SOLARSTONE

OVERVIEW

SOLARSTONE roofs

VERSIOON:
1.0 | 01.04.2026 (EN)

Table of Contents

Roof.
Design.
Power.

Foreword

This document provides an overview of what a Building-Integrated Photovoltaic (BIPV) solar roof is - this is not about adding solar panels on top of a roof, but rather **an innovative roofing material and roofing construction solution**.

👉 Solar panels installed on top of a roof are an add-on to the roofing material - not a solar roof.

When a building owner says, "*we'll add solar panels to the roof later*," it often means that a separate solar installation crew will come later, which may damage the roof covering and drill into rafters to fasten the substructure for the panels.

Without an understanding of roofing construction principles, the roofer's work may be unintentionally compromised, increasing the risk of damaging the roof structure or the underlayment. As a result, water and moisture may enter the building's primary structures and, among other things, **void the roofing material and construction work warranty**.

The SOLARSTONE solution has been developed **by roofers for roofers** and follows standard roofing construction methods and principles. This enables the roofer to complete the entire roof as one integrated solution.

📌 SOLARSTONE roofs can be installed only by a licensed roofing contractor.
📌 Installing SOLARSTONE roofs is a competitive advantage for roofers.

If you have any questions, feel free to contact us!

Sales

KASPAR TAMKIVI
Regional Sales Manager
kaspar.tamkivi@solarstone.com
+372 5184499

Technical support

KARL-KASPAR KOTTISSE
Head of Partnerships
support@solarstone.com
+372 56974363

Roof.
Design.
Power.

SOLARSTONE

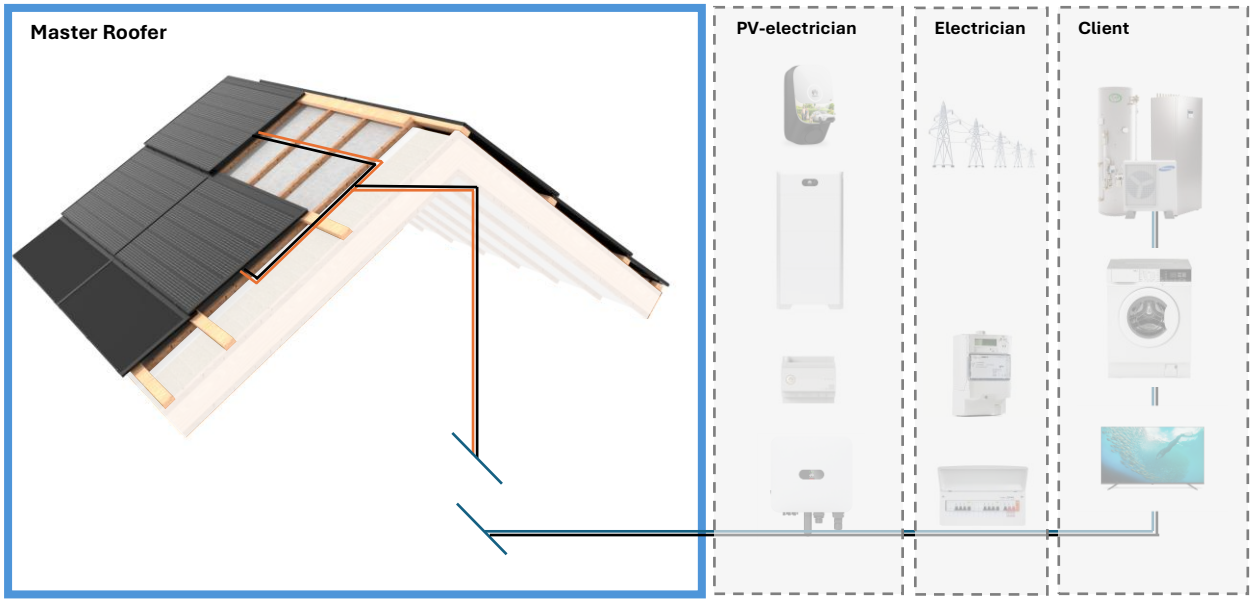
Who does what?

A solar roof and a solar power plant (PV system) form one integrated system, but installation and responsibilities are clearly divided among different specialists.

👉 **Master Roofer** – installs the BIPV modules and components of the solar roof. This is roofing work where structural strength, underlayment watertightness, and installation quality are critical.

👉 **PV-electrician** – the electrical/automation solar specialist, is responsible for the entire electrical solution: equipment selection, design, inverter and battery installation, work in the electrical panel, grid connection, system configuration, and final documentation. The roofer does not need to handle these topics - everything electrical is handled by partners with the required competence.

👉 **SOLARSTONE** – is the solar roof solution developer and technical partner. We support the development of the roof solution, prepare roofing construction drawings, and help resolve more complex technical situations. Our team includes an architect, a structural engineer, estimator, site manager and partner support specialist.



The area marked in blue is the roofer's scope of work

Maintenance and faults

The master roofer is responsible for the quality of the roofing work, including watertightness, correct structural construction, and installation of the BIPV modules. The master roofer is involved only if the issue is related to the installation of solar roof components.

👉 The PV-electrician is responsible for the day-to-day operation of the solar power system, monitors system performance, and resolves possible faults. If the building owner has a problem with the system, they first contact the PV-electrician, who diagnoses the issue and resolves it remotely or on-site if needed.

In practice, most faults are related to the inverter, software, or electrical connections - issues with the solar roof itself are relatively rare.

Energy-Efficient Buildings with Solar Roofs

The European Union has adopted a decision that will significantly change the role of buildings in the coming years - especially in terms of **roofs and façades**. These are no longer just weather protection; they are becoming a natural part of a building's energy-production infrastructure.

The updated **Energy Performance of Buildings Directive** (EPBD) sets a clear direction: using solar energy is no longer just a "green add-on" or a special solution but is gradually becoming a **mandatory part of construction**. This means that new buildings - and in certain cases also renovated buildings - must be designed so that they can produce energy themselves.

ℹ️ **From 2027**, new public buildings (e.g., schools, kindergartens) and non-residential buildings (e.g., warehouses, manufacturing and office buildings) must be equipped with a solar energy solution, and it must also be added in the case of major renovations.

ℹ️ **From 2029**, this requirement will also extend to new homes - meaning that practically all new houses must be designed to produce electricity themselves.

In addition, all new buildings must already be designed to be "solar-ready" - i.e., roofs must be planned so that a solar system can be integrated.

This creates a completely new field of work in roof and façade construction. Solar solutions are no longer a separate add-on job done by someone else - they become a natural part of building construction. This is no longer "extra work"; it becomes a standard part of roof construction.

Soon:

- the roof = an energy-producing technical system
- a solar roof is not an exception - it becomes a mandatory standard

Read more (in English):

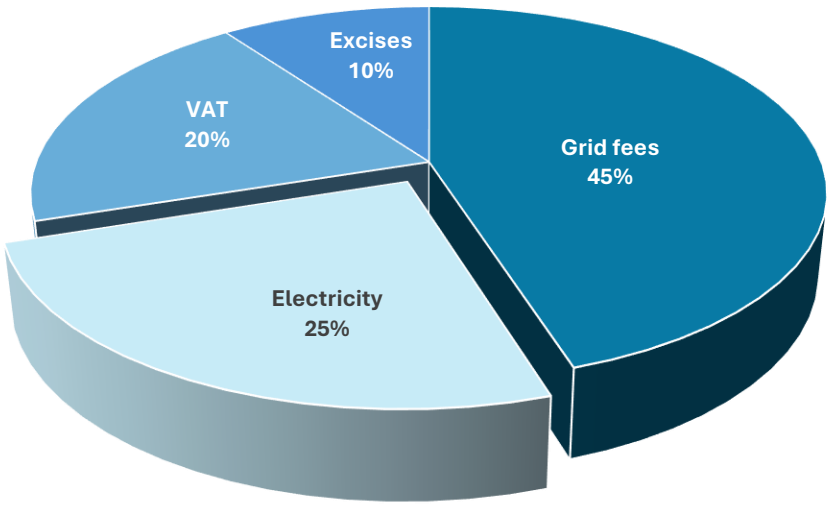
- Energy Performance of Buildings Directive
- Solar energy in buildings

Is electricity free?

The media often reports that electricity is sometimes almost free or even priced negatively. This only concerns the electricity market price, which is just one part of the total electricity bill.

In addition to the market price, the electricity bill also includes grid fees (transporting electricity to the building) and taxes, which make up a large share of the total cost. This means that even if the market price is €0.00/kWh or negative, you still must pay for using electricity.

On average, a building's electricity bill breaks down roughly as follows:



Therefore, when assessing electricity costs, you cannot focus only on the market price. The biggest impact comes from grid fees and taxes.

👉 Simple conclusion: electricity is never truly free
👉 The less electricity you buy from the grid, the lower your total cost

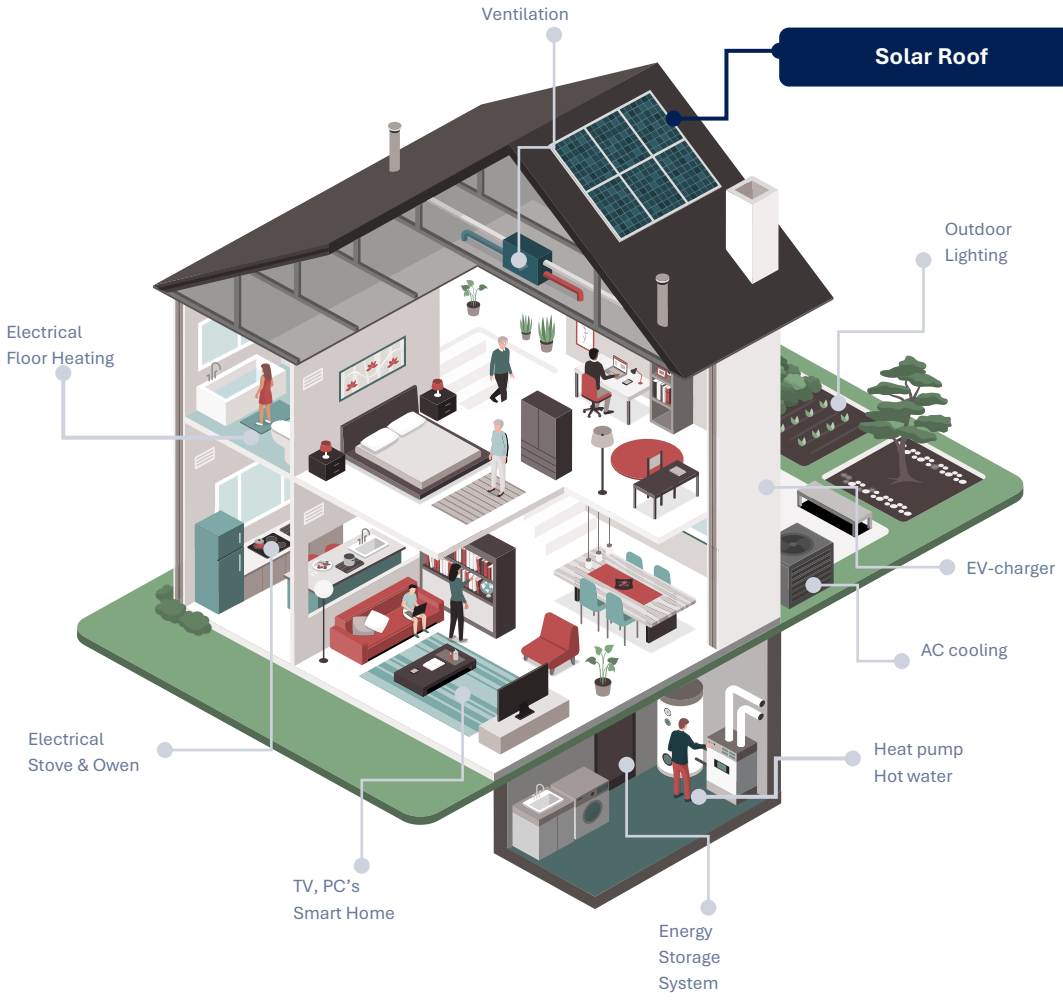
This is exactly where producing your own electricity becomes important - a solar roof helps reduce the energy you buy from the grid and keeps costs under control.

Why a solar roof and PV-powerplant?

Modern buildings are clearly moving toward electrification - building technical systems that previously used fossil fuels **now run on electricity**. Heating, hot water, ventilation, cooling, and increasing transportation (electric cars) significantly increases buildings' electricity consumption. At the same time, electricity prices are volatile, **grid fees are rising, and fossil fuels are becoming more expensive**.

Therefore, the question is no longer only whether to install a solar roof, but how large it should be. The general principle is simple: the system must be planned according to the building's current and future electricity consumption. You must consider both existing loads and future needs, such as an electric car, heat pump, or cooling.

In short, a solar roof is becoming a **natural part of a modern building** - not an add-on, but part of the core infrastructure that helps cover growing energy demand and stabilize and reduce costs.

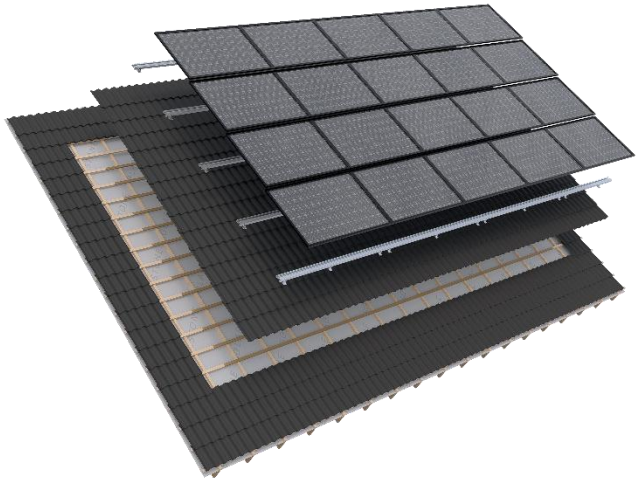


Roof.
Design.
Power.

SOLARSTONE

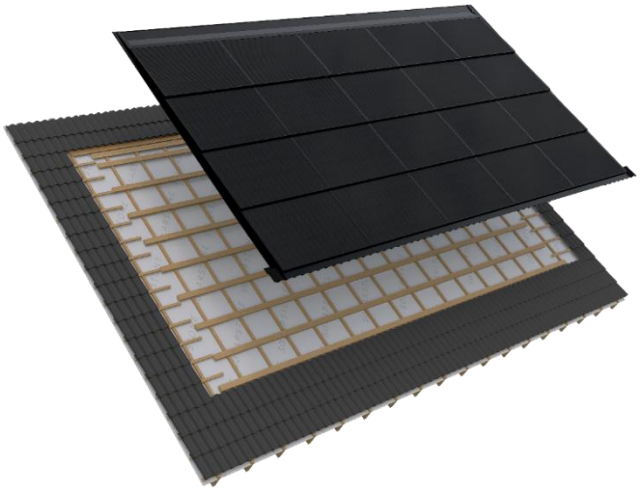
Building-Integrated Solar Roof

or Building-Integrated Photovoltaics, abbreviated as BIPV



With the traditional solution (BAPV), the roof is built first and then solar panels are installed on top of it. This means more layers - roofing material, mounting system, and panels. The work is divided between multiple teams, and additional fasteners and penetrations are made in the roof.

6 layers:
Rafters
Underlayment
Battens
Roof covering material
Mounting system
Solar panels



The SOLARSTONE roof works differently. The BIPV modules of a solar roof are not something that is added later top of the roof; they are the roof covering material itself. This means the roof structure and the solar roof form one integrated whole.

4 layers:
Rafters
Underlayment
Battens
BIPV modules

For the roofer, this means:

- fewer material layers
- a simpler and more logical roof structure
- one installation process, not multiple stages
- no need for separate mounting systems or drilling through the roof

The result is a lighter roof, faster installation, and fewer risks. In addition, all work is done by one team - the roofer - not by separate solar panel installers who may damage the roofer's work, the roof substructure, and thereby void the valid warranties for roofing work and materials.

Types of solar power plants

On-grid (grid-connected solution)

A grid-connected (on-grid) solution is the most common type of solar system. The solar roof is connected to the electricity grid, and the generated electricity is first used in the building. Any surplus is fed into the grid.

If production is not sufficient (e.g., at night or in winter), electricity is taken from the grid. This type of solution does not require batteries, which makes it simpler and more affordable.

An on-grid system is suitable for buildings that have a grid connection. It is important to note that **in the event of a power outage, the solar roof system automatically shuts down for safety and electricity is not produced** (except in the case of a special solution with a so-called *back-up* system).

This is necessary for safety: if the main fuse is switched off or the grid operator is carrying out maintenance work, the solar power plant must not continue producing electricity and supplying the building or the grid. Otherwise, it would pose a danger to electrical workers both inside the building and in the electricity network.

Hybrid (solution with energy storage)

A hybrid solution combines grid connection and energy storage. The system is connected to the electricity grid and includes batteries where excess solar energy is stored.

During the day, the generated electricity is first used in the building, then the batteries are charged, and any surplus is fed into the grid. In the evening and at night, the energy stored in the batteries can be used, which reduces the amount of electricity purchased from the grid.

A hybrid solution provides greater energy independence and enables better control of consumption. Some systems also allow limited use of electricity during power outages.

Compared to an on-grid solution, a hybrid system is more complex and more expensive, but it offers more flexibility and control.

Off-grid (solution without a grid connection)

If an autonomous solution is desired, an off-grid system can be installed. In this case, the building is not connected to the electricity grid, and all generated energy is either used on-site or stored in batteries.

In an off-grid solution, batteries are essential to use the energy produced during the day in the evening and at night. The system size and battery capacity must be carefully planned according to the building's consumption - otherwise there may be an energy shortfall, or the solution may become too expensive.

This type of solution is best suited for locations where a grid connection is not available or is very expensive.

Solar roof and PV system equipment

Inverter

A household electrical system runs on alternating current (AC), but solar panels produce direct current (DC). Therefore, an inverter is needed to convert the electricity produced by the panels into a form that can be used in the building.

The inverter is the central device in a solar PV system. In addition to converting current, it enables monitoring of production, system status, and operating parameters. A high-quality inverter also ensures safety by detecting, for example, overheating, leakage current, and other anomalies, and shutting down the system when necessary.

The inverter selection depends on the building's consumption, system capacity, phase distribution, and possible energy storage. The electrical designer determines the suitable solution, and it is finalized during the project.

👉 **AFCI (arc-fault detection)**

An important inverter safety function is arc-fault detection (*Arc-Fault Circuit Interrupter*, abbreviated as AFCI). An arc fault can occur, for example, when cable connections are of poor quality, contacts are loose, or cables are damaged during installation. In such cases, electrical sparking can occur, which may cause wires and connections to heat up and create a fire hazard.

Because the SOLARSTONE roof is a building-integrated solution and is installed directly on the building structure, early arc-fault detection is especially important. Therefore, only inverters with a built-in AFCI function are used; it detects the hazard in time and shuts down the system to ensure safety.

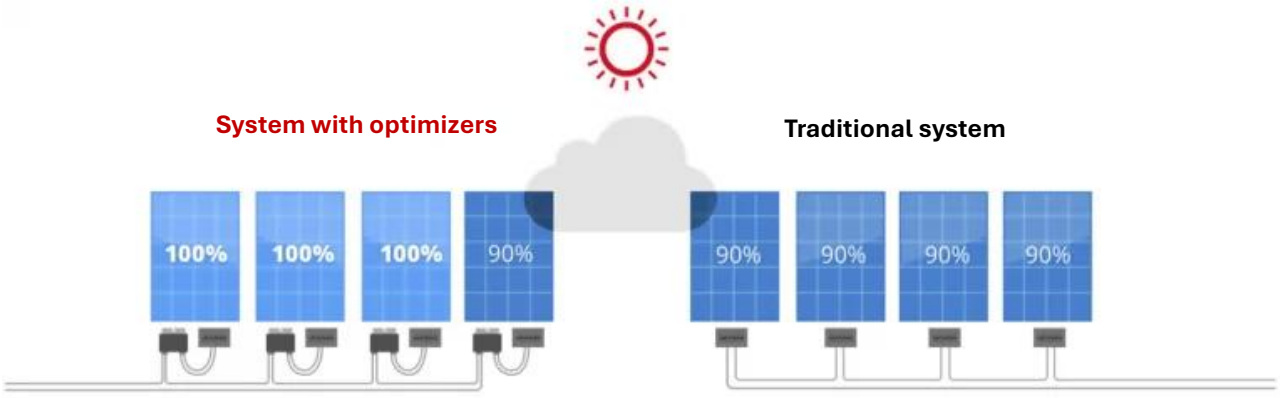
Energy meter

While the current meter in the electrical panel serves only to measure electricity consumption for billing, an energy meter has a broader role: it measures consumption on each phase and also communicates with the inverter via a data cable, enabling intelligent monitoring and control of electricity production and consumption - such as self-consumption, solar plant output, and managing electricity purchase and sale.

Modern hybrid inverters have built-in power consumption measurement capability, and it may not be necessary to add a separate energy meter. This need will be determined by the PV electrician.

Optimizers

Optimizers are additional devices used to optimize the operation of solar panels in more complex conditions. They are typically installed at each panel or panel group and help improve system performance in situations where not all panels receive uniform sunlight.



Optimizers become important when the roof has shading or different slopes and orientations. For example, panels can be shaded by trees, nearby buildings, dormers, chimneys, ventilation pipes, or even temporary shading such as clouds. Without optimizers, the system follows the principle of “the weakest link sets the pace” - if one panel is shaded, the productivity of the entire string drops. Optimizers allow each panel to operate at its maximum possible performance.

In addition to improving performance, an advantage of optimizers is better monitoring. The inverter can track each panel or panel group separately, enabling quick detection of deviations - for example, the impact of dirt, leaves, snow, or a technical fault.

At the same time, it must be considered that optimizers are additional electrical components. This means that an extra device is added under each BIPV module or module group, which can fail over time and whose replacement will add cost.

In addition, optimizers and inverters from different manufacturers may not be compatible with each other. This can make a later inverter replacement difficult or even impossible without also replacing the optimizers. Replacing optimizers, in turn, means that the solar roof modules must be temporarily removed, which makes the work time-consuming and expensive.

Therefore, SOLARSTONE does not recommend using optimizers in every system. The need for them is decided by the electrical system designer, considering the roof’s specifics, shading, the overall functioning of the system, and future needs.

Energy storage system (battery)

The more of the solar energy produced is consumed within the household, the more profitable the system becomes – the most affordable electricity is the one you produce yourself. In residential homes, the highest electricity consumption typically occurs in the evening, when there is no solar production. Therefore, it is practical to store excess energy generated during the day in batteries for later use.

Battery systems are divided into two types based on installation: indoor and outdoor solutions.

Indoor solutions are generally more cost-effective but require installation in a dedicated technical room that is warm, dry, well-ventilated, and located close to the electrical panel. Safety requirements for such rooms are defined by local fire safety authorities. If needed, batteries can also be installed outdoors in specially designed insulated and heated enclosures.

Outdoor solutions are designed for installation outside the building, for example under the eaves, protected from rain and snow. These systems are equipped with internal heating but are typically more expensive.

Battery capacity is measured in kilowatt-hours (kWh). When determining the appropriate size, it is important to consider the size of the solar system, the type of system (grid-connected or off-grid), backup power needs, and especially the building's evening and nighttime energy consumption. Most modern battery systems are modular, allowing capacity to be expanded as needed.

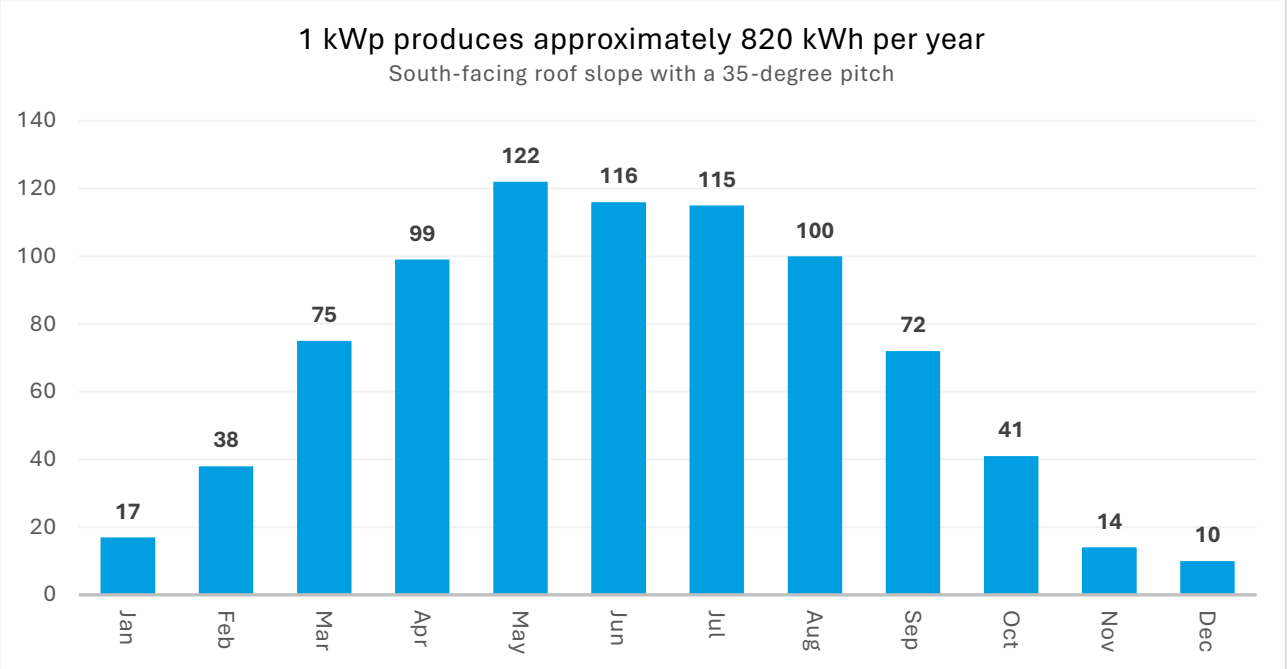
It is important to understand that total battery capacity and usable capacity are not the same. Typically, 80–90% of the total capacity is usable to extend battery lifespan. For example, a 10-kWh battery provides approximately 8–9 kWh of usable energy.

An incorrectly sized battery system reduces efficiency and profitability – a battery that is too small will not meet demand, while a battery that is too large may not fully charge during the day. When planning a battery system, it is also possible to include additional capacity to sell excess energy to the grid or participate in energy markets (such as frequency markets and energy arbitrage). These options can significantly reduce the payback period, which typically ranges between 3–5 years.

👉 The selection and sizing of the battery system should always be carried out by a qualified PV electrician.

Sunlight and roof orientation

A solar roof produces electricity from solar radiation - even in cloudy weather and rain, but with lower output. In Estonia, there are about 1600–1900 hours of sunshine per year. In the winter months (November–January), days are shorter and solar radiation is weaker, so production is significantly lower compared to other months.



It is important to consider the position of the solar panels in relation to the cardinal directions. In Estonian conditions, the best option is to install the solar panels facing south, at an angle of about 35 degrees relative to the ground.

Under these ideal conditions, 1 kWp of solar would produce, on average, about 820 kWh of electricity per year.

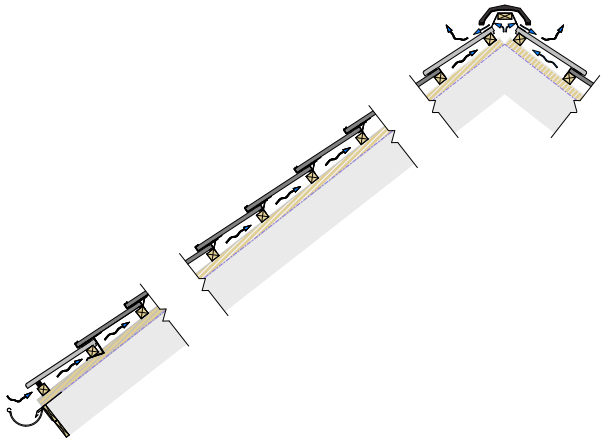
ASPECT	SOUTH	SOUTHEAST or SOUTHWEST	WEST or EAST	NORTHEAST or NORTHWEST	NORTH
Productivity	100%	~ 95 %	~ 75 %	~ 60 %	~ 50 %
1 kWp / year	~ 820 kWh	~766 kWh	~ 640 kWh	~ 490 kWh	~ 410 kWh

A north-facing roof produces about 50% less energy than a south-facing roof but still provides a significant additional yield.

An east–west installation helps make better use of the electricity produced in terms of daily consumption, because production is higher in the morning and evening hours, when household energy demand is typically higher.

Roof.
Design.
Power.

Ventilation



Solar panel output is rated at +25°C. In summer, in warm weather, as panels heat up, their efficiency drops by 10% to 25%, by about 0.4% per degree. Under SOLARSTONE BIPV modules, a ventilation gap is created with battens (at least 50 mm), which ensure airflow and the ventilation required for panel cooling.

The operating temperature of solar panels is significantly higher than the surrounding air temperature. In direct sunlight, a panel's temperature can typically be about 20–35°C higher than the outdoor air, depending on wind and the installation method.

For example, if the air temperature is 25°C, the panels may heat up to approximately 45–60°C. On hot and windless days, the temperature can rise even higher.

Higher temperature also affects panel productivity - on average, power decreases by about 0.3–0.4% for each additional degree above the standard condition (25°C). This means that on very hot days, panel efficiency is slightly lower, even though solar radiation is strong and production is still good.

For example, if a solar panel's nominal power is 430 W (under standard conditions at 25°C), then in real conditions higher temperature affects its output.

Example:
If the air temperature is 25°C, the panel temperature may rise to about 55°C (≈ +30°C). This is 30°C above the standard. If we assume an average temperature loss of –0.4% / °C, then:

- Loss: 30 × 0.4% = 12%
- Actual power: 430 W × (1 – 0.12) ≈ 378 W

So, under these conditions, instead of 430 W the panel produces approximately 380 W.

If ventilation is insufficient - for example, the panels are installed too close to the roofing material or insulation - heat accumulates and panel temperature rises even more. In this case, the production loss increases and the actual output may be even lower.

In addition, if the roof surface temperature rises too high and adequate ventilation is not ensured, it can also damage the underlayment membrane. Over time, the membrane may lose its water-repellent and "breathable" properties, become brittle and water-permeable, and no longer fulfill its protective function.

Therefore, it is very important that SOLARSTONE roofs use a high-quality underlayment material specifically suited for this purpose - not all underlayment's are suitable for these conditions.

Underlayment

In practice, clients and so-called building owners tend to assume that the roofing material (tile, sheet metal, or panel) is the main protection against rain and moisture. From a roofer's point of view, however, depending on the roofing material, it may not be completely watertight. Due to the combined effect of wind, rain, and snow, some amount of moisture always gets under the roof covering. Therefore, the underlayment is the layer that protects the building structure from this excess water.

For SOLARSTONE roofs, the role of the underlayment is especially important because this is a panel-type solution. Due to different materials, fasteners, and penetrations, under certain conditions water or condensation can reach the underlayment - this is normal and follows from basic building physics. What matters is that this moisture is safely directed out, not into the structure.

The underlayment must be water-repellent and at the same time "breathable" so that moisture can exit the structure. It must also withstand higher temperatures; therefore, only an underlayment membrane specifically intended for installing solar panels should be used - one that is waterproof, UV-resistant, and suitable for temperatures from –40 °C to +120 °C in accordance with EN 13859-1:2014.

Installation is just as important as the material. The underlayment must function as a complete system - overlaps, penetrations, and water drainage must be correctly detailed. In addition, ventilation must also work properly, helping moisture escape and keeping temperatures under control.

In summary, the underlayment is not just an extra layer, but the roof's most important safety layer. The right material and correct installation ensure that moisture reaching the underlayment does not become a problem.

Suitable underlayment and their technical specifications are provided in the datasheets and in the installation manual.

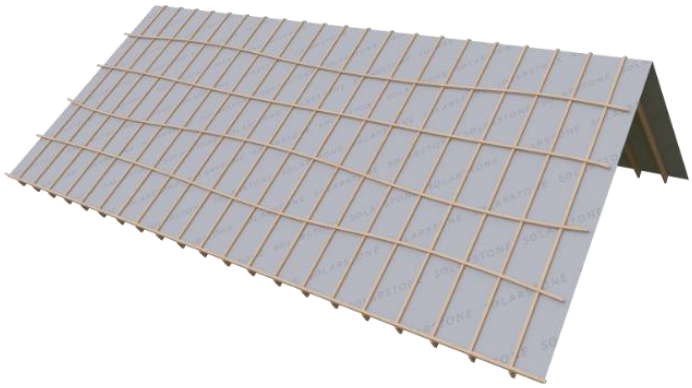
Rafters and battens

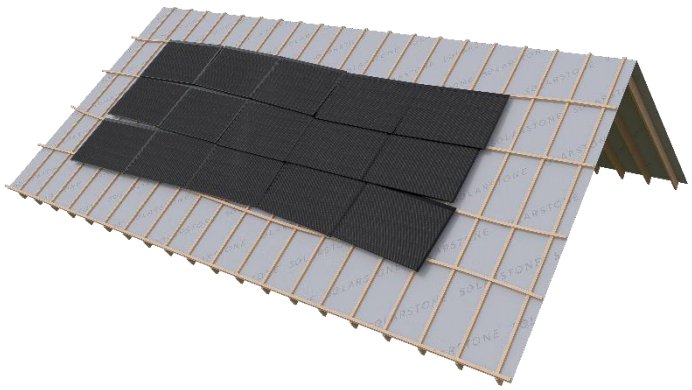
The roof's performance does not depend only on the roof covering and the quality of the underlayment, but on the entire structure. The rafters, ventilation and battens form an integrated system that the SOLARSTONE BIPV modules are supported by.

The rafters - the load-bearing structure - must be strong, straight, and free of damage. Although the SOLARSTONE solution is lightweight (approx. 13–15 kg/m^2), the structure must comply with building standards and be stable.

It is important to use high-quality, dry timber, because material that is too wet can warp as it dries and affect installation accuracy.

Ventilation battens and roof battens must be installed straight and level. The battening must be plumb and even - otherwise the error carries over to the solar roof modules, which will look visually uneven. The images below illustrate the situation when the battens are not straight and level.





In summary, the rafters, ventilation, and battens form one complete system. A properly executed structure is the foundation for a durable and high-quality SOLARSTONE roof.

PV cabling

A large part of the work - structure, underlayment, battens, and installing the roof covering - is exactly what the roofer already knows how to do.

The difference is that **one new work step is added**: interconnecting the BIPV modules. This requires some new knowledge, but it does not make the work fundamentally more complex - it is a simple part that is quick to learn.

The most important thing is to follow the project documentation and the installation manual. Solar roof modules are not installed “by feel” - the position of each module, grouping, cable routing, and connections are predefined. If you follow the design, the installation is logical and smooth.

Special attention must be paid to PV cabling. Cables must be handled carefully - they must not be damaged, crushed, or left against sharp edges. They must be routed correctly, protected, and roof penetrations must be watertight.

To connect the modules, special PV connectors are used, for example Stäubli MC4. It is important to use connectors from the same manufacturer and not to mix connectors from different manufacturers when making connections. Correct connections are critical, because a poor connection can cause sparking, arc faults, and failures. Therefore, proper techniques and special tools must be used - anti-oxidation paste, crimping pliers, cable cutter, and insulation stripper.

It is important that after bringing the PV cables through the roof, the roofer measures the open-circuit voltage (*Voc*) of each PV group and marks the measurement date and result on the wires.

This provides initial assurance that the panels have been installed and connected correctly, and it is important for the PV-electrician who will take over the work later.

Is a solar roof dangerous?

A solar roof is part of a building's technical systems and produces and uses electricity. Like any electrical system, it involves certain risks. However, when high-quality, tested, and certified equipment is used that complies with applicable electrical and fire safety requirements, the risks in a correctly designed and installed solution are very small.

The system connection, inspection, and commissioning are always carried out by a qualified electrical partner who ensures that everything works safely and correctly. In addition, an independent third-party electrical audit is performed, confirming that the installation complies with requirements.

There is also a common myth that if a building has solar panels, firefighters will not extinguish it. This is not true. The Rescue Board confirms that this is an urban legend, and no building is left without firefighting because it has solar panels or batteries.

It is important to understand that a solar roof does not make a building dangerous if the system is properly installed and maintained. As with any technical system, the key is high-quality installation and solutions that meet requirements.

Certificates and standards


DECLARATION OF CONFORMITY

CE

EU Declaration of Conformity

SOLARSTONE Solar Full Roof™

kiwa kiwa

Roof. Design. Power.

SOLARSTONE has placed strong emphasis on product standardization, testing, and certification, focusing primarily on roofing requirements as well as electrical and fire safety. The goal has been to create a solution that simultaneously meets the standards applicable both to roofing materials and to solar electricity generation.

All SOLARSTONE solutions have a CE declaration of conformity and comply with international solar module standards IEC 61215 (design) and IEC 61730 (safety), which confirm product reliability and electrical safety.

From a roofing perspective, fire safety is especially important. SOLARSTONE systems have been tested in accordance with EN 13501-5 and achieved the classifications Broof (t1) and Broof (t2), confirming the roof's resistance to external fire spread. In addition, the Solar Full Roof™ solution also has a façade fire classification according to EN 13501-1 (Class E).

Testing and certification have been carried out by recognized international laboratories and organizations such as TÜV Rheinland, Dekra, RiSE, and LAPI, ensuring that the solutions comply with European requirements and practice.

In summary, this means that a SOLARSTONE roof is not only an energy-producing solution, but also meets all key standards for roofing construction, electrical safety, and fire safety.

Warranty

SOLARSTONE's **20-year product warranty** applies to its own manufactured products - i.e., BIPV modules and components (e.g., panels, fillers, clamps) - and ensures that these components are free from material and manufacturing defects under normal use.

SOLARSTONE's **30 or 25-year performance warranty** ensures that the solar panels maintain the specified energy output over time. This means panel degradation remains within permitted limits, and the system provides stable and reliable long-term energy production.

The roofer is responsible for the quality and watertightness of the roofing work and provides a separate construction warranty for their work. This means that any defects or shortcomings related to the installation of the solar roof fall within the roofer's scope of responsibility.

PV system equipment (e.g., inverters, batteries) is covered by the manufacturers' warranties, and day-to-day functionality is ensured by the electrical partner who installs the equipment, commissions the system, monitors operation, and is the first to respond in case of faults.

In summary:

- SOLARSTONE is responsible for the materials it manufactures, including BIPV modules and clamps.
- The roofer is responsible for the roofing work and installation of the BIPV modules.
- The PV-electrician & equipment manufacturers are responsible for the system's electrical performance.

This division of responsibilities ensures that each party is accountable for its area of expertise and that the overall system functions as a coherent, transparent whole.

Use and maintenance

SOLARSTONE roofs require minimal intervention, but regular visual inspection and periodic maintenance are needed to ensure safe and efficient operation and to keep warranties valid.

The solar roof should be visually inspected at least twice a year, and larger dirt and debris accumulated on it - such as leaves - should be removed. Do not use a pressure washer.

📌 Do not walk on SOLARSTONE BIPV modules; however, it is allowed to walk on FILLER panels and walkways.

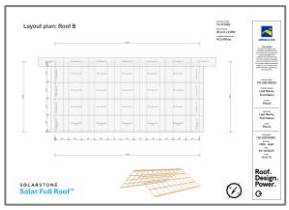
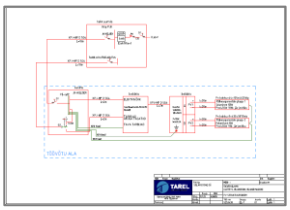
In case of inverter error messages, you must respond and keep software updates up to date; in general, this is handled by the PV-electrician.

SOLARSTONE does not recommend removing snow from solar roofs. Winter energy production is low, and snow load does not damage BIPV modules, so removal isn't necessary. Mechanical snow removal can damage panels and lead to costly repairs. If you choose to remove snow, use a brush or leaf blower-never a shovel, ice scraper, or other abrasive tools.

👉 To inspect the solar roof and detect faults, it is not always necessary to go onto the roof or rent lifting equipment. PV-electricians use specialized drones that can detect anomalies in the operation of each individual BIPV module.

SOLARSTONE

Project documentation (Estonia)

DOCUMENT		PARTNER
	COMPLETE SOLAR PV SYSTEM SOLUTION *The partner for the complete PV-system solution, in cooperation with the building owner (Client), selects the full electrical solution, prepares the design and shop drawings, installs the equipment, completes the commissioning protocol and declaration, arranges the electrical installation audit, and submits the required documents to the local municipality.*	**PV-ELECTRICIAN**
	**DOCUMENTS FOR GRID CONNECTION** *In general, the grid-connection application must be submitted by the building owner; an authorized person can do it with a power of attorney. The process includes the following steps:* 1. *The Client submits the connection application* 2. *The grid operator issued an offer and invoice* 3. *After payment, the connection agreement is signed* 4. *The grid operator replaces the electricity meter* 5. *The PV-system equipment is installed* 6. *A compliance audit for the PV-plant has been ordered* 7. *The grid agreement has been signed*	**CLIENT**
	**SOLAR ROOF CONSTRUCTION SHOP DRAWINGS** *SOLARSTONE's estimator prepares the solar-roof shop drawings, including:* • *3D model and views of the solar roof* • *Batten layout plan with roof dimensions* • *Layout of BIPV and FILLER modules* • *Full bill of materials*	**SOLARSTONE OÜ** supprt@solarstone.com +372 56316666
	**PV-SYSTEM ELECTRICAL DESIGN** *Electrical design is legally required and mandatory. It can be prepared and signed up only by a competent electrical engineer and includes:* • *PV-system design explanatory note* • *PV-system specification* • *Solar roof site plan* • *Solar roof construction shop drawings* • *BIPV module grouping plan (string plan)* • *PV-system single-line diagram* • *Product technical data sheets* • *Product installation manuals* • *EU Declaration of Conformity (DoC)* • *EU Declaration of Performance (DoP)* • *Product warranty terms*	**PV-ELECTRICIAN**

Planning and installation process (Estonia)

For an existing building or a roof renovation, an on-site inspection is important and recommended. A site visit provides a clear overview of the roof structure and underlayment condition, the actual scope of work, and helps plan PV cable penetrations and equipment locations (inverter, batteries). This significantly reduces later surprises and additional work. For a new, planned, or under-construction building, solution planning is based on project documentation and collaboration with designers and engineers. All key decisions are made based on drawings, calculations, and technical solutions.

Pre-sales, incl. mapping and design

ACTIVITY	PARTY	WEEK 1					WEEK 2				
		P1	P2	P3	P4	P5	P1	P2	P3	P4	P5
Client requires roofing work [1]	[1] Client [2] Roofer [3] Solarstone	■									
Site mapping and/or inspection [2]			■								
PV-power plant pre-validation questionnaire [2+3]			■								
Solar roof drawings → Smart Roof Planner [2+3]				■							
Quotation for roofing works and the solar roof [2+3]				■	■						
The client approves the preliminary quotation [1]					■	■					
Submission of the grid connection application [1]	[1] Client [4] PV-electrician	■	■	■	■	■	■	■	■	■	■
Preparation of the solar power plant quotation [4]						■	■	■			
The client approves the final solution quotation [1]								■	■		
Preparation of the solar plant electrical design [4]									■	■	
Submission of the construction permit notice [4]										■	■

Roof works

ACTIVITY	PARTY	WEEK 3					WEEK 4				
		P1	P2	P3	P4	P5	P1	P2	P3	P4	P5
Roof deck preparation works [2]	[2] Roofer	■	■	■	■	■					
Install solar roof modules [2]							■	■			
Roof finishing incl. flashings [2]									■	■	■

PV system works

ACTIVITY	PARTY	WEEK 5					WEEK 6+				
		P1	P2	P3	P4	P5	P1	P2	...		
Build internal cable penetrations [4]	[1] Client [4] PV-electrician	■	■								
Install PV-system equipment [4]			■	■							
System setup and protocol [4]				■	■						
Declaration and audit [4]					■	■					
Submit docs to grid operator [4]							■				
Update Building Register data [4]								■			
System monitoring, fault contact [4]											
Feed-in tariff (FiT) agreement (Enefit) [1]											

Roof.
Design.
Power.

SOLARSTONE

Solar roof planning questions

QUESTION	ANSWER
WHAT TYPE OF CONSTRUCTION IS IT? *Clarifies whether the solar roof is part of a new building or a renovation project. The answer helps define the scope of roofing works required, incl. the structure and underlayment.*	☐ New house construction ☐ Roof renovation ☐ Partial roof replacement ☐ Other
EXACT ADDRESS OF THE BUILDING? *Knowing the address of the existing or planned building, we can retrieve drawings and designs from public databases. In addition, location is important for calculating solar intensity and solar power yield.*	
WHAT IS THE BUILDING'S INTENDED USE? *Clarifies how the building is used, as it affects electricity consumption, payback calculations, and possible design requirements related to building and occupancy permits.*	☐ Single-family house ☐ Semi-detached or terraced house ☐ Apartment building ☐ Public or commercial building ☐ Industrial building ☐ Other
HOW MANY STOREYS DOES THE BUILDING HAVE? *Helps understand whether lifting equipment, scaffolding, etc. is needed.*	floor(s)
DO YOU HAVE A BUILDING PROJECT, ROOF DRAWINGS, DIMENSIONS? *Help with planning and preparing the final design solution.*	
WHAT ROOF MATERIAL IS USED OR PREFERRED? *Helps understand how the roof covering fits BIPV solutions, whether it is used together with other roofing materials, the client's visual preferences, and which installation methods are needed.*	☐ Metal roof ☐ Tile roof ☐ Asbestos roof ☐ Fiber cement roof ☐ Asphalt/wood/shingle roof ☐ Other
WHAT IS THE ROOF PITCH? *Roof pitch affects system design and work planning and is important for calculating solar power output. Note that the SOLARSTONE solution cannot be installed on flat roofs.* ** Note that the SOLARSTONE roof is suitable for 18 degrees*	☐ 11–18 degrees * ☐ 18–25 degrees ☐ 25–45 degrees ☐ > 45 degrees
WHEN WOULD YOU LIKE TO START WORK? *One of the most important questions: shows the project's urgency, whether the client has a serious plan or is still deciding. This helps schedule the work and determine whether the project needs priority.*	

Roof.
Design.
Power.

PV system planning questions

QUESTION	ANSWER
WHAT TYPE OF SOLAR PV SYSTEM IS PLANNED? *This is important, because it determines the overall system setup and affects both equipment selection and installation scope.*	☐ On-grid, grid-connected ☐ Hybrid, grid + battery ☐ Off grid, no grid + battery
WHO IS THE ELECTRICITY GRID OPERATOR? *Connection terms, requirements, and the process depends on the grid operator (e.g., Elektrilevi), who also sets technical limits and connection possibilities.*	
WHAT IS THE MAIN FUSE SIZE AT CONNECTION POINT? *Determines the maximum allowed system capacity and affects how large a PV system can be installed.*	amps (A)
HOW MANY PHASES DOES THE ELECTRICAL SYSTEM HAVE? *Affects inverter selection and the PV system operating logic.*	☐ Single-phase ☐ Three-phase
HAS THE PRODUCER CONNECTION APPLICATION BEEN SUBMITTED? *Without grid-operator approval, the PV system cannot be legally connected to the grid or commissioned, except for an off-grid solution. If a grid connection agreement exists, I will send it to the PV electrician by email.*	☐ No, submitted by the Client ☐ No, submitted by the PV electrician ☐ Yes, application submitted ☐ Yes, connection agreement signed ☐ Yes, grid agreement signed
IS THE ALLOWED EXPORT TO GRID KNOWN? *Determines how much produced electricity may be sold back to the grid and affects system size planning.*	☐ No export to grid ☐ Simplified plug-in, 0-1 kW ☐ Residential solar roof 10-20 kW ☐ Commercial solar 30-50 kW
IS THERE A DEDICATED TECHNICAL ROOM IN THE BUILDING? *This is important because the inverter, batteries, and other electrical equipment need a suitable and safe installation location.*	☐ Yes ☐ No
Where IS THE MAIN ELECTRICAL DISTRIBUTION BOARD (MDB)? *This is important because it affects cable-route planning and installation complexity.*	
IS THERE SPACE IN THE MDB FOR ABOUT 6–8 ADDITIONAL BREAKERS? *This is important because connecting a PV system requires additional protections and components, and there must be enough space in the board.*	
WHERE DO YOU PLAN TO INSTALL THE INVERTER AND BATTERIES? *This is important because equipment location affects cable length, installation works, maintenance, and system safety.*	

Roof.
Design.
Power.

SOLARSTONE

Additional questions

QUESTION	ANSWER
DO YOU HAVE BUILDING PROJECT DOCUMENTATION? *Enables accurate planning of both roofing and electrical works and reduces risks and surprises on site.*	☐ Yes, I will send them by email ☐ No
WHAT IS THE USABLE (HEATED) AREA OF THE BUILDING? *Usable area provides an overview of the building's energy needs and helps estimate the required system size.*	m^2
WHAT IS THE BUILDING'S ANNUAL ELECTRICITY CONSUMPTION? *Helps plan an optimally sized PV system based on actual consumption.*	kWh / year
WHAT HEATING SYSTEM IS USED IN THE BUILDING? *This is important because the heating solution directly affects electricity consumption today and in the future.*	☐ Oil, wood, wood pellets ☐ Electric heating ☐ Air/air or air/water heat pump ☐ Ground-source heat pump ☐ District heating ☐ Other
DOES THE BUILDING HAVE COOLING AND/OR MECHANICAL VENTILATION? *This is important because these systems increase electricity consumption and affect PV system capacity planning.*	☐ Cooling, or planned in the future ☐ Ventilation, or planned in the future
DO YOU HAVE AN ELECTRIC CAR OR PLAN TO BUY ONE? *EV charging can significantly increase electricity consumption and affect system size and payback.*	☐ Already have ☐ Plan to buy

Installation stage compliance check

The purpose of this chapter is to define the requirements for site readiness before starting the installation of the solar roof and PV system, to ensure safety, quality, and compliance with the design.

- **Client** – ensures site access, infrastructure, and general working conditions
- **Roofer** – checks roof structure, documentation compliance, and installation conditions
- **PV electrician** – is responsible for meeting the prerequisites for the electrical installation

SITE SAFETY, ACCESS AND INFRASTRUCTURE	RESPONSIBLE
☐ The work area is safe and vehicle access to the site is ensured.	Client
☐ There is sufficient space for receiving, unloading, and storing materials.	
☐ A crane and/or lifting equipment can be used on site.	
☐ An electrical connection (min 16A) is available for tools and charging.	
☐ Scaffolding is installed or will be installed for the installation period.	Roofer
☐ Scaffolding allows material storage at the same level as the roof.	
PROJECT DOCUMENTATION COMPLIANCE	**RESPONSIBLE**
☐ All necessary approvals and permits for the work are in place.	Roofer
☐ Project documentation is available on site, valid, and compliant.	
☐ The solution for snow guards, walkways, and ladders is planned in the design.	
☐ For larger areas, required maintenance walkways have been considered.	
☐ For penetrations, fire-safety clearance zone ≥ 800 mm have been considered.	
ROOF STRUCTURE AND UNDERLAYMENT	**RESPONSIBLE**
☐ Roof pitch complies with manufacturer requirements and the design; min ≥ 18°	
☐ Roof structure complies with building standards and has load capacity ≥ 16 kg/m^2	Roofer
☐ Roof structure is straight and plumb; no deflection.	
☐ Roof geometry is correct; diagonals match; tolerance ±20 mm.	
☐ Underlayment is water- and UV-resistant; watertightness class ≥ W1; –40 °C to +120 °C	
☐ Underlayment is watertight sealed according to the manufacturer's instructions.	
☐ Excess water on the underlayment is directed to the eaves and/or the rainwater system.	
☐ Ventilation batten dimensions are at least 45×45 mm.	
☐ Batten dimensions: Solar Full Roof 45×95 mm; Solar Tiled Roof 45×45 mm.	
☐ Battening complies with the design; straightness and spacing tolerance ±2 mm.	
☐ Batten nails/screws are properly fixed, approx. 2/3 into the rafter.	
☐ Ventilation batten–underlayment–battening gaps are sealed with sealing tape.	

Roof.
Design.
Power.

PV CABLING	RESPONSIBLE
☐ PV cable grouping and layout follow the design.	Roofer
☐ PV cables are fixed, not resting on underlayment; main route is in conduit.	
☐ Roof cable penetrations are watertight and properly sealed.	
☐ PV group open-circuit voltage measured; results marked on cable ends.	
SOLAR ROOF INSTALLATION	**RESPONSIBLE**
☐ Valleys and eave flashings installed; penetrations watertight sealed.	Roofer
☐ Fascia board, drip edge and gutter brackets installed.	
☐ For Solar Tiled Roof, bottom and right-side tiles are installed.	
☐ Edge flashings properly fixed.	
☐ BIPV modules correctly in clamps, straight and flush.	
☐ For Solar Full Roof, panels fit tightly edge to edge.	
PREPARATION OF THE LOCATION FOR SOLAR POWER SYSTEM EQUIPMENT	**RESPONSIBLE**
☐ Back wall at inverter location is non-combustible.	Client
☐ Power and data cable routes between inverter and panel are built.	
☐ Internet connection available at inverter location.	
☐ Battery location planned per fire-safety requirements.	

Compliance check conditions:

- Before starting the next stage, all items must be checked and documented.
- If non-compliances exist, installation must not start until issues are fixed.
- Results are recorded in the handover or work-start report.

It is important to document the work in detail-photograph all stages, watertight penetrations, PV cable connections and fixing points. The more photos, the better!

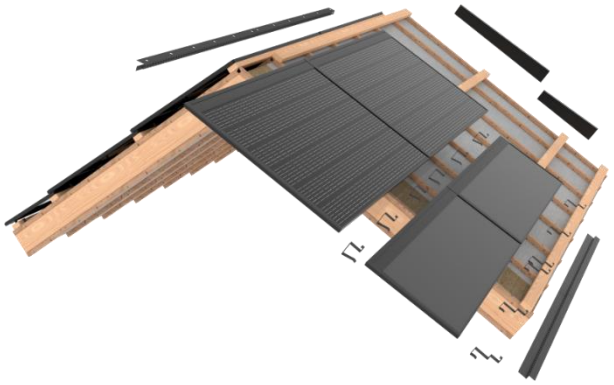
Regular inspection and maintenance

To keep the SOLARSTONE manufacturer warranty valid, it is important that the PV electrician performs an on-site service inspection at least once a year. In addition, it is recommended to have a specialist review of the system more thoroughly every 3 years to assess the solar roof condition, connections, productivity, and electrical equipment performance.

FREQUENCY	PV CABLING	PERFORMER
Ongoing	Monitors production via the mobile app vs. weather and season.	Owner
	Responds to inverter error messages; informs PV electrician if needed.	
	Performs PV system equipment software updates.	
	Checks roof condition (cracks, stains, discoloration).	
	Remove larger dirt and debris from the roof.	
1× per year *Remote, paid service*	Checks system operation; analyses logs and error messages.	PV-electrician
	Analyses production data vs. previous periods.	
	Installs electrical equipment software updates if needed.	
	If needed, agrees a PV electrician visit with the owner.	
Every 3 years *On-site, paid service*	Checks system operation; analyses logs and error messages.	PV-electrician
	Analyses production data vs. previous periods.	
	Installs electrical equipment software updates if needed.	
	Visual inspection and IR scan of BIPV modules (thermal drone) *Detects overheating connections and defective BIPV modules.*	
	Open-circuit voltage measurement (Voc) *Measures string voltages and compare them to baseline to detect non-working BIPV modules, bad connections and circuit breaks.*	
	String (group) short-circuit current measurement (Isc) *Provides info on string/group performance and identifies the weakest string.*	
	Insulation resistance measurement. *Detects cable damage and moisture in connections.*	
	If necessary, will coordinate an inspection by a master roofer.	

Roof.
Design.
Power.

SOLARSTONE roofs & tech tools



Solar Full Roof™

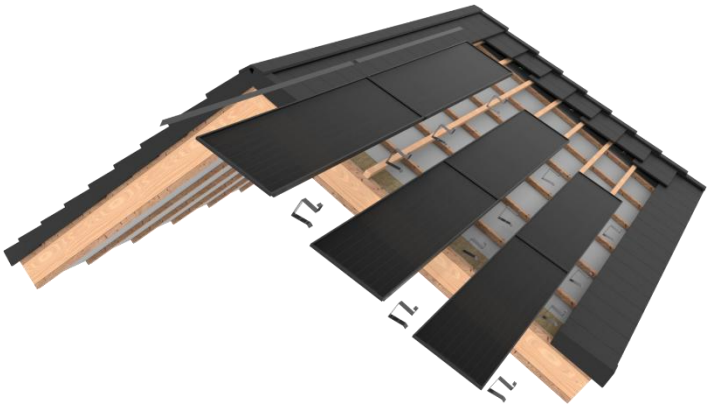
A roofing solution where the entire roof surface is covered with BIPV and/or FILLER modules, ensuring a uniform and visually seamless result. It is well suited for buildings with higher electricity consumption, where the goal is to maximize self-generated energy.

Solar Full Roof™ is a full-roof covering solution that completely replaces traditional roofing materials – roof surfaces, edges, transitions, and penetrations are all handled using dedicated FILLER panels. The installation of the structure, underlayment, and battens follows standard roofing practices. The only addition is the installation and connection of BIPV and FILLER modules, which is simple and quick to execute.

	Solar Full Roof™ BIPV module
PV panel	FuturaSun Nova Duetto
Peak Power	430 Wp | 215 W/m^2
Efficiency	High, 22 %
Type	Glass/Glass 2.0 + 2.0 mm
Weight	28 kg | 14 kg/m^2
Design Load	5,400 Pa (~550 kg/m^2)
	2,400 Pa (~224 kg/m^2)
Impact Resistance	25mm hail at 23 m/s
EN Standards	EN 61215:2021 - Design Qualification EN 61730:2023 - Safety Qualification
Electrical Safety	EN 61730:2023 - Class II
Fire Class	EN 61215:2021 - Class C EN 13501-1 - Class E
Fire Certification	EN 13501-5:2016 - Broof (t1) EN 13501-5:2016 - Broof (t2)

Solar Tiled Roof™

A roofing solution where BIPV modules are installed together with traditional roof tiles, forming one integrated roof. Standard battens and tile installation methods are used, with solar modules added in defined zones.

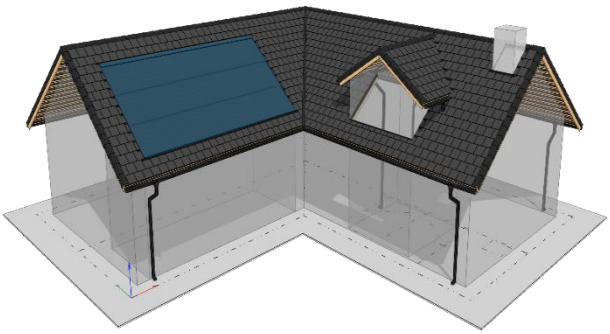


Solar Tiled Roof™ is designed for projects where the entire roof is not covered with BIPV modules but instead combines solar modules with conventional roofing materials. This allows the building to retain its traditional or historical appearance while adding electricity generation. It is well suited for renovation projects and buildings where architectural requirements impose certain limitations.

	Solar Tiled Roof™ BIPV module
PV panel	Solarstone FRS 105W/HC27
Peak Power	105 Wp | 215 W/m^2
Efficiency	Medium, 15.2 %
Type	Glass/Glass 2.0 + 2.0 mm
Weight	10 kg | 13.5 kg/m^2
Design Load	5,400 Pa (~550 kg/m^2)
	2,400 Pa (~224 kg/m^2)
Impact Resistance	25mm hail at 23 m/s
EN Standards	EN 61215:2021 - Design Qualification EN 61730:2023 - Safety Qualification
Electrical Safety	EN 61730:2023 - Class II
Fire Class	EN 61215:2021 - Class C EN 13501-1 - Class E
Fire Certification	EN 13501-5:2016 - Broof (t1) EN 13501-5:2016 - Broof (t2)

Roof.
Design.
Power.

SOLARSTONE



Solar Full Roof™ Power Set

Created to make offering solar-roof solutions simple and installation fast - the solar roof can be installed in one day. Compatible with different roof-covering materials such as tile or sheet metal. This is a “boxed product” – a complete set packed on one wooden pallet, ready-to-pick, quick to deliver, and easy to install.

For the homeowner – the solution is optimized for a typical single-family home’s energy needs, producing part of the household electricity on-site, reducing dependence on the grid and fluctuating electricity prices.

For the roofer – designed to be installed like a regular roof, without a separate solar-panel crew. All components are pre-matched and fit together, reducing on-site issues and installation time, enabling faster work on more sites, and providing more stable and predictable profitability.

	LARGE	MEDIUM	SMALL
PEAK POWER	**8.6 kWp**	**6.88 kWp**	**5.16 kWp**
MAX OUTPUT	~8810 kWh / year	~7048 kWh / year	~5286 kWh / year
BIPV MODULES	20 x 430Wp	16 x 430Wp	12 x 430Wp
LAYOUT	5 cols × 4 rows	4 cols × 4 rows	4 cols × 3 rows
COVERAGE SIZE	8815 x 4615 mm	7060 x 4615 mm	7060 x 3475 mm
COVERAGE AREA	~40 m^2	~35 m^2	~25 m^2
EFFICIENCY	215 W / m^2		
WEIGHT	~600 kg	~560 kg	~400 kg
	~16 kg / m^2		
WARRANTIES	30-year performance & 20-year product warranty		
CERTIFICATES	Comply with EU EN quality, safety and fire requirements		
COMPATIBILITY	Benders · RUUKKI · BMI MONIER · wienerberger		

Includes: Solar Full Roof BIPV modules and mounting clamps, tile-to-BIPV transition flashings, formable sealing tape (Wakaflex), cable penetrations (Airstop), PV cables with connectors, grounding cable, PV cable conduit, wood screws.

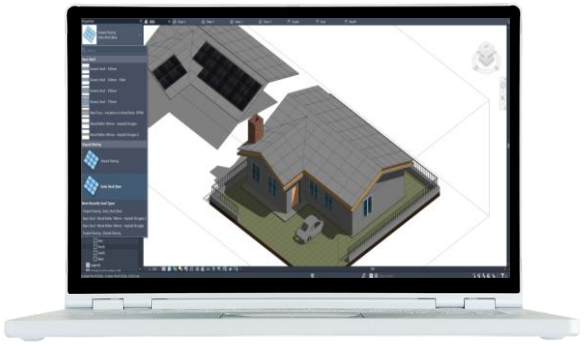
Roof.
Design.
Power.

Smart Roof Planner™

SOLARSTONE has developed, with roofers in mind, roof-planning software in cooperation with the Czech software company HiStruct. While there are several tools on the market for designing solar-panel solutions, until now there has been no simple, practical solution for roofers that enables end-to-end planning of a roof together with BIPV and traditional roofing materials, such as tile and metal roofs.

Smart Roof Planner™ helps cover the entire process from start to finish-from accurate roof geometry and solution planning to installation drawings, dimensions, a step-by-step installation plan, and a bill of materials (BOM). All the information needed is brought together into one logical workflow, making work faster, more accurate, and reducing the risk of errors on site.

In addition, the software helps standardize the workflow, improve reliability for the roofer, and creates prerequisites for more efficient project execution and offering new services.



BIM models

We have created accurate BIM models for architects, engineers, and real-estate developers, primarily supporting the design and planning of new buildings. Modern construction processes increasingly rely on BIM workflows, where all parties work in a shared digital environment and solutions must be thought through already during the design phase.

SOLARSTONE BIM models (parametric models) are based on Solarstone products and can be used in Autodesk Revit. The models include exact dimensions, materials, technical data, and classification information, ensuring reliable design and correct documentation.

In addition, the models are built to support collaboration between discipline architecture, structures, and building services (MEP). This makes it possible to identify potential conflicts early (*clash detection*), reduce design errors, and ensure the solution is feasible and well thought through in the construction phase.

Roof.
Design.
Power.

Version

NR	DATE	CHANGE	MADE BY
1.1 (EE)	03.04.2026	Korrigeeritud versioon	R. Roosalu
1.0 (EE)	01.04.2026	Avaldatud versioon	R. Roosalu
0.1 (EE)	28.02.2026	Mustand versioon jagamiseks	R. Roosalu

SOLARSTONE

www.solarstone.com