IBM Storage DS8A50F

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 using the Product Attributes to Impact Algorithm (PAIA) model.

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 life cycle carbon footprints of products.

The PAIA model was developed by the Massachusetts Institute of Technology's Materials Systems Laboratory and partners, Version 1.4.7, April 9, 2025, copyright by the ICT Benchmarking collaboration including the Massachusetts Institute of Technology's Materials Systems Laboratory and partners.

Components
This product consists of multiple components. A carbon footprint report is provided here for each component. To estimate the carbon footprint of your configuration, use the carbon footprint reports of the appropriate components [7].

Management Enclosure →

Central Processor Complex (CPC) →

I/O Bay Enclosure →

High Performance Flash Enclosure with FCM4 →

High Performance Flash Enclosure with IS Drives →

Management Enclosure Product Carbon Footprint

Table 1 describes a typical IBM DS8A50F Management Enclosure configuration. For this configuration, Table 2 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over 5 years, using hypothetical average GHG emissions factors.

Figure 1 shows the estimated contribution of each life cycle phase to the total estimated mean GHG emissions.

The data used in the PAIA server tool for each representative configuration is provided in Table 3. This PCF was generated using a distribution of emissions factors across the location, based on International Energy Agency (IEA) emissions factors[3].

	Management Enclosure
HMC appliance	2
Intra-rack ethernet switch	2
Rack control cards	2
Power supply units (PSU)	2
Frame with covers, cables, and rails	1
Annual energy use	1,572 kWh

Table 1: *Typical product configurations of the IBM DS8A50F Management Enclosure. The estimated carbon footprint for the Management Enclosure is for a single enclosure. One enclosure is used per DS8A50F.*

Impact by phases of the product's life cycle

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 respective location. Table 2 shows that 12% - 41% of the carbon footprint occurs in the use phase. IBM recommends that you customize the use phase GHG emissions based on your specific data center conditions.

Uncertainty in the product carbon footprint

All estimates of carbon footprint are uncertain. To provide transparency around this uncertainty, Table 2 also reports the standard deviation and the 95th percentile of the carbon footprint estimate. The 95th percentile means that 5% of the time the carbon footprint will exceed the value provided.

Configuration	Geography	Total estimated mean GHG emissions in kg CO_2e[1,3]	% of Estimated mean GHG emissions in the use phase	Standard deviation of the estimated GHG emissions in kg CO_2e[1]	95th percentile of the estimated GHG emissions in kg CO_2e[1]
Management Enclosure	European Union	15,620	12%	3,500	29,700
	Asia Oceania	20,320	22%	4,100	36,000
	United States	7,120	41%	1,600	14,500

Table 2: *Summary of the estimated GHG emissions for the typical product configuration of the IBM DS8A50F Management Enclosure*

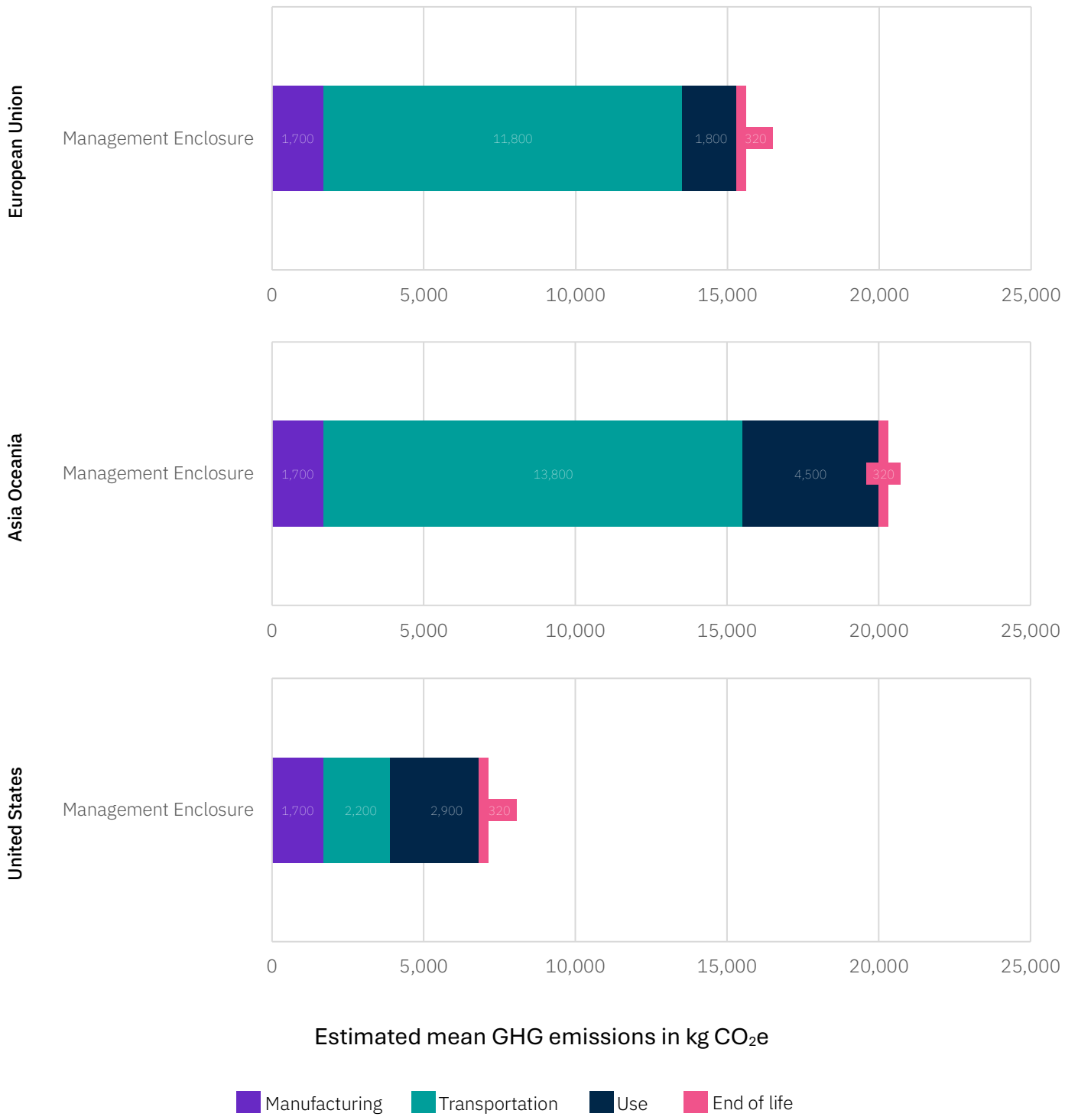

Figure 1: *Carbon footprint impact by phase for the IBM DS8A50F Management Enclosure configuration listed in Table 1 using the PAIA model assuming a 5-year product lifetime*

PAIA input data		Management Enclosure	
Server type		Rack	
Server quantity		1	
Number of PSU		4	
Number of fans		12	
Server weight		35.4 kg	
Rack and mount weight		371.0 kg	
Packaging weight		45.4 kg	
Motherboard PWB area		1,630.6 cm^2	
CPU quantity		2	
CPU package area (custom IC)		50.0 cm^2	
DRAM total capacity		64 GB	
Chipset and other ICs package area		45.3	
Chipset and other ICs quantity		10	
SSD quantity		2	
Sub card total PWB area		1,417.6 cm^2	
Sub card main chip package area		22.0 cm^2	
Sub card chip count		12	
PSU weight		0.90 kg	
PSU dimensions		19.1 cm x 8.0 cm	
Product lifetime		5 years	
Yearly energy consumption[5]		1,572 kWh	
Assembly location		Mexico	
Transportation		Mode: Air	Mode: Truck
	European Union	9,700 km	300 km
	Asia Oceania	11,738 km	300 km
	United States	0 km	3,200 km
Fraction recycled		0.90	

Table 3: *Data used in the PAIA server model for the IBM DS8A50F Management Enclosure*

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Central Processor Complex (CPC) Product Carbon Footprint

Table 4 describes a typical IBM DS8A50F Central Processor Complex (CPC) configuration. For that configuration, Table 5 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over 5 years, using hypothetical average GHG emissions factors.

Figure 2 shows the estimated contribution of each life cycle phase to the total estimated mean GHG emissions.

The data used in the PAIA server tool for the representative configuration is provided in Table 6. This PCF was generated using a distribution of emissions factors across the location, based on International Energy Agency (IEA) emissions factors[3].

	CPC
Power9® 10-core processor	2
Memory	2,304 GB
PCIe interconnect card	7
Power supply unit	4
Annual energy use	9,382 kWh

Table 4: *Typical product configuration of the IBM DS8A50F Central Processor Complex (CPC)*

Impact by phases of the product's life cycle

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 respective location. Table 5 shows that 79% - 91% of the carbon footprint occurs in the use phase. IBM recommends that you customize the use phase GHG emissions based on your specific data center conditions.

Uncertainty in the product carbon footprint

All estimates of carbon footprint are uncertain. To provide transparency around this uncertainty, Table 5 also reports the standard deviation and the 95th percentile of the carbon footprint estimate. The 95th percentile means that 5% of the time the carbon footprint will exceed the value provided.

Configuration	Geography	Total estimated mean GHG emissions in kg CO_2e[1,3]	% of Estimated mean GHG emissions in the use phase	Standard deviation of the estimated GHG emissions in kg CO_2e[1]	95th percentile of the estimated GHG emissions in kg CO_2e[1]
CPC	European Union	13,230	79%	12,700	79,000
	Asia Oceania	29,830	91%	16,800	86,500
	United States	19,030	90%	5,200	32,100

Table 5: *Summary of the estimated GHG emissions for the typical product configuration of the IBM DS8A50F Central Processor Complex* [6]

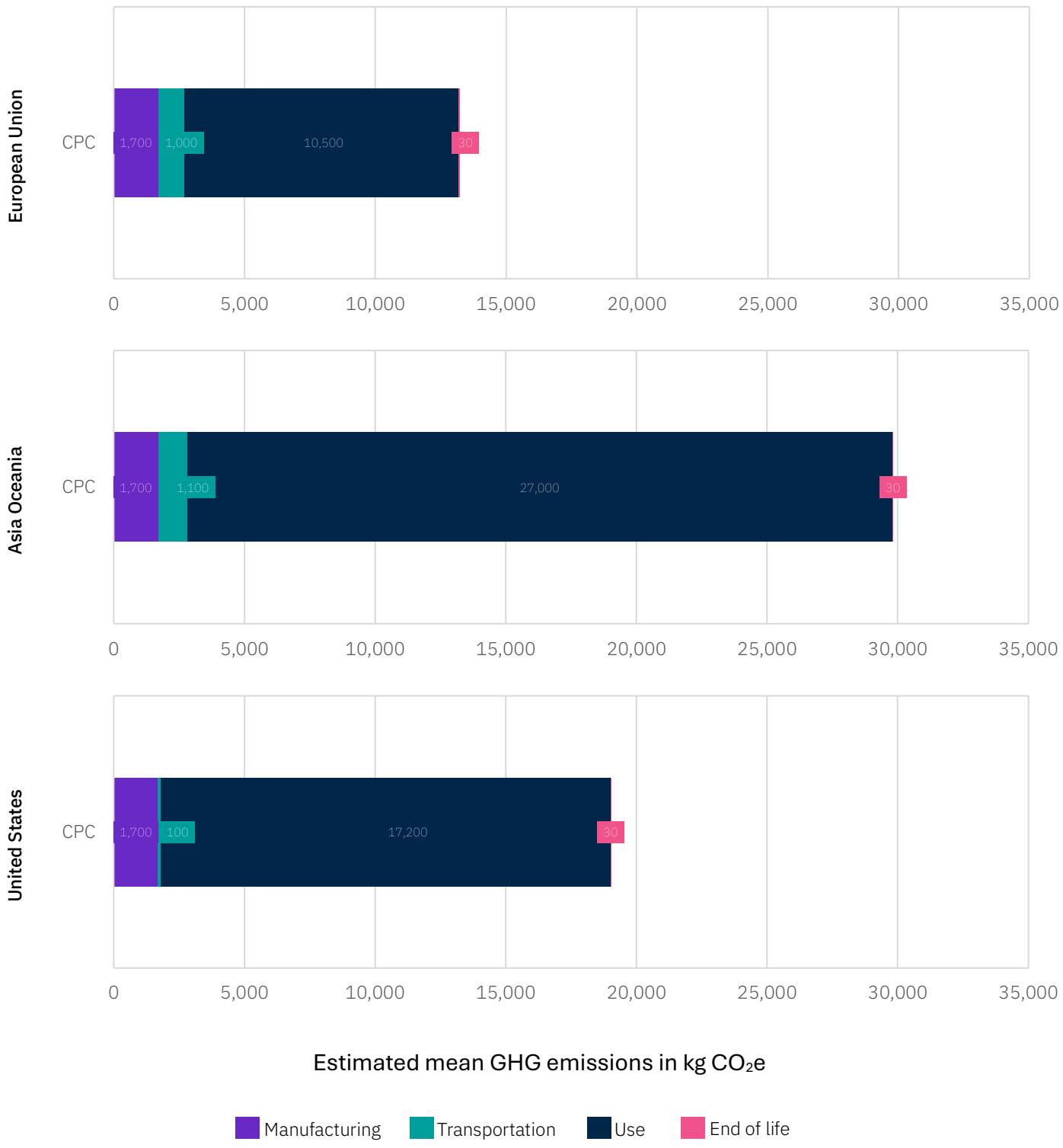

Figure 2: *Carbon footprint impact by phase for the IBM DS8A50F Central Processor Complex product configuration listed in Table 4 using the PAIA model assuming a 5-year product lifetime* [6]

PAIA input data		CPC	
Server type		Rack	
Server quantity		1	
Number of PSU		4	
Number of fans		4	
Server weight		36.2 kg	
Rack and mount weight[4]		0.0 kg	
Packaging weight[4]		0.0 kg	
Motherboard PWB area		2,196 cm^2	
CPU quantity		2	
CPU package area (custom IC)		47.0 cm^2	
DRAM total capacity		2,304 GB	
Chipset and other ICs package area		Default	
Chipset and other ICs quantity		Default	
SSD quantity		2	
Sub card total PWB area		Default	
Sub card main chip package area		Default	
Sub card chip count		Default	
PSU weight		0.90 kg	
PSU dimensions		19.0 cm x 8.0 cm	
Product lifetime		5 years	
Yearly energy consumption[5]		9,382 kWh	
Assembly location		Mexico	
Transportation		Mode: Air	Mode: Truck
	European Union	9,700 km	300 km
	Asia Oceania	11,738 km	300 km
	United States	0 km	3,200 km
Fraction recycled		0.90	

Table 6: *Data used in the PAIA server model for the IBM DS8A50F Central Processor Complex*

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I/O Bay Enclosure Product Carbon Footprint

Table 7 describes the IBM DS8A50F I/O Bay Enclosure configuration. For that configuration, Table 8 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over 5 years, using hypothetical average GHG emissions factors.

Figure 3 shows the estimated contribution of each life cycle phase to the total estimated mean GHG emissions.

The data used in the PAIA server tool for each representative configuration is provided in Table 9. This PCF was generated using a distribution of emissions factors across the location, based on International Energy Agency (IEA) emissions factors[3].

	I/O Bay Enclosure
32 Gb FCP/FICON≈ host adapter	4
Device adapter	2
PCIe switch card	1
PSU	2
Annual energy use	6,377 kWh

Table 7: *Typical product configuration of the IBM DS8A50F I/O Bay Enclosure*

Impact by phases of the product's life cycle

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 respective location. Table 8 shows that 77% - 91% of the carbon footprint occurs in the use phase. IBM recommends that you customize the use phase GHG emissions based on your specific data center conditions.

Uncertainty in the product carbon footprint

All estimates of carbon footprint are uncertain. To provide transparency around this uncertainty, Table 8 also reports the standard deviation and the 95th percentile of the carbon footprint estimate. The 95th percentile means that 5% of the time the carbon footprint will exceed the value provided.

Configuration	Geography	Total Estimated mean GHG emissions in kg CO_2e[1,3]	% of Estimated mean GHG emissions in the use phase	Standard deviation of the estimated GHG emissions in kg CO_2e[1]	95th percentile of the estimated GHG emissions in kg CO_2e[1]
I/O Bay Enclosure	European Union	9,730	77%	9,800	69,100
	Asia Oceania	20,730	88%	11,600	59,000
	United States	13,030	91%	3,600	22,700

Table 8: *Summary of the estimated GHG emissions for the typical product configuration shown in Table 7 of the IBM DS8A50F I/O Bay Enclosure*

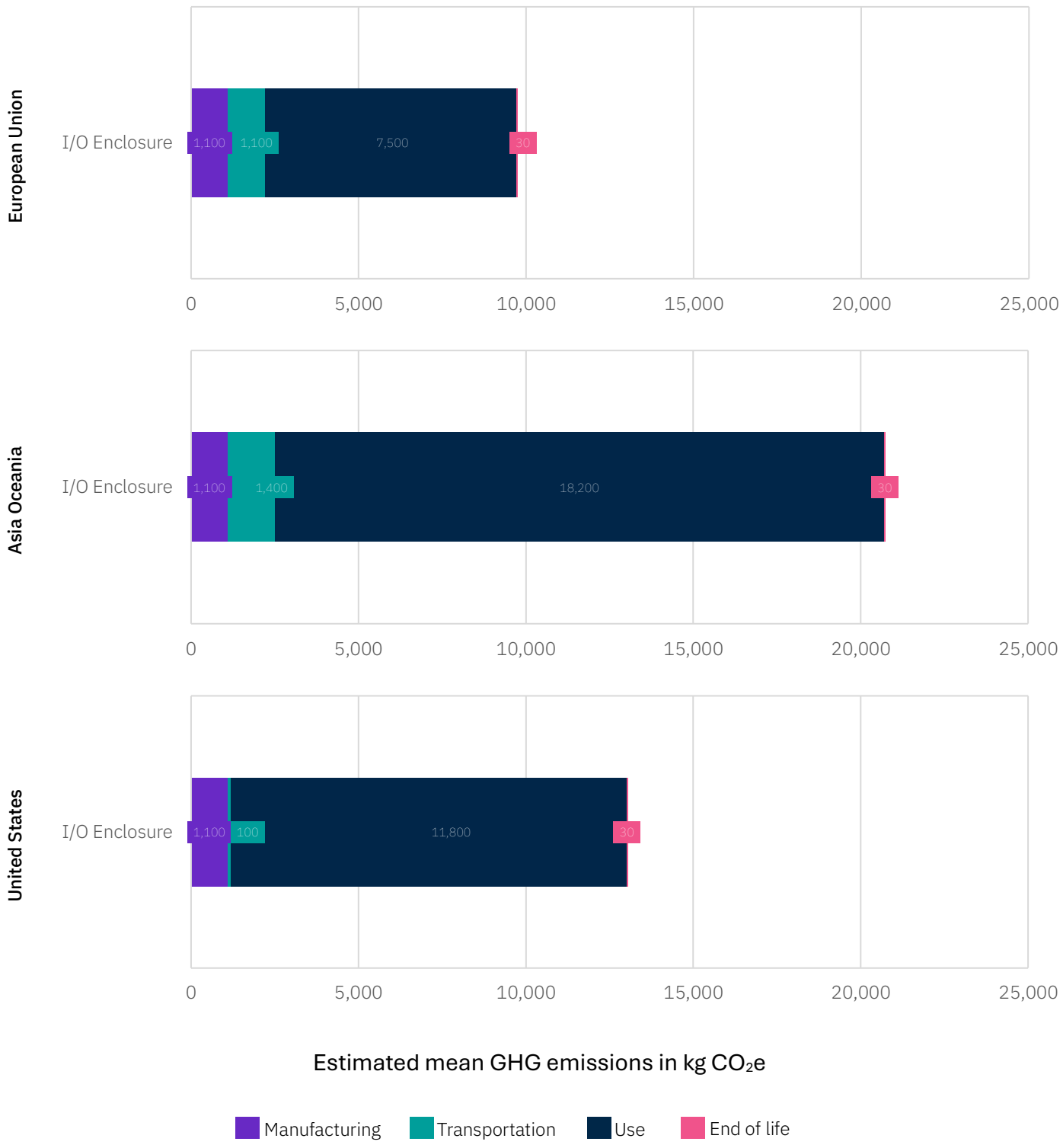

Figure 3: *Carbon footprint impact by phase for the IBM DS8A50F I/O Bay Enclosure product configuration listed in Table 7 using the PAIA model assuming a 5-year product lifetime*

PAIA input data		I/O Bay Enclosure	
Server type		Rack	
Server quantity		1	
Number of PSU		2	
Number of fans		4	
Server weight		46.3 kg	
Rack and mount weight[4]		0.0 kg	
Packaging weight[4]		0.0 kg	
Motherboard PWB area		1,298 cm^2	
CPU quantity		2	
CPU package area (custom IC)		25.0 cm^2	
DRAM total capacity		32 GB	
Chipset and other ICs package area		60.0 cm^2	
Chipset and other ICs quantity		20	
Sub card total PWB area		5,739 cm^2	
Sub card main chip package area		454 cm^2	
Sub card chip count		200	
PSU weight		0.90 kg	
PSU dimensions		19.0 cm x 8.0 cm	
Product lifetime		5 years	
Yearly energy consumption[5]		6,377 kWh	
Assembly location		Mexico	
Transportation		Mode: Air	Mode: Truck
	European Union	9,700 km	300 km
	Asia Oceania	11,738 km	300 km
	United States	0 km	3,200 km
Fraction recycled		0.90	

Table 9: *Data used in the PAIA server model for the IBM DS8A50F I/O Bay Enclosure*

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High Performance Flash Enclosure Gen3 with IBM FlashCore Module 4 Product Carbon Footprint

Table 10 describes a typical IBM DS8A50F High Performance Flash Enclosure (HPFE) Gen3 with IBM FlashCore Module 4 (FCM4) configuration. For that configuration, Table 11 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over 5 years, using hypothetical average GHG emissions factors.

Figure 4 shows the estimated contribution of each life cycle phase to the total estimated mean GHG emissions.

The data used in the PAIA storage tool for each representative configuration is provided in Table 12. This PCF was generated using a distribution of emissions factors across the location, based on International Energy Agency (IEA) emissions factors[3].

	HPFE (FCM4)
ESM card	2
IBM FlashCore Module 4 (19.2 TB)	16
Power supply unit	2
Annual energy use	4,804 kWh

Table 10: *Typical product configuration of the IBM DS8A50F High Performance Flash Enclosure with FlashCore Module 4*

Impact by phases of the product's life cycle

The PCF for storage 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 respective location. Table 11 shows that 73% - 88% of the carbon footprint occurs in the use phase. IBM recommends that you customize the use phase GHG emissions based on your specific data center conditions.

Uncertainty in the product carbon footprint

All estimates of carbon footprint are uncertain. To provide transparency around this uncertainty, Table 11 also reports the standard deviation and the 95th percentile of the carbon footprint estimate. The 95th percentile means that 5% of the time the carbon footprint will exceed the value provided

Configuration	Geography	Total Estimated mean GHG emissions in kg CO2e[1,3]	% of Estimated mean GHG emissions in the use phase	Standard deviation of the estimated GHG emissions in kg CO2e[1]	95th percentile of the estimated GHG emissions in kg CO2e[1]
HPFE (FCM4)	European Union	7,530	73%	6,500	43,300
	Asia Oceania	15,930	86%	8,400	45,000
	United States	10,030	88%	2,700	18,100

Table 11: *Summary of the estimated GHG emissions for the typical product configuration of the IBM DS8A50F High Performance Flash Enclosure Gen3 with IBM FlashCore Module 4* [6]

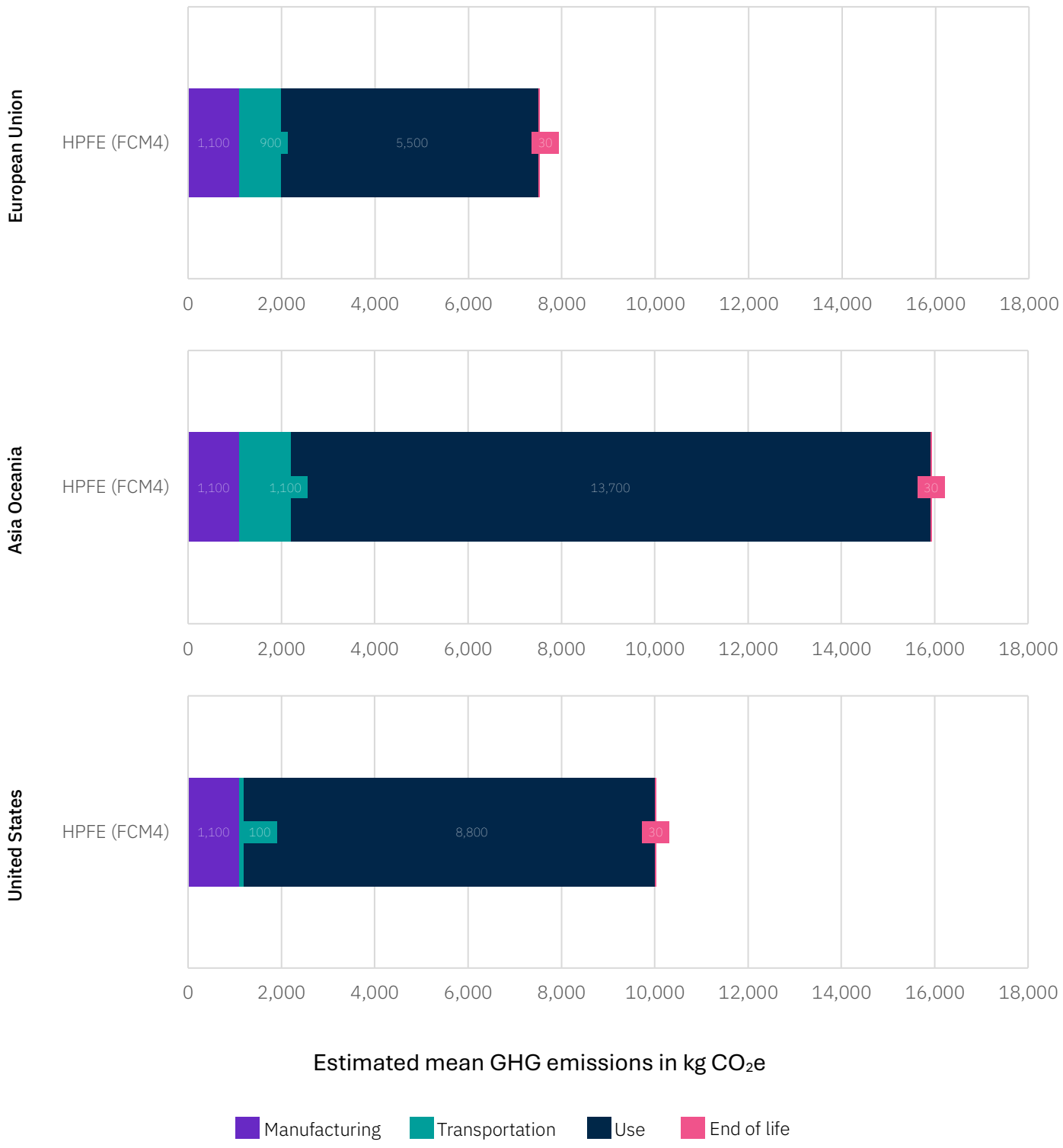

Figure 4: *Carbon footprint impact by phase for the IBM DS8A50F High Performance Flash Enclosure Gen3 with IBM FlashCore Module 4 product configuration listed in Table 10 using the PAIA model assuming a 5-year product lifetime* [6]

PAIA input data		HPFE Gen3 with FCM4	
Storage enclosure type[4]		Rack	
Storage array weight		25.0 kg	
Number of arrays		1	
Chassis weight		10.1 kg	
Non-ferrous metal chassis weight		Default	
Chassis IC package area		Default	
Chassis PWB area		Default	
Number of PSU		2	
PSU dimensions		32.0 cm x 5.4 cm	
PSU mass		1.25 kg	
Length of cable		2 m	
Number of fans		6	
Number of SSD per array		16	
Mass of SSD		0.176 kg	
SSD IC die area		Default	
SSD IC package area		125.8 cm^2	
SSD IC fabrication location		Asia IEA	
SSD non-ferrous metal mass		0.074 kg	
SSD PWB area		239 cm^2	
SSD PWB substrate layers		12	
Number of mainboards		2	
Area of mainboard PWB		1,246.0 cm^2	
Mainboard PWB layers		12	
Mainboard IC quantity		14	
Mainboard IC fabrication electricity intensity		Default	
Mainboard IC die area		Default	
Total mainboard IC package area		31.0 cm^2	
DRAM IC count		0	
DRAM IC package area		0.0 cm^2	
DRAM die area		0.0 cm^2	
DRAM IC fabrication location		Asia IEA	
Number of sub-boards		0	
Assembly location		Mexico	
Product lifetime		5 years	
Yearly energy consumption[5]		4,804 kWh	
Transportation		Mode: Air	Mode: Truck
	European Union	9,700 km	300 km
	Asia Oceania	11,738 km	300 km
	United States	0 km	3,200 km
Fraction recycled		0.90	

Table 12: *Data used in the PAIA storage model for the IBM DS8A50F High Performance Flash Enclosure with IBM FlashCore Module 4*

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High Performance Flash Enclosure Gen3 with Industry Standard Drives Product Carbon Footprint

Table 13 describes a typical IBM DS8A50F High Performance Flash Enclosure (HPFE) Gen3 with Industry Standard (IS) Drives configuration. For that configuration, Table 14 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over 5 years, using hypothetical average GHG emissions factors.

Figure 5 shows the estimated contribution of each life cycle phase to the total estimated mean GHG emissions.

The data used in the PAIA storage tool for each representative configuration is provided in Table 15. This PCF was generated using a distribution of emissions factors across the location, based on International Energy Agency (IEA) emissions factors[3].

	HPFE (IS)
ESM card	2
NVMe Flash drives	24
Power supply unit	2
Annual energy use	2,245 kWh

Table 13: *Typical product configuration of the IBM DS8A50F High Performance Flash Enclosure Gen3 with Industry Standard Drives*

Impact by phases of the product's life cycle

The PCF for storage 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 respective location. Table 14 shows that 56% - 79% of the carbon footprint occurs in the use phase. IBM recommends that you customize the use phase GHG emissions based on your specific data center conditions.

Uncertainty in the product carbon footprint

All estimates of carbon footprint are uncertain. To provide transparency around this uncertainty, Table 14 also reports the standard deviation and the 95th percentile of the carbon footprint estimate. The 95th percentile means that 5% of the time the carbon footprint will exceed the value provided.

Configuration	Geography	Total Estimated mean GHG emissions in kg CO_2e[1,3]	% of Estimated mean GHG emissions in the use phase	Standard deviation of the estimated GHG emissions in kg CO_2e[1]	95th percentile of the estimated GHG emissions in kg CO_2e[1]
HPFE (IS)	European Union	4,430	56%	3,100	21,500
	Asia Oceania	8,530	75%	3,900	23,200
	United States	5,330	79%	1,300	10,300

Table 14: *Summary of the estimated GHG emissions for the typical product configuration of the IBM DS8A50F High Performance Flash Enclosure Gen3 with Industry Standard Drives* [6]

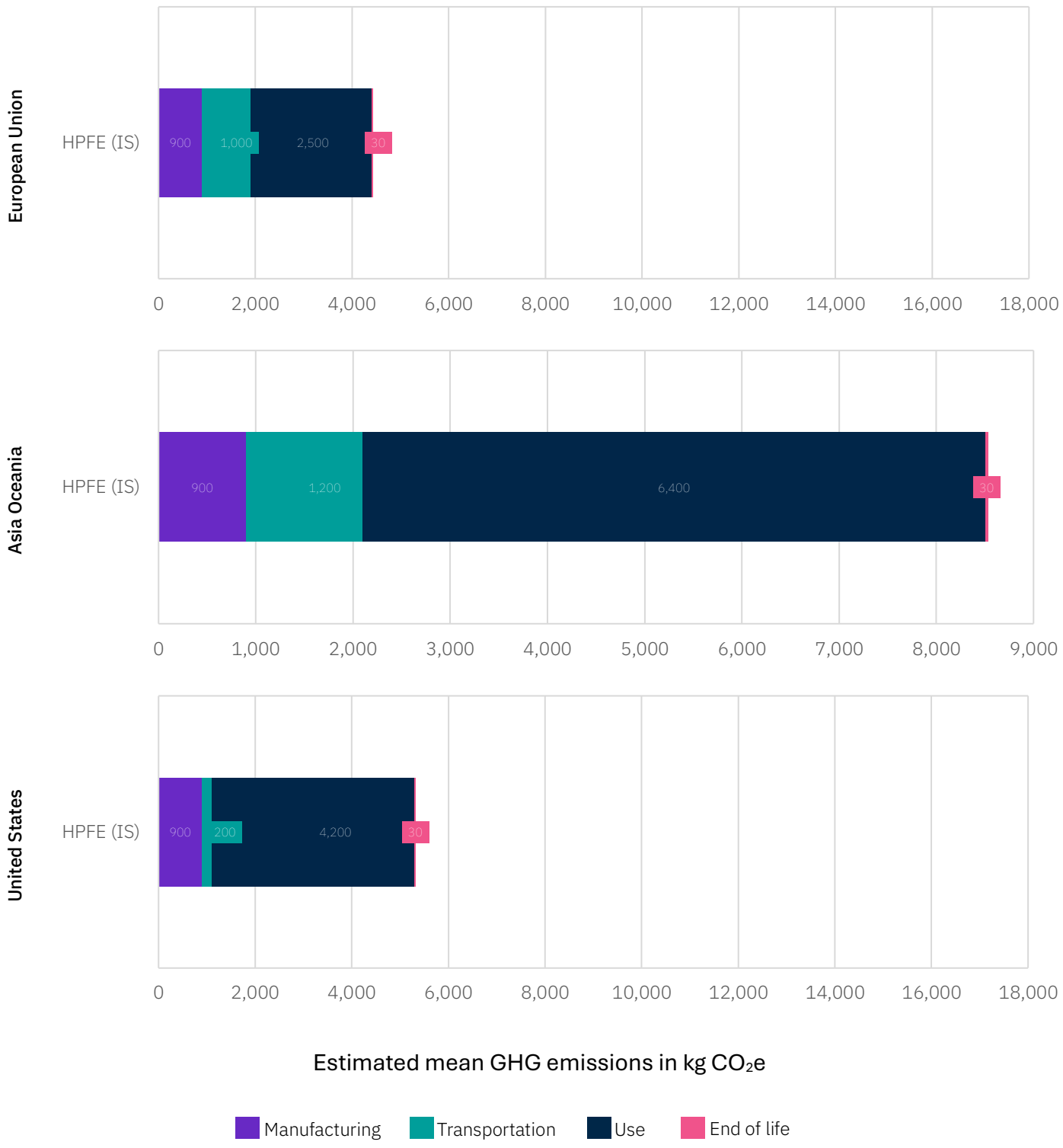

Figure 5: *Carbon footprint impact by phase for the IBM DS8A50F High Performance Flash Enclosure Gen3 with Industry Standard Drives product configuration listed in Table 13 using the PAIA model assuming a 5-year product lifetime* [6]

PAIA input data		HPFE Gen3 with IS drives	
Storage enclosure type[4]		Rack	
Storage array weight		29.0 kg	
Number of arrays		1	
Chassis weight		10.1 kg	
Non-ferrous metal chassis weight		Default	
Chassis IC package area		Default	
Chassis PWB area		Default	
Number of PSU		2	
PSU dimensions		32.0 cm x 5.4 cm	
PSU mass		1.25 kg	
Length of cable		2 m	
Number of fans		6	
Number of SSD per array		24	
Mass of SSD		0.5 kg	
SSD IC die area		Default	
SSD IC package area		31.4 cm^2	
SSD IC fabrication location		Asia IEA	
SSD non-ferrous metal mass		Default	
SSD PWB area		59.0 cm^2	
SSD PWB substrate layers		12	
Number of mainboards		2	
Area of mainboard PWB		1,246.0 cm^2	
Mainboard PWB layers		12	
Mainboard IC quantity		14	
Mainboard IC fabrication electricity intensity		Default	
Mainboard IC die area		Default	
Total mainboard IC package area		31.0 cm^2	
DRAM IC count		0	
DRAM IC package area		0.0 cm^2	
DRAM die area		0.0 cm^2	
DRAM IC fabrication location		Asia IEA	
Number of sub-boards		0	
Assembly location		Mexico	
Product lifetime		5 years	
Yearly energy consumption[5]		2,245 kWh	
Transportation		Mode: Air	Mode: Truck
	European Union	9,700 km	300 km
	Asia Oceania	11,738 km	300 km
	United States	0 km	3,200 km
Fraction recycled		0.90	

Table 15: *Data used in the PAIA storage model for the IBM DS8A50F High Performance Flash Enclosure with Industry Standard Drives*

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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 CO2 which would have the same instantaneous warming effect. Recognizing the uncertainty in carbon footprint estimates, the results have been rounded.

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 mean electricity emissions factor used in the PAIA analysis for each location is calculated based on the energy consumption and use phase emissions. The mean use phase emissions values are 0.23 kg CO_2e/kWh for Europe, 0.57 kg CO_2e/kWh for Asia Oceania, and 0.37 kg CO_2e/kWh for the United States.

4. The estimated carbon footprint was computed without including the system frame(s) and shipping crate. The estimated carbon footprint of the system frame and shipping crate are included in the carbon footprint of the IBM DS8A50F Management Enclosure.

5. Power consumption data is obtained from development lab measurements. Configurations and conditions represent typical power requirements for the specific configurations listed under Normal operating conditions. The power consumption assumes that the product operates 24 hours a day, 365 days a year for its product lifetime.

6. The estimated carbon footprint was computed for a single enclosure. The Processor Complex (CPC) and the High Performance Flash Enclosure Gen3 features are installed as pairs or two enclosures. The contribution of these elements can be estimated by multiplying the estimated carbon footprint of these elements by two.

7. The estimated carbon footprint for the DS8A50F system can be approximated as: 1 x Management Enclosure product carbon footprint + 2 x Processor Complex (CPC) product carbon footprint + 2 x High Performance Flash Enclosure Gen3 with IBM FlashCore Module 4 feature product carbon footprint x number of ordered features + 2 x High Performance Flash Enclosure Gen3 with Industry Standard Drives feature product carbon footprint x number of ordered features + 2 x I/O Bay Enclosure feature product carbon footprint x number of ordered features.

Produced in the United States of America, April 30, 2025.