

World Solar Cell Market: Key Research Findings 2009

- The market is in chaos! Is it possible to come up with a scenario for the future? -

Research Outline

Yano Research Institute has conducted a study on the world solar cell market as described below.

1. Research period: April to July 2009
2. Research targets: Solar cell and module manufacturers, solar cell production equipment manufacturers, etc.
3. Research methodologies: Face-to-face interviews with relevant personnel, supplemented by interviews via telephone and e-mail, and literature researches.

<What is the world solar cell market?>

In this research, the solar cell market is defined to include 5 major solar cell categories, crystal silicon solar cell, thin-film silicon solar cell, CdTe (Cadmium telluride) solar cell, compound-based solar cell, and dye-sensitized solar cell.

Key Findings

- ◆ **Although the world solar cell production has increased largely in 2008, achieving 6.5GW, the growth is flattened in 2009. The market environment is changing from “what is produced can be sold easily” to “how to sell the product”.**

The world market condition for solar cell has been changing drastically since the fall of 2008, triggered by the major revision of a feed-in tariff system in Spain. The financial crisis started and emerged around the same time in the United States led to the global recession which gradually impacted the solar cell market and further suppressed the demand.

The world solar cell production in 2009 is estimated to be 8.3GW, although it may depend on the economic conditions in the latter half. Although the actual installation of solar power generation systems will be lower than this level, manufacturers are likely to increase their production volume for securing a certain level of production at their factories, which are intensifying the price competitions among them.

- ◆ **Although full-scale demand expansion was expected, the production of “thin-film silicon solar cell” will be limited to 500MW in 2009, far smaller than originally planned.**

Thin-film silicon solar cell has started attracting attentions, due to its very little usage of silicon material, around 2006 when the polysilicon price has escalated, and many enterprises have rapidly entered into the manufacture as turn-key manufacturing systems have been introduced into the market by the production equipment manufacturers. After the financial crisis, however, the demand for solar cells became stagnant, loosening the demand-and-supply balance of polysilicon, which had been very tight, and causing the polysilicon price to drop rapidly. Along with these changes in the market, the price of crystal silicon solar cell has fallen down close to the half, and the competitiveness of the thin-film silicon solar cell has decreased due to its lower conversion efficiency and reduced price difference from the crystal silicon solar cell.

Report format:

Published report: “Solar Power Generation Market: Cell/Module and Production Equipment 2009”

Issued in: August 2009

Language: Japanese

Format: 212 pages in A4 format

Price: 200,000 yen (10,000 yen of consumption tax shall be charged for the sales in Japan.)

Contacts: Public Relations

Yano Research Institute Ltd. (URL: <http://www.yanoresearch.com>)

Phone: +81-3-5371-6912

E-mail: press@yano.co.jp

➔ Research Summary

1. Market overview

1) Crystal silicon solar cell

The production volume of the crystal silicon solar cell in 2008 is estimated to be 5.6GW. The market has expanded by about 2.5 times in the past 2 years. As the installation of solar power generation system has been stagnant in the first half of 2009, however, it has become difficult to expect the market to grow same as before.

Also, in response to the stagnant demand, the price of polysilicon, which had been consistently escalating, has dropped rapidly, intensifying the price competitions among the crystal silicon solar cell manufacturers. In fact, the price at the level of 3.5 US\$/W or so in September 2008 has dropped down to the level lower than 2.0US\$/W in the spring of 2009, and the profitability of crystal silicon solar cell manufacturers is worsening. The crystal silicon solar cell manufacturers, therefore, are strengthening their activities on the conversion efficiency improvement and cost reduction harder than ever to cope with these market conditions.

Major activities for cell conversion efficiency improvement may include the adoption of back-contact method*, surface texture improvement, miniaturization of electrode wiring and so forth. In addition, "N-Type" with N-type substrate, which has been researched and developed mainly by China and Taiwan manufacturers, is beginning to be recognized. Which technology to select for improving the conversion efficiency is becoming a major issue for the future business development.

*: A solar cell with electrode placed on the back side only, which is generally placed on both front and back side.

2) Thin-film silicon solar cell

Thin-film silicon solar cell has been recognized because it uses very little amount of silicon material since 2007 or so when the demand-and-supply balance of polysilicon became very tight, and many enterprises have started manufacturing. The production volume has increased steadily as 165MW in 2007 and 357MW in 2008. However, it is expected that the production in 2009 will be limited to 500MW or so.

This limited growth in 2009 may be attributable to the factors such as the delay in starting the operation of turn-key production systems* introduced into the market one after another, in addition to the tendency that the price difference between thin-film silicon and crystal silicon solar cells is narrowing, and the delay in the mass production on highly expected tandem production systems.

It has become a major concern in the industry if thin-film silicon solar cell could become firmly established in the market.

Although there have been consistent controversies on the safety issues of Cd and the finiteness of Te, it is also a fact that a leading US manufacturer who has established itself as the price leader in the market is becoming a benchmark for the solar cell manufacturers. For the thin-film silicon solar cell manufacturers, especially, their power as a manufacturer is being challenged in the issues such as conversion efficiency improvement, yield rate improvement, parts and material cost reduction, and so forth.

*: Complete thin-film silicon solar cell production line with manufacturer's guarantee on the system performance and output capacity

3) Compound (CIS, CIGS) based solar cell

The production volume of CIGS (Copper Indium Gallium DiSelenide) solar cell has been 20MW in 2007 and 50MW in 2008. The production volume in 2009 is expected to increase to 180MW or so with the increase of additional enterprises entering into the market, although the demand is weak in Europe where the demand has been centered.

As close to 20% conversion efficiency has been achieved on CIGS solar cell in research laboratories, it is attracting increasing attentions as a solar cell with high conversion ratio, which could compete with the crystal silicon solar cell. While activities on production volume increase are becoming active as observed in the announcement of a top runner, domestic leading manufacturer on their plan to build additional factory, it is urgently required to establish stable and cost effective mass production technology for competing with crystal silicon solar cell.

4) Dye-sensitized solar cell

As dye-sensitized solar cell has outstanding features, including its low production cost as spraying and printing processes are mainly used, capability to produce stable power generation with limited luminous energy environment, such as indoors, it is attracting attentions as one of the next generation solar cells. The efficiency improvement with small size cell is progressing, as a research group in Switzerland has achieved the conversion efficiency over 12% in March 2009. However, as there are still issues in durability and large size cell fabrication, the commercialization for electric power

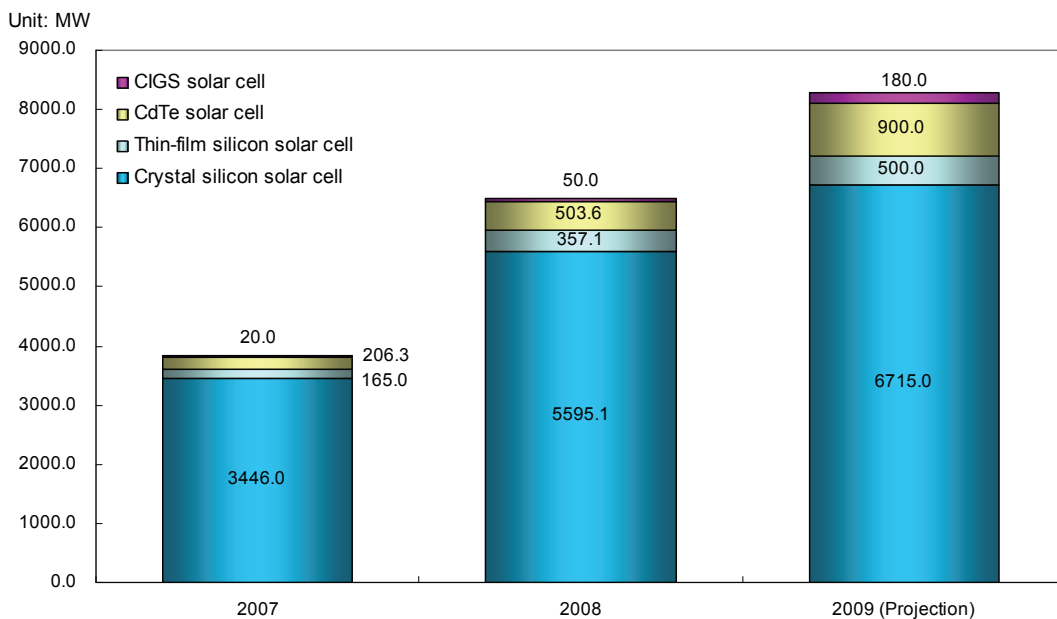
generation is expected to be about 2015.

2. Future perspectives

The current market environment can be viewed as evanescent largely impacted by the global recession. It is expected that the installation of solar power generation system will be positively promoted as one of the measures for utilizing natural and renewable energy to cope with the global warming, and the market to grow continuously. In 2009, however, the market environment is changing and the competitions among the manufacturers are being intensified, as leading manufacturers who have been steadily increasing their market share are struggling and allowing the competitors to follow and catch up.

The market environment has changed from “what is produced can be sold easily” to “how to sell the product”. For the manufacturers, it is not enough to secure the materials and to enhance the production capacity, but the strategy on how to expand their solar cell business from now on is becoming extremely important. Nowadays, multifaceted and strategic decision-making is required, including issues such as business domain and product mix, capital investment, technology positioning and so forth in addition to the technologies and production scales.

Graph/Table 1: World Solar Cell Production Volume Transition



Estimated by Yano Research Institute

(Unit: MW, %)

	2007			2008			2009 (Projection)		
	Production (MW)	Y/y (%)	% Share	Production (MW)	Y/y (%)	% Share	Production (MW)	Y/y (%)	% Share
Crystal silicon solar cell	3446.0	-	89.8%	5595.1	162.4%	86.0%	6715.0	120.0%	81.0%
Thin-film silicon solar cell	165.0	-	4.3%	357.1	216.4%	5.5%	500.0	140.0%	6.0%
CdTe solar cell	206.3	-	5.4%	503.6	244.1%	7.7%	900.0	178.7%	10.8%
CIGS solar cell	20.0	-	0.5%	50.0	250.0%	0.8%	180.0	360.0%	2.2%
Total	3837.3	-	100.0%	6505.8	169.5%	100.0%	8295.0	127.5%	100.0%

Estimated by Yano Research Institute

Note 1: Based on the production of manufacturers

Note 2: (Projection) indicates projected figure.

Note 3: Crystal silicon solar cell is based on the cell, and the others on the module.

Note 4: As the production of CdTe solar cell is limited, the estimation is based on the one leading manufacturer.