

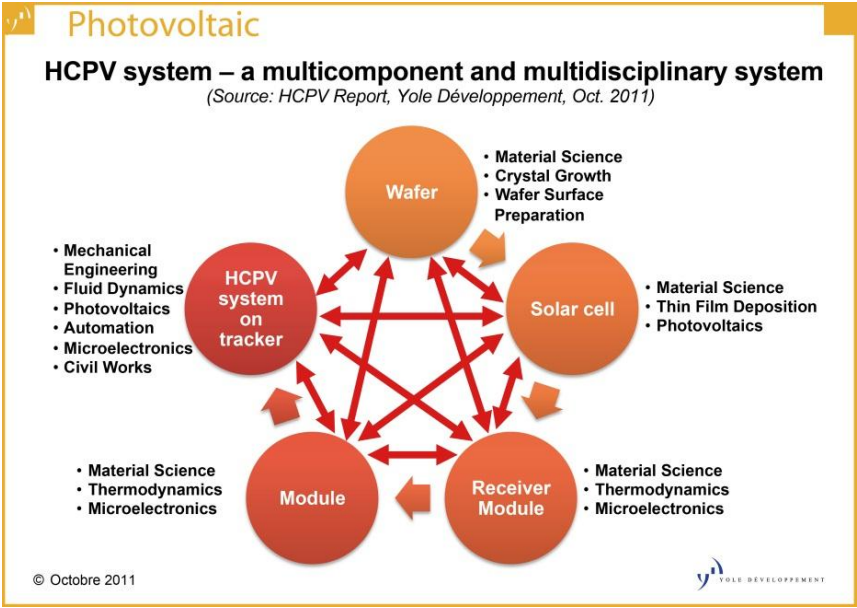
**High Concentration Photovoltaics:**  
- **A technology on the way to the utility market**  
- **Growing interest for III-V players**

**High Concentration Photovoltaics: Technology, Applications, Industry & Market Report**  
A report from Yole Développement

Lyon, France – Nov. 7th, 2011 – Yole Développement announces its report “**High Concentration Photovoltaics: Technology, Applications, Industry & Market Report**”.

This report evaluates the market potential based on HCPV market demand forecast through 2018. It also includes a description of technology trends, challenges and requirements of all elements of HCPV systems (Ge & GaAs wafer, III-V cell, receiver module, optics, module, tracker, inverter...).

“With this report, investors and utilities learn about the technology needs for HCPV large-scale deployment, about market drivers and barriers and about site requirements for HCPV installations”, explains Milan Rosina, Yole Développement. “Our Market & Technology report describes the technological approaches in the HCPV equipment & material business. This report helps the companies to identify the rights partners, targets and take the right decision before committing to one particular supplier.



## **Industry supply chain**

The growing HCPV market reveals a strong attention of numerous industrial players. Indeed, HCPV technology development requires knowledge from various technology fields and therefore many technology players (wafer manufacturers, epi-foundries, IC companies, mechanical engineering companies, etc.) could take part in this development. Although HCPV market is shared currently mainly between a few established players with long project track records and important pipelines for new installations, like Amonix, Soitec and SolFocus, a fast growing HCPV market will provide new opportunities also for newcomers coming with novel approaches.

The compatibility of all HCPV system components is crucial for maximizing the system performance, reliability and durability as well as for decreasing its cost. Such compatibility could be well controlled by a vertically-integrated player that covers the whole technology chain. However, the current small HCPV market size does not enable the advantages of a vertical integration as known from the flat-plate PV. Such integration would entail high economic risk.

Therefore, the HCPV supply chain is currently very dispersed and system elements are supplied by a big number of players accounting for 80+ companies. However, there is an increasing demand for stronger cooperation between different technology players in order to improve the performance of HCPV systems and to lower the manufacturing costs.

An exhaustive list of the main players with their key characteristics for each element of the HCPV supply chain, their position on supply value chain and their geographical localization is given in this report. The examples of strategic partnerships and relationships as well as the level of integration of the main players allow to identify the main trends within the HCPV supply chain

## **Deep insight into HCPV technologies**

This report provides a detailed overview of all information needed to understand the challenges related to HCPV system components: wafer, epiwafer, solar cell, receiver module, concentrating optics, HCPV module, inverter and tracking system. The analysis of different approaches allows to identify the main technology trends, materials and manufacturing techniques used. It helps to evaluate the feasibility of mass-scale manufacturing of different HCPV components and the performance of different complete systems in real conditions.

Today, HCPV solar cells are typically grown in multijunction design on 4" germanium substrates. Although the cell is accounting for 10-20% of total system cost, there is a significant potential for its cost (\$/W) decrease.

This could be done by new cell designs, manufacturing processes and by using larger wafers. Indeed, 6" wafers are already commercially available by major Ge wafer producers, such as Umicore. However, because of some limitations of Ge-wafer-based multi-junction

cells, several companies, such as Spire and Solar Junction are already investigating GaAs as an alternative material. The recent efficiency records obtained by Solar Junction on cells grown using GaAs substrate demonstrate the high potential of this substrate. If produced at competitive cost, HCPV cells on GaAs could increase their market share in the market dominated today by germanium substrate.

### **Multi-MW project pipeline indicates the HCPV market breakthrough**

Although cumulative High Concentration Photovoltaics (HCPV) installed capacity represents only about 30 MW (less than 1% of the total PV market), it is currently at an inflection point to be deployed in utility-scale applications in some sunny locations and may surpass 1GW of the new yearly installed capacity in 2018.

Indeed, in locations with very high Direct Normal Irradiation, HCPV is already proposing a lower levelized cost of electricity (LCOE) than flat-plate PV. Moreover, HCPV has high, still unused potential for cost decrease, mainly by increasing system efficiency and manufacturing volume.

Several multi-megawatt projects announced within the last months are indicating that the HCPV technology is beginning its transition from R&D development and small demonstration projects to utility-scale installations. The massive increase of production capacities mainly in the USA will strongly support the HCPV entry to the electricity business.

### **About High Concentrated Photovoltaic report:**

- **Author:**

**Milan Rosina** is a full time analyst at Yole Développement for photovoltaic market & technologies. He received his Ph. D. in 2002 from the INPG in France. He gained experience as a research scientist in several renowned R&D institutions & industrial companies where he worked in the field of microelectronics, PV, LED & nanotechnology.

- **Catalogue price:**

Euros 3,990.00 (single user license) - Publication date: Oct. 2011.

For special offers and the price in dollars, please contact David Jourdan (jourdan@yole.fr or +33 472 83 01 90).

- **Companies cited in the report:**

10x Technology, 3M, Abengoa Solar, Amonix, Arima, Arima EcoEnergy, Azur Space, AXT, Browave, CESI, Chevron, CompSolar, Concentrator Optics GmbH, Concentrix Solar, Cool Earth Solar, Cyrium, DEGEREnergie, Daido Steel, Delta Electronics, DongFang Electric Corporation, Edmund Optics, Emcore, Energy Innovations, Envoltek, Epistar, ES systems, EverPhoton, Evonik Industries, Freiburger, Fresnel Optics GmbH, Green and Gold Energy, GreenVolts, Guascor Foton, Heliotrop, Hitachi Cable, Hokuang Optics, Indra, IQE, Isofoton, Isuzu Glass, JDSU, Kimoga, LPI, M-Com, Magpower, Microlink Devices, Microsharp Solar, Mitsubishi Chemicals, Morgan Solar, Opel Solar International, Quantasol, Pairan, PBT

Silicon, Powercom, Probright, Pyron Solar, Renovalia, RFMD, SanAn Optoelectronics, San Diego Gas & Electric, Semprius, Sener, Sharp, Silex Systems, SOITEC, Sol3G, Solapoint, SolarTec International, Solar Junction, Solar Systems, Solergy, SolFocus, Soliant Energy, SMA, Southern California Edison, Spectrolab, Spire Semiconductor, Spirox, Sumitomo Electric Industries, Suncore Photovoltaic Technology, Sungri, Sylarus Technologies, Titan Tracker, Tong Hsing Electronic Industries, Umicore, VPEC, Zenith Solar...

**About Yole Développement – [www.yole.fr](http://www.yole.fr)**

Beginning in 1998 with Yole Développement, we have grown to become a group of companies providing market research, technology analysis, strategy consulting, media in addition to finance services. With a solid focus on emerging applications using silicon and/or micro manufacturing Yole Développement group has expanded to include more than 40 associates worldwide covering MEMS, Microfluidics & Medical, Advanced Packaging, Compound Semiconductors, Power Electronics, LED, and Photovoltaic. The group supports companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to develop their business.

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