The modular energy storage system for a reliable power supply
The optimal combination of power electronics based on lithium-ion batteries ensures a stable and reliable power supply.

Our products, systems, and solutions for low- and medium-voltage make power distribution efficient, reliable, and safe – in cities, infrastructure, buildings, and industrial plants. They can be linked to industrial and building automation, and are rounded out by comprehensive support throughout the entire lifecycle.

Recent changes to the energy system are creating completely new challenges for distribution grids. More renewable energy in the power mix, which can be highly volatile, can impact on grid stability. A good solution to grid instability is to use an energy storage system as a buffer.

Totally Integrated Power (TIP) – We bring power to the point.
As part of Totally Integrated Power, the energy storage system SIESTORAGE exemplifies the motto “We bring power to the point”. Renewable energy sources have already become key power sources in the current energy mix. Their heavy penetration and the growth of distributed generation have changed the structure of power grids. However, the unpredictable nature of renewable energy generation capacity can lead to fluctuations and imbalances between generation and load, affecting grid stability and power quality.

To ensure a stable and reliable power supply, Siemens has developed SIESTORAGE, a sustainable and modular stationary energy storage and power flow management system that combines fast-acting power regulation function and lithium-ion batteries.

The batteries are supplied by world leading manufacturers. The system can reach a performance of up to 20 megawatts at a capacity of 20 megawatt-hours. The modular concept can be adapted to specific demands, covering any storage power need or capacity, and provides a large range of applications for utilities, network operators, industries, cities, and infrastructure. SIESTORAGE enables them to save potential with asset optimization. Thanks to Siemens’ comprehensive range of products and systems, as well as expertise in solution and implementation, customers profit from an all-in-one solution from planning to engineering, through to installation, commissioning and after-sales service.

SIESTORAGE offers more:

- **Consistency**
  Comprehensive range encompassing everything from LV, MV and storage components to power supply solution expertise

- **One-stop-shop**
  From planning and installation through to commissioning and services

- **Flexibility**
  Modular concept for all needs related to storage power and capacity up to 20 MW / 20 MWh

- **Reliability**
  Power supply in milliseconds and high redundancy of the system for outstanding availability

- **Efficiency**
  Optimization and savings potential for a wide range of applications

- **Safety**
  Overall safety equipment, proven components and battery systems

- **Advanced technology**
  State-of-the-art components combining cutting edge power electronics and Li-ion batteries
The challenge: Reliable power supply
Sustainable energy supply is no longer conceivable without renewable energy sources. Even if the pace of transition from fossil and nuclear power sources towards wind, solar and bioenergy differs from one country to another, the general framework for energy supply has already been established. In this context, energy storage systems play a key role in the transition of grids.

The use of renewables on a large scale leads to new challenges for grid stability: Short-circuit power is a measure for grid stability which producers using wind and solar energy can usually not provide. The infeed of energy from distributed sources can cause a reversed load flow. In distribution grids not designed for this event, damages and power outages can be the result.

Power generation from renewable sources naturally varies to a great extent. This quite often causes imbalances between generation and load, which impair the stability of the grid, going as far as a mains failure. Even the shortest interruption of energy supply can lead to a complete failure of production plants and result in an enormous loss of quality and time, along with noticeable financial damage. A sufficient amount of balancing energy needs to be provided to secure a constant high quality of power supply.
SIESTORAGE can be readily adapted to specific power demands and storage capacities, and therefore used for a wide range of applications.

Thanks to SIESTORAGE, an increasing number of solar and wind power plants can be integrated into distribution grids.

Consequently, grid operators are better able to meet the high energy demands of industrial and infrastructure businesses.

The answer: SIESTORAGE

Conventional energy storage systems cannot readily ensure the stable grid operation on the lower distribution grid levels today. There is a high demand for energy storage solutions that provide balancing power for primary reserve power.

SIESTORAGE is able to deliver available power with next to no delay. Indeed it improves the voltage and supply quality by providing active and reactive power on demand, thus compensating for low voltage fluctuations in generation within milliseconds.

In this way, SIESTORAGE makes it possible to integrate an increasing amount of solar and wind power plants into distribution grids without having to extend them immediately. Thus, the system not only contributes to grid relief, but also buffers additional capacity for electromobility and public transport.

Finally, SIESTORAGE ensures the reliability of electrical grids for isolated sites and areas where access to power is limited. In this case, the system represents a sustainable solution combined with renewable energy sources also suited for microgrids supplied with diesel gensets. When no balancing power is available to improve the gensets’ efficiency, SIESTORAGE can serve as a “range-extender” at higher loads for smaller gensets, optimizing the size and efficiency of the generators.

During low load periods, energy can be taken from the grid and stored for peak load periods since exceeding the maximum output agreed to with the utility only once can cause high costs. This way, SIESTORAGE helps to avoid expensive peak loads and provides a sustainable solution for industrial processes, infrastructure businesses, and energy-efficient buildings.

Another field of application for SIESTORAGE is the continuous power supply of sensitive industrial production processes, data centres, hospitals, etc. The system is able to guarantee energy reliability even in the case of an outage. The black-start capability of SIESTORAGE makes the start-up of a grid possible when the main supply is not available. The energy stored is sufficient to start a gas turbine, for example, and bridge the grid’s power requirements.

Bulky storage
- Resource adequacy
- Frequency regulation
- Time shifting
- Renewable firming

Ancillary services
- Spinning reserve
- Ramping control
- Black start
- Reactive power

- Upgrade deferral
- Renewable smoothing
- Congestion relief
- Voltage support

- Peak load management
- Power quality
- Backup power
- Offset diesel
Analysing the grid as a first step

Everything begins with an analysis of the grid to determine the adequate business model. A simulation of several potential applications is carried out including the assessments of the efficiency of the SIESTORAGE use. Siemens offers a complete consultation package that includes power flow calculation and reactive power analysis, contingency analysis, short-circuit current calculation, probabilistic reliability analysis, dynamic stability calculation, and protection coordination.

Offset diesel application example: Improvement of the size and efficiency of gensets
Saving potentials for various sustainable business cases

In case a PV or wind system is connected as a power source, weather and seasonal dependencies as well as the forecastability of these dependencies must be looked into. A regulating function of SIESTORAGE must implement a charging/discharging behavior according to the forecast curve. A statistical limit needs to be set for the availability of the storage system, when assuming fluctuating power sources. This limit is defined in the planning process for the implementation of SIESTORAGE. It is dependent on the specific application and goes in the planning as boundary condition. The optimized efficiency of an application also depends on the local regulation and on potential financial incentives. SIESTORAGE can therefore play a key role in the achievement of ambitious climate goals. The following examples can be considered as sustainable business cases.

Spinning reserve

The variation between power generation and actual load is compensated with the help of spinning reserve. SIESTORAGE reliably provides balancing power within milliseconds, guaranteeing a constant energy supply and cost savings for power generation and the provision of additional reserve power. In addition to that, the stored renewable energy can be traded at electricity exchanges in a more targeted manner.

Peak load management

Energy operators fix with their customers a price for maximum load, which is the reason why e.g. industrial businesses generally use their own generators for short-time peak loads – because exceeding the maximum load can cause high costs. These generators are not always emission-free. SIESTORAGE can balance peak loads with stored energy and thus supports eco-friendly operation.

T&D deferral

Fluctuating infeed puts strain on low- and medium-voltage grids. SIESTORAGE compensates for this by storing excess energy and transferring it into the grid later. The amount of energy to be transmitted remains constant and the load on the distribution grid even, avoiding grid extensions and protecting the grid’s LV and MV components.

Offset diesel

With SIESTORAGE, the size of generators can be optimized, since SIESTORAGE functions as “range-extender” to smaller gensets. SIESTORAGE is able to reduce the runtime of diesel generators (switch off at lower loads), thus providing lower fuel consumption and gas emissions for a better environmental footprint.
A modular concept to address all needs of storage power and capacity

4 Power Stacks – Content

- 2 inverter cabinets (with max. 2 inverter modules)
- 1 control cabinet
- 1 grid connection cabinet (optional)
- X battery cabinets*
- Power: max. 472 kVA
- Rated capacity: from 180 to 900 kWh

12 Power Stacks – Content

- 6 inverter cabinets (with max. 2 inverter modules)
- 1 control cabinet
- 1 grid connection cabinet (optional)
- X battery cabinets*
- Rated power: 1,080 kW (scalable)
- Rated capacity: from 540 to 2,700 kWh (scalable)

2x12 Power Stacks (e.g. in 45’ container solution)

- incl. HVAC (Heating Ventilation and Air Conditioning) control, fire detection and extinguishing system
- Rated power: 2,160 kW (scalable)
- Rated capacity: 1,080 kWh (scalable)

*max. 5 connected to one inverter module, depending on the battery manufacturer
The modularity of SIESTORAGE enables the highest design flexibility. The system can be combined and adapted to suit any customer's needs. It comprises an inverter cabinet, a control cabinet, a grid connection cabinet, and up to five battery cabinets per inverter, depending on the battery supplier. It is scalable from approximately 0.1 to 20 MW and can be integrated into a standard container. SIESTORAGE can thus be adapted to meet any storage power and capacity needs for any application.

**High reliability by lowest maintenance**

Thanks to the parallel connection of the inverters on the AC side, the very high redundancy of the SIESTORAGE system is an advantage in case of a single point of failure, which has no influence on the availability of the storage system. This leads to the highest availability of power and a high reliability. Through individual balancing of the battery cabinets, the installed battery capacity is optimized at the maximum and provides more reliability by lowest maintenance.

**Highest availability with the SIESTORAGE solution**

1. High availability and power reliability thanks to parallel connection of the inverters on the AC side
2. Optimization of the installed battery capacity through individual balancing of the battery cabinets

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**Grid connection cabinet**

- (400 x 600 x 2,200 mm)
- Cable tap for grid connection
- Busbar system
- *optional

**Inverter cabinet**

- (600 x 600 x 2,200 mm)
- 2 inverter modules and related control equipment
- Each module:
  - V nominal: 400 V
  - I nominal: 170 A
  - S nominal: 118 kVA
- P nominal: depending on the battery type

**Control cabinet**

- (800 x 600 x 2,200 mm)
- HMI (Human Machine Interface)
- SCU (System Control Unit)
- Ethernet switch
- 24 V DC power distribution
- Auxiliary power transformer (optional)

**Battery cabinet**

- (600 x 650 x 2,200 mm)
- Content example*:
  - 14 modules
  - 1 BMS (Battery Management System)
  - Power: 90 kW
  - Capacity: 45 kWh
- *Depending on supplier
Benefits of comprehensive competence

With its comprehensive competence, Siemens contributes to maximizing returns and optimizing energy consumption. Decades of experience and continuous innovation are the basis for this know-how. The results are integrated solutions with state-of-the-art components ranging from storage components, including power electronics and Li-ion batteries, to LV and MV switchgear, transformers and energy automation, all of which ensure grid integration. In addition, Siemens provides a HVAC system (heating/ventilation/air conditioning) for smooth operation at high ambient temperatures, as well as a fire detection and extinguishing system. As an E-House manufacturer, Siemens has expertise in power packaging and can deliver a ready-to-install solution that has been thoroughly developed, manufactured, assembled and pre-tested. This reduces both construction risks and installation time.

With SIESTORAGE, customers benefit from the consistency of Siemens’ advanced technology competence in power supply solutions and expertise in implementation. Everything from a single source!

**Technology expertise**
- Power electronics and storage systems
- Low- and medium-voltage switchgear
- Transformers
- Energy automation and grid integration

**Solution and implementation expertise**
- Experience with network operators
- E-House manufacturing
- Power packaging solution expertise
- One of the leaders in smart systems
Our after-sales service concept is based on a Customer Support Center (hotline) available 24/7. It offers professional maintenance services, scheduled or on call. Life time of the batteries can be extended by tracking crucial parameters and optimizing operation.

After-sales service

One-stop-shop
Siemens is with its customers every step of the way through all phases of the project, from engineering to installation and commissioning. Reliable and competent local support is provided right from planning to after-sales service. Components and auxiliary equipment are globally sourced, and integrated in an E-House or the customer’s building. Siemens’ production facilities and centers of competence are found around the globe. Siemens supports the local creation of value, and guarantees a competent contact person is in close reach of every project. Siemens experts bring their experience in project management, financial services, and life cycle management to every project. This enables them to consider any aspect of safety, logistics, and environment protection.

Consulting, planning
Engineering
Order, delivery
Installation, commissioning
Operation
Service, modernization

Project life cycle management

Consulting,
planning
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Order,
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Operation
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After-sales service

Our after-sales service concept is based on a Customer Support Center (hotline) available 24/7. It offers professional maintenance services, scheduled or on call. Life time of the batteries can be extended by tracking crucial parameters and optimizing operation.

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of the products. An obligation to provide the respective
characteristics shall only exist if expressly agreed in the
terms of contract.