



**Punjab Tourism for Economic Growth Project (PTEGP)
P&D Board, Government of the Punjab, Lahore**

Terms of Reference (TORs)

SOLAR ENERGY DESIGN AND SUPERVISION AT HERITAGE SITES IN PUNJAB

Introduction:

Government of Punjab, Planning & Development Board in collaboration with World Bank Group (WBG) and multiple implementing agencies is implementing Punjab Tourism for Economic Growth (PTEG) Project over five years (30th April 2023). The project aims to promote the tourism sector by strengthening the institutional capacity through better skills development, increased private sector participation and improved infrastructure services in support of the tourism sector in the province of Punjab.

Objectives of the Project:

The main objective of PMU-PTEG's solar feasibility study (load assessment and design) is to lower energy consumption and promote energy conservation approaches in Punjab in order to lower the burden of energy load on national grid; in this connection the consultant firm is required to assess the energy needs with design to install solar energy system at selected heritage sites; and to provide this action plan in the form of a report to guide PMU-PTEG to save energy, reduce operating costs and minimize the impact on the environment.

Scope of Work:

PTEG intends to conduct solar feasibility study and preparation of procurement documents for 06 heritage sites by hiring services of Consulting Firms. PMU-PTEGP intends to initiate the procurement process for the provision of solar power systems at the below heritage sites:

- i. Jahangir Tomb, Lahore.
- ii. Noor Jahan Tomb, Lahore.
- iii. Hiran Minar, Sheikhpura.



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- iv. Harappa Museum & Site, Harappa.
- v. Rohtas Fort, Jhelum.
- vi. Taxila Museum, Taxila.

The following aspects but not limited to, are to be covered while performing the feasibility study for the above mentioned sites

1. PTEG expects the energy auditor to include all the necessary matters of information in the reports. Analyze and comment on patterns and trends in seasonal energy consumption.
2. Analyze the historical energy consumption (minimum past two years) and establish an energy baseline and annualized costs
3. Review energy meters and list with reference to site energy end use. Review tariff structure and provide breakdown between peak and off peak. Identify appropriate opportunities in peak/load shifting and propose solar capacity and its design as per site specific conditions.
4. Describe the site's energy using systems and operation & maintenance procedures.
5. Prepare but not limited to inception report, detailed audit/feasibility report and summary report.
6. The Consulting Firm/Consultant shall meet with the client to develop;
 - a) an approved schedule and time to access each site
 - b) Identify the areas and equipment that will be inspected.
 - c) Describe the method and equipment that will be inspected.
 - d) The duration of each site inspection.
7. Surveys, measurements, photographs and other data collection methods shall be performed in a way that it minimizes disruption to the site occupants.
8. The electrical measurement should include electricity consumption profile in order to identify solar plant capacity, design and type needed to reduce consumption. Voltage, current, active power and energy, reactive and distorting power and reactive energy,



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- and power factor calculations is expected to be included in the study. PTEG expects that the reports submitted should include: Overall load summary of the government institute; department/building Wise load summary of the institute; and Appliance Wise Load summary of the same institute i.e. list of all types of indoor and outdoor lights, fans, types of air conditioners installed, etc. is to be included.
9. Solar PV Potential, its expected capital investment and expected saving potential per annum of the site is considered a vital part of the study. On the basis of this information, Solarization of rooftops of public sites will be done as an alternate source of energy source. On-Grid Solar PV Design using Helioscope, PVSyst or a similar software is to be used for detailed analysis including shading factor of the obstacles on rooftop. Since it is a clean energy source, the reduction in Green House Gases (GHG) is also made a part of the study.
 10. Details regarding Generators installed in the site as well as Transformer detail is required since that would help calculate Generator Set (Gen-Set) and fuel consumption calculations. The overall cost saving should also be calculated.
 11. The information gathered from energy assessment is to be used to introduce energy conservation methods and retrofit appropriate energy saving technologies. Identify and list all opportunities to reduce energy consumption, costs, payback period, energy savings and greenhouse gas emissions.
 12. Capital cost estimates based on energy savings in to be included. Capital Expenditure (CAPEX) based on local market equipment of renowned brand for replacement of indoor lights, street lights, fans, air conditioners etc. Also, provide IRR and Power factor of these appliances to be retrofitted.
 13. PVSyst / Helioscope simulation software report for all sites conducted (06) will be provided by the consultant.
 14. Cost Estimates required for the purpose will also be prepared by the Consultant along with technical inputs in procurement documents on the basis of the recommendations after completion of the feasibility report and approval of the client.



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15. World Bank's Environmental and Social Safeguard (E&S) Framework requirements and mitigation measures covered by the E&S instruments will be duly reflected in the deliverables including engineering designs for sites.
16. Supervision plan during installation of solar energy systems at selected heritage sites.
- 17.

Duration

Overall duration of the assignment is expected to be of **4 months for Phase-I (Design) and 4 months for Phase-II (Supervision of installation)** from the date of the signing of agreement with the Consultant.

Deliverables

The Consultants shall be required to fulfill the following reporting requirements:

Sr. No.	Deliverables	Copies (Hard and Soft)	Timelines
1.	Inception Report including Report template, strategy, methodology of analysis, signed time sheet of each person and schedule of work (after signing of the Contract)	3+1	One week



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2.	Upon completion of three (03) reports of the sites followed by furnishing and approval of the Solar Feasibility Report (Sites)	3+1	6 weeks
3.	Upon completion of three (03) reports of the sites followed by furnishing and approval of the Solar Feasibility Report (Sites)	3+1	7 weeks
4.	Submission of Final Solar Feasibility Report and Preparation of PC-1 after approval from the Client.	3+1	One week
5.	Preparation of Procurement documents after approval from the client.	3+1	One week

Note: Provide 3 copies of the Report at each phase of the project to the Project Manager. Also, provide 2 CDs of the final approved report and all of the contents with any drawings in “.dwg” (native file format for AutoCAD).

Qualification and Experience of Firm:

1. The selected Consultant shall be a professional registered engineering firm, incorporated for at least past 10 years in this business, with at least five years of experience dealing with renewable energy technologies, and a track record of relevant work in Pakistan.
2. They should have successfully completed at least two assignments of similar scale and complexity, out of which at least one assignment has involved renewable energy.
3. Firm should have adequately established offices
4. Firm must have the personnel with the following qualification and experiences;

S. No	Key Professional	No. Of Persons	Qualification	Experience
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1.	Resident Engineer/Team Leader	01	Masters in Electrical/Alternate Energy Engineering or similar field	Relevant experience of at least 10 years in relevant field
2.	Civil Engineer/Relevant	01	Bachelors in Civil Engineering	Relevant experience of 5 years in civil field
3.	Electrical Engineer	01	Bachelors in Electrical Engineering	Relevant experience of 3 year5
5.	Technicians	02	Diploma in Electrical/Mechanical/HVAC	Relevant experience of 2 years
6.	Astt: Resident Engineer	03	Bachelors in Electrical Engineering with PEC certification	Relevant experience of 3 years

Reporting Arrangements

The Consultant shall report to Project Manager, PTEG for the said Services.

Selection Method

Consultant will be selected in accordance with Selection Based on Consultants Qualification method in accordance with paragraph 3.7 of "Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers January 2011 (revised July 2014).



REPORT FORMAT

Based on the results of the findings, the Consultant shall prepare feasibility Report that incorporates the following elements:

1. Table of Contents

Provide a table of contents and page numbers for the Feasibility.

2. Executive Summary

Include a brief introduction to the facility and a description of the project objective and overall conclusions and recommendations of the feasibility study.

3. Site /Facility Information

- i. Provide a general background description of the facility along with the pictures and geo tagging, Site components, mechanical systems, electrical systems, automation systems, and operational profiles and schedules. A description of the Site envelope, age and construction history, number of employees, occupancy patterns, and a discussion of the O&M program shall be included.
- ii. The Site information section shall also contain relevant photos of the facility, Sites, and mechanical systems, a description of energy types used, and a description of the primary mechanical systems and controls.



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2. Utility Summary

Provide energy accounting information for a minimum of one year, as well as selected charts and graphs that will demonstrate the overall energy demand trend and usage patterns of the facility or Site.

Energy Conservation Measures and Solar Feasibility

- i. Provide a narrative summary for each recommended ECM that meets the objective of this project scope of work. Provide the estimated cost, estimated savings, simple payback, and other data for each ECM in the required Energy Conservation Measure. The description of each ECM shall also include the following information following this Energy Conservation Measure:
 - ii. A one or two-page description of each ECM and supporting calculations.
 - iii. No-cost measures such as adjusting equipment, control systems, or schedules shall be addressed first.
 - iv. Energy use and savings calculations and economic analysis.
 - v. Assumptions that were made regarding operation or equipment efficiency.
 - vi. Estimated installation cost, including cost of all equipment and materials, and source of cost estimate.
 - vii. Estimated energy savings (in energy specific volume units).
 - viii. Estimated annual energy cost savings based on current historical energy costs of the facility.
 - ix. Estimated annual operating cost savings, including reductions in maintenance expense.
 - x. Estimated lifetime energy cost savings.



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- xi. Simple payback.
- xii. Options for funding the installation of recommended measures.
- xiii. Equipment standards that must be used in the design, procurement, and installation of all ECM's such as ASHRAE 90.1, ASHRAE 155P etc.

4. Renewable/Distributed Energy Measures

Recommend any viable renewable/distributed energy technologies such as solar power, wind power, geothermal systems, etc., which could be cost effectively, implemented for the facility.

5. Cost Estimates of the Solar Systems for each site

The cost to implement each ECM shall be estimated and presented in an appendix of the report. A table shall be included that identifies costs associated with each improvement. The Information and cost data will be used to make decisions on facility planning and yearly capital appropriation requests.

- i. Each ECM cost estimate shall include:
- ii. Narrative explanation of the work, including diagrammatic sketches if required to explain the work.
- iii. List of assumptions made in compiling the estimate.
- iv. Cost of impact of facility operations on ECM implementation (work restrictions).