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Global Concentrated Solar Power Markets and Strategies: 2010–2025

April 2010

Market Study Excerpt

The attached excerpt represents sample pages from IHS EER's market study released in April 2010.
The complete 289-page study is available for purchase and immediate download at
www.emerging-energy.com or by filling out the order form on the last page of this excerpt.

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Excerpt – Global Concentrated Solar Power Markets and Strategies: 2010-2025

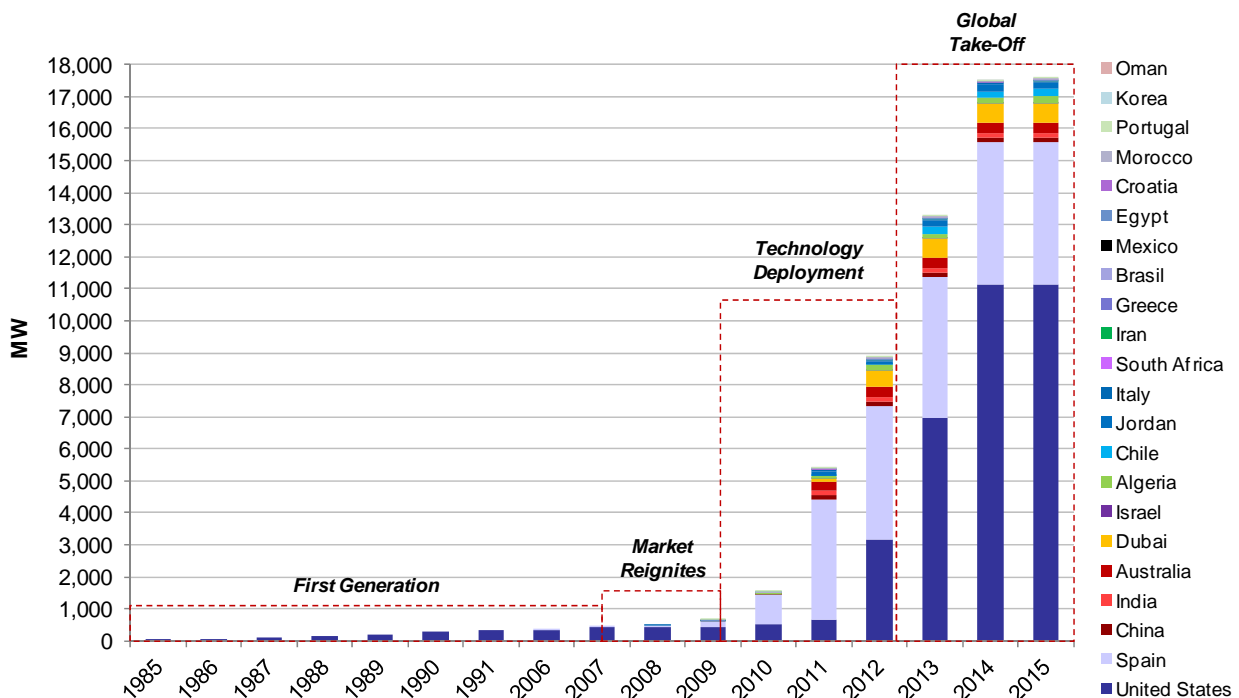
Amidst a rapidly changing energy landscape, the concentrated solar power (CSP) sector is battling to secure a foothold as a competitive renewable technology. Confronted with sustained low natural gas prices, increased competition from other renewable technologies, and long development leads times, the pressure has increased significantly for the CSP industry in 2010.

However, CSP maintains advantages that support recent high profile acquisitions by traditional power players and continued global development activity. More significantly, the range of technology choices and applications—electricity generation, integrated solar combined cycle, industrial steam, and enhanced oil recovery—underpin CSP’s attractiveness. The 2.3 GW pre-registered for development in Spain, 5.5 GW fast-tracked for US Bureau of Land Management (BLM) permits, and a 4 GW stream of project announcements out of the Middle East / Africa and Asia Pacific regions signal a broader geographic interest in CSP.

CSP technology’s continued adoption depends on a series of factors, including scalability, significant cost improvements through technology innovation, complementary applications to existing infrastructure (e.g. integrated solar combined cycle), and overcoming development challenges (e.g. water, transmission). Without these necessary changes, the industry risks failure to launch as a reliable and widespread technology option.

This market study addresses the key factors driving CSP adoption globally and the players shaping the competitive landscape. The analysis covers the regulatory mechanisms, developer strategies, suppliers, and trends underlying development activity and long-term forecasts in Spain, the US, and burgeoning second-tier markets.

Exhibit: Global CSP Project Pipeline by Country: 1985–2015



Source: Emerging Energy Research

CSP Project Activity by Markets

Spain and the US will continue leading project development activity due to a combination of resource and policy support. The global financial crisis has created some uncertainty in the industry, drawing attention to more speculative technology projects that face higher financing hurdles. More established technologies—parabolic trough projects, in particular—are finding development paths still relatively clear, particularly in Spain where a €0.28/kWh feed-in tariff (FIT) solidifies project economics.

Beyond the US and Spain, a series of one-off projects are forecast to evolve into trends as project costs decline and the global economy stabilizes. Of the world's other regions, North Africa and the Middle East have seen the most CSP activity to date. The evolving DESERTEC initiative illustrates the significant potential of the region, but the obstacles remain significant into the long term. Additionally, the Asia Pacific region has drawn significant interest, partly as a means of leveraging existing industrial manufacturing strengths in China and India.

Competition for Spanish CSP Leadership Solidifies

Spain represents the CSP industry's opening act for global development activities, as it is now prepared to deliver 2.3 GW of capacity through 2013. Underpinning this status is the Ministry of Industry and Tourism's (MITC's) December 2009 pronouncement to "preregister" 57 CSP projects, thereby guaranteeing certain developers the €0.28/kWh feed-in tariff (FIT). More important, the CSP sector's competitive landscape has become clearer over the near term, as players across the value chain—technology promoters, utilities, independent power producers (IPPs), and suppliers—secure their positions in the most active market globally.

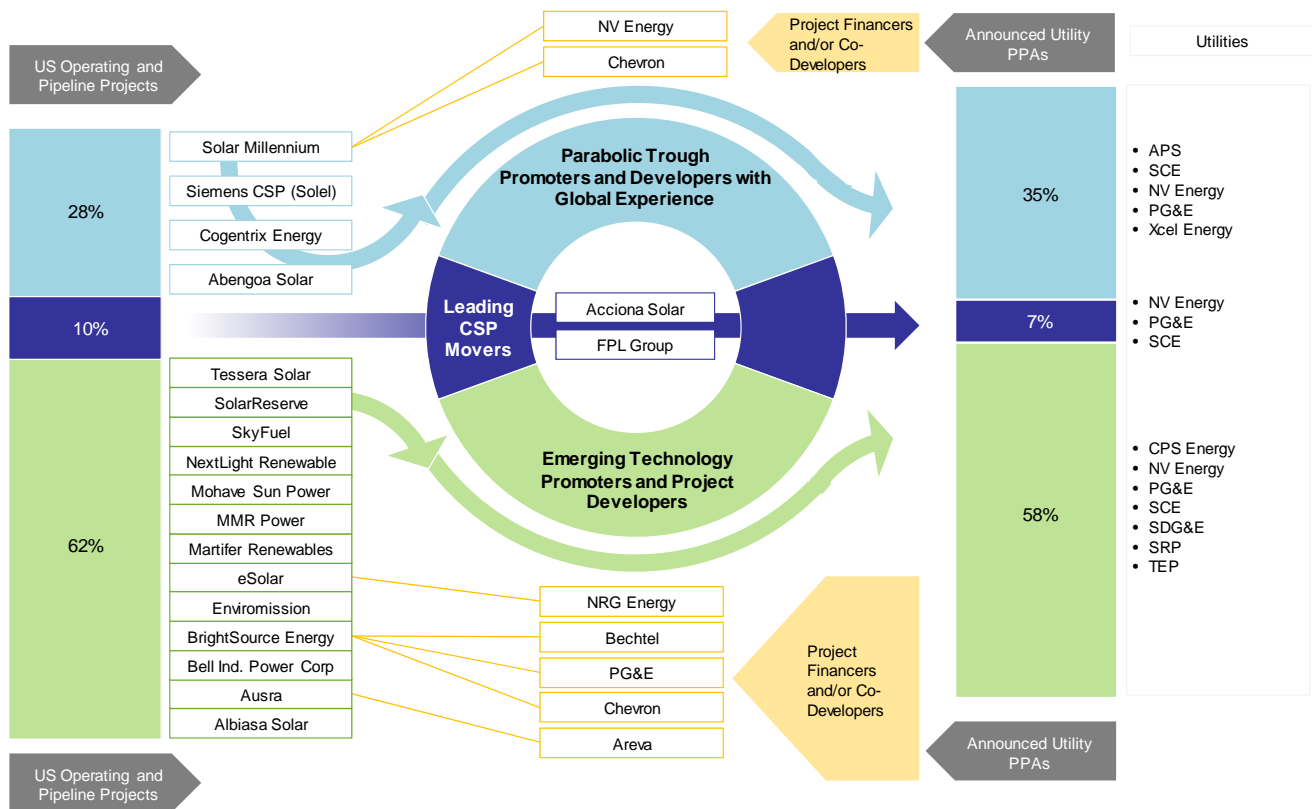
The Spanish market has attracted more than 40 project developers with 159 projects in various stages of planning and permitting. Leading renewable IPPs Acciona, Abengoa, and ACS Cobra are positioned at the market's leading edge because they have leveraged their in-house construction capabilities and financial presence. In their wake are an emerging group of smaller technology IPPs and technology promoters: Aries Solar Termoeléctrica, Grupo SAMCA, Ibereólica, Solar Millennium, FCC, and others. These players are attempting to establish themselves primarily through partnerships and joint ventures before the market shakes out through consolidation.

United States CSP Sector Awaits Promise

Over the last 12 months, the US CSP competitive landscape has continued to evolve. The entrance of strong industrial power players, large engineering, procurement, and construction (EPC) firms, and oil companies underpin a shift to greater penetration. Given the western US' increasing electricity loads and scaling intermittent renewable capacity, CSP technology has the potential to provide unique dispatchable electricity compared to other renewables. However, the US market continues to be held up by permitting in California, the US BLM, and the tightened financial markets.

The announced US pipeline has surpassed 13 GW across a mix of parabolic trough, central receiver, and dish engine technologies. As Florida Power & Light's (FP&L's) 75 MW hybrid plant in Martin County, Florida, US is the only commercial-scale plant under construction—the first system to be installed since Acciona Solar's 64 MW Nevada Solar One—significant progress must be made for CSP to meet its 8.5 GW of power purchase agreements (PPAs) with utilities.

Exhibit: US CSP Market Evolution



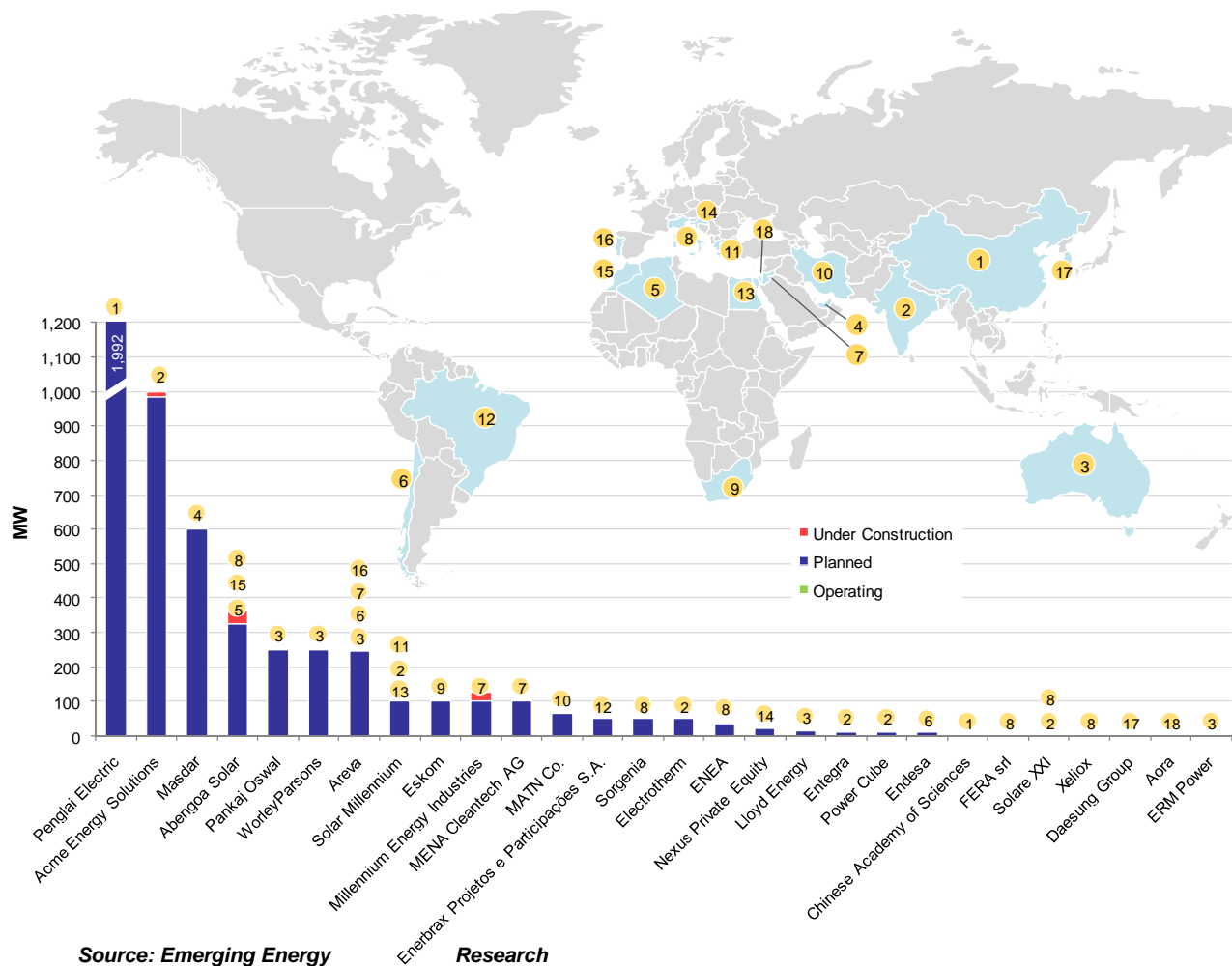
Source: Emerging Energy Research

Activity Scales in Second-Tier Markets

CSP technology’s demand for high solar resources and long development timeline is forcing developers to leave no stone unturned. Far from sustainable growth, CSP competition in second-tier markets is largely fragmented and driven by disparate opportunities. Competition among parabolic trough system integrators to supply the requests for proposals (RFPs) by state-owned entities, such as Abu Dhabi Water & Electricity Authority and Morocco’s Office National de l’Electricité (ONE), has become heated. Seeking every opportunity to install systems, parabolic trough system integrators are taking advantage of their proven status to win bids.

At this early stage, the landscape has evolved into several key market categories: southern European countries (Italy, France, Greece, and Croatia) broadening their renewables footprints on the heels of Spain’s rapid build-out; fossil-fuel-dependant countries (Middle East, South Africa, Australia) with high solar insolation looking to diversify their energy mixes; and high power demand countries (e.g., China and India) capable of following an industrial development strategy.

Exhibit: Second-Tier CSP Development Rankings



Source: Emerging Energy

Research

CSP Value Chain Positioning

The global CSP pipeline boasts more than 25 GW spread among 75 project developers, and continues to expand with activity in second-tier markets. While some of these developers are speculative in nature, an emerging group of well-financed multinational power and construction companies are getting in on the game. The current tight supply of proven technology providers and operating projects are driving these new market entrants to position themselves with existing players, or venture out with their own systems. At the same time, traditional IPPs and utilities are tapping industry for greenfield development and to leverage CSP hybrid capabilities.

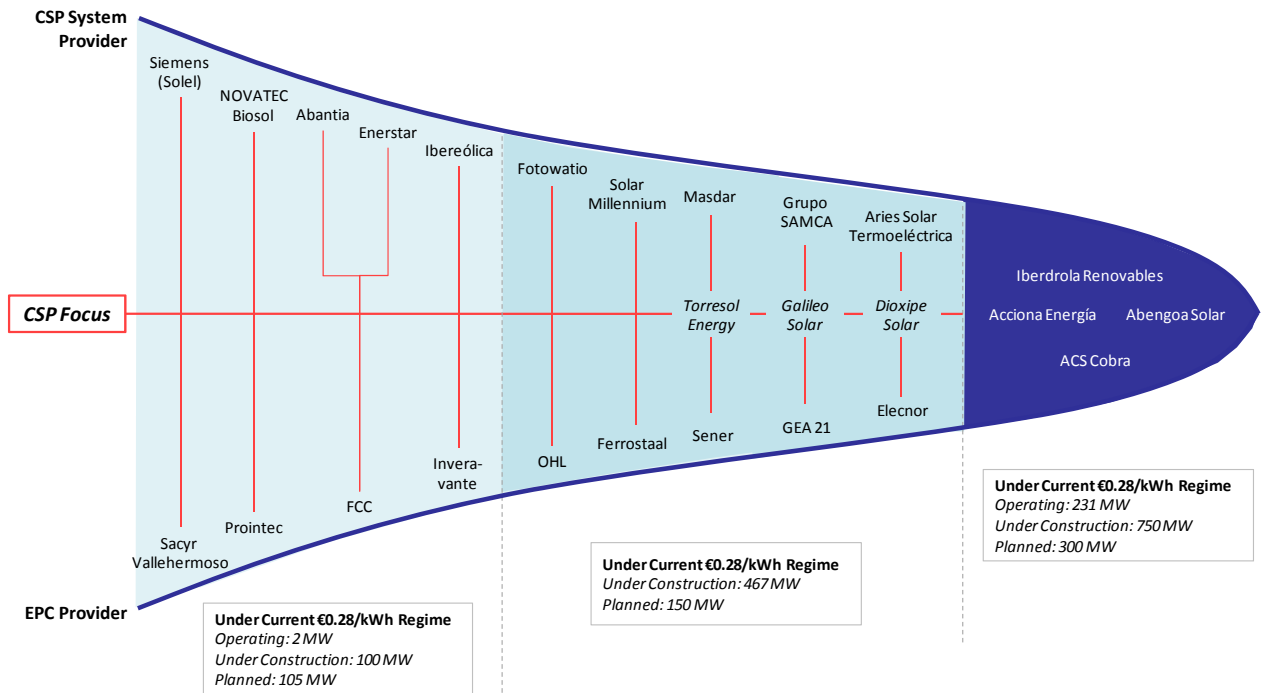
Leading Renewable Utilities and IPPs Reposition

In 2007, the CSP sector emerged as the next potential opportunity for large utilities and IPPs to add to their wind trophy cases. Therefore, companies such as Iberdrola, Acciona, Endesa, and Enel began driving forward with CSP pipelines. However, a host of unforeseen challenges have arisen, pushing some away from the technology.

The overarching factors have included a devastated economy, uncertain regulatory environment in Spain prior to December 2009, and a dearth of suppliers. Furthermore, the high FIT in Spain, where

the lion's share of development activity has taken place, is not driving down costs in the face of alternative PV technology.

Exhibit: Spain Solar Power Development Slipstream



Source: Emerging Energy Research

CSP Technology and Power Plant Supply Landscape

After years of building on promise, CSP technology and component suppliers found more solid footing at the end of 2009. Regulatory clarity in Spain and the burgeoning activity in Asia Pacific have helped offset the plodding US market, which remains the most attractive longer-term market. As such, the upstream CSP landscape has further evolved with a host of new key component suppliers (e.g., receiver tubes, mirrors, steam turbines) and EPC players positioning themselves for larger build-out.

A key factor in the industry's long-term competitiveness will be CSP technology suppliers' ability to deliver on their promised costs. Since late 2008, the pressure has increased because of a sharp decline in natural gas prices, which is a lower-cost alternative to CSP; available project finance; and growing environmental challenges (e.g., water, land use).

GLOBAL CONCENTRATED SOLAR POWER MARKETS AND STRATEGIES: 2010-2025 April 2010

CSP STUDY HIGHLIGHTS

Global Coverage – CSP Environment

Snapshots

Europe: Spain, Italy, Greece

North America: US

Asia Pacific: Australia, China, India

Middle East/Africa: Algeria, Egypt, Israel, Jordan, Libya, Morocco, South Africa

Latin America: Chile, Mexico

Global CSP Market Incentives and Challenges

- CSP Competitiveness in Renewables Landscape
- Supply Chain Constraints
- Land and Environmental Constraints
- Regulatory Environments
- Cost and Operating Economics

Global CSP Power Forecasts and Pipeline Analysis Through 2025

- Global CSP Forecasts
- CSP Forecast by Region
- CSP Forecast by Technology
- CSP Component Forecasts
- CSP Development Pipeline

Strategy Profiles of CSP Players

- Independent Power Producers
- Utilities
- Developers
- Technology Promoters
- EPC Providers
- Component Suppliers

Competitive Trends in CSP Technology Development

- Value Chain Positioning
- Supply Chain Analysis
- Technology Strategies
- Utility Pipeline Analysis
- Developer Pipeline Analysis

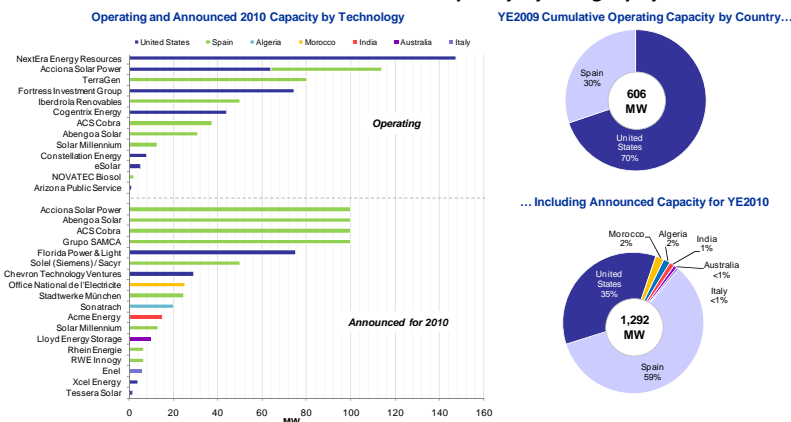
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With 57 pre-registered CSP projects in Spain--slated for operation by 2013--Spanish participants have moved to the forefront of the concentrated solar power industry. By contrast, US and emerging global players must navigate complex permitting and financing obstacles in the face of shrinking power demand and lower energy prices. By the end of 2010, Spain will have eclipsed the US as the world's leading CSP market, accounting for 59% (1,292 MW) of global installed capacity. While global CSP additions grew 50% in 2009, rising to 649 MW from 430 MW in 2008, the long-term outlook for CSP remains promising, with over 25 GW anticipated globally by 2025.

EER's new study, *Global Concentrated Solar Power Markets and Strategies: 2010-2025*, provides actionable strategic market intelligence while offering a global perspective on long term trends across both established and emerging CSP markets. Following are just a few of the key trends addressed in EER's newest landmark solar energy market study:

- **Surging development in Spain draws CSP focus.** The Spanish CSP market has exceeded expectations and is on track to reach 2.3 GW through 2013. The regulatory environment has established near-term winners and losers in the Spanish market. Led by IPPs Acciona Energía, Abengoa Solar, NextEra Energy Resources, and ACS Cobra, a host of IPPs, utilities, developers, and EPC providers have fallen in line to seize on the opportunity.
- **Project developers slowly navigate permitting challenges in the US market.** Long considered the holy grail for CSP, the US market -- with its 15 GW of announced pipeline -- has been hamstrung by financing and environmental hurdles. US CSP developers have been forced to reshape their development strategies to mitigate environmental issues.
- **CSP development progresses in Asia Pacific.** Led by more than 3 GW in India and China (eSolar and Solare XXI), heated competition for the 500 MW of CSP slated in Australia, burgeoning CSP markets are attracting attention from global players. With regulatory policies still in early stages a growing list of developers are looking for opportunities beyond Spain and the US.
- **Industrial power players crank up consolidation.** M&A activity across the CSP landscape has picked up in recent months. Siemens led the way with its US\$418 million acquisition of parabolic trough technology promoter Solel, and was followed by French energy giant Areva, which swept up struggling linear Fresnel start-up Ausra. A group of large power players are expected to leverage their broader technology and financial positions to extend their traditional thermal applications in a carbon-constrained environment.

Exhibit: Global Concentrated Solar Power Capacity by Geography and Technology



Source: Emerging Energy Research

TABLE OF CONTENTS

<p>I. EXECUTIVE SUMMARY</p>	<ul style="list-style-type: none"> • CSP Value Chain Positions • Spain Project Developer Strategies <ul style="list-style-type: none"> <i>Spain CSP Pivots on EPC Providers</i> <i>Leading Renewable Utilities and IPPs Reposition</i> <i>Smaller Developers Emerge with Potential Opportunity</i> <i>European Investment Bank Adds Value to CSP</i> 	<p style="text-align: right;"><i>US System Supplier Penetration in Its Infancy</i></p>
<p>II. GLOBAL SOLAR CSP TECHNOLOGY AND COST ENVIRONMENT</p> <p>1. Plant Technology and Competitiveness</p> <ul style="list-style-type: none"> • CSP Technology Opportunity <ul style="list-style-type: none"> <i>Storage Central to Long Term Competitiveness</i> <i>CSP Leverages Traditional Power Synergies</i> • CSP Technology Evolution <ul style="list-style-type: none"> <i>Parabolic Trough System Integrators and Suppliers Seek Improvements</i> <i>Central Receiver Systems Take on Different Shapes</i> <i>Dish Engine Seeks High Efficiency and Modularity</i> <i>Linear Fresnel Seeks to Leverage Simplicity</i> • Supply Chain <p>2. CSP Development Challenges</p> <ul style="list-style-type: none"> • Development Timeline Hobbles Industry • Land Availability Plays key Role • Water Usage Spikes Interest in Dry Cooling • Public Entity Financing Scales <p>3. Renewable Cost Comparison</p> <ul style="list-style-type: none"> • Capital and Operating Economics • Parabolic Trough System Breakdown • Emerging Technology Costs 	<p>3. Spain CSP Technology Landscape</p> <ul style="list-style-type: none"> • CSP Technology Trends <ul style="list-style-type: none"> <i>CSP Technology Slow to Evolve in Spain</i> <i>Storage Experience Key to Long-Term Competitive Positioning</i> • Spain CSP Supply Chain <ul style="list-style-type: none"> <i>Spain, Europe Scale CSP Presence</i> <i>Parabolic Trough Technology Suppliers Dominate Spain</i> 	<p>4. US Utility Profiles</p> <ul style="list-style-type: none"> • Arizona Public Service (APS) • CPS Energy • El Paso Electric (EPE) • Florida Power & Light (FP&L) • NV Energy • Pacific Gas & Electric (PG&E) • Salt River Project (SRP) • San Diego Gas & Electric (SDG&E) • Southern California Edison (SCE) • Tucson Electric Power (TEP) • Xcel Energy (Public Service Company of Colorado)
<p>III. GLOBAL CSP MARKET AND TECHNOLOGY FORECASTS</p> <p>1. Global CSP Market Forecast: 2010–2025</p> <ul style="list-style-type: none"> • Global CSP Forecast Methodology • CSP Market Forecast Scenarios • Regional CSP Market Forecast: 2010–2025 <ul style="list-style-type: none"> <i>Spain Carries Industry to Next Level</i> <i>US Market Represents Longer-Term Proposition</i> <i>Beyond Spain, Europe Moves Slowly</i> <i>Asia Pacific Activity on the Horizon</i> <i>Middle East/Africa Region Heats Up</i> <p>2. Global CSP Technology Forecast: 2010–2015</p> <p>3. Primary Component Forecast: 2010–2015</p>	<p>V. UNITED STATES CSP MARKET ANALYSIS</p> <p>1. Market Environment</p> <ul style="list-style-type: none"> • Regulatory Incentives <ul style="list-style-type: none"> <i>ITC Provides Long-Term Potential</i> <i>Loan Guarantee Yet to Deliver at Scale</i> <i>Stimulus Grants Are Out of Play for CSP</i> • Renewable Energy Targets <ul style="list-style-type: none"> <i>RPS Remains Key to Solar CSP</i> <i>Solar Carve-Outs Drive Activity</i> <i>California RPS Target Drives Renewables, CSP</i> • Grid Connection and Permitting <ul style="list-style-type: none"> <i>Fast-Tracked Projects Give Select Developers a Head Start</i> <i>Water Proves to Be High Barrier for CSP</i> <i>Nevada Transmission Highlights Strategies for Export</i> • Solar Resources • Regional Project Development Activity <p>2. US CSP Competitive Landscape</p> <ul style="list-style-type: none"> • Project Developer and Ownership Rankings • Project Developers by Value Chain Position • US Project Developer Strategies <ul style="list-style-type: none"> <i>Large IPPs Push Forward with Develop-and-Own Strategies</i> <i>Turnkey CSP Developers Emerging</i> <i>NRG Brings Solar Technologies into the Mix</i> <i>Chevron Dives into CSP, Bolsters Solar Millennium and BrightSource</i> <i>SES and Tessera Split Activities</i> <i>Technology Promoters Line Up EPC Agreements</i> <i>IPPs and Developers Await BLM Clarity</i> <p>3. US CSP Technology Landscape</p> <ul style="list-style-type: none"> • US Technology Trends <ul style="list-style-type: none"> <i>Emerging Technologies Dominate Pipeline</i> <i>Integrated Solar Combined Cycle Applications Scale</i> <i>Storage Currently Limited in the US</i> • US Supply Chain <ul style="list-style-type: none"> <i>CSP Increasingly Leans on Detroit, Automotive Sector</i> <i>Manufacturing Tax Credit Stimulates Mirrors</i> 	<p>VI. SECOND-TIER CSP MARKET ANALYSIS</p> <p>1. Second-Tier CSP Market Environments</p> <ul style="list-style-type: none"> • Solar Resources • Regulatory Environments • Grid Connection and Permitting <p>2. Second-Tier CSP Market Competitive Landscape</p> <ul style="list-style-type: none"> • CSP Development Rankings • Project Developers by Value Chain Positions <p>3. Second-Tier CSP Regional Activity</p> <ul style="list-style-type: none"> • Southern Europe <ul style="list-style-type: none"> <i>Italy Market Yet to Deliver</i> <i>Turkey's Renewable Pledge Offers Hope to CSP</i> • Middle East / Africa <ul style="list-style-type: none"> <i>DESERTEC Remains Long on Promise</i> <i>Morocco Heating UP</i> <i>South Africa Attracts Private Investment for Renewables Growth</i> <i>Israel, UAE RFPs Draw Attention</i> • Asia Pacific <ul style="list-style-type: none"> <i>India CSP Development Picks up</i> <i>eSolar Spotlights China CSP Interest</i> <i>Australia CSP Development Slow to Progress</i> • Latin America <p>4. Second-Tier CSP Market Technology Landscape</p> <ul style="list-style-type: none"> • Technology Trends • ISCC Technology Trends
<p>IV. SPAIN CSP MARKET ANALYSIS</p> <p>1. Market Environment</p> <ul style="list-style-type: none"> • Regulatory Incentives <ul style="list-style-type: none"> <i>Spain FIT Set in Stone</i> <i>Prescribed CSP Installations in Place</i> • Renewable Energy Targets • Grid Connection and Permitting • Solar Resources • Regional Project Development Activity <p>2. CSP Competitive Landscape</p> <ul style="list-style-type: none"> • Competition for Spanish CSP Leadership Solidifies • Regulatory Certainty Solidifies CSP Playing Field • Project Developer and Ownership Rankings 	<p>VII. COMPETITIVE ANALYSIS: CSP POWER PLANT SUPPLY</p> <p>1. CSP Technology</p> <ul style="list-style-type: none"> • Large Industrial Conglomerates Enter CSP Sectors • Technology Promoters Demonstrate, Build Pipelines • Component and Technology Supplier Ownership in Transition • Emerging Technologies Proceed with Demonstrations <p>2. CSP Technology Strategies</p> <ul style="list-style-type: none"> • Parabolic Trough Suppliers <ul style="list-style-type: none"> <i>Siemens Leapfrogs Technology Competition</i> <i>Trough Suppliers Push Ahead</i> 	



Italian Companies Flock Together

- Emerging CSP Technologies Seek to Change Game
 - Licensing Strategy Gains Favor*
 - Central Receiver Technology Providers Take Alternate Technology Routes*
 - Dish Engine Players Attempt to Scale with Manufacturing Strategy*
- Storage Technology Development
 - Storage Technology Finds Outlet in Parabolic Trough*
 - Aerospace Players Prepare to Launch CSP*

3. CSP Supply Chain Evolution

- Supply Chain Scales
 - Emerging Component Suppliers Tested by eSolar*
 - Babcock & Wilcox Re-diversifies with CSP Receiver Tube Suppliers Reset Positions*
 - Mirrors Suppliers Expand*
- Power Block and Balance of Plant
 - Steam Turbines Players Bridge Power Divide*
 - HTF Suppliers Broaden Positions*
 - Haifa, SQM Tap into CSP Storage Chemicals*

4. EPC Critical to Industry

- Spanish EPC Providers Positions Continue to Unfold
- EPC Players Emerge in the US, Globally

5. Strategy Profiles: Multitechnology Players

- Abengoa Solar
- Grupo Sener

6. Strategy Profiles: Parabolic Trough System and Component Manufacturers

- Acciona Solar Power
- Alcoa, Inc.
- Archimede Solar Energy SpA
- Enertol-Santana
- FLABEG Holding GmbH & Co.
- Flagsol GmbH (Solar Millennium AG)
- Glaston Corp. (Kyro Oyj Abp.)
- Gossamer Space Frames
- Hydro Aluminum Extrusion Americas (Norsk Hydro ASA)
- Rioglass Solar
- Ronda Reflex srl
- Saint-Gobain
- SCHOTT AG (SCHOTT Solar)
- Solel Solar Systems Ltd. (Siemens)
- Sopogy

7. Strategy Profiles: Central Receiver System and Component Suppliers

- BrightSource Industries Israel (BrightSource Energy)
- Lockheed Martin Corp.
- SolarReserve (United Technologies Corp.)

8. Strategy Profiles: Dish Engine Component Suppliers

- Infinia Corp.
- Stirling Energy Systems

9. Strategy Profiles: Power Block and BOP Suppliers

- 3M
- Aalborg Industries Group A/S
- ABB Ltd
- Alfa Laval

- Alstom SA
- Bertrams Heatec AG
- Dow Chemical Co.
- Emerson Electric Co. (Emerson Process Management)
- Flowserve Corp.
- Friatec AG
- General Electric Co. (GE) Oil & Gas
- GEA Group AG
- Haifa Chemicals Ltd. (Ferquisa SA)
- Holtec International
- MAN Turbo AG
- Ormat Technologies
- Parker-Hannifin Corp.
- Siemens Power Generation
- SPX Cooling Technologies
- Radco Industries
- Solutia, Inc.

10. EPC Providers and Consultants

- ACS Actividades de Construcción y Servicios SA (Grupo Cobra)
- Bechtel Corp.
- Fichtner AG
- Fluor Corp.
- Lauren Engineers & Constructors
- Lahmeyer AG
- Ferrostaal AG
- Sacyr Vallehermoso SA
- Techint Group
- United Research Services Corp. (URS)
- WorleyParsons Ltd

VIII. CSP DEVELOPER PROFILES

1. CSP Developer Profiles

- Global CSP New Ownership
- Ownership by Geography
- Global Pipeline Rankings
- Technology Promoters and System Integrators
 - Abengoa Solar*
 - ACS Cobra*
 - Aries Solar Termoeléctrica*
 - Areva (Ausra)*
 - BrightSource Energy*
 - eSolar*
 - Grupo Sener*
 - Lloyd Energy Storage Ltd.*
 - NOVATEC Biosol*
 - Siemens CSP Ltd. (formerly Solel Solar Systems)*
 - SkyFuel*
 - Solar Millennium*
 - SolarReserve*
 - Solare XXI*
 - Stirling Energy Systems (SES)*
 - Other System Integrators*
- Global Utilities/IPPs
 - Acciona Energía (Acciona Solar)*
 - Cogentrix Energy*
 - Iberdrola*
 - NextEra Energy*
 - NRG Energy*
 - Other Utilities/IPPs*
- Global Project Developers
 - Albiosa Solar*
 - Ibereólica*

Grupo SAMCA

Other Developers and Investors

LIST OF EXHIBITS

I. EXECUTIVE SUMMARY

II. GLOBAL SOLAR CSP TECHNOLOGY AND COST ENVIRONMENT

1. Technology Competitive Positioning
2. California Utility Peak Hours
3. Solar Collector Design
4. Temperature and Efficiency Comparisons
5. Scaling Supply Chain
6. Development Timelines of Competing Power Generation Technologies
7. Land Requirements by Technology
8. Cooling Technology Estimates
9. Solar CSP Announced Project Costs
10. Electricity Generation Cost Comparison
11. US Solar CSP Cost Breakdown
12. Spain Parabolic Trough System Breakdown
13. eSolar Solar Field Details and Costs, 5 MW Plant

III. GLOBAL CSP MARKET AND TECHNOLOGY FORECASTS

1. Global CSP Project Pipeline by Country: 1985–2014
2. Global CSP Forecast Methodology
3. Global CSP Growth Scenario Comparison by Total Installations: 2008–2025
4. Global CSP Scenario Comparison by Annual Additions: 2008–2025
5. Total Installed CSP by Region: 2008–2025
6. Spain CSP Additions: 2008–2025
7. US CSP Additions: 2008–2025
8. Europe CSP Additions: 2008–2025, Base-Case
9. Asia Pacific CSP Additions: 2008–2025, Base-Case
10. Middle East/Africa CSP Additions: 2008–2025, Base-Case
11. Global CSP Additions by Technology: 2009–2015, Base-Case
12. Global Parabolic Trough Component Additions: 2010–2015, Base-Case

IV. SPAIN CSP MARKET ANALYSIS

1. Spain CSP Market Evolution by Cumulative Installed Capacity
2. Spain CSP Program Summary Details: 2007 and 2009
3. Spain CSP by Regimen Especial
4. Spain and Europe Renewables Targets: 2010
5. Spain Solar Resources Map
6. Spanish Solar Project Activity by Region
7. Spain CSP Winners and Losers by Royal Decree 6/2009
8. Spain's Current FIT Scenario
9. Spain Cumulative CSP Development by Company and Year
10. Spain Solar Power Value Chain Positions
11. Spain Solar Power Market Strategic Positions
12. Spain Solar Power Projects Owned by EPC Providers
13. Spain Solar Power Development Slipstream

14. EIB Loans to Spain CSP Developers
15. Spain CSP Technology Applications: 2009–2013
16. Spain Reference Projects Utilizing Storage Technology
17. Europe CSP Key Suppliers by Geography
18. Spain CSP Component Penetration

V. UNITED STATES CSP MARKET ANALYSIS

1. US CSP Market Evolution
2. Federal Investment Tax Credit Program Details
3. US Departments of Energy and Treasury Stimulus Timelines
4. Overview of Projects Funded by US Treasury Grants
5. Overview of Select State RPSs
6. Solar Focus Sharpened in RPS Legislation
7. California RPS Targets
8. BLM and CEC Permitting Process
9. Fast-Tracked US Projects
10. Water Usage for Select CSP Technologies
11. Southern Nevada Transmission and BLM CSP Applications
12. US Solar Resources
13. US CSP Projects by Geography
14. US CSP Operating and Pipeline Rankings by Developer: 2009
15. US CSP Value Chain
16. US CSP Pipelines by Vendor
17. US CSP Positions By Vendor
18. Recent EPC Agreements
19. US BLM CSP Applications to Date by Developer and State
20. US Utility PPAs Signed by Technology
21. US Integrated Solar Combined Cycle Plants
22. US CSP Plants Including Storage
23. US Solar Power Supply Chain Geography
24. US Manufacturing Tax Credit Awards
25. US Solar Power Component Penetration by Pipeline

VI. SECOND-TIER CSP MARKET ANALYSIS

1. Second-Tier CSP Market Landscape: 2008–2015
2. Select Solar Resource and Country Incentives
3. Global Solar Resources
4. Select Second-Tier Market CSP Incentive Regimes

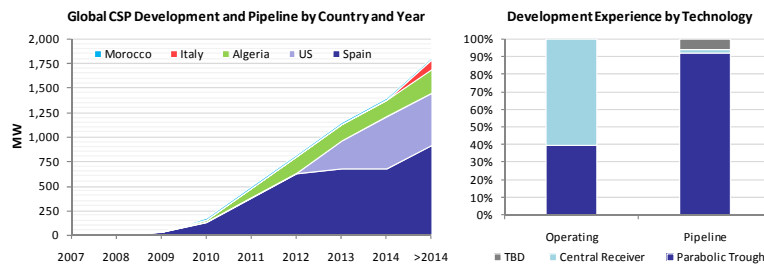
5. Second-Tier CSP Development Rankings
6. Second-Tier CSP Market Value Chain
7. Southern Europe Announced CSP Activity
8. Italy CSP Market Snapshot
9. Turkey Renewable Energy Policies: 2008 and 2023
10. North Africa CSP Market Snapshot
11. DESERTEC Map
12. South Africa CSP Market Snapshot
13. India CSP Market Snapshot
14. China CSP Market Snapshot
15. Australia CSP Market Snapshot
16. Second-Tier Market Technology Trends by Announced Projects
17. Integrated Solar Combined Cycle Activity

VII. COMPETITIVE ANALYSIS: CSP POWER PLANT SUPPLY

1. Global CSP Upstream Landscape
2. Top 30 Technology Pipeline Developers
3. Global CSP Technology M&A Activity Timeline
4. Siemens CSP Value Chain Positioning
5. Parabolic Trough Technology Providers by Tier
6. Italy Domestic CSP Supply Chain
7. Technology Promoter Strategic Positioning
8. eSolar Footprint
9. Technical and Project Pipeline Comparison by Central Receiver Technology Provider
10. Reference Capital Costs and Capacity Factors of Global CSP Plants with Storage
11. eSolar Solar Field Details and Costs for 5 MW Plants
12. Global CSP Receiver Tube Positioning
13. Global CSP Specialized Component Capacity Upgrades
14. Global CSP Announced Turbine Agreements
15. Global CSP Announced Heat Transfer Fluid Supply Agreements
16. Major EPC Relationships Along the Spanish CSP Value Chain
17. Global CSP Molten Salt Deployment
18. Abengoa Solar Profile
19. Grupo Sener Profile
20. Acciona Solar Power Profile
21. Alcoa Profile
22. Archimede Solar SpA Energy Profile
23. Enertol-Santana Profile
24. FLABEG Profile

25. Flagsol Profile
26. Glaston Profile
27. Gossamer Space Frames Profile
28. Hydro Aluminum Profile
29. Rioglass Solar Profile
30. Ronda Reflex Profile
31. Saint-Gobain Profile
32. SCHOTT Solar Profile
33. Solel Solar Systems (Siemens) Profile
34. Sopogy Profile
35. BrightSource Industries Israel Profile
36. Lockheed Martin Profile
37. SolarReserve Profile
38. Infinia Profile
39. Stirling Energy Systems Profile
40. 3M Profile
41. Aalborg Industries Profile
42. ABB Profile
43. Alfa Laval Profile
44. Alstom Profile
45. Bertrams Heatec Profile
46. Dow Chemical Profile
47. Emerson Electric Profile
48. Flowserve Corp. Profile
49. Friatec Profile
50. General Electric Co. Profile
51. GEA Group Profile
52. Haifa Chemicals Profile
53. Holtec International Profile
54. MAN Turbo Profile
55. Ormat Technologies Profile
56. Parker-Hannifin Corp. Profile
57. Siemens Power Generation Profile
58. SPX Cooling Technologies Profile
59. Radco Industries Profile
60. Solutia Profile
61. Grupo Cobra Profile
62. Bechtel Corp.
63. Fichtner Profile
64. Fluor Corp. Profile
65. Lauren Engineers & Constructors Profile
66. Lahmeyer Company Profile
67. Ferrostaal AG Profile
68. Sacyr Vallehermoso Profile
69. Techint Group Profile
70. URS Corp. Company Profile
71. WorleyParsons Profile

Exhibit: Abengoa Solar CSP Profile



Global Development and Technology Relationships

	Operating MW (# of projects)	Pipeline MW (# of projects)	Co-Developers	EPC Provider	Receiver Tubes	Mirrors	Power Block	Balance of Plant (BOP)	Owner(s)	Power Off-taker
Spain	31 (2)	890 (19)	• EON • Hyperion Energy	• Abener • Abener Ghenova	Schott Solar	Rioglass	BK Aalborg	• Abantia Ticsa • Alfa Laval • Altac • GEA Ibérica • Prysman	Abengoa Solar	–
United States	–	534 (3)	• Inland Energy • Xcel Energy	Abener	Schott Solar	Rioglass	–	–	Abengoa Solar	• APS • Inland Energy • PG&E • Xcel Energy

Source: Emerging Energy Research



Additional solar market studies available for purchase from IHS Emerging Energy Research:

- US Solar Power Markets and Strategies: 2011-2025 (Coming June 2011)
- Global Solar PV Supply Chain Strategies: 2010-2025 (Released October 2010)
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