

Energy Harvesters: Market Shares, Strategies, and Forecasts, Worldwide, 2013 to 2019

Mountains of Opportunity



Picture by Susan Eustis

REPORT # SH25831952

597 PAGES

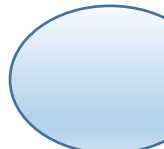
288 TABLES AND FIGURES

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WinterGreen Research, INC.

Lexington, Massachusetts



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CHECK OUT THESE KEY TOPICS

Energy Harvesting: Users Harness Ambient, Low Level Heat and Vibration to Achieve Powering the Internet of Things

Energy Harvesting
Wireless Nodes
Microcontroller
Energy Harvesting
Vibration-Based Wireless
Energy
Piezoelectric Energy
Harvesters
Thermoelectrics
Generating Power From Heat
Smart Computing
Power Community
Energy Harvestings
Smart Cities
Smart Buildings
Military Remote Energy
Applications
Off-Grid Special Energy
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
Microgenerator

Power Source Of Sensor
Sensor node
Vibration Energy Harvesting
Photovoltaics
Piezoelectrics
Thermovoltaics
Energy Scavenging
Power Harvesting
Capture Of Ambient Energy
Algorithmic Control
Energy Harvesters
Sensors Based On Magnetic
Materials
Energy Harvesting
Economies of Scale
Internet of Things
IoT
Powering Current Sensors

Energy Harvesting: Economies of Scale Provide Growth Strategy

**Energy Harvesting: Market Shares, Strategies, and Forecasts, Worldwide,
2013-2019**

LEXINGTON, Massachusetts (December 19, 2013) – WinterGreen Research announces that it has published a new study **Energy Harvesting Market Shares, Strategy, and Forecasts, Worldwide, 2013 to 2019**. The 2013 study has 597 pages, 288 tables and figures. Worldwide markets are poised to achieve significant growth as the Energy Harvesting is used inside telemedicine systems and m-health initiatives as a way to implement ruggedized handset communications for all clinicians.

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 are evolving at a slower pace. The energy harvesting and energy storage market factors implement 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.

According to Susan Eustis, the lead author of the team that created the study, “Converting ambient energy to useable electrical energy harvesting (EH) systems is a useful and compelling technology. The technologies offer an inexpensive and compact way to power portable electrical devices initially and to create stores of power in the long term.”

Electronics tends to rely heavily on batteries. EH technology powers an increasing number of consumer and industrial products that are untethered or need to become disconnected from electrical outlets. As initial projects succeed and prove their worth, the technology is set to proliferate.

Energy Harvesters markets at \$131.4 million in 2012 are projected to increase to \$4.2 billion in 2019. Growth is anticipated to be based on demand for micro power generation that can be used to charge thin film batteries. Systems provide clean energy that is good for the environment. Growth is based on global demand for sensors and wireless sensor networks that permit control of systems.

At some point energy harvester markets will shift from simple growth to rapid growth measured as a penetration analysis. This will happen as markets move beyond the early adopter stage. Eventually energy harvesters will be used as fuel to power batteries for electronic devices and smart phones. The energy is manufactured from vibration and thermal differentiation that is ambient in the environment. Energy harvesters have become more feasible as the technology evolves.

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, Electronics.CA, Bloomberg, and Thompson Financial.

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288 TABLES AND FIGURES

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WinterGreen Research is positioned to help customers face challenges that define the modern enterprises. The increasingly global nature of science, technology and engineering is a reflection of the implementation of the globally integrated enterprise. Customers trust WinterGreen Research to work alongside them to ensure the success of the participation in a particular market segment.

WinterGreen Research supports various market segment programs; provides trusted technical services to the marketing departments. It carries out accurate market share and forecast analysis services for a range of commercial and government customers globally. These are all vital market research support solutions requiring trust and integrity.

Companies Profiled

Market Leaders

Northrop Grumman
Boeing
KCF Technologies
Marlow Industries
Cymbet
Micropelt

EnOcean
Silicon Laboratories
Perpetuum
Arveni
Infinite Power Solutions (IPS)

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Market Participants

ABB	Perpetuum Electromagnetic	Phononic Devices
Adaptive Materials Technology /	Vibration Energy Harvesting	Polatis Photonics
Adaptamat Ltd	Device	Primus Power
Alphabet Energy	GMZ	PS
Arrow Electronics	Honeywell	Schneider Electric
American Elements, USA	Infinite Power Solutions	Severn Water / Modern Water /
Australian Defence Science &	Inventec	Cymtox Limited
Technology Organisation (DSTO)	IO	Silicon Labs
Arveni	ITN Lithium Technology	Syngenta Sensors UIC
Avnet	II-VI incorporated / Marlow	Teledyne / Rockwell Scientific
BAE Systems	Industries	Texas Instruments (TXN:NYSE)
Boeing	JonDeTech	Trophos Energy
BYD	KCF Technologies Inc	University of California, Berkeley
	Kelk	University of Michigan
CST	Levant Power	University of Michigan's
Cymbet	LORD Corporation	Department of Electrical
Digi International	MacSema	Engineering and Computer
Dust Networks	MicroGen Systems	Science Nano-Thin Sheets Of
EnOcean GmbH	Micropelt	Metal
Finmeccanica	Millennial Net	Vishay Precision Group
Flexible Electronics Concepts	Modern Water	KELK integration
Ferro Solutions	Nature Technology	Zarlink Semiconductor AB
Fraunhofer Institute for	Nextreme	US Department of Energy's
Integrated Circuits IIS	Northrop Grumman	Advanced Research Projects
General Electric Company	OMRON	Agency-Energy (ARPA-E) Seed
GE Energy Wireless Condition	Planar Energy Devices –	Funding
Monitoring System /	Perpetua	
	Perpetuum	

**Energy Harvesting: Market Shares, Strategies, and Forecasts,
Worldwide, 2013 to 2019**

Report Methodology

This is the 583rd 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.

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.

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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.

The base year for analysis and projection is 2010. With 2010 and several years prior to that as a baseline, market projections were developed for 2011 through 2017. 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 reference 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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Table of Contents

Energy harvesting devices create power from ambient energy that can be used to charge batteries for electronic devices, significantly extending the life of the battery. Advanced energy harvesting technologies are associated with emerging Internet of Things sensors. Technologies that make energy harvesting feasible are closely associated with smaller, lighter, more feature loaded electronics and sensors.

Energy Harvesting Executive Summary

The study is designed to give a comprehensive overview of the Energy Harvesting device market segment. Research represents a selection from the mountains of data available of the most relevant and cogent market materials, with selections made by the most senior analysts. Commentary on every aspect of the market from independent analysts creates an independent perspective in the evaluation of the market. In this manner the study presents a comprehensive overview of what is going on in this market, assisting managers with designing market strategies likely to succeed.

Energy Harvesting Market	34
Energy Harvesting Minimization of Power Consumption	37
Energy Harvesting Market Shares	38
Energy Harvesting Market Forecasts	40

Energy Harvesting Market Description and Market Dynamics

1. ENERGY HARVESTING MARKET DESCRIPTION AND MARKET DYNAMICS	42
1.1 Sources of Energy Harvesting	42
1.1.1 Connected Devices	43
1.1.2 Energy Harvesting vs. Nonrechargeable Batteries	45
1.2 World Economy Undergoing A Transformation	46
1.2.1 Energy Harvesting Process Of Converting Energy From External Sources	47
1.2.2 Energy Is Everywhere In The Environment	51
1.2.3 Energy Harvesting	51
1.2.4 Wireless Sensor Nodes Powered By Batteries	52
1.3 Zero Power Wireless Sensors	53
1.3.1 Energy Processors and Solid State Batteries Enable Zero Power Wireless Sensors	53
1.4 Energy Harvesting Value	55
1.4.1 Energy Harvesting Applications	56
1.4.2 Common Sources of Energy for Harvesting	58

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

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WinterGreen Research, INC.

1.5 Components of an Energy Harvesting System	60
1.6 Smarter Computing	61
1.6.1 Energy Harvesting Power Management Solutions	64
1.7 Energy Harvesting Target Markets	65
1.8 Smart Buildings / Energy Harvesting	66
1.8.1 Permanent Power for Wireless Sensors	67
1.8.2 Electric Grid Energy Harvesting Services For Smart Buildings	68
1.8.3 Commercial Applications For Advanced Batteries	70
1.8.4 Challenges in Energy Harvesting System Design	71
1.8.5 Ultra Capacitors	74
1.8.6 Fuel Cells	74
1.9 Transportation Industry Target Market	75
1.9.1 Transportation Use of Energy Harvesting	75
1.10 Energy Storage For Grid Stabilization	80
1.10.1 Local Energy Storage Benefit For Utilities	81
1.11 Applications Require On-Printed Circuit Board Battery Power	81
1.11.1 Thin-film vs. Printed Batteries	82
1.12 Battery Safety / Potential Hazards	83
1.13 Thin Film Solid-State Battery Construction	83
1.14 Battery Is Electrochemical Device	85
1.15 Battery Depends On Chemical Energy	86

Energy Harvesting Market Shares and Market Forecasts

This section selectively describes market shares, forecasts, segments, and regional revenue. Numbers are the result of primary research in all cases. Selected companies are described from an independent analyst perspective with a thumbnail sketch or analysis of their market numbers or commentary on their strengths and weaknesses. Some of the analysis is focused on looking at the topic segment by segment, including company descriptive analyses by segment and subsegment.

2. ENERGY HARVESTING: VIBRATION, THERMOVOLTAICS, PIEZOELECTRICS MARKET SHARES AND FORECASTS	87
2.1 Energy Harvesting Market	87
2.1.1 Energy Harvesting Minimization of Power Consumption	90
2.2 Energy Harvesting Market Shares	91
2.2.1 Silicon Laboratories	94
2.2.2 KCF Technologies	95
2.2.3 Perpetuum	96
2.2.4 II-IV / Marlow Industries Inc	101
2.2.5 Arveni	101
2.2.6 Cymbet	101
2.2.7 Infinite Power Solutions –	102
2.2.8 Micropelt Energy Harvesting:	103

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

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WinterGreen Research, INC.

2.2.9	EnOcean Equipped Devices	103
2.2.10	EnOcean Technology	105
2.2.11	Leading Energy Harvesting Market Participants by Technology	106
2.3	Energy Harvesting Market Forecasts	109
2.3.1	Energy Harvesting Market High End and Low End Device Forecasts	111
2.3.2	Energy Harvesting Market Unit Forecasts	116
2.3.3	Sensor Nodes	120
2.3.4	Energy Harvesting Market Industry Segments, Vibration, Thermovoltaics, Piezoelectrics, Photovoltaics Units	120
2.4	Smarter Computing Depends on Instrumented Devices	123
2.4.1	IBM The Leader In Smart Computing By A Wide Margin	123
2.4.2	Smarter Computing Market Driving Forces	127
2.4.3	Advantages Offered By SOA	128
2.4.4	SOA As An Architecture	130
2.4.5	Thin Film Battery Market Driving Forces	131
2.4.6	IBM WebSphere Product Set Leverages Thin Film Batteries	132
2.4.7	Thin Film Batteries Market Shares	136
2.5	Nanotechnology Providing Next Generation Systems	136
2.5.1	Nanotechnology Thin Film	137
2.5.2	Silver Nanoplates Silicon Strategy Shows Promise For Batteries	140
2.5.3	Argonne Scientists Watch Nanoparticles	140
2.5.4	Thin Film Batteries Use Nanotechnology to Achieve Combining Better Performance With Lower Cost	141
2.6	Energy Harvesting Pricing	142
2.6.1	Silicon Labs Energy Harvesting Pricing	143
2.6.2	EnOcean Products	144
2.6.3	Thin Film Battery: STM, IPS, Cymbet, GS	147
2.6.4	Thermal EH solutions	153
2.7	Energy Harvesting Geographical Region Analysis	155
2.7.1	Geographical Region Analysis	157

Energy Harvesting Product Description

This section describes selected companies and selected products. Products for this market segment are described with attention to the most significant aspect of features and functions in this category of product. The juxtaposition of a range of different product descriptions from a single market category provides a really good way to access market directions and achieve market competitive analysis. This section is arranged products. Company products are described in the appropriate sections, meaning a company is mentioned several times in the chapter in different places.

3. ENERGY HARVESTING PRODUCT DESCRIPTION

158

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

3.1 Energy Harvesting Devices	158
3.2 Silicon Laboratories	158
3.2.1 Silicon Laboratories Energy Harvesting Applications	159
3.2.2 Energy Harvesting Reference Design	160
3.2.3 Silicon Labs Solutions For Energy Harvesting Systems	161
3.2.4 Silicon Labs Energy Harvesting Tipping Point for Wireless Sensor Applications	164
3.2.5 Silicon Laboratories Low-Power Optimization	165
3.2.6 Silicon Labs Solutions For Energy Harvesting Systems	166
3.2.7 Silicon Labs Minimizing The Amount Of Time The Radio Is On	167
3.2.8 Silicon Laboratories Managing Harvested Energy	168
3.2.9 Silicon Labs Ability To Power Wireless Sensor Nodes	172
3.2.10 Silicon Labs Powers Wireless Node with Energy Harvesting	172
3.3 KCF Technologies	173
3.3.1 KCF Technologies Energy Harvesting for WMD Detection Systems	174
3.3.2 KCF Technologies Wireless Accelerometer with Ultra-Compact Energy Harvesting for Rotorcraft	176
3.3.3 KCF Technologies Harvester-Powered Wireless Accelerometers for Extreme Temperature Monitoring in Fossil Fuel Power Plants	178
3.3.4 KCF Technologies Wireless Vibration Sensors for Shipboard Environments with Broadband Energy Harvesting	179
3.3.5 KCF Technologies Harvester-Powered Wireless Sensors for Industrial Machine Monitoring and Condition Based Maintenance	180
3.3.6 KCF Technologies Piezoelectric and Smart Material Devices	182
3.3.7 KCF Technologies Compact Narrowband High-Acoustic Sound Source for Particle Agglomeration	183
3.3.8 KCF Technologies Low-Cost Liquid Atomization and Dispensing with a Miniature Piezoelectric Device	185
3.3.9 KCF Technologies Extreme Amplitude Piezoelectric Noise Source for HUMVEE Air Filter Cleaning	186
3.3.10 KCF Technologies High-Temperature Piezoelectric Alarm for Personnel Safety Devices	187
3.3.11 KCF Technologies Micro-Robot Swarms for Desktop Manufacturing	188
3.4 Perpetuum	188
3.4.1 Perpetuum PMG Rail: Transportation / Powering Wireless Rail Monitoring Solutions	191
3.4.2 Perpetuum Engineering Evaluation and Development	192
3.4.3 Perpetuum Condition Monitoring	192
3.4.4 Perpetuum Condition Monitoring Technology To Predict Failure	197
3.4.5 Perpetuum Holistic View Of Equipment Condition	197
3.4.6 Perpetuum Need For Greater Accuracy In Condition Assessment Failure Prediction	198
3.4.7 Perpetuum PMG FSH Free Standing Harvester Integrated Perpetual Power Solutions:	199
3.4.8 Perpetuum Powering Wireless Rail Monitoring Solutions	199

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

3.4.9	Perpetuum Machine Vibration/Motion Energy Harvesting	200
3.4.10	Perpetuum Vibration Energy Harvesting	200
3.4.11	Perpetuum Vibration Source	217
3.4.12	Perpetuum Resonant Frequency: Tuning the Vibration Energy Harvester	218
3.4.13	Perpetuum Vibration Level: Achieving Maximum Power Output	218
3.4.14	Perpetuum Basic Operating Principles Of A Vibration Energy Harvester	220
3.5	II-IV / Marlow Industries Inc	231
3.5.1	Marlow Industries Converting Small Degrees Of Temperature Difference Into Milliwatts Of Electrical Power	233
3.5.2	EverGen™ Plate Exchanger	235
3.6	Micropelt Energy Harvesting:	241
3.6.1	Micropelt Thermogenerator	242
3.6.2	Micropelt Two Micro Thermogenerators In Series	245
3.6.3	Micropelt Thermoharvester	246
3.6.4	Micropelt Products	248
3.6.5	Micropelt Peltier Coolers and Thermogenerators	248
3.6.6	Micropelt Small Micropelt Peltier Cooler	249
3.7	EnOcean	251
3.7.1	EnOcean Faster Development	253
3.7.2	EnOcean Link Fully Prepared Data	253
3.7.3	EnOcean ECO 200 - Motion Energy Harvesting	255
3.7.4	EnOcean ECT 310 - Thermo Energy Harvesting	258
3.7.5	EnOcean Energy Harvesting Wireless Sensor Solutions	260
3.7.6	Energy Harvesting Wireless Sensor Technology From EnOcean	261
3.7.7	EnOcean Energy Harvesting Wireless Sensor Solutions	261
3.7.8	EnOcean Alliance Energy Harvesting Solutions	266
3.7.9	EnOcean-Enabled Wireless Networks	266
3.7.10	EnOcean Alliance	268
3.8	Arveni	272
3.8.1	Arveni's Microgenerator Transforms Mechanical Energy	276
3.9	Ferro Solutions	278
3.9.1	Ferro Solutions Energy Harvesters	279
3.9.2	Ferro Solutions Inductive and PME.	279
3.9.3	Ferro Solutions Piezo-based PME Energy Harvesters	279
3.9.4	Ferro Solutions	280
3.10	Trophos Energy	281
3.11	BYD-Developed Fe Battery	285
3.12	Researchers at MIT	286
3.13	Cymbet Energizing Innovation	290
3.13.1	Cymbet EnerChip EP Universal Energy Harvesting Eval Kit	291
3.13.2	Cymbet EnerChip EP Enables New Applications	292
3.13.3	Cymbet Products	294
3.13.4	Cymbet Rechargeable EnerChips and Effective Capacity	295
3.13.5	Energy Harvesting Based Products Enabled By Cymbet EnerChip™ EP CB915:	299

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

3.13.6	Cymbet Development Support	301
3.13.7	Cymbet Solid State Energy Storage for Embedded Energy, Power	
	Back-up and Energy Harvesting	301
3.13.8	Cymbet Energy Harvesting	304
3.13.9	Cymbet Zero Power Devices	307
3.13.10	ComtexCymbet EnerChip™ Thin-Film Batteries	308
3.13.11	Cymbet's EnerChip and Energy Harvesting Solutions	308
3.13.12	Cymbet EnerChip Solid State Battery Energy Harvesting (EH) / TT's	
	LaunchPad Development Kit	309
3.13.13	Cymbet Corporation	310
3.13.14	Cymbet's EnerChip™ EP CBC915,	310
3.14	Infinite Power Solutions (IPS)—	311
3.14.1	Infinite Power Solutions High-Volume Production Line for TFBs –	313
3.14.2	Infinite Power Solutions Solid-State, Rechargeable Thin-	
	Film Micro-Energy Storage Devices	313
3.14.3	Infinite Power Solutions IPS THINERGY® MEC Products	314
3.14.4	Infinite Power Solutions THINERGY MEC	314
3.14.5	Infinite Power Solutions, Inc. Recharge From A Regulated 4.10 V Source	316
3.14.6	Infinite Power Solutions, Inc. SRAM Backup Guidelines	316
3.14.7	Infinite Power Solutions, Inc. SRAM Backup Power Solution	318
3.14.8	Infinite Power Solutions Recharging THINERGY Micro-Energy Cells	320
3.14.9	Infinite Power Solutions Charging Methods	321
3.14.10	Infinite Power Solutions, Inc. THINERGY MECs	323
3.14.11	MicroGen Systems and Infinite Power Solutions Wireless	
	Sensor Network (WSN)	324
3.14.12	Maxim Integrated, Infinite Power Solutions IC to Integrate	
	All Of The Power-Management Functions For Ambient Energy Harvesting	325
3.14.13	Maxim Integrated Products (Nasdaq:MXIM) MAX17710 IC	
	Integrates Power-Management	326
3.14.14	Maxim / Infinite Power Solutions, Inc. (IPS) THINERGY(R) Solid-State,	
	Rechargeable MEC Battery Products	329
3.14.15	Maxim introduces MAX17710 PMIC :: Uniquely enables	
	Energy Harvesting with THINERGY MECs	329
3.14.16	IPS iTHINERGY ADP	330
3.14.17	IPS and ITT	331
3.14.18	Infinite Power Solutions, Inc. (IPS)— Global Leader In Manufacturing Solid-State	332
3.14.19	Infinite Power Solutions (IPS)	332
3.15	JonDeTech AB	333
3.15.1	JonDeTech AB Applications of Infrared Sensing Thermopiles	336
3.15.2	JonDeTech AB Preventive and Predictive Maintenance	337
3.15.3	JonDeTech Thermopile Products	338
3.15.4	JonDeTech Surface Mount Plastic Thermopiles	345
3.15.5	JonDeTech Thermopiles	346
3.15.6	JonDeTech Horizontal Thermocouple	347

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

3.15.7	JonDeTech Advantage Of Nanotechnology Vertical Thermocouple	348
3.16	Microchip Technology Inc.	352
3.17	MicroGen Systems	353
3.17.1	MicroGen Systems BOLT™ - R MicroPower Generators	357
3.18	Nextreme Thermal Solutions	359
3.19	Perpetua	360
3.20	Phonomic Devices	365
3.20.1	Phonomic Devices Solid State Cooling, Refrigeration and Air Conditioning	365

Energy Harvesting Technology

4. ENERGY HARVESTING TECHNOLOGY	367
4.1 Energy Processing for Wireless Sensors	367
4.1.1 Cymbet CBC915 EnerChip Energy Processor	367
4.1.2 Differences Among Power Transducers	368
4.1.3 CBC915 EnerChip Energy Processor	371
4.2 Wireless Sensor Solutions For Use In Buildings And Industrial Installations - Green. Smart. Wireless.	373
4.2.1 Energy Harvesting Wireless Sensor Solution	374
4.2.2 EnOcean Dolphin Interoperable System Architecture	375
4.2.3 Energy-Autonomous Systems	377
4.2.4 Reliable Transmission	378
4.2.5 Opening The Door To Smart Metering	379
4.2.6 Enhanced Data Protection	380
4.3 Nanotechnology Graphene	381
4.3.1 Nanoscale Semiconductor Materials:	383
4.3.2 Nanotechnology Nanomaterials	384
4.4 Components of an Energy Harvesting System	384
4.5 Piezoelectric Devices	385
4.5.1 Polymer Film Substrate for Thin Flexible Profile	386
4.5.2 Comparison Of Battery Performances	387
4.6 Energy Densities	387
4.6.1 Lithium-Ion Batteries	392
4.6.2 Power Scavenging	393
4.6.3 Temperature Gradients	394
4.6.4 Human Power	394
4.6.5 Pressure Variations	395
4.6.6 Vibrations	395
4.7 Energy Harvesting Known As Power Harvesting Or Energy Scavenging	397
4.7.1 Engine Coatings	397
4.7.2 Self-Sustaining Materials	398

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

4.7.3	Artificial Neural Networks	399
4.7.4	Cloud Computing Social Networking-	399
4.8	Thermopile	400
4.9	Fabrication Of High Energy And Power Density Thin-Film Super-Capacitors	403
4.10	Silicon Carbide Substrate Market	403
4.11	Fraunhofer Institute	404
4.12	Tadiran Batteries	405
4.13	Perpetua	405
4.14	ZigBee® Alliance	409
4.15	ALD Energy Harvesting Modules	410
4.16	Advanced Cerametrics	410

Energy Harvesting Company Profiles

This section selectively describes company strategies, partners, acquisitions, and revenue by segment and regional revenue when available. Companies are described by looking at what is most interesting about that company. The descriptions collectively give a sense of market directions within the industry segment. The alphabetical listing of company thumbnail sketches provides an accessible way to find out what is going on in any particular company.

5. ENERGY HARVESTING COMPANY PROFILES	411
5.1 ABB	411
5.1.1 ABB and IO Deliver Direct Current-Powered Data Center Module	411
5.1.2 ABB / Validus DC Systems DC power infrastructure equipment	412
5.2 Adaptive Materials Technology - Adaptamat Ltd	414
5.3 Alphabet Energy	415
5.3.1 Alphabet Energy Inexpensive Waste Heat Recovery Technology	418
5.3.2 Alphabet Thermoelectrics	420
5.4 Arrow Electronics	421
5.5 American Elements, USA	421
5.6 Australian Defence Science & Technology Organisation (DSTO)	421
5.7 Arveni	422
5.8 Avnet	426
5.9 BAE Systems	427
5.9.1 BAE Key Facts	428
5.9.2 BAE Strategy	429
5.9.3 BAE Operational Framework	430
5.9.4 BAE Key Performance Indicators (KPIs)	430
5.9.5 BAE Systems Ant Size Robot	430
5.9.6 BAE Project Management	432
5.9.7 BAE Engineering	433
5.9.8 BAE Personal Robots	435
5.9.9 BAE Systems Large UGV	436
5.9.10 BAE Systems Plc (BAES.L) Hired Advisors To Sell Part Of Its North American Commercial Aerospace Business	436

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

5.10 Boeing	438
5.10.1 Boeing Automated Identification Technology (AIT)	439
5.10.2 Boeing Structural Health Monitoring	443
5.10.3 Boeing Aircraft Health Monitoring	444
5.10.4 Boeing	445
5.10.5 Boeing 787 Dreamliner	446
5.10.6 Boeing 787 Dreamliner Performance	447
5.10.7 Boeing Advanced Technology	447
5.10.8 Boeing Participation In Commercial Jet Aircraft Market	448
5.10.9 Boeing Participation In Defense Industry Jet Aircraft Market	448
5.10.10 Boeing Defense, Space & Security	449
5.10.11 Boeing Advanced Military Aircraft:	450
5.10.12 Boeing Military Aircraft	450
5.10.13 Boeing Robots	456
5.11 BYD	456
5.11.1 BYD Cell Phone Batteries	457
5.11.2 BYD Auto Co	457
5.11.3 BYD Commitment Green Energy	458
5.12 CST	458
5.13 Cymbet	459
5.13.1 Cymbet Team:	459
5.13.2 Cymbet Investors:	460
5.13.3 Cymbet Investors	460
5.13.4 Cymbet Partners, Sales and Distribution:	461
5.13.5 Cymbet Manufacturing:	461
5.13.6 Cymbet to Open World's Highest Volume Solid-State Battery Manufacturing Facility	461
5.13.7 Cymbet Partnering with X-FAB	462
5.13.8 Cymbet / X-FAB, Inc.	462
5.13.9 Cymbet Expanding in Minnesota	463
5.13.10 Cymbet / LEDA	463
5.13.11 Smart Solid-State Batteries for Embedded Energy, Power Back-up and Energy Harvesting	463
5.13.12 Cymbet EVAL-09 Utilizes Harnessing Ambient Energy	464
5.13.13 Cymbet Secures \$31 Million in Private Financing	465
5.14 Digi International	465
5.14.1 Digi International Revenue	466
5.14.2 Digi International Business Highlights:	467
5.14.3 Digi International/MaxStream	468
5.15 Dust Networks	468
5.15.1 Dust Networks Self-Powered IPV6 Wireless Sensor Network	469
5.16 EnOcean GmbH	470
5.16.1 EnOcean Technology	471
5.16.2 EnOcean Alliances	472

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

5.16.3	EnOcean Self-Powered Wireless Technology	474
5.17	Finmeccanica	475
5.17.1	Finmeccanica / SELEX Galileo	476
5.17.2	SELEX Galileo Inc.	476
5.17.3	SELEX Galileo Technologies	477
5.18	Flexible Electronics Concepts	478
5.19	Ferro Solutions	478
5.19.1	Ferro Solutions	481
5.20	Fraunhofer Institute for Integrated Circuits IIS	486
5.21	General Electric Company	486
5.21.1	GE Energy Wireless Condition Monitoring System / Perpetuum Electromagnetic Vibration Energy Harvesting Device	487
5.21.2	GE HabITEQ Systems and EnOcean Energy-Harvesting Technology Joint Venture	487
5.21.3	General Electric / EnOcean Equipped Devices Sensors Fit In Ultra- Thin Switches On Glass Panels	488
5.21.4	GE Smart Energy Technologies	489
5.22	GMZ	489
5.23	Honeywell	490
5.23.1	Honeywell Energy-Harvesting Sensing and Control	490
5.24	Infinite Power Solutions	492
5.24.1	Infinite Power Solutions Solid-State, Thin-Film Batteries	492
5.24.2	Infinite Power Solutions Micro-Energy Storage Devices	493
5.24.3	Infinite Power Solutions Battery Applications	493
5.24.4	Infinite Power Solutions And Tokyo Electron Device Global Distribution Agreement	493
5.24.5	Infinite Power Solutions Financing	494
5.25	Inventec	496
5.26	IO 496	
5.27	ITN Lithium Technology	497
5.27.1	ITN's Lithium EC sub-Division Focused On Development And Commercialization of EC	498
5.27.2	ITN's SSLB Division Thin-Film Battery Technology	499
5.27.3	ITN Lithium Air Battery	499
5.27.4	ITN Fuel Cell	501
5.27.5	ITN Thin-film Deposition Systems	503
5.27.6	ITN Real Time Process Control	505
5.27.7	ITN Plasmonics	509
5.28	II-VI incorporated / Marlow Industries	510
5.28.1	II-VI Incorporated (NASDAQ: IIVI)	511
5.28.2	II-VI Incorporated / Marlow Infrared And Near-Infrared Laser Optical Elements	513
5.28.3	II-VI incorporated / Marlow Markets	515
5.29	JonDeTech	515
5.30	KCF Technologies Inc	516
5.31	Kelk	517
5.32	Levant Power	521

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

5.33 LORD Corporation	521
5.33.1 LORD Corporation, MicroStrain	523
5.34 MacSema	523
5.35 524	
5.36 MicroGen Systems	525
5.37 Micropelt	526
5.37.1 Micropelt Thin Film Thermogenerators	526
5.37.2 Micropelt Systems	527
5.37.3 Micropelt Thermogenerators	529
5.37.4 Micropelt at a Glance	530
5.38 Millennial Net	530
5.38.1 Millennial Net Wireless Sensor Network:	531
5.38.2 Millennial Net 1000-node MeshScape GO wireless sensor network (WSN)	532
5.38.3 Millennial Net's MeshScape GO WSN Technology	533
5.39 Modern Water	535
5.40 Nature Technology	537
5.41 Nextreme	537
5.42 Northrop Grumman	539
5.42.1 Northrop Grumman Smart Grid	541
5.42.2 Northrop Grumman	541
5.42.3 Northrop Grumman Corp (NOC.N) Spinning Off Or Selling Its Shipbuilding Business	542
5.42.4 Northrop Grumman Remotec Robots	542
5.42.5 Northrop Grumman Design and Manufacture of Unmanned Ground Vehicles	543
5.42.6 Northrop Grumman Business Sectors:	545
5.42.7 Northrop Grumman Aerospace Systems	548
5.43 OMRON	549
5.43.1 Omron Revenue	550
5.44 Planar Energy Devices –	551
5.44.1 Planar Energy DOE for Oak Ridge National Laboratory Next-Generation Battery Development	553
5.45 Perpetua	555
5.46 Perpetuum	558
5.46.1 Perpetuum Alliances	558
5.46.2 Perpetuum Venture Capital Investors	559
5.47 Phononic Devices	560
5.48 Polatis Photonics	561
5.48.1 Polatis Technology and Products	562
5.49 Primus Power	562
5.50 PS 562	
5.51 Schneider Electric	563
5.51.1 Schneider Electric	563
5.51.2 Smart Grid: Schneider Electric vision	563
5.51.3 Schneider Electric Triggers of the Smart Grid	565
5.52 Severn Water / Modern Water / Cymtox Limited	566

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

5.53	Silicon Labs	567
5.53.1	Silicon Laboratories Energy Harvesting Applications	568
5.53.2	Silicon Labs Revenue	568
5.53.3	Silicon Laboratories Products	570
5.54	Syngenta Sensors UIC	574
5.55	Teledyne / Rockwell Scientific	574
5.56	Texas Instruments (TXN:NYSE)	575
5.56.1	Texas Instruments	575
5.57	Trophos Energy	576
5.58	University of California, Berkeley	579
5.59	University of Michigan	579
5.59.1	University of Michigan's Department of Electrical Engineering and Computer Science Nano-Thin Sheets Of Metal	579
5.60	Vishay Precision Group	580
5.60.1	KELK integration	580
5.60.2	Vishay Precision Group Revenue	580
5.60.3	Vishay Precision Group Segments	581
5.61	Zarlink Semiconductor AB	582
5.62	US Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) Seed Funding	583
5.63	Selected Energy Harvesting Market Participants	585
5.63.1	Leading Wireless Sensor Networks Market Participants by Technology	594

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

List of Tables and Figures

Energy Harvesting

Table ES-1	35
Energy Harvesting And Energy Storage Market Factors	35
Table ES-2	36
Energy Harvesting Market Driving Forces	36
Figure ES-3	39
Energy Harvesting Market Shares, Dollars, 2012	39
Figure ES-5	41
Energy Harvesting Device Market Industry Forecasts Dollars, Worldwide, 2013-2019	41
Figure 1-1	42
Sources of Energy Harvesting	42
Figure 1-2	43
Connected Devices	43
Table 1-3	49
Smarter Planet Sensor Network Systems Functions	49
Figure 1-4	50
Energy Harvesting Circuit Board	50
Figure 1-5	50
Energy Harvesting on Bear Sensor	50
Table 1-6	57
Energy Harvesting Applications	57
Table 1-7	59
Common Sources of Energy Harvesting	59
Table 1-8	60
Components of an Energy Harvesting System	60
Figure 1-9	63
IBM WebSphere Application Server Implements Smarter Computing	63
Table 1-10	65
Energy Harvesting Target Markets	65
Table 1-11	68
Principal Features Used To Compare Rechargeable Batteries	68
Table 1-12	72
Challenges in Battery and Energy Harvesting System Design	72
Figure 1-13	77
BMW's Mini E Electric Car Powered By A Rechargeable Lithium-Ion Battery	77
Table 1-14	78
Examples of Hybrid Electric Vehicles	78
Figure 1-15	84

WinterGreen Research, INC.

Typical Structure Of A Thin Film Solid State Battery	84
Table 2-1	88
Energy Harvesting And Energy Storage Market Factors	88
Table 2-2	89
Energy Harvesting Market Driving Forces	89
Figure 2-3	92
Energy Harvesting Market Shares, Dollars, 2012	92
Table 2-4	93
Energy Harvesting Market Shares, Vibration, Piezoelectric, Thermoelectric, Magnetic, Dollars, Worldwide, 2012	93
Figure 2-5	94
Silicon Labs Solutions For Energy Harvesting Systems	94
Figure 2-6	98
Perpetuum Markets Served By Industry	98
Figure 2-7	99
Perpetuum ROI Addresses The Hidden Costs Of Under Monitored Assets	99
Figure 2-8	100
Perpetuum Estimates Number of BOP Machine Assets Under Monitored Exceeds 70%	100
Table 2-9	106
Leading Energy Harvesting Market Participants by Technology	106
Figure 2-10	110
Energy Harvesting Device Market Industry Forecasts Dollars, Worldwide, 2013-2019	110
Table 2-11	111
Energy Harvesting Market Segments, Worldwide, 2013-2019	111
Figure 2-12	112
Energy Harvesting High End Device Market Forecasts, Dollars, Worldwide, 2013-2019	112
Figure 2-13	114
Energy Harvesting Low End Device Market Forecasts, Dollars, Worldwide, 2013-2019	114
Table 2-14	115
Energy Harvesting Market Forecasts, Dollars and Units, Worldwide, 2013-2019	115
Figure 2-15	117
Energy Harvesting High End Devices, Units, Worldwide, Forecasts, 2013-2019	117
Figure 2-16	119
Energy Harvesting Low End Devices, Units, Worldwide, Forecasts, 2013-2019	119
Table 2-17	121
Energy Harvesting Market Segments, Vibration, Thermovoltaics, Piezoelectrics, Photovoltaics, Dollars, Worldwide, 2013-2019	121
Table 2-18	122
Energy Harvesting Market Segments, Vibration, Thermovoltaics, Piezoelectrics, Photovoltaics, Percent, Worldwide, 2013-2019	122
Figure 2-19	124
Smarter Computing Depends on Instrumented Devices	124
Figure 2-20	125
Smarter Planet Impact on IT	125
Table 2-21	126
Smarter Computing Market Driving Forces	126
Figure 2-22	127
Number and Floor Space of US Commercial Buildings	127
Table 2-23	129

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Advantages Offered by SOA	129
Table 2-24	132
Thin Film Battery Market Driving Forces	132
Table 2-25	133
Thin Film Battery Benefits	133
Table 2-26	134
Comparison Of Battery Performance	134
Figure 2-27	135
Thin Film Battery Energy Density	135
Figure 2-28	140
Silver Nanoplates	140
Figure 2-29	152
Marlow Energy Harvesting Device Price	152
Figure 2-30	153
Nextreme Energy Harvesting Modules WPG-1 WRLES PWR GEN 1mW 3.3, 4.1 OR 5V	153



Figure 2-31	153
MicroPelt Energy Harvester	154
Table 2-32	154
Energy Harvesting Regional Market Segments, Dollars, 2012	156
Table 2-33	156
Energy Harvesting Regional Market Segments, 2012	157
Figure 3-1	157
Silicon Laboratories Energy Harvesting Components	159
Table 3-2	159
Silicon Labs Solutions For Energy Harvesting Applications	161
Table 3-3	161
Silicon Labs Solutions For Energy Harvesting Solutions	162
Table 3-4	162
Silicon Labs Solutions For Energy Harvesting Systems	163
Figure 3-5	163
Silicon Laboratories Wireless Sensor Node Power Cycle	165
Figure 3-6	165
Silicon Labs Solutions For Energy Harvesting Systems	169
Table 3-7	169
KCF Technologies Energy Harvesting Wireless Sensors Offered	173
Figure 3-8	173
KCF Technologies Smart Rod End for Wireless Monitoring of Helicopter Rotor Components	174
Figure 3-9	174
KCF Technologies Rotor Energy Harvesting Devices	176
Figure 3-10	176
KCF Technologies Harvester-Powered Wireless Accelerometers	178

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Table 3-11	179
KCF Technologies Wireless Vibration Sensors for Shipboard Environments	179
Figure 3-12	181
KCF Technologies Harvester-Powered Wireless Sensors for Industrial Machine Monitoring	181
Table 3-13	182
KCF Technologies Energy Harvesting Devices	182
Table 3-14	183
KCF Technologies Piezoelectric Devices	183
Figure 3-15	184
KCF Technologies Compact Narrowband High-Acoustic Sound Source	184
Figure 3-16	185
KCF Technologies Liquid Atomization and Dispensing	185
Figure 3-17	186
KCF Technologies Extreme Amplitude Piezoelectric Noise Source for HUMVEE Air Filter Cleaning	186
Figure 3-18	189
Perpetuum Rail Based Vibration Energy-Harvesting	189
Figure 3-19	190
Perpetuum Industrial Based Vibration Energy-Harvesting	190
Table 3-20	191
Applications Powered By PMG Rail	191
Table 3-21	193
Perpetuum Condition Monitoring Technologies	193
Table 3-22	194
Perpetuum Business Benefit To Dominate The Industrial Maintenance Scene	194
Figure 3-23	195
Perpetuum Vibration Energy-Harvesting Wireless Sensor Node Components And Structure	195
Figure 3-24	196
Perpetuum Switch Mode Efficiency	196
Figure 3-25	201
Perpetuum Condition Assessment Need	201
Figure 3-26	202
Perpetuum Condition Assessment Principle of Operation	202
Figure 3-27	203
Perpetuum Vibration Energy Harvesting for Rail Cars	203
Figure 3-28	204
Perpetuum Vibration Energy Harvesting for Rail Wheels and Bearings	204
Figure 3-29	205
Perpetuum Temperature Variation Energy Harvesting for Rail Wheels and Bearings	205
Figure 3-30	206
Perpetuum Temperature Variation and Vibration Energy Harvesting Wireless Network Solution	206
Figure 3-31	207
Perpetuum Vibration Energy Harvesting Solution Benefits	207
Figure 3-32	208
Perpetuum Energy Harvesting ROI for Ten Years	208
Figure 3-33	209

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Perpetuum Energy Harvesting Current Produced	209
Figure 3-34	210
Perpetuum Energy Harvesting Power Measurement	210
Figure 3-35	211
Perpetuum Energy Harvesting Wireless Monitoring	211
Figure 3-36	212
Perpetuum Energy Harvesting Installation	212
Figure 3-37	213
Perpetuum Energy Harvesting Innovation Solutions	213
Figure 3-38	214
Perpetuum Energy Free Standing Harvesting Development Kit	214
Figure 3-39	215
Perpetuum Energy Harvesting Wireless Monitoring and Automation	215
Figure 3-40	216
Perpetuum Energy Harvesting of Under Monitored BOP Assets	216
Figure 3-41	219
Perpetuum Power Output Spectrum	219
Figure 3-42	221
Perpetuum Vibration Energy Harvester powering the Wireless Sensor Node	221
Figure 3-43	222
Perpetuum Vibration Energy Harvesters	222
Figure 3-44	223
Perpetuum Power Solutions for Wireless Monitoring and Automation	223
Table 3-45	224
Perpetuum Vibration Energy Harvester (VEH) Functions	224
Figure 3-46	225
Perpetuum Vibration Energy Harvester	225
Table 3-47	226
Perpetuum Industrial Markets Served	226
Figure 3-48	227
Perpetuum Markets Served By Industry	227
Figure 3-49	228
Perpetuum ROI Addresses The Hidden Costs Of Under Monitored Assets	228
Figure 3-50	229
Perpetuum Estimates Number of BOP Machine Assets Under Monitored Exceeds 70%	229
Figure 3-51	230
Perpetuum Assessment of Machine Assets Under Monitored	230
Figure 3-52	232
Marlow Industries Evergen	232
Figure 3-53	234
Marlow Industries Evergen	234
Figure 3-54	235
Marlow Industries Evergen Heat Source	235
Table 3-55	236
Marlow Industries EverGen™ Plate Exchanger Advantages:	236
Table 3-56	237
Marlow Industries EverGen™ Plate Exchanger Target Markets:	237
Figure 3-57	238

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Marlow Industries Evergen Plate Exchanger	238
Table 3-58	239
Marlow Industries Evergen Energy Harvesting Solutions	239
Figure 3-59	242
Micropelt Energy Harvester	242
Figure 3-60	243
Micropelt Energy Thermogenerator	243
Figure 3-61	244
Micropelt Energy Thermogenerator	244
Figure 3-62	247
Micropelt Thermoharvester	247
Figure 3-63	248
Micropelt Peltier Coolers and Thermogenerators	248
Figure 3-64	249
Small Micropelt Peltier Cooler	249
Figure 3-65	250
Micropelt Peltier Cooler	250
Figure 3-66	251
Micropelt Small Peltier Cooler Specifications	251
Figure 3-67	252
EnOcean Middleware For Energy Harvesting	252
Figure 3-68	255
EnOcean ECO 200 - Motion Energy Harvesting	255
Table 3-69	256
EnOcean ECO 200 - Motion Energy Harvesting	256
Figure 3-70	257
EnOcean ECO 100 - Motion Energy Harvesting	257
Table 3-71	258
EnOcean Energy Harvesting Motion Converter	258
Table 3-72	258
EnOcean ECT 310 Perpetuum	258
Table 3-73	259
EnOcean Thermo Converter	259
Table 3-74	260
EnOcean Energy Converters For Energy Harvesting Wireless Applications	260
Figure 3-75	262
EnOcean-Enabled Wireless Sensor Networks	262
Table 3-76	267
EnOcean Alliance Energy Harvesting Solutions Advantages	267
Table 3-77	269
EnOcean Energy Harvesting Sources	269
Figure 3-78	270
EnOcean Energy Harvesting Wireless Sensor Technology	270
Figure 3-79	271
EnOcean Energy Harvesting Wireless Sensor Devices	271
Figure 3-80	272
Arveni Core Business In Energy Harvesting Using Piezo Electricity	272
Figure 3-81	273

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Arveni Wireless Network Sensor	273
Table 3-82	274
Arveni Wireless Network Sensors Used	274
Table 3-83	275
Arveni Wireless Network Sensors Range & Link Budget	275
Table 3-84	277
Arveni Micro Generator Features	277
Figure 3-85	280
Ferro Solutions Wireless Sensor Network	280
Table 3-86	282
Trophos Energy Marine Applications	282
Table 3-87	283
Trophos Energy Land Applications	283
Figure 3-88	284
Trophos Energy innovative Marine, Land, and Electroics Power Generation Products	284
Figure 3-89	287
MIT Energy Harvesting Device Converts Low-Frequency Vibrations Into Electricity	287
Figure 3-90	291
Cymbet Energy Harvesting Transducers	291
Figure 3-91	292
Cymbet EnerChip Energy Processor CBC915-ACA and Universal Energy Harvesting Eval Kit	292
Table 3-92	293
Cymbet Solid State Energy Storage Energizing Innovation Target Markets	293
Table 3-93	294
Cymbet Solid State Energy Storage products	294
Table 3-94	296
Cymbet EnerChip™ Solid-State Product Line	296
Table 3-95	298
Cymbet's EnerChip Benefits	298
Table 3-96	300
Cymbet Energy Harvesting (EH) Features	300
Figure 3-97	302
Cymbet EnerChip CBC3105-BDC:	302
Table 3-98	303
Cymbet EnerChip CBC001-BDC: Target Markets	303
Table 3-99	305
Cymbet Energy Harvesting Applications	305
Figure 3-100	312
Infinite Power Solutions Thinergy Component	312
Table 3-101	315
Infinite Power Solutions THINERGY® Product Family	315
Table 3-102	320
Infinite Power Solutions, Inc. Applications For Energy Harvester	320
Table 3-103	322
Infinite Power Solutions Charging Methods	322
Table 3-104	328
Wireless Sensor Network Applications	328
Figure 3-105	334

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

JonDeTech Thermopile SMDs	334
Table 3-106	335
JonDeTech AB Thermopile Features	335
Figure 3-107	336
JonDeTech AB Low-Cost, Surface Mount Thermopiles	336
Table 3-108	337
JonDeTech AB Consumer Electronics Mid IR Sensors	337
Table 3-109	338
JonDeTech AB Residential Control Systems Mid IR Sensors	338
Table 3-110	339
JonDeTech's Technology Competitive Advantages	339
Figure 3-111	340
JonDeTech AB JIRS3 Sensor	340
Table 3-112	341
JonDeTech AB Key Features of the Thermopile	341
Figure 3-113	342
JonDeTech AB JIRS5 Sensor	342
Figure 3-114	343
JonDeTech AB Close-up of JIRS5 Sensor	343
Figure 3-115	344
JonDeTech AB Nanowire Sensors	344
Figure 3-116	345
JonDeTech AB Linear Array of IR Sensorson Polyimide Foil	345
Table 3-117	347
JonDeTech Thermopile Applications	347
Figure 3-118	349
JonDeTech AB Vertical Heat Flow Model Of Jondetech Thermopiles	349
Figure 3-119	350
JonDeTech AB Vertical Heat Flow Model	350
Figure 3-120	351
Jondetech Thermopile Infrared Radiation Tetectors Generation Flex	351
Figure 3-121	352
Microchip Technology Energy Harvesting Kit	352
Figure 3-122	353
Microchip Technology Energy Harvesting Kit Features	353
Table 3-123	354
MicroGen Systems Leveraging of Factors Converging To Open Up Opportunity In Energy Harvesting	354
Table 3-124	356
MicroGen Systems Energy Harvesting For Battlefield	356
Table 3-124	357
MicroGen Systems BOLTTM family of Micro Power Generator Features	357
Table 3-126	358
MicroGen Systems BOLT Industrial Product	358
Figure 3-127	360
Perpetua Renewable Energy Source for Wireless Sensors	360
Figure 3-128	361
Perpetua Renewable Energy Source Applications	361

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Figure 3-129	362
Perpetua Energy Harvesting Device	362
Table 3-130	363
Perpetua Thermoelectric Technology Key Differentiating Features	363
Figure 3-131	364
Perpetua Technology	364
Figure 4-1	367
Energy Processing for Wireless Sensors	367
Figure 4-2	368
Energy Harvesting Transducers Variable Impedance	368
Figure 4-3	370
Maximum Peak Power Point for Variable Resistance Transducer 0	370
Figure 4-4	372
Normalized Power From a Constant Impedance Transducer	372
Figure 4-5	374
Energy Harvesting Wireless Sensor Technology	374
Figure 4-6	375
Energy Harvesting Wireless Sensor Solution	375
Figure 4-7	376
EnOcean Dolphin Interoperable System Architecture	376
Table 4-8	377
Energy Harvesting Modules Functions	377
Figure 4-9	382
Graphene Nanostructure	382
Figure 4-10	385
Piezoelectric Devices	385
Table 4-11	388
Smarter Computing Market Driving Forces	388
Table 4-12	389
Thin Film Battery Benefits	389
Table 4-13	390
Comparison Of Battery Performance	390
Figure 4-14	391
Thin Film Battery Energy Density	391
Figure 4-15	396
Comparison of Power Density of Energy Harvesting Methods/	396
Figure 4-16	400
Principle Of A Thermocouple	400
Figure 4-17	401
JonDeTech's Thermopiles Vertical Heat Flow Model	401
Figure 4-18	407
Perpetua Flexible Thermoelectric Film	407
Figure 4-19	408
Perpetua Technology	408
Table 5-1	414
ABB Product Launches	414
Figure 5-2	416
Alphabet Energy Heat To Electricity Examples	416

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

WinterGreen Research, INC.

Figure 5-3	422
Arveni Harvesting Energy Target Markets	422
Figure 5-4	423
Arveni Wireless Sensor Block Diagram	423
Table 5-5	424
ARVENI's Microgenerators Systems Functions	424
Figure 5-6	425
Arveni Strategic Focus	425
Table 5-7	426
Arveni Strategic Focus	426
Figure 5-8	435
BAE Military Robot in Development	435
Figure 5-9	441
Boeing Vulture technology	441
Table 5-10	451
Boeing Military Aircraft Key programs	451
Table 5-11	454
Boeing Unmanned Airborne Systems:	454
Table 5-12	455
Boeing Weapons:	455
Table 5-13	458
CST Target Markets	458
Table 5-14	474
Selected Enocan Shareholders:	474
Figure 5-15	479
Ferro Solutions Energy Harvesters And Sensors	479
Figure 5-16	480
Ferro Solutions Energy Harvesters And Sensors Target Markets	480
Table 5-17	480
Ferro Solutions Selected Clients	480
Table 5-18	481
Ferro Solutions Energy Harvester Uses	481
Table 5-16	484
Ferro Solutions FS Energy Harvester Industrial & Process Automation and Utilities	484
Table 5-17	492
Honeywell Energy-Harvesting Sensing and Control	492
Table 5-18	500
ITN Technologies	500
Figure 5-19	501
ITN Thin Film Battery Technology	501
Figure 5-20	502
ITN Battery	502
Figure 5-21	503
ITN Thin-Film Deposition Systems	503
Figure 5-22	504
ITN's Thin-Film Deposition Systems	504
Table 5-23	507
ITN Thin-Film Deposition Systems Products and Services Offered	507

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

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Table 5-24	508
ITN Thin-Film Deposition Systems	508
Figure 5-25	510
ITNIYN Fuel Cells	510
Table 5-26	517
KCF Technologies Core Technical Focus Areas	517
Table 5-27	518
Kelk Recent Orders	518
Table 5-28	527
Micropelt Thin Film Thermogenerator Functions	527
Figure 5-29	527
Micropelt Systems	527
Figure 5-30	528
Micropelt Switch Gear Sensor Systems	528
Figure 5-31	529
Micropelt Thermogenerators	529
Table 5-32	534
Millennial Net's MeshScape System Functions	534
Table 5-33	535
MeshScape GO Deployment Components:	535
Figure 5-34	555
Perpetua Renewable Energy Solutions For Wireless Sensors	555
Figure 5-35	556
Perpetua Energy Harvesting Product Set	556
Table 5-36	557
Perpetua's Thermoelectric Technology Features	557
Figure 5-37	564
Schneider Energy Value Chain	564
Table 5-38	565
Schneider Electric Intelligent Energy Management Solutions	565
Figure 5-39	566
Schneider Electric Revenue	566
Table 5-40	571
Silicon Laboratories Product Functions	571
Table 5-41	572
Silicon Laboratories Product Areas and Description	572
Table 5-42	578
Trophos Energy Harvesting Power Solutions Applications	578
Table 5-43	594
Leading Wireless Sensor Networks Market Participants by Technology	594

REPORT # SH25831952

597 PAGES

288 TABLES AND FIGURES

2013

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ABOUT THE COMPANY

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.

About The Principal Authors

Ellen T. Curtiss, Technical Director, co-founder of WinterGreen Research, conducts strategic and market assessments in technology-based industries. Previously she was a member of the staff of Arthur D. Little, Inc., for 23 years, most recently as Vice President of Arthur D. Little Decision Resources, specializing in strategic planning and market development services. She is a graduate of Boston University and the Program for Management Development at Harvard Graduate School of Business Administration. She is the author of recent studies on worldwide telecommunications markets, the top ten internet equipment companies, the top ten contract manufacturing companies, and the Top Ten Telecommunications market analysis and forecasts.

Susan Eustis, President, co-founder of WinterGreen Research is a senior analyst. She has done research in communications and computer markets and applications. She holds several patents in microcomputing and parallel processing. She has the original patents in electronic voting machines where she was featured in People Magazine in 1976. She has new patent applications in format varying, multiprocessing, and electronic voting. She is the author of recent studies of the Solar Renewable Energy, Wind Energy, Thin Film Batteries, Business Process Management marketing strategies, Internet equipment, biometrics, a study of Internet Equipment, Worldwide Telecommunications Equipment, Top Ten Telecommunications, Digital Loop Carrier, Web Hosting, Web Services, and Application Integration markets. Ms. Eustis is a graduate of Barnard College. Susan Eustis was named as top female executive of the year by Who's Who Worldwide in 2012. She was named page one of the top 100 Industry leaders in Who's Who Worldwide in 2013.

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