DOMESTIC SOLAR PHOTOVOLTAIC

CODE OF PRACTICE FOR INSTALLERS

Version 1.1

July 2018

Contents

1 Definitions

AC Electrical System	All AC components connecting the PV inverter (and Battery) to the consumer unit, including cables, isolators, junction boxes, protective devices etc.
Battery Energy Storage System (BESS)	The system for storing energy from the solar PV system for later use within the home
DC Electrical System	All DC components connecting the PV module array to the inverter, including cables, isolators, junction boxes, fuses etc.
Homeowner	The owner of the home / applicant for grant.
Installer	Person who is named on SEAI's Renewable Installers Register under the Solar Photovoltaic category, and SEAI Solar PV Installer Register
Inverter	The power converter for converting the energy generated from the Solar PV System into AC electricity for connection to the domestic electrical system
Micro-Inverter	Inverter which has one or two solar PV modules connected to it, typically installed at the back of the solar PV modules
Module	The Solar PV panel including all solar PV cells, frame, and electrical connections
Module Array	A collection of multiple solar PV modules, making up part of the overall PV system
Mounting Bracket	The bracket for fixing the solar PV system to the roof structure
Mounting System	The Mounting System includes the mounting frame, connection to the roof (mounting bracket), connection to the ground or building, and connection to the solar modules.
Peak Output - Wp	The rated peak power output (DC) of the Solar PV system at Standard Test Conditions
Slate/Tile	General term for any pitched roof covering including slates, tiles, bitumen shingles etc.
Solar PV Installer Register	SEAI maintain a Renewable Installer Register which has a Solar Photovoltaic category. Conditions for registration on this Register can be found at www.seai.ie. In addition, for the purposes of the grant scheme, Installers must register for the Solar PV Installer Register. See T&Cs for details.
Roof	In this document Roof means the roof supporting structure, covering, and all associated roof elements
Scheme	SEAI's Domestic Solar PV Pilot Scheme
Self-consumption	The energy generated by the solar PV system that is used by the homeowner, either directly or indirectly (i.e. through storage)
Solar PV System	All components, wiring, electrical interfaces making up the operating Solar PV generator
Standard Test Conditions (STC)	Standard Test Conditions in accordance with EN 60904
Storage	Refers to energy storage of all types – thermal, battery etc.
String Inverter	Inverter which has a string or strings of one or more solar PV modules connected to it, typically installed inside the home

2 Installer Requirements & Competency

For the purposes of the Scheme all elements of a solar PV system must be compliant with all applicable legislation and applicable guidance, which may or may not be included in this Code of Practice. The Installer has total responsibility for ensuring compliance and must obtain assistance where required. The Installer must hold a valid and current registration, under the Solar Photovoltaic category, on SEAI's Renewable Installer Register AND a registration on SEAI's Solar PV Installer Register at the time the installation is carried out. The Installer must satisfy themselves, and certify, that the solar PV system installation has been designed, installed, tested and commissioned in accordance with this code of practice, and other relevant codes and standards. The Installer must, at his/her cost, provide all information required by SEAI or SEAI's agents for the purposes of audit and inspection.

Any queries on this code of practice can be sent to solarpv@seai.ie

3 Solar PV System Design Requirements

The Installer must use due care and attention to design a suitable, and optimum, solar PV system (and storage system, if included) for the homeowner, considering;

- A minimum design life of 20 years
- Planning, and local authority requirements
- The age, condition, and construction of the roof (for roof-mounted systems) considering the current age, the design life of the roof, and the requirement of the solar PV system to have a design life of 20 years
- The orientation of the building, pitch of the roof, any local shading effects from trees, vegetation, adjacent structures
- The solar PV module array must be installed where minimal shading may be encountered for the building/site. Where shading is likely to be encountered consideration should be given to micro-inverters or optimisers to minimise the energy performance effect from shading
- Local conditions including wind, pollution, potential for corrosion from proximity to sea, wildlife (nesting birds and mammals)
- Compliance with component installation and warranty requirements
- Maximising the energy yield (kWh/kWp) of the solar PV system
- Maximising the homeowners' likely self-consumption of generated solar electricity, either through appropriate sizing of the solar PV system, or additional storage solutions.
- Compliance with the Safety, Health and Welfare at Work (Construction) Regulations 2013, and access for routine inspection and maintenance.

4 Component and Installation Requirements

4.1 All Components

All equipment and/or components of the PV systems must carry a valid CE mark as required by the specific EU directive(s).

Warranty: Overall, the PV system shall have a minimum design life of 20 years. The following minimum warranties duration should apply:

- Solar PV modules: Product Warranty 10 years. Performance Warranty: ≥90% of rated output power (Wp) after 10 years ≥80% of rated output power after 25 years.
- String Inverter: Product Warranty 5 years.
- Micro Inverter: Product Warranty 10 years.
- Mounting System: Product Warranty 10 years.

4.2 PV Modules

PV Modules must;

- Meet the requirements of EN 61215 and 61730
- Have a Minimum Peak Output (Wp) per m2 (at STC) of;
    - 170 Wp/m2 for Crystalline Silicon modules
    - 40 Wp/m2 for Thin-Film modules
- Have a maximum power tolerance of 5%, with a maximum range either side of zero, i.e. +/- 5%, OR a maximum range above zero, i.e. 0% to 5%.
- Must be mounted and fixed according to manufacturer's instructions including recommended fastening torque.

4.3 Mounting Systems

4.3.1 Acceptable Forms of Mounting System

There are numerous solutions available for mounting systems for solar PV systems. The following categories of mounting systems are considered acceptable for the Scheme. If an Installer is uncertain if a mounting system is acceptable, they are advised to seek approval from SEAI in advance of installation.

- Roof Mounted – Pitched or Flat Roof
- Integrated or 'In-Roof' systems
- Wall/Cantilever or Brise Soleil Mounted
- Ground Mounted or Car Port Mounted

The following mounting configurations are not considered acceptable (without prior written approval BEFORE installation by SEAI) for the Scheme

- Horizontal or Vertical mounted (i.e. laid flat on roof or ground, or fixed flat to wall or another surface)
- Building Integrated PV (BIPV), i.e. where solar PV is used to replace traditional building materials such as glazing or cladding.

- Solar Tiles, Coatings or Flexible Solar Membranes

4.3.2 Roof Mounting Systems – Loading and Structure

When considering roof mounted PV system, the Installer must consider and assess the below;

- The design and specification of the PV mounting system for all installation types shall consider
    - Building Regulations TGD A – Structure
    - Design wind and snow loads – derived from Eurocode-1 (and Irish National Annex)
    - Appropriate safety factors – derived from Eurocode-1 (and Irish National Annex)
    - Strength and suitability of the supporting structure
    - Strength of the fixing – using fixing data from Eurocode-5
    - Proposed mounting system and suitability for roof supporting structure and roof tile system
    - Weather sealing of any impacted parts of the roof for mounting system and cable access
    - Impact of any additional stress or strain on the roof tile system, particularly over time and during multiple temperature changes.
- The roof structure shall be checked to ensure it can withstand the imposed loads from the solar PV system. This should include a site inspection by a suitably qualified, competent person
- **Where there is <u>any doubt</u> to the suitability of the roof structure to withstand the imposed loads, a qualified structural engineer should be consulted**. Reasons for consulting a qualified structural engineer may include, but are not limited to;
    - Signs of structural distress
    - Signs of post construction modification
    - Shallow roof pitch (<30°)
    - Roof design has potential for snow build up (e.g. dormers, valleys, parapets)
    - The roof is an unusual, non-standard, construction

4.3.3 Roof Mounting Systems – Installation

The following requirements for roof mounting systems shall be met by the Installer;

- The PV system should not adversely affect the weather tightness of the structure to which they are fitted, and for the design life of the PV system (20 years).
- The PV modules must not overhang the edge of the roof at any point, must not extend within 500mm of the roof edge/perimeter, and must not be fixed at the ridge cap/tile (which in many cases may be cemented in place)
- The solar PV module array must not be installed over any roof vents, or other necessary roof ventilation.
- A rail and clamp system, or a comparable system, will be used to fix/mount the PV modules on the mounting system.

- The rail and clamp system, including accessories, shall be austenitic ('300 series') stainless steel, aluminium, or galvanised steel (80 microns minimum, not BZP), and of a suitably heavy duty for the 20-year design life.
- The selection, amount and location of mounting points, and clamp points, shall be calculated based on the site requirements. Two mounting brackets are required, at a minimum, per PV module installed. Four clamping points are required, at a minimum, per PV module installed (middle clamps counting as two clamping points for each of the adjacent PV modules).
- Where screw fixing to the roof timber structure is required, screw holes shall be pre-drilled (pilot drilled) to avoid damaging or splitting the timber.

4.3.3.1 Non-Integrated (above roof) Mounting Systems)

- For non-integrated (above roof) mounting systems, the fixing brackets should not affect the weather tightness of the roof they are fitted to and should not impose a load on tiles/slates or displace tiles/slates causing gaps between tiles.
- The following non-integrated mounting systems are generally permissible
    - hook brackets
    - stand-off brackets
    - mounting systems which replace a tile/slate with a durable mounting point (sometimes referred to as slate sets/slate plates)
- Mounting brackets shall be austenitic ('300 series') stainless steel, aluminium, or galvanised steel (80 microns minimum, not BZP), and of a suitably heavy duty for the 20-year design life. Galvanised brackets shall be installed in such a way that the roof tiles/slates cannot remove the galvanised layer through wear action.
- For the avoidance of doubt hanger bolts / through bolts or any mounting system which penetrates the roof tile or slate is not permitted (without prior written approval from SEAI) and are generally not permitted where they;
    - Transfer any load onto the tile/slate
    - Rely on silicone or other sealants for weather tightness
    - Rely on a sealing washer or plate for weather tightness
    - Do not seal over every layer of roof covering that is perforated by the bolt system
    - Are connected into battens
- Mounting brackets should be fixed to the rafter or 'noggin' (where the noggin is of suitable strength) of the roof, under the roof tile, and must be fixed above the roof membrane (where an existing membrane is in place)
- Mounting brackets shall be fixed, as per manufacturer's instructions, noting that additional reinforcement to the roof timber structure may be required to allow adequate fixing to be made.
- Cutting, notching and other modification of roof tiles/slates is permitted, so long as;
    - The modification does not affect the weather tightness of the roof,
    - Silicone or other sealant is not required for weather tightness following modification of the tile/slate.

4.3.3.2 Integrated (in roof) Mounting Systems

- For integrated (in roof) mounting systems, a waterproof membrane must be installed underneath the system, and the weather tightness must be the same, or better, than the existing roof system.

4.3.3.3 Metal deck, Standing Seam, and Single Skin Roof Mounting Systems

- For metal deck, trapezoidal, and standing seam roofs, a fixing or clamping system should be used which meets the requirements of the roofing manufacturer and does not penetrate through the roof.
- For metal deck, trapezoidal, and standing seam roofs, the mounting system must be connected to the roof with a system which does not penetrate the entire roof system – such as a clamp or connection to the external roof surface.
- For single-skin roofs (e.g. corrugated steel) a through fixing is permitted to the rafter or purlins, ONLY if the building below this roof is not occupied as a dwelling. This would typically be for a shed, garage, workshop or 'lean-to'.

4.3.3.4 Flat Roof Mounting Systems

- For flat roof mounted systems, a mounting frame, with appropriate ballast (calculated for the site conditions), shall be used for mounting the PV modules.
- For flat roof mounted systems, the mounting system must not penetrate the roof surface, must not deform the roof surface such that pooling of rainwater or damage may occur.
- Suitable protection between the mounting frame and roof surface shall be installed.

4.3.4 Roof Mounting Systems – Earthing and Lightning Protection

- Earthing of the metallic parts of the solar PV modules and mounting system should be made in accordance with ET101:2008.
- In general, where there are no adjacent metallic elements of the building (e.g. structural steel or piping) that are connected to the building earth, no additional equipotential bonding or connections to building earth are required.
- Installation of solar PV systems in domestic properties does not generally increase the level of risk from lighting, particularly as modules tend to be located below ridge level and are not higher than the chimney. The risk of lightning should be assessed for individual buildings in accordance with EN 62305. Where a building has an existing lightning protection system, the solar PV modules and frame shall be bonded to the lightning protection system with an appropriately sized conductor.

4.3.5 Ground and Car-Port Mounting Systems - Installation

When considering a ground mounted or car port mounted PV system the Installer must assess the below

- The design and specification of the PV ground or car-port mounting system shall consider
    - Building Regulations TGD A – Structure
    - Expected wind and snow loads – derived from Eurocode-1 (and Irish National Annex)

- Appropriate safety factors – derived from Eurocode-1 (and Irish National Annex)
- Strength and suitability of the supporting structure
- Strength of the fixing – using fixing data from Eurocode-5
- Strength and suitability of the ground area, soil conditions, stability, and risk of subsidence

- Ground mounted systems over soil/grass, shall have a minimum clearance of 300mm from the ground level to the bottom of the solar PV modules to allow for vegetation/grass growth, and maintenance of same.
- Cables from the ground mounted system to the dwelling shall be installed underground, in a suitable duct.

4.4 DC Electrical System

DC Electrical System shall meet the following requirements;

- The DC system must comply with ET101:2008
- All DC components must be rated for
  - The maximum voltage (VOC(stc)) with a safety factor of 15% that may be generated from the PV module array
  - The maximum current (IOC(stc)) (with a safety factor of 25%) that may be generated from the PV module array
  - The maximum and minimum temperatures that they may be exposed to
  - The environment in which they are to be installed (considering outdoor conditions, UV degradation and water ingress)
- A DC isolator switch (2 pole) shall be provided at the connection point to the Inverter, and accessible from the inverter location – for string inverter configurations.
- DC isolator must be labelled – "PV Array DC Isolator – DANGER – Contains Live Parts During Daylight"
- DC cables must be segregated from AC cables
- DC circuits must be designed to minimise resistive losses, and voltage drop, to <3%
- Positive and Negative DC cables must be identified at either end of each circuit
- All DC cables must be double insulated
- DC cables must be SWA where mechanical protection is required
- For long runs of DC cables an earthed metal trunking system must be used
- DC connectors (typically MC4) must be rated to IP21, class II, shrouded, and must be labelled positive and negative
- DC Connectors must comply with EN 62852, and EN 50521
- String fuses are required in arrays with more than 2 strings (i.e. 3 or greater) and are typically not required in a domestic installation.
- Where the DC cables penetrate the roof surface and membrane a waterproof system shall be provided to ensure that the cable way cannot affect the weathertightness of the roof. This will include a membrane grommet if required.

4.5 Inverters and Power Converters

Inverters are the systems to convert power generated by the PV modules into AC power for connection to the consumer load and grid. Inverter categories of string inverters, and micro-inverters (sometimes called AC modules) are considered here. Power Converters for optimiser configurations are also considered in this section.

4.5.1 Inverters and Power Converters:

Inverter and Power Converters must either be listed on SEAI's Triple E register OR;

- Meet the requirements of EN 62109
- Comply with EN50438 (With Irish Protection Settings)
- Comply with ET101:2008 Section 712
- Have a rated efficiency of >95%
- Have an AC power rating of 80% or more of the DC peak power (Wp) of the PV module array
- The inverter will be specified and commissioned to operate within the maximum parameters of the PV module array, and will maximise the PV output and allow for connection to the consumer unit in the dwelling
- Micro-inverters (for single or dual modules) satisfying the requirements above should be used instead of string inverters if there is a foreseeable risk of electrical output reduction due to shading from structures, trees and vegetation, above a no-sky angle of 15°

4.5.2 Inverters and Power Converters - Installation Requirements

- String Inverters must be installed on a flat vertical, fire-resistant (concrete/masonry) surface, according to manufacturer's recommendations, with adequate surrounding space to allow for ventilation
- Where string inverters are not installed on a fire resistance surface (such as in attic spaces), they must be installed on a fire-resistant substrate which extends to a minimum of 150mm beyond the edge of the inverter
- Where installed externally, inverters must have an ingress rating of IP65 or greater
- String inverters must be installed with clearly labelled, lockable, accessible (from the inverter location), DC and AC isolator switches.
- The inverter must carry a warning label, prominently located – "Inverter. Isolate AC and DC before carrying out work"
- A separate metering device must be supplied, on the AC side of the inverter, which records the energy generated (in kWh) by the solar PV system. This metering device must be capable of accurately measuring, recording and displaying the energy generated and must not be reset during prolonged loss of power.
- The inverter must at a minimum measure, record, and display the generated AC energy (kWh) for that day, week, month and year. The display function can be either through an integrated display screen on the inverter, or through a web based portal, smart phone app, or remote display within the home. This display

must provide a simple indication to the homeowner that the solar generation system is not working normally, or has failed.

4.6 AC Electrical System

AC Electrical System shall meet the following requirements;

- The AC system must be tested and certified by a Registered Electrical Contractor and a Safe Electric certificate must be provided
- The AC system must comply with ET101:2008
- Where the PV system does not have at least simple separation between the AC and DC side protection for domestic PV systems at the main domestic consumer unit must be via a dedicated Type B RCD protective device, rated for 25A (or larger where required).
- Where the PV system cannot, by reason of its construction, feed DC currents into the electrical installation (i.e. AC system), a Type B RCD shall not be required, and electrical protection of the AC circuit shall be in accordance with ET101:2008.
- An AC isolator (2 pole, switching live and neutral) must be installed between the inverter and the consumer unit, and accessible from the inverter location
- AC isolator must be labelled – "PV System MAIN AC Isolator"
- The main incoming point of the dwelling (typically the meter box) must contain a warning label indicating the presence of a separate source of electrical supply to the building.

4.7 Emergency Isolation

Section 5.4.5 of Building Regulation TGD B - Fire Safety (2017) states that "where Photovoltaic (P.V.) panels are provided on buildings, provision should be made for the isolation of the panel array externally and in accordance with ET101, 2008".

This requirement is regularly referred to incorrectly as a fireman's switch.

Section 537.4 – Emergency Switching of ET101:2008 states that emergency switching is required

- For all live conductors where a risk of electric shock is involved
- Must act as directly as possible on the appropriate supply conductors
- Accessible, readily identifiable and convenient for intended use

Through these requirements of Part B of the building regulations and ET101, all domestic PV installations installed under this Scheme must;

- Provide an automatic shunt isolation of the circuit (whether AC **or** DC, and two pole) from the solar PV modules into the building, as close to the solar PV modules as possible, and a maximum of 1.5m from the point of cable entry to the building.
- Where the circuit from the solar PV modules does not enter the building, e.g. for a ground mounted array, this point of automatic isolation must be within 1.5m of the solar PV modules.

- This system of isolation shall automatically isolate the DC circuit when the AC supply is disconnected to the building, i.e. a shunt isolation function.
- 'Shunt' isolation of the DC circuit is the only acceptable manner of meeting the Building Regulation TGD B – Fire Safety (2017) for the purposes of this Scheme.
- For the avoidance of doubt the disconnection of the circuit from the solar PV modules must be automatic and operated by removal of AC supply to the building, and must **not be operated** by means of a dedicated switch, pushbutton, 'fireman's switch' or other manner.
- This system of isolation must automatically reconnect upon restoration of AC supply to the building.

A warning label must be applied to the main external AC connection point to the building stating "In Emergency Solar PV DC Circuit Automatically Disconnected with Disconnection of AC Supply to Building"

4.8 Distribution System Operator (ESB Networks)

- All microgeneration (<6kW/25Amps AC for single phase connections) must complete a NC6 form from ESB Networks and submit by email or post to ESB Networks in advance of the installation
- All micro generation must comply with ESB Networks Conditions Governing the Connection and Operation of Micro-generation
- ESB Networks may reject the application within 20 working days of receipt
- The completed NC6 form and the record of issuing the form to ESB Networks must be retained for the PV system
- Where an AC connected battery is included in the system, this battery is also considered a microgenerator for ESB Networks purposes and should be included in the NC6 application as an additional generator to the PV generator

4.9 Energy Storage Systems

4.9.1 Battery Energy Storage System

Battery Energy Storage System (BESS) is a system for storage of energy, generally which would otherwise export to the grid, within a battery. For the purposes of the pilot Scheme the below battery energy storage systems are considered acceptable

- AC connected BESS, where the battery is connected on the AC side of the PV inverter
- DC connected BESS, where the battery is connected on the DC side of the PV inverter
- All common battery chemistries including, gel lead acid (NOT flooded lead acid), lithium-ion, lithium-ion polymer, NiCad, NiMH, lithium ferro phosphate ($LiFePO_4$), and nickel manganese phosphate

The below battery energy storage systems are not considered acceptable (unless specifically approved BEFORE installation by SEAI) for the Scheme

- Flooded lead acid batteries

- Any high-temperature battery technologies, such as sodium sulphur,
- Flow batteries.

Requirements of Battery Energy Storage Systems:

- Meet the requirements of EN 62133 and EN 62619
- Comply with EN50438 (With Irish Protection Settings) for batteries connected on the AC side of the PV inverter
- Meet the requirement of the DC Electrical System and AC Electrical System (if appropriate) section of this Code of Practice including isolation, protection and labelling
- Wall mounted BESS must be installed on a flat vertical surface, according to manufacturer's recommendations, with adequate surrounding space to allow for ventilation
- Where wall mounted BESS are not installed on a fire resistance surface (such as in attic spaces), they must be installed on a fire-resistant substrate which extends to a minimum of 150mm beyond the edge of the inverter
- Floor mounted BESS must be installed on a flat horizontal surface, according to manufacturer's recommendations, with adequate surrounding space to allow for ventilation
- AC connected BESS, must be included on the ESB Networks NC6 application, with the rated output listed as an additional generator output

4.9.2 Hot Water Diversion

For homes with a well-insulated (factory insulated) hot water cylinder with electric immersion heater, self-consumption can be increased with the inclusion of a hot water diversion system. This will increase self-consumption, by storing excess energy (i.e. energy which would export to the grid) as hot water. Several technologies exist for hot water diversion but it is recommended that the hot water diversion system shall;

- Automatically detect and measure exported energy from the home
- Have a controlled diversion system which matches the amount of power diverted to the hot water cylinder to the power which otherwise would be exported (i.e. the diversion controller has a variable or incremental output)

4.9.3 Space Heating and Electric Vehicle Diversion

For homes with electrical space heating (e.g. storage heating, heat pumps) or Electric Vehicles self-consumption can be increased by allowing excess energy (i.e. energy which would export to the grid) heat the space in the home, or charge the electric vehicle. Several technology options exist for this type of technology but it is recommended that any space heating of electric vehicle diversion system shall;

- Automatically detect and measure exported energy from the home
- Have a controlled diversion system which matches the amount of power diverted to space heating or electric vehicle to the power which otherwise would be exported (i.e. the diversion controller has a variable or incremental output)

4.10 Inspection, Testing, Commissioning and Handover

- The solar PV system shall be commissioned according to a documented procedure to ensure that the system is safe, has been installed in accordance with the requirements of this code of practice and the manufacturers' requirements, and is operating correctly in accordance with the system design.
- Inspection and testing of the completed system to the requirements of the National Rules for Electrical Installations (ET101:2008 and associated amendments) must be carried out and documented. The inspection and testing of the PV system shall be in accordance with the requirements of ET101, Safe Electric requirements, and EN 62446 Grid connected photovoltaic systems — Minimum requirements for system documentation, commissioning tests and inspection.
- Additional documentation to be handed over to customer shall include:
    - Datasheets for Solar PV Modules, Inverters, and Battery Energy Storage System
    - Warranties for Solar PV Modules, Inverters, Mounting System
    - O&M Manual for Homeowner
    - Basic start up, shut down, safety, operation and maintenance instructions
    - Estimation of system performance calculated using common estimator tools and databases such as PVSyst, PVSol, PVGIS or other equivalent, considering the actual location, orientation, pitch, location and over shading conditions of the PV modules.

5 Documentation to be Completed / Provided

The following documentation and records must be maintained by the Installer and submitted through SEAI's application system to enable the homeowner to receive a grant payment.

1. Declaration of Works – Completed and signed by the Installer
2. Inspection, Test and Commissioning Report (EN 62446)
3. Safe Electric ('RECI') Certificate – Completed and signed by a Registered Electrical Contractor
4. Submitted ESB Networks NC6 Form
5. Building Energy Rating (BER) Certificate for the Property
6. Invoice describing the works
7. Photographs of the installation including
    a. Mounting system as installed
    b. PV Module Array as installed
    c. PV Module Nameplate
    d. Inverter as installed – showing isolators
    e. Consumer Unit with Solar PV MCB/RCD and Solar PV Meter
    f. Battery Energy Storage System as installed (IF APPLICABLE)

In addition, the following documentation and records must be maintained by the Installer and provided to the homeowner for safe operation of the PV system

8. Datasheets for Solar PV Modules, Inverters, and Battery Energy Storage System
9. Warranties for Solar PV Modules, Inverters, Mounting System
10. O&M Manual for Homeowner
11. Basic start up, shut down, safety, operation and maintenance instructions
12. Estimation of system performance calculated using common estimator tools and databases such as PVSyst, PVSol, PVGIS or other equivalent, considering the actual location, orientation, pitch, location and over shading conditions of the PV modules.

6 Completion Documentation

The Installer is required to complete the below Declaration of Works which includes three parts

1. Declaration of Works
2. Inspection, Test and Commissioning Report to IEC 62446
3. Completion Checklist

Part 1 – Declaration of Works

Installation Details:

Applicant Name*	
Installation Address	
Installation Eircode	
Installation MPRN	

**This will be the person claiming the SEAI grant*

System Details

Solar PV System Size	kWp*	Battery Storage (if applicable)	kW kWh
Solar PV System Annual Estimated Yield	kWh**	Method of Yield Calculation (e.g. PVSyst)	
Hot Water Diverter Installed?	Y/N?		

** Total DC Installed Capacity at STC – (Nameplate Capacity, NOT Flash Test)*

*** AC kWh based on estimated calculation*

Renewable Installer Details (MUST BE ON THE SEAI SOLAR PV INSTALLER REGISTER)

Renewable Installer Name	
Renewable Installer Identification Number	

Registered Electrical Contractor Details (REC WHO COMPLETED THE SAFE ELECTRIC FORM)

REC Safe Electric Identification Number	
Safe Electric Certificate Serial Number	
Safe Electric Certificate Date	

ESB Networks NC6 Form Submission Date	

Property year of Construction (see BER Cert)	
Total cost of installation (including VAT)	€

System Components

Component	Make	Model	Rating	Quantity
Solar PV Modules			Wp at STC	
Mounting System			N/A	
Inverter			kW	
Energy Meter			N/A	
Battery Energy Storage System		DC Connected ☐ AC Connected ☐	kW kWh	

Date of Works Completion			
By signing this Declaration of Works, the undersigned declares that; • The Solar PV system (and, if applicable, battery system) has been installed and commissioning at the above Installation Address on the Date of Works Completion • All works indicated are fully compliant with SEAI Domestic Solar Photovoltaic - Code of Practice for Installers, SEAI Renewable Installer Register Terms and Conditions and SEAI Solar PV Installer Register Terms and Conditions. • The electrical installation has been installed in accordance with ET101:2008 and a Safe Electric certificate ('RECI cert') has been issued by a Registered Electrical Contractor for the electrical installation • I have been paid in full or an agreed payment schedule contract is in place by the homeowner for the works described. • I have completed an Inspection, Test and Commissioning Report for this solar installation and have given it to the homeowner • I have provided the homeowner with the required documentation to complete their grant application			
Signed	Date		

Part 2 – Inspection, Test and Commissioning Report

Test Report for grid-connected photovoltaic systems
according to EN 62446, Annex A

Customer:
Customer Name:
_____
Customer Address:
_____
Customer Eircode:
_____

Installation Contractor:
Company Name:
_____
Company Representative:
_____
Company Address:
_____

PB System Description:

PV Module:

Manufacturer: _____ Module Type: _____
PV Module Performance: _____ Number of Modules: _____
Short Circuit Current Isc (A): _____ MPP Current (A): _____
Open Circuit Voltage Voc (V): _____ MPP Voltage (V): _____

PV Inverters:

Manufacturer: _____ Inverter Type: _____
AC Nominal Power (W): _____ Inverter Quantity: _____
AC Maximum Power (W): _____ DC Maximum Power (W): _____

Test Date: _____ Test Reason: ☐ Initial inspection
Next Test Date: _____ ☐ Retesting

Electrical Certs:
Safe Electric Cert Number: _____ Test Record Sheet Cert Number: _____

DC Test Results:
RE: _____ Loop: _____ RCDx1: _____ RCDx5: _____

Design, construction, inspection and testing

I/we, the responsible person(s) for the design, construction, inspection and testing of the electrical system (as specified by the signature(s)), details of which are described above, have inspected and tested the design and structure with suitable skill and care and confirm that the said words, for which I/we am/are responsible, were carried out to the best of our knowledge and expertise.

Test Result:

☐ No defects were found ☐ Defects were found

☐ The Photovoltaic system complies with the standards of electrical engineering

Signature/Tester: _____ Date: _____

Remarks:

_____

_____

_____

Inspection test report

according to EN 62446, Annex B

Testing:

Test Date: _____ Signature/Tester: _____

Inspected circuits (fill out one sheet for large systems and for separate inspections per inspection):

Design and installation of the PV generator

- ☐ The DC system was generally designed, selected and set up in accordance with the requirements in DIN VDE 0100 (IEC 60364) and in particular in accordance with DIN VDE 0100-712 (IEC 60364-7-712)
- ☐ The DC components were measured for DC operation
- ☐ The DC components are rated for the maximum current and maximum voltage
- ☐ Protection is provided by application of class II or equivalent insulation on the DC side
- ☐ PV strand cables, PV generator cables and PV DC main cables have been selected and constructed so that the risk of earth faults and short circuits is reduced to a minimum (DIN VDE 0100-712 para. 522.8.1)
- ☐ The wiring system has been selected and constructed so that it can withstand expected external influences such as wind, ice temperature and solar radiation (DIN VDE 0100-712. 522.8.3)
- ☐ AC and DC cables are physically separated
- ☐ Systems without strand overcurrent protective device: Strand cables are designed so that they can take up the highest combined leakage current of parallel lines (DIN VDE 0100-712 para.433)
- ☐ Systems with strand overcurrent protective device: Overcurrent protective devices are set correctly according to local rules or according to the PV module manufacturer's instruction (DIN VDE 0100-712 para. 433.2)
- ☐ There are DC load break switches installed on the DC side of the inverter (DIN VDE 0100-712 para. 536.2.2)

PV System/overvoltage protection/electric shock

- ☐ The inverter has a simple separation between the AC side and the DC side
- ☐ Alternatively: A residual device is installed in the circuit and corresponds to a type B RCD (DIN VDE 0100-712 para. 413.1.1.1.2)
- ☐ The area of wiring loops was kept as small as possible (DIN VDE 0100-712, para. 54)
- ☐ If equipotential bonding conductors are installed, they run in parallel and in as close contact as possible to the PV DC cables

Special factors of PV system – AC circuit

- ☐ Devices for disconnecting the inverter are provided on the AC side
- ☐ Separating and switching devices are connected so that the PV installation in connected on the "load" side and the public supply on the "sources" side (DIN VDE 0100-712 par,. 536.2.2.1)

☐ Protection settings of the inverter are programmed according to local regulations

Marking and labelling of the PV system

☐ All circuits, protection devices, switches and terminals have appropriate markings

☐ All DC connection boxes (PV sub-generator connection box and PV generator connection box) bear a warning that the active parts present in the connection box are supplied by a PV generator and may still be live after the shutdown of PV inverters and public supply

☐ The AC main switch has a clear inscription

☐ Warnings are present for the double supply at the point of interconnection

☐ The protection settings of the inverter and details of the installation are provided on site

☐ The procedures for emergency shutdown are provided on site

☐ All signs and markings are suitable and permanently attached.

General (mechanical) installation of the PV system

☐ Ventilation is provided behind the PV generator to prevent overheating/reduce the fire risk

☐ The frame and materials are properly attached and stable; the roof fasteners are weather-resistant

☐ The cable routing is weather-resistant

Notes:

_____

_____

_____

Test Report for grid-connected photovoltaic systems

according to EN 62446, Annex C

Test

String		**1**	**2**	**3**
PV generator	Module			
	Quantity			
PV generator parameters	Voc (STC)			
	Isc (STC)			
Protection device (branch fuse)	Type			
	Rated Value (A)			
	DC rating (A)			
	Capacity (kA)			
Wiring	Type			
	Phase conductor (mm2)			
	Earth conductor (mm2)			
Testing and Measurement of the strand	Voc (V)			
	Isc (A)			
	Irradiance			
Polarity monitoring				
Array Insulation Resistance	Test Voltage (V)			
	Pos – Earth (MΩ)			
	Neg – Earth (M Ω)			
Earth continuity (where fitted)				

Switchgear functioning correctly				
Inverter Make/Model				
Inverter Serial Number				
Inverter functioning correctly				
Loss of mains test				

Notes:

_____
_____
_____

Part 3 – Completion Checklist

The Installer must confirm that all the below documentation is complete, and has been provided to the homeowner

Required Document for Grant	**Tick if Provided**
Declaration of Works – Completed and signed by the Installer	
Inspection, Test and Commissioning Report (EN 62446)	
Safe Electric ('RECI') Certificate – Completed and signed by a Registered Electrical Contractor	
Submitted ESB Networks NC6 Form	
Building Energy Rating (BER) Certificate for the Property	
Invoice describing the works	
Photographs of the installation	
a. Mounting system as installed	
b. PV Module Array as installed	
c. PV Module Nameplate	
d. Inverter as installed – showing isolators	
e. Consumer Unit with Solar PV MCB/RCD and Solar PV Meter	
f. Battery Energy Storage System as installed (IF APPLICABLE)	

Required Document for Homeowner	**Tick if Provided**
Datasheets for Solar PV Modules, Inverters, and Battery Energy Storage System	
Warranties for Solar PV Modules, Inverters, Mounting System	
O&M Manual for Homeowner	
Basic start up, shut down, safety, operation and maintenance instructions	
Estimation of system performance calculated using common estimator tools and databases such as PVSyst, PVSol, PVGIS or other equivalent, considering the actual location, orientation, pitch, location and over shading conditions of the PV modules.	