Hewlett Packard Enterprise Product Recyclability Assessment

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Abstract: Hewlett Packard Enterprise utilized the International Electrotechnical Commission's (IEC) published standard 62635 **Guidelines for End-of-Life Information Provided by Manufacturers and Recyclers and for Recyclability Rate Calculation of Electrical and Electronic Equipment 2012** as well as the NSF International Standard NSF/ANSI 426 – 2017 **Environmental Leadership and Corporate Social Responsibility Assessment of Servers** to measure the recyclability of HPE's products. This paper will show the methodology use by HPE to calculate product recyclability and the recycling methods assumed.

Introduction

Hewlett Packard Enterprise (HPE) contributes to a circular economy by designing products that have long life spans, are easily repaired, upgradable, highly reused, and highly recyclable at the eventual end of their lives. This paper quantifies just how recyclable HPE's products are by utilizing the internationally accepted standard for calculating the recyclability of electronic products known as IEC 62635. This paper is required to be made publicly available to meet HPE's obligations for the Electronic Product Environmental Assessment Tool (EPEAT) server standard as defined in section 9.1.4 in NSF/ANSI 426 – 2017 **Environmental Leadership and Corporate Social Responsibility Assessment of Servers**. The EPEAT standard refers to IEC 62635, but deviates in how printed circuit boards are handled. Consequently, HPE uses IEC 62635 for all calculations aside from for printed circuit boards, for which HPE uses the method described by NSF.

In order to meet the EPEAT requirements, HPE has completed recyclability assessments for products that represent each of HPE's major server product families. HPE uses a Recyclability Assessment Tool (RAT) that has been validated by a third-party recycler for accuracy. Although a high percentage of HPE products are typically recovered, repaired, and resold as used equipment, this methodology is focused exclusively on recyclability, therefore all products were assumed to have no components recoverable for reuse.

Measuring Recyclability

Recyclability can vary greatly depending on what materials products are made from, how they are collected at the end of their lives, how easily they can be disassembled, and what methods are used by the recycling facility that handles them. IEC 62635 works to address some of this variability by creating a common methodology for the recyclability rate calculation.

IEC 62635 determines that there are generally four phases of product end-of-life (EoL) treatment: pre-treatment which involves separating parts to mitigate hazards (such as removing batteries); material separation which can be achieved in many ways including manual, mechanical (shredding), chemical, floatation, or thermal (smelting); energy recovery; and finally disposal.

The more recyclable a product is, the lower the proportion of it that should be sent for energy recovery or disposal. The recyclability rate of the product is thus the ratio or recyclable mass over the total mass of the product, resulting in a percentage as follows:

$$R_{CYC} = \frac{\text{Sum of recyclable masses of each parts}}{\text{Total product mass}} \times 100\%$$

HPE's End-of-Life Scenario

For the purpose of validating this methodology, HPE partnered with a recycler in Germany with whom HPE has had a long-standing relationship to analyze HPE products. IEC 62635 states that clear communication between manufacturers and recyclers is vital to achieving high recyclability rates. For the benefit of recyclers, HPE provides product disassembly instructions and information on parts that require special treatment such as batteries. This information is gathered and released as part of every new product introduction process, so recyclers have it long before a product should approach its EoL. The recycler provided HPE with information on their recycling process and methods, recovery rates, and the actual recyclability rates of products. Additionally the recycler has helped HPE to understand the end-of-life monetary value of HPE products. The recycler did not check any products or components for reuse potential, as the focus was exclusively on the recyclability rate.

The recycler's process is to first engage in pre-treatment of all products to remove any hazardous components such as batteries. HPE does not use glue to attach batteries to products so the recycler is able to remove them manually, with commonly available tools. Batteries are sent to a specialized battery processing facility. The recycler then disassembles the products manually. This is eased by the fact that HPE products are either separable by hand or with common tools. As components of the servers are separated they are sorted by material type. This results in higher recycling rates and a higher economic value for the recycler than using a mechanical shredder to separate out material types. It is assumed that that other recyclers would choose to use a manual separation method as well, because of the higher economic returns reported.

Recyclability Results

Product printed circuit boards such as RAM, the motherboard, storage controllers, expansion cards, and other circuit boards, as well as the products' processors are sent to a precious metals processor. The precious metals processor uses thermal sorting to extract valuable precious metals such as copper, gold, palladium, and platinum. These metals have very high economic values. For all product types 100% of printed circuit boards can be recovered and sent for metals recycling at smelters. Thus, under EPEAT, the NSF standard considers this portion of the product to be 100% recyclable.[1]

The majority of HPE's server products' weight is ferrous metal. Product chassis, hard drive trays, PCI expansion slots, risers, screws, and many more components are made from ferrous metal. Non-ferrous metals such as aluminum and copper are used inside hard drives, for heat sinks, and in cables. The recycler sends metals to a smelter which is able to recover all of these metals so that they may be used in place of virgin metals that are mined directly from the ground.

HPE products use relatively little plastic compared to many consumer electronic products. Plastic may be used in the airflow bezel (if present), fan housing, latches, and the insulation on cables. Most plastic components are easily separated manually aside from the plastic cable insulation.

Finally the recycler found a very small volume of material that did not have post EoL value for recycling. An example of this material is foam used to form an air barrier between the fan mount and the chassis while reducing vibration. This material is sent to energy recovery rather than landfill.

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[1] "Printed circuit board substrate material, included in printed circuit boards that will be sent to a smelter for metals recycling, shall be considered recyclable for the purpose of the calculation." NSF International Standard NSF/ANSI 426 – 2017 **Environmental Leadership and Corporate Social Responsibility Assessment of Servers**, Section 9.1.4.

EPEAT for Servers (NSF/ANSI 426 – 2017); Criterion 9.1.4 Results:

HPE ProLiant DL380 Gen10 Recyclability Results

The ProLiant DL380 Gen10 is a highly configurable 2U rack server that is representative of HPE's "DL" family of servers. The configuration used for this recyclability calculation included: two processors; four DIMM cards (RAM); the maximum six fans; two hot-swappable power supplies; two hard disk drives; a drive controller; and a PCIe Riser Card. The majority of the product's weight is from the major metal components such as the chassis. This configuration weighted 18,599 grams, of which 18,326 can be recycled, so its recyclability rate is 98.53%.

$R\_cyc = 18599g/18326g \times 100\% = 98.53\%$

Materials and Components	Weight (g)	% Weight	Recyclability Rate
Steel—Chassis, Brackets, Screws, etc.	10110	54%	100%
Aluminum—Heatsinks	340	2%	100%
PC/ABS Plastic—Air Bezel, Clips, etc.	565	3%	100%
Internal Wire and Cables	140	<1%	38%
Button Cell Battery	119	<1%	100%
Two Power Supplies	1520	8%	90%
Six Fans	900	5%	100%
Hard Disk Drives	1400	8%	98%
Motherboard and Processors	2830	15%	100%
RAM (4X)	200	1%	100%
PCI Riser Assembly	320	2%	100%
Drive Controller	80	<1%	100%
SAS PCA	75	<1%	100%
	Total Weight	**Recyclable Weight**	**Recyclability Rate**
	18599 grams	**18326 grams**	**98.53%**

HPE ProLiant BL460c Gen9 Recyclability Results

The ProLiant BL460c Gen9 is a blade server that allows for converged data centers that is representative of HPE's "BL" family of servers. Blade servers share some infrastructure such as power supplies, cooling, and networking with other blades contained within the same enclosure (e.g., HPE BladeSystem c7000). This recyclability calculation is for the blade alone: power supplies, fans, the blade enclosure, and networking connections are not considered. HPE aims to assess the recyclability of a blade enclosure soon. This configuration does include two 2.5-inch hard disk drives. Steel and printed circuit boards account for a similar share of the BL460c Gen9's weight, and together comprise nearly 80% of the total. The hard drives and heatsinks comprise much of the remainder. This blade server does not contain much plastic. This blade configuration weights 4,727 grams, of which 4,720 grams is recyclable resulting in a recyclability rate of 99.84%.

$$R\_cyc = 4727g/4719g \times 100\% = 99.8\%$$

Materials and Components	Weight (g)	% Weight	Recyclability Rate
Steel—Chassis, Brackets, Screws, etc.	1856	39%	100%
Aluminum—Heatsinks	463.8	10%	100%
PC	89.4	2%	100%
PC/ABS	120.6	3%	100%
PET	23.2	<1%	100%
Button Cell Battery	3.2	<1%	100%
Motherboard and Processors	1492	32%	100%
RAM	144	3%	100%
PCI Riser Assembly	53	1%	100%
Other Printed Circuit Boards	110	2%	100%
Two 2.5-Inch Hard Disk Drives	372	8%	98%
	Total Weight	**Recyclable Weight**	**Recyclability Rate**
	4727 grams	**4720 grams**	**99.84%**

HPE ProLiant ML350 Gen9 Recyclability Results

The HPE ProLiant ML350 Gen9 server is designed for use in both enterprise data centers and as a tower server for small and medium sized businesses that is representative of HPE's "ML" family of servers. It is a large unit offering a lot of customization and expandability. The configuration used for this recyclability assessment included two power supplies, four 3.5-inch hard disk drives, an optical disk drive, and three fans. A significant majority of the products weight is steel from the chassis, mounting brackets, drive cages, and so on. In total the product weights 33,691 grams, of which 33,057 grams are recyclable. The recyclability rate is 98.12%.

$$R\_cyc = 33691g/33057g \times 100\% = 98.12\%$$

Materials and Components	Weight (g)	% Weight	Recyclability Rate
Steel—Chassis, Brackets, Screws, etc.	23194.4	69%	100%
Aluminum—Heatsinks	418.6	1%	100%
PC	1112	3%	100%
PC/ABS	571.15	2%	100%
LDPE	11.1	<1%	100%
Wire and Cables (Internal to System)	627	2%	38%
Button Cell Battery	131.2	<1%	100%
Motherboard and Processors	1486	4%	100%
RAM	264	<1%	100%
Other Printed Circuit Boards	132.85	<1%	100%
Optical Disk Drive	153	<1%	80%
Four 3.5-Inch HDDs	3188	9%	98%
Power Supplies	1510	4%	90%
Three Fans	892	3%	100%
Total Weight	**Recyclable Weight**	**Recyclability Rate**	
33691 grams	33057 grams	98.12%	

HPE XL190r Node Gen10 Recyclability Results

The XL190r Gen10 is a compute-intensive server node for HPE Apollo 2000 Gen10 systems that is representative of HPE's "XL" family of node servers. Two of these half-width server nodes can fit in a standard 2U Apollo 2000 Gen10 chassis and each can be serviced without impacting the whole system. This recyclability assessment looks at only a single node, not the associated chassis. The configuration used for this assessment does not include fans, power supplies, or any drives. The majority of the node's weight is from the steel tray, motherboard, and heatsinks. In total the node weights 5,503 grams of which 5,472 grams are recyclable resulting in a recyclability rate of 99.44%.

$R\_cyc = 5503g/5471g \times 100\% = 99.44\%$

Materials and Components	Weight (g)	% Weight	Recyclability Rate
Steel—Chassis, Brackets, Screws, etc.	3050	55%	100%
Copper and Aluminum Heatsinks	800	15%	100%
PC/ABS Plastic—Air Bezel, Clips, etc.	50	1%	100%
Internal Wire and Cables	50	1%	38%
Button Cell Battery	3.2	0.1%	100%
Motherboard and Processors	1000	18%	100%
RAM (4X)	100	2%	100%
PCI Riser Assembly	100	2%	100%
SAS PCA and NIC Controller	350	6%	100%
	Total Weight	**Recyclable Weight**	**Recyclability Rate**
	5503.2 grams	**5472.2 grams**	**99.44%**

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