Connecting energy for a stable supply

A stable power supply is the focus of current energy debates. The ultimate target is to become independent from fossil fuels. However, the change from a few centralised energy producers to many decentralised ones means a complete reorganisation of the power grid, which has existed in this form for over 100 years, something that isn't entirely without risk.

The change to decentralised energy production carries many risks, not least that grid stability could be jeopardised. To avoid this scenario, the decentralised plants must contribute to grid stability in two main ways. On the one hand, autonomously based on the available amount of energy produced in conjunction with the grid frequency, and on the other, centrally controlled by grid control centres, mostly aimed at regulating the active power.

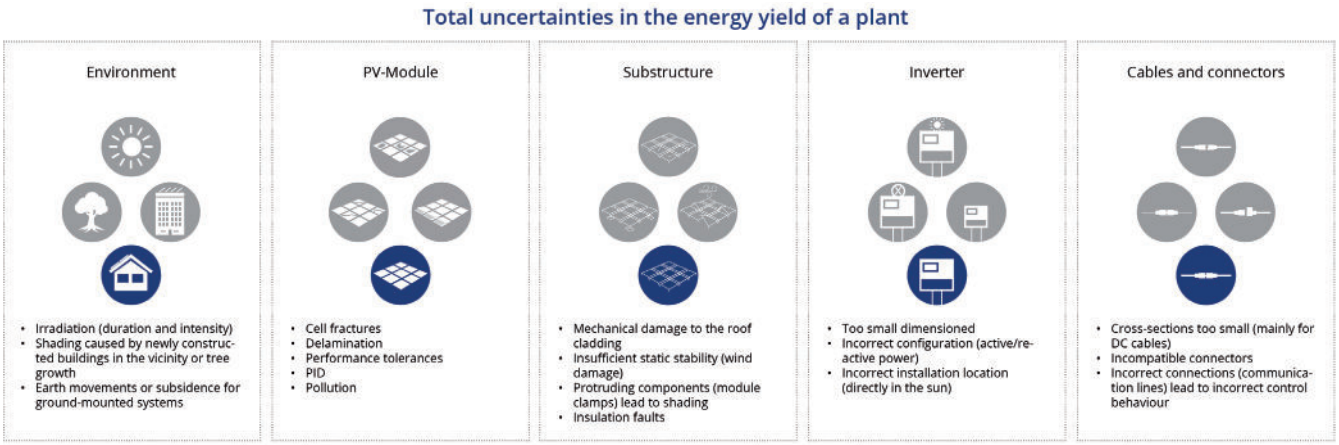
Decentralised generation plants, together with corresponding battery storage systems, offer very reliable control and regulation options. On the plant side, the control and regulation capability are provided by so-called energy monitoring and management solutions. These systems take over a wide range of important functions of a PV system.

First and foremost, of course, it must be ensured that the expected yields of a PV system are actually achieved. This, in turn, is a core function of energy monitoring and management systems. These calculated yields are not only relevant for the plant operator, but also for grid stability. They have been firmly calculated into the quantity calculation of the demands.

The Solar-Log energy management system shows exactly how these solutions look and function. With its many years of experience, this provides reliable solutions for both the national and international PV market.

Avoid yield losses with professional PV monitoring

The smooth operation of a PV system should always be ensured to avoid yield losses. This can only be achieved for existing and new systems with seamless monitoring of the system components. The tasks of the monitoring system are to identify problems immediately and in a targeted manner and to report them immediately with concrete statements on possible optimisation measures.



We can substantiate these diverse influences with direct examples, for this we use the CPN method (Cost-Priority-Number, financial influence on the system yield):
Module - Delamination à 3.59 EUR/kWp, Inverter - Overtemperature à 1.64 EUR/kWp, Cabling - Different connector types à 0.39 EUR/kWp

The causes for such disturbances and system failures are manifold. From the failure of individual modules, for example due to lightning, cable and glass breakage, or hail damage, to complete failure, almost anything is possible. Particularly critical are so-called creeping power losses, since they are usually discovered late without monitoring. These are caused, for example, by soiling of the modules or growing shading, perhaps from a tree growing in the garden. In addition, there are influences on the modules themselves that gradually reduce the performance of the system. These include, for example, so-called vicarious micro-cracks at cell level or potential-induced degradation (PID).

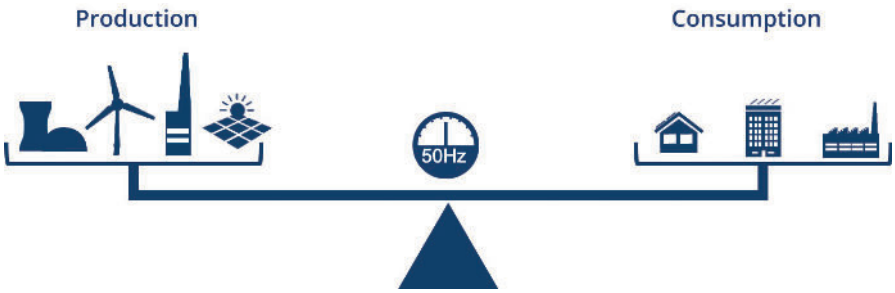
However, PV modules are not the only sources of plant malfunctions and yield failures and thus financial losses. The power electronics of inverters or DC-DC optimised inverter systems can be the source of plant disturbances. Thus, on the basis of recognised field investigations, it can be stated that far more than 50% of all causes of faults and thus of the possible yield losses of a PV system can be traced back to the two components PV modules and PV inverters.

Seamless PV monitoring system

The Solar-Log system consists of coordinated hardware and software. The hardware records the data and delivers it to the software. The so-called Solar-Log WEB Enerest 4.

The Solar-Log™ system monitors the photovoltaic system and detects faults, such as the failure of an inverter, before they become a permanent problem. For a complete overview, the status and error codes of the individual inverter manufacturers are permanently recorded and saved in the event log. The Enerest ToGo App displays the deviations directly.

To recognise whether the photovoltaic system is working trouble-free and efficiently, the power of the inverters is compared. The Solar-Log™ works with the kWp power, the normalised power of the inverters, to compare inverters of different sizes. With multi-tracker inverters, the Solar-Log™ can detect deviations down to MPP tracker level.



How the grid operators ensure the balance of the power grid, for voltage and frequency. The aim is to keep supply, that is the production of electricity and demand, or the consumption of electricity, in balance

Feed-in management simply implemented

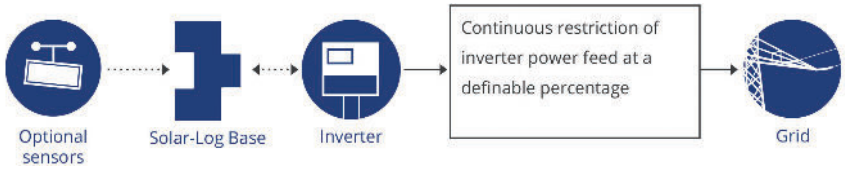
The collection of system data is the cornerstone for intelligent energy management. One component of this is the so-called feed-in management of decentralised energy producers and consumers. It makes it possible to switch more quickly to renewable, decentralised power generation. Other measures, such as grid expansion and the construction of energy storage facilities, are more likely to be implemented in the medium term.

Feed-in management enables decentralised electricity producers to feed in their electricity and the utilities to ensure the necessary stability of the electricity grid. In order to stabilise the power grid even on critical days, there will be new requirements for grid stability in the medium term in all countries that provide larger capacities of decentralised power generation.

Figure 1 shows how the grid operators ensure the balance of the power grid, for voltage and frequency. The aim is to keep supply, that is the production of electricity and demand, or the consumption of electricity, in balance.

Limited feed-in (x %)

A central function is the limitation of the feed-in to the grid. In many countries, fixed or dynamic power limits are now prescribed. This limit can be set flexibly with the energy-management system for different threshold values. Thus, different requirements, such as 70% regulation, 50%, or 60% regulation for storage promotion, 0% regulation in Spain, etc., can be served.



A central function is the limitation of the feed-in to the grid

Control with self-power consumption offsetting

This function offers the possibility to minimise losses caused by x% control. The current consumption is measured for the control. The Solar-Log™ offsets this with the current production of the inverters. Only if the difference between production and consumption exceeds, for example, 70% of the module power, the inverters are regulated accordingly.

For implementation, a meter is required that determines the consumption directly in the consumption branch.

Feed-in management with ripple control receiver

Another variant for feeding PV electricity into the grid in a controlled manner is 'simplified feed-in management', which is usually implemented using a ripple control receiver. For this, only the current own power consumption must be measured by a separate consumption meter.

- The signals for active power reduction are usually output via a ripple control receiver.
- The Solar-Log MOD I/O has an additional interface for potential-free contacts.
- Up to two ripple control receivers, one for power reduction and one for reactive power control, can be connected to this interface.

Control of PV systems on the medium-voltage grid using Germany as an example

In Germany, PV systems that are connected to the medium-voltage grid are subject to extended requirements. The various regulations that may be applied in a system are bundled in VDE-AR-N-4110 (VDE-4110).

As a rule, in addition to the type of control of the PV system, it is also stipulated that various information about the current status of the PV system must be made available to the energy company.

Communication with the energy company is implemented via telecontrol systems. The signal transmission between the telecontrol system and the Solar-Log Base normally takes place via a Modbus/TCP interface. In addition to the control of active power, the control of reactive power is a particular technical challenge.

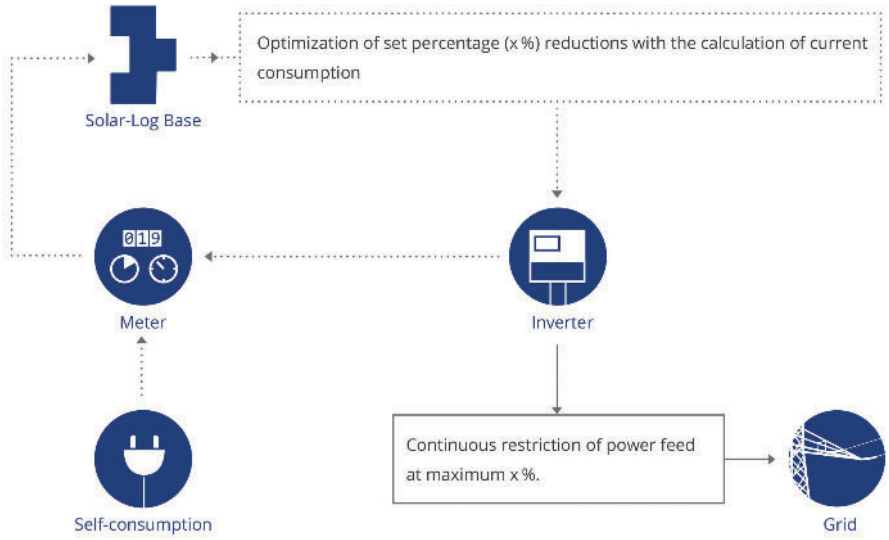
The VDE-4110 provides for various voltage or power-controlled concepts here. The voltage-guided reactive power control requires a measurement at the feed-in point, for which a meter (Utility Meter) approved by Solar-Log GmbH is required.

Various options for transmitting commands and feedback between the Solar-Log™ and the grid control centre.

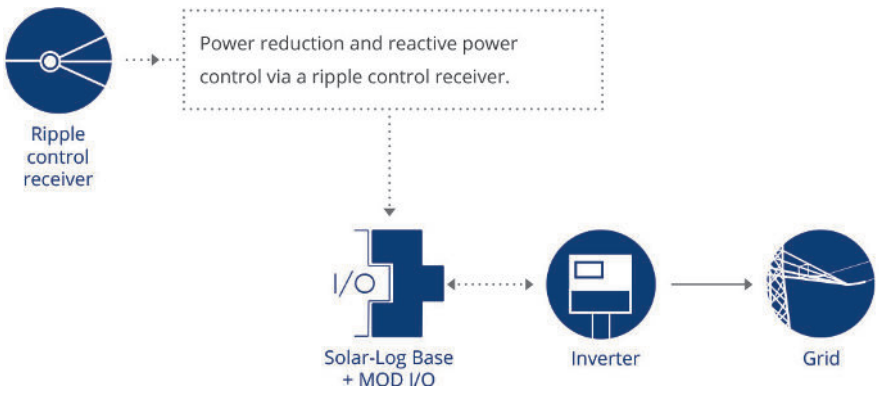
Clever use of self-generated electricity

In addition to feed-in management, the use of self-generated electricity is another pillar of energy management. This helps to better integrate decentralised plants into the existing energy infrastructure.

Solutions for the use of own electricity are offered, for example by intelligent heating with PV electricity. Solar-Log™ controls and supplies the heat pump, the heating element, or your charging station with surplus energy from your photovoltaic system. Thanks to the Solar-Log™ Smart Energy logic in conjunction with a variety of compatible devices, you can implement a wide range of applications. The basis here is the networking of the photovoltaic system with flexible consumers in order to locally optimise self-consumption.



For the control with self-power consumption offsetting, a meter is required that determines the consumption directly in the consumption branch



Another variant for feeding PV electricity into the grid in a controlled manner is 'simplified feed-in management', which is usually implemented using a ripple control receiver

Benefits of an energy management system for commercial and industrial customers:

With zero-feed-in, self-consumption control, peak shaving, and charging control for e-charging stations, you have a smart energy control system at the grid transformer.

You gain transparency about your energy consumption and energy production.

If required, Solar-Log Base can be easily extended with additional interface modules.

You fulfill the required certifications for the grid connection.*

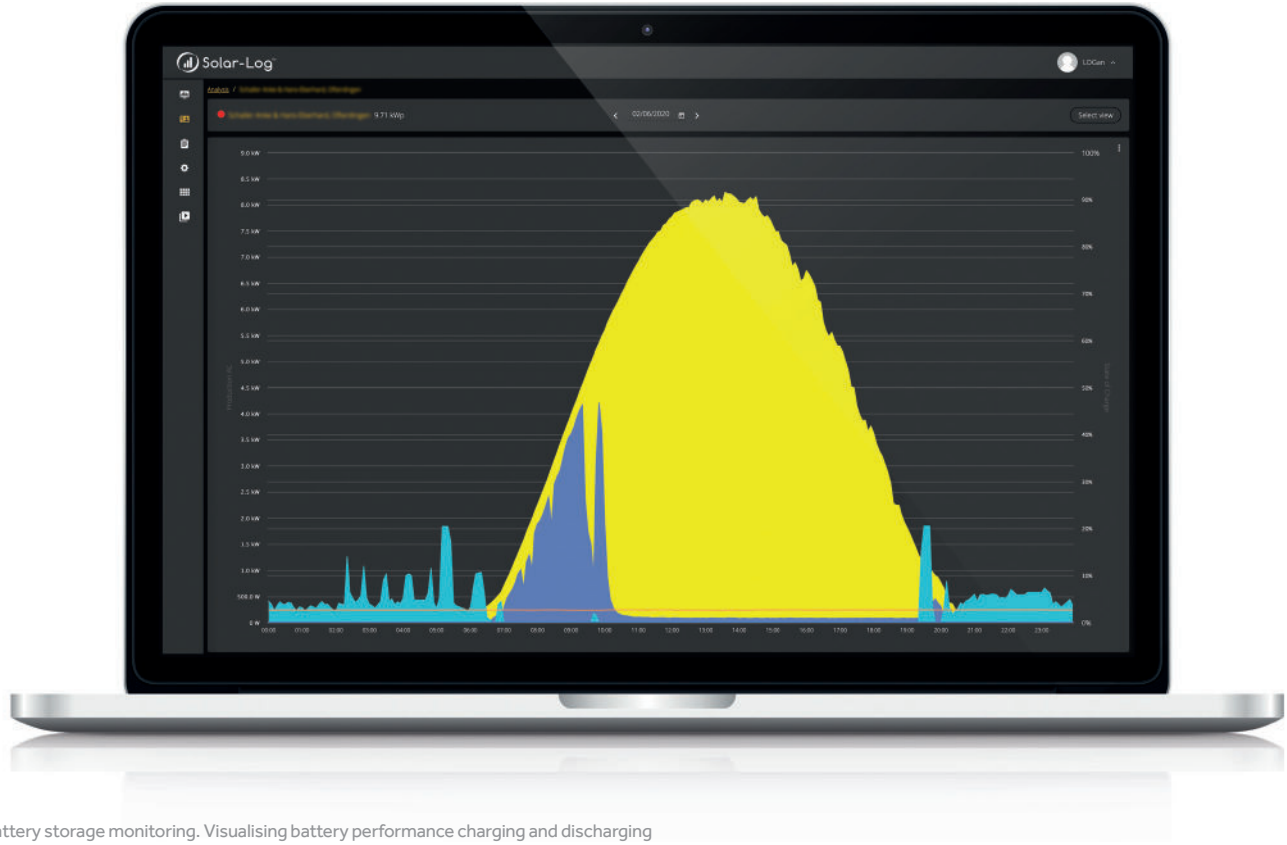
You get a complete and reliable monitoring of your investment, so that you reach your energetic and financial goals, with a maintenance-friendly all-round carefree service, which has access to your plants worldwide.

We will provide you with comprehensive training to build expertise.

We will also be happy to monitor your system for you.

* According to the currently available certifications of the Solar-Log products, for more details: www.solar-log.com

These systems make a significant contribution to optimising self-consumption of electricity.



Battery storage monitoring. Visualising battery performance charging and discharging

The intelligent energy management system

The menu structure of the Solar-Log™ enables intuitive operation. Thus, intelligence can be controlled and prioritised in and taking the surplus into account. Different energy profiles and components can be linked and checked based on the simulation.

Visualising battery performance charging and discharging

In addition to direct consumption, another use of self-generated electricity is storage in battery storage systems.

They are the ideal solution for storing PV electricity and making it available for self-consumption. These systems make a significant contribution to optimising self-consumption of electricity. In the balance view, the battery storage system functions either as a producer or as a consumer and is displayed accordingly.

In conclusion, a manufacturer-independent monitoring and energy management system not only supports the plant owner in getting the most out of his investment or in supporting grid stability by means of sophisticated control and regulation options, it also helps by providing a variety of added values.

Benefits of an energy management system for installers

Manufacturer-independent system with maximum compatibility to third-party systems and loggers.

Flexible hardware and software modules for a customised system solution.

Simple plug & play ensures smooth commissioning.

With our solutions, you can coordinate the various smart energy systems with little effort via standardised interfaces.

Our innovative Solar-Log WEB Enerest™ 4 offers you the possibility to analyze errors highly efficiently, to detect malfunctions, and to delegate error messages as quickly as possible.

With our services and support, you gain important time for your customers.

www.solar-log.com