IBM z17™ multi frame

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 might 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 carbon footprint life cycles of products."

The PAIA model was developed by the Massachusetts Institute of Technology's Materials Systems Laboratory and partners, Version 1.4.6, January 24, 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.

CPC drawer report →

PCIe+ I/O drawer report →

Support element report →

Ethernet switch report →

IBM

CPC Drawer Product Carbon Footprint

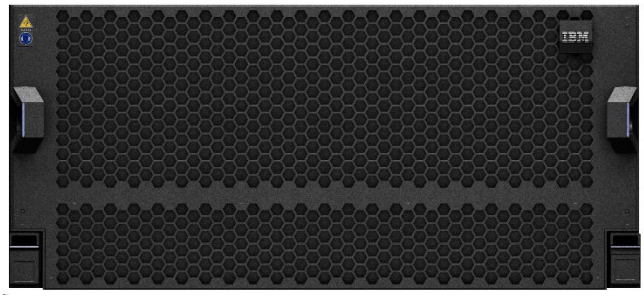

Table 1 describes three typical IBM z17™ CPC drawer configurations. For those configurations, Table 2 provides the total estimated mean GHG emissions in carbon dioxide equivalent (kg CO_2e[1]) associated with manufacturing, assembly, electricity consumption[2], transportation and end-of-life handling over five years, using hypothetical average GHG emissions factors. In addition, Table 2 provides the estimated mean GHG emissions for the frame and packaging, which can be added to you configuration as needed.

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].

	Small	**Medium**	**Large**
Processor chips	4	4	4
Active customer cores	2	16	43
Customer memory	512 GB	4,352 GB	12,032 GB
PCIe+ Fanout Gen4	0	3	6
ICA-SR 2.0	2	4	6
Annual energy use	18,948 kWh	23,372 kWh	26,902 kWh

Table 1: *Typical product configurations of the IBM z17 CPC drawer*

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 71% - 87% 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. IBM focuses on improving our product energy efficiency and on providing tools for our clients to estimate and measure the energy consumption of their product. The Power and Weight Estimation Tool can be used to estimate the power consumption of your specific product configuration.

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]
Small	European Union	27,460	76%	24,000	148,000
	Asia Oceania	61,760	87%	31,000	163,000
	United States	40,370	87%	8,000	62,000
Medium	European Union	36,460	74%	31,000	196,000
	Asia Oceania	77,770	86%	39,000	206,000
	United States	51,370	84%	10,000	81,000
Large	European Union	43,470	71%	36,000	228,000
	Asia Oceania	90,760	85%	46,000	245,000
	United States	61,370	81%	12,000	96,000
Frame and packaging	European Union	11,600	N/A	2,400	18,100
	Asia Oceania	19,500	N/A	4,000	29,400
	United States	4,100	N/A	1,400	9,000

Table 2: *Summary of the estimated GHG emissions for the typical product configurations of the IBM z17 CPC drawer*

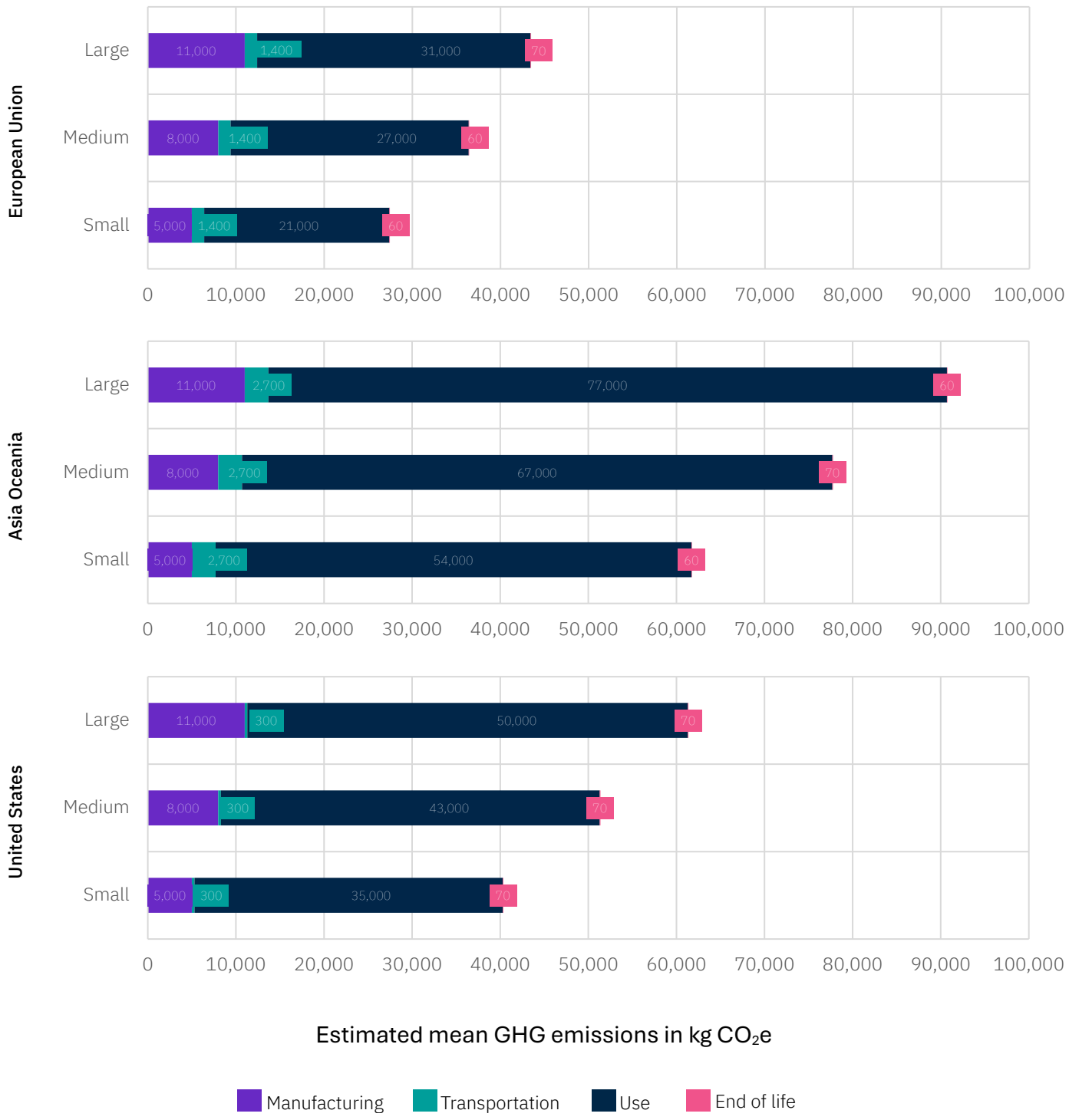

Figure 1: *Carbon footprint impact by phase for the IBM z17 CPC drawer product configurations listed in Table 1 using the PAIA model assuming a five-year product lifetime*

PAIA input data	Small	Medium	Large
Server type	Rack	Rack	Rack
Server quantity	1	1	1
Number of PSU	4	4	4
Number of fans	5	5	5
Server weight	83.0 kg	83.0 kg	83.0 kg
Rack and packaging weight[4]	0.0 kg	0.0 kg	0.0 kg
Motherboard PWB area	2,112.0 cm^2	2,112.0 cm^2	2,112.0 cm^2
CPU quantity	4	4	4
CPU package area (custom IC)	56.5 cm^2	56.5 cm^2	56.5 cm^2
DRAM total capacity	512 GB	4,352 GB	12,032 GB
Chipset and other ICs package area	Default	Default	Default
Chipset and other ICs quantity	Default	Default	Default
Sub card total PWB area	6,434.8 cm^2	9,378.9 cm^2	9,731.0 cm^2
Sub card main chip package area	688.5 cm^2	968.4 cm^2	926.8 cm^2
Sub card chip count	3046	4455	4088
PSU weight	1.42 kg	1.42 kg	1.42 kg
PSU dimensions	19.5 cm x 10.0 cm	19.5 cm x 10.0 cm	19.5 cm x 10.0 cm
Product lifetime	5 years	5 years	5 years
Yearly energy consumption[5]	18,948 kWh	23,372 kWh	26,902 kWh
Assembly location	United States	United States	United States
Transportation		Mode: Air	Mode: Truck
	European Union	6,120 km	300 km
	Asia Oceania	12,350 km	300 km
	United States	0 km	1,549 km
Fraction recycled	0.97	0.97	0.97

Table 3: *Data used in the PAIA server model for the IBM z17 CPC drawer*

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PCIe+ I/O Drawer Product Carbon Footprint

Table 4 describes three typical IBM z17 PCIe+ I/O drawer configurations. For those configurations, 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 five 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 each 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].

	Small	Medium	Large
FICON Express32G LX	1	4	4
OSA-Express7S 1.2 GbE LX	0	2	6
Network Express LR 10G	0	2	2
Crypto Express8s (2 HSM)	0	0	2
zHyperLink Express2.0	0	0	2
PCIe Interconnect	2	2	2
Annual energy use	1,656 kWh	3,215 kWh	5,265 kWh

Table 4: *Typical product configurations of the IBM z17 PCIe+ I/O drawer*

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 55% - 81% 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. IBM focuses on improving our product energy efficiency and on providing tools for our clients to estimate and measure the energy consumption of their product. The Power and Weight Estimation Tool can be used to estimate the power consumption of your specific product configuration.

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]
Small	European Union	3,430	55%	2,400	15,200
	Asia Oceania	6,730	70%	3,000	17,000
	United States	4,130	73%	900	7,200
Medium	European Union	5,730	65%	4,500	26,500
	Asia Oceania	11,730	78%	5,800	31,400
	United States	7,530	78%	1,800	12,900
Large	European Union	9,130	67%	7,800	48,800
	Asia Oceania	18,530	81%	9,300	51,000
	United States	12,330	79%	3,000	21,100

Table 5: *Summary of the estimated GHG emissions for the typical product configurations of the IBM z17 PCIe+ I/O drawer*

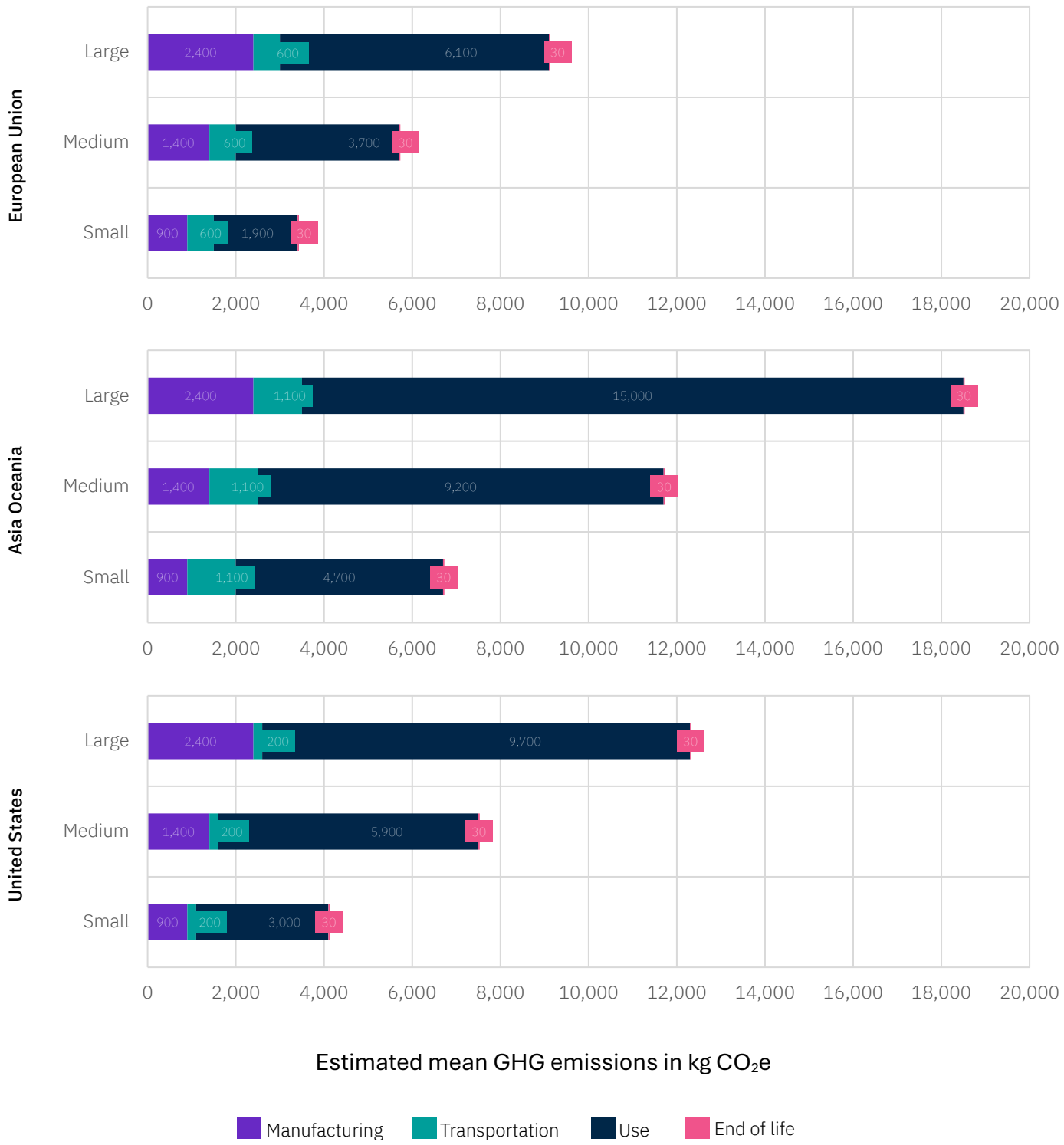

Figure 2: *Carbon footprint impact by phase for the IBM z17 PCIe+ I/O drawer product configurations listed in Table 4 using the PAIA model assuming a five-year product lifetime*

PAIA input data	Small	Medium	Large
Server type	Rack	Rack	Rack
Server quantity	1	1	1
Number of PSU	2	2	2
Number of fans	6	6	6
Server weight	34.8 kg	34.8 kg	34.8 kg
Motherboard PWB area	1,177.0 cm^2	1,177.0 cm^2	1,177.0 cm^2
Sub card total PWB area	2,641.9 cm^2	6,342.1 cm^2	10,994.7 cm^2
Sub card main chip package area	118.4 cm^2	285.1 cm^2	643.1 cm^2
Sub card chip count	294	533	1125
PSU weight	1.04 kg	1.04 kg	1.04 kg
PSU dimensions	20.0 cm x 10.0 cm	20.0 cm x 10.0 cm	20.0 cm x 10.0 cm
Product lifetime	5 years	5 years	5 years
Yearly energy consumption[5]	1,656 kWh	3,215 kWh	5,264 kWh
Assembly location	United States	United States	United States
Transportation		Mode: Air	Mode: Truck
	European Union	6,120 km	300 km
	Asia Oceania	12,350 km	300 km
	United States	0 km	1,549 km
Fraction recycled	0.97	0.97	0.97

Table 6: *Data used in the PAIA server model for the IBM z17 PCIe+ I/O drawer*

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Support Element Product Carbon Footprint

Table 7 describes the IBM z17 Support Element 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 five 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].

	Support element
Model	2461-SE4
CPU	3.4 GHz Intel Xeon
Memory	64 GB
Storage	2 TB SSD
Annual energy use	657 kWh

Table 7: *Typical product configurations of the IBM z17 support element*

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 48% - 69% 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. IBM focuses on improving our product energy efficiency and on providing tools for our clients to estimate and measure the energy consumption of their product. The Power and Weight Estimation Tool can be used to estimate the power consumption of your specific product configuration.

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]
Support element	European Union	1,470	48%	900	5,700
	Asia Oceania	2,910	65%	1,100	6,900
	United States	1,730	69%	400	3,100

Table 8: *Summary of the estimated GHG emissions for the typical product configuration shown in Table 7 of the IBM z17 support element*

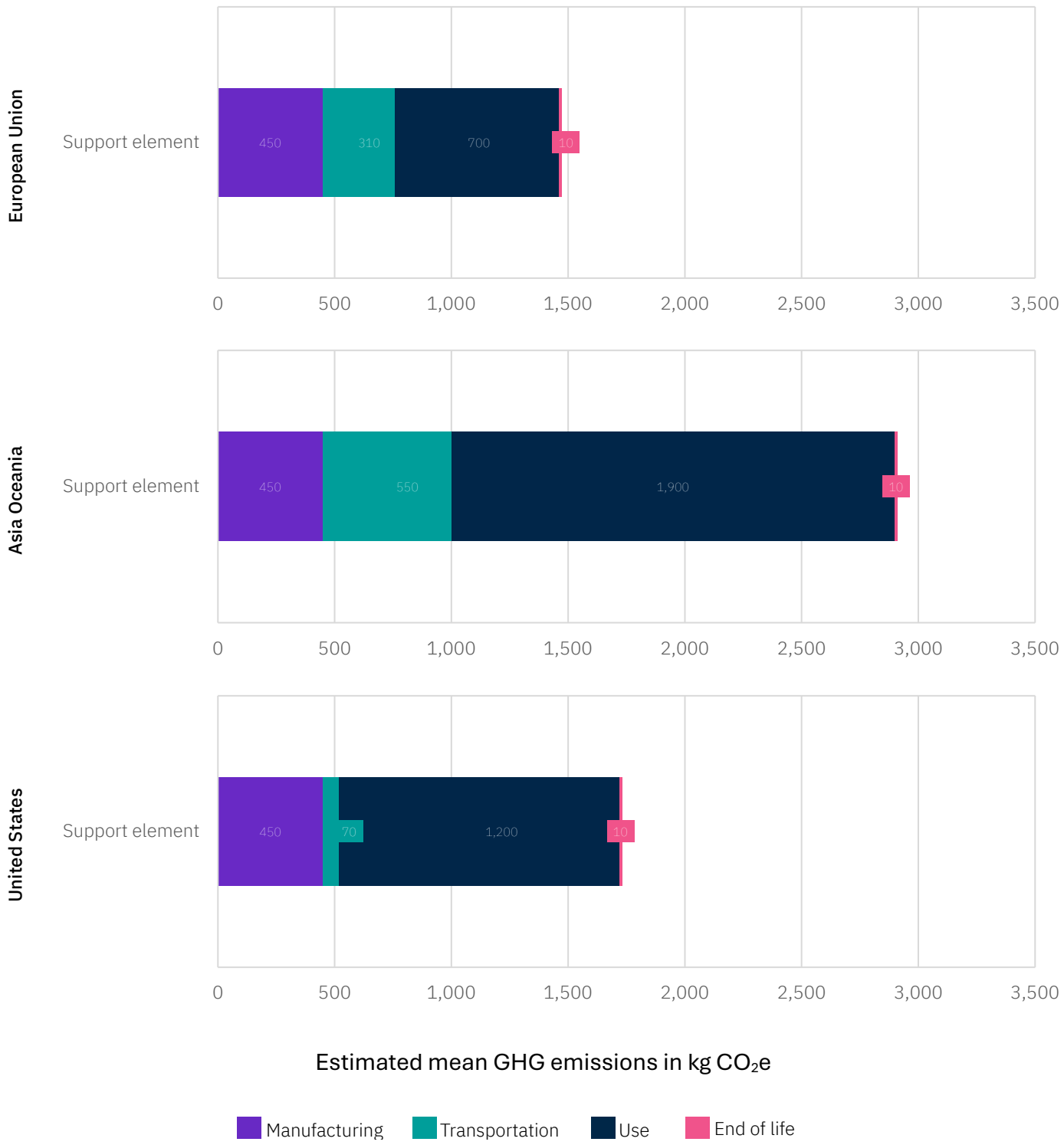

Figure 3: *Carbon footprint impact by phase for the IBM z17 support element product configuration listed in Table 7 using the PAIA model assuming a five-year product lifetime*

PAIA input data		Support element	
Server type		Rack	
Server quantity		1	
Number of PSU		2	
Number of fans		5	
Server weight		16.0 kg	
PWB area		791.1 cm^2	
CPU quantity		1	
CPU package area		14.1 cm^2	
DRAM total capacity		64 GB	
Chipset and other ICs package area		15.8 cm^2	
Chipset and other ICs quantity		5	
SSD quantity		1	
Sub card total PWB area		863.9 cm^2	
Sub card main chip package area		0.0 cm^2	
Sub card chip count		1	
ODD quantity		1	
PSU weight		0.89 kg	
PSU dimensions		19.4 cm x 8.0 cm	
Product lifetime		5 years	
Yearly energy consumption[5]		657 kWh	
Assembly location		United States	
Transportation		Mode: Air	Mode: Truck
	European Union	6,120 km	300 km
	Asia Oceania	12,350 km	300 km
	United States	0 km	1,549 km
Fraction recycled		0.97	

Table 9: *Data used in the PAIA server model for the IBM z17 support element*

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24-port Ethernet Switch Product Carbon Footprint

Table 10 describes a typical IBM z17 24-port Ethernet Switch 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 five 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 network switch 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].

	Ethernet switch
Ports	24
Annual energy use	482 kWh

Table 10: *Typical product configurations of the IBM z17 24-port ethernet switch*

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 11 shows that 72% - 86% 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. IBM focuses on improving our product energy efficiency and on providing tools for our clients to estimate and measure the energy consumption of their product. The Power and Weight Estimation Tool can be used to estimate the power consumption of your specific product configuration.

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 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]
Ethernet switch	European Union	830	72%	680	4,300
	Asia Oceania	1,710	82%	830	4,500
	United States	1,050	86%	270	1,800

Table 11: *Summary of the estimated GHG emissions for the typical product configurations of the IBM z17 24-port ethernet switch*

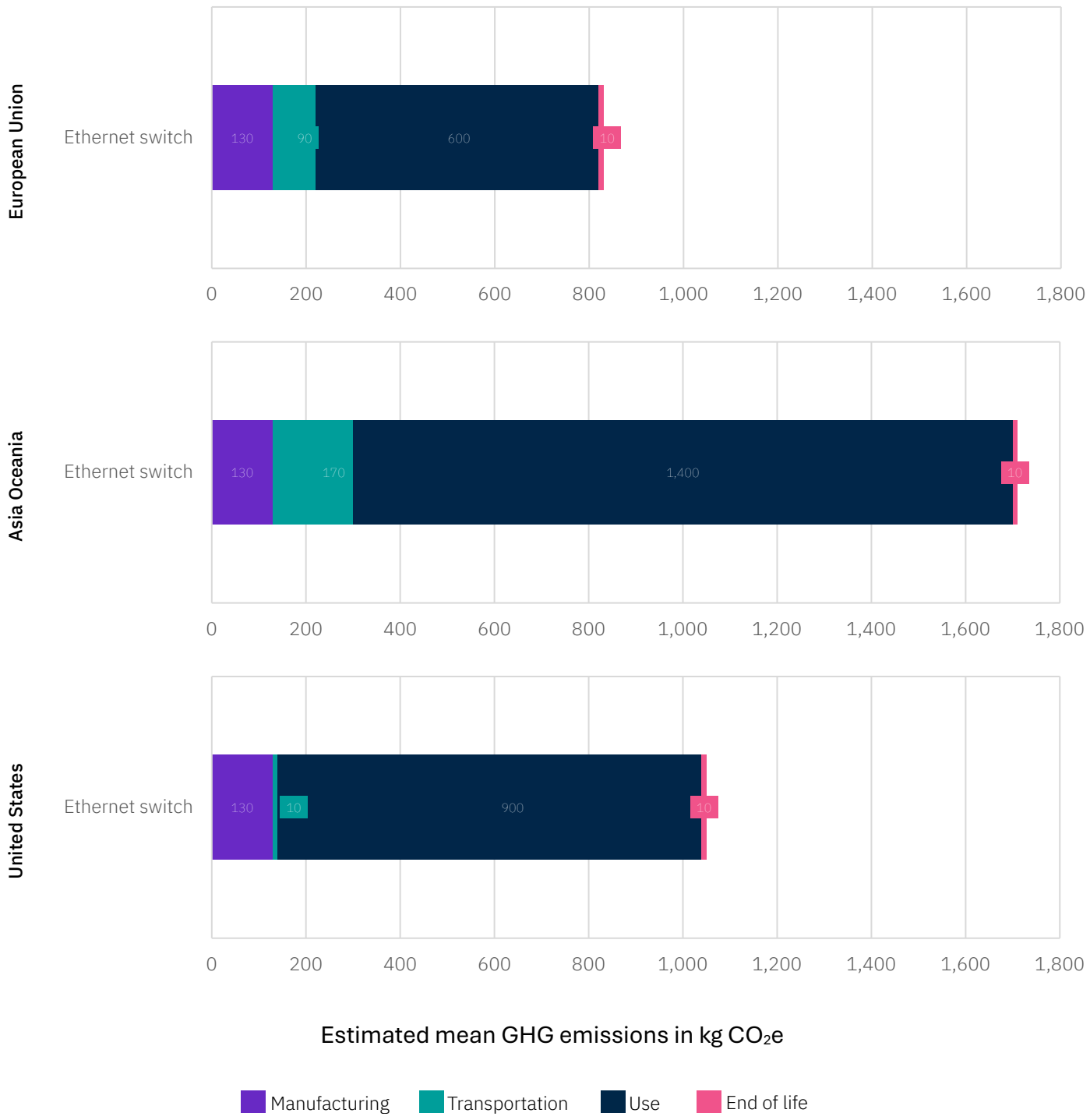

Figure 4: *Carbon footprint impact by phase for the IBM z17 24-port ethernet switch product configuration listed in Table 11 using the PAIA model assuming a five-year product lifetime*

PAIA input data		Ethernet switch	
Form factor		Rack	
Product-only weight		3.3 kg	
Packaging weight[4]		0.0 kg	
Chassis weight		2.6 kg	
Number of switches sharing chassis		1	
PWB area		0.06 m^2	
CPU quantity		1	
CPU package area		7.3 cm^2	
DRAM total capacity		1 GB	
Chipset and other ICs package area		3.0 cm^2	
Chipset and other ICs quantity		4	
Sub card total PWB area		N/A	
Sub card main chip package area		N/A	
Sub card chip count		1	
Fan count		1	
Ports count		24	
PSU count		1	
PSU weight		0.19 kg	
PSU dimensions		12.7 cm x 7.6 cm	
Product lifetime		5 years	
Yearly energy consumption[5]		482 kWh	
Assembly location		Taiwan	
Transportation		Mode: Air	Mode: Truck
	European Union	6,120 km	300 km
	Asia Oceania	12,350 km	300 km
	United States	0 km	1,549 km

Table 12: *Data used in the PAIA server model for the IBM z17 24-port ethernet switch*

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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.

3. The estimated carbon footprint was computed without including the system frame(s) and shipping crate. The estimated carbon footprint for each frame and shipping crate is provided in Table 2. This estimate can be added based on your specific product configuration.

4. Power consumption data is obtained using the IBM Power Estimation Tool for 9175, a web-based tool for estimating power requirements for the IBM z17. This tool estimates the typical power requirements for the specific configuration listed in under Normal operating conditions. The energy consumption assumes that the product operates 24 hours a day, 365 days a year for its product lifetime.

Produced in the United States of America, April 8, 2025.