National Electric Power Regulatory Authority
Islamic Republic of Pakistan

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No. NEPRA/TRF-403/GSPL-2017/1190-1192
January 25, 2018

Subject: **Determination of National Electric Power Regulatory Authority in the matter of Tariff Petition filed by M/s. Gharo Solar (Pvt.) Limited for Determination of Reference Generation Tariff in respect of 50 MWp Solar Power Project** (Case No. NEPRA/TRF-403/GSPL-2017)

Dear Sir,

Please find enclosed herewith the subject Determination of the Authority along with Annex-I & II (24 pages) in Case No. NEPRA/TRF-403/GSPL-2017.

2. The Determination is being intimated to the Federal Government for the purpose of notification in the official gazette pursuant to Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

3. Order of the Authority along with Annex-I & II of the Determination needs to be notified in the official Gazette.

Enclosure: As above

25 01 18

(Syed Safeer Hussain)

Secretary
Ministry of Energy
'A' Block, Pak Secretariat
Islamabad

CC:

1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.

DETERMINATION OF NATIONAL ELECTRIC POWER REGULATORY AUTHORITY IN THE MATTER OF TARIFF PETITION FILED BY M/S GHARO SOLAR (PRIVATE) LIMITED FOR DETERMINATION OF REFERENCE GENERATION TARIFF IN RESPECT OF 50 MWp SOLAR POWER PROJECT

1. M/s Gharo Solar (Pvt.) Ltd. (hereinafter referred to as the "GSPL" or "the petitioner/company") filed a tariff petition before National Electric Power Regulatory Authority ("NEPRA/the Authority") on July 28, 2017 for determination of reference generation tariff in respect of its 50 MWp solar power project to be set up at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh under NEPRA (Tariff Standards and Procedure) Rules, 1998 ("Tariff Rules").

2. The petitioner submitted that it is a special purpose company incorporated at Securities and Exchange Commission of Pakistan (SECP) for setting up, owning and operating the subject solar PV project.

3. Summary of the key information provided in the tariff petition is as follows:

Project company	Gharo Solar (Private) Limited.
Sponsor	Rana Nasim Ahmed (COO JDW Sugar Mills Ltd.) Windforce (Private) Limited
Capacity	50 MWp
Project location	Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh
Concession period	25 years from COD
Purchaser	K-Electric Limited
Capacity Factor	20.50%
EPC contractor	Self EPC mode by GSPL
Project basis	BOO
Project cost	**USD (Million)/MW**
EPC cost	0.7500
Degradation	0.0270
Adjusted EPC Cost	0.7770
Project Development Land Cost	0.0605

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Pre-COD Insurance cost	Included in EPC cost figure	
Financing fees & Charges	0.0186	
Interest during construction	0.0189	
Total project cost	**0.875**	
Financing structure	Debt: 75% Equity: 25%	
Debt composition	100% Foreign	
Interest rate	3 month LIBOR of 1.22% + 4.5%	
Debt repayment term	13 years	
Grace period	1 year	
Repayment basis	Quarterly	
Return on equity	17% (IRR based)	
Operations cost including Insurance	**USD 24,000/ MW/Year**	
Tariff:	**PKR/kWh**	**US Cents/kWh**
Year (1-13)	7.910	6.663
Year (14-25)	3.706	3.5295
Levelized Tariff	**6.996**	**6.663**
Exchange rate	1 USD = 105 PKR	

PROCEEDINGS

4. In accordance with Rule 4 of Tariff Rules, the tariff petition was admitted by the Authority on August 23, 2017. Notice of admission was published in the daily national newspapers on 16th and 19th September, 2017 providing salient features of the petition and inviting comments/intervention request from the interested parties. In response to notice of Admission, intervention requests were received from Whistleblower Pakistan (WBP) and Mr. Muhammad Arif Bilvani, which were approved by the Authority. Further, comments were received from K-Electric Limited (KE) and Chaudhary Mazhar Ali. The submissions of interveners and commentators were sent to the petitioner for comments on which the petitioner vide letter dated November 28, 2017 has submitted its response.

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5. Based on the submissions of the petitioner and interveners/commentators, following issues were proposed to be considered during the course of hearing:-

ISSUES OF HEARING

6. Following is the list of issues that were framed by the Authority for the hearing:

- Whether the claimed EPC cost is competitive, comparative and justified?
- Whether the claimed Non-EPC cost is justified?
- Whether the claimed capacity utilization factor of 20.5% is reasonable and justified?
- Whether the petitioner's proposed solar modules and inverter technology satisfies the international standards of quality and operation?
- Whether calculation/study of ground irradiance data was carried out or otherwise?
- Whether the assumed degradation factor of 0.5% per annum is reasonable and justified?
- Whether the claimed O&M costs are justified?
- Whether the claimed return on equity of 17% is justified?
- Whether the financing/debt terms are justified?
- Whether the claimed construction period of 12 months is justified?
- Whether K-Electric considered GSPL project in its long term transmission system study conducted for determining the share of renewable energy?
- Whether KE has completed its study for interconnection of renewable energy in its network?
- Whether the proposed indexation/adjustment mechanism at COD and during operation is justified?
- Any other issue with the approval of the Authority.

7. The Authority also decided to conduct a hearing for which notices of hearing were also published in daily national newspapers on 26th and 27th October, 2017 conveying schedule of hearing for November 9, 2017 and issues framed for the hearing. Individual notices of hearing were also served to the relevant stakeholders vide letters dated October 26, 2017 for participation in the hearing. Subsequently, the hearing was adjourned by the Authority and re-scheduled for November 21, 2017. Notice of re-scheduling of hearing was published in daily national newspapers on November 8, 2017 and individual notices were also sent to the petitioner and the stakeholders vide letters dated November 10, 2017 accordingly.

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8. The hearing was held on November 21, 2017 (Tuesday) at 11:00 A.M. at NEPRA Tower, G-5/1, Islamabad which was attended by a large number of participants including the petitioner, K-Electric and others.

9. Having considered the respective submissions of the parties and after careful consideration of record, issue wise findings of the Authority are as under:-

Whether the claimed EPC cost is competitive, comparative and justified?

10. The petitioner has claimed USD 0.75 million per MW on account of EPC cost. To support its claim, following comparison has been submitted by GSPL. Explaining its claim, GSPL submitted that 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 0.38 USD million/MW. GSPL submitted that 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, it is aggressively assuming increase of only 0.05 USD million/MW in this category compared to the NEPRA's benchmark. The substantial cost decline has also been assumed for inverters in line with global trends. GSPL submitted that 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. Further, GSPL submitted that it is taking on a very substantial execution role itself and not incorporating margin for an external EPC contractor.

11. In its petition, GSPL submitted that under the claimed EPC cost, it shall install the equipment of following brands which is 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.)
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 Pakistani or Chinese brand
6	Step Up Transformers	Siemens, ABB, TBEA, QRE, Chint, etc.

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7	Medium Voltage Switchgear & Sub-station	Siemens, ABB, Chint, etc.
8	SCADA	ABB, Schneider, Meteocontrol, etc.

12. However, GSPL vide its letter dated December 26, 2017 submitted its application for the grant of generation license. In the instant application, GSPL submitted that it shall setup its project based on PV modules from Phono Solar. For inverters, GSPL has submitted that it shall purchase and install inverters from Sungrow.

13. GSPL submitted that it does not intend to award EPC contracts 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 ("EPC Guidelines") are not applicable to the instant petition.

14. WBP submitted that the petitioner is executing the project in self EPC mode which is a way to circumvent the provisions of EPC Guidelines and NEPRA Competitive Bidding Tariff (Approval Procedure) Regulations, 2017 ("Tariff Bidding Regulations"). The Authority has considered this submission of the intervener and is of the view that EPC Guidelines provide applicability on the projects that intend to award EPC contracts for whole or part of their power projects. It does not bind the companies to execute the projects only under the EPC mode. As GSPL does not intend to award EPC contract, therefore, the said EPC Guidelines do not apply on this project. Regarding the point of Tariff Bidding Regulations, it is informed that NEPRA dated March 03, 2017 issued its tariff decision for solar power projects. In the instant decision, the Authority decided to discontinue the upfront tariff regime and shifted towards competitive bidding for induction of solar power. Nevertheless, the Authority is of the view that it cannot refuse the interested parties, subject to fulfilment of the stipulated conditions, to not file petition under the Tariff Rules, 1998 especially when the agencies who have to carry out the bidding process are in process of developing the requisite documents.

15. K-Electric submitted that the EPC cost of USD 0.75 Million offered by GSPL is quite competitive for single axis tracking system which is quite capital intensive. K-Electric also submitted that civil works have been assumed in line with the latest upfront tariff allowed by NEPRA although the actual piling cost on the project site are much higher considering the low elevation and tidal/marshy land.

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16. To evaluate the EPC cost claim of GSPL, the Authority has relied upon the EPC cost and project cost data in different countries. The prices of different types of modules, inverters and mounting structures in different parts of the world were researched through a number of reports published by credible organizations. Moreover, a number of online sources providing spot prices data of equipment of solar power system were also surfed. Furthermore, the costs being claimed by other comparable solar power projects were also examined. It was found that the equipment prices (modules, inverters, mounting structures etc.) in most of the countries were roughly the same. The differences were noticed in total setup cost primarily because of the soft costs such as land cost, development cost, available expertise, cost of labour, manufacturing facilities etc. Analysing all this data, the Authority is of the view that cost claimed by GSPL of USD 0.75 million per MW (USD 37.50 million) is reasonable and decided to approve the same.

17. The allowed EPC cost is the maximum limit on overall basis. Applicable foreign portion of this cost shall be allowed variations at Commercial Operations Date ("COD") due to change in PKR/USD parity during the allowed construction period, on production of authentic documentary evidence to the satisfaction of the Authority.

Whether the claimed Non-EPC cost is justified?

18. Project development cost: The petitioner has claimed USD 36,658/MW or USD 1.833 million on account of project development cost. The petitioner stated that development cost has been assumed in line with the recent NEPRA upfront solar tariff. The Authority has examined this cost claim of GSPL while comparing the same with the claim of other solar power projects and has decided to allow USD 1.50 million under this head. Project Development Cost shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.

19. Land cost: The petitioner has claimed USD 23,810/MW or USD 1.191 million in respect of cost of land. The petitioner has stated that land for the project has been selected based on input from power purchaser i.e. K-Electric. As per GSPL petition, land acquisition for the project is currently underway with earnest money has been paid to the vendor and final registration and transfer formalities being concluded. Chaudhary Mazhar Ali submitted that cost of land in this remote area can be much less than estimated by GSPL. The Authority noted that comparing the cost of land of GSPL with other projects shall not be meaningful as the land of other projects have been leased out by respective provincial government on concessionary rates. Further, it has been learnt that the projects developed on tracking technology requires relatively more land.

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Moreover, the Authority noted the claimed cost is the same which was allowed to the previous projects under upfront tariff. In view of the above, the Authority has decided to allow USD 1.190 million under this head. Cost of land shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.

20. Financing fees & charges: The petitioner has claimed USD 0.942 million on account of financing fees & charges on the basis of 3% of the debt portion of the claimed capital cost. In line with its most recent decision in the comparable renewable energy projects, the Authority has decided to allow financing fee & charges at the rate of 2.5% on the allowed debt portion of the approved capital cost of GSPL. Accordingly, the allowed amount under this head works out to be around USD 0.754 million. Financial Charges shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.

21. Interest During Construction: The petitioner has claimed USD 0.929 million on account of interest during construction (IDC) based on 3 months LIBOR (1.22%) plus spread of 4.5%. Based on the approved EPC cost, drawdowns schedule as provided by the petitioner and taking into account the allowed construction period of ten months, the interest during construction works out to be around USD 0.676 million and is hereby approved. The terms of financing used to work out the aforesaid amount of IDC is discussed in the ensuing relevant sections. The allowed IDC shall be re-computed at COD, for the allowed construction period starting from the date of financial close, on the basis of actual drawdowns (within the overall debt allowed by the Authority at COD) by applying 3 month LIBOR applicable at the day of the respective drawdowns.

22. Recapitulating above, the approved project cost under various heads is given hereunder:

Project cost	**(USD Million)**
EPC Cost	37.500
Project Development Cost	1.500
Land Cost	1.190
Financing fees & Charges	0.754
Interest During Construction	0.676
Total	**41.620**

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Whether the claimed capacity utilization factor of 20.5% is reasonable and justified? Whether the petitioner's proposed solar modules and inverter technology satisfies the international standards of quality and operation? And whether calculation/study of ground irradiance data was carried out or otherwise?

23. GSPL in its petition submitted that it intends to achieve the highest capacity factor by installing latest equipment including sun trackers. GSPL also submitted that it has done detailed PV system simulations using two of the most bankable databases namely Meteonorm and Solargis for assessment of the capacity factor. According to GSPL, the average capacity factor for single axis tracker varies from 19.21% to 20.69% which is a significant uplift over the fixed system. In addition to the aforementioned, GSPL is of the view that it has assumed more ambitious capacity factor for 20.5% close to the average P50 value to align with the basis for the NEPRA fixed systems benchmark. The assumed capacity factor of 20.5% is approximately 14% higher than the NEPRA benchmark of 18% and represents a cutting edge solar plant with the local context.

24. WBP submitted that the capacity factor of GSPL is lower than capacity factor of 22.21%, proposed by comparable solar power projects, and will thereby result in higher capacity charges. WBP further submitted that GSPL has not mentioned any mechanism for sharing the benefit of extra electricity produced. K-Electric submitted that the capacity factor of 20.5% assumed by GSPL compares favourably with the NEPRA's benchmark figure of 18.0% for South Region in last Upfront Tariff.

25. The Authority has considered the submissions of the petitioner and commentators. The solar resource figure as submitted by the petitioner has also been checked. Most importantly, the Authority has given due consideration to the submission of the WBP that the projects being setup in the comparable locations are claiming considerably better net plant capacity utilization factors. In view thereof, the Authority has decided to approve the tariff of GSPL on net annual plant capacity factor of 22.21%. Further, the Authority has decided that the solar resource risk shall be borne by the power producer and a sharing mechanism given in the order part of this determination shall be applied on the energy produced beyond the approved capacity utilization factor.

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Whether the assumed degradation factor of 0.5% per annum is reasonable and justified?

26. GSPL in its petition claimed a levelized annual degradation factor of 0.5% of EPC cost in its tariff petition. WBP submitted that the proposed degradation factor of 0.5% per annum is on the higher side and needs to be allowed on comparable basis as being allowed in the rest of the world. The Authority has considered the submissions of the petitioner and intervener. The data with respect to degradation being allowed in different parts of the world has also been referred. Based on that, the Authority has decided to allow degradation factor of 0.5%. As requested by the petitioner, the impact of degradation factor has been capitalized in the approved project cost. The amount of USD 1.357 million has been made part of the approved project cost based on the levelized rate of 3.62% of the allowed EPC cost.

Whether the claimed O&M costs are justified?

27. The petitioner has claimed O&M cost of USD 24,000 per MW inclusive of insurance during operation. Justifying its claim, GSPL has submitted that the proposed cost is competitive figure and is 35% lower than the comparable benchmark in the proposed upfront solar tariff advertised by NEPRA on 14 June 2016. GSPL further submitted that a tracking system typically has higher operational costs due to motors and rotating parts. GSPL also emphasized that its project size is relatively small; hence, it does not benefit from the very substantial economies of scale in O&M costs available to large solar plants. For that purpose, GSPL referred that the operational manpower requirements for both 50 and 100 MW plants will be almost same and so the larger plant will have close to half the O&M cost of GSPL.

28. WBP submitted that O&M cost of GSPL needs to be reduced as the O&M of solar projects is on the lower side. K-Electric submitted that the GSPL has claimed O&M of USD 0.024 million/MW which is lower than the O&M cost claimed by Zorlu solar project on per MW basis.

29. To evaluate this claim of GSPL, the O&M cost being allowed in other parts of the world has been referred while keeping in view the market conditions, required skilled manpower, spare parts, inverters etc. As this cost component constitutes significant portion of the cost of human resource, hence, it was noted that doing comparison of O&M cost with the developed countries may not appropriate due to higher labour costs in those countries. The submissions of the petitioner regarding higher O&M cost of tracking solar power plants and smaller size of the project were also given due consideration. Based on these analyses, the Authority has decided to approve USD 0.759 million per year in respect of O&M cost to GSPL. The Authority has noted

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that the cost of manpower required for management office and site office constitutes quite a large portion of the total O&M cost which can be incurred in local currency. Further, it has also been noted that O&M cost in upfront tariffs were approved allowing major portion in local cost. In view thereof, the allowed O&M cost has been divided into local and foreign components in the ratio of 50:50. For insurance during operation, the Authority has decided to allow USD 0.187 million per year on the basis of 0.5% of the allowed EPC cost of the project.

Whether the claimed return on equity of 17% is justified?

30. GSPL has submitted that return on equity has been assumed at 17% on IRR basis as per established precedent for renewable energy projects. GSPL also added that it has no implementation agreement as well as sovereign guarantee like other IPPs supplying electricity to the system of National Transmission and Despatch Company Limited ("NTDCL"). WBP submitted that IRR proposed by Zorlu itself is 11.9% whereas the IRR proposed by GSPL is way higher.

31. The Authority has noted that in the most recent comparable cases of renewable technologies, it has allowed IRR to the limit of 15%. In view thereof, the Authority has decided to approve ROE of 15% on IRR basis for GSPL.

Whether the financing/debt terms are justified?

32. GSPL has claimed a debt: equity structure of 75:25 with foreign financing on the basis of LIBOR plus 4.5%. The debt utilized by GSPL will be repayable in a period of 13 years plus grace period of 1 year. GSPL has not claimed any indexation of debt servicing component on the basis of variation in LIBOR/KIBOR and has requested that no adjustment shall be made to the any debt mix of local or foreign currency including debt secured under the SBP financing scheme for renewable energy.

33. Chaudhary Mazhar Ali submitted that the debt service period of 13 years is not justified and should be around 08 years. WBP submitted that the financing terms need to be rationalized.

34. The Authority has noted that the premiums of 4.25% over base LIBOR has been allowed in the most recent cases of comparable renewable technologies. In view thereof, the Authority has decided to allow financing cost at the rate of LIBOR plus premium of 4.25% to GSPL. The

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claimed debt to equity ratio of 75:25 and debt servicing tenor of thirteen years are found reasonable and hereby approved.

Whether the claimed construction period of 12 months is justified?

35. The petitioner in its tariff petition has proposed a construction period of 12 months. WBP submitted that the construction period in development of a solar power project is on the lower side therefore, the constriction period of GSPL being a solar power plant should not be more than 9 months. GSPL during the hearing requested the Authority to award a construction period of 12 months while submitting that the site is very tough with fish ponds and water pools which make it difficult for civil works. According to GSPL a 10 months construction period for 50MW will be a tight period for the company. The Authority pointed out that if GSPL had chosen other part of land then construction period should have not been 12 months. Responding that, GSPL submitted that the project has been planned in the same area as Oursun Solar which is being developed right next to GSPL. The said site has been selected to minimize the interconnection cost to KE.

36. The Authority noted that the construction period of 10 months was allowed for a solar power project of 50 MW under the previous upfront tariffs. Oursun solar project of 50 MW next to GSPL project site also opted for upfront tariff with a construction period of 10 months. The Authority has considered that the claim of the petitioner is not reasonable and has decided to allow the construction period of 10 months to GSPL.

Whether K-Electric considered GSPL project in its long term transmission system study conducted for determining the share of renewable energy? Whether K-Electric has completed its study for interconnection of renewable energy in its network?

37. GSPL submitted that KE has included GSPL in its long term transmission study which is being conducted by Shanghai Electric Power Design Institute and is scheduled to be completed in January 2018. During the hearing, K-Electric also submitted that GSPL has been included in the transmission study which shall be completed in January 2018. KE further submitted during the hearing that a transmission line is being laid from KE's Dhabeji grid station to Gharo to evacuate power from Oursun Solar project. As the project of GSPL is adjacent to Oursun site a minimal infrastructure cost of 700 meters line would only be required to interconnect and evacuate power from GSPL as well with which KE has no issues. The Authority has considered these submissions of GSPL and K-Electric. Further, the Authority has noted that with its petition, GSPL

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submitted a term sheet signed between the petitioner and K-Electric which, inter alia, provides that the power purchaser shall exclusively purchase all the energy produced by GSPL under the provisions of EPA. In view thereof, the Authority understands that these issues have been settled between the power purchaser and the project company.

Whether the proposed indexation/adjustment mechanism at COD and during operation is justified?

38. GSPL had claimed indexations of tariff components different than the indexation mechanism generally claimed by the petitioners and allowed by NEPRA. GSPL had not solicited any one time adjustment at COD for exchange rate variation in EPC price, variation in interest during construction, insurance during construction, sinsoure fee, debt mix etc. Further, no indexation for variation in LIBOR/KIBOR rates had been solicited by GSPL during its operation period. GSPL has submitted that the 65% and 35% of the approved tariff may be allowed indexations with respect to variations in exchange rate and local inflation respectively on every 1st January, 1st April, 1st July and 1st September. The Authority has considered the submissions of GSPL and is of the view that the proposed mechanism may not be entertained under the Tariff Rules, 1998. The adjustment mechanism approved by the Authority is given in the Order Part of this determination.

General Submissions of WBP

39. WBP submitted that tariff petition of GSPL has been admitted by the Authority prior to the submission of the application of generation license by the petitioner which is contrary to the provision of rules and regulations of NEPRA. The intervener said that the technical scrutiny of the power project can only be made during the process of application of generation on the basis of feasibility study submitted along generation license application which covers the technical details. GSPL vide its petition submitted that the instant tariff petition is submitted in advance pursuant to the NEPRA Tariff Rules, 1998 which permit "any licensee", "consumer" or a "person interested in tariff" to file a tariff petition with the Authority. GSPL while advocating for its case also referred the tariff petition of Matiari-Lahore Transmission line wherein NEPRA acknowledged the petitioner PPIB as an interested person and awarded tariff without the application and award of generation license. During the hearing GSPL was inquired by the Authority regarding it generation license to which GSPL responded that the application for generation license application shall be filed at the earliest. The Authority has noted that GSPL

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dated December 26, 2017 has filed the application for its generation license which is currently under process with NEPRA.

40. WBP argued that solar PV power plants are replacing energy generation from base load thermal power plants with fixed capacity payments which results in an increase in costs for the power purchaser. GSPL submitted that unlike coal, furnace oil and other thermal projects, solar projects do not have capacity payments linked to their installed capacity. Further, a sizeable portion of the current installed capacity of Pakistan is inefficient and uneconomical to operate. GSPL also highlighted that even in the best scenario of low fossil fuel prices; the tariff based on furnace oil/diesel is still higher than the proposed solar tariff. GSPL also pointed out that the current power mix of the country is heavily dependent on imported fossil fuels, thus creating severe environmental as well as balance of payment issues and putting pressure on the Rupee. The Authority has noted that around 50% of the owned generation capacity of K-Electric and quite a large portion of its total basket comprises of old and relatively inefficient units. K-Electric's whole fleet is primarily based on fossil fuels, i.e. gas and furnace oil. Due to non-availability of sufficient gas, K-Electric has been running its power stations/units on furnace oil which costs higher both due to relatively higher prices and less efficiency. It has been analysed that fuel cost component of furnace oil based power stations is higher than the tariff being approved for GSPL even for the first thirteen years. It has also been noted that power purchase price that has been approved vide recent multi-year tariff of K-Electric works out to be around Rs. 8/kWh and the tariff being approved for GSPL is considerably lower at any time of its control period. Further, this arrangement shall also increase the share of renewables in the system of K-Electric.

41. WBP also raised its concerns regarding these projects being planned on "Take or Pay" and 'Must Run' policy for renewable energy projects. WBP also submitted that levelized tariff of GSPL is although lower, however, GSPL power project may not be economically and financially viable as the same is non-base load power plant with a capacity factor of only 19-20% which increases the cost of evacuation/ interconnection from a solar power plant. In response GSPL submitted that unlike thermal projects, the proposed project does not have the capability to store the energy resource, so any 'Take and Pay' model would render the project unviable. Any un-evacuated energy would impact the plant factor negatively and the Company would not to be able to recover its costs and investment. GSPL highlighted that solar power plants are globally considered as must-run units. Various countries including India, China, Chile, European Union, Sri Lanka, Turkey, Egypt, Mexico, UAE etc. all have policies ensuring must-run / priority dispatch status for solar projects and Pakistan has followed the same principle in its Renewable Energy Policy 2006. GSPL also submitted that the current market operates with a single buyer model in

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place and in this scenario solar projects would not be bankable on 'Take and Pay' basis. GSPL also submitted that NEPRA has acknowledged the same policy in its previous determination dated 09.08.16 for NPPML, an LNG based power plant wherein it was stated: "Regarding Take or pay arrangement, it is observed that this arrangement is in accordance with the application Power Policy and unless there is a competitive power market in the country this regime will be hard to change." The Authority has noted that the tariff being approved is not based on "take or pay" arrangement as the project sponsor shall not be ensured the recovery of its tariff on certain level of energy. Doing so, the risk of resource shall be borne by the power producing company. K-Electric has agreed to purchase all the energy offered for sale by GSPL which is in line with the arrangement given in Renewable Energy Policy, 2006. Regarding the submission of transmission cost, K-Electric has submitted that the project site is adjacent to the Oursun solar project for which KE is already in process of laying a 132 KV double circuit line from Dhabeji to the switchyard of Oursun solar in Gharo. Hence, the line being built shall be utilized for the evacuation of additional power which would result in optimization of transmission line and reduction of transmission cost.

42. WBP further submitted that it is in favour of the induction of the renewable power projects only if they are economically feasible and GSPL solar tariff is still higher than solar tariff in UAE and India which is in the range of around US cents 3/kWh. Further, WBP also pointed out that the tariff of GSPL is higher than the tariff requested by Helios, Meridian, Helios and HNDS. GSPL submitted that the proposed tariff by Gharo Solar is one of the lowest tariffs offered for any type of project in Pakistan. According to GSPL, the proposed tariff is lower than thermal (e.g. coal, LNG), large hydel and wind projects. With development in renewable technologies, electricity tariffs for the same have become cheaper than conventional power plants. GSPL also submitted that it is important to understand that solar tariffs are dependent on multiple factors which include solar irradiance in the area of installation and cost of capital of the country. Comparison of solar tariffs across countries has to be made within context of these factors and other considerations including state of maturity of the sector. Further, when comparing costs with neighbouring countries such as India, it needs to be recognized that India is a mature market with an installed solar PV capacity of over 14,000 MW till September 2017 and plans to add further 20,000 MW in 2017-18 alone. Regarding the comparison with Helios, HNDS and Meridian, GSPL submitted that every project is different in capacity, technology selection, capital structure and is not practical to compare projects while they are different in their base assumptions. The Authority has considered the submissions of the intervener and petitioner and has addressed the certain concerns of the interveners while approving the parameters of this tariff determination.

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43. Mr Arif Bilvani and WBP have submitted that after the recovery of all the development and operational costs by the investor the project should be transferred to an appropriate Government Agency. It is informed that the tariff under the transfer model works out to be higher as the redemption of equity is made part thereof which burdens the consumer upfront. Further, in view of rate of technological advancement in the solar energy, there are higher chances that such projects may become obsolete after the control period of twenty five years. In view thereof, it may not be considered a good option to transfer the project either to power purchasing agency or any government entity.

44. **ORDER**

The Authority hereby determines and approves the following generation tariff along with terms and conditions for M/s Gharo Solar (Private) Limited for its 50 MWp power project for delivery of electricity to the power purchaser:

Rs./kWh

Tariff Components	Year 1-13	Year 14-25
Operations and Maintenance Cost	0.8192	0.8192
Insurance during Operation	0.2024	0.2024
Return on Equity	1.8446	1.8446
Debt Servicing	3.8610	-
Total	**6.7272**	**2.8662**

- Levelized tariff works out to be US Cents 5.6073/kWh.
- The aforementioned tariff is applicable for twenty five (25) years.
- Debt Service shall be paid in the first 13 years of commercial operation of the plant.
- Debt Servicing has been worked out using three months LIBOR (1.694%) + Spread (4.25%).
- Debt to Equity of 75:25 has been used.
- Return on Equity during construction and operation of 15% has been allowed.
- Construction period of ten (10) months has been allowed for the workings of ROEDC and IDC.
- Insurance during Operation has been calculated as 0.50% of the allowed EPC Cost.
- Reference Exchange Rates of 105 PKR/USD has been used.
- Detailed component wise tariff is attached as **Annex-I** of this order.
- Debt Servicing Schedule is attached as **Annex-II** of this order.

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A. One Time Adjustments at COD

- Applicable foreign portion of the allowed EPC cost will be adjusted at COD on account of variation in PKR/USD parity, on production of authentic documentary evidences to the satisfaction of the Authority. The adjustment in approved EPC cost shall be made only for the currency fluctuation against the reference parity values.
- For cost items other than EPC cost, the amounts allowed in USD will be converted in PKR using the reference PKR/USD rate of 105 to calculate the maximum limit of the amount to be allowed at COD.
- Duties and/or taxes, not being of refundable nature, relating to the construction period directly imposed on the company up to COD will be allowed at actual upon production of verifiable documentary evidence to the satisfaction of the Authority.
- IDC will be recomputed at COD on the basis of actual timing of debt draw downs (for the overall debt allowed by the Authority at COD), applicable LIBOR and premium.
- The tariff has been determined on debt : equity ratio of 75 :25. The tariff shall be adjusted on actual debt : equity mix at the time of COD, subject to equity share of not more than 25%. For equity share of more than 25%, allowed IRR shall be neutralized for the additional cost of debt : equity ratio.
- The reference tariff has been worked out on the basis of 3 month LIBOR of 1.694% plus a premium of 425 basis points. In case negotiated spread is less than the said limits, the savings in the spread over LIBOR shall be shared between the power purchaser and the power producer in the ratio of 60:40 respectively.
- ROEDC will be adjusted at COD on the basis of actual equity injections (within the overall equity allowed by the Authority at COD) during the project construction period of ten months allowed by the Authority.

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B. Indexations

i) **Operation and Maintenance Costs**

O&M components of tariff shall be adjusted on account of change in local Inflation (CPI), foreign inflation (US CPI) and exchange rate quarterly on 1st July, 1st October, 1st January and 1st April based on the latest available information with respect to CPI notified by the Pakistan Bureau of Statistics (PBS), US CPI issued by US Bureau of Labor Statistics and revised TT & OD selling rate of US Dollar notified by the National Bank of Pakistan as per the following mechanism:

F. $O\&M_{(REV)}$	=	F. $O\&M_{(REF)}$ * US $CPI_{(REV)}$ / US $CPI_{(REF)}$ * $ER_{(REV)}$ / $ER_{(REF)}$
L. $O\&M_{(REV)}$	=	L. $O\&M_{(REF)}$ * $CPI_{(REV)}$ / $CPI_{(REF)}$
Where;		
F V. $O\&M_{(REV)}$	=	The revised O&M Foreign Component of Tariff
L. $O\&M_{(REV)}$	=	The revised O&M Local Component of Tariff
F. $O\&M_{(REF)}$	=	The reference O&M Foreign Component of Tariff
L. $O\&M_{(REF)}$	=	The reference O&M Local Component of Tariff
US $CPI_{(REV)}$	=	The revised US CPI (All Urban Consumers)
US $CPI_{(REF)}$	=	The reference US CPI (All Urban Consumers) of 246.669 for the month of November, 2017
$CPI_{(REV)}$	=	The revised CPI (General)
$CPI_{(REF)}$	=	The reference CPI (General) of 220.420 for the month of November, 2017
$ER_{(REV)}$	=	The revised TT & OD selling rate of US dollar
$ER_{(REF)}$	=	The reference TT & OD selling rate of RS. 105/USD

Note: The reference indexes shall be revised after making the required adjustments in tariff components at the time of COD.

ii) **Insurance during Operation**

The actual insurance cost for the minimum cover required under contractual obligations with the Power Purchaser, not exceeding 0.5% of the EPC cost, will be treated as pass through. Insurance

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component of reference tariff shall be adjusted annually as per actual upon production of authentic documentary evidence according to the following formula:

AIC	=	$Ins_{(Ref)} / P_{(Ref)} * P_{(Act)}$
Where;		
AIC	=	Adjusted insurance component of tariff
$Ins_{(Ref)}$	=	Reference insurance component of tariff
$P_{(Ref)}$	=	Reference premium @ 0.5% of EPC Cost at Rs. 105
$P_{(Act)}$	=	Actual premium or 0.5% of the EPC Cost converted into Pak Rupees on exchange rate prevailing at the time of insurance premium payment of the insurance coverage period whichever is lower

iii) **Return on Equity**

The ROE component of the tariff will be adjusted on quarterly basis on account of change in USD/PKR parity. The variation relating to these components shall be worked out according to the following formula;

$ROE_{(Rev)}$	=	$ROE_{(Ref)} * ER_{(Rev)} / ER_{(Ref)}$
Where;		
$ROE_{(Rev)}$	=	Revised ROE Component of Tariff
$ROE_{(Ref)}$	=	Reference ROE Component of Tariff
$ER_{(Rev)}$	=	The revised TT & OD selling rate of US dollar as notified by the National Bank of Pakistan
$ER_{(Ref)}$	=	The reference TT & OD selling rate of Rs. 105/USD

Note: The reference tariff component shall be revised after making the required adjustments at the time of COD.

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iv) **Indexations applicable to debt**

Foreign debt and its interest will be adjusted on quarterly basis, on account of revised TT & OD selling rate of US Dollar, as notified by the National Bank of Pakistan as at the last day of the preceding quarter, over the applicable reference exchange rate.

v) **Variations in LIBOR**

The interest part for the tariff shall remain unchanged throughout the term except for the adjustment due to variation in interest rate as a result of variation in LIBOR according to the following formula;

ΔI	=	$P_{(REV)}$* ($LIBOR_{(REV)}$ - 1.694%) /4
Where;		
ΔI	=	The variation in interest charges applicable corresponding to variation in 3 month LIBOR. ΔI can be positive or negative depending upon whether 3 month $LIBOR_{(REV)}$ per annum > or < 1.694%. The interest payment obligation will be enhanced or reduced to the extent of ΔI for each quarter under adjustment.
$P_{(REV)}$	=	The outstanding principal (as indicated in the attached debt service schedule to this order), at the relevant quarterly calculations date. Quarter 1 shall commence on the commercial operations date (i.e. the first figure will be used for the purposes of calculation of interest for the first quarter after commercial operations date).
$LIBOR_{(REV)}$	=	Revised 3 month LIBOR as at the last day of the preceding quarter

Note: The reference tariff component shall be revised after making the required adjustments at the time of COD.

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C. Terms and Conditions

The following terms and conditions shall apply to the determined tariff:

- All plant and equipment shall be new and of acceptable standards. The verification of the plant and equipment will be done by the independent engineer at the time of the commissioning of the plant duly appointed by the power purchaser.
- This tariff will be limited to the extent of net annual energy generation supplied to the power purchaser up to 22.21% net annual plant capacity factor. Net annual energy generation supplied to the power purchaser in a year, in excess of 22.21% net annual plant capacity factor will be charged at the following tariffs:

Net annual plant capacity factor	% of the prevalent tariff
Above 22.21% to 23.21%	80%
Above 23.21% to 24.21%	90%
Above 24.21%	100%

- The risk of solar resource shall be borne by the power producer.
- In the tabulated above tariff no adjustment for certified emission reductions has been accounted for. However, upon actual realization of carbon credits, the same shall be distributed between the power purchaser and the power producer in accordance with the applicable GOP Policy, amended from time to time.
- In case the company shall secure full or certain portion of debt under any concessionary financing including one introduced by State bank of Pakistan, the tariff of the company shall be adjusted at COD on the terms of the said financing.
- Allowed limit of degradation has been made part of the approved project cost. No extra financial compensation shall be provided in the EPA.
- The plant PV capacity may vary from 50 MWp, provided that the maximum power to be evacuated in MWac shall remain consistent with grid study approved by KE. Benchmark energy calculations shall be made on revised PV capacity and no additional cost in this regard shall be allowed to GSPL.
- The company will have to achieve financial close within one year from the date of issuance of this tariff determination. The tariff granted to the company will no longer remain

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applicable/valid, if financial close is not achieved by the company in the abovementioned timeline or its generation license is declined/revoked by NEPRA.

- The targeted maximum construction period after financial close is ten months. No adjustment will be allowed in this tariff to account for financial impact of any delay in project construction. However, the failure of the company to complete construction within ten months will not invalidate the tariff granted to it.
- Pre COD sale of electricity is allowed to the power producer, subject to the terms and conditions of EPA, at 50% of the applicable tariff. However, pre COD sale will not alter the required commercial operations date stipulated in the EPA in any manner.
- In case the company is obligated to pay any tax on its income from generation of electricity, or any duties and/or taxes, not being of refundable nature, are imposed on the company, the exact amount paid by the company on these accounts shall be reimbursed on production of original receipts. This payment shall be considered as a pass-through payment. However, withholding tax on dividend shall not be passed through.
- No provision for the payment of Workers Welfare Fund and Workers Profit Participation has been made in the tariff. In case, the company has to pay any such fund, that will be treated as pass through item in the EPA.
- The approved tariff along with terms & conditions shall be made part of the EPA. General assumptions, which are not covered in this determination, may be dealt with as per the standard terms of the EPA.

45. The Order part along with two Annexures is recommended for notification by the Federal Government in the official gazette in accordance with Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

Case No.NEPRA/TRF-403/GSPL-2017

January ________, 2018

Petitioner:

Gharo Solar (Pvt.) Limited

Authority:

Himayat Ullah Khan
Member

Syed Masood-ul-Hassan Naqvi
Member

Saif Ullah Chattha
Vice Chairman

23.1.2018

Brig (R) Tariq Saddozai
Chairman

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Annex-I

Gharo Solar (Pvt.) Ltd.
Reference Tariff Table

Year	O&M Local	O&M Foreign	Insurance	Return on Equity	Loan Repayment	Interest Charges	Tariff
	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh
1	0.4096	0.4096	0.2024	1.8446	1.8333	2.0277	6.7272
2	0.4096	0.4096	0.2024	1.8446	1.9447	1.9163	6.7272
3	0.4096	0.4096	0.2024	1.8446	2.0629	1.7981	6.7272
4	0.4096	0.4096	0.2024	1.8446	2.1883	1.6727	6.7272
5	0.4096	0.4096	0.2024	1.8446	2.3213	1.5397	6.7272
6	0.4096	0.4096	0.2024	1.8446	2.4624	1.3986	6.7272
7	0.4096	0.4096	0.2024	1.8446	2.6121	1.2489	6.7272
8	0.4096	0.4096	0.2024	1.8446	2.7709	1.0901	6.7272
9	0.4096	0.4096	0.2024	1.8446	2.9393	0.9217	6.7272
10	0.4096	0.4096	0.2024	1.8446	3.1179	0.7431	6.7272
11	0.4096	0.4096	0.2024	1.8446	3.3074	0.5536	6.7272
12	0.4096	0.4096	0.2024	1.8446	3.5085	0.3525	6.7272
13	0.4096	0.4096	0.2024	1.8446	3.7217	0.1393	6.7272
14	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
15	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
16	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
17	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
18	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
19	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
20	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
21	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
22	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
23	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
24	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
25	0.4096	0.4096	0.2024	1.8446	-	-	2.8662
Levelized Tariff	**0.4096**	**0.4096**	**0.2024**	**1.8446**	**1.9375**	**1.0840**	**5.8877**

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Annex-II

Gharo Solar (Pvt.) Ltd.
Debt Servicing Schedule

Relevant Quarters	Principal (USD)	Principal Repayment (USD)	Interest (USD)	Balance Principal (USD)	Total Debt Service (Million USD)	Annual Principal Repayment Rs./kWh	Annual Interest Rs./kWh
1	32,232,891	415,279	479,003	31,817,612	894,282	1.8333	2.0277
2	31,817,612	421,450	472,832	31,396,162	894,282		
3	31,396,162	427,713	466,569	30,968,448	894,282		
4	30,968,448	434,070	460,213	30,534,379	894,282		
5	30,534,379	440,520	453,762	30,093,859	894,282	1.9447	1.9163
6	30,093,859	447,067	447,216	29,646,792	894,282		
7	29,646,792	453,710	440,572	29,193,082	894,282		
8	29,193,082	460,453	433,830	28,732,629	894,282		
9	28,732,629	467,295	426,987	28,265,333	894,282	2.0629	1.7981
10	28,265,333	474,240	420,043	27,791,094	894,282		
11	27,791,094	481,287	412,995	27,309,806	894,282		
12	27,309,806	488,440	405,843	26,821,367	894,282		
13	26,821,367	495,698	398,584	26,325,668	894,282	2.1883	1.6727
14	26,325,668	503,065	391,218	25,822,604	894,282		
15	25,822,604	510,540	383,742	25,312,063	894,282		
16	25,312,063	518,127	376,155	24,793,936	894,282		
17	24,793,936	525,827	368,455	24,268,109	894,282	2.3213	1.5397
18	24,268,109	533,641	360,641	23,734,467	894,282		
19	23,734,467	541,572	352,711	23,192,896	894,282		
20	23,192,896	549,620	344,663	22,643,276	894,282		
21	22,643,276	557,788	336,495	22,085,488	894,282	2.4624	1.3986
22	22,085,488	566,077	328,206	21,519,412	894,282		
23	21,519,412	574,489	319,794	20,944,923	894,282		
24	20,944,923	583,026	311,256	20,361,897	894,282		
25	20,361,897	591,690	302,592	19,770,206	894,282	2.6121	1.2489
26	19,770,206	600,483	293,799	19,169,723	894,282		
27	19,169,723	609,407	284,876	18,560,316	894,282		
28	18,560,316	618,463	275,819	17,941,853	894,282		
29	17,941,853	627,654	266,628	17,314,199	894,282	2.7709	1.0901
30	17,314,199	636,981	257,301	16,677,218	894,282		
31	16,677,218	646,447	247,835	16,030,770	894,282		
32	16,030,770	656,054	238,228	15,374,716	894,282		
33	15,374,716	665,803	228,479	14,708,913	894,282	2.9393	0.9217
34	14,708,913	675,698	218,585	14,033,215	894,282		
35	14,033,215	685,739	208,543	13,347,476	894,282		
36	13,347,476	695,930	198,353	12,651,547	894,282		
37	12,651,547	706,272	188,011	11,945,275	894,282	3.1179	0.7431
38	11,945,275	716,767	177,515	11,228,508	894,282		
39	11,228,508	727,419	166,863	10,501,089	894,282		
40	10,501,089	738,229	156,054	9,762,860	894,282		
41	9,762,860	749,200	145,083	9,013,660	894,282	3.3074	0.5536
42	9,013,660	760,333	133,949	8,253,327	894,282		
43	8,253,327	771,632	122,650	7,481,695	894,282		
44	7,481,695	783,099	111,183	6,698,596	894,282		
45	6,698,596	794,737	99,546	5,903,859	894,282	3.5085	0.3525
46	5,903,859	806,547	87,735	5,097,312	894,282		
47	5,097,312	818,533	75,750	4,278,779	894,282		
48	4,278,779	830,697	63,586	3,448,083	894,282		
49	3,448,083	843,042	51,241	2,605,041	894,282	3.7217	0.1393
50	2,605,041	855,570	38,713	1,749,471	894,282		
51	1,749,471	868,284	25,998	881,187	894,282		
52	881,187	881,187	13,095	(0)	894,282		

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