

Pre-qualification guidelines for Solar suppliers (Component-based solar home systems)

PMIC – KFW Renewable Energy Initiative through
Microfinance (PRIME)



September 2021

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1. Introduction

Pakistan Microfinance Investment Company Limited (PMIC) is registered as an Investment Finance Company under NBFCs regulations with Securities and Exchange Commission of Pakistan. It is setup jointly by, Pakistan Poverty Alleviation Fund (PPAF), Department for International Development (DFID) through Karandaaz Pakistan and the German Development Bank (KFW) to catalyse and lead the next phase of growth in the microfinance sector of Pakistan. The purpose of the organization is to provide a wide range of financial services, including wholesale funding to microfinance institutions and microfinance banks to promote financial inclusion in Pakistan to alleviate poverty and contribute to broad based development.

Pakistan Microfinance Investment Company (PMIC) and German Development Bank – KFW has launched a program in Pakistan in August 2019 that aims to support the financing of Lighting Global Quality verified Pico PV and Solar Home Systems packaged with appliances for households in poor grid and off-grid locations in the rural and peri-urban areas of Pakistan. An amount of Euro 15 million is earmarked for on lending to MFIs and solar product vendors ensuring delivery of a responsible financing mechanism. A technical assistance support of Euros 1 million to build capacity of MFPs and other stakeholders is also part of the program.

To facilitate affordability and remove barriers to financing for end clients purchasing solar PV products for rural households, the program activities will include:

- ✓ **Pre-qualify** solar suppliers & products; set & enforce quality standards for solar products & services;
- ✓ **Assist** MFPs in designing consumer loan product; formalize MFP-qualified solar supplier relationships & support smooth collaboration;
- ✓ **Provide** trainings to MFP's credit officers and qualified solar supplier's sales agents to equip them with the required product knowledge and refine their sales skills.
- ✓ **Raise** awareness among rural households and in MFP branches to ensure uptake of quality certified solar products & microfinance;
- ✓ **Provide** technical guidance to environmental improvement on battery and electronic waste recycling support.

Pakistan Microfinance Investment Company (PMIC) is responsible for the coordination of all program activities, including the pre-qualification of solar suppliers and their products; on-going quality control; consumer awareness for demand generation, trainings and collaboration with all program stakeholders for effective delivery.

1.1 Benefits for MFPs and Solar Suppliers

Microfinance Providers (MFPs) benefit from participation in the Program in numerous ways, including wholesale financing from PMIC dedicated to solar loans, business relationships with qualified solar suppliers to offer consumer financing products for high quality solar products offered by pre-qualified solar suppliers; a quality assurance framework that guarantees high quality solar products and a full range of customer satisfaction services; promotional activities, and mass media communication for solar loan products; access to market intelligence; technical assistance for solar loan product design and access to training for credit officers.

Qualified solar suppliers benefit from participation in the Program in numerous ways, including business relationships with MFPs to offer consumer financing products for certified solar products; business development support through consumer awareness raising campaigns; and mass media communication for certified solar products; facilitate access to vendor financing (trade finance); access to training and business development services; access to MFPs existing clients and outreach; and access to market intelligence.

1.2 Expectations from qualified solar suppliers

Most of the solar systems to be sold under the PRIME target end users in poor grid mostly peri-urban areas and off-grid locations in the rural areas of Pakistan. To reach them, qualified solar suppliers are required to make investments in distribution logistics, collaboration with MFPs, after sales service provision through local community technicians, trainings of MFP credit staff on product features and assist MFPs in awareness raising/promotion activities.

The program intends to promote the following product categories.

1. **Lighting Global verified solar products** hence the applicants are required to establish partnership with any of the Lighting Global Affiliate prior to applying for pre-qualification on the PMIC Solar Microfinance program.
2. **Component based solar home systems** up to 2kW. Applicants are requested to establish relationships with manufacturers offering IEC certified products eligible to be imported to Pakistan after the implementation of SRO 604.

***Note:** 10 solar vendors have already been qualified on PRIME program for supplying Lighting Global verified solar products in March 2019. The program now intends to qualify solar suppliers for supply and installation of larger component based solar home systems only.*

The Program also encourages partnerships between qualified solar suppliers and MFPs. Solar financing will lower the initial investment barrier in solar PV products for rural households and MFP clients. Solar suppliers can leverage the trust MFPs have already developed with existing borrowers, and also take advantage of MFP's established rural outreach network. Suppliers and MFPs need to dedicate time and resources to ensure efficient coordination of promotional activities, the loan application process, loan disbursement and product sales, and payment collection and after-sales services.

While these efforts may result in higher costs per product and services at the beginning of the Program, the Program is designed to support qualified solar suppliers and MFPs with their support services mentioned above under Program objectives.

1.3 Objective of this call for application

The objective of this call for application is the pre-qualification of solar suppliers to operate under PRIME that can provide Component based solar home systems up to 2kW with and without inverter.

Qualified solar suppliers commit to comply with the technical and performance standards established by the PMIC's PRIME Program; and their application for pre-qualification set out a plan for their performance in the Program.

In particular, the application process assesses the Solar suppliers' (a) experience and current business performance, including market share and capacity of their rural distribution network, (b) commitment and current approach to delivering high quality customer services, (c) current target group, understanding of customer needs, and willingness to cater to a target group that may require loans from an MFP in order to make an investment in a solar product, (d) current approach to business planning, increase sales levels / expand business operations and; (e) Ability to achieve targets.

2 Technical Requirements for Product Eligibility

2.1 Solar Modules

For Solar Home Systems with an array Peak Watt Rating Greater than 100Wp

Solar modules with a peak power rating greater than 100W shall meet either

The relevant following design qualification and type approval standards

- IEC 61215 Terrestrial photovoltaic (PV) modules - Design qualification and type approval

and

- IEC 61730 Photovoltaic (PV) module safety qualification

Each module shall be marked with a serial number with the purpose of providing traceability to the manufacturer's name, factory and date of manufacture.

The module label must show the correct Certifier Mark (logo) corresponding to that on the test certificate supplied at the time of approval.

If the certificate on which the listing was based becomes invalid, then the Qualified Company must supply a new certificate for the module or cease using that in the systems supplied under PRIME program.

2.2 Batteries

Preferably Lead Acid Battery Banks with energy rating greater than 1,000 watt-hours (Wh) at C_{10} acid batteries used in a battery bank with an energy rating greater than 1,000Wh (C_{10}) shall meet one of the following standards:

- IEC 61427 Secondary Cells and Batteries for Solar Photovoltaic Energy Systems - General Requirements and Methods of Test
- IEC 60896 Stationary lead-acid batteries (series)

OR

The battery types with the following minimum technical specifications are also eligible to supply for the period of **2 years**. PIC will review the Quality standards after completion of two years and shall allow battery types with above mentioned IEC standards to be packaged with the component based solar home systems. No other than the stated battery chemistries and types shall be accepted.

- a. The battery shall be Deep cycle, GEL, OPzS/OPzV, LFP and Lead Carbon type or equivalent.
- b. The battery must ensure safe and reliable operations in the whole range of ambient temperatures from -9°C ~ $+50^{\circ}\text{C}$.
- c. The minimum permeable discharge rate shall not be more than 5% of rated capacity per month at 25 C.
- d. Each battery shall have the following minimum information printed on battery.
 - ✓ Model number, serial number and type of battery
 - ✓ Rated voltage and capacity (Ah) at discharge rate of 10 hours
 - ✓ Origin of made
 - ✓ Manufacturer name with distinct logo
- e. Battery disconnect switch / breaker of suitable size shall be installed between batteries and inverter /charge controller
- f. The battery shall have flame retardant container & cover with ABS Material

GEL batteries

- Cycle life of the GEL battery (12V) before 80% capacity of initial capacity shall be minimum 800 cycles @ 50% depth of discharge at discharge rate of 10 hours.

LEAD CARBON

- Cycle life of the LEAD CARBON battery (12V) before 80% capacity of initial capacity shall be minimum 700 cycles @ 50% depth of discharge at discharge rate of 10 hours.

OPzS/OPzV batteries

- Cycle life of the **OPzS/OPzV** battery (12V) before 80% capacity of initial capacity shall be minimum 1500 cycles @ 50% depth of discharge at discharge rate of 10 hours.

Lithium batteries (LiFePO4)

- Cycle life of the **LiFePO4** battery (12V) before 80% capacity of initial capacity shall be minimum 3000 cycles @ 50% depth of discharge at discharge rate of 10 hours.
- The **LiFePO4** battery must have battery management system (BMS) to ensure battery safety and reliability
- The **LiFePO4** battery shall have LED status and alarm indication
- The charge and discharge rate of the battery shall be designed at .2C minimum but capable of handling .5C charge and discharge currents.

In addition to meeting the requirements of the above referenced standards, lithium-ion batteries shall be:

- supplied with a manufacturer's approved Battery Management System (BMS); and
- marked with a serial number with the purpose of providing traceability to the manufacturer name, factory and date of manufacture

2.3 Solar Charge Controllers

The controllers shall either meet one of the standards listed below or one of the markings listed below.

Standards include:

- IEC 62509 Safety of power converters for use in photovoltaic power systems
- IEC 62509-1 Part 1: General requirements
- UL Standard 1741: Standard for Inverter, converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources

Markings include:

- Underwriters Laboratory (UL) Listing and Classification Mark
- Conformity European (CE) marking

In addition to meeting the requirements of the above referenced standards, each controller shall be marked with a serial number with the purpose of providing traceability to the manufacturer name, factory and date of manufacture.

2.4 Inverters

The inverters shall meet one of the following standards:

- IEC 62109 Safety of power converters for use in photovoltaic power systems
 - IEC 62109-1 Part 1: General requirements
 - IEC 62109-2 Part 2: Particular requirements for inverters
- UL Standard 1741: Standard for Inverter, converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources

The inverters shall be rated to provide an a.c. voltage within the range of 220V and 240V

In addition to meeting the requirements of the above referenced standards, each inverter shall be marked with a serial number with the purpose of providing traceability to the manufacturer name, factory and date of manufacture.

2.5 Additional mandatory components

Qualified component based Solar Home Systems include a set of additional mandatory components to ensure the highest possible level of safety and installation quality, as defined below:

- Mandatory components for safety reasons include:
 - Enclosure/tamperproof for Battery and Charge Controller;
 - DC protection for load;
 - DC sockets for load connection;
- Mandatory components for installation reasons include:
 - Mounting system for Solar Panel;
 - Cables, wiring and soldering to connect components;
 - Cables, switches and DC connectors;
 - Additional connectors for DC appliances;

2.6 Warranty

Two years comprehensive repair and maintenance warranty at site (free of cost) shall be provided for all system components.

The photovoltaic modules shall be warranted to provide their rated output at standard conditions within $\pm 10\%$ for a minimum of 10 years under the operating conditions at the sites. The modules shall be warranted against physical defects for a period of at least 5 years following installation.

The battery shall have 18 months and solar controller (PWM or MPPT), inverter shall each have a minimum 2-year comprehensive replacement warranty.

The responsibility to carry and honour these warranty provisions is borne by the Qualified Company and applies even if the product manufacturer fails to honour the warranty and/or the company manufacturing the product no longer exists.

3 Qualified Company Requirements

3.1 Financial and operation requirements

- Company is officially registered with Securities & Exchange Commission of Pakistan (under Companies Ordinance, 1984).
- Applying company shall provide last three (03) years of Audited financial statements.
- Company has at least 03 years' experience distributing solar PV products, and at least 01-year experience distributing solar PV products in rural areas of Pakistan. Joint ventures or Consortium are also eligible.
- Applying company shall have an implementation of an electronic waste (e-waste) management procedure, in particular a strategy for used battery disposal. As a minimum

the e-waste management procedure will ensure safe collection and safe disposal or recycling of the provided system components once they are no longer in use. In this context safe means that there are no detrimental effects to human beings or to the environment during the stated procedures.

- Applying company has at least 03 years' experience distributing solar PV products, and at least 01-year experience distributing solar PV products in rural and peri-urban areas of Pakistan. Joint ventures or Consortium are also eligible.
- Applying company has a proper implementation procedure of an after-sales service program that repairs/replaces equipment that is covered under the warranty on no fee charged basis. Fee-based service must also be available for repair/replacement of components after expiration of the warranty.
- Applying company shall provide;
 - List of staff members who have relevant experience, summarize this experience with solar PV and what (if any) certifications and/or training they have had.
 - List of projects or system installations for which they have previously supplied solar equipment and/or list the number of solar products provided under previous programs or sold directly to end customers.
 - Description of warranty and after-sales service procedures.
 - List of all their regional outlets; retailers, distributors.
 - Nominate at least one person who will be the contact person for PMIC and MFPs. This person will take responsibility for the company meeting all the requirements specified in this document and be the person formally authorised to answer any questions regarding the application. The Applying Company shall provide organisational details of their business to show where this person is positioned within the existing management structure and to include the name and position of at least one alternate contact person.
 - Information on their staff who will deal with MFP's staff.
 - Information on their complaint procedure (if one exists).

3.2 Company Technical Requirements

Qualified company shall only use components within their solar home systems that have been tested and certified against the required standards that are specified in Section 2.

The Applying Company shall provide:

- a list of all the different brands/models of products that they will be used as components within their solar home systems;
- provide brochures for the different products and models; and
- provide the test certificates from a testing laboratory accredited to ISO/IEC 17025 **General Requirements for the Competence of Testing and Calibration Laboratories** verifying that the product meets the specified standard.
- Provide if any, agreement/ purchase order/ dealership/ MoU executed with the supplier/manufacturing company
- Standard timeline to supply different products after placement of purchase order by MFP.

- Product warranty/replacement terms
- If imported, provide products evidence/ assurance of custom clearance

4 Design of systems

Applying Companies shall also share the designs of their systems in accordance with the requirements of the “*Solar Home System Design Guidelines*”.

With the application, the Applying Company shall provide designs of three systems they will supply. These systems shall have solar arrays in the range from 100W_p to 2000W_p. The purpose of providing these designs is to verify that the systems being designed by the companies are in accordance to the “*Solar Home System Design Guideline*”.

The design documentation shall include the following details (as a minimum):

- The total daily load energy: a.c. and/or d.c. that the system can supply. For systems that are designed to provide both a.c. and d.c., the design energy for each shall be stated.
- Size or capacity of individual modules (W_p)
- Open circuit voltage (V_{oc}) as per name plate of module
- Number of modules used in the system
- Number of modules connected in series
- Number of series strings in parallel
- The daily irradiation value (Peak Sun Hour) used in the design.
- The type of controller (Maximum Power Point Tracker (MPPT) or standard controller Pulse Width Modulated (PWM) provided with the system.
- The ratings of the controller: maximum current in, maximum current out, voltage in and voltage out and if a MPPT the input voltage range and maximum PV array power.
- The type of battery (e.g. flooded lead acid, valve regulated lead acid, lithium ion etc).
- The battery voltage and battery capacity (in ampere-hours (Ah) or watt-hours (Wh) of the individual batteries (or cells).
- The number of battery (cells) in series and number of parallel strings of batteries
- The total battery bank voltage and battery capacity (in ampere-hours (Ah) or watt-hours (Wh)
- If applicable the inverter rating in VA or kVA;
- The array oversize factor.
- The days of autonomy used in the design.
- Maximum battery depth of discharge considered in battery sizing.
- The subsystem losses including:
 - Battery efficiency;
 - Cable efficiency (if applicable);
 - MPPT efficiency (if applicable);
 - Inverter efficiency (if applicable).

Overall system design and configuration (i.e. the interplay of individual system components) is then evaluated by the Technical Advisor-PRIME and Implementation Consultant to confirm the appropriate balance between energy generation and storage capability of the system, and the correct sizing of system components in relation to each other is assessed in order to assure energy output performance and longevity of the product over time. Finally, a *guaranteed system energy output* the CB-SHS can deliver is calculated based on its configuration.

If a CB-SHS is found to be fully compliant with the Program's *Quality Charter* requirements, all product characteristics are recorded in a *Product Datasheet* and the Qualified Company receives a *Certification Letter* for the specific CB-SHS design. *Datasheet* records all approved components and system configuration characteristics of the Quality approved CB-SHS. It also contains a unique identification number for the Quality approved product design i.e. *Product Verification Number* [PRIMEPV#]. The *Product Datasheet* forms the basis for later quality control activities in the field.

5 Installation of Systems

The Qualified Company shall employ or sub-contract installers responsible for the installation of CB-SHS. Installers are then pre-qualified by PMIC according to process mentioned in this section. Solar Installers shall install CB-SHS in accordance with the "*Solar Home System Installation Guidelines*" "*Solar Home System Installation Guidelines*" and "Product data sheet" approved by PMIC. A testing and commissioning sheet approved by PMIC shall also be provided with every system installation. The information required in the testing and commissioning sheet is the minimum that shall be included in any test certificate developed by a Qualified Company.

5.1 Number of Installers per Company

Three installers from each Applying Company will be assessed by the PMIC consultant. A Minimum of two from each Applying Company must pass the assessment and be approved as installers under the quality assurance framework.

For this quality assurance framework, it would be unfeasible to expect that all the installers will meet the requirements specified in this document. Also, it would be impossible to assess every single installer. However, whether the installer is approved or not under the requirements of this document, it will be the installer's responsibility to install a component-based solar home system in compliance with all the requirements of the Solar Home System Installation Guidelines. The Qualified Company will be held responsible if the system installation does not meet those guidelines.

5.2 Installer Qualification and Experience Requirements

To be an approved installer under the qualifications framework the installer shall meet the following pathway:

Be an Experienced Installer who has

- Been a solar home system installer for a minimum of two years;
- Undertaken in-house training or attended a third-party training course(s) on solar home system design and installation; and

or

- Holds the Solar Technician certificate provided by the any recognized authority;

and
or

- Undertaken and passed a solar course conducted by any training centre within Pakistan.

5.3 Information to be provided about the Installers

Each Applying company shall provide the following information:

- A letter from the Applying company, on company letterhead stating when the installer started working for the company as an installer;
- How many (approximately) component-based solar home systems they have installed and the range of sizes?
- A list of all the educational certificates/degrees and courses they have attended including copies of any certificates they have received.
- Information on three different sized systems they have installed. If available, include photos of some of the installations.

6 Application Process

A company applying to be eligible to apply for PRIME program shall complete the Company Application Form provided in Section 10. This form is divided into 4 parts:

- Part 1: General Information
- Part 2: Component Documentation
- Part 3: Systems Designs
- Part 4: Installer Information

All the information requested in this form must be provided with the application

The form is provided as a Word document and an applicant must submit the application in the same order as shown on the form and must respond to all questions in each section.

Part 1: shall be completed and provided either as a separate document or included in the first pages of a submission document that includes all the evidence and documents requested in Parts 1 through to 4

Part 2: Requires the list of all the components being used in the Applying Company's solar home system; the test certificates required to prove that they meet the required standards and a statement on the warranty of the components.

Part 3: Requires information on the Applying Company's installers as detailed in section 6.3.

The application shall be submitted electronically. The electronic version can be provided via email or by post.

The application shall be submitted to:

Head of Sector Development

Pakistan Microfinance Investment Company

e-mail: saqib.siddiqui@pmic.pk

Tel: +92 51 84 87 820
Ufone Tower, Blue Area
Islamabad
Pakistan

6.1 Processing by PMIC

Once an application by an Applying Company to be technically approved for eligibility to supply CB-SHS to MFPs has been received, the PMIC shall provide the application to its Technical Committee within 2 working days of receiving the application. The Technical Committee will complete the verification checklist as provided in Section 10. The verification process involves:

1. Confirming that the application form is complete
2. Confirming that all the components: solar modules, batteries, solar controllers and inverters meet requirements.
3. Confirming that the Applying Company is able to design systems in accordance with the design guidelines.
4. Confirming that the installers meets the eligibility requirements
5. Confirming the Applying Company's contact person has been specified.
6. Confirming that the Applying company has provided information on their operation.

Each review will take between 1 to 2 days to process subject to the number of applications submitted to the PRIME Technical Committee. The Committee shall undertake the review and submit the verification checklist within 5 to 10 working days after receiving a completed application.

The checklist includes an area for stating why a company was not yet eligible and what needs to be done to rectify the situation.

6.2 Processing of the Installer Application by PMIC Consultants

With respect to the Applying (or Approved) Company's installers, PMIC can then inform the Applying (or Qualified) Company what installers are approved.

7 Application Timeline & Instructions

7.1 Application Period and Deadline for applications

The application period for solar suppliers to seek pre-qualification under the PRIME Program opens **23 September 2021** and closes on **08 October 2021 at 5:00pm Pakistan Standard Time (PST)**. Please note that any application received after the deadline will not be considered.

7.2 Clarifications

Any questions or clarifications regarding this call for application should be addressed to Faheem.khalid@pmic.pk by **30 September 2021 at 5:00pm**. A document consisting of response to all clarifications will be sent to email addresses of all the applicants by **01 October 2021**.

7.3 Application language

Only applications filled in the English language will be accepted.

7.4 Address for submission

Completed applications using the forms provided must be submitted **electronically** to faheem.khalid@pmic.pk. Applicants will receive an acknowledgement of receipt. Please note that hard copies of the applications shall also be sent on the following mailing address by **08 October 2021 at 5:00pm Pakistan time;**

Head of Sector Development

Pakistan Microfinance Investment Company (PMIC)

21st Floor, Ufone Tower, 55 C,

Main Jinnah Avenue, Blue Area,

Islamabad 44000, Pakistan

Tel: (+92-51) 8487820-45

7.5 Announcement of results

All applicants will be informed about the result of their application by **11 October 2021**.

8 Application Form

8.1 General Information in Company

COMPANY APPLICATION FORM	
Part 1: General Information on Company	
Name of Company	
Physical Address of Main Office/Shop	
Postal Address (if different)	
Website	
Name of Contact	
Position	
E-mail	
Phone	
Mobile Phone	
Name of Alternate Contact	
Position	
E-mail	
Phone	
Mobile Phone	
Information on the company management structure showing where the contact person is positioned is included with the application? <i>(please tick if yes, cross if no)</i>	
List any accreditation that company might have and the date of their expiry	
Information on their number of staff with a breakdown is included with the application <i>(please tick if yes, cross if no)</i>	
Information on their operation including number of outlets is included with the application <i>(please tick if yes, cross if no)</i>	
Information on their complaints procedure is included with the application <i>(please tick if yes, cross if no)</i>	

8.2 Component Information

Part 2: Component Information					
<p>List All Brands , the product models or range of models and enter tick that test certificate has been provided or enter a cross if not . Please provide copies of the product brochures. (add more lines as required)</p>					
Name of Company					
Brands of Solar Modules					
Models	Model Number (s)	Peak Power Rating (or range)	Number of Cells in Module	Test Certificate Provided (tick if yes, cross if no)	
Brands of Batteries Models					
Models	Model Number (s)	Battery Chemistry- Lead or Lithium or?	Capacity (Ah or Wh)	Voltage of Battery (V)	Test Certificate Provided (tick if yes, cross if no)
Brands of Solar Controllers					
Models	Model Number (s)	MPPT or PWM	Current or power rating in	Voltage rating out	Test Certificate Provided (tick if yes, cross if no)
Brands of Inverters					
Models	Model Number (s)	Capacity (VA or W)	d.c. Voltage (V)	Test Certificate Provided	

8.3 System Designs

Part 3: System Designs				
Complete this form for three different system designs and provide any other evidence that is relevant				
Name of Company				
Design Number One				
The total load energy : a.c and/or d.c. that the system can supply.	a.c. only system	Wh	d.c only systems	Wh
	System designed for a.c. and d.c, loads			
	a.c. loads	Wh	d.c loads	Wh
d.c. system (battery) voltage			V	
Brand of solar module		Model number		
Peak Power Rating		Number of cells		
Number of solar modules				
Size of array in Watts peak (Combined power of all modules)			W _p	
Number of solar modules in series		Number of parallel strings of modules		
The open circuit voltage of the array (nameplate).			V	
The daily irradiation value used in the design			kWh/m ²	
Brand of Solar Controller		Model Number		
The type of solar controller (Maximum Power Point Tracker (MPPT) or standard controller Pulse Width Modulated (PWM) provided with the system. (Please Tick)		MPPT		PWM
Specifications of the solar controllers	Maximum d.c. current in	A	Maximum d.c. current out	A
	d.c. voltage in	V	d.c voltage out	V
	If MPPT Max voltage In	V	If MPPT Max Power (Array) In	W
	Maximum Load Current (if applicable)			A
The total capacity of the battery bank (Wh or Ah)				
The type of battery (e.g. flooded lead acid, valve regulated lead acid , lithium ion etc).				
Brand of Battery		Model Number		
Capacity of each battery (Wh or Ah)		Voltage of each battery	V	
Total number of individual batteries in the battery bank				
Number of individual batteries in series		Number of parallel strings of batteries		
Brand of Inverter		Model Number		
Power Rating of Inverter (VA or W)		d.c. Voltage	V	
	Temperature		Dirt	

Module Derating Factors used in determining the energy output of the system	Manufacturers Tolerance			
Array oversize factor				
Battery days of autonomy				
Battery maximum depth of discharge				
Sub-system losses	Controller efficiency (Considered in design)			
	Battery efficiency (Considered in design)			
	Cable efficiency (Considered in design)			
	Inverter efficiency (Considered in design)			
Design Number 2				
The total load energy : a.c and/or d.c. that the system can supply.	a.c. only system	Wh	d.c only systems	Wh
	System designed for a.c and d.c loads			
	a.c. loads	Wh	d.c loads	Wh
d.c. system (battery) voltage			V	
Brand of solar module		Model number		
Peak Power Rating		Number of cells		
Number of solar modules				
Size of array in Watts peak (Combined power of all modules)			W _p	
Number of solar modules in series		Number of parallel strings of modules		
The open circuit voltage of the array (nameplate).			V	
The daily irradiation value used in the design			kWh/m ²	
Brand of Solar Controller		Model Number		
The type of solar controller (Maximum Power Point Tracker (MPPT) or standard controller Pulse Width Modulated (PWM) provided with the system. (Please Tick)		MPPT		PWM
Specifications of the solar controllers	Maximum d.c. current in	A	Maximum d.c. current out	A
	d.c. voltage in	V	d.c voltage out	V
	If MPPT Max voltage In	V	If MPPT Max Power (Array) In	W
	Maximum Load Current (if applicable)			A
The total capacity of the battery bank (Wh or Ah)				
The type of battery (e.g. flooded lead acid, valve regulated lead acid , lithium ion etc).				
Brand of Battery		Model Number		
Capacity of each battery (Wh or Ah)		Voltage of each battery	V	
Total number of individual batteries in the battery bank				
Number of individual batteries in series		Number of parallel strings of batteries		
Brand of Inverter		Model Number		

Power Rating of Inverter (VA or W)		d.c. Voltage	V	
Module Derating Factors used in determining the energy output of the system	Temperature	Dirt		
	Manufacturers Tolerance			
Array oversize factor				
Battery days of autonomy				
Battery maximum depth of discharge				
Sub-system losses	Controller efficiency (Considered in design)			
	Battery efficiency (Considered in design)			
	Cable efficiency (Considered in design)			
	Inverter efficiency (Considered in design)			
Design Number 3				
The total load energy : a.c. and/or d.c. that the system can supply.	a.c. only system	Wh	d.c. only systems	Wh
	System designed for a.c and d.c. loads			
	a.c. loads	Wh	d.c loads	Wh
d.c. system (battery) voltage			V	
Brand of solar module		Model number		
Peak Power Rating		Number of cells		
Number of solar modules				
Size of array in Watts peak (Combined power of all modules)			W_p	
Number of solar modules in series		Number of parallel strings of modules		
The open circuit voltage of the array (nameplate).			V	
The daily irradiation value used in the design			kWh/m ²	
Brand of Solar Controller		Model Number		
The type of solar controller (Maximum Power Point Tracker (MPPT) or standard controller Pulse Width Modulated (PWM) provided with the system. (Please Tick)		MPPT	PWM	
Specifications of the solar controllers	Maximum d.c. current in	A	Maximum d.c. current out	A
	d.c. voltage in	V	d.c voltage out	V
	If MPPT Max voltage In	V	If MPPT Max Power (Array) In	W
	Maximum Load Current (if applicable)			A
The total capacity of the battery bank (Wh or Ah)				
The type of battery (e.g. flooded lead acid, valve regulated lead acid , lithium ion etc).				
Brand of Battery		Model Number		
Capacity of each battery (Wh or Ah)		Voltage of each battery	V	
Total number of individual batteries in the battery bank				

Number of individual batteries in series		Number of parallel strings of batteries		
Brand of Inverter	Model Number			
Power Rating of Inverter (VA or W)	d.c. Voltage		V	
Module Derating Factors used in determining the energy output of the system	Temperature	Dirt		
	Manufacturers Tolerance			
Array oversize factor				
Battery days of autonomy				
Battery maximum depth of discharge				
Sub-system losses	Controller efficiency (Considered in design)			
	Battery efficiency (Considered in design)			
	Cable efficiency (Considered in design)			
	Inverter efficiency (Considered in design)			
The total load energy : a.c. and/or d.c. that the system can supply.	a.c. only system	Wh	d.c. only systems	Wh
	System designed for a.c and d.c. loads			
	a.c. loads	Wh	d.c loads	Wh

8.4 Installer Information

Part 4: Application by Experienced Installer			
Name of Installer			
Name of Company			
Letter is provided from company stating how many years you have been an installer with the company.			
How many systems (approximately) have you installed?			
Based on the size of the solar array: What has been smallest system (and what has been the largest system you have installed.		From	Wp to Wp
List the Training Courses the Installer has completed? <i>Please attach any certificates or documents verifying that the courses were undertaken</i>	Course	Year	Certificate Attached (tick)

