Product Environmental Profile

Variable speed drive ACS580-04 Frame R10 250 to 355 kW

In accordance with ISO 14025:2006

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Registration number: ABBG-00151-V01.02-EN

START

Company information

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB's success is driven by about 105,000 talented employees in over 100 countries.

ABB Motion keeps the world turning, while saving energy every day. Our pioneering drives, motors, generators products and integrated digital powertrain solutions are driving the low-carbon future for industries, cities, infrastructure and transportation. Through our global presence we are always close to our customers. We help them optimize energy efficiency, and improve safety, reliability and performance.

Aiming to achieve these crucial sustainability targets by 2030

Our 2030 sustainability targets, as shown in this image, are intended to help ABB enable a low-carbon society, promote social progress and preserve natural resources. Working with our customers and suppliers, our aim is to firmly embed sustainable practices across our complete value chain in every step of the lifecycle of our products and solutions. We are equally committed to driving social progress, along with our suppliers and in our communities.

A key part of ABB's 2030 sustainability strategy is to work to support our customers' and suppliers' efforts to reduce their emissions, and aim to achieve carbon neutrality in our own operations. Our greenhouse gas emissions reduction targets have been validated by the Science Based Targets initiative as being in line with the 1.5 °C scenario of the Paris Agreement.

To ensure that we are focused on achieving our goals, the ABB sustainability targets are integrated into our decision-making processes, and we have accountabilities and incentive plans in place to drive the appropriate actions.

Link to our website

Abbreviations

ABS	Acrylonitrile butadiene styrene
APOS	Allocation at point of substitution
CTU	Comparative toxic unit
DOL	Direct on line
EoL	End of life
HVAC-R	Heating, ventilation, air conditioning and refrigeration
LCA	Life cycle assessment
LCIA	Life cycle impact assessment
PC	Polycarbonate
PCBA	Printed circuit board assembly
PCR	Product Category Rules
PE	Polyethylene
PEP	Product Environmental Profile
PSR	Product Specific Rules
PVC	Polyvinyl chloride
R factors	Proportions of recyclable materials
VSD	Variable speed drive
WEEE	Waste from Electric and Electronic Equipment

Production plant location of ABB: Helsinki, Finland

Product information

This environmental product declaration describes the environmental performance of Variable speed drive ACS580-04-650A-4.

Product group: Electrical, Electronic and HVAC-R products

Representative product	Variable speed drive ACS580-04-650A-4, nominal power 355 kW
Product description	Variable speed drive (VSD) is used to control the speed and torque of (three phase) electrical motors (e.g asynchronous, permanent magnet and synchronous reluctance motors), which are used in compressors, conveyors, mixers, pumps, centrifuges, fans and many other variable and constant torque applications in different industries. The benefits of VSD control are gained because of precise process control, which leads to significant energy savings due to the optimal speed being applied at all times.
UN CPC code	UN CPC 46122
Total mass of the product including product package	193 kg
Reference lifetime	10 years

Product range covered

Product	P_N (kW)	I_N (A)	U_N (V)	Enclosure class
ACS580-04-505A-4	250	505	400	IP00
ACS580-04-585A-4	315	585	400	IP00
ACS580-04-650A-4 (representative product)	**355**	**650**	**400**	**IP00**

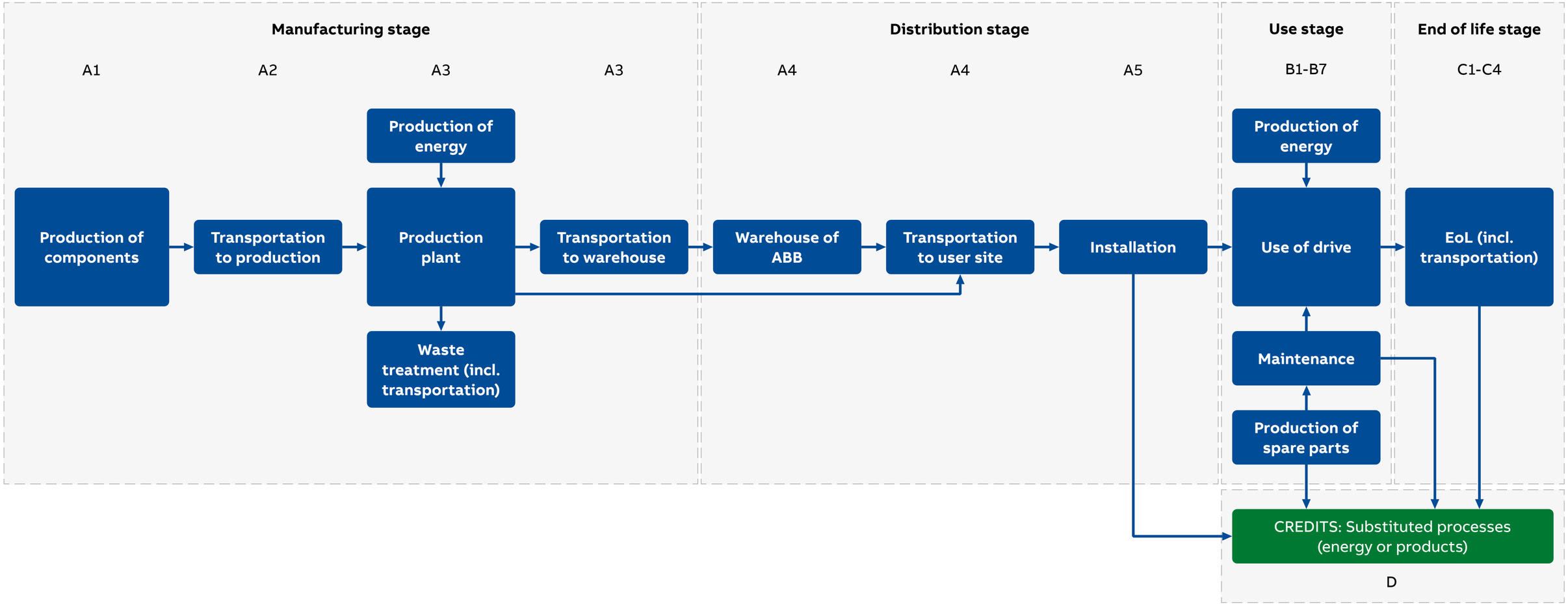
LCA information

Scope definition

Functional unit	To control the speed and torque of three phase motors (Asynchronous and Permanent Magnet motors) in energy management for machine applications. Calculation of the environmental impacts is based on 10 years of product service lifetime. The usage profile considered is 12.5% uptime in use phase at 100 % loading rate, 12.5% uptime in use phase at 49% loading rate, 12.5% uptime in use phase at 21.6% loading rate, 12.5% uptime in use phase at 8.4% loading rate, 10% uptime in standby phase and 40% in OFF phase.
System boundary	Throughout the whole life cycle of the product, including also net loads and benefits beyond system boundaries.
Description of data representativeness	Primary data used in the modelling represents the year 2022. Helsinki plant data is allocated based on annual data of 2021. Production of energy consumed in the manufacturing is modelled according to the country in question based on market mix. Use stage modelling represents as average European user of the product. Technological and geographical representativeness otherwise is as good as possible based on data availability.
Allocation methods applied	At the point of substitution for EoL allocation. Allocation choices in secondary datasets may vary between datasets.
Cut-off rule applied and main exclusions	Cut-off according to applied PCR: The mass, energy flows or environmental impacts of intermediate flows not considered shall be less than or equal to 5% of the mass of the elements/total energy consumption or environmental impacts of the reference product corresponding to the functional unit.
Modelling software	SimaPro 9.4.0.2
Secondary dataset	Ecoinvent 3.8 (APOS system model)

LCA information

System boundary



LCA information

Main assumptions used in the modelling

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Manufacturing

Component manufacturing

Component manufacturing is fully modelled with secondary data since the supplier-specific data was not available. Some of the components are modelled with component specific average data (e.g. PCBAs) and the rest of the components with material specific (e.g. ABS plastic part) secondary data. Component specific data was used whenever it was available in Ecoinvent database.
For components manufactured within Europe, European average datasets were used whenever available. Otherwise, global average datasets for component manufacturing were used.
Thus, the energy model is either average Europe or Global.

Manufacturing at ABB site

Data about the energy consumption and waste generation was obtained for one year for whole plant. It was allocated between production lines. Energy model for manufacturing at ABB site is based on local electricity market mix and supplier specific district heat.

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Distribution

Distribution of products is modelled based on primary data of the year 2021. Distribution considers the whole transportation route from centralized warehouses and ABB manufacturing sites to customers. Weighted average distribution route was applied in the modelling.

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Installation

Installation stage considers production of cables and mounting bolts. Waste management of packing materials of the product is also included. Energy consumption in installation is negligible and is excluded.

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Use stage

The use profile considered is 12.5% uptime in use phase at 100% loading rate, 12.5% uptime in use phase at 49% loading rate, 12.5% uptime in use phase at 21.6% loading rate, 12.5% uptime in use phase at 8.4% loading rate, 10% uptime in standby phase and 40% in OFF phase for a reference service life of 10 years. Supply voltage is 400 V and default switching frequency is used. Use stage energy model is based on Europe without Switzerland consumption mix data (of year 2014).
Thus, the use stage related environmental impacts are likely to be different at the user site depending on the origin of energy consumed. More information about ABB products load points at https://ecodesign.drivesmotors.abb.com/drive.

Production of replacement parts and waste treatment of removed parts are considered in the use stage.

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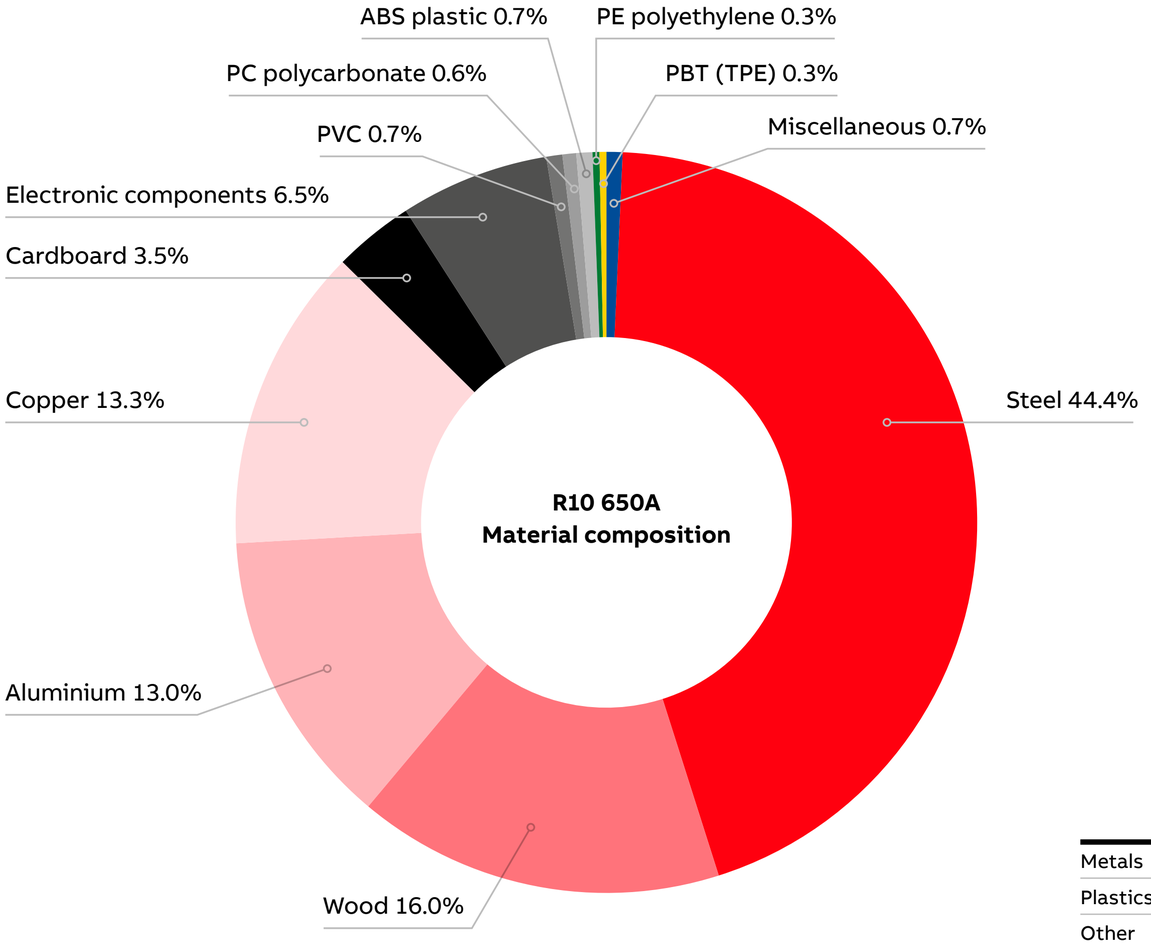
End of life stage

EoL treatment of the product is modelled based on the ABB recycling instructions. R factors of PEF requirements are applied for EoL modelling to estimate the share of materials directed for material and energy recovery and landfilling after manual dismantling and mechanical treatment of WEEE waste. Energy model is applied similarly to the component manufacturing stage.

Content declaration

Product and its package under study consists of:



Biogenic carbon content		
Biogenic carbon content of product	0.00	kg C
Biogenic carbon content of product package	17.69	kg C

Metals	71%
Plastics	2%
Other	27%

Environmental performance

Life cycle impact assessment results – core impact indicators

Impact category		Unit	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads	TOTAL (without benefits and loads)
Global warming	TOTAL	kg CO_2 eq.	1.80E+03	2.54E+01	1.05E+02	8.06E+04	2.01E+02	-3.81E+02	8.27E+04
	Fossil	kg CO_2 eq.	1.86E+03	2.54E+01	4.00E+01	8.03E+04	2.00E+02	-3.79E+02	8.25E+04
	Biogenic	kg CO_2 eq.	-6.48E+01	0.00E+00	6.48E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Land use and land use change	kg CO_2 eq.	3.43E+00	1.57E-02	1.61E-01	2.26E+02	1.86E-01	-1.64E+00	2.29E+02
Ozone depletion		kg CFC-11 eq.	1.33E-04	5.19E-06	5.46E-06	5.14E-03	1.21E-05	-4.19E-05	5.29E-03
Acidification of soils and water		mole H^+ eq.	2.49E+01	6.87E-01	1.76E+00	4.94E+02	2.34E+00	-1.48E+01	5.24E+02
Eutrophication	Freshwater	kg P eq.	3.38E+00	9.92E-04	1.36E-01	8.29E+01	1.34E-01	-1.17E+00	8.66E+01
	Marine	kg N eq.	3.22E+00	1.70E-01	1.14E-01	8.04E+01	1.92E-01	-9.46E-01	8.41E+01
	Terrestrial	mole N eq.	4.23E+01	1.89E+00	1.40E+00	7.04E+02	2.23E+00	-1.18E+01	7.52E+02
Photochemical ozone formation		kg NMVOC eq.	1.15E+01	4.93E-01	3.85E-01	1.95E+02	6.52E-01	-3.41E+00	2.08E+02
Depletion of abiotic resources	Minerals, metals	kg Sb eq.	3.59E-01	3.85E-05	3.97E-02	1.05E+00	4.74E-02	-3.35E-01	1.49E+00
	Fossil fuels	MJ	2.30E+04	3.36E+02	6.68E+02	1.72E+06	1.67E+03	-5.05E+03	1.75E+06
Water deprivation		m^3 world eq.	6.09E+02	7.57E-01	3.82E+01	2.66E+04	7.93E+01	-3.44E+02	2.73E+04

Environmental performance

Life cycle impact assessment results – additional impact indicators

Impact category		Unit	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads	TOTAL (without benefits and loads)
Particulate matter		Disease incidences	1.56E-04	1.21E-06	5.24E-06	1.64E-03	1.03E-05	-4.98E-05	**1.81E-03**
Ionizing radiation		kBq U235 eq.	2.13E+02	1.54E+00	7.32E+00	4.62E+04	2.15E+01	-5.96E+01	**4.65E+04**
Ecotoxicity		CTUe	2.75E+05	2.22E+02	1.37E+04	1.46E+06	1.79E+04	-1.17E+05	**1.77E+06**
Human toxicity	**Cancer**	CTUh	5.17E-06	1.29E-08	3.48E-07	3.58E-05	2.67E-06	-3.56E-06	**4.40E-05**
	Non cancer	CTUh	1.84E-04	1.67E-07	2.20E-05	1.12E-03	5.43E-05	-1.86E-04	**1.38E-03**
Land use/soil quality index		–	1.55E+04	1.19E+02	7.89E+02	3.59E+05	1.55E+03	-6.61E+03	**3.77E+05**

Environmental performance

Life cycle inventory results – resource use indicators

Parameter	Unit	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads
Use of renewable primary energy resources as energy	MJ	9.34E+02	7.79E-01	4.51E+01	5.08E+04	7.63E+01	-4.58E+02
Use of renewable primary energy resources as raw materials	MJ	5.05E+02	0.00E+00	0.00E+00	6.54E+00	0.00E+00	0.00E+00
Total use of renewable primary energy	MJ	1.44E+03	7.79E-01	4.51E+01	5.08E+04	7.63E+01	-4.58E+02
Use of non-renewable primary energy as energy	MJ	2.25E+04	3.35E+02	6.24E+02	1.72E+06	1.67E+03	-5.05E+03
Use of non-renewable primary energy as raw materials	MJ	4.09E+02	1.44E+00	4.37E+01	7.23E+01	0.00E+00	0.00E+00
Total use of non-renewable primary energy	MJ	2.30E+04	3.36E+02	6.68E+02	1.72E+06	1.67E+03	-5.05E+03

Life cycle inventory results – indicators describing the use of secondary materials, water and energy resources

Parameter	Unit	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads
Use of secondary materials	kg	2.21E+01	0.00E+00	4.08E-02	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	1.73E+01	2.21E-02	9.65E-01	1.62E+03	2.02E+00	-8.61E+00

Environmental performance

Life cycle inventory results – waste flow and output flow indicators

Parameter	Unit	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads
Hazardous waste disposed	kg	2.27E-01	4.20E-04	4.79E-02	1.39E+00	1.61E+02	-3.50E-02
Non-hazardous waste disposed	kg	3.93E+02	7.63E+00	5.54E+01	6.61E+03	7.17E+01	-1.52E+02
Radioactive waste disposed	kg	7.59E-02	2.32E-03	2.67E-03	1.25E+01	1.11E-02	-2.22E-02
Components for re-use	kg	1.47E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	2.31E+01	0.00E+00	3.39E+00	4.71E+00	1.12E+02	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Environmental performance

Determination of the environmental impacts of the other products with the same frame size

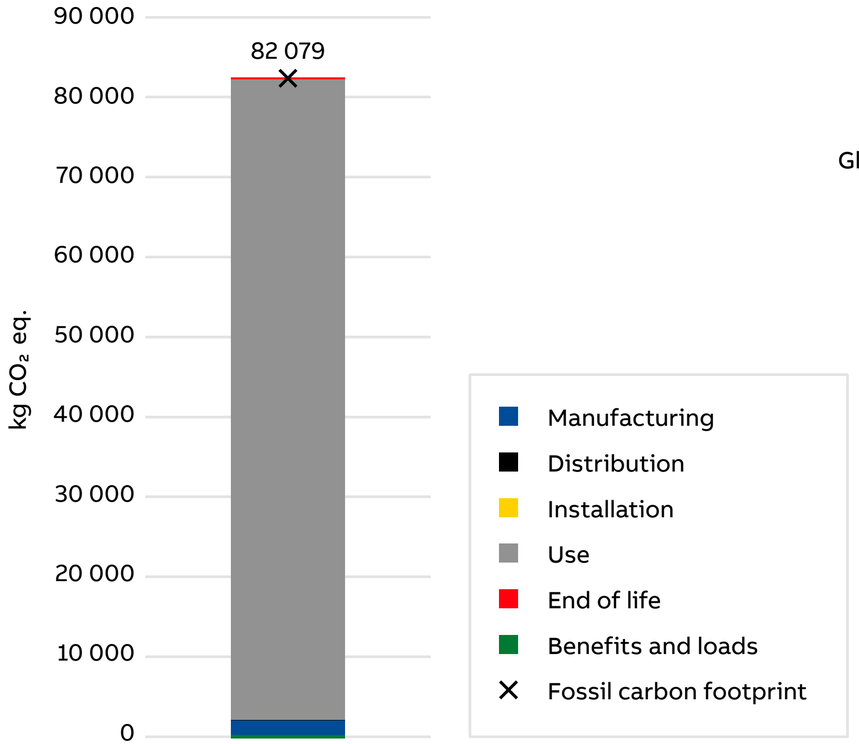
According to the conducted LCA study, proportionality rules to evaluate the environmental impacts of other products from this product family have been defined. To estimate the environmental impact of a specific product, the LCIA results presented in this PEP document for each life cycle stage should be multiplied with the factor presented in table below to estimate the environmental impacts from them.

Products	Manufacturing	Distribution	Installation	Use	End of life	Benefits and loads
ACS580-04-505A-4	0.998	0.997	1.000	0.825	0.997	0.997
ACS580-04-585A-4	1.000	1.000	1.000	0.863	1.000	1.000
ACS580-04-650A-4 (representative product)	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Environmental performance
Summary

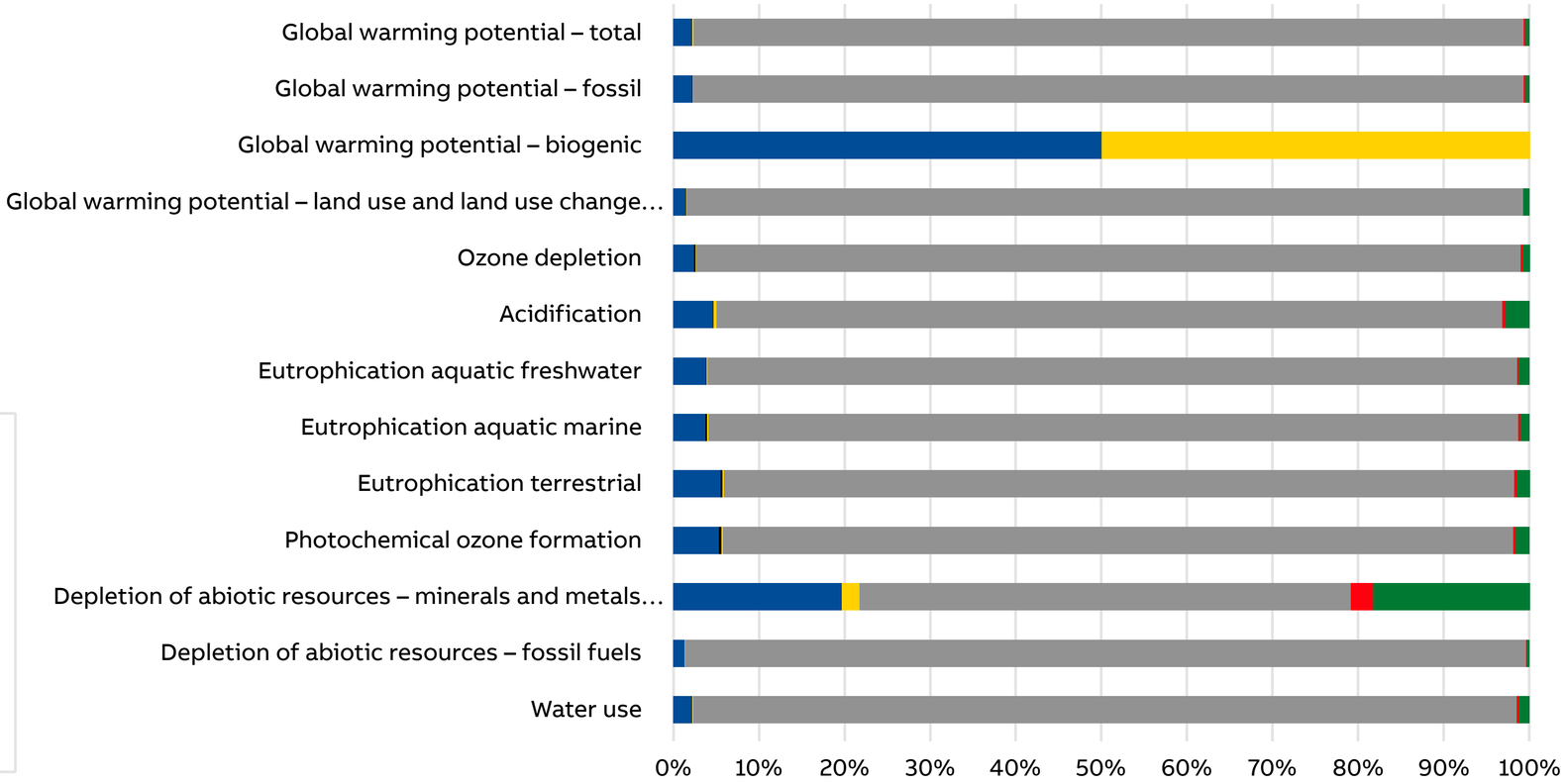
Global warming potential / ACS580-04-650A-4

Global warming potential fossil results – i.e. the carbon footprint results of studied variable speed drive including also the benefits and loads beyond life cycle.



Contribution analysis / ACS580-04-650A-4

Contribution of life cycle stages to the core environmental impacts.



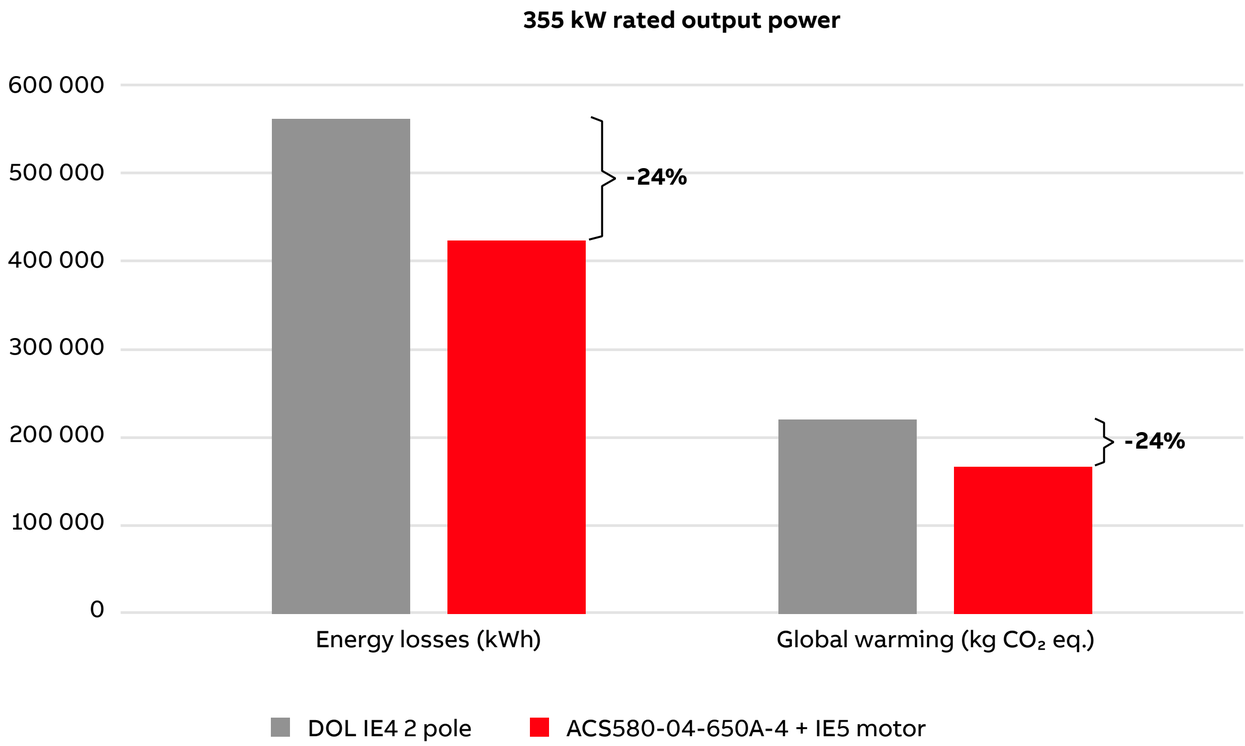
Additional environmental information

Energy savings, and potential for reduced emissions, when using a variable speed drive (VSD) to control an electrical motor

Using a variable speed drive (VSD) with an electrical motor enables significant energy savings and emission reduction compared to a Direct-on-Line (DOL) motor. The benefits of VSD control are gained via precise process control, which leads to significant energy savings due to the optimal speed being applied at all times.

The figures below present the use stage energy losses and contribution to global warming of ACS580-04-650A-4 VSD + IE5 VSD motor system and an equivalent DOL motor. The losses and emissions have been calculated for the reference service life of the drive, which is 10 years.

Drive losses for each operating point have been calculated by applying the linear interpolation method taken from IEC61800-9-2. Rated current of the drive has been used in the calculation as 100% reference value. This is overestimating the drive losses (by up to +13%) as drive current is higher than motor current. DOL motor losses for each operating point are taken from IEC60034-30-1. VSD motor losses for each operating point have been calculated using interpolation method from IEC 60034-31.



Use stage energy losses and contribution to global warming of ACS580-04-650A-4 VSD + IE5 VSD motor system and an equivalent DOL motor.

Programme information and references

Commissioner of the study

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PEP are compliant with XP C08-100-1:2016 or EN 50693:2019 The elements of the present PEP cannot be compared with elements from another program.	
Document in compliance with ISO 14025:2006 Environmental labels and declarations. Type III environmental declarations.	

References

ISO. (2006a). ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures. Geneva: International Organization for Standardization.

ISO. (2006b). ISO 14040: Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO. (2006c). ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

PEP ecopassport® PROGRAM. (2021). Product Category Rules for Electrical, Electronic and HVAC-R Products, PCR-ed4-EN-2021 09 06. https://www.pep-ecopassport.org

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ABB Drives

Empowering your business, with profitable and sustainable efficiency

You base your business on efficiency and performance. You know that everything counts to make you more competitive. Our drives are made with all this in mind, empowering productivity and efficiency. They provide flexibility to help you optimize your processes and control, and reliable for less downtime. You also get premium service and expertise, anywhere on the globe.

Link to our website

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