

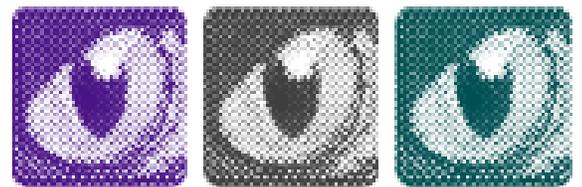
White Paper

Process Efficiency for Improved Sustainability

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Digital Dots

Process Efficiency for Improved Sustainability: A Kodak White Paper

This white paper is about how process efficiency improves a printing business' environmental impact, with a particular focus on the European market. The white paper's objective is to explain how technological advances in the graphic arts have contributed to the printing industry's improved environmental impact, ever since the advent of digital technology in prepress. The industry's progress across Europe demonstrates how technical innovation can help printers to meet changing market expectations. Kodak has developed a range of eco-innovations that help organisations to align their businesses with key sustainability objectives.

Industry Trends & the Evolution of Prepress

Ever since the desktop publishing revolution in 1984, the printing and publishing industries have been in a state of turmoil and almost constant upheaval. The introduction of open computing in prepress, and new production models based on digital technologies, paved the way for massive change. As printers and publishers worked to cut costs to remain competitive in the new standardised environment another unseen revolution was also underway. As cost control became more important to printers and their customers, there was a steady and relentless improvement in process management, resource efficiency and environmental impact.

Production improvements and the growing sophistication of digital technologies have led to considerable consolidation in graphic arts supply chains. A 2009 PhD thesis looking at the environmental impact of print in Australia¹ found that between 1990 and 2000, 87% of the country's 5,000 printing companies cut their environmental impact by an astonishing 97%. For the most part the industry's environmental impact reduction has been the result of technology innovation and the use of digital processes to eliminate costly working methods.

¹ Barriers and Incentives to Ecological Modernization
"SME Printing Firms: Accidental Environmentalists" Phillip Lawrence 2009

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In most markets printers that have survived and embraced digital technologies and new media opportunities have also substantially cut emissions and waste.

Globally, print revenues are commonly accepted to be around €300 billion. Market data suggests that the European printing market is worth around a third of this: 130,000 printing companies in the EU serve a population of over five hundred million, even as traditional business models decline and businesses consolidate. Over the last five years global printing revenues in developed markets have declined by around 1% per year, largely due to competition from electronic media. Most printing businesses are small companies employing less than 100 people, and many of those that have failed to embrace digital technologies have closed.

All EU markets have experienced a collapse in traditional print revenue streams. Work from high value services such as colour scanning, screening, trapping and CMYK separation has been digitised and automated. Conversely the numbers of digital printers, and printers who run fully automated operations exploiting digital technologies and quality control standards, are rising. They are growing in tandem with the emergence of new applications for print and new transmedia production models that interrelate digital media with print.

Survivors thrive in a new environment where process efficiency, quality management and process control drive profitability and investment. Environmental accountability is not a top priority for all printing companies and print buyers, however changing regulatory requirements are forcing it to the top of many agendas. Companies such as Lannoo Print in Belgium and Vögeli AG in Switzerland are part of a growing cohort of printing companies that comply with

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ISO 14001. This standard was first published in 2004 and specifies what is required of an organisation to enable it to develop and implement an environmental management system. ISO 14001 does not state specific environmental performance criteria, but focuses instead on establishing, implementing, maintaining and improving environmental management. Thousands of companies throughout Europe have achieved compliance to ISO 14001, including many printing companies. Another consideration for printers and their customers is the EU's work on Product Carbon Footprinting and Organisational Carbon Footprinting currently underway. It will be published as a directive, but could well become the basis for regulation in the future. Compliance to ISO 14001 provides printing companies with a foundation for environmental accountability that could aid future regulatory compliance.

In response to market expectation and shareholder pressure, publicly traded companies have Corporate Social Responsibility (CSR) policies which service providers are encouraged to support. In the UK, for instance, all FTSE companies have a legally required carbon reporting obligation. Depending on the nature of their business their reporting may include print media supply chains. The EU's Green Public Procurement (GPP) policy encourages member states to use materials and services that have a comparatively reduced life cycle environmental impact. The idea is that environmental impact criteria should be part of all decisions by public bodies and private enterprises to purchase services such as electricity or IT, so that collectively the EU reduces its environmental impact. Whether legislation or market forces and shareholder pressure exert greatest influence on commercial behaviour is an ancient conversation. In the European graphic arts market, market growth will be in response to both, in line with local expectations and demands. It should be noted that local cultures and values are a major influence on the shift to more environmentally positive business and social priorities.

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Eight out of 10 EU citizens² believe that legislation is necessary for environmental protection in their country. Obviously this is an average number, so local expectations will vary throughout Europe according to local attitudes. However, using less input to produce more value is every company's goal because it improves profitability. Protection and improvement of the environment is enshrined in the Treaty on European Union and so far the EU has approved over 200 pieces of environmental legislation relating to pollution, emissions control, land use and waste management. In 2012 the EU economy generated 492kg of municipal waste per person and had to treat 480kg per person on average, with 15% composted, 34% sent to landfill and 24% incinerated. Only 27% was recycled. The EU Emissions Trading Scheme initiative to combat climate change also affects many European companies. As part of the EU's commitment to cut carbon emissions by 50% by 2050, this legislation requires companies to monitor and report CO₂ emissions. Wherever they apply, rules and regulations put additional pressure on businesses to prove accountability and provide appropriate audit trails.

Regulatory compliance squeezes print service providers, their customers, and associated product and media supply chains. The combination of shareholder pressure and environmental legislation means that all services and manufacturing processes must be as environmentally efficient as possible. This includes print media production, but there is an added dimension of market perception for the printing industry. Printing is often accused of being environmentally hostile, despite the fact that its primary resource, paper, is recyclable. Many people would be surprised to know that as much as 70% or more of the carbon footprint of print media products is attributed to paper, a sustainable resource.

It is also important to remember that printed products have a one-time carbon footprint (during manufacture), embed carbon and can be recycled. Electronic

² The European Union Explained: Environment ISBN 978-92-79-23948-9

media devices, such as laptops or tablets, require energy every time media are viewed, so the emissions associated with electronic media use are high compared to print media. Sectors such as commercial offset and newspaper printing are also heavy users of aluminium, which is used to make printing plates, and which can also be recycled.

Environmental impact reduction has been largely incidental to wider changes in the printing industry, but in cutting costs as part of its reinvention for the digital age, the industry has also cut carbon. There is more the industry can do, through improved process and consumables management, for instance eliminating the processing chemistry and equipment costs associated with printing plate production.

Recycling & Reuse

Most recycling and reuse business models are about economics and business efficiency, combined with effective resource management. Print is the only media channel based on a renewable and sustainable resource, and its raw materials can mostly be recycled. Printed products store carbon, do not generate emissions during use and when they reach end of life, they can revert either to a recycling stream or be sent for benign disposal, such as biomass or fertiliser. Printing plates, which are made of aluminium, can also be sold into the recycling stream. Paper and aluminium provide raw materials for a range of other manufacturing processes.

Aluminium recycling saves over 90 million tonnes of CO₂ annually in Europe and over 50% of the aluminium produced in Europe originates from recycled raw materials. Aluminium recycling provides printers with an economic benefit however it has a substantial environmental benefit as well. Once aluminium is processed from bauxite it stores the energy required for primary production, and this energy is still stored in the aluminium scrap entering recycling streams. The atomic structure of aluminium is unaffected by melting, so it can be recycled

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almost endlessly, for instance into packaging, engine blocks and aircraft parts, window frames, doors, furniture and even escalators.

Printing plates cannot be recycled as printing plates or made from recycled aluminum because they require an extremely hard surface able to withstand the rigours of the printing process. The aluminium must be virtually 100% pure, so that it can be effectively grained and anodised to maintain optimum dampening properties on press and retain its physical properties when subjected to high mechanical stress. Recycled aluminium has a lower environmental impact than the aluminium produced in primary manufacturing, with energy savings of 95% per tonne of aluminium produced from scrap compared to primary production.

Aluminium is hugely beneficial for industry because of its durability and recyclability, and it provides revenue streams for offset printers. At least four printing plates are required for each colour print run, and many printing companies get through hundreds, even thousands, of printing plates per week. Sustainability in print can be improved yet further by working with processless printing plates which eliminate the processing and chemistry associated with conventional plate imaging. In the case of Kodak's Sonora, an advanced processless plate technology, production improvements are achieved without compromising on quality or productivity. Streamlined platemaking with fewer production steps and fast plate imaging reduces time to press. This keeps printing presses running and aids return on capital invested in high value plant, such as printing presses and finishing equipment. It improves a business' process management and helps companies to fulfil fiscal and environmental responsibilities to shareholders.

The Law & the Market

Environmental legislation ensures that, to some extent, environmental impact mitigation is part of every business' responsibility. The market is also applying pressure in unprecedented ways, through conventional channels and through online media. Print buyers are sensitive to market expectations and legal compliance for environmental impact and are increasingly concerned that service providers develop and implement environmental policies. There is a concern in the market that, unless industries demonstrate proactive environmental awareness and accountability, further regulation will restrict environmentally hostile business practices. Print buyers will be sensitive to the potential risks associated with how their brand is perceived. No part of the print media supply chain will be unaffected by legislation, from content development through to media consumption.

All markets, regardless of local cultures and environmental priorities and especially those within the EU, are affected by regulation and market pressure. Environmental priorities vary according to local considerations. Natural resources influence energy generation. For instance in Poland coal is the country's most important mineral resource and the country's primary source of energy. But in Switzerland and Finland where rain, snow and mountains are in abundant supply, water provides energy in the form of hydroelectric power. Government and social priorities also help shape environmental priorities in different geographies. France has complex rules relating to water management and to recycling processes. And in Germany a very strong and proactive industry research association, FOGRA, is taking a greater interest in how print can improve its environmental management.

The interplay of regulation and market pressure shape environmental priorities, however the possibility to save time and improve margins is universally relevant. This is true even in geographies where appetites for sustainability are relatively low, such as in countries that have only recently joined the EU. All print media

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production markets and sectors care about improving business performance, however. Process control and consumables with a reduced environmental impact support positive environmental messages for the printing industry. They are also powerful tools for improving profits and margins.

Implementing production processes that mitigate environmental impact aids both economic performance and regulatory compliance for printers and their customers. For instance, by using processless printing plates a printer can remove chemistry, water, energy and waste from the platemaking process. Some processless plates can be used with board and recycled stocks as well as IPA (isopropyl alcohol) free fountain solutions, making them suitable for a wide range of commercial printing applications. This is important because the rules governing chemicals, water management, emissions reporting and device disposal are increasingly restrictive. The European Union's Waste Electrical and Electronic Equipment (WEEE) directive, for instance, requires member states to collect 45% of electronic and electrical waste by weight placed on their markets from 2016. This rises to 85%, some 20 kilos per person, by 2019.

The march towards industrial regulation is relentless. But printers making the move to processless platemaking in prepress are ahead environmentally and can reap economic and efficiency benefits, as Chevillon Imprimeur in Burgundy, France has done. Dominique Haudiquet, general manager, said: "We are very impressed with the Sonora XP [processless] plates. They have helped the business take another big step forward, and not just from a productivity perspective. Using process-free plates underlines to our customers that we are an environmentally responsible company." In Denmark Chronografisk has trebled plate output following installation of a platesetter and processless technology. Prepress manager Mads Bindslev says that "having the latest technology and confidence in our ability to deliver the job makes sure that we are giving our customer the best possible service". Processless platemaking removes the costs associated with plate processing: time, human resources and chemistry.

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Francesco Niorettini, general manager of the Konig Print Group in Italy says that *“Using Kodak Sonora XP plates has enabled us to eliminate the most harmful part of the process, i.e. the developer and chemicals, and we are delighted to have made this decision because it is perfectly in line with our company philosophy of environmental friendliness and using ecological processes wherever possible”*.

For Yann Madec, managing director of Val pg Pôle Graphique in Nantes, France, investing in the latest printing innovations is crucial to a company’s growth: *“Print specialists need to constantly adapt their offering to take into account new digital technologies.”* He adds: *“Our aim was to reach an output of 150 to 200 plates a day as quickly as possible – which we’ve achieved with the Sonora XP Plates.”*

Chemistry & Water

The printing industry has relied on chemistry ever since Gutenberg introduced antimony to lead and tin to invent hot metal type in 1454. Within Europe chemical transportation, use and disposal is now tightly regulated through legislation including the EU’s REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation, in place since 2006 and still the world’s most advanced chemicals legislation. Printing companies that can minimise their dependence on chemicals cut costs associated with reporting and compliance, as well as on consumables, inevitably optimising their production processes.

The REACH objectives are part of the EU’s wider environmental policy to change behaviours so that environmental impact is improved because “business as usual is not an option”. REACH involves four phases of implementation: registration, evaluation, authorisation and restriction of chemicals and is expected to be fully implemented by 2018. The effect of REACH on the marketplace so far has been

to make the chemicals industry much more accountable and of course more creative. However the legislation has been costly for companies to implement and it has been charged with compromising global trade.

Water is an important resource for print production; however demand for water is increasing by 64 billion m³ per year. 20% of this increase is required for industry, according to the UN. In the last century water use rose at twice the rate of population growth and water scarcity has become a real threat in many regions. Industry, which accounts for 53% of water usage in the EU, is expected to contribute to managing water's use and waste. Water restrictions such as those enshrined in EC Directive (85/337/EEC) for reporting environmental impact assessments do not yet appear to have had a substantial impact on the printing industry. But this will change because in most developed markets water use and conservation are moving up the environmental agenda. France introduced its Water Act, a water resources planning system, in 1992 several years before the EU brought in its Framework Water Directive in 2000. Water management is particularly important for countries which depend on other countries for their continuity of supply, such as the Netherlands and Portugal. Supply is finite, but usage is not and demands on this precious resource are constantly rising. According to McKinsey³ only about 2% of water is freshwater and competing demands could lead to an estimated 40% global water supply shortage by 2030.

Quality Control

For many companies, such as Olegáron Fernandes in Portugal or Quad Graphics in Poland or Kristianstad Boktryckeri AB in Sweden plus countless others, environmental impact mitigation is a core company philosophy. But equally it is recognised as a driver for changing business processes and improving resource management and output quality. For years companies have worked hard to automate processes in order to eliminate process variables that may have a negative impact on quality and costs. Process control improves

³ Charting Our Water Future: Economic Frameworks to Inform Decision-Making 2009

colour appearance and consistency in print, speeds job processing and reduces production errors. For many printers the goal in implementing these technologies has been lower costs and better margins. However process improvements also help cut carbon footprints. Compliance with such standards as the EU Ecolabel or ISO 16759 for calculating and communicating the carbon footprint of print media is simpler for companies with tight control over processes and quality management.

Such efficiencies reduce the amount of energy required to produce print media, but technology has also made it possible to optimise production in prepress. It began with the advent of direct to plate production, also referred to as computer-to-plate (CtP), which images page impositions straight onto the printing plate, without the interim step of film imaging. This has allowed many commercial printers to achieve compliance to international standards such as ISO 12647-2 (Process control for offset lithography). This standard specifies various process parameters and values for producing printing plates for four colour printing. Output that meets requirements of ISO 12647-2 is the printing industry's most important quality benchmark. Plates for commercial printing applications that can hold a 20 μ dot for tone values of 1-99% at 200 lines per inch (lpi) help a printing company to be well within ISO 12647-2's quality specifications.

Computer-to-Plate Production

In removing the need for film imaging and processing, CtP takes film processing chemistries out of the production equation and reduces water usage and the associated waste. Agfa has pioneered chemistry-free plates and recent plate technologies from Fujifilm and Kodak have taken this one step further. Their technologies cut altogether the need for chemical processing to prepare printing plates for the press. CtP production with output to processless printing plates obviously cuts water consumption and chemical usage substantially. CtP also improves output quality on press, since plates are imaged with a first generation dot, rather than being imaged from film. Film based workflows produce printing

plates with softer dots which leads to inferior colour appearance in print.

The latest generation of processless plates overcomes limitations such as durability and imaging speed, which plagued earlier technologies. They also reduce the overall carbon footprint of print media. With an exposure sensitivity of $150\text{mJ}/\text{cm}^2$, plate technologies such as Kodak Sonora image quickly for higher productivity in prepress. To be suitable for a range of high quality applications, processless plate technology must be able to support AM and stochastic (FM) screening. Processless plates should also have a good plate contrast and be able to be handled in white light or even daylight for limited periods. The perfect processless plate should be a drop-in replacement for conventional digital plates, requiring no gumming and robust enough for over 100,000 impressions on a sheet-fed press. Such plates inevitably have a positive impact on production efficiency, output quality, resource management and the costs associated with print production.

The Technology

Kodak's Sonora processless plate technology was introduced in 2012. It is the latest evolution of Kodak's Thermal Direct, a proven Process Free (PF) plate technology in use at over 1,500 print production sites worldwide, at the time of Sonora's introduction. Currently around 900 customers have either moved to Sonora from Thermal Direct or invested in PF technology for the first time with Kodak. Sonora is a nonablative, thermal negative working plate suitable for runs of up to 100,000 on sheet-fed presses and 200,000 on web presses, so it has the advantages of conventional plates without the associated processing costs.

Printers can use this technology to cut carbon footprints and improve productivity because processless plates require less energy and chemicals to image. Kodak is making this technology available for both commercial printers (Sonora XP) and newspaper printing (Sonora News). Kodak offers this technology in many different formats, so the plates can be used for all commercial printing

applications, newspaper printing and even to print packaging. These plates also work with UV-inks, which expands their application scope yet further. The current customer base is producing high quality work in all these applications, however commercial applications dominate.

Industry Leadership

Kodak has been in the vanguard of sustainability developments for many years and has a long history of commitment to social and environmental sustainability. For instance the company's design strategy considers the complete life cycle of Kodak's products, to ensure that products and services support print's sustainability and Kodak's environmental impact values. The company's manufacturing plants around the world reflect this commitment: Kodak's factory in Osterode where Sonora plates are manufactured for European customers is certified to ISO 50001, for energy management. Certification to this ISO standard confirms that the Osterode plant's energy usage is managed through proactive controls and processes that allow for constant improvements in emissions management. The factory is also certified for compliance to ISO 14001 and ISO 9001 for quality management, plus ISO 18001 for occupational health and safety management systems.

Call to Action & Conclusion

Sustainability in the graphic arts and the environmental impact of print has evolved in tandem with technical advances over the last couple of decades. Kodak has driven many of these advances in prepress, from developments with its Unified Workflow and ColorFlow technologies, through to its plate technologies and comprehensive digital press portfolio. Thermal Direct has had global success with thousands of installations in commercial printing companies and many hundreds of sites for newspaper production. Kodak's latest iteration of this proven technology, Sonora, was introduced at drupa 2012, the print industry's most important trade show. Since then Kodak has been steadily building its base of processless plate installations and has introduced additional

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gauges and plate sizes to meet the needs of more customers. Kodak has also been working with industry colleagues in the newspaper sector to increase the speed with which plates get on press. Using bar code readers and automated punching and bending equipment improves the efficiency of plateloading, so that editors can close their pages to ever tighter deadlines.

For too long the printing industry has allowed its sustainability credentials to go unrecognised. Technologies such as processless printing plates drive further reduction in print's environmental impact and will continue to evolve to be even more environmentally friendly. This technology allows printers to reduce their carbon footprint and production costs. Those who want to cut carbon can invest in technology that benefits the environment and provides customers with more competitive products. Kodak Sonora allows printers to increase their productivity and profitability. And it provides print buyers with the quality they need for effective and environmentally friendly communications. Our industry has a responsibility to ensure that print's ability to exploit digital technologies for sustainable communications is fully appreciated in the market.