



Independence with Sunny Island



Grid-connected storage systems for increased self-consumption



SUNNY ISLAND – AN ALL-IN-ONE SOLUTION INCREASING INDEPENDENCE

Simply take a look at Germany's rooftops and you're bound to find one thing for certain: Photovoltaics has been playing an increasingly important role in the country's energy supply. However, at the same time, the markets are changing. Due to the reduced feed-in compensation for renewable energy, system operators are no longer yielding high profits by feeding PV power into the utility grid alone. And during lunchtime, when PV systems typically feed the most current into the utility grid, the public transmission line sometimes reaches its capacity limits. As a result, there is an excess supply in the electricity markets. This simply does not make sense, not just from an economic perspective but from an environmental perspective. If we are truly supposed to make an energy transition, we will need a significantly more flexible energy supply.

Solutions that enable system operators to maximize their use of the PV power they produce provide a huge step in this direction. After all, a truly sustainable energy supply is one where solar energy is generated and consumed at the same location while simultaneously building a reserve energy supply for evening and overnight use.

Harvesting and Conserving the Sun

A roof PV system that is designed to maximize your use of solar power creates incredible added-value for your household. Increased self-consumption creates independence from energy producers and rising electricity prices as the PV power that you yourself generate is considerably more cost-effective than the electricity you purchase from energy suppliers, which ultimately leads to more freedom and a better

quality of life. Whoever takes up gardening as a hobby reaps the improved quality of life from growing their own products and knows the feeling of freedom from market prices that bringing in their own harvest creates. Conserved or frozen fruit and vegetables from your own garden put this feeling back on your plate time and time again. This is also how increased self-consumption works. A rooftop PV system generates the solar power that is then consumed in the household. Excess solar energy is "conserved" in the battery for later use. Washing machines, ovens and computers can be operated using the energy produced on your own roof. This allows everyone to shape their own personal energy transition. A number of small steps become a huge step towards a sustainable energy supply in towns, cities and countries. Grid



operators also benefit from increased self-consumption as it reduces the load placed on the utility grid and reduces transmission losses.

All-in-one Solution

Decentralized storage system solutions for increased self-consumption absorb excess solar energy during high production times and provide it for later use as needed. These consist of a PV system, a battery, which includes a battery powered inverter, and intelligent energy management. The Sunny Island 6.0H combined with an SMA PV inverter and Sunny Home Manager offers a system solution to increase self-consumption. In doing so, we are combining our proven global core competencies in grid-connected PV inverters and off-grid inverters. Ultimately, the requirements that

off-grid systems place on the system technology also apply to grid-connected systems:

- Grid supporting features for the PV system
- Adjustable PV power and fast power control when there is excess of PV energy
- PV energy storage for evening and night use
- Intelligent management for generation or consumption

Sunny Island is the solution for everyone who wants greater independence from energy suppliers and rising electricity prices. Increased self-consumption with Sunny Island turns the energy supply of the future into child's play while simultaneously contributing to sustainably harnessing energy

resources. Those who grow fruit in their own garden undoubtedly enjoy it more than off-the-shelf fruit and vegetables. And the fact that tomatoes, cucumbers, strawberries and apples are grown in their garden and not simply found on a shelf at the super market gives children a greater understanding of where their food comes from. Sometimes it's little changes that make a huge difference.



FLEXIBLE FOR MAXIMUM FREEDOM

The Sunny Island 6.0H is ideal for people who are striving to be as independent as possible and want to be actively involved in shaping their own energy supply. This is true both for new systems and for system operators who would like to retrofit their existing PV systems to further emphasize self-consumption. After all, the battery-powered inverter fits for all PV-plant sizes, PV inverters and battery types.

Just like the hobby gardener determines how much he plants in his flower beds, we give system operators the opportunity to design the self-consumption system to precisely meet their needs. After all, a household's energy demand changes over time, for example, it increases when the family grows and decreases when children leave

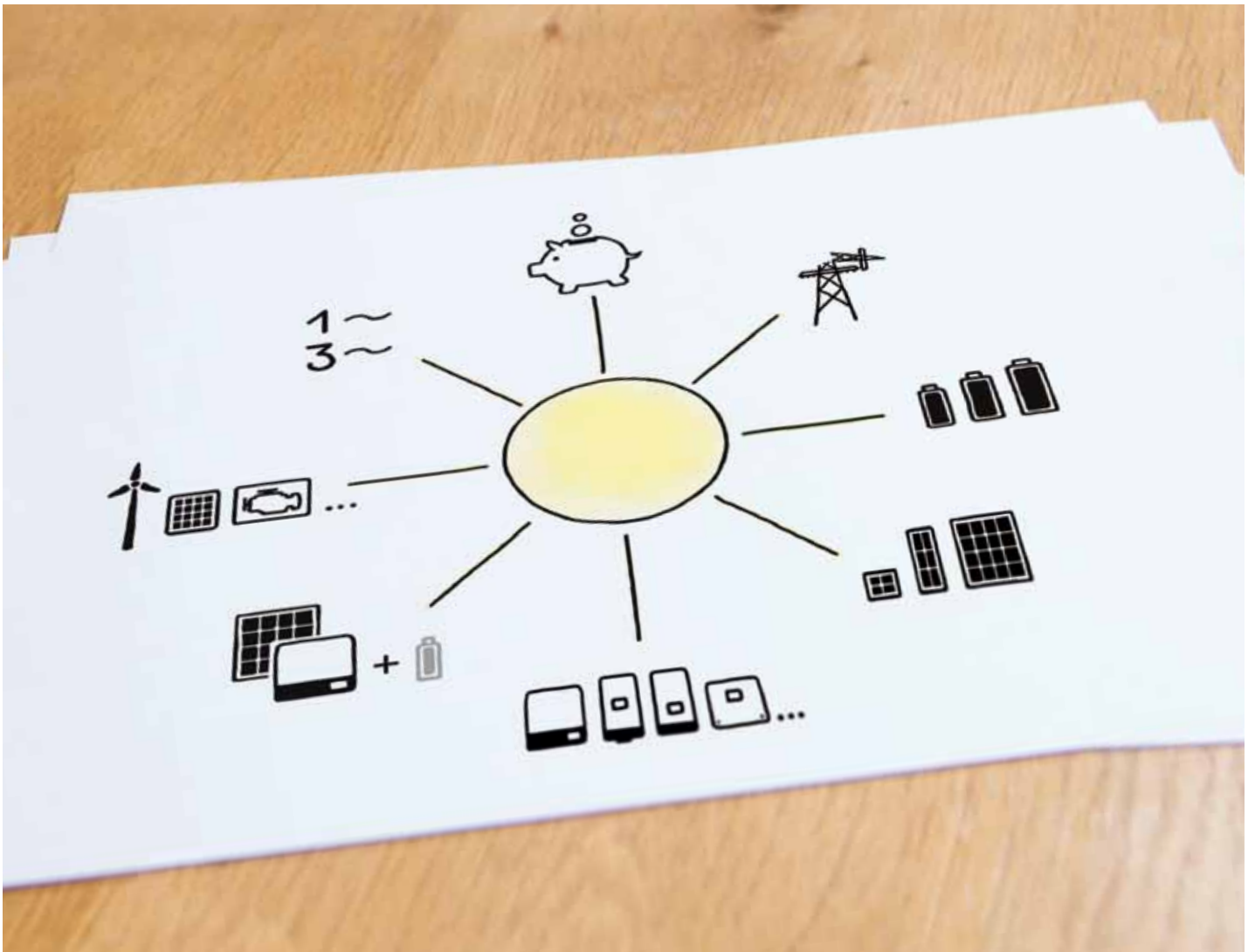
home. A decentralized storage system equipped with Sunny Island offers the flexibility needed to meet changes in electricity needs.

Anything Is Possible

Sunny Island system technology is not designed solely with photovoltaics in mind. Depending on local conditions, other renewable energy sources, such as small turbines, hydropower or CHP plants, can also be integrated into the storage system. CHP plants, in particular, can prove a meaningful addition for winter months that demand a lot of heat. This allows users to avoid additional energy costs.

In terms of savings, Sunny Island makes it possible to reduce the need to purchase

electricity in your own home for all three phases. Thus, you don't need to rely on only one phase, it is simply enough to financially offset generation and consumption in the overall system. Consumption in one phase can be offset by generating power in this phase or any other phase. And this holds true even if the storage system only comprises a single-phase design. The system can be easily expanded to three phases. Sunny Island has the best solution for every need.



Self-Sufficient with Sunny Island



Greater independence from energy suppliers and increasing electricity prices.



Choose the PV inverter size and type.



Greater independence from the electricity grid – when the utility grid fails, the Sunny Island sets up a separate grid. The necessary software update will be available in third quarter 2013.



Excellent for new PV systems and retrofitting.



Choose the battery size, type and manufacturer.



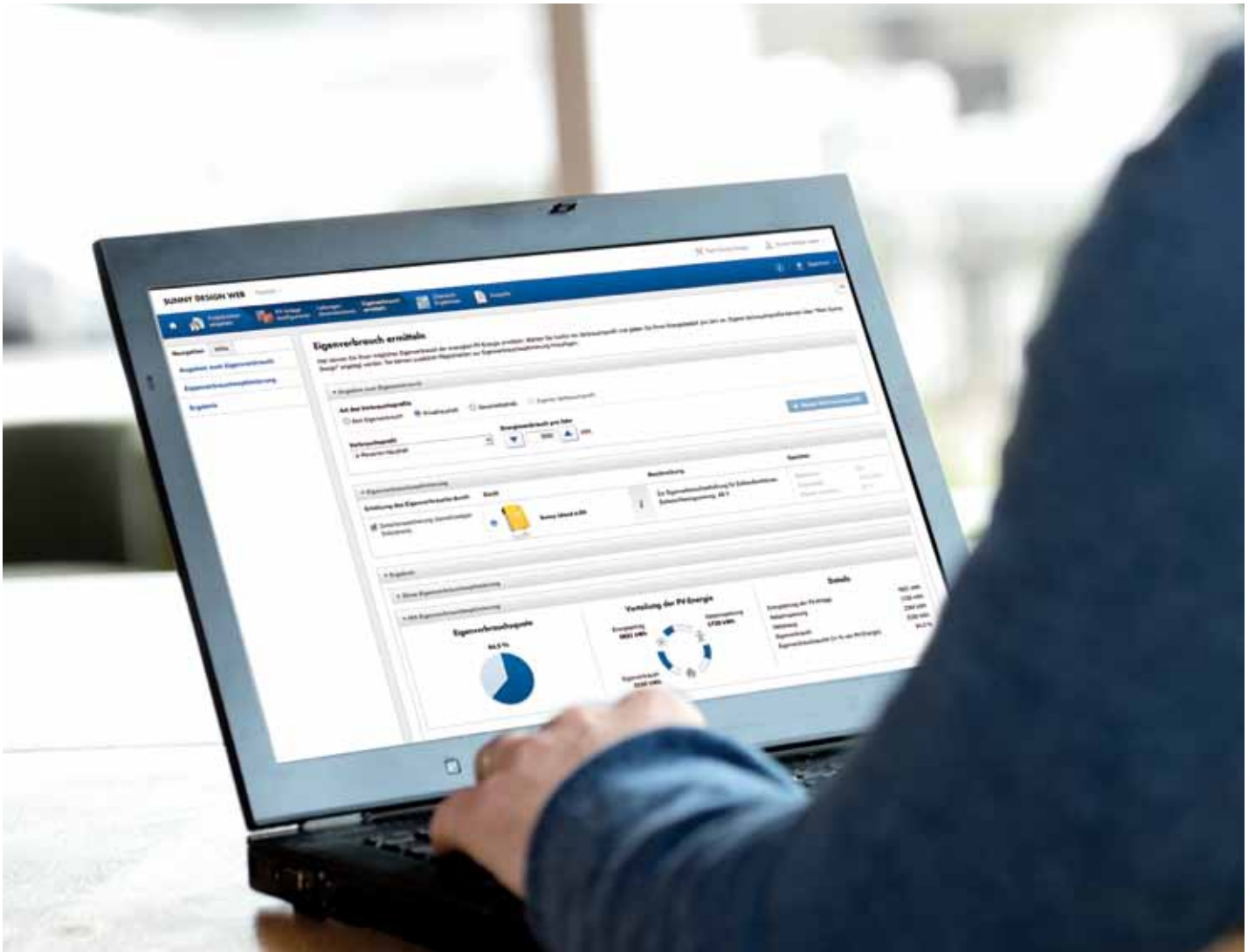
Integrate renewable energy sources.



Choose the PV system size.



For single-phase or three-phase installations.



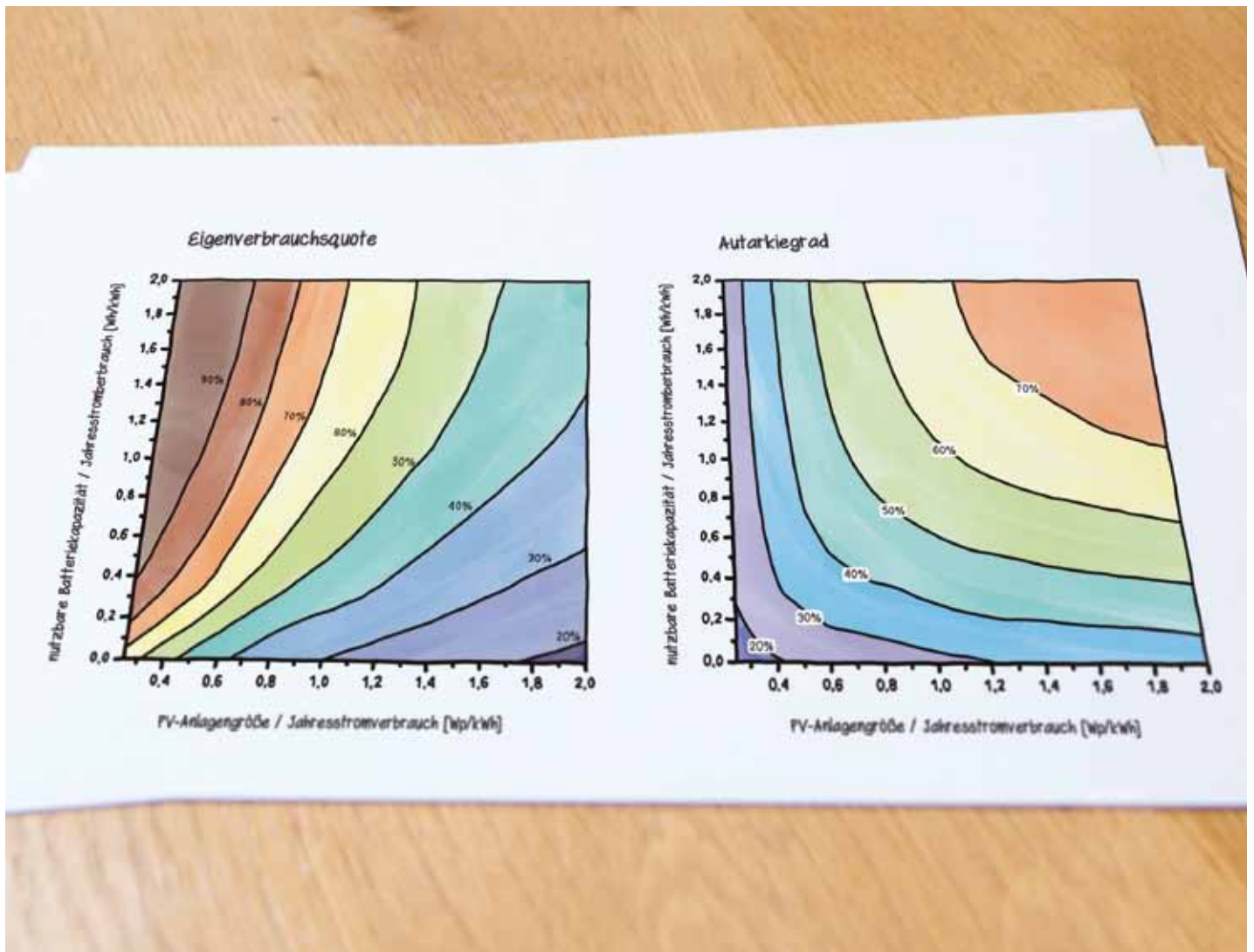
EASY TO USE EVERY LAST DETAIL COVERED

A hobby gardener's plan is simple. They sow seeds and plants, water, harvest and conserve as needed. The same also applies to a household self-consumption system. It should always be as easy as possible to work with, for system operators as well as for installers and system designers. This is exactly what we've done. The Sunny Island was designed to increase self-consumption and with its OptiUse operating concept it makes installation, commissioning and daily use incredibly user-friendly, regardless of who that user is. For installers, we simplified system planning using the web version of our Sunny Design planning software. In only a few steps, they can customize the PV system including the storage system and forecast a customer's potential self-consumption. And the easy-to-understand planning guidelines facilitate comprehen-

sive consultation services in designing the ideal system and in preparation for installation. Technical explanations and calculation examples provide helpful answers to additional important questions.

Always Up to Date

Sunny Island is as easy to install as a Sunny Boy PV inverter. The clear menu navigation via the external user interface Sunny Remote Control helps you complete commissioning in just a few steps. With three different user levels, everyone receives precisely the information they need. The system operator is provided with a clear display of the most important values, such as consumption and battery status, while the installers and service technicians can work with detailed settings.



Rate of Self-Consumption

The rate of self-consumption refers to the share of solar energy that is used directly in the home or indirectly through intermediate storage. The higher the self-consumption rate, the better it is for the PV system's ideal operational conditions. Since the feed-in compensation for solar power is clearly less than the typical household electricity tariff, it makes sense to use as much solar energy as possible for yourself and feed as little as possible into the utility grid. This makes you less dependent on energy suppliers and rising electricity prices. The intermediate storage of PV power increases the self-consumption rate by creating a reserve supply of solar power for use in the evening and at night.

Medium power range PV systems provide an ideal self-consumption rate. First of all, they cover the appliances' energy requirements, store excess power in the battery and thus reduce the amount of PV energy that is fed into the utility grid. The energy is only drawn from the grid during periods when demand is high or when power generation levels are low.

The Degree of Self-Sufficiency

Self-sufficiency means that the connected loads are able to achieve the greatest possible independence from the utility grid. This has less to do with ideal economic profits and more to do with the degree of self-sufficiency describes the share of the home's economic and technical independence from the energy supplier, in other words, the ratio of the solar energy the operator uses to the power consumption.

The larger the PV system, the greater the potential degree of self-sufficiency - in particular, with a correspondingly large intermediate storage system. Theoretically, total self-sufficiency can be achieved, however, it drives down profitability. After all, despite having an intermediate storage system, a large-scale PV plant will still feed a great deal of PV energy into the utility grid, which reduces the rate of self-consumption. This is why self-consumption and self-sufficiency can only be simultaneously optimized to a limited extent.



EFFICIENT INTELLIGENT SYSTEM SOLUTIONS

Hobby gardeners always plant their flowerbeds so that all the plants receive enough light and nutrients. This way, they get the maximum harvest and also have sufficient provisions for the winter. They ensure maximum efficiency by maintaining the right flowerbed spacing and planting times.

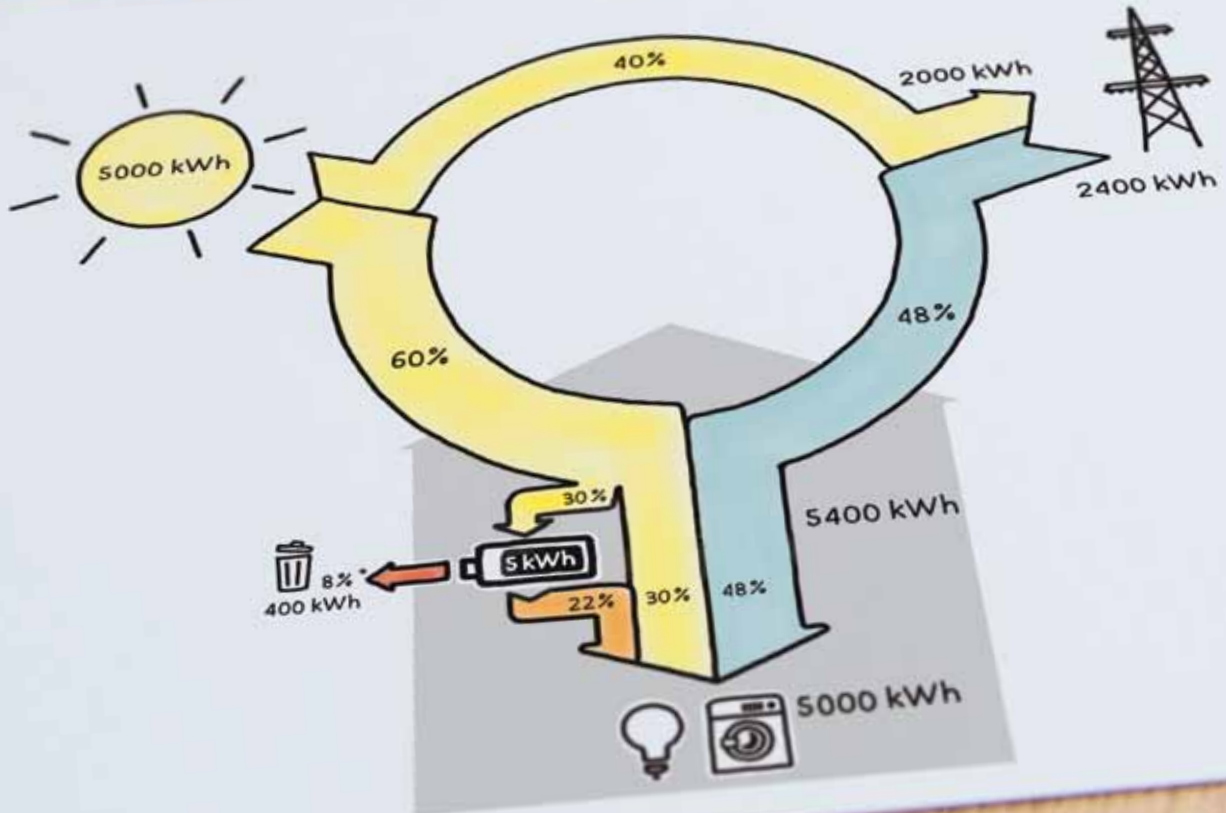
When combined with the Sunny Home Manager, the Sunny Island operates at maximum efficiency and thus automatically ensures the best possible use of solar energy. It manages the temporary storage of PV energy, so that the household only draws a minimum of power from the utility grid, while also needing to feed as little as possible back into the grid. Although the Sunny Island is only connected to one phase, the automatic control can monitor

total power. The energy meters work in a cumulative manner. The power from the individual line conductors is tallied thus allowing the Sunny Island to always feed or draw the maximum amount of energy accordingly. And the Sunny Island system's high efficiency ensures that self-consumption is even more efficient.

Working Together to Achieve the Optimal Solution

We know that a system only functions as good as the sum of all its components. Therefore, SMA continuously works with battery manufacturers to develop optimum solutions. In the end, the battery plays an important role in the efficiency of the self-consumption system: It must have a long cycle life, so that it can handle the charging

and discharging processes related to the intermediate storage of PV power. As a result, the Sunny Island is now already compatible with low-loss lithium-ion batteries that have long cycle lives from manufacturers such as Akasol, Leclanché, LG Chem, SAFT, Samsung and Sony. If the battery fails, it can thus be replaced anytime, ensuring that the system operates efficiently.



* Values for lead acid battery, 5% for lithium-ion battery

Calculated Efficiency

The average annual power consumption of a four-person household is around 5,000 kilowatt hours (kWh). Without a storage system, you can achieve a self-consumption share of 30 percent with a PV system. A battery bank with a useable capacity of 5 kWh allows you to double self-consumption to 60 percent. Even if you subtracted the loss of approximately 8 percent due to the intermediate storage, the electricity bill is still considerably reduced. The household can supply itself with up to 52 percent of power through its local storage system and only requires 48 percent of its annual electricity demand from the energy supplier. Battery banks connected to the utility grid make you even less dependent on energy suppliers, because the quantity of electricity purchased and fed into the utility grid is reduced accordingly.



INTELLIGENT CONTROL WITH SMA SMART HOME

Whether washing and drying laundry or washing the dishes: Every home has appliances that don't follow a time-specific operating schedule. An automatic controller makes it easy for you to conveniently manage, for instance, the turn-on time of the washing machine so it operates during times when the sun is delivering the most energy. This system offers you a host of benefits, including the ability to increase self-consumption and thus lower costs, gain more independence from energy suppliers and also use variable electricity tariffs.

Shaping Your Own Personal Energy Transition

Intelligent energy management is made easy with SMA Smart Home. It combines the PV system, loads and storage system

and automatically controls all energy flows. The Sunny Home Manager is the central component. It bundles all data for generation and consumption, analyzes it and clearly displays the most important values. How much PV power is available and when? When and for how long do larger loads need power? How much stored heat or electricity is available and what is the current charging or discharging power? How much electric current is being generated by the PV system, consumed and exchanged with the electricity grid at this moment?

Managing Loads Automatically

Excellent candidates for time-delayed use are large programmable appliances, in particular, heat pumps for supplying do-

mestic hot water. All in all, integrating the heat supply into the electrical load management creates significant synergy effects: Heat generation is less time-critical than power consumption. At the same time, thermal energy storage systems are already available in a great number of homes and are considerably more affordable than electrical storage systems.

Thinking Ahead With Solar Power

A storage system consisting of a battery, Sunny Island 6.0H and Sunny Home Manager makes it easy to temporarily store solar power for later use. This increases the self-consumption rate and also self-sufficiency. While the cost of fossil fuels continues to rise, there is a clear downward trend in the price of storage technology.

① **Sunny Boy 5000TL**

This PV inverter converts the direct current produced by PV modules into alternating current. This is primarily used by the loads in the home and stored in the battery. Only excess power flows into the electricity grid.

② **Sunny Home Manager**

As the central energy manager, this device analyzes a wide range of input parameters and then uses an intelligent planning algorithm to harmonize power generation and consumption schedules.

③ **Sunny Portal**

The Sunny Portal is used to operate and configure the Sunny Home Manager. These functions are available via any Internet browser and can be accessed using a PC or smartphone. The live display of all energy values provides further energy saving incentives.

④ **Sunny Island**

The Sunny Island provides for temporary storage of solar power perfect for supplying loads in the evening and at night. With the software update, available third quarter 2013, it will also offer a grid-quality power supply with protection against outages (page 14).

⑤ **Energy meter**

Up to three energy meters can be connected to the Sunny Home Manager via S0 or D0 interfaces. Once connected, the device monitors all relevant energy flows in the home.

⑥ **Non-controllable loads**

Many appliances like stoves, televisions and computers are not controlled by the Sunny Home Manager. However, appliance control planning does automatically take typical switch-on times into account.

Controllable loads

Electrical appliances that are not subject to a defined turn-on time can be integrated into the intelligent load management system and activated remotely by the Sunny Home Manager.

⑦ **Washing machine**

⑧ **Clothes dryer**

⑨ **Thermal energy storage with heating element**

⑩ **Heat pump**

A software update will enable a timer control for a heat pump.

⑪ **SMA Bluetooth® radio-controlled socket**

Loads that can be operated at various times and have no control interface can be activated at the optimal time by the Sunny Home Manager via a radio-controlled socket. The socket also features an integrated measurement function that records the exact amount of energy consumed by the connected device so that planning accuracy improves.

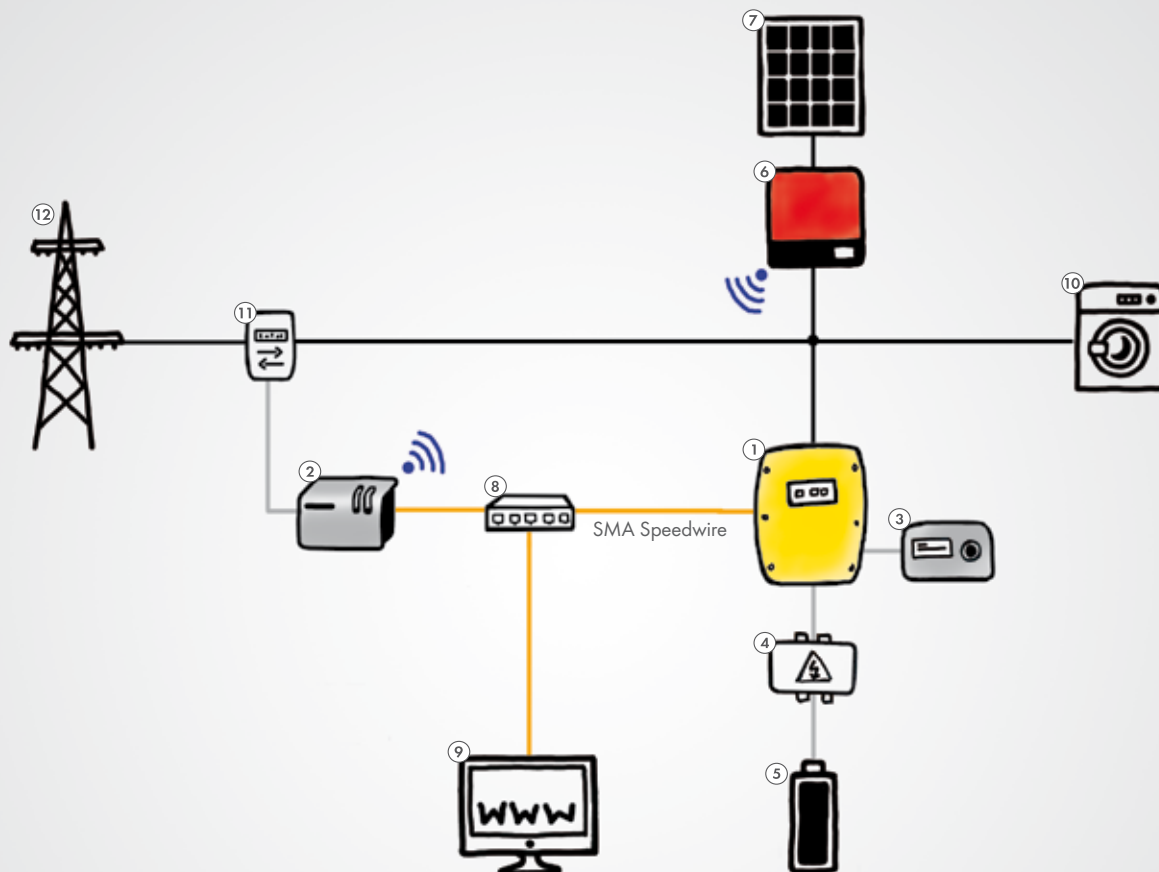
⑫ **Utility grid**

The load on the utility grid is reduced through self-consumption since the household consumes less power from the grid and at the same time feeds less PV power into it. If a lot of power is available in the utility grid, the Sunny Home Manager can also take this into account in controlling appliances, thus further reducing the costs of drawing grid power.

Even small storage systems can reduce grid load by limiting the maximum feed-in capacity and avoiding power loss due to throttling. Storage systems can also protect your home from grid failures and create less dependency on energy suppliers.

With the integration of electric vehicles into the household energy concept, yet another storage option becomes available. Other conceivable options are applications that draw power from the utility grid and generate attractive additional compensation, for example, that provide system services via virtual power plants. SMA continuously works to optimize product functions to remain on the cutting edge of new technologies. With their own PV system and integrated storage system, homeowners can become their own energy service provider.

SMA Smart Home ensures that everyone can successfully achieve their own personal energy transition.



1. Sunny Island 6.OH, 2. Sunny Home Manager, 3. Sunny Remote Control, 4. Batfuse battery fuse, 5. Storage system, 6. Sunny Boy, 7. PV array, 8. Router, 9. www.Sunny-Portal.de, 10. Load, 11. Meter, 12. Utility grid

MAXIMUM SELF-CONSUMPTION FOR TODAY AND TOMORROW

The Sunny Island system makes sure solar energy is always available when it's needed – even after sunset or when the sun is hiding behind clouds. Just like the hobby gardener preserves fruit and vegetables, the Sunny Island stores solar energy in the battery to provide it for use later. It automatically charges and discharges the connected battery via its battery management. Only when the battery is fully charged and no load in the household requires power, does the PV inverter feed electricity into the utility grid.

Getting Through the Day With Sun

Under ideal conditions, solar energy can cover more than 50 percent of the annual energy demand.

As everyone gets up in the morning, showers, brushes their teeth and makes break-

fast, the household's energy demand gradually increases. The sun rises and the PV system starts to produce power. As solar irradiation levels increase, the PV system provides more energy and the Sunny Island charges the battery. Typically, at noon on sunny days, PV systems also produce the most energy making this an excellent time to switch on the major appliances, such as the washing machine, dryer or dishwasher. When energy demand increases, the battery can switch on and provide support at any time. Take for example a typical work day, people return home in the evening creating an increase in their energy demands while at the same time the sun is setting and only provides a little PV energy. The energy needed for dinner, lights, TV or computers is provided by the battery or utility grid. When everyone is asleep, only

the basic consumption requirements for the refrigerator and freezer, clock radio, night lighting or other devices that are continuously operated must be covered - until a new day begins.

SYSTEM TECHNOLOGY

With the right system technology for the Sunny Island, everyone can shape their own personal energy transition and SMA products make it as easy as possible. They automatically combine intelligent load management with temporary storage of PV energy. This allows you to make optimum use of solar energy at anytime. For example as an intelligent interface, the Sunny Home Manager, can also significantly increase the rate of self-consumption.



Sunny Home Manager

Automatically optimizing household energy. As the central energy manager, the Sunny Home Manager analyzes various input parameters and provides for optimal timing of power generation and consumption using calculated recommended actions. This increases the rate of self-consumption and makes you less dependent on energy suppliers.



Speedwire Data Module for Sunny Island

For smooth communication, the SWDMSI-10 data module in the Sunny Island enables communication with the Sunny Home Manager. As a result, the Sunny Home Manager can transmit the energy meter data to the Sunny Island and thus facilitates an ideal rate of self-consumption.



Sunny Remote Control

For maximum user convenience, the external Sunny Remote Control unit allows convenient commissioning and monitoring without needing to be directly in front of the inverter. The device can be used at a distance of up to 20 meters and processes information from up to three Sunny Island devices. The rotary switch enables intuitive operation. The four-line display provides you with clearly arranged, at a glance information on the system's current status. An SD card serves as the service interface.



Batfuse

Increased safety for the Sunny Island system: As an external DC distribution board, the BatFuse secures the Sunny Island's battery connection cables. It ensures all-pole battery fuse protection and facilitates disconnection of the battery-powered inverters. Depending on the variant, the devices offer up to three connections for the inverters and up to six connections on the DC side.



SUNNY OUTLOOK SECURITY FOR THE FUTURE

With the Sunny Island system designed to increase self-consumption, homeowners can secure their energy supply of tomorrow. When augmented by a stand-by power feature, the household energy supply can be maintained even during a power outage. The stand-by power feature is easily implemented with a software update and an add-on in the household distribution. Grid-connected storage solutions provide two-fold security for your power supply – with the Sunny Island, you can secure yourself against electricity price increases and grid failures.

Energy According to Plan

Good news for all future PV system operators: In May 2013, the German Federal Environment Ministry will launch a market

incentive program for decentralized battery storage. The German Federal government's goal is to improve integration of small and medium-sized PV systems in the utility grid. System operators receive a subsidy if their storage batteries meet specific criteria. SMA Smart Home equipped with Sunny Home Manager and Sunny Island 6.0H fulfills all known requirements of the planned storage battery subsidy, for example, a flexible power limit at the grid connection point. Increased self-consumption with the Sunny Island means using technology that is always one step ahead.

SUNNY ISLAND 6.0H

TECHNICAL DATA

| Technical Data | Sunny Island 6.0H |
|--|--|
| Operation on the utility grid (or PV array) | |
| Rated voltage / AC voltage range | 230 V / 172.5 V ... 264.5 V |
| Rated frequency / permissible frequency range | 50 Hz / 40 Hz ... 70 Hz |
| Maximum AC current for increased self-consumption | 20 A |
| Maximum AC power for increased self-consumption | 4.6 kVA |
| Stand-alone or emergency power operation | |
| Rated grid voltage / AC voltage range | 230 V / 202 V ... 253 V |
| Rated frequency / frequency range (adjustable) | 50 Hz / 45 Hz ... 65 Hz |
| Rated power (for Unom, from / 25 °C / cos φ = 1) | 4,600 W |
| Maximum AC power at 25 °C for 30 min / 5 min / 3 sec | 6,000 W / 6,800 W / 11,000 W |
| Rated current / maximum output current (peak) | 20 A / 120 A |
| Total harmonic factor output voltage / power factor with rated power | < 4% / -1 ... +1 |
| Battery DC input | |
| Rated input voltage / DC voltage range | 48 V / 41 V ... 63 V |
| Maximum battery charging current / DC rated charging current | 110 A / 100 A |
| Battery type / battery capacity (range) | Li-ion*, FLA, VRLA / 100 Ah ... 10,000 Ah |
| Charge control | IUoU charge procedure with automatic full charge and equalization charge |
| Efficiency / self-consumption of the device | |
| Maximum efficiency | 95 % |
| No-load consumption / standby | < 26 W / < 4 W |
| Protective devices (equipment) | |
| AC short circuit / AC overload | ● / ● |
| DC reverse polarity protection / DC fuse | - / - |
| Overtemperature / battery deep discharge | ● / ● |
| Overvoltage category as per IEC 60664-1 | III |
| General data | |
| Dimensions (width x height x depth) | 467 mm x 612 mm x 242 mm |
| Weight | 63 kg |
| Operating temperature range | -25 °C ... +60 °C |
| Protection class (according to IEC 62103) | I |
| Climatic category according to IEC 60721 | 3K6 |
| Degree of protection according to IEC 60529 | IP54 |
| Features / function | |
| Operation and display / multifunction relay | External via SRC-20 / 2 |
| Three-phase systems / parallel connection | - / - |
| State of charge calculation / full charge / equalization charge | ● / ● / ● |
| Battery temperature sensor / data cables | ● / ● |
| Certificates and approvals | www.SMA-Solar.com |
| Warranty (5 years) | ● |
| Accessories | |
| Battery cable / battery fuse | ○ / ○ |
| SI-COMSMA (RS485) / SWDMSI-10 (SMA Speedwire) interface | ○ / ○ |
| Type designation | SI6.0H-11 |
| <p>● Standard features ○ Optional features – Not available * From Akasol, Leclanché, LG Chem, SAFT, Samsung, Sony Data at nominal conditions, provisional data, last updated: January 2013</p> | |

ENERGY
THAT
CHANGES

