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PHOTOVOLTAIC SYSTEMS IN HORTICULTURAL BUSINESS

Requirements, risks, insurance coverage

With check-list!

GARTENBAU VERSICHERUNG

CONTENTS

1. PHOTOVOLTAIC SYSTEMS in horticultural businesses.

A sustainable and cost-effective investment.

Photovoltaic systems (PV systems) have become firmly established in today's world and will develop even more potential in the coming years. At the same time, many horticultural businesses are considering decommissioning their greenhouses for economic or age-related reasons and are therefore looking for alternative uses for them. Investing in PV systems is proving to be highly beneficial for these businesses, not only from an ecological perspective, but also economically.

Good reasons to generate your own electricity with PV systems:

- High purchase prices for electricity
- Concerns about blackouts and the resulting desire for independence
- Electricity production to cover the company's own energy requirements and those of its electric vehicle fleet
- Improved conditions for subsidization under the German Renewable Energy Sources Act (EEG 2023) and promotional loans for electricity and heating from KfW

a) The right location

If you are planning to generate your own solar power, the first questions you need to ask yourself are: What type of PV system do you need? Where and how should it be installed? What type of construction would be most suitable? Most horticultural businesses in Germany looking to install a PV system are planning to install it on existing buildings. However, such an extension needs to be carefully considered. Storage buildings and production halls, cold storage rooms, connecting areas, work aisles, sales facilities and adjoining residential buildings or employee accommodation are particularly suitable locations for installing solar modules. In contrast to agrivoltaic systems, no conflicts arise between “harvesting” the maximum amount of sun from the PV system and the needs of the plants cultivated underneath. In addition, PV systems can now also be installed on water surfaces (rainwater storage tanks).

b) Electricity for your own use or to feed into the grid?

If you are generating electricity for your own use, you can consume the PV electricity during regular date-time operation. However, if the system generates more electricity than can be consumed, you have two options. You can either store the surplus in battery systems for later use or feed it into the public power grid in return for remuneration.

Important information:

Anyone who feeds energy into the public grid is regarded as an energy supplier and must register or deregister this activity with the Federal Network Agency (supplier notification in accordance with Section 5 of the German Energy Industry Act (Energiewirtschaftsgesetz)). This does not apply to suppliers providing household customers with energy exclusively within a customer facility (Section 3 (24a) of the Energy Industry Act), within a closed distribution network (Section 110 of the Energy Industry Act) or via power lines that are not permanently installed.

Marketing tip:

Anyone operating large PV systems in decommissioned greenhouse facilities, for example, can offer the electricity generated for sale, either directly or via a broker, on the European Energy Exchange (EEX).

c) A tricky installation site: The greenhouse roof

If you are installing solar modules on existing greenhouses, special attention must be paid to the load-bearing capacity of the existing substructure. PV systems can be installed on the roofs of buildings in various ways: as so-called **on-roof systems** or as **roof-integrated systems.**

1 On-roof systems

On-roof systems are considered to be the standard form of module installation on house roofs. They can also be installed on greenhouses. However, a few important points must be taken into account. As a rule, production greenhouses are buildings for which a load calculation with reduced load assumptions in accordance with DIN 11535-1 applies. This is in contrast to the standards DIN 1055-4 and 1055-5, which are normally used for building constructions. If PV modules are installed at a later date, this can be problematic due to the special simplified requirements, particularly with regard to snow load-bearing capacity and the areas exposed to wind. However, such simplified requirements for the structural design of production greenhouses are subject to various obligations. Accordingly, a production greenhouse that has a single roof and was built in accordance with DIN 11535-1 with a snow load calculation of 0.25 kN/m² (25 kg/m²) must always be heatable. If a load reduction of the structural calculation is planned, the European standard DIN EN 13031-1 requires heatability to at least +12°C for single roof cladding and at least +17°C for an insulating glass roof. In practice, it has proven impossible to remove a layer of snow from multi-aisle greenhouse systems.

Venlo greenhouses are ideal because they can meet the structural requirements by means of additional fittings. Additional rows of supports can be added to reinforce the existing gutters and thus considerably reduce the load on the structure. It is important to ensure that such retrofits are calculated and installed by professionals, as the structure will have to be able to effectively withstand snow loads as well as tensile and compressive forces in windy conditions.

If the substructure is mounted parallel to the roof over the existing roof covering, experience has shown that the greenhouse structure will be subjected to an additional load of at least 0.15 kN/m² (15 kg/m²). In this case, it is vital to ensure that the minimum static requirements are still met.

2 Roof-integrated systems

Roof-integrated systems can be the better solution for a PV system, due to the fact that the old roof covering is removed and replaced with PV modules. As a result, the substructure is subjected to less load. In other words, there are few to no limitations from a structural point of view. Other advantages include the fact that snow loads can be melted through heating and roof cleaner machines can continue to be used.

Important information:

When planning (larger) systems on (decommissioned) greenhouses, the local building authorities should always be consulted! Depending on the federal state, different regulations apply.

d) Installation on permanent structures

Production halls, garden centers or other permanent buildings are considered unproblematic locations for the installation of PV systems. Such buildings are subject to the building construction standard as per DIN 1055-4 and 1055-5. A standard snow load calculation of at least 0.75 kN/m² (75 kg/m²) therefore applies to them. Once the PV modules have been installed, the load must under no circumstances fall below 75 kg/m², so there must still be reserves in the structural calculation. This means that if a PV system is installed on a building with a maximum load-bearing capacity of 75 kg/m², this amounts to an additional load of approx. 15 kg/m², with the result that the building could only bear 60kg/m² of snow, which is not allowed!

Any measures taken that affect the stability of the greenhouse or other buildings should be checked and certified by a structural engineer.

2. DAMAGE RISKS for PV systems.

Protective measures and prevention in the event of storms, fire and other hazards.

1 Hail

Risks: Thunderstorms with hail pose a serious hazard for PV systems. Most PV modules are certified according to the IEC 61215 standard (terrestrial crystalline silicon PV modules) and IEC 61646 (terrestrial thin-film PV modules). These each require a hail impact test with hailstones of 2.5 cm diameter. For areas at greater risk of hail, such as southern Germany, modules of resistance class 4 or 5 are recommended. This means that hailstones with a diameter of 4 to 5 cm do not cause any significant damage. With regard to hail damage to modules, a distinction is made between visible and invisible damage. The latter can be small hairline cracks, for example, which are not visible to the naked eye. They can be made visible with the help of electro-luminescence analysis or a thermal imaging camera.

Gartenbau-Versicherung covers the costs of these analyses as loss locating costs for the PV systems we insure.

After a storm:

After a hail event, owners should always examine their PV modules for visible damage. Cracks or fissures in the glass cover indicate that water has most likely also penetrated the module. In such an event, there is a risk of short circuiting, so the system should be disconnected from the mains immediately. A specialist company should also be contacted as soon as possible so that repairs can be carried out promptly.

2 Storm

Risks: Storm risks vary depending on the region. One of the critical elements here is the way the PV system is mounted on the supporting structure. In many cases in German horticulture, do-it-yourself constructions are used to install them on the greenhouse roof. The risks arising from storms can therefore generally be classified as high. They are particularly attributable to the increased areas exposed to wind and the resulting compressive and tensile forces. These have an effect on supports, gutters and also on glazing bars and wind bracing. By contrast, modular systems inserted into glazing bars (roof-integrated systems) are much less vulnerable. However, care must be taken to ensure that the gable and standing wall glazing is carried out to a professional standard and that the modules are carefully installed into the glazing bars. The latest generation of PV systems provides a higher energy yield because the solar modules automatically align themselves with the position of the sun. The disadvantage, however, is that they are much more vulnerable to storm damage. They are therefore not used on roofs in German horticulture.

After a storm:

Just as after hail events, it is important to check the system after heavy storms, and particularly to make sure that the installation is still securely in place.

3 Snow and ice load

Risks: One of the greatest risks for PV systems are loads caused by snow and ice. For various reasons, buildings with a reduced snow load, such as most production greenhouses, are particularly at risk. On the one hand, the building must be able to withstand **multiple loads** – consisting of the modules and the substructure (where applicable). On the other hand, snow loads **cannot be melted by means of heating** in systems with a substructure. The reason for this is that the PV modules, on which the actual snow load lies, are some distance away from the roofing material. Moreover, one cannot be certain that fallen snow will always slide off the modules into the gutter. Even if it does, there are considerable point loads in the area of the gutters and the lower panes.

Protective measures:

Normally, it is better to leave the snow on the modules, as snowfall only occurs during the lowest-yield period in winter anyway. If you do want to clear snow from roof systems, you should purchase special PV clearing tools that make it unnecessary to walk on roofs. For multi-aisled greenhouses, snow shafts should be included through which the snow can slide into the interior.

4 Fire

Risks: Fire is always a **major risk** for PV systems. Horticulture businesses are no exception. Fires are very rarely caused by parts of the PV system itself (inverters, modules, storage). However, past experience shows that there is a high risk of a large fire breaking out in horticultural businesses, depending on the fire load. Unfortunately, a major fire often causes the PV system to suffer a **total loss.**

Protective measures:

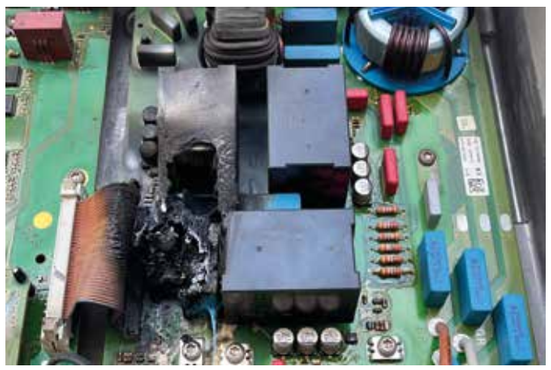
In order to prevent a small fire from spreading, fire detection and specific fire extinguishing systems are necessary. Networked systems are ideal.

5 Lightning strike / overvoltage

Risks: Lightning poses a considerable risk to the modules and the connected electrical components, such as inverters. A lightning strike not only has a significant impact on the electrical system, but often also causes fires. An **overvoltage** can also travel through the power grid.

Protective measures:

Overvoltage protection is therefore absolutely essential. Without it, damage can occur to the inverter. Lightning and overvoltage can cause considerable financial damage to PV systems. Horticultural businesses are often located at the end of a supply line due to their usually exposed location. This means that they are subjected to the full destructive force of overvoltage surges. In order to reduce the risks of overvoltage, it may be advisable to connect the PV system to a transformer station. There are various ways to gradually reduce overvoltage waves and lightning using protective devices. Lightning conductors are rarely feasible for greenhouse complexes and are also not practical on grounds of cost.



6 Theft/vandalism

Risks: If the horticultural business‘s PV systems are located in the immediate vicinity of residential buildings, the risk of theft decreases, but nevertheless exists. While PV systems on roofs are less at risk of theft and vandalism, ground-mounted systems and agrivoltaic systems installed at low levels in open areas are at considerable risk.

Protective measures:

To protect against theft or vandalism, **fences with anti-climb protection** and **video surveillance systems** are required by many insurance providers. Other protective devices are also available, for example by securing the modules with **special bolts.** The longer the perpetrators need to dismantle the system, the greater the risk of being discovered. We also recommend attaching a special marker to modules and inverters. This should be applied to the object in question in a way that makes it difficult to remove. Such procedures are referred to as **“artificial DNA”**. In addition, there are also special alarm systems for PV systems.

7 Business interruption

Risks: In addition to the risks described above due to forces of nature, technical defects and criminal acts, operators of PV systems have to bear **losses due to business interruption.** The fixed costs for interest and repayment must also continue to be met.

Protective measures:

Financial burdens of this kind following a damage event should not be underestimated. However, they are included in the insurance cover offered by Gartenbau-Versicherung as part of the **HORTISECUR** product. Longer downtimes must also be factored into your calculations. This is due to the fact that the procurement of components may be delayed as a result of high demand. The delivery time for new transformer stations, for example, can be more than a year.

3. SAFETY AND MAINTENANCE

Professional installation and regular maintenance contribute to ensuring a long service life for the system.

To prevent damage before the system is actually put into operation, the installation and the electrical connections should be carried out by a specialist company. It is, for example, essential to ensure that the polarity is correct when connecting the systems. If this is done incorrectly, this can result in serious damage to the horticultural business‘s electrical equipment. Regular inspections and maintenance are essential to ensure that the systems run reliably and safely for as long as possible. Visual inspections should take place at least once a year and after special weather events (see chapter 2). These can be carried out by the horticultural business itself. Alternatively, a specialist company can also be commissioned to carry out inspection/maintenance.
A commercial or agricultural business must arrange for an E-Check-PV to be conducted at least every four years. In addition to the visual inspection, further checks and documentation must be carried out.

These include:

- Electrical function measurements
- Photographs with a thermal imaging camera
- Creating a maintenance log

An e-check of this kind also proves to the insurance company that the PV system is in perfect condition. Systems that are more than 20 years old pose an increased risk of fire due to wear and tear, component failure and cable breaks. Modules that were fitted with unsuitable polyamide or PET back sheets between 2010 and 2012 can pose a particular risk to life and limb from electric shock due to the fact that the modules lose their insulation capacity. Corrosion of cell connectors, chalking, delamination, cracking or brown discoloration are signs of such an uninsured material defect. The problem is that spare parts for old systems are difficult to obtain or in some cases no longer available at all. This can mean that it may be necessary to carry out expensive retrofits.

Service life of inverters & storage systems

Experts estimate the average service life of crystalline PV cells to be 30 years. Inverters only last half as long on average, due to the fact that electrical stress causes continuous wear and tear. To ensure that its service life is as long as possible, the inverter should be installed in a dry, dust-free location in which there are no major temperature fluctuations.
An electricity storage system has an average lifespan of 15 to 20 years, but this depends to a large extent on the number of charging cycles. These battery systems also need to be installed and connected professionally.

Temperatures between 10°C and 25°C and moderate humidity are ideal. Concerns about storage system fires, which may have arisen due to reports about battery fires, are unnecessary. Fires in storage systems caused by mechanical damage, wear and tear or incorrect handling are relatively rare.

4. Other *USES* of PV systems.

In addition to the PV systems commonly used today, there are other forms of use that could become increasingly interesting in the future. These include floating solar parks, known as aquaculture photovoltaics (aqua-PV), and agrivoltaics (agri-PV).

Water surfaces (rainwater storage tanks) are often available, especially in larger horticultural businesses. These can be used for aqua-PV (also known as floating photovoltaics (FPV)). A substructure with the PV modules is mounted on an anchored floating system. Such floating solar parks are said to have great potential. As BayWa r.e., a leading company in the field of the development of floating PV systems, reports, it will soon be possible to build floating PV systems for areas of 50 hectares or more in southern Europe without subsidies or state funding.

The advantages of this type of power generation are:

- less water evaporation
- reduced algae growth in the tanks thanks to the sha de provided by the modules
- higher electricity yield due to reflection on the water
- improved system performance due to the cooling effect of the water
- no additional land consumption
  In Europa befindet sich eine der größten FPV-An lagen in den Niederlanden. Eine der derzeit größten Floating-PV-Anlagen in Deutschland hat BayWa r.e. für die Quarzwerke GmbH in Haltern am See auf einer Fläche von knapp 1,8 Hektar realisiert.

Agri-PV is also currently gaining in popularity in Germany. This term refers to the dual use of agricultural land. This means that the land in question is used for both crop and electricity production

The first projects of this kind are also underway in fruit orchards in Germany, for example at Lake Constance, in the Rhineland and in Westphalia. The stability of such ground-mounted systems must also be ensured, taking into account all the components (modules, substructure, foundation and mounting fixtures). This means that a structural analysis must also be provided. In addition, the inverters of such systems must be housed in weatherproof buildings or at least protected against corrosion.

5. INSURANCE COVERAGE

Gartenbau-Versicherung insures its members against material damage to PV systems. This type of insurance cover is possible for PV systems on residential buildings, greenhouses with retail facilities, production halls, cold storage rooms, connecting areas or even (old) production greenhouses and agrivoltaic systems. It is advisable to carry out a structural analysis of the buildings including all additional PV systems installed on the buildings (on-roof systems). In the case of roof-integrated systems, the decisive factor is which roofing material (e.g. glass, plastic sheets or hard roofing) is removed and how thick the single-pane safety glass of the PV modules is. A replacement of this kind usually results in no or only very little additional load. Such systems can often be insured in consultation with Gartenbau-Versicherung specialists without the need for a new structural analysis.

Before a PV system can be insured, an individual inspection of the system is conducted. This is carried out on site by Gartenbau-Versicherung‘s field staff assisted by their specialist colleagues in the office.

Depending on the type of construction, a risk assessment is carried out in order to possibly be able to directly minimize the risk. When planning the system, it is therefore a good idea to already involve Gartenbau-Versicherung‘s experts in the projection planning stage. This enables them to pass on their experience and take into account any special features of the existing buildings or of the installation on the greenhouse that may arise.

Comprehensive risk package

Insurance cover includes all components necessary for the operation of the system, such as modules, substructure, inverters and cabling, transformer systems, storage systems and wallboxes. Our comprehensive risk package also includes compensation for business interruption.

The situation in other countries

Many new and particularly large-scale installations of PV systems can be found in France. There, energy companies often lease agricultural land, build greenhouses with PV roofing on it and offer them to horticultural businesses for crop production. The European standard EN13031 poses a problem here, as it is only defined for agricultural production with a theoretical service life of 15 years for greenhouses.

However, the significantly longer service life of PV systems means that they are of much greater economic interest.

The increase in the number of PV systems in Italy is rather modest. However, interest is growing there due to rising energy costs. A boom was recorded in 2010/11, driven by government subsidies available at the time. Currently, smaller systems are mostly installed on permanent buildings operated by horticultural businesses.

6. CHECKLIST photovoltaic on greenhouses / buildings

Is my location and/or the alignment of the buildings suitable for a PV system?

☐ Yes ☐ No ☐ Not sure

What type of PV module installation is feasible?

☐ Roof-integrated ☐ On-roof

For existing (older) greenhouses: Have the structural requirements been checked?

☐ Yes ☐ No

Does the conversion of the greenhouses / buildings have to be reported to the building authorities?

☐ Yes ☐ No ☐ Not sure

Has an application been made for connection to the power grid?

☐ Yes ☐ No

***Alternatively:* Are my electrical installations designed correctly for the consumption of self-generated electricity and is there sufficient storage capacity available?**

☐ Yes ☐ *No*

Has an economic efficiency calculation been carried out by an independent partner?

☐ Yes ☐ No

Have I already contacted my Gartenbau-Versicherung risk advisor?

☐ Yes ☐ No

Module selection

- Only use certified modules!
- Make sure they are hail-resistant!

Installation

- Observe correct cable and module installation as well as fire and lightning protection!

Operation

- Insure the system!

For further detailed information, please also refer to the “Safety regulations and underwriting policy for the insurance cover of PV systems on greenhouses” published by Gartenbau-Versicherung VVaG.

These are available for download at www.gartenbau-versicherung.de

Your personal risk consultant in the field will be happy to advise you - please contact us!

Gartenbau-Versicherung VVaG
Von-Frerichs-Straße 8
D-65191 Wiesbaden

Telephone: +49 611 5694-0
Telefax: +49 611 5694-140
Email: service@gevau.de
www.gartenbau-versicherung.de
An AgroRisk Group company

Author: Klaus Bingel
Klaus Bingel is a qualified gardener and horticultural engineer. He has been working as a risk consultant at Gartenbau-Versicherung since December 1995 and is responsible for horticultural businesses in the regions of Münsterland, Osnabrücker Land and southern Emsland. His tasks include providing advice on insurance cover, risk management and claims settlement.

Editing: Christine Schonschek
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