

Critical components and subsystems for the PV manufacturing industry

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ABSTRACT

Explosive growth in sales of critical subsystems and components for use in photovoltaic manufacturing equipment provided one of the few bright spots in an otherwise depressed market during 2008. The outlook for sales into the PV industry in 2009 is for demand to be relatively flat, but strong underlying demand for PV cells should lead to a recovery in 2010 and a return to double-digit growth rates, as outlined in this paper.

The critical subsystem market

Suppliers of critical subsystems and components to the semiconductor and related manufacturing industries have experienced a real rollercoaster ride in recent times. Growth of around 30% in 2006, followed by a flat year in 2007, then a drop of 22% in 2008 has got the industry right back to where it started in 2005 at a value of US\$5.5 billion.

Considering that the market peaked at US\$7.3 billion back in 2000, and sales will struggle to beat US\$3.1 billion in 2009, this decade looks drastic in terms of market growth. However, behind the appalling numbers, there has been one area that has delivered consistently high growth rates to become one of the major market sectors. The photovoltaic cell manufacturing industry has emerged from its status as a niche market and has claimed its place in mainstream manufacturing.

The PV industry now accounts for over 11% of the total market for critical subsystems and components. With the PV industry set to outgrow the semiconductor and flat panel display industries over the next five years, the market for critical subsystems used in PV manufacturing equipment is expected to represent about 25% of the total market by 2014.

PV manufacturing equipment contains numerous parts, many of which are generic and can be used in a wide range of industries. Critical subsystems and components, however, are products that have been specifically designed to address applications within the semiconductor and related manufacturing industries, and to actively affect the processing and handling of substrates.

A well-defined group of companies has emerged to serve this market with products such as vacuum pumps, process power supplies, robots, fluid delivery systems, integrated process diagnostics and thermal control subsystems. One of the defining features of the critical subsystems industry is the level of dependency that equipment companies have on this group of suppliers to provide

the products and technology that enable them to develop the next generation of process tools.

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The critical subsystem market for photovoltaic applications

In 2000, the photovoltaic industry was just one of many small and diverse markets being served by critical subsystems and components suppliers. At that time, the main industry sectors of semiconductor, flat panel display and data storage accounted for virtually all the demand for high-value, high-technology products. However, since then, the photovoltaic industry has come out of the background and sales of critical subsystems for PV applications, which totalled less than US\$10 million in 2000, have grown to reach a value of almost US\$600 million in 2008. These figures

represent a compound annual growth rate of 66% and the expectation is that it will continue growing at double-digit growth rates after the 2009 hiatus.

Clearly, the photovoltaic industry is now on the radar screens of all suppliers eager to capture a piece of the action. Interestingly, the main beneficiaries to date are those companies that took decisive action during the last downturn in 2001 to 2002 to insulate themselves from the volatility that goes hand-in-hand with the semiconductor industry. The key players actively took steps to diversify into other industries, broaden their product portfolios, extend their global service and support networks and cut costs by manufacturing in low cost regions of the world.

This is proving to be a winning strategy as the companies that followed this path have been ideally placed to provide the photovoltaic industry with the products, technology and support while being able to handle rapidly-growing order volumes. Clear leaders in the field are Advanced Energy, Edwards and MKS Instruments, although they are finding increased competition from various quarters as late entrants fight for a piece of the market.

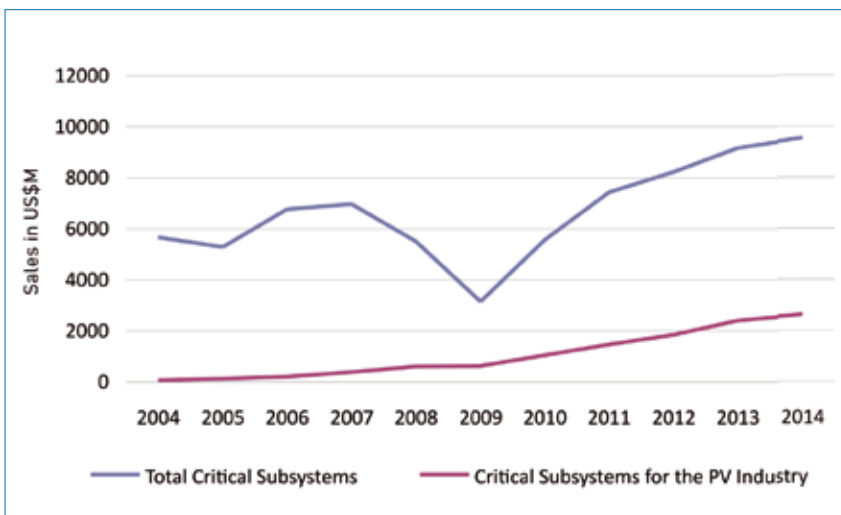


Figure 1. The critical subsystems market (photovoltaic) – projection to 2014.

for process power subsystems, including RF, DC and microwave power supplies, matching networks and fluorine gas generators, representing 16% of the market at US\$97 million. Both these subsystems technologies have key roles to play in vacuum deposition tools, particularly for PV cells based on thin-film technology.

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As current forecasts indicate that demand for equipment used for silicon thin-film-on-glass cell technology will outgrow the market for other cell technologies, then the 46% combined share of the market held by vacuum and power subsystems today is expected to account for over half the subsystems market by 2014.

The PV equipment market

The first real challenge to the photovoltaic equipment industry is happening right now. Following several years of strong growth, a relatively flat year for suppliers of equipment to the PV solar industry in 2009 is starting to spell trouble for the

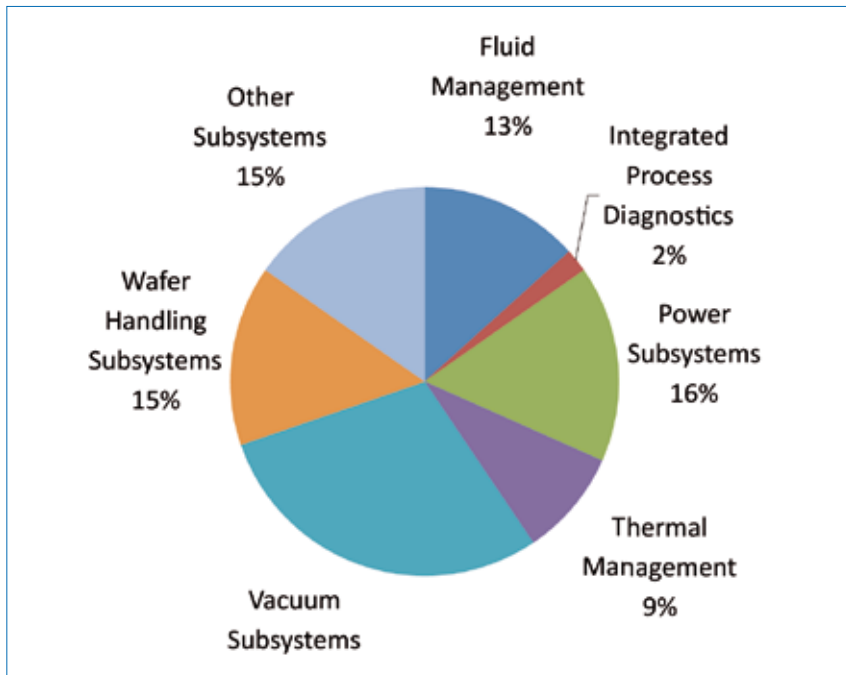


Figure 2. The critical subsystems market by subsystems technology (PV) in 2008.

The market for critical subsystems – breakdown by technology type

The main subsystems technologies used in PV cell manufacturing equipment are fluid management, integrated process diagnostics, process power, thermal management, vacuum subsystems, wafer handling and other subsystem

technologies. Demand for critical subsystems used for PV applications grew 60% in 2008 to reach a value of just under US\$600 million.

The largest segment is for vacuum subsystems, which includes vacuum pumps, pressure gauges, and abatement subsystems and represents 30% of the total for 2008 with a value of US\$175 million. The next largest segment was

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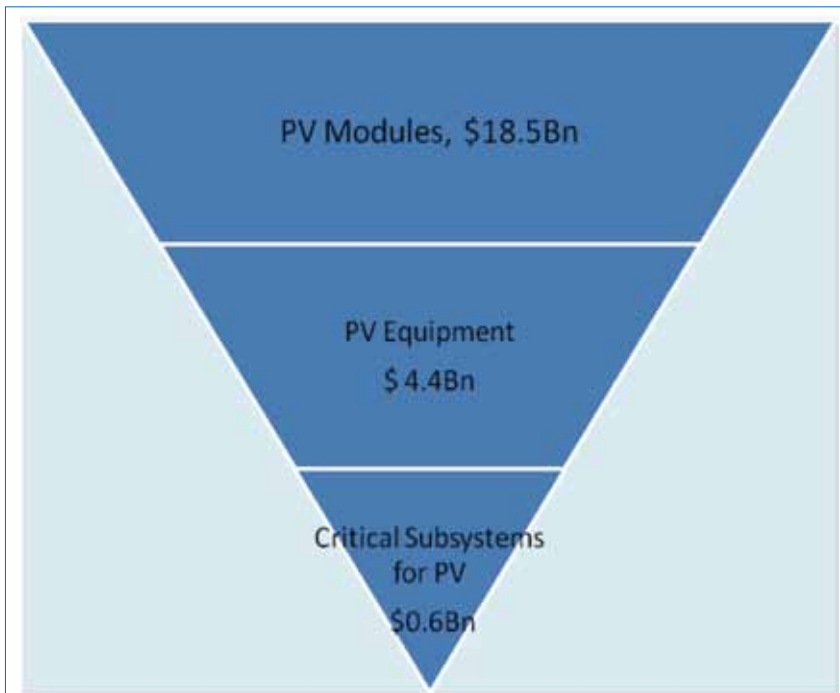


Figure 3. PV industry supply chain 2008.

smaller, less well-resourced equipment companies. In the current business climate, most companies would be delighted with flat sales, but, for an industry that has experienced such rapid growth in recent years, it is a serious problem. Those equipment suppliers basing their expansion plans on double-digit growth for 2009 have overshot the market and are now having to go through the painful process of resizing their businesses.

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This could be too much for some and, with over 250 equipment companies actively engaged in the market, we expect some fallout and consolidation. It is a telling fact that the publicly listed PV equipment companies delayed their earnings releases for the fourth quarter of 2008 and have been reluctant to give clear guidance for 2009. Order visibility has undoubtedly decreased, but a look at what is happening to the suppliers of critical subsystems and components used in PV equipment provides an insight into the size of the problem.

A recent survey of these companies revealed that subsystems and components orders for the PV industry for the first quarter of 2009 are likely to be down around 25% on the previous quarter. A significant portion of this decline can be attributed to the depletion of the supply chain through inventory consumption, but continued weakness in orders points to a negative quarter for equipment sales in Q2, and maybe also for Q3. Once cell demand starts to catch up with the installed production capacity, which should be in the second half of the year, we will start to see equipment sales recover.

Overall, equipment sales revenues are expected to grow around 6.7% in 2009, but these numbers are slightly skewed by the fact that long customer acceptance times mean a sizeable portion of revenues in 2009 will be for tools that were actually shipped in 2008. Although the number of PV manufacturing systems shipped in 2009 is expected to decline, sales of critical subsystems are still forecast to grow, albeit at a lower rate of 3.4%. This is due to the fact that supply chains will need to be replenished by the end of 2009 if the equipment suppliers are to fulfil their equipment orders at the beginning of 2010.

While the overall equipment market is flat, the picture on a company-by-company basis is different. Some of the larger companies are still expecting to outgrow the market at the expense of the smaller companies, and the longer this situation continues the greater the possibility that some of those smaller equipment companies will be shaken out of the industry.

Unfortunately, it is the smaller equipment companies that are the ones most likely to be using smaller locally available critical subsystems suppliers that are trying to establish a position in the market.

Nevertheless, it is not all bad news for the smaller critical subsystems supplier as the current market adjustment that is currently underway is forcing the larger equipment suppliers to reassess their costs and look to lower cost alternatives. In particular, many are questioning whether they actually need such highly specified subsystems on PV cell manufacturing equipment.

The majority of critical subsystems are used in vacuum-based thin-film deposition equipment and etching and cleaning equipment. Most of this technology has its origins in the semiconductor industry and it is not surprising that many of the equipment suppliers are also from the semiconductor industry. For many suppliers, the equipment used in PV cell manufacture is actually based on the same platforms as that used for semiconductor or flat panel display manufacture; tools are often made to a similar specification with the same parts.

“Sales of equipment and subsystems are expected to pick up in the second half of 2009 as the financial markets start to free up.”

While the PV industry has been growing so quickly, the focus has been on delivery and performance rather than the cost of subsystems. Now that demand has fallen away, the attention is firmly back on cost. In reviewing areas where costs can be reduced, it is clear that for some applications highly specified parts are not warranted and there is some scope for change. This opens the door for some of the smaller subsystems suppliers or suppliers with lower technology products to enter the market with lower value products that are no longer deemed to be critical to the process. The dilemma for equipment manufacturers, however, is that in taking this approach, it may be possible to reduce the purchase price of the tool, but the risk is that it may have a negative impact on the total cost of ownership of the tool.

For example, if the subsystem is less reliable, needs more frequent maintenance, or its use results in lower yields, then the initial cost savings could be counter-productive. The major critical

subsystems vendors recognise this and are mounting a strong case for continued use of highly specified products on the grounds of cost of ownership. However, equipment companies are seriously considering this option, thereby presenting an opportunity for latecomers and new entrants to establish themselves in the market.

Conclusion

The photovoltaic equipment industry has undergone explosive growth in recent years to become a significant market that reached a value of US\$4.4 billion in 2008. Suppliers of subsystems and components have been major beneficiaries as it has resulted in sales of almost US\$600 million and helped to offset their reliance on the semiconductor and flat panel display industries.

Uncertainty in the financial markets is currently tempering the growth in all PV markets. End demand for PV cells has weakened, and reduced access to finance has caused PV cell and module manufacturers to pull back on their original expansion plans. This, in turn, is having an impact on the suppliers of critical subsystems and components, not just in terms of sales, but also from their customers looking to cut their material costs. This situation is expected to be temporary, as the underlying demand for PV cells, which is driven by continued

government subsidy and the long-term need to reduce the reliance on fossil fuels, remains strong. Sales of equipment and subsystems are expected to pick up in the second half of 2009 as the financial markets start to free up.

One of the main difficulties in forecasting the demand for PV cells, and hence equipment and subsystems, is because actual sales still depend heavily on subsidies and will continue to do so at least until the industry is able to supply PV cells that can compete directly with other sources of electricity. Predicting the level of subsidy or the point at which parity between solar and grid electricity are reached with a high level of confidence is not possible. But based on current government commitments to transition more of their electricity supply to renewable sources, the PV equipment and subsystems industries are likely to grow at a compound annual growth rate in the region of 30% over the next five years.

While this is a very attractive market, it should be remembered that virtually all of the demand is for additional capacity and there are very few purchases that are being made to replace obsolete equipment. This means that, unless there is a major step change in manufacturing technology, the equipment that is being installed today is still likely to be producing

PV cells long into the future. The implication of this is that at some point, currently beyond our forecast horizon, the market will eventually mature and turn into a replacement market. Also, if there are limited developments in manufacturing technology then there will be reduced scope for the development of new subsystems, which may result in the commoditisation of subsystems where cost rather than technology becomes the focus. This contrasts to the semiconductor industry, where continued technology transitions ensure that whole swathes of equipment become obsolete and are retired each year and that new subsystems have to be continually developed to enable the new manufacturing technologies.

For now, at least, the PV industry is proving to be a major driver of new business for critical subsystems and components suppliers and, for many, is proving to be a real lifesaver during difficult times.

About the author

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