Hewlett Packard

Declaration 11CA41590.122.1
According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs 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. EPDs 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. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs 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. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Hewlett Packard
DECLARATION NUMBER	4786895603.135.1
DECLARED PRODUCT	Printer HP LaserJet Enterprise Flow MFP M527z
REFERENCE PCR	Product Category Rules for Preparing an Environmental Product Declaration for Printers and Multi-Function Printing Units (UL – December 2012)
DATE OF ISSUE	April 20, 2016
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics 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 verifications

The PCR review was conducted by:	EarthShift, LLC Lise Lauren 31 Leach Road Kittery, Maine 03904 lise@earthshift.com
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Wade Stout, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	François Charron-Doucet

Hewlett Packard
Printer HP LaserJet Enterprise Flow MFP M527z

Product Description

Product Type	Monochrome Single-function printer
Print Speed (mono)	45 ppm
Intended use	Office
Product Lifetime	5 years
Range of applications	High-volume printing of documents in greyscale
Technical Properties	http://www8.hp.com/us/en/products/printers/product-detail.html?oid=7326601&jumpid=reg_r1002_usen_c-001_title_r0001#!tab=specs
Introduction Date	November, 2015
Functional Unit	The functional unit has been defined as printing 1000 pages in accordance with the Energy Star Total Energy Consumption test procedure and the reference PCR
Scope of Validity / Applicability	The document is representative for the HP printer model HP LaserJet Enterprise Flow MFP M527z sold as a stand-alone unit (not as part of managed print services) and used in the US. Differences between product impacts are not guaranteed as valid basis for comparison between products of different manufacturers.
Product System Description	This document describes the lifetime use of the printer, including production of all materials and components, assembly in the final configuration, delivery to the customer, use of the product, and expected end-of-life scenarios. All packaging, in-box accessories, and all consumables (paper, cartridges, and replacement parts) are considered, including associated end-of-life treatment. Printing is considered the main function of the product, and the impacts of other functions (scanning, copying, etc.) are not considered.

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System Boundary

The study considers all phases of the life cycle, as shown below.

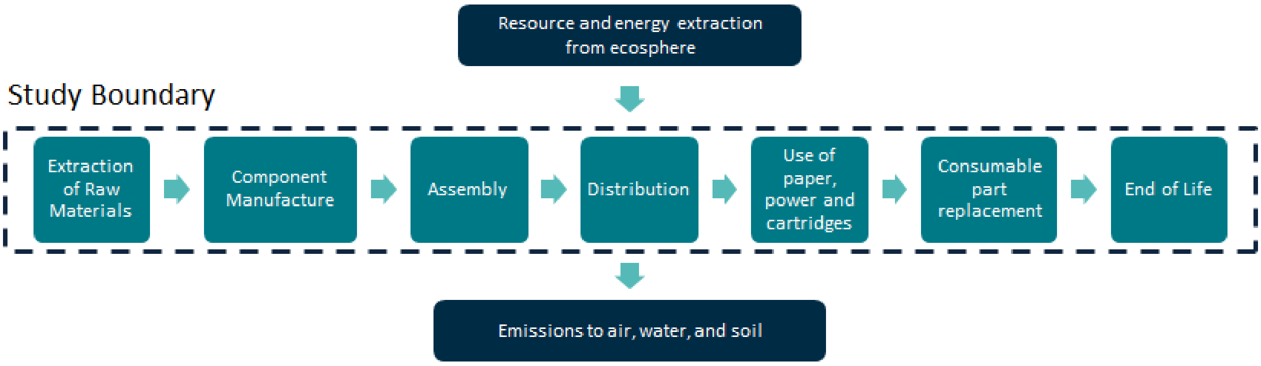

Figure 1: System Boundaries

Declaration of Basic Materials

The printer is composed of mechanical assemblies (housing and structure, paper handling mechanisms), electromechanical systems (cabling, motors), and electronics (populated printed wiring boards, laser diode). The printer materials can be identified using the following basic material fractions:

Material	Mass (kg)
Paper	1.12
Plastics	14.52
Steel	7.685
Aluminum	0.945
Copper	0.0796
Gold (in electronics)	0.000319
Silver (in electronics)	0.00275
Palladium (in electronics)	0.000256
Platinum (in electronics)	1.19E-05
Other	3.85

Table 1: Basic Material Declaration

Product Supply Chain

The printer is manufactured and assembled in Southeast China. The main control panel, control circuitry, and scanning equipment are manufactured by separate suppliers in China, Indonesia, and Vietnam.

Assumptions and Estimations

The model assumes a printer lifetime of 5 years, which is prescribed by the PCR. Based on the PCR, the printer is assumed to print an average of 2.63E005 images per year, or 1.01E003 images per day (5 days/week). This unit has built-in functionality for automatic duplexing. As such, a 25% reduction in paper use has been reflected, in accordance with the governing PCR.

Power consumption figures are based on Energy Star testing of the printer in each of these modes, using the average job load described above.

The LCA data for office paper is based on the uncoated freesheet paper developed by the American Forest & Paper Association, and models paper production, transportation, and end-of-life treatment. This paper dataset assumes that average office paper contains 4% recycled content, and is recycled 72% of the time. An average paper weight of 20 lb. (75 g/m^2) was assumed.

The end-of-life treatment for the printer and mechanical consumables represents a best case for electronics recycling- i.e. separation of bulk parts, shredding, incineration or landfilling of mechanical materials and smelting of electronics to regain precious metals. As LCI models for uncontrolled recycling/disposal of products are not available, this case was not considered in this study. The results exclude any credits for materials or energy regained at end of life, in accordance with the PCR.

Materials sent to end-of-life recycling are considered to leave the system boundary for calculation of results in the body of this EPD document. Only the impacts associated with the separation and transport processes and landfilled wastes are shown in the end-of-life results on pages 4-8 of the EPD; the calculation of a "credit" associated with the recycling of the materials is used by HP to inform their design process but is only considered in the appendix.

Life Cycle Assessment Results

The following sections describe the printer's impacts over the full printer life cycle. These represent the typical impacts for an average system sold in the North American market. The life cycle environmental impacts of the printer are described using unweighted material flows, and by categorizing and normalizing the emission and resource flows, as in the Life Cycle Impact Assessment section below. Results are presented per product or, if specified, per the reference unit (printing 1000 images of the reference standard).

Manufacturing Energy Inventory

The following tables (Tables 2, 3 and 4) describe the renewable and non-renewable material inputs to printer manufacturing. These reflect one printer's lifecycle.

	Laser Printer Production
Chromium	0.0316
Cobalt	0.000974
Copper	0.53
Iron	0.128
Lead	0.138
Magnesium	0.000958
Manganese	0.00664
Molybdenum	0.00148
Nickel	0.0263
Phosphorus	-0.0149
Rare-earth metals	0.00221
Silicon	0.00186
Silver	0.000386
Sulphur	0.000187
Zinc	0.165

Table 2-1: Non-renewable elements in printer production, mass (kg)

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	Laser Printer Production
Bauxite	0.675
Chromium ore (39%)	0.1
Colemanite ore	0.409
Copper - Gold - Ore (1,07% Cu; 0,54 g/t Au)	1.48
Copper - Gold - Silver - ore (0,51% Cu; 0,6 g/t Au; 1,5 g/t Ag)	4.26
Copper - Gold - Silver - ore (1,0% Cu; 0,4 g/t Au; 66 g/t Ag)	18.8
Copper - Gold - Silver - ore (1,1% Cu; 0,01 g/t Au; 2,86 g/t Ag)	11.5
Copper - Gold - Silver - ore (1,13% Cu; 1,05 g/t Au; 3,72 g/t Ag)	60.4
Copper - Gold - Silver - ore (1,16% Cu; 0,002 g/t Au; 1,06 g/t Ag)	6.51
Copper - Gold - Silver - ore (1,7% Cu; 0,7 g/t Au; 3,5 g/t Ag)	0.574
Copper - Silver - ore (3,3% Cu; 5,5 g/t Ag)	2.39
Copper ore (0.14%)	124
Copper ore (1.2%)	1.95
Dolomite	1.14
Inert rock	634
Iron ore (56,86%)	21.6
Kaolin ore	0.846
Limestone (calcium carbonate)	5.74
Manganese ore (R.O.M.)	0.346
Nickel ore (1,5%)	1.11
Nickel ore (1.6%)	0.153
Potashsalt, crude (hard salt, 10% K2O)	0.947
Precious metal ore (R.O.M)	-0.151
Quartz sand (silica sand; silicon dioxide)	3.57
Sodium chloride (rock salt)	5.89
Soil	3.81
Stone from mountains	0.183
Tin ore	0.359
Vanadium ore (ROM)	0.886
Zinc - copper ore (4.07%-2.59%)	10.7
Zinc - lead - copper ore (12%-3%-2%)	7.39
Zinc - Lead - Silver - ore (8,54% Zn; 5,48% Pb; 94 g/t Ag)	1.3

Table 2.2: Non-renewable materials in printer production, mass (kg)

	Laser Printer Production
Water	108,583.32

Table 3: Renewable materials in printer production, mass (kg)

The following table describes primary energy inputs into the printer manufacturing- including all upstream inputs into material processing, but excluding other life cycle stages of the printer. Energy associated with manufacturing cartridges and paper is excluded, making this a "cradle-to-gate" inventory. Values are presented per product, for cradle-to-gate production.

	Laser Printer Production
Crude oil (MJ)	746
Hard coal (MJ)	1.15E003
Lignite (MJ)	79.9
Natural gas (MJ)	994
Uranium (MJ)	228
Biomass- Wood (MJ)	0.469
Geothermal Energy (MJ)	3.71
Hydropower Energy (MJ)	104
Solar Energy (MJ)	92.6
Wind Energy (MJ)	23

Table 4: Primary Energy Demand in printer production

	Laser Printer Production
Blue water consumption [kg]	955.20

Table 5: Blue water consumption in printer production

Energy Consumption during Utilization

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

	Per 1000 Pages	Product Lifetime
Energy Consumption During Utilization (kWh)	0.486	639

Table 6: At-wall power consumption during utilization

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Waste Flows

The following waste index flows represent net waste materials deposited as the result of the product's life cycle, including those related to upstream impacts and power generation.

	HP Laserjet Lifecycle	Laser Printer Production
Hazardous waste (kg)	3.04	0.259
Radioactive waste (kg)	0.856	0.0844

Table 7: Declaration of significant waste flows

Life Cycle Impact Assessment

The following provides an overview of the printer life cycle impact assessment results, reported using the Recipe H 2008 midpoint characterization factors, per the governing PCR. The water inventory should not be used for comparison with other products due to the inconsistent application of water methodology in background datasets. This assessment does not include human health and eco-toxicity impacts due to their uncertainty; see section "Additional Environmental Information" for toxicity assessment metrics, per the PCR requirements. It should be recognized that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Life Cycle Impact Assessment Results					
		Results for Each Scenario			
ReCiPe 2008		**For the Declared Unit (per 1000 pages)**		**For the Printer Unit (per lifetime)**	
Impact Category	*Units*	*Paper Included*	*Paper Excluded*	*Paper Included*	*Paper Excluded*
Global Warming Potential	kg CO2 eq	7.55	1.16	9.93E003	1.53E003
Ozone Depletion Potential	kg CFC11 eq	2.56E-007	1.44E-008	0.000337	1.9E-005
Acidification Potential	kg SO2 eq	0.0465	0.00432	61.3	5.68
Eutrophication Potential	kg P eq	0.0016	3.78E-006	2.11	0.00498
Fossil Fuel Depletion *	kg oil eq	1.23	0.427	1.62E003	561
Mineral Resource Depletion	kg Fe eq	1.3E004	0.11	1.71E007	144
Water Depletion**	liters	1.19	0.954	1.57E003	1.26E003

** Fossil Fuel Depletion for the Lifecycle with paper included should not be compared with printer EPDs published prior to the current publication; Impact values for Fossil Fuel Depletion of paper in the final version of the AFPA report differ from values reported prior to the final publication of the AFPA report and used in past EPDs.*
*** Water Depletion Potential for the Lifecycle with paper included should not be compared with printer EPDs published prior to the current publication; Impact values for Water Use in the current version of the AFPA report differ from values reported prior to the final publication of the AFPA report and used in past EPDs.*

Table 8: Summary of Life Cycle Impact Assessment Results

Interpretation of Results

The study presents findings consistent with other assessments of the life cycle impacts of printing systems. The results, presented with respect to the functional unit of 1000 impressions of the reference image, show the dominance of printer use in the overall life cycle impacts, as the production impacts of the product are amortized over a very long lifetime. Paper consumption dominates the overall impacts of the printer, followed by cartridge use, power consumption, and the printer production in close succession. Within the printer manufacture, the massive components of the laser engine (i.e. housing and superstructure) contribute significantly to both the mass and the overall environmental impacts of the system. The impact of the electronics, including the control panel, contribute an additional 25% of the impacts of the system. The high-capacity input trays contribute about 25% of the printer's production impacts. Efficient distribution, packaging, and power management systems help reduce the impacts of these life cycle phases, which might have otherwise had significant impact on the results.

Description of Data and Period under Consideration

Printer production is representative of design data at the time of the study, collected in 2015, and based on a combination of primary and secondary data. Data for the design of the printer are based on a combination of tear-down (disassembly of the printer and weighing of parts) and bill of materials information. Materials and electronic components are represented using secondary data from the GaBi database. The analysis is representative of the annual period of year 2015.

Data Quality

Manufacturing data for printers and consumables is based on 2015 design data collected through product tear-down and manufacturing bills of materials, and is considered to be overall of high quality with low uncertainty. Transportation, of subassemblies to the assembly site and of the printer from the assembly site to regional distribution hubs, is based on 2013 primary data and is of high quality and low uncertainty. Distribution from regional hubs to the end consumer is representative of best estimates of regional average shipping distances, and is of moderate quality and high uncertainty. Most background data is representative of 2010 through 2013. No background (secondary) data used in the study is older than 10 years. Data represent technology in use and reflect, to the extent possible, the physical reality of the background materials and printer.

Printer power consumption represents measured power consumed during printer operation in accordance with the use scenario outlined in the reference PCR, and is of high quality and moderate uncertainty; actual print loads may differ. 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 other consumable parts, where applicable, 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 analytical models for average treatment of the materials in the US, where data was available. This data is of average quality, and moderate uncertainty. No end-of-life secondary data used in the study is older than 10 years. Data for landfilling, shredding and incineration represent technology in use and reflect, to the extent possible, the physical reality of the processes used.

Background Data

Background data is based on "GaBi 6" Software System for Life Cycle Engineering, and GaBi Databases 2013. All background datasets relevant to production, power generation, transportation, and material disposal were taken from the GaBi 6 software.

The data used for office paper is based on the data developed by the American Forest & Paper dataset (AF&PA 2010), as required by the PCR.

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.

Credits for end-of-life material and energy recovered are excluded from the inventory, following the cut-off approach per the PCR.

A description of all of the methodological decisions made in modeling the life cycle impacts of office paper, including descriptions of the approach to modeling carbon sequestration and paper recycling, are described in the American Forestry and Paper Association report on printing and writing papers.

Additional Environmental Information

Life Cycle Impact Assessment methodologies model the potential environmental impact of a product system, but have an associated degree of uncertainty- this is particularly the case when assessing toxic emissions, the impact of which are dependent exposure of susceptible organisms to these toxics. The following metrics can help identify toxicity hot spots, but decision-making should also consider an exposure assessment. End-of-life toxicity impacts are not reported due to uncertainty about the toxic releases of electronics in landfilling or uncontrolled end-of-life scenarios.

	Laser Printer Production	Transport to Customer	Laserjet Use	Transport to EoL
Ecotoxicity [CTUe]	0.0425	0.0042	31.3	9.76E-011
Human toxicity [CTUh]	1.59E-010	1.05E-011	3.21E-008	4.53E-016

**Data on the toxicity potentials for the Lifecycle with paper included should not be compared with printer EPDs published prior to the current publication; Impact values in the final version of the AFPA report differ from values reported prior to the final publication of the AFPA report and used in past EPDs.*

Table 9: USEtox 2008 toxicity metrics for printer life cycle phases

Additional Life Cycle Scenarios

It is important to understand that the Life Cycle Impact Assessment model is based on one particular scenario for printer distribution, utilization, and end-of-life. Impacts for each of these areas will vary among users, as described in the companion LCA report.

For ease of conveying the results, additional scenarios are not included in the body of this document.

References and Standards

(2013). GaBi 2013, GaBi 6: Software and Database for Life Cycle Engineering, IKP [Institute for Polymer Testing and Polymer Science] University of Stuttgart and PE Europe GmbH, Leinfelden-Echterdingen/ http://www.gabi-software.com

(2010). Printing and Writing Papers, Life-Cycle Assessment Summary Report. American Forestry & Paper Association, http://www.afandpa.org

(2006). ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

(2006). ISO 14040: Environmental management - Life cycle assessment – Principles and framework.

(2006). ISO 14044: Environmental management - Life cycle assessment – Requirements and guidelines.

(1999). ISO/IEC 10561: Information technology -- Office equipment -- Printing devices -- Method for measuring throughput -- Class 1 and Class 2 printers

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Appendix: Additional Life Cycle Impact Information - Not to be published with the Environmental Product Declaration

The following pages provide additional results charts and tables, intended to provide additional insight into the environmental impacts of the printers and provide guidance to stakeholders within HP. For HP's internal use, the end-of-life considers a recycling credit for open-loop recycling of valuable materials. This represents a theoretically possible "best-case" scenario; the "real life" end-of-life credits are dependent on the technology applied by a specific recycler.

Results are presented per the reference unit (printing 1000 images of the reference standard) unless otherwise specified.

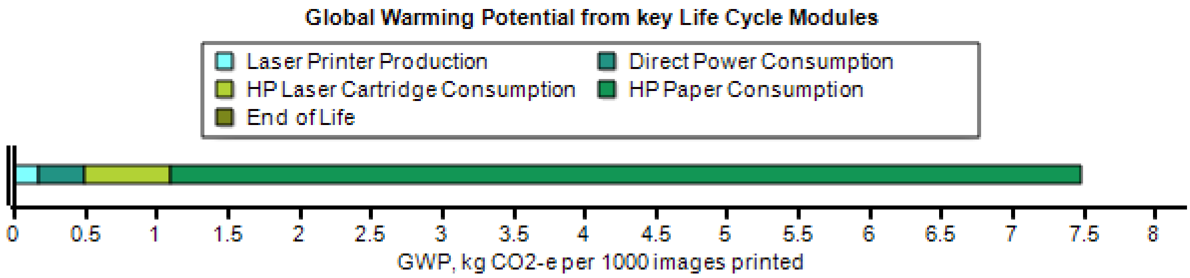

Figure 2: Significant Contributors to Global Warming Potential

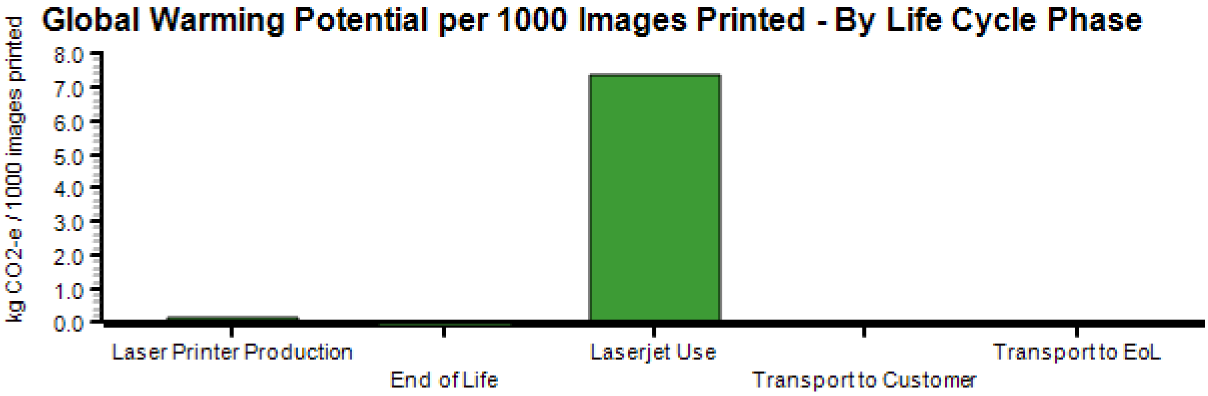

Figure 3: Contribution to Global Warming Potential by Life Cycle Stage

	Laser Printer Production	Transport to Customer	Laserjet Use	Transport to EoL	End of Life
Global Warming Potential [kg CO2-Equiv.]	0.167	0.0281	7.35	0.00034	-0.0276
Acidification Potential [kg SO2 eq]	0.000918	6.65E-005	0.0456	1.16E-007	-0.000345
Eutrophication Potential [kg P eq]	5.39E-007	2.2E-008	0.0016		4.34E-007
Fossil Fuel Depletion [kg oil eq]	0.0577	0.0102	1.16		-0.0126
Metal Depletion [kg Fe eq]	0.0472	4.76E-005	1.3E004		-0.0516
Ozone Depletion Potential [kg CFC-11 eq]	2.33E-009	1.86E-013	2.54E-007		-2.76E-013

Table 6: Analysis of Environmental Impact Contributions by Life Cycle Stage (per declared unit of 1000 printed pages)

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Impact Details: Printer Use

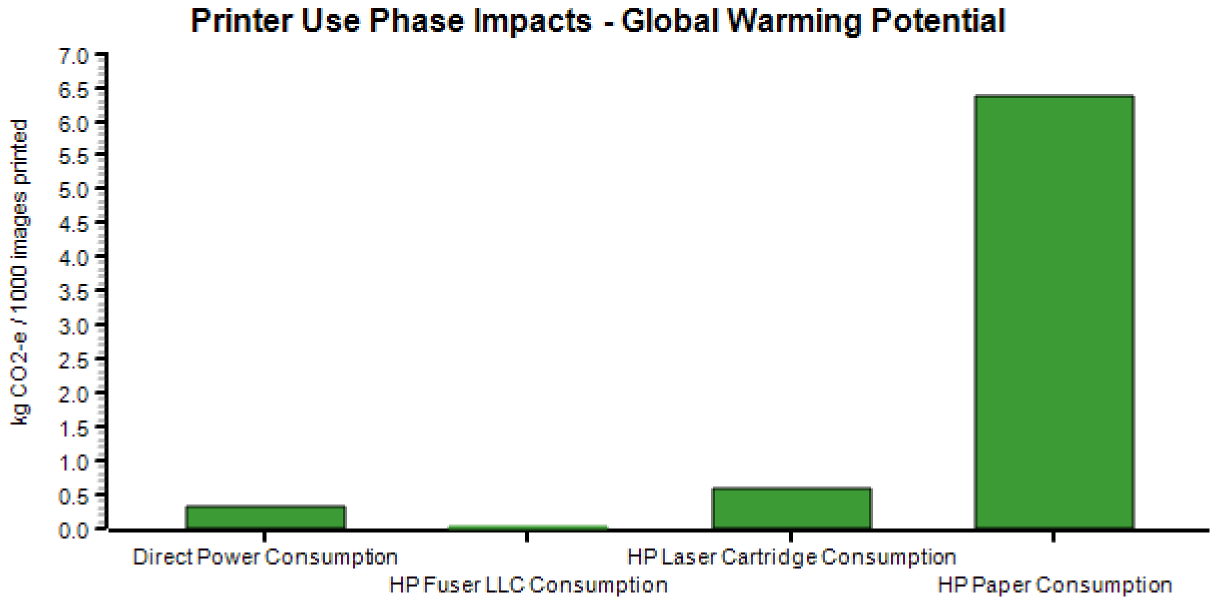

Figure 4: Contribution to Global Warming Potential of Printer Use by Consumable

	Direct Power Consumption	HP Fuser LLC Consumption	HP Laser Cartridge Consumption	HP Paper Consumption
Global Warming Potential [kg CO2-Equiv.]	0.327	0.041	0.599	6.38
Acidification Potential [kg SO2 eq]	0.000951	0.0003	0.00208	0.0422
Eutrophication Potential [kg P eq]	5.48E-008	2.11E-007	2.49E-006	0.0016
Fossil Fuel Depletion [kg oil eq]	0.0955	0.0148	0.248	0.802
Metal Depletion [kg Fe eq]	0.000861	0.00338	0.058	1.3E004
Ozone Depletion Potential [kg CFC-11 eq]	1.13E-010	9.06E-010	1.11E-008	2.42E-007

**Data on the Mineral Resource Depletion Potential of Paper is not available from the AFPA at the time of the study*

Table 7: Analysis of Environmental Impact Contributions within Product Utilization Life Cycle Stage (per declared unit of 1000 printed pages)

Hewlett Packard
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Impact Details: Printer Production

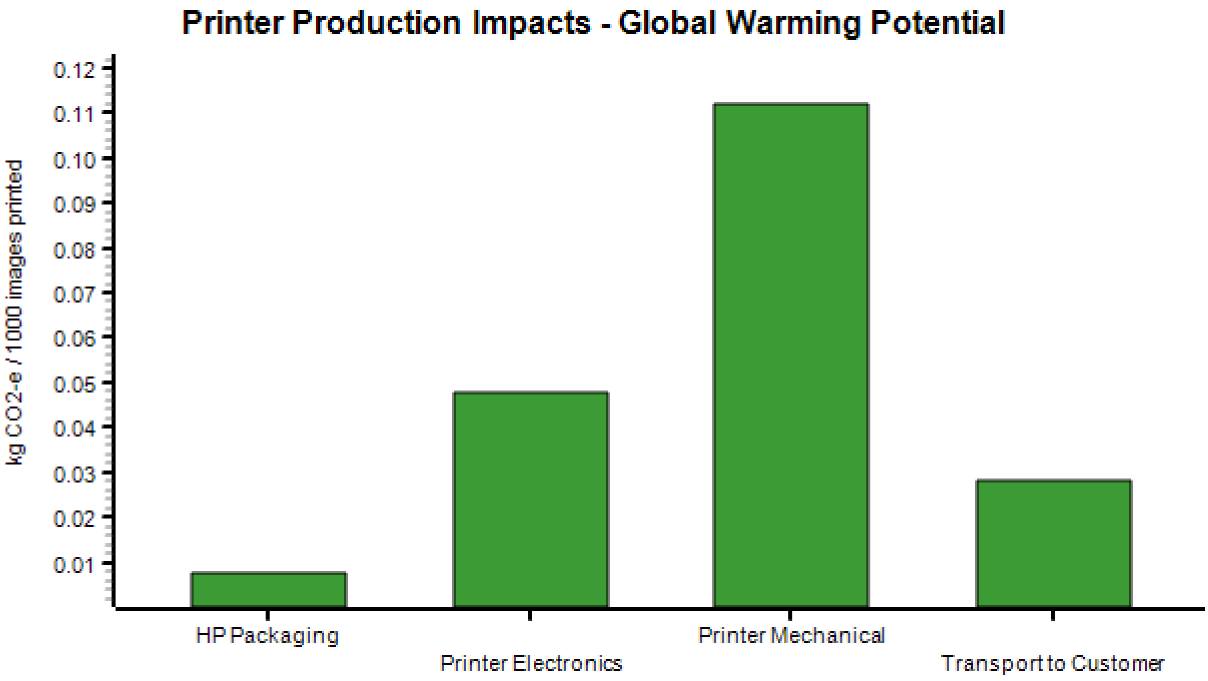

Figure 5: Contribution to Global Warming Potential of printer manufacturing by printer subassembly

	HP Laserjet Lifecycle	HP Packaging	Printer Electronics	Printer Mechanical
Global Warming Potential [kg CO2-Equiv.]	7.52	0.00771	0.0478	0.112
Acidification Potential [kg SO2 eq]	0.0462	1.5E-005	0.00038	0.000526
Eutrophication Potential [kg P eq]	0.0016	3.55E-008	2.97E-007	2.06E-007
Fossil Fuel Depletion [kg oil eq]	1.22	0.00219	0.0144	0.0412
Metal Depletion [kg Fe eq]	1.3E004	8.04E-006	0.0273	0.02
Ozone Depletion Potential [kg CFC-11 eq]	2.56E-007	2.13E-010	2.19E-010	1.9E-009

Table 8: Analysis of Environmental Impact Contributions within Printer Production Life Cycle Stage (per declared unit of 1000 printed pages)