The modular energy storage system for a reliable power supply

SIESTORAGE

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Global annual utility-scale energy storage power capacity additions are expected to grow from 1,158.8 MW in 2017 to 30,472.5 MW by 2026.

Global annual DESS power capacity additions are expected to grow from 683.9 MW in 2017 to 19,699.7 MW by 2026.

In 2017, five countries are expected to account for 58 percent of new energy storage capacity across both utility-scale and distributed markets.

By 2026 the five largest country markets are expected to represent only 51 percent of new energy storage capacity.

Source: Navigant Research
Energy Storage – Local Overview

Agência Nacional de Energia Elétrica – ANEEL
Superintendência de Pesquisa e Desenvolvimento e Eficiência Energética – SPE

CHAMADA Nº 021/2016

PROJETO ESTRATÉGICO: “ARRANJOS TÉCNICOS E COMERCIAIS PARA A INSERÇÃO DE SISTEMAS DE ARMAZENAMENTO DE ENERGIA NO SETOR ELÉTRICO BRASILEIRO”
The energy business is changing dramatically

- Customer behavior: Dependency relationships dissolve
- Big data: has to be turned into smart data
- Distributed energy systems: increase complexity
- Frequency and voltage stability challenges: More load fluctuations need to be managed
- Shorter time-to-market intervals: make asset management more difficult
- Capacity constrains: require fast reacting grid control and adaptive assets
The solution: energy storage for very different purposes

Application
- Reserves
- Firming
- Time shifting
- System stability

Segmentation
- Reserve capacity
  - Response to emergencies

Application
- Reserves
- Distribution grid
  - Ensure stability
  - Load optimization
- Transmission grid
  - Ensure power system stability
- Decentralized generation
  - On-grid + grid upgrade deferral
  - Remote areas/off-grids
- Variable generation (PV, wind)
  - Avoid curtailment
  - Rules for grid integration
  - Energy arbitrage (time shifting)
- Consumer/Prosumer
  - Residential/commercial self-supply
  - Industrial peak shaving
- Conventional power plants
  - Increase flexibility/load optimization

Power
- 1 kW
- 100 kW
- 1 MW
- 10 MW
- 20 MW
Energy storage technologies and application areas

- Know-how in different battery technologies and chemistries
- Designed for the use of various battery suppliers
- Technical data depending on supplier
- Maximum savings through optimized plant operation


CAES – Compressed Air Energy Storage
<table>
<thead>
<tr>
<th>Applications</th>
<th>Use cases</th>
</tr>
</thead>
</table>
| Electricity supply for microgrids/ isolated grids | • Black start  
• Ramping control  
• Time shifting  
• Capacity firming  
• Diesel offset  
• Frequency regulation (Primary Control Reserve)  
• Peak load management |
| Electricity supply for industry                  | • Black start  
• Backup energy  
• Diesel offset  
• Peak load management |
| Integration of renewable energy                  | • Ramping control  
• Time shifting  
• Capacity firming |
| T&D upgrade deferral                             | • Peak load management  
• Ramping control  
• Frequency regulation |
With Siemens as a reliable partner for energy distribution, you benefit from a consistent, end-to-end product offering as well as a fully integrated solution – all from a single source!

SIESTORAGE Battery Energy Storage System - A fully integrated power supply solution
With a fully integrated Microgrid Management Controller

Features

- Distributed generator control also for renewable generation
- Network synchronisation
- Load control
- Storage control
- Online control via HMI
- Grid monitoring and control
- Generation forecast
- Load forecast
- Schedule optimization
- Enhanced SCADA functionality
- Dynamic grid constraint consideration using state estimator function
State-of-the-art power electronics, advanced control – and Li-ion batteries

- Response within milliseconds
- High efficiency
- Longevity (design lifetime ≥ 20 years)
- IT security (remote access) according to IEC 61443-3-3
Frequency regulation with SIESTORAGE to ensure grid stability
Advantages

Modularity

A modular system, flexible and scalable

- Flexible design for various power and capacity requirements
- High redundancy for outstanding availability
Modular design concept for standard applications

A) GRID CONNECTION CABINET
- Cable tap for grid connection
- Busbar system

B) CONVERTER CABINET
- S nominal: 140 kVA or 800 kVA
- V nominal: 400 V

C) CONTROL CABINET
- HMI (Human Machine Interface)
- SCU (System Control Unit)
- Ethernet switch
- 24 V DC power distribution
- Auxiliary power transformer

D) BATTERY CABINET
- Use of various battery suppliers
- Technical data depending on supplier
Advantages

Flexible configuration for all BESS* applications

- Power Converter System (PCS) hardware and software developed specifically for BESS* applications
- Grid-forming parallel operation with wind, solar, and diesel possible
- Black start capability
- High system dynamics: POI voltage regulation within < 10 ms
- High short-circuit power (2 - 3 x rated power)
- Choice of different external communication interfaces (IEC 60870-5-104, S7, IEC 61850 and PROFIBUS DP)

* Battery Energy Storage System

**Configuration model**

![Configuration model diagram](image_url)
Example of system configuration

SIESTORAGE components
- Converter cabinet
- Grid connection cabinet
- Control cabinet

Battery cabinets incl. battery management system
- Battery cabinet

LV + MV components
- 8DJH gas-insulated medium-voltage switchgear
- SIVACON S8 low-voltage switchboard
- GEAFOL cast-resin rectifier transformer

HVAC, fire fighting and safety equipment
- HVAC
- Fire detection and extinguishing system
Certified system in compliance with all international standards

**Applicable regulations / standards and conformity**

<table>
<thead>
<tr>
<th>Conformity (LV-D 2006/95/EG)</th>
<th>CE</th>
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</thead>
<tbody>
<tr>
<td>System standard of the converter</td>
<td>EN 61439, IEC 60146</td>
</tr>
<tr>
<td>System standard of the batteries</td>
<td>EN 50178, EN 50272-2</td>
</tr>
<tr>
<td>EMC compatibility of the system</td>
<td>EN 61000-6-2</td>
</tr>
<tr>
<td>EMC emissions of the system</td>
<td>EN 61000-6-4</td>
</tr>
<tr>
<td>Degree of protection (EN 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>Grid Code</td>
<td>BDEW, AR-N-4110</td>
</tr>
</tbody>
</table>
SIESTORAGE for electrical balance of plant to integrate PV generation into the grid

1. Combiner box
2. MV converter station
3. SIESTORAGE
4. E-House
5. Transformer
6. Monitoring & control center
References – Know how & Experience to build on (~ 65 MW)

26 Projects in operation / under construction

In 9 countries

7 different Use Cases
Germany, VEO (Vulkan Energie Oderbrücke GmbH)
The steel plant of Eisenhüttenstadt depends on it

2.8 MW
1080 kWh
SIESTORAGE system

Main applications
Black start of a gas turbine

Turnkey solution
Portugal, InovGrid Évora, edp
Energy storage pilot project

472 kW
360 kWh
SIESTORAGE system

Main applications
Energy backup, voltage regulation, peak shaving

Turnkey solution
Island of Ventotene, ENEL, Italy: SIESTORAGE and SICAM Microgrid Manager – Off-grid electrification and sustainable microgrid

500 kW
600 kWh
SIESTORAGE system

~15%
Fuel savings

~ -55%
gen-set operating hours

Improved grid stability, reduction of CO2 and maintenance costs
1.6 MW
1.3 MWh
SIESTORAGE system

Main applications
Primary Reserve Power

Turnkey solution
27" container

Netherlands, SIESTORAGE for Primary Reserve Power
Very compact design = 27 ft Container only
1 MVA
500 kWh
SIESTORAGE system

Main applications
Network stabilization for decentralized power generation / integration of renewables

Turnkey solution
England, The University of Manchester
Technology and solution for green energy

236 kW rated active power
180 kWh
SIESTORAGE system

Main applications
Power supply of the campus
For R&D purpose

Turnkey solution
Germany, Hydroelectric Power Plant
SIESTORAGE for Frequency Regulation

10 MW
13 MWh
SIESTORAGE system

Main applications
Network stabilization for
decentralized power
generation

Turnkey solution
6 MW
8.2 MWh
SIESTORAGE system

Main applications
Primary reserve power

Turnkey solution
Germany, Siemens
SIESTORAGE for Peak Shaving (Grid Fee Reduction)

1.4 MW
1.8 MWh
SIESTORAGE system

Main applications
Peak Load Management
ROI ≈ 4yrs through yearly grid fee reduction

Turnkey solution
Obrigado

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