# 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 – 2019: Environmental Leadership and Corporate Social Responsibility Assessment of Servers** to do the evaluation for recyclability of Lenovo server products. Lenovo server products were assessed by an independent lab to the IEC 62635 standard. In this whitepaper, we share assumed recycling methods and the methodology used to calculate product recyclability.

## 1 INTRODUCTION

Lenovo devises the choice of materials for the crucial goal on the establishment of a recycling society. Lenovo server products are so designed that the sustainability is taken into account. 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 – 2019 **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.

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. Lenovo has completed recyclability assessments for products that represent each of Lenovo's major server product families by a recycler. The products' recyclability results were analyzed by a third-party laboratory.

## 2 LENOVO'S PRODUCTS

Recyclability assessments of the following representative servers are discussed here:

1) Rack server – Lenovo ThinkSystem SR670
2) Tower server – Lenovo ThinkSystem ST250

3) Blade server – Lenovo ThinkSystem SN850
4) Dense server – Lenovo ThinkSystem SD650 V2

## 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.

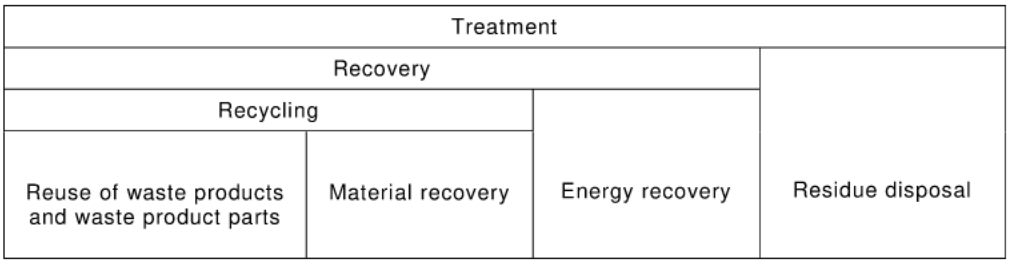


**Figure 1 –Framework of the main definition covering end-of-life treatment**

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:

$$R_{cyc}=\frac{\text{sum of recyclable masses of each parts}}{\text{total product mass}}x100\%$$

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 LENOVO'S End-of-Life Scenario

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.

The methodology required is used to complete the recyclability assessment as below: Lenovo sent server products to a third party laboratory. Then the laboratory evaluated the design/end-of-life treatment feedback based on actual testing combined with the information provision from Lenovo and recyclers. Clear communication between recyclers and manufacturers is an 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 all kinds of parts that require selective treatment, single recyclable materials, parts difficult to process, and treatment of remaining parts.. Instructions for removing parts in each product can be found in the maintenance manual which include the product specification, disassembly guide, etc.

## 5 RECYCLING PROCESS

The recycler's processes are consistent with the end-of life treatment process phases defined in the IEC standard. Takes all practical steps to separate as appropriate, through manual dismantling and/or mechanical processing to make the materials in equipment and components that are not directed to reuse, i.e. plastics and metals. The product is broken into four streams for recycling:

- Precious Metal Processor: 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 extracts 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.
- Metal Smelter: metal parts of HDD and fans, screws, metal brackets, chassis metallic parts, metal from cables. The recycler sends metals to a smelter which is able to recover all of these metals.

- Plastic processor: Bezel, ABS plastics parts, plastic from cables. Most plastic components are easily separated manually aside from the plastic cable insulation.
- Primary battery is sent to Battery recycler.

## 6 RECYCLING RESULTS

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 metal parts, plastic parts, etc.

### Recyclability Results For Criterion 9.1.4 of EPEAT Servers (NSF/ANSI 426 – 2019):

#### *Lenovo ThinkSystem SR670*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem SR670” 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 which means the recyclability rate is the minimum under this configuration by the third-party laboratory assessed and shows the data in the following table. The configuration used for this recyclability assessment included processors, power supplies, M.2, 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 23229.2 grams of which 21084.69 grams are recyclable resulting in a recyclability rate of 90.77%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{21084.69}}{\mathbf{23229.2}} \times \mathbf{100\%} = \mathbf{90.77\%}$$

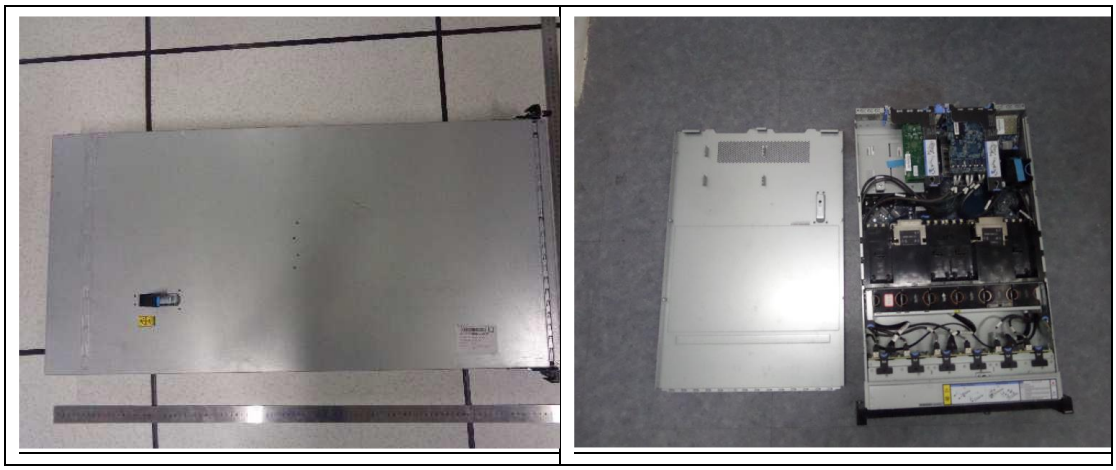

**Figure 2: Lenovo ThinkSystem SR670 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Button Cell Battery (Lithium) | 2.88 | <1% | 45% |
| Internal cable | 1359.08 | 6% | 24% |
| Power Supplies | 1064.2 | 5% | 94.80% |
| M.2 | 22.66 | <1% | 100% |
| DC cooling fan | 1278.12 | 5% | 85% |
| Motherboard and Processors | 1447.42 | 6% | 100% |
| RAM | 285.46 | 1% | 100% |
| Other Printed Circuit Boards | 514.61 | 2% | 100% |
| Aluminum for Heatsinks | 728.66 | 3% | 95% |
| Other metal in chassis, Brackets, Screws, etc. | 16500 | 71% | 95% |
| ABS+PC for Air Bezel, Clips, etc | 26.14 | <1% | 94% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 23229.2 | 21084.69 | 90.77% |

**Figure 3: Weight and Recyclability Rate for Lenovo ThinkSystem SR670**

## *Lenovo ThinkSystem ST250*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem ST250” 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 which means the recyclability rate is the minimum under this configuration by the third-party laboratory assessed 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 13354.11 grams of which 12223.11 grams are recyclable resulting in a recyclability rate of 91.53%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{12223.11}}{\mathbf{13354.11}} \times \mathbf{100}\% = \mathbf{91.53}\%$$

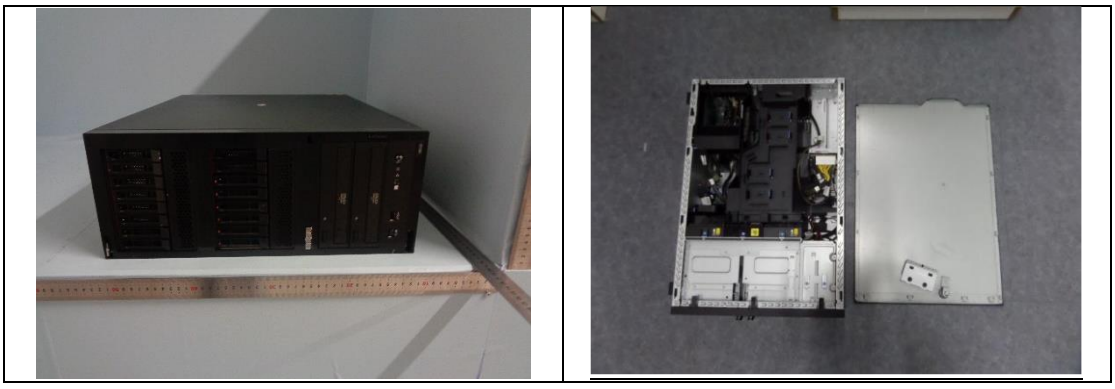

**Figure 4: Lenovo ThinkSystem ST250 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Lithium battery | 2.83 | <1% | 45% |
| Internal cable | 600 | 5% | 24% |
| Aluminum for Heatsinks | 253.87 | 2% | 95% |
| Power Supplies | 796.7 | 6% | 95.62% |
| Hard Disk Drives | 229.1 | 2% | 95.25% |
| DC cooling fan | 814.93 | 6% | 85% |
| Motherboard and Processors | 484.58 | 4% | 100% |
| RAM | 44.26 | <1% | 100% |

| | | | |
|---|---|---|---|
| Other Printed Circuit Boards | 331.66 | 2% | 100% |
| Other metal in chassis, Brackets, Screws, etc. | 9500 | 71% | 95% |
| ABS+PC for Air Bezel, Clips, etc | 296.18 | 2% | 94% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 13354.11 | 12223.11 | 91.53% |

**Figure 5: Weight and Recyclability Rate for Lenovo ThinkSystem ST250**

## *Lenovo ThinkSystem SD650 V2*

Lenovo has completed recyclability assessments on “Lenovo ThinkSystem SD650 V2” as a representative for Lenovo dense server products. Products were ssessed 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 which means the recyclability rate is the minimum under this configuration by the third-party laboratory assessed 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 SGC. In total the node weighs 20362.8 grams of which 18903.7 grams are recyclable resulting in a recyclability rate of 92.8%. Please refer to the assessment details below.

$$\mathbf{Rcyc} = \frac{\mathbf{18903.7}}{\mathbf{20362.8}} \times \mathbf{100\%} = \mathbf{92.8\%}$$

**Figure 6: Lenovo ThinkSystem SD650 V2 Server**

| Product/Component | Weight (g) | % Weight | Recyclability Rate |
|---|---|---|---|
| Lithium Battery | 11.2 | <1% | 45% |
| PCBA for Server | 4317.4 | 21% | 100% |
| Internal Cable for Server | 96.2 | <1% | 24% |
| PC+ABS for Server | 74.0 | <1% | 94% |
| Other Plastic for Server | 256.8 | 1% | 0% |
| PP for Server | 124.2 | <1% | 94% |
| EPDM for Server Brackets | 34.4 | <1% | 94% |
| SGC for Server | 6433.8 | 32% | 95% |
| Stainless Steel for Server | 598.8 | 3% | 95% |
| Metal for Server | 8416.0 | 41% | 91% |
| | **Total Weight** | **Recyclable Weight** | **Recyclability Rate** |
| | 20362.8 | 18903.7 | 92.8% |

**Figure 7: Weight and Recyclability Rate for Lenovo ThinkSystem SD650 V2**

### *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 which means the recyclability rate is the minimum under this configuration by the third-party laboratory assessed 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**