



ENVIRONMENTAL PRODUCT DECLARATION

SINAMICS G220 IP20

High-end converters for
continuous motion

Type II according to ISO 14021 including life cycle impact assessment (LCIA)



SIEMENS

General information

This environmental product declaration (EPD) is based on the international standard ISO 14021 (“Environmental labels and declarations – Self declared environmental claims – Type II environmental labelling”). 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.

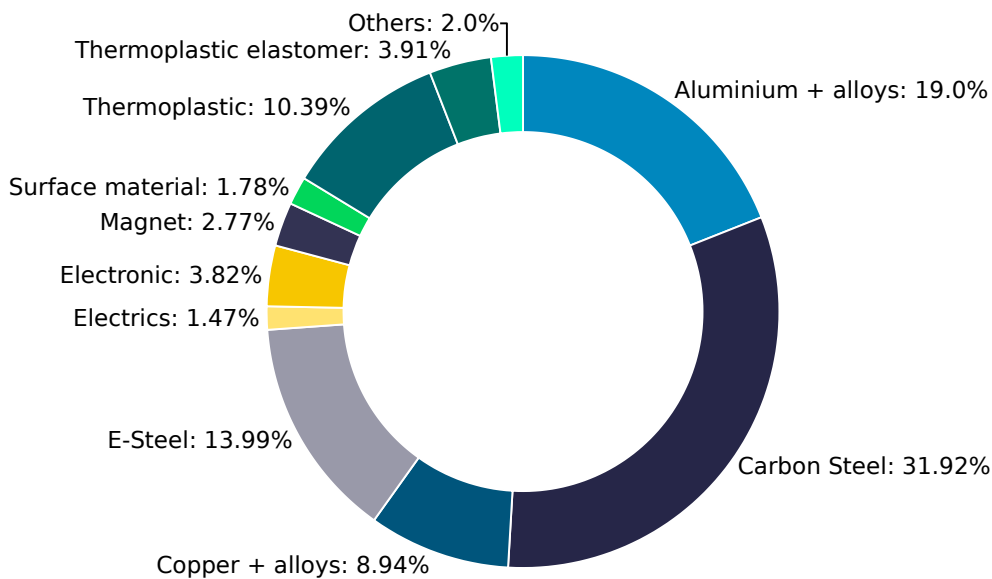
Products	SINAMICS G220 in frame sizes FSA, FSB, FSC, FSD1, FSD2 and FSE, and FSF1 voltage classes 200 V...240 V 3 AC (0.55 kW - 55 kW) and 380 V...500 V 3 AC (1.1 kW - 110 kW) in IP20 degree of protection.
Represented by the reference product	6SL4113-0CA21-2AF0, 22 kW (LO), 3AC 380-500V, Filter C2, IP20, PROFINET
Product Description	SINAMICS G220 converter, safety & security integrated, IP20, air cooling, analog and digital I/Os, PROFINET, Modbus TCP/IP, EtherNet/IP
Functional Unit	Speed and torque control of asynchronous induction motors, synchronous reluctance motors and permanent-magnet synchronous motors. ¹

¹ The lifetime value used for calculation is a reference value and does not equate with the minimum, average or real life time.

Material composition

The following chart outlines the overall material composition of the calculated reference product without packaging. Product weight of 18.0 kg adds up with packaging weight of 1.54 kg to a total weight of 19.54 kg. Packaging consists of: Graphic paper, Corrugated box (average composition), PE film, Polyethylene foam.




Product Weight 18.0 kg



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: [Product Related Environmental Protection](#)

Life cycle stages and reference scenarios

 Manufacturing This stage covers the extraction of natural resources, production of raw materials, manufacturing, packaging, and transportation.	 Distribution and Operation This stage covers the product's distribution, installation, use, and maintenance. Different operating conditions can lead to deviations from the reference scenario.	 End-of-Life This stage covers the disassembly or shredding and material recycling of all recyclable materials, as well as energy recovery, thermal treatment and the disposal of all other materials.
Scenarios		
Energy model used: Thailand (standard mix), Germany (standard mix), Germany (Thermal energy from biogas), Japan (standard mix), Europe (standard mix) Transportation model: Truck 7.5t-12t gross weight 1000km average distance	Energy model used: Europe (standard mix) Distribution scenario: Truck (7.5 t-12 t) 3500 km Use Scenario: 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	Energy model used: EMEA End-of-Life methodology: Avoided burden (net-scrap calculation)

Key environmental performance indicators

The following impact categories characterize the product's environmental footprint. They have been calculated with LCIA methodology EF3.1; LCA tool: Green Digital Twin (GDT), Database: One Siemens LCA Database (based on MLC CUP 2023.2, formerly GaBi).

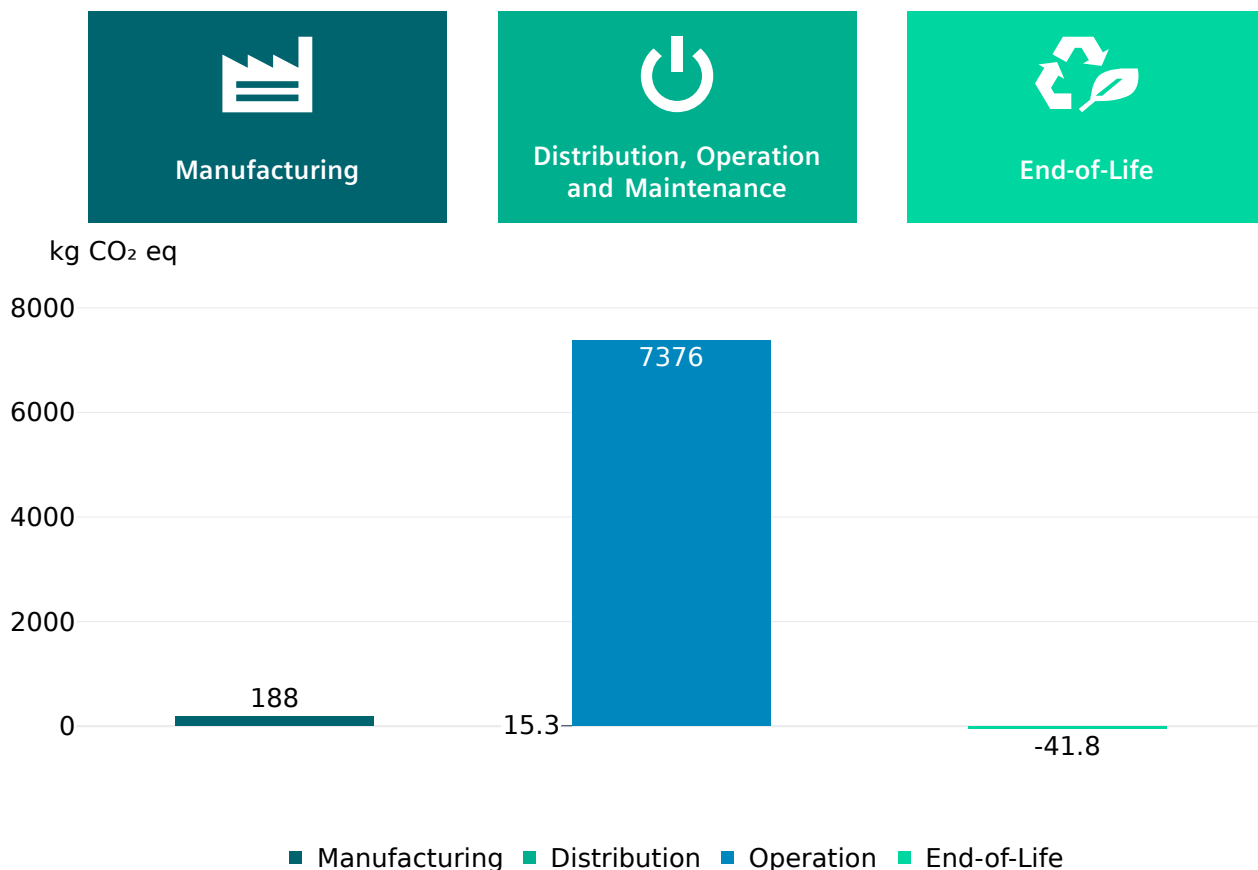
To ensure the high quality and completeness of the LCA results, Primary Data have been used whenever possible. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting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

For products belonging to the same homogeneous product family range the following extrapolation criteria (Appendix) can be used to derive their climate change impact in kg CO₂ eq. The rest of the listed impacts will be determined in the next version of the EPD.

Impact Category	Unit	Total	Manufacturing	Distribution	Operation	End of life
Acidification	Mole of H+ eq	1.82E+1	2.90E+0	2.22E-2	1.56E+1	-3.30E-1
Climate change – total	kg CO ₂ eq	7.54E+3	1.88E+2	1.53E+1	7.38E+3	-4.18E+1
Climate change – fossil	kg CO ₂ eq	7.47E+3	1.86E+2	1.51E+1	7.31E+3	-4.18E+1
Climate change – biogenic	kg CO ₂ eq	6.69E+1	2.17E+0	4.12E-2	6.47E+1	-2.96E-2
Climate Change, land use and land use change	kg CO ₂ eq	8.73E-1	1.06E-1	1.42E-1	7.97E-1	-2.98E-2
Ecotoxicity, freshwater – total	CTUe	4.40E+4	1.29E+3	1.50E+2	4.27E+4	-1.73E+2
Eutrophication, freshwater	kg P eq	2.88E-2	1.34E-3	5.61E-5	2.74E-2	-2.85E-5
Eutrophication, marine	kg N eq	4.06E+0	3.60E-1	7.94E-3	3.73E+0	-4.11E-2
Eutrophication, terrestrial	Mole of N eq	4.26E+1	3.91E+0	9.46E-2	3.90E+1	-4.37E-1
Human toxicity, cancer – total	CTUh	2.40E-6	1.39E-7	3.04E-9	2.26E-6	-6.16E-9
Human toxicity, non-cancer – total	CTUh	3.92E-5	3.32E-6	1.35E-7	3.60E-5	-3.03E-7
Ionising radiation, human health	kBq U235 eq	4.06E+3	1.02E+1	5.85E-2	4.05E+3	-3.66E+0
Land Use	dimensionless (pt)	6.17E+4	1.23E+3	8.73E+1	6.05E+4	-8.88E+1
Ozone depletion	kg CFC-11 eq	1.81E-7	4.63E-8	2.00E-12	1.35E-7	-2.22E-10
Particulate matter	Disease incidences	1.58E-4	3.01E-5	1.93E-7	1.31E-4	-3.69E-6
Photochemical ozone formation, human health	kg NMVOC eq	1.09E+1	1.09E+0	1.93E-2	9.96E+0	-1.31E-1
Resource use, fossils	MJ	1.56E+5	2.54E+3	2.09E+2	1.54E+5	-5.61E+2
Resource use, mineral and metals	kg Sb eq	1.44E-1	1.55E-1	1.02E-6	1.13E-3	-1.20E-2
Water use	m ³ water eq deprived water	1.64E+3	3.71E+1	1.85E-1	1.61E+3	-1.06E+1

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 references scenario. The distribution stage of the reference product is not shown in the chart due to its relatively small contribution to climate change and its impact is included in the operation bar.



End-of-Life results



The end-of-life stage considers the recyclability rates of metal, plastics contents and minimum disposal rates according to the guidelines IEC TR 62635:2012 for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment.

It leads to:

- an overall **product recyclability of up to 72%** mainly due to metal content
- an **energy recoverability of up to 15%** from plastic materials
- a **minimum disposal rate of 13%**

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

Appendix

For other MLFBs covered by this EPD under G220 IP20 homogenous product family, the climate change impact (CC) in kg CO₂eq. can be calculated for the manufacturing and end of life phases using linear regression based on the mass in kg (x) of the assessed product.

The following equation based on linear regression is defined as:

$$y = m \times x + b$$

where,

y climate change in kgCO₂eq.

m.... scaling factor in kgCO₂eq./kg of product

x mass of the product in kg without packaging

b intercept (offset) in kg CO₂eq.

Thus, the factors for the **manufacturing phase** are:

m = 12.25 kgCO₂eq./kg of inverter, b= 22.69 kgCO₂eq.

For End of Life:

m = 0.21 kgCO₂eq./kg of inverter, b= -2.21 kg CO₂eq.

For the operation phase, the climate change in kgCO₂eq was derived for 230 V (Tab.1 – Tab. 3), 400 V (Tab. 4 – Tab. 6) and 500V (Tab. 7) and rated power P_R (LO) in kW for European standard energy mix, lifetime of 15 years and annual operation 5000h/year.

Tab. 1 Climate change results of the operation phase of 230V variants

Voltage	V	230	230	230	230	230	230
P _R (LO)	kW	0.55	0.75	1.1	1.5	2.2	3
Climate change	kg CO ₂ eq	1144	1292	1639	2074	2573	2868

Tab. 2 Climate change results of the operation phase of 230V variants

Voltage	V	230	230	230	230	230	230	230	230
P _R (LO)	kW	4	5.5	7.5	11	15	18.5	22	30
Climate change	kg CO ₂ eq	3271	4259	5305	6441	8768	10550	12346	15650

Tab. 3 Climate change results of the operation phase of 230V variants

Voltage	V	230	230	230
P _R (LO)	kW	37	45	55
Climate change	kg CO ₂ eq	16092	19979	22875

Tab. 4 Climate change results of the operation phase of 400V variants

Voltage	V	400	400	400	400	400	400	400
P _R (LO)	kW	1.1	1.5	2.2	3	4	5.5	7.5
Climate change	kg CO ₂ eq	1349.788	1541.779	1992.489	2552.072	3156.140	3214.674	3940.492

Tab. 5 Climate change results of the operation phase of 400V variants

Voltage	V	400	400	400	400	400	400	400	400
P _R (LO)	kW	11	15	18.5	22	30	37	45	55
Climate change	kg CO ₂ eq	4928.542	6080.486	6493	7373	9710	11554.562	13247.358	16637.633

Tab. 6 Climate change results of the operation phase of 400V variants

Voltage	V	400	400	400
PR (LO)	kW	75	90	110
Climate change	kg CO ₂ eq	28157.08	34251.61	26096.69

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Published by

Digital Industries
Motion Control
Frauenauracher Str. 80
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