# Lenovo Server Product Recyclability Assessment

**Abstract:**
Lenovo utilized methodology described in **IEC/TR 62635: Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment** which is a technical report and prepared by IEC technical committee, and as well as the NSF International Standard **NSF/ANSI 426 – 2018: Environmental Leadership and Corporate Social Responsibility Assessment of Servers** to do the evaluation for recyclability of Lenovo server products. The related methodology and the recycling methods assumption in the above standard are considered and addressed in this whitepaper.

## 1 INTRODUCTION

This paper is required to be published to meet Lenovo's obligations for the Electronic Product Environmental Assessment Tool (EPEAT) server standard as defined in the required criterion 9.1.4 in NSF/ANSI 426 – 2018 **Environmental Leadership and Corporate Social Responsibility Assessment of Servers.** The EPEAT standard refers to IEC/TR 62635, but deviates in how printed circuit boards are handled. Consequently, Lenovo uses IEC/TR 62635 for all calculations except printed circuit boards and will use the method described by NSF for the printed circuit board recyclability calculation.

Lenovo has completed recyclability assessments for products that represent each of Lenovo's major server product families. The products' recyclability results were analyzed by a third-party laboratory along with the recycler's related information. Although a high percentage of Lenovo 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.

## 2 LENOVO'S PRODUCTS

Recyclability assessments of the following representative servers are discussed here:

1) Rack server – Lenovo ThinkSystem SR650
2) Tower server – Lenovo ThinkSystem ST550
3) Blade server – Lenovo ThinkSystem SN850
4) Dense server – Lenovo ThinkSystem SD530

## 3 RECYCLABILITY ASSESSMENT IN IEC/TR 62635

The IEC/TR 62635 recyclability assessment addresses the importance of information exchange between manufacturers and recyclers and establishes a method for recyclability rate calculation. It aims to provide information to recyclers to enable appropriate and optimized end-of-life (EoL) treatment operations and to provide sufficient information to characterize activity at EoL treatment facilities in order to enable manufacturers to implement effective environmentally conscious design (ECD). The recyclability rate is expressed as a percentage of the mass of the product that can be recycled or reused, excluding energy recovery and residue disposal. Figure 1 provides a synthesis of the main definition covering EoL treatment.

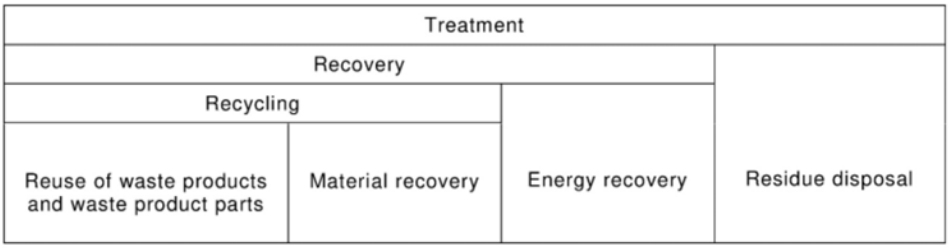


**Figure 1 –Framework of the main definition covering end-of-life treatment**

The recyclability rate of the product is calculated as the sum of recyclable masses of each parts (numerator) divided by the total product mass (denominator), resulting in a percentage as follows:

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

IEC/TR 62635 generally presents four phases of product EoL treatment: pre-treatment, material separation, energy recovery and disposal. Pre-treatment includes dismantling and requires selective treatment. During materials separation, several techniques may be used such as mechanical separation or thermal separation (smelting). Remaining and unsorted materials are normally considered for energy recovery. Residues are then disposed of in landfills.

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. Lenovo worked with a laboratory and recycler to provide recyclability rates in this

whitepaper.

## 4 RECYCLABILITY ASSUMPTIONS, METHODOLOGY AND CALCULATION

In order to verify this methodology and complete the recyclability assessment, Lenovo sent server products to a third party laboratory. Then the laboratory evaluated the design/end-of-life treatment feedback based on actual testing and information between Lenovo and the recycler. Clear communication between recyclers and manufacturers is important part of the IEC standard. To facilitate the information exchange in this EoL treatment process, Lenovo shared the disassembly instructions with the recycler and also provided the WEEE end-of-life information for parts that require selective treatment. Detailed product information was exchanged with the recycler through the product specification and maintenance manual documentation (which includes product, disassembling guide, dimension, etc.).

## 5 RECYCLING PROCESS

Determination of the recyclability rate starts with the receipt of the untreated waste equipment (if beyond reuse) and ends when the end-of-waste status for fractions is achieved. Lenovo 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 or any refresh process through internal documentations, so recyclers have it long before a product should approach its EoL.

The recycler's process is to first engage in pre-treatment of all products to remove hazardous parts, such as batteries. The recyclers use a manual separation method to separate servers' parts until it will be separate to the ones which are not economically feasible from recyclability perspective. Most parts can be removed easily by hand and common household tools such as flat head screw drivers may be necessary. Instructions for removing parts in each product can be found in the maintenance manual.

## 6 RECYCLING 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 following removal of batteries and mercury and then smelting for metals recovery. 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.

Lenovo used the recyclability percentage from the IEC/TR62635 IT and telecommunications scenario and consumer equipment for components other than printed circuit boards, such as fan, internal cable, aluminum, plastic parts etc.

## Recyclability Results For Criterion 9.1.4 of EPEAT Servers (NSF/ANSI 426 – 2018):

### *Lenovo ThinkSystem SR650*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem SR650” as a representative for Lenovo rack server products. Products were assessed by a recycler and results were analyzed by a third-party laboratory based on the standards mentioned in the “Abstract” of this whitepaper. Lenovo chooses the worst case of the recyclability rate and shows the data in the following table. The configuration used for this recyclability assessment included processors, power supplies, hard disk drives, fans, riser cards, RAID Cards, network cards etc. The majority of the product’s weight is from the major steel components such as the chassis. In total, the product weighs 18470.5 grams of which 17317.91 grams are recyclable resulting in a recyclability rate of 93.75%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{17317.91}}{\mathbf{18470.5}} \times \mathbf{100}\% = \mathbf{93.75}\%$$

**Figure 2: Lenovo ThinkSystem SR650 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Button Cell Battery (Lithium) | 2.9 | <1% | 45% |
| Internal cable | 332 | 2% | 24% |
| Aluminum for Heatsinks, CPU Brackets | 1327 | 7% | 95% |
| Steel (general) for chassis, Screws, etc. | 11688 | 63% | 95% |
| Power Supplies | 1712.6 | 9% | 95.78% |
| Hard Disk Drives | 262.6 | 1% | 95.26% |
| DC cooling fan | 899.4 | 5% | 85% |
| Motherboard and Processors | 974.3 | 5% | 100% |
| RAM | 88 | <1% | 100% |
| Other Printed Circuit Boards | 877.7 | 5% | 100% |
| ABS+PC for Air Bezel, Clips, etc. | 306 | 2% | 94% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 18470.5 | 17317.91 | 93.75% |

**Figure 3: Weight and Recyclability Rate for Lenovo ThinkSystem SR650**

## *Lenovo ThinkSystem ST550*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem ST550” as a representative for Lenovo tower server products. Products were assessed by a recycler and results were analyzed by a third-party laboratory based on the standards mentioned in the “Abstract” of this whitepaper. Lenovo chooses the worst case of the recyclability rate and shows the data in the following table. The configuration used for this recyclability assessment included processors, power supplies, hard disk drives, fans, riser cards, RAID Cards, network cards etc. The majority of the product’s weight is from the major steel components such as the chassis. In total, the product weighs 24029.3 grams of which 22398.89 grams are recyclable resulting in a recyclability rate of 93.21%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{22398.89}}{\mathbf{24029.3}} \times \mathbf{100}\% = \mathbf{93.21}\%$$

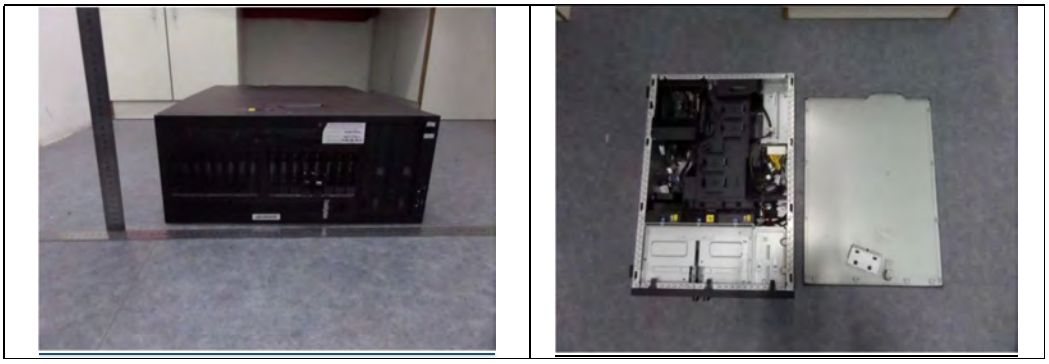

**Figure 4: Lenovo ThinkSystem ST550 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Button Cell Battery (Lithium) | 2.8 | <1% | 45% |
| Hard Disk Drives | 242 | 1% | 95.24% |
| DVD-ROM | 1228.4 | 5% | 93.19% |
| Internal cable | 542 | 2% | 24% |
| ABS+PC for Air Bezel, Clips, etc. | 942 | 4% | 94% |
| Power Supplies | 1712.6 | 7% | 95.78% |
| DC cooling fan for display card | 124.9 | <1% | 85% |
| Fan | 990.6 | 4% | 85% |
| Aluminum for Heatsinks, CPU Brackets | 1324.0 | 6% | 95% |
| Steel (general) for chassis, Screws, etc. | 14990.0 | 62% | 95% |
| Motherboard and Processors | 1432.4 | 6% | 100% |
| Other Printed Circuit Boards | 454.4 | 2% | 100% |
| RAM | 43.2 | <1% | 100% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 24029.3 | 22398.89 | 93.21% |

**Figure 5: Weight and Recyclability Rate for Lenovo ThinkSystem ST550**

## *Lenovo ThinkSystem SD530*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem SD530” as a representative for Lenovo dense server products. Products were assessed by a recycler and results were analyzed by a third-party laboratory based on the standards mentioned

in the “Abstract” of this whitepaper. Lenovo chooses the worst case of the recyclability rate and shows the data in the following table. This recyclability assessment looks at only a single node, not the associated chassis. A significant majority of the node’s weight is from the node chassis, motherboard, and heatsinks. In total the node weighs 4699.06 grams of which 4437.826 grams are recyclable resulting in a recyclability rate of 94.45%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{4437.826}}{\mathbf{4699.06}} \times \mathbf{100}\% = \mathbf{94.45}\%$$

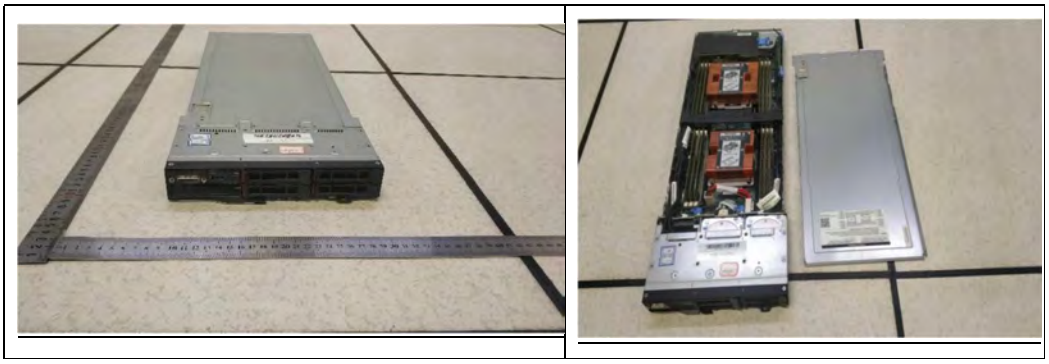

**Figure 6: Lenovo ThinkSystem SD530 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Button Cell Battery (Lithium) | 2.84 | <1% | 45% |
| Motherboard and Processors | 920.74 | 20% | 100% |
| RAM | 74.4 | 2% | 100% |
| Internal cable | 123.0 | 3% | 24% |
| Hard Disk Drives | 269.1 | 6% | 95.2% |
| ABS+PC for Air Bezel, Clips, etc. | 54.8 | 1% | 94 |
| Aluminum for Heatsinks , CPU Brackets | 900 | 19% | 95% |
| Other metal in chassis, Screws, etc. | 2100 | 44% | 95% |
| Other Printed Circuit Boards | 254.18 | 5% | 100% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 4699.06 | 4437.826 | 94.45% |

**Figure 7: Weight and Recyclability Rate for Lenovo ThinkSystem SD530**

## *Lenovo ThinkSystem SN850*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem SN850” as a representative for Lenovo blade server products. Products were assessed by a recycler and results were analyzed by a third-party laboratory based on the standards mentioned in the “Abstract” of this whitepaper. Lenovo chooses the worst case of the recyclability rate and shows the data in the following table. This recyclability assessment looks at only a single node, not the associated chassis. A significant majority of the node’s weight is from the node chassis, motherboard, and heatsinks. In total, the node weighs 10499.18 grams of which 10143.98 grams are recyclable resulting in a recyclability rate of 96.61%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{10143.98}}{\mathbf{10499.18}} \times \mathbf{100\%} = \mathbf{96.61\%}$$

**Figure 8: Lenovo ThinkSystem SN850 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Button Cell Battery (Lithium) | 3.06 | <1% | 45% |
| Motherboard and Processors | 2906.46 | 28% | 100% |
| RAM | 175.84 | 2% | 100% |
| Hard Disk Drives | 269.1 | 2% | 95.2% |
| ABS+PC for Air Bezel, Clips, etc. | 285.22 | 3% | 94% |
| Aluminum for Heatsinks , CPU Brackets | 1520 | 15% | 95% |
| Other metal in chassis, Screws, etc. | 4950 | 46% | 95% |
| Other Printed Circuit Boards | 389.5 | 4% | 100% |

| | Total Weight | Recyclable Weight | Recyclability Rate |
|---|---|---|---|
| | 10499.18 | 10143.98 | 96.61% |

**Figure 9: Weight and Recyclability Rate for Lenovo ThinkSystem SN850**