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Organic Electronics Association

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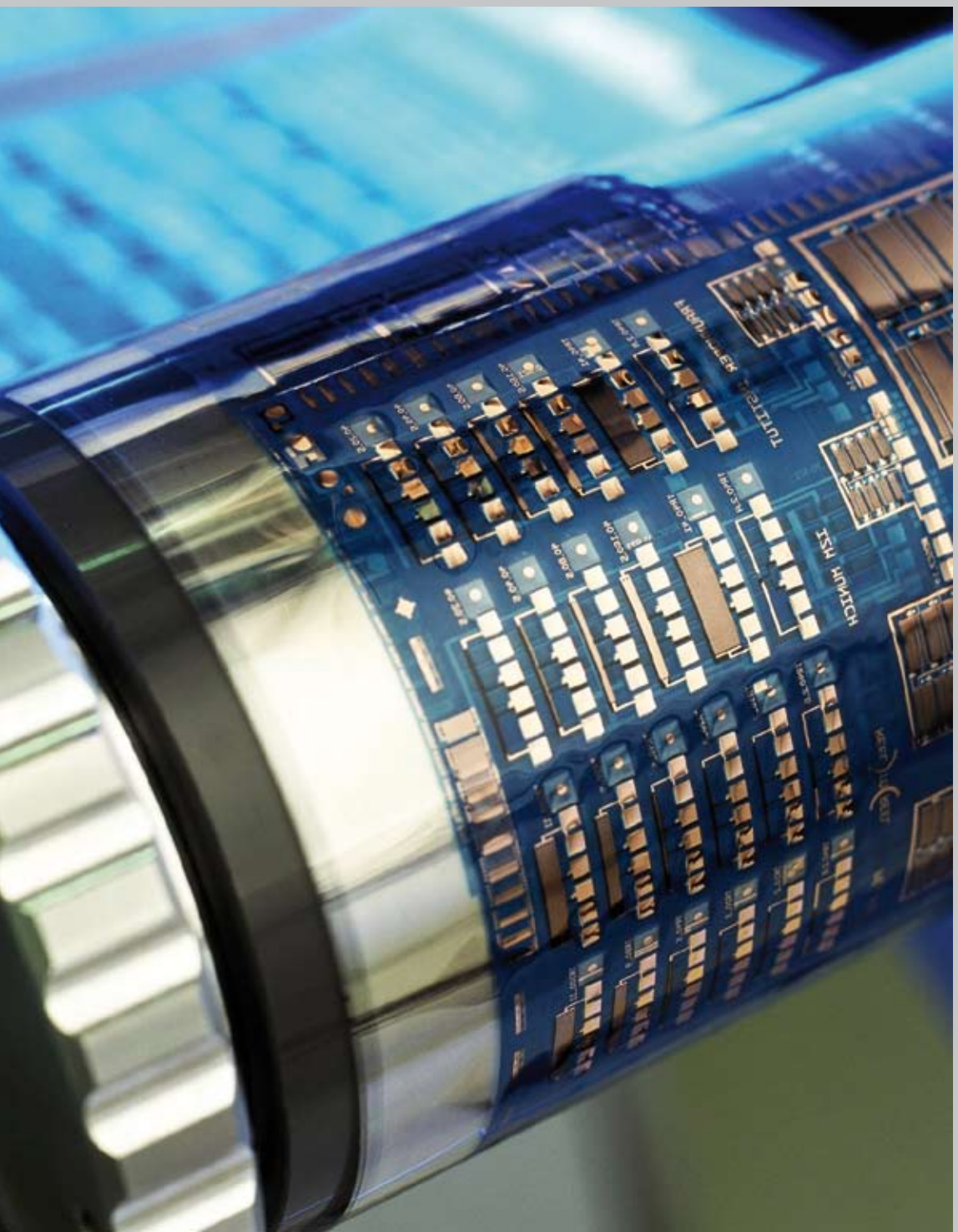
Organic Electronics



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Investment in production capacity key to establishing organic electronics industry

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There is a growing consensus within the organic electronics industry that if the forecasts by leading market analysts are correct then currently available production capacity is inadequate to satisfy anticipated market demand. Since it can easily take between 12 to 18 months to bring a production plant into full-scale operation now is the time for this building and investment if organic electronics is going to meet its full potential.

To meet anticipated market demands there will be a need to establish multiple production facilities to manufacture OLED lighting, organic RFID, organic backplanes, organic photovoltaic and organic memory devices.

The reason is simply that there is no significant overlap between individual facilities as OLED lighting is very different from organic backplanes. In addition, given that there is likely to be more than one competing company in each of these applications then further manufacturing facilities will be necessary. This suggests that if just four application areas were to be established then there could be at least four or more companies actively engaged in manufacturing products. For analysis purposes lets assume a minimum of two competitors per application, although there could be more depending on market attractiveness. Therefore, at least eight companies requiring investment. If the expected average investment required is about $50 million (range $20-$70 million) then there could be a short-term demand of about $400 million over the next 18 to 24 months.

The analysis is based on assuming the following

- The forecasted markets are expected to grow from only a few $10s of millions over the next three years to being worth $1.4 billion within five years. Organic lighting, organic RFID, organic backplanes, organic photovoltaic and organic memory devices will be behind these early applications.
- Currently, production capacity available in the companies and research institutions actively engaged in developing technology and products suitable for organic electronics is predominantly limited to R&D and prototype capacity.
- Individual investments have been below $25 million. Typically, these investments have been for seed funding or in a limited number of cases for 1st or 2nd round funding.
- Early indications suggest that the development of a production facility will, depending on the application, require $30 to $100 million of capital investment to be fully operational.

Markets

Organic electronics are projected to become a substantial market over the course of the next three to five years. While OLED displays receive much attention there is a growing list of early applications in which organic electronics will offer substantial advantages over existing technologies. In the short-term, with the exception of OLED displays, the opportunities for organic electronics products will start small – 2006 revenues is projected to be about $10 million – and grow rapidly. Organic lighting, organic photovoltaic and organic RFID are forecast to be worth in excess of $1.4 billion by 2011.

Organic Electronics – Market Forecast

	2006 Million US$	2011 Million US$
OLED	660	8,100
OLED-lighting	small	238
Photovoltaic	small	729
RFID	small	500

Source: NanoMarkets

Organic Electronics – Application Areas

Application Area	Market advantages of Organic Electronics	Competitive Technologies
Displays	OLEDs currently in use for low end displays in cell phones/MP3 player. However, the main opportunity is in high quality television screens that can be produced for lower costs than current generation of LCD and CRT televisions. Flexible displays would almost certainly require an OLED solution	Mostly competition from LCD displays, which is a very entrenched technology
Backplanes	Not usually seen as an immediate prospect for organic electronics, but a potential market as organic transistor technology evolves. The advantage would be low materials and production cost	Active-matrix backplanes based on amorphous silicon current dominant technology for LCD
RFIDs	Printed RFIDs using organic semiconductors are considered by industry opinion makers as a viable means to lower cost of RFIDs to a price point where they could compete with bar codes	Silicon based RFID is a dominant technology
Photovoltaics	Organic PV would be a low-cost, lightweight and printable solution that would be particularly applicable to rooftop panels and novel applications such as smart fabrics	Organic PV is just one of a number of thin film PV approaches, some of which are already well established
Lighting	Novel general illumination and other products possible including flexible lighting products. Low power consumption and long-lasting	Almost all lighting technologies would be competitive and will often be less expensive (but with higher power consumption)
Computer memory	Organic computer memories could be created by the same process as RFIDs, smart cards and other disposable electronics	Some kind of polymer/organic memory would seem to be necessary for disposable electronics. But mainstream computing does not look like it will adopt
Sensors	Opportunity to create low-cost sensors for smart packaging, embedded computing, etc.	Numerous technologies evolving for nanosensors of various kinds.

Source: NanoMarkets

OLED Displays: OLED displays are already established in low-end mobile applications and will account for over $600 millions in 2006. Revenues could rise to $8.1 billion by 2011 as OLED displays get adopted in more mainstream applications such television, computer display and content rich mobile appliances.

OLED Lighting: Using OLED technology for solid-state lighting applications looks promising. Market forecasts suggest that this market will be worth $238 millions by 2011. Early applications will be in using OLED lighting for specialty lighting or where unobtrusive and flexible lighting panels are deemed important.

Organic Photovoltaic: Organic and hybrid organic based photovoltaic (solar cells) devices are currently expected to generate $729 millions by 2011. Key drivers for solar cell adoption are environmental concerns, government subsidies, cost and low weight. Organic photovoltaic devices are expected to be inexpensive and be a significant competitor to incumbent photovoltaic technologies. Two application areas where these production attributes will prove attractive will be roofing panels and as a portable power source for mobile devices.

Organic RFID: Early indications are that market size of $500 millions could be realised by 2011. By using solution processible materials in conjunction with printing techniques, organic based RFIDs have the potential to deliver high-volumes at low costs. This would accelerate adoption of the technology across a wide number of applications that cannot be satisfied by silicon based solutions.

Organic Memory: Many of the above organic electronics applications will require memory. However, it is likely to be integrated as part of the final product rather than as stand-alone item. It is expected that low density organic memory will be widely used in early applications such RFIDs, smart cards and sensors.

Manufacturing

It goes without question that the ability to manufacture devices is an essential part of building an industry. The organic electronics industry, while still very much in the early stage of its evolution, is beginning to show signs of making the transition from an R&D mode to early stage manufacturing mode.

Current production capacity across the organic electronics industry is primarily limited to demonstrator and prototype facilities (see table below). At present there are only five companies that have made public announcements of their intention to make the transition to production scale facilities – Nanoident, Nanosolar (printable PV), Plastic Logic, PolyIC, printed systems and Polymer Vision.

	Companies	Timescale	Capacity
Demonstrator	All companies involved with organic electronics will have established this level of manufacturing capability. Without this level they would not be able to participate	Available now	Many small facilities
Prototype	Add-Vision CDT (Chemistry) CDT (Device) COLED Technologies DuPont Display Flexible Display Centre Konarka Microemissive Displays (MED) Merck OLED Novaled OLED-T OTB Display (Philips) Orgatronics OrganicID (working with partners) Plastic Logic PolyIC Polymer Vision printed systems Sumation Thin Film Electronics Universal Display Vitex Systems Acreo (Corporate R&D) VTT (Corporate R&D)	Now	Small-Medium
Prototype (planned)	CENAMPS (planned) Nanoident	2007 2006/2007	Small-Medium
Initial Production Planned	MED (outsourced) Plastic Logic PolyIC Polymer Vision	2005 2007/2008 2007 2007/2008	Medium
Volume Production	All OLED and all based in Far East OSRAM, LG Philips, Pioneer, RiTDisplay, Samsung, etc.	Now	Large

Source: cintelliq

The only firms that have made the transition to volume manufacturing are all OLED display manufacturers. These are predominantly based in the Far East, in a number of cases these are business division of LCD manufacturers.

Making the transition from Demonstrator to Prototype facility or from Prototype to Production facility is a significant step. Requiring not only an increase in resources (money, equipment, and people) but also additional time to install and commission equipment as well as qualify the final production processes.

Ramp-up time for a prototype facility is between 12 to 18 months. A similar figure would be expected for establishing initial output from a production facility.

Money

Over the course of the past three years the amount of money being invested into the organic electronics industry has been steadily increasing. The main recipients of this funding have included many organic electronic device companies as well companies focused on developing materials and encapsulation.

Devices	Materials
• Add-Vision	• Cambrios
• Konarka	• Coled Technologies
• Nanoident	• Novaled
• ORFID	• OLED-T
• OrganicID	• Plextronics
• Plastic Logic	• Vitex *

Source: cintelliq

* multi-layer encapsulation

For the period January 2003 to December 2005 Venture Capital (VC) funding has totalled more than $200 million (includes £ and € amounts converted into $).

Individual sums raised to date have been below 25 million USD. Investments received by these companies have been used mainly to fund technology development, rather than build manufacturing facilities. Most investment rounds are seed funding to enable founders to establish the business and secure their IP position, this has been followed by 1st round funding to enable laboratory facilities to be built and to hire staff, and some 2nd round funding to build prototype production facilities.

Early stage organic electronics companies are unlikely to have established significantly strong cash-flow with which to fund their capital expenditure needs as they start building production capacity. They will have to turn to the investment community to access the necessary capital.

In other instances, demonstrator facilities exist within the Corporate R&D centres. Here small amounts of capital investment needs are likely to be met by internal budgets. However, even here there is likely to be a finite appetite to provide funding all the way to full production capacity, and therefore this may increase the need to access external capital investment.

Initial estimates would suggest that setting up a prototype facility costs $5 to $30 million, and a production facility costs $30 million to $100 million (see table below).

Capacity type	**Capacity (units per month)***		**Facility Ownership**	**Installation Cost (USD)**
	Batch (e-paper back-plane)	**Continuous (RFID Tags)**		
Demonstrator	10s to 100	100s to 10,000s	Research and Development	1 million to 10 million
Prototype	100s to 1,000s	100,000	Research and Development	5 million to 25 million
Initial Production	10,000s plus	1000,000	Manufacturing	20 million to 50 million
Volume Production	100,000s plus	10,000,000	Manufacturing	40 million to 100 million

Source: cintelliq

* typical – depends on unit area, print speed, yields

Imprint

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