

## *Checklists for Final Design Evaluation*

### Description

This Form contains the checklists for the Final Design evaluation.

### Information to be Submitted with the Single Line Diagram

Below is a checklist that summarises the information submitted:

*Table 1 – Required information from Single Line Diagrams*

DESCRIPTION	NOTES
<b>Title Block</b>	
Date (Year, Month, Day)	With any updates
Author (affiliation if any)	With any updates
Signature	With any updates
Name of the project	
Subject ("Electric SLD" or similar)	
Reference (e.g. sequence number)	
<b>Content</b>	
Lines and symbols according to international standards (ISO and IEC). They should be visible, clear and fully understandable	
The size of the drawing proportionate to the extent of the design	
The writings are clear and understandable	
Components identified with its abbreviation	

## *Checklists for Final Design Evaluation*

### Information required from Site Plans

Below is a checklist to verify the information from site plans and their updates:

*Table 2 – Required information from Site Plans*

DESCRIPTION	NOTES
<b>Title Block</b>	
Date (Year, Month, Day)	With any updates
Author (affiliation if any)	With any updates
Signature	With any updates
Name of the project	
Subject ("Site Plan")	
Scale of the drawing	
Reference (e.g., sequence number)	
<b>Content</b>	
Lines and symbols according to international standards (ISO and IEC). They should be visible, clear and fully understandable	
The size of the drawing proportionate to the extent of the design	
The writings are clear and understandable	
Any meaningful part identified with a name or description	
Drawings with all the components and equipment properly represented and connected each other with electric lines	
Specific details may be represented on an extended scale when necessary	The scale shall be indicated

## Checklists for Final Design Evaluation

### Information required from PV System Supporting Structures

Below is a checklist that summarises the information required information from PV System Supporting Structures:

Table 3 – Required information from PV System Supporting Structures

DESCRIPTION	NOTES
<b>Title Block</b>	
Date (Year, Month, Day)	With any updates
Author (affiliation if any)	With any updates
Signature	With any updates
Name of the project	
Subject (“PV System Layout” or similar)	
Scale of the drawing	
Reference (e.g. sequence number)	
<b>Content</b>	
Lines and symbols according to international standards (ISO and IEC). They should be visible, clear and fully understandable	
The size of the drawing proportionate to the extent of the design	
The writings are clear and understandable	
Any meaningful part identified with a name or description	
Drawings with all the components and equipment properly represented and connected each other with electric lines	
Supporting structures represented in different views (top, front, side)	
Specific details may be represented on an extended scale when necessary	The scale shall be indicated

## Checklists for Final Design Evaluation

### Information required in the Final Design Report

Below is a checklist that summarises the information required in the Final Design Report:

Table 4 – Required information in the Final Design Report

DESCRIPTION	NOTES
<b>Frontpage</b>	
Name of the project	
Subject (“Design Report” or similar)	
Author (affiliation if any)	With any updates
Signature	With any updates
Date (Year, Month, Day)	With any updates
<b>Content</b>	
Site-related data (Geographical coordinates, monthly averages of solar radiation, temperature, wind speed, and other specific characteristics)	
Electric data (voltage and frequency at POC, specific characteristics of POC)	
Detailed characteristics of the PV modules	
Detailed characteristics of the Inverters	
The main characteristics of the relevant components and equipment are Interface Protection, transformers (if present), MV switchgears (if present), and Combiner boxes.	
A detailed description of the PV System electrical design	
DC calculations: voltages, currents, voltage drops, cable sizes, MPPT voltages verification.	
Main characteristics of the DC components and equipment	
AC calculations, currents, cable sizes, overcurrent, short-circuit, dimensioning of switches, fuses, RCDs, transformers (if present), MV circuit, and equipment (if present).	
Calculation of the supporting structures (when necessary).	Fixed or tracker system
Description of the monitoring system	
Calculation of the monthly and yearly energy production	
Commissioning plan	
Maintenance plan	

## Checklists for Final Design Evaluation

### Checklist to Evaluate the Final Design Documentation

The following Table is a minimum information verification checklist for Kahramaa in order to check the completeness and adequacy of the documentation delivered.

Table 5 – Checklist for Evaluation of the Final Design documentation

Data name	Result / Value
<b>a) Consumer Information</b>	
Application ID	<input type="checkbox"/> Yes <input type="checkbox"/> No
Account Number	<input type="checkbox"/> Yes <input type="checkbox"/> No
AC Output Power Capacity (kW)	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>b) Completeness of the documentation</b>	
Basic System Information	<input type="checkbox"/> Yes <input type="checkbox"/> No
Information on Solar REG Designer	<input type="checkbox"/> Yes <input type="checkbox"/> No
Information on Solar REG Installer	<input type="checkbox"/> Yes <input type="checkbox"/> No
<i>Design Report</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Wiring Diagrams (Single Line and Multi Line)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Planimetry and string layout	<input type="checkbox"/> Yes <input type="checkbox"/> No
PV module datasheet	<input type="checkbox"/> Yes <input type="checkbox"/> No
Inverter datasheet	<input type="checkbox"/> Yes <input type="checkbox"/> No
Interface Protection datasheet	<input type="checkbox"/> Yes <input type="checkbox"/> No
Mechanical design information	<input type="checkbox"/> Yes <input type="checkbox"/> No
Emergency systems	<input type="checkbox"/> Yes <input type="checkbox"/> No
Estimate of the yearly energy production	<input type="checkbox"/> Yes <input type="checkbox"/> No
Project Implementation Schedule – Detailed	<input type="checkbox"/> Yes <input type="checkbox"/> No
Expected date of installation/energisation	<input type="checkbox"/> Yes <input type="checkbox"/> No
Operation and Maintenance Manual	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>c) Evaluation of the documentation</b>	
Are the DC and AC power capacity of the Solar REG equal to the Initial Enquiry?	<input type="checkbox"/> Yes <input type="checkbox"/> No
In case one or both have been changed, have they been reduced?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Production details (at least kWh per annum) provided?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>d) Verification of the completeness of the Design Report – Foreword</b>	
PV module installation	<input type="checkbox"/> Ground <input type="checkbox"/> Building <input type="checkbox"/> Canopy <input type="checkbox"/> Other _____
Building Installation (in case of PV module installation on the building)	<input type="checkbox"/> Flat rooftop <input type="checkbox"/> Roof flap <input type="checkbox"/> Facade <input type="checkbox"/> Other
PV Technology	<input type="checkbox"/> Crystalline Silicon <input type="checkbox"/> Thin Film <input type="checkbox"/> CPV
Mounting structure	<input type="checkbox"/> Fixed <input type="checkbox"/> 1-axis Tracker <input type="checkbox"/> 2-Axes Tracker

## *Checklists for Final Design Evaluation*

Data name	Result / Value
Are the above data consistent with the PV Application?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>e) Verification of the completeness of the Design Report – Main devices and equipment</b>	
DC combiner boxes description	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Interface protection description	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monitoring system description	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>f) Verification of the completeness of the Design Report – System architecture and Dimensioning</b>	
The general architecture of the system	<input type="checkbox"/> Yes <input type="checkbox"/> No
Characteristics of the PV strings and PV array(s)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Verification of compliance for PV strings/array(s) and inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>g) Verification of the completeness of the Design Report – DC Section</b>	
Verification of compliance for DC cables	<input type="checkbox"/> Yes <input type="checkbox"/> No
Measures to prevent overcurrent in parallel PV strings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Characteristics of the DC disconnectors	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
<b>h) Verification of the completeness of the Design Report – AC Section</b>	
Description of measures to prevent electric shocks from direct contacts	<input type="checkbox"/> Yes <input type="checkbox"/> No
Description of measures to prevent electric shocks from indirect contacts	<input type="checkbox"/> Yes <input type="checkbox"/> No
Characteristics of the main AC devices	<input type="checkbox"/> Yes <input type="checkbox"/> No
AC calculations (verification of compliance for AC devices and cables)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Interface Switch description	<input type="checkbox"/> Yes <input type="checkbox"/> No
Backup Switch description	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
UPS description	<input type="checkbox"/> Yes <input type="checkbox"/> No
RCD Protection device(s)	<input type="checkbox"/> Yes <input type="checkbox"/> No
External Lightning Protection System (LPS)	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>i) Verification of the completeness of the Design Report – Civil and mechanical installation</b>	
Description of the mounting structures	<input type="checkbox"/> Yes <input type="checkbox"/> No
Structural calculations	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
<b>j) Certifications required</b>	
PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No
Inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No
Interface protection	<input type="checkbox"/> Yes <input type="checkbox"/> No
Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Was the Design Evaluation successful?</b>	<input type="checkbox"/> <b>Passed</b> <input type="checkbox"/> <b>No Passed</b>

## Checklists for Final Design Evaluation

### Checklist for Evaluation of Final Design Evaluation of PV Systems $\leq 11$ kW

The following Table contains the verification list for the Final Design Evaluation of PV Systems  $\leq 11$  kW.

Table 6 – Checklist for Evaluation of Final Design of PV Systems  $\leq 11$  kW

<b>Checklist for Final Evaluation of PV System with <math>P_N \leq 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
<b>Wiring Diagram – General Contents</b>		
Inclusion of the Solar PV System in the existing installation is clearly indicated in the wiring diagrams	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Single line diagram, with details of metering and protection system (relays, CTs and VTs when adopted, e.g. for MV network connections)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Wiring diagram</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
Type of PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Tot. number of PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Number of strings	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Number of PV modules per string	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Connection strings / inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
String cable size and type	<input type="checkbox"/> Yes <input type="checkbox"/> No	
String overcurrent protective device – type and voltage/current ratings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Blocking diode type	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Array main cable: Size, type, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Combiner boxes: Locations, manufacturer, model and internal electric diagram	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
DC switch disconnecter: Location and rating (V/A), manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Other arrays with electronic protective circuitry: Type, location, rating, manufacturers and models	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
AC isolator location: Type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No	
AC overcurrent protective device: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Residual current (where fitted): Device location, type and rating	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Interface protection: Type, manufacturing and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Interface switch: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Backup switch: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Details of all earth/bonding conductors – size and type	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Details of array frame equipotential bonding cable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

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<b>Checklist for Final Evaluation of PV System with <math>P_N \leq 11</math> kW</b>		
Field	Result / Value	Notes
Details of any connections to an existing LPS	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Details of any surge protection device installed	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Check of Connection Requirements</b>		
Is the proposed diagram compliant with Kahramaa applicable rules, particularly the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If three-phase inverters are not used, is the maximum power imbalance limited to the values specified in the Technical Standards for the Connection of PV Systems to the LV and MV Distribution Networks?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Planimetry and String layout</b>		
Site setting out plan showing details of proposed works, PV modules layout, meter location(s), etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Indication of tilt and orientation	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Sources of shading are clearly indicated	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Layout drawing showing how the array is split and connected into strings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
<b>Sizing of the Solar PV System</b>		
Is the compatibility between the strings and the Inverter been verified?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the sizing of the PV system elements (inverters, solar cables, cables, panels, etc.) correct?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In the case of installation on buildings, is the maximum string voltage $\leq 1000$ Vdc?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In the case of ground-mounted installation, is the maximum string voltage $\leq 1500$ Vdc?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Protection against overcurrent: Are there suitable provisions of the Building Code taken into consideration during the installation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In case of use of transformer with fewer inverters, has an RCD (Residual Current Device) of Class B (Class A is sufficient in case of inverters which cannot inject DC currents) been considered on AC side?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Lightning protection: Is there a need for LPS to be evaluated, and, if required, relative provisions have been taken?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Datasheets and Certification</b>		



## Checklists for Final Design Evaluation

<b>Checklist for Final Evaluation of PV System with <math>P_N \leq 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
Details on PV modules for each kind employed in the plant (Manufacturer, Model reference, Efficiency, Warranty years for manufacturing defects, Peak capacity per single PV module [Wp], Surface per single PV module [m <sup>2</sup> ], Orientation (South= 0°, East= -90°, West=90°), Tilt angle (inclination to horizontal), Number of modules of this type)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Compliance (to applicable Standard) certificate of the modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Details on Inverters, for each kind employed in the plant (Number of inverters of each type, Manufacturer, Model reference, Compliance with the Inverters approved by Kahramaa, Warranty years, Rated AC power, Nominal power factor and adjustable range, Maximum DC input voltage, AC output voltage, Connection phases, Total Current Harmonic Distortion, Synchronisation method with Kahramaa network, Environmental protection rating (IP), Means to avoid dust penetration in the installation room (if any)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
The Inverter AC Output Voltage is compatible with the LV Distribution Networks of Kahramaa with which the Solar PV System is connected to	<input type="checkbox"/> Yes <input type="checkbox"/> No	
The Inverters are compliant with Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks <sup>(1)</sup>	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Degree of Protection IP of the Inverter compatible with the location of installation (Indoor min IP41 ; Outdoor IP54)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Miscellaneous</b>		
Ground Floor and/or typical floor layout indicating Location of Electrical rooms, MDB / SMDB, DB, Inverters, etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Dimensional layout of electrical RMU rooms, LV switch rooms with the arrangement of the panels, metering rooms or enclosures	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Array mounting system documentation	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Documentation of any emergency systems	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Other drawings/technical specification as applicable, complete	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Result</b>	<input type="checkbox"/> <b>Passed</b> <input type="checkbox"/> <b>No Passed</b>	

<sup>1</sup> In future the proposed inverters shall be included in the list of those approved by Kahramaa.

## Checklists for Final Design Evaluation

### Checklist for Evaluation of Final Design Evaluation of PV Systems > 11 kW

The following Table contains the verification list for the Final Design Evaluation of PV Systems > 11 kW.

Table 7 – Checklist for Evaluation of Final Design of PV Systems > 11 kW

<b>Checklist for Final Evaluation of PV System with <math>P_N &gt; 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
<b>Design Report – Foreword</b>		
Type of solar system, integration if relevant, fixed mounting or tracking, technology	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Short description of the purpose of the project	<input type="checkbox"/> Yes <input type="checkbox"/> No	
information for all bodies responsible for the design	<input type="checkbox"/> Yes <input type="checkbox"/> No	
information for all bodies responsible for the installation	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Design Report – Input data</b>		
Definitions	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Most relevant laws and standards applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Solar and environmental data of the site	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Geological and environmental constraints	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Characteristics of the distribution network at POC	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Design Report – Characteristics of the main devices and equipment</b>		
PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No	
DC combiner boxes	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Interface protection	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Monitoring system	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
<b>Design Report – System architecture and dimensioning</b>		
It explain how the DC and AC capacity is obtained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
General architecture of the system	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Characteristics of the PV strings and PV array(s)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Verification of compliance for PV strings/array(s) and inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Description of the grid connection and power delivery	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Design Report – DC section</b>		
Verification of compliance for DC cables	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Measures to prevent overcurrent in parallel PV strings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
<b>Design Report – AC section</b>		
Description of measures to prevent electric shocks from direct contacts	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Description of measures to prevent electric shocks from indirect contacts	<input type="checkbox"/> Yes <input type="checkbox"/> No	

## Checklists for Final Design Evaluation

<b>Checklist for Final Evaluation of PV System with <math>P_N &gt; 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
Characteristics of the main AC devices	<input type="checkbox"/> Yes <input type="checkbox"/> No	
AC calculations (verification of compliance for AC devices and cables)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Design Report – Civil and mechanical installation</b>		
Description of the mounting structures	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Structural calculations	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
<b>Design Report – Performance calculations</b>		
Calculation of the solar radiation on the PV system	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Energy Yield (monthly and yearly)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
CO2 saved	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Wiring Diagram – General Contents</b>		
The inclusion of the Solar PV System in the existing installation is clearly indicated in the wiring diagrams	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Single line diagram, with details of metering and protection system (relays, CTs and VTs when adopted, e.g. for MV network connections)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Wiring diagram</b>		
Type of PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Tot. number of PV modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Number of strings	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Number of PV modules per string	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Connection strings / inverters	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
String cable size and type		
String overcurrent protective device – type and voltage/current ratings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Blocking diode type	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Array main cable: Size, type, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Combiner boxes: Locations, manufacturer, model and internal electric diagram	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
DC switch disconnecter: Location and rating (V/A), manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Other arrays with electronic protective circuitry: Type, location, rating, manufacturers and models	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
AC isolator location: Type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No	
AC overcurrent protective device: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Residual current (where fitted): Device location, type and rating	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Interface protection: Type, manufacturing and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

## *Checklists for Final Design Evaluation*

<b>Checklist for Final Evaluation of PV System with <math>P_N &gt; 11 kW</math></b>		
Field	Result / Value	Notes
Interface switch: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Internal	
Backup switch: Location, type, rating, manufacturer and model	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Details of all earth/bonding conductors – size and type	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Details of array frame equipotential bonding cable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Details of any connections to an existing LPS	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Details of any surge protection device installed	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Fulfilment of the Connection Requirements</b>		
Is the proposed diagram compliant with Kahramaa applicable rules, particularly the Technical Standards for the Connection of PV Systems to the LV and MV Distribution Networks?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the Interface Protection external to the Inverter?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the Interface Protection act on a specific Interface Switch?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the Interface Switch a motorised circuit breaker or a Contractor?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the Interface Switch opening coil an undervoltage release?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are the Interface Protection and the undervoltage release fed via a UPS with at least 5s of autonomy?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In case the size of the Solar PV System $> 20kW$ :	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is there a backup switch that can receive the opening command if the Interface Switch fails?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the external Interface Protection include all the needed protection functions (27,59, 81<, 81>)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does either the external Interface Protection or the protection built in the Inverter include an Anti-Islanding protection function?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the Interface Protection correctly connected (line voltages sensed)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If three-phase inverters are not used, is the maximum power imbalance limited to the values specified in the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Planimetry and String layout</b>		
Site setting out a plan showing details of proposed works, PV modules layout, meter location(s), etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Indication of tilt and orientation	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are the sources of shading clearly indicated?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

## Checklists for Final Design Evaluation

<b>Checklist for Final Evaluation of PV System with <math>P_N &gt; 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
Layout drawing showing how the array is split and connected into strings	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
<b>Sizing of the Solar PV System</b>		
Is the compatibility between the strings and the Inverter checked?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the sizing of the PV system elements (inverters, solar cables, cables, panels, etc...) correct?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In the case of installation on buildings, is the maximum string voltage $\leq 1000$ Vdc?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In the case of ground-mounted installation, is the maximum string voltage $\leq 1500$ Vdc?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Protection against overcurrent: have suitable provisions in the agreement with Building Code Section 407 been taken during the installation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
In case of use of transformer with fewer inverters, has an RCD (Residual Current Device) of Class B (Class A is sufficient in case of inverters which cannot inject DC currents) been considered on the AC side?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Lightning protection: Is there a need for LPS to be evaluated, and, if required, relative provisions have been taken?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Datasheets and Certification</b>		
Details on PV modules for each kind employed in the plant (Manufacturer, Model reference, Efficiency, Warranty years for manufacturing defects, Peak capacity per single PV module [Wp], Surface per single PV module [m <sup>2</sup> ], Orientation (South= 0°, East= -90°, West=90°), Tilt angle (inclination to horizontal), Number of modules of this type)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Compliance (to applicable Standard) certificate of the modules	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Details on Inverters, for each kind employed in the plant (Number of inverters of each type, Manufacturer, Model reference, Compliance with the Inverters approved by Kahramaa, Warranty years, Rated AC power, Nominal power factor and adjustable range, Maximum DC input voltage, AC output voltage, Connection phases, Total Current Harmonic Distortion, Synchronisation method with Kahramaa network, Environmental protection rating (IP), Means to avoid dust penetration in the installation room (if any)	<input type="checkbox"/> Yes <input type="checkbox"/> No	

## Checklists for Final Design Evaluation

<b>Checklist for Final Evaluation of PV System with <math>P_N &gt; 11</math> kW</b>		
<b>Field</b>	<b>Result / Value</b>	<b>Notes</b>
The Inverter AC Output Voltage is compatible with the LV Distribution Networks where the PV System is connected	<input type="checkbox"/> Yes <input type="checkbox"/> No	
The Inverters are compliant with Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks <sup>2</sup>	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are the Harmonic Currents generated by the inverters retrievable from the received datasheets? (Solar PV Systems > 50kW)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Degree of Protection IP of the Inverter compatible with the location of installation (Indoor min IP54; Outdoor min IP65)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Details of external Interface Protections (Number, Manufacturer, Model reference, Compliance with the protections approved by Kahramaa)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Compliance to Kahramaa and International Standard certificate of the external interface protection (if not in the list of the already approved ones) (until transitional rules are no more in force)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Miscellaneous</b>		
Plan of substation location (in case of MV connection)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Ground Floor and / or typical floor layout indicating location of Electrical rooms, MDB / SMDB, DB, Inverters, etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is there a dimensional layout of electrical RMU rooms, LV switch rooms with an arrangement of the panels, metering rooms or enclosures?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Is the array mounting system documentation clear and complete?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Documentation of any emergency systems	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Are other drawings/technical specification as applicable complete?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Operation and Maintenance criteria and main planned actions in agreement with Kahramaa's recommendations	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Result</b>	<input type="checkbox"/> <b>Passed</b> <input type="checkbox"/> <b>No Passed</b>	

<sup>2</sup> In future the proposed inverters shall be included in the list of those approved by Kahramaa.