ENVIRONMENTAL PRODUCT DECLARATION

SINAMICS V20

Basic 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, as well as product specific rules (PSR) for low-voltage switchgear and control gear equipment in IEC TS 63058 ED1.0

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.

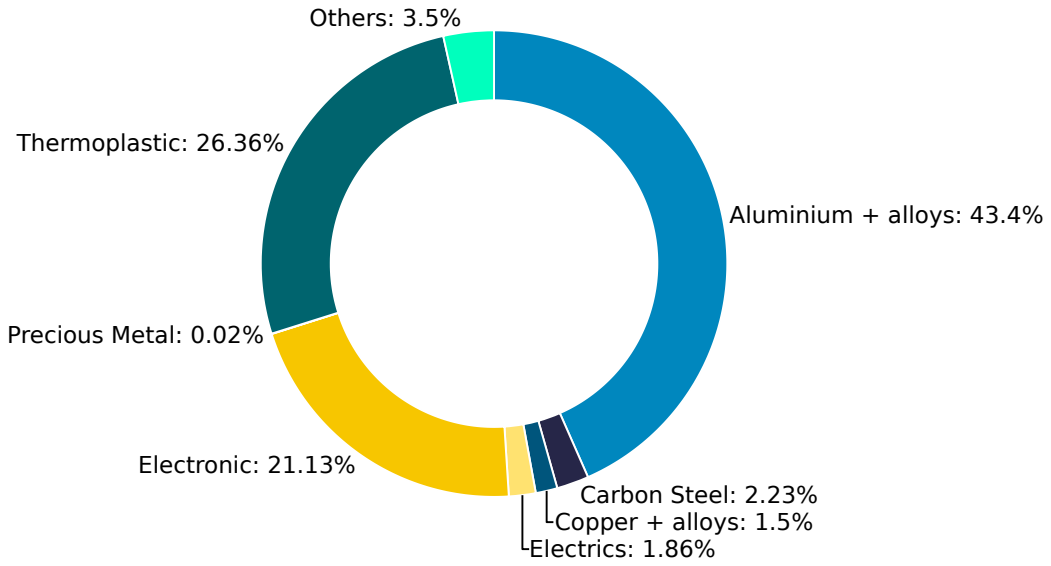
Products	**SINAMICS V20 converters, power range 0.12 to 3 kW at 200 ... 240 V 1 AC and 0.37 to 30 kW at 380 ... 480 V 3 AC**
Represented by the reference product	6SL3210-5BE21-5UV0, 1.5 kW (Unfiltered), 3AC 380 ... 480 V, IP20
Product Description	SINAMICS V20 converter, IP20, air cooling, analog and digital I/Os, Modbus RTU and USS
Functional Unit	Speed control of asynchronous motors. Calculation of the environmental impacts is based on 15 years of product service lifetime[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 1.0 kg adds up with packaging weight of 0.11 kg to a total weight of 1.11 kg. Packaging consists of: Corrugated box, PET, polyethylene foam and paper.

Product Weight 1.0 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:
China (standard mix)

Transportation model:
Truck, 7.5 t - 12t gross weight 1000km

Energy model used:
Europe (standard mix)

Distribution scenario:
Truck, 7.5 t - 12t gross weight 1000 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:
APAC

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).

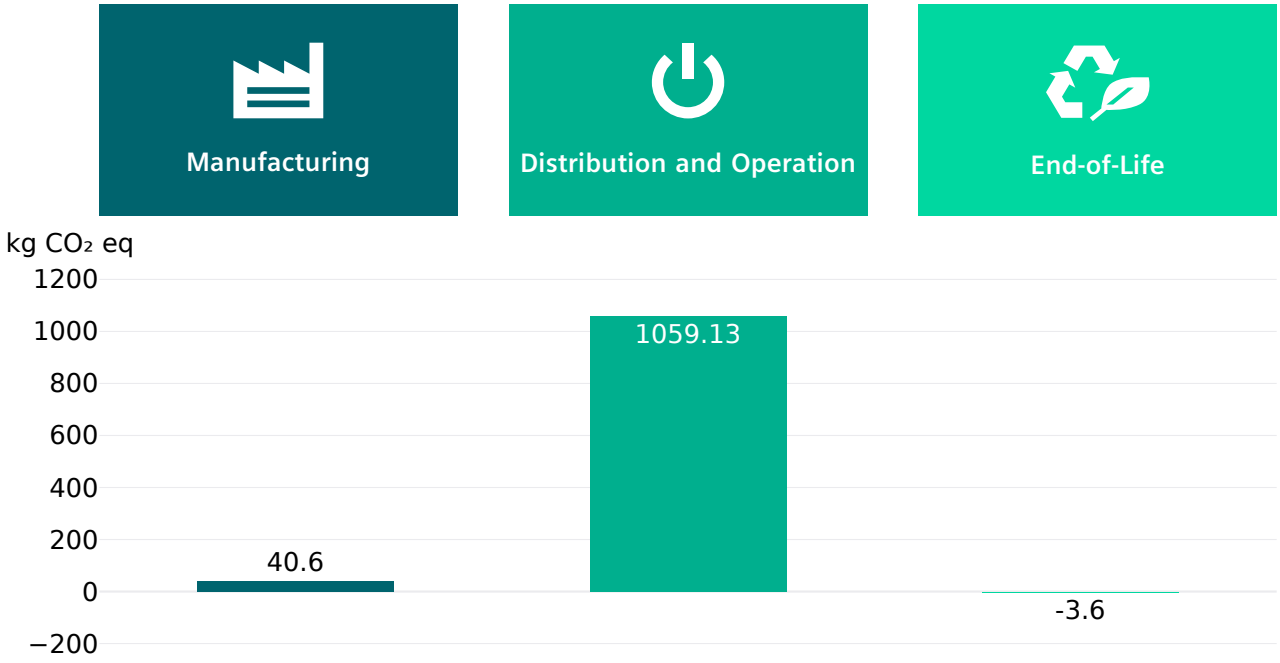
To ensure the high quality and completeness of the LCA results, Primary Data have been used whenever possible. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting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

Impact Category	Unit	Total	Manufacturing	Distribution	Operation	End-of-life
Acidification	Mole of H+ eq	2.42E+0	2.32E-1	3.58E-4	2.24E+0	-4.57E-2
Climate change – total	kg CO_2 eq	1.10E+3	4.06E+1	2.47E-1	1.06E+3	-3.60E+0
Climate change – fossil	kg CO_2 eq	1.09E+3	4.05E+1	2.44E-1	1.05E+3	-3.60E+0
Climate change – biogenic	kg CO_2 eq	9.35E+0	6.42E-2	6.66E-4	9.29E+0	-4.12E-3
Climate Change, land use and land use change	kg CO_2 eq	1.34E-1	2.18E-2	2.30E-3	1.14E-1	-1.98E-3
Ecotoxicity, freshwater – total	CTUe	6.34E+3	2.21E+2	2.42E+0	6.13E+3	-1.78E+1
Eutrophication, freshwater	kg P eq	4.06E-3	1.30E-4	9.06E-7	3.93E-3	-2.64E-6
Eutrophication, marine	kg N eq	5.65E-1	3.31E-2	1.28E-4	5.36E-1	-4.66E-3
Eutrophication, terrestrial	Mole of N eq	5.91E+0	3.59E-1	1.53E-3	5.60E+0	-5.09E-2
Human toxicity, cancer – total	CTUh	3.48E-7	2.46E-8	4.91E-11	3.24E-7	-1.53E-9
Human toxicity, non-cancer – total	CTUh	5.58E-6	4.53E-7	2.18E-9	5.17E-6	-4.34E-8
Ionising radiation, human health	kBq U235 eq	5.83E+2	2.11E+0	9.46E-4	5.81E+2	-4.29E-1
Land Use	dimensionless (pt)	8.76E+3	8.01E+1	1.41E+0	8.69E+3	-4.98E+0
Ozone depletion	kg CFC-11 eq	2.00E-8	6.36E-10	3.22E-14	1.94E-8	-2.54E-11
Particulate matter	Disease incidences	2.29E-5	4.53E-6	3.12E-9	1.88E-5	-4.87E-7
Photochemical ozone formation, human health	kg NMVOC eq	1.52E+0	1.02E-1	3.12E-4	1.43E+0	-1.48E-2
Resource use, fossils	MJ	2.25E+4	5.12E+2	3.38E+0	2.20E+4	-5.06E+1
Resource use, mineral and metals	kg Sb eq	2.06E-2	2.18E-2	1.64E-8	1.62E-4	-1.39E-3
Water use	m^3 world eq	2.39E+2	9.42E+0	2.99E-3	2.31E+2	-1.05E+0

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. 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 47% mainly due to high metal content
- **an** energy recoverability of up to 27% from plastic materials
- **a** minimum disposal rate of 25%

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.

Appendix

For other MLFBs covered by this EPD under SINAMICS V20 homogenous product family, the climate change impact (CC) in kg CO_2 eq. can be calculated for the manufacturing and end of life phases using linear regression equations according to the weight (Mass) in kg of the assessed product. Climate change impact of use phase referring to Table 1.1-1.4 and mass of V20 modules referring to Table 2.1-2.2.

The following equations based on linear regression is defined as:

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

where,

y .... climate change in kgCO_2eq.

m.... scaling factor (without dimension)

x .... mass of the inverter in kg

b .... intercept (offset) in kg

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

m = 23.26, b= 17.02

For **End of Life**:

m = -3.43, b= -0.09

For the operation phase, the climate change in kgCO_2eq was derived for 230 V and 400 V and rated power PR (LO) in kW for European standard energy mix, lifetime of 15 years, annual operation 5000h/year and three operational points.

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

Table 1.1 Climate change impact of use phase

Version	Unfiltered									
Voltage	V	230	230	230	230	230	230	230	230	230
PR(LO)	kW	0.12	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3
Climate change	kg CO_2eq	538	639	722	895	955	1128	1576	2095	2429

Table 1.2 Climate change impact of use phase

Version	Filtered									
Voltage	V	230	230	230	230	230	230	230	230	230
PR(LO)	kW	0.12	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3
Climate change	kg CO_2eq	539	640	726	901	964	1138	1592	2125	2473

Table 1.3 Climate change impact of use phase

Version	Unfiltered														
Voltage	V	400	400	400	400	400	400	400	400	400	400	400	400	400	400
PR(LO)	kW	0.37	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	18.5/22	22/30
Climate change	kg CO_2eq	668	725	742	910	1059	1332	1701	1973	2386	3140	4377	5030	6543	7193

Table 1.4 Climate change impact of use phase

Version	Filtered														
Voltage	V	400	400	400	400	400	400	400	400	400	400	400	400	400	400
PR(LO)	kW	0.37	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	18.5/22	22/30
Climate change	kg CO_2eq	668	725	742	910	1059	1332	1703	1976	2393	3146	4393	5054	6569	7232

Table 2.1 Mass of modules

Voltage(V)	Version	MLFB	Power Rating(kW)	Mass(kg)
230	Unfiltered	6SL3210-5BB11-2UV1	0.12	0.6
		6SL3210-5BB12-5UV1	0.25	0.6
		6SL3210-5BB13-7UV1	0.37	0.6
		6SL3210-5BB15-5UV1	0.55	0.8
		6SL3210-5BB17-5UV1	0.75	0.8
		6SL3210-5BB21-1UV1	1.1	1.2
		6SL3210-5BB21-5UV1	1.5	1.2
		6SL3210-5BB22-2UV1	2.2	1.9
		6SL3210-5BB23-0UV1	3	1.9
	Filtered	6SL3210-5BB11-2BV1	0.12	0.7
		6SL3210-5BB12-5BV1	0.25	0.7
		6SL3210-5BB13-7BV1	0.37	0.7
		6SL3210-5BB15-5BV1	0.55	0.9
		6SL3210-5BB17-5BV1	0.75	0.9
		6SL3210-5BB21-1BV1	1.1	1.4
		6SL3210-5BB21-5BV1	1.5	1.4
		6SL3210-5BB22-2AV1	2.2	2.2
		6SL3210-5BB23-0AV1	3	2.2

Table 2.2 Mass of modules

Voltage(V)	Version	MLFB	Power Rating(kW)	Mass(kg)
400	Unfiltered	6SL3210-5BE13-7UV0	0.37	0.9
		6SL3210-5BE15-5UV0	0.55	0.9
		6SL3210-5BE17-5UV0	0.75	0.9
		6SL3210-5BE21-1UV0	1.1	1
		6SL3210-5BE21-5UV0	1.5	1
		6SL3210-5BE22-2UV0	2.2	1
		6SL3210-5BE23-0UV0	3	1.6
		6SL3210-5BE24-0UV0	4	1.6
		6SL3210-5BE25-5UV0	5.5	2.4
		6SL3210-5BE27-5UV0	7.5	3.7
		6SL3210-5BE31-1UV0	11	3.7
		6SL3210-5BE31-5UV0	15	3.9
		6SL3210-5BE31-8UV0	18.5/22	6.2
		6SL3210-5BE32-2UV0	22/30	6.4
	Filtered	6SL3210-5BE13-7CV0	0.37	1
		6SL3210-5BE15-5CV0	0.55	1
		6SL3210-5BE17-5CV0	0.75	0.9
		6SL3210-5BE21-1CV0	1.1	1.1
		6SL3210-5BE21-5CV0	1.5	1.1
		6SL3210-5BE22-2CV0	2.2	1.1
		6SL3210-5BE23-0CV0	3	1.8
		6SL3210-5BE24-0CV0	4	1.8
		6SL3210-5BE25-5CV0	5.5	2.6
		6SL3210-5BE27-5CV0	7.5	4
		6SL3210-5BE31-1CV0	11	4.1
		6SL3210-5BE31-5CV0	15	4.3
		6SL3210-5BE31-8CV0	18.5/22	6.8
		6SL3210-5BE32-2CV0	22/30	7

Legal Disclaimer

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