

# The Grid Battery Energy Storage Technologies Market Report 2015

https://marketpublishers.com/r/GDE111C8A52EN.html

Date: September 2015

Pages: 273

Price: US\$ 2,425.00 (Single User License)

ID: GDE111C8A52EN

#### **Abstracts**

The Grid Energy Battery Storage (GEBS) technologies storage market is beginning to gain momentum as many electro-chemical technologies evolve from a demonstration projects into commercial deployment on a grid scale level. GEBS technologies provide a number of advantages over other established, emerging and competing technologies such as ease of deployment, flexibility of use, the precision and quality of the service they can provide to grid operators and the lack of geographical constraints experienced by technologies such as CAES and PHS.

Market dynamics such as ageing electrical grids, utility financial constraints, development of renewable intermittent energy sources and an evolving regulatory environment will be key drivers of the adoption of GEBS technologies. As production costs of grid scale battery technologies decline we expect to see increased deployment around the world with U.S, Germany China and Japan being early adopter and drivers, further driving down costs of these systems.

Why you should buy The Grid Battery Energy Storage Technologies Market 2015

273 pages of comprehensive analysis

55 tables, charts, and graphs quantifying the market in detail

Grid Battery Energy Storage Technologies market forecasts between 2015 and 2025

Ten year market forecasts for 5 GBES submarket forecasts including:



## Lead-Acid Lithium-Ion Sodium-Ion Flow Batteries Other Battery Types Forecasts for the 12 leading and Rest of the World (RoW) markets within the Grid Battery Energy Storage Technologies market: US Germany Canada China Japan Spain Italy France UK South Korea Australia South Korea

Rest of the World



A SWOT analysis that examines the GBES market

74 key companies identified and profiled operating within the Grid Battery Energy Storage Technologies market.

You can order this report today and discover the latest market trends and uncover sources of future market growth for the Grid Battery Energy Storage Technologies industry and gain an understanding of how to tap into the potential of this market by ordering The Grid Battery Energy Storage Technologies Market 2015.



#### **Contents**

**Executive Summary** 

Benefits of the Report

Intended Audience

Report Contributors

Methodology

Introduction to the Grid Battery Energy Storage Technologies Market

History of the Evolution Battery Storage Technology

How Rechargeable Batteries Work

Description of Grid-scale Battery Energy Storage Technologies and System

Components

Figure 1: Overview of Grid Battery Electro-Chemical Technologies

Figure 2: Typical Wind Farm Grid Battery Storage Facility

Conventional Batteries

Lithium-Ion Batteries

Lithium-Ion Battery Composition

Figure 3 Lithium-Ion Battery Configuration

Lithium-Ion Battery Characteristics

Figure 4: Map of Planned and Existing Lithium Ion Demonstrations (2009)

Advantages Lithium-ion batteries

Disadvantage Lithium-ion batteries

Table 1: Lithium-Ion Battery Features

Table 2: Lithium-Ion Battery Costs by Benefit (2010\$)

**Lead-Acid Batteries** 

Figure 5: Lead-acid Battery Configuration

**Lead-Acid Battery Configuration** 

Types of Lead-Acid Batteries

Flooded Type Lead-acid Batteries

Valve-Regulated Lead acid Batteries

Maintenance Requirements for Lead-acid Batteries

Advanced Lead-acid Batteries

Cost of Operating Lead-acid Batteries

Table 3: Lead acid battery costs by application (\$)

Table 4: Lead-Acid and Advanced Lead Acid Battery Costs by Application (\$)

Advantages of Lead-acid Batteries

Disadvantages of Lead-acid Batteries

**High Temperature Batteries** 

Sodium-Based Batteries



Figure 6: Sodium Sulphur Cell Construction

Sodium-Sulphur Battery Configuration

Commercialization of Sodium-Sulphur Batteries

Operating Ranges of Sodium-Sulphur Batteries

Operating Costs of Sodium-Sulphur Batteries

Sodium-Nickel-Chloride (ZEBRA) Batteries

Technical Characteristics of Sodium Nickel-Chloride

Table 5: Sodium sulphur battery costs by application (\$)

Table 6: Sodium Sulphur Battery Costs by Benefit (\$)

Advantages of Sodium-Based Batteries

Figure 7: Advantages of NaS Battery Technology

Disadvantages of Sodium-Based Batteries

Flow Batteries

Figure 8: Flow battery system

Types of Flow Battery

Figure 9: Flow battery Cell construction

Hybrid Flow Batteries compared with Redox Flow Batteries

**Redox Flow Batteries** 

Vanadium Redox Batteries

Composition of Vanadium Redox Flow Batteries

Response Time of Vanadium Redox

Table 7: Technical characteristics of VRB systems by application

Vanadium Redox Batteries Energy & Power Characteristics

Vanadium Redox Batteries Facilities

Operating Costs of Vanadium Redox Batteries

Figure 10: Component costs of a VRB as a percentage of total capital cost (\$)

Figure 11: Present capital costs estimates of VRB systems

Table 8: VRB capital and operating costs (\$)

Table 9: VRB Costs by Benefit (\$)

**Hybrid Flow Batteries** 

Zinc Redox

Zinc-Bromine Flow Battery

Figure 12: Zinc bromine battery composition

Operating Range of Zinc-Bromide

Zinc Bromine Flow Batteries Facilities

Operating Costs of Zinc-Bromine Flow Batteries

Table 10: Zinc Bromine Battery Costs by Application (2003\$)

Table 11: Zinc Bromine Battery Cost by Size and Application (2010\$)

Advantages of Flow Batteries



Disadvantages of Flow Batteries

Nickel-Cadmium (NiCd) & Other Nickel Electrode Batteries

Figure 13: Nickel cadmium cell composition

Operating Ranges of Nickel-Cadmium Batteries

Types of Nickel-Based Batteries

Table 12: Nickel Cadmium Battery Costs by Application (2003\$)

Table 13: Nickel Cadmium Battery Features

Advantages of Nickel-Based Batteries

Disadvantages of Nickel-Based Batteries

Other Battery Designs

Metal Air Batteries

Figure 14: Metal air battery compositions

Molten/Liquid Metal Batteries

Figure 15: General Molten air battery composition

Figure 16: Liquid Metal battery composition

Advantages of Metal Air & Metal Liquid Batteries

Disadvantages of Metal Air & Metal Liquid Batteries

A Comparison of the Different Battery Technologies

Table 14: Select Battery Technology Comparison. (MW, \$/kWh, MWH)

Traditional Electro- Chemicals

New Electro-Chemical Approach

Figure 17: Power rating and discharge duration at rated power

Figure 18: A comparison of technology maturity and anticipated R&D expenditure

**Cost Comparison** 

Table 15: Summary of the main Mechanical & electrical Energy Storage systems (MW, \$/kWh, MWH)

Figure 19: Per unit energy and power capital costs by technology

Table 16: Present worth cost of 10-year operation in year 1 (\$/kW)

Figure 20: Energy Storage Technology Applications

Review of other Relevant Utility Scale Storage Technologies

Figure 21: Comparison of PHS, CAES, and Emerging Technologies, system ratings

Figure 22: Comparison of PHS, CAES, and Other Emerging grid scale storage

Technologies costs

Pumped Hydro Storage

Compressed Air Energy Storage

CAES Heat Storage and Advanced Adiabatic CAES

Other Emerging Grid Scale Energy Storage Technologies

Figure 23: Maturity stage of energy storage systems

Ultracapacitors



Flywheels

Global Grid Battery Energy Storage Technologies Industry SWOT Analysis

Global Grid Battery Energy Storage Technologies Industry Outlook

Table 17: Global Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 1: Global Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 2: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Lithium-Ion Grid Battery Energy Storage Sub-Market

Table 18: Lithium-Ion Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 3: Lithium-Ion Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Table 19:Li-ion Batteries SWOT

Chart 4: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Lead-Acid Grid Battery Energy Storage Sub-Market

Table 20: Lead-Acid Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 5: Lead-Acid Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Table 21:Lead-Acid Batteries SWOT

Chart 6: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Flow Batteries Grid Battery Energy Storage Sub-Market

Table 22: Flow Batteries Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 7: Flow Batteries Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Table 23: Flow Batteries SWOT

Chart 8: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Sodium-Based Grid Battery Energy Storage Sub-Market

Table 24: Sodium-Based Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 9: Sodium-Based Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Table 25: Sodium-Based (NaS) Batteries SWOT



Chart 10: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Other Grid Battery Energy Storage Sub-Market

Table 26: Other Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 11: Other Grid Battery Energy Storage Sub-Market Forecast 2011-2025 (\$m, AGR %)

Chart 12: Global Grid Battery Energy Storage Technologies Capacity Additions Forecast 2013-2025 (MW)

Drivers & Restraints of the Grid Battery Energy Storage Technologies Market

Drivers of the Grid Battery Energy Storage Technologies Market

Rising Energy Prices Indirectly Incentivise Grid Scale Battery Storage

Figure 24: U.S Residential Retail Electricity Price, 1960-2014 (USc/kW)

Investments in Research, Development and Demonstration Projects

Importance of Renewable Energy Integration

Smart Grids and Distributed Power Generation Systems

How Expanding Electricity Demand Can Drive Demand of Grid Scale Battery Storage

The Developing Electric Vehicle Market as a Growth Factor

The Role of Changing National Policies Towards Energy Storage

The Potential of Deregulating the Electric Utility Markets

Grid benefits

Load Levelling

Figure 25: Stylized Representation of a Daily Load Curve

Capacity Factor/Dispatch for Intermittent Renewables

**Peaking Power Support** 

Offset of Needed Peaking Power Generation Capacity

Offset of Needed Renewable Generation Capacity

**Economic Benefits** 

**Energy Arbitrage** 

**Investment Deferral** 

Renewable Energy Dispatch and Timing Benefits (ability to meet Renewable Energy targets, etc.)

Figure 26: Renewable Offsetting Example,

Restraints of the Grid Battery Energy Storage Technologies Market

The Long-Standing Constraint of High Capital Costs of Grid Scale Battery Storage

The Policy and Regulatory Challenges Ahead

How Conservatism in the Utility Industry May Hinder Growth

The Need for Large-Scale Demonstration Projects

Competition From Other Energy Storage Technologies in the Market



**Environmental Concerns** 

**Energy Loss During Storage** 

Economic Risk

Regional Grid Battery Energy Storage Technologies Market Outlook

Table 27: Regional Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 13: Regional Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

U.S Grid Battery Energy Storage Technologies Market Outlook

Table 28: U.S. Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 14: U.S. Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

German Grid Battery Energy Storage Technologies Market Outlook

Table 29: German Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 15: German Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Canadian Grid Battery Energy Storage Technologies Market Outlook

Table 30: Canadian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 16: Canadian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chinese Grid Battery Energy Storage Technologies Market Outlook

Table 31: Chinese Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 17: Chinese Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Japanese Grid Battery Energy Storage Technologies Market Outlook

Table 32: Japanese Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 18: Japanese Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Spanish Grid Battery Energy Storage Technologies Market Outlook

Table 33: Spanish Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 19: Spanish Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Italian Grid Battery Energy Storage Technologies Market Outlook



Table 34: Italian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 20: Italian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

French Grid Battery Energy Storage Technologies Market Outlook

Table 35: French Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 21: French Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

United Kingdom Grid Battery Energy Storage Technologies Market Outlook

Table 36: United Kingdom Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 22: United Kingdom Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

South Korean Grid Battery Energy Storage Technologies Market Outlook

Table 37: South Korean Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 23: South Korean Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Australian Grid Battery Energy Storage Technologies Market Outlook

Table 38: Australian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 24: Australian Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Table 39: Selected Australian Energy Storage Facilities

Rest of the World Grid Battery Energy Storage Technologies Market Outlook

Table 40: RoW Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Chart 25: RoW Grid Battery Energy Storage Technologies Market Forecast 2011-2025 (\$m, AGR %)

Regulatory Developments

United States Regulatory Support and Incentives

Federal

U.S. Internal Revenue Service

Renewable Electricity Production Tax Credit

Table 41: Renewable Electricity Production Tax Credit: In-service deadline 2014 (¢/kWh)

Figure 26: Impact of production tax credit expiration and extension on U.S. annual installed wind capacity



Qualifying Advanced Energy Manufacturing Investment Tax Credit

Clean Renewable Energy Bonds

**Qualified Energy Conservation Bonds** 

U.S. Department of the Treasury

Renewable Energy Grants

U.S. Department of Energy

Green Power Purchasing Goal

Loan Guarantee Program

Innovative Technology Loan Guarantee Program

Temporary Loan Guarantee Program

Smart Grid Investment Grant Program

International Regulatory Support and Incentives: Europe

European Union

EU Climate and Energy Package: Renewable Energy Targets

An Energy Policy for Europe

European Council Action Plan (2007–2009) Energy Policy for Europe

Seventh Framework Program for Research and Technological Development

Table 42: Energy Research Under EU initiatives

International Regulatory Support and Incentives: Asia-Pacific

Australia

Renewable Energy Target

Clean Energy Program

China

Preferential Tax Policies for Renewable Energy

Medium- and Long-Term Development Plan for Renewable Energy

Wind Power Concession Programme

India

Renewable Energy Certificates System

Indonesia

National Energy Blueprint

Japan

Strategic Energy Plan (2014)

Basic Energy Plan (2014)

New Zealand

Marine Energy Deployment Fund

**Thailand** 

Strategic Plan for Renewable Energy Development

**Industry Trends And Developments** 

Market Overview



Vendor Market Space

Figure 27: Energy Storage Vendor Organisation

Figure 28: Energy Storage Vendor Organisation

Figure 29: U.S. Solar and Storage Vendor Market Space

#### **COMPANY PROFILES**

Leading Venders Grid Scale Battery Storage Companies

BYD Co. Ltd

**GE Energy Storage** 

NGK Insulators Ltd.

Samsung SDI Co. Ltd.

Sumitomo Electric Industries, Ltd

Other Leading Manufacturers & Supply Companies in the Grid Scale Battery industry

A123 Energy Solutions LLC

ABB Ltd.

Advanced MicroGrid Solutions, Inc.

AES Energy Storage LLC

Alevo Group

Ambri Inc

American Vanadium Corp.

Amprius Inc.

Aquion Energy, Inc.

Automotive Energy Supply Corporation (AESC)

Axion Power International, Inc.

BrightSource Energy, Inc.,

**Bosch Group** 

Boston-Power Inc.

Chulan Group

Coda Energy Holdings LLC

Cobasys LLC

**Demand Energy** 

**Dyna Power Corporation** 

**Duke Energy Corporation** 

**Ecoult** 

Electrovaya Inc.,

**EnerVault Corporation** 

Envia Systems, Inc.

**EOS Energy Storage** 



FIAMM S.p.A.

Furukawa Battery Co., Ltd.

Gildemeister Energy Solutions

Green Charge Networks, LLC

Greensmith Inc.

**GS** Yuasa Corporation

Hokkaido Electric Power Company

**Imergy Power Systems** 

JLM Energy Inc.

Johnson Controls, Inc.

LG Chem Ltd

Lithium Energy Japan (LEJ)

Mitsubishi Heavy Industries, Ltd. (MHI)

NEC Energy Solutions Inc.

Outback Power Systems, Inc.

Panasonic Corporation

Pellion Technologies

**Primus Power Corporation** 

Prudent Energy Inc.

QuantumScape Corporation

RedFlow Energy Storage Solutions

Renewable Energy Systems Americas Inc. (RES America)

S&C Electric Company Inc.

Saft Groupe S.A.

Sakti3, Inc.

Seeo, Inc.

**Sharp Corporation** 

SK Continental E-motion Korea Co., Ltd.

Siemens Energy

SolarCity Corporation

Solar Grid Storage

Sonnenbatterie GmbH

Spider9 Inc

Stem Inc.

Sunverge Energy, Inc.

Tesla Motors, Inc.

TesVolt GMBH

Tianjin Lishen Battery Co., Ltd.

Toshiba



UET (UniEnergy Technologies)

ViZn Energy Systems, Inc.

Xcel Energy Inc.,

Younicos, Inc

**ZBB** Energy Corporation

Conclusions

Glossary Of Terms

Methodology

How We Generate Our Industry Forecasts

Disclaimer

Appendix A

Appendix B



#### I would like to order

Product name: The Grid Battery Energy Storage Technologies Market Report 2015

Product link: <a href="https://marketpublishers.com/r/GDE111C8A52EN.html">https://marketpublishers.com/r/GDE111C8A52EN.html</a>

Price: US\$ 2,425.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer

Service:

info@marketpublishers.com

### **Payment**

First name:

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <a href="https://marketpublishers.com/r/GDE111C8A52EN.html">https://marketpublishers.com/r/GDE111C8A52EN.html</a>

To pay by Wire Transfer, please, fill in your contact details in the form below:

Last name:	
Email:	
Company:	
Address:	
City:	
Zip code:	
Country:	
Tel:	
Fax:	
Your message:	
	**All fields are required
	Custumer signature

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <a href="https://marketpublishers.com/docs/terms.html">https://marketpublishers.com/docs/terms.html</a>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970