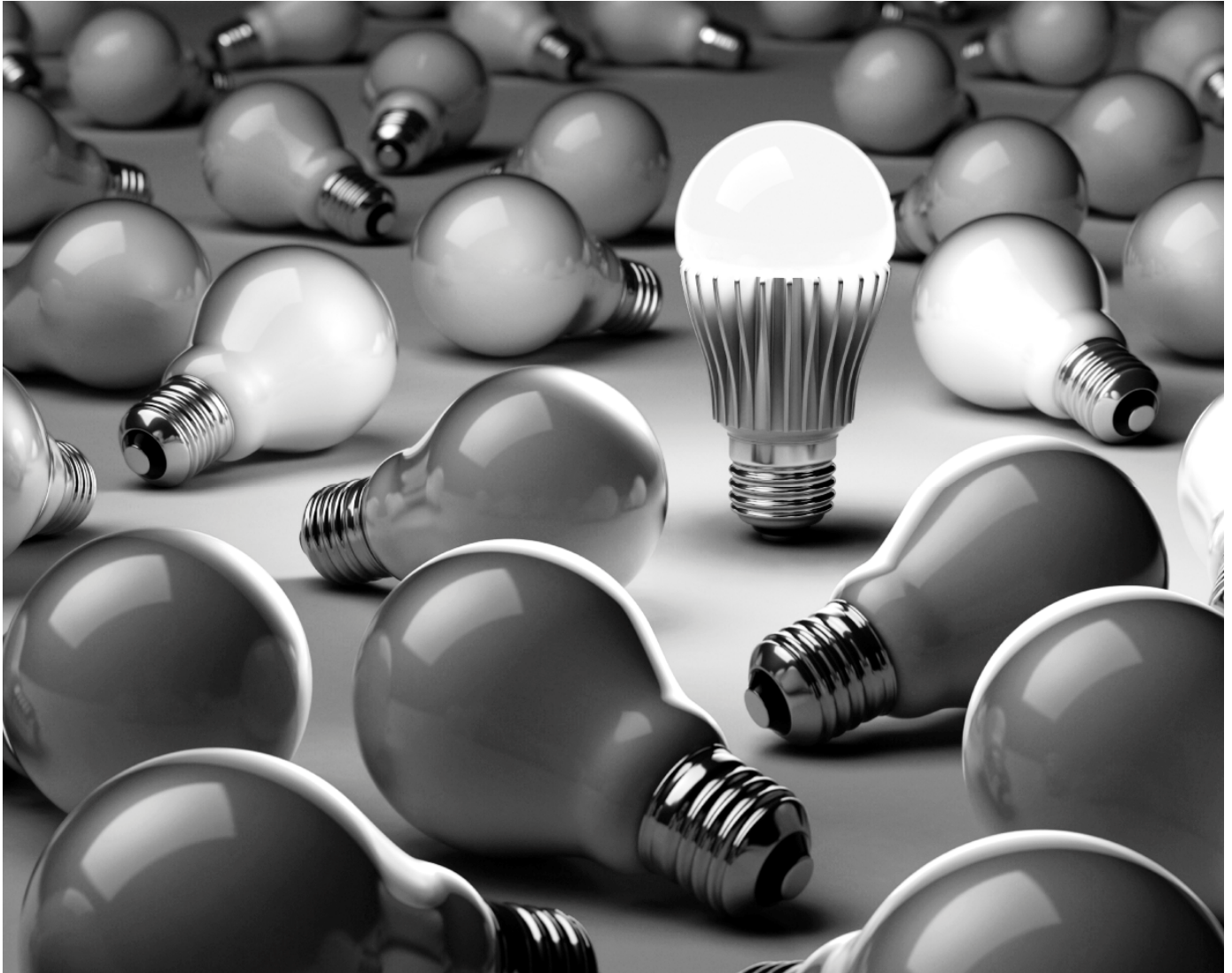




# EDISON



## LED spotlight

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Technology sector

June 2013

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# LED spotlight

LED there be light

Technology

19 June 2013

**The transition to LED technology is shaking-up the lighting industry. Existing players are struggling to compensate for traditional lighting's decline with LED lighting growth. Each stage of the value chain is feeling the impact in different ways. This report is a guide to the opportunities and threats that exist for each lighting sub-segment and each part of the value chain.**

## A ubiquitous and multi-faceted industry

LED lighting is potentially a \$60bn industry with an expected CAGR of 45% to 2016. Replacement of incandescent, CFL and other lighting types is being driven not only by the high energy efficiency of LEDs but also by other benefits such as improved robustness/lifetime, improved colour mix and wider form factor options versus traditional alternatives. However, it is a very fragmented market and each application has its own requirements into which the key benefits and drawbacks of LED play very differently. Thus the rate of LED adoption and the predominant technologies used will differ greatly from application to application.

## Supply chain shake-up ongoing

The long lifetime of LEDs will disrupt the lighting industry, undermining the established replacement market and shifting value towards fixtures and fittings. Meanwhile, LED's growth potential combined with the environmental benefits has attracted high levels of investment from both the investment community and governments globally. This has created a crowded competitive landscape with multiple competing technologies, over capacity in some areas and margin pressure being felt throughout the supply chain. Broader end user adoption will alleviate some of these issues, but a wave of consolidation is needed to optimise manufacturing margins. Many technology companies will inevitably be drawn up evolutionary dead ends, creating inherent risk to investing at this level. We see risks as being particularly prevalent in the middle of the supply chain – the wafer, chip and module manufacturers, which bear competitive, technology, end market and supply chain risk.

## Supply chain threats and opportunities

For public market investors, we see the most obvious investment opportunities at the extremities of the supply chain. The shift in value to fixtures and fittings is likely to continue and companies that have focused on addressing niche markets where the benefits of LED play strongest should continue to grow strongly. In this context, we see the recent weakness at Dialight as an opportunity for investors with a longer-term view. PhotonStar LED also has a good opportunity for growth through its relationship with a UK housebuilder. While currently suffering from an oversupplied market and although the timing of a broad-based demand upswing is difficult to predict, the two main suppliers of MOCVD equipment, AIXTRON and Veeco, look the most reliable beneficiaries from mass market LED uptake. Nanoco has unique technology for improving light quality with its cadmium free quantum dots. Its partnership with Osram could drive significant growth and its initiatives in other markets mean it has other strings to its bow.

### Companies in this report

AIXTRON  
Cree  
Dialight  
Dr. Hönle  
FW Thorpe  
Holders Technology  
IQE\*  
LPA Group  
Nanoco Group  
OSRAM  
PhotonStar LED  
ProPhotonix  
Rubicon Technology  
The Vitec Group  
Zumtobel

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## Purpose of this report

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The purpose of this report is to describe the impact that LED technology may have on each stage of the lighting supply chain. It will also give a description of LED lighting technology, a breakdown of the LED lighting sector and the key factors that will drive uptake. The intention is to provide investors with background knowledge and the areas to focus on for further investigation, and to highlight some interesting companies to consider for potential investments.

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## **Investment summary: LED future**

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### **LED is the future of lighting**

Light emitting diodes (LEDs) are the next generation of lighting technology. They are longer lasting, more efficient and more flexible, both in terms of form factor and colour, than the traditional incandescent and fluorescent lights that they are trying to replace. For a typical replacement light, an LED lamp will use 90% less energy than an incandescent lamp and 50% less than a fluorescent lamp. We argue that LED technology will, in time, become the default option for most lighting applications, but at the moment is being held back by high pricing. This will change as the prices of LEDs fall and energy prices continue to rise, resulting in a rapidly declining cost of ownership when compared to traditional lighting technology. In an effort to reduce CO<sub>2</sub> emissions and improve energy efficiency many governments are choosing to ban incandescent lighting and set minimum efficiency standards for lighting products. These bans will be an important driver to uptake, despite some opposition to the bans and exploitation of loopholes, but other factors such as price and customer perception will be equally, if not more, important.

### **All lights are not created equal**

Lights have many different uses and the attributes of lights required for different applications vary significantly. The attributes of LEDs that make them appealing for general lighting are their high energy efficiency, ruggedness, long lifetime, ability to tune the colour and potential for developing new form factors. The variation in attributes required for each application is one of the key reasons why the level of adoption of LED lighting varies significantly across lighting sub-sectors. For example, adoption has been high in architectural lighting applications because of LEDs' very long lifetime and the ability to tune to a wide range of colours, but has been slower in the residential market because of their current higher initial cost versus existing lighting technologies. The growth rate and uptake of LED lighting therefore needs to be assessed on a sector by sector basis.

### **Key technological battlegrounds**

As with many new technologies, numerous different companies own and control the patents to many different aspects of LED lighting technology. The winning technological solutions are not yet clear, but the key battlegrounds are processes that enable production of LEDs on silicon, technologies that enable low-cost colour tuning, and technologies that improve the efficiency and efficacy of LED chips.

### **Replacement market eroded by the success of LED**

The replacement market is a relatively small percentage of the total lighting market. It is currently worth €8bn against a total general lighting market size (including fixtures and fittings) of €57bn, but this is forecast to fall to €7bn by 2020 as a result of the significantly longer lifetime of LEDs. Despite the reduction in the replacement market, the LED component of that market is forecast to increase from the current value of €800m to €4.2bn in 2020. This will obviously mean a significant reduction in revenue from sales of traditional replacement bulbs and these suppliers are therefore diversifying into LED fixtures and complete lighting solutions to compensate for the decline. In the longer term it is also likely that industry consolidation will be required.

## **Intense competition and excess supply suppress margins**

Subsidies offered by governments, particularly the Chinese government, as well as high growth expectations for the LED market have attracted numerous new players to many areas of the supply chain. In addition, excess supply has built up as a result of incumbents investing in additional capacity, which outpaced the growth in demand. LED chip manufacturing and wafer supply is a part of the supply chain that has been particularly hard hit, with prices falling faster than costs and some companies writing down inventory and making gross losses. However, this is helping the fixture manufacturers by keeping their component prices low and enabling them to produce fixtures at a more appealing price point for consumers, which in turn is encouraging uptake. However, this situation is not sustainable and the industry, specifically within China, is already going through a period of consolidation. Additional consolidation and possibly asset write-downs are likely to be required before the manufacturing and wafer supply industry returns to growth. However, competition is likely to remain high, and therefore margins are likely to be suppressed.

## **Value shifts to fixtures and fittings companies**

Most of the value in the general lighting market is in fixtures and fittings, and the shift in value from light sources to fixtures and fittings is accelerating. Some of the largest traditional manufacturers, such as GE and Philips, have adapted to this by investing in companies offering complete lighting solutions. Smaller players such as Dialight and LPA have taken advantage by occupying niches, protecting them from competition and enabling them to maintain their margins.

## **A rollercoaster ride for equipment suppliers**

The two major MOCVD equipment suppliers, AIXTRON and Veeco, have over 90% combined market share and are therefore very sensitive to trends in the LED market as a whole. They experienced a surge in demand for MOCVD equipment in 2010 following massive investment by the Chinese government in LED technology, but demand has fallen dramatically since then due to overcapacity in the chip manufacturing market, resulting in a write-down of inventories and gross losses. They are unlikely to see a surge of that level again, but demand should gradually improve as the excess supply of chips and wafers is absorbed and LED uptake increases. Despite the write-downs and falling revenues, AIXTRON and Veeco have the benefit of being in the part of the supply chain that is not under significant competitive threat from cheaper Chinese start-ups, which concentrate on chips and wafers. The timing of the recovery of AIXTRON and Veeco is uncertain, but given the concentrated market and limited threat from new entrants, in the medium term they could be the two companies that benefit the most from the wider uptake of LED lighting. Despite recent losses, both AIXTRON and Veeco appear to have strong balance sheets. However, Veeco is at risk of being delisted due to failing to file Q412 results with the SEC on a timely basis, as a result of a review of its revenue recognition policy.

## **Short term**

- Fixture and fittings companies focused purely on LED technology will benefit most.
- Companies targeting the residential market will benefit from the largest and fastest-growing sub-segment, but competition is intense so margins may be low and there is unlikely to be an outright winner.

## **Medium term**

- Companies such as Dialight and LPA, which operate in niches, should be able to protect themselves from intensifying competition, but margins may fall for lighting companies that operate in more competitive areas such as residential lighting.

- The replacement market will start to level off as the proportion of LEDs, with their long lifetime, increases. Value will therefore shift further towards fixtures and fittings companies.
- It will start to become clearer what the winning technologies are in terms of the substrates and colour tuning methodologies, and therefore which companies may go on to become dominant.
- AIXTRON and Veeco may start seeing gains from the wider uptake of LED lighting.

## Long term

- The industry is likely to consolidate further and the dominant players in the LED chip market will become apparent. It is too early to say who these might be, but they are likely to include Cree, OSRAM, Samsung and Philips.
- Competition is likely to increase in the fixtures and fittings market, resulting in lower margins and lower profits.
- AIXTRON and Veeco are likely to see falling revenues from LED equipment sales in the longer term as the technology stabilises and the market reaches steady state.
- Organic light emitting diodes (OLEDs) might start to replace LEDs in some applications, but this is likely only to be in decorative applications because of their lower efficiency.

## Ones to watch: Companies of interest

**Nanoco** is developing quantum-dot technology to alter the colour of LEDs without the need for expensive phosphors. At the moment it is developing the technology with OSRAM. If the development is successful and can be used in all of OSRAM's lighting systems, Nanoco's revenues could increase significantly and the relationship could prove transformational for the business.

**Dialight** has shown strong sustained growth and operates in a defensible niche (hazardous lighting), which should protect its margin and market share from new entrants.

**AIXTRON** and **Veeco**, although going through tough times at the moment, could be two of the main beneficiaries of LED lighting uptake because of the highly concentrated industry and the use of their equipment for all LED substrates. Short-term earnings visibility may be low, but they cannot be discounted in the medium and long term.

**Cree**, with its high proportion of LED-related revenues and integrated supply chain, is one of the stronger players in the LED market and, with its recently introduced sub-\$10 LED bulb, is leading the way in terms of performance and cost.

**PhotonStar LED** could be one of the smaller players that gains substantially from LED uptake. Its innovative Chromawhite technology and agreement with a large UK house builder could see its revenues grow quickly over the next few years, although competition in that market is intense and the key winners are not yet clear.

## Introduction

This report aims to provide the reader with sufficient background information and insight into the LED market to enable further analysis of key companies that could offer an investment opportunity. The report is broken down into a description of LED technology, the current position of the global lighting market, an analysis of the impact LED lighting will have on each stage of the value chain and, finally, the key factors that will drive LED uptake. The main focus of each of these sections is the general lighting LED market and not automotive or backlighting.

Two-page profiles have been included on the 15 listed companies that have been selected based on their exposure or potential exposure to the LED industry. The companies cover all stages of the value chain and sub-segments of the lighting market. Some niche companies such as Dr. Hönle have been included to illustrate other markets LED technology is entering that could present investment opportunities.

Exhibit 1 shows the list of companies that have been profiled and their position within the lighting market value chain.

**Exhibit 1: Market position of profiled companies**

Company	Production equipment	Wafers	LED chips/packages	Modules	Fixtures and fittings
AIXTRON	●				
Cree		●	●	●	●
Dialight					●
Dr. Hönle				●	●
FW Thorpe			●*	●*	●
HOLDERS Technology					●
IOE		●			
LPA Group					●
Nanoco Group			●		
OSRAM			●	●	●
PhotonStar LED					●
ProPhotonix				●	
Rubicon Technology		●			
The Vitec Group					●
Zumtobel				●	●

Source: Edison Investment Research. Note: \*Assembly and distribution only.

The lighting market is very fragmented and the characteristics of each market sub-segment can be very different. Companies should therefore be assessed based on the lighting sub-segments that they focus on.

To assist with this, Exhibit 2 shows the sub-segments that each of the profiled companies operates in (only fixture and fittings companies are included as there is limited segment differentiation before the fixture and fittings level of the value chain).

**Exhibit 2: Lighting sub-sector of profiled fixture companies (largest sub-sector on left to smallest on right)**

Company	Residential 56% CAGR	Office 49% CAGR	Outdoor 56% CAGR	Retail 54% CAGR	Hospitality 44% CAGR	Industrial 47% CAGR	Architectural 16% CAGR
Cree	●	●	●	●	●	●	●
Dialight						●	
Dr. Hönle						●	
FW Thorpe	●	●	●	●	●	●	●
Holders Technology	●	●		●	●	●	
LPA Group						●	
OSRAM	●	●	●	●	●	●	●
PhotonStar LED	●	●	●	●	●	●	●
Zumtobel		●	●	●	●	●	●

Source: Edison Investment Research. Note: CAGR growth rate estimates are for the period 2012-16 and are based on McKinsey data.

The level of exposure to the LED industry for each of the profiled companies is summarised in Exhibit 3. Traditional lighting companies (indicated by \*) typically have a relatively low proportion of revenues from LED lighting, but are in the process of expanding their portfolios and are generally experiencing strong growth in LED sales and a decline in traditional lighting sales.

**Exhibit 3: Percentage of revenue generated from LEDs**

Company	0-25%	25-50%	50-75%	75-100%
AIXTRON				●
Cree				●
Dialight				●
Dr. Hönle	●			
FW Thorpe*	●			
Holders Technology		●		
IQE	●			
LPA Group*	●			
Nanoco Group		●		
OSRAM*		●		
PhotonStar LED				●
ProPhotonix	●			
Rubicon Technology				●
The Vitec Group	●			
Zumtobel*	●			

Source: Edison Investment Research. Note: \*Traditional lighting companies.

Exhibit 4 shows some of the key financial figures for the profiled companies

**Exhibit 4: Company fundamentals**

Company	Currency	Market cap (m)	Net debt (m)	EV (m)	EV/sales	EV/EBITDA	P/E	Gross margin	EBIT margin	EBITDA margin
AIXTRON SE	€	1,279	(210)	1,069	4.2x	N/A	N/A	0%	-84%	-48%
Cree Inc	US\$	7,273	(745)	6,529	4.7x	23.5x	47.5x	35%	6%	16%
Dialight PLC	£	391	(15)	376	2.5x	12.4x	22.2x	36%	17%	20%
Dr. Hönle AG	€	60	(4)	56	0.7x	5.1x	12.6x	N/A	11%	14%
FW Thorpe PLC	£	133	(32)	102	N/A	N/A	N/A	45%	21%	25%
Holders Technology PLC	£	3	(1)	2	0.1x	9.3x	43.3x	25%	0%	0%
IQE PLC	£	140	16	156	1.1x	5.7x	10.8x	21%	8%	17%
LPA Group PLC	£	9	2	11	0.6x	N/A	13.0x	28%	5%	7%
Nanoco Group PLC	£	276	(15)	261	66.2x	N/A	N/A	60%	-94%	-125%
PhotonStar Led Group PLC	£	8	(1)	7	0.7x	7.5x	19.1x	35%	-12%	-9%
ProPhotonix Ltd	£	1	7	8	0.5x	N/A	N/A	30%	0%	-15%
Rubicon Technology Inc	US\$	162	(44)	118	2.2x	N/A	N/A	0%	-19%	-1%
Vitec Group PLC/The	US\$	264	64	328	1.0x	6.0x	11.0x	43%	14%	19%
Zumtobel AG	€	373	135	508	0.4x	5.5x	15.2x	31%	2%	7%

Source: Bloomberg, Edison Investment Research. Note: Based on current year consensus forecasts apart from Dialight and IQE, which use Edison current year forecasts - FY13/FY14. Net debt figures are from the last reported full-year results.



## LED technology summary

### LED lighting technology nears maturity

LEDs (light emitting diodes) are semiconductor-based devices that emit light when current flows through them. The colour of the LED is dependent on the material it is made from and typically occupies a very narrow spectrum. LEDs have been around for decades, but generally have not been able to produce the quality and quantity of light to be suitable for use in general lighting. This is now changing, with total light output per device going up, efficiency going up and cost coming down.

#### Exhibit 5: Components used within an LED lighting system



LED chips and wafers	Packaged LEDs	Lighting modules	Lamps and lighting systems
The semiconductor chip consists of active layers that emit the light and the substrate, which supports the structure and upon which the active layers are grown. As with computing chips, they are produced in wafer form and then cut into chips.	The LED package provides the following functions: <ul style="list-style-type: none"> <li>protects the semi-conductor,</li> <li>provides contacts for the electronics,</li> <li>provides basic optics to direct light as required, and</li> <li>converts the narrow spectrum light from the diode into broad spectrum white light, typically by using a phosphor.</li> </ul>	The LED package is integrated into a module with the power and controlling electronics and additional optics. The module may contain more than one LED package to produce the required lumen output.	The module is then integrated with the rest of the lighting system. It varies significantly depending on the application, but will generally consist of at least one LED module, a heatsink, the luminaire (lighting fixture) and the control system.

Source: Edison Investment Research, images from Intel, OSRAM, i-micronews.com (courtesy of OSRAM)

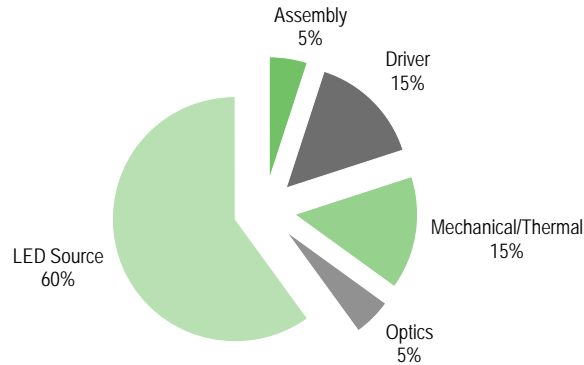
### Chips are the fundamental driver of LED lighting adoption

LED chips are the key components that determine the cost and quality of the lighting system. The efficiency and overall performance of the LED light source has a significant effect on the design of the system and its overall cost. The more efficient the LED light source, the fewer LEDs are required in the module and the smaller and cheaper the heatsink can be. However, more efficient LEDs tend to be more expensive and therefore the total cost of the system is a trade-off between LED cost and performance.

### LED chip cost is a significant component of total cost

Although the cost will vary depending on the application, for a typical replacement bulb the LED package is c 60% of the cost of the total lamp. For more complex lighting systems the LED component cost will be lower as a percentage of total system cost. For example, Dialight, a specialist in LED lighting for hazardous environments, has said 15% of its cost of sales is for LED light sources.

**Exhibit 6: Cost breakdown for a replacement lamp**

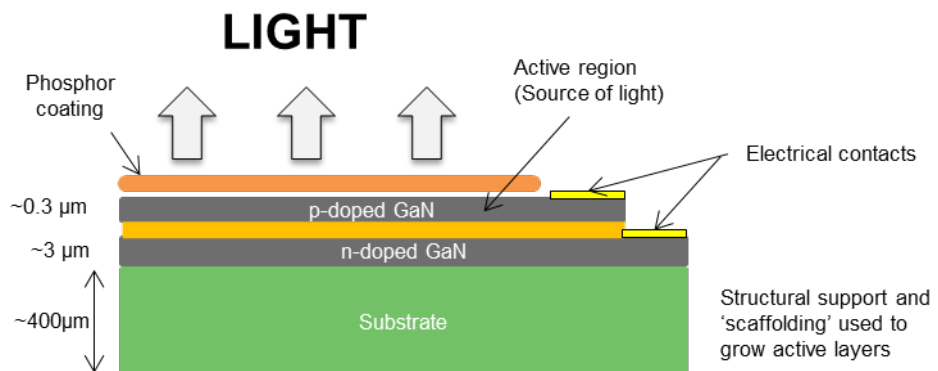


Source: DOE SSL Roundtable 2011

**Substrate material is a key determinant of overall system cost**

Exhibit 7 shows the basic structure of an LED. The active region, where light is generated, is formed between two extremely thin layers of GaN that are deposited using a metal-organic chemical vapour deposition (MOCVD) process. The substrate provides structural support and assists in the growth of the active layers but does not generate light. The substrate is two orders of magnitude thicker than the active layers, so it is a substantial component of the material cost of the diode, but more importantly, it has a significant impact on the yield and efficiency of the resulting LED and so has an even greater effect on total system cost.

**Exhibit 7: LED simplified schematic**



Source: Edison Investment Research

The majority of white LEDs currently use gallium nitride (GaN) as the *active* semiconductor material because it produces blue light, which makes it possible to produce broader spectrum white light. Although there is a general consensus that GaN is the way forward for the active layer of high-brightness white LEDs, the choice of *substrate* is a key strategic battleground.

## Substrate comparison

Exhibit 8 shows the main substrate options for use with GaN-based LEDs, ordered from the most established downwards.

Exhibit 8: Substrate comparison					
Chemical name	Material cost	Wafer size	Yield/efficiency	Equipment cost/supply chain	Development status
Sapphire (Al <sub>2</sub> O <sub>3</sub> )	★★★ Cheaper than GaN and SiC	★★ Available up to 300mm Larger diameter wafers are expensive	★★ Results in a higher number of defects when used with GaN	★★★ Most mature established LED technology	Widely in use commercially (90% of LEDs are based on sapphire). <b>Nichia</b> , the leading manufacturer of LEDs, is focusing development on sapphire rather than silicon.
Silicon carbide (SiC)	★★ Expensive compared to silicon	★★★ Producing on 150mm wafers	★★★★ Relatively low number of defects and therefore more efficient	★★ Well established but proprietary to Cree	Patented and in use commercially by <b>Cree</b> . Approximately 10% of commercially available LEDs are SiC-based.
Silicon (Si)	★★★★★ Cheapest substrate material	★★★★★ Large wafer size possible	★ Different thermal expansion properties between GaN and silicon results in higher number of defects and lower efficiency	★★★★★ Advantage of leveraging conventional semiconductor industry infrastructure and expertise	In development by many different manufacturers. <b>Toshiba</b> in partnership with <b>Bridgelux</b> announced they were producing commercial quantities of GaN-on-Si based LEDs in December 2012. China's <b>Lattice Power</b> started commercially producing GaN-on-Si LEDs in mid-2012.
Gallium nitride (GaN)	★ GaN is very expensive compared to other options	★ It is difficult to manufacture GaN in large wafers, which further increases the cost of manufacture per device	★★★★★ Using GaN for the substrate as well as the active material means that the number of defects is significantly reduced, which improves yield, device efficiency and lumen output per device	★ Higher light output and fewer LEDs are needed per module	<b>Seoul Semiconductor</b> and <b>Soraa</b> have developed GaN-based devices and have started or are soon to start mass production.

Source: Edison Investment Research

### Improvements in silicon substrate technology to drive cost reductions

Currently 90% of commercial LED devices use a sapphire (aluminium oxide) substrate and most of the remaining 10% use silicon carbide (SiC). However, there has been significant desire for and investment in developing ways of growing GaN-on-silicon because of its lower cost.

Silicon could potentially lower the cost of LED manufacture significantly because it is much cheaper as a material, but also because of the infrastructure that is already in place for silicon-based devices. However, it is difficult to grow GaN-on-silicon without defects because of the mismatch in atomic structure. These defects reduce the yield and efficiency of the LEDs and therefore increase total system cost.

### GaN-on-silicon yield needs to improve to achieve significant cost savings

Numerous companies are working on ways to improve yield and recently a number of different companies have released GaN-on-silicon-based LEDs including Toshiba, Lattice Power and Plessey Semiconductor. Whether they are doing so profitably remains a different question, and there is a general acceptance that wafer yields still need to improve significantly (some suggest 10-20 fold<sup>1</sup>) for GaN-on-silicon to become truly commercially viable.

<sup>1</sup> i-Micronews.com.

### **Wafer size and yield are key areas for further cost reductions**

Wafer size, material cost and yield are the key areas where cost savings can be made in the future. Wafer size is important because it determines how many devices can be made on each wafer; an 8" wafer has 80% more surface area than a 6" wafer and four times as much as a 4" wafer. More devices per wafer mean higher throughput and lower cost per device.

### **Sapphire cost reductions reduce silicon's advantage**

Sapphire wafers are more expensive than silicon, but the cost is coming down as a result of improved manufacturing techniques and competition in the industry. Although the material cost is higher for sapphire, it has advantages when it comes to yield and LED efficiency. Sapphire wafers are commonly 2" to 6" in size, but 8" wafers are available and 12" wafers are being developed. If further cost reductions for sapphire wafers are realised the uptake of silicon-based devices could be delayed further.

### **Sapphire and SiC performance remains better than silicon, but the gap is closing**

Sapphire and SiC currently generate more lumens per watt than silicon-based devices. As manufacturing techniques improve and the number of defects falls, both cost and efficiency will improve and also make silicon-based devices more competitive. In terms of lumen per watt, SiC and sapphire are 12-24 months ahead of silicon<sup>2</sup> but the yield of silicon-based devices is still poor so they are not commercially competitive.

### **Silicon substrates likely to gain market share in lower performance areas**

There is an adage in the compound semiconductor industry that if silicon can replace another material, then it eventually will, primarily because of the huge historic investment in silicon technology for the manufacture of IC chips. It seems therefore inevitable that silicon will eventually prevail, particularly in the price-sensitive, less performance-led residential market. However, lighting is a very fragmented market and this will not change as LEDs become more dominant. The lighting module and luminaire manufacturers will choose LEDs based on the application they are designing for.

### **Each substrate has advantages for different applications**

We expect sapphire-based revenue to grow in absolute terms but fall as a percentage of the total market, with growth coming from general mid-range lighting. GaN is likely to remain a relatively small percentage of the market due to its high costs, but its higher efficiency and lumen output could mean it sees growth in applications where intense, compact point-source light is required. SiC, through Cree, is likely to gain market share in the short to medium term due to good performance at moderate cost, which is suitable for a wide range of applications, but it may be undercut in price by silicon for some applications. Although Cree's devices are currently exclusively SiC-based, Cree has conducted research into other substrates and is willing to change if the economics are right.

### **Fixtures and control system design requires more expertise**

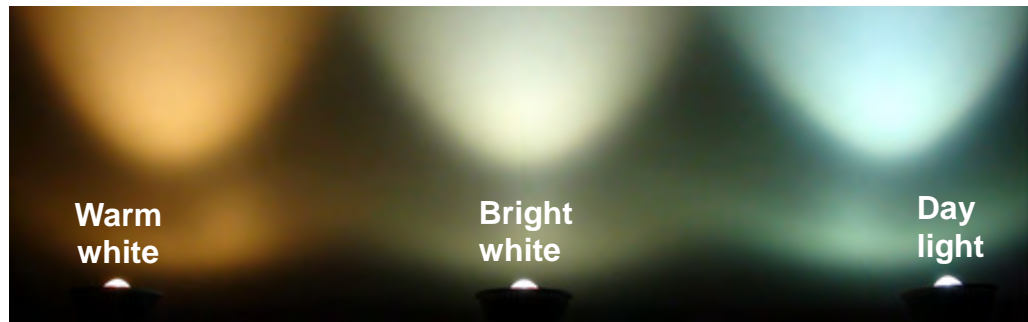
LED lighting systems require a more complicated power and control system than traditional lights. Traditional lighting generally operates directly off mains power, but LED lighting requires lower voltage DC, which means that transformer and driver circuitry is required. Managing and dissipating the heat generated by the LEDs is also important in achieving a long lifetime, so lighting companies need to develop expertise in both these areas to be able to design high-quality LED lighting products.

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<sup>2</sup> i-Micronews.com

## Colour tuning

Exhibit 9: LED lighting colour



Source: [lightingmatters.com.au](http://lightingmatters.com.au)

### Poor light quality could hold back uptake

One of the disadvantages of LED lights is that they emit light over a very narrow spectrum and therefore do not produce the 'natural' colour of light we are used to. This creates a barrier to adoption in verticals where aesthetics are important. For example in retail environments the blue hue of LED lights can make fruit and vegetables look unappealing. It is also likely to be a significant obstacle to LEDs gaining acceptance in the domestic market, which could be exacerbated if low-cost or cold lights tarnish their reputation at this early stage of adoption.

### Many early adopters are unhappy with LED performance

A survey conducted by lighting firm Havells-Sylvania in 2011 that found 85% of consumers who had bought LED lamps were unhappy with the quality of light produced and would not be purchasing them again. The colour rendering index (CRI) is a measure of the quality of light produced and is measured on a scale of 0-100. Draft requirements for Energy Star certification suggest that LED lamps have a minimum CRI of 80. Energy Star certification is an internationally accepted voluntary labelling system for energy efficient products, and while not mandatory for companies to comply with, it will be very important from a marketing perspective.

### Phosphors: Widely used but expensive with low CRI

The shade of light that is emitted from white light LEDs is typically 'tuned' using phosphors, similar to the phosphors that are currently used in fluorescent lights. Cerium doped YAG (yttrium aluminium garnet) phosphors are the most commonly used because they have relatively good efficiency, strong absorption of light from blue LEDs, do not degrade with moisture and are straightforward to manufacture. The main disadvantages are that the patents for this technology are owned by Nichia and OSRAM and the light produced typically has a CRI less than 80 as a result of low output in the red end of the spectrum. This means that while they do not meet the standards for EnergyStar they may still be suitable for applications where high CRI is not required.

### Multichip LED: High CRI with dynamically tuneable colour, but expensive

A multichip-LED system is another method used to tune the colour of the light. Three or four different colour LEDs are combined in the one system to produce white light, which can then be tuned by altering the brightness of each of the individual colours within the module. These give out a very high quality of light but are expensive because of the need for more LEDs per unit. They are useful for applications where light needs to be dynamically tuned and are already used in many decorative lighting applications.

Photonstar LED uses this multi-LED approach in its Chromawhite technology; a sensor in each light actively monitors and adjusts the colour of the light produced so that the colour stays consistent over its lifetime. They can also be programmed to automatically change colour throughout the day to match changes in natural lighting as the sun rises and sets. This type of colour variation is claimed to have numerous health benefits and gives customers much more control over the quality of their light.

### **Quantum dots: Efficient and flexible, but still in development**

Quantum dots are another option for tuning the colour of LED lights. Quantum dots are small particles of a semiconductor material such as cadmium selenide that emit light when excited with an electric current or by another light source. They can be tuned to absorb or emit specific wavelengths by adjusting their composition and dimensions. The ability to tune the colour of light emitted means that LEDs that use this technology can have a higher CRI than phosphor-based LEDs, which typically lack the red component of the spectrum.

### **Cadmium dots tried and tested, but potentially harmful to health**

NASDAQ-listed Revolution Lighting Technologies (formerly Nexxus Lighting) in partnership with MIT spin-off QD Vision launched bulbs containing cadmium-based quantum dots in 2010. They have a high CRI of 90 and were more efficient than similar phosphor-based, LEDs. However, cadmium is a toxic and heavily regulated substance, which increases the cost of manufacturing and disposal as well as potentially being harmful to health.

### **Growth opportunity for cadmium-free quantum dots**

The only company that can currently make cadmium-free quantum dots in large quantities is UK-based Nanoco. In August 2011 it signed an initial joint development agreement with OSRAM, which was followed up with an additional development agreement in October 2012. Its quantum dots have not been released in a commercial general lighting LED product yet, but the signing of the follow-on development agreement indicates that the technology has potential and if commercially viable could transform Nanoco and the LED lighting industry.

### **OLED: The next, next big thing**

LEDs are the first stage of the lighting revolution; the next stage is organic LEDs (OLEDs), which are LEDs formed from organic compounds rather than semiconductor crystals. OLEDs are still in development for general lighting purposes but are currently commonly being used for TV, monitor and smartphone displays. They are six or seven years off being widely used in general lighting and are likely to be used in more decorative applications rather than for general lighting purposes because of their generally lower efficiency and shorter lifetime.

### **OLEDs: Lower efficiency and shorter lifetime**

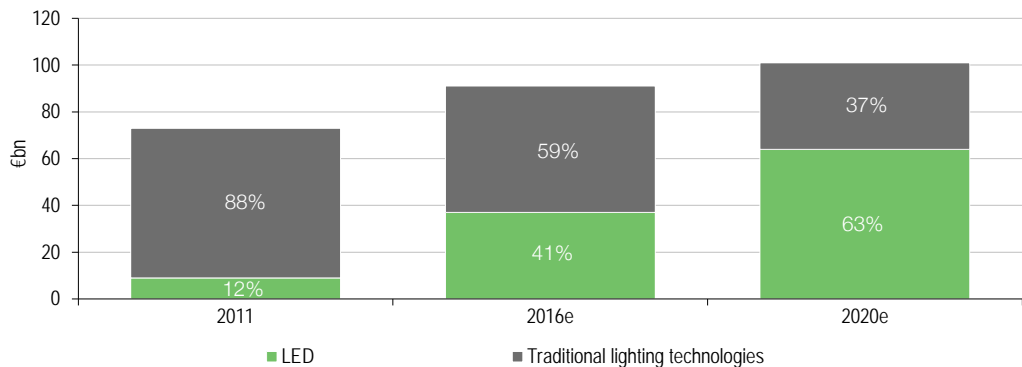
Although the technology is still relatively immature, Philips has already released an OLED light panel branded the Lumiblade OLED Panel, which is intended for general light purposes. It has an estimated lifetime of 10,000 hours, outputs 120 lumens of light (compared to a 40W traditional incandescent, which outputs approximately 400 lumens) and has an efficacy of 16.7 lm/W compared to 100+ for some of the highest-performing LED lights. The performance is clearly somewhat behind that of standard LED technology, but it also does have some benefits: it offers good colour quality and operates 'cold' meaning there is no requirement for a heatsink. It also emits a softer, glare-free light because it is spread over a wider area. These qualities make it suitable for decorative lighting, and the range of uses will increase as the technology improves, but the market share for these types of lights will continue to be relatively small for the next few years because of their lower efficiency and shorter lifetime.

## Market outlook

### 33% CAGR with €100bn potential market

The total lighting market (including backlighting, automotive and general lighting) is currently worth €73bn and is expected to grow to over €100bn by 2020 (5% CAGR). General lighting is where most of the growth opportunity lies, since LED penetration is currently relatively low and the market segment is the largest of the three (75% of the total market in 2011). LEDs currently have a small (12%/€9bn) but growing share of that market and are expected to see c 33% compound growth over the next three years.<sup>3</sup> Underlying this growth rate is the assumption that residential lighting (the largest end market within general lighting) will adopt LED lighting.

**Exhibit 10: LED vs traditional lighting market size**



Source: McKinsey, "Lighting the way: Perspectives on the global market"

### Different lights for different applications

The general lighting segment can then be divided into seven different sub-sections, each with different requirements and characteristics.

**Exhibit 11: General lighting sub-segments (ordered from largest to smallest market size)**

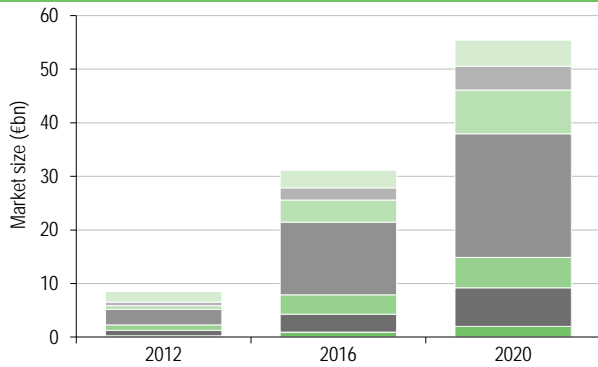
Sub-sector	Description
Residential	This is the largest potential market within general lighting but is also the most cost sensitive. It will be more difficult for LEDs to displace traditional lighting technologies such as CFLs and halogen downlights in the short term because of their comparatively higher initial cost.
Office	In many offices the owner of the building does not pay utility or maintenance bills so there is little incentive for them to upgrade the lighting systems. This has meant that the LED uptake has been relatively subdued.
Outdoor	A large portion of the outdoor market is made up of street lighting and outdoor lighting provided by government and local authorities; therefore this segment is exposed to government spending policy more than the other segments. LEDs are already being used for street lighting in numerous places but local authorities are unlikely to make significant capital investments until their existing lighting infrastructure reaches the end of its useful life.
Retail	Colour quality is the most important aspect for this sector; if the products being sold do not look good under the light then it is unlikely that shop owners would choose to purchase them. Market penetration is currently relatively low but expected to grow at 38.5% a year until 2020.
Hospitality	Long lifetime and good quality light is important in this sector. A long lifetime reduces maintenance costs, and energy efficiency reduces energy bills. The penetration within this sector is already quite high because of the long-term cost benefits.
Industrial	Cost of ownership is key for the industrial sector. The quality of light is less important and therefore there has been little movement away from linear fluorescents, which, while they give out a relatively poor quality of light, are still cheaper overall than LEDs. This will change as LEDs become more efficient so this segment is expected to grow the fastest at 37.4% CAGR to 2020 but will remain the smallest of all the segments.
Architectural	Market penetration for LEDs is already quite high because of the ability to dynamically change the colour and their high durability. Estimated CAGR of 14% to 2020 but comparatively small market size.

Source: Edison Investment Research/McKinsey

<sup>3</sup> McKinsey, "Lighting the way: Perspectives on the global lighting market"

Exhibit 12 shows the current market size and market penetration for each application and how it will change between now and 2020. Residential is the largest segment and currently has low market penetration and therefore one of the highest expected growth rates over the next three years. Architectural uses have already seen strong adoption and therefore the growth rate is one of the lowest among all the segments.

**Exhibit 12: LED market size and penetration in general lighting market 2012 to 2020**



Sub-segment	CAGR 2012-16	CAGR 2016-20
Residential	56%	14%
Office	49%	22%
Outdoor	56%	18%
Retail	54%	12%
Hospitality	44%	18%
Industrial	47%	20%
Architectural	16%	10%

Source: McKinsey, "Lighting the way: Perspectives on the global market"

### Longer life results in a decline in the replacement market

Each sub-segment can also be divided into new installations and replacements. Currently the replacement market for light sources is valued at €8.6bn, with this projected to fall to €7.1bn by 2020 as a result of the longer lifetime of LED lights. Despite the decline in overall market size, the LED component of this is expected to increase from €0.8bn currently to €4.2bn by 2020. The increase in the new installation LED market should compensate for the decline in the replacement market until the market matures.

The market size for new installation LED light sources is currently €2.6bn, but is expected to increase to €9.2bn by 2020. This movement in value from replacement to new installation means that LED lighting companies will need to develop new sales channels such as construction companies and architects in order to access the new installation market.

**Exhibit 13: LED vs traditional lighting market size – light sources only**

Light source type	2012 (€bn)	2020e (€bn)
Replacement – LED	0.8	4.2
Replacement – other	7.8	2.9
New – LED	2.6	9.2
New – other	2.5	1.2

Source: McKinsey, "Lighting the way: Perspectives on the global market"

### Value chain revenue share

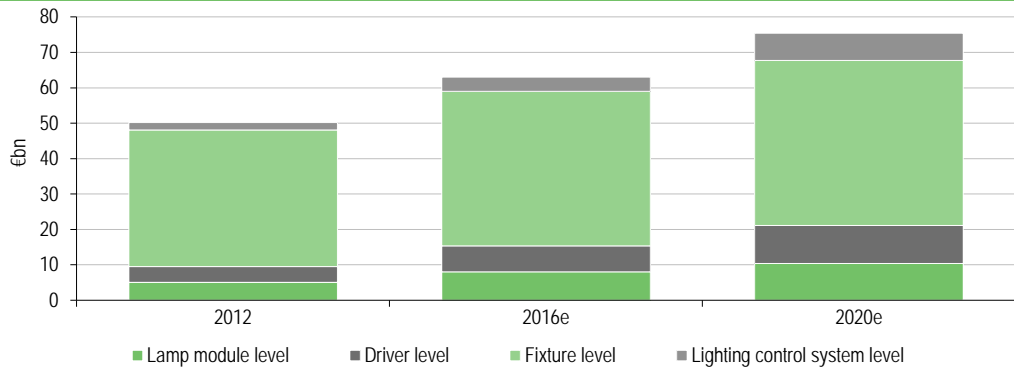
The following sections break the market down into revenue share for different parts of the value chain, and then split by geography.

#### Fixture manufacturers take the largest share

Breaking the market into each of the components levels (Exhibit 14), it is apparent that the fixtures and fittings segment is the largest, but the driver and lighting control system levels are growing the fastest at 12% and 18% CAGR respectively to 2020. The driver and control systems are often designed and manufactured by the same companies that develop the fixtures and fittings and therefore they can take advantage of the growth potential in the control systems segment as well as the fixtures and fittings.



**Exhibit 14: Value chain revenue share (general lighting market)**



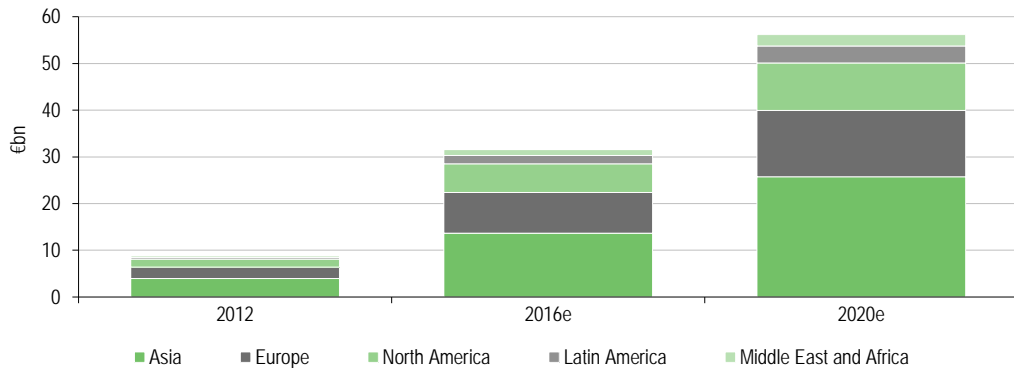
Source: McKinsey, "Lighting the way: Perspectives on the global market"

### Asia leads the way

Exhibit 15 shows the LED market size from 2012 to 2020 split by geography. Asia is leading the way mainly as a result of the push for LED lighting in China. LED lighting is a key strategic technology for the Chinese government so external companies may struggle to capitalise fully on this opportunity.

Though the Western European, North American and Asian markets present the most obvious opportunities for the companies featured in this report, the Latin American and the Middle East and African markets should not be ignored as they are expected to exhibit the fastest growth, albeit from a low base.

**Exhibit 15: LED general lighting market size – geographical split**



Source: McKinsey & Company

## Impact on the value chain

### The value chain

Exhibit 16 shows the approximate revenue of some of the key players (>€50m revenue) in the LED value chain. The value chain becomes more fragmented nearer the end user as a result of the many different requirements for the different applications. Samsung and GE are also key suppliers of LED lighting, but their lighting revenues are not disclosed separately. As a rough guide for GE, management disclosed in 2010 that the lighting division generated ~\$3bn, 10% of which was related to LED products. No figures are available for Samsung. Figures for the companies disclosed in the table below are from the most recently reported period except for Nichia, which is a private company and sales figures were only available for 2010.

Company name	Equipment manufacturers	Wafer suppliers	LEDS (wafers and packages)	Lighting modules	Lamps & lighting systems
AIXTRON <sup>5</sup>	€0.46bn				
Veeco Instruments <sup>5</sup>	€0.63bn <sup>3</sup>				
Rubicon Technology		€0.05bn <sup>3</sup>			
Nichia			€2.89bn <sup>1</sup>		
Seoul Semiconductor			€0.59bn <sup>6</sup>		
EpiStar			€0.50bn <sup>8</sup>		
Cree			€0.58bn <sup>3</sup>	€ 0.25bn <sup>2,3</sup>	
GE Lighting				€0.3bn <sup>7</sup>	
OSRAM				€1.8bn	
Philips				€1.2bn	
Samsung LED				Not disclosed	
Zumtobel				€0.05bn	€0.1bn
Dialight <sup>4</sup>					€0.1bn

Source: Edison Investment Research, Company accounts. Note:

1. LED specific revenue is not available. This figure is the total revenue for the Lighting Products segment.
2. Includes both traditional and LED lighting
3. Figures were disclosed in US\$. An exchange rate of €0.76/US\$ has been used.
4. Figures were disclosed in UK pounds. An exchange rate of £0.83/€ has been used.
5. Revenue for the complete business – not LED specific.
6. Figure was disclosed in South Korean won. An exchange rate of KRW1,444.6/€ has been used.
7. Estimate of LED revenue from 2010.
8. Figures were disclosed in Taiwan dollars. An exchange rate of TW\$39.82/€ has been used.

### The top two MOCVD equipment suppliers control over 90% of the market

AIXTRON and Veeco operate in a very concentrated market and although their deposition equipment is used for a range of applications, including power electronics, high frequency transistors and solar cells, the predominant revenue source in the last few years has been from the LED industry. With such a large combined market share, both companies are highly affected by changes in the overall LED market. This is demonstrated in Exhibit 17, which shows the revenue changes for AIXTRON and Veeco, which together account for over 90% of the MOCVD equipment market.

### Overcapacity leads to inventory write-downs

Both AIXTRON and Veeco experienced a large increase in revenue followed by a rapid decline as a result of Chinese government investment in LED lighting in 2009-10. They are still suffering, with AIXTRON writing down inventory by \$43m in Q113 after a \$51.5m write-down in Q312 and Veeco unable to publish its FY12 annual results due to a review of accounting policies in relation to revenue recognition.

### Industry utilisation rates starting to recover

Both AIXTRON and Veeco are now waiting for the wider uptake of LED lighting technologies, which will encourage further demand for their equipment and they are indicating they are starting to see signs of recovery, with utilisation rates for some customers nearing 100%. However, they are unlikely to see the same level of revenue growth as they experienced in 2010-11. Both manufacturers produce MOCVD equipment that is capable of being used with all the relevant substrates, so they will benefit whichever substrate choice gains market share.

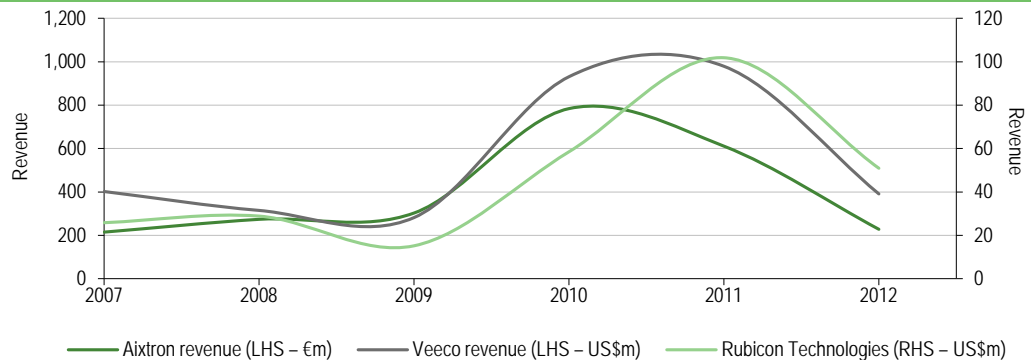
### Barriers to entry could mean AIXTRON and Veeco gain most from LED uptake

With their dominance of the MOCVD market and barriers to entry provided for by the technical expertise required to design and build that type of equipment, AIXTRON and Veeco are less exposed to competition than other parts of the supply chain. This should mean that, although they are struggling at the moment, when LED uptake really takes off they could be two of the greatest beneficiaries.

### Strong balance sheets, but threat of delisting for Veeco

AIXTRON and Veeco both have strong balance sheets, with last reported net cash of €220m and \$568m for AIXTRON and Veeco respectively. However, Veeco has not yet reported its Q412 results and has not met the SEC filing deadline. It is therefore required to attend a hearing with a NASDAQ panel to maintain its listed status, and there is a risk the panel will decide to force Veeco to delist.

**Exhibit 17: LED revenue trend**



Source: Edison Investment Research

### Substrate providers act as a bellwether

Substrate manufacturers such as Rubicon Technology have also seen a surge in demand followed by an equally rapid decline (see Exhibit 17). However, they are likely to see the recovery first since there is capacity in the industry to produce more LEDs without the need for new equipment. As with LED chip manufacture, material suppliers are experiencing pricing pressure as a result of overcapacity created during the LED backlighting boom. In addition, many firms, particularly in China, have purchased equipment to manufacture sapphire substrates, so although most of the current excess capacity is a result of incumbents over-investing, if the new entrants can start producing at scale it may have an additional negative impact on revenues and margins.

### GaN-on-Si wafer suppliers have a significant growth opportunity

The impact of LED uptake on companies that enable GaN-on-silicon manufacture will be even more pronounced since they are starting from a much lower base level and, thanks to silicon's lower cost, could potentially dominate the market, if the technical problems of manufacturing GaN-on-silicon are solved. Numerous companies are developing GaN-on-Si technology, such as Translucent Inc.,

which is developing a 'virtual GaN' silicon-based wafer technology to simplify and improve the yield of GaN-on-silicon manufacture. Its technology offers significant cost reductions but is yet to be used in large-scale production so its success in the market place is yet to be tested. Azzurro Semiconductors and EpiGaN are also starting to commercialise GaN-on-silicon wafer technology. EpiGaN has started volume production and Azzurro has licensed its technology to OSRAM. Plessey, a privately owned UK company, is also producing GaN based LEDs on 6" silicon wafers with R&D efforts in moving to 8" wafers.

### **Consolidation needed for chip manufacturers**

There are now numerous LED wafer manufacturers throughout China as a result of the significant government investments and incentives. Some estimates have placed the number of firms manufacturing LEDs at 4,000,<sup>4</sup> many of which are small players that are struggling to compete. The fierce competition is helping to lower the cost of LEDs and therefore encourage LED uptake, but in many cases the quality of the lighting being produced is poor, which may in the long run discourage and/or delay adoption. The industry is highly fragmented and probably over-invested, and therefore further consolidation and asset write-downs will be needed for the industry to reach sustainable profitability.

### **Backlighting LEDs used for general lighting**

Some of the big firms that have been developing LEDs for backlighting purposes, such as Samsung and LG, are now starting to move their focus onto general lighting. The scale and expertise they gained in producing backlighting LEDs means they can produce LEDs at a price point that others may struggle to match. Although backlighting LEDs tend to be lower power, if the price point is attractive enough, multiple LEDs can be used in place of fewer higher-power LEDs to achieve the same effect.

### **Fixture manufacturers take the largest share**

Fragmentation in the fixtures market provides opportunities for differentiation among companies and protects them from the fierce competition seen at the LED chip level. Numerous companies are already starting to exploit this: Dialight has shown strong revenue growth as a result of its focus on LED products for hazardous environments, LPA Group has done similarly in the railway industry, Vitec in the broadcast and photography industry, FW Thorpe in industrial and Dr. Hönle in UV illumination.

### **Greatest opportunity in residential fixtures market**

The residential lighting fixtures market is the largest by size and therefore presents one of the biggest opportunities for LED lighting companies. PhotonStar LED is one of the companies attempting to take advantage of this opportunity and it has gained ground by obtaining a rolling one-year exclusive supply agreement with a major UK house builder. Under the contract, PhotonStar will supply LED lighting fixtures for all of the developer's new homes.

### **New thinking needed by existing players**

Three of the largest traditional lighting companies are GE, Philips and OSRAM, with a combined market share of 50%.<sup>5</sup> OSRAM is currently owned by Siemens but is in the process of being spun-off. The reason management has given for this is that with the longer lifetime of LED lighting technologies, value is shifting from components to complete solutions and therefore a smaller, more focused and adaptable company is needed to manage the change in business model.

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<sup>4</sup> Reuters Analysis: Failing firms cloud China's LED lighting vision (7 February 2013)

<sup>5</sup> Cleantech group LLC, Market Insight: Advanced Lighting March 2011.

Philips and GE have taken the investment approach to solving this problem, and started acquiring lighting solutions companies from 2005 onwards when they first identified this trend. These three big players have a significant advantage with their well-established sales channels so should remain dominant, but their market share and margins are likely to be eroded by increased competition from new players that are not handicapped by the historic focus on traditional lighting technology such as incandescent and fluorescent lighting.

### **Control systems is the fastest-growing sub-segment with 18% CAGR**

With the 'internet of things' coming closer to reality and the ability to control every aspect of a light's characteristics, control systems are another area of growth for lighting companies. Many lighting companies develop the controls internally, but purchase the micro-controllers and drivers from traditional electronic component manufacturers. This end of the market is very fragmented so it is difficult to identify any one company, at this stage, that will benefit significantly from the growth in control systems, but it will become important for fixture companies to develop expertise in this area.

## Drivers for LED adoption

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### Government policy

#### EU bans all incandescents...except for the long list of exceptions

The EU has banned all traditional inefficient incandescent bulbs for domestic use. However, the ban does not include bulbs with reflective surfaces, such as spotlights and halogen downlights, and some manufacturers have circumvented the ban by classifying their incandescent lights as industrial bulbs, which are also exempt. The effectiveness of the ban is therefore questionable and is unlikely, in its present form, to drive the uptake of LEDs in Europe.

#### China commits to LED lighting

China has banned 100W incandescent bulbs and is planning to ban 60W incandescent bulbs in October 2014. The Chinese government has also introduced subsidies and spending policies to encourage the uptake of LED lighting across the country. Their objective is for 30% of lighting to be LED-based by 2015, replacing up to 5bn incandescent bulbs. Their motivation for this investment is to temper China's growing energy requirements and to develop expertise in LED lighting in order to become the largest global supplier of LED light sources.

#### Effectiveness of US ban reduced through lack of funding for enforcement

In 2007 the then US President George W Bush signed the Energy Independence and Security Act (EISA), Section 321 of which required that lamps had to be 25-30% more efficient, starting with 100W bulbs in January 2012 and continuing in stages until 2014. A second phase of the act requires light bulbs to be 45% more efficient by 2020. While the act does not explicitly ban incandescent or halogen light sources, it does so implicitly by setting the efficiency requirements at levels that are difficult to meet without recourse to CFLs or LEDs. Although an attempt by Republicans in July 2011 to reverse this legislation (The Better Use of Light-Bulbs Act) was unsuccessful, in December 2011, Republicans added a provision to the 2012 budget, removing any funding for enforcing the standards. While this amendment enabled consumers to make their own choices on light bulbs without government intervention, in reality US light bulb manufacturers had already changed their production lines to meet the new standards. In parallel, individual states are passing their own legislation. California passed legislation phasing out inefficient 100W bulbs from January 2011, a year earlier than required by the original EISA legislation.

#### Government legislation is important but not the key factor

Although government legislation is a significant push towards energy efficient technology there are enough exceptions to the legislation and sufficient alternative energy saving technologies that legislation by itself will not be sufficient to drive the uptake of LEDs.

#### Government spending

Government subsidies on LED lighting would increase the speed of uptake, but are unlikely to be a major driver given the pressure on government budgets globally. Government expenditure presents an opportunity for companies that choose to focus on areas such as street lighting and lighting of schools and hospitals, but this is a relatively small share of the total market.

#### Manufacturers

Currently there is an oversupply of LED chips, which is depressing prices. This is assisting uptake, but hurting margins for the LED light source manufacturers. As the industry consolidates,

specifically within China, more business is likely to be directed to the large global players, which should support their margins and help them achieve a more economic level of production.

Margin improvements for LED manufacturers are likely to come from cost reductions and increased efficiencies rather than price increases. This means that companies further along the value chain will not be adversely affected by price increases as the industry consolidates and, in fact, are likely to experience cost reductions as a result of the increasing performance of new LEDs.

## **End user**

### **Technological**

There are many alternatives to LED lighting and the most suitable option will vary significantly depending on application. LED is the best when it comes to efficiency, but the colour quality, especially for cheaper lighting, is not yet as good as traditional incandescent bulbs. These problems are being solved and there are few, if any, significant technological reasons why LED lighting cannot be used in most applications. The main issue, therefore, is cost.

### **Cost**

In the residential market it is estimated that the total cost of ownership for LED lights is already lower than that for traditional incandescent and halogen bulbs (see Exhibit 18), but market penetration remains low because of the high initial cost. This barrier to uptake will reduce as efficiencies and yield improvements reduce the initial cost, but LEDs are unlikely to ever be as cheap as traditional incandescents and therefore a change in customer perception and understanding of reduced lifetime costs will be as important as a reduction in price.

### **More awareness of cost of ownership required**

Residential users currently perceive lighting to be a relatively inexpensive commodity and do not dedicate too much time researching or selecting the type of lighting that they use. Until awareness of LED lighting and its benefits increases, the residential user is therefore unlikely to change their habits unless either forced to through banning of all incandescents, including reflectors, or widespread advertising. Individual companies have launched advertising campaigns encouraging the sale of their own individual products, and LED bulbs are now widely available, but many people still appear to be put off by LED bulbs' high initial cost compared to alternatives.

### **Disappointment from early adopters**

The 85% of people who responded to the 2011 Havells-Sylvania survey stating that they were unhappy with the quality of light from their LED lamps and would not be buying them again illustrates the problem with the cost and quality trade-off. Part of the reason for the low-quality light is consumers choosing lower-cost, lower-quality lights rather than it being a fundamental problem with the technology itself, but the risk is that these lower-quality lights will put consumers off and slow the uptake of LED lighting.

### **Energy Star sets benchmark to help improve quality**

The Energy Star labelling is important in guiding consumers to better-quality lights, and the industry appears to have learned from past mistakes with CFLs where manufacturers promised too much and delivered too little. Energy Star has set a minimum level of requirements for colour quality, lifetime and efficiency that must be met before LED products can use their label. So far relatively few LED light bulbs have been certified, partially because of the long test time (approximately nine months), but this is expected to increase relatively quickly as more bulbs come to market.

**Exhibit 18: Comparison of different lighting types**

	Efficiency lumen/watt	Typical lifetime (hours)	40W equivalent	Price tag	Cost of ownership <sup>1</sup>	Pros	Cons
Incandescent	8-12	1,000	40W	£0.65	£332.50	Familiar, dimmable, low initial purchase cost CRI >95	Emits heat and UV, fragile, being phased out in many jurisdictions worldwide due to low efficiency, low useful life
Halogen	15-25	2,000	28W	£2.45	£271.25	Similar output to incandescent, dimmable CRI >95	Emits heat and UV, fragile, although more efficient than incandescent – still relatively inefficient
CFL (not dimmable)	45-65	4,000-8,000	8W	£2.99	£84.92	Meets government legislation, high intensity lights available, energy efficient with relatively low purchase cost CRI ~80	Emits UV, fragile, contains mercury, disposal issues, incompatible with dimmers, "cold" light, slow warm-up
Cold Compact Fluorescence	40-60	15,000-20,000	8W	£9.18	£86.23	Meets government legislation, dimmable (although not to 0%), relatively long lifetime, instant turn on The long lifetime and energy efficiency means CCFLs are commonly used in backlighting for LCD monitors and TVs CRI ~80	Contains mercury Larger form factor than LED alternatives
Induction lighting	60-90	60,000-100,000	5W	£16.51	£58.91	Very long lifetime Natural colour High brightness Energy efficient The high power light output, long life and energy efficiency means induction lighting is typically used in outdoor and large open spaces CRI ~80	Contains mercury (in solid form so easier to extract) Can produce RF interference Higher efficiency is only obtained for higher power lighting, large form factor Larger form factor means induction lights are not generally suitable for residential use
High Intensity discharge	60-100	12,000-24,000	5W	£17.19	£85.24	High intensity light source – good for lighting large areas and therefore commonly used in lighting large public areas, roadways and car headlamps CRI varies depending on type of HID lamp. Range from ~44 to 70	Relatively poor efficiency Produce significant UV radiation, which requires UV-blocking filters to be built into the lamp.
LED Retrofit (dimmable)	52-67	25,000	6W	£10.24 <sup>a</sup> £9.67 <sup>b</sup>	£87.98 <sup>a</sup> £64.34 <sup>b</sup>	Meets government legislation Very efficient Multi-LED systems can dynamically change colour of light CRI 70-90+ Wide range of form factors are possible eg strip, spot, bulb.	Some incompatible with dimmers or emitting "cold" light. Difficult to produce high intensity light

Source: Edison Investment Research. Note:

- 1) Over 50,000 hours of operation and 15p per kWh electricity cost.
- a) Philips 9W B22 A60 Warm white LED light bulb (£10.24 from Amazon.co.uk).
- b) LEDON GLS A60 6W LED light bulb (£9.67 from www.lyco.co.uk).



### **Construction companies and builders are key distribution channel**

Installation of new lighting systems in the residential market is the largest single market opportunity. To access this market, companies will need to be chosen by construction companies, builders and renovators. The motivations for construction companies, however, are not always aligned with those of the end user. Construction companies want to produce homes that meet the homeowner's requirements but for minimal cost. Currently LED lighting is not top of a home buyer's wish list and therefore given its higher cost, construction companies are unlikely to choose it above cheap, more traditional lighting technologies such as halogen downlights and CFLs. This will change as residential users' perceptions change and use of LED lighting becomes more common.

### **Regulations encourage construction companies to build efficient homes**

Building regulations, in Europe are least, are also starting to require construction companies to meet certain energy requirements for their new-builds, which is encouraging the use of LED, but this is still not widespread globally and does not mandate the use of LED lighting. Despite this, construction companies are still a very important distribution channel for LED companies that want to exploit the residential market. PhotonStar LED is one of the companies that has successfully started to access this distribution channel by signing an exclusive supply agreement with a major UK house builder.

## Company profiles

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# AIXTRON

## Key equipment supplier to the LED industry

With its large share of the MOCVD (metal-organic chemical vapour phase deposition) market, AIXTRON saw its revenues increase dramatically in 2010, but then fall in 2011 and 2012 when excess capacity in the LED industry started to take effect. As the LED chip industry consolidates, technologies improve and uptake of LED lighting accelerates, AIXTRON has the potential to improve profitability.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
●					
<b>% of revenue generated from LED market</b>					
0-25%	25-50%	50-75%	75-100%		

Source: Edison Investment Research

### Company description

AIXTRON develops and manufactures deposition systems for the global semiconductor industry. They are used to manufacture electronic and opto-electronic components based on compound, silicon and organic semiconductor materials and are one of the critical tools used in LED production. AIXTRON and its main competitor Veeco account for more than 90% of MOCVD reactor sales with an approximately even split of market share between them.

### Product focus and strategy

Deposition systems are used in a wide range of applications such as the manufacture of LEDs, laser diodes, solar cells, high-frequency transistors and power electronics. Although there are a wide variety of applications, the most significant potential market is for LEDs due to the high volume of devices that are expected to be required if widely adopted. The AIX G5+ planetary reactor is one of AIXTRON's key products for future growth as it is dedicated to the production of GaN-on-Si LEDs, a significant growth area for the industry and it has won a manufacturing award from *Compound Semiconductor* magazine for its innovative technology. Sales of spare parts and servicing of equipment also contributes significantly to revenue, with 27% of revenue in Q113 being from servicing and spare parts.

### Consensus estimates

Year End	Revenue (€m)	PBT (€m)	EPS (€)	DPS (c)	P/E (x)	Yield (%)
12/11	610.9	115.0	0.79	0.25	15.8	2.0
12/12	227.8	(129.9)	(1.44)	0.00	N/A	N/A
12/13e	239.5	(89.5)	(0.86)	0.00	N/A	N/A
12/14e	370.5	36.4	0.21	0.16	59.6	1.3

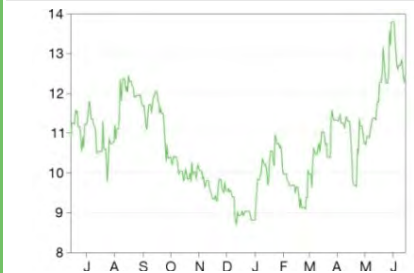
Source: Thomson Reuters

### Technology

19 June 2013

**Price** €12.52  
**Market cap** €1,279m

### Share price graph



### Share details

Code	AIXX
Listing	Frankfurt
Shares in issue	102.17m
Net cash (€m) as at March 2013	219.9

### Business description

AIXTRON develops and manufactures deposition systems for the global semiconductor industry. These are used to build electronic and opto-electronic components based on compound, silicon and organic semiconductor materials.

### Bull

- Dominant market share.
- Preparing for the next stage of the LED revolution with equipment to manufacture OLEDs.
- MOCVD market is showing early signs of recovery.

### Bear

- Excess capacity in LED market has caused a slump in demand, which may not recover to 2010 levels.
- MOCVD tool market is becoming more competitive.
- Second-hand equipment may prevent an increase in demand as market recovers.

### Analysts

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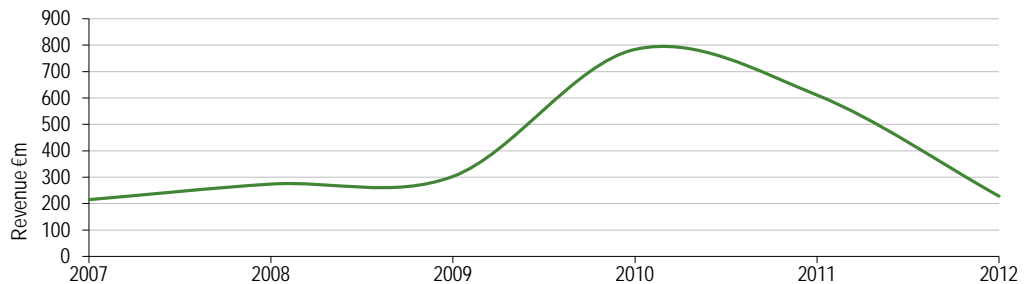
## Preparing for OLEDs

AIXTRON also produces equipment for the mass production of OLEDs, which use an organic vapour phase deposition process rather than MOCVD. The OLED market is still in the early stages, especially for general lighting purposes, so this is a long-term opportunity. However, it could be valuable, with management expecting it to drive global equipment sales of \$0.5-1.0bn a year in six or seven years.

## Financials

AIXTRON experienced a significant increase in revenues in 2010 as a result of the uptake of LEDs used for backlighting and a significant investment in LED technology from the Chinese government. This investment led to overcapacity in the industry and a significant reduction in demand in 2011 and 2012 (see Exhibit 1). Management expects revenue to recover as LED becomes more widely adopted for general lighting. The recovery is slower than management had expected, with a €51.5m inventory write-down in Q312 and an additional €43m write-down in Q113 resulting in a €48m gross loss. Order intake in Q113 was also down 16% sequentially and 5% year-on-year, indicating that revenue may still fall further. Sales in non-LED segments particularly sub 30nm DRAM and power electronics were encouraging but not sufficient to compensate for sluggish LED sales. Net cash was €219.9m as at 31 March 2013, with no borrowings.

**Exhibit 1: AIXTRON revenue trend**



Source: AIXTRON

Prospects depend on the timing of the upswing in demand for general lighting LEDs and the level of utilisation of existing equipment. Management has reported that utilisation rates are recovering, with some customers reaching the 90% utilisation level where they should start thinking about investing in new equipment. However, industry-wide utilisation rates are lower, although also increasing, and given the fragmentation and complex dynamics in the market, specifically within China, it is hard to predict and quantify when increased utilisation rates will translate into higher sales.

# Cree

## Breaking the \$10 barrier

Cree is one of the LED industry technical leaders and has a strong history of innovation. Like others in the industry, it is experiencing the shift in value from LED chips to fixtures, but its vertically integrated business model should enable it to benefit from all aspects of industry growth.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
	●	●	●	●	●

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
			●

Source: Edison Investment Research

## Company description

Cree is one of the leading global players in the LED lighting industry. It operates in each stage of the value chain from producing LED wafers to complete lighting systems. Lighting systems are designed for indoor and outdoor applications with a focus on the commercial and industrial markets. Cree's business is split into three segments: LED products (56% of Q313 revenue), lighting products (37%) and power and RF products (7%). The LED products segment includes wafers, LED chips and other LED components, and the lighting products segment includes complete lighting systems (both traditional and LED). The power and RF products segment are SiC-based semiconductor devices primarily for the wireless communications industry.

## Product focus and strategy

All of Cree's LED products are based on silicon carbide substrates, for which it owns the patents. Silicon carbide (SiC) produces LEDs with fewer defects and higher efficiency than sapphire and silicon and as a result its devices are currently leaders in terms of performance.

Despite the commercial and industrial markets focus, in March 2013 the lighting products division released a 40W replacement LED bulb for the residential lighting market that retails for less than the psychologically important \$10 barrier.

### Consensus estimates

Year End	Revenue (\$m)	PBT (\$m)	EPS (\$)	DPS (\$)	P/E (x)	Yield (%)
06/11	987.6	178.2	1.35	0.00	46.2	N/A
06/12	1,164.7	47.6	0.39	0.00	159.9	N/A
06/13e	1,386.0	185.0	0.80	0.00	77.9	N/A
06/14e	1,660.9	271.0	1.33	0.00	46.9	N/A

Source: Thomson Reuters

## Technology

19 June 2013

Price **\$62.35**  
Market cap **\$7bn**

### Share price graph



### Share details

Code	CREE
Listing	NASDAQ
Shares in issue	116.65m
Net cash (\$m) as at March 2013	937.1

### Business description

Cree is one of the largest LED lighting manufacturers in the world and produces a wide range of products across the LED lighting value chain. It also produces power and RF products, which contribute approximately 6% to revenue.

### Bull

- Strong existing supply chain and sales channels.
- Extensive patent portfolio.
- High level of technical expertise.

### Bear

- Silicon-based products may undercut SiC-based device pricing.
- Highly competitive market.
- High growth rate priced in.

### Analysts

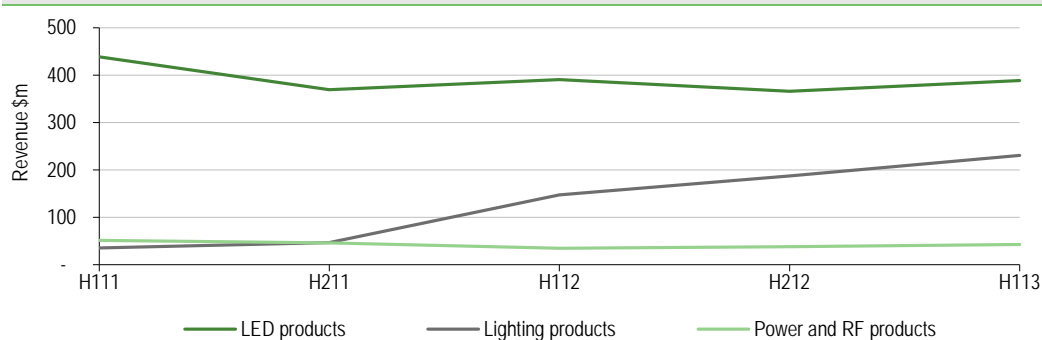
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It is still early days for silicon-based LEDs, but there is a risk that they will ultimately undercut SiC-based device pricing given the much lower substrate cost. This is unlikely to happen within the next 12-24 months, if ever, and silicon-based devices will always struggle to match the performance of SiC given its inherent limitations. We would therefore expect Cree to remain a strong competitor, particularly in the high-performance LED space. Cree has also mitigated this risk through conducting research into other substrates and would therefore be willing to move to other substrates if they prove to have a commercial advantage.

## Financials

**Exhibit 1: Segmental revenue**



Source: Cree Inc Annual report and accounts

Like others in the industry, Cree is experiencing a shift in value derived from LED chips to value derived from LED lighting fixtures. Exhibit 2 shows the segmental revenue for Cree from H111 to Q313. Although the lighting products segment includes both traditional and LED lighting, most of the increase has been driven by LED lighting. It is clear that revenue from lighting products is increasing while revenue from LED products is falling, and this trend is likely to continue.

### Margins accentuate shift in value

The shift in value is accentuated by falling margins for chips and wafers and increasing margins for complete systems (see Exhibit 2). Falling LED product margins have been caused by competition pushing down prices, primarily as a result of huge Chinese government investment and incentives encouraging LED start-ups. Margins are starting to recover as the excess supply dissipates and the industry consolidates. Q313 gross margins for LED products increased to 43.8% up from 38.3% in Q312 and 41.1% in Q2. The overall gross margin fell slightly quarter-on-quarter, due to slightly lower margins in the lighting products and power and RF segments, but management expects group gross margins to improve again in Q4. This reduction in margins was the primary reason for the significant fall in profit in FY12, along with an increase in R&D spend. Net cash at March 2013 was \$937.1m with no debt.

**Exhibit 2: Segmental gross margins**

	FY10	FY11	FY12	Q1-Q313
LED products	51%	46%	38%	42%
Lighting products	28%	29%	31%	32%

Source: Company accounts

# Dialight

## Defensible niche

Having made the sound strategic decision to target high-growth and defensible niches, Dialight is now enviably positioned to take advantage of the LED revolution. We believe the strong balance sheet, management's focused approach and cutting-edge products will enable the group to grow significantly above market average for a sustained period, making the shares' current valuation undemanding.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
<b>% of revenue generated from LED market</b>					
0-25%	25-50%	50-75%	75-100%		

Source: Edison Investment Research

## Company description

Dialight designs, manufactures and sells LED-based industrial lighting (the lighting division accounted for 39.5% of FY12 revenues), LED-based traffic signals and obstruction signals (signals division: 41.7%) and LED indication components (components division: 18.7%).

## Product focus and strategy

Dialight's business is exclusively based on LEDs, as management understood the potential for LEDs in lighting early on, and decided to focus on niche segments while disposing of other non-core activities. Dialight's strategy was to target segments with high barriers to entry where LED technology can deliver significant immediate savings and rapid payback for customers. Such niche markets are the heavy industrial and the hazardous lighting segments, where lighting systems have to withstand onerous conditions and are used non-stop. In addition, maintenance is expensive in these segments, while safety and other regulations require complex (and hence costly) lighting systems, offering higher margins. This strategy is supported by Dialight's history and expertise in electronics and management's strong relationships with high-quality suppliers such as Nichia and Cree.

### Historic financials and estimates

Year End	Revenue (£m)	PBT* (£m)	EPS* (p)	DPS (p)	P/E (x)	Yield (%)
12/11	102.5	18.0	32.1	0.10	36.3	0.8
12/12	115.1	22.1	40.7	0.14	28.6	1.0
12/13e	139.8	28.8	52.5	0.17	22.2	1.3
12/14e	172.9	37.1	68.7	0.21	17.0	1.8

Source: Edison Investment Research, company accounts. Note: \*PBT and EPS are normalised, excluding intangible amortisation, exceptional items and share-based payments.

Industrials

19 June 2013

Price 1,166p  
Market cap £377m

### Share price graph



### Share details

Code	DIA
Listing	LSE
Shares in issue	32.3m
Net cash (£m)	15

### Business description

Dialight designs, manufactures and sells LED lighting fixtures, LED-based traffic and obstruction signals as well as LED indication components. The group currently operates through three divisions: lighting, signals and components.

### Bull

- Operating in a high-growth, defensible niche.
- LED costs and production costs will continue to fall, increasing margins further.
- Strong balance sheet.

### Bear

- The 10-year warranty may result in large costs in the future if lifetime is not as expected.
- Industry will become more competitive as more companies develop LED expertise.
- The components and signals division shows limited growth potential due to the maturity of the market.

### Analyst

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Dialight is covered by the Edison institutional team. Please call Zsolt Mester for more information.

### **Short-term: Lighting to drive strong earnings growth**

A key driver of earnings has been the operational leverage in lighting (combined with its growing sales mix), stemming from the fact that 90% of production costs and 55% of administrative costs are fixed. Our base case forecasts divisional revenues to rise by 50% and contribution margins to increase by 160bps. However, we believe there is upside risk, as the group is capable of achieving higher than expected margins (as in FY12), resulting in enhanced leverage.

### **Medium-term: Potential for further market share gains**

Dialight's products have competitive advantages not only against conventional lighting (due to higher output, a longer lifetime, higher efficiency and easier maintenance), but also against other LED products in industrial lighting (via higher luminous efficiency, wider product range, vertically integrated design/production and a unique warranty offering). As a result, we believe the lighting division can continue to grow faster than both the overall and the LED lighting market and can gain further market share in the hazardous and heavy industrial segments, more than making up for the slow growth in the signals and components divisions.

### **Long-term: Scope for continued profit growth post-FY14**

We think that, in addition to rapid growth in the next two years, Dialight can sustain a high level of profit growth beyond our forecast horizon. While there is clearly uncertainty when looking so far ahead, our scoping estimates outline a scenario suggesting operating profit growth of c 27% pa in 2015-17, with group operating profit potentially reaching £69m by FY17 (implying a 2013 share price of 1,568p).

## **Financials**

The group's rapid growth is expected to be driven by the lighting division (with sales realistically growing by 50% in FY13 and 45% in FY14), while we expect signals and components to grow only modestly in the next few years due to maturity in key markets. June's IMS confirmed the strength in Lighting but weakness in Signals due to the run-off in a large cell phone tower contract, the delay in a major obstruction lighting contract and the decline in US wind market sales. Segmental revenues are therefore likely to be more heavily weighted towards lighting in future (62% of FY14 revenues are expected to be from the lighting division compared to 30% signals and 8% components). Given that the lighting division's revenues and (to an even larger extent) profits are heavily H2 oriented, we expect the group to post more back-end loaded results as the lighting business continues to drive growth. On margins, we expect post-amortisation group operating margin to expand from 17.0% in FY12 to 18.1% in FY13 and to 19.4% in FY14, while our scoping estimates suggest 22.5% is possible by FY17. Dialight's balance sheet remains healthy with a net cash position of £15.0m at end FY12. We forecast net cash to increase to £18.8m in FY13 and then to £26.0m in FY14.

## **Valuation**

On an unadjusted P/E basis, Dialight (at an FY13 P/E of 22.2x) looks expensive given that it is currently trading at a c 35% premium to the FTSE 350 Electronic & Electrical Equipment Index (F3ELTR). However, we believe this is not highly relevant as it does not account for the company's enhanced growth prospects. On an FY13 PEG basis, Dialight trades at a c 25% discount to the F3ELTR index. We believe this discount is unwarranted given Dialight's strong track record, healthy balance sheet, cutting-edge product quality and sustainable long-term growth potential in markets that are in a macroeconomic sweet spot.



# Dr. Hönle

## UV LED technical expert

Dr. Hönle is leading the adoption of UV LEDs in the adhesive, printing and other industries. As the technology improves UV LEDs will be used in more applications and Dr. Hönle is well placed to gain market share in those new and growing markets.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%

Source: Edison Investment Research

## Company description

Dr. Hönle is a leading supplier of industrial UV technology. It is split into three segments: equipment and systems (52.4% of H113 revenues), glass and lamps (24.6%) and adhesives (23%). Applications of the equipment and systems include curing of UV sensitive substances such as adhesives, UV disinfection for the food and beverage industry and sunlight simulation. One of Dr. Hönle's key strengths is the adaptation of products to specific customer requirements, particularly with respect to the spectral output. Headquartered near Munich, two-thirds of its revenues are from exports.

## Product focus and strategy

UV lighting systems are traditionally based around gas-discharge lamps, but LEDs are now offering an alternative. At present UV LEDs are less efficient and have lower UV output than traditional gas-discharge lamps, but have other qualities that make them suitable for use in certain applications: the ability to instantly turn on and off, long life time and compact size. This makes them particularly suitable for curing of UV sensitive adhesives and drying of ink in printers, but the number of applications should grow as the technology improves. Exhibit 1 details the applications for Dr. Hönle's products.

### Consensus estimates

Year End	Revenue (€m)	PBT (€m)	EPS (€)	DPS (€)	P/E (x)	Yield (%)
09/11	67.88	10.8	1.3	0.50	8.5	4.5
09/12	72.09	7.7	0.9	0.50	12.2	4.5
09/13e	75.80	7.7	0.8	0.50	13.8	4.5
09/14e	85.30	10.9	1.2	0.60	9.2	5.5

Source: Thomson Reuters

Industrials

19 June 2013

Price **€11.00**  
Market cap **€61m**

### Share price graph



### Share details

Code	HN
Listing	XETRA
Shares in issue	5.51m
Net debt (€m) as at March 2013	5.9

### Business description

Dr. Hönle produces a range of UV products including equipment, lamps and adhesives. Most are based on traditional gas-discharge lamps, but LEDs are being used for an increasing number of applications.

### Bull

- Industry leader in industrial UV equipment.
- UV adhesives are increasingly being used in consumer electronics, including smartphones.
- Strong position to exploit UV LED developments.

### Bear

- Capital spending by customers is falling as a result of the economic downturn, which may affect short-term equipment sales.
- UV LED technology is still relatively immature so it will take time for the market to develop.
- UV LED technology is not suitable for all applications, which may limit leverage of the company's knowledge and expertise.

### Analysts

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**Exhibit 1: Dr. Höhle's products**

Product description	Detailed description
Drying equipment for the printing industry	Drying systems are required for many printing processes including traditional offset printing and growing digital inkjet printing.
Drying of coatings	Similar to drying ink after printing, UV light can be used to dry coatings of paint and finishes for a variety of substrates and objects. Typically this will be used for screens for the automotive industry, casings and flat screens used in the IT industry and furniture veneers.
Surface disinfection	UV light kills bacteria effectively without the need for chemicals and is therefore commonly used in the food and beverages industry to disinfect equipment and products.
Sun simulation and lighting technology	Light from the sun contains a high degree of UV light that is not generally present in standard light sources. Dr. Höhle products accurately simulate the light from the sun and are used for a variety of purposes including testing product wear when exposed to sunlight and research.
Adhesives and equipment for curing adhesives	UV cured adhesives are popular in the manufacturing industry because they can be cured quickly by exposure to UV light and they form a strong bond. Dr. Höhle produces the UV adhesives as well as the UV systems used to cure them.
UV lamps	In addition to the complete systems Dr. Höhle produces lamps and replacement lamps for use in its own and third-party systems. The lamps can be used in a variety of systems and applications.
Quartz glass	Quartz glass is required for the production of UV lamps but is also used in a variety of other applications, so in addition to producing it for its own application Dr. Höhle sells quartz glass to third parties.

Source: Dr. Höhle

One of the areas of strongest growth has been in UV sensitive adhesives, primarily as a result of their increased use in consumer electronics. Revenue in the adhesives segment grew by 8.7% y-o-y in H113, building on the 6% increase in FY12. The development of UV technology is likely to have helped increase the uptake of adhesives for these commercial applications since it lowers operating costs and reduces maintenance time.

The company has many years' experience of designing LED systems and has sold more than 2,000. Its pure UV LED Powerline range has already become established in the inkjet printing segment for pinning (first stage semi-curing of ink to enable higher-quality images) and final drying as its low weight and small dimensions enable integration into narrow spaces. The lower power output of UV LED technology means LEDs are not suitable for applications that require higher power output, such as solar simulation. As a result, only 10% of Dr. Höhle's products are LED based. They do, however, have the advantage of being compact and are therefore commonly used in the printing sector where high power is not required but small size is important.

## Financials

The introduction of LED technology has had a relatively minor impact on Dr. Höhle because, as indicated above, LEDs are currently only suitable for a relatively small proportion of applications. Nevertheless, the adoption of LEDs has been beneficial because it widens the choice of products available to customers and puts Dr. Höhle in a leading position to take advantage of LED technology in the longer term. LED technology is likely to grow in importance for Dr. Höhle, particularly once advances in technology produce LED devices with higher lumen output that can cover the full breadth of the UV spectrum.

The company acquired 80% of Raesch Group, a quartz tubing manufacturer, in Q212. Raesch contributed €9m to revenue and €0.8m to PBT for FY12. Comparative revenues therefore fell compared to FY11, which in combination with an impairment of €1.1m of receivables due to the insolvency of a customer (Manroland AG) caused the €3m fall in PBT in FY12. Management and consensus forecast an improvement in FY13.

The company also acquired the assets of insolvent Grafix GmbH and Platsch GmbH in December 2012 for €4.5m and expects this to contribute positively to the group earnings in FY13. Grafix is a supplier of peripheral equipment for the colour fixing segment and therefore has good access to printing firms and printer manufacturers, which should provide Dr. Höhle with increased access to those markets. Net debt as at March 2013 was €5.9m.

# FW Thorpe

## Exploiting lighting fixture niches

FW Thorpe has a long history in the lighting industry and has established itself in many different niche areas in addition to general professional lighting. 75% of its products are still based on traditional lighting technology, but this is rapidly changing with significant investment in LED-based products. Revenue growth should return as the proportion of LED products increases and starts compensating for the decline in the traditional lighting business.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%

Source: Edison Investment Research

## Company description

Thorpe is engaged in the design, manufacture and supply of professional lighting systems. Its largest subsidiary, Thorlux Lighting, provides lighting for a range of industrial and commercial lighting applications. Currently c 25% of revenues are from LED lighting, but the proportion is growing.

## Product focus and strategy

Exhibit 1 shows the main group companies that make up FW Thorpe plc. FW Thorpe has made substantial investments in LED technology, acquiring the requisite electronic and thermal management design skills to complement its mechanical and optical expertise. During FY12, it formed a new subsidiary, TRT Lighting, which is located in a 1,000m<sup>2</sup> factory purchased for around £0.75m. TRT specialises in LED-based outdoor lighting, enabling Thorlux to focus on indoor lighting. Historically, Thorlux has supplied over 30,000 luminaires for road tunnels in the UK and Far East. TRT has adopted Thorlux's outdoor product range, with its associated control systems, and created LED variants. It is also now entering the street lighting segment and has developed a range of road luminaires that accommodate wireless-based communications systems.

### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
06/11	52.83	11.6	80.3	17.6	14.2	1.5
06/12	55.56	12.7	96.5	19.4	11.8	1.7
06/13e	N/A	N/A	N/A	N/A	N/A	N/A
06/14e	N/A	N/A	N/A	N/A	N/A	N/A

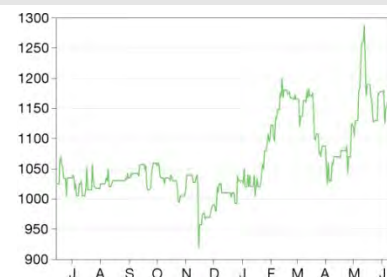
Source: Thomson Reuters

## Industrials

19 June 2013

**Price** 1,140p  
**Market cap** £133m

### Share price graph



### Share details

Code	TFW
Listing	AIM
Shares in issue	11.69m
Net cash (£m)	32.7

### Business description

FW Thorpe designs, manufactures and supplies professional lighting systems to the industrial, retail, commercial and outdoor sectors.

### Bull

- Operates in many niche application areas, which should protect margins.
- Strong balance sheet with sufficient resources for investment in new products and facilities.
- Rapidly expanding LED product portfolio.

### Bear

- Only 25% of product portfolio is LED.
- LED lighting may cannibalise traditional part of the business.
- Competition in the lighting industry is increasing as a result of the transition to LED.

### Analysts

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## Transitioning to LED

During FY12 there was continued investment in LED products across the group. The bulk of new products use LED light sources, with more than 25% of all products now being LED-based. The growth of the LED market has led to a significant number of new entrants to the industry, so while FW Thorpe is investing heavily in LED technology there is a risk that its sales of LED products will not be sufficient to compensate for the decline in the traditional lighting products.

### Exhibit 1: Group companies

Subsidiary	Product focus and strategy
Thorlux Lighting	Thorlux lighting is the largest subsidiary of the group. It designs and manufactures a range of lighting products for architectural, commercial, floodlighting, industrial, hazardous area and tunnel applications. 81% of 2012 revenue was attributable to Thorlux Lighting.
Compact Lighting	Premium lighting solutions for retail and display environments. It also provides product design, project management and light planning services. It is based in the UK with a manufacturing facility in Portsmouth.
Philip Payne	Designs and manufactures emergency exit signage products. Based in the West Midlands, UK.
Sugg Lighting	Manufactures and restores decorative and heritage lighting.
Solite	Manufactures lighting products for high-hygiene and clean-room type environments. The luminaires are designed to ISO standards to prevent the ingress of dust and moisture.
Portland Lighting	Designs, manufactures and supplies lighting products to the sign lighting industry.
TRT Lighting	Focuses on the design and manufacture of LED road and tunnel luminaires. Has worked on large-scale projects in the UK, Hong Kong and Ireland.

Source: FW Thorpe

## Financials

Revenues from continuing operations in H113 were down 9.4% y-o-y with a resulting 9.6% fall in net profit. The revenue fall is likely to be due to the decline in traditional lighting sales outpacing the gain in LED sales. The second quarter of the half showed an improved performance, however, with a renewed upward trend in revenue. As the proportion of revenue attributable to LEDs increases, revenue growth should return, but with the current LED product portfolio being approximately 25% of the total product portfolio, new LED-based products will have to be developed before the declining lighting sales can be offset by growing LED sales. The group is progressing rapidly with this task; more than 25% of products are now LED-based compared to only 3% in 2011.

The balance sheet remains strong, with no debt and £32.7m cash. There therefore remains significant capacity for additional investment in developing LED products and manufacturing capacity. One of the largest recent investments has been in a new 2,400m<sup>2</sup> warehouse, which will allow more storage for finished goods and increase manufacturing capacity.

# Holders Technology

**Industrials**
**19 June 2013**

## Diversification to LED

Holders' management entered the LED market in order to gain a complementary revenue stream with strong growth prospects, the potential for growth in the European printed circuit board (PCB) market being somewhat limited following the migration of much volume electronics manufacturing to Asia. Despite a difficult time in its core market, management is continuing to invest in the LED business.

### Market position

Production equipment	Wafers	LED chips	LED packages*	Modules*	Fixtures and fittings
			●	●	●

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
	●		

Source: Edison Investment Research. Note: Assembly and distribution only.

## Company description

Holders Technology traditionally provided products and services to the PCB industry, but has expanded into LED lighting to diversify its business away from declining PCB-related sales. The LED component of revenue is growing strongly and now constitutes 35% of total group revenue (FY12). The lighting segment consists of two brands: Opteon lighting and NRGstar. Opteon lighting sells a range of replacement lamps and downlighters for commercial and residential applications, while NRGstar provides consultancy services for the design, specification and installation of energy efficient lighting solutions. To encourage uptake it also offers financing for its range of products. Holders Components (a subsidiary) sells LED chips, optics, drivers and thermal solutions as well as customised PCBs, which include LED chips and optics.

## Product focus and strategy

In December 2009, Holders acquired a small distributor of LED products with a UK customer base. Holders already had established infrastructure in Germany, thus giving it a platform for extending LED activities into continental Europe. Holders enlarged the range of LED products offered, using assembly services from other parts of the group to create a number of customised modules.

### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
11/11	19.6	0.4	6.6	5.35	10.0	8.2
11/12	15.6	(0.4)	(9.5)	2.00	N/A	3.1
11/13e	15.2	0.1	1.5	2.00	43.3	3.1
11/14e	17.0	0.4	7.0	2.50	9.29	3.7

Source: Thomson Reuters

Price **65.00p**  
Market cap **£3m**

### Share price graph



### Share details

Code	HDT
Listing	AIM
Shares in issue	3.9m
Net cash (£m)	0.7

### Business description

Holders Technology distributes materials and specialist equipment and provides services to the printed circuit board (PCB) industry. It also offers LED lighting products and solutions.

### Bull

- Small, flexible and offers customers focused solutions.
- In-house assembly capacity provides flexibility and quick response to customer requests.

### Bear

- Narrow margins as a result of sub-contracting.
- PCB market is likely to continue to decline as a result of increased competition from lower-cost Asian manufacturers.

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### **Expanding from replacement bulbs to consultancy services**

The replacement bulb market is a relatively small part of the general lighting LED market and therefore Holders Technology is attempting to expand its potential market base by providing value-added services. It has started to do this through the development of custom products for clients and through NRGstar consultancy services, but continued investment in new LED products is likely to be necessary to be able to complement consultancy services with sales of internally developed lighting products.

To keep costs low, Holders Technology sub-contracts the manufacture of lighting products to offshore manufacturers but assembles these in the far east or the UK. This ensures a flexible cost base that can be matched to the level of demand but also reduces gross margins to a relatively low 25% (FY12). The lighting products are generally in the mid-price range, but the product portfolio is being expanded to include more products (including CFLs) in a wider range of price points with the aim of accelerating LED adoption.

### **Financials**

LED sales grew 27% in FY12, but this was not enough to offset the decline in the PCB products segment where revenues fell by 30%. With LEDs only generating 26% of revenue this meant that overall revenues fell by 20% over the year. The gross margins for both divisions were approximately 25% for FY12, with PCB unchanged from prior year but LED gross margin up from 14%. The LED segment also made an operating profit for the first time since it was first created in FY10.

The group has assembly operations in India and China that have been restructured to focus on LED assembly. As a result of this restructuring an impairment of £287k was recognised in FY12 against the Chinese operations.

At FY12 year end the company had cash of £700k with no debt, and despite the loss for the year positive cash flow was maintained through a reduction in working capital.

Revenue for the first half of FY13 was down 9.5% on H112 and consensus estimates forecast a small reduction in revenue for the full year, with a recovery in profit before tax to £0.1m as a result of cost reductions and the non-recurring impairment of Chinese operations in FY12. Revenue and profit is expected to grow more strongly in FY14 as a result of the increased growth of the LED lighting segment.

# IQE

Technology

19 June 2013

## Innovative GaN wafers to lower LED cost

IQE is the dominant wafer supplier to RF chip manufacturers, with 50-60% market share and c 80% of its revenue attributable to wireless products. It acquired NanoGaN and its Nanocolumn technology in 2009, which enables lower-cost bulk GaN manufacture, and provides an opportunity for incremental licensing revenues when development is complete.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
	●				

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
	●		

Source: Edison Investment Research

## Company description

IQE is the leading supplier of epitaxial wafers globally, both in terms of scale and the breadth of its offering. Wafers for RFICs are the mainstay of the business but it has also built up a broad portfolio of capabilities across a range of compound semiconductor materials and applications. Wafers for the wireless industry accounted for 78.4% of revenue in 2012, photonics accounted for 20.5% and the remaining 1.1% was for general electronics.

## Product focus and strategy

Epitaxial wafers are wafers with layers of crystalline materials deposited on the surface of a substrate to create a higher-quality wafer material. The epitaxial wafers are then sold to customers to use to manufacture their devices. The substrate and the deposited materials vary depending on the application, with the primary applications being in the field of wireless communications and photonics. In addition to epitaxial wafers IQE offers a range of substrates, specialising in substrates for infrared applications.

IQE's dominance of the wireless market was strengthened in 2012 by the acquisition of Kopin Wireless and RFMD's epitaxy division, which extended its market share to 50-60% of the RF wafer market. Its photonics products are used in a wide variety of applications including optical fibre communications, optical storage (DVDs and CDs), laser printing and copying, solar cells and solid state lighting.

### Historic financials and estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
12/11	75.3	8.2	1.5	0.0	14.3	N/A
12/12	88.0	8.3	1.4	0.0	15.4	N/A
12/13e	145.2	13.4	2.0	0.0	10.8	N/A
12/14e	155.4	17.9	2.6	0.0	8.3	N/A

Source: Edison Investment Research, company accounts

Price 21.50p

Market cap £139m

### Share price graph



### Share details

Code	IQE
Listing	AIM
Shares in issue	645.9m
Net debt (£m) as at December 2012	15.5

### Business description

IQE is the leading supplier of epitaxial wafers globally. These wafers are used to make radio frequency chips for mobile handsets and infrastructure, concentrator photovoltaic cells for solar energy and a variety of other optoelectronic applications.

### Bull

- Diversified semiconductor business – not reliant on any one industry.
- Novel production process for high-performance LED wafers.
- Wide range of technical expertise and strong supply chain and distribution network.

### Bear

- Relatively low exposure to LED market will limit any revenue gains from LED uptake.
- GaN bulk substrate is likely only to be used for a relatively small share of the LED market.
- Nanocolumn technology still in development so there is still scope for technical problems.

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**IQE is a research client of Edison Investment Research**

## **Novel production process acquired with NanoGaN**

IQE acquired NanoGaN, a spin-out from the University of Bath, in November 2009. NanoGaN's technology enables the production of cheaper and larger GaN bulk substrates. From a performance perspective GaN bulk substrate is the ideal material to use for the manufacture of blue and green laser diodes as well as high brightness LEDs because it significantly reduces the number of defects and therefore improves the overall performance of the resulting device. However, GaN bulk substrates are extremely expensive and cannot currently be produced in larger wafer sizes that would help to improve manufacturing yield and reduce cost. NanoGaN's technology should enable cheaper production of larger size wafers for use in laser diodes and high brightness LEDs.

It is likely that this technology will be most beneficial to the laser diode industry, as it requires higher performance for each individual chip. The general lighting LED market needs to compromise between cost and performance. The extra cost of GaN bulk substrate, even after cost savings from this novel process, is likely to be significantly higher than that of silicon or sapphire substrate and therefore is unlikely to be widely adopted.

## **Financials**

NanoGaN is still in the technology development phase, with the first prototypes potentially available during FY13. IQE will use the technology itself to manufacture substrates for niche markets such as infrared LEDs. IQE plans to license the technology to LED chip manufacturers, to avoid direct competition with the capital intensive and competitive LED wafer market. The technology is not yet fully developed and therefore there remains a technology risk. If it reaches licensing stage this could lead to incremental licensing revenues, which are not factored into forecasts.

In addition, IQE's share price has suffered on concerns over the impact of Qualcomm's introduction of silicon-based RF chips, which could damage IQE's competitiveness and the wafer discounts given to RFMD as consideration for the acquisition of its epitaxy division. The shares are currently trading at 10.8x FY13 expected earnings and 8.3x FY14, which even given the above concerns is potentially undervaluing IQE's extensive IP portfolio, including NanoGaN.



# LPA Group

## LEDs for trains and transport infrastructure

LPA operates in the rail sector and has seen strong growth in its lighting division, which has built success around its LumiSeries range of LED lights. Although competition in the LED lighting industry is increasing, LPA is somewhat protected by its knowledge and expertise in the rail sector.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
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### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
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Source: Edison Investment Research

## Company description

LPA designs, manufactures and supplies lighting and electro-mechanical systems for use in applications where durability and high reliability are required. Its main focus is on the rail industry, with 30% of revenues from other industry segments such as aerospace and defence. It employs 170 people around the UK and exports to 50 countries. Both traditional and LED lighting technology is used, but LED is the key growth area and now contributes approximately 20% of revenues.

## Product focus and strategy

LPA's flagship products are the LumiSeries range of LED lights based on the LumiMatrix lighting system, which uses a series of low power LEDs to enable a flexible luminaire configuration. This enables LPA to quickly develop lighting solutions that can be designed around a variety of space requirements.

In addition to lighting and electro-mechanical products, LPA offers design, manufacturing and installation services under its Transport+ brand. This offering was introduced in 2011 and has completed a number of successful contracts with positive feedback from customers.

### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
09/11	17.32	0.4	2.92	0.90	25.0	1.2
09/12	18.35	0.9	6.13	1.10	11.9	1.5
09/13e	18.30	0.8	5.60	1.30	13.0	1.8
09/14e	N/A	N/A	N/A	N/A	N/A	N/A

Source: Thomson Reuters

Industrials

19 June 2013

Price 73p  
Market cap £9m

### Share price graph



### Share details

Code	LPA
Listing	AIM
Shares in issue	11.80m
Net debt (£m) as at September 2012	2.4

### Business description

LPA Group designs, manufactures and supplies LED-based lighting and electro-mechanical systems. Its primary market is the railway industry. It also serves other industries operating in demanding environments, including aerospace, defence, infrastructure and marine.

### Bull

- Well placed to exploit increased investment in rail infrastructure in the UK.
- Nature of products favours LED technology.
- Potential for margin expansion.

### Bear

- Threat from global industrial lighting companies moving into industry.
- Low gross and operating margins.
- Risk of disruption as a result of moving premises.

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### **Niche expertise provides market protection**

The key difficulties with designing lighting for rail carriages are dealing with the variable power supply and severe shock and vibration. While these difficulties are not insurmountable, LPA's expertise in this area currently presents a barrier to entry, preventing some of the general lighting companies offering their products to the rail sector. This offers some degree of protection to LPA's margins and market share.

LPA has also diversified into other demanding environments that favour the use of LED technology, including transport infrastructure, hazardous areas and selected other high value-add industrial and commercial lighting sectors. The proportion of non-rail related sales is growing, particularly for hazardous areas, where it won significant orders in FY12.

### **Rail industry is a high-value, niche market**

Most of LPA's revenue comes from the UK and therefore it is dependent on the spending and franchise decisions made by the UK government. Recent problems with the franchising process have delayed two key franchise agreements until 2016/17. This has had a short-term impact on demand for LPA products but overall tendering activity remains strong.

LPA should benefit from a £37bn investment plan recently announced by Network Rail. As part of this plan, 4,100 new carriages will be introduced between 2014 and 2019 and 1,400 more will be upgraded. In addition to this, London Underground is planning to acquire 2,780 new carriages, all of which will require new or renovated lighting systems. LPA will be competing indirectly for a share of this investment through the train carriage manufacturers that win the overall contracts. There will be strong competition for both the carriage contracts and the lighting of those carriages, but LPA is well placed and is likely to benefit, at least indirectly, from these substantial investments in rail infrastructure. LPA's main competition for internal carriage lighting is from the carriage manufacturers, which may decide to design the lighting system internally, and from smaller private companies that also specialise in carriage lighting.

LPA has been increasingly successful in winning orders outside the UK, specifically in Asia and Australasia. Revenue from outside Europe increased by almost 50% between 2011 and 2012 in contrast with a modest decline in the UK and Europe. This reduces its exposure to the volatility of the UK rail market and improves its credibility as a global player.

### **Financials**

Management and consensus expects revenues for FY13 to be slightly lower than for FY12, mainly due to an exceptional FY12. However, January and February have beaten their expectations and therefore there is potential for FY13 to show continued revenue growth.

LPA is in the process of moving offices and upgrading manufacturing facilities to cope with increased demand. New office premises were acquired during FY12 for £1.3m with the intention of moving to those facilities during 2013 after a significant renovation project. The LED lighting manufacturing facility is also in the process of being renovated to increase manufacturing space by 50%. As a result of these changes, costs are expected to be higher for 2013, with the potential increase in revenue coming through in 2014 as utilisation of the expanded facilities. Net debt was £2.4m as at December 2012, with £7k of cash and £1.12m of un-drawn overdraft facilities available.

# Nanoco Group

**Technology**
**19 June 2013**

## A quantum leap in lighting technology

Nanoco signed a transformational deal with Dow Chemical in January 2013, which should see significantly higher revenues starting in FY14. The company also signed an extension to a joint development agreement with OSRAM for the use of its quantum dot technology in general lighting LEDs. This could be another transformational deal if it reaches commercial production.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%

Source: Edison Investment Research

## Company description

Quantum dots are advanced semiconductor nano-particles that have numerous potential applications including display technology, LED lighting, solar cells and biological imaging. Nanoco Group is the only manufacturer currently able to supply production quantities of quantum dots that do not use a regulated heavy metal. Nanoco is currently focused on developing the technology for use in general lighting and backlighting for LCD displays.

Nanoco sells the quantum dot material for an agreed amount plus a royalty for each product sold to the consumer. Given the widespread potential applications for LED lighting and the growing market, this royalty model provides a lucrative and secure source of revenue once the quantum dots are designed into products.

## Product focus and strategy

Quantum dots can be used within LEDs to change the colour of the light emitted by changing the diameter of the dots. Typically phosphors are used to perform the same function, but they can be expensive and cannot be tuned to produce the wide spectrum of light that can be produced using quantum dots.

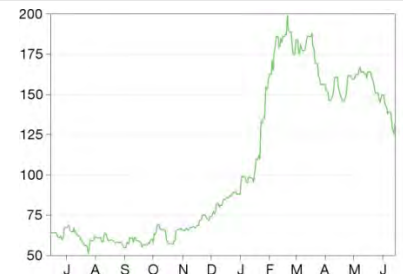
### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
07/11	2.94	(1.4)	(1.3)	0.00	N/A	N/A
07/12	2.64	(3.2)	(1.8)	0.00	N/A	N/A
07/13e	3.99	(4.4)	(1.9)	0.00	N/A	N/A
07/14e	4.70	(5.0)	(2.2)	0.00	N/A	N/A

Source: Thomson Reuters

**Price** 133.75p  
**Market cap** £280m

### Share price graph



### Share details

Code	NANO
Listing	AIM
Shares in issue	208.99m
Net cash (£m) as at January 2013	12.5

### Business description

Nanoco Group produces quantum dots that are free from regulated heavy metals and can be used in many applications including colour tuning for LED lighting.

### Bull

- Innovative patent-protected technology.
- Dow Chemical deal potentially transformational.
- Signing of extension to JDA with OSRAM could lead to product design-in resulting in a transformational, long-term revenue stream.

### Bear

- Uncertainty over cost-effectiveness of technology compared to other colour tuning solutions.
- Reliance on technology roadmaps of a small number of customers.
- The terms of the agreement with OSRAM are unclear and therefore its financial impact is uncertain.

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### **Success in the display market**

On 23 January 2013 Nanoco announced a worldwide licensing agreement with Dow, which gave Dow exclusive rights to the sale, marketing and manufacture of Nanoco's quantum dots for use in electronics displays, initially as part of LCD backlighting. This is a big step up for Nanoco and should give investors confidence that the technology works and is commercially viable.

The agreement with Dow is initially for quantum dot use in backlighting for LCD displays. Mobile LCD displays are frequently now being replaced by OLED displays, which do not require backlighting and TV LCD backlighting technology is evolving to use fewer LEDs. As a result, the backlighting market is expected to decline by 14-18% annually between 2012 and 2020. However, if Nanoco's technology can become the new standard in LCD backlighting it should still experience growth through increased market penetration. There is also potential for quantum dots to create a new display technology to replace both LCD and standard OLED technology. While this may still be a while off in terms of commercialisation, it shows the potential range of opportunities open to quantum dot technology.

Nanoco has a production facility in Runcorn, UK, which is capable of producing 25kg of quantum dots annually. New facilities are being developed at the same site, which would scale up production to 400kg annually, and Dow is expected to build additional facilities in Asia based on this same design. Construction of the facility in Runcorn is expected to take 18 months and will be timed to coincide with the growth in the order book.

### **Viability of use in general lighting yet to be proven**

Nanoco signed a follow-on JDA with OSRAM in October 2012 for the development of a general lighting product that uses quantum dots. OSRAM is one of the big three market leaders in lighting, so if this product is successful and goes into production it could also prove to be transformational for Nanoco. However, the details and scope of this agreement and its potential impact on Nanoco's results are as yet unknown.

### **Cost will be the deciding factor**

Quantum dots are an efficient and flexible solution to the LED colour problem, but fundamentally their success or otherwise in the general lighting market will come down to cost. The performance of quantum dots in relation to colour tuning is expected to be somewhere between that of phosphors and multi-LED based systems. The cost will therefore need to be between these two points. OSRAM obviously thinks that the technology has potential, but it is unclear whether this is at the premium, low-volume end of the market or the higher-volume, lower-cost end, which would benefit Nanoco most.

### **Financials**

To date most of Nanoco's revenue has been from payments in relation to reaching milestones on JDAs, so the licensing agreement with Dow is transformational for Nanoco and should lead to a significant increase in revenues. Commercial production under this agreement starts in 2014, so revenues should contribute to 2014 results with 2015 being the first full year of Dow-related royalties. The consensus for revenue growth in 2014 and 2015 is 57% and 460% respectively. After 2015 growth will come from increased market penetration in the LED backlighting market and from new product design-ins. The OSRAM deals could provide further meaningful upside. Net cash at January 2013 was £12.5m.

# OSRAM

**Technology**

19 June 2013

## Traditional leader transitioning to LED

OSRAM is one of the two dominant suppliers in the traditional lighting industry, but it is now losing market share as a result of increased competition in LED lighting. OSRAM is currently owned by Siemens, but is being spun-off to enable it a greater focus and adaptability within the LED lighting market. It will remain a dominant player in the industry but requires restructuring.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
		●	●	●	●

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
	●		

Source: Edison Investment Research

## Company description

OSRAM is one of the leading light manufactures in the world, with over 39,000 employees worldwide. It is currently 100% owned by Siemens but is in the process of being spun-off, with registration of shares expected to complete in early July 2013. It is vertically integrated, producing everything from semiconductor LED chips to complete lighting solutions and control systems. Approximately 75% of its revenue in FY12 was from traditional lighting products and 25% from LED.

## Product focus and strategy

Prior to the take-off of LED lighting, replacement bulbs were a strong and recurring source of revenue for OSRAM. The shift in value from the replacement market to new installations and from traditional to LED therefore requires a significant change in business model for traditional suppliers like OSRAM. It has already initiated a restructuring plan to cut €1bn in expenses by 2015 and has recently sold one of its traditional lighting production facilities with plans to replace it with the construction of a new c €100m LED only assembly facility that should start production later this year. To assist with the restructuring of the business and achieve a more flexible organisational structure, management has decided to spin off the OSRAM division from Siemens.

### Consensus estimates

Year End	Revenue (€bn)	Gross profit (€bn)	Gross margin (%)	EBITDA (€bn)	Net income (€bn)	Net margin (%)
09/10	4.7	1.6	34	0.8	0.3	6.3
09/11	5.0	1.6	32	0.7	0.2	4.0
09/12	5.4	1.4	26	0.4	(0.4)	N/A
09/13e	N/A	N/A	N/A	N/A	N/A	N/A

Source: Siemens, OSRAM Licht Joint spin-off report

Price	N/A
Market cap	N/A

### Share price graph

### Share details

Code	N/A
Listing	N/A
Shares in issue	N/A
Net cash	N/A

### Business description

OSRAM is one of the leading lighting companies globally. It is currently 100% owned by Siemens but is in the process of being spun-off. It is vertically integrated, producing everything from semiconductor LED chips to complete lighting solutions and control systems.

### Bull

- Strong existing supply and sales channels.
- Dominant industry market share.
- Strong product portfolio.

### Bear

- Significant restructuring and change of business model required.
- Detailed financials not available.
- Large exposure to traditional lighting technology, which is a declining market.

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## New business units focused on value chain components

OSRAM is split into six business units: lamps, light engines and controls, luminaires, solutions, specialty lighting, and opto semiconductors. Exhibit 1 details the activities conducted by each division.

<b>Exhibit 1: OSRAM Licht AG business units</b>	
<b>Business unit</b>	<b>Description</b>
Lamps	Includes both traditional lighting and solid state lighting (LEDs) and are typically retrofit lamps such as light bulbs, CFLs, LFLs and LED lamps (eg LED light bulbs).
Light engines and controls	LED systems and light management systems, which are typically sold through OEM channels and enable advanced control over the light systems.
Luminaires	Complete lighting luminaires for private end consumers and the professional field.
Solutions	This business unit was created from the acquisition of Traxon Technologies and supplies scalable network control systems and custom LED solutions.
Specialty lighting	LEDs and lighting system for non-general lighting purposes such as automotive and entertainment.
Opto semiconductors	Produces the semiconductor devices that form the basis of LED lighting systems as well as other semiconductor devices such as detectors, sensors and laser diodes. The products are used internally as well as sold to external customers.

Source: OSRAM Licht AG, Siemens Joint spin-off report

OSRAM already offers an extensive LED product portfolio including light engines, LED modules, luminaires and control systems, so it is well placed to take advantage of the growth in all aspects of LED lighting. However, it will have to manage its cost base as traditional revenues decline.

As well as LED products OSRAM also offer services such as energy audits, lighting design and development as well as maintenance. While these services add to the complete package that OSRAM can offer its customers, individually they are unlikely to contribute significant revenue or profit.

## Financials

According to the Joint spin-off report, the consolidated net assets of the new OSRAM Group will be €2bn with cash of €31m. Agreements are in place to replace the inter-group loans from Siemens Group with €1.25bn in loan facilities from a consortium of four banks. 19.5% of shares will be retained by Siemens with 2.5% of those being contributed to the group pension shortly after the spin-off.

Although the business was loss making in 2012 this can be partially blamed on significant expenses incurred as a result of the restructuring, so 2011 and 2010 earnings (€246m, €334.6m respectively) may be a better reflection of the underlying business. The 7.3% revenue growth from 2011 to 2012, although partially due to the acquisition of Siteco Lighting in July 2011, should also give investors confidence that the business remains strong and has the potential to return to profitability after the restructuring is complete and the potential to be a serious player in the LED market.

# PhotonStar LED Group

**Technology**
**18 June 2013**

## Building access to the residential LED market

PhotonStar LED Group is an LED lighting company focused on the commercial, residential and retail lighting markets. Revenue has grown 44% in the last year despite component supply problems. An exclusive supply agreement was signed with a large UK house builder in September 2012, which puts the company in a good position to take advantage of the growing residential LED lighting market.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
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### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
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Source: Edison Investment Research

## Company description

PhotonStar LED Group Plc was born out of a reverse takeover of AIM-listed Enfis Group by PhotonStar LED Limited in December 2010. The company designs, manufactures and sells LED-based lighting systems targeted at the commercial, residential and retail lighting markets. The business is divided into two segments: LED light fixtures (93% of H112 revenue) and LED light engines (7% of H112 revenue). Its products are used for general lighting, film and TV, and UV curing, with most of the revenue coming from general lighting products.

## Product focus and strategy

The flagship Chromawhite series of lights started shipping in H212. Chromawhite is PhotonStar's innovative and patented LED technology that enables dynamic tuning of the colour of the light. A light sensor built into the LED modules measures the colour and brightness of the light and an embedded microprocessor adjusts each of the LED outputs so that the desired light colour and intensity is reached. This technology produces a very high light quality at high efficiency, which is suitable for applications such as retail and art, which require high CRI, and residential and hospitality applications where changing the 'mood' of the light is desirable.

### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
12/10	2.7	(0.9)	(1.7)	0.0	N/A	N/A
12/11	6.1	(1.1)	(1.1)	0.0	N/A	N/A
12/12	8.7	(1.0)	(0.8)	N/A	N/A	N/A
12/13e	12.3	0.4	0.39	N/A	19.6	N/A

Source: Thomson Reuters

**Price** 7.63p  
**Market cap** £9m

### Share price graph



### Share details

Code	PSL
Listing	AIM
Shares in issue	112.37m
Net cash (£m) as at December 2013	1.1

### Business description

PhotonStar LED Group designs, manufactures and sells LED-based lighting systems targeted at the commercial, residential and retail lighting markets. Its main focus is on LED light fixtures but the company also produces and sells light engines.

### Bull

- Award winning products.
- Specialises in rapidly growing commercial and residential LED lighting markets.
- Has signed an agreement with a major UK construction company to supply LED lighting for its houses.

### Bear

- LED lighting, specifically in the residential segment, is very competitive.
- Products are at the premium end of the price scale so it may struggle to compete with cheaper Asian imports.
- UK-based manufacturing could result in less competitive product pricing and/or lower margins.

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### **Highly competitive market**

Competition within the lighting market is increasing and it will be a challenge for all players, including PhotonStar, to compete in this market. However, PhotonStar's innovative and patented Chromawhite technology and extensive range of products puts it in a good position to grow in line with the overall commercial and residential LED market, which is expected to grow on average at 56% a year until 2016.

In addition to the products that PhotonStar sells, it has an extensive portfolio of patents related to the LED light extraction chip design, packaging, colour mixing and control, which it licenses to third-party LED manufacturers. A non-exclusive licence agreement was signed in December 2012 with a leading LED chip manufacturer and it is continually developing its patent portfolio to further increase potential licensing fees.

### **Exclusive supply agreement with UK house builder facilitates access to residential market**

New installations of LED lighting in the residential market is one of the fastest growing segments and potentially the largest segment for LED lighting, and is the focus of much of PhotonStar's efforts. House builders are one of the key channels for gaining access to this market, so the signing of an exclusive supply agreement with a major UK house builder in September 2012 is an important step for PhotonStar. As part of this agreement PhotonStar will design and supply the lighting for all new houses and therefore should benefit significantly when the UK housing market starts to recover from its current low activity levels.

PhotonStar's international reach was also increased with the signing of a five-year partnership with Middle-East-based conglomerate Debbas Group. The agreement was signed in March 2012 and will see Lightitude, the lighting division of the Debbas Group, represent PhotonStar in 19 countries across the Middle East and North Africa.

### **Financials**

Revenue grew by 44% to £8.7m in FY12 with gross profit increasing by 60% to £3.4m and an increase in gross profit margin to 40%. However, the business is still loss making, with FY12 adjusted EBITDA losses of £0.29m. Consensus estimates predict revenue growth of 41% in FY13, with the business earning a small profit. Earnings are weighted towards H2, with an approximate split of 40:60 (H1:H2). Given the supply issues in 2012, the expected growth of the market and the growth demonstrated in FY12, this should be achievable. At 31 December 2012 the group had net cash of £1.1m with borrowing facilities of £0.5m.

As part of its investments to increase manufacturing capacity and expertise in LED lighting, PhotonStar acquired Camtronics Vale in May 2011 for £375k. Camtronics is a specialist contract assembly company focused on complex electronic products and will therefore provide PhotonStar with the necessary skills and resources to expand production of its lighting solutions. All LED fixtures are manufactured on a site next to the Camtronics site in South Wales, with the ChromaWhite light engine technology being manufactured in Romsey.



# ProPhotonix

## LED-on-board

ProPhotonix has a proprietary technique for creating ultra-high brightness light sources. There is potential for this to be used in a range of industries, but the company has historically been heavily exposed to the solar panel industry, which has had a negative impact on its recent performance.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
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### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
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Source: Edison Investment Research

## Company description

ProPhotonix designs and manufactures diode-based laser modules and LED systems for OEMs and medical equipment companies. It also distributes diodes for Opnext, QSI, Ondax, Sanyo and Sony. Markets served include machine vision, industrial inspection, defence, sensors, solar and medical. The LED manufacturing facility is in Cork, Ireland. Laser module production and laser diode distribution are based near Bishop's Stortford, UK. LED sales were 43% of total revenue for FY12, with the remainder being from laser diodes.

## Product focus and strategy

ProPhotonix's LED system business specialises in ultra-bright lighting for use in small spaces. In order to achieve high lighting intensity, unpackaged LEDs must be mounted close to each other on a circuit board using "chip-on-board" technology. This in itself is relatively rare because it requires a clean room, wire-bonding and encapsulation, but ProPhotonix trumps this with a proprietary technique, originating from the Tyndall Institute in Cork, in which the LEDs are placed in a reflective cavity. ProPhotonix sells the LED lights for line-scan applications including PCB and silicon wafer inspection, optical sorting of fruit and vegetables and inspection of flat panel glass for solar panels. In one specialist application for dentistry, it packs 200 LEDs into a five pence piece sized area. It also sells systems for incorporation in equipment that automatically reads car licence plates.

### Consensus estimates

Year End	Revenue (\$m)	PBT (\$m)	EPS (\$)	DPS (\$)	P/E (x)	Yield (%)
12/11	16.98	(1.4)	(0.02)	0.00	N/A	N/A
12/12	13.90	(2.9)	(0.04)	0.00	N/A	N/A
12/13e	14.57	(0.7)	0.00	0.00	N/A	N/A
12/14e	20.53	1.99	0.00	0.00	N/A	N/A

Source: Thomson Reuters

Industrials

19 June 2013

Price **3.75p**  
Market cap **£1m**

### Share price graph



### Share details

Code	PPIX
Listing	AIM
Shares in issue	29.21m
Net debt (£m)	1.7

### Business description

ProPhotonix is a designer and manufacturer of LED light engines and laser diode modules with operations in Ireland and the UK.

### Bull

- Advanced chip-on-board technology, which is not provided by many manufacturers.
- Wide variety of applications.

### Bear

- Decline in solar cell industry in Europe may not recover completely as production increasingly shifts to China.
- Requires re-financing.

### Analysts

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In mid-2012 the company expanded its machine vision product range and signed three new distribution partners based in Asia, Europe and the United States.

Although LEDs and ProPhotonix's proprietary chip-on-board technology increase the number of applications where ProPhotonix's products can be used, demand for its products is also strongly influenced by the overall performance of the market those products are serving. 76% of revenue comes from the industrial sector, which is sensitive to the economic environment, particularly for product inspection and automotive production.

## **Financials**

Revenue for FY12 declined 18% y-o-y, with LED lighting in particular falling by 30%. Management has blamed this on the decline in production of solar cells due to significant over-supply and low prices in the industry. A high proportion of sales to the solar industry were to four key German solar equipment manufacturers that have been hit particularly hard by the solar downturn, reducing sales from the solar sector from 15% to 2% of revenues. Management expects some of this revenue to return when the solar market improves, but in the meantime it is shifting sales efforts to other industries to replace the lost sales. Management is also expanding the sales team globally with a focus on non-solar related industries and expects a significant sequential increase in H2 revenues. Consensus expects a fall in revenue and profitability in FY13 with a return to growth in FY14.

At the end of FY12 ProPhotonix had \$1.3m of cash and \$3.0m of debt due in the following 12 months. The company has stated that without additional financing its operations would be severely constrained, but it is confident financing can be obtained to meet its needs over the next 12 months.

# Rubicon Technology

**Technology**

19 June 2013

## Key wafer supplier to LED industry

Rubicon Technology is the leading sapphire wafer supplier to the LED industry, so it is well placed to take advantage of the growth in LED lighting. However, excess capacity within the industry has led to a fall in prices, write-downs of inventory and low margins. Accelerated uptake of LEDs and industry consolidation are needed for Rubicon to return to profitability.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%

Source: Edison Investment Research

## Company description

Rubicon Technology is an electronic materials provider that develops and manufactures sapphire-based wafers and products that are widely used in the LED and RFIC industries. Sapphire is the most commonly used LED substrate, accounting for approximately 90% of the market. Sales to the LED industry (sapphire wafer polishers and LED manufacturers) are the largest component of revenue and are expected to increase further as LED uptake increases.

## Product focus and strategy

Rubicon Technology specialises in sapphire-based products, specifically sapphire ingots, wafers and lenses. Its focus is on the supply of wafers to the LED industry. Ingots are the pure sapphire crystals from which wafers and optical windows are cut. Polished sapphire windows and lenses are as clear as glass but scratch resistant and extremely durable.

**Price** **\$8.21**  
**Market cap** **\$185m**

### Share price graph



### Share details

Code	RBCN
Listing	NASDAQ
Shares in issue	22.58m
Net cash (\$m)	43.9

### Business description

Rubicon Technology produces sapphire-based products for the LED, RFIC and optics industries. It is the leading supplier of sapphire wafers for use in LEDs.

### Bull

- Leading supplier of sapphire wafers to the LED industry.
- Also supplies sapphire to the RFIC and optics industries so it is not entirely dependent on the success of LEDs.

### Bear

- Risk of silicon-based LEDs replacing sapphire.
- Highly competitive industry will keep margins low.

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### Consensus estimates

Year End	Revenue (\$m)	PBT (\$m)	EPS (\$)	DPS (\$)	P/E (x)	Yield (%)
12/11	134.00	54.6	1.7	0.00	5.8	N/A
12/12	67.24	(12.6)	(0.3)	0.00	N/A	N/A
12/13e	54.56	(20.4)	(0.5)	0.00	N/A	N/A
12/14e	87.79	2.2	0.1	0.00	82.1	N/A

Source: Thomson Reuters

Rubicon sells sapphire ingots in 2" through 4" diameters and polished wafers in 6" and 8" diameters. The company has demonstrated the capability for 12" wafers. Its expertise in large diameter wafers is a key advantage over others in the industry, and will start to benefit it as LED manufacturers move to larger diameters in an effort to improve yields and lower cost.

90% of LEDs are currently based on sapphire substrates. This could fall if LEDs based on cheap silicon substrates overcome technical hurdles. Despite this, revenue is still likely to increase due to the growth in the overall market.

### **Silicon-based LEDs a key threat to business**

The performance of silicon-based LEDs is starting to reach the point where they can compete with sapphire-based LEDs, but low yields mean they are still not commercially competitive. If the manufacturing problems can be solved and performance per dollar for silicon becomes significantly greater than that of sapphire, it is possible that the entire market would move to silicon-based LEDs and Rubicon's revenue would fall significantly. However, it is more likely that silicon-based products will improve to the point where they can compete on a performance per dollar basis, but still cannot compete on an absolute performance basis. This will mean some of sapphire's market share will be lost to silicon, but sapphire will continue to be used where higher performance is required. Given the rate of growth of the overall market, the total value of sapphire-based LEDs is likely to increase despite the fall in market share.

### **Excess supply hits margins**

The initial wave of demand for LEDs was for the display backlighting market. Market penetration accelerated rapidly and peaked in 2011, at which point there was a pull-back in demand partly due to a change in backlighting technology, which required fewer LEDs per unit. Incumbent sapphire suppliers invested in additional capacity, which led to oversupply when demand fell back resulting in price drops across the industry. Competition from new Asian suppliers is another potential risk for Rubicon. Numerous Chinese manufacturers have started manufacturing single-crystal sapphire, and although there is not yet evidence of large volumes of sapphire entering the market from these new market entrants, if they achieve the quality and yield required to be commercially competitive they could pose a threat to Rubicon's market share.

In addition the Korean Ministry of Knowledge Economy has designated single-crystal sapphire as one of the 10 materials in which it wants to develop expertise internally. To achieve this, it has created a government supported-body, managed by Rubicon's competitor Sapphire Technology, aiming to reduce reliance on foreign suppliers for sapphire products. This could obviously reduce Rubicon's market share in Korea and Asia more generally and restrain margins, but there is sufficient opportunity in the rest of the world for Rubicon to maintain a significant share of the market.

### **Financials**

As a result of the price drops caused by the excess capacity Rubicon recognised a \$1.5m inventory write-down in FY12 and other wafer suppliers have suffered in a similar way. This is clearly not sustainable for the industry and prices will have to increase or costs fall in the medium to the long term, which is likely to occur through industry consolidation, although competition is likely to remain high, suppressing margins.

Rubicon is also highly dependent on relatively few customers; 69% of revenue in 2011 was from only three customers. While losing one of these major customers is a significant risk to the business, it also indicates that Rubicon supplies to some of the largest LED manufacturers and therefore is likely to grow with those key players as LED uptake increases and the industry consolidates towards those large players. Net cash was \$43.9m as at December 2012, with no debt.

# The Vitec Group

**Industrials**
**19 June 2013**

## LED for media

Vitec is benefiting from being the first to market with LED-based products for the broadcast and photographic industries, having strong brands and established sales channels. Mastery of LED technology, together with selective acquisitions and developing new products, is helping Vitec grow despite economic headwinds.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
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### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
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Source: Edison Investment Research

## Company description

The Vitec Group is split into three divisions: Videocom, imaging and services. The Videocom division (42% of FY12 sales) provides equipment for use in producing professional video content for the broadcasting and media markets, and wireless communication and surveillance equipment for the military, aerospace and government markets. The imaging division (48% of FY12 sales) provides photography and video equipment to both the professional and non-professional markets. The services division (10% of FY12 sales) provides equipment rental and technical support to large-scale events that require broadcasting or recording such as the 2012 Olympics and the UEFA Euro 2012 Championships. The services division is also important in driving the sales of Vitec Group products.

## Product focus and strategy

As part of its complete product portfolio Vitec produces many types of lighting products for use in video production and photography. Its two key lighting product brands are Litepanels and Manfrotto in the Videocom and imaging divisions respectively. The Litepanels products are designed for lighting broadcast studios and outdoor shoots and all are based on LED technology.

### Consensus estimates

Year End	Revenue (£m)	PBT (£m)	EPS (p)	DPS (p)	P/E (x)	Yield (%)
12/11	351.0	33.0	33.9	20.5	17.6	3.4
12/12	345.3	36.2	13.4	22.0	44.4	3.7
12/13e	330.0	35.7	53.8	23.5	11.1	3.9
12/14e	351.7	40.0	60.1	24.5	9.9	4.1

Note: PBT figures exclude acquisition-related costs and losses from disposals of businesses.  
Source: Thomson Reuters

**Price 595.00p**
**Market cap £261m**

### Share price graph



### Share details

Code	VTC
Listing	LSE
Shares in issue	43.81m
Net debt (£m) as at April 2013	66.0

### Business description

Vitec is an international provider of products and services for the broadcast, photographic and military, aerospace and government (MAG) markets. These include systems for live entertainment, film and video production and equipment and accessories for photography, video and events.

### Bull

- Strong cross-selling opportunities between divisions.
- Leading the development and implementation of LED technology for broadcasting and photography.
- Wide range of brands and products to diversify the business.

### Bear

- Declining broadcasting advertising revenues could lead to a reduction in demand.
- Competition is increasing with more competitors developing LED-based products.

### Analysts

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They are designed to give a flicker-free, colour accurate, directional light and consume up to 95% less energy than conventional lighting. The lower power requirements mean broadcast studios are cooler and the panels can be run off batteries and are therefore more mobile.

The Manfrotto brand is used for camera-mounted LED lights and for mobile phone clip-on LED lights. These lights are more energy efficient and can give out a constant light rather than a flash, therefore improving image quality.

The introduction of new products throughout the group, whether through internal product development or external acquisition, is important for revenue growth since it encourages customers to upgrade their equipment sooner than they would if it was just a like-for-like replacement. The Vitec Group therefore invests 4% of group product sales into research and development and, according to management, new products accounted for almost half of the revenue growth in FY11.

Vitec's competitive advantage with LED lighting is in its existing sales channels. It offers complete video and photographic production solutions, which are natural channels for the introduction of LED lighting. This has enabled it to expand into consumer electronics, specifically LED lights for cameras and smartphones, including the iPhone.

## Financials

Videocom revenues grew by 7.3% to £146.2m in the year to December 2012, partially thanks to a contribution from projects related to the Olympics and the acquisition of Camera Corps. Camera Corps produces a remotely operated camera system called Q-ball and was acquired in April 2012 for £8.0m. The Olympics contributed 19% of divisional operating profit (£3.0m out of a divisional operating profit of £15.8m) and therefore it is likely that without the Olympics and the acquisition of Camera Corps there would have been a decline in Videocom's revenues.

Imaging revenues declined by 4.6% y-o-y even after taking into account the disposal of the staging business; however, the decline was only 0.4% on a constant currency basis. The decline in revenue was mainly due to the decision to cease distribution of some lower-margin third-party products and a contraction in the photographic equipment bag market.

LED lighting sales are mixed between the Videocom and Imaging divisions, with most currently coming from the Videocom division. LED lighting sales are not disclosed separately, although it showed a "good performance" according to management.

Services revenues grew by 4.4% y-o-y mainly due to coverage of the London Olympics and the US presidential election. Operating margin of this division is relatively low, however, at 3.6% in 2012 up from 1.9% in 2011. The cross-sell of products as a result of providing these services is not factored into this segment's financial results, and therefore the benefit from the services division is likely to be much greater than these results indicate.

The LED share of revenue is not disclosed but management has stated that Litepanels product revenues grew by 20% in FY11 and are expected to continue to grow strongly. LED-related revenues are likely to remain a relatively small share of total revenue but will become more important to the business as LED technology develops and uptake increases. Photography is also a strong area of growth for the business.

Margins improved by 160bp to 11.4% between FY11 and FY12 and 90bp between FY10 and FY11 as a result of cost reductions and increased efficiencies, as well as a £1.6m benefit from higher pricing over commodity cost increases.

Net debt increased from £63.7m in December 2012 to £66.0m in April 2013, with trading in line with expectations for the first four months of the year and the Manfrotto brand in particular gaining market share.

# Zumtobel Group

## Transitioning to LED

Zumtobel is a global supplier of lighting fixtures and components. It has strong supply and distribution channels, but group revenues are falling as a result of the decline in traditional lighting sales. Growth is likely to return when LED sales become a greater proportion of revenue.

### Market position

Production equipment	Wafers	LED chips	LED packages	Modules	Fixtures and fittings
				●	●

### % of revenue generated from LED market

0-25%	25-50%	50-75%	75-100%
●			

Source: Edison Investment Research

## Company description

Zumtobel Group is global provider of lighting systems and components. Its key brands are Zumtobel, Thorn and Tridonic. The company is divided into two segments, lighting (70% of FY12 revenues) and components (30% of FY12 revenues). The lighting segment covers indoor and outdoor professional lighting solutions and the components segment covers the components of the lighting systems, such as LED modules and control systems. The company's headquarters are in Austria and it has approximately 7,500 employees worldwide.

## Product focus and strategy

Tridonic (part of the components segment) manufactures control equipment that is used both within the group (20%) and sold externally to lighting manufacturers (80%). The company works closely with luminaire manufacturers and lighting designers to develop products to match their requirements as well as selling control gear, light engines and connectors for LED and fluorescent lighting products.

### Consensus estimates

Year End	Revenue (€m)	PBT (€m)	EPS (€)	DPS (€)	P/E (x)	Yield (%)
04/11	1,228	59.8	1.23	0.50	7.1	5.7
04/12	1,280	20.7	0.39	0.20	22.3	2.2
04/13e	1,254	16.1	0.33	0.14	26.4	1.6
04/14e	1,267	28.7	0.56	0.24	15.5	2.8

Source: Thomson Reuters

Industrials

19 June 2013

Price €8.70  
Market cap €378m

### Share price graph



### Share details

Code	ZAG
Listing	Vienna
Shares in issue	43.50m
Net debt (€m)	140.1

### Business description

Zumtobel is a global lighting company that offers a full range of lighting solutions including indoor and outdoor lighting, lighting management systems and lighting components.

### Bull

- Strong supply and distribution channels.
- Extensive product portfolio.
- Strong growth in LED lighting and components sales.

### Bear

- Relatively low proportion of LED sales compared to traditional lighting sales.
- High level of competition in LED lighting at both the components and fixtures levels.
- Reliance on Europe – 79% of revenues are from Europe.

### Analysts

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Thorn develops and sells lighting (both traditional and LED) for a wide range of professional applications such as office, industrial, retail and transportation. It has strong market positions in the UK, France, the Nordic regions, Australia and Hong Kong and 40% of its revenues are related to lighting for streets and public buildings.

The lighting segment includes the Zumtobel Brand and the Thorn brand, which together contributed 74% of group revenues in FY12 with a 50:50 split between Zumtobel and Thorn. Both offer professional lighting solutions and maintenance services, but Zumtobel is targeted at the premium end of the market.

### **Sale of LEDON**

A subsidiary called LEDON was created in 2009 to focus on the development and sale of LED retrofit lamps (lamps designed to replace traditional incandescent lights) for the consumer market. It was sold in February 2013 so the rest of the group could focus on its core business of the professional market. The retrofit market is a relatively small proportion of the total market and in the long term is likely to reduce in value, due to the longer replacement cycle of LED lamps. The sale of LEDON is not likely to have a detrimental effect on the group.

### **Financials**

Group revenues for the three quarters to 31 December 2012 were €946.5m, 1.8% down on the same period in FY12. This was despite 55.4% growth in LED-related revenues to €201.1m. Most of this LED revenue growth came from the lighting segment (a 63.2% increase to €154.7m) with the remainder coming from the components division (a 31.0% increase to €53.7m against an overall component segment decline of 7.3%). The operating margin for the group for the nine-month period has improved but remains low at 3.5%, up from 3.1%. Adjusted EBIT declined by 13.5%, primarily due to the reduction in revenue, pricing pressures and a higher share of LED revenues, which are not yet profitable. This performance is consistent with what other traditional lighting companies are experiencing. The macroeconomic environment in the key market of Europe remains difficult, with very low visibility. Zumtobel has a strong product portfolio in both traditional and LED lighting, so should be able to weather this transition better than some competitors. Consensus forecasts assume that the company returns to growth in FY14.

Net debt as at January 2013 was €140.1m, with €6.9m of operating cash flow being used to pay down debt and a €11.0m beneficial movement in working capital. Free cash flow improved significantly from (€19.6m) in Q1-Q312 to €19.2m in Q1-Q313.



## Glossary

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CAGR	Compound annual growth rate
CFL	Compact Fluorescent Light
CRI	Colour rendering index – a quantitative measure of the colour quality of a light source
DRAM	Dynamic Random Access Memory – A type of memory used in computers, laptops etc.
Heatsink	A mechanical device used to dissipate heat from an LED or other heat generating component
IC	Integrated circuits – a general term for traditional silicon-based computer chips
Incandescent light sources	Traditional Edison-style bulbs that generate light by heating a material to high temperatures
LED	Light emitting diode
Lumen	An SI measure of visible light output
Luminaire	A lighting fixture.
MOCVD	Metal-organic chemical vapour deposition (a process for manufacturing LED chips)
Phosphor	Material that absorbs a narrow spectrum of light and emits light over a wider spectrum
RF	Radio Frequency – generally refers to wireless communications technology
RFIC	Radio Frequency Integrated Circuit – a general term that refers to integrated circuits used for wireless communications.
Semiconductor	Materials that conduct under certain conditions and are used to make electronic components including LEDs
Substrate	Material on which LED active layers are grown
Transformer	Device used to change the input voltage to an output voltage appropriate for the required device
Wafer	Disk of semi-conductor material from which LEDs are cut

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