Use of the below table:

The below listed point of attention can be used while evaluating offers for off-grid Solar Energy Systems (SES) in order to come to equal technical offers and to receive a reliable Solar Energy System solution.

Item #	Item description	Remarks
1	**System load requirement / load list**	
1.1	Is the total load consumption (= energy consumption) defined at the nominal system voltage (Vnom = 12.0V, 24.0V or 48.0V)?	
1.2	Is the runtime (e.g. duty cycle) taken into account when defining the required total daily load?	Using the right runtime could result in lowering the load which will result in a smaller Solar Energy System.
1.3	Have efficiency losses for solar energy system's internal DC/DC converters, inverters or regulators for load outputs been taken into account?	Datasheets to be provided that the used efficiencies are correct. Not including the correct efficiencies will lead to under sizing the Solar Energy System.
2	**Solar Energy System sizing calculations**	
2.1	Does the system sizing consider the worst case scenario (= solar insolation in winter period or monsoon season)?	Yearly average values will lead to under sizing the Solar Energy System therefor worst case values to be used. Values for insolation to be provided from an Internationally recognized source.
2.2	Is the tilt-angle optimized for the worst case scenario?	The tilt angle depends on the actual location of the system.
2.3	Has the (correct) reduction factor for battery ambient temperature been considered for battery sizing at lower or higher temperatures?	If indicated by the project specifications the worst case ambient temperature to be used. Note: each battery brand and type has its' own reduction factor.
2.4	Have the reduction factors for dust (solar modules) and ageing (solar modules and battery) according project specifications been considered?	Not including the correct reduction factors will lead to under sizing the Solar Energy System.
3	**Solar modules**	
3.1	Are offered safe area solar modules certified according IEC 61215 and IEC 61730?	
3.2	Can cables be terminated properly inside solar module junction box?	Fixation of cables inside the solar module junction box will provide the most reliable connection. Use of (MC4) connectors should be avoided at all times as they become brittle due to UV. This can result in poor or no connection which will lead to not charging the batteries.

3.3	For a PWM charge controller the maximum power point voltage (Umpp) should be within the correct limits for the nominal system voltage (Umpp = 16.7V ≤ 18.5V (for 12V), Umpp =33.5V ≤ 37.0V (for 24V).	A voltage less than 16.7V/33.5V will result in incorrect / not fully charging battery banks. A voltage above 18.5V/37V is not required for charging batteries sufficiently. Too high Umpp will lead to higher costs and more space will be required. For an MPPT charge controller the minimum and maximum array input voltage should be observed.
3.4	Is the performance warranty on offered solar modules 10 years for 90% output and 25 years for 80% output?	This is nowadays the standard performance warranty offered.
3.5	Is the nominal Watt peak value 0% - +5% (or +/- 5Wp) according solar module datasheet?	A possible negative tolerance could result in a lower output of the solar array. This negative tolerance should be considered as additional losses for solar modules in the system sizing.
4	**Charge controller equipment**	
4.1	Is the charge controller operating with a high charging efficiency (>98%) and suitable for the actual ambient temperature range between -10° C and +75° C under full load conditions and without any derating?	Please note that the temperature inside a control enclosure will be higher (can be up to 25°C) than the ambient temperature as per project specifications. A too high controller temperature can lead to a shutdown of the system.
4.2	Is the charge controller provided with a field-test facility for easy system diagnostics?	During maintenance the performance of the charge controller can be quickly checked.
4.3	Is the charge controller provided with multiple array inputs for more accurate battery charging?	At least 2 array inputs are required to spread energy generation and provide a higher system reliability. If only one array is used a bad connection or damaged cable will lead to not charging a battery.
4.4	Is the charge controller provided with an electronic array input switching device and (build in) electronic reverse current protection?	Mechanical relays will have a low (< 5 year) lifetime expectancy due to the very frequent switching in float charge mode. Diodes will lead to extra power loss and extra connections.
4.5	Is a temperature compensation for the battery charging voltage included and fail safe?	In case of a malfunctioning temperature sensor, a backup mechanism must be available to keep the charging voltage within safe limits to prevent overcharging battery banks.
4.6	Is the charge controller/system capable of providing the peak load current under all circumstances?	Peak currents should be delivered by each individual sub-system in case of malfunctioning of a sub-system.
4.7	Is the charge regime designed and optimized for the offered battery cell type?	Lead acid battery cells require a different charge regime compared to NiCd battery cells. The used charge regime should be confirmed by the battery supplier.

5	**Battery banks**	
5.1	Do battery cells comply to IEC 61427-1 (for use in solar applications)?	Often batteries which are only suitable for UPS (= constant voltage) applications are offered which will result in a shorter lifetime. Compliance to IEC 61427-1 should be confirmed by a respectable inspection company.
5.2	Is the minimum number of duty cycles for 20% DOD = 6000 @ 25°C?	DOD = Depth of discharge. A lower amount of cycles is not desirable for a high reliable SES as the lifetime expectancy will become too low.
5.3	Is a maximum number of 4 battery sets in parallel considered for each (sub-)system?	More than 4 battery sets in parallel will result in an improper / less accurate / unbalanced battery charging which will lead to a shorter battery lifetime for all battery sets. This is also a recommendation provided by the battery manufacturers.
5.4	Is the minimum SOC (for VRLA) or maximum SOC (for NiCd) considered for a correct system sizing?	The full battery capacity is never available since a VRLA battery should not be discharged completely (minimum SOC 15%-20%) and a NiCd battery for solar cannot be charged completely (maximum SOC 95%) in a solar energy system.
6	**Battery box**	
6.1	Is the battery box providing enough ventilation even after being in service for a few months?	In order to cool the batteries and to ventilate eventual hazardous gasses a good natural ventilation should be provided. The use of filters should be avoided as they get full of dust blocking the required ventilation. An IP43 battery enclosure is normally providing the required ventilation and enough protection against rain.
7	**ATEX/IECEx specific requirements**	
7.1	Are the offered hazardous area solar modules certified acc. to the latest ATEX/IECEx standard and allowed to be used at areas with a high change of an impact?	An ATEX/IECEx Certificate of the solar module should be provided by the supplier and the special conditions for safe use to be read as sometimes these includes restrictions for use in the environment in which the solar module will be installed.
7.2	Are the offered hazardous area solar modules or enclosures certified for the ambient temperature in which it will be used?	The ambient temperature should be mentioned on the ATEX/IECEx certificate. If not mentioned the maximum ambient temperature is 40°C.
7.3	Solar modules, assembled enclosures and complete control racks can only be produced by ATEX/IECEx certified companies.	A valid ATEX examination certificate and/or IECEx notification should be provided proving that the company is allowed to produce Ex e an Ex d certified equipment.