Xerox® VersaLink® C415 Life Cycle Assessment Summary Report

For the Xerox® VersaLink® C415 Multi-Function Printer.

xerox™

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Summary Report

Introduction

Xerox has a long history of interest in preserving our natural environment. In keeping with this interest, we seek to ascertain the environmental impact of our new devices. In understanding these impacts we can accurately represent our environmental initiatives to our stakeholders.

Xerox commissioned Sphera to conduct a life cycle assessment (LCA) study for the Xerox® VersaLink® C415 Multi-Function Printer (MFP). The goals of this study include the following:

1. Perform a cradle-to-grave LCA to quantify the potential environmental impacts of the Xerox® VersaLink® C415 throughout its life cycle.
2. Quantify the environmental hotspots within the cradle-to-grave boundary for the product.

Product Overview

Technical Properties	Xerox MFP Printer	Unit
Color options	Color	—
Color print resolution	1200 x 1200	dpi
Color print speed	42	Pages per minute (ppm)
Connectivity/data inputs	Ethernet 10/100/1000 Base-T, High-speed USB 2.0 direct print, NFC; Optional: WiFi®/WiFi® Direct with Xerox Wireless Network Adapter	—
Automatic mechanical duplexing feature	Yes	—
Duplexing setting default or optional	Default	—
Energy efficiency or environmental labels	Energy STAR, EPEAT, Blue Angel	—
Functions	Print, copy, scan, fax	—
Maximum document print size	216 x 356	mm × mm
Maximum document scan size	216 x 356	mm × mm
Maximum scan resolution	600 x 600	dpi
Printer memory	32	GB
Dimensions (depth x width x height)	47.5 x 47.9 x 49.1	cm
Weight (unpackaged)	27.7	kg

Table 1 – Overview of the technical properties and specifications of the VersaLink® C415 MFP.

Product Function and Functional Units

The Xerox VersaLink® C415 MFP offers standard black-and-white and color printing capabilities. In accordance with the Product Category Rule (UL, 2018), this study considers two functional units: (1) providing printer functionalities over its assumed lifetime of 5 years with an expectation of 1,126,286-page simplex job (impressions) in total, (2) a 1,000-page simplex job. The former value was calculated using the ENERGY STAR test method, which establishes a daily print volume that can be extrapolated to lifetime volume based on device speed (ENERGY STAR, 2018).

The reference flow for two functional units is the number of printers needed to fulfill the printing job:

- Perform a cradle-to-grave LCA to quantify the potential environmental impacts of the Xerox VersaLink® C415 MFP throughout its life cycle.
- Quantify the environmental hotspots within the cradle-to-gate system boundary for the product.

System Boundary

The processes included and excluded from the system boundary for the study is defined in **Table 2**. This LCA study covers the entire product life cycle, from cradle to grave, including raw material extraction, product manufacturing, distribution, use, maintenance, and end-of-life (EoL) treatment.

Included	Excluded
• Extraction of raw materials • Printer manufacturing • Printer distribution • Printer use, including electricity consumption, paper production and disposal, and consumables production, distribution, and EoL • Printer maintenance, including technician service, and spare parts production, distribution, and EoL • Printer EoL	• Production of capital equipment (factories, tooling, etc.) • Network infrastructure outside of the product itself • Manual labor

Table 2 – System boundaries of this life cycle assessment.

Methodology and Standard Used

ISO STANDARDS

This study was carried out according to the requirements of the international standards ISO 14040 and ISO 14044 (ISO, 2006). The findings of this study serve for external communication purposes, such as making marketing claims and gaining a public relations or marketing advantage by presenting the results in various formats such as white papers, sustainability reports, and conferences. The results generated in this study are not intended to support comparative assertions.

IMPACT CATEGORIES

The evaluated impact categories and metrics included the 100-yr Global Warming Potential (GWP) excluding biogenic CO2, Non-Renewable Primary Energy Demand (PEDnr), Acidification Potential (AP), Eutrophication Potential (EP), Particular Matter (PM), Ozone Depletion Potential (ODP), Smog Formation Potential (SFP), and blue water consumption.

Despite being a major factor in the impacts of a device's use phase, printer manufacturers typically have little involvement in paper manufacturing and disposal. For this reason, the environmental impacts of the VersaLink® C415 MFP were analyzed both with and without considering paper-related impacts.

Results

As shown in the table below, the GWP 100 (excluding biogenic CO2) amounts to 6,420 kg of CO2 eq. per printer lifetime with the inclusion of paper-related impacts, and 1,743 kg of CO2 eq. per printer lifetime when paper-related emissions are excluded.

Scope	Impact Category	Total	Manufacturing	Distribution	Use	Maintenance	EoL
Excluding Paper	GWPe (kg CO_2 eq.)	1,743	184	19	1,240	297	2.97
Including Paper	GWPe (kg CO_2 eq.)	6,420	184	19	5,910	297	2.97

Table 3 – GWP 100 of the VersaLink® C415 MFP, both including and excluding paper-related impacts, throughout the device's lifetime.

Excluding paper-related impacts, consumables make up the largest share of GWP at 67%, where the manufacturing of toner and cartridge body are the primary contributors. The manufacturing stage contributes 11% of the life cycle GWP, where the printer itself accounts for 93% of the manufacturing GWP with packaging accounting for the remaining 7%. The main contributors to the printer manufacturing GWP are the chassis, mainboard, and power supply unit, which collectively account for 64%. For the maintenance stage, technician service and spare part-related emissions account for 2% and 16% of the total life cycle GWP, respectively. The largest GWP contributors to the consumables in the maintenance phase are the manufacturing of the waste toner bottle and imaging unit. Electricity consumption accounts for 4% of the life cycle GWP, while distribution and EoL together account for 1%. For other environmental impacts, similar to GWP, the dominant contributors are use-phase consumables, which contribute approximately 40 to 71% of the impacts. However, for ODP, manufacturing accounts for 99% of the impact. Figures 1 and 2 on the next page illustrate the distribution of GWP across the device's lifetime—in addition to the other impact categories outlined earlier in this report.

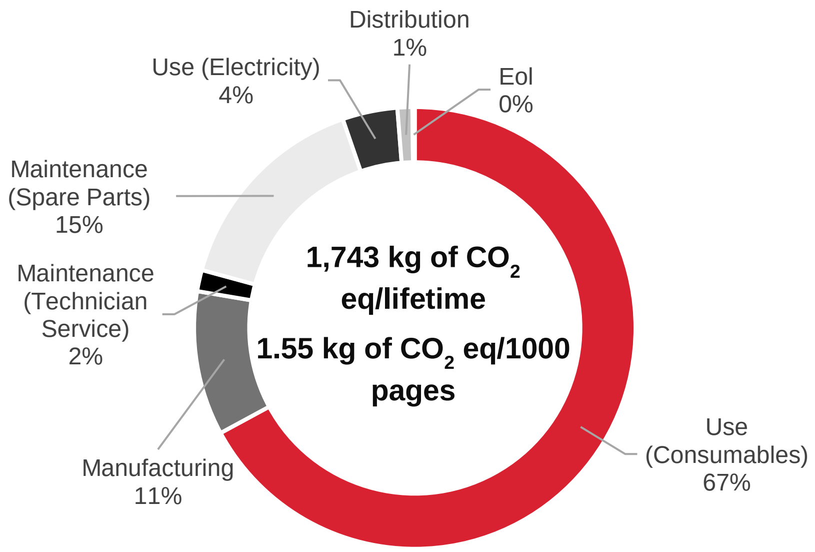

Figure 1 - GWP 100 (excluding biogenic CO_2) of printer life cycle without paper manufacturing and disposal.

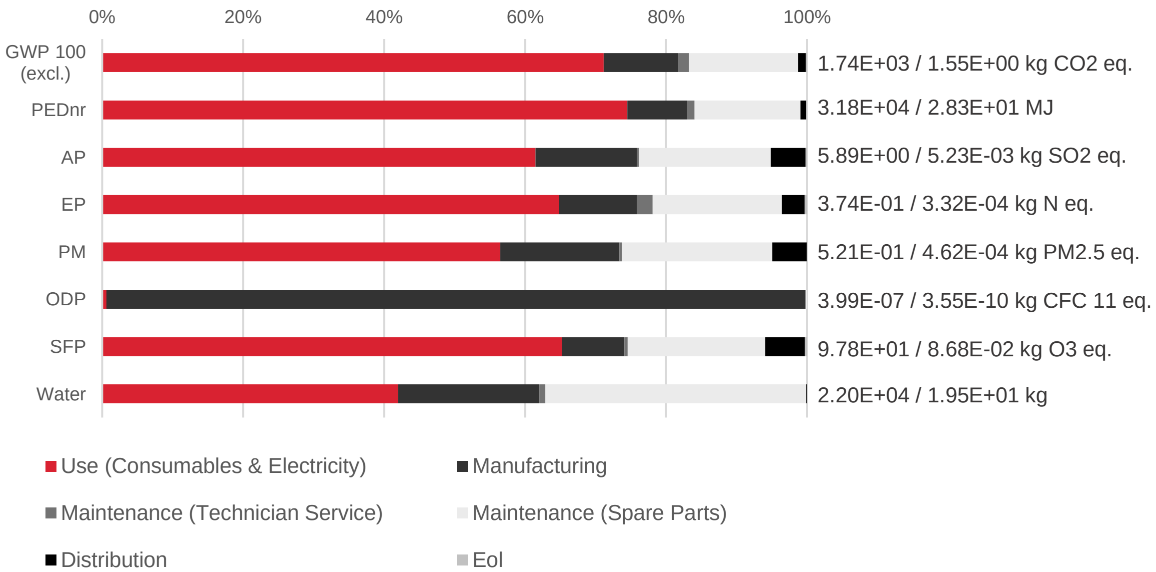

Figure 2 - Contribution analysis of environmental impacts of each printer life cycle stage, without paper manufacturing and disposal. The numbers on the right represent the total of each impact category per lifetime and per 1000 pages.

After including paper manufacturing and disposal in the device's total impacts, the printer was found to have a GWP 100 (excluding biogenic CO2) of 6,420 kg of CO2 eq. per printer lifetime and 5.70 kg of CO2 eq. per 1,000 pages (Table E-1). As shown in Figure 3, paper manufacturing has the largest contribution with a share of 63% of total life cycle GWP, followed by consumables in the use phase (toner cartridges) with a share of 18%. Similarly, for most of the other evaluated impacts, such as AP, EP, PM, SFP, PEDnr, and water consumption, paper manufacturing contributes 67% to 78% of these impacts.

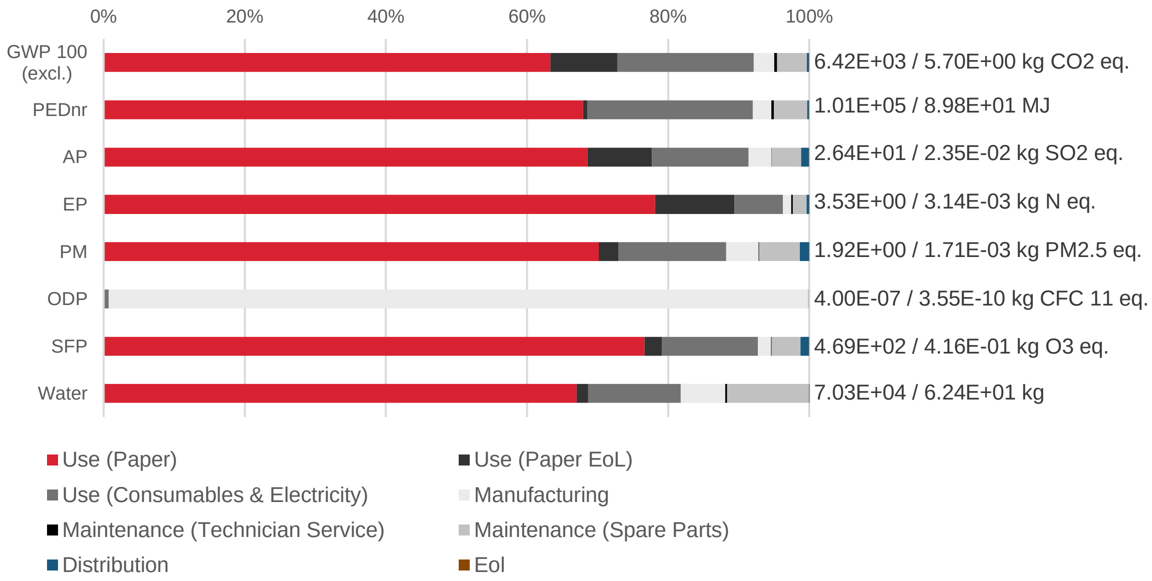

Figure 3 - Contribution analysis of environmental impacts of each printer life cycle stage, including paper manufacturing and disposal. The numbers on the right represent the total of each impact category per lifetime and per 1000 pages.

Assumptions and Limitations

This section discusses the main assumptions (e.g., a conservative approach used) in relation to the key finding presented in the previous subsections of results and sensitivity analyses. In addition, this section elaborates on the limitation of the results relative to the defined goal and scope.

- The weight of some components in the BOM, such as display, grease, and small labels, was not available, and therefore they are not included in the model. In this study, the difference between the weight estimated based on the BOM and the actual weight of the device is less than 1%, making the impact of these gaps on the results not significant.
- Although the printer and consumables (use phase and maintenance phase) are assumed to be 100% recycled by recycling programs at Xerox, a small portion of these products may not be captured by the program and may end up in municipal solid waste management. However, the impact on the results is deemed insignificant because the printer's materials are primarily inert, and landfilling is the primary waste management method in the U.S., causing minimal environmental impact.
- The paper dataset developed by Sphera is based on the EU scenario and may differ from the scenario in the U.S., which may cause a discrepancy in the paper manufacturing impacts.
- The energy consumption associated with the final product assembly is not taken into account. This data gap is deemed not to have high significance since the final assembly primarily relies on manual labor and is not considered an energy-intensive process, however,

there is still some energy consumption involved within the assembly facility. Consequently, this data gap may lead to a slight underestimation of the overall impacts.

- Since the dataset on the scanner glass coating process is not available, this study employed the coil coating process as a proxy, which might potentially lead to the discrepancy of the ODP.

Critical Review Statement

Below are the critical review statement, comments, and opinions from the third-party reviewer in their assessment of the full version of this LCA report.

Date	August 16, 2024
Title of the study	**Life Cycle Assessment of Xerox Versalink C415 Multifunction Printer**
The commissioner of the LCA study	Xerox
The practitioners of the LCA study	External – Sphera
The exact version of the report to which the critical review statement belongs	August 6, 2024, v3.0
The reviewer(s) or, in the case of a panel review, the panel members, including the identification of the panel chairperson	Thomas Etheridge EarthShift Global Juanita Barrera-Ramirez EarthShift Global
Description of the review process, including information on:	
• whether the review was performed based on ISO 14044:2006, 6.2 or 6.3;	6.2
• whether the review was performed in parallel or at the end of the study;	End
• whether the review included or excluded an assessment of the LCI model;	The inventory provided by Xerox was not independently verified. It was assumed accurate as presented for the study. The inventory was reviewed to ensure that aspects likely to be material were not omitted. Assumptions for modeling inventory were reviewed. Boundary conditions and excluded processes were reviewed to ensure they were properly documented in the report.
• whether the review included an analysis of individual data sets;	Individual data set selections were reviewed at a high level across the study, with special focus on datasets that result in high impacts and on unique components where the selection of datasets could be challenging or debatable.
Description of how comments were provided, discussed and implemented;	Comments and clarifications were provided in a written summary provided on June 10, 2024
Panel Decision:	The study meets the ISO 14040 and 14044 standards for third-party reports.
Applicability of Study Results:	The study applies to the Xerox Versalink C415 Multifunction Color Printer produced by Xerox. The results are specific to this product and the data and assumptions used. The results are not considered to be representative of all printers, and the study results should be viewed in the context of potential variations in product features and in product use.

Critical Review Summary

A Critical Review of Life Cycle Assessment of Xerox Versalink C415 Multifunction Printer has been carried out by Juanita Barrera-Ramirez and Tom Etheridge. The review has been carried out according to ISO 14044:2006 for a non-comparative LCA report prepared for third party review. This review statement in no way endorses the products mentioned in the study.

The reviewer critically reviewed this LCA study and supporting documents to determine if the following conditions were met:

- The methods used to carry out the LCA are consistent with the International Standards (ISO 14040 and 14044);
- The methods used to carry out the LCA are scientifically and technically valid;
- The data used are appropriate and reasonable in relation to the goal of the study;
- The interpretations reflect the limitations identified and the goal of the study; and
- The study report is transparent and consistent.

To conduct this critical review, after a review of adherence to ISO 14044, the reviewer carefully reviewed the assumptions and data used to develop the models to ensure the data were transparent and consistent and the data and assumptions were reasonable. The methods were reviewed for validity and consistency, and the results were reviewed to ensure they were accurate and accurate. The study underwent three rounds of revisions based on reviewer comments, after which there were no objections, and this final review statement was prepared.

Final Review Statement

All of the issues raised by the reviewer have been properly addressed in the LCA report, and the reviewer assesses that overall the LCA study is in compliance with and fulfills the requirements in ISO 14040 and 14044 for studies used for publication.

Are the methods used to carry out the LCA consistent with the international standards (ISO 14040, 14044)?

The reviewer finds that the study is consistent with the ISO LCA standards. The methodology is clearly described, and all modeling assumptions are documented and explained.

Are the methods used to carry out the LCA scientifically and technically valid?

The reviewer finds that the methods used to carry out the LCA are scientifically and technically valid.

Are the data used appropriate and reasonable in relation to the goal of the study?

The reviewer finds that the use of data is appropriate and reasonable in relation to the goal of the study.

Do the interpretations reflect the limitations identified and the goal and scope of the study?

The reviewer finds that the interpretations reflect the limitations identified and the goal of the study.

Is the study report transparent and consistent?

The reviewer finds that the study report is transparent and consistent.

Respectfully submitted,

Thomas Etheridge. EarthShift Global

Juanita Barrera Ramirez

Juanita Barrera-Ramirez. EarthShift Global