











Unrestricted © Siemens AG 2017







Energy Storage – Global Overview

• 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-tomarket intervals make asset management more difficult

Capacity constrains require fast reacting grid control and adaptive assets





The solution: energy storage for very different purposes







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



FIEE

Source: Study by DNK/WEC "Energie für Deutschland 2011", Bloomberg – Energy Storage technologies Q2 2011 CAES – Compressed Air Energy Storage





Applications and use cases

Applications		Use cases
Ele mi	ectricity supply for icrogrids/ isolated grids	 Black start Ramping control Time shifting Capacity firming Diesel offset Frequency regulation (Primary Control Reserve) Peak load management
Ele	ectricity supply for industry	 Black start Backup energy Diesel offset Peak load management
	tegration of renewable energy	 Ramping control Time shifting Capacity firming
<u>=</u> Т т т т	&D upgrade deferral	 Peak load management Ramping control Frequency regulation





SIESTORAGE Battery Energy Storage System - A fully integrated power supply solution



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!







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





Advantages



State-of-the-art power electronics, advanced control – and Li-ion batteries

- Response within milliseconds
- High efficiency
- Longevity (design lifetime \geq 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

SIESTORAGE functional diagram







Modular design concept for standard applications



GRID CONNECTION CABINET

- Cable tap for grid connection
- Busbar system



CONVERTER CABINET

- S nominal: 140 kVA or 800 kVA
- V nominal: 400 V

CONTROL CABINET

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

BATTERY CABINET

Use of

various battery suppliers

Technical data depending on supplier





Advantages



- 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)

Configuration model













Example of system configuration



SIESTORAGE components

Converter cabinet	1	
Grid connection cabinet	2	
Control cabinet	3	
Battery cabinets incl. battery management system		
Battery cabinet	1	
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

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• Fire detection and extinguishing system





Advantages

Conformity with standards

Certified system in compliance with all international standards

Applicable regulations / standards and conformity

Conformity (LV-D 2006/95/EG)	CE
System standard of the converter	EN 61439, IEC 60146
System standard of the batteries	EN 50178, EN 50272-2
EMC compatibility of the system	EN 61000-6-2
EMC emissions of the system	EN 61000-6-4
Degree of protection (EN 60529)	IP20
Grid Code	BDEW, AR-N-4110









SIESTORAGE for electrical balance of plant to integrate PV generation into the grid







References – Know how & Experience to build on (~ 65 MW)



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

Portugal, InovGrid Évora, edp Energy storage pilot project

472 kW 360 kWh SIESTORAGE system ENERGYSTORAGE eda distribuição Main applications A sua energia passa por aqui Energy backup, voltage regulation, peak shaving **Turnkey** eda 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 stabili reduction of CO2 and maintenance costs

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

1 мva **500 кwh** SIESTORAGE system

Main

applications

Network stabilization for decentralized power generation / integration of renewables

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

Germany, Hydroelectric Power Plant SIESTORAGE for Frequency Regulation

10 MW 13 MWh SIESTORAGE system

Main applications

Network stabilization for decentralized power generation

6 MW

Main

8.2 MWh

Germany, Public Utility **SIESTORAGE** for Primary Reserve Power

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

Obrigado

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