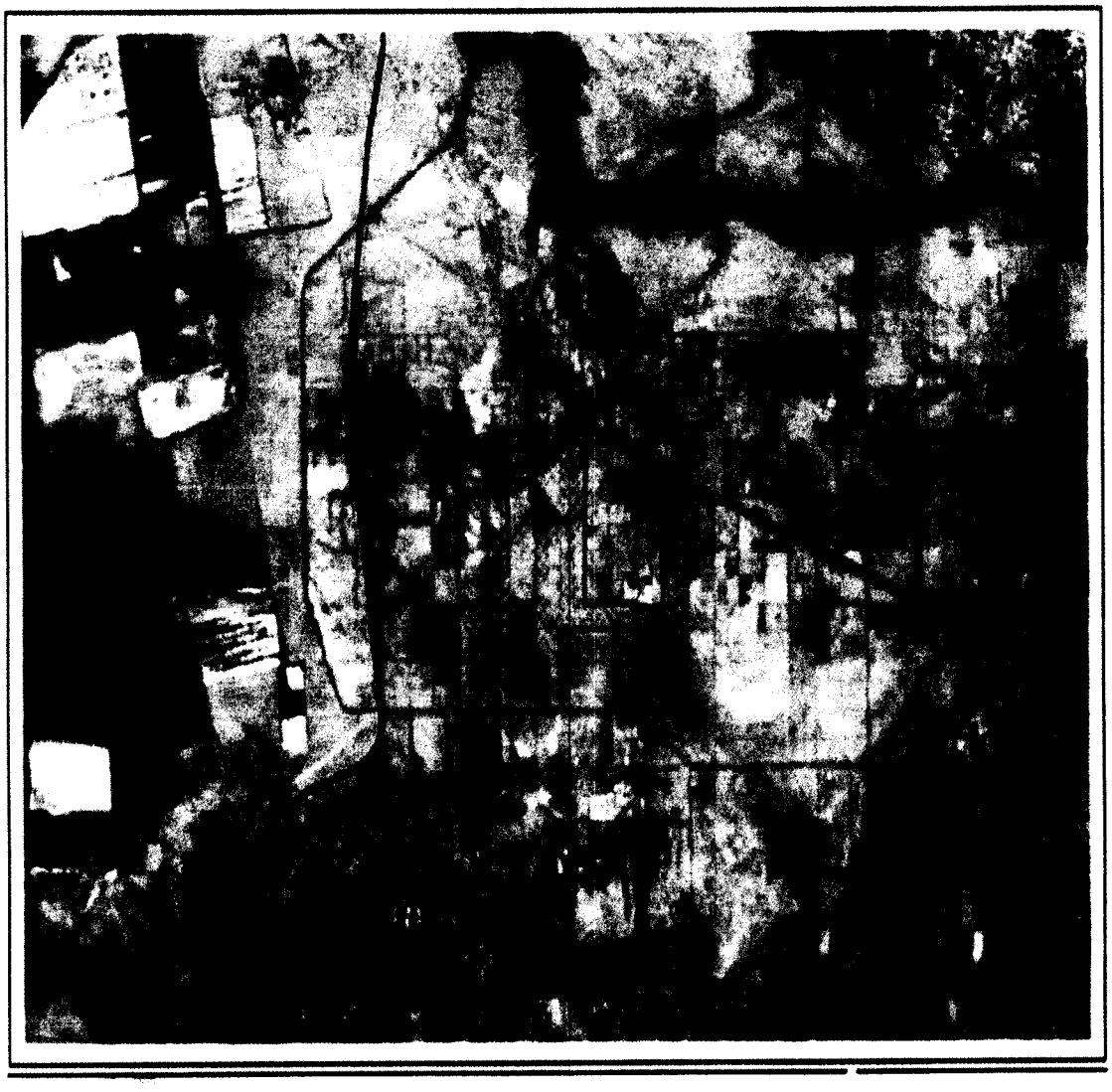
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

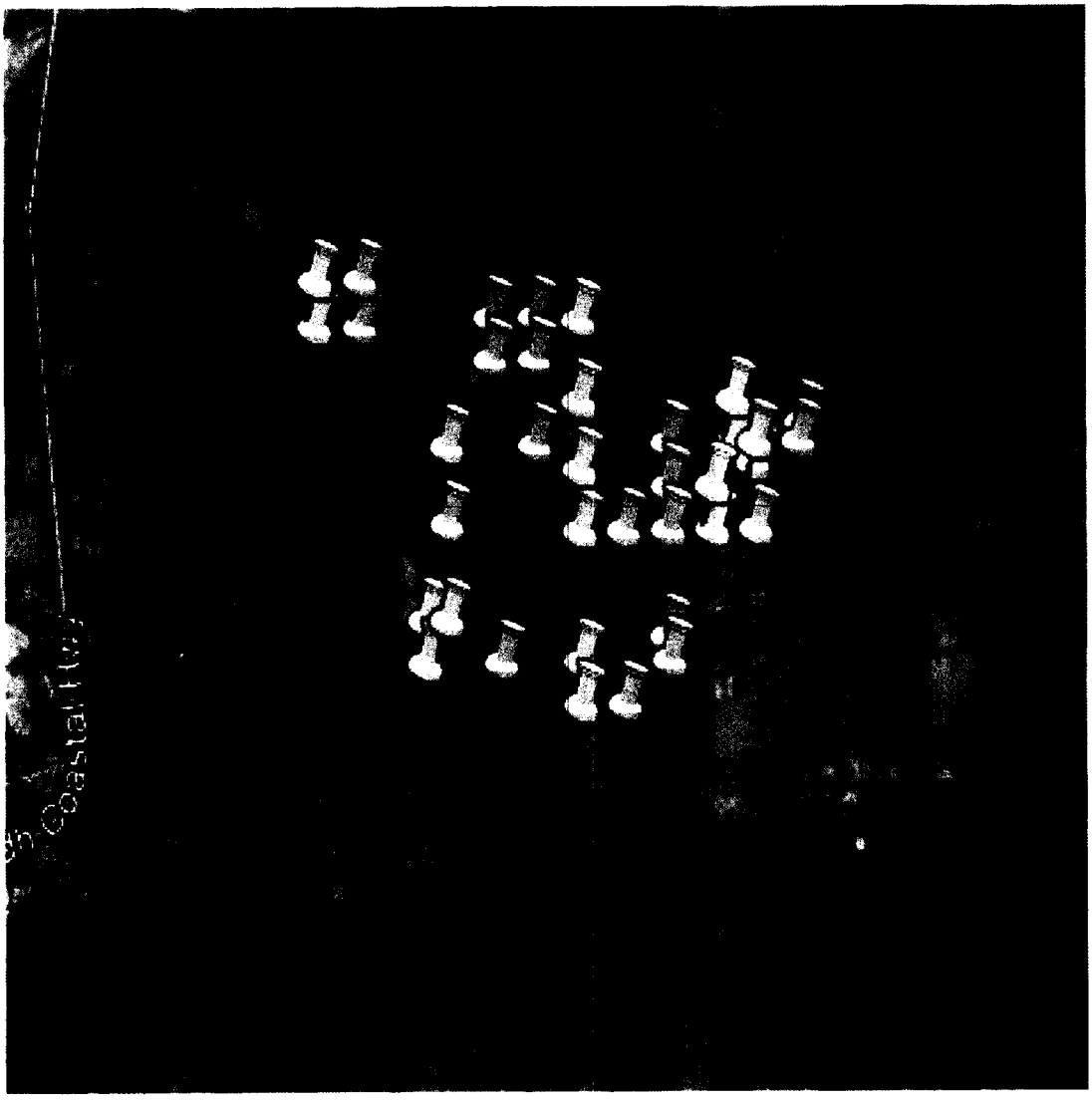
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

North	East
24°43'14.06"N	67°33'27.04"E
24°43'13.96"N	67°33'19.91"E
24°43'13.89"N	67°33'12.73"E
24°43'8.66"N	67°33'12.79"E
24°43'8.73"N	67°33'19.97"E
24°42'58.26"N	67°33'20.06"E
24°42'58.13"N	67°33'5.75"E
24°42'48.77"N	67°33'5.89"E
24°42'37.20"N	67°33'6.00"E
24°42'37.16"N	67°33'2.40"E
24°42'31.93"N	67°33'2.46"E
24°42'32.04"N	67°33'14.82"E
24°42'32.17"N	67°33'27.51"E
24°42'26.94"N	67°33'27.57"E
24°42'27.00"N	67°33'34.72"E
24°42'32.31"N	67°33'41.85"E
24°42'35.16"N	67°33'41.43"E
24°42'48.01"N	67°33'41.67"E
24°42'47.94"N	67°33'34.52"E
24°42'47.87"N	67°33'27.33"E
24°42'55.31"N	67°33'27.26"E
24°43'3.55"N	67°33'27.17"E
24°43'3.77"N	67°33'52.24"E
24°42'58.54"N	67°33'52.30"E
24°42'58.47"N	67°33'41.55"E
24°42'53.24"N	67°33'41.61"E
24°42'53.31"N	67°33'48.76"E
24°42'48.07"N	67°33'48.82"E
24°42'48.14"N	67°33'55.97"E
24°42'56.00"N	67°33'55.53"E
24°42'58.58"N	67°33'55.86"E
24°42'58.64"N	67°34'2.87"E
24°43'3.35"N	67°34'2.79"E
24°43'18.63"N	67°32'51.51"E
24°43'18.56"N	67°32'44.19"E
24°43'12.78"N	67°32'44.16"E
24°43'12.78"N	67°32'51.54"E

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

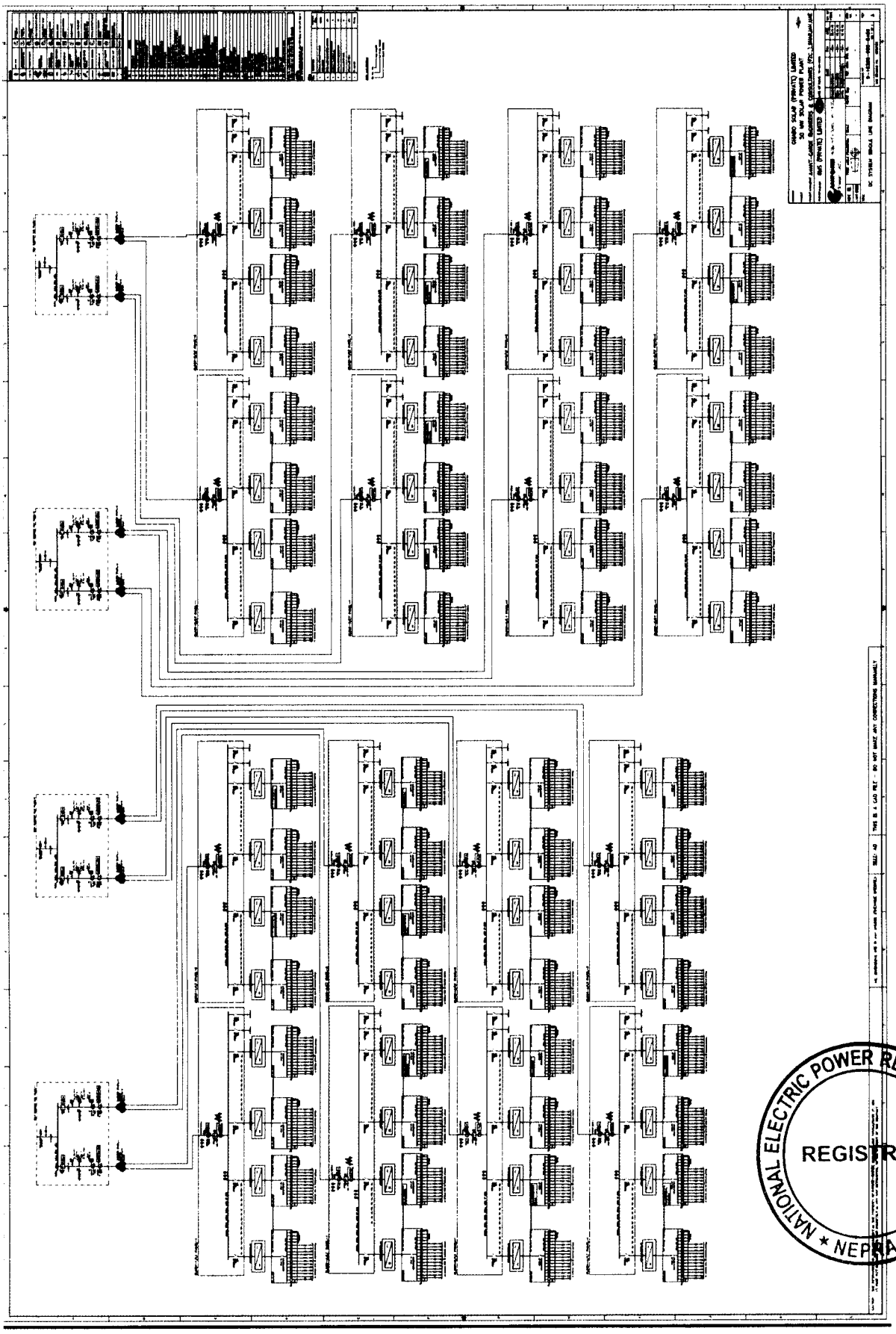
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Schematic Diagram of the Layout of the Generation Facility/Solar Power Plant/Solar Farm of the Licensee

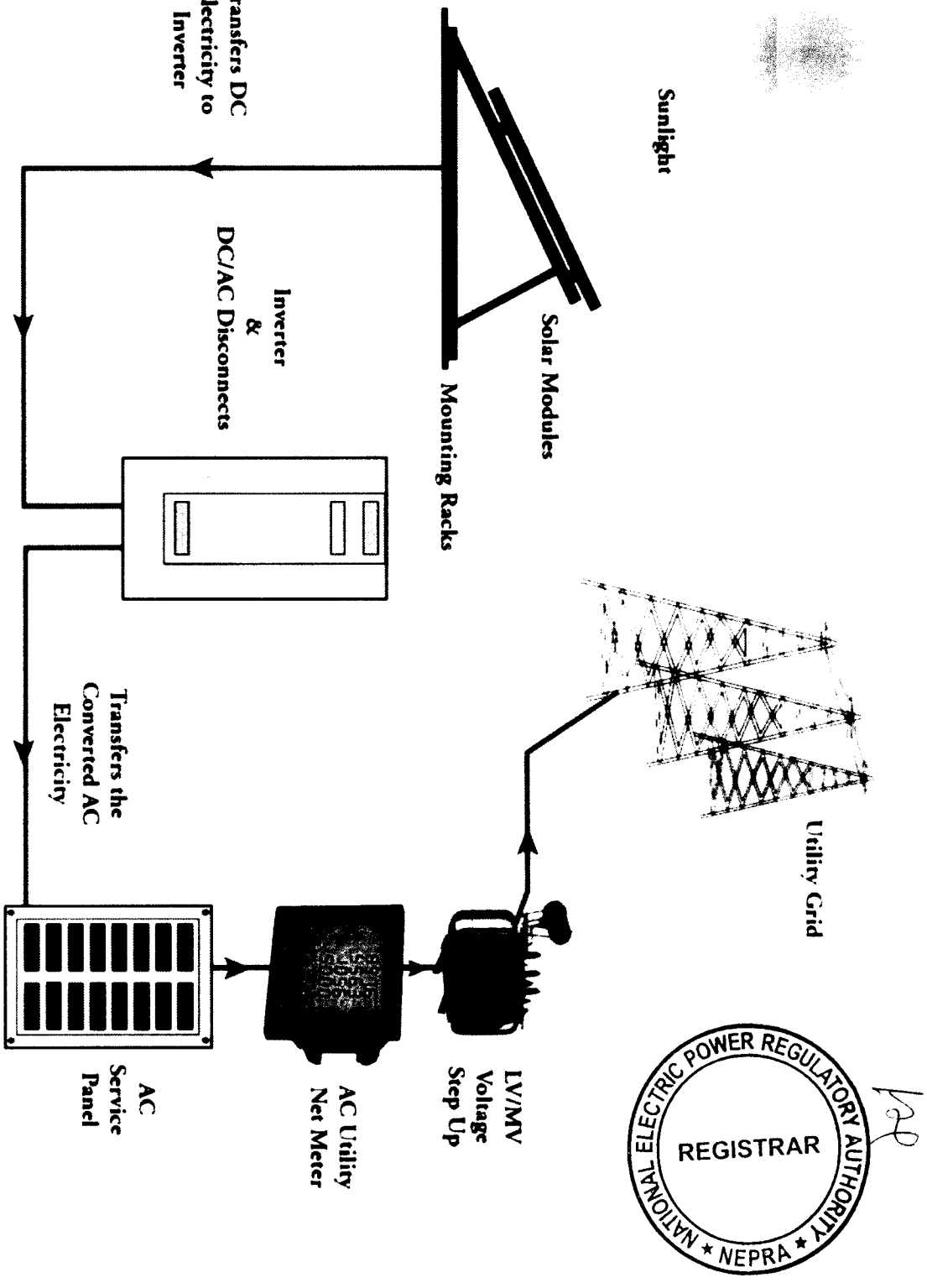
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

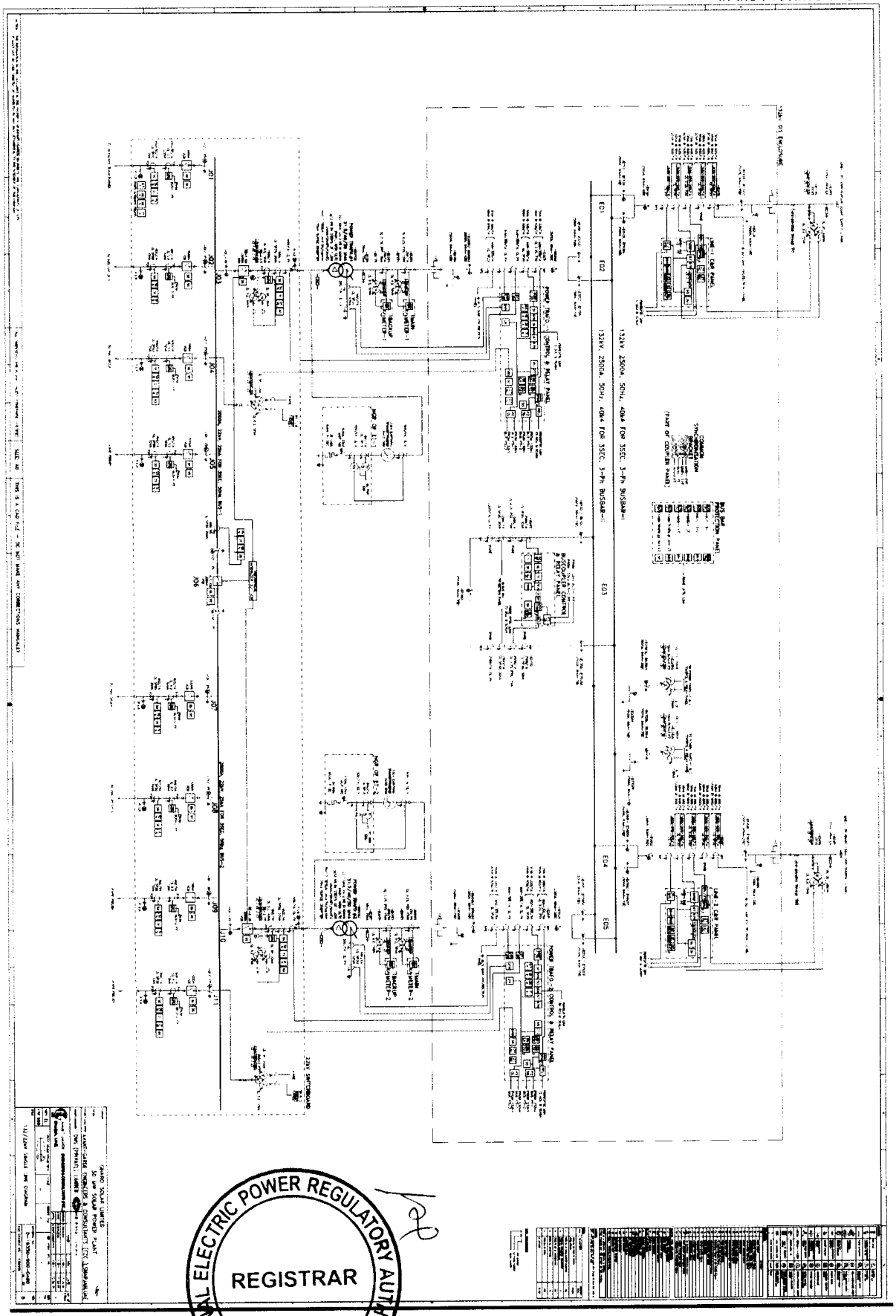
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

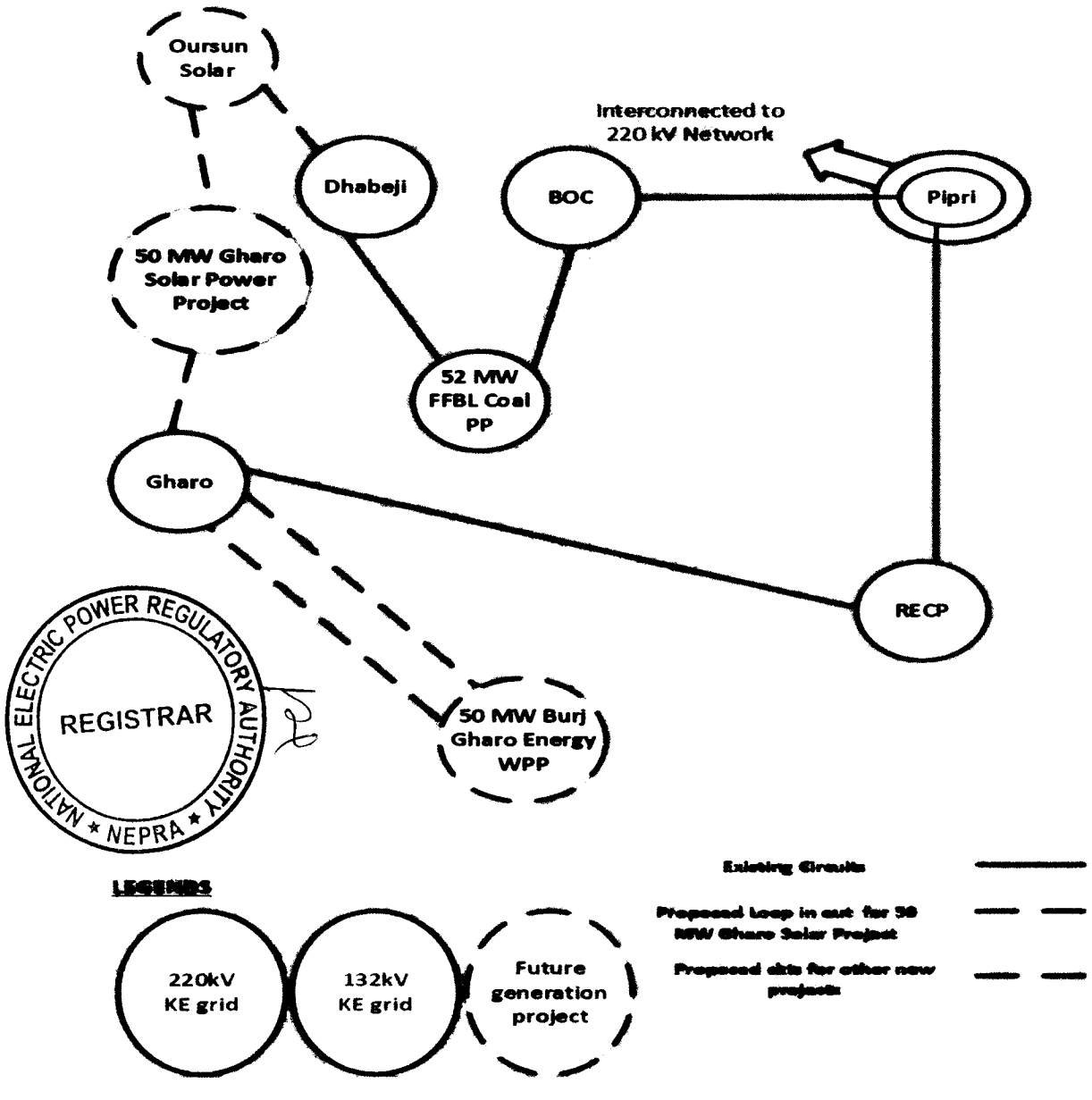
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Schematic Diagram of the Interconnection Arrangement/Transmission Facility for Dispersal of Power from the Generation Facility/Solar Power Plant /Solar Farm

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA


Oursun Solar
Interconnected to 220 kV Network
Dhabeji
BOC
Pipri
50 MW Gharo Solar Power Project
52 MW FFBL Coal PP
Gharo
RECP
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA
50 MW Burj Gharo Energy WPP
LEGENDS
220kV KE grid
132kV KE grid
Future generation project
Existing Circuits
Proposed Loop in out for 50 MW Gharo Solar Project
Proposed dots for other new projects

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

The electric power generated from the Generation Facility/Power Plant/Solar Farm of GSPL shall be sold to K-Electric and dispersed to the load center of K-Electric.

(2). The proposed Interconnection Arrangement/Transmission Facility for dispersal of electric power for the Generation Facility/Solar Power Plant/Solar Farm comprises the following: -

(a). 132 kV double circuit (400 sq mm, Cu conductor) of about 2.5 km length to loop in-out the already existing Oursun Solar – Gharo single circuit located near the Gharo Solar Plant.

(3). Any change in the above Interconnection Arrangement/Transmission Facility duly agreed by GSPL and K-Electric, shall be communicated to the Authority in due course of time.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Detail of Generation Facility/Solar Power Plant/ Solar Farm

(A). General Information

(i).	Name of the Company/Licensee	Gharo Solar Limited
(ii).	Registered/ Business office of the Company/Licensee	1485/C-2A, Asad Jan Road, Lahore Cantt.
(iii).	Location of the generation facility Solar Power Plant/ Solar Farm	The proposed plant is located at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh
(iv).	Type of the generation facility/ Solar Power Plant/ Solar Farm	Solar PV Power Plant

(B). Solar Power Generation Technology & Capacity

(i).	Type of Technology	Photovoltaic (PV) with single-axis tracking
(ii).	System Type	Grid Connected
(iii).	Installed Capacity of the generation facility Solar Power Plant/ Solar Farm (MW)	50 MWp

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(C). Technical Details of Equipment

(a).	**Solar Panels – PV Modules**	
(i).	Type of Module	380Wp – JA Solar bifacial dual glass module
(ii).	Type of Cell	Mono Crystalline
(iii).	Dimension of each Module	2004±2mm×1000±2mm×30±1mm
(iv).	No. of Panel /Modules	131,579 Nos of 380Wp corresponding to 50 MWp

(v).	Single Module Area	2.004 m^2
(vi).	Frame of Panel	Anodised Aluminium Alloy
(vii).	Weight of one Module	29.8kg±3%
(viii).	No of Solar Cells in each module	72 Cells
(ix).	Efficiency of module	19.00%
(x).	Maximum Power (P_{max})	380 W_P
(xi).	Voltage @ P_{max}	40.02V
(xii).	Current @ P_{max}	9.50A
(xiii).	Open circuit voltage (V_{oc})	48.81V
(xiv).	Short circuit current (I_{sc})	10.03A
(xv).	Maximum system open Circuit Voltage	1500V DC
(b).	**PV Array**	
(i).	Nos. of Strings	11-16 Strings per inverter
(ii).	Modules in a string	30 Nos
(c).	**Inverters**	
(i).	Capacity of each unit	125kW
(ii).	Manufacturer	Sungrow
(iii).	Nominal Input Voltage	1050V_{dc}
(iv).	Number of Inverters	352 Nos
(v).	Efficiency of inverter	98.7% (Euro Efficiency)
(vi).	Max. Allowable Input voltage	1500 V_{dc}
(vii).	Max. Current	148A DC
(viii).	Max. Power Point Tracking Range	860-1450V_{dc}
(ix).	Output electrical system	600V
(x).	Rated Output	480-690 V

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

	Voltage		
(xi).	Power Factor (adjustable)	Adjustable >0.99 (at nominal power)	
(xii).	Power control	Dynamic	
(xiii).	Rated Frequency	50 Hz	
(xiv).	Other Parameters	Allowable Relative Humidity	0-100%
		Audible Noise	< 65 dB(A)
		Operating Elevation	4000m (>3000m derating)
		Corrosion Category	C5
		Operating temperature	-25℃~+60℃
(xv).	Grid Operating protection	A	DC Over Voltage Protection
		B	DC reverse polarity
		C	Low Voltage Ride Through (LVRT)
		D	Anti-Islanding Protection
		E	AC & DC short circuit
		F	AC & DC overvoltage
		G	Leakage Current Protection
(d).	**String Combiner Box**		
(i).	Number of J/Box units	1 SCB per inverter & 352 Nos of SCB in total	
(ii).	Input circuits in each box	16 Inputs	
(iii).	Max. input current for each circuit	15A	
(iv).	Protection Level	IP 65	
(v).	Over current protection	Over Current and Short Circuit Protection available	
(vi).	Surge protection	Available	
(e).	**Data Collecting System**		
(i).	Weather Data	Global horizontal irradiation pyranometer, Tracking irradiation pyranometer, Ambient Air Temperature Sensor, PV Panel Temperature Sensor, Anemometer, Relative Humidity, Rain Gauge	
(ii).	System Data	(a).	DC input voltage(V) & current (A) of each Inverter (Phase, Line)

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

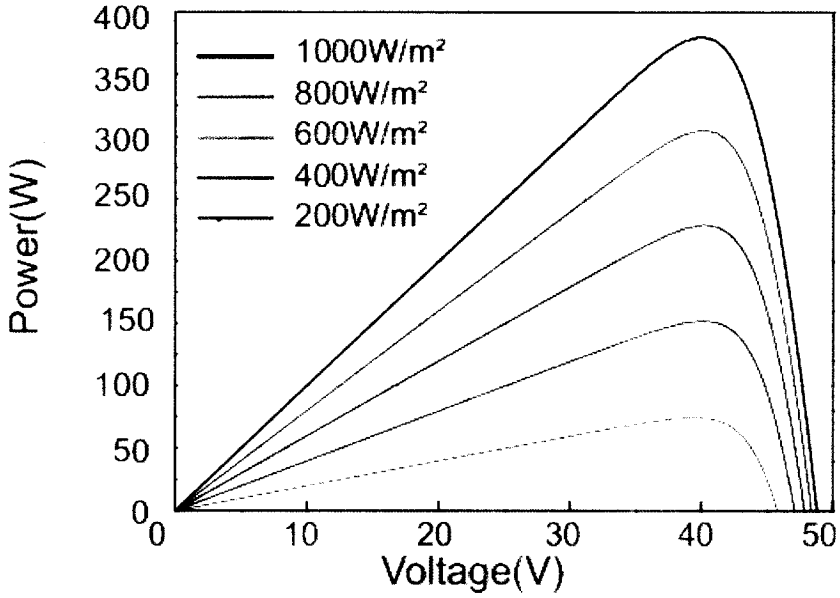
		(b).	Total DC power (kW) generated by PV array.
		(c).	AC output voltage (V) and current (A) of each Inverter (Phase, Total)
		(d).	AC output power (kW) and energy (kWh) of each Inverter
		(e).	Frequency (Hz)
		(f).	Power Factor (PF)
(f).	**Power Transformer**		
(i).	Rating	31.5/40/50 MVA	
(ii).	Type of transformer	Power Transformer - ONAN (Oil Natural Air Natural) – ONAF1 – ONAF2	
(iii).	Purpose of transformer	Step-up (22 kV/132 kV)	
(iv).	Output Voltage	132 kV	
(g).	**Unit Transformer**		
(i).	Rating	5.60MVA	
(ii).	Type of transformer	Inverter Duty Transformer - ONAN (Oil Natural Air Natural)	
(iii).	Purpose of transformer	Step-up (0.60kV/22kV)	
(iv).	Output Voltage	22 kV	

(D). Other Details

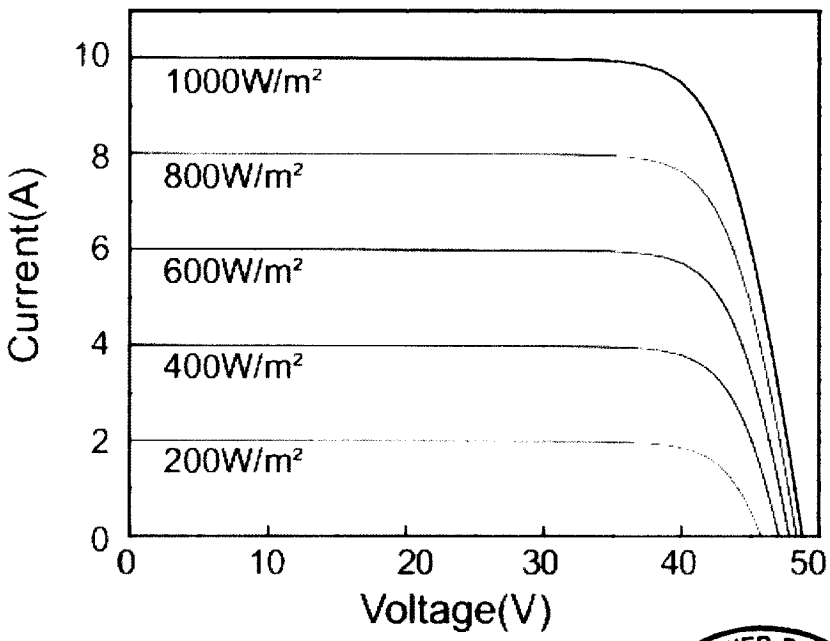
(i).	Expected COD of the generation facility Solar Power Plant/Solar Farm	November 30, 2019
(ii).	Expected useful Life of the generation facility Solar Power Plant/Solar Farm from the COD	25 years

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Power-Voltage Curve JAM72D09-380/BP



Current-Voltage Curve JAM72D09-380/BP



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

SCHEDULE-II

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

SCHEDULE-II

(1).	Total Installed Capacity of the Generation Facility/Solar Power Plant/Solar Farm	50.00 MW_P
(2).	Average Sun Hour Availability/Day (Irradiation on Inclined Surface)	6.0 Hrs
(3).	No. of days per Year	365
(4).	Annual generating capacity of Generation Facility/Solar Power Plant/Solar Farm (As Per Tariff Determination)	97,279.80 MWh
(5).	Total expected generation of the Generation Facility/Solar Power Plant/Solar Farm during the twenty five (25) years term of this licence	2,431,995 MWh
(6).	Annual generation of Generation Facility/Solar Power Plant/Solar Farm based on 24 hours of working	438,000 MWh
(7).	Net Capacity Factor of Generation Facility/Solar Power Plant/Solar Farm (4/6)	22.21%

Note

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA