

# Global Nanotechnology Market for Energy Storage - Analysis and Forecasts to 2015

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*Commercialized nano based storage products are expected to be launched in large numbers post-2012.*

## **Markets for Nano-Based Energy Storage Products are Expected to Take Off from 2012**

Markets for nano-based energy storage products are expected to take off from 2012. Robust sales growth opportunities are expected for nanotechnology based rechargeable batteries (Lithium-ion) and ultracapacitors as these energy storage products are expected to be the early adopters of nanomaterials in their production.

The global nanotechnology enhanced energy storage products market is in the pre-market stage and will gain critical mass when the usage of nano-based materials in the production of energy storage products is expected to become mainstream post-2012. The R&D pipeline for nano storage products is replete with promising nano-prototypes and mockups, some of which are tested in pilot markets. Commercialized nano based storage products are expected to be launched in large numbers post-2012.

## **Constant Evolution of Nanotechnologies Makes Patents Regulation and Streamlining the Commercialization Process Tougher**

Nanotechnology is a highly evolving, multidisciplinary technology spanning different industries and therefore regulating nanotechnology is becoming increasingly difficult. Nanotechnology companies are endeavoring to offer multiple applications for several industries all at once. The acquisition and protection of intellectual property is a huge challenge in the nanotechnology field as the patent offices are yet to fully understand the technology. There are difficulties in assessing whether it is worthwhile to patent the result of research work.

## **Governments and Corporations are Expected to Join Forces to Expedite the Commercialization of Nanotechnology**

The long gestation period of nanotechnology from research lab prototypes to commercialized products can be reduced through government efforts to bring together academia and industry. Successful commercialization of nanotechnology requires the leveraging of public funds with private funding. Close collaboration between the funding bodies and nanotechnology companies is required to address these barriers. It is extremely difficult to raise funds from private investors for the early stages of academic research of products or technology. Hence, federal or state funding should be optimally channeled to plug the gaps between research and the early stages of commercialization.

## **Inventing Nanomaterials for Energy Storage Products is the Primary Focus of R&D**

Companies are developing new high energy electrode materials and more stable electrolytes to enhance the functionalities of batteries. The main R&D focus is on integrating nanoparticles in the materials for storage devices and ensuring tight packing of nanoparticles in electrodes, in order to maximize energy density, power output, charge/discharge time, and number of charge/discharge cycles. The performance improvements in energy storage devices due to nanotechnologies are likely to upstage the higher costs associated with the nano-enabled energy storage products. Hence, companies are less focused on decreasing the manufacturing costs associated with nano-based storage products.

## **Rise in Government Spending Continues to Drive R&D and Innovations in Nanotechnology**

The rise in governmental earmarks and investments has been driving the innovations in nanotechnology globally. Governments are acting as central elements bridging the gap between science and industry, providing support to innovative small and medium-sized enterprises. Other elements of the strategy are special financial support initiatives to set up the infrastructure, equipment and top level technological tools in order to develop the research and innovation at cutting-edge level. Increase in global public funding for R&D initiatives across the globe augurs well for quicker commercialization of nano-based energy storage products.

The overall US nanotechnology budget proposed for 2010 under the National Nanotechnology Initiative (NNI) is \$1.6 billion. The cumulative NNI investment between 2001 and 2010 is estimated

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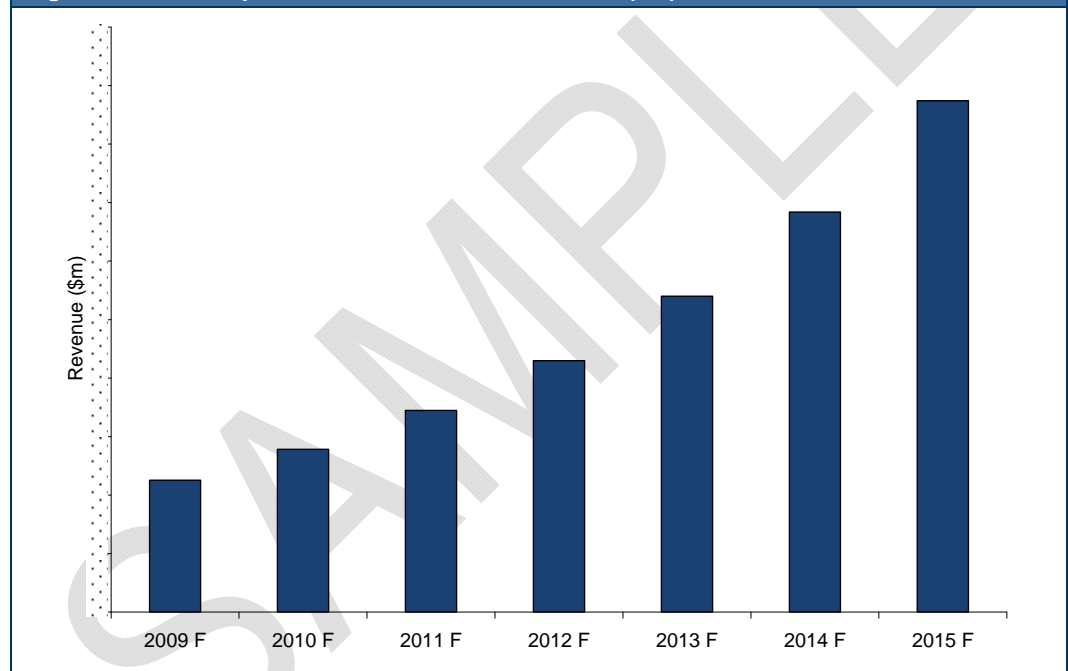
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## 4.2 Nanotechnology Enabled Ultracapacitors Market Potential

Capacitors use physical charge separation between two electrodes to store charge. Ultracapacitors are electrical storage devices that can store a much higher density of energy in a short time based on increased surface area afforded by the use of nanomaterials. The charge they hold is compared to the static electricity on a balloon, but is much greater due to the very high surface area of their inner materials. They polarize electrolytic solutions to store energy electrostatically and this highly reversible energy storage mechanism allows the ultracapacitors to charge and discharge hundreds of thousands of times. The total number of charge discharge cycles for the commercial ultracapacitor lies in the range of 500,000 and 1 million. The high power density of ultracapacitors allows their use in portable electronics, electric vehicles and for storing energy generated from renewable sources such as wind and solar power. Ultracapacitors are also finding applications in which a large, rapid pulse of energy is required.

The global ultracapacitors market is in the development stage of the market cycle. Advanced features of ultracapacitors such as quick charging, longer life span, wide temperature range, and lower internal resistance than batteries, are expected to widen their application in hybrid electric vehicles, military operations, and consumer electronics such as laptops, digital cameras, and iPods. Global ultracapacitors revenues are expected to reach \$XXm by the end of 2015, at a Compound Annual Growth Rate (CAGR) of XX%.

**Figure 5: Ultracapacitors Market, Global, Revenue (\$m), 2009–2015**



Source: GBI Research  
The Suffix "F" denotes the forecast values

**Table 3: Ultracapacitors Market, Global, Revenues (\$m), 2009–2015**

Year	Revenue (\$m)
2009 F	
2010 F	
2011 F	
2012 F	
2013 F	
2014 F	
2015 F	

Source: GBI Research  
Note: The Suffix "F" Denotes The Forecast Values

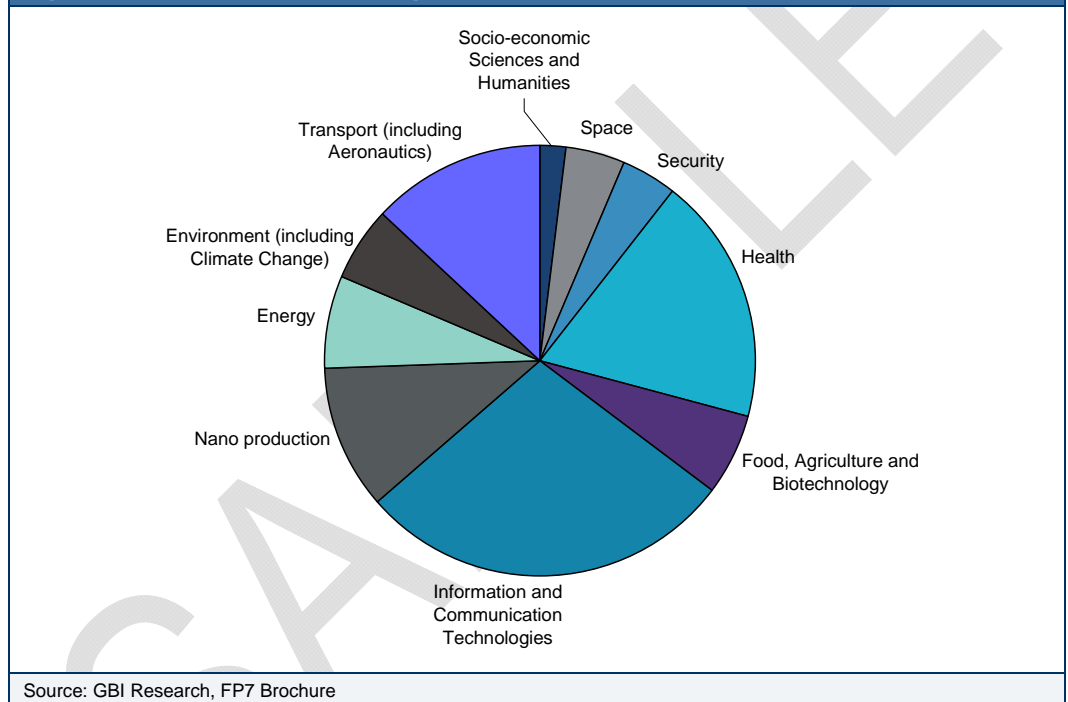
**Table 12: Framework Program for Research and Technological Development Budget Structure, (\$m), 2007–2013**

Building Blocks	Allocated Budget (\$m)
JRC (EC)	
Cooperation	
Ideas	
People	
Capacities	

Source: GBI Research, FP7 Brochure

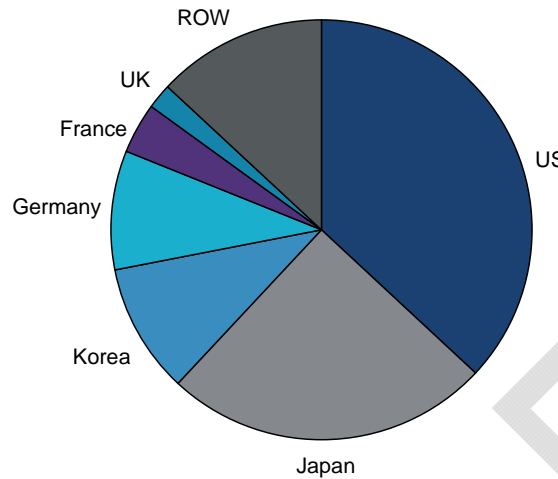
Under the program “Cooperation”, research support is provided to international cooperation projects across the European Union and beyond. In 10 thematic areas, corresponding to major fields in science and research, the programme promotes the progress of knowledge and technology. The budget allocated to “Cooperation” is \$XX billion.

**Figure 13: The Cooperation Program Breakdown, (\$m), 2007–2013**



The statistical patent analysis in the 'Energy' technology sector shows the US to be the leader as it covers XX% of all applications filed in the energy sector. The US is followed by Japan and Korea with contribution XX% and XX% respectively

**Figure 17: Nanotechnology Patent Applications Filed to Date in the Energy Sector, Region-Wise Break-Down (%), December 2008**



ROW — Rest of World  
 Source: GBI Research, European Patent Office (EPO)

**Table 23: Nanotechnology Patent Applications Filed to Date in the Energy Sector, Region-Wise Break-Down (%), December 2008**

Region	Share
US	38
Japan	22
Korea	15
Germany	8
France	3
UK	2
Rest of World	12

Source: GBI Research, European Patent Office (EPO)

The number of patent applications in nanotechnology has been increasing. The statistical patent analysis in the 'Energy' technology sector shows the US to be the leader as it covers XX% of all applications filed in the energy sector. The US is followed by Japan and Korea with contribution XX% and XX% respectively. Among the applicants, companies such as Canon, Matsushita, Toshiba, Zeiss, and General Electric amongst others are associated with the main contributors. The increasing number of nanotechnology patents in the energy sector indicates the onset of a new technology wave and could lead to a new commercialization phase within the next decade.



## 9 Appendix

### 9.1 Market Definitions

The report covers the entire globe for quantitative assessment of the nanotechnology for energy storage market. For the purpose of the reporting, the global sales are split into four major regions namely Asia-Pacific, Europe, the US and Rest of the world.

- Asia Pacific includes all landlocked, peninsular and island countries in the continent of Asia, ASEAN, Australasia and other Pacific Islands.
- Europe comprises all member countries of European Union, and the whole of the Nordic region, Benelux, Iberia, Western Europe and Eastern Europe including Russia.
- All of the Latin American Countries (including Mexico), African Countries and Countries from the Middle East are covered under Rest of the world

SAMPLE

## 9.2 Abbreviations

Table 45: Abbreviations	
Abbreviation	Expanded Form
AFSSET	French Agency for Environmental and Occupational Health Safety
BPS	Basis Point
CAGR	Compound Annual Growth Rate
CFI	Canadian Foundation for Innovation
CIHR	Canadian Institutes for Health Research
CMFNC	Carbon Metal Lithium Fluoride Nanocomposites
CREEES	Cooperative State Research, Education, and Extension Service
DEFRA	Department for environment, Food and Rural Affairs
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DIN	Deutsches Institut für Normung
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOT	Department of Transportation
ECHA	European Chemicals Agency
EFSA	European Food Safety Authority
EMEA	Europe, Middle East and Africa
EPA	Environmental Protection Agency
EPO	European Patent Office
FDA	Food and Drug Administration
FeF	Iron Fluoride
FHA	Federal Housing Administration
FHWA	Federal Highway Administration
FOEN	Office for the Environment
FP6	Sixth Framework Programme
FP7	Seventh Framework Programme
FS	Forest Service
GDP	Gross Domestic Product
HEV	Hybrid Electric Vehicle
IEC	International Electrotechnical Commission
IPO	Initial Public Offering
ISO	International Standards Organization
JPO	Japan Patent Office
KATS	Korean Agency for Technology and Standards
Li-ion Battery	Lithium Ion Battery
METI	Ministry of Economy, Trade and Industry
Mg-Ni	Magnesium Nickel
MEMS	Micro Electro Mechanical Systems
MOE	Ministry of the Environment
NASA	National Aeronautics and Space Administration
NBCI	Nanotechnology Business Creation Initiative
NEDO	New Energy and Industrial Technology Development Organization

NESTA	National Endowment for Science, Technology and the Arts
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NNI	National Nanotechnology Initiative
NRC	National Research Council
NSERC	National Science and Engineering Research Council
NSF	National Science Foundation
OECD	Organization for Economic Co-operation and Development
PPY	Polypyrrole Nanotubes
PS-PEO	Polystyrene-Polyethylene Oxide
S&T	Science and Technology
SC	Subcommittee
SCC	Standards Council of Canada
SFOPH	Swiss Federal Office of Public Health
TAG	Technical Advisory Group
TC	Technical Committee
TSA	Transportation Security Administration
USDA	U.S. Department of Agriculture
USPTO	United States Patent and Trademark Office
VC	Venture Capital
Working Group	WG
Source: GBI Research	

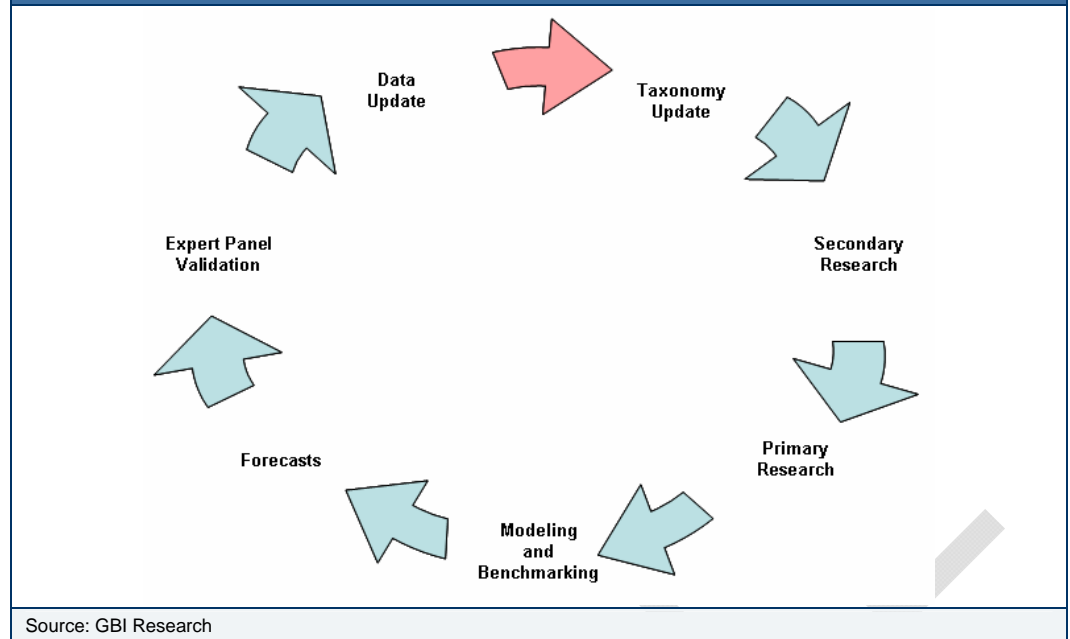
### 9.3 Methodology

GBI Research's dedicated Research and Analysis Teams consists of experienced professionals with a pedigree in marketing, market research, consulting background in the energy industry and advanced statistical expertise.

GBI Research adheres to the Codes of Practice of the Market Research Society ([www.mrs.org.uk](http://www.mrs.org.uk)) and the Society of Competitive Intelligence Professionals ([www.scip.org](http://www.scip.org)).

All GBI Research databases are continuously updated and revised. The following research methodology is followed for all databases and reports

Figure 19: GBI Research Methodology



Source: GBI Research

### 9.3.1 Coverage

The objective of updating GBI Research's coverage is to ensure that it represents the most up to date vision of the industry possible.

Changes to the industry taxonomy are built on the basis of extensive research of company, association and competitor sources.

Company coverage is based on three key factors: market capitalization, revenues and media attention/innovation/ market potential.

An exhaustive search of 56 member exchanges is conducted and companies are prioritized on the basis of their market capitalization.

The estimated revenues of all major companies, including private and governmental, are gathered and used to prioritize coverage.

Companies which are making the news, or which are of particular interest due to their innovative approach are prioritized.

GBI Research aims to cover all major news events and deals in the energy industry, updated on a daily basis.

The coverage is further streamlined and strengthened with additional inputs from GBI Research's Expert Panel (see below).

### 9.3.2 Secondary Research

The research process begins with exhaustive secondary research on internal and external sources being carried out to source qualitative and quantitative information relating to each market.

The secondary research sources that are typically referred to include, but are not limited to:

- Company websites, annual reports, financial reports, broker reports, investor presentations and SEC Filings
- Industry trade journals and other literature
- Internal and external proprietary databases
- National government documents, statistical databases and market reports

- News articles, press releases and web-casts specific to the companies operating in the market

### 9.3.3 Primary Research

GBI Research conducts hundreds of primary interviews a year with industry participants and commentators in order to validate its data and analysis. A typical research interview fulfills the following functions:

It provides first-hand information on the market size, market trends, growth trends, competitive landscape, future outlook etc.

- Helps in validating and strengthening the secondary research findings.
- Further develops the Analysis Team's expertise and market understanding.
- Primary research involves e-mail interactions, telephone interviews as well as face-to-face interviews for each market, category, segment and sub-segment across the geographies covered.
- The participants who typically take part in such a process include, but are not limited to:
- Industry participants: CEOs, VPs, business development managers, market intelligence managers and national sales managers
- Outside experts: investment bankers, valuation experts, research analysts and key opinion leaders specializing in oil and gas markets.

### 9.3.4 Expert Panel Validation

GBI Research uses a panel of experts to cross verify research and forecast methodologies and drive its analytical content. The GBI Research expert panel comprises of marketing managers, product specialists, international sales managers from energy companies; academics and geologists from research universities, consultants from venture capital funds and distributors/suppliers of oil and gas goods and services. Details of the makeup of the expert panel can be viewed through website, and are available to clients on request.

## 9.4 Related Reports

Table 46: Related Reports from GBI Research, 2009	
S.No.	Report Title
1	Global Micro Electro Mechanical Systems(MEMS) Market Analysis and Forecasts to 2015
Source: GBI Research	

## 9.5 Contact Us

If you have any queries about this report or would like further information, please contact

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