IBM® Storage

FlashSystem 5035 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.

IBM FlashSystem 5035 configuration	
16GB Fibre Channel 4-port Adapter	2
3.84TB Flash Drives	14
Cache	64GB

Table 1: *Typical product configuration*

The estimate

9,800

kg CO2e[1]

This number is the estimated mean GHG emissions in carbon dioxide equivalent associated with the manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling of the IBM® FlashSystem 5035 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 26th, 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 9,800 kg CO_2e and a standard deviation of 5,900 kg CO_2e (9,800 ± 5,900 kg CO_2e) 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 26,000 kg CO_2e 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 85.3% 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.

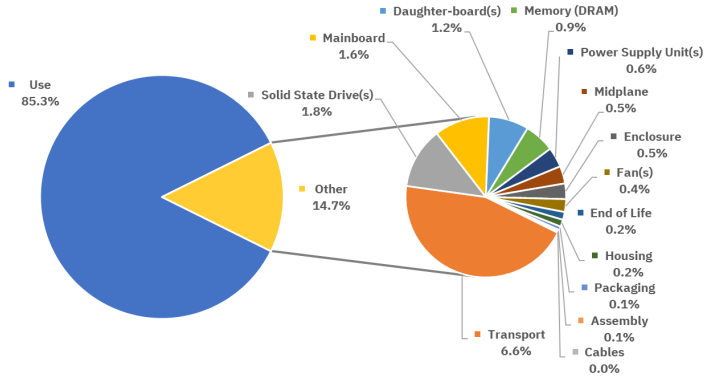

Figure 1: *Carbon footprint impact by phase for the IBM® FlashSystem 5035 typical product configuration listed in Table 1 using the PAIA model; 85.3% occurs in the use phase and the remaining 14.7% is broken out.*

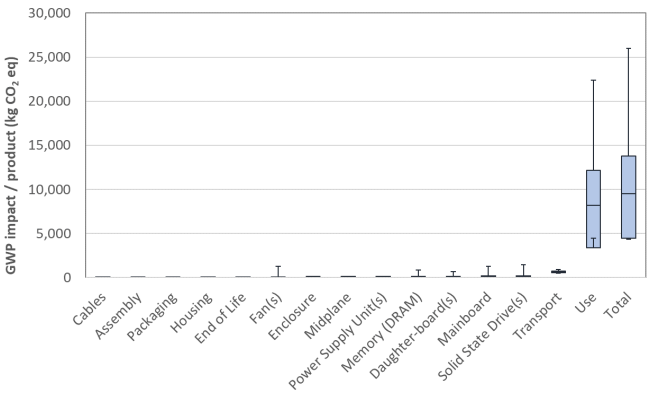

Figure 2: *Uncertainty in the PCF estimate for the IBM® FlashSystem 5035 typical product configuration listed in Table 1; the estimate has a total mean of 9,800 ± 5,900 kg CO_2e over a use period of 5 years.*

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 server tool is provided in Table 2 for the IBM® FlashSystem 5035.

PAIA input information[3]	
Storage enclosure type	Rack
Storage array weight	6.0 kg
Number of arrays	1
Packaging	
Cardboard mass	3.8 kg
Plastic foam mass	0.56 kg
Cardboard insert mass	0 kg
Chassis / Enclosure	
Chassis weight	9.9 kg
Non-ferrous metal chassis weight	5.0 kg
Chassis IC package area	1.5 cm^2
Chassis PWB area	0.04 m^2
Power Supply Unit	
Number of PSU	2
PSU dimensions	27.7 x 20.8 cm
PSU mass	2.5 kg
Cable	
Length of cable	Default
Fan	
Number of fans	8
SSD	
Number of SSD per array	14
Mass of SSD	0.13 kg
SSD IC die area	Default
SSD IC fabrication location	Asia
SSD non-ferrous metal mass	Default
SSD PWB area	59.0 cm^2
SSD PWB substrate layers	12
Mainboard and DIMM / Memory	
Number of mainboards	2
Area of PWB	555.6 cm^2
Mainboard PWB layers	12
IC quantity	114
IC fabrication electricity intensity	Default
IC die area	Default
Total IC package area	82.8 cm^2
DRAM IC count	72
DRAM IC package area	55.4 cm^2
DRAM die area	Default
DRAM IC fabrication location	Asia
Sub-boards	
Number of sub-boards	6
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	3328 kWh
End of life	
Fraction recycled	0.97
Fraction shredded recycling	0.00

Table 2: *PAIA input information for the FlashSystem 5035*

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 foot printing 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 CO_2e). This represents the amount of global warming caused by a quantity of GHGs (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) at a specific point in time, expressed in terms of the amount of CO_2 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 is obtained using lab measurement data during performance testing.

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