LIFE CYCLE ASSESSMENT

LASER PRINTER MX912DXE

According to ISO 14040 and ISO 14044



Lexmark's innovative imaging solutions and technologies help customers worldwide print, secure and manage information with ease, efficiency and unmatched value. Lexmark simplifies the complex intersection of digital and printed information.

As part of the commitment to our customers, Lexmark performs Life Cycle Analysis on our products. The results of the LCA analysis continues to assist Lexmark in reducing the environmental impact of the hardware, software and services offered to our customers.

High-volume output, long-life components, solid security and advanced finishing make the Lexmark MX910 Series the ultimate SRA3 capability multifunction product from Lexmark. As a complete line of SRA3 monochrome multifunction products by Lexmark, the MX910 Series brings speed, connectivity, security, sustainable design, a user-centric interface and advanced finishing to your enterprise supported by the complete Lexmark user experience, service options and solution library. The MX912 takes only seconds to produce a first page, then prints up to 65 pages per minute. The fast printing mechanism is backed by a powerful 800 MHz dual-core processor and up to three gigabytes of memory to ensure swift output and satisfied users.

This document is the summary of an LCA study aiming to represent the product properties, related assumption, impact categories and potential environmental impact results of Lexmark's MX912dxe printer product. Lexmark generates LCAs for a series of printers and multi-functional devices. The LCAs are critically reviewed by an independent expert. Each LCA is created using the same software model and workflows while changing only printer-specific data points via parameter settings. Each LCA submitted for critical review will then be accompanied by a brief technical summary of the relevant data points, as well as a methodology report.

This LCA study is carried out based on ISO 14040 and ISO 14044, and generally follows the requirements of the Product Category Rules (PCR) Guidance for the product category printers and multi-function printing units, version 2, published by UL Environment (ULE) in April 2018. This LCA study has a few deviations from the PCR, including the following:

- The PCR bases the images per day calculation on the Version 2.0 of the Imaging Equipment ENERGY STAR® Program Requirements. However, using this estimation method results in a calculated printing volume that greatly exceeds actual customer usage. In this study, the images per day calculation has been replaced by actual customer printing data, Average Monthly Print Volumes (AMPV), per product family. The new methodology aligns with realistic customer printing.
- The PCR requires using ReCiPe 2016 or TRACI 2.1 as the impact assessment methodology. This study selects TRACI 2.1 as it is currently the only impact assessment methodology framework that incorporates US average conditions to establish characterization factors (Bare, 2012) (EPA, 2012). For global warming potential, the TRACI characterization factors are not the most current, therefore it is assessed based on the current IPCC characterization factors taken from the 6th Assessment Report (IPCC, 2021) for a 100-year timeframe (GWP100) as this is currently the most commonly used metric.
- Sphera updated paper dataset is selected to replace dataset developed based on information from the American Forest and Paper Association (NCASI, 2010).

COMPANY	Lexmark
PRODUCT SYSTEM	Laser Printer MX912dxe
REFERENCE STANDARD	*ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines.* Geneva: International Organization for Standardization.
DATE OF ISSUE	1/11/2025
CONTENTS OF THE REPORT	Product definition Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and critical review
This life cycle assessment was independently reviewed in accordance with ISO 14044 by:	Thomas Gloria, Indust. Ecology Consultants

Product Description

Product Type	Mono Laser Printer
Printer Model	MX912dxe
Maximum Print Speed	65 pages per minute
Intended use	primarily office
Range of applications	print images or text in mono or color onto paper or paper-like media
Product Lifetime	5 years
Introduction Date	6/17/2014
Product Specifications	http://www.lexmark.com/en_US/products/series/printer-and-multifunction/finder.shtml
Functional Unit	The functional units has been defined as (1) a 1,000 page simplex job; (2) lifetime page simplex job
Product Characterization	A solutions-capable, network-ready mono laser printer with standard 2-sided printing, an 800 MHz dual-core processor, and up to 3GB of standard memory that prints up to 65 ppm black. The printer fuses to a medium (such as paper) to create hard copy images from electronic or hard copy originals. The printer product delivered to the customer consists of the printer, a power cord, printed setup instructions, a CD/DVD that includes the User Guide and Printer Drivers and an initial set of product supplies. The printer is delivered in packaging that can be recycled locally and is not needed for product operation. Product supplies include toner cartridges, imaging kits and the fusing mechanism. The power supply is internal to the product and the imaging kit and fusing mechanism are installed at the factory. Only the toner cartridges must be installed by the customer. The printer can be setup by the customer without assistance.

Lexmark

Laser Printer MX912dxe

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Technical Data

Product specifications	Lexmark MX910de	Lexmark MX911dte	Lexmark MX912dxe
Printing			
Display	Lexmark e-Task 10-inch (25 cm) class color touch screen		
Print Speed: Up to[3]	Black: 45 ppm	Black: 55 ppm	Black: 65 ppm
Time to First Page: As fast as	Black: < 5.6 seconds	Black: < 5.5 seconds	Black: < 5.2 seconds
Print Resolution	Black: 1200 Image Quality, 1200 x 1200 dpi, 2400 Image Quality, 600 x 600 dpi		
Memory / Processor	Standard: 1024 MB / Maximum: 3072 MB / Dual Core, 800 MHz	Standard: 1024 MB / Maximum: 3072 MB / Dual Core, 0.8 MHz	
Hard Disk	Included in configuration		
Recommended Monthly Page Volume[2]	15000 - 50000 pages		
Maximum Monthly Duty Cycle: Up to[2]	200000 pages per month	300000 pages per month	
Copying			
Copy Speed: Up to[5]	Black: 45 cpm	Black: 55 cpm	Black: 65 cpm
Time to First Copy: As fast as	Black: 5.8 seconds		Black: 5.6 seconds
Scanning			
Scanner Type / ADF Scan	Flatbed scanner with ADF / DADF (single pass Duplex)		
A4/Ltr Duplex Scan Speed: Up to	Black: 140 sides per minute / Color: 140 sides per minute		
A4/Ltr Simplex Scan Speed: Up to	Black: 80 sides per minute / Color: 80 sides per minute		
ADF Paper Input Capacity: Up to	100 pages 20 lb or 75 gsm bond		
Faxing			
Modem Speed	ITU T.30, V.34 Half-Duplex, 33.6 Kbps		
Supplies			
Laser Cartridge Yields (up to)[1]	32,500-page High Yield Cartridge		
Photoconductor Estimated Yield: Up to[4]	125000 pages, based on 3 average letter/A4-size pages per print job and ~ 5% coverage		
Cartridge(s) Shipping with Product[1]	21,000-page Starter Toner Cartridge		
Paper Handling			
Included Paper Handling	250-Sheet Output Bin, 150-Sheet Multipurpose Feeder, 2 x 500-Sheet Input	250-Sheet Output Bin, 150-Sheet Multipurpose Feeder, 2 x 500-Sheet Input, 2 x 500-Sheet Tray	250-Sheet Output Bin, 150-Sheet Multipurpose Feeder, 2 x 500-Sheet Input, 2500-Sheet Tandem Tray
Optional Paper Handling	Staple Punch Finisher, Inline Stapler, 2500-Sheet Tandem Tray, 3000-Sheet Tray, Booklet Finisher, 2 x 500-Sheet Tray	Staple Punch Finisher, Inline Stapler, 3000-Sheet Tray, Booklet Finisher	Staple Punch Finisher, 3000-Sheet Tray, Booklet Finisher
Paper Input Capacity: Up to	Standard: 1150 pages 20 lb or 75 gsm bond / Maximum: 6650 pages 20 lb or 75 gsm bond	Standard: 2150 pages 20 lb or 75 gsm bond / Maximum: 5150 pages 20 lb or 75 gsm bond	Standard: 3650 pages 20 lb or 75 gsm bond / Maximum: 6650 pages 20 lb or 75 gsm bond
Paper Output Capacity: Up to	Standard: 250 pages 20 lb or 75 gsm bond / Maximum: 3500 pages 20 lb or 75 gsm bond		
Media Types Supported	Card Stock, Envelopes, Labels, Plain Paper, Transparencies, Refer to the Card Stock & Label Guide.		
Media Sizes Supported	10 Envelope, 7 3/4 Envelope, 9 Envelope, A3, A4, A5, B5 Envelope, C5 Envelope, DL Envelope, Executive, Folio, JIS-B4, JIS-B5, Ledger, Legal, Letter, Statement, Universal, Super Tabloid (12 x 18"), Oficio, A6, SRA3		
General Information			
Standard Ports	One Internal Card Slot, USB 2.0 Specification Hi-Speed Certified (Type B), Gigabit Ethernet (10/100/1000), Front USB 2.0 Specification Hi-Speed Certified port (Type A), Two Rear USB 2.0 Specification Hi-Speed Certified ports (Type A)		
Optional Network Ports / Optional Local Ports	Internal MarkNet N8350 802.11b/g/n Wireless / Internal RS-232C serial, Internal 1284-B Bidirectional Parallel		
Noise Level: Operating	Print: 52 dBA / Copy: 53 dBA / Scan: 57 dBA	Print: 53 dBA / Copy: 54 dBA / Scan: 56 dBA	Print: 55 dBA / Copy: 55 dBA / Scan: 56 dBA
Specified Operating Environment	Altitude: 0 - 2500 Meters (8,200 Feet), Humidity: 15 to 85% Relative Humidity, Temperature: 10 to 30°C (50 to 86°F)		
Limited Warranty - See Statement of Limited Warranty	1-Year Onsite Service, Next Business Day		
Size (in. - H x W x D) / Weight (lb.)	35.8 x 24.2 x 27.4 in. / 209.4 lb.	45.4 x 24.2 x 27.4 in. / 266.8 lb.	45.4 x 24.2 x 27.4 in. / 264.6 lb.

[1]Average standard page yield value declared in accordance with ISO/IEC 19752. [2]"Recommended Monthly Page Volume" is a range of pages that helps customers evaluate Lexmark's product offerings based on the average number of pages customers plan to print on the device each month. Lexmark recommends that the number of pages per month be within the stated range for optimum device performance, based on factors including: supplies replacement intervals, paper loading intervals, speed, and typical customer usage. [3]"Maximum Monthly Duty Cycle" is defined as the maximum number of pages a device could deliver in a month using a multishift operation. This metric provides a comparison of robustness in relation to other Lexmark printers and MFPs. [4]Actual Yield may vary based on other factors such as device speed, paper size and feed orientation, toner coverage, tray source, percentage of black-only printing and average print job complexity. [5]Print and copy speeds measured in accordance with ISO/IEC 24734 and ISO/IEC 24735 respectively (ESAT). For more information see: www.lexmark.com/ISOspeeds.

This is a Class A device according to the FCC Rules and international electromagnetic emissions standards. This device is not intended for use in residential or domestic environments due to potential interference to radio communications.

Declaration of Basic Materials

The printer consists of mechanical, electromechanical, and electronic components. Its material composition can be described using the basic material fractions given below. Please note that the category 'Electronics' also includes all wiring.

Material	Mass (kg)
Plastics (recyclable)	29.5
Plastics (non-recyclable)	7.03
Ferrous Metals	62
Aluminum	0.726
Copper	0.178
Glass	2.24
Electronics	12.8
Other Materials	0.259
Total	115

Table 1: Basic Material Declaration

Product Supply Chain

The printer is manufactured and assembled in Southeast China. The cartridges for the North American market are manufactured and assembled in Juarez, Mexico.

Life Cycle Assessment Results

The following sections describe the printer's cradle-to-gate resource use and potential environmental impacts over the full printer life cycle. These represent the typical impacts for an average system sold in the North American market. All impacts are presented per functional units.

Printer Manufacturing Resources Use

Table 2 displays the use of material resources (kg) and of non-renewable as well as renewable primary energy demand necessary for printer manufacturing, but excludes other life cycle stages of the printer (cradle-to-gate). Likewise, material and energy consumption associated with printer packaging, cartridges, and paper is excluded here.

Use of Material Resources [kg]	
Non-Renewable	6.14E003
Renewable (excl. water)	1.33E004
Water	4.64E010
Use of Non-Renewable Primary Energy [MJ]	
Crude Oil	2.44E003
Hard Coal	6.56E003
Lignite	271
Natural Gas	4.04E003
Uranium	960
Use of Renewable Primary Energy [MJ]	
Biomass	1.23E-005
Geothermal	49.9
Solar	1.44E003
Wind	729
Hydropower	717

Table 2: Use of Material and Energy Resources for Printer Manufacturing (Cradle-to-Gate)

Energy Consumption During Utilization

Based on the ENERGY STAR® Typical Energy Consumption (TEC) test methodology, the printer is expected to have the following power consumption for an assumed average job load.

	Per 1,000 page	Per product lifetime
Energy Consumption During Utilization [kWh]	0.618	426

Table 3: At-wall power consumption during utilization

Life Cycle Impact Assessment

The following provides an overview of the potential printer life cycle impacts with emissions classified and characterized to standard environmental impact metrics based on TRACI 2.1 method. Global warming potential is evaluated based on IPCC AR6. Ecotoxicity and human toxicity are not included in this study, due to their respective uncertainties.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	5.31E00	2.20E00	3.67E03	1.52E03
AP [kg SO2 eq.]	2.48E-02	1.04E-02	1.71E01	7.15E00
EP [kg N eq.]	8.02E-03	5.44E-04	5.54E00	3.75E-01
ODP [kg CFC 11 eq.]	2.07E-09	2.07E-09	1.43E-06	1.43E-06
RDP [MJ surplus energy]	6.82E00	2.65E00	4.71E03	1.83E03
SFP [kg O3 eq.]	4.03E-01	1.24E-01	2.78E02	8.54E01

Table 3: Summary of Life Cycle Impact Assessment Results

Interpretation of Results

Dominance Analysis

Due to the 5 year lifetime and the number of pages printed per day based on the actual customer printing information, the use phase with paper heavily dominates the life cycle impacts. The below tables and charts display the results of the dominance analysis for each impact category addressed in Table 3. The first row in each table, labeled Printer, is the printer manufacturing phase which includes raw material extraction and manufacturing.

Global Warming Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	1.50E00	1.50E00	1.04E03	1.04E03
Use phase <LC>	3.80E00	6.80E-01	2.62E03	4.70E02
EoL phase <LC>	1.47E-02	1.47E-02	1.01E01	1.01E01

Table 4: GWP100 dominance analysis [kg CO2 equiv]

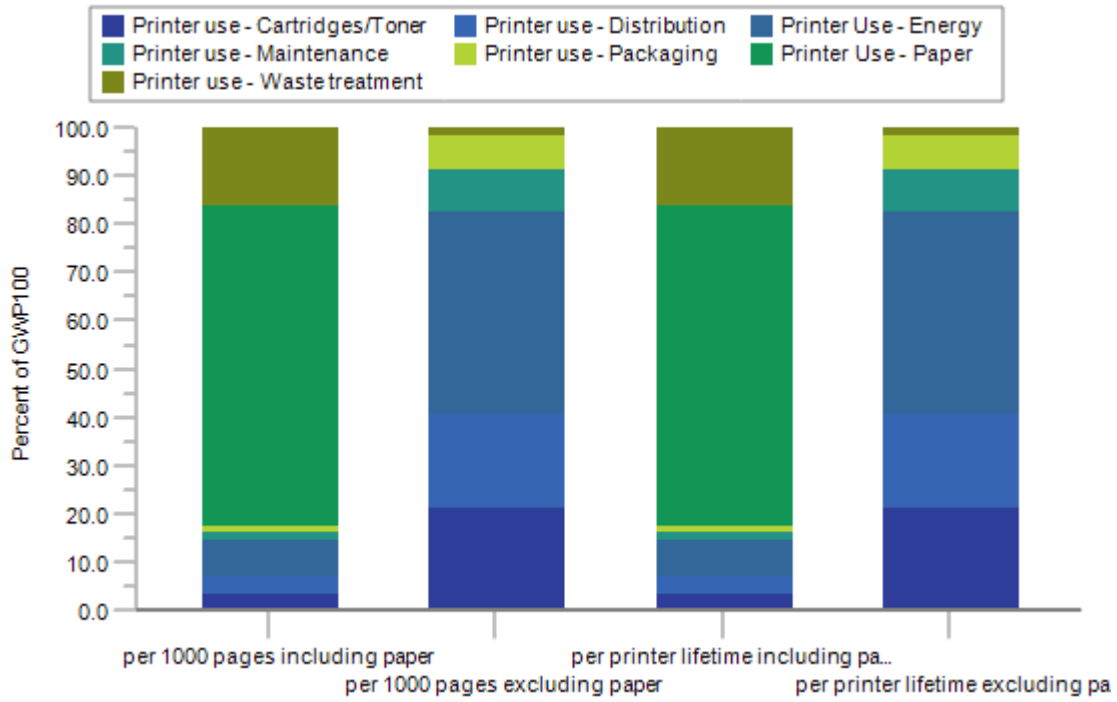


Figure 1: GWP100 dominance analysis of the life cycle stage

Total lifetime distribution: 149.82 kg CO2 equiv

Ozone Depletion Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	4.46E-10	4.46E-10	3.08E-07	3.08E-07
Use phase <LC>	1.62E-09	1.62E-09	1.12E-06	1.12E-06
EoL phase <LC>	1.01E-16	1.01E-16	6.99E-14	6.99E-14

Table 5: ODP dominance analysis [kg CFC-11 equiv]

Acidification Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	7.45E-03	7.45E-03	5.14E00	5.14E00
Use phase <LC>	1.73E-02	2.84E-03	1.19E01	1.96E00
EoL phase <LC>	7.12E-05	7.12E-05	4.91E-02	4.91E-02

Table 6: AP dominance analysis [kg SO_2 equiv]

Eutrophication Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	3.68E-04	3.68E-04	2.54E-01	2.54E-01
Use phase <LC>	7.65E-03	1.69E-04	5.28E00	1.17E-01
EoL phase <LC>	6.17E-06	6.17E-06	4.26E-03	4.26E-03

Table 7: EP dominance analysis [kg N equiv]

Resource Depletion Potential (fossil fuel)

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	1.49E00	1.49E00	1.03E03	1.03E03
Use phase <LC>	5.30E00	1.14E00	3.66E03	7.87E02
EoL phase <LC>	2.72E-02	2.72E-02	1.88E01	1.88E01

Table 8: RDP dominance analysis [MJ surplus energy]

Smog Formation Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	7.14E-02	7.14E-02	4.93E01	4.93E01
Use phase <LC>	3.30E-01	5.07E-02	2.28E02	3.50E01
EoL phase <LC>	1.63E-03	1.63E-03	1.12E00	1.12E00

Table 9: SFP dominance analysis [kg O_3 equiv]

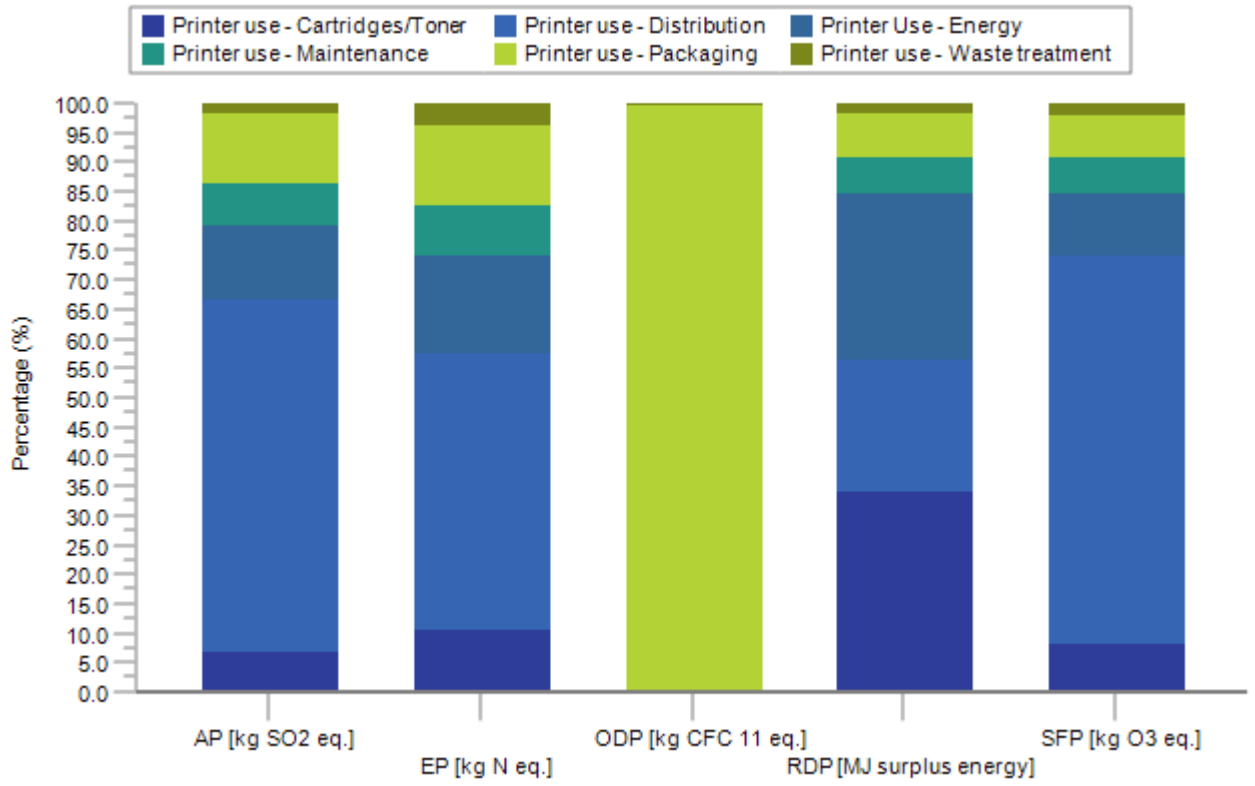


Figure 2: Contribution analysis of the use phase (per 1000 pages excluding paper)

Assumptions and Estimations

Assumptions and estimations are documented in the methodology report, which was provided for critical review purposes alongside this document. The LCA results represent the specific printer model as sold in the North American market.

The model assumes a printer lifetime of five (5) years. The printer is modeled to print an average pages per day

based on actual customer printing information. The printer further possesses an automatic mechanical duplexing feature.

Power consumption figures are based on ENERGY STAR® testing of the printer using the average job load described above. Consumables rate of consumption is based on the market-average yield across all available cartridge capacities. In addition, market-average use of remanufactured cartridges is taken into account, as applicable.

Transportation distances to the end consumer are based on their points of origin and the population-weighted average distance to the 100 most populous cities in the continental US based on 2020 census data. The printer as well as replacement fuser kits and waste toner bottles are manufactured in China and shipped to the point of use from the distribution center near Jeffersonville, IN, while the cartridges and the imaging unit are shipped from Ciudad Juarez, MX to Jeffersonville, IN.

The paper dataset developed by Sphera represents European and used as proxy in lieu of current US data.

The End-of-Life treatment for the printer is based on the assumption that 90 % of the printers are either recycled or remanufactured, while the remainder is disposed of through local waste streams, where the metal fractions are assumed to be recycled and the remainder landfilled. The EoL cartridges are assumed to be split as such: 80% to remanufacturing or recycling, and 20% landfill.

In accordance with the cut-off methodology, materials sent to End-of-Life recycling are considered to cross the system boundary without any further transformation. Only the impacts associated with waste transportation and disposal are included in the results.

Description of Data and Period Under Consideration

All primary data is based on technical documentation and sales data accessed in 2024. All background data is taken from the MLC 2024-10.9.0.31 Databases. No primary data is collected from the Original Equipment Manufacturer's manufacturing plant.

Data Quality

Manufacturing data of printers and consumables is based on a combination of Bills of Material and teardown analyses and is considered to be of overall high quality with low uncertainty. Distribution from printer manufacturing to the end consumer is representative of logistical data from Lexmark and best estimates of US average shipping distances, and is of moderate quality and high uncertainty.

Printer power consumption represents measured power consumed during printer operation. The electricity consumed is calculated based on TEC specification, and is of high quality and moderate uncertainty. Toner cartridge use is based on expected yields based on the ISO test standards for cartridge use, and is of high quality and low uncertainty. Replacement rate for consumable parts is based on part design specifications, and is of high quality and moderate uncertainty.

The disposition of the printer and consumables at End-of-Life is based on best-available information by the respective experts at Lexmark. This data is of average quality and moderate uncertainty.

Background Data

All background datasets relevant to production, power generation, transportation, and material disposal were taken from Sphera's MLC 2024-10.9.0.31 Databases.

The additional use of third-party background data from industry associations (e.g., worldsteel) is documented in the methodology report. They represent the latest LCI data as available in the MLC 2024-10.9.0.31 Databases.

Allocation and Methodological Principles

No significant allocations have been considered for the production of the printer. Allocation of production or use impacts across the various functions of a multi-function system is not included (i.e., allocation of production impacts to the provision of scanning services) and the impacts from all life cycle stages are considered within the system boundaries for the printing system.

Treatment of recycled or resold material is not considered in the body of the LCA, in accordance with the cut-off methodology.

References and Standards

Bare, J. (2012). Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) - Software Name and Version Number: TRACI version 2.1 - User's Manual. Washington, D.C.: U.S. EPA.

EPA (2021) ENERGY STAR® Program Requirements for Imaging Equipment – Test Method (Rev. Nov-2021) https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Imaging%20Equipment%20Version%203.2%20Final%20Specification.pdf

ISO (2006a) ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures. International Organization for Standardization. Geneva.

ISO (2006b) ISO 14040: Environmental management - Life cycle assessment – Principles and framework. International Organization for Standardization. Geneva.

ISO (2006c) ISO 14044: Environmental management - Life cycle assessment – Requirements and guidelines. International Organization for Standardization. Geneva.

NCASI (2010) Life Cycle Assessment of North American Printing and Writing Paper Products – Final Report. Prepared for the American Forest and Paper Association (AF&PA) and the Forest Products Association of Canada (FPAC) by the National Council for Air and Stream Improvement, Inc. Research Triangle Park, NC

Sphera. (2025) *LCA for Experts Documentation*. Retrieved from Sphera Solutions, Inc.: https://sphera.com/solutions/product-stewardship/life-cycle-assessment-software-and-data/lca-for-experts/

ULE (2018) Product Category Rules for preparing an environmental product declaration (EPD) for printers and multi-function printing units (v2.0). UL Environment. Washington, DC. Expired in April, 2023.

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Dr. Gloria is a certified Life Cycle Professional (LCACP) through the American Center for Life Cycle Assessment.

LIFE CYCLE ASSESSMENT

Lexmark

Letter of Equivalency

LCA Model Evaluated: MX912dxe

Equivalent Models: MX912de, XM9165

Life Cycle Assessments (LCA) are in accordance with ISO 14040 and ISO 14044. Life Cycle Assessments provide information on a number of environmental impacts of products over their life cycle. LCAs may be used equivalently for programs with multiple configurations if the differences in configurations are evaluated and determined to be negligible to the global warming impact. Printer configurations with the same parameters for mass, typical electricity consumption (TEC), rated pages per minute are considered equivalent. In many cases, several configurations are identical, but the model names are different among various sales channels. For printer configurations that have slight differences, they are determined to be equivalent only when those differences are considered to have a negligible contribution to the LCA results.

Accuracy of Results and Comparability: LCAs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. LCAs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. LCAs from different programs may not be comparable.

Exclusions: LCAs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. LCAs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Full details are documented in the LCAs methodology report, which was provided for verification purposes alongside the LCA. Assumptions and estimations generally follow the governing PCR on printing equipment. The LCA results represent the specific printer model as sold in the North American market.