
The case for LED curing

The next generation of inkjet

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1. Summary

UV inkjet printing has long been established as the preferred technology because it is more economical, more versatile, and easier on the environment. UV ink must be cured using a heat source. Mercury vapor lamps have been the predominant means of curing. However, LED light sources are making their way into the mainstream. Their advantages are significant. They emit far less heat so the surfaces and types of materials on which they can print are virtually unlimited. Since they cure at lower temperatures they consume less energy, use less ink, and present no danger if the lamp surface breaks.

The recent economic downturn taught us significant lessons. Businesses today need to run lean, have a competitive advantage, and be ready to redirect and retarget their products and services. LED technology gives the ability to meet these demands. It saves money and allows companies to offer current customers new products and target new industries with new capabilities. At the same time, it is very easy on the environment, an important consideration for many print buyers when choosing their print providers.

2. Introduction

When making a case for any technology, you need to look first at the driving forces that lead to its need — both market directed and economical.

2.1 Market-directed influences

Take a look at how the printed page is shifting. Sure, direct mail and marketing collateral are still being used, and very effectively. But traditional documents have been virtually replaced by electronic media. That trend is crossing over into other venues. You'll remember Moore's Law that correctly predicted the exponential advancement of computing technology. While we prefer to think we are in the printing business, we are not; we are in the communication business, and that business is driven by computing technology. Think about it. Few tools of the trade are not processor-driven. And certainly the ultimate consumer of graphic images is electronics driven.

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The key reason that electronics advance so quickly is because the media delivers real, life-changing benefits such as mobility, real-time communications, and, let's not forget, entertainment. Mobile technology has stretched time, shortened distances, and even saved lives. There's no going back.

There are few touch points at which we do not see the results of the advancement of technology. Even billboards are going digital. Large monitors are replacing printed boards. They can keep consumers updated in real time with flexible messaging options. Images and messages can be changed instantly without printing or installation costs. Plus, digital billboards can carry emergency alerts and critical safety messages. There's no going back.

This is a significant change for large-format printers. It means that they must look elsewhere for new revenue streams. They must look to growth markets.

Following the growth markets is not all that complicated. Just ask, "What types of printing will never grow obsolete?" Packaging is a great example. It's difficult

to sell a product without a box or a wrapper. And consumers choose only those that pop off the shelf. So it is unlikely packaging will go away anytime soon.

The CEO of EFI™, Guy Gecht, talks about the "imaging of things." He believes that print is moving from traditional substrates to "things." Things include objects such as wood panels for furniture, decorated mirrors, personalized murals, thermoformed (plastic molded) displays, vehicle graphics, building wraps, textiles, ceramic tiles, and more. Perhaps these are the avenues that need to be explored.

2.2 Economic influences

If the "Great Recession" has taught us anything, it is that running a business will never be the same. Never again can you get comfortable in your niche. No matter how successful you are, you need to expect that change is around the corner.

Since some types of businesses struggled to recover, in particular retailers, creative ideas are on the rise to lure consumers into shopping malls. Such enterprises are welcoming museums into spaces where businesses failed in an effort to entice shoppers into malls.

Many printing businesses went under because of the recession. At the same time, marketers cut their spending or moved their funds to low-cost media. Industries that relied on traditional print media, such as tourism, have declined. While the population of printing establishments has decreased, those that remain are competing for a smaller share.

Businesses that succeeded through the recession are those which did more with less, minimized expenses, and used technology to tighten efficiencies.

We learned three important lessons. Businesses today need to run lean, have a competitive advantage, and be ready to redirect and retarget their products and services.

3. The case for LED curing

3.1 The inkjet curing process

The trend toward ultraviolet (UV) inks is well established. UV inks offer a number of advantages over solvent and latex inks. UV inks do not evaporate; they must be cured. A UV light source generates heat causing a chemical reaction where photoinitiators cause the ink components to cross-link into a solid. As a result, the ink does not penetrate the substrate. Because they “dry” as soon as they are cured, they readily adhere to non-absorbent substrates such as PVC, carton, wood, aluminium, glass, and ceramics, and substrates can be stacked, rolled, and finished immediately after printing. The solidification of the ink is also the reason that they produce intense coloration and yield exceptionally high quality. Also, the combination of UV ink formulation and the curing process means UV printing emits virtually no volatile organic compounds (VOC).

3.2 Mercury vs. LED curing

Traditionally, mercury vapor lamps have been used to cure UV inks. By their nature mercury lamps emit extremely high heat. Yet only five percent of this energy is used to cure the ink. The other 95 percent heats up the substrate and the entire print engine.

Light-emitting diodes (LEDs) are tiny light diodes (bulbs) that are extremely energy efficient. You know them as the source that illuminates pen lights, electronics, instrument panels, and, most recently, you may see them strung together as Christmas lights or patio décor. Dozens, even hundreds of these little bulbs clustered together form a single light source or LED lamp. An advantage of this array is that if one diode fails, the light intensity of the surface light is only minimally affected. Most importantly, LED lamps reach a maximum of 104 degrees fahrenheit, whereas mercury lamps heat up to more than 140 degrees.

In contrast to mercury lamps, LED lamps use approximately 20 percent of UV radiation for curing and only 80 percent of the energy is converted into heat. However, this heat is typically discharged from the lamps via air or water-cooled heat sinks protecting both the substrates and the print engine from the extreme heat.

An LED lamp is guaranteed for several years and a mercury lamp provides 2000 to 3000 hours of usage, which, at seven hours per day, five days a week, equates to 1.5 years at best.

With a mercury lamp you have to turn the machine on and wait a few minutes until it reaches its curing temperature. This is necessary every time you change a job, which results in a loss of time. An LED reaches its curing temperature immediately.

3.3 Energy consumption

In a comparison of the energy consumption of two similar 3.2 meter systems, one with mercury-lamp curing and one with LED, the results are dramatic. A VUTEK® GS3250 printer uses four mercury lamps. It consumes roughly 15kW of electricity per hour. Its LED counterpart, the VUTEk GS3250Lx, uses only 3.6 kW per hour. For a two-shift, five-day week, the GS3250 (mercury) uses 46,800 kilowatt hours of energy each year while the GS3250Lx (LED) uses about 9,000 kilowatt hours. That's a difference of 37,800 kilowatt hours of energy. For a three-shift, six-day week, the energy consumption of printers with mercury lamps is 2,160 kilowatt hours per week, which totals 108,000 kWh in 50 weeks. By using LED lights, this number falls to 30,420 kWh per year, representing a savings of 77,580 kWh every year.

A study by Fogra Graphic Technology Research Association showed that LED curing, in particular in EFI VUTEk printers, show energy reductions of up to 82% when compared with devices that use conventional mercury arc lamps¹. Even in print-ready mode, the LEDs were shown to save up to 77% in electricity usage, simply because the LEDs are off, unlike mercury arc lamps that still consume power when the machine is idle between jobs. The calculations of Fogra's Energy Efficiency Project demonstrated that users can save around \$18,000 per printer every year on power consumption.

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¹ “Energy efficiency of large and small format printing systems”

3.4 Printing speed

New inkjet nozzle technologies and larger print heads result in increasingly faster inkjet printing, so UV ink curing has to keep pace. A critical component of the curing process is the ink. With UV inks formulated to match the wavelength of LED diodes, systems that cure with LED lamps are as fast as, if not faster than mercury-cured systems. In fact, among the most recent technology releases, LED systems are matching the speed of high-speed production printers. One reason for this is that LED drying means less dwell time after the printing process. Artwork is dried immediately after printing, which accelerates the overall production speed.

3.5 Lower cost of operation

In addition to consuming far less energy, LED technology also consumes less ink. Inks developed for this technology are more responsive. Plus, powerful digital front-end software controls ink application requiring a thinner layer of ink. So in addition to saving energy, LED technology uses less ink. Color management software, which is found in EFI's Fiery® XF front end also ensures color accuracy, thereby reducing waste.

3.6 Environmental advantages

LED technology consumes less energy, uses less ink, and produces less waste. In addition LED lamps are safe. If the outer shield is damaged there are no harmful effects. In contrast, if the outer bulb of a mercury lamp breaks intense UV radiation is emitted. UV exposure can cause eye and skin burns, blurred or double vision, headaches, and nausea.

As reported by Laurel Brunner in Spindrift, "As of the 13th April 2015 the mercury used in high pressure curing lamps such as lighting and some curing applications will be illegal. However for the low and medium pressure lamps more commonly used in the graphic arts, the exemptions don't expire until July 2016."

While she also cites "wobble room" in terms of the timing for most printing companies, her report points to an important advantage of LED light sources.

Print buyers increasingly want to do business with companies that can demonstrate their contributions to sustainability. With LED technology it is easy to flaunt its environmental benefits.

3.7 LED-formulated inks

Ink contains a combination of eight to 10 components. One of them is the photoinitiator. That's the chemical that responds to the wave length of the UV curing lamp. For LED technology to deliver speed and quality the inks have to be formulated with a photoinitiator package that responds to the new LED wave length while maintaining good adhesion, flexibility, and weather fastness.

For a large-format printer to move at high production speeds, it requires super-fast jetting. Eye-popping quality demands smaller drop sizes. Making the inks receptive to these conditions requires grinding the pigments and controlling them for tight, even distribution. The quality and consistency of the ink components is what enables faster jetting while ensuring a full cure.

3.8 Higher quality

Inks are also a critical component of the quality equation. The right pigment and carrier combinations can expand the color gamut. Properly formulated LED UV inks work in tandem with color-management software for near-perfect color matching and consistency.

During LED curing, the ink is not absorbed into the substrate; instead, 100 percent of the pigment solidifies, intensifying coloration.

To make their systems the printer of choice for a 3M™ MCS™ Warranty², EFI formulates inks in collaboration with 3M. The 3M™ MCS™ Warranty assures brand owners that the graphics produced with EFI inkjet technologies in combination with 3M media will perform as expected for the lifetime of the graphic. To make this possible EFI used automotive-grade pigments, grinding and controlling them to maintain tight tolerances.

² The 3M™ MCS™ Warranty backs graphics printed with 3M co-branded ink and select 3M flexible media, printed and applied according to 3M product and instruction bulletins. See www.3M.eu/efi to register and for more details.

3.9 Broadening market reach

Vibrant UV inks that cure at low temperatures open doors to a myriad of opportunities. In the labelling industry, for example, brand managers and designers are continually looking for new ways to catch consumers' attention. The ability to print on unusual substrates such as highly reflective metallics, highly textured surfaces or sliver-thin, heat-sensitive films is a decided advantage.

With LED technology, you can print on laminated corrugated board with excellent results and this opens up yet another door to the packaging industry.

Polyester and other special textiles, too, are prone to distorting under high heat. The ability to print on these materials lets you go beyond the typical exhibit display application to print on textiles for home décor, multiple-use murals, wall coverings, and tablecloths.

Hard, .8 mm-thick PVC is extremely difficult to print on. LED technology makes it possible to print on PVC as thin as .2 to .5 mm.

The ability to print on less expensive substrates not only allows entry into new markets but it allows you to save money as well — for you and your customers.

Delicate surfaces, such as glass, are difficult to print on. High heat can be damaging and typical inks may not be long lasting. With LED technology, you can approach interior decoration or other markets that use thin glass and other delicate materials.

4. Expert witnesses

The following owners of a variety of different LED inkjet printers offer the closing remarks in the case for LED curing.

“LED curing also harmonizes with our lean manufacturing philosophy – even though the costs of the investment are higher, it pays for itself in the form of lower expenses on energy.”

“Constant development and pursuit of technological innovations are yet another element of our business strategy. Hence the investment in the innovative UV LED curing technology by EFI. It enables us to offer our customers an even broader portfolio of applications and spectrum of media. Now, we have no problems printing on very temperature-sensitive Kapa foam or static foil, for instance. Plus, LED lamps have longer service life than the conventional ones, and therefore, thanks to their lower servicing frequency, the operations and maintenance costs are much lower.”



Michał Makaruś

Michał Makaruś,
Vice-President
of the Board,
Voigt Promotion,
Police, Poland

“Exploiting all the possibilities is now up to our own creativity and that of our customers. In combination with the high resolution, the H1625 LED printer surpasses screen printing in many respects. When you tell customers you can now print in 162 x 300 cm format at a thickness of up to 5 cm, they just can’t get over it.”



Josef Rechberger

Josef Rechberger,
General Manager,
Druckerei Walding,
Linz, Austria

“Compared with a Latex or traditional UV printer, energy consumption is more or less three times lower. If you calculate that on an annual basis, you soon arrive at a difference of a few thousand dollars. What’s more, the LED lamps account for 10,000 hours of usage, which is around ten times longer than a conventional UV lamp. Another advantage of LED technology is that it emits little or no heat during the curing, thus making it ideal for printing on heat-sensitive materials.”

“Thanks to the investment in the VUTEk printer, we now have a ready-made solution for both internal and external applications. Whether it’s textiles, vinyl, or other substrates, it makes no difference. It all goes through one single machine, and we think that’s just wonderful.”



Johan Ceuleers (left)

Johan Ceuleers,
General Manager,
PRINTiX,
Mechelen, Belgium

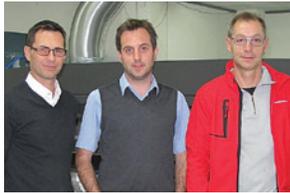
“The environmental question is extremely important for customers who require CO² emission data using recycled paper, among other requirements. So, possessing equipment that allows us to meet these requirements is a great help...During the crisis of the last few years we’ve seen demand fall, but we’re starting to see things pick up, and that’s why we didn’t hesitate to invest. This way we are prepared to offer our clients better service, and we can reach out to new markets as well.”



Bernardo Velázquez (middle)

Bernardo Velázquez,
General Manager,
Algo + Edición Digital,
Madrid, Spain

"We opted for the new VUTEK 3-meter LED printer because it was a printer with the latest technology enabling us to create the best quality prints in the market and thus increase our competitive edge. The plates do not get as warm and do not bend, which makes transport more reliable. We can now print thinner plastic films, the whole machine does not heat up as much and the lamps save an enormous amount of energy."



André Stutz (left) and team

André Stutz,
Managing Director,
richnerstutz ag,
Villmergen, Switzerland

"The VUTEK has allowed us to attack new markets with very demanding color-rendering requirements: events, stage decoration, photo exhibitions, interior design. We mainly use innovative new substrates, such as honeycomb cardboard, that are still not found very often in Morocco. It's another way to differentiate ourselves."



Sophie Lecomte

Sophie Lecomte,
Marketing Manager,
Visual Impact,
Casablanca, Morocco

"Having a variety of stock readily available and a flawless knowledge of turning them into products allow us to deliver carpets, brushed cottons, PVC, and adhesives to our customers within 24 hours. The market has led us to develop new skills: fabric for stretch ceilings, shop visuals, and signs and mirror-effect film, among others...we also produce mirrors made from polymer film instead of glass. The film is highly reflective and can exceed 95% reflection with a particularly light weight of 900 g/m² (2.95 oz/ft²), which makes it suitable for multiple applications. LED is superior here as this delicate medium requires a certain degree of caution for printing, in particular the drying process as it cannot be heated."



Trompe l'oeil covers on the old Laennec Hospital

Patrick Roque and
Amaud Durand,
Directors,
CTN Group,
Saint-Denis, France

"The printing time has been reduced to 25 percent of what it was with the old printers, and immediate LED curing gives us a significant saving in time for markets like events, where time is often of the essence."



Nabil Mikou

Nabil Mikou,
Owner and Managing
Director,
Visual Impact,
Casablanca, Morocco

EFI fuels success.

We develop breakthrough technologies for the manufacturing of signage, packaging, textiles, ceramic tiles, and personalized documents, with a wide range of printers, inks, digital front ends, and a comprehensive business and production workflow suite that transforms and streamlines the entire production process, increasing your competitiveness and boosting productivity. Visit www.efi.com or call 650-357-3500 for more information.



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