# Laboratory Testing for Solar Water Pumps

## INTRODUCTION

The UK aid funded Low Energy Inclusive Appliances programme (LEIA) aims to accelerate the availability, affordability, efficiency, and performance of a range of appliances particularly suited to off- and weak-grid market segments in developing countries. Solar water pumping technology is a major focus of this effort.

The LEIA programme will be delivered through an international Efficiency for Access Coalition convened by UK aid and Power Africa, involving a range of co-funders including Lighting Global, Rockefeller Foundation, Shell Foundation, Sida, EnDev, Good Energies Foundation, and more. The Efficiency for Access Coalition is coordinated by CLASP, the leading international voice and resource for appliance energy efficiency policies and market acceleration initiatives, working alongside the UK's Energy Saving Trust, which specializes in energy efficiency product verification, data and insight, advice, and research.

To support the Efficiency for Access Coalition and LEIA programme's interest in evaluating solar water pump performance, quality, durability, and energy efficiency of solar water pumps, CLASP and EST are soliciting cost estimates from qualified test laboratories.

Information on the background, test parameters and methods, submittals, and timeline for RFP submission is provided below.

## BACKGROUND

Appropriately-designed, energy-efficient, affordable solar water pumps (SWP) have the potential to improve lives and livelihoods for smallholder farmers who lack energy access by reducing their labor burden and increasing productivity, yields, and incomes. However, solar water pumps present significant technical challenges since their performance is highly dependent on use case, intended application, size of the associated energy system, etc.

Another key challenge to the solar water pump market, and thus to related energy access outcomes, is the lack of consistent and comparable performance data that helps market stakeholders make effective and informed decisions.

Robust laboratory testing ensures product performance lives up to the performance, energy efficiency, and quality claims of manufacturers and is a best practice, especially in nascent markets. To this end, we request detailed quotes – with line item cost breakdowns for each referenced test method – from qualified test laboratories. This requirement is further explained in the "submittal" section below.

To enable this testing, we are also seeking quotes from qualified test laboratories for consultative services that will result in the finalization of an appropriate test procedure. This will build on work already completed by the LEIA programme and summarized in the tables included

in the “Submittal” section below. The test procedure will heavily leverage existing internationally accepted test methods for solar water pumps, such as **IEC 62253 (edition 1.0, 2011-07**) and **MED 20 (11177) – Draft Indian Standard on Solar Powered Pumpset**.

## SCOPE OF WORK

As directed by CLASP, the test laboratory or team contracted for this work will be responsible for the following:

1. Collaborate with CLASP to provide input on and finalize the proposed test methods to deliver results that enable evaluation of metrics described in *Annex 1: Draft Solar Water Pump Testing Conditions and Parameters/Metrics*.
2. Collaborate with CLASP to develop a standard test report template to document product testing results.
3. Coordinate with CLASP on the product shipping process, including providing any necessary assistance related to shipping, custom clearance, notifying CLASP of receipt of product(s), verifying model numbers of received product sample(s), packaging and reshipping after testing if necessary.
4. Inspect the product sample(s) received and identify and record any external damage.
5. Perform tests on product sample(s) as defined in the final test method per tasks 1 above (to be referred to as the Global LEAP Off-Grid Solar Water Pump Test Method).
6. As relevant, document and communicate to CLASP any difficulties with the Global LEAP test methods experienced during product testing. Where relevant and possible, suggest improvements to the test method that would improve clarity, quality, and/or lower costs.
7. Record all test results in the test report template and provide brief, succinct descriptions of any relevant observations.
8. Submit test results to CLASP within five (5) business days of test completion.
9. Respond to any inquiries that CLASP may have about testing, including requests for periodic updates about the testing queue and any issues that may arise during testing.

## TIMELINE

Consultative work to finalize the test method will begin immediately and conclude as soon as possible.

Testing will commence as soon as the contract is signed and continue throughout 2019. The exact testing start date will be coordinated with the contracted test laboratory or team after contract execution.

## SUBMITTAL

Companies and organizations that wish to respond to this RFP must complete the LEIA prequalification questionnaire. This is a requirement for all sub-recipients of UK DFID funding. Companies must also register as a CLASP Implementing Partner. Registration is easy, and must be completed via the CLASP website before final submittal.

Applicants are also required to submit one file with required information as listed below. The file should be named as per the following example: “**Organization Name: RFP 8-18**”

The quotation for solar water pump testing must include the following elements:

- Test laboratory profile, including ISO/IEC 17025 accreditation and a summary of any experience testing solar water pumps (and the test methods used).
- A summary of regional presence, especially in Africa and Asia, and related experiences of conducting testing for solar water pumps or other solar-powered products, including any experience in round robin testing.
- A summary of qualifications of key personnel that will be engaged in the assignment, along with a description of each person's role.
- Detailed cost estimate and timeline for consultative activities that support the finalization of the proposed test methods.
- Detailed cost estimate (in US Dollars) outlining testing cost and duration for one sample and ten samples respectively, as specified in the following table.

| **Description of Parameter/Test** | **Reference Test Method** | **Estimates for 1 Solar Water Pump Sample** | | **Estimates for 10 Solar Water Pump Samples** | |
|---|---|---|---|---|---|
| | | Cost (USD) | Testing Time (Hours) | Cost (USD) | Testing Time (Hours) |
| Total volume of water moved per typical perfectly sunny solar day ($m^3$/day) at 7 constant TDH values | IEC62253: P-Q characterization (5.3.2) or H-Q characterization (5.3.3) | | | | |
| Total volume of water moved per typical partially cloudy solar day ($m^3$/day) at 7 constant TDH values | IEC62253: P-Q characterization (5.3.2) or H-Q characterization (5.3.3) | | | | |
| Total volume of water moved per typical fully cloudy solar day ($m^3$/day) at 7 constant TDH values | IEC62253: P-Q characterization (5.3.2) or H-Q characterization (5.3.3) | | | | |
| Minimum power to cold-start (W) | IEC62253: Start-up power measurements (5.3.4) | | | | |
| Laboratory staff visual inspection of general quality and workmanship | TBD | | | | |
| General pump, motor, and controller design standards | MED20 (11177) | | | | |
| **TOTAL** | | | | | |

The deadline for quotation submission is October 26, 2018. Proposals must be submitted online via the CLASP website using the “Submit Bid” button above and filling out all the requested information. Late or incomplete quotations or quotations submitted directly to anyone at CLASP will not be accepted.

All questions may be addressed to Wendy Hado at whado@clasp.ngo. The last date for submission of questions related to this RFP is **October 26, 2018**. We request all inquiries be made by email and not by phone.

## INFORMATION FOR POTENTIAL APPLICANTS

**Confidentiality Statement**
All data and information received from test laboratories or other entities for the purpose of this assignment are to be treated confidentially and are only to be used in connection with the execution of this assignment. All intellectual property rights arising from the execution of this assignment are assigned to LEIA program donors and their designees. The contents of data sets or written materials obtained and used in this assignment may not be reused or disclosed to any third parties without the expressed advance written authorization of LEIA designees.

ANNEX 1: Draft Solar Water Pump Testing Conditions and Parameters/Metrics

| **Standardized Metric / Proposed Test Conditions** | **Purpose / Description** | **Referenced Test / Method** |
|---|---|---|
| 1. Total Dynamic Head (TDH) | Controlling for standard TDH values at which products are tested in each category controls for pipe length, diameter, and material | IEC62253: P-Q characterization (5.3.2) or H-Q characterization (5.3.3) |
| 2. Power input based on bundled or declared optimal PV size | Companies will include the size (Wp) of the PV panel sold or recommended for each nominated product. Power input supplied to the products during testing will match (or be an equivalent ratio) of nominated PV size. | TBD |
| 3. Power input based on typical solar days | Power input supplied to the products during testing will simulate irradiance profiles of 3 typical solar days (sunny, partially cloudy, fully cloudy). | TBD |
| 4. Elevation | Testing will happen at a single elevation above sea level, thereby controlling for variations in pumping performance at different elevations. | TBD |
| **Variable Metric** | **Purpose / Description** | **Referenced Test / Method** |
| **Primary Operating Performance Testing** | | |
| 1. Total volume of water moved per typical solar day ($m^3$/day) at multiple constant TDH values | Primary service rendered by product. Measured for 3 different typical solar days: perfectly sunny, partially cloudy, fully cloudy – at 7 different TDH values. | IEC62253: P-Q characterization (5.3.2) or H-Q characterization (5.3.3) |
| 2. Maximum TDH value (m) | Used to calculate other metrics for evaluation. Maximum TDH is the TDH at which flow-rate reaches zero (i.e. water stops flowing). | MED20 (11177) |
| 3. Minimum power to cold-start (W) | The minimum required power to start the pump, measured from power supply, not pump (to allow for battery innovations). | IEC62253: Start-up power measurements (5.3.4) |
| 4. Maximum flow rate per typical solar day (m3/s) at multiple constant TDH values and duty point | Maximum flow rate for 3 typical solar days, at 7 different TDHs (to compare to rated max performance and duty point performance). | Data pulled from tests for Metric #1 |
| 5. Useful operating TDH range per typical solar day (m-m) | This is the range at which the pump operates at a useful level (i.e. the flow rate across this TDH range is within XX% of duty point flow-rate). | TBD |

| Variable Metric | Purpose / Description | Referenced Test / Method |
|---|---|---|
| **Energy Performance** | | |
| 6. Average pump efficiency per typical solar days (%) at multiple constant TDH values | Total volume of water moved per total energy put into the system for a solar day (including hours when energy is put into system but the pump has not started) at multiple constant TDH values, for each of the 3 solar days. | Data pulled from tests for Metric #1; MED20 (11177) |
| 7. Maximum pump efficiency per typical solar day (%) at multiple constant TDH values | Maximum flow rate per corresponding energy input measured at multiple constant TDH values, for each of the 3 solar days. | Data pulled from tests for Metric #1 |
| 8. Performance variations when exposed to voltage fluctuations common to off-grid low-voltage DC solar systems and weak-grid power supply | Off-grid solar systems can experience voltage fluctuations while charging or discharging, and during morning and evening hours with insolation is limited. | Data pulled from tests for Metric #1; Global LEAP Awards test methods |
| **Quality Inspection** | | |
| 9. Dry run protection (if needed) | Does the SWP automatically shut off when the pump runs dry? | TBD |
| 10. Laboratory staff observations on general quality and workmanship | SWPs will be subjected to visual observation and inspection for their general quality and workmanship. | Previous Global LEAP test methods |
| 11. General pump, motor, and controller design standards | Reference to multiple features in MED 20 (11177) standard draft. | MED20 (11177) |
| 12. Warning labels | Are the appropriate warning labels included on the product? | IEC62253: Relations to other standards (4.2) |