

WinterGreen Research, INC.

**Energy Harvesting Market Shares, Strategies, and Forecasts,
Worldwide, Nanotechnology, 2012 to 2018**

**Energy Harvesting Supports Sensor Networks and Provides High Density
Charging of Thin Film Batteries**

Mountains of Opportunity



Picture by Susan Eustis

WinterGreen Research, Inc.

Lexington, Massachusetts

www.wintergreenresearch.com

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REPORT # SH24891852

625 PAGES

209 TABLES AND FIGURES

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CHECK OUT THESE KEY TOPICS

<p>Keywords: Wireless Sensor Network Wireless Nodes Microcontroller Energy Harvesting Vibration-Based Wireless Energy Piezoelectric Energy Harvesters Thermoelectrics i Generating Power From Heat Smart Computing Power Community Wireless Sensor Networks Smart Cities Smart Buildings Military Remote Energy Applications Off-Grid Special Energy</p>	<p>Energy harvesters Powering Pipeline Monitoring Stations Navigational aids energy Spacecraft energy Thermoelectric cooling Automotive Energy Lighting Community Manganese dioxide Nanoparticles Nanotechnology Graphene Self-assembly Nanostructured Thin Films Microgenerator Transforms Mechanical Energy Vibration Electricity Pressure Of A Finger Piezoelectricity Solid State Technology</p>	<p>Microgenerator Power Source Of Sensor Sensor node Vibration Energy Harvesting Photovoltaics Piezoelectrics Thermovoltatics Energy Scavenging Power Harvesting Capture Of Ambient Energy Algorithmic Control Energy Harvesters Sensors Based On Magnetic Materials Powering Current Sensors</p>
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Energy Harvesting Market Growth Strategy:

Energy Harvesting: Market Shares, Strategies, and Forecasts, Worldwide, Nanotechnology, 2012-2018

LEXINGTON, Massachusetts (November 22, 2011) – WinterGreen Research announces that it has a new study on Energy Harvesting Market Shares and Forecasts, Worldwide, Nanotechnology 2012-2018. Products power sensors that are the base for smarter computing. The 2011 study has 625 pages, 209 tables and figures. Energy harvesting devices are evolving in the context of the development of solid state technology that provides vast improvements. Improvements in energy density are one of the benefits of energy harvesting give to traditional rechargeable and solid state batteries.

Advanced technologies associated are emerging that make energy harvesting feasible. Advanced storage devices are emerging simultaneously. Storage devices can leverage the power captured by energy harvesting devices. Energy storage technologies of super-capacitors and thin-film batteries have become cost-effective. Energy harvesting devices have attained workable levels of efficiency. There are significant cost reductions. Many applications are related to smarter computing that depends on sensors capturing change in conditions and making adjustments to the environment based on measured change.

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Existing energy harvesting and storage applications include vibration-based wireless train measuring systems, wireless sensors distributed city wide to implement smart cities, oil field monitoring systems, windup laptops for use in remote regions, and wireless light switches for use in smart buildings. Wireless sensors are self-powering. They can be used to alert and monitor a range of environments and incidents, pollution and forest fires, robberies in a city, temperature in a building, and movement around a border fence.

Energy harvesting technologies include electrodynamics, photovoltaics, piezoelectrics, and thermovoltaics. Photovoltaic systems for solar energy is mostly outside the scope of this study. The energy harvesting and energy storage market factors light harvesting for small devices

Technological developments in the fields of low-power electronics and energy storage systems have allowed energy harvesting to become an increasingly viable technology. It is alternatively referred to as energy scavenging and power harvesting. Energy harvesting technology has become sophisticated and efficient.

Energy harvesting is the use of ambient energy to provide electricity for small electronics, for sensor networks, and for mobile equipment. It is able to provide maintenance free, long life energy for equipment, reducing the need for batteries. Units are used to recharge solid state batteries that can handle as many as 40,000 recharges. Energy harvesting provides the ability to connect with existing devices. Energy harvesting is used when wires or batteries are too expensive to be practical.

Energy harvesting” depends on the capture of ambient energy, its conversion to usable form, and storage. Common examples of energy harvesting include wristwatches powered by body movement and bicycle dynamo powered by the motion of the wheel.

Integrated circuits can perform algorithmic control and achieve wireless communications using tiny amounts of energy. These integrated circuits provide a technological tipping point that permits the evolution of energy-harvesting-based systems from niche products, to widespread use in wireless networks.

According to Susan Eustis, the senior analyst for the study, “The wireless sensor node is the most important product type forecast for growth as an energy-harvesting solution. Wireless sensors are ubiquitous and very attractive products to implement smarter planet initiatives using harvested energy.”

Wireless sensors nodes are commonly placed in hard-to-reach locations. Changing batteries can be costly and inconvenient. Wireless sensors using harvested energy provide off-the-shelf availability of ultra-low-power, single-chip wireless microcontrollers (MCUs) capable of running control algorithms and transmitting data using sophisticated power management techniques.

Energy harvesting markets at \$511 million a year market worldwide in 2011 is anticipated to increase tenfold to \$5.1 billion by 2018. This strong growth is anticipated to come as units are less expensive and more effective in the same amount of space. Wireless sensor networks are useful almost everywhere, creating the opportunity to implement controls and manage every aspect of human activity in ways that have not even been imagined hitherto.

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WinterGreen Research is an independent research organization funded by the sale of market research studies all over the world and by the implementation of ROI models that are used to calculate the total cost of ownership of equipment, services, and software. The company has 35 distributors worldwide, including Global Information Info Shop, Market Research.com, Research and Markets, Bloomberg, and Thompson Financial.

Companies Profiled

Selected Market Leaders

IBM
Northrop Grumman
EnOcean
Silicon Laboratories
KCF Technologies

Perpetuum
Marlow Industries
Arveni
Cymbet

Infinite Power
Solutions (IPS)
Micropelt

Market Participants

ABB
Adaptive Materials Technology -
Adaptamat Ltd
Alphabet Energy
Arrow Electronics
American Elements, USA

Avnet
Arveni
BAE Systems
Boeing
CST
Cymbet

Digi International
Dust Networks
EnOcean GmbH
Finmeccanica
Flexible Electronics Concepts
Ferro Solutions

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Fraunhofer Institute for
Integrated Circuits IIS
General Electric Company
Perpetuum Electromagnetic
Vibration Energy Harvesting
Device
GE HabITEQ Systems and
EnOcean Energy-
Harvesting Technology Joint
Venture
General Electric / EnOcean
Equipped Devices
GMZ
Honeywell
Infinite Power Solutions
Inventec
IO
ITN Lithium Technology

II-VI incorporated / Marlow
Industries
KCF Technologies Inc
Kelk
Levant Power
Micropelt
Millennial Net
Modern Water
Nature Technology
Nextreme
Northrop Grumman
OMRON
Planar Energy Devices –
Perpetua
Perpetuum
Phononic Devices
Polatis Photonics
PS
ReVolt Technology

Teledyne / Rockwell Scientific
Severn Water / Modern Water /
Cymtox Limited
Silicon Labs
Schneider Electric
Syngenta Sensors UIC
Texas Instruments
Trophos Energy
University of California, Berkeley
University of Michigan
Zarlink Semiconductor AB
US Department of Energy's
Advanced Research
Projects Agency-Energy (ARPA-E)
Seed Funding
Selected Energy Harvesting
Market Participants

Energy Harvesting: Market Shares, Strategies, and Forecasts, Worldwide, Nanotechnology, 2012 to 2018

Report Methodology

This is the 489th report in a series of primary market research reports that provide forecasts in communications, telecommunications, the Internet, computer, software, telephone equipment, health equipment, and energy. Automated process and significant growth potential are priorities in topic selection. The project leaders take direct responsibility for writing and preparing each report. They have significant experience preparing industry studies. Forecasts are based on primary research and proprietary data bases.

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The primary research is conducted by talking to customers, distributors and companies. The survey data is not enough to make accurate assessment of market size, so WinterGreen Research looks at the value of shipments and the average price to achieve market assessments. Our track record in achieving accuracy is unsurpassed in the industry. We are known for being able to develop accurate market shares and projections. This is our specialty.

The analyst process is concentrated on getting good market numbers. This process involves looking at the markets from several different perspectives, including vendor shipments. The interview process is an essential aspect as well. We do have a lot of granular analysis of the different shipments by vendor in the study and addenda prepared after the study was published if that is appropriate.

Forecasts reflect analysis of the market trends in the segment and related segments. Unit and dollar shipments are analyzed through consideration of dollar volume of each market participant in the segment. Installed base analysis and unit analysis is based on interviews and an information search. Market share analysis includes conversations with key customers of products, industry segment leaders, marketing directors, distributors, leading market participants, opinion leaders, and companies seeking to develop measurable market share.

Over 200 in depth interviews are conducted for each report with a broad range of key participants and industry leaders in the market segment. We establish accurate market forecasts based on economic and market conditions as a base. Use input/output ratios, flow charts, and other economic methods to quantify data. Use in-house analysts who meet stringent quality standards.

Interviewing key industry participants, experts and end-users is a central part of the study. Our research includes access to large proprietary databases. Literature search includes analysis of trade publications, government reports, and corporate literature.

Findings and conclusions of this report are based on information gathered from industry sources, including manufacturers, distributors, partners, opinion leaders, and users. Interview data was combined with information gathered through an extensive review of internet and printed sources such as trade publications, trade associations, company literature, and online databases. The projections contained in this report are checked from top down and bottom up analysis to be sure there is congruence from that perspective.

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The base year for analysis and projection is the first three quarters of 2011. With 2011 and several years prior to that as a baseline, market projections were developed for 2012 through 2018. These projections are based on a combination of a consensus among the opinion leader contacts interviewed combined with understanding of the key market drivers and their impact from a historical and analytical perspective.

The analytical methodologies used to generate the market estimates are based on penetration analyses, similar market analyses, and delta calculations to supplement independent and dependent variable analysis. All analyses are displaying selected descriptions of products and services.

This research includes referencde to an ROI model that is part of a series that provides IT systems financial planners access to information that supports analysis of all the numbers that impact management of a product launch or large and complex data center. The methodology used in the models relates to having a sophisticated analytical technique for understanding the impact of workload on processor consumption and cost.

WinterGreen Research has looked at the metrics and independent research to develop assumptions that reflect the actual anticipated usage and cost of systems. Comparative analyses reflect the input of these values into models.

The variables and assumptions provided in the market research study and the ROI models are based on extensive experience in providing research to large enterprise organizations and data centers. The ROI models have lists of servers from different manufacturers, Systems z models from IBM, and labor costs by category around the world. This information has been developed from WinterGreen research proprietary data bases constructed as a result of preparing market research studies that address the software, energy, healthcare, telecommunications, and hardware businesses.

YOU MUST HAVE THIS STUDY

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WinterGreen Research, research strategy relates to identifying market trends through reading and interviewing opinion leaders. By using analysis of published materials, interview material, private research, detailed research, social network materials, blogs, and electronic analytics, the market size, shares, and trends are identified. Analysis of the published materials and interviews permits WinterGreen Research senior analysts to learn a lot more about markets. Discovering, tracking, and thinking about market trends is a high priority at WinterGreen Research. As with all research, the value proposition for competitive analysis comes from intellectual input.

WinterGreen Research, founded in 1985, provides strategic market assessments in telecommunications, communications equipment, health care, Software, Internet, Energy Generation, Energy Storage, Renewable energy, and advanced computer technology. Industry reports focus on opportunities that expand existing markets or develop major new markets. The reports access new product and service positioning strategies, new and evolving technologies, and technological impact on products, services, and markets. Innovation that drives markets is explored. Market shares are provided. Leading market participants are profiled, and their marketing strategies, acquisitions, and strategic alliances are discussed. The principals of WinterGreen Research have been involved in analysis and forecasting of international business opportunities in telecommunications and advanced computer technology markets for over 30 years.

The studies provide primary analytical insight about the market participants. By publishing material relevant to the positioning of each company, readers can look at the basis for analysis. By providing descriptions of each major participant in the market, the reader is not dependent on analyst assumptions, the information backing the assumptions is provided, permitting readers to examine the basis for the conclusions.

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