

Brief on 100 MW Solar Power Plant in Bahawalpur

1.	Renewable Energy Policy	<ul style="list-style-type: none"> Solar power projects in Pakistan are being installed under Renewable Energy Policy 2006 which recognizes the solar energy resources in the country and provides incentives for setting up solar power plants 														
2.	Global Trend in Solar Energy	<ul style="list-style-type: none"> Solar Power is being harnessed worldwide to inject renewable energy in the energy basket. Global PV installation in some reference countries is as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Country</th> <th style="text-align: right;">Installed Capacity [MW] as of 2014</th> </tr> </thead> <tbody> <tr> <td>Germany</td> <td style="text-align: right;">38,200</td> </tr> <tr> <td>China</td> <td style="text-align: right;">28,200</td> </tr> <tr> <td>Japan</td> <td style="text-align: right;">23,300</td> </tr> <tr> <td>Italy</td> <td style="text-align: right;">18,500</td> </tr> <tr> <td>USA</td> <td style="text-align: right;">18,300</td> </tr> <tr> <td>India</td> <td style="text-align: right;">3,100</td> </tr> </tbody> </table> <p style="text-align: center; font-size: small;">Source: Report IEA PVPS T1-26: 2015 [Annexure 1]</p>	Country	Installed Capacity [MW] as of 2014	Germany	38,200	China	28,200	Japan	23,300	Italy	18,500	USA	18,300	India	3,100
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3.	Pakistan's Solar Profile	<ul data-bbox="800 683 1898 1263" style="list-style-type: none"> • NEPRA provided levelized upfront tariff of US cents 16.3 per kWh on January 21, 2014. Despite passage of a year and a half, no solar plant has been installed in the country on this attractive upfront tariff. The LOI holders have so far not even achieved financial close. • GoPb launched an initiative to establish a 1000 MW solar power park in Bahawalpur. To develop the sector, GoPb established first 100 MW solar power plant in the park, through Quaid-e-Azam Solar Power Company, which started supplying power to the National Grid in April 2015. 														
4.	Hiring of EPC Contractor for 100 MW Plant	<ul data-bbox="800 1300 1898 1403" style="list-style-type: none"> • Public Procurement Rules were followed and EPC Contractor hired through International Competitive Bidding. 														

		<ul style="list-style-type: none"> • 12 companies out of 45 were pre-qualified. 5 companies participated in the bid. 3 qualified the technical criteria. The highest bid was USD 200 million and the lowest bid was USD 151 million. The contract was awarded on USD 131 million. • Renowned German Consultants carried the diligence before and during the award of contract.
5.	Execution of EPC Works	<ul style="list-style-type: none"> • Leading German Consulting Firm prepared feasibility for 100 MW plant. Bank of Punjab, provided the debt financing for the project and engaged a German Firm, 8p2 with excellent track record in solar power was engaged to supervise the project as Lender’s Engineer. • ILF Germany is the Owners Engineer and it was responsible on the behalf of the owner Quaid-e-Azam Solar Power to insure the compliance of international and local standards including IEC and NTDC standards. • A third German Independent Testing Agency: PVLab was hired for the Quality Assurance of PV Modules and Inverters. • All these consultants ensured execution of EPC works by the EPC Contractor with highest international standards.

		<ul style="list-style-type: none"> ● The salient features of the plant are as follows: <ul style="list-style-type: none"> ▪ Plant Name Plate Capacity 100 MWp DC at STC ▪ PV modules (255Wp): 392,160 ▪ DC Combiner Boxes: 1,300 ▪ Inverters (500KW): 200 ▪ Transformer (0.315/33kV): 100 ▪ 33kV Collection System loops: 20 Feeders ▪ SVC (-5~+15 MVAR): 02 ● Main Transformer (100MVA): 02
6.	EPC price of 100 MW Plant vs International prices at that time	<ul style="list-style-type: none"> ● QA Solar locked the EPC price in the Contract at USD 131 million equivalent of USD 1.31 million per MW ● Prior to this, German Technical Agency, GIZ, conducted a study for Pakistan in 2013 and established EPC Cost of USD 2.04 million per MW. ● NEPRA approved EPC Cost of USD 1.69 million per MW following GIZ study. ● Comparative EPC Cost in other markets at that point in time was: <ul style="list-style-type: none"> USA – USD 1.80 million per MW [Annex 3] India – USD 1.50 million per MW [Annex 4]

7.	Solar Tariff	<ul style="list-style-type: none"> • Tariff determination in Pakistan is the responsibility of National Electric Power Regulatory Authority which is a statutory body independent of Government control. • Tariff is determined after taking into account numerous factors such as: solar irradiation; solar hours; temperature; cost of equity and debt (including interest rates and tenor); country risk classification; risk premium; insurance coverage; level of local solar industry and availability of domestically produced solar plant components. • NEPRA determines upfront tariff structure on a levelized basis for 25 years keeping in view repayment of the debt within first 10 years. This means that levelized upfront tariff of US cents 16.30 per kWh in the first 10 years would be US cents 20 per kWh and US cents 8.34 per kWh for the remaining 15 years [Annexure 5] • 100 MW solar power project achieved a low EPC price which set a new benchmark for NEPRA on the basis of which levelized tariff of US cents 14.15 per kWh was notified on January 22, 2015. A revised order for the same was issued on April 8, 2015. [Annexure 6]
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8.	Solar power production on a typical day	<ul style="list-style-type: none"> • Solar power varies according to the intensity and inclination of Sun. • Generation in the 100 MW plant starts at around 6:00 am and continues till 6:30 pm in summer season. The peak production is achieved around noon. This is consistent with the production trend in other countries with good solar irradiation. • NEPRA's tariff estimates average of 12.7 GWh of energy per month during year 1 of production. 100 MW solar power plant is producing 13.87 GWh energy per month. The plant has thus not only lowered EPC Cost but has also exceeded the estimated energy production.
9.	Benefits of Solar Power	<ul style="list-style-type: none"> • Solar power is indigenous and does not require imported or domestic fossil fuels. • It contributes to national energy security by freeing up dependence on imported fuels. • Solar plants require meagre Operations and Maintenance cost with low degradation factor. • Solar power supports the fuel mix by meeting the peaking load during day time, particularly in summer months.

		<ul style="list-style-type: none"> • Renewable energy is the future given the global emphasis on environmental protection and climate change.
10.	Actual Energy Production and Plant Factor	<ul style="list-style-type: none"> • The availability of solar power (Plant Factor) is around 16% to 21% in different regions of the world based on sun hours, irradiation and technology. • NEPRA requires plant factor of 17.5% for southern region of Pakistan. 100 MW plant has already exceeded NEPRA's requirement. • There is a commonly held misconception that 100 MW power plant produces only 12-18 MW. Reality is that 100 MW power plant has already achieved peak of 85 MW (average of 72-74 MW) during noon time in summer. • Solar power plant is dependent on the Sun for energy production. Whenever optimal conditions are available, the plant produces 100 MW with net injection of 85 MW to the grid subtracting the auxiliary requirements. • The plant Energy production sheet and daily Energy production curves, and weather data specimen are attached as annex 7.

11.	Compatibility with the grid	<ul style="list-style-type: none"> • 100 MW plant was connected to the grid on March 30, 2015 after required technical diligence. NTDC conducted Reliability Run Test which has established that 100 MW plant is safely connected to the National Grid. Even the expected minor hiccups during grid connection have not occurred during the last 5 months and the interconnection is smooth and seamless. • NTDC has conducted a grid study with support from USAID which has established that around 2500 MW of Renewable Energy (Solar and Wind) can be safely injected in National Grid.
12.	Social impacts	<ul style="list-style-type: none"> • The solar power park has transformed the southern region of Punjab through provision of semi-skilled and unskilled jobs, introduction of technology and development of a barren tract of land. Bahawalpur is now on global solar map and would be a center of development of solar technologies in this part of the world. During the EPC phase of the project, 800-3000 workers were working simultaneously at Project site. After complete energization, 100 MW plant provides energy equivalent to consumption requirement of 54000 households

		(calculated on the basis of per capita energy consumption [261 kWh] stated in NEPRA State of the Industry Report 2014).
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Conclusion:

100 MW solar power plant established by GoPb achieved lower EPC Cost and provided a new benchmark to NEPRA for lowering the upfront tariff. It exceeds NEPRA’s requirements in terms of power production and Plant Factor. The plant is capable of generating 100 MW of gross solar power under optimal conditions. The plant is safely injecting solar power in the National Grid without any technical hiccups. The solar tariff is front loaded in the first 10 years for debt repayment but has excellent returns over the project life cycle. Solar power is indigenous and replaces expensive imported fuel. It fits into the peak consumption pattern of Pakistan and international experts have determined that the country can safely inject around 2500 MW of renewable energy in the National Grid.