



Innovations in cartridge recycling



As an environmentally responsible provider of products, Lexmark designs every cartridge and device with recyclability in mind. We design products with easily removed materials and components to facilitate reuse. For over 30 years, Lexmark has reclaimed material through our Lexmark Cartridge Collection Program (LCCP), and for nearly 11 years has reused the plastic in

our closed-loop process at our Mexico facility. We focus on reusing materials through circular manufacturing within our own product lines. Where necessary, we seek innovative reuse opportunities in other industries.

Reclaimed plastic

Innovative processes created by our engineers recover post-consumer recycled (PCR) plastic from empty cartridges and pelletize the plastic for integration into new parts. All plastic collected from cartridges at our LCCP facilities is reused or recycled diverting plastic away from landfills and incineration. Reclaimed PCR plastic is incorporated into over 60 Lexmark components at a level up to 100 percent PCR plastic.

Plastics for 3D printing

As we form new partnerships, the materials from our returned cartridges and printers receive new life as fundamental components in nontraditional products. Our partnership with Sinctronics, a Brazilian electronics recycling company, expanded our efforts in circular manufacturing by reusing our end-of-life cartridges to produce high quality plastic. New plastic resin developed from recycled Lexmark cartridges is used for injection molding and in 3D printers.

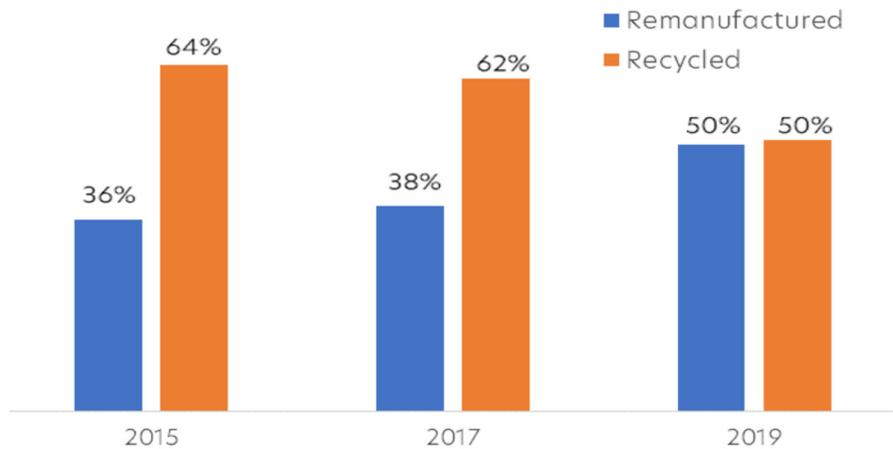
Return-for-remanufacture

To ensure more recycled plastics find their way into new products, Lexmark partners with syncreon in Poland to re-manufacture our cartridges. Plastics, metals and toner from Lexmark end-of-life cartridges are processed by syncreon to create brand-new Lexmark cartridges. The high-performing remanufactured cartridges are designed with the same engineering specifications and assessed with the same quality tests as new cartridges. Collecting materials for reuse at syncreon made it possible for us to expand our remanufactured parts in Europe from 36 percent in 2015 to 64 percent in 2021.

Continual improvement of our process increases the amount of materials we reuse and provides Lexmark the opportunity to assist the European Commission in achieving ten million tons of recycled plastics in new products by 2025.

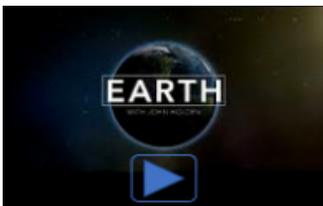


Cartridge Remanufacturing in Europe



Toner extending road life

Dedicated to maximizing the reuse of our customer's returned toner cartridges, Lexmark worked with our longtime sustainability partner, Close the Loop, to collaborate on ways to reuse toner. Close the Loop developed TonerPave, an asphalt additive composed of recycled tires, toner powder and recycled oil. This innovative additive provided Lexmark the opportunity to bring our excess toner back to life at our Lexington campus with the first commercial application of TonerPave in North America. Roads with TonerPave have characteristics superior to comparable roads with virgin raw materials. In 2021, Lexmark captured 319 metric tons of toner from recycled printer cartridges and manufacturing processes. Close the Loop created TonerPave and other engineered composites with 114 metric tons of toner. In 2016, TonerPave was awarded a Manufacturing Leadership award and High Achiever in the Sustainability category. An additional 88 metric tons of toner generated construction materials and alternate fuels. Waste-to-energy processes consumed 117 metric tons.



[Watch to learn about Lexmark's partnership with Close the Loop as reported by John Holden.](#)

Renewed roller

Creating a cleaning process to extend the life of a laser printer component was no easy task for Lexmark engineers. Before the new cleaning process, the developer roller in a laser cartridge was rarely a part of a Lexmark remanufactured cartridge. The roller possesses a difficult-to-clean film of toner on the rubber surface that inhibited its reuse. Testing revealed the roller had an extensive life if the film of toner was removed. Lexmark engineers created a novel washing system to remove the toner film using ceramic agitators with scrubbing agents to clean the roller without damaging it or altering its properties.



Reuse of developer rollers results in substantial environmental savings caused by eliminating the need to harvest new raw materials. In 2021, 161,737 rolls were reused in remanufactured cartridges providing savings of 46 metric tons of material and 795 cubic meters of water. Lexmark was awarded a Frost & Sullivan's 2015 Manufacturing Leadership Award in Sustainability Leadership for reconditioning our developer rolls.

New life for returned photoconductors

Lexmark devices contain photoconductor units, which are imaging cylinders with photosensitive coatings. In 2021, 260,000 photoconductors from our returned cartridges were collected and sent to our facilities in Boulder, Colorado, for recoating and reuse. An additional 118,000 photoconductors were recovered from the manufacturing line resulting in the reuse of 30 metric tons of aluminum.

Packaging with reduced carbon footprint

Lexmark engineers re-design packaging to increase the amount of material reused and minimize waste. Package design revisions of the Lexmark CX73x printers improve container efficiency during shipping by over 30.47 percent through volume-efficient packaging and utilizing alternate materials. The new design uses 50.17 percent less plastic, to facilitate an increase in recovery and recycle, and reduces total material by 38.30 percent. These efficiencies result in energy and natural resource savings, and fewer greenhouse emissions.



Embracing the circular economy, Lexmark creates molded pulp cushions composed of used paper. These packaging cushions provide excellent protection for our cartridges during shipping and are made from 100 percent post-consumer waste. In 2021, our pulp cushions gave over 190 metric tons of used paper a second life protecting our cartridges. This project was awarded a Manufacturing Leadership Award in 2013.