****Checklist for PV installation****

**GEAR@SME: G**enerate **E**nergy-efficient **A**cting and **R**esults at **S**mall and **M**edium-size **E**nterprises

Content

[1 Introduction 2](#_Toc96718906)

[2 Situation description 2](#_Toc96718907)

[2.1 Data related to the building where the PV plant will be installed 2](#_Toc96718908)

[2.1.1 For rooftop installations: 2](#_Toc96718909)

[2.1.2 For ground based installations: 3](#_Toc96718910)

[2.2 Data related to the local energy usage 3](#_Toc96718911)

[3 Evaluation of the offer 4](#_Toc96718912)

[3.1 Technical criteria 4](#_Toc96718913)

[3.1.1 General characteristics for the installation 4](#_Toc96718914)

[3.1.2 Characteristics of PV modules 4](#_Toc96718915)

[3.1.3 Characteristics of the inverter 5](#_Toc96718916)

[3.2 Execution and handover 6](#_Toc96718917)

[3.3 Maintenance 6](#_Toc96718918)

[3.4 Cost criteria 7](#_Toc96718919)

[3.5 Proposed weighting of award criteria 7](#_Toc96718920)

[4 Abbreviations and definitions 8](#_Toc96718921)

# Introduction

The following checklist is designed to support the procurement of PV installation in requesting quotes from supplier(s). It can be used both from individual SME or from Trusted Partner in charge of procurement for a group of SMEs (named hereafter “client”).

The checklist consists mainly in two parts. In the first part, entitled "Situation description", the information to be provided by the client when requesting a quote is listed. This information allows the supplier to adapt his answer to the specificity of the project.

In the second part, "Evaluation of the offer", the specifications related to PV installation that could be included in the supplier's quote is listed.

For general on supplier selection and on drafting a contract we refer to:

* [Gear@SME Supplier selection tool]
* [Gear@SME Example contract with supplier]

# Situation description

In this chapter, the information to be provided when requesting a quote is listed. This information should be given by the client and allows the supplier to adapt his answer to the specificity of the project.

## Data related to the building where the PV plant will be installed

* Ownership certificate (or rental contract) for the interested building(s) or approval of the owner (if not the contract party)
* Planimetry of the site, Google-maps aerial views, local pictures of the building (including indication of surrounding buildings and trees that induce shading on projected PV location)

### For rooftop installations:

* type of roof and bedding
* photos of the roof and environment (shadow)
* roof tilt
* roof orientation
* roof surface
* building height, as a permission might be needed for some buildings
* presence of installations on the roof (cables, shafts, pipes…)
* state of the roof (renovated?)
* information regarding the static (if available)
* Information about the building type, usage destination and potential limitations to changes to the building

### For ground based installations:

* Clear indication of area for solar panels
* Known information on presence of ground cables for gas, electricity etc.
* Possibly requests for orientation of panels
* Location and capacity of electricity connection to the net
* prescription of areas to be kept available for passage through the PV park

## Data related to the local energy usage

* Electricity bills and projection of future use
* Extract from the energy authority of energy demand profiles
* Use of electricity (warm water?)
* Desired installed power
* Building connection situation (in A): is there enough reserve? Is there space for a sub-distribution or meter?

# Evaluation of the offer

Specific information regarding PV installation is listed in this chapter. For general criteria, please refer to [GEAR@SME Example Tender document].

## Technical criteria

### General characteristics for the installation

Static the stability of the roof should be confirmed by a recognized structural engineer (taking in account snow and wind load), preferably before but also possible after contracting. On site check, sometimes also with available documentation.

Simulation software used for the system simulation of the solar yield

Location of the installation specification of the type of surface where the PV modules will be installed (i.e. tilted roof, flat roof, other surface)

Nominal power (kW) peak installed power of the PV plant (the power delivered in nominal conditions, i.e. 1000 W/m2 irradiation.

Specific weight (kg/m2) the weight of the modules (with and without the supporting structures) per unit of surface.

Occupied surface the total surface needed for the PV installation (both structure and modules).

Cable paths information about cables, sometimes in chimney shafts

Warranty clear information about the PV warranties.

The compatibility of all components should be guaranteed.

### Characteristics of PV modules

Module types module producer, specific technology and type of the PV modules (e.g. monocrystalline, polycrystalline, PERC, and thin-film panels). For the visual appearance it is possible to specify that panels should have an all-black appearance.

Origin national, european or international origin of the modules.

Nominal Power Rating or Maximum Power at STC (W) the amount of energy the panel will generate under Standard Test Conditions (STC).

Power tolerance (%) the range within which a panel manufacturer is saying the module can deviate from its specified STC Max Power.

Module efficiency (%) The efficiency of the panels is defined as the ratio between the incoming solar radiation and the electric output of the PV module, per m2 in standard conditions.

Operating module temperature (°C) the range of variation of the operating temperature of the panel.

Maximum Power at NOCT (Nominal Operating Cell Temperature) (W) Note that not all data sheets have this number.

Module warranty: comprises the performance warranty (years) end the equipment warranty (years). A solar panel’s product warranty insurance covers the integrity of the panel itself and protects the customer against problems such as manufacturing defects, environmental issues, premature wear and tear etc. A longer period is generally more advantageous, if solar panel system is owned by the customer. When evaluating a solar panel warranty and its manufacturer, the two most important factors to focus on are: Performance warranty: a solar panel’s performance warranty will typically guarantee 90% production at 10 years and 80% at 25 years. Product (or materials) warranty. An equipment warranty will typically guarantee 10-12 years without failing.

### Characteristics of the inverter

Location: on the roof (less cables, more room elsewhere) or in a technical room with better shielding from weather conditions.

Maximum AC output power (W or kW) the maximum power the inverter can supply to a load on a steady basis at a specified output voltage.

Peak output power (W) the maximum power that an inverter can supply for a short time.

AC output voltage (V) this value indicates to which utility voltages the inverter can connect.

Peak efficiency (%) the ratio of the usable AC output power to the sum of the DC input power and any AC input power.

Maximum Input Current (A) the maximum direct current that the inverter can utilize.

Maximum Output Current (A) the maximum continuous AC that the inverter supplies.

Peak Power Tracking Voltage (V) the DC voltage rate in which the inverter’s maximum power point tracker operates.

Start Voltage (V) minimum DC voltage required for the inverter to turn on and begin operation.

Warranty (years) solar inverters are usually warrantied for a period ranging from 5 to 15 years, with an average standard warranty period of 10 years. Some companies offer the possibility to extend this period to up to 20 years.

Monitoring The system should be connected to the internet to monitor generated power per inverter. In case of failures the system should automatically generate messages to a prescribed mobile or email address.

## Execution and handover

The supplier should make available at the end of the project to the client:

* On-site inspection for measurements and surveys:
  + shading
  + distance from the grid
  + available surface area
* and drafting of the final project in accordance with current regulations.
* Practices for requesting authorization from the Municipality, for type and size of plant.
* Request for connection to the grid and for authorization to start up.
* Management of the bureaucratic process with the energy service supplier
* Site preparation, installation of the photovoltaic modules, making the string connections, and laying the cables for the DC lines; functional testing of the panels with measurement of open circuit voltages and short circuit currents. Assembly of the DC (direct current) and AC (alternating current) side panels, the inverter and accessory devices with installation of all relevant connection cables.
* Testing of the photovoltaic system, in the presence of the client and one or more of the client's technicians.
* Preparation of the documentation required for admission to the photovoltaic incentives and any premiums on the incentive tariffs.

Technical documents to be supplied to the customer:

The technical documents should be supplied both physically and digitally (pdf format).

* Test certificate
* Certificate of conformity of the installation
* User manuals of installed equipment and warranty
* Technical data sheet of the system (all components) and maintenance schedule as per guarantee
* Electrical plans and construction drawings
* Request for connection

## Maintenance

* Maintenance contract: a maintenance contract with the firm who installed the PV system can be of advantage to assure replacement of defect units and optimal system performance.

## Cost criteria

For general criteria, please refer to [GEAR@SME Example Tender document].

Indicate the total cost of the PV system with bill of materials (list of individual components). It should be mentioned if the costs are a flat rate for delivery and installation or with hourly rate (first option preferred).

Cost items:

* Cost of panels
* The approximate cost of individual photovoltaic solar panels
* Cost of structures to support photovoltaic panels
* Cost of the inverter for the photovoltaic system
* Other miscellaneous costs: combiner boxes, electric cables connecting the various devices.
* Specialized labour
* Bureaucratic costs (authorizations, cost of connection to the electricity grid)
* Storage system, if applicable (significantly affects the cost of a photovoltaic system)

It should be mentioned if other costs (external structural engineer, chimney inspector) are to be covered by the SME itself. Transparency in the costs can be gained.

Bank warranty

In order to obtain a warranty that suppliers claims can be resolved under all circumstances, it could be wise to obtain a bank warranty from supplier for the whole warranty period of the modules. In the bank warranty, it should be made clear under which circumstances it can be invoked.

## Proposed weighting of award criteria

The buyer of a PV system should indicate the evaluation criteria that are of critical importance in the evaluation of offers. Below an example of possible award criteria and their weighing.

|  |  |
| --- | --- |
| Award criterion | weighting (%) |
| Price per Watt peak | 50 |
| Warranty | 20 |
| Supplier rating and references | 15 |
| Installation plan | 15 |
| TOTAL | 100 |

# Abbreviations and definitions

Inverter: A solar inverter or PV inverter, is a type of electrical converter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid.

NOCT- Normal Operating Cell Temperature (NOCT) is a testing standard geared to the operational conditions of solar cells, defined as the temperature reached by open circuited cells in a module assuming 800W/ m² irradiance, 20°C ambient temperature and wind speed of 1m/ s.

PERC- it stands for Passivated Emitter and Rear Cell. PERC cell technology defines a solar cell architecture that differs from the standard cell architecture and enables manufacturers to achieve higher efficiencies.

photovoltaic (PV) module - Also called solar panels, a solar module is a single photovoltaic panel that is an assembly of connected solar cells. The smallest environmentally protected, essentially planar assembly of solar cells and ancillary parts, such as interconnections, terminals, intended to generate DC power under unconcentrated sunlight.

photovoltaic (PV) peak watt -Maximum "rated" output of a cell, module, or system. Typical rating conditions are 1000 watts per square meter of sunlight, 20 degrees C ambient air temperature and 1 m/s wind speed.

STC - stands for Standard Test Conditions and is the major solar panel output performance testing condition used by most manufacturers and testing bodies. It specifies a cell temperature of 25°C and an irradiance of 1000 W/m2 with an air mass 1.5 (AM1.5).