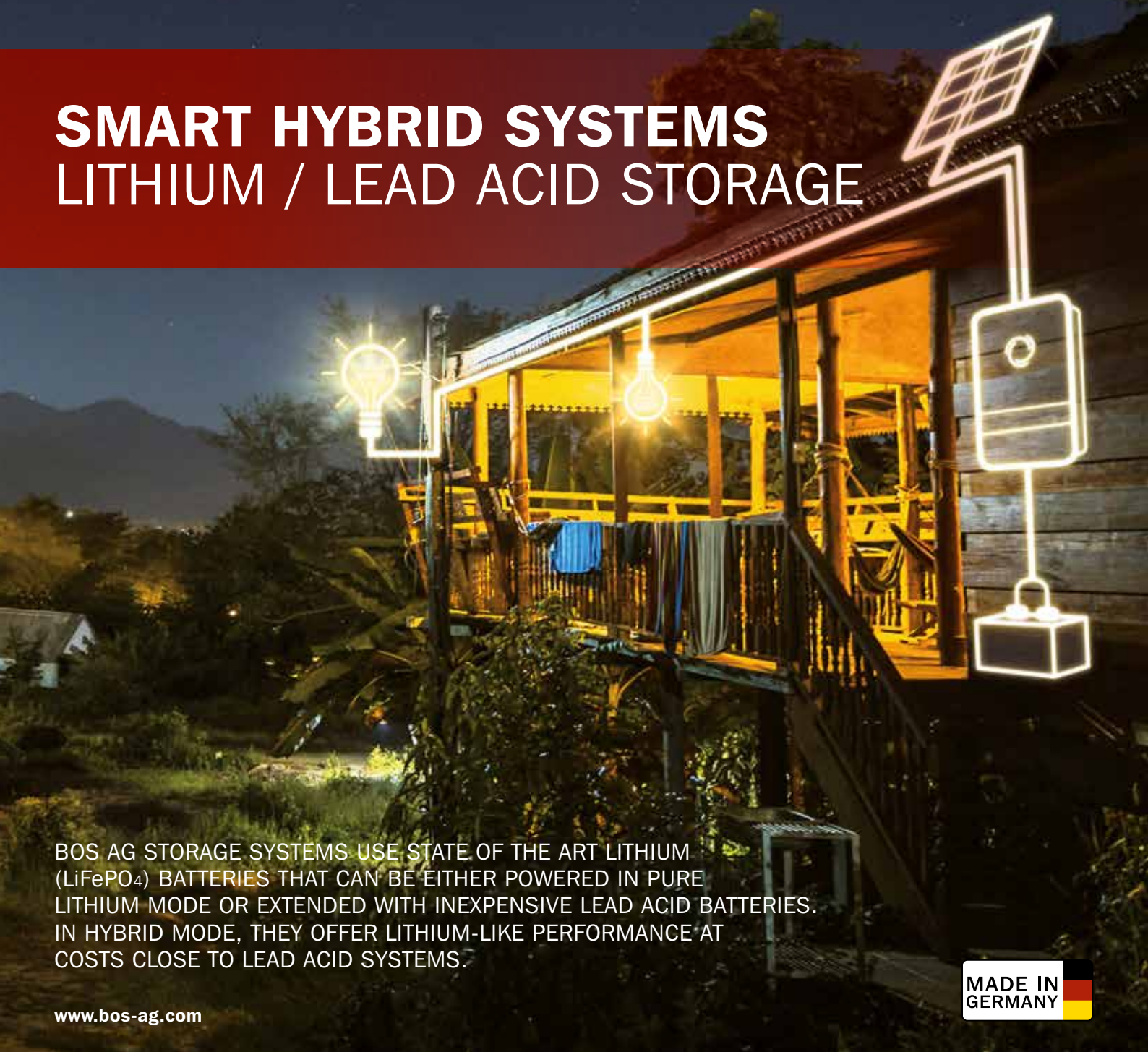
BOS
BALANCE OF STORAGE SYSTEMS

BALANCED SYSTEMS.
SMART ENERGY.

SMART HYBRID SYSTEMS
LITHIUM / LEAD ACID STORAGE



BOS AG STORAGE SYSTEMS USE STATE OF THE ART LITHIUM ($LiFePO_4$) BATTERIES THAT CAN BE EITHER POWERED IN PURE LITHIUM MODE OR EXTENDED WITH INEXPENSIVE LEAD ACID BATTERIES. IN HYBRID MODE, THEY OFFER LITHIUM-LIKE PERFORMANCE AT COSTS CLOSE TO LEAD ACID SYSTEMS.

MADE IN GERMANY

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OUR CUSTOMERS. OUR MARKETS.

LITHIUM PERFORMANCE. LEAD ACID COSTS.

HYBRID TECHNOLOGY PERFORMS AS WELL AS A LITHIUM SYSTEM AT A PRICE CLOSE TO THAT OF A LEAD ACID SYSTEM.

IN DEVELOPING COUNTRIES

Hybrid systems are perfectly suited for Solar Home System applications in private households and for the electrification of schools and health posts in remote places. They are also the perfect central storage solution for DC mini grids. In areas with high power outage rates the systems can be used as an Uninterruptible Power Supply (UPS).

IP 65 INDUSTRIAL HOUSING

Hybrid systems are available in an IP65 industrial power cabinet housing, so the systems are easy to install in multiple ways. They can be customized for special purposes and are perfectly suited for rough conditions such as energy infra-structure along streets, humid areas or public places.

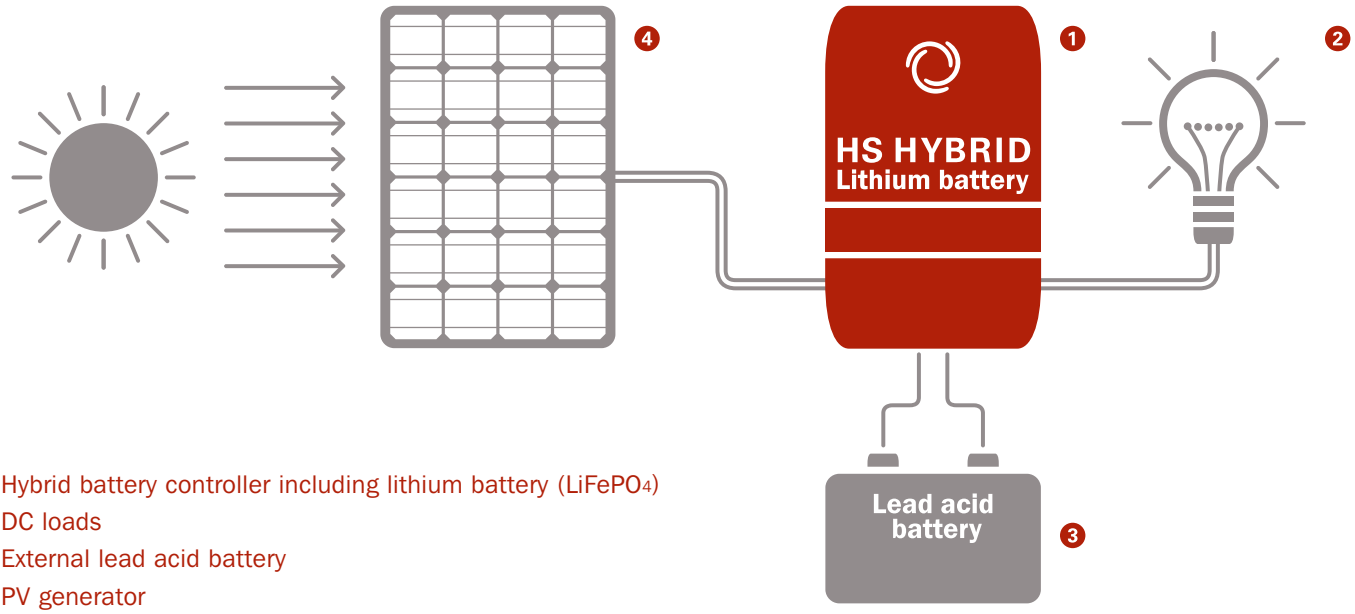
IN INDUSTRIAL COUNTRIES

Remote energy supply in industrial countries, e.g. in mountain huts, remote resorts, cabins or light-houses are a classical field of operation for hybrid systems. The combination of inexpensive power with superb performance offers the best value for money.

BALANCED STORAGE. SMART FEATURES.

HYBRID SYSTEM OVERVIEW

BOS HYBRID SYSTEMS STORE ENERGY IN LITHIUM AND LEAD ACID BATTERIES AND MANAGE THEIR STATE OF CHARGE IN AN INTELLIGENT WAY.



1. Hybrid battery controller including lithium battery ($LiFePO_4$)
2. DC loads
3. External lead acid battery
4. PV generator

1 HYBRID BATTERY SYSTEM

The BOS hybrid system is the central unit in the solar home system. It comes with integrated lithium ($LiFePO_4$) batteries. The hybrid system contains a combined, fully featured charge controller for lithium and lead acid batteries that manages the state of charge of both batteries in an intelligent way.

3 LEAD ACID BATTERY

BOS hybrid systems work with AGM, gel and standard lead acid batteries. Already existing batteries can be used as well. The system controls the lead acid battery's state of charge smartly and includes all relevant protection and performance features.

2 SMART LOAD MANAGEMENT

An excess energy output is only switched on if excess power is available. This helps to run fans, chargers or other high-power devices only if there is enough energy. It automatically keeps enough energy for devices that need to be available 24/7. All hybrid systems come with an integrated USB port.

4 EASY TO INSTALL

Lithium battery and hybrid charge controller are one unit. A lead acid battery, the solar generator and different loads are simply connected to the BOS hybrid systems using standard wire connectors. The customer does not have to configure any lithium battery parameters.

SMART LOAD MANAGEMENT

INTEGRATED USB PORT TO CHARGE PHONES

SIGNIFICANTLY INCREASED SYSTEM LIFETIME

TWO DIFFERENT VOLTAGE LEVELS - 12V AND 24VDC

HIGH-PERFORMANCE LITHIUM BATTERY INCLUDED

EASY UPGRADE OF EXISTING LEAD ACID SYSTEMS

LITHIUM PERFORMANCE AT LEAD ACID COSTS

PURE LITHIUM MODE

LOW INVESTMENT. HIGH PERFORMANCE.

LITHIUM PERFORMANCE AT LEAD ACID COSTS

In pure lead acid systems, batteries often fail within 1 to 3 years, as batteries get damaged by continuous operation at low states of charge. Pure lithium systems perform way better and show longer lifetimes, but are very expensive. Initial investment costs for hybrid systems are close to the costs of pure lead acid systems and approx. 50% lower than pure lithium systems. As costs per stored kWh are around 60% lower in hybrid systems than in lead acid systems, the hybrid system becomes the most cost-effective option within the first 3 years.

EASY UPGRADE OF LEAD ACID SYSTEMS

In existing lead acid systems battery capacity can be increased by adding lithium (whilst it is technically not recommended to mix old and new lead acid batteries). As BOS hybrid systems feature state-of-the-art lead acid charging, all different kinds of lead acid systems can be upgraded. In existing off-grid systems, the old charge controller simply needs to be replaced by the BOS hybrid system. This improves system performance and reduces power costs immediately. The electrical installation can stay the same, hence efforts and additional costs are minimized.

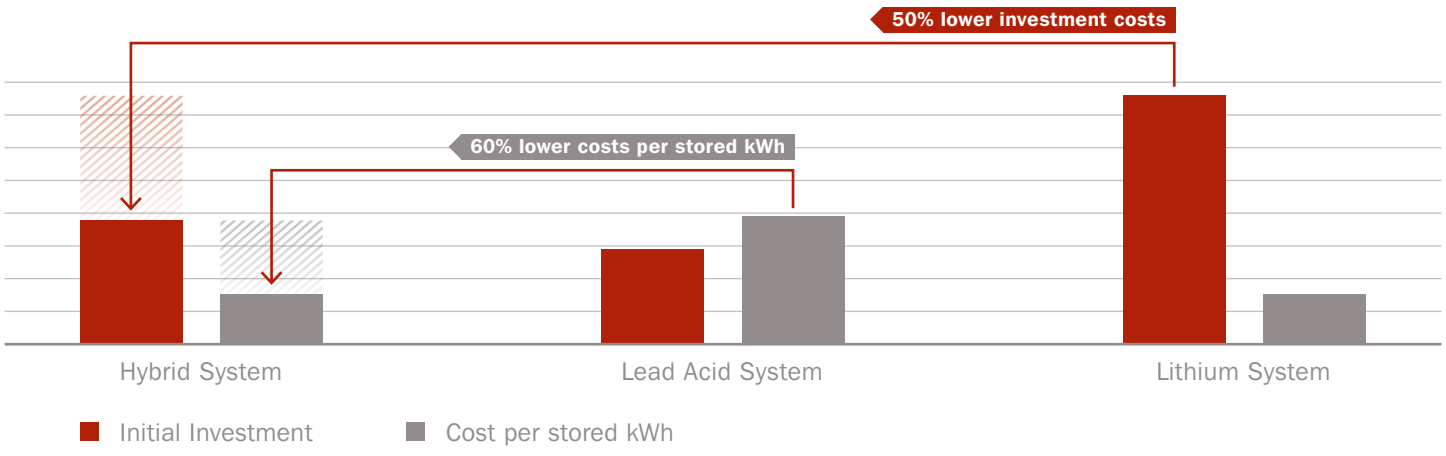
LITHIUM FOR CYCLING, LEAD ACID FOR BASIC LOAD

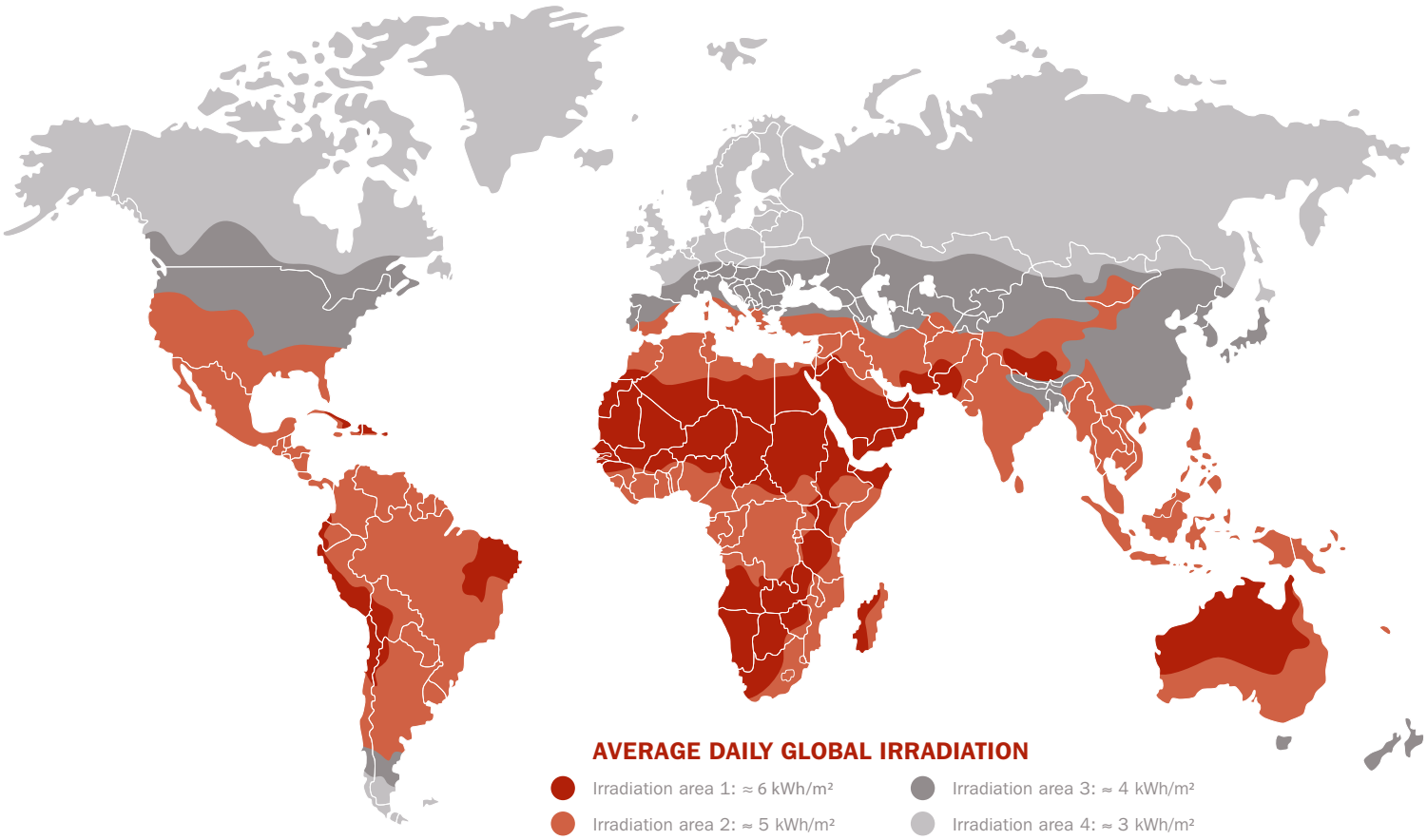
BOS hybrid systems combine the advantages of both battery technologies. During the day, the lead acid battery is charged with higher priority, maximising the time at full state of charge. Surplus energy is stored in the lithium battery, which is used for small cycles and operated optimally by taking advantage of its DOD >90% and its high cycle life. The lead acid battery is only used to power loads once the lithium battery is flat, offering additional power and high backup capacity, whilst staying in a high state of charge at most times.

LONGER BATTERY LIFETIME

The lead acid battery is not strained by many deep charging cycles, as the lithium battery is used for daily cycles. During its long hours at full state of charge, the lead acid battery is floated. Compared to pure lead acid systems both effects positively impact the lead acid battery lifetime. By preventing harmful sulphation, the system's lifetime can be increased to more than 10 years. This lowers energy storage costs significantly and has a positive impact on the environment. The lithium battery offers enough charging cycles for more than 10 years of daily use.

COMPARISON OF DIFFERENT STORAGE SYSTEMS





TECHNICAL SET-UP. SMART SYSTEM SIZING.

EXEMPLARY HYBRID SYSTEM SIZING FOR 2 DAYS' AUTONOMY

Exemplary system configurations		Bat. size net	Panel size	Recommended hybrid system
Mid-size household (186Wh/day) • 5 LED lights (4hrs) • 2 mobile charges • 1 DC TV 17" (3hrs) • 1 DC fan (3hrs) • 1 notebook (2hrs)	5x, 2x, 1x, 1x, 1x	6 kWh/m² area	375 Wh	1 x 50 Wp	150 Wh lithium + 40Ah lead acid
		5 kWh/m² area	375 Wh	1 x 65 Wp	150 Wh lithium + 40Ah lead acid
		4 kWh/m² area	375 Wh	1 x 80 Wp	150 Wh lithium + 40Ah lead acid
DC mini grid application for 20 households (25Wh/day), each household: • 2 LED lights (5hrs) • 2 mobile charges	2x, 2x	6 kWh/m² area	1 kWh	1 x 135 Wp	300 Wh lithium + 125Ah lead acid
		5 kWh/m² area	1 kWh	2 x 80 Wp	300 Wh lithium + 125Ah lead acid
		4 kWh/m² area	1 kWh	2 x 100 Wp	300 Wh lithium + 125Ah lead acid
School classroom including fans and notebooks (1480Wh/day) • 20 LED lights (6hrs) • 20 mobile charges • 6 DC fans (6hrs) • 1 DC TV 17" (3hrs) • 5 notebooks (3hrs)	20x, 20x, 6x, 1x, 5x	6 kWh/m² area	3 kWh	4 x 100 Wp	656 Wh lithium + 2 x 150Ah lead acid
		5 kWh/m² area	3 kWh	4 x 120 Wp	656 Wh lithium + 2 x 150Ah lead acid
		4 kWh/m² area	3 kWh	4 x 150 Wp	656 Wh lithium + 2 x 150Ah lead acid

EASY INSTALLATION

DIFFERENT LITHIUM BATTERY SIZES AVAILABLE

COMPATIBLE WITH ANY LEAD ACID BATTERY TYPE

BALANCED SYSTEMS. SMART ENERGY.

BOS Balance of Storage AG is a German company offering smart hybrid energy storage solutions and DC grid technology. With our technologies, large parts of the off-grid community in developing and industrialised countries get access to high-quality, long-lasting and affordable energy solutions.

BOS AG works at the intersection where People, Planet and Profit meet. Optimizing the footprint and the return in each impact area is the strategic objective.

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BALANCE OF STORAGE SYSTEMS

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