

# Energy Storage Systems

## FAQs on energy storage systems technology

Do you have any questions on the subject of energy storage systems? This info paper may very well provide answers to some of these. If the corresponding answer is not included, feel free to contact us.



### Why is energy storage technology important?

Energy storage systems are used in a huge range of applications, for example for providing electricity in the event of grid outages. Within the environment of the energy revolution, energy storage systems play a key role, in particular with the increasing role of renewable energies, because these sources of energy are not always available when they are needed. The supply of and demand for electrical energy are quite often out of sync. Energy storage systems can bring synchronization to this equation by storing excess electricity produced by solar and wind power systems. Whenever the demand for energy from the grid is higher than that available, the energy storage systems can make this excess electricity available again.



## Can energy storage systems reduce costs?

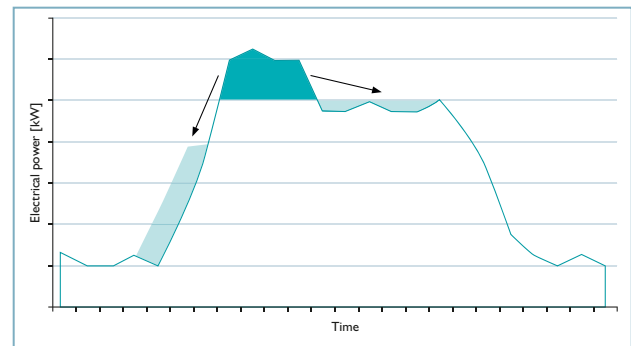
Energy storage systems improve the economic efficiency of the energy supply system in several ways: First, they enable the rapid temporal synchronization of the demand for and supply of energy. They therefore reduce the time needed to operate the supply system using the costly so-called second reserve based on fossil raw materials. Second, they support energy grids that do not have sufficient capacity at suitable nodes, meaning that grid extension costs can be kept low. In combination

with solar and wind turbine generator systems, energy storage systems are replacing diesel generators in off-grid regions. This means that diesel fuel is saved and harmful emissions are reduced. Third, fast energy storage systems integrated into the peak load management systems of industrial and other large-scale consumers reduce the height of peak loads at the grid connection point. This significantly reduces the electricity supply costs for these operations.

## What does the term “peak shaving” mean?

The grid connection points of companies and other large consumers are designed with regard to capacity such that they can supply the expected maximum requirements. These maximum requirements are often significantly higher in the manufacturing industry, for example, than the average energy requirement, and they are largely defined by so-called peak loads. Such peak loads occur, for example, when large rotating machines are switched on. The energy costs of large consumers are not only determined by the amount of energy used, but also, due to the required grid capacity, by the peak loads that actually arise.

By using a number of energy storage systems, consumers can manage their peak loads themselves, thus reducing the maximum energy requirement from the perspective of the supply company. The peak loads are capped; that is to say, shaved. Therefore, in cases such as this, the term “peak shaving” is used.



Load optimization through shifting or limiting the peak load

A well-designed peak load management system can noticeably reduce a company's energy costs, and the investment in the required energy storage system can be amortized over just a short period of time.

## How large are battery energy storage systems?

Battery systems for private homes that are often operated in combination with photovoltaic systems are roughly the size of a refrigerator.

Depending on their capacity, commercial and industrial energy storage systems used in production plants, office buildings, and other commercial facilities fill entire technical rooms with an area of up to 100 m<sup>2</sup> and more. They are generally built in a control cabinet format and are aligned together and interconnected accordingly for the required capacity.

Utility-scale storage systems with capacities of a few 100 MWh, such as those used for grid support, range in size from the equivalent of one to a large number of shipping containers.



## What is the service life of battery energy storage systems?

The service life of a battery energy storage system is based on the number of charging and discharging cycles. The cell chemistry degrades as the number of charging cycles increases. The operating temperature, the charging and discharging power, as well as the depth of discharge also have a significant effect on the service life of an energy storage system.

Different battery types have different service lives. For example, lead-acid batteries can be subjected to around 600 to 1,400 cycles before their capacity reduces drastically and they have to be replaced. On the other hand, lithium-ion batteries can be subjected to a significantly higher number of cycles. In fact, with normal loads, they are capable of more than 8,000 cycles.

## FAQs on energy storage system safety aspects

### Do battery energy storage systems pose any significant dangers?

With a clear conscience, this question can be answered with a no, even though fires and other accidents in connection with battery energy storage systems are reported from time to time. State-of-the-art battery energy storage systems are produced by the manufacturers in accordance with applicable directives and standards, and are installed and commissioned by specialists. As a result of these conditions, critical errors in such systems are a rare exception.

That said, battery energy storage systems are also to be considered as devices and plants with a very high energy content. Dangerous conditions can arise in the event of unauthorized access, willful destruction, or circumvention of the safety measures and equipment. In this respect, battery energy storage systems are no different to comparable energy technology devices such as motor-driven generator systems with fuel tanks.



However, the manufacturers themselves take such scenarios into account through measures such as Failure Mode and Effect Analyses. Depending on the probability of occurrence and the expected severity of the effects, additional measures are put into place to increase the safety and security of the systems.

### Do battery energy storage systems require maintenance?

As is the case with most technical devices and systems, battery energy storage systems should also be checked and serviced regularly. Depending on the storage media used, this maintenance work can be reduced significantly to just visual inspections, the tight fit of screw connections, and so on, as is the case with common lithium-ion batteries. With other systems, however, the amount of work can also be higher, such as with lead-acid batteries, in which the electrolyte has to be checked and topped up regularly.



## Can battery energy storage systems be installed outdoors?

Battery energy storage systems are electrical devices that must be protected from environmental influences such as high levels of humidity, moisture, and contamination to ensure their safe and intended operation. The operating temperature should also be maintained within the range specified by the manufacturer. Suitable measures can be put into place to ensure that these and other conditions are complied with. These include the use of a water and dust-tight housing, as well as air conditioning and ventilation. As long as all of the conditions that should be described by the battery energy storage system manufacturer are met, the devices can also be installed and operated outdoors.





## FAQ on energy storage connection technology

### Can the plug for the busbar connection be removed again after installation on the panel-mount frame?

This is not designed for removal after installation. The panel-mount frame can no longer easily be separated from the connector. Therefore, if a connector has to be replaced, it must be ensured that the panel-mount frame is also replaced. This ensures that the locking mechanism of the panel-mount frame does not become fatigued from repeated use and that the entire system becomes unsafe as a result.



### Can the battery-pole connectors be plugged into any position?

The Phoenix Contact battery-pole connectors can be plugged in and pulled out in any orientation. Moreover, they can be rotated through 360° when plugged in. This simplifies mounting and maintenance enormously. Moreover, it increases flexibility when designing the system.



### Is it possible to reverse the “+” and “-” poles with the battery-pole connector?

Unintentional polarity reversal of the battery connection can lead to enormous damage and, in the worst case, to danger to life and limb. For this reason, the Phoenix Contact battery-pole connectors are color-coded and mechanically coded. The plus pole only fits into the plus position, and negative only into the negative. Moreover,

it is also ensured that the two polarities cannot be short-circuited. If this were the case, the high energy content of the battery would cause the conductors to melt and, with a high degree of probability, lead to a fire in the system.

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