PikeResearch
Cleantech Market Intelligence

Research Report

EXECUTIVE SUMMARY:
Energy Harvesting
Photovoltaic, Piezoelectric, Electromagnetic, and Thermoelectric Technologies for Consumer and Industrial Applications: Market Analysis and Forecasts

NOTE: This document is a free excerpt of a larger report.
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Published 4Q 2011

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Section 1

EXECUTIVE SUMMARY

1.1 Introduction to Energy Harvesting

An increasing number of consumer and industrial products that are untethered or need to become disconnected from the electrical outlet will become powered by some form of energy harvesting (EH) technology in the near future. The environmental and economic costs of changing and maintaining batteries for portable devices will not be endured indefinitely. Before long, consumer and industrial application practitioners will no longer be willing, economically or otherwise, to change and maintain batteries to the extent that they have traditionally done so.

Consumer products such as laptops and mobile phones are already being powered by EH technology. The continuous search for an electrical outlet to power or recharge devices is a real concern. Many of us have been in a situation where we have forgotten to pack a charger for the laptop or mobile phone. As a result, we have had to fork out extortionate amounts of money at airport consumer stores to replace these chargers. It would be much easier to carry just the mobile device and have the device charge itself continuously without our intervention. This could be done while we walk or sit in an environment with a modest amount of light, temperature differences, or vibration (e.g., from a moving object like a car, train, or plane). Such is the future of mobile devices – and the technology to make it happen has arrived.

Laptops that will work for 14 hours with a single charge are available to the consumer now. Samsung manufactures environmentally friendly consumer goods and its laptop can be operated for one hour with two hours of charge. Cellular phones with similar functionality are also available.

Devices in a pervasive setting where thousands of sensors are monitoring every possible measurable commodity at breakneck speeds without our knowledge are a reality as well. These devices are diligently working to bring us information about temperature, humidity, security, machine health, structural health, and much more. It is inconceivable that this revolution be delayed or postponed until some form of perpetual energy source can be invented. The technology exists today and developers are fast becoming familiar with how to implement it into ever-innovative applications.

1.2 Energy Harvesting Technology

Energy harvesting is the conversion of ambient energy to useable electrical energy to power portable electrical devices that in many cases rely heavily on batteries. Energy sources available for EH include electromagnetic radiation, thermal energy, and mechanical energy. The technologies used for the transduction of the energy sources into useable electrical energy include photovoltaic (PV), thermoelectric, piezoelectric, and electromagnetic. Section 3 takes an in-depth look of the merits and technical issues of these energy sources and conversion technologies.

Innovative technologies are coming to market in both the consumer and industrial sectors. Some technologies will be seen in products over the forecast period of this report, but others will be seen beyond 2015.

1.3 Drivers for Energy Harvesting Technology

Advances in electronics and the pervasive use of technology have seen EH being used in both industrial and consumer applications. The most advanced EH technology was first seen in the Industrial sector used in wireless sensor networking (WSN) around 10 years ago and most recently in consumer devices such as laptops and mobile phones. However, EH technology is not completely unfamiliar to us; we have seen its use in numerous applications such kinetic wrist watches, cigarette lighters and bicycle dynamos.

Embedded technology is ubiquitous in most locations today. A quick survey of the home, car or office will reveal microprocessors at work, diligently carrying out computations at extraordinary speeds and all mostly without our intervention. A relatively short time ago these processes were only possible with high power computers. The convergence of many technological breakthroughs has allowed these processes to be accomplished on small low power microprocessors, frequently running on portable energy storage devices, untethered from grid power. The convergence of technologies combined with low-cost manufacturing processes has allowed the amalgamation of miniaturized low power electronics with advanced energy storage and wireless connectivity. This has brought about highly portable, extremely efficient, low-power wireless connected devices.

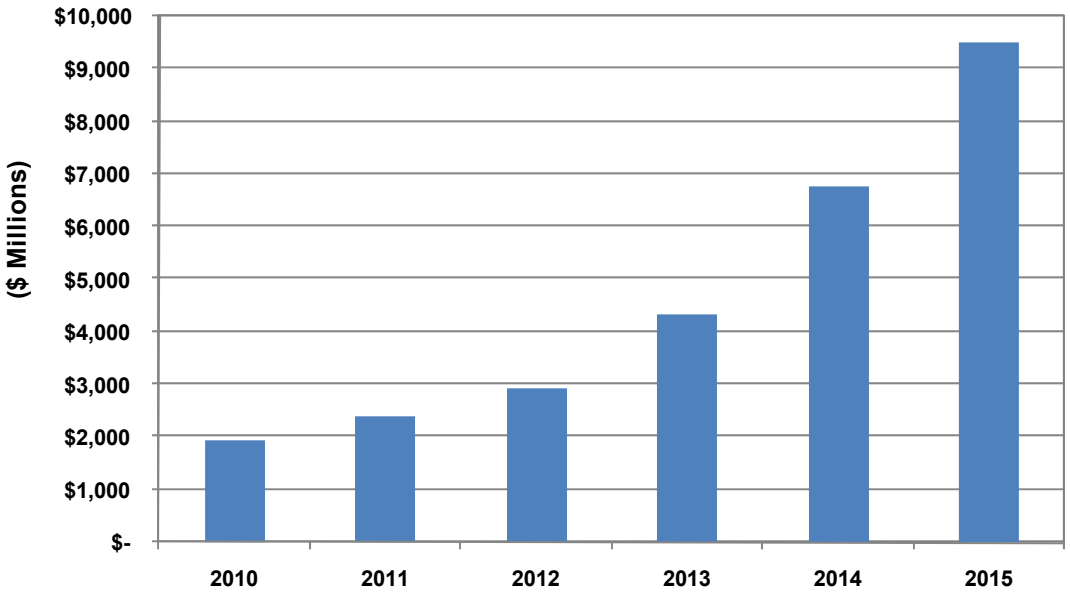
One of the original founders of the Intel Corporation, Gordon E. Moore predicted in 1965 that an exponential increase in the number of transistors being placed on an integrated circuit would be seen. History has validated his predictions with the number of transistors on an integrated circuit doubling every two years. These advances have given rise to the advent of ubiquitous computing which is impacting almost every part of our daily lives. An important but lagging technology in this vision is the power source; the trend in the power density of batteries has not shown the same advances as those seen in the electronics world. To fill this gap a newer, more integrated approach has emerged where a device has an onboard self-sustaining energy supply, continuously recharging the energy storage device. This approach promises to revolutionize mobile and wireless technology by eliminating the regular maintenance and disposal of spent power supplies, thereby eliminating the maintenance and environmental cost of using battery technology.

1.4 The Energy Harvesting Market

EH is an emerging nascent market with enormous potential. Its technologies are groundbreaking and revolutionary and are widely associated with disruptive trends in every segment in which they are used. The EH industry is going through a galvanization period; where vendors, systems integrators, and end users all recognize that a joint approach in terms of standardization and initial market push will lead to an aggressive market acceptance curve.

Chart 1.1 shows Pike Research's revenue projections for the 2010-2015 forecast period. We estimate that EH revenue was just under $2 billion at the end of 2010 and will reach $9.5 billion in 2015.

Chart 1.1 Energy Harvesting Revenue, World Markets: 2010-2015



(Source: Pike Research)

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SCOPE OF STUDY

Pike Research has prepared this report to provide interested stakeholders with an analytical overview of the energy harvesting industry. In brief, the study examines the industry by end user applications for the consumer, industrial EH technology markets.

The report's purpose is not to present an exhaustive technical assessment of the technologies. Rather, it aims to offer a strategic assessment of current market positioning and issues that the industry is facing. The study also provides a projection for the EH Industry and reviews the main technology types and information from key companies.

Pike Research endeavors to identify and examine new market segments to aid readers in the development of their business models. All major global regions are covered and the forecast period extends through 2015 with commentary beyond in particular end user application segments

SOURCES AND METHODOLOGY

Pike Research's industry analysts utilize a variety of research sources in preparing Research Reports. The key component of Pike Research's analysis is primary research gained from phone and in-person interviews with industry leaders including executives, engineers, and marketing professionals. Analysts are diligent in ensuring that they speak with representatives from every part of the value chain, including but not limited to technology companies, utilities and other service providers, industry associations, government agencies, and the investment community.

Additional analysis includes secondary research conducted by Pike Research's analysts and the firm's staff of research assistants. Where applicable, all secondary research sources are appropriately cited within this report.

These primary and secondary research sources, combined with the analyst's industry expertise, are synthesized into the qualitative and quantitative analysis presented in Pike Research's reports. Great care is taken in making sure that all analysis is well-supported by facts, but where the facts are unknown and assumptions must be made, analysts document their assumptions and are prepared to explain their methodology, both within the body of a report and in direct conversations with clients.

Pike Research is an independent market research firm whose goal is to present an objective, unbiased view of market opportunities within its coverage areas. The firm is not beholden to any special interests and is thus able to offer clear, actionable advice to help clients succeed in the industry, unfettered by technology hype, political agendas, or emotional factors that are inherent in cleantech markets.

NOTES

CAGR refers to compound average annual growth rate, using the formula:

CAGR = (End Year Value ÷ Start Year Value)$^{(1/steps)}$ – 1.

CAGRs presented in the tables are for the entire timeframe in the title. Where data for fewer years are given, the CAGR is for the range presented. Where relevant, CAGRs for shorter timeframes may be given as well.

Figures are based on the best estimates available at the time of calculation. Annual revenues, shipments, and sales are based on end-of-year figures unless otherwise noted. All values are expressed in year 2011 U.S. dollars unless otherwise noted. Percentages may not add up to 100 due to rounding.

Published 4Q 2011

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