Recyclability Assessment of PowerEdge Server products based on IEC 62635 standards

Abstract

The focus of IEC 62635 standard is on design for end-of-life treatment, information exchange between manufacturers and recyclers. Dell EMC conducted recyclability assessment on server products using IEC 62635 methodology. Products were assessed by an independent lab to the IEC 62635 standard. In this paper, we share the calculation, reuse & recycling methods.

1 INTRODUCTION

International Electrotechnical Commission (IEC) published the IEC-62635 Standard titled '*Guidelines for End of life information provision from manufacturers and recyclers, and for recyclability rate calculation of Electrical and Electronic Equipment'.* This standard provides a methodology for calculating the recyclability and recoverability rates based on product attributes and reflecting end-of-life practices.

In this paper[1] we share highlights of the recyclability assessment of Dell EMC PowerEdge Server product, based on the IEC-62635 methodology. Products were assessed by a recycler and results were analyzed by an independent lab.

2 PRODUCTS

Recyclability assessments of following PowerEdge Servers are discussed here:

- Tower – PowerEdge T440
- Rack – PowerEdge R740
- Blade – PowerEdge M640
- Sled – PowerEdge FC640

3 IEC 62635 RECYCLABILITY ASSESSMENT

The standard for recyclability assessment addresses the importance of information exchange between manufacturers and recyclers and establishes a method for recyclability rate calculation. It thereby aims to address the issue of increasing efficiency in improving reuse, recovery and recycling, end of life treatment process and practices and understand the global nature of reverse logistics. Recycling is defined as *processing of waste for the original purpose or for other purposes, excluding energy recovery* and recyclability rate is determined as *ability of waste product parts or waste materials to be reused or recycled.* See Fig. 1

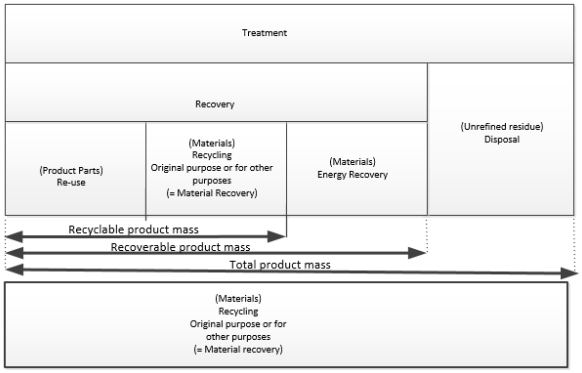

Fig. 1: Table of key terms covering end of life treatment

Calculating Recycling Rate

IEC-62635 defines recyclability and recoverability rates as follows:

Recyclability rate:

$$R_{cyc} = \frac{sum\ of\ recyclable\ masses\ of\ each\ parts}{total\ product\ mass} \times 100\%$$

End-of-Life (EoL) treatment scenarios are used when calculating recyclability and recoverability rates of electronics. Two main elements that influence recycling and recover rates of electronics in EoL treatment include local infrastructure and design characteristics of the product. Dell worked with a recycler and this work provides actual recyclability rates.

End-of-Life treatment process

There are four end-of-life treatment phases defined in the IEC standard: pre-treatment, material separation, energy recovery and disposal. Pretreatment includes dismantling and requires selective treatment. During materials separation, several techniques may be used, such as mechanical separation, chemical separation, or thermal separation. Remaining and unsorted materials are normally considered for energy recovery. Residues are then disposed of in landfills as shown in Fig 2.

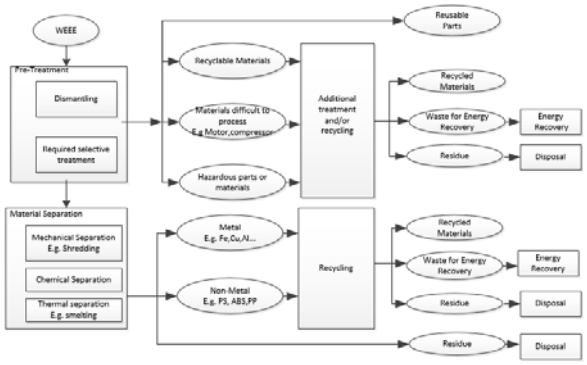

Fig. 2: End of Life treatment process

4 ASSUMPTIONS, METHODOLOGY AND CALCULATION

The following section describes the methodology of completing the recyclability assessment

- A third party lab was sent upto two units for recyclability assessment. These systems were the proto units along with packaging.
- Lab coordinated and evaluated the design/end-of-life treatment feedback with a leading US based recycling company.

The *Information exchange between recyclers and manufacturers* is important part of the IEC standard. To facilitate information exchange in this study, Dell shared the disassembly instructions with the recycler. Dell also provided the WEEE End-of-life information for parts that require selective treatment, single recyclable materials, parts difficult to process, and treatment of remaining parts. Detailed product information was exchanged with the recycler through the environmental datasheet document (which includes product, battery and packaging weight, dimension etc.), list of plastics parts over 25 grams, information on flame retardants, if any, and ISO 11469 marking of plastics parts. Dell received information about treatment characteristics for the different components of the products from recycler.

5 RECYCLING TECHNOLOGY

Determination of the recyclability rate start with the receipt of the untreated waste equipment (if beyond reuse) and end when the end-of-waste status for fractions is achieved. The product was broken into following stream for recycling:

- *Precious Metal Processor*: RAM, system board, processor, other circuit boards, heatsink, sever backplane.
- *Metal Smelter*: metal parts of HDD and fans, screws, metal brackets, chassis metallic parts, metal from cables
- *Plastic processor***:** Bezel, ABS plastics parts, plastic from cables
- Primary battery is sent to Battery recycler.

6 RESULTS

The lab obtained recyclers feedback on parts which can be reused, require special treatment, are difficult to process and a list of treatment methods for recovery and recycling of these systems. From a recyclability assessment perspective, important information was the mass of materials to calculate the recycling rate of individual parts or materials. Recycler feedback suggests presence of an well established refurbishment and reuse program for the server hard drive, RAM, motherboard, power supply, backplane and processor. These parts were identified to be readily reusable. Components were easily removed from the unit making it worthwhile to re-use and extend the life of a component.

Special Treatment: Care was taken by recyclers when handling the Lithium ion batteries to ensure that the battery terminals are covered during storage to prevent accidental fire.

Other system parts were observed to be of a single material and separable which included the chassis, bezel, fan, processor, screws, metal brackets and miscellaneous cards. Circuit boards, RAM and processor is sent to a recycling stream for precious metal recovery. Plastic parts from the internal parts and bezel is sent for plastics recycling, and all other metal parts (e.g from hard drive, chassis and metal brackets) undergo further separation and are sent to a metal smelter. The table below shows the list of

key parts, their weight as percentage of whole product and recyclability rate:

1)Tower Server – PowerEdge T440

Fig. 3 PowerEdge T440 Server

Product/ Component	% Weight	Recyclability Rate
Chassis	69%	100%
Fan	2%	90%
Metal brackets (multiple)	3%	100%
Plastic Wiring	3%	85%
RAM	<1%	100%
Hard Drive (SATA)	4%	98%
Printed circuit boards	9%	100%
ABS plastic	7%	100%
Processor	1%	100%
Button cell battery	<1%	100%
Screws	<1%	100%
Heatsink		100%

Table 1: Weight and recyclability rate for PowerEdge T440

Parts which had a complex metal and plastics assembly such as the fan assembly or certain parts which have comingled metal and plastics such as plastics coated wiring are considered less recyclable. Certain metal screws have plastic rubber glued which also makes them less recyclable as they are sent to a smelter. The net result: Recyclability rate of is:

$$R_{cyc} = \frac{17687g}{17824g} \times 100\% = 99.2\%$$

2) Rack Server – PowerEdge R740

Fig. 4 PowerEdge R740 Server

Results for rack server were consistent with the tower server results

Primary Parts	% Weight	Recyclability Rate
Chassis	60%	100%
Fans	5%	90%
Metal brackets (multiple)	5%	100%
Plastic Wiring	1%	85%
RAM	<1%	100%
Hard Drive (SATA)	5%	98%
Printed circuit boards	17%	100%
ABS plastic	<1%	100%
Processor	1%	100%
Riser card	1%	100%
NIC card	1%	100%
Server Backplane	1%	100%
Button cell battery	<1%	100%
Screws	<1%	100%
Heatsink	2%	100%

Table 2: Weight and recyclability rate for PowerEdge R740

$$R_{cyc} = \frac{15151g}{15277g} \times 100\% = 99.26\%$$

3) Blade – PowerEdge M640

To be updated with results

4) Sled – PowerEdge FC640

To be updated with results.

REFERENCES

[1] Dell Design for Environment White Paper: http://i.dell.com/sites/content/corporate/corp-

comm/en/Documents/design-for-environment.pdf

[2] PowerEdge Servers Environmental Datasheet and Product Manuals

http://www.dell.com/support/home/us/en/19/products/ser_stor_net/poweredge