

# Concentrating Solar Power (CSP) Systems: Market Shares, Strategies, and Forecasts, Worldwide, 2014 to 2020

## Mountains of Opportunity



Picture by Susan Eustis

REPORT # SH25931852

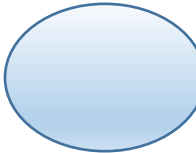
436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

**Lexington, Massachusetts**



**CHECK OUT THESE KEY TOPICS**

**Concentrating Solar Power (CSP) Provides Solar Power for Everyone:  
Systems in the Desert Generate Utility Scale Electrical Power**

<b>Heliostats</b> Concentrating Solar Power Solar Utility Power Utility Peak Power Residential Solar Consumer Solar Concentrated Solar Smart Grid	<b>Solar Panel Technologies</b> Conversion Efficiency Confirmation From NREL Nanosolar HelioVolt Solar Applications Sunlight Intensity Micromorph Modules	<b>Solar Regional Market</b> Concentrated Solar Thermal Concentrated Solar Power CSP Photovoltaic Conversion Of Sun Light
--	--	--

**Concentrated Solar Power (CSP) Storage Technologies Provide Growth Strategy**

**Concentrated Solar Power (CSP): Market Shares, Strategies, and Forecasts,  
Worldwide, 2014-2020**

LEXINGTON, Massachusetts (March 31, 2014) – WinterGreen Research announces that it has published a new study Concentrated Solar Power (CSP): Market Shares, Strategy, and Forecasts, Worldwide, 2014 to 2020. The 2014 study has 436 pages, 190 tables and figures. Worldwide markets are poised to achieve significant growth as the Concentrated Solar Power (CSP) integrates molten salt storage technologies and leverages the existing steam electrical power generating capacity.

The concentrated solar power market is set to explode despite environmental objections to the technology. The latest CSP launch, Ivanpah solar electric generating system is an engineering marvel that delivers on the full promise of solar energy. Ivanpah has 347,000 garage door-sized mirrors distributed across 173,500 heliostats. The heliostats track with the sun so that the mirrors can efficiently reflect its rays up to boilers that sit on top of the facility's three towers. The system uses solar field integration software and a solar receiver steam generator.

Concentrating Solar Power (CSP) solar energy is the most promising and sustainable renewable energy; rolling out CSP systems offers both performance and competitive energy prices. CSP Solar provides a

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

## WinterGreen Research, INC.

crucial energy solution that is utility scale and works 24 x 7 in combination with back-up stationary fuel cells.

Concentrating solar power is one of several preferred methods of solar electricity production. In most places it has achieved 'grid-parity' when considering ROI over 35 years. The mainstream cost of electricity from the grid can be complemented by solar systems. The solar industry in China is funded by the government. This unrelenting investment in energy efficiency has thrust the Chinese companies into the forefront of the industry.

Other countries rely on tax incentives and special tariffs to sustain further investment in solar electricity generation. This has enabled the industry to develop and provides very attractive investment opportunities, and is expected to do so for some time to come.

There is a move in the solar industry to achieve grid-parity. Once this is secure, the solar market can expand very rapidly achieving penetration growth calculations that exceed any growth rate per se. A step-change in system costs is being achieved, putting the industry on the cusp of a major growth spurt. Concentrating solar technology uses traditional electricity steam generators to make power fueled by solar heat.

The decrease in the costs of implementing CSP solar energy will continue. The competitiveness of concentrated solar power (CSP) will increase. Ultimately the ability to run a utility scale system that provides 24 x 7 electricity, is able to store energy and use it during the night when the sun is down provides competitive advantage to the CSP.

Concentrated Solar power markets at \$1.3 billion in 2013 are anticipated to reach \$53.7 billion by 2020 because the systems are able to be built at utility scale and to provide 24 x 7 solar renewable energy power. Campus stationary fuel cell power is mature and available to act as a backup power source for CSP, creating greater capabilities and a better story for justifying the build out of CSP.

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.

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.

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

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

<b>Abengoa</b>	<b>Solar Millennium AG</b>
<b>Acciona</b>	<b>SolFocus</b>
<b>BrightSource Energy</b>	<b>United Technologies / SolarReserve</b>

### Market Participants

<b>Amonix</b>	<b>eSolar</b>	<b>Tooele Army Depot</b>
<b>AORA</b>	<b>NextEra Energy</b>	<b>US Silica</b>
<b>Areva / Ausra</b>	<b>Soitec</b>	
<b>Entech Solar</b>	<b>SolarReserve</b>	

## Concentrated Solar Power (CSP): Market Shares, Strategies, and Forecasts, Worldwide, 2014 to 2020

### Report Methodology

This is the 593rd 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.

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

## WinterGreen Research, INC.

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.

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

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

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

### Concentrating Solar Power (CSP) Market Shares, Strategy, and Forecasts, 2014 to 2020

#### Table of Contents

##### Concentrating Solar Power (CSP) Executive Summary

<b>CONCENTRATING SOLAR POWER (CSP) SOLAR EXECUTIVE SUMMARY</b>	<b>ES-1</b>
Concentrating Solar Power (CSP) Solar Market Driving Forces	ES-1
Utilities Can Add Concentrated Solar Power Systems Incrementally	ES-2
Worldwide Demand For Energy	ES-2
US, Chinese, and European Solar Companies	ES-4
Impact of High Solar Irradiance	ES-5
Forces Driving Investment in Solar Energy	ES-7
Concentrating Solar Power Market Shares	ES-9

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

## Concentrating Solar Power (CSP) Market Description and Market Dynamics

<b>1. CONCENTRATING SOLAR POWER (CSP) MARKET DESCRIPTION AND MARKET DYNAMICS</b>	<b>1-1</b>
1.1 Sun Abundant Source Of Energy	1-1
1.1.1 Solar Energy From the Sun	1-1
1.2 Power From the Sun	1-3
1.2.1 Solar Energy Supports Worldwide Demand For Electricity	1-4
1.2.2 The Solar Solution	1-5
1.3 Solar Industry Key Drivers	1-6
1.3.1 Demand Driven By The Availability Of Government Economic Incentives	1-7
1.3.2 Government Incentives for Solar Power:	1-8
1.3.3 Solar Energy Benefits	1-9
1.4 Concentrating Solar Power (CSP) Technologies	1-11
1.5 Sunlight Intensity in Various Regions	1-11
1.5.1 Average Solar Irradiance	1-13
1.5.2 Global Solar Resources for PV Photovoltaic and CSP Technologies	1-14
1.5.3 Sunshine Index	1-17
1.5.4 Economics of PV	1-18
1.6 Solar Technology	1-21
1.6.1 Cost-Competitive Solar	1-21
1.7 Utility Power Positioning	1-22
1.7.1 Utility Solar Decision Making	1-23
1.8 Smart Electric Grid Overhaul: Utility	1-25
1.8.1 IBM Smart Grid	1-25
1.8.2 U.S. Electric Grid Needs Major Overhaul: Utility	1-26
1.9 Competition and Advanced PV Technologies	1-26
1.10 Era Of Cheap Energy	1-27
1.10.1 Unprecedented Level Of Development Worldwide	1-29
1.10.2 Population Increases	1-29
1.11 Tackling Climate Change	1-29
1.11.1 Greenhouse Gases	1-32

## Concentrating Solar Power (CSP) Market Shares and Market Forecasts

<b>2. CONCENTRATING SOLAR POWER (CSP) SOLAR MARKET SHARES AND FORECASTS</b>	<b>2-1</b>
2.1 Concentrating Solar Power (CSP) Solar Market Driving Forces	2-1
2.1.1 Utilities Can Add Concentrated Solar Power Systems Incrementally	2-2
2.1.2 Worldwide Demand For Energy	2-2
2.1.3 US, Chinese, and European Solar Companies	2-4
2.1.4 Impact of High Solar Irradiance	2-5
2.1.5 Forces Driving Investment in Solar Energy	2-7
2.2 Concentrating Solar Power Market Shares	2-9
2.2.1 Abengoa Solar Commercializes High-Concentration Photovoltaic System	2-11
2.2.2 SolFocus	2-11
2.2.3 Acciona	2-12
2.2.4 Solar Millennium –	2-13
2.2.5 Solar Millennium	2-14
2.2.6 Areva	2-15



# WinterGreen Research, INC.

2.2.7	Areva / Ausra	2-16
2.2.8	Alstom	2-16
2.2.9	BrightSource Ivanpah	2-17
2.2.10	BrightSource Hidden Hills Economic Benefits	2-17
2.2.11	Brightsource Energy -	2-18
2.2.12	eSolar Concentrated Solar Thermal	2-20
2.2.13	eSolar / Google	2-20
2.2.14	GE to Invest \$40 Million in eSolar	2-21
2.2.15	eSolar and GE	2-22
2.2.16	Siemens	2-23
2.2.17	Siemens / Solel	2-23
2.2.18	Boeing / Spectrolab	2-24
2.2.19	Boeing / SpectroLab	2-25
2.2.20	Solar Reserve Partnered With United Technologies	2-26
2.2.21	SolarReserve	2-27
2.2.22	Schott	2-27
2.2.23	Amonix Financial Flexibility For Utilities Adds Solar Power Systems Incrementally As They Become Needed	2-28
2.2.24	Clark Energy Group	2-28
2.2.25	Solaflect Energy	2-29
2.2.26	Amonix Utility Solar Resources	2-29
2.2.27	Masdar Operates Through Five Integrated Units	2-31
2.2.28	Masdar PV Production Capacity at Ichtershausen	2-32
2.2.29	Masdar PV	2-32
2.2.30	Masdar PV Thin-Film Photovoltaics	2-33
2.2.31	Masdar PV and Beck Energy Open-Space Solar Park In Germany	2-33
2.2.32	ET Solar Grid Connection of a 2.9MW Power Plant in Germany	2-34
2.2.33	Beijing Jingyuntong Technology	2-34
2.2.34	Companies Offering Fresnel Lens Systems	2-35
2.3	Concentrated Solar Market Forecasts	2-35
2.3.1	Concentrated Solar Power CSP	2-39
2.4	Developing Technologies: Concentrators	2-41
2.4.1	Solar Energy Cost-Of-Electricity Analysis	2-42
2.4.2	Concentrated Solar Thermal - Segment	2-43
2.4.3	Concentrating Solar Power Glass Discussion	2-45
2.4.4	Concentrated Solar Power Plants	2-47
2.4.5	Concentrating Solar Energy Market Forecast Analysis	2-49
2.4.6	Solar-Thermal Power Plant Technology:	2-50
2.5	Molten Salt Solar Utility Scale Energy Market Forecast	2-51
2.6	Solar Steam Generators	2-54
2.6.1	Parabolic Dish Stirling Solar Collectors	2-55
2.6.2	Solar Power Tower	2-55
2.7	Renewable Energy Growth	2-56
2.7.1	Buildings & Solar	2-58
2.8	Solar Market Opportunity	2-59
2.9	Solar Power Markets	2-63
2.9.1	Solar Power Market Shares	2-64
2.9.2	Solar Market Forecasts	2-68
2.9.3	Grid Parity	2-72
2.9.4	Impact of Oil Price on Solar Industry	2-82
2.9.5	Outlook for Solar Electricity	2-82
2.9.6	Solar Electricity Storage: Thin Film Batteries Complement The Hydrogen Manufacture	2-83
2.10	Solar Industry Segment Demand	2-85
2.11	Global Solar Resources	2-87
2.12	Solar Market Installed Capacity	2-88
2.12.1	PV Countries 2010	2-88
2.12.2	PV Installations by Technology	2-89
2.12.3	PV Installations by Application and Country	2-89

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

2.13	Solar Regional Market Segments	2-90
2.13.1	United States Solar Market	2-91
2.13.2	Germany, Italy, Spain, France, the United States, Canada, China, India, and Australia provide FiT, Rebates, Tax Incentives, And Other Incentives Subsidies	2-93
2.13.3	Australia: Solar Market	2-94
2.13.4	China: Solar Market	2-94
2.13.5	China's Insatiable Demand For Energy	2-95
2.13.6	Environmental Concerns Continue To Mount	2-96
2.13.7	Chinese Concerns About Power Reliability And Energy Security	2-97
2.13.8	China's Energy Policies Are Focused On Fostering Energy And Environmental Conservation	2-97
2.13.9	India: Solar Market	2-100

## Concentrating Solar Power (CSP) Product Description

<b>3</b>	<b>CONCENTRATING SOLAR POWER (CSP)</b>	<b>3-1</b>
3.1	Heliostats	3-1
3.2	Abengoa SA	3-2
3.2.1	Abengoa Solar Commercial Operation of Solnova 3	3-4
3.2.2	Abengoa Solar Concentrating Solar Power	3-10
3.2.3	Abengoa Solar Power Tower	3-13
3.2.4	Abengoa Solar Operating Scheme For Tower Technology	3-14
3.2.5	Abengoa Solar Hybridation and Storage	3-17
3.2.6	Abengoa Solar Land Requirement For 20 MW Plants	3-19
3.2.7	Abengoa Solar ISCC (Integrated Solar Combined Cycle)	3-21
3.2.8	Abengoa Large Scale Solar Plants	3-23
3.3	eSolar	3-23
3.3.1	eSolar / Google	3-23
3.3.2	eSolar Technology	3-24
3.3.3	eSolar Products	3-25
3.3.4	eSolar Startup in the US Solar Technology Market	3-25
3.4	Google Solar Thermal Plant	3-26
3.5	BrightSource Energy	3-27
3.5.1	BrightSource. Energy / Luz	3-28
3.5.2	Brightsource Energy \$1.4 Billion In Loan Guarantees From U.S. Department Of Energy	3-28
3.5.3	BrightSource Energy Ivanpah Project	3-29
3.5.4	BrightSource Energy Luz Power Tower 550 (LPT 550) Technology	3-31
3.5.5	Brightsource Energy Reduced Footprint Mitigation For Ivanpah Solar Electric Generating System	3-32
3.5.6	BrightSource Energy Mirrors	3-33
3.5.7	BrightSource Energy Heliostats	3-34
3.5.8	BrightSource Energy Heliostat Control System	3-36
3.5.9	BrightSource Energy Tower and Boiler	3-38
3.5.10	BrightSource Energy Power Block	3-40
3.6	Schott	3-41
3.6.1	Schott Parabolic Recievers	3-41
	Schott Powered Thermal Parabolic Trough Power	3-43
3.7	Areva / Ausra	3-43
3.7.1	Areva Strategy	3-44
3.7.2	Ausra	3-44
3.8	Ausra	3-45
3.8.1	Ausra Compact Linear Fresnel Reflector (CLFR)	3-47
3.9	Acciona	3-49
3.9.1	Acciona	3-52
3.10	Concentrating Photovoltaic Systems	3-52
3.11	Amonix	3-53
3.11.1	Thermax Limited Partners With Amonix	3-54
3.11.2	Amonix Manufacturing Facility	3-55

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

3.11.3	Amonix Solar Power Distributed Utility Model	3-56
3.11.4	Amonix Financial Flexibility For Utilities: Power Systems Added Incrementally As Needed	3-56
3.11.5	Amonix / Thermax	3-57
3.12	Entech Solar Energy Hybrid	3-59
3.12.1	Entech Collimating Skylight Overview	3-60
3.12.2	Entech Inexpensive Fresnel Lenses	3-61
3.12.3	Entech Collimating Skylight Overview	3-61
3.12.4	Entech Solar SolarVolt™ Module	3-63
3.13	Fresnel Lens Systems	3-66
3.14	Soitec Group / Concentrix Solar	3-66
3.14.1	Soitec Concentrix™ Technology	3-66
3.15	Green and Gold Energy / SolarCube	3-69
3.16	Emcore	3-71
3.16.1	Emcore Supplies Concentrator Solar Cells from Green and Gold Energy	3-71
3.16.2	EMCORE Acquires Soliant Energy	3-71
3.17	Parabolic Dish Stirling Engine	3-76
3.18	Stirling Energy Systems	3-77
3.18.1	Stirling Energy Systems	3-77
3.18.2	Stirling Energy Systems SunCatcher	3-77
3.18.3	Stirling Energy Systems SunCatcher™ Technology	3-78
3.18.4	Stirling Energy Systems SunCatcher	3-82
3.19	Infinia	3-83
3.19.1	Infinia Powerdish	3-83
3.19.2	Infinia PowerDish	3-83
3.20	SOL3G	3-84
3.20.1	SOL3G M40 module	3-85
3.20.2	SOL3G Gira-Sol System GS700	3-86
3.21	Solergy	3-87
4.1.1	Solergy Cogen CPV™	3-88
4.1.2	Solergy Solar PV / Concentrated	3-89
3.22	SolFocus	3-90
3.22.1	SolFocus CPV Systems	3-90
3.23	Pacific SolarTech	3-96
3.23.1	Pacific SolarTech MicroPV™ Concentrator Photovoltaic Modules	3-97
3.24	Whitfield Solar	3-98
3.24.1	Whitfield Solar System Solar Panel Two-axis Tracker	3-101
3.25	Prism Solar Technologies	3-106
4.1.3	Prism Solar Modules	3-108
3.25.1	Prism Solar Technologies Dual Aperture Aspect	3-109
3.26	EMCORE Concentrator Photovoltaic Arrays (CPV) Solar Power Solutions	3-110
3.26.1	Emcore's Multi- Junction Solar Cell Technology Adapted to Terrestrial Power Generation	3-111
3.26.2	Emcore / Soliant / Heliotube	3-113
3.27	ZenithSolar Concentrated	3-113
3.27.1	Z20 Solar Energy Generator	3-114
3.28	Sunrgi Concentrated Photovoltaic System	3-119
3.28.1	SUNRGI	3-119
3.28.2	Sunrgi Technology	3-119
3.29	CoolEarth Solar	3-121
3.29.1	CoolEarth Solar Concentrators Focus the Sun	3-123
3.29.2	CoolEarth Solar Support System	3-123
3.29.3	CoolEarth Solar Balloon Technology	3-124
3.30	GreenVolt	3-124
3.30.1	GreenVolt Scalable, Reliable, High Performance Solar	3-125
3.31	Lateral Aperture Solar Design	3-126
3.32	Maxxun	3-126
3.32.1	Maxxun PV Cell	3-126

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

3.33	Stellaris	3-127
3.33.1	Stellaris ClearPower Modules	3-127
3.34	Sol Solution	3-128
3.35	H2Go	3-128
3.36	Sunengy Liquid Solar Array	3-128
3.36.1	Sunengy Liquid Solar Array LSA Technology	3-129
3.36.2	Energy Innovations	3-131
4.1.4	Energy Innovations Technology	3-135
3.36.3	Energy Innovations Advanced Optical Design	3-135
3.36.4	Energy Innovations Triple Junction Cells	3-136
3.36.5	Energy Innovations 2-Axis Tracking	3-136
3.36.6	Energy Innovations Built-in Performance Monitoring	3-136
3.36.7	Energy Innovations Low-Profile Design	3-137
3.36.8	Energy Innovations Ease of Installation	3-137
3.36.9	Energy Innovations Lowest Installed Cost	3-137
3.36.10	Energy Innovations Micro-Converter Technology	3-138
3.37	Pythagoras Solar	3-139
4.1.5	Photovoltaic Glass Unit (PVGU)	3-139
3.38	SVV Technology Innovations	3-140
3.38.1	SVV Technology Ring - Array Solar Concentrator	3-142
3.38.2	SVV Technology Slat - Array Solar Concentrator (SAC)	3-144
3.39	Solalect Energy	3-145
3.39.1	Solalect Energy Hot Water or Electricity	3-145
3.39.2	Solalect Energy Hot Water	3-145
3.39.3	Solalect Energy Electricity	3-147
3.40	Concentrating Thermal Systems	3-148
3.41	AORA	3-148
4.1.6	AORA Technology	3-148
3.42	Beam Down Solar	3-149
3.43	BrightSource	3-150
3.43.1	BrightSource Ivanpah	3-151
3.43.2	BrightSource Energy Solar Energy Development Center	3-154
3.43.3	BrightSource Energy Hidden Hills	3-155
3.44	Solargenix	3-157
3.44.1	Solargenix Nevada Solar One, a 64-Megawatt (MW) Solar Electric Power Plant Project	3-159
3.45	Solucar	3-161
3.46	Sopogy	3-161
3.47	Biomass / Solar Concentrated	3-161
3.48	Andersen Manufacturing	3-161
3.49	Spain Plugs In World's Largest Solar Tower	3-163
3.50	Parabolic Trough Technology	3-163
3.50.1	Abengoa Solar Parabolic Trough	3-163
3.50.2	Abengoa Solar Concentrating Solar Power Requirements	3-170
3.51	Flagsol	3-175
3.52	SkyFuel	3-175
3.53	HelioDynamics	3-175
3.54	Practical Solar	3-176
3.55	GreenShift'	3-176
3.56	Menova Energy	3-176
3.57	AXT	3-177
3.58	AzurSpace	3-178
3.59	Boeing / SpectroLab	3-178
3.59.1	Spectrolab	3-178
3.59.2	Boeing Satellite Solar-Cell Technology	3-179
3.60	Spire Semiconductor, LLC	3-182

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

3.61	Masdar PV	3-183
3.61.1	Masdar PV Modules Amorphous Modules	3-186
3.61.2	Masdar PV Micromorph Modules	3-187
3.62	Solar Thermal	3-191
3.63	Solar Millennium –	3-191
3.63.1	Solar Millennium Salts To Replace Oil In Parabolic Trough Power Plants	193
3.64	Intersolar North America	3-196
3.65	United Technologies	3-196
3.65.1	United Technologies / Hamilton Sundstrand / SolarReserve	3-197
3.65.2	United Technologies Hamilton Sundstrand Unit	3-197
3.65.3	United Technologies Hamilton Sundstrand	3-199
3.65.4	United Technologies / Hamilton Sundstrand / SolarReserve Power Towers	3-201
3.65.5	United Technologies / Hamilton Sundstrand / SolarReserve	3-201
3.65.6	United Technologies / Hamilton Sundstrand / SolarReserve	3-202
3.65.7	United Technologies / Hamilton Sundstrand / SolarReserve	3-202
3.65.8	Rocketdyne / SolarReserve	3-203
3.65.9	Solar Thermal With Molten Salt Energy Storage: SolarReserve Heads to Nevada	3-203
3.65.10	Solar Reserve Partnered With United Technologies	3-204
3.66	Siemens Energy Sector / Renewable Energy Division	3-206
3.66.1	Siemens Solar-Thermal Power Plant	3-206
3.66.2	Siemens Global Market Leader For Turbines In Solar Thermal Parabolic Trough Power Plants	3-208
3.66.3	Siemens Solar-Thermal Power Plant: Putting the Desert to Use	3-209
3.66.4	Siemens 123-MW Steam Turbine-Generator For Solar Thermal Power Plant In California	3-210
3.66.5	Siemens Solar Efficiency	3-212
3.66.6	Siemens Next-Generation Solar UVAC Receiver Increases Thermal Output Of Power Plants	3-213
3.66.7	Siemens –	3-216
3.67	Asahi Glass	3-217
3.67.1	Asahi Glass Flexible Solar Cells	3-217
3.68	GE	3-221
3.69	Hitachi	3-222
3.70	Solar Thermal Water Heating Units	3-223
3.70.1	Zing Solar Water Heating	3-223
3.70.2	Vajra Plus Solar Water Heating	3-224
3.70.3	Hotmax Nova Solar Heating	3-224
3.70.4	TATA BP Solar Business Energy	3-224
3.71	Daqo New Energy Solar Module	3-226
3.72	Dyesol DSC Applications Designs In BIPV	3-227
3.73	JinkoSolar Value Chain	3-228
3.73.1	JinkoSolar Product Traceability Control	3-228
3.73.2	JinkoSolar High Efficiency Modules	3-229
3.73.3	JinkoSolar High Efficiency Cells	3-230
3.73.4	JinkoSolar High Quality Wafers	3-230
3.73.5	JinkoSolar Advanced Technology	3-230

## Concentrating Solar Power (CSP) Technology

### 4. CONCENTRATING SOLAR SYSTEMS STRATEGY, TECHNOLOGY, AND APPLICATIONS

4.1	Types of PV Systems	4-1
4.2	Concentrating Solar Power	4-4
4.3	Solar Reflectors	4-11
4.3.1	Semiconductors Absorb Light	4-12
4.3.2	How Solar Energy Works	4-13
4.3.3	Connecting to the Grid:	4-13
4.3.4	SunEdison's Approach:	4-13
4.3.5	Solar Electricity	4-14

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

4.4	Entech Solar Collimator™ Technology	4-14
4.5	CSP Used To Produce Electricity	4-16
4.5.1	Parabolic Trough	4-17
4.5.2	Solar-Thermal Power Plant Technology:	4-17
4.6	Parabolic Dish Stirling Solar Collectors	4-18
4.7	Solar Power Tower	4-19
4.8	Fresnel Lenses	4-19
4.8.1	Fresnel Reflectors	4-20
4.9	Pacific Solartech Concentrator Photovoltaic Modules Technology	4-20
4.10	BrightSource Energy LPT Solar Thermal Energy System	4-22
4.10.1	BrightSource's LPT solar thermal system Heliostats	4-23
4.10.2	BrightSource Solar Receiver (Boiler)	4-25
4.10.3	BrightSource Storage	4-26
4.10.4	BrightSource Technology	4-27

## Concentrating Solar Power (CSP) Company Profiles

<b>5. CONCENTRATING SOLAR ENERGY COMPANY PROFILES</b>	<b>5-1</b>
5.1 Abengoa Solar	5-1
5.1.1 Abengoa Solana: The World's Largest Solar Plant	5-3
5.1.2 Abengoa Solar	5-6
5.1.3 Abengoa Solar Concentrating Solar Power	5-8
5.1.4 Abengoa Solar Photovoltaic	5-8
5.1.5 Abengoa Solar Customized Industrial and Commercial Applications	5-12
5.1.6 Abengoa Research and Development of Solar Technology	5-12
5.1.7 Abengoa Solar Commercializes High-Concentration Photovoltaic System	5-15
5.1.8 Joint Venture Between Masdar (60%), Total (20%) and Abengoa (20%) Shams-1 Solar Project	5-16
5.1.9 Abengoa	5-18
5.1.10 Abengoa and Climate Change	5-19
5.2 Acciona Solar Power	5-27
5.2.1 Acciona Sustainability	5-29
5.2.2 Acciona U.S. Projects	5-29
5.2.3 Acciona Canadian Projects	5-30
5.2.4 Acciona Energia, s.a. –	5-31
5.2.5 Acciona World Leader In Renewables	5-31
5.2.6 Acciona (Navarre, Spain)	5-33
5.2.7 Ten Entities Finance Acciona's Eurus Windpark In Mexico With Usd375m	5-34
5.2.8 Acciona Energy Wind Parks in Mexico	5-34
5.2.9 Acciona And Dhamma Energy Sign An Agreement To Develop 250 Mw Of Photovoltaic Power In France	5-35
5.2.10 Acciona Financial Information	5-36
5.2.11 Acciona2009 Revenue Results	5-37
5.2.12 Acciona Business strategy	5-38
5.2.13 Acciona Project Development	5-39
5.2.14 Acciona Exploitation And Sale Of Power	5-40
5.2.15 Acciona Wind Energy	5-42
5.2.16 Acciona Production	5-44
5.2.17 Acciona Photovoltaic	5-44
5.2.18 Acciona Other Facilities	5-45
5.2.19 Acciona Solar Thermal Power	5-46
5.2.20 AccionaFour Plants in Spain	5-47
5.2.21 Acciona Installations for Customers	5-47
5.2.22 Acciona Hydropower	5-48
5.3 Andersen Manufacturing	5-58

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

5.4	Applied Materials	5-59
5.4.1	Applied Materials Segment Analysis	5-60
5.4.2	Applied Materials Silicon Segment	5-61
5.4.3	Applied Three-Dimensional (3D) ICs	5-63
5.4.4	Applied Materials Deposition	5-64
5.4.5	Applied Materials Atomic Layer Deposition	5-64
5.4.6	Applied Materials Chemical Vapor Deposition	5-65
5.4.7	Applied Materials Applied Producer CVD Platform	5-65
5.4.8	Applied Materials Low k Dielectric Films —	5-66
5.4.9	Applied Materials Lithography-Enabling Solutions	5-66
5.4.10	Applied Materials Gap Fill Films —	5-66
5.4.11	Applied Materials Strain Engineering Solutions	5-67
5.4.12	Applied Materials Epitaxial Deposition	5-67
5.4.13	Applied Materials Polysilicon Deposition —	5-68
5.4.14	Applied Materials Tungsten Deposition —	5-68
5.4.15	Applied Materials Physical Vapor Deposition	5-69
5.4.16	Applied Materials Etch	5-70
5.4.17	Applied Materials Rapid Thermal Processing	5-71
5.4.18	Applied Materials Chemical Mechanical Planarization	5-72
5.4.19	Applied Materials Metrology and Wafer Inspection	5-72
5.4.20	Applied Materials Critical Dimension and Defect Review Scanning Electron Microscopes (CD-SEMs and DR-SEMs)	5-72
5.4.21	Applied Materials Wafer Inspection	5-74
5.4.22	Applied Materials Mask Making	5-74
5.4.23	Applied Materials Display Segment	5-75
5.4.24	Applied Global Services Segment	5-75
5.4.25	Applied Materials Fab Services —	5-76
5.4.26	Applied Films Vacuum Coating Technologies	5-76
5.4.27	Applied Materials Energy and Environmental Solutions Segment	5-77
5.5	AORA	5-81
5.5.1	AORA (formerly EDIG Solar) Belongs To The EDIG Group Of Companies	5-82
5.6	Areva / Ausra	5-83
5.6.1	AREVA Leads Global Nuclear Power Industry	5-84
5.6.2	Areva Ranked First In The Global Nuclear Power Industry	5-84
5.6.3	Areva / Ausra	5-86
5.6.4	Areva Group	5-87
5.6.5	An Organization Combining Operational Decentralization And Global Coordination	5-87
5.6.6	Areva Power Generation With Less Carbon Solutions	5-88
5.6.7	Areva Fundamentals Of A World Leader In Energy	5-88
5.6.8	AREVA Key Figures for 2010	5-89
5.6.9	AREVA Group	5-90
5.6.10	AREVA Mining-Front End Business Groups – One Of The Leaders In Its Field	5-91
5.6.11	AREVA Reactors and Services, Number 1 in the World	5-91
5.6.12	AREVA Back End Activities, A Major Technological And Industrial Advance	5-92
5.6.13	Renewable Energy, a Major Challenge	5-92
5.6.14	Revenue	5-93
5.7	Asahi Glass Co Ltd	5-93
5.7.1	Asahi Glass Fuel Cell	5-96
5.7.2	Asahi Glass Fuel Cells Close To Practical Use	5-97
5.7.3	Asahi Glass Fuel Cells In Daily Life In 2010	5-98
5.7.4	Asahi Glass Chemicals Business as Core Business to the AGC Group	5-98
5.7.5	Asahi Glass ETFE Film With High Transparency And Flexibility	5-101
5.7.6	AGC Asahi Glass Revenue	5-102
5.7.7	Asahi Glass Revenue	5-108
5.8	AZUR SPACE Solar Power	5-113
5.9	Battelle	5-113
5.10	BrightSource Energy	5-114

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING



# WinterGreen Research, INC.

5.10.1	BrightSource. Energy / Luz	5-115
5.10.2	BrightSource Energy \$1.4 billion In Loan Guarantees From The U.S. Department of Energy	5-115
5.10.3	BrightSource Energy Ivanpah Project: Clean Energy, Union Jobs, Environmentally-Responsible	5-116
5.10.4	BrightSource Energy Luz Power Tower 550 (LPT 550) Technology	5-117
5.10.5	Brightsource Energy \$150 Million Of Equity Financing	5-117
5.10.6	BrightSource Energy	5-119
5.10.7	BrightSource Investors	5-121
5.10.8	BrightSource Energy Hiddens Hills Solar Electric Generating System	5-123
5.10.9	BrightSource Hidden Hills Economic Benefits	5-124
5.11	Boeing	5-127
5.11.1	Boeing 787 Dreamliner	5-128
5.11.2	Boeing 787 Dreamliner Performance	5-128
5.11.3	Boeing Advanced Technology	5-129
5.11.4	Boeing Participation In Commercial Jet Aircraft Market	5-130
5.11.5	Boeing Participation In Defense Industry Jet Aircraft Market	5-130
5.11.6	Boeing Defense, Space & Security	5-131
5.11.7	Boeing Advanced Military Aircraft:	5-131
5.11.8	Boeing Military Aircraft	5-132
5.11.9	Boeing Continuing Progress	5-138
5.11.10	Boeing-iRobot Team Receives New SUGV Task Order From US Army	5-138
5.11.11	Boeing Company/ Spectrolab,	5-139
5.12	Cool Earth Solar	5-140
5.12.1	Cool Earth Solar Expands Operations	5-140
5.13	Corning	5-141
5.13.1	Corning Display Technologies Segment	5-141
5.13.2	Corning Revenue	5-143
5.13.3	Corning Display Technologies Segment	5-146
5.13.4	Corning Telecommunications Segment	5-147
5.13.5	Corning Environmental Technologies Segment	5-148
5.13.6	Corning Specialty Materials Segment	5-148
5.13.7	Corning Life Sciences Segment	5-149
5.14	Directed Vapor Technology	5-149
5.14.1	Directed Vapor Deposition Next Generation Coating Technology	5-149
5.15	du Pont	5-151
5.15.1	DuPont	5-151
5.15.2	DuPont™ Kapton®	5-154
5.15.3	DuPont™ Kapton® Polyimide Films	5-154
5.15.4	DuPont Teonex	5-157
5.16	Emcore	5-158
5.16.1	Fiber Optics	5-161
5.16.2	Cable Television (CATV) and Fiber-To-The-Premise (FTTP) Networks	5-163
5.16.3	Telecommunications Networks	5-164
5.16.4	Data Communications Networks	5-165
5.16.5	Satellite Communications Networks	5-167
5.16.6	Storage Area Networks	5-167
5.16.7	Emcore Defense and Homeland Security	5-167
5.16.8	Photovoltaics: EMCORE Photovoltaics and Solar Power	5-168
5.16.9	Emcore Acquires CPV Soliant	5-171
5.17	Energy Innovations	5-172
5.18	WorldWater & Solar Technologies / Entech Solar	5-173
5.18.1	WorldWater & Solar Technologies / Entech	5-174
5.18.2	Entech Solar Certification of Daylighting Product	5-175
5.18.3	Energy Focus / Entech Solar Commercial Skylighting Distribution Agreement	5-176
5.19	eSolar	5-177

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**



# WinterGreen Research, INC.

5.19.1	eSolar Investors	5-178
5.19.2	GE to Invest \$40 Million in eSolar	5-182
5.19.3	eSolar Awards	5-185
5.20	ET Solar	5-185
5.20.1	ET Solar Corporate Vision	5-186
5.20.2	ET Solar Modules Adopted in a UK Commercial Rooftop Project	5-187
5.20.3	ET Solar / Zep Compatible Modules for Rooftop PV Systems	5-187
5.20.4	ET Solar Grid Connection of a 2.9MW Power Plant in Germany	5-188
5.21	GE Energy	5-189
5.21.1	GE Steam Turbines to Boost Output, Efficiency of Saudi Electricity Company's Qurayyah Power Plant	5-189
5.21.2	GE Emissions Testing Team Becomes Early Adopter of Future EPA Standards	5-191
5.21.3	GE Smart Grid Technologies Transform Ireland's Energy	5-192
5.22	Green and Gold Energy / SunCube™	
	International Group (SCIG)	5-193
5.23	GreenVolts	5-195
5.23.1	GreenVolts Global Cleantech 100 Clean Technology Company	5-197
5.24	Hitachi	5-198
5.24.1	Hitachi America	5-201
5.24.2	Hitachi America, Ltd. Focusing On Smart Grid Energy Storage for Solar Farms	5-202
5.24.3	Hitachi Long Life Lead Acid Batteries	5-203
5.25	Infinia	5-204
5.26	Mubadala / Masdar	5-207
5.26.1	Masdar Operates Through Five Integrated Units	5-209
5.26.2	Masdar PV	5-211
5.26.3	Masdar Initiative	5-213
5.26.4	Masdar PV Production Capacity at Ichtershausen	5-217
5.26.5	Masdar PV and Raabvill Kft. Build Solar Parks With Full Size Modules	5-218
5.26.6	Masdar PV and Beck Energy Open-Space Solar Park In Germany	5-219
5.27	Pacific Solar Tech	5-220
5.28	Prism Solar Technologies	5-221
5.29	Pythagoras Solar	5-222
5.29.1	Prism Solar Technologies BIPV	5-223
5.29.2	Pythagoras Solar Solution	5-223
5.30	Schott	5-225
5.30.1	Schott Electronic Packaging GmbH	5-229
5.30.2	Schott AgFlat Glass	5-233
5.30.3	Schott Technological Competence	5-235
5.30.4	SCHOTT Solar Global presence	5-236
5.30.5	SCHOTT Solar Photovoltaics (PV) Business Division	5-236
5.30.6	SCHOTT Solar 2008 – Hospital Ward In Senegal	5-238
5.30.7	SCHOTT Light for Tanzania	5-239
5.30.8	SCHOTT Solar PV and Consolidated Solar Technologies Inaugurate Photovoltaic Solar Installation at Moriarty High School	5-239
5.30.9	SCHOTT Solar Black Frame Modules	5-240
5.30.10	SCHOTT Solar comes out on top in PV+ Test Conducted by Solarpraxis and TÜV Rheinland	5-241
5.31	SEIA:	5-241
5.32	Siemens	5-242
5.32.1	Siemens Business Areas	5-244
5.32.2	Siemens Steam Turbine-Generator to England – Delivery Scheduled In 13 Months	5-247
5.32.3	Siemens Energy Sector	5-249
5.32.4	Siemens / Solel	5-250
5.32.5	Siemens Wind Power A/S –	5-252
5.32.6	Siemens Fossil Power Generation	5-253
5.32.7	Siemens Renewable Energy Revenue and Orders	5-255

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

5.32.8	Siemens Regional Revenue	5-256
5.32.9	Siemens Revenue	5-258
5.32.10	Siemens' Worldwide Network	5-259
5.33	Sol3G	5-260
5.34	Solafllect Energy	5-261
5.34.1	Solargenix Energy, LLC	5-262
5.34.2	Solafllect Energy Non-Tracking Evacuated Tube Collectors	5-264
5.34.3	Solafllect Energy Solar Trough Power Plants	5-264
5.34.4	Solafllect Energy Desalination	5-265
5.35	Solergy	5-268
5.35.1	Solergy Building Integrated CPV (BICPV) Solution for Greenhouses And To Cultivate Roses	5-268
5.36	SolFocus	5-269
5.36.1	SolFocus CPV System Leverages Panel Technology and Optimizes Large-Scale Deployments	5-270
5.36.2	SolFocus	5-271
5.36.3	SolFocus Low Lifecycle Greenhouse Gas Intensity	5-273
5.36.4	No Water Consumption	5-273
5.36.5	SolFocus Less Disruption of the Land and Local Ecosystem	5-274
5.36.6	CPV technology:	5-277
5.36.7	SolFocus Partners with Bechtel to Deliver Renewable Power for California Agribusiness	5-278
5.36.8	SolFocus and Vision Electro Mechanical Company to Build the Largest Solar Power Plant of its Kind in Saudi Arabia	5-279
5.37	Solitec / Concentrix Solar	5-279
5.37.1	Soitec Concentrix™ Technology	5-280
5.38	Solar Millennium	5-280
5.38.1	Solar Millennium Revenue First Half Of The Fiscal Year	5-283
5.38.2	Solar Millennium AG: Solar-Thermal Power Plant Technology:	5-284
5.39	Solyndra Shut The Doors To Its California Headquarters	5-287
5.39.1	Solyndra: The Rooftop Solar Leader	5-288
5.40	Sol Solutions	5-289
5.41	Stellaris	5-290
5.42	Stirling Energy Systems	5-290
5.42.1	Stirling Energy Systems SunCatcher™ Technology	5-292
5.43	Sunengy Liquid Solar Array	5-292
5.44	Sunrgi	5-295
5.45	SVV Technology Innovations	5-295
5.46	Trans-Mediterranean Renewable Energy Cooperation (TREC)	5-296
5.46.1	TREC-UK -	5-296
5.47	United Technologies / SolarReserve	5-297
5.47.1	United Technologies	5-298
5.47.2	United Technologies / Hamilton Sundstrand	5-301
5.47.3	Hamilton Sundstrand Technologically Advanced Aerospace And Industrial Products	5-303
5.47.4	United Technologies Revenue	5-305
5.48	Whitfield Solar	5-306
5.48.1	Whitfield CPV- The Power To Progress	5-315
5.49	Whole Energy Solar	5-316
5.50	Zenith Solar	5-317
5.50.1	ZenithSolar Values	5-319
5.50.2	ZenithSolar Strengths	5-320
5.50.3	ZenithSolar to Build Two 10 MW CHP Solar Stations in Gansu, China	5-320
5.51	Three US Solar Companies Go Bankrupt	5-322

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

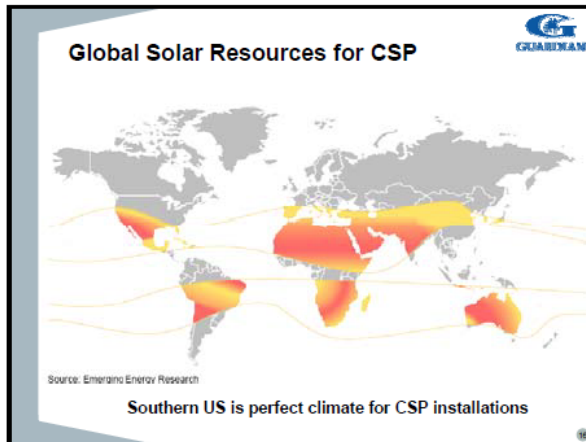
## List of Tables and Figures

### Concentrating Solar Power (CSP) Executive Summary

Table ES-1	ES-4
Solar Market Growth Key Factors Driving Demand	
Figure ES-2	ES-6
Average Solar Irradiance	
Table ES-3	ES-7
Forces Driving Investment in Concentrating Solar Energy	
Figure ES-4	ES-9
Concentrating Solar Market Shares, Dollars, Worldwide, 2010	
Figure ES-5	ES-11
Concentrated Solar Power Market Forecasts, Worldwide, Dollars, 2011-2017	

### Concentrating Solar Power (CSP) Market Description and Market Dynamics

Figure 1-1	1-6
Global Primary Energy Scenario	
Table 1-2	1-10
Solar Fosters Energy Independence	
Figure 1-3	1-12
Solar Panel Azimuth Angle and Magnetic Declination	
Figure 1-4	1-13
Average Solar Irradiance	
Figure 1-5	1-14



Global Solar Resources for PV Photovoltaic and CSP Technologies	
Figure 1-6	1-15
Regional Power Output Levels Per kw Of Generation Using GE Solar Electric Power Systems	
Figure 1-7	1-16
Map of Solar Electricity Potential In Europe	
Figure 1-8	1-17
Sunshine Index, U.S.	
Figure 1-9	1-19
US Average Daily Solar Energy Received By A Latitude	

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

Tilt Photovoltaic Cell	
Table 1-10	1-20
Sustainable Solar Energy Market Aspects	
Figure 1-11	1-30
Driving Forces for Climate Change	
Table 1-12	1-31
International Energy Agency Forecasts for 2030	
Table 1-13	1-32
Importance of Energy Management	

## Concentrating Solar Power (CSP) Market Shares and Market Forecasts

Table 2-1	2-4
Solar Market Growth Key Factors Driving Demand	
Figure 2-2	2-6
Average Solar Irradiance	
Table 2-3	2-7
Forces Driving Investment in Concentrating Solar Energy	
Figure 2-4	2-9
Concentrating Solar Market Shares, Dollars, Worldwide, 2010	
Table 2-5	2-10
Concentrating Solar Energy Market Shares, Dollars, Worldwide, 2010	
Table 2-6	2-30
Solargenix Energy, LLC Nevada One	
Figure 2-7	2-36
Concentrated Solar Power Market Forecasts, Worldwide, Dollars, 2011-2017	
Table 2-8	2-37
Concentrated Solar Market Forecasts, Dollars and Megawatts, Worldwide, 2011-2017	
Figure 2-9	2-44
Concentrating Solar Power	
Figure 2-10	2-47
Parabolic Trough CSP System	
Figure 2-11	2-52
Molten Salt Storage Receiver Market Forecasts Dollars, Worldwide, 2010-2016	
Table 2-12	2-53
Solar Power Thermal Market Shipment Forecasts, Molten Salt Storage Units and Dollars, Worldwide, 2010-2016	
Table 2-13	2-54
Solar Power Thermal Market Shipment Forecasts, Molten Salt Storage Units, Worldwide, 2010-2016	
Table 2-14	2-59
Solar BIPV Advantages:	
Table 2-15	2-61
Solar Panel Megawatts Shipped Market Shares, Worldwide, 2009 and 2010	
Figure 2-16	2-65
Solar Panel and Systems Market Shares, Dollars, 2010	

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

Table 2-17	2-66
Solar Energy Market Shares, Dollars, Worldwide, 2010	
Figure 2-18	2-69
Solar Panel and Systems Markets Forecasts Dollars, Worldwide, 2011-2017	
Table 2-19	2-70
Solar Crystalline Silicon, Thin Film, Concentrated Power Market Segments, Dollars, Worldwide, 2011-2017	
Table 2-20	2-71
Solar Market Segments MegaWatts, Worldwide, 2011-2017	
Figure 2-21	2-73
First Solar Module Roadmap to Grid Parity	
Table 2-22	2-74
Solar Crystalline Silicon, Thin Film, Concentrated Power Market Segments, Percent, Worldwide, 2011-2017	
Figure 2-23	2-75
Solar Industry Dollars to Megawatts Ratio, Worldwide, Forecasts, 2010-2017	
Figure 2-24	2-76
Solar Industry Dollars to Megawatts Ratio, Forecasts, 2010-2017	
Table 2-25	2-77
Solar Market Segments MegaWatts and Dollars Comparison, Worldwide, 2011-2017	
Table 2-26	2-84
Electrical Storage Mechanisms	
Figure 2-27	2-87
Global Solar Resources for PV Photovoltaic and CSP Technologies	
Table 2-28	2-90
Solar Panel and Systems Regional Market Segments, 2010	
Table 2-29	2-98
Risks Related to Doing Business in China	

## RISKS RELATED TO DOING BUSINESS IN CHINA

- Amount of government involvement
- Level of development
- Growth rate
- Control of foreign exchange
- Allocation of resources

Source: WinterGreen Research, Inc

## Concentrating Solar Power (CSP) Product Description

Figure 3-1	3-3
Abengoa SA Solar Positioning	

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

Figure 3-2	3-5
Abengoa SA Solar Parabolic Trough	
Figure 3-3	3-6
Abengoa SA Solar Parabolic Trough ISCC	
Figure 3-4	3-8
Abengoa SA Solar Parabolic Trough	
Figure 3-5	3-9
Abengoa SA Solar Parabolic	
Figure 3-6	3-10
Abengoa Solar Radiation Concentration	
Figure 3-7	3-12
Abengoa Solar Concentrating Power	
Figure 3-8	3-14
Abengoa Solar Tower Systems Create A Heliostat Field Comprised Of Movable Mirrors	
Table 3-9	3-15
Abengoa Solar Operating Scheme For Tower Technology	
Figure 3-10	3-16
Abengoa Solar Towers	
Table 3-11	3-18
Abengoa Solar Tower Technology Plant Requirements	
Figure 3-12	3-19
Abengoa Solar Tower Technology	
Figure 3-13	3-20
Abengoa Solar Land Requirements	
Table 3-14	3-21
Abengoa Solar Solar Tower Basic Requirements	
Figure 3-15	3-22
Abengoa Solar Independent Projects	
Figure 3-16	3-33
BrightSource Energy Mirrors	
Figure 3-17	3-34
BrightSource Energy Heliostats	
Figure 3-18	3-36
BrightSource Energy Heliostat Control System	
Table 3-19	3-37
BrightSource Energy Control System Functions	
Table 3-20	3-38
BrightSource Energy Control System Conditions Controlled	
Figure 3-21	3-39
BrightSource Energy Tower and Boiler	
Figure 3-22	3-40
BrightSource Energy Power Block	
Table 3-23	3-42
SCHOTT POLY® PV Modules Key Advantages:	
Table 3-24	3-46
Ausra Rows Of Mirrors Advantages	
Figure 3-25	3-47
Ausra Mirror Reflectors	
Figure 3-26	3-48
Ausra Long Rows of Fresnel Reflector Mirrors	
Figure 3-27	3-49
Acciona Solar Power	

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Figure 3-28	3-50
Acciona Solar Power Modules	
Figure 3-29	3-51
Acciona Solar Mirrors	
Figure 3-30	3-58
Amonix Utility CPV Module Pods	
Table 3-31	3-59
Entech Modules	
Figure 3-32	3-62
Entech Solar Energy Hybrid Tubular Skylight Lighting	
Figure 3-33	3-64
Entech Solar Concentrator	
Table 3-34	3-65
Entech Solar Concentrator Benefits:	
Table 3-35	3-68
Soitec Solar Energy Solutions Advantages	
Figure 3-36	3-69
Green and Gold Energy / SolarCube	
Table 3-37	3-70
Green and Gold Energy SolarCube Power Generation	
Figure 3-38	3-73
Solient To Leverage EMCORE's Highly-Efficient Solar	
Figure 3-39	3-74
Emcore Concentrating Solar Specifications	
Figure 3-40	3-75
Emcore Concentrating Solar	
Figure 3-41	3-78
Stirling Energy Systems Suncatcher Mirror and Power Conversion	
Figure 3-42	3-80
Stirling Energy Systems Suncatcher	
Figure 3-43	3-81
Stirling Energy Systems Dish Engine	
Figure 3-44	3-85
SOL3G M40 Module	
Figure 3-45	3-86
SOL3G Gira-Sol System	
Table 3-46	3-88
Solergy CPV Unique Attributes:	
Table 3-47	3-89
Solergy Cogen CPV™ Variety Of Applications	
Figure 3-48	3-90
SolFocus CPV Systems	
Table 3-49	3-92
SolFocus CPV Power Unit	
Table 3-50	3-93
SolFocus CPV Panel	
Table 3-51	3-94
SolFocus Dual Axis Tracker	
Table 3-52	3-95
SolFocus CPV System Benefits	
Figure 3-53	3-96
Pacific SolarTech	
Table 3-54	3-98

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Pacific SolarTech MicroPV Concentrator  
Photovoltaic Module Benefits

Table 3-55

3-99

Whitfield Solar System Functions

## WHITFIELD SOLAR CONCENTRATOR SOLUTION TARGET MARKETS

- Solar farms
- Rooftops
- Car parks

**Source: WinterGreen Research, Inc.**

Table 3-56

3-100

Whitfield Solar Concentrator Solution Target Markets

Table 3-57

3-100

Whitfield Solar Concentrator Solution Positioning

Table 3-58

3-101

Whitfield Solar System Solar Panel Two-Axis Tracker

Table 3-59

3-102

Whitfield Solar System Frame

Table 3-60

3-104

Whitfield Solar System Power Troughs

Table 3-61

3-105

Whitfield Solar System Mounting System

Table 3-62

3-106

Whitfield Solar System Mounting System

Figure 3-63

3-108

Prism Solar Technologies Modules

Figure 3-64

3-111

Emcore Lens Solar Concentration

Figure 3-65

3-112

Emcore Multi-Junction Solar Cell

Figure 3-66

3-114

Z20 Solar Concentrator CHP Solar Energy Generator

Table 3-67

3-116

Combined Heat and Power (CHP) Generation Benefits

Table 3-68

3-117

Combined Heat and Power (CHP) Generation Features

Table 3-69

3-117

Combined Heat and Power (CHP) Generation Applications

Figure 3-70

3-118

Zenith Solar Device Concentrates The Light A Thousand Times

Table 3-71

3-120

Sunrgi Solar Concentrator Functions

Figure 3-72

3-122

CoolEarth Solar Inflated, Balloon-Shaped Concentrators

Table 3-73

3-125

GreenVolt Concentrated Solar Functions

Figure 3-74

3-129

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**



# WinterGreen Research, INC.

Sunengy Liquid Solar Array LSA Technology Figure 3-75	3-131
Energy Innovations Sunflower Table 3-76	3-132
Energy Innovations Sunflower Systems Functions Table 3-77	3-133
Energy Innovations Sunflower Systems Features Table 3-78	3-134
Energy Innovations Sunflower Systems Functions Micro-Converter Technology Performance Monitoring High Concentration Figure 3-79	3-139
Pythagoras Solar PVGU Reflectors Table 3-80	3-140
Pythagoras Solar PVGU Features & Benefits Figure 3-81	3-142
SVV Technology Ring - Array Solar Concentrator Figure 3-82	3-144
SVV Technology Slat - Array Solar Concentrator (SAC) Table 3-83	3-146
Solaflect Energy Hot Water Features Figure 3-84	3-147
Solaflect Energy Hot Water System Figure 3-85	3-151
BrightSource Installation Table 3-86	3-152
BrightSource Ivanpah Project Overview Table 3-87	3-153
BrightSource Ivanpah Projects Figure 3-88	3-153
BrightSource Energy Ivanpah Table 3-89	3-156
BrightSource Energy Hidden Hills Overview Fact Sheet Figure 3-90	3-157
BrightSource Energy Hidden Hills Project Figure 3-91	3-158
Solargenix Energy Multi-megawatt Solar Power Plants For The Kramer Junction Facility in California Table 3-92	3-160
Solargenix Energy, LLC Nevada One Figure 3-93	3-162
Andersen Manufacturing Satellite Antennae Useful Model for Concentrating Solar Dish Table 3-94	3-164
Abengoa Solar Operating Scheme For Parabolic Trough Table 3-95	3-165
Abengoa Solar Main Components For Parabolic Trough Technology Table 3-96	3-166
Abengoa Solar Parabolic Trough Reflector Table 3-97	3-167
Abengoa Solar Receiver Tube Or Heat Collection Element:	

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Table 3-98 Abengoa Solar Untracking and Support Structure System	3-168
Table 3-99 Abengoa Solar Parabolic Trough Models:	3-169
Figure 3-100 Abengoa Solar Concentrating Solar Power	3-170
Table 3-101 Abengoa Solar Trough. Technology Variables To Be Analyzed When Defining An Installation	3-171
Figure 3-102 Abengoa Solar Land Requirements for 100 MW Plants	3-172
Figure 3-103 Abengoa Solar Individual Parabolic Trough Collector Modules Attached Together	3-173
Table 3-104 Abengoa Concentrating Solar Power Trough Specifications	3-174
Figure 3-105 Masdar PV modules	3-183
Figure 3-106 Masdar PV Thin-film Modules	3-185
Table 3-107 Masdar PV Modules Quality and Performance Aspects	3-187
Table 3-108 Masdar PV Micromorph Thin-Film Solar Modules Quality and Performance	3-188
Table 3-109 Masdar PV Micromorph Thin-Film Solar Modules Production Lines	3-189
	
Figure 3-110 Solar Millennium Provides Parabolic Trough Technology Able To Provide A Turnkey Solution	3-192
Figure 3-111 Molten Salt As Solar Heat Battery	3-198
Figure 3-112 Siemens Solar-Thermal Power Plant: Putting the Desert to Use	3-206
Figure 3-113 Siemens Turbines for Solar Thermal Parabolic Trough	3-208
Table 3-114 Siemens CSP Solar Receiver (Universal Vacuum Air Collector UVAC 2010) Features	3-214
Figure 3-115 Asahi Glass Solar Curve Factor	3-219
Figure 3-116 Asahi Glass Textured Finish To Solar Panel	3-220

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Figure 3-117	3-221
GE10 MW Solar Park Caceres, Spain 2008	
Table 3-118	3-227
Daqo New Energy Module Characteristics	
Figure 3-119	3-229
JinkoSolar Produces Ingots, Wafers, Cells, and Modules	

## Concentrating Solar Power (CSP) Technology

Table 4-1	4-1
Types of PV Systems:	
Figure 4-2	4-2
Photovoltaic PV Theoretical Limits	
Figure 4-3	4-4
Abengoa Solar Radiation Concentration	
Figure 4-4	4-5
Abengoa Solar Tower Technology	
Figure 4-5	4-6
Abengoa Solar Land Requirements	
Figure 4-6	4-8
Abengoa Solar Concentrating Power	
Table 4-7	4-9
Abengoa Solar Operating Scheme For Parabolic Trough	
Table 4-8	4-10
Abengoa Solar Parabolic Trough Models:	
Figure 4-9	4-11
Solar Reflector System	
Table 4-10	4-21
Pacific SolarTech Concentrator Photovoltaic Modules Technology	

## Concentrating Solar Power (CSP) Company Profiles

Figure 5-1	5-4
Abengoa Building of Solana	
Figure 5-2	5-5
Abengoa International Presence	
Table 5-3	5-6
Abengoa Solar Commitment to Solar Energy	
Figure 5-4	5-7
Abengoa Solar Global Presence	
Figure 5-5	5-9
Abengoa Solar Power PlantsPS10 Heliostats Construction	
Table 5-6	5-10
Abengoa Solar Promotion, Construction, and Operation	
Figure 5-7	5-11
Abengoa Solar Types of Solar Power	
Table 5-8	5-13
Abengoa Solar R&D	
Figure 5-9	5-14
Abengoa Solar and City Council of SanLúcar la MayorPS10 In OperationBeside=S Ps20 Under Construction	
Table 5-10	5-15

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

# WinterGreen Research, INC.

Abengoa Solar Project Activities	
Figure 5-11	5-20
Abengoa International Presence	
Figure 5-12	5-21
Abengoa Projects in Spain	
Figure 5-13	5-22
Abengoa US Projects and Presence	
Figure 5-14	5-23
Abengoa Algeria Projects and Presence	
Figure 5-15	5-24
Abengoa Algeria Siting	
Figure 5-16	5-25
Abengoa Morocco Projects and Presence	
Figure 5-17	5-26
Abengoa Moroccan Firm ONE Projects	
Table 5-18	5-28
ACCIONA Business Divisions	
Figure 5-19	5-30
Acciona's Nevada Solar One Project	
Figure 5-20	5-31
Acciona Wind Towers	
Table 5-21	5-38
Acciona Three Lines Of Business	
Table 5-22	5-42
Acciona Range Of Renewable Energy Sources	
Table 5-23	5-43
Wind Power Capacity Installed By Acciona Energy By Country, 2009	
Table 5-24	5-46
Photovoltaic Capacity Installed By Acciona Solar (MWp)	
Table 5-25	5-48
CSP Plants Operated by Acciona Energy	
Table 5-26	5-49
Hydropower capacity owned by Acciona Energy in Spain	
Table 5-27	5-54
Acciona Divisions	
Figure 5-28	5-94
Asahi Glass Transparent Conductive Film Glass Substrates	
Figure 5-29	5-97
Asahi Glass Fuel Cell	
Figure 5-30	5-99
AGC Asahi Glass Ecoglass Sun Balance	
Figure 5-31	5-100
AGC Asahi Glass Comparison Between Ordinary Windshield and Coolverre	
Figure 5-32	5-101
AGC Asahi Glass Effects of Coolverre	
Figure 5-33	5-103
Asahi Glass Revenue	
Figure 5-34	5-104
Asahi Glass Sales Ratios	
Figure 5-35	5-106
AGC Asahi Glass New Glass Products	

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Figure 5-36	5-107
AGC Asahi Glass New Glass Products	
Figure 5-37	5-108
Asahi Glass Segments	
Figure 5-38	5-109
Asahi Glass Sales	
Figure 5-39	5-110
Asahi Glass Performance Trends	
Figure 5-40	5-111
Asahi Glass Growth Positioning	
Figure 5-41	5-112
Asahi Glass Production Technologies	
Table 3-42	5-120
BrightSource Projects	
Figure 5-43	5-121
BrightSource Investors	
Table 5-44	5-132
Boeing Military Aircraft Key programs	
Table 5-45	5-136
Boeing Unmanned Airborne Systems:	
Table 5-46	5-137
Boeing Weapons:	
Figure 5-47	5-150
Directed Vapor Technology	
Figure 5-48	5-152
DuPont Photovoltaic Encapsulant Functions	
Figure 5-49	5-153
DuPont Photovoltaic Encapsulants	
Table 5-50	5-155
DuPont Kapton® Features:	
Table 5-51	5-156
DuPont Technical Data for Standard Kapton® Polyimide Film	
Table 5-52	5-157
DuPont Teonex	
Figure 5-53	5-158
Emcore Gen3 CPV Installation on Maui, Hawaii	
Figure 5-54	5-159
Emcore Headquarters	
Figure 5-55	5-160
Emcore Solar Cell	
Table 5-56	5-161
Emcore's Solutions	
Table 5-57	5-162
Markets Served by Emcore's Fiber Optics Segment	
Table 5-58	5-164
Emcore's CATV and FTTP Products	
Table 5-59	5-165
Parallel Optical Transceiver Product Family	
Table 5-60	5-166
Emcore's Optical Components and Modules for Data Applications	
Figure 5-61	5-172
Energy Innovations Sunflower	

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

# WinterGreen Research, INC.

Table 5-62	5-194
Green and Gold Energy / Suncube Exclusive Licensed States And Countries:	
Table 5-63	5-195
GreenVolts Solar Power Positioning	
Table 5-64	5-196
GreenVolts Functions	
Table 5-65	5-199
Hitachi Industrial Systems	
Table 5-65 (Continued)	5-200
Hitachi Industrial Systems	
Table 5-66	5-200
Hitachi Large Generator Positioning	
Table 5-67	5-201
Hitachi Product Positioning	
Figure 5-68	5-205
Infinia Solar Electric Power Generation Technologies And Products	
Table 5-69	5-205
Infinia Solar Strategy	
Figure 5-69	5-211
Masdar PV Thin-Film Modules	
Table 5-70	5-214
Masdar PV Focused And Holistic Strategy Activities	
Table 5-71	5-215
United Arab Emirates Technology Commitment to Masdar	
Table 5-72	5-216
Masdar PV Technology Development Partners	
Table 5-73	5-224
Pythagoras' Photovoltaic Glass Unit (PVGU) Energy Efficiency	
Figure 5-74	5-226
Schott Products Glass-to-Metal-Seals and Ceramic-to-Metal-Seals	
Figure 5-75	5-227
Schott Automotive Glass	
Figure 5-76	5-227
Schott Defense Seals	
Figure 5-77	5-227
Schott Industry Special Products	
Figure 5-77 (Continued)	5-228
Schott Industry Special Products	
Figure 5-77 (Continued)	5-229
Schott Industry Special Products	
Table 5-78	5-230
Schott Electronic Packaging Product Benefits:	
Figure 5-79	5-231
Schott A Flexible Glass Fiber Light Guides Transmit The Light	
Figure 5-80	5-234
Schott Ultra thin Glass Flexible Substrates	
Table 5-81	5-237
SCHOTT Solar Products Photovoltaic Modules Advantages	
Table 5-82	5-245
Siemens Business Areas	
Table 5-83	5-246

**REPORT # SH25931852**

**436 PAGES**

**190 TABLES AND FIGURES**

**2014**

**\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING**

## WinterGreen Research, INC.

Siemens Industrial Portals Figure 5-84	5-247
Siemens Generator Turbine Table 5-85	5-267
Solargenix Energy's Power Roof™ Technology Features Figure 5-86	5-275
SolFocus CPV systems Thin Film Solutions Figure 5-87	5-285
Solar Thermal Electricity Generation: Parabolic Trough Power Plants Table 5-88	5-300
United Technologies Operating Segments Figure 5-89	5-307
Whitfield Solar Systems Table 5-90	5-318
ZenithSolar Materials	

## 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

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING

## WinterGreen Research, INC.

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.

REPORT # SH25931852

436 PAGES

190 TABLES AND FIGURES

2014

\$3,900 SINGLE COPY -- \$7,800 WEB SITE POSTING