DIGITALEUROPE

Best Practices
in Recycled Plastics

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INDEX

Recycled Plastics in your ICT Products: The State-of-Play

Industry has been experimenting with the use of recycled plastics in electric and electronic equipment (EEE) since the early 2000s. Where post-consumer recycled material was once considered novel, recycled plastics are now found in a variety of ICT products as companies start to use recycled plastics as part of voluntary agreements/certifications or broader green marketing initiatives.

The imaging equipment industry, for example, has signed a voluntary agreement[1] (VA) in the framework of the Ecodesign Directive, which requires producers to declare the use of recycled plastics to customers since 2015. The VA was signed by 15 producers that account for more than 95% of all office and household imaging equipment sold in Europe. Declaration requirements of the use of recycled plastics are also in the ECMA 370 Eco Declaration[2].

As the use of recycled plastics is already gaining momentum in some sectors – now presenting a good opportunity to share existing industry best practices for addressing the challenges in using recycled plastics in ICT products.

Currently, the Circular Economy and the development of secondary raw material markets are high on the European agenda, and are attracting member state support[3]. At present, however, there are a number of challenges yet to be overcome for recycled plastics to be more widely used. For any product, material sourcing and selection is one of the most important business decisions. For ICT products that are subject to complex legal requirements it is even more critical to ensure that all materials, including recycled plastics, meet multiple requirements for hazardous substance screening, safety and quality assessments, security of supply, economic viability, cosmetics, performance and consumer preference. While recyclers have made technical progress in the past few years, it is still not easy to find sufficient supply of high quality post-consumer recycled plastics that meets all the technical, economic, and aesthetic requirements.

The idea for this paper emerged from a series of industry workshops and visits to recycling plants. It is clear that the widespread use of recycled plastics in all ICT products remains a challenge. However, with a combination of economic incentives and technical progress, the ICT industry could make a meaningful progress. This paper aims to showcase current best practices of early adopters to inspire other producers and also to highlight ongoing issues to policy-makers. After an initial assessment of the market size and expected trends, the paper briefly looks at opportunities and challenges in using recycled plastics and presents a number of industry case studies.

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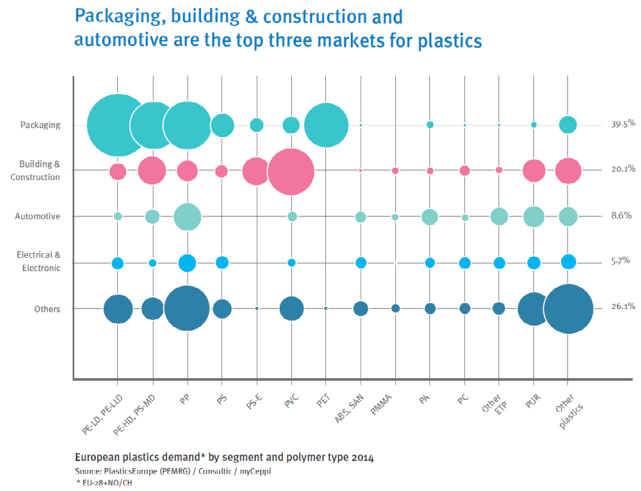
[1] http://www.eurovaprint.eu/home/. The text of the voluntary industry agreement can be found on this Website.
[2] This standard details environmental attributes and measurement methods for ICT and CE products, see: http://www.ecma-international.org/publications/standards/Ecma-370.htm
[3] See brochure prepared by NRKs and Philips. Can be downloaded here:
http://www.partnersforinnovation.com/media/Guidelines-designing-with-recycled-plastics.pdf
http://www.partnersforinnovation.com/media/Caseguide-Designing-with-Recycled-Plastics-digitaal-spreads-1.pdf

The vast majority of plastics are used in the packaging industry, building/construction and automotive sectors. PlasticsEurope estimates that the electric and electronics industry accounts for about 5-7% of the total European plastic demand about 2.7 million tons out of a total 47.8 million tons. The figure below shows the European plastics market per sector, and per polymer type. As can be seen in in other market segments, the highest share of polymers in EEE products is taken by PP (Polypropylene) and PUR (Polyurethane). Other important plastic types in EEE are PS, ABS and PA.



(Plastics – The Facts 2015[4], p. 18)

A 2013 study on the German plastics market[5] presents comparable results. In Germany, 6% of plastics was used in EEE products (705,000 tons), with PP, and the group of ABS, ASA and SAN polymers being used most frequently.

Electronic products contain a large number of parts and materials because of to their heterogeneous and diverse applications. Most of the plastic materials used in PCs, for example, are used as housing. In imaging equipment, next to plastic housing, also has many internal plastic parts that play a structural and load bearing role. Therefore, different grades are required depending on the nature and purpose of each part. For plastics used in small, integrated mechanical components the situation is again very different. Plastics used in customer facing applications (such as product chassis) have to meet particular aesthetic and mechanical requirements, which often limit the possibility to use material from recycled sources.

A handful of recyclers are focusing on the recycling of common plastic types like and ABS, PP and (HI)PS. Rising WEEE volumes will result in higher availability and recycling of these plastics. However, several types of ICT products often use engineering plastics (complex polymer blends such as PC+ABS), typically with additional requirements such as flammability class and stringent cosmetic demands. Finally, for engineering plastics, a large variety of plastic sub-types (with glass fiber fillers, talcum fillers, flame retardants, etc.) is used. Due to these fillers and additives, these plastics types have overlapping densities. This, in addition to their relative low volumes, makes it difficult and economically challenging to separate for high quality recycling.

Closed B2B recycling for products, such as PET bottles, have proven to be economically and legally feasible as the material has a consistent chemistry. Due to the complexity of recycling engineering plastics as described above, virgin plastics are often cheaper and more widely available in reliable supply volumes the recycled alternative. Nevertheless, DIGITALEUROPE expects the number of recyclers for some of the more commonly used plastics available from the WEEE waste stream to grow and for quality to improve[6]. This will have a huge impact on the ability for companies in the sector to incorporate more recycled plastics into their products.

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[4] http://www.plasticseurope.org/Document/plastics---the-facts-2015.aspx
[5] http://www.plasticseurope.org/documents/document/20141008165104-endbericht_2013_2_%2823__sep_2014%29_kurzfassung.pdf
[6] See also a study by ecoprog on the European Plastics Recycling Market:
http://www.ecoprog.com/en/publications/waste-industry/plastic-recycling.htm

Merits and Opportunities of Using Recycled Plastics

Why should companies start using recycled plastics as of today?

- **It is ecological:** Users of plastics will be less dependent on crude oil, which is a finite resource. Recycled plastics avoid the use of new materials and save energy for production. Life Cycle Assessments have shown that using recycled plastics results in lower environmental impact.

- **It supports the development of a market for secondary plastics:** In Europe only 29.7% of all plastics are currently recycled[7]. Supply will reflect demand, so demand for recycled plastics will help to develop a market for secondary raw materials.

- **It spurs innovation:** Cooperation with recyclers and researchers will provide new inputs for design and manufacturing to unlock innovation potential.

- **It is a sales driver in the BtoC space:** Recycled plastics and "green products" can be easily taken up for marketing strategies to consumers, and function as direct sales drivers.

- **It supports the brand image:** A product with recycled plastics components can support CSR policies and be a flagship for brands.

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[7] http://www.epro-plasticsrecycling.org/pages/75/epro_statistics

Challenges and the Way Forward

While the merits and opportunities of using recycled plastic are numerous, there are just as many barriers and challenges, which should not be ignored.

- Using recycled plastics in EEE products create additional challenges in complying with EU chemical substance regulations such as RoHS and REACH since recycled plastic content introduces a risk of unknown contaminants. Where stricter criteria for chemicals substances are introduced under voluntary eco-labeling schemes (e.g. EU Eco-flower), moreover, it becomes practically impossible to reconcile the goal of using recycled plastics and full compliance with chemicals criteria.

- The market for recycled plastics in terms of quality, quantity, dependability and price is uncertain, and the roll-out potential seems to be difficult to assess for producers. Furthermore, a switch in an existing product to recycled content requires expensive re-testing to ensure compliance with safety regulations and quality/durability requirements.

- Recycled plastics are likely to come from several different suppliers, which are smaller in size than typical suppliers of virgin plastics. Hence, they are less able to meet fluctuations in demand volume as they cannot control the rate of source materials arising without holding expensive feedstock or finished material buffer volumes.

- Consumer acceptance needs to be tackled. Cosmetic blemishes from recycled content may not affect technical performance of a product, but can still influence aesthetic factors. So it is difficult to expect the wide use of recycled plastics for the products whose design and look can play a critical role in consumer purchase decisions.

Until the above barriers have been resolved, EEE manufacturers are likely to try to avoid the risks of either low supply volumes or sporadic availability, from affecting their manufacturing output. Unintended chemical contamination also presents risks for both chemical compliance and consumer safety, and variable purity can affect quality failure rates or warranty claim rates.

Then, **what is a good way forward for overcoming these barriers and challenges?**

There may be no magic solution but it will likely be a combination of methods. The most critical element for success is to encourage innovative solution development in the marketplace and to put in place framework agreements that will encourage uptake and ensure scalability of already existing initiatives (e.g. financial incentives or R&D support for recycled plastic projects). In addition, DIGITALEUROPE encourages its members and other EEE manufacturers to:

- Identify products or components that are most suitable for the use of recycled plastics where barriers are relatively low
- Design products with the recycling and dismantling process already in mind
- Use recyclable material and adapt the design to recycled plastics' potential (colour, surface, focusing on interior parts, …).
- Enter into a dialogue/project with plastic recyclers on:
    - ***qualities*** – acceptance of recycled content demands that it can meet the same stringent quality requirements as virgin material, and will not affect the final product (e.g. surface defects, or delamination, etc.); and
    - ***amounts*** – supply volume is less of a problem if the initial usage starts low (e.g. a 10% blend) and increases slowly over time, but reliability of supply (e.g. X tons per month for Y months) and predictability of cost are needed to compete against virgin materials.
- Test recycled material in a limited number of products and components to start with.
- Secure strategic support for a recycled plastic project

The case studies in the next chapter show that **it is feasible** to use recycled plastics in a number of ICT products when innovative solutions are explored for particular products or components. We hope the case studies provide sufficient inspiration for more companies to join the projects.

DELL: Closing the loop for plastics in electronic products

At Dell, we challenged ourselves to create a closed loop supply of plastics whereby Dell can make plastics parts for personal computers using plastics recycled from old electronic equipment (a closed loop system). In 2014, Dell announced the partnership for closed loop plastics with our ODM partner Wistron and the Dell-Goodwill Reconnect Program. With this program, plastic from obsolete IT products are collected, reprocessed, and moulded into plastic parts to be used in new Dell products.

What is Circular Economy?

The last 150 years of industrial evolution have been dominated by a one-way or linear model of production and consumption, in which goods are manufactured from raw materials, sold, used, and then discarded as waste. Increased volatility in commodities and growing pressure on resources have alerted business leaders and policy makers to the necessity of rethinking materials and energy use - the time is right, many argue, to take advantage of the potential benefits of a circular economy. As demonstrated in the Ellen MacArthur model, there is opportunity to move away from our "take - make - dispose" production and consumption patterns.

In 2013, Dell announced the 2020 Legacy of Good sustainability plan, where one of the environmental goals is to use 50 million pounds of post-consumer recycled-content plastics and other sustainable materials in our products by 2020. This goal served as a key driver to increase use of recycled content in our products and encouraged us to develop new and unique sustainable solutions that promote the recycling of plastics. In 2014, with the launch of the OptiPlex 3030 All-in-One, we became the first in industry to use closed loop plastics in our products. Today, 48 of our flat panel monitors, desktops and all-in-one computers use closed loop plastic, bringing our total volume of closed loop plastic shipped to over 3.4 million kg.

OptiPlex 3030, the first product to contain 10% closed loop material, a process validated by ULe

Closed Loop Process

Together with UL Environment, we developed a standard for the closed loop supply chain – 'Environmental Claim Validation Procedure (ECVP) for recycled content UL ECVP 2809,' in which closed loop system is defined as "a system in which materials are reclaimed, returned to and reused for the production of the same type of product in which the material was first used" e.g. from a plastics used in electronics to another plastic in electronics or from water bottle to a plastic bottle.

In order to implement such a system, engagement from both internal and external stakeholders was critical. External stakeholders included Dell's recycling service partners (environmental partner) who provide collection and recovery of old electronic equipment. Internal stakeholders included leads from various function critical for this project's success. We built a cross functional team from environmental compliance, services, procurement, marketing, engineering and supply chain. This team was critical to understanding the business challenges from the entire product lifecycle perspective and help driving the necessary action within their business.

Cloud Computing

Dell has a decade long partnership with Goodwill Industries[8] in the United States. Under this program, consumers have easy drop off access to recycle any brand of computer equipment for free at over 2000 participating Goodwill locations in North America. Since 2007 this effort has kept over 722 million kg of e-waste from potentially getting into landfill by responsibly recycling it. Dell opened up this channel for diverting old electronics to our certified environmental partner Wistron Green Tech (WGTX). Old systems destined for recycling are treated per the Dell Disposition Policy and our takeback agreements with environmental partners. They are disassembled and sorted into various recyclable streams.

Plastics from electronic waste, which is traditionally incinerated or down-cycled, is used as feedstock in this closed loop initiative through a recycling system. Plastics are sorted, baled and further processed by Wistron Advanced Material (WAM), a producer of post-consumer (PCR) plastic materials. The compounded PCR pellets produced by WAM are used as raw material by moulders who manufacture them into new parts for computer cover, housing etc.

Both WGTX and WAM facilities were audited according to Dell's environmental partner performance standard. The entire process and products were additionally validated per the UL ECVP 2809 procedure for closed loop plastics certification. Before the part goes into mass production, it has to go through stringent engineering qualifications.

Engineering Qualifications

At Dell, product designers are aware of the inherent trade-off when choosing plastics. They use several design for recycling principles to aid recovery and recycling. Designers facilitate recycling by selecting materials that can be used in internal "closed loop" recycling processes. This approach helps provide an outlet for the plastic at the end of its life. Additionally, using recycled-content plastics and other sustainable materials is one key opportunity to curb our resource use.

Sustainability of Closed Loop

We understand that a closed loop system can drive up demand for end-of-life plastics for recycling. This is good from an economic and recyclability perspective, and closed loop recycling also has substantial sustainability benefits. Closed loop plastic has an 11% lower carbon footprint when compared to virgin ABS. To date, Dell has shipped 3.4 million kg of closed loop plastic, resulting in an emissions reduction of 509,000 kgCO2eq, or the equivalent of removing over 100 cars from the road for one year.

In 2015, Trucost evaluated the net benefit of closed loop ABS compared to virgin ABS. The net benefit takes into account the sum of many environmental impacts, including ecotoxicity, fossil fuel depletion, CO2 emission and human health impacts. It was found that closed loop recycled plastics has 44% higher environmental benefits over virgin ABS.

Dell has continued to gain industry recognition for the closed loop initiative. Dell was honoured with the 2015 Accenture Award for Circular Economy Pioneer at the Circulars, and the Green Electronics Council's 2015 Catalyst Award, which celebrates innovative solutions and tangible environmental accomplishments throughout the lifecycle of electronic technologies. Additionally, Dell received the Sustainable Purchasing Leadership Council's 2015 Outstanding Case Study Award for our closed loop recycled plastics initiative. We were also honoured to again win the U.S. EPA's Sustainable Materials Management Electronics Challenge, recognizing our commitment to driving the circular economy.

Dell has launched an innovative closed loop recycled plastics program and has realized that there is tremendous opportunity to divert plastics from electronic waste into new electronic products. By reusing plastics already in circulation, Dell is cutting down on e-waste, reducing carbon emissions and helping drive a circular economy for IT. For more information, please visit www.dell.com/closedloop.

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[8] http://www.dell.com/learn/us/en/uscorp1/corp-comm/usgoodwill-reconnect

HP Inc.: Recycled plastics in Inkjet cartridges

In 1991 HP Inc. launched the "Planet Partners Program", allowing customers to return used original HP print cartridges for recycling. In 2000, HP Inc. started an investigation of closed-loop recycling for the plastic recovered from recycled inkjet cartridges. Over the next five years, the HP team, along with supplier partners tested numerous recipe iterations, making improvements to meet moulding, manufacturing and product requirements. HP engineers, chemists and partners dedicated themselves to finding a way to provide the environmental benefits of using recycled materials while still delivering the uncompromising quality and reliability customers count on from HP. Finally, in 2005, HP successfully developed a closed-loop PET plastic that met moulding, manufacturing and product specification requirements for original HP inkjet cartridges.

Included in the final recycled PET (rPET) recipe was a combination of HP product take-back, recycled PET water bottles and a suite of additives necessary to return the recycled resin to virgin material performance standards. The HP closed-loop ink cartridge recycling process was the first of its kind. The initial recycled PET solution was qualified into a single HP inkjet cartridge in HP's Puerto Rico manufacturing facility. Lessons learned from this effort led to the successful program expansion to all families of HP inkjet cartridges that use PET plastic in manufacturing locations worldwide – including closing the loop in 2007 with rPET qualified into the original **HP Thinkjet printhead** – originally designed in 1984! Despite reduced volumes, even this legacy inkjet supply is now manufactured using closed-loop PET.

Since 2005, HP Inc. has closed the plastics loop into a number of additional inkjet supplies families, including two large families using polypropylene (PP) plastic in 2013 and 2014. The recycled PP solution for the first (2013) family includes a combination of HP product return plastic, recycled clothing PP hangers and additives. The second PP solution involves 100% HP take-back material and is being combined with virgin resin at a 10-20% mix rate.

As a result of these multiple closed-loop plastic material qualification, at the end of HP's fiscal 2015, HP had used more than **50 million kilograms** of recycled content, including the plastic up-cycled from more than **3.3 billion PET water bottles** and **50 million clothing hangers**, in producing more than **2.7 billion original HP inkjet cartridges.**

An HP Inc. funded, externally reviewed, Life Cycle Analysis (LCA), first conducted in 2010 and updated in 2013, concluded that HP's first closed-loop plastics rPET material in comparison to virgin resin provided a 33% carbon footprint reduction, consumed less than 54% fossil fuels and enabled an amazing 75% reduction in water usage.

HP inkjet cartridges returned through HP's Planet Partners Program undergo a multi-phase recycling process that reduces them to raw materials such as plastics and metals. As part of HP's continuous improvement process and desire to improve recycling efficiency, HP continued to look for further opportunities to optimize the recycling and recovery of PET and PP plastic from returned HP cartridges. Collaborating with strategic partners, HP developed a breakthrough automated dismantling process, increasing the quantity of plastic recovered from each PET cartridge by 50%. This innovative solution helped to reduce processing nodes since the recovered plastic needs less contaminant removal and cleaning, reduces transport, energy and water requirements.

The amount of recycled plastic in the HP inkjet cartridge families varies between 50 and 75% of the total plastic used, and in all cases, the reliability results for each product are stringently tested and consistent or better than the prime resin.

Unlike companies that simply remanufacture cartridges, HP Inc. has found a way to mould these recycled plastic components into new Original HP inkjet cartridges.

In 2008, The Society of Plastics Engineers recognised HP Inc. with their highest environmental award – The Dan Eberhard Environmental Stewardship Award' and in describing the HP Inc. accomplishment commented *"HP's use of recycled plastic in an application as technically demanding as their inkjet cartridges represents an unprecedented engineering innovation,"* (Larry Koester, VP Communications, Environmental Division, Society of Plastics Engineers).

HP's approach to environmental management of its print cartridges considers every facet of the product lifecycle – using recycled content is the latest advancement from HP's Design for Environment program, which reduces the environmental impact of HP cartridges through material usage, ease of recycling and packaging efficiency.

Lenovo: Post-consumer and post-industrial recycled content in various products[9]

Lenovo challenges itself to be one of the environmental leaders in the industry, including activities and continuing efforts on recycled content, phasing-out brominated flame retardants and PVC, low halogen transition, designing for recycling and reducing energy consumption.

Concerning recycled plastics in Lenovo products, the first steps were already taken in the early Lenovo days, 2005-2006. At that time, Lenovo recognised the environmental considerations and potential environmental benefits of using recycled content plastics and took strategic actions to increase their use in the production of Lenovo products. Initially, Lenovo identified recycled content plastics as an "environmentally preferred" material in order to reduce the use of natural resources and the carbon footprint of its products and build the infrastructure and demand for recycled content plastics.

To demonstrate "engineered" recycled content plastics could successfully be used in computer applications and satisfy the demanding requirements, Lenovo's team first worked with post-industrial content (PIC) recycled plastics, in collaboration with a major plastic manufacturer. Then, they moved to a plastic compounder to develop and qualify a second kind of 25% recycled FR-PC/ABS material. In 2007, they had progressed to 30% post-consumer-content (PCC) stemming from PET water bottles. This represented one of the first large-scale industry usages of recycled plastics.

After starting to use PCC and PIC in selected products, Lenovo broadened the scope of recycled content usage. Lenovo's team of engineers works closely with PCC suppliers to develop and test new grades of plastic resins previously unavailable to the IT industry. All materials receive environmental and performance qualifications, so that these environmentally friendly solutions also meet Lenovo's highest quality standards in terms of performance.

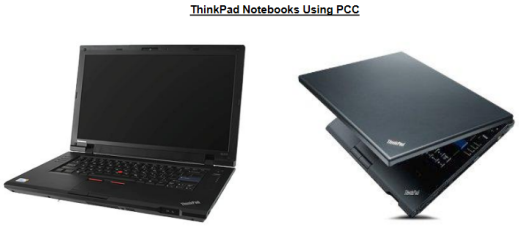
Lenovo challenged its product teams to incorporate at least some PCC into every PC product released by the end of the fiscal year (March 2013). Today, Lenovo uses PCC and PIC across all PC product categories, namely in all Lenovo desktops, AIOs, workstations, notebooks, visuals, options and servers. In 2015, Lenovo used more than 9,000 tons (gross) of recycled plastics. It continues its efforts of increasing the use of these environmentally preferred materials; the goals for 2015/2016 included:

- All product BUs shall use PCC in every product
- Maintain and increase current percent PCC usage levels in the next generation of existing products.

Lenovo Monitors and Notebooks

In 2009, Lenovo worked with a Lenovo recycled plastic supplier to develop and qualify a new HB-ABS recycled material with 65% PCC from end-of-life electronic products plus 20% PIC for use in producing monitor parts. After successfully completing moulding trials and product testing, this material was eventually introduced in the production of Lenovo's new series of ThinkVision Monitors.

Lenovo L2251x Wide Monitor



A similar process was adopted for Lenovo ThinkPad notebooks, resulting in recycled plastics used in the LCD cover, base cover, top cover, palm rest and the thermal door. Both ThinkPad SL410 and SL510 include more than 10% net PCC from sources such as used office water jugs and IT equipment. Currently, almost all ThinkPad Edge notebooks and ThinkPad L notebooks contain at least 10% post-consumer recycled content. Many Lenovo commercial desktops use significant amounts of PCC, including the ThinkCentre M92p Tiny (39%), the ThinkCentre M92p and M82 Tower (42%), and the ThinkCentre M92p and M82 Small Form Factors (36%).

Beyond that, ThinkPads use uniform materials with uniform colours: ThinkPad is made to be recycled. One example is the "unification of the material." To make recycling process easier, unification of the material including the colour is considered. Also, all plastics over 25g are material-coded for recycling[10].

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[9] https://www.lenovo.com/social_responsibility/us/en/GreenPaper_Recycled_Content.pdf
http://www.lenovo.com/social_responsibility/us/en/materials/

[10] https://www.lenovo.com/social_responsibility/us/en/GreenPaper_ThinkPad_Design_for_Environment.pdf

Lexmark: Use of plastic and post-consumer plastic in Lexmark products

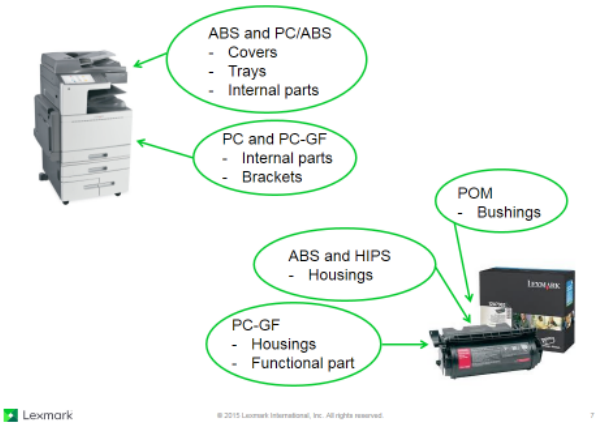
Lexmark is a global technology leader creating enterprise software, hardware and services, embracing the vision of building a circular economy. It is now Europe's leading remanufacturer of printer cartridges in proportion to its share of the market. For Lexmark, being a responsible neighbour, employer and global corporate citizen is woven into everything it does. To align with the corporate sustainability goals, Lexmark has identified many opportunities to utilize post-consumer recycled (PCR) materials in its products.

Changing regulations have led to an increase in suppliers offering quality recycled plastic materials. Lexmark engineers study the broader use of post-consumer recycled plastic in its products to identify new sources and grades of post-consumer recycled plastics for use in electronics. The consistency of both supply and quality of post-consumer plastic is of primary importance. Lexmark looked at third-party resin suppliers for PCR in printers, identified stable suppliers and quality resins focusing on 8–10 material grades, and taking more risk, convinced Design Engineers to use more PCR in printers.

The product PCR initiative has evolved from 2007 when PCR was returned to cartridges, and 2009 when Lexmark returned PCR content to its printers with 4% PCR content in one high-end colour laser printer. Now all Lexmark devices and cartridges contain PCR content. In 2012, Lexmark's new product line announced three lines of printers having 5% to 40% PCR content.

These achievements are especially notable for their closed-loop use of electronic waste into new electronic products. To expand its goal of prioritising long-life, reliability and sustainability in its products, Lexmark announced its 2016 product line meeting EPEAT Gold. The series' plastic components contain around 50% PCR material by weight, diverting what would otherwise be landfill waste. The CS72x printer, for example, is made of 53% recycled plastics. That was not only a one-time accomplishment. Lexmark has taken the circular economy to heart, with more than 30% of the Lexmark printer line now having a minimum of 5% recycled plastic content. The company also follows a zero-landfill policy for all the used cartridges it collects. Of the empty cartridges returned to the company, 100 percent are either reused or recycled.

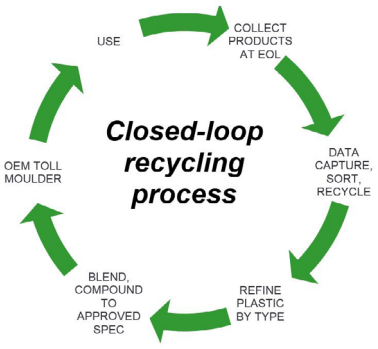
Lexmark also continues its innovative closed-loop toner cartridge recycling operations. Through the award-winning LCCP, its engineers reclaim feed streams of various types of plastics in Lexmark's own R2 Certified Recycling Center. Lexmark is an industry leader in the use of reclaimed plastic in its cartridges with 18% average PCR plastic content, by weight, across all toner cartridges, with several cartridges containing over 25% PCR in 2015: 92% of Lexmark-branded toner cartridges contain at least some PCR content. The 2018 goal is to average 25% PCR plastic content across the entire toner cartridge product line.



Where post consumer plastic is used

Lexmark has a growing presence within the European Union and has established printer cartridge (re) manufacturing lines in Poland, employing more than 300 people. By 2017, Lexmark expects to source 80% of its cartridges being sold in Europe from within the continent. By 2018, Lexmark also aims to reuse 50% by weight of the cartridges returned, a substantial increase on the current figure of 34%, which currently establishes the company as the industry leader.

Lexmark intends to partner with other industry sectors as well as plastics recyclers to develop a strong network. The network should identify new sources of plastics and line them up with the growing number of users of PCR plastic. This would ultimately help to stabilize the feed stream cycle of the recycled plastic industry and drive it to improve quality and cost competitiveness for the global market.



Closed-loop recycling process

In addition, Lexmark has partnered with the Ellen MacArthur Foundation to unlock the commercial opportunities that arise through such factors as designing products for reuse, new or enhanced recovery models and the introduction of new business models that promote greater circularity. Taking part in the "Circular Economy 100" program allows Lexmark to work together with a group of like-minded businesses to promote the benefits of the circular economy, and its involvement maintains and improves its own approach to incorporating such practices.

CE100

Integrating sustainable thinking into the Lexmark product strategy optimises the manufacturing process, reduces environmental impact and ultimately eliminates waste. Leveraging circular economy principles to help retain more value from the material, energy and labour that goes into its products, Lexmark is committed to create a home within its products for recycled plastics to return to the cycle.

Océ-a Canon Company: Recycled plastics in a complex electronic product

A CANON COMPANY

Océ - A Canon Company - is active in digital imaging, industrial printing and business services. Océ designs with the circular economy in mind. Our products have a long lifetime and can be effectively reused and recycled. Furthermore, we have experimented with the use of recycled content for several of our printers. Our very first pilot was that of the varioPRINT 135 production printer where we used post-consumer recycled polycarbonate (PC) obtained from water bottles.

varioPRINT 135 production printer

The varioPRINT135 is a black-and-white production printer. It is based on the unique Océ DirectPress® Technology, a highly stable technology that prints consistently high-quality images on a wide range of media. The result is new standards in image consistency, intuitive operation, systems configurability and performance uptime. This production printer helps cut costs, expands business opportunities and reduce customers' environmental footprint with the following sustainable innovative technologies:

- Ozone-free printing
- EPA ENERGY STAR® rated with lowest TEC value in its class
- Reduced energy usage with Océ HeatXchange
- Smart energy usage with Océ EnergyLogic
- EPEAT[11] Bronze registered

varioPRINT 135 production printer

Océ has used recycled PC in a PC+ABS blend for a non-visible component of the printer. This component, an internal support bar for the outside panels of the printer (a low-risk part was chosen for this pilot), is manufactured using a PC+ABS blend. The recycled PC replaces the virgin PC and contains approximately 30% of the PC+ABS. The PC was sourced from water bottles. This material is food-grade and therefore compliant to strict chemical safety legislations (such as REACH, RoHS).

Designing with recycled plastics for complex electronic products such as a printer has its challenges in terms of quality, feasibility and cost, see table below for more information.

Quality

- chemical safety and legislation: REACH/RoHS
- flammability class (Expensive UL registration and testing required)
- issue with aesthetics such as colour, texture, shine

Feasibility

- availability (no interruptions at the production line allowed)
- material properties have to be comparable to the virgin material
- suitable design parameters
- Business case, virgin plastics are cheaper, recycled plastics has low priority for a professional market

Summarising, there are still several conditions to be met for recycled plastics to become feasible for a complex electronic product such as a production printer. Notably the lack of a good business case (since virgin material is cheaper than the recycled material) is a deterrent to introduce this on a larger scale. Finally, for large production printers it is reuse and recycling that has real significance when it comes to business circularity.

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[11] EPEAT (Electronic Product Environmental Assessment Tool) is a method of evaluating the impact of products on the environment. It assesses the environmental aspects of the life-cycle of products and awards a gold, silver or bronze label.

Samsung Electronics: 85% increase in recycled plastic use in 3 years

Samsung Electronics has recognised the importance of reducing the environmental impact generated from the production process of petroleum-based plastics and establishing a resource circulation society. After classifying, cleaning, and shaping plastics from collected waste products in collaboration with its recycling partners, Samsung uses recycled plastics for selected product ranges.

We work hard to expand the application of recycled plastics, develop new internal specifications for quality of recycled plastics and share new technologies with recycled resin suppliers.

In 2015, we applied a total of 34,322 tons of recycled plastics (6.3 percent of total plastic use of Samsung Electronics) to monitors, printers, washing machines, refrigerators, vacuum cleaners and earphone cases.

Samsung's LCD monitors deliver an unmatched user experience, while maximising energy-savings and sustainable design for reduced environmental impact.

All of our 2015 monitors are designed with a 30 percent recycled plastic content and PVC-free body and the testing institute Intertek has certified the accuracy of this claim via its established recycled content audit. Furthermore, Samsung uses 20% of recycled plastics in the cases of the smartphone chargers, notably the Samsung Galaxy S6 and S7 chargers.

The replacement of virgin with recycled plastics makes business sense. The procurement of recycled plastics is decoupled from the fluctuating crude oil prices and positvely contributes to a substantial saving in CO2 equivalent. We look forward to further expanding the use of recycled plastics across Samsung's product range.

The business monitor is an ideal example of Samsung's commitment to a low carbon, circular economy.

Samsung Galaxy S6 and S7 chargers

Classification	2013	2014	2015
Recycled Plastics (tons)	19,403	33,628	34,322
Percentage (%)*	3.4	5.0	6.3

**Percentage (%): Use of recycled plastics to total use of plastics*

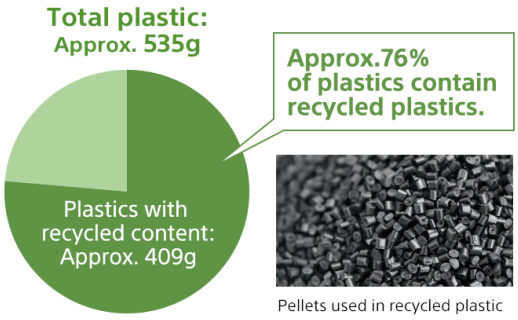
Sony: expanding our own brand of recycled plastic: SORPLAS™ (Sustainable Oriented Recycled PLAStic)

SONY

Sony recognises the importance of preserving the natural environment that sustains all life on earth for the future generations and thereby ensuring that all humanity can attain a healthy and enriched life. To this end, Sony strives to achieve a zero environmental footprint throughout the lifecycle of its products and business activities. By capitalising on its superior technology and ability to innovate, Sony strives not only to reduce the environmental impact of its business activities, but also to deliver environmentally conscious products and services that enrich customers' lives.

In FY2010, Sony established its Road to Zero environmental plan in a quest to reach zero environmental footprint in 2050. In order to attain our goal, our Green Management 2020 strategy establishes intermediate steps to be taken by FY2020. One of the objectives is to reduce virgin plastics per product by 10% (vs. FY2013). To achieve this, we are continuously increasing our use of recycled plastics. As such, for FY2014, over 19,000 tons of recycled plastics were used (63% scrap from manufacturing process and 37% post-consumer recycled plastic).

An example hereof is our BDP-S6200 Blu-ray player, which uses approximately 76% recycled plastics.



Pellets used in recycled plastic

We have taken our commitment to help build a sustainable society even further. As such, we developed SORPLAS™ (Sustainable Oriented Recycled PLAStic), which is our own brand of recycled plastic. It has several unique features. First, its recycled material rate can go up to 99%, which is the highest rate of recycled content achieved by any manufacturer. Second, the manufacturing process for SORPLAS™ generates 80% less CO2 than the processes used for conventional virgin plastics. Third, it has excellent material performance such as high heat resistance and impact strength, and good luster without coating. Finally, it excels in cost performance, being equally or less expensive than other recycled plastic types[12].

Practical usage of SORPLAS™ started in 2011, and now covers our various products using SORPLAS technology. For instance, our BRAVIA® 4K LCD TV X93C series and 4K Handycam® FDR-AX53 use SORPLAS in their internal parts and/or housing. The total amount of SORPLAS used in our products in FY2015 was about 400 tons.

Sony remains committed to our goals of decreasing our environmental footprint and contributing to constructing a more sustainable society. Therefore, we continuously look for opportunities to use SORPLAS™ and other recycled plastic types in more products.

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[12] For more information, please refer to http://www.sony.net/SonyInfo/News/Press/201408/14-073E/.

About DIGITALEUROPE

DIGITALEUROPE represents the digital technology industry in Europe. Our members include some of the world's largest IT, telecoms and consumer electronics companies and national associations from every part of Europe. DIGITALEUROPE wants European businesses and citizens to benefit fully from digital technologies and for Europe to grow, attract and sustain the world's best digital technology companies.

DIGITALEUROPE ensures industry participation in the development and implementation of EU policies. DIGITALEUROPE's members include **62** corporate members and **37** national trade associations from across Europe. Our website provides further information on our recent news and activities: http://www.digitaleurope.org

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