

FlashSystem 9500 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 for representative products.

| FlashSystem 9500 configuration | |
|--------------------------------|-------------------------------------|
| Model | 4666-AH8 |
| System memory | 2048 GiB |
| I/O adapter cards | 4x Quad 32Gb Fibre Channel HBA pair |
| Flash drives | 36 x 19.2 TB FCM 3 |

Table 1: Typical product configuration

The estimate

49,000

kg CO₂e¹

This number is the estimated mean GHG emissions in carbon dioxide equivalent associated with the manufacturing, assembly, electricity consumption², transportation and end-of-life handling of the IBM® Storage FlashSystem 9500 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, March 10, 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 49,000 kg CO₂e and a standard deviation of 30,000 kg CO₂e (49,000 ± 30,000 kg CO₂e) over a use period of 5 years using hypothetical average GHG emissions factors for the European Union. IBM also reports the 95th percentile of the carbon footprint estimate, which is 127,000 kg CO₂e over a use period of 5 years using hypothetical average GHG emissions factors for the European Union. The 95th 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 86.5% 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 5th and 95th percentile of the carbon footprint estimate.

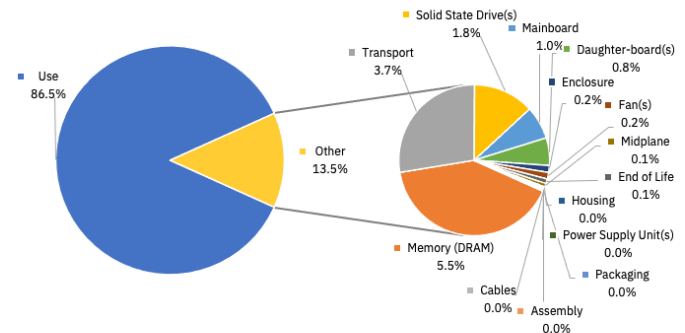


Figure 1: Carbon footprint impact by phase for the IBM® Storage FlashSystem 9500 typical product configuration listed in Table 1 using the PAIA model; 86.5% occurs in the use phase and the remaining 13.5% is broken out.

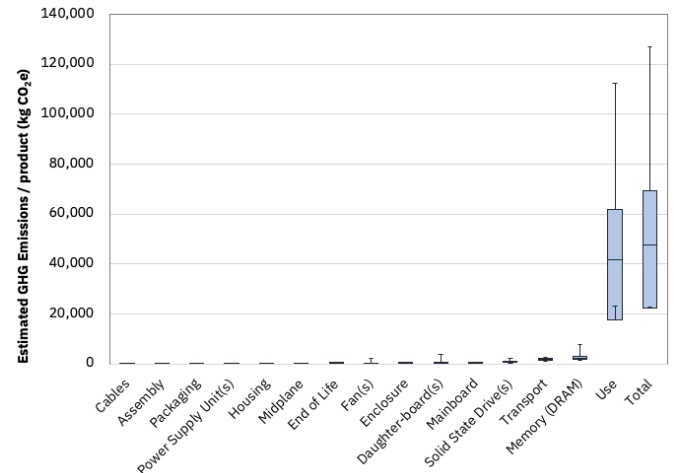


Figure 2: Uncertainty in the PCF estimate for the IBM® Storage FlashSystem 9500 typical product configuration listed in Table 1; the estimate has a total mean of 49,000 ± 30,000 kg CO₂e over a use period of 5 years.

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® Storage FlashSystem 9500.

| PAIA input information ³ | |
|--------------------------------------|------------------------|
| Storage enclosure type | Rack |
| Storage array weight | 44.3 kg |
| Number of arrays | 1 |
| Packaging | |
| Cardboard mass | 4.5 kg |
| Plastic foam mass | 1.5 kg |
| Cardboard insert mass | 0.0 kg |
| Chassis / Enclosure | |
| Chassis weight | 18.6 kg |
| Non-ferrous metal chassis weight | 6% |
| Chassis IC package area | 11.1 cm ² |
| Chassis PWB area | 0.09 m ² |
| Power Supply Unit | |
| Number of PSU | 4 |
| PSU dimensions | 32.1 x 5.5 cm |
| PSU mass | 1.25 kg |
| Cable | |
| Length of cable | Default |
| Fan | |
| Number of fans | 20 |
| SSD | |
| Number of SSD per array | 36 |
| Mass of SSD | 0.17 kg |
| SSD IC die area | Default |
| SSD ICC packaging area | 125.8 cm ² |
| SSD IC fabrication location | Asia |
| SSD non-ferrous metal mass | 0.07 kg |
| SSD PWB area | 239 cm ² |
| SSD PWB substrate layers | 12 |
| Mainboard and DIMM/Memory | |
| Number of mainboards | 2 |
| Area of PWB | 2501.6 cm ² |
| Mainboard PWB layers | 12 |
| IC quantity | 26 |
| IC fabrication electricity intensity | Default |
| IC die area | Default |
| Total IC package area | 307.5 cm ² |
| DRAM IC count | 1152 |
| DRAM IC package area | Default |
| DRAM die area | 1258.6 cm ² |
| DRAM IC fabrication location | Asia |
| Sub-boards | |
| Number of sub-boards | 20 |

| Assembly | |
|--------------------------------|-----------|
| Assembly location | Mexico |
| Transportation | |
| To country of use by air | 9700 km |
| Within country of use by truck | 150 km |
| Use ⁴ | |
| Use location | Europe |
| Product lifetime | 5 years |
| Yearly energy use | 16661 kWh |
| End of Life | |
| Percent recycled | 0.97 |
| Percent shredded recycling | 0.00 |

Table 2: PAIA input information for the FlashSystem 9500

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

¹ The results are reported using the units of kilograms of carbon dioxide equivalent (kg CO₂e). This represents the amount of global warming caused by a quantity of GHGs (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆) at a specific point in time, expressed in terms of the amount of CO₂ which would have the same instantaneous warming effect. Recognizing the uncertainty in carbon footprint estimates, the results have been rounded to the nearest thousand.

² 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.

³ The estimated carbon footprint was computed excluding the system frame.

⁴ Power consumption data was obtained using the IBM Storage Modeller, a web-based tool for estimating performance for IBM Storage systems. This tool estimates typical power requirements for a specific system configuration under normal operating conditions. The power consumption assumes that the product operates at maximum throughput across a range of I/O workloads, 24 hours a day, 365 days a year, for its product lifetime.

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

Produced in the United States of America, March 10, 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

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.