

# GHARO SOLAR (PRIVATE) LIMITED

C-2A, Asad Jan Road, Lahore Cantt.

Ph: 042 36687823-24, Fax: 042 36687825

Ref: GSPL/NEPRA/TP-17/01

Date: July 28, 2017

Registrar

National Electric Power Regulatory Authority (NEPRA)

NEPRA Tower, Ataturk Avenue (East)

Sector G-5/1, Islamabad.

Subject: Tariff Petition under NEPRA (Tariff Standards and Procedure) Rules 1998 by Gharo Solar (Private) Limited in relation to a 50 MWp Solar PV Power Plant to be set up near Gharo, District Thatta, Sindh, Pakistan

Dear Sir,

Gharo Solar (Private) Limited hereby submits its petition for generation tariff pursuant to the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules 1998 for consideration and determination by the National Electric Power Regulatory Authority ("NEPRA") in relation to a 50 MWp Solar PV power plant to be set up near Gharo, District Thatta, Sindh, for sale of electric power to K-Electric Limited.

The Tariff Petition is submitted in triplicate along with the following:

1. Bank Draft No. 17831195 dated 26-06-17 for applicable fee pursuant to NEPRA (Fees Pertaining to Tariff Standards and Procedure) Regulations, 2002;
2. Board Resolution of Gharo Solar (Private) Limited; and
3. Affidavit by the authorized representative of the company.

We would be grateful for timely processing of the Tariff Petition and remain at your disposal in case of any queries.

Thank you and best regards,

*Binyameen*

Binyameen  
Company Secretary  
Gharo Solar (Private) Limited



— SA (Tech)

— SAT-I

— DG (M&E)

— Dir (Fin)

— LA (M&E)

— M (P)

For information & up to H.

— DRO/DReg-I

Gt 10:

31.07.17

cc: chairman  
VC/M (M&E)  
MCT  
MCH  
MCA

Dated: 31-07-17

BEFORE THE NATIONAL ELECTRIC POWER REGULATORY  
AUTHORITY

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PETITION FOR GENERATION TARIFF  
UNDER  
NEPRA (TARIFF STANDARDS AND PROCEDURE) RULES 1998

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In relation to:  
50 MWP SOLAR PV PROJECT

Petitioner:  
GHARO SOLAR (PRIVATE) LIMITED

Power Purchaser:  
K-ELECTRIC LIMITED

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DATED 28 JULY 2017

DETAILS OF THE PETITIONER

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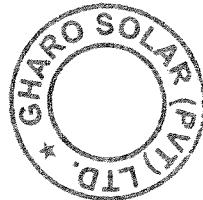
NAME AND ADDRESS

Gharo Solar (Private) Limited

1485/C-2A, Asad Jan Road,  
Lahore, Cantt, Pakistan.  
Tel: +92 42 36687823-24  
Fax: +92 42 36687825

AUTHORIZED REPRESENTATIVES OF GHARO SOLAR (PVT) LIMITED

1. Mr. Rana Uzair Nasim  
Chief Executive Officer
2. Mr. Binyameen  
Company Secretary



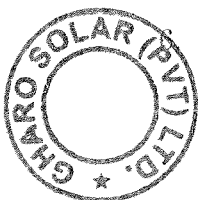
Tariff Petition under NEPRA (Tariff Standards and Procedure) Rules 1998 by Gharo Solar (Private) Limited in relation to a 50 MWp Solar PV Power Plant to be set up near Gharo, District Thatta, for Sale of Electric Power to K-Electric Limited

1. Gharo Solar (Private) Limited ("GSPL" or the "Company") hereby submits its petition for generation tariff (the "Tariff") pursuant to the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules 1998 (the "Tariff Rules 1998") for consideration and determination by the National Electric Power Regulatory Authority (the "Authority" or "NEPRA") in relation to a 50 MWp Solar PV power plant to be set up near Gharo, District Thatta, Sindh, for sale of electric power to K-Electric Limited ("KE" or "K-Electric").
2. The Authority is exclusively responsible for regulating the provision of electric power services and to determine tariffs pursuant to the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act"). Section 7(3) of the NEPRA Act specifically mandates the Authority to determine tariffs and the Tariff Rules 1998 lay down the broad procedural framework for tariff applications and determinations. This petition is being submitted before the Authority pursuant to Section 7 of the NEPRA Act read with Rule 3 of the Tariff Rules 1998 and other enabling provisions of the applicable law and policy.

**Grounds for Petition**

3. GSPL is a special purpose company incorporated for the purpose of setting up, owning and operating a 50 MWp Solar PV power project near Gharo, District Thatta, Sindh (the "Project"). GSPL intends to sell and KE intends to purchase the electricity generated by the Project, in pursuance of which KE has issued a Letter of Intent dated 1 July 2016 (the "LOI") to GSPL.
4. Subsequently, GSPL and KE executed a term sheet dated 10 November 2016 (the "Term Sheet") setting out the broad terms and conditions agreed between the parties in relation to the energy purchase agreement. The Term Sheet provides, *inter alia*, that the parties may opt for the upfront tariff or a negotiated tariff to be approved by NEPRA. However, pursuant to the Authority's determination No. NEPRA/SPVPGT-2017/2915-2917 dated 3 March 2017 (the "Solar Determination"), it appears that no further upfront tariff for solar is to be determined in the immediate future.
5. As further delays in the development of the Project would jeopardize its realization, GSPL has decided to submit this petition to the Authority for determination of generation tariff under the Tariff Rules 1998. It is highlighted that the competitive bidding framework referred to by the Authority in the Solar Determination is not applicable in the instant case as the Project is a raw site and Regulation 1(4) of the NEPRA Competitive Bidding Tariff (Approval Procedure) Regulations 2017 (the "Competitive Bidding Regulations 2017") stipulate that "*these regulations shall only be applicable in cases where detailed feasibility studies are available and are not applicable in cases of Raw Sites*".

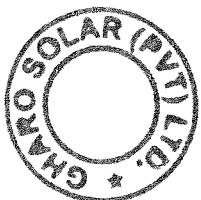
Additionally, in its recent determination No. NEPRA/TRF-WPT/2017/8179-8181 dated 30 May 2017 (the "Wind Review Determination"), the Authority while declining to issue new upfront tariff for unsolicited wind projects has noted in



*Bayan*

para 16 that its decision “does not restrict the unsolicited projects to get tariff approvals under NEPRA Tariff (Standard & Procedure) Rules, 1998.”

7. Therefore, a harmonious reading of the Competitive Bidding Regulations 2017 and the Authority's directions in the Solar Determination and Wind Review Determination lends support to the filing of this Tariff petition. The Authority is humbly requested to take a holistic approach in evaluating the GSPL Tariff structure and methodology, and to be guided by its statutory mandate of protecting consumers from monopolistic prices, encouraging efficiency and minimizing economic distortions (*see* Sections 31(2)(a), (d) and (f) of the NEPRA Act 1997).
8. In devising the Tariff, GSPL has chosen a structure that is novel, transparent and consumer-friendly. A concerted effort has been made to ground the methodology adopted in this Tariff petition on the mandate of Rule 3(2)(f) of the Tariff Rules 1998 i.e. “*data, facts and evidence*” to best assist the Authority to arrive at a well-informed understanding of the proposed tariff structure. In fact, the GSPL Tariff in certain respects is more beneficial to the power purchaser than the new benchmark levelized wind tariff announced by NEPRA for competitive bidding.
9. This petition is being submitted by GSPL in advance of its generation licence application pursuant to Rule 3 of Tariff Rules 1998, which permits “*any licensee, consumer or person interested in the tariff*” to file a tariff petition with the Authority. As such, there is no strict requirement under the Tariff Rules 1998 for the petitioner to be a licensee or to have submitted an application for generation licence prior to tariff filing. The same interpretation has recently been affirmed by NEPRA in para 48.5 of its determination No. NEPRA/TRF-351/PPIB-2016/11318-11321 dated 18 August 2016 as it admitted the tariff petition by PPIB “*being an interested person*” in the matter of the Matiari-Lahore HVDC Transmission Line Project. GSPL shall submit its generation licence application to the Authority separately in due course and shall certainly only undertake construction and installation of the Project after award of the generation licence.
10. K-Electric is currently undertaking a system-wide study on the integration of renewables as per NEPRA’s directives and has engaged international experts for this purpose. However, the Authority may kindly note that in the event that the findings of the study have any impact in relation to the Project, such concerns may be adequately addressed at the generation license stage. The findings of the study do not have any bearing on the instant petition whose applicability shall in any case be subject to the grant of a generation license.
11. As elaborated in subsequent sections, this petition is based on a top-down approach where a single tariff figure for years 1-13 and 14-25 is being submitted to NEPRA for determination with no specific adjustments or true-ups linked to estimated costs or individual tariff components. While broad benchmarks relating to cost and operational parameters are provided, these are only to assist the Authority in assessing whether the tariff is reasonable and equitable and not presented on a cost-plus basis. Accordingly, there is no one-time adjustment at COD, no indexations for debt mix or variation in LIBOR / KIBOR, no true-up for insurance costs, etc. Further, GSPL does not intend to award EPC contracts for



either whole or part of the Project and shall implement the Project in self-EPC mode through direct supervision and management of multiple consultants, suppliers and contractors. Accordingly, the recently issued NEPRA (Selection of Engineering, Procurement and Construction Contractor by Independent Power Producers) Guidelines, 2017 are not applicable to the instant petition.

### Key Project Sponsors

12. The Project sponsors have unique hands-on experience of every major renewable technology -- including 123 MW of biomass projects, 77 MW wind, 20 MW small hydro and 43 MWp of solar projects. They are co-sponsoring the 18 MWp Harappa Solar project, which is on track to be the first private sector solar IPP in Pakistan and first with single axis tracking technology when commissioned in October 2017 (expected). The key sponsors include:

#### *Rana Nasim Ahmed*

13. Mr. Ahmed is the main sponsor of GSPL. He is the Chief Operating Officer of JDW Sugar Mills Limited. He has helped transform JDW into one of the largest and most efficient sugar sector enterprises in Pakistan. He has spearheaded high-pressure cogeneration in the sugar industry by leading the development, construction and operations of the 53 MW bagasse-based project at JDW Unit-II and Unit-III. These pioneering projects were the first to materialize in 2014 under the NEPRA upfront bagasse tariff. He also has many years of experience managing JDW's low-pressure captive power plants of 70 MW cumulative capacity. He is sponsoring the Project in his personal capacity.

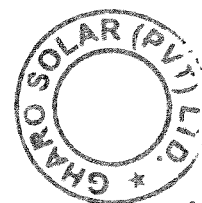
#### *Windforce (Private) Limited*

14. Windforce is a pioneering Sri Lankan renewable energy generation company. It was the first to introduce state-of-the-art wind power plants in Sri Lanka in 2010. Windforce directly owns and operates a portfolio of 77 MW of wind projects in Sri Lanka and 12 MW in small hydro through an affiliate company. In addition, the company recently commissioned 2 x12.5 MWp solar power plants in Sri Lanka. Windforce has a very experienced development team along with in-house engineering and project management expertise.
15. Shareholders / sponsors may be added or revised in due course as the project progresses further.

### Context for Proposed Supply to KE

16. Pakistan is an energy-deficient country and has faced a persistent and acute power generation shortage for the last several years. The maximum total demand recorded by KE in 2014-15 stood at 3,056 MW, whereas maximum generation capability including import was 2,632 MW<sup>1</sup>. While the peak deficit of 424 MW or 16% is significantly lower than the NTDC system, KE is continuing to invest substantial resources in enhancing generation capacity, improving its fleet efficiency and launching transmission & distribution enhancement programs such as the TP-1000 initiative.

<sup>1</sup> NEPRA State of Industry Report 2015

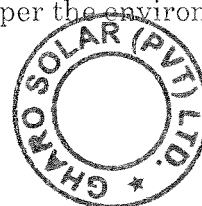


*[Signature]* 6

17. On the generation side, KE is also entering into new power / energy purchase agreements with IPPs on diverse fuels including natural gas, LNG, coal, etc. At the same time, the utility as part of its Climate Change Policy is encouraging the development of renewable energy projects including solar and wind in its licensed territory. The 50 MWp Gharo Solar Project is proposed to fulfil KE's twin imperatives of continuously augmenting generation given increasing electricity demand and demonstrating its commitment to harnessing indigenous and environmentally friendly energy resources. The latter goal assumes particular importance given that KE's current generation on renewables (both internal and from IPPs) is 0%, which is far behind regional / national grids in other countries and also trails renewable penetration of almost 4% in the CPPA/NTDC system<sup>2</sup>.

### Project Status

18. The management of GSPL, immediately upon receipt of the LOI, shortlisted the location of the Project and initiated the following development activities:
- Initial energy yield studies
  - Land inspection, title checks and negotiations
  - Preliminary site surveys
  - Grid interconnection study
  - Environmental studies
  - Preliminary plant design
19. Pursuant to the certificate dated 19 September 2016 issued by KE (the "Grid Study Approval"), the Project has been accorded approval in relation to the grid connectivity and simulation studies submitted by GSPL. KE has further certified its willingness to evacuate power generated by the Project and that such evacuation shall be in compliance with the grid code and shall have no adverse effects on KE's grid system.
20. The land for the Project has been selected based on input from KE's designated team in order to minimize additional infrastructural expenditure by KE. The identified site is adjacent to the 50MWp Oursun solar plant that shall also be supplying electricity to KE. Land acquisition for the Project is currently underway with earnest money already paid to the vendor and final registration and transfer formalities being concluded.
21. A detailed Initial Environmental Examination ("IEE") Report has been prepared by Global Environmental Management Services (Pvt) Ltd. on behalf of GSPL and is being submitted to the Sindh Environmental Protection Agency (EPA) for approval. As per the IEE Report, the Project has no significant adverse impacts and shall contribute positively to the environment and socioeconomic development of the area. Further, the Project land is marginal in nature with no endangered flora or fauna species in the area. Appropriate measures for environmental monitoring and mitigation have been proposed in the report, which shall be further augmented if required as per the environmental approval accorded by the Sindh EPA.



<sup>2</sup> Based on units generated on wind, solar and bagasse as per CPPA Energy Procurement Report for April 2017 available on NEPRA website

22. The following table provides a summary of the completed tasks and anticipated timeline for achieving future Project milestones.

Period	Tasks
July 2016 to September 2016	<input checked="" type="checkbox"/> Issuance of LOI and incorporation of Project Company <input checked="" type="checkbox"/> Identification of Project land and initial yield study <input checked="" type="checkbox"/> Grid study approval
October 2016 to March 2017	<input checked="" type="checkbox"/> Preliminary technical design <input checked="" type="checkbox"/> Feasibility Study ... Project land negotiations and acquisition ... Environmental studies and approval ... Awaiting determination of solar upfront tariff by NEPRA
April 2017 to December 2017	... Tariff submission and approval <input checked="" type="checkbox"/> Generation licence application and approval <input checked="" type="checkbox"/> Signing of EPA with K-Electric <input checked="" type="checkbox"/> Contractor/Supplier negotiation and selection
January 2018 to June 2018	<input checked="" type="checkbox"/> Lenders' Due Diligence <input checked="" type="checkbox"/> Financial Close
July 2018	<input checked="" type="checkbox"/> Commencement of works and supply
June 2019	<input checked="" type="checkbox"/> Commissioning of the Project

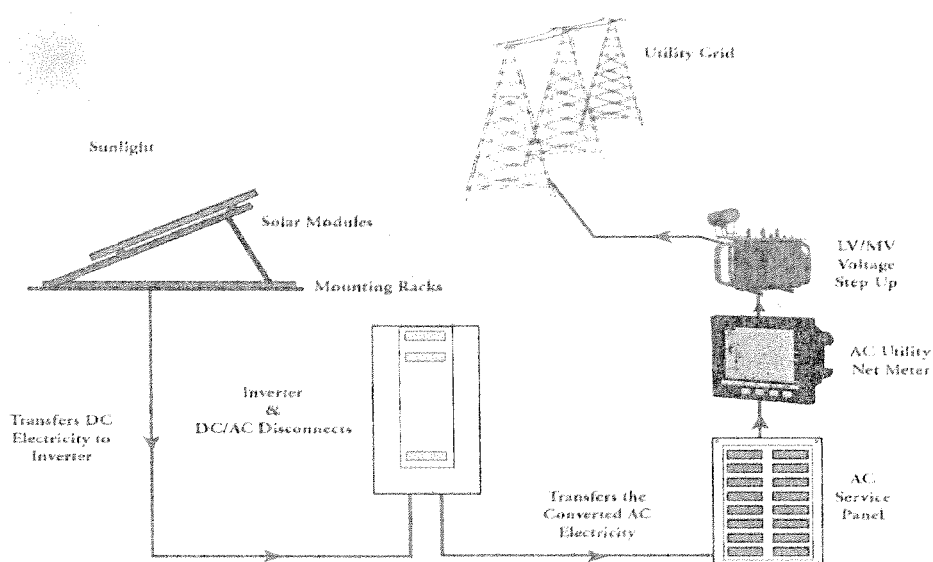
✓ Completed

... Under Progress

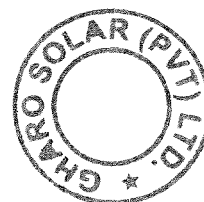
☒ To be initiated

### Project Overview

23. The Project comprises the installation of a 50 MWp solar photovoltaic power plant with mono or poly crystalline modules mounted on single axis tracker tables. The energy generated from the plant would be stepped up to 132 kV and disbursed to the KE grid network in the vicinity of the site. The figure and description below gives an overview of a typical grid-connected solar PV power plant and the main components involved<sup>3</sup>.



<sup>3</sup> Source: Utility-Scale Solar Photovoltaic Power Plants – A Project Developer's Guide (IFC)



*Signature*



*Solar PV Modules*

24. PV modules convert solar radiation directly into electricity through the photovoltaic effect in a silent and clean process that requires no moving parts. Solar panels are made up of a network (or array) of interconnected solar cells which convert solar radiation into electricity. The output from a solar PV cell is direct current (DC) electricity. A PV power plant contains many cells connected together in modules and many modules connected together in strings to produce the required DC power output.
25. The effectiveness of solar panels is subject to a number of factors such as the solar irradiation available at a particular location, shade from the surroundings or other panels and dirt or dust on the panels. These factors reduce the effectiveness of the solar panels. Panel degradation also occurs over time where the panels become less effective due to degradation of the components. These factors are taken into account in determining figures for projected production and profits.

*Mounting or Tracking Systems*

26. These allow PV modules to be securely attached to the ground at a fixed tilt angle, or on sun-tracking frames. These mounting structures may be set up on piled foundations or directly rammed into the ground, although piled foundations are recommended for a longer life.

*Inverters*

27. Inverters are a key component of solar farm technology used to convert the direct current (DC) collected from the solar panels into the alternating current (AC) for connection to the utility grid. Many modules in series strings and parallel strings are connected to the inverters.

*Step Up Transformers*

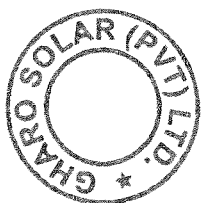
28. A simple yet highly efficient and integral component not only on solar farms but in electricity distribution in general, step up transformers take the output from the inverters to the higher voltage level (e.g. 11 kV, 33 kV or 132 kV) required at the grid interconnection point. The higher voltage enables electricity to be transmitted economically over large distances with minimum loss of energy.

*Cables*

29. PV or DC cables are the means of transportation of electricity from the solar panels to the inverters while AC cables transport electricity from the inverters to the interconnection point. A loss of energy is expected during the transfer of electricity via cabling. This is due to electrical resistance present in all conductors. The conversion of electricity to high voltage/low current by transformers for transport keeps this loss to a minimum.

*Sub Station*

30. This is the grid connection interface, where the electricity is exported into the grid network. The substation will also have the required grid interface switchgear such as circuit breakers and disconnects for protection and isolation of the PV power plant as well as generation and supply metering equipment.



*Balance of Plant*

31. The balance of plant typically comprises string combiner boxes, HT Panels / RMU Units, SCADA System, earthing system, illumination system, module cleaning system and civil works including foundations, inverter and control rooms, fencing, etc.

*Project Site*

32. The Project site is located at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh at approximately 6 km along the Sindh Coastal Highway and then 1.25 km via connecting road from the Highway. The site is about 55 km from Jinnah International Airport, Karachi and is adjacent to the 50 MWp Oursun Solar Plant, which shall also supply electricity to K-Electric. The location map is shown below.

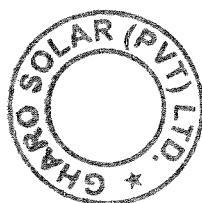


33. The Project has been planned in the same area as Oursun Solar to minimize the interconnection cost to K-Electric. K-Electric has already finalized its tendering and procurement for 132 kV double circuit line up to the switchyard of the Oursun Solar plant from the existing 132 kV Dhabeji-Gharo circuit. As per approved grid study for Gharo Solar, the interconnection scheme for the Project comprises 132 kV double circuit of about 0.7 km length to loop in-out the already planned Oursun Solar – Gharo single circuit located near the Gharo Solar Plant.

*Equipment Details*

34. The likely key equipment brands / suppliers for the Gharo Solar Project based on the sponsors' prior experience on solar projects are indicated below. These are subject to change following the completion of Project design.

No.	Equipment	Brands
1	PV Modules	Tier 1 (JA Solar, Trina, Jinko, Lerri Solar, Phono Solar, etc.)



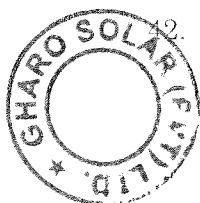
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2	Single Axis Tracker	Leading global supplier (Soltec, Optimum Tracker, Grupo Clavijo, Gonvarri, etc.)
3	Central Inverter	ABB, GE, Sungrow, etc.
4	String Combiner Boxes	Schneider, Sungrow, etc.
5	DC / AC Cables	Any top tier Chinese or Pakistan brand
6	Step-Up Transformers	Siemens, ABB, TBEA, QRE, Chint, etc.
7	Medium Voltage Switchgear and 132 kV Sub-Station	Siemens, ABB, Chint, etc.
8	SCADA	ABB, Schneider, Meteococontrol, etc.

## TARIFF

### Methodology and Structure

35. Traditionally, tariffs for IPPs regardless of whether cost-plus or upfront in nature, have been based on a bottom-up approach by considering various cost components and justifying each individually on the basis of budgetary / firm costs, precedent determinations, market assumptions, etc.
36. However, it is submitted that ultimately the end-result is more important, i.e. the actual tariff and its terms and conditions. An approach narrowly focused on individual cost components still leaves open the possibility of distortions in the end tariff if the total tariff and its terms and conditions are not contextualized.
37. As per Section 31(2)(f) of the NEPRA Act, the Authority is mandated to determine tariffs so as to "*eliminate exploitation and minimize economic distortions.*" In order to achieve these objectives, a top-down methodology has been adopted in the instant case which focuses on the actual tariff figure and its indexations / adjustments in an effort to provide a transparent and competitive result.
38. Accordingly, this petition is based on a simplified and consumer-friendly tariff structure with significant risk transferred to GSPL.
39. The Tariff is characterized by limited indexation of certain fixed percentages with USD/PKR exchange rate and local CPI only.
40. There is no indexation for LIBOR or KIBOR variation and the risk of this is to the account of GSPL. Similarly, there is no adjustment for actual debt mix or sinosure fees.
41. There is no one-time adjustment at commercial operations date for exchange rate variation in EPC price, variation in interest during construction or insurance during construction.
42. The Tariff assumes investment in higher capex to set up an advanced solar plant with single axis tracking. Utilization of tracking technology will result in higher energy production and smoother daily generation curve.



43. The Authority will also appreciate that the competitive tariff structure envisaged in this petition is not backstopped by a sovereign guarantee or other Government assurances available to IPPs contracting with CPPA-G.
44. As this top-down tariff approach ensures that very limited adjustments / true-ups are required to the benefit of KE and its customers, the Authority is likewise requested to adopt a holistic view in reviewing this tariff petition. While indicative assumptions relating to different cost and operational parameters are provided in subsequent sections, the benchmarks are only submitted to assist the Authority in determining a reasonable and equitable tariff. It is explicitly highlighted that the actual parameters may vary upwards or downwards from the benchmarks as GSPL shall attempt to balance various factors to successfully set up and operate the Project on this challenging tariff structure.

#### Proposed Tariff along with Terms & Conditions

45. The Tariff proposed by GSPL to be applicable from commercial operations date ("COD") through the end of the 25<sup>th</sup> year after COD is as follows:

Year	Tariff
1 – 13	7.910 Rs/kWh
14 – 25	3.706 Rs/kWh
Levelized	6.996 Rs/kWh 6.663 US\$/kWh

46. The Tariff shall be revised with effect from the first day of each calendar quarter (i.e. 1<sup>st</sup> January, 1<sup>st</sup> April, 1<sup>st</sup> July and 1<sup>st</sup> October) for the following indexations:
- 65% of the Tariff shall be revised on the basis of the prevailing TT & OD selling rate of US Dollar as notified by the National Bank of Pakistan on the last available day prior to start of the quarter. Reference TT & OD selling rate shall be Rs. 105/USD.
  - 35% of the reference Tariff shall be linked to the Consumer Price Index (General) published by the Pakistan Bureau of Statistics for the month prior to the start of the quarter. Reference CPI for the purpose of indexation shall be 215.45 for the month of June 2017.
  - Accordingly, the revised Tariff for the quarter shall be calculated as per the following formula:

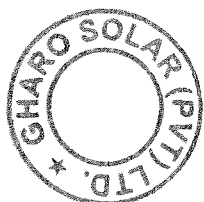
$$\text{Tariff}_{(\text{rev})} = \text{Tariff}_{(\text{ref})} * [(65\% * \text{FX}_{(\text{rev})} / 105) + (35\% * \text{CPI}_{(\text{rev})} / 215.45)]$$

Where:

$\text{Tariff}_{(\text{rev})}$  is the calculated revised tariff for the relevant quarter;

$\text{Tariff}_{(\text{ref})}$  is 7.910 Rs/kWh fixed in years 1-13 and 3.706 Rs/kWh fixed in years 14-25;

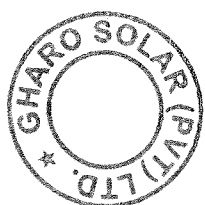
$\text{FX}_{(\text{rev})}$  is the revised TT & OD selling rate of US Dollar for the last available day prior to the start of the quarter as per para 46(a) above;



CPI<sub>(rev)</sub> is the revised Consumer Price Index (General) for the last month prior to the start of the quarter as per para 46(b) above.

47. The following terms and conditions are submitted for inclusion in the Authority's Tariff determination:

- a. GSPL shall be required to achieve financial close within one (1) year of approval of the Tariff by NEPRA, failing which the Tariff shall lapse.
- b. Following financial close, GSPL shall be required to achieve COD within one (1) year. Failure to achieve COD within this period shall not void the Tariff; however, KE may impose liquidated damages (except for delays due to force majeure or other reasons outside the control of GSPL) through appropriate mechanisms to be included in the Energy Purchase Agreement.
- c. The Tariff shall only be indexed for exchange rate and local inflation as provided in the Tariff petition. No other adjustment or indexation shall be applicable except for any pass-through items.
- d. The Tariff shall be notified only once and the relevant indexations shall be applied by GSPL and verified by KE directly given the simplified Tariff structure. However, the parties may approach NEPRA in case any index ceases to be available or if the parties require clarification relating to any aspect of the Tariff.
- e. Variation in tentative DC plant capacity of 50 MWp is allowed and this will not affect the Tariff, provided that the sum of the nominal rated output of plant inverters shall not exceed 50 MWac.
- f. All plant and machinery installed in the Project shall be new and as per international or equivalent standards.
- g. GSPL shall bear the full downside and upside of variations in actual energy output.
- h. All energy offered for sale by GSPL shall be purchased by KE.
- i. No extra financial compensation for degradation shall be provided in the EPA. However, the parties may agree on reasonable allowances in EPA for plant technical performance to account for degradation, plant outages, variability in irradiation, etc.
- j. The Tariff term shall be twenty-five (25) years from COD.
- k. Any energy generated prior to COD shall be sold at 50% of the Tariff.
- l. Debt financing may be secured through any combination and tenor of local and foreign debt. No adjustment shall be made for actual debt mix including in case GSPL secures debt under the State Bank Refinancing Scheme for Renewable Energy as the Company is bearing interest rate risk and this is taken to be a saving to the purchaser / end-consumers.
- m. In case the Company is obligated to pay any tax on its income from generation, supply or sale of electricity, or any non-refundable duties and/or taxes are imposed on the Company at any stage prior to or after its commercial operations date, the exact amount paid by the Company on these accounts shall be reimbursed by the purchaser as a pass-through



*Buyer*

payment on production of documentary evidence. However, withholding tax on dividend will not be passed through.

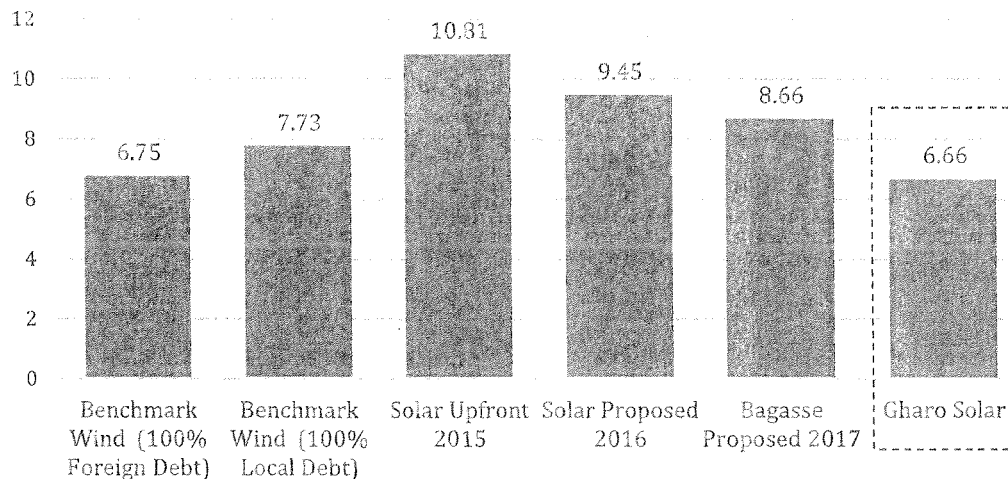
- n. Other terms and conditions not covered in this determination may be dealt with in the Energy Purchase Agreement.

### Justification of Proposed Tariff

#### *Comparison with other renewable and thermal tariffs in Pakistan*

48. The proposed Tariff represents a breakthrough for solar power generation in Pakistan as it brings solar to grid parity. Indeed, the tariff for GSPL is markedly lower than the levelized tariff for various upcoming power projects on different technologies. Figure 1 below compares the GSPL Tariff with other recently determined or proposed tariffs for renewable energy projects in Pakistan.

Figure 1 – Comparison of Gharo Solar Levelized Tariff with other Renewable Tariffs (US¢/kWh)<sup>4</sup>



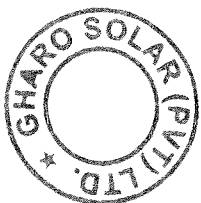
49. As can be seen from Figure 1, the proposed Tariff in equivalent US¢ of 6.663 / kWh is approximately 38% lower compared to the levelized figure of US¢ 10.8101 / kWh determined by NEPRA for plant size of 20-50 MW in its last upfront tariff dated 16 December 2015.
50. Compared to the more recent new upfront tariff of US¢ 9.4511 / kWh for South Region advertised by NEPRA on 14 June 2016 (but not ultimately issued), the proposed Tariff still represents a steep decline of 30%.
51. The proposed Tariff of US¢ of 6.663 / kWh also compares favourably with the benchmark competitive bidding wind tariff of US¢ of 6.7467 / kWh on foreign debt recently determined by NEPRA on 27 January 2017. As the GSPL Tariff is not subject to any adjustment for debt mix, it is significantly cheaper compared to the benchmark wind tariff of US¢ 7.7342 / kWh for projects with local debt.

<sup>4</sup> - Benchmark Wind (both foreign and local) figures from NEPRA determination dated 27-01-2017

- Solar Upfront 2015 based on NEPRA upfront tariff determination dated 16-12-2015

- Solar Proposed 2016 from Notice of Suo Moto Proceedings for Development of New Tariff for Solar PV Power Projects dated 14-06-2016

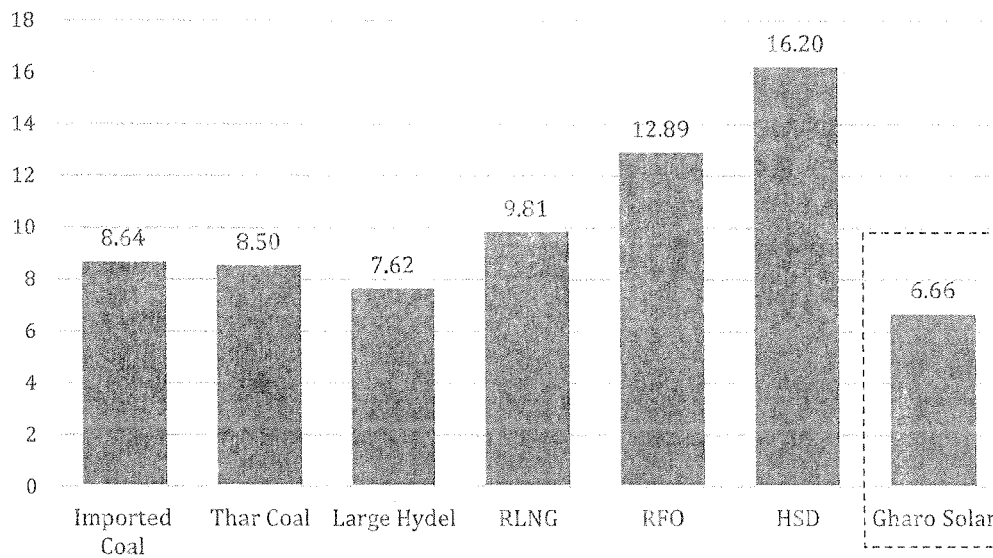
- Proposed Bagasse Tariff 2017 based on Notice of Hearing for determination of New Upfront Tariff for Bagasse Based Cogeneration Projects dated 18-03-2017



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52. Perhaps most significantly, the proposed levelized Tariff of US¢ 6.663 / kWh is markedly cheaper than the levelized tariffs for conventional plants including imported coal, local coal and large hydel. Figure 2 below compares the proposed Tariff to other current or recently determined tariffs for thermal and hydel plants. It is highlighted while Figure 2 illustrates the competitive nature of the GSPL tariff, it does not capture the full extent as the other tariffs are subject to various adjustments / true-ups (debt mix, sinosure fee, fuel price variation, local transportation, jetty costs and various others) that do not apply in the case of the proposed Tariff.

Figure 2 – GSPL Tariff Compared to Conventional Plants (levelized US¢/kWh)<sup>5</sup>



#### *Comparison with KE's Power Procurement Cost*

53. It is instructive to compare the proposed Tariff with KE's existing power procurement cost. As per para 28.30.23.2 of the recently issued Multi-Year Tariff for K-Electric dated 20 March 2017 (the "MYT Tariff"), KE's power purchase cost for FY 2016-17 is Rs. 8.60 / kWh. Due to its highly competitive structure, the proposed Tariff would be cheaper than KE's current cost even in GSPL's debt repayment years and help reduce KE's average power purchase price. It is also highlighted that KE's cost of procurement from other IPPs is subject to fuel price variation and is likely to increase going forward as oil, gas and coal prices have started rising again in 2017. As such, the difference between the GSPL tariff and purchase price from other IPPs is likely to widen over time.

<sup>5</sup> - Imported Coal Tariff from upfront tariff for coal projects (up to 220MW foreign financed) dated 26-06-2014

- Tariff figures for Thar Coal from upfront tariff (330MW – foreign financed) dated 09-07-2014

- Large Hydel tariff based on Karot Power Company Ltd. dated 27-04-2016.

- RLNG Tariff based on determination of Quid-e-Azam Thermal Power (Pvt) Ltd. dated 14-04-2016, as revised for fuel price through order dated 07-04-2017 and quarterly adjustment for tariff dated 21-04-2017

- RFO Tariff from determination of Nishat Chumian Power Ltd. dated 05-03-2007, as revised for fuel price through order dated 25-05-2017 and quarterly adjustment dated 13-04-2017

- HSD Tariff based on Saif Power Ltd. dated 21-10-2007, as revised for fuel price through determination dated 09-06-2017 and quarterly adjustment dated 21-04-2017



*Bayan*

*Comparison with global solar tariffs*

54. As the Authority is aware, solar tariffs have exhibited a markedly declining trend globally in the last several years. In certain countries with favourable dynamics such as UAE and Chile, solar tariffs have plunged to record lows unmatched by coal, natural gas, hydel or other traditionally cheap sources of electricity as is case with the GSPL Tariff compared to other generation technologies in Pakistan.
55. Tariffs for solar projects vary from country to country due to various reasons such as maturity and existing installed capacity of the solar sector, government policies, regulatory stability, length and complexities of development cycle, operational costs, etc. However, there are two dominant factors that determine the overall tariff: (1) cost of capital and (2) capacity factor. The following table compares recent solar tariffs for different countries with their capacity utilization factors and weighted average cost of capital.

Table 1 – Solar Tariffs compared to Capacity Factor and Cost of Capital<sup>6</sup>

Country	Solar Tariff US¢/kwh	Capacity Utilization Factor	Weighted Average Cost of Capital
Chile <sup>7</sup>	2.91	24.45%	5.00%
UAE <sup>8</sup>	2.94	20.32%	4.18%
Mexico <sup>9</sup>	3.35	22.23%	5.85%
Peru <sup>10</sup>	4.85	23.34%	6.26%
Zambia-Site 1 <sup>11</sup>	6.02	19.63%	10.23%
Pakistan – GSPL	6.66	18.65%	13.71%
Turkey <sup>12</sup>	6.99	18.31%	8.03%
China <sup>13</sup>	7.80	18.52%	5.82%
Egypt <sup>14</sup>	7.80	22.21%	15.15%
Zambia-Site 2	7.84	19.63%	10.23%
Vietnam <sup>15</sup>	9.35	15.99%	10.45%

56. Table 1 above demonstrates that the lowest prevailing tariffs are in countries such as Chile, UAE, Mexico and Peru which have an ideal mix of some of the highest solar capacity factors in the world along with very low cost of capital. Developers in these countries are able to deploy debt with long tenors of up to twenty years at very competitive interest rates. Similarly, they also benefit from access to regional and international institutional investors including pension / insurance funds with long payback expectations. In contrast, even 10 year sovereign Pakistan Investment Bonds have a coupon rate of 8.75%<sup>16</sup> despite an all-time low interest rate scenario whereas sovereign 20 years sovereign bonds routinely remain unsold in auctions.

<sup>6</sup> World Bank Global Solar Atlas - <https://globalsolaratlas.info> and WACC Expert - <https://www.waccexpert.com>

<sup>7</sup> <https://thinkprogress.org/solar-delivers-cheapest-electricity-ever-anywhere-by-any-technology-c2ef759ac33f>

<sup>8</sup> <https://www.pv-tech.org/news/jinkosolar-in-deal-to-build-1.2gwp-solar-plant-in-abu-dhabi>

<sup>9</sup> <https://renewablesnow.com/news/clean-electricity-prices-fall-in-mexicos-2nd-auction-541329/>

<sup>10</sup> <https://www.engie.com/wp-content/uploads/2016/03/solar-power-peru.pdf>

<sup>11</sup> [https://www.pv-magazine.com/2016/06/14/zambia-to-be-home-to-africas-cheapest-solar\\_100024977/](https://www.pv-magazine.com/2016/06/14/zambia-to-be-home-to-africas-cheapest-solar_100024977/)

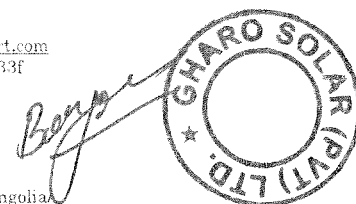
<sup>12</sup> <http://af.reuters.com/article/energyOilNews/idAFL5N1GX268>

<sup>13</sup> <https://cleantechnica.com/2016/10/03/china-gets-lowest-solar-bid-yet-1-gigawatt-solar-auction-inner-mongolia/>

<sup>14</sup> <https://www.pv-magazine.com/2017/04/18/scatec-solar-secures-ppa-for-400-mw-of-solar-plants-in-egypt/>

<sup>15</sup> <https://www.pv-tech.org/news/vietnam-introduces-utility-scale-solar-fit-and-rooftop-net-metering>

<sup>16</sup> State bank of Pakistan Auction for Investment Bonds on 19-04-2017 - <http://www.sbp.org.pk/ecodata/Auction-Investment.pdf>





57. The GSPL Tariff in equivalent US¢ of 6.66 / kWh is competitive with the record low tariffs cited in Table 1 when assessed against relative capacity factors and cost of capital. Further, the proposed Tariff compares well with countries such as Turkey, China and Egypt, which have similar or higher tariffs despite benefitting from more favourable capacity factors and cost of capital.
58. To further illustrate this point and normalize for these two key variables, the formula below calculates simplified levelized cost of energy based on varying capacity factor and cost of capital by country with a constant notional project cost and annual O&M expense. While the formula allows for meaningful comparisons, it should be interpreted as an indicative proxy as the actual tariffs incorporate other variables and involve discounting of cash flows.

$$CoE = ((PC * WACC) + OM) / (8760 * CUF * 10)$$

Where:

CoE	=	Calculated cost of energy in US¢ / kWh
PC	=	Solar PV project cost in USD per MW
WACC	=	Weighted average cost of capital in %
OM	=	Annual operation & maintenance expense in USD per MW
CUF	=	Capacity utilization factor in %

59. Assuming a constant notional project cost<sup>17</sup> and annual O&M<sup>18</sup> expense, Table 2 below compares the actual tariff and the implied cost of energy for different countries based on varying capacity factors and cost of capital. As the table illustrates, the tariffs for Chile, UAE, Mexico and Zambia Site 1 are generally in line with or slightly lower than the implied cost of energy, whereas other countries such as Turkey, Egypt, China and Vietnam actually have higher tariffs than implied by their capacity factor and cost of capital. As demonstrated by the table, the GSPL proposed Tariff is very competitive and significantly lower than the cost of energy implied by the relatively higher cost of capital in Pakistan and average capacity utilization factor.

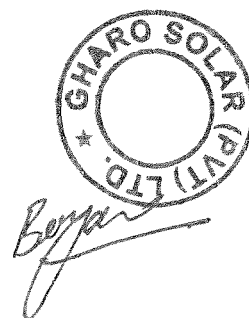
Table 2 – Comparison of Actual Tariff vs Implied Cost of Energy<sup>19</sup>

Country	Actual Solar Tariff (US¢/kwh)	Implied Cost of Energy (US¢/kwh)
Chile	2.91	2.93
UAE	2.94	3.17
Mexico	3.35	3.56
Peru	4.85	3.55
Zambia-Site 1	6.02	6.00
Pakistan – Gharo Solar	6.66	7.97
Turkey	6.99	5.38
China	7.80	4.26
Egypt	7.80	7.27
Zambia-Site 2	7.84	6.00
Vietnam	9.35	7.50

<sup>17</sup> Notional Project Cost \$775,000 per MW for fixed tilt solar plants

<sup>18</sup> Assumed O&M costs of \$24,000 per MW

<sup>19</sup> Implied cost of energy is based on respective capacity utilization factors and cost of capital in Table 1



### Assessment of Tariff based on Relevant Benchmarks

60. To provide further grounds for comparison and justification of the proposed Tariff, relevant cost and operational benchmarks are provided below for the Authority's reference. However, it is emphasized that these benchmarks are only indicative and not presented on cost-plus basis as the instant tariff petition is based on a single tariff figure for years 1-13 and 14-25 and accompanying terms and conditions. GSPL shall ultimately be guided by the overall tariff figure determined by the Authority and shall vary the actual cost and operational parameters as required to successfully set up and operate the Project.

#### Project Cost

61. The proposed Tariff is based on an aggressive base EPC cost of USD 750,000 per MW including higher capex for single axis tracking technology. An uplift factor of 3.62% representing levelized cumulative impact of 0.5% annual degradation is applied to the base EPC cost as per NEPRA precedent to give an adjusted EPC cost of USD 777,150. The assumed EPC cost represents a steep decline of 29% relative to the last determined upfront solar tariff<sup>20</sup> and reduction of 20% compared to the proposed benchmark in the draft upfront tariff advertised on 14 June 2016<sup>21</sup>. It is important to highlight that the NEPRA benchmarks were based on fixed tilt system, which has significantly lower capex and energy yield than the cutting-edge tracking solar plant assumed in this petition.
62. Table 3 compares the indicative breakdown of the EPC cost with the benchmarks assumed by NEPRA in the last upfront tariff. As the Authority will appreciate, GSPL is passing on both recent as well as projected declines in solar equipment costs. Further, GSPL is taking on a very substantial execution role itself and not incorporating margin for an external EPC contractor. GSPL shall endeavour to compensate its shareholders for this significantly expanded role and additional guarantees / coverage required by project lenders through relentless optimization of various cost and operational parameters.

Table 3 – Indicative Breakup and Comparison of EPC Cost Benchmark

Item	Last Upfront Tariff (USD million/MW)	Assumed by GSPL (USD million/MW)
PV module	0.550	0.340
Inverter	0.090	0.060
Mounting System	0.100 (Fixed Tilt)	0.150 (Tracking)
Cable & Transformer	0.100	0.100
Civil & General Work	0.100	0.100
Sub-Total	0.940	0.750
EPC Margin	0.094	-
<b>Base EPC Cost</b>	<b>1.034</b>	<b>0.750</b>
Degradation Adjustment	0.0374	0.0272
Adjustment for Project Size	0.0214	-
<b>Adjusted EPC Cost</b>	<b>1.092859</b>	<b>0.777150</b>

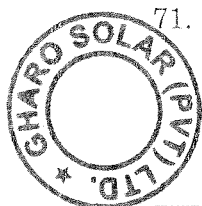
<sup>20</sup> Compared to EPC cost of USD 1,092,859 per MW plus insurance during construction of USD 9,107 for 20 to 50 MW project size in the determination dated 16 December 2015

<sup>21</sup> Proposed EPC cost was USD 968,847 per MW

63. The module price has been targeted at 0.340 USD million / MW even though the average spot price is currently varying between 0.37 to 0.385<sup>22</sup> USD million / MW. The mounting system cost assumed by GSPL is for single axis tracking, which is typically 0.08 – 0.12 USD million / MW higher than fixed system. However, GSPL is aggressively assuming increase of only 0.05 USD million / MW in this category compared to the NEPRA benchmark for fixed tilt on the basis of its sponsors' established experience with single axis tracking systems in Sri Lanka and Pakistan and planned optimization of tracker design and cost. The other substantial cost decline is assumed for inverters in line with global trends.
64. Other cost benchmarks such as cable & transformer and civil & general work remain the same as assumed by NEPRA in the upfront solar tariff as these are general equipment and works and not linked to solar PV price declines. In fact, piling and installation works for tracking plants are typically more complex as the structural load of the tracker is higher than a fixed system. Nonetheless, the civil works component has not been changed and GSPL shall endeavour to closely manage this scope of work to avoid any cost overruns.
65. Land and development costs are assumed in line with the most recent NEPRA upfront solar tariff. Land is budgeted at USD 23,810 per MW while development costs are assumed at USD 36,658 per MW.
66. Interest during construction ("IDC") is calculated as USD 18,591 per MW based on 1 year construction period and financing terms outlined in subsequent paras.
67. No separate insurance during construction is applied as it is included within the base EPC cost figure and the Authority may please also keep this in mind when assessing the EPC cost benchmark.
68. Financing fees & charges are budgeted at 3% of debt figure considering 75% of project cost before IDC and amount to USD 18,846 per MW. The budgeted amount is lower than the NEPRA benchmark of 3.5% in the last upfront solar tariff and is an aggressive target considering planned financing on foreign debt. Foreign lenders routinely require higher arrangement fees and due diligence costs for foreign legal and technical advisors.
69. Total project cost based on the above assumptions sums up to USD 875,055 per MW.

#### *Capacity Utilization Factor*

70. As GSPL intends to install state of the art equipment including single-axis sun trackers, the plant is expected to achieve the highest capacity factor to date in Pakistan. In order to assess the capacity factor, detailed PVsyst simulations utilizing the two most bankable databases, Meteonorm and Solargis, have been performed (enclosed at Annex B and C respectively).
71. Meteonorm contains a comprehensive database of ground station measurements of irradiation and temperature at various locations across the globe. Meteonorm uses long term data sets to calculate hourly values, monthly average values and yearly sums for various meteorological parameters such as radiation, temperature, precipitation and sunshine durations. For locations where there is



<sup>22</sup> Based on price trend section of EnergyTrend ([www.energytrend.com](http://www.energytrend.com))

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no data available from measurement stations, the data is calculated by means of an interpolation between the closest available stations, based on a 3-D inverse distance model. For locations where there are not enough nearby stations available for interpolation, satellite data is used to fill the gaps.

72. The Solargis database is a high-resolution database recognized as amongst the most reliable and accurate source of solar resource information. The database resides on about 100 terabytes of data and it is continuously updated on daily basis. The data is calculated using in-house developed algorithms that process satellite imagery and atmospheric and geographical inputs. Solargis provides recent 10 years data for the solar resource and energy yield estimation. One of the major factors for considering recent 10 years solar data is due to reduced uncertainties with the coverage of high resolution (daily) aerosol data for improved irradiation distribution since 2003.
73. Table 4 below summarizes the results of the simulations carried out with PVsyst.

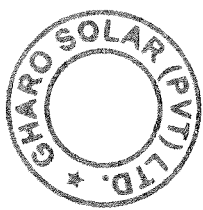
Table 4 – Simulations of Capacity Utilization Factor for Gharo Solar

	Fixed Tilt			Single Axis Tracker		
Capacity Factor	P50	P75	P90	P50	P75	P90
Meteonorm	17.57%	16.90%	16.31%	20.02%	19.27%	18.59%
Solargis	18.87%	18.16%	17.52%	21.36%	20.55%	19.83%
Average	18.22%	17.53%	16.91%	20.69%	19.91%	19.21%

74. As can be seen from Table 4, the average capacity utilization factor for fixed tilt considering Meteonorm and Solargis databases varies between 16.91% for P90 to 18.22% for P50 probability of exceedance. The NEPRA benchmark of 18.00% for South Region is close to the average P50 value in Table 4.
75. The average capacity factor for single axis tracker varies from 19.21% to 20.69%, which is a significant uplift over the fixed system. While lenders typically work only with P75 or P90 values, GSPL has decided to assume the more ambitious capacity factor of 20.5% close to the average P50 value to align with the basis for the NEPRA fixed system benchmark. The assumed capacity factor of 20.5% is approximately 14% higher than the NEPRA benchmark of 18.0% and represents a cutting-edge solar plant within the local context.

#### *Capital Structure*

76. Debt servicing component has been worked out on the basis of debt to equity ratio of 75:25 as per standard precedent.
77. Loan tenor of 14 years including grace period of 1 year and debt repayment period of 13 years with equal quarterly instalments has been assumed. This in an unprecedented tenor to arrange within the local context for renewable projects, particularly on foreign debt. The tenor is also challenging considering that GSPL is bearing the risk of LIBOR/ KIBOR variation over such a long tenor. GSPL is assuming the longer tenor as it reduces the tariff significantly in debt repayment years to the benefit of the power purchaser.



78. Return on equity is assumed at 17% on IRR basis as per established precedent for renewable energy projects. It is highlighted that GSPL is bearing substantially more risk due to the tariff structure than the typical IPP and can end up with a much lower return due to limited true-ups / indexations depending on interest rate movements, actual debt mix, insurance costs, etc. or cost overruns and unforeseen risks due to self-EPC mode of Project execution. It is also highlighted that GSPL does not benefit from an Implementation Agreement or sovereign guarantee unlike other IPPs.
79. Debt is assumed to be 100% foreign. However, debt may be raised in either foreign or local currency or any mix of the two and the risk of higher debt servicing on this account shall be borne by GSPL. Any variations in the debt mix shall not affect the Tariff and GSPL shall not be entitled to petition for any revision in the Tariff on this account.
80. The cost of debt is assumed at current 3 month LIBOR of 1.22% + 4.5% premium as per NEPRA precedent. Actual spreads over LIBOR are typically in the range of 4.75% - 5.0% based on recently closed renewable projects. There shall be no indexation or change in the Tariff to account for variations in LIBOR or if GSPL arranges local debt linked to KIBOR. It is highlighted that the 3 month LIBOR is presently at historically low levels and GSPL is taking significant risk on this account considering that LIBOR has touched 5.36% in the last decade.
81. There shall be no adjustment in the Tariff to account for sinosure or any other debt enhancement / guarantee fees.

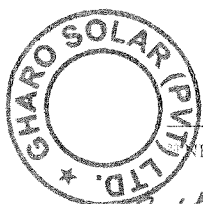
#### *Operations and Maintenance Costs*

82. The Tariff is based on annual O&M cost of USD 24,000 per MW inclusive of insurance. This is a very competitive figure and is 35% lower than the comparable benchmark in the proposed upfront solar tariff advertised by NEPRA on 14 June 2016<sup>23</sup>. While the NEPRA benchmark was for a fixed system, GSPL is assuming a much-reduced figure for a tracking system which typically has higher operational costs due to motors and rotating parts. Further, since insurance is included within the O&M cost, there shall be no separate true-ups or adjustment on this account.
83. It is also highlighted that the Project size is relatively small and GSPL does not benefit from the very substantial economies of scale in O&M costs available to large solar plants. For example, if Gharo Solar is compared to a solar plant of 100 MWp, the operational manpower requirements for both plants will be almost same and so the larger plant will effectively have close to half the O&M cost of GSPL.

#### **Key Benefits of Proposed Tariff**

##### *One of the lowest generation tariffs in Pakistan*

84. The proposed Tariff of US¢ 6.663 / kWh on levelized basis represents a breakthrough for renewable energy projects in Pakistan as it is lower than tariffs for various upcoming thermal and hydel projects in the country. The Tariff even in debt repayment years is cheaper than K-Electric's current power purchase



<sup>23</sup> NEPRA benchmark was USD 36,693 per MW comprising USD 27,005 for O&M and USD 9,688 for insurance

cost and shall lead to a reduction in its consumer-end tariff from the onset, apart from offering an environmentally friendly and indigenous source of energy.

#### *Burden of Debt-Servicing on Company*

85. It may please the Authority to note that GSPL has taken the onus of assuming an unprecedented debt tenor of 14 years in foreign currency to reduce the initial tariff. GSPL may have to partially forego its returns in debt servicing years if it is unable to meet the challenging debt assumptions or has to arrange debt partially in local currency. The proposed Tariff shifts the burden of higher debt servicing cost in the initial tariff years, which has traditionally been borne by the purchaser and the end-consumers, on to the Company.
86. Further, while the Tariff has been assumed on 100% foreign debt, it shall not be subject to adjustments for any variation in debt mix and the risk of higher loan repayments for partial or full local debt shall be borne by GSPL. Similarly, no adjustment for sinosure fees on foreign debt is claimed.

#### *No Indexation for Interest Rates*

87. The proposed Tariff is also unique in that no indexation for LIBOR or KIBOR variation in debt is requested and the risk of higher interest rates is to be borne by GSPL. While GSPL has modelled different interest rate scenarios, the Authority may note that KIBOR is currently at an all-time low, while LIBOR is also at a relatively low level compared to historical trends. As such, interest rates are bound to rise significantly in the coming years, and KE and its end consumers shall not be bearing the burden of such future increases in interest rates.

#### *Non-Indexation of the Insurance Component*

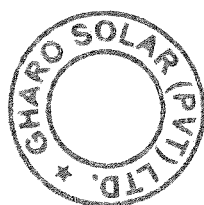
88. Another consumer-friendly feature of the proposed Tariff is that no separate indexation for insurance has been assumed. Typically, NEPRA allows a maximum of 1% of EPC cost indexed to USD:PKR rate as insurance component of the tariff. Due to the indexation with exchange rate, the actual allowed insurance increases over time in PKR terms. This increase would not apply in the instant case.

#### *Limited one-time adjustments at COD*

89. It is highlighted that apart from pass-through taxes and duties, the Tariff does not assume any one-time adjustment at COD for exchange rate variations in EPC cost, insurance during construction or interest during construction. Hence, the exposure of the purchaser to these potential risks is eliminated.

#### *Higher Energy Output*

90. GSPL intends to invest in higher capex to install cutting-edge tracking technology at the Project. Besides being one of the few solar plants in Pakistan to showcase single-axis trackers, the Project shall also provide a higher plant factor and higher energy output to the purchaser. Importantly, the yield curve from the tracking plant will be flatter and more attuned to grid requirements compared to a fixed system.

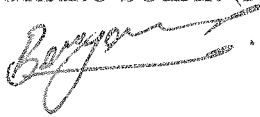


**Relief Sought**

91. In light of the above, it is respectfully prayed that the Authority may kindly admit and approve this Tariff petition, based on the assumptions and grounds stated herein, and on the terms and conditions as set out above.
92. The petitioner remains at the Authority's disposal to address any queries or clarifications.

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For and on behalf of  
GHARO SOLAR (PVT) LIMITED



Binyameen  
Company Secretary



ANNEXURE – A  
(REFERENCE TARIFF TABLE)



## Reference Tariff Table for 50MW Gharo Solar Power Project

Year	Reference Tariff (Rs/kWh)
1	7.910
2	7.910
3	7.910
4	7.910
5	7.910
6	7.910
7	7.910
8	7.910
9	7.910
10	7.910
11	7.910
12	7.910
13	7.910
14	3.706
15	3.706
16	3.706
17	3.706
18	3.706
19	3.706
20	3.706
21	3.706
22	3.706
23	3.706
24	3.706
25	3.706
Average Tariff (Rs/kWh)	5.892
Levelized (Rs/kWh)	6.996
Levelized (US¢/kWh) at 105 PKR/USD	6.663

