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ENVIRONMENTAL PRODUCT DECLARATION

SINAMICS G220

High-end converters for continuous motion

Type III according to ISO 14025

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IN COMPLIANCE WITH ISO 14025 and EN 50693, and EPD Italy007	
6SL4113-0CA21-2AF0	EPD scope: Cradle to Grave
Independent Verification: Independent verification of the declaration and data, according to ISO14025:2011-10 ☒ Internal ☐ External	Program instructions: The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2024.09.18 version 4 Håkon Hauan Managing Director of EPD-Norway

General information

This environmental product declaration (EPD) is based on the international standard ISO 14025 (“Environmental labels and declarations — Type III environmental declarations”). The data in this EPD has been evaluated on a full-scale life cycle assessment (LCA) study according to ISO 14040/44, taking into account the product category rules (PCR) for electronic and electrotechnical products and systems defined in EN 50693. The applied use phase scenario including load profile is based on EN 50598-3:2015.

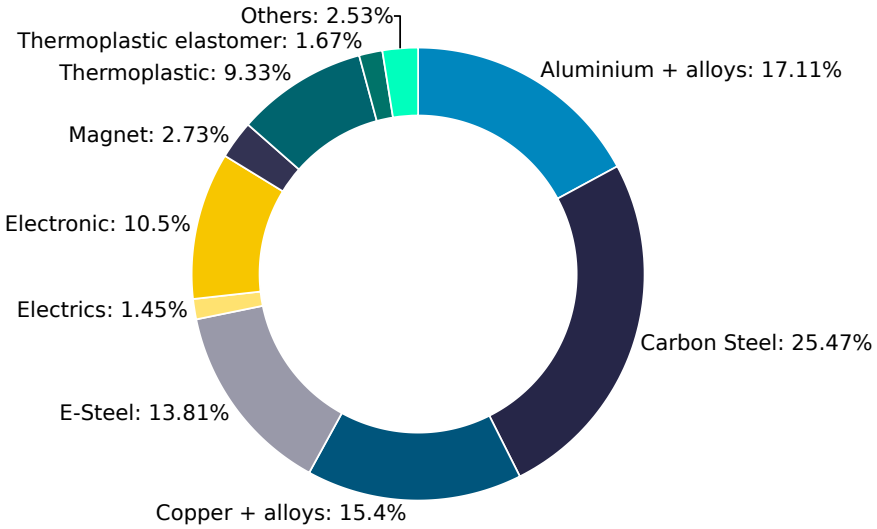
Siemens is dedicated to an environmentally conscious design of its products in line with IEC 62430 and has implemented an integrated management system according to ISO 9001, ISO 14001 and ISO 45001.

Products	SINAMICS G220 converter in framesize FSD1, safety & security integrated, IP20, air cooling, analog and digital I/Os, PROFINET, Modbus TCP/IP, EtherNet/IP.
Represented by	6SL4113-0CA21-2AF0
Product Description	SINAMICS G220 380-500 V 3AC + 10/-20% 47-63 Hz power low overload: 22 kW 150% 3 s, 110% 57 s power high overload: 18.5 kW 200% 3 s, 150% 57 s 400x 150x 245 (HxWxD) frame size: FSD1 degree of protection IP20 / UL open type Safety SIL3 with integrated braking chopper basic version radio interference suppression filter category C2 . PROFINET PN, Modbus TCP
Functional Unit	Production and EoL of one converter SINAMICS G220 , operating over 15 years of reference lifetime maintenance free. Main function of the SINAMICS G220 converter is speed and torque control of asynchronous reluctance motors and permanent- magnet synchronous motors. Product description and characteristics: SINAMICS G220 converter, safety & security integrated, IP20, air cooling, analog and digital I/Os, PROFINET, Modbus TCP/IP, EtherNet/IP. Conversion factor 1/18 kg.
Production Site	Manufactured in Motion Control Factory in Erlangen, Germany.

Material composition

The product weight of 18.24 kg combined with the packaging weight of 1.54 kg results in a total weight of 19.78 kg. The following chart outlines the overall material composition of the reference product, excluding packaging.
Packaging consists of: Graphic paper, Corrugated box (average composition), PE film, Polyethylene foam.

Product Weight 18.24 kg



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Substance assessment

At Siemens, we are committed to the development and production of environmentally sound and sustainably produced equipment. This includes avoiding hazardous substances in our products without compromising their benefits for our customers.
Please visit the following website to learn more about how we comply with product-related environmental regulations like RoHS, REACH, WEEE and others: G220 catalogue list

System boundaries and scenarios

The EPD covers the cradle to grave of the product including the following stages.

Manufacturing stage			Distribution	Installation	Use stage							End-of-Life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Production	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-Installation	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	0	0	0	0	0	X	0	0	0	X	X	X

Temporal and geographical scope and representativeness	Primary data of 2024 (Bill of materials, SESIS report, SAP); Secondary data : LCA for Experts (GaBi) 10.8, Database valid until 2025. The materials and components used in production are globally sourced and have been selected from Sphera data sets according to the global or regional representativeness.
Data quality	Both primary and secondary data are used. To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. The main sources for primary data are the bill of materials and the bill of processes. Site specific data are provided by Siemens reporting system. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered. Generic data originating from the LCA tool: LCA for Experts (GaBi) 10.8, Database: MLC (“Managed LCA Content” formerly known as GaBi) Professional & Extensions are used.
Allocation	Amount of resources used and waste generated in production at Siemens is allocated based on annual production volume. For the end-of-life allocation, the “Polluter Pays” principle is adopted as required by the PCR EPDItaly007. Waste treatment processes are allocated to the product system that generates the waste until the end-of-waste state is reached. The environmental burdens of recycling and energy recovery processes are therefore allocated to the product system that generates the waste, while the product system that uses the exported energy and recycled materials receives it burden-free. Potential benefits and avoided loads from recovery and recycling processes are considered in separate Benefits & Loads beyond system boundary section.

Cut-off	The following flows and operations have been cut-off: · Production, use and disposal of the packaging of components and semi-finished intermediates. · Material and energy flows related to the installation stage. · Material and energy flows related to dismantling phase, whenever it is reasonable to assume that dismantling · Devices external to the product itself required for installation. · The product is maintanance free · According to EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts.

Scenarios:

The following information describes the scenarios in the different modules of the EPD.

Manufacturing	This stage covers the extraction of natural resources, production of raw materials, manufacturing such as plastic injection moulding , aluminium machining, steel sheet stamping and bending, electrolytic galvanisation, steel laser cutting, packaging, and upstream transportation.
Transportation to production site	Inbound transport scenario is divided: 80% allocated as international transport 17% allocated as local transport 3% allocated as intracontinental transport Scenarios are based on the definition in based on PCR EN 50693 § 4.3.2 transport scenarios and customer region
Production energy model used	Germany (standard mix)
Distribution	This stage covers the product's distribution.
Distribution: Transport model use	Costumer region EMEA, manufacturing site Erlangen Germany, chosen scenario based on PCR EN 50693 § 4.3.2 transport scenarios and customer region : Intracontinental transport: 3500km by lorry (85% payload) .
Installation	This stage covers the End-of-Life treatment of transport packaging.
Installation: Energy model used	Not relevant
Use	This stage covers the operational energy use. All other modules do not apply for this product. Different operating conditions can lead to deviations from the reference scenario.
Use: Energy model used and use scenario	Europe (standard mix) Operation profile is defined by 3 operational points (OP): OP1 : 20% of time at 100% speed and 100% torque OP2: 70% of time at 50% speed and 25% torque OP3: 10% of time at 0% speed and 25% torque Lifetime 15 years and annual operation 5000h/year

EoL	This stage covers the disassembly, material recycling in addition to thermal treatment of all recoverable materials and the disposal of all other materials. EoL scenario is based on default values of IEC/TR 62635.
EoL: Transport model use	3500 km; GLO: Truck-trailer, Euro IV, 27 t payload, 85% loading rate
EoL: Energy model used	EMEA

Life cycle assessment - results

The following impact categories characterize the product's environmental footprint. They have been calculated with LCIA methodology 01 EN15804+A2 (EF 3.1); LCA tool: Green Digital Twin (GDT), Database: One Siemens LCA Database (based on MLC CUP 2024.1, formerly GaBi).

To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered.

Environmental performance indicators

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
CC - total	kg CO_2 eq	9.92E+3	2.53E+2	1.64E+1	2.12E+0	9.65E+3	5.50E+0	-4.89E+1
CC - fossil	kg CO_2 eq	9.81E+3	2.30E+2	1.61E+1	2.08E+0	9.56E+3	5.50E+0	-4.87E+1
CC - biogenic	kg CO_2 eq	1.12E+2	2.30E+1	3.85E-2	4.55E-2	8.89E+1	1.89E-3	1.78E-3
CC - luluc	kg CO_2 eq	2.09E+0	3.66E-1	2.71E-1	1.63E-5	1.46E+0	4.05E-4	-1.71E-1
ODP	kg CFC-11 eq	2.59E-7	4.24E-8	2.38E-12	1.22E-13	2.17E-7	4.92E-12	-2.38E-10
AP	Mole of H+ eq	2.15E+1	3.04E+0	2.46E-2	2.33E-4	1.84E+1	1.59E-3	-4.83E-1
EP - freshwater	kg P eq	4.10E-2	1.05E-3	6.89E-5	1.57E-6	3.99E-2	7.50E-6	-9.27E-5
EP - marine	kg N eq	5.01E+0	3.89E-1	9.31E-3	5.52E-5	4.61E+0	4.60E-4	-5.42E-2
EP - terrestrial	Mole of N eq	5.26E+1	4.23E+0	1.10E-1	1.06E-3	4.82E+1	5.96E-3	-5.86E-1
POCP	kg NMVOC eq	1.34E+1	1.18E+0	2.44E-2	1.70E-4	1.22E+1	1.29E-3	-1.72E-1
ADP - M & M	kg Sb eq	9.48E-2	9.30E-2	1.41E-6	1.39E-9	1.79E-3	4.46E-8	-1.59E-2
ADP - fossil	MJ	2.04E+5	3.36E+3	2.13E+2	3.15E-1	2.00E+5	6.12E+0	-5.83E+2
WDP	m^3 world eq deprived water	2.65E+3	4.68E+1	2.50E-1	1.92E-1	2.60E+3	5.38E-1	-1.54E+1
PM	Disease incidences	1.82E-4	2.73E-5	2.71E-7	1.47E-9	1.54E-4	1.25E-8	-4.62E-6
IRP	kBq U235 eq	5.28E+3	1.79E+1	5.62E-2	2.34E-3	5.26E+3	1.14E-1	-3.79E+0
ETP - fw	CTUe	5.96E+4	1.38E+3	1.58E+2	2.06E-1	5.80E+4	2.57E+0	-2.00E+2
HTP - c	CTUh	3.45E-6	1.85E-7	3.19E-9	1.53E-11	3.26E-6	1.20E-10	-1.66E-8
HTP - nc	CTUh	5.25E-5	2.43E-6	1.43E-7	1.88E-10	5.00E-5	2.14E-9	-6.64E-7
SQP	dimensionless (pt)	8.58E+4	9.65E+2	1.05E+2	8.77E-2	8.48E+4	2.18E+0	-6.29E+1

***CC-total**: Climate change; **CC-fossil**: Climate change fossil fuels; **CC-biogenic**: Climate change biogenic; **CC-LULUC**: Climate change land use and land use change; **ODP**: Depletion potential of the stratospheric ozone layer; **AP**: Acidification potential, Accumulated Exceedance; **EP-freshwater**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq. **EP-marine**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestrial**: Eutrophication potential, Accumulated Exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil**: Abiotic depletion potential for fossil resources; **WDP**: Water deprivation potential, deprivation weighted water consumption; **PM**: Particulate matter emissions; **IRP**: Ionizing radiation, human health; **ETP-fw**: Ecotoxicity (freshwater); **HTP-c**: Human toxicity, cancer effects; **HTP-nc**: Human toxicity, non-cancer effects; **SQP**: Land use related impacts / soil quality*

Resource use indicators and biogenic carbon content

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
PERE	MJ	1.46E+5	1.38E+3	1.83E+1	7.88E-2	1.45E+5	3.30E+0	-1.91E+2
PERM	MJ	6.50E+0	1.22E+1	0.00E+0	-5.70E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	1.46E+5	1.40E+3	1.83E+1	-5.62E+0	1.45E+5	3.30E+0	-1.91E+2
PENRE	MJ	2.04E+5	3.36E+3	2.13E+2	3.15E-1	2.00E+5	6.12E+0	-5.84E+2
PENRM	MJ	3.26E+0	7.93E+1	0.00E+0	-3.20E+1	0.00E+0	-4.40E+1	0.00E+0
PENRT	MJ	2.04E+5	3.44E+3	2.13E+2	-3.17E+1	2.00E+5	-3.79E+1	-5.84E+2
SM	kg	1.39E+0	1.39E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m3	1.12E+2	1.86E+0	2.04E-2	4.49E-3	1.10E+2	1.37E-2	-1.62E+0
BIOGCPRODUCT	kg of C	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
BIOGCPACKAGIN(	kg of C	3.73E-1	3.73E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

***PERE**: Use of renewable primary energy; **PERM**: Use of renewable primary energy resources used as raw material; **PERT**: Total use of renewable primary energy resources; **PENRE**: Use of non-renewable primary energy; **PENRM**: Use of non-renewable primary energy resources used as raw material; **PENRT**: Total use of non-renewable primary energy resources; **SM**: Use of secondary materials; **RSF**: Use of renewable secondary fuels; **NRSF**: Use of non-renewable secondary fuels; **FW**: Use of net fresh water*

End-of-Life - Waste and output flows

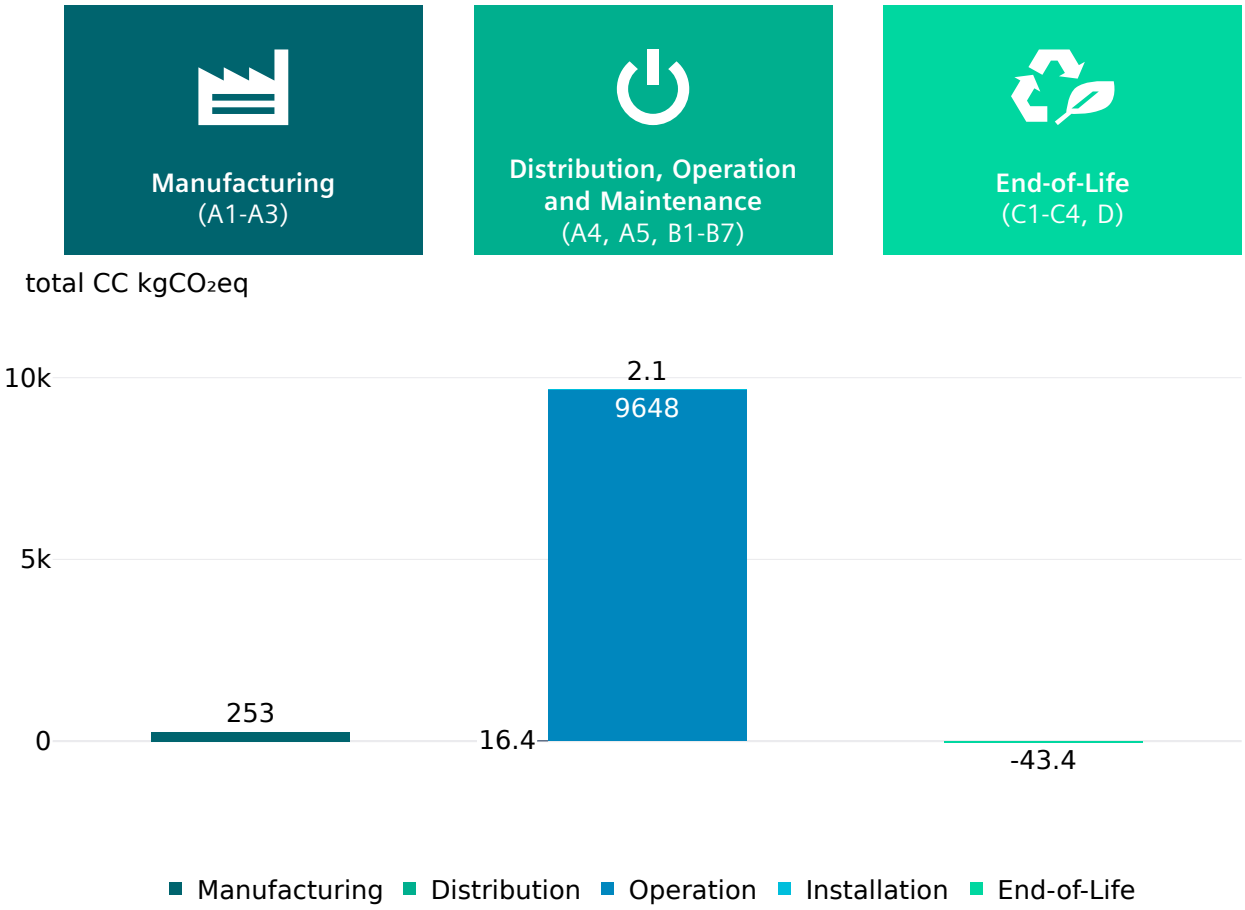
Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
HWD	kg	3.80E-4	9.10E-5	8.14E-9	1.60E-10	2.89E-4	6.55E-9	-4.71E-6
NHWD	kg	1.82E+2	1.26E+1	3.47E-2	1.09E-1	1.66E+2	3.88E+0	-6.43E+0
RWD	kg	3.21E+1	1.57E-1	3.87E-4	1.47E-5	3.19E+1	6.96E-4	-2.35E-2
MER	kg	2.85E+0	4.26E-2	0.00E+0	6.61E-1	0.00E+0	2.14E+0	0.00E+0
MFR	kg	1.09E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.09E+1	0.00E+0
CRU	kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
ETE	MJ	2.32E+1	2.67E-1	0.00E+0	9.18E+0	0.00E+0	1.38E+1	1.38E+1
EEE	MJ	1.30E+1	1.49E-1	0.00E+0	5.15E+0	0.00E+0	7.72E+0	7.76E+0

***HWD**: hazardous waste disposed; **NHWD**: non-hazardous waste disposed; **RWD**: radioactive waste disposed; **MER**: materials for energy recovery; **MFR**: material for recycling; **CRU**: components for reuse; **ETE**: exported thermal energy; **EEE**: exported electricity energy.*

Additional environmental information

Climate change

This chart shows the overall impact of the product on climate change – total. The operations phase is the lifecycle phase with the biggest overall impact. Different operating conditions can lead to deviations from the reference scenario.



End-of-Life results

The end-of-life stage was modelled by shredding of the device, followed by sorting and material separation process. EoL scenario is based on default values of IEC/TR 62635.

It leads to:

- **an overall** product recyclability of up to 69% mainly due to metal content
- **an** energy recoverability of up to 15% from plastic materials
- **a** minimum disposal rate of 16%

The exact final values depend on the used recycling process and add up to 100%.

Note: The device should not be disposed of as unsorted municipal waste. Special treatment for specific components may be mandated by law or recommended for environmental reasons. Observe all local and applicable laws.

References

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040/44	Lifecycle Assessment – Principles and framework
EN 50693	Product category rules for life cycle assessments of electronic and electrical products and systems
EPDItaly007	Core PCR EN 50693 - ELECTRONIC AND ELECTRICAL PRODUCTS AND SYSTEMS
EN 50598-3:2015	Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Part 3: Quantitative eco design approach through life cycle assessment including product category rules and the content of environmental declarations

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Please be aware that the data of this EPD cannot be compared with data calculated based upon product category rules (PCRs) other than the standards mentioned above. The values given are only valid within the context specified and cannot be used directly to draw up the environmental assessment of an installation.

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