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OLED Lighting Products and Market Strategies–2012

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This NanoMarkets report will be essential reading for marketers, corporate planners, investors and others, who need to understand the inner workings of the leading OLED lighting firms. It will help identify the likely winners and losers in the emerging OLED lighting space and will also provide a perspective on the activities of the active OLED lighting firms told from NanoMarkets' insider perspective

This report provides an in-depth analysis of the product, market and manufacturing strategies of all the current major players in the OLED lighting space. Included in the coverage of this report are both OLED lighting panel and luminaire makers. We have also added a section that shows the main trends in the evolution of the OLED industry that are revealed by our analysis. These trends cover both supply chain and product design issues.

The comprehensive coverage of the OLED lighting industry provided in this report sets out how NanoMarkets sees the leading OLED lighting firms evolving and We comment on current product ranges and suggest how these will evolve in the future at each of the OLED lighting firms included. And we also examine how these firms are building alliances with other firms in the supply chain and where that might lead them.

In addition, we look at each OLED lighting supplier's manufacturing strategy and technology evolution. This analysis takes into the consideration the many new manufacturing plants that are being built around the world to produce OLED lighting and how the various approaches to manufacturing that have been proposed for OLED lighting are shaping up in the real world.

Firms included in this report include the largest lighting and electronics firms – such as Philips and LG – that are pouring financial and marketing resources into OLED lighting and who clearly expect large revenues to result from their activities over the next five years. It also includes luminaire firms that plan to take OLED lighting to the next stage, beyond the luxury lighting and designer kits to mid-range luminaires designed for office and professional lighting.

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Chapter One: Introduction

1.2 Background to this Report and Changes Since Our Last Report

Before this report, NanoMarkets most recently published a report analyzing the firms and products within the OLED lighting sector in March 2010. At that time there were very few OLED lighting products commercially available. This report from two years ago consequently had a different “look and feel,” from the one provided here.

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In particular, in the earlier report, our primary goal was to list every firm that had shown some interest in OLED lighting and had some resources—marketing and financial—to turn that interest into a business. For example, we included OEMs that were not really in—or likely to enter—the OLED lighting business as such, but which had designed some OLED lighting panels into a concept product, such as a piece of furniture intended primarily for booths at trade shows.

We understood, of course, that some of these activities would never amount to much. However, the justification for this approach at the time was that at that very early stage of the evolution of OLED lighting, any product trend or company activities in the OLED lighting space were worth reporting because they might turn into something substantial in the future. In other words, it was—at that stage of the OLED lighting game—difficult to know who would emerge as a real industry leader and who was simply playing with some concepts/business ideas.

1.1.1 The OLED Lighting Industry: Evolution of Manufacturing Infrastructure and OLED Supply Chain Strategies

But, in NanoMarkets’ opinion those very earliest days of the OLED lighting market are behind us:

- What we are seeing now are important lighting and electronics firms building manufacturing plants. While such activity was noticeable in limited amounts at the time of our earlier report, what NanoMarkets is seeing now is that the number of plants being built to manufacture OLED lighting is growing rapidly. In our judgment, this is not only a *quantitative* change, but a *qualitative* one too, signifying the arrival of a well-defined OLED lighting industry, rather than merely a community of interest.
- In addition to these developments at the manufacturing level it is becoming clearer how a supply chain will emerge for OLED lighting. It seems the Internet will play an important role in the future distribution of OLED lighting, but this should hardly be a surprise.

Because of its current commercialization focus for luxury lighting, it is fair to say that OLED lighting is well established in the supply chains that serve this specialist lighting sector.

Neither of these two points could have been made with confidence at the time of the last report on OLED products and companies published by NanoMarkets. However, there is still some way to go in this regard:

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- Most—but not all—of the manufacturing plants that are now in place could reasonably be categorized as pilot plants. One could not really say that OLED lighting infrastructure is really in place until a substantial number of full-scale production plants have been built.
- Similarly, supply chains for OLED lighting products are still uncertain. We note, however, that it is now clear that most of the leading players in this space have long-established channels to electronics and/or lighting markets. It is to be presumed that future marketing channels for OLED lighting will evolve out of these existing channels, but we cannot be sure about this as yet.

But what has changed since our last report of this kind is not *just* the fact that the OLED lighting business has demonstrated that it can move beyond the pure development phase. It is also the fact that an extraordinarily impressive group of electronics and lighting firms seem willing to commit serious resources to the OLED lighting market. *This is an important factor that has caused NanoMarkets to take another look at the structure and strategies in the OLED lighting market.*

Among the firms that are now making an effort in this space are GE, Osram, LG, NEC Lighting, Mitsubishi, Panasonic, Philips and Samsung, to name but a few. It is hard to think of many other new market segments that could line up such an impressive list of participants in such a short space of time.

Of course, not all of the firms active in the OLED lighting space are as big or important as the ones listed above. There are a number of smaller firms that are either potentially influential in the OLED lighting space or have interesting value propositions or both. There would probably be more smaller firms in the OLED lighting space if the investment climate in general and the IPO market in particular was in better shape.

With all this in mind, in this report we have focused on those firms who are making significant strides towards building real OLED lighting businesses and either have actual products in the

marketplace or clearly have the ability and intent to offer such products in volume in the next one to three years. Towards the end of this report, however, we have chronicled (briefly) why some of the firms and products covered in the original version of this report are absent from this report; we have done this where the change appears to indicate some trend in the OLED lighting industry that we think is worth noting.

1.1.2 OLED Lighting: Today's Product Offerings

In our earlier report our discussion and analysis of OLED lighting products included a considerable number of speculative concepts that were listed as interesting applications for OLED lighting by the various firms planning to get into this space. It was clear even then, however, that many of the suggestions that were being made for where OLED lighting could be headed in terms of applications had not been given that much consideration. The strategic thinking around future products and applications for OLED lighting was often intended more as a way to impress investors, industry journalists and the like, rather than as a way to inform commercial product design.

This is a typical situation with new technology areas and NanoMarkets has seen it happen with many new technologies. As OLED lighting product directions have crystallized and become clearer, a lot more thought has gone into where actual demand might be found for such products

One of the ideas that has certainly gone by the wayside since NanoMarkets published the original version of this report is that there is a strong potential for using OLED lighting for backlighting. A few years back, there were several firms that were formed with such backlighting products at the heart of their business planning. Such firms have now either disappeared from the OLED lighting business altogether or have moved on to other areas. Other concepts for using OLED lighting from its earliest days have usually been less well defined.

By contrast, today most of the commercial activity in OLED lighting has become focused on a few areas and the products that are discussed in this report primarily fall into a few categories. Based on the revenue potential projections that NanoMarkets publishes for OLED lighting on a regular basis, these are also the product categories that will generate the most money in the next decade.

Designer kits: OLED lighting “designer kits” consist of one or more small OLED lighting panels together with the necessary electronics to make them work. Their intended audience is

designers, architects and product designers who want to play around with the OLED lighting concept, but who are not yet ready to make a large investment in this kind of technology.

Such kits are now sold by a handful of firms around the world. They are clearly intended as a marketing exercise to spread the word about OLED lighting technology. None of the firms that currently sell these kits are willing to disclose sales figures for these items. However, based on the little data that is available, NanoMarkets believes that they are doing quite well in the marketplace.

The profitability of these kits, however, is hard to speak for and given the promotional intent of these products may be beside the point. However, there does appear to be a healthy premium added to the basic cost of the components in the kits, presumably reflecting the convenience and ease of use that they can bring to the ultimate customer.

Obviously, this is not a product that will get many repeat buyers. Either an end user is captivated by the OLED lighting concept and wants to pursue it more seriously or it sees nothing worth taking to the next stage. In the first case, the end user will want to seek out lower-cost/higher volume ways of purchasing OLED panels and related components. In the second case, obviously, no further purchases will be necessary.

However, NanoMarkets believes that the designer kit will be a permanent feature of OLED product offerings throughout the next several years for a number of reasons. First there are very large numbers of designers, architects and so on who have yet to meet the OLED lighting concept; so the addressable market for these kits is large and highly unsaturated. Second, NanoMarkets believes that kits of this kind will eventually make their way into design schools and maybe even the hobbyist market.

Luxury luminaires: OLED luminaires are now available to wealthy consumers from a select number of high-end lighting and furniture stores around the world, as well as on the Internet. At its current level of technological development, OLED lighting seems to be especially well suited to this application because it does not require high performance (on luminance or efficiency, for example) and is relatively cost insensitive.

With regard to that latter point the pricing for today's OLED-based table lamps and chandeliers generally fall into the \$1,000 to \$5,000 range. This obviously falls into a price range that puts them out of the reach of most consumers. However, OLED lighting of this kind is now priced at a similar level to the very high end of the luxury lighting market more generally. And this luxury

lighting sector—although it sells only small volumes of individual lights—should be considered as relatively mature.

NanoMarkets believes that this kind of luxury lighting will be a part of the OLED lighting market for the foreseeable future, if only because OLED lighting offers unique potential for clever designs and designers. Prices may be expected to drop somewhat too, but there will always be a design premium included in the products from this part of the OLED lighting marketplace.

So this luxury lighting should not be considered as a start-off point for the use of OLEDs in general illumination. If OLEDs are to be used widely in offices and homes it will take considerable leaps forward in performance and panel size and not just the lowering of price.

Trade shows, showrooms and prestige buildings: Another current feature of the OLED lighting market is the deployment of OLED lighting for large installations at trade shows, in show rooms and in the lobbies of prestige buildings. The general motivation for such deployments is similar to that of luxury lighting; the attractiveness in every sense of good design and, once again, this clearly trumps performance in this particular sector.

But the number of OLEDs deployed at any given location may be very large. Up to 2,000 individual panels at a single location is possible and the supply chain is obviously different than in the case of the luxury lighting market.

At this relatively early stage in the evolution of OLED lighting the take up of individual OLED panels by this segment of the market is big enough to generate a significant share of the entire OLED lighting market. However, while NanoMarkets expects that this use of OLED lighting will continue indefinitely, the fact that OLED lighting will become less novel combined with the fact that the addressable market in this segment is relatively niche-like, will tend to make sales of OLED lighting for trade shows, showrooms and prestige buildings less important to OLED lighting supplier than they are now.

Office lighting: The fact that firms of the caliber of those listed above are participating seriously in the OLED lighting market suggests strongly to us that they believe there is going to be a lot more to this business than just the very specialized markets that are outlined above. In particular, their current level of involvement would seem to be proof positive that they expect OLED lighting to account for a measureable share of the general and architectural illumination market.

This report chronicles how some of these large firms have gone to a lot of trouble to build extensive facilities to fabricate OLED lighting and there seems very little reason to do so unless

they believe a mass market for such products lies ahead. This would mean OLED lighting penetrating the general illumination market to some extent; a least a few percentage point share of the market anyway.

This penetration could occur in either the residential lighting or the commercial lighting part of the market and in either case would require a great leap forward in performance, since design is likely to be much less of a factor in consumer choice in general illumination than in the currently existing parts of the OLED lighting market. Different firms have different ideas about what levels of performance are required, however, although there is something of a consensus that to penetrate significantly into the general illumination market, OLED lighting must be able to offer 100 lm/watt in terms of efficiency, as well high luminance and panel size. The new kind of OLED lighting will also have to be priced effectively in the sense that it will have to be priced to sell against some very mature technologies.

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OLED lighting luminaires that comply with these requirements have been shown at trade shows, but NanoMarkets' investigations suggest that they will not be widely available until at least 2015 and possibly a year or two after that. But the question of most importance in the context of this report is what form will the OLED lighting that sells into the general illumination market take.

Here we note that both fluorescent lights and the new LED lighting have attempted to break into the general illumination market by emulating the classical light bulb in form factor. It is not impossible that the OLED lighting business might attempt to follow suit, but this would not be a direction that would be very easy to follow, since OLED lighting is intrinsically in a panel format:

- This suggests to us that the fit for OLED lighting in the future would be in offices, where panel-like fixtures in the form of recessed fluorescent lit luminaires are almost ubiquitous and have been for many years.
- Given the fact that OLED lighting, even if expected price declines occur, is likely to appear quite expensive to potential consumers for the next few years, the strongest case for using it may come where it can be cost justified in terms of energy efficiency; that is where electricity bills can be shown to be reduced significantly and sufficiently to justify the cost of OLED lighting.

This would be easier to do in the case of office luminaires, where installations are based on the usual business considerations, than for residential applications, where the determinants of consumer choice are harder to pin down. In particular, it seems

unlikely that homeowners could be easily talked into buying OLED lighting based on what would presumably be small savings in electricity.

The bottom line here then is that the first mass market OLED lighting products for general illumination will most probably be aimed at commercial and professional owners. We are not certain the degree to which this is accepted already in the OLED lighting community, but there are already several important firms that have taken this position either privately or publicly.

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OLED lighting integration: The other factor that plays a role in product strategies of some of the players here is the use of OLEDs to integrate into other structures that have a panel-like form factor. The point here is that OLEDs could be laminated onto furniture, wall and ceiling coverings, windows, PV panels, etc. In the future, OLEDs could be created together with other functional substrates in an integrated manufacturing process.

No other extant type of lighting could be integrated into other panel light products in the ways described above. This means that among lighting types, OLEDs are uniquely positioned to serve or create certain markets and, for obvious reasons, this fact has attracted the interest of OLED lighting makers.

A few products that might fall into the “integrated OLED lighting” space have appeared at shows or in labs. There have been examples of concept furniture with built-in OLED lighting, for example. And there have been research devices that combine OLEDs with smart windows. OLED furniture is not especially hard to create. But an OLED-smart-window or an OLED-PV-panel combo certainly is.

At the present time, such approaches are not shaping product offerings to any great degree. However, it is acknowledged by some of the firms profiled in this report that this may be the direction that their product offerings ultimately take.

1.2 Objective and Scope of this Report

The twin objectives of this report are (1) to profile the leading firms offering OLED lighting panels, modules and luminaires and (2) to analyze these firms' product/market and manufacturing strategies. To reach these objectives we have assessed the firms based on how NanoMarkets—after almost six years of coverage of the OLED lighting space—sees the OLED market evolving over the coming decade.

NanoMarkets' first version of this report was published in 2010. This report covers similar ground to that earlier one; that is, the scope is very similar. While many of the companies

covered in this report are the same as that earlier one, the profiles have been completely re-written.

Some of the firms covered in the original report have been dropped on the grounds that they have shown very little activity in this space in the past couple of years and hardly seem worth covering. But new firms have been added. And while the primary focus is on OLED lighting panel/luminaire firms, we also provide some focused profiles of important materials firms that supply this sector.

1.3 Methodology of this Report

This report is based both on interviews with leading OLED panel, module and luminaire manufacturers and on published sources. Interviews were conducted by phone and in person at major trade shows.

The published sources used to compile this report were quite diverse. For obvious reasons, considerable attention was paid to the publications and Web sites of the main firms reviewed in this report. We have also drawn heavily on other NanoMarkets reports that both profile companies and provide the market context for the product/market strategies of these firms. Where necessary, we have also drawn on databases, trade press articles, financial filings, and other corporate literature to fill out what is going on in this sector.

1.4 Plan of this Report

This report consists of three chapters. Chapter Two takes up most of the report and consists of the profiles of panel, module and luminaire manufacturers mentioned above. We believe that these profiles represent a more or less complete “listing” of the firms that are significant players in the OLED lighting space at the present time. That said, there are a rapidly growing number of small luminaire makers and it is possible that we have missed some of these. In addition, we have dropped a few of the companies mentioned in the version of this report that was published by NanoMarkets two years ago on the grounds that little has been heard of their OLED lighting activities since that time.

Finally, in Chapter Three we have pointed to the key OLED lighting marketing and product strategy trends revealed by Chapter Two.