

# IBM® Storage Scale System



## ESS 3500 product carbon footprint



IBM® is committed to environmental leadership in all its business activities, from operations to the design of its products and use of its technology. To help our clients better understand the environmental impacts associated with IBM products, we report the product carbon footprint (PCF) for representative products.

IBM ESS 3500 configuration	Quantity
IBM ESS 3500 5141 Model FN2	1
7.68 TB 2.5 Inch PCIe Gen4 NVMe	24
CX-6 InfiniBand® / VPI adapter	2
Canister with Single Socket AMD EPYC	2
64GB DDR4 3200 MT/s DIMM	16

**Table 1:** Typical product configuration

## The estimate

# 35,000

## kg CO<sub>2</sub>e<sup>1</sup>

This number is the estimated mean greenhouse gas (GHG) emissions in carbon dioxide equivalent associated with the manufacturing, assembly, electricity consumption<sup>2</sup>, transportation and end-of-life handling of the IBM® ESS 3500 over 5 years using hypothetical average GHG emissions factors for the European Union.

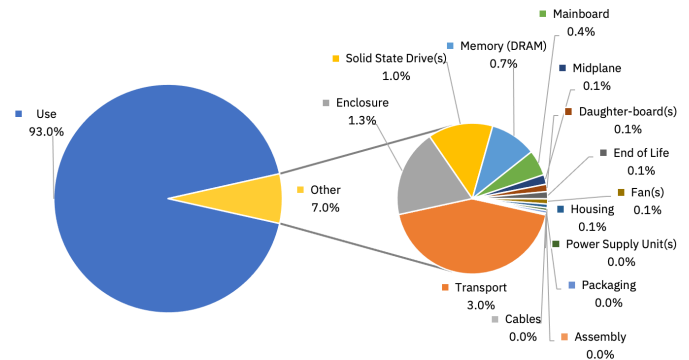
This PCF estimate was produced using the Product Attributes to Impact Algorithm (PAIA) model, developed by the Massachusetts Institute of Technology's Materials Systems Laboratory and partners, Version 1.3.2, April 6, 2023, copyright by the ICT Benchmarking collaboration including the Massachusetts Institute of Technology's Materials Systems Laboratory and partners.

All estimates of carbon footprint are uncertain. For this product, the estimate has a mean of 35,000 kg CO<sub>2</sub>e and a standard deviation of 23,000 kg CO<sub>2</sub>e (35,000 ± 23,000 kg CO<sub>2</sub>e) over a use period of 5 years using hypothetical average GHG emissions factors for the European Union. IBM also reports the 95<sup>th</sup> percentile of the carbon footprint estimate, which is 93,000 kg CO<sub>2</sub>e over a use period of 5 years using hypothetical average GHG emissions factors for the European Union. The 95<sup>th</sup> percentile means that 5% of the time the carbon footprint will exceed the value provided.

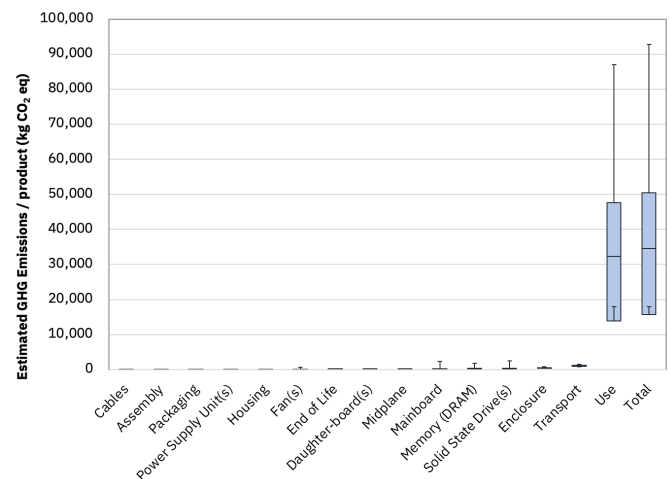
### Impact by phases of the product's lifecycle

The PCF for server equipment is largely driven by the use phase which is highly variable based on the electricity generation source used to power the product, the expected use life of the product, and the power profile. This PCF was generated using a distribution of emissions factors across the European Union. The analysis for this product shows that 93.0% of its carbon footprint occurs in the use phase.

Figure 1 shows the estimated mean contribution for the individual phases of the product's lifecycle over a use period of 5 years using hypothetical average GHG emissions factors for the European Union. Figure 2 shows the uncertainty in the product's carbon footprint. The blue bar representing the mean and one standard deviation and the error bars representing the 5<sup>th</sup> and 95<sup>th</sup> percentile of the carbon footprint estimate.



**Figure 1:** Carbon footprint impact by phase for the IBM® ESS 3500 typical product configuration listed in Table 1 using the PAIA model; 93.0% occurs in the use phase and the remaining 7.0% is broken out.



**Figure 2:** Uncertainty in the PCF estimate for the IBM® ESS 3500 typical product configuration listed in Table 1; the estimate has a total mean of 35,000 ± 23,000 kg CO<sub>2</sub>e over a use period of 5 years.

## PAIA input assumptions

The PCF assumes a typical configuration of the product as described in Table 1. The numbers for your specific configuration might be different. The data used in the PAIA storage tool is provided in Table 2 for the IBM® ESS 3500.

PAIA input information <sup>3</sup>	
Storage enclosure type	Rack mount
Storage array weight	26.8 kg
Number of arrays	1
Packaging	
Cardboard mass	3.0 kg
Plastic foam mass	1.6 kg
Cardboard insert mass	0.0 kg
Chassis / Enclosure	
Chassis weight	9.5 kg
Non-ferrous metal chassis weight	100%
Chassis IC package area	738.0 cm <sup>2</sup>
Chassis PWB area	0.35 m <sup>2</sup>
Power Supply Unit	
Number of PSU	2
PSU dimensions	18.5 x 7.4 cm
PSU mass	0.97 kg
Cable	
Length of cable	Default
Fan	
Number of fans	6
SSD	
Number of SSD per array	28
Mass of SSD	0.23 kg
SSD IC die area	Default
SSD ICC packaging area	Default
SSD IC fabrication location	Asia
SSD non-ferrous metal mass	Default
SSD PWB area	Default
SSD PWB substrate layers	Unknown
Mainboard and DIMM/Memory	
Number of mainboards	2
Area of PWB	708.1 cm <sup>2</sup>
Mainboard PWB layers	12
IC quantity	143
IC fabrication electricity intensity	Default
IC die area	Default
Total IC package area	26.8 cm <sup>2</sup>
DRAM IC count	Default
DRAM IC package area	Default
DRAM die area	Default
DRAM IC fabrication location	Asia
Sub-boards	
Number of sub-boards	2

Assembly	
Assembly location	Mexico
Transportation	
To country of use by air	9700 km
Within country of use by truck	150 km
Use <sup>4</sup>	
Use location	Europe
Product lifetime	5 years
Yearly energy use	13140 kWh
End of Life	
Percent recycled	0.97
Percent shredded recycling	0.00

**Table 2:** PAIA input information for the IBM ESS 3500

## Limitations of PAIA

PAIA results represent a streamlined Life Cycle Assessment (LCA). While the product carbon footprint provides a high-level estimate of the emissions associated with the product, it should not be used for emissions inventory, formal carbon footprinting exercises or comparing products. LCA results are strongly influenced by the assumptions made by the analyst; if those assumptions are inconsistent, comparisons are not likely meaningful. Furthermore, PAIA may not be compliant with the primary data requirements of some LCA standards. The results from the PAIA tools are liable to change over time as the methodology is improved and data is updated. More information on these limitations, as well as general guidance for interpreting this report, is available in the publication "[Assessment of lifecycle carbon footprints of products](#)"

## Disclaimers

<sup>1</sup> The results are reported using the units of kilograms of carbon dioxide equivalent (kg CO<sub>2</sub>e). This represents the amount of global warming caused by a quantity of GHGs (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>) at a specific point in time, expressed in terms of the amount of CO<sub>2</sub> which would have the same instantaneous warming effect. Recognizing the uncertainty in carbon footprint estimates, the results have been rounded to the nearest thousand.

<sup>2</sup> The electricity consumption is incurred by clients using an IBM product. The estimate used is not specific to any client deployment of the IBM product or client workload.

<sup>3</sup> The estimated carbon footprint was computed excluding the system frame.

<sup>4</sup> Power consumption data is obtained using the published electrical power consumption for the [5141+03 IBM Elastic Storage System 3500](#). The power consumption assumes that the product operates 24 hours a day, 365 days a year for its product lifetime.

© Copyright 2023 IBM Corporation  
New Orchard Road  
Armonk, NY 10504

Produced in the United States of America, April 11, 2023

IBM, the IBM logo, ibm.com are trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies.

A current list of IBM trademarks is available on the web at “Copyright and trademark information” at [ibm.com/legal/copytrades.html](https://ibm.com/legal/copytrades.html)

This document is current as of the initial date of publication and may be changed by IBM at any time. Not all offerings are available in every country in which IBM operates.

The performance data discussed herein is presented as derived under specific operating conditions. Actual results may vary.

THE INFORMATION IN THE DOCUMENT IS PROVIDED “AS IS” WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY OR CONDITION ON NON-INFRINGEMENT. IBM products are warranted according to the terms and conditions of the agreements under which they are provided.