DOMESTIC SOLAR PHOTOVOLTAIC

CODE OF PRACTICE FOR INSTALLERS

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Sustainable Energy Authority of Ireland

SEAI is Ireland's national energy authority investing in, and delivering, appropriate, effective, and sustainable solutions to help Ireland's transition to a clean energy future. We work with homeowners, businesses, communities, and the Government to achieve this, through expertise, funding, educational programmes, policy advice, research, and the development of new technologies.

SEAI is funded by the Government of Ireland through the Department of Communications, Climate Action, and Environment.

Domestic Solar PV Scheme

The Domestic Solar PV Scheme operates under the Microgeneration Support Scheme (MSS) and provides a grant towards the purchase and installation of a solar PV system for homeowners. This takes the form of a once-off payment to a homeowner based on the installation of products which meet the requirements of the Scheme. This document describes the requirements that eligible systems under the scheme are required to meet.

Version Control

Version Number	Purpose/Change	Page	Date
V1.5	Update 4.3.1		26/07/2022
V1.6	Formatting		02/12/2022
V1.7	Replacing 'NSAI Certification' with 'Irish Agrément Certified or Equivalent'		17/07/2023
V1.8	Update Section 4.7 and 5.8		30/06/2024
V1.9	Update Section 4.3.3		22/01/2025
V2.0	Update Section 4.3.3.4		03/03/2025

Document changes

In this version 2.0 the following changes have been made:

- Update to section 4.3.3.4

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.
Programme	Microgeneration Support Scheme
Scheme	SEAI's Domestic Solar PV 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

Table 1

2. Installer Requirements & Competency

For the purposes of the Scheme all elements of a solar PV system must be compliant with all applicable Irish legislation, building regulations, 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 be registered 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, standards and building regulations. 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).

All labels must be affixed in a suitable, visible location and shall be of a suitable durability for the environment in which they are installed. (Sample labels included in Annex).

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.
- Must be designed to withstand a minimum positive pressure of 1000 Pa, and negative pressure of -1000 Pa in line with SR 50-2 "Code of Practice for Building Services Part 2: Thermal Solar Systems".

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' system
- Wall/Cantilever or Brise Soleil Mounted
- Ground Mounted or Car Port Mounted

The following mounting configurations are not considered acceptable 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.
  - Building Regulations TGD D – Materials and Workmanship.
  - SR 50-2 "Code of Practice for Building Services Part 2: Thermal Solar Systems" and Agrément Certificates for Solar Thermal and Solar PV systems.
  - Site specific design wind and snow loads – derived from Eurocode-1 (and Irish National Annex).
  - Appropriate safety factors – derived from Eurocode-0 (and Irish National Annex).
  - Strength and suitability of the supporting structure.
  - Strength of the fixing – using fixing data from Eurocode-5 (for standard fixings).
  - 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 overall roof structure and 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 competent person.
- **Where there is any doubt 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.
- The Installer must retain documentary evidence of the calculations and assessment undertaken in the design of the mounting system showing that site specific structural and wind risks have been considered appropriately in the design.

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 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) or within 200mm of the top of the ridge. 500mm is a minimum and some designs, particularly for taller buildings, may require a higher setback distance. Where less than 500mm is required, approval (planning permission) from a local authority may be required along with appropriate wind load calculations.
- The PV modules must not be within 200mm of **any** roof penetration or mountings, such as but not limited to, chimneys, roof windows, soil pipes etc. This is to allow for maintenance of both the array and the roof penetration/mounting in question.

- Where the solar PV module array is installed over any roof vents, or other necessary roof ventilation, the ventilation must be moved to an unobstructed area, or a new, equivalent vent added. This must be in compliance with SR 54:2014 Code of Practice for the Energy Efficient Retrofit of Dwellings.
- 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.
- Mounting rail end caps should be installed in accordance with manufacturers guidelines.
- It is recommended that the end of the rail, where the end-clamps for the solar panel are attached, is not cut flush to the clamp and a minimum of 20mm is provided beyond the end of the clamp.

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 – with reference to preceding Agrément Certificates.
    - 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 are generally not permitted, unless complying with SR 50-2 "Code of Practice for Building Services Part 2: Thermal Solar Systems" or approved with Irish Agrément Certified or equivalent.
- Mounting brackets should be fixed to the rafter/timber reinforcing plant, or suitable/dedicated '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 plant to the roof timber structure may be required to allow adequate fixing to be made and to meet Irish building regulations. Installers should refer to the building regulations, NSAI Code of Practice (SR 50-2), and Irish Agrément Certified or equivalent.
- 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. Installers should refer to the building regulations, NSAI Code of Practice (SR 50-2), and Irish Agrément Certified or equivalent.

4.3.3.3. Metal deck, Standing Seam, and Single Skin/Unoccupied Spaces 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 of unoccupied buildings (typically a shed, garage, workshop or 'lean-to') a through fixing is permitted to the rafter or purlins. This fixing must meet the requirements of the building regulations (Part D) and must not affect the weathertightness of the building.
- Installers should refer to the building regulations, NSAI Code of Practice (SR 50-2), and Irish Agrément Certified or equivalent.

4.3.3.4. Flat Roof Mounting Systems

- For flat roof mounted systems, a ballasted frame, or engineered fixed solution, is acceptable.
- For flat roof ballasted mounted systems, a mounting frame, with appropriate ballast (calculated for the site conditions), shall be used for mounting the PV modules.
- The required ballast, and the structural and wind loading, shall be assessed in accordance with section 4.3.2
- 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.
- For non-ballasted systems an engineered solution, such as upstands or structural supports, is acceptable where this is assessed and approved by a qualified structural engineer and does not affect the weather-tightness of the roof.
- The PV Modules must not be within 200mm of inside of parapet wall. This is to allow for maintenance of both the array and any roof penetration/mounting/flashings. In the case of a low-rise parapet, further set back may be required if deemed necessary due to wind loading.
- 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 I.S. 10101.
- 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 carport mounting system shall consider the requirements of Section 4.3.2 and
    - Strength and suitability of the ground area, soil conditions, stability, and risk of subsidence.
    - Ground mounted systems over exposed 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 I.S. 10101.
- 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.
- A Battery Energy Storage System (BESS) isolator switch (2 pole) shall be provided at the connection point to the Battery, and accessible from the battery location.
- DC isolator must be labelled – "PV Array DC Isolator – DANGER – Contains Live Parts During Daylight" or an equivalent statement.
- 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 in accordance with I.S. 10101.
- 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.
- DC cables must be suitable secured when routed from the PV module array across the roof area to the entry point to the building. Cables must not be exposed to excessive movement from wind or any other mechanical stress due to their 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 EN50549 (With Irish Protection Settings).
- Comply with I.S. 10101
- Have a rated efficiency of >95%
- Have a maximum DC power rating of at least the DC peak power (Wp) of the PV module array. Note that inverters with DC coupled BESS may have a rating of lower than this – subject to compliance with OEM requirements.
- 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, and in an accessible location with a permanent boarded walkway if in an uninhabited roof space (with the exception of micro-inverters which, by design, are inaccessible).
- Separation distance to allow ventilation must be to manufacturer's recommendations.
- Inverters must not be installed within a 'hot press' / airing cupboard due to the higher ambient temperatures and risk of ventilation paths being obstructed unintentionally.
- 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 (Class 0) 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, 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" or an equivalent statement.
- 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:

- Type B RCD 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 I.S. 10101
- Where an RCD is used for protection of the PV a.c. supply circuit, The RCD shall be of type B according to I.S. EN62423 or I.S. EN60947-2, unless:

- the inverter provides at least simple separation between the ac side and the dc side or
- the installation provides at least simple separation between the inverter and the RCD by means of separate windings of a transformer; or
- the inverter does not require a type B RCD as stated by the manufacturer of the inverter.

- 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
- Where an RCD device is installed on the AC circuit feeding an inverter, the RCD type must be selected according to IEC TS 62548:2013.
- AC isolator must be labelled – "PV System MAIN AC Isolator" or an equivalent statement.
- 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 (PV) panels are provided on buildings, provision should be made for the isolation of the panel array externally and in accordance with ET101, 2008" which has been replaced by I.S. 10101.

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

Section 465 – Emergency Switching off I.S. 10101 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 I.S. 10101, all domestic PV installations installed under this Scheme must:

- Provide an automatic (i.e., automatically operated by disconnection of the main AC supply to the building) shunt (or interlocked) 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 cable length internally from the point of cable entry to the building.
- Where the circuit from the solar PV modules does not enter the building, this point of automatic isolation must be within 1.5m cable length of the solar PV modules.
- For ground mounted system the shunt (automatic isolator) must be within 1.5m cable length of the solar PV modules.
- This system of isolation shall automatically isolate the circuit from the solar PV modules when the AC supply is disconnected to the building, i.e., a shunt or interlocked isolation function.
- 'Shunt' or 'interlocked' 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.
- For the avoidance of doubt an isolation of the supply from the PV modules is required in ALL cases, whether micro-inverters, DC optimised inverters, where the inverter is within 1.5m of cable entry or any other configuration is used.
- 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" or an equivalent statement.

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. Off-Grid and Backup Operation

Off-grid operation is defined here as a solar PV (and battery storage) system which is not connected to the electrical distribution system (typically a remote dwelling). Backup operation is defined here as a solar PV (and battery storage) system which is required to provide electricity to the dwelling during periods of grid outage.

- Off-grid systems must comply with the requirements of this code of practice but do not need to meet the requirements of Section 4.8, and can achieve the requirements of Section 4.7 as per the backup operation requirements below
- Backup operation is permitted so long as the below conditions are met
  - The backup supply from the PV and battery energy storage system must be on the load side of the ESB meter and cannot feed any other premises.
  - The requirements of I.S. 10101 must be met, particularly relating to the requirements of 'standby supply' and break-before-make changeover switch, and the requirements for neutral treatment in island mode and impacts on protection operation.
  - There can be no circumstances where the PV and battery system will feed energy into the grid during backup operation.
  - Ensure that, by design, loss of mains (LOM) protection is not compromised. This could be either by relocating LOM to ESBN-Customer interface or by interlocking LOM changeover switch.

4.10. Energy Storage Systems

4.10.1. Battery Energy Storage System

After 16th February 2022, BESS are no longer funded under the Solar PV Scheme. The below section is applicable for battery grant applications that preceded 16th February 2022

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 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:

Note the below requirements shall be met by the relevant components of the storage system such as the battery cells, battery packs, enclosures, or battery controller/power converter

- Lithium based battery systems must meet the below standards:

  - EN 62133-2 **or** EN 62619
  - EN 62109 for AC connected BESS
  - EN50549 (With Irish Protection Settings) for AC connected BESS

- Nickel based or Lead Acid battery systems must meet the below standards:

  - EN 62133-1 **or** EN 62485
  - EN 62109 for AC connected BESS
  - EN50549 (With Irish Protection Settings) for AC connected BESS

  - 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.
  - Floor mounted BESS must be fixed in place on a flat horizontal surface, according to manufacturer's recommendations, with adequate surrounding space to allow for ventilation. Where BESS are not installed on a fire resistance surface (such as in attic spaces), they must be installed on a fire-resistant substrate (Class 0) which extends to a minimum of 150mm beyond the edge of the Battery.
  - All battery systems must comply with I.S. 10101. All battery systems, should be installed in a suitable enclosure which ensures that
    - The battery is maintained in a clean, dry, and adequately ventilated environment and has suitable protection from environmental conditions.
    - Cable connections/termination are not accessible outside the enclosure.
    - Is insect, vermin proof.
    - Allows sufficient clearance for installation, inspection, maintenance and repairs.
    - Not be near conductive objects capable of falling across battery terminals or causing a short circuit.
    - A pre-assembled BESS may inherently include a suitable enclosure.
  - AC connected BESS, must be included on the ESB Networks NC6 application, with the rated output (in kW) listed as an additional generator output.

4.10.2. 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).

- Meet the requirements of IEC 61000.
- Be compatible with equipment required for its intended use

4.10.3. 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).
- Meet the requirements of IEC 61000.

4.11. 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 I.S. 10101 must be carried out and documented. The inspection and testing of the PV system shall be in accordance with the requirements of I.S. 10101 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 (IF APPLICABLE)
  - 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 provided to the Homeowner.

The following should 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. Invoice describing the works
6. Photographs of the installation including
    a. Total Mounting system as installed
    b. Total 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)
g. Inverter data label per installation
h. Battery Energy Storage System data label per installation (If applicable)
i. Shunt Switch as Installed - Showing cable entry if possible
j. Power Diverter 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

Safety File

7. Basic start up, shut down, safety, operation, and maintenance instructions (**Hard Copy**)
8. O&M Manual for Homeowner (**Soft Copy**)
9. Datasheets for Solar PV Modules, Inverters, Mounting System and Battery Energy Storage System (If applicable)
10. Warranties for Solar PV Modules, Inverters and Battery Energy Storage System (If applicable)
11. Estimation of system performance calculated using common estimator tools and databases such as PVSyst, Poul, 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*

Solar PV Registered Company (Must be on the **SEAI Solar PV Company Register)**

Company Name	
Company Identification Number	

Property year of Construction (see BER Cert)	
Total cost (in Euros) of installation (Including Parts, Labour, and 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 (if applicable)		DC Connected □ AC Connected □	kW kWh	

Installer Declaration (Must be on the **SEAI Solar PV Installer Register)**

By signing this Declaration of Works, the undersigned declares that

- The Solar PV system (and, if applicable, battery system) has been installed and commissioned 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 I.S. 10101 and a Safe Electric certificate ('RECI cert') has been issued by a Registered Electrical Contractor for the electrical installation.
- 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 claim application.

Signed		Date								
Name (CAPITALS)										
DATE the Grant work was **Completed**										

Section to be completed by Homeowner
(Please note this Declaration **must be signed** by the Homeowner)

Homeowner Declaration

I declare that I am the owner of this dwelling and that the works detailed overleaf have been completed to my satisfaction. I confirm that I have paid the contractor in full or entered an agreed payment schedule contract for the works described. I understand that where my total expenditure is less than the fixed grant amount then the lower amount will be the grant payment.

I understand that all works may be inspected by SEAI or its agents. I undertake to facilitate any reasonable request to conduct the inspection / audit process.

Signed		Date								
Name (CAPITALS)										

Please note
This **Declaration of Works form should be returned with all other completed documents** relating to this application. If any form is incomplete or missing, then the request for payment will be returned.

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	
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)	
g. Inverter data label	
h. Battery Energy Storage System data label (If Applicable)	
i. Shunt Switch as Installed	
j. Power Diverter as installed (If Applicable)	

Required Document for Homeowner	Tick if Provided
Datasheets for Solar PV Modules, Inverters, and Battery Energy Storage System (If Applicable)	
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.	

7. Annex Labels

WARNING - DUAL SUPPLY

Mains & Solar PV/Battery

Do not work on AC supplied electrical equipment until isolated from both mains and inverter AC supplies

Do not work on DC supplied electrical equipment until isolated from both AC and DC supplies

Locations of emergency switches

Mains AC supply: _____

Inverter AC supply: _____

Solar PV DC supply: _____

Battery DC supply: _____

Automatic switching

Solar PV panels automatically connect/disconnect with connection/disconnection of AC supply to building

Label No 1
In ESB meter cabinet.
Add locations of emergency switches.

WARNING - DUAL SUPPLY

Mains & Solar PV/Battery

Do not work on electrical equipment until isolated from both mains and inverter AC supplies

Locations of emergency switches

Mains AC supply: _____

Inverter AC supply: _____

Solar PV DC supply: _____

Battery DC supply: _____

Label No 2
In/on consumer unit and all distribution boards.
Add locations of emergency switches.

WARNING

Off-Grid AC Supply

Disconnect battery before carrying out work

Label No 10
On all off-grid AC supplied boards and equipment

Grid AC Supply

Label No 3
Grid AC supply

Inverter AC Supply

Label No 4
Inverter AC supply

At breakers in consumer unit and sub-boards

Emergency switch

AC supply to/from inverter

WARNING - DUAL SUPPLY
Mains & Solar PV/Battery

Label No 5
At/on inverter AC isolator

Emergency switch

Solar PV DC supply

CONTAINS HIGH VOLTAGE DC DURING DAYLIGHT
Disconnect DC cables before carrying out work

Label No 6
At/on PV System DC isolator
(not used with microinverters)

Emergency switch

Supply to/from battery

Disconnect cables before carrying out work

Label No 7
At/on battery AC or DC isolator

WARNING

CONTAINS HIGH VOLTAGE DC DURING DAYLIGHT

Inverter

Disconnect AC & DC cables before carrying out work

Label No 8
On string inverters

WARNING

MAY CONTAIN HIGH VOLTAGE DC DURING DAYLIGHT

Automatic Switch

Disconnect AC & DC cables before carrying out work

Label No 9
On automatic isolator

Solar PV Check Meter

Label No 11
At check meter

Battery AC Supply

Label No 12
Battery AC supply
At breakers in consumer unit and sub-boards

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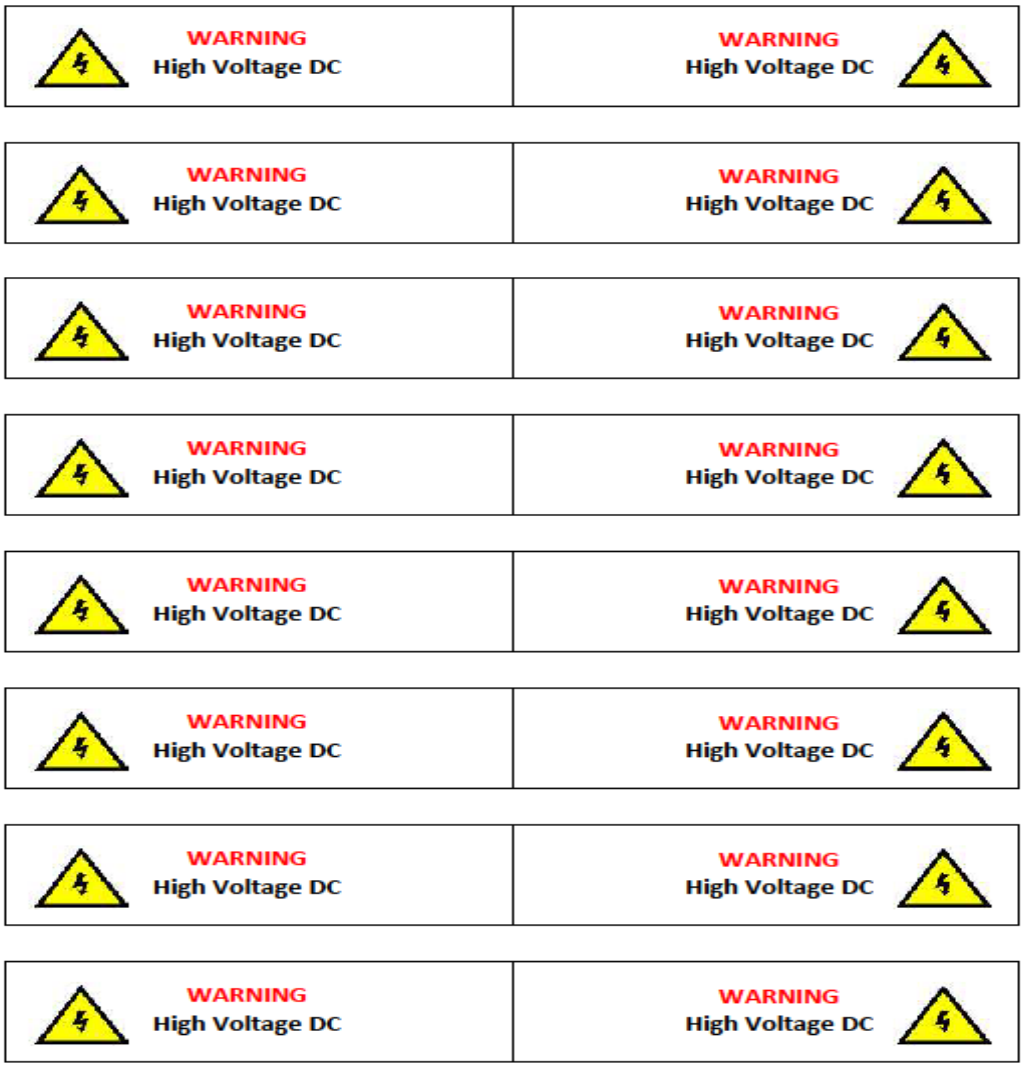

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SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Rialtas na hÉireann
Government of Ireland