The modular energy storage system for a reliable power supply

SIESTORAGE
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 swings need to be managed

Shorter market time intervals
make asset management more difficult

Capacity constrains
require fast reacting grid control and adaptive assets
SIESTORAGE Battery energy storage system

**Benefits**

- **One-stop shop:**
  From analysis to planning, system integration and services

- **Advanced technology:**
  Cutting-edge power electronics and control combined with Li-ion batteries

- **Safety:**
  Fully security-tested and certified system

- **Reliability:**
  Power supply in milliseconds and high redundancy for outstanding availability

- **Cost-efficiency:**
  Optimization and savings potential for a wide range of applications

- **Flexibility:**
  Covering many power and capacity needs thanks to a modular system design

- **Eco-friendly:**
  Integration of renewables and less CO₂ emissions
Energy storage technologies and application areas

- Electrical storage
- Mechanical storage
- Electrochemical storage
- Chemical storage


CAES – Compressed Air Energy Storage

- 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

Technology:
- Chemical storage
- Electrochemical storage
- Mechanical storage
- Electrical storage

- Li-ion batteries
- NaS batteries
- Redox flow batteries
- Diabatic/adiabatic CAES
- Water pumped storage
- Flywheel energy storage
- SIESTORAGE
- Dual film capacitor
- Superconductor coil
- Compressed Air Energy Storage (CAES)

Time in use:
- Minutes
- Hours
- Days/months

SIEMENS
### Applications and use cases

<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 |
Comprehensive system and cutting-edge technology

Cutting-edge technology

- SIESTORAGE combines cutting-edge power electronics, automation, and state-of-the-art Li-ion battery technology, resulting in the following advantages:
  - Fast and accurate response time to consume and discharge energy
  - Assured power quality
  - Flexible and scalable design for many use cases
  - Increased reliability thanks to system architecture redundancy
Modular concept for standard applications design

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

Example of a schematic diagram
Point of interconnection (POI)
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

Interactive
Fully integrated Microgrid Management System

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
Software tools
For business case development and network studies

PSS SinCal

PSS (Simpson)

Simulation examples
KPI results

Unrestricted © Siemens AG 2017
Page 10  Nov 2017  EM MS PA APS
Reduced interfaces through one-stop shop

Service
over the entire asset life cycle

Commissioning and installation
in e-houses, existing buildings, or containers

Construction and integration
of components and systems

Analysis
of grid and user requirements

Development
of business cases

Planning
of the complete project
References - Know how & Experience to be build on

26 Projects installed
In 9 countries
7 different Use Cases
InvovCity Évora, edp, Portugal
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
Sustainable and independent microgrid

10-15% Oil/CO₂ savings

Off-grid electrification…
Increased use of renewable energy and optimized fuel engine operation

Grid stabilization
VEO (Vulkan Energie Oderbrücke GmbH), Eisenhüttenstadt, Germany: The Steel Plant depends on it

2,8 MW
720 kWh
SIESTORAGE system

Main applications
Black start of a gas turbine

Turnkey solution

1 Modular battery storage system
2 Starting motor of the gas turbine
3 Natural gas turbine
4 Standalone grid/plant grid
5 Public grid
6 Integrated steel works
7 Power failure/blackout in the local grid
VDL, Netherlands: SIESTORAGE for Primary Reserve Power
Very compact design = 27 ft Container only

1.6 MW
1.3 MWh
SIESTORAGE system

Main applications
Primary Reserve Power

Turnkey solution
27’’ container
Main applications
Primary Reserve Power

Turnkey solution

Germany, Public Utility
SIESTORAGE for Primary Reserve Power

6 MW
8.2 MWh
SIESTORAGE system

Primary Reserve Power
Germany, Hydroelectric Power Plant
SIESTORAGE for Frequency Regulation

10 MW
13 MWh
SIESTORAGE system

Main applications
Network stabilization for decentralized power

Turnkey solution
Romania, Wind Farm
Energy storage system deployed to increase utilization of Wind plant

1 MW
1 MWh
SIESTORAGE system

Main applications
Increase utilization of Wind plant

Turnkey solution

Challenge:
• Reduce forecast errors from the power schedule submitted day-ahead to reduce balancing costs.
• Enable hybrid-plant deliver extended power services of frequency & voltage stability, island operation.
Romania, Wind Farm
Energy storage system deployed to increase utilization of Wind plant
Romania, Wind Farm
Energy storage system deployed to increase utilization of Wind plant

Project scope
Demonstration battery project to gain experience in its deployment, implementation, operational capabilities, performance and costs.

Objectives
Driver for future global renewable investment strategy
Contact page

Panagiotis Stamoulis
E-mail: panagiotis.stamoulis@siemens.com
Phone: +49 172 533 08 47

www.siemens.com/siestorage