

Technology - FAQ

Frequently Asked Questions

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1. What is the difference between a solar module and a solar collector?

A solar collector uses sunlight to heat water, which can then be used for daily hot water and heating requirements. A solar module (also referred to as PV module or solar generator) converts light directly into electricity.

2. What does PV mean?

PV is the international abbreviation for photovoltaic conversion and refers to the physical process by which sunlight is converted into electricity by means of a solar cell.

3. What are photovoltaics?

"Photovoltaics" denotes the direct production of electricity from sunlight (also referred to as the photovoltaic effect). In 1839, the French physicist Alexandre-Edmond Becquerel discovered the phenomenon on which solar cell technology is based, the so-called photoelectric effect. However, the first photovoltaic cell was not developed until the 1950s.

Since then solar cells have been used in aerospace, pocket calculators, watches and emergency telephones, but the main application today is to supply power to buildings and the national grid.

4. What does kWp stand for?

Kilowatt peak (kWp) specifies the power of a PV or solar module under certain conditions, which are standard test conditions: STC (1.000 W/qm insolation, 25 °C module temperature, AM 1.5 spectrum).

5. What does Wp stand for?

The abbreviation Wp stands for watt peak power [Wp (1.000 W p = 1 kWp)]. This is the rated power, which is the power generated under certain test conditions (see kWp). The Wp rating does not therefore indicate the actual power supplied by a module but rather the maximum power supplied under optimal conditions.

6. What does kWh stand for?

kWh is the abbreviation for kilowatt hour, the unit for measuring energy produced. 1 kWh corresponds to the continuous generation of 1,000 watts over a one-hour period. It also is the unit your utility company uses to charge you for the electricity you consume and pay you for the electricity you deliver to the grid.

7. What is solar energy?

Solar energy is the energy produced by insolation (the amount of sunlight available to the module). The sun is the largest and richest energy source available to humankind. Despite the distance at which the Earth orbits the Sun (150 million kilometers), the Sun provides an unfailing supply of radiant energy on the order of 15,000 times the primary energy requirements of the entire population of Earth. This means that solar power stations covering an area of only 3% of the Sahara Desert could supply the entire energy requirements of Europe and Africa.

Solar energy is a renewable resource, and is classified as a directly usable form of energy. Wind is an indirect form of energy, and biomass (wood, grasses and biogas) are stored solar energy. All of these energy forms together form the basis

for a sustainable energy supply.

8. How does a PV installation work?

Individual solar cells are interconnected to so-called solar modules (also referred to as PV modules or solar generators), which convert sunlight into electrical power. When light falls on a PV module, the radiation energy is converted into direct current (DC). The direct current is then converted into household-compatible alternating current (AC) by means of an inverter. The inverter is installed at a suitable location between the solar modules and the meter box.

A PV module therefore is able to turn sunlight into electricity. It can do this even when there is some cloud cover in the sky or when the sky is completely clouded over. It can even use artificial light. Of course, the yield depends on the quantity of light.

9. What are monocrystalline, polycrystalline and thin-film solar arrays?

There are three types of cell: monocrystalline, polycrystalline and amorphous.

To manufacture monocrystalline silicon cells, ultra-pure semiconductor material is used. Out of a silicon melt, monocrystalline rods are drawn and subsequently sawn into thin slices. This process ensures relatively high cell efficiency but does not tell much about the resulting efficiency of a module. Originally, all monocrystalline material came from chip production.

Using polycrystalline cells is more cost-effective. The process involves casting liquid silicon into blocks which subsequently are sawn into slices. During solidification of the material, different sizes of crystalline structures are formed at the edges where defects occur. Such defects lower the efficiency of the solar cell. However, this degradation can often be compensated in the module since -- unlike the monocrystalline material -- rectangular cells are produced resulting in better utilization of the area available for modules.

If a photovoltaically active layer is deposited on glass -- or another substrate - the resulting solar cell is called thin-film. The thickness of the film is less than 1 μm (by way of comparison, the thickness of a human hair is 50-100 μm). Because material costs are low, production costs are lower. However, relative to crystalline-type cells, the efficiency of thin-film cells is considerably lower.

There are many types of thin-film technologies available, each with unique characteristics. The importance of thin-film technologies will increase over time. To date, they have been used mainly for low-power applications, such as in watches and pocket calculators, or for facade panels.

10. What does solar cell efficiency or power mean?

Solar cell power (the product of current and voltage) is temperature-dependent. Higher cell temperatures result in lower power output and thus in lower efficiency. The efficiency figure (or cell efficiency) states how much insolation is converted into available electrical power. The higher the efficiency of a cell, the better its ability to convert radiant light into electric power.

The higher the efficiency, the more power is generated by a given area of solar panels. Thus, a solar module with an efficiency of 12.5% generates 125 watts of peak power per square meter. If the efficiency is 10%, 100 watts of peak power is generated (under standard test conditions with 1,000 watt insolation per square meter). In other words, given installations of the same size, the first module produces 25% more solar power per year.

11. What is a grid-connected PV installation?

A grid-connected PV installation is an installation tied to the national grid. The grid works like a large "lake" that is fed from a variety of sources and has many outlets serving residences, businesses and industrial sites. The more solar is power fed in, the cleaner the grid becomes.

12. What is a standalone or off-grid PV system?

Standalone systems are found where there is no connection to the grid. This occurs where, for instance, a connection to the grid would be too expensive. Examples include the illumination of light buoys at sea, street lights in remote areas, and highway signs. Although in Europe standalone systems are used only for niche applications in Central Europe where connecting to the grid would be uneconomical, in many parts of the world they are the only ecologically and economically sensible way to supply electricity. Thus, they give billions of people the opportunity to continue working after sunset without having to rely on expensive fuel or exposure to the poison from the waste gases of cheap fuel. Such systems usually work with direct current and battery backup.

13. Can I touch a solar module without getting an electrical shock?

Naturally, the solar module itself is not live. However, because of the way the modules are connected in series within the system, dangerous voltages are present. Thanks to high protection standards, they are just as safe as other domestic appliances.

14. What is the life expectancy of a solar installation?

A PV module has an average life expectancy of more than 30 years. The design life

of the inverter is usually more than 20 years, but is not always achieved. In the event of breakdown, replacement at reasonable cost is not a problem. Overall losses in system efficiency can be identified -- at least on an annual basis -- using publicly available insolation data. Our experts can analyze the cause quickly and rectify the problem as needed.

15. Do I need to clean the installation every week?

PV installations do not require a lot of care. Rain ensures that they remain clean if the angle of inclination is at least 10-15 degrees. If necessary, the modules can be cleaned with a cloth. This can be done, for example, when gutters are cleared.

16. Do I need to protect the installation from snow?

Every Ecostream installation is installed in such a way as to withstand most weather conditions. Moreover, they contain toughened safety glass. Gales, snow and harsh frost therefore are no problem. The modules even withstand hail under normal conditions. For installations in areas with extreme weather conditions, insurance coverage is an option. However, insurance industry data shows that claims are very rare.

17. Is there a greater danger of a lightning strike with a PV installation on the roof?

Studies have shown that the danger of lightning strike does not increase with the installation of a PV system on the roof. However, the electronics and in particular the inverter of the system are very sensitive. This means that when lightning strikes in the vicinity there is a risk of damage. Such incidents are referred to as indirect lightning strikes.

The risk of damage due to induced transients from load switching is low, but when it happens, the damage is considerable. A short circuit resulting from a lightning strike can destroy many types of equipment. However, damage due to induced transients often is included in homeowner's insurance, in which case your solar generator would be covered. Please check with your insurer.

18. Does my installation generate electricity when the sun is not shining?

It can happen that the measured yield for a slightly overcast day in May is higher than that for a warm and sunny day in August. One of the reasons for this is that as the solar module warms up the efficiency with which it converts sunlight into electricity decreases.

19. What about subsidies?

Subsidies vary in each country.

20. What rate will I be paid for the electricity I "export" to the national grid?

Rates are not the same in every European country.

21. What contribution do I make to the environment?

If you invest in a solar installation, you also invest in the environment. Thus, a PV installation with an area of 8.5 square meters and a power output of 1 kWp renders an average of 850 kWh per year, which corresponds to a reduction in CO₂ output to the atmosphere of approximately 70 kg per year, which in turn amounts to 14 ton over 20 years. With an installation of this size, your own roof can contribute slightly more than one-fourth of the power consumed by an average family of four. Possibly more important is that with this decision you are stimulating a market that will respond by developing products at lower cost and thus save far more CO₂.

22. What does the term NEG (net energy gain) mean exactly?

By net energy gain (sometimes also referred to as energy amortization or energy payback) we mean the time it takes for a solar installation to generate the amount of energy it took to produce the installation. A PV installation based on amorphous silicon has -- according to a study by the Technical University of Berlin -- a payback period of 17-41 months. Crystalline modules have a similar payback period, whereas monocrystalline modules perform slightly inferior because the process is more costly. Power stations that run on fossil fuels, however, can never compete.

Study: A solar module generates the amount of energy used for its manufacture within three years. One of the ways to compare different processes is to use -- in addition to known criteria such as the cost and impact on the environment -- the time it takes to reproduce the energy used to manufacture the installation itself. Example: Large power stations run on fuel, water power or nuclear energy and require considerable amounts of energy for their construction. A new study by Energy and Environment Economics reveals that now it only takes one to three years for a solar generator to reproduce the energy used in its manufacture. The study examined the manufacture of two types of solar generators in a factory run by Siemens Solar Industrie. It is expected that by the end of their life the modules will have produced 9-17 times the energy it took to manufacture them.

23. What ongoing maintenance costs are there?

After the initial costs of purchasing and installing the solar power system, there are no further costs for fuel. Only small amounts need to be budgeted for maintenance,

repairs and insurance.

24. What is meant by roof pitch?

Although the question of the pitch of the roof is asked when planning a solar installation (for instance for an online-calculation), it is not the inclination of the roof that matters but the inclination or pitch of the solar module. By means of a support structure, solar modules can be brought into an appropriate position even if the pitch of the roof or the roof orientation is unfavorable.

To make best use of the radiation from the sun, the angle of incidence of the sun rays should be 90 degrees. The optimal angle of inclination and orientation must correspond to the latitude of the location (for instance, Freiburg in Germany's Black Forest is situated at 48° latitude and Lübeck on the Baltic Sea at 54°).

Since in summer the sun is higher in the sky than in winter, it also depends on the season in which the solar installation is mainly used. During the long days of summer, for instance, photovoltaic installations generate the highest yield. As a rule of thumb, an installation angle of latitude minus 10° is used where the main use is in the summer and one of latitude + 10° where the main use is in the winter.

The angle of inclination should not be confused with a southern orientation. In practical terms, small deviations from the optimal angle of inclination or orientation have only a slight effect on the yield. If shadows are cast onto the solar module, the effect on the yield is greater.

25. What is the optimal orientation of a solar installation?

A solar system should be oriented to the south, although the installation does not have to face due south. Even if solar modules are installed on a roof that deviates up to 40° from south, only small losses are incurred. In terms of inclination, the modules can be at an angle of 20°-60° without much impact. Smaller angles of inclination increase the yield in summer whereas larger angles of inclination increase the yield in winter. Since annual yield is what counts in the case of grid-connected installations, our advisor will assist you with this calculation.

TOPICS



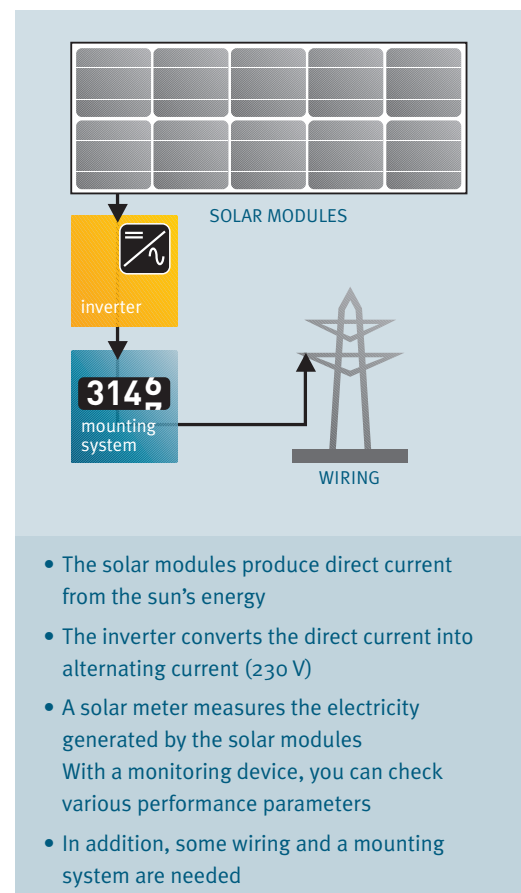
What is photovoltaics?

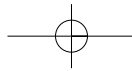
Naturally economical

The sun is the largest and richest source of energy at our disposal. Every day it provides approximately 15,000 times more than the daily primary energy needs of our planet's entire population. And it does this free to your door and without producing any environmentally harmful emissions. With solar power systems in an area only three percent of the area of the Sahara desert, the energy requirements of Europe and Africa would be met.

More and more businesses and private home-owners are using their roofs to capture environmentally friendly energy from the sun. The reasons for this are obvious: increasing environmental awareness, rising energy prices and, last but not least, the attractive revenue through subsidies guaranteed by law in some European countries.

A solar energy system generally comprises the following components:





How it works

Solar cells transform the sunlight directly into electrical energy. This process is called the photovoltaic (PV) effect. Thus the official designation is abbreviated as PV-cell or PV-module. Each of these solar cells is built of razor-thin layers of semi-conducting material, between whose contact areas a potential difference appears, under the influence of sunlight.

A solar module consists of several rows of smaller solar cells connected to each other. In general the front part of the module is covered with a hardened glass plate, while the back section is usually protected by a plastic film.

Thus, A PV-module uses the light of the sun and provides energy when the sky is cloudy or entirely overcast. The PV-module continues to work even with artificial light, although it delivers correspondingly less energy.

The direct current obtained in this manner is transformed by an inverter into a grid-compliant alternating current and is fed into the public grid by way of a second energy meter and credited to the user.

Best conditions: choose the sunny side

The efficiency of a solar energy system is optimized when the module is positioned facing south and it is set up at a 20–50° angle. However, even under less than ideal conditions, very good results can still be achieved. Note that, depending upon the quality of the design, the energy yield can be strongly influenced by shade (e.g. from nearby trees).

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Photovoltaics from A to Z

Essential terminology

Photovoltaics

The term photovoltaics denotes the process whereby electricity is directly captured from sunlight. This process is also referred to as the photovoltaic (PV) effect. Since 1950 solar cells have been used in space travel, pocket calculators, watches and emergency telephones – but now the vast majority of solar cells are used to capture solar power which is fed into the public grid.

kWp

Kilowatt peak (kWp) is used to measure the power of a PV or solar module or system and to indicate the theoretical maximum output of such a solar system under normal conditions (standard test conditions: 1,000 W/m² insolation, 25°C module temperature, AM 1.5 spectrum).

kWh

kWh – the unit used to measure energy produced – is an abbreviation for kilowatt hours. One kWh corresponds to 1000 watts produced continuously over a period of one hour. It is the same unit which your electricity supplier uses to invoice you for the electricity you have consumed.

Efficiency

The power (product of current and voltage) generated by a solar cell depends on temperature. Higher cell temperatures result in lower output,

thus reducing efficiency. The efficiency (also referred to as cell or module efficiency) indicates how much of the insolation is converted into useful energy. The greater the efficiency of a cell the more power it produces. Efficiency here is first and foremost a measure of the area required and does not directly relate to the quality of the modules.

Example: Module A has an efficiency of 12.5% and produces power in the order of 125 watt peak per square metre. Module B is, technically speaking, identical but has an efficiency of only 10% and produces 100 watts peak. Module A therefore produces 25% more solar power per year with the same size of equipment.

Grid-connected PV-system

A grid-connected PV-system feeds power into the national grid. In most European countries, electricity produced by this kind of system is fed directly into the grid. In these countries, it is credited to the producer at a minimum rate guaranteed by law, which is higher than electricity produced from non-renewable sources. The grid could be compared to a large lake which is fed by many different sources and which provides water for many tapping points (for households, trade and industry). The more solar power is fed into the grid, the “cleaner” the energy lake.

Photovoltaics from A to Z

FAQ

Is it possible to suffer an electric shock from solar modules?

Easily accessible parts of the solar module are, of course, not live. Nevertheless, since the modules are connected in series, dangerous voltages are present. Due to high safety standards, our modules are as safe as other electrical equipment in the household.

How long is the service life of a PV-system?

A PV-module has an average life span of over 30 years. The design life of the inverter is over 20 years. If replacement is required, the unit can be exchanged at a moderate cost and without any problems. Loss of system efficiency can be easily detected and remedied by means of an annual inspection.

Does one need to pay particular attention to maintenance? Are ongoing maintenance costs likely?

Compared to other types of equipment, the maintenance requirements for photovoltaic equipment are extremely low. Even cleaning and care are, as a general rule, not necessary since the rain ensures that the modules remain clean. Small amounts should be budgeted for occasional repair and insurance cover if desired.

Can bad weather damage the equipment?

Any Ecostream system is capable of withstanding even extreme weather conditions. Gales, snow,

harsh frost and even hail usually do not cause any problem. To safeguard against extreme weather conditions insurance cover is recommended which, according to the insurance industry, is hardly ever called upon.

What are the benefits for the environment?

A PV-system with a module surface of approximately 8.5 square metres (corresponding to 1 kWp) reduces CO₂ output by as much as approximately 700 kg per year, which amounts to 14 tonnes over a period of 20 years. Moreover, a system of this size can produce more than one quarter of the electricity required for an average family of four. Also, investment into PV-systems promotes innovative technologies.

What is the best orientation?

Pitched roofs facing south are best. If the existing roof pitch or orientation is unfavourable, the position of the modules can be improved by erecting a support structure.

Generally speaking, all roofs with a pitch between 10° and 50° and a deviation from the south facing aspect of up to 45° can be used without any problem. Even when there are larger deviations, solutions can usually be found. In such cases qualified consultation is strongly recommended.

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TOPICS



Show us your roof and let us take care of the rest

Step 1

Free on-site appointment

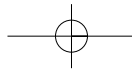
All you need to benefit as quickly as possible from your solar system investment is a large roof, ideally one with a surface area of at least 300 m². Most suitable, of course, are pitched roofs that face south. However, other options are possible, such as flat roofs. You can even use south-facing façades. During a site inspection – with absolutely no obligation on your part – our systems consultant will be pleased to outline a range of economically interesting options.

Step 2

Individual planning

To ensure that your system delivers high yields in the long term, construction, climate, and static conditions need to be taken into account, alongside your personal wishes. Thus, prior to planning and installation, a thorough location analysis is performed. Only then – when all the details have been clarified – do our engineers custom-design your system and select appropriate, optimally fitted components.

To this end, EcoStream works exclusively with leading manufacturers of solar system components, such as Sharp and SMA.



Step 3

Professional installation

Ecostream is responsible for precise engineering and planning, construction surveillance, and final inspection and approval of the installation. You profit not only from the experience of our partner firms – with whom we have carried out numerous projects involving sophisticated installations – but you can also be assured that our expert colleagues will personally supervise the problem-free commissioning of your solar system.

From delivery to installation and connection to the public grid, Ecostream coordinates all of the planning in close consultation with the customer.

Step 4

Reliable follow-up

Our commitment does not stop with setting up your solar system. With the Ecostream service packages we offer tailor-made solutions based on independent external system surveillance. Moreover, we are always at your disposal with expert advice about your system, monitoring, and evaluation of alternative options, and we're ready to answer any questions you may have about maintenance.

Step 5

Solar advantage

We use extremely high-quality components, which virtually exclude the need for maintenance. As long as the sun shines, you can relax and concentrate on the benefits, both financial and environmental, of your new system.

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