



SMA LARGE SCALE ENERGY SOLUTIONS

# My Investment. Our Grids. Our Climate.

Make your energy investment ready  
for the grids of the future.



Generate solar power  
and use it effectively



Store energy and  
use it broadly



Manage and  
connect energy



Grid independence  
with solar power



Stabilize grids and  
generate revenue



Power conversion for  
hydrogen applications

# Large Scale Energy Solutions by SMA

## Clean energy and stable grids for future generations

The world of energy is changing. Diverse interconnected power plants are driving the energy transition forward. Digital technologies are creating completely new opportunities and possibilities for market participants to shape the energy transition. With 40 years of energy experience, SMA is uniquely qualified to navigate and shape this complex landscape. Let's partner up and achieve your investment and sustainability goals together.



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Why SMA?

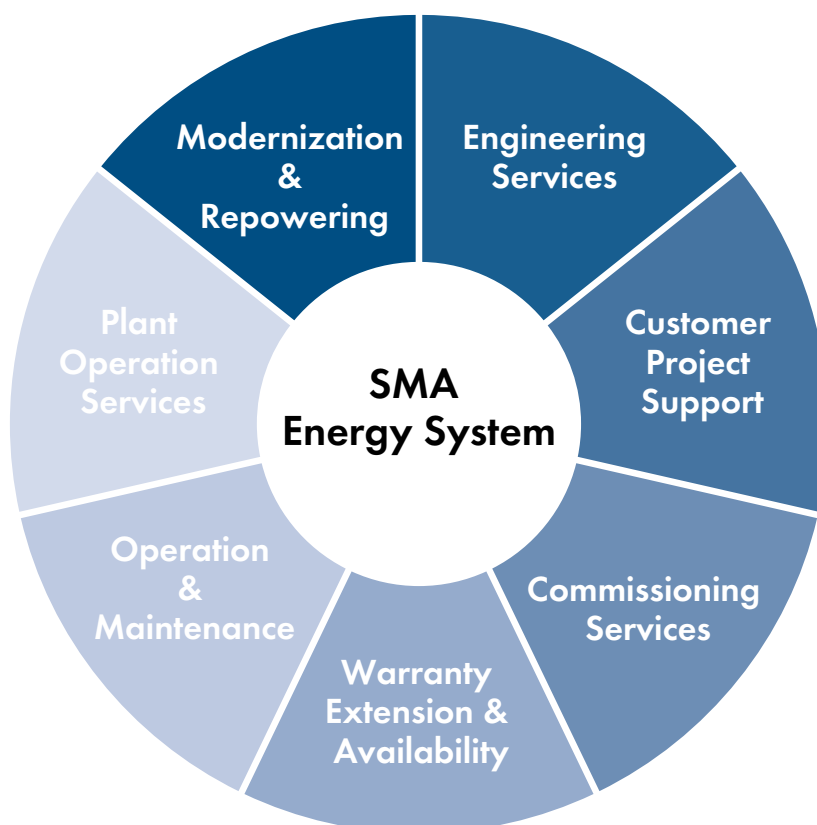
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## New business models require new applications

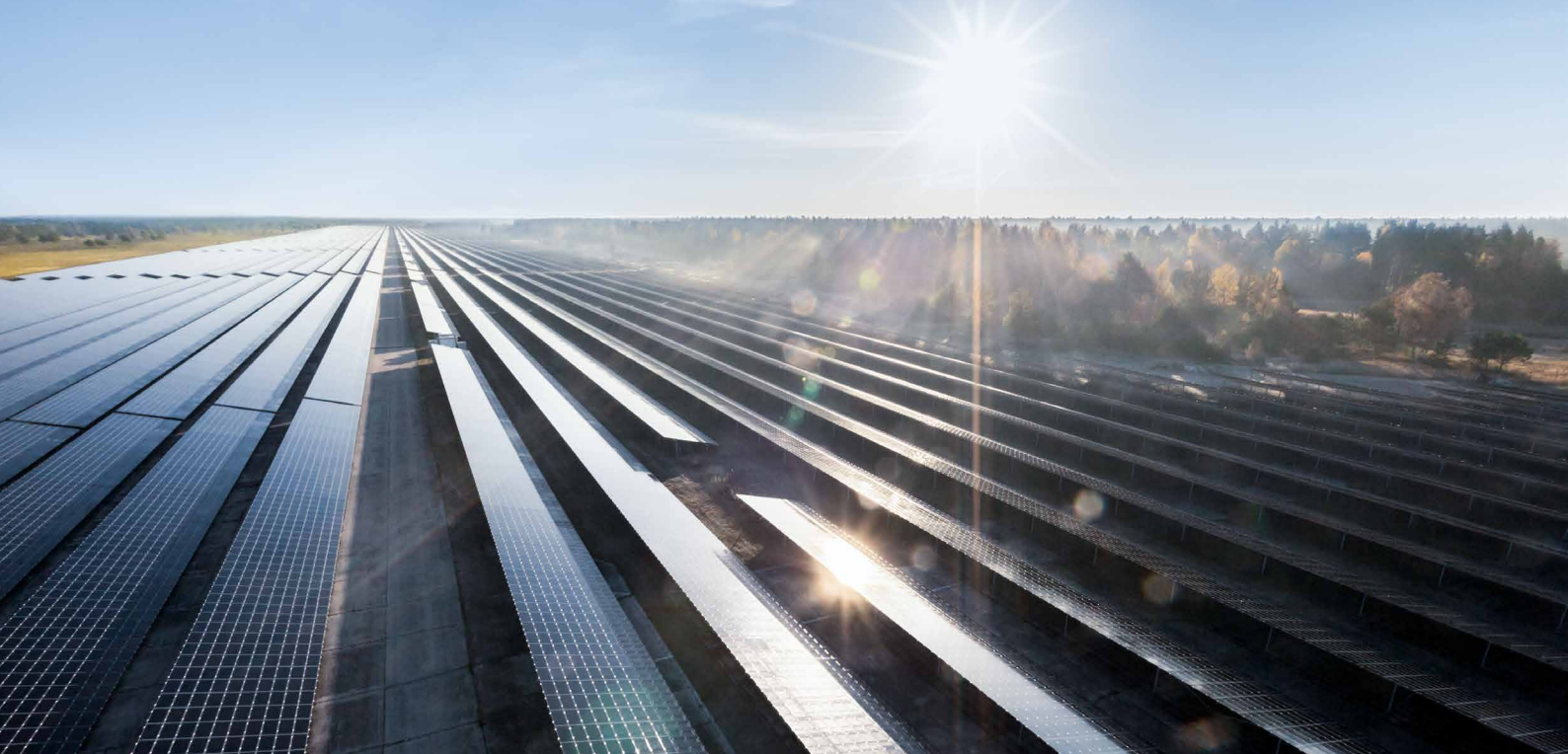
As the energy market becomes more and more complex, it also becomes vital to anticipate future developments, needs and functionalities. One thing is certain: in the highly dynamic energy market of the future, seamless integration of different systems will be crucial. Whether you want to form grids, facilitate black starts or ensure an uninterruptible power supply, system integration will play a major role.\*

## One system. Everything from a single source

With the **SMA Energy System**, you receive a customized solution for your specific investment objectives: optimize energy yields, link energy sectors and manage them intelligently. The portfolio is supplemented by convenient service solutions. The longevity of our equipment ensures the sustainability of your SMA Energy System over a long period of time. Best of all, with the SMA Energy System and its modular design, you are ideally equipped for future requirements.



\*The availability of products and services may vary from country to country.



# Generate solar power and use it effectively.

## Maximum profitability and reliability

The **SMA Energy System** stands for longevity, maximum performance and top quality. Highly integrated solutions for PV power plants with varying system structures provide you with maximum flexibility in implementation and options for expansion at all times. That gives you the highest possible yields for over 20 years and guarantees maximum return on investment.



Medium Voltage Power Station UP

## A truly global system

The SMA Medium Voltage Power Station (MVPS) offers the highest power density in a plug & play design, which is suitable for global use. Rely on the most robust, technically advanced and internationally certified hardware for power conversion in any climate. As one of the first truly global systems, it is the ideal choice for next-generation PV power plants operating at 1,500 VDC.

- Sunny Central UP, our most powerful inverter with up to 4,600 kVA, is the heart of the MVPS UP
- Easy transport with a CSC-compliant container
- Pre-installed components
- Minimum O&M requirements
- Integrated switchgear and transformer
- Maximum design flexibility

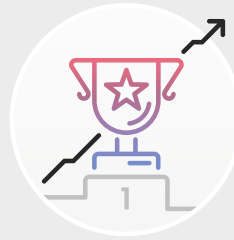
## Benefits



Maximum energy yield



Quick profit



Increased competitiveness

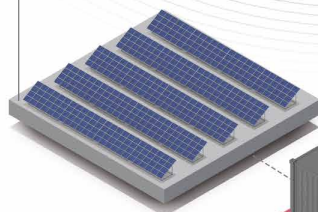


No commodity price risk

## SMA offers a fitting solution for every project

A centralized system layout is ideally suited for large-scale, ground-mounted PV projects. A few large central inverters are used here.

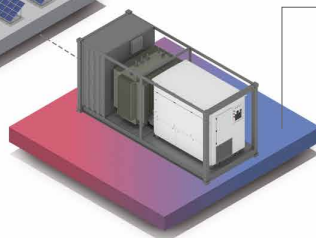
**PV modules:**  
Optimized for the local conditions and your requirements



**SMA Monitoring:**  
Enables easy and efficient online monitoring of your SMA Energy System



**Sunny Central UP:**  
The SMA Central inverter. Can be integrated in an MVPS UP turnkey container solution with a perfectly coordinated medium-voltage solution that includes a transformer and switchgear





# Generate solar power and use it effectively.

## We create system architectures tailored to your project's needs

Which setup is the right one for your project – a few large central inverters or several smaller string inverters? Well, it all depends on your project requirements and your investment objectives. In any case, you can rest assured that SMA offers the right solution for your needs. Moreover, we'll work with you and advise you in the decision-making process, setting up your project for success from the get-go.



Sunny Highpower PEAK3

### Compact string solution

PEAK3 stands for pure power. With its compact design, it offers the highest power density per device and is ideally suited for inhomogeneous layouts, floating applications and repowering projects.

- Powerful 100 to 180 kW decentralized inverter offering 100% power up to 50°C
- Quick & safe installation
- Increased yield at the plant level by reducing AC cabling losses
- OptiCool™, an intelligent temperature management system, increases inverter life
- Single MPP tracker for a lower failure rate
- SMA Smart Connected reduces revenue losses and downtime thanks to AI and predictive maintenance
- Extra high design life and warranty extensions up to 25 years
- Compatible with AC voltages down to 200V for flexible repowering solutions

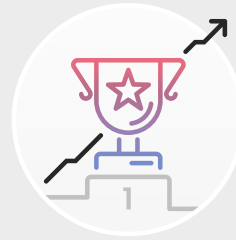
## Benefits



Maximum energy yield



Quick profit

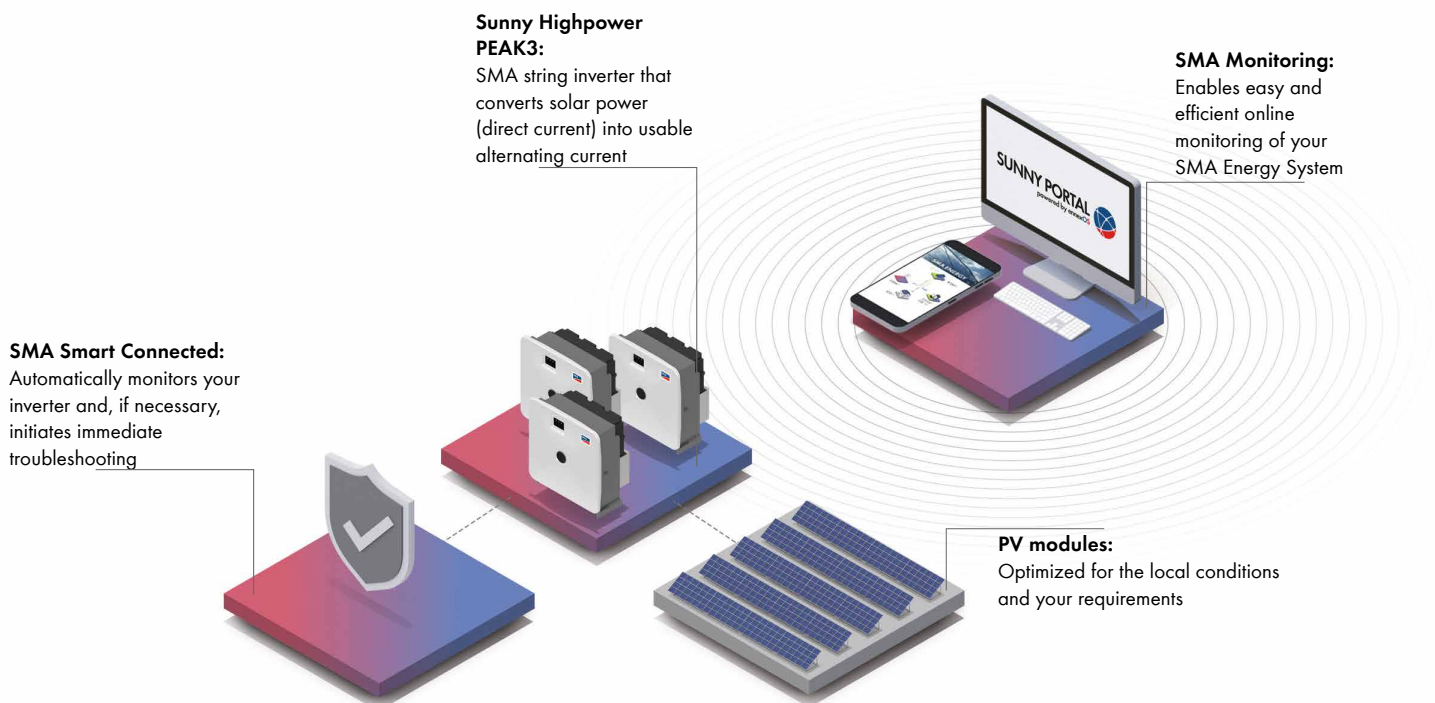


Increased competitiveness



No commodity price risk

If the project basis is very heterogeneous, several smaller and easier-to-handle inverters can be used.





## Store energy and use it broadly.

### Smart energy storage for higher ROI

The SMA Sunny Central Storage UP battery storage system allows you to store and use energy flexibly.. This enables you to manage peaks in demand, stabilize grid voltage and reduce energy costs considerably. The battery storage systems increase the efficiency of your power plant and perform important grid management functions. Grid frequency fluctuations are avoided thanks to smart plant control with the Power Plant Manager and grid voltage is restored in seconds.



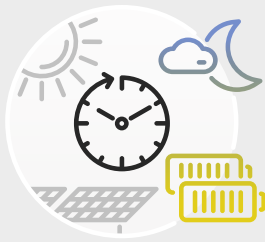
SMA Sunny Central Storage UP battery inverter

### Solar power available day and night

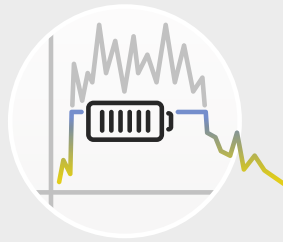
The Sunny Central Storage UP battery inverter stores energy in high-voltage batteries and makes it available as required. It can be used flexibly in both PV and hybrid systems. Its intelligent OptiCool cooling system ensures smooth operation, even in extreme ambient temperatures.

- Extremely efficient with a power output of up to 4,600 kVA
- Can store and discharge energy within milliseconds
- Suitable for continuous power in power plants in any climate
- Enables dynamic grid support

## Benefits



Supplies renewable energy  
24/7



Compensates for load  
peaks with stored power



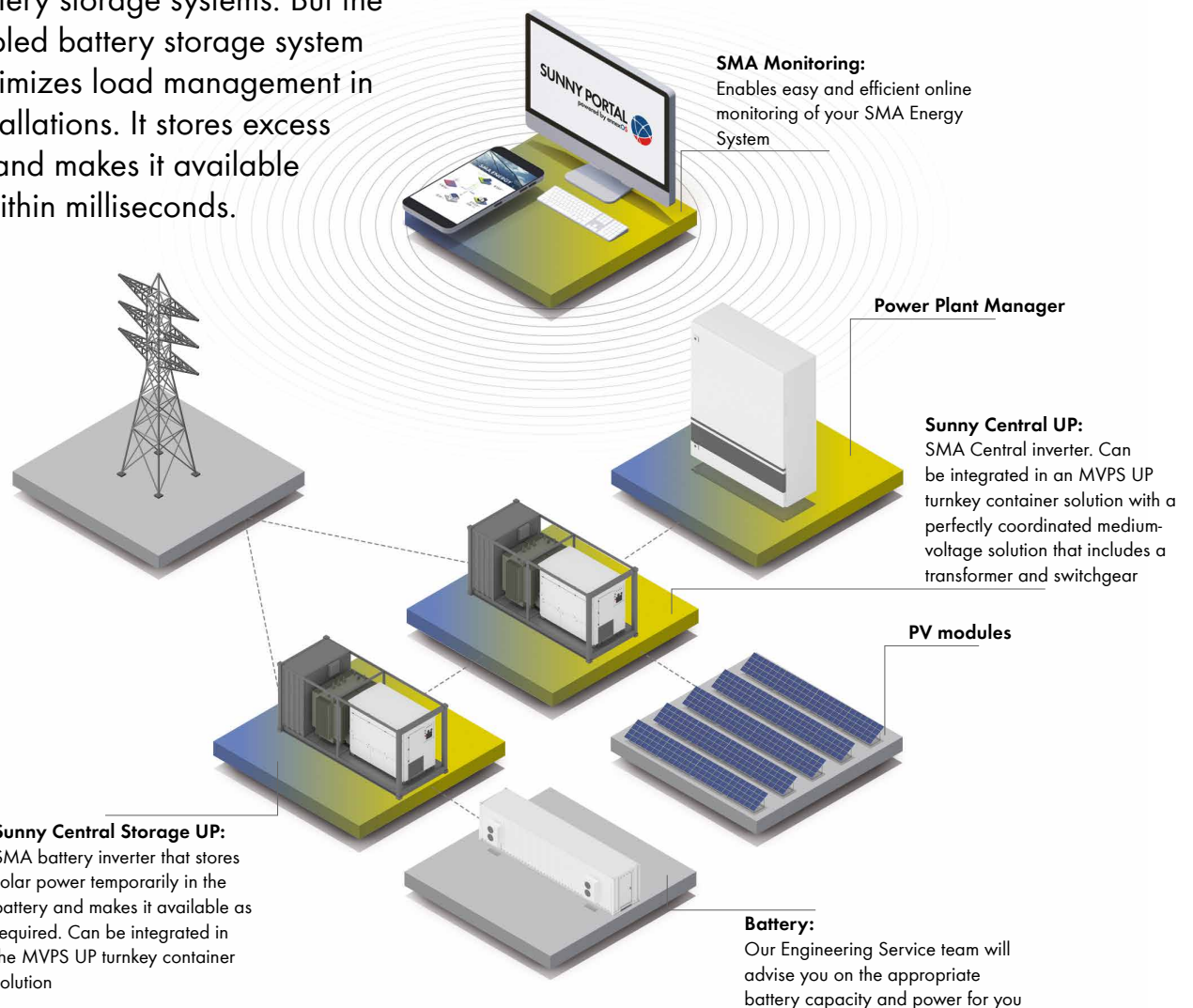
High flexibility through  
extremely fast charging/  
discharging



Additional profit maximization

## AC-coupled systems

AC-coupled systems are ideal when existing power plants are retrofitted with battery storage systems. But the AC-coupled battery storage system also optimizes load management in new installations. It stores excess energy and makes it available again within milliseconds.





## DC-coupled systems

DC-coupled systems are ideally suited for the new installation of large PV power plants with Sunny Central 1,500 V technology. Here, the battery and PV array are connected to the central inverter on the DC side, and excess solar energy is fed directly into the battery in a particularly efficient manner.



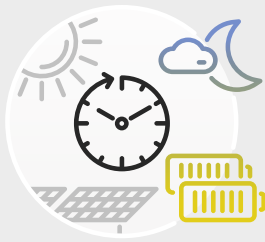
SMA DC-DC Converter

## Greater efficiency for large PV power plants

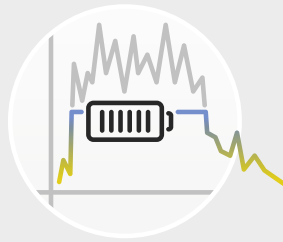
The SMA DC-DC Converter allows designers to increase their PV power plant's yields by oversizing the DC array without compromising energy losses. The inverter can intelligently control the flow of power for many different use cases. The stored energy can be fed in at attractive times, for example, in the morning or at night, to achieve a better price point for the energy.

- Up to six DC-DC converters can be connected and operated simultaneously with the Sunny Central inverter
- Intelligent power flow control of the system via the Sunny Central
- Step-up/step-down converter with battery charge/discharge function
- Enables new business models with stacked revenue streams

## Benefits



Supplies renewable energy  
24/7



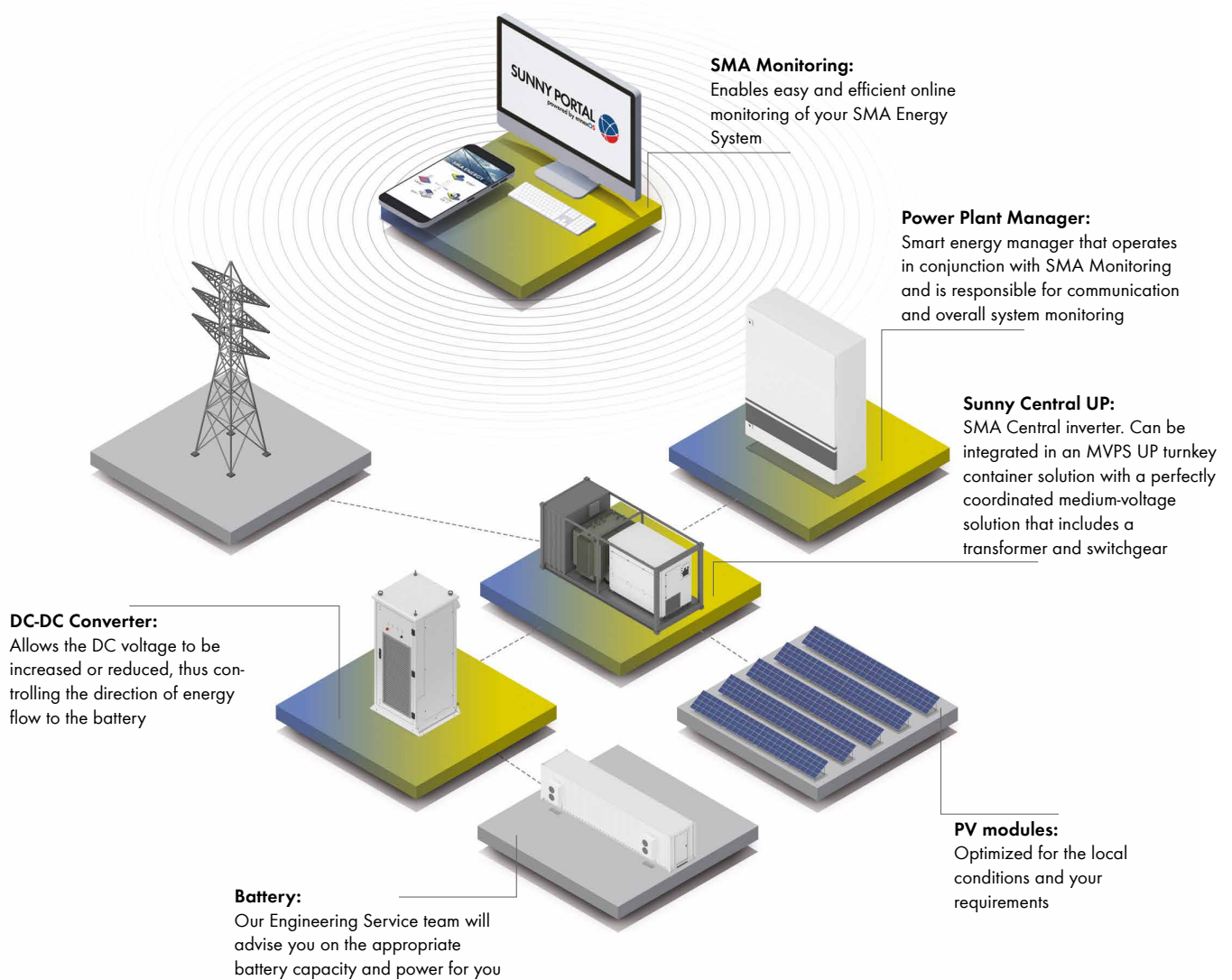
Compensates for load  
peaks with stored power



High flexibility through  
extremely fast charging/  
discharging



Additional profit maximization





# Manage and connect energy.

## Intelligent energy management

The **SMA Energy System Large Scale** combines all the energy flows and system components in your PV power plant to create a single, all-encompassing system. This enables smart energy management across different sectors.



Power Plant Manager

## The brain of your SMA Energy System Large Scale

Together with Sunny Portal powered by ennexOS, the Power Plant Manager is the central system of your SMA Energy System Large Scale and intelligently manages all energy flows.

- Controls generation power and optimizes energy flow
- Controls active and reactive power as necessary
- Supports voltage and frequency control
- Records, analyzes and visualizes relevant data in Sunny Portal

## Benefits



Save on generator and diesel costs



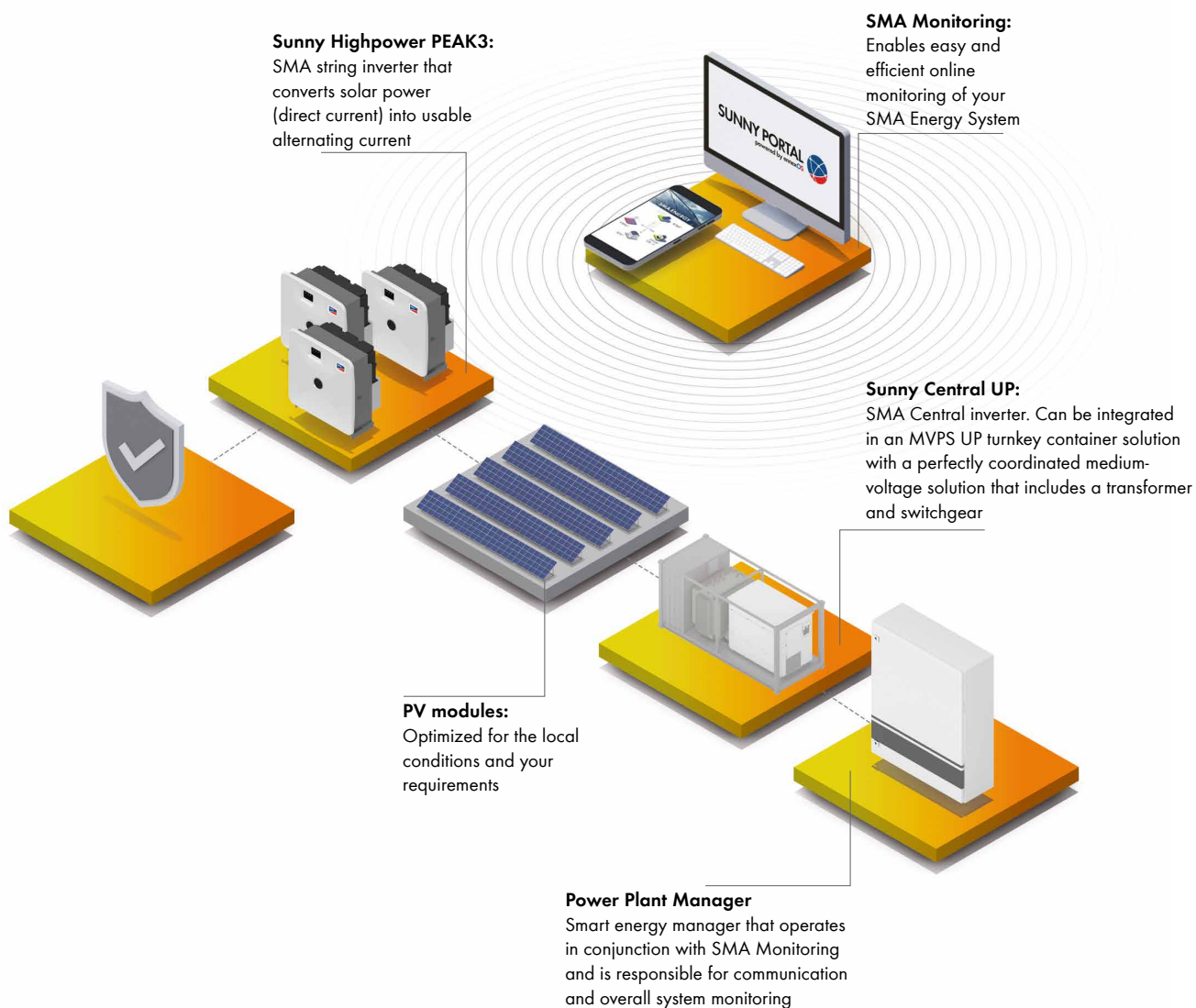
Central interface for data overview and analysis: Sunny Portal



Easy monitoring and control of large-scale PV power plants



Remote access: reduced service costs and increased security





# Grid independence with solar power.

## Off-grid energy worldwide

Battery storage systems provide remote regions with a reliable supply, covering up to 100% of their needs with sustainable energy and reducing harmful emissions.

With their grid-forming properties, the SMA Sunny Central Storage battery inverter and the intelligent SMA Power Plant Manager plant control ensure that utility grids are 100% stable and guarantee an all-round supply that conserves resources.



Power Plant Manager

## Manage energy and digitalize power plants

By intelligently managing all energy flows within a micro-grid, the Power Plant Manager enables a 100% renewable energy supply.

- Keeps reserve power available
- Establishes grid-forming operation including black start in the event of utility grid failure
- Secures a back-up power supply

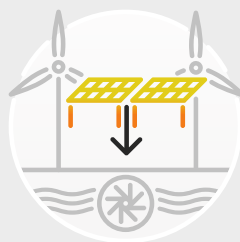
## Benefits



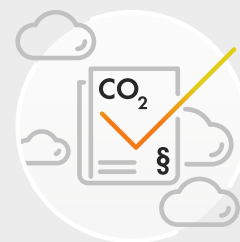
Green energy supply 24/7  
anywhere in the world



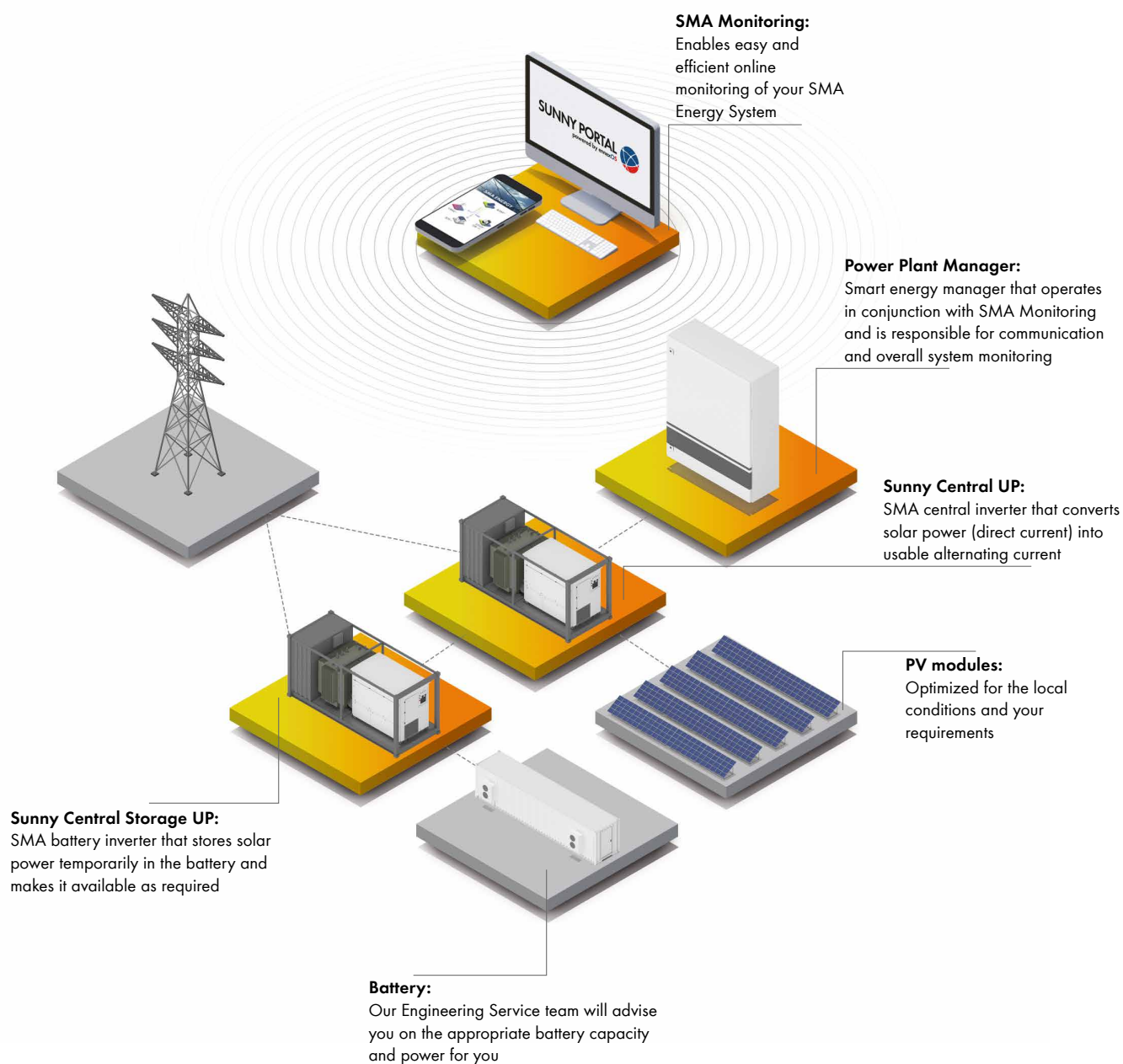
Save on generator and  
diesel costs



Integrate solar energy  
optimally into existing  
infrastructures



Reliably comply with CO<sub>2</sub>  
and other environmental  
regulations





## Stabilize grids and generate revenue.

Energy storage plants with SMA Grid Forming Solutions enable the energy transition and are multi-purpose assets for future generations. They are taking a leading role in grid stabilization as conventional power plants are increasingly phased out.

### Grid Forming Energy Storage

In a power system that is 100% powered by renewable energy, Grid Forming will be the hallmark of grid quality and stability by contributing to

- Inertia
- System strength
- Short-circuit level
- System restoration
- Power system stabilizer
- Power quality

SMA offers solutions that enable innovative business cases for these new stability-related ancillary services. They can be used in various applications as well as stacked with other services such as energy arbitrage and traditional ancillary services such as frequency control.

SMA Grid Forming Solutions also constitute an alternative to installing new transmission lines, as they enable existing power lines to be utilized more efficiently. This application is called Grid Booster. It offers public policymakers and network operators a remarkable way to cut costs and save time by eliminating the need to build time-intensive and expensive new transmission lines.

In this decade, energy storage plants will be deployed at a large scale to ensure a cost-efficient and secure supply of renewable energy to the world.

Owners of such assets have a lucrative business case and can enable the supply of electricity with low carbon emissions and low cost.

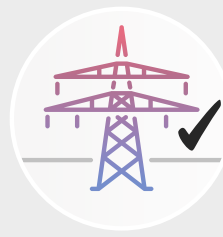
## Benefits



Enable reliable cross-continental energy exchange



Reduce the need for network reinforcement and redispatch measures



Provide stable grids powered by 100% clean energy



Guarantee security of supply

# Stabilization sells.

SMA Grid Forming provides stability for power systems to ensure the future supply of energy from entirely carbon-free sources.

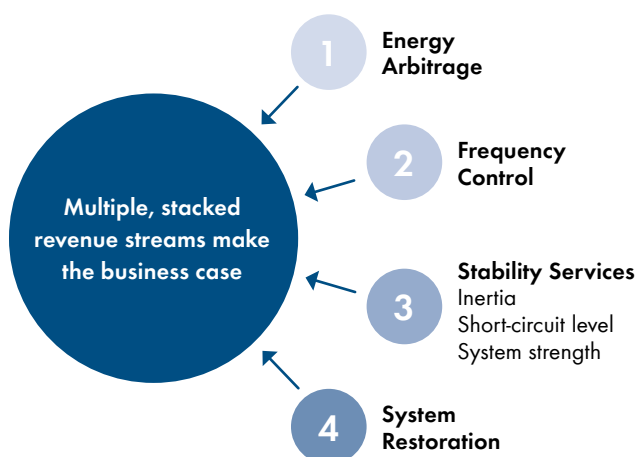
Energy storage plants can now provide new stability-related ancillary services in place of conventional power plants. This opens up attractive business models for investors and alternative investment options for transmission system operators.

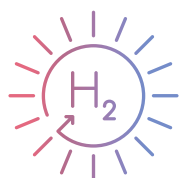
These stability services are inertia and system strength/short circuit current. The first major advantage is that these two services can be performed simultaneously. On top of that, the previous revenue streams of energy trading or frequency control can continue to run while the stability services are active.

The ability to stabilize power systems adds a lucrative new revenue stream for your project and further increases the return on investment.

Early adopters will in addition gain a favorable position in the network. The time to invest is now.

## Multi-use of battery storage





# Power conversion for hydrogen applications.

## Green hydrogen – New market meets proven technology

The world's supply of energy is facing two major sustainability challenges: The increasing proportion of fluctuating renewable energies and reducing global CO<sub>2</sub> emissions in the industrial, mobility and energy sectors. The simple solution: Green hydrogen.

Green hydrogen produced by electrolysis and renewable energy is 100 % CO<sub>2</sub> free, it can be stored and is key to de-carbonisation in major industrial processes such as refining, ammonia production, steel making and other chemical industries. Green hydrogen production with SMA Power Conversion Systems is the key to sustainable energy management of your hydrogen application.

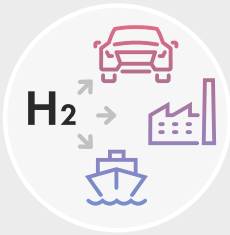


SMA Electrolyzer Converter

## The core of the SMA Energy System Large Scale for hydrogen applications

- With a capacity of up to 4.6 MW
- Patented SMA air-cooling system OptiCool
- Pre-commissioned plug & play solution including MV transformer and switchgear, auxiliary transformer for easy commissioning available
- Integrated IGBT technology makes harmonic filters or compensation units superfluous
- Electrolyzer type agnostic (PEM, alkaline, SOEC)

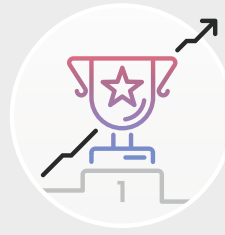
## Benefits



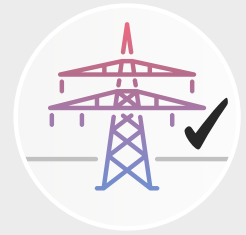
Modular design enables flexible project sizing



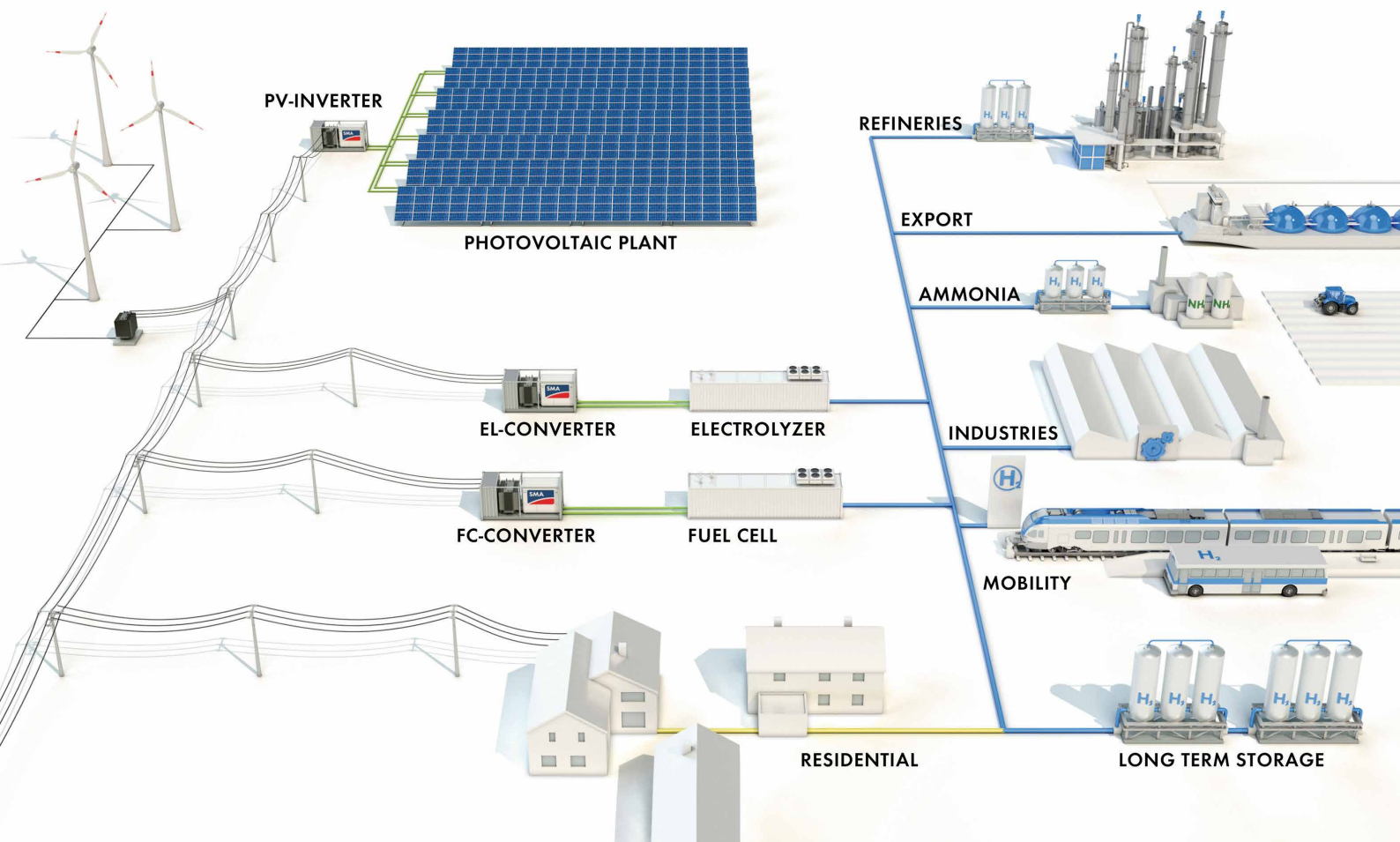
Low OPEX due to very high converter and connected transformer efficiency



Based on a technology platform with >30 GW global track record



Integrated IGBT technology enables high grid compliance and a lean plant design without additional filters or compensation units

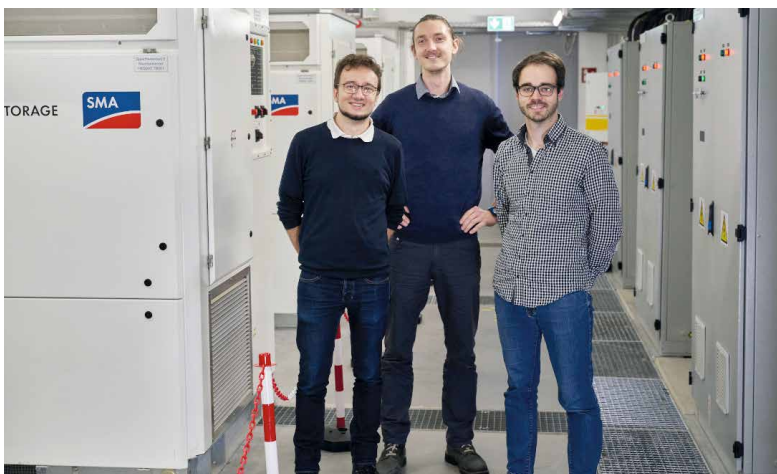




## **/ Reference project for Grid Forming**

# **The Bordesholm stand-alone grid ensures the supply of electricity even in the event of a grid failure.**

With a large-scale battery storage system, the public utility company Versorgungsbetriebe Bordesholm in northern Germany is able to supply the European utility grid with balancing energy – a lucrative business model. In a unique experiment, the electric utility company and TH Köln, University of Applied Sciences in Germany, proved that the entire region can be supplied 100 percent with electricity from renewable energies. Setting a milestone for the energy transition.



The municipality of Bordesholm is located in the northern German state of Schleswig-Holstein, between Kiel and Neumünster. The name means “at the shore of the island.” Thanks to an SMA Energy System Large Scale, Bordesholm is living up to its name and is literally heading for new shores with a 15 MW storage system. The SMA storage system has a capacity of 15 megawatt-hours and, in off-grid operation, ensures the supply of electricity for the entire Bordesholm region in the event of grid failure.

## The objectives

To provide a primary control reserve and ensure a reliable electricity supply at all times.

## The solution

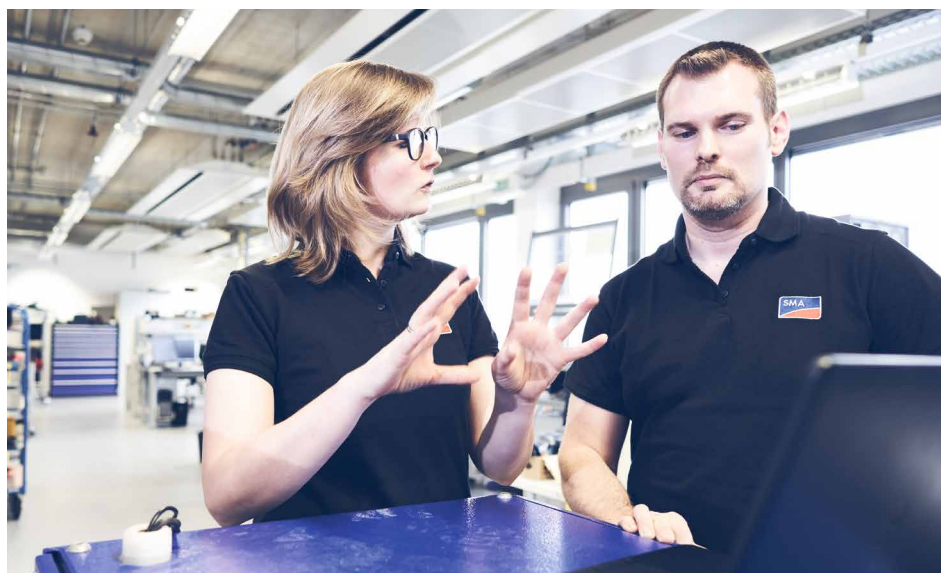
To use an SMA Energy System Large Scale to generate and store clean energy, and to optimally control and monitor energy flows both in the utility grid and in stand-alone mode.

## The outcome

1. A contribution to stable grid frequency in the European utility grid
2. A lucrative business model through the primary control reserve
3. Stand-alone mode and black-start function ensure the supply of electricity 24/7
4. 100 percent electricity supply from renewable energy

**« With the SMA Energy System Large Scale, we are proving that it is possible to run a public electricity grid on fully renewable energy and maintain stable frequencies. In doing so, we have created a starting point for the development of largely self-sufficient electricity grids. On a larger scale, the world could one day have an energy supply that is not dependent whatsoever on fossil fuels or nuclear power. »**

**Frank Günther, General Manager of Versorgungsbetriebe Bordesholm GmbH**





# SMA Service

## More power and more profit for your energy asset

A successful renewable energy project does not end when the commissioning phase is over. Profitable projects begin as early as the first planning steps and ensure maximum availability over their entire life cycle. With our SMA 360° Professional Support, we make life easy for you – from planning, engineering, installation and commissioning to targeted modernization.

### Engineering Services – success right from the outset

SMA Engineering Services is designed to optimize power plants around the world in line with individual needs – right from the planning phase. The Engineering Services experts ensure that all components, services and software solutions are customized to the specific power plant and ambient conditions. Country-specific requirements of grid operators are also taken into account.

### Commissioning Services – for perfect installation

SMA's Commissioning Services package ensures that your devices are properly installed electrically and mechanically by experienced service technicians. We test everything by the book and work through an extensive checklist – from monitoring AC and DC power output to updating firmware. This gives you the confidence that your plant has been properly connected and optimized in line with your specific requirements.

### Operations & Maintenance Services safeguard yields and investments worldwide

With our Operations & Maintenance Services package, we take care of the complete technical operation of your energy system. The services we perform include everything from regular on-site maintenance activities to multiple remote service actions to increase the power plant's performance. This ensures optimal and reliable system performance over more than 25 years – and can potentially increase yields by as much as 30 percent.

## Greater availability, greater profits

Thanks to SMA solutions, you can achieve availability rates as high as 99.98 percent and ensure project success over the entire system lifetime. To be eligible for our inverter availability service, the inverter you have installed must be covered by the SMA Factory Warranty or SMA Extended Warranty. Our portfolio for maximum availability and quality encompasses a wide range of customized solutions – for applications worldwide.

## Maximize your returns with preventative maintenance

Take advantage of SMA's Preventative Maintenance Services and optimize your device's performance to maximize your returns. SMA inspects and tests your device for wear and tear and checks that the device is working properly. We conduct a range of checks, carry out cleaning, update the firmware and supply detailed maintenance reports. This is the only way to ensure that your device continues to operate properly long term and that you comply with the terms of your warranty.

Whatever direction you take, SMA enables you to respond to changing market requirements so that you are fit for the future.

## Make sure your energy project is fit for the future – with an extended warranty

Under the terms of your factory warranty, our service team is at your service 24/7. If the problem in your system can't be fixed by remote analysis, our service experts will come to you and fix the problem on-site. If a component needs replacing, you will get it free of charge and as quickly possible. An extended warranty is both sensible and extremely worthwhile because it allows you to take advantage of this full service even after the five-year factory warranty ends. The service scope includes a 100 percent guarantee on all replacement parts\* and diagnostic and repair services rendered on-site or remotely.

## Fit for the future with SMA Repowering

Availability is one of the most important factors determining the profitability of your project. The rapid pace of technological development in the solar industry means that taking deliberate steps to modernize your system is the only way to ensure the continued profitability of your project. SMA Repowering offers a range of customized solutions designed to enhance the performance and yield of your system and equip your power plant with innovative functions and storage integration interfaces – all in line with the latest cybersecurity standards.

\* Medium-voltage components are excluded from the extended warranty.





# SMA Repowering focuses on innovation and reliability.

## SMA Repowering packages: as unique as your system

Modernizing outdated PV systems and storage systems offers a number of advantages: Enjoy the benefits of the SMA warranty and additional future-proof storage solutions.

Our flexible repowering packages are designed to impress thanks to their highly efficient technology and broad/comprehensive range of services – from low-cost assembly and inverter replacement to

installation of additional state-of-the-art energy management and storage solutions.

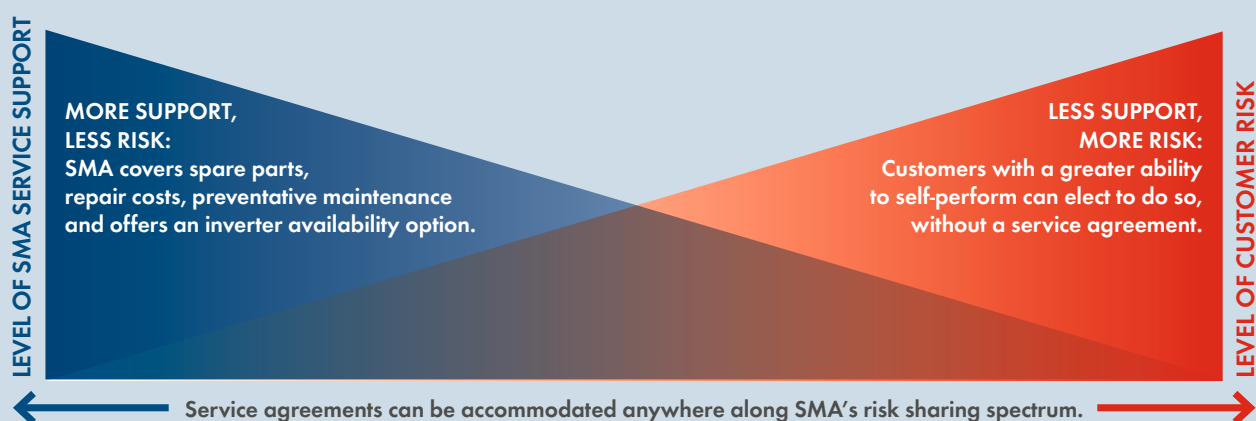


## Extended warranty: an investment in the future

Protect your system outside the factory warranty with Extended Warranty Flex. If you choose "Active," we will cover the hardware costs. With "Comfort," we'll cover the costs arising during field work performed on customer premises; and with "Extended warranty Flex," you can terminate the warranty contract on an annual basis as needed.

### Benefits at a glance:

- Minimal, calculable downtime
- Immediate installation of a compatible replacement device
- Smooth, end-to-end device replacement directly on-site
- No hidden costs
- Cost-effective peace of mind over the entire system life cycle



## More specialist knowledge. More success.

### Expand your professional expertise profitably – with the SMA Solar Academy

Achieve greater success by enhancing your know-how: The SMA Solar Academy provides expertise and targeted, highly skilled, hands-on training in SMA products and photovoltaics. This will equip you with all the skills you need for long-term success in the fast-paced solar industry. Whether you are an installer, sales representative or system designer, we offer the right seminar or webinar to suit any field. Our broad-based and hands-on training program offers just the right training course whatever your level.





# Why SMA?



## Broad support every step of the way

SMA is with you every step of the way. A dedicated and local team of engineers will be by your side to design and plan your installation. We also offer several service solutions that will ensure maximum operational reliability and profitability for your project. From preventive maintenance to quick mobilization of local engineers in the event of failure, SMA offers peace of mind to all its customers thanks to tailor-made maintenance and warranty contracts.

We also go the extra mile. Take our repowering service, for example. Our engineers optimize your plant architecture to make use of the latest technological possibilities, thereby ensuring your return on investment reaches its full potential.



## At SMA, we design for life

Our inverters are designed to last for 20 to 30 years. How do we achieve this kind of longevity? It starts with selecting the right components. The most critical ones are produced in-house, other components are rigorously tested and selected. We only use the cream of the crop. Moreover, we also take good care of our (or your) electronics. With the OptiCool™ system, temperature variation within our inverters is reduced to an absolute minimum, which increases lifespan.

But sometimes less is more. We aim to reduce the number of components in our installations, which means less opportunity for component failure and thus less downtime and lower maintenance costs. When we design our systems, we also take into account the increasing importance of cybersecurity in the energy market. Rest assured that, as energy systems increasingly become information systems, SMA is always thinking about the best way to keep its clients and their power plants safe.



# Sustainable in every way.

For 40 years, we have been building the sustainable power supply of the future with our products and solutions. We know all too well that sustainable power is not just about developing the right technologies. How this development takes place is at least as important. That is why we take a resolute stance.

We protect the environment and save on raw materials. We use renewable energy. Our company is built on transparency, fairness and honesty. We build on these foundations with guaranteed quality, steadfastness and reliability. We propagate these values on the shop floor, in our daily activities, within our organization and beyond. **For a world worth having. Powered by us.**



## 90%

By reducing the amount of materials used in our products, we save resources and thus protect the environment. In 2022, we further reduced the average weight of our inverters to 1.40 kg/kW of inverter power produced. The high power density also reduces the number of inverters required within a PV power plant.



## Leader in the energy transition

SMA Inverters, with a total capacity of about 118 GW, help avoid the emission of 60 million tons of CO<sub>2</sub> per year worldwide.



## Carbon-neutral production

We have set ourselves the goal of supplying SMA with climate-neutral electricity and heating worldwide by 2025. The electricity supply at the headquarters in Niestetal/Kassel, Germany, has been climate-neutral since 2020. Globally, we have already achieved a climate neutrality ratio of 95.1% in 2022.



**SMA-Solar.com**

