Product Environmental Profile

SIGMA ELECTRIC VEHICLE CHARGING STATION

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COMPANY INFORMATION AND CONTACT

Jema is a benchmark company in the energy sector that has been innovating in the design and manufacture of energy conversion systems for 70 years and its business international scope involves European projects in nuclear fusion, electromobility, hydrogen, solar energy and energy storage. In 2009, Jema became part of Irizar Group, a leading business group in the bus and coach sector, a reference in the electronics, communication (ITS solutions) and rotating machinery sectors.

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PRODUCT DESCRIPTION & HOMOGENEOUS ENVIRONMENTAL FAMILY

SIGMA Electric Vehicle Charging Infrastructures (EVCIs) are modular electric vehicle chargers with a power range from 60 kW to 360 kW. SIGMA chargers can be configurated according to the selected power and energy output in order to be adapted to the customer requirements. Their compactness and modular design reduce their maintenance time, their noise and the space required for installation and operation.

SIGMA chargers can have up to 3 outputs from a single charger and can increase or decrease the given power depending on the needs of the vehicle. The interoperability of SIGMA chargers allows them to be used for numerous and diverse applications; while their maximum versatility for connection by pantograph and/or hose opens the option to several possible configurations.

Characteristic		SIGMA EVCI	Characteristic		SIGMA EVCI
Input data	Input voltage	400 VAC 3Ph + N + PE / 480 VAC 3Ph + N + PE	General data	Communications / OCPP	Ethernet / 1.6 port of communication
	Harmonic distortion and power factor	≤ 5% | 0.99		Standards	EC, IEC-61851, IEC 61000, DIN70121, ISO 15118
	Efficiency	≥ 95%		Operating temperature	- 20ºC to 40ºC nominal power
	Frequency	50/60 Hz		Relative humidity	10% to 95% without condensation
	Galvanic isolation	Yes		Altitude	2000 m above sea level
Output data	Output voltage range	150-1,000 VDC		Dimensions	2,150 x 800 x 800 mm
	Control structure	Logical control and DSP technology		Color	White structure (RAL7035)
Protection	Overvoltage / Overcurrent	Input and output		Protection class	IP54/IK10
	Reverse polarity	Yes		Degree of pollution	P3
	System for detecting insulation leaks	Yes		Corrosion	C4M
	Overheating	Yes (included with power regulation)		Ventilation	Forced air

Following the characteristics mentioned above, the reference technical properties of SIGMA EVCIs can be defined as:

Product family	Station type	Installation type	Charging type	Number of charging points	Charging mode	Presence of connected sockets	Reference power	Current type	Reference service life
Active product	Private or semi-public stations on a base and running on DC	Business	Fast	Up to 3 charging points (CCS or pantograph)	Mode 4	No	>=50kW	DC	10 years

In the case of this PEP, SIGMA charging stations between 60 and 180 kW of output power are analysed.

SIGMA EVCIs have the same dimensions since they have the same cabinet; but differ in their internal composition and, consequently, in their weight depending on the number of connections to the vehicle desired in their configuration. The configuration also affects the input and output power of the charging stations.

Characteristics	SIGMA 60	SIGMA 90	SIGMA 120	SIGMA 150	SIGMA 180	SIGMA 60D	SIGMA 90D	SIGMA 60T
Maximum input power (kVA)	64	95	125	155	186	125	186	186
Maximum input current (A)	116	174	232	290	348	232	348	348
Output power (kW)	60	90	120	150	180	2 x 60 / 120	2 x 90 / 180	3 x 60 /180
Maximum output current (A)	200	250	250	250	CCS 250 Pantogr. 375	CCS 250 Pantogr. 375	CCS 250 Pantogr. 375	CCS 250 Pantogr. 375
Connexion to the vehicle	CCS: 5m	CCS: 5m or pantogr	CCS: 5m or pantogr	CCS: 5m or pantogr	CCS: 5m or pantogr	2 output CCS: 5m or pantogr.		3 output CCS: 5m or pantogr.

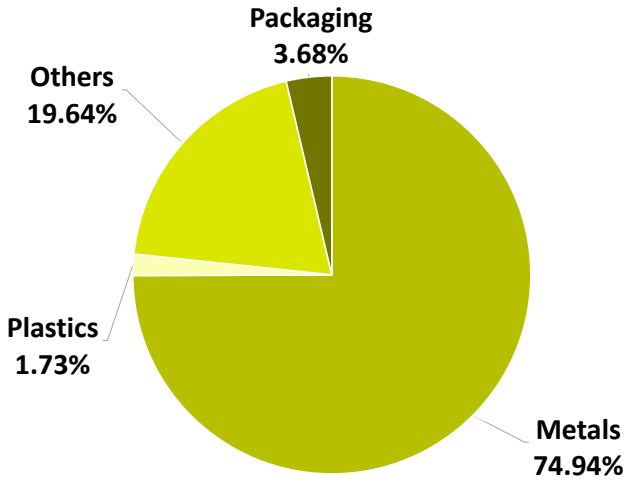
The reference product for the PEP from this product family is **SIGMA 60 T charging station.**

The present declaration is valid for all the products in the SIGMA homogeneous environmental family. The extrapolation-coefficient table provided in section *Extrapolation factors* shall be used to extrapolate the impact of the reference product to the other products from SIGMA family.

CONSTITUENT MATERIALS

SIGMA electric chargers are mainly composed of metal, plastic and electronic components. The chargers are packed on a wooden pallet wrapped with a plastic packaging film and protective cardboard corners.

Material		Weight (kg)	Share (%)
Metal 74.94%	Steel	3.53E+02	57.58%
	Aluminium	2.77E+01	4.51%
	Brass	2.34E+01	3.82%
	Copper	2.29E+01	3.73%
	Other metals	3.26E+01	5.31%
Plastics: 1.73%	Polyamide	4.51E+00	0.74%
	Polycarbonate	2.04E+00	0.33%
	Other plastics	4.06E+00	0.66%
Others 19.64%	Electronic components	6.41E+01	10.44%
	Filters	3.78E+01	6.15%
	Other materials	1.87E+01	3.05%
Packaging 3.68%	Wood	2.10E+01	3.42%
	Plastic film	4.24E-01	0.07%
	Cardboard	1.18E+00	0.19%
Reference product		**5.91E+02**	**96.32%**
Packaging		**2.26E+01**	**3.68%**
TOTAL		**6.14E+02**	**100.00%**



All the components of the reference product have been included in the analysis, including the charging cables.

The elements used for connecting the station to the mains grid and to the monitoring and communication network are excluded.

FUNCTIONAL AND DECLARED UNIT

Functional unit: “Supply 1 kW to one electrical vehicle, through a private or semi-public station on a base and running on direct current, during 10 years, following the corresponding use case scenario for active products for private or semi-public stations on a base and running on direct current, as described in PSR0018 and its annex.”

This functional unit refers to the provisions of a finite quantity of energy to a vehicle and the temporal dimension is integrated through the reference scenario between product and function. In order to facilitate the understanding and integration of the results in larger systems (i.e. buildings, parking, etc.), the results can be declared in a declared unit.

Declared unit: “To ensure the recharging of electric vehicles through three recharging points (3 output CCS or pantograph) of a private or semi-public station on a base and running on direct current, in mode 4, characterised by a total output power of 180 kW with a maximum output current of 250A for CCS and 375 A for pantograph, during a reference lifetime of 10 years, with IP 54 and IK10.”.

For the correlation between the functional unit and the reference product, the environmental declared is calculated as follows:

Environmental impact of the PEP for 1 kWh = Environmental impact of the reference product / Quantity of energy supplied to one or more vehicle by the EVCI over its RL

Life Cycle Assessment Information

Reference service life: 10 years

Time representativeness: The data collection from factory are from 01/01/2022 to 31/12/2022. In this study, no datasets older than 10 years were used.

Technical representativeness: All the manufacturing data used to model the process and obtain the Life Cycle Inventory are specific data and have been obtained by measurements made during the period from 01/01/2023 to 31/12/2023. This data is representative of the different processes implemented during the manufacturing process. The data has been measured directly at the company's own premises.

For the installation, use and end-of-life stages, scenarios based on reliable sources have been used (i.e. default scenarios defined by the PSR-0018 & Standard EN 50693).

Database and LCA software used: For this study, Ecoinvent database version 3.9 has been used as it is the most complete and highest quality European life cycle database. Ecoinvent 3.9 contains the most extensive and updated information and its scope coincides with the geographical, technological and temporal area of the project. The LCA was modelled with Simapro software version 9.5.0.1.

SYSTEM BOUNDARIES

Manufacturing stage			Distribution stage	Installation stage	Use stage							End-of-life stage				Benefits
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport to the customer	Construction/installation process	Use of the installed product in terms of emissions	Maintenance	Repair	Replacement	Rehabilitation	Energy consumption during the use phase	Water consumption during the use phase	Demolition/disassembly	Transport to waste treatment	Waste treatment for reuse, recovery and/or recycling	Elimination	Benefits and loads beyond the system
Inc.	Inc.	Inc.	Inc.	Inc.	Not inc.	Inc.	Not inc.	Inc.	Not inc.	Inc.	Not inc.	Inc.	Inc.	Inc.	Inc.	Inc.

MANUFACTURING STAGE (Modules A1-A3)

This initial stage includes the production, industrial transformation, manufacturing processes and transportation of raw materials and components making up the reference product. The components of the product received from suppliers, as well as the packaging materials, are assembled, packaged and tested by Jema Energy in their Lasarte-Oria (Spain) manufacturing plant. The generated wastes attributed to the manufacturing of the reference product have also been taken into account.

This manufacturing stage has been divided into three modules: A1 Raw material extraction and processing, A2 Transport of raw materials to the manufacturer and A3 Manufacturing.

DISTRIBUTION STAGE (Module A4)

The chargers are directly distributed from Jema´s manufacturing plant to the final customers. The distribution scenario includes the transportation by lorry of the packaged charging stations to their place of installation.

INSTALLATION STAGE (Module A5)

The chargers are provided to the client with additional elements for installation. The installation does not require electricity consumption, except for the commissioning of the equipment after the installation to ensure a proper functioning. In this stage, the end-of-life of packaging of the reference product is considered.

USE STAGE (Modules B1-B7)

The use stage of the SIGMA chargers is composed of the regular maintenance operations (module B2), the periodical replacement of the filters and fans (module B4), and the energy consumption of the equipment during its reference service life (module B6).

First, Jema ensures the correct operation of the chargers through annual preventive maintenance operations. These operations involve the travelling of a technician to the place of installation for an on-site visual inspection and condition checking of the internal components, a cleaning to remove dust, dirt and foreign bodies of the internal and external parts; and even test operation of the emergency systems and switch systems of the chargers. In addition to these preventive operations, the maintenance includes an annual replacement of the inlet air filters and a 5-year replacement of the fans.

Second, the energy consumption by the reference product during its reference lifetime is included in this stage. The usage scenario for all the products of SIGMA family is defined as *Active products running on direct current (DC)* group while their station type is *Products for private or semi-public use and running on DC.*

According to this definition by the PSR, the energy consumption associated with base-mounted stations intended for private or semi-public use and running on direct current is associated with 1) the energy dissipated during the usage phase and 2) the intrinsic consumption of the station. For the calculation of the electricity consumption, the following characteristics of the reference product have been taken into consideration:

Parameter	Reference product - SIGMA 60T
Reference service lifetime	10 years
Number of simultaneous charging points	3
Station power of each charging point	60 kW
Number of charges per day	1 charge per day
Effective charging time	6 hours
Converter yield	95%

END-OF-LIFE STAGE (Modules C1-C4)

End-of-life stage is breakdown in deconstruction (module C1), the transport to the waste manager (C2), the waste treatment for recycling, recovery or reuse (C3), and the elimination (C4) through disposal and/or incineration. As SIGMA chargers are innovative products for which little time has passed since they were placed on the market, currently no charging station installed by Jema has reached the end of its useful life. For this reason, the end-of-life scenario has been obtained from data from the PCR and the PSR due to the lack of specific data.

Taken into account these modules, the end-of-life scenario includes the manual dismantling process of the reference product, its transport to the waste manager (1,000 km by lorry) and the treatment method of the separated parts. As no data about treatment method is available, table G-4 of the EN 50693 standard has been used in order to simulate the treatment scenario.

ENVIRONMENTAL IMPACTS

The Environmental impacts of the reference product (SIGMA 60T) have been calculated at the declared unit level and the functional unit level separately. Total column impact is the sum of the manufacturing, distribution, installation, use and end-of-life stages, excluding Benefits.

Environmental impacts of the reference product per Declared Unit:

Impact category	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
GWP - Total	kg CO_2 eq.	**1.73E+06**	7.57E+03	8.26E+01	2.79E+00	7.65E+03	9.11E+01	1.04E+01	2.98E+03	1.54E+03	1.72E+06	1.72E+06	5.05E+00	1.10E+02	5.72E+01	1.85E+02	3.58E+02	-1.04E+03
GWP – Fossil	kg CO_2 eq.	**1.59E+06**	7.54E+03	8.25E+01	2.70E+00	7.62E+03	9.10E+01	7.23E+00	2.98E+03	1.53E+03	1.58E+06	1.59E+06	5.33E+00	1.10E+02	5.72E+01	1.84E+02	3.57E+02	-1.05E+03
GWP – Biogenic	kg CO_2 eq.	**1.39E+05**	8.54E+00	4.83E-02	8.73E-02	8.67E+00	7.00E-02	3.17E+00	4.34E-01	6.65E+00	1.39E+05	1.39E+05	-2.93E-01	9.97E-02	2.75E-02	8.61E-01	6.95E-01	2.03E+01
GWP - Luluc	kg CO_2 eq.	**3.76E+02**	2.34E+01	4.68E-02	7.29E-03	2.35E+01	4.28E-02	5.32E-03	6.13E-01	1.65E+00	3.50E+02	3.52E+02	5.90E-03	5.35E-02	2.02E-02	1.63E-01	2.42E-01	-7.13E+00
OD	kg CFC-11 eq.	**4.38E-02**	1.26E-03	1.64E-06	6.59E-08	1.26E-03	1.99E-06	1.59E-07	5.24E-05	4.90E-03	3.76E-02	4.26E-02	7.08E-08	2.40E-06	5.19E-07	9.92E-06	1.29E-05	-2.18E-05
AP	mol H+ eq.	**6.92E+03**	9.71E+01	8.97E-01	8.95E-03	9.80E+01	3.06E-01	2.57E-02	1.20E+01	7.30E+00	6.80E+03	6.82E+03	5.26E-02	3.59E-01	2.53E-01	2.68E-01	9.33E-01	-6.14E+01
EP - Freshwater	kg P eq.	**3.71E+01**	1.23E+00	5.64E-04	4.14E-05	1.23E+00	7.35E-04	1.14E-04	1.81E-02	9.73E-02	3.58E+01	3.59E+01	1.45E-04	8.81E-04	3.38E-04	3.61E-03	4.97E-03	-1.05E-01
EP - Marine	kg N eq.	**9.98E+02**	1.08E+01	2.41E-01	2.01E-03	1.11E+01	1.05E-01	7.22E-03	4.30E+00	1.35E+00	9.81E+02	9.86E+02	7.68E-03	1.22E-01	9.44E-02	6.74E-02	2.92E-01	-1.48E+00
EP - Terrestrial	mol N eq.	**1.21E+04**	1.31E+02	2.64E+00	2.23E-02	1.33E+02	1.12E+00	7.73E-02	4.63E+01	1.42E+01	1.19E+04	1.20E+04	1.92E-01	1.30E+00	1.03E+00	7.43E-01	3.27E+00	-1.95E+01
POCP	kg NMVOC eq.	**5.04E+03**	4.18E+01	8.13E-01	8.77E-03	4.26E+01	4.77E-01	3.47E-02	1.59E+01	7.44E+00	4.97E+03	5.00E+03	2.68E-02	5.37E-01	3.25E-01	2.86E-01	1.17E+00	-9.47E+00
ADP - Elements	kg Sb eq.	**2.15E+01**	3.20E+00	2.12E-04	6.55E-06	3.20E+00	2.45E-04	4.34E-05	9.73E-03	4.42E-02	1.82E+01	1.83E+01	9.62E-05	3.54E-04	1.28E-04	1.97E-04	7.75E-04	-3.38E-01
ADP - Fossil fuels	MJ	**2.48E+07**	9.67E+04	1.12E+03	6.15E+01	9.79E+04	1.33E+03	1.26E+02	3.95E+04	3.03E+04	2.47E+07	2.47E+07	5.54E+01	1.56E+03	4.55E+02	8.16E+02	2.89E+03	-1.26E+04
Water use	m^3 eq. depriv.	**1.01E+06**	1.73E+03	4.05E+00	1.11E+00	1.74E+03	6.36E+00	1.46E+00	1.25E+02	3.47E+02	1.01E+06	1.01E+06	1.41E+00	6.37E+00	1.44E+00	1.81E+01	2.73E+01	-4.13E+02
GWP-GHG	kg CO_2 eq.	**1.61E+06**	7.58E+03	8.25E+01	2.74E+00	7.66E+03	9.11E+01	7.28E+00	2.98E+03	1.54E+03	1.60E+06	1.61E+06	5.41E+00	1.10E+02	5.72E+01	1.85E+02	3.58E+02	-1.06E+03

GWP: Global Warming Potential; OD: Ozone Depletion; AP: Acidification Potential of soil and water; EP: Eutrophication Potential; POCP: Photochemical Ozone Potential; ADP: Abiotic resources Depletion Potential; GHG: Greenhouse gases.

Inventory flows indicators of the reference product per Declared Unit:

Impact category	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
PERE	MJ	**8.22E+06**	1.18E+04	1.50E+01	1.55E+01	1.19E+04	1.95E+01	1.35E+00	4.14E+02	1.38E+03	8.20E+06	8.21E+06	1.58E+01	2.42E+01	1.60E+01	7.84E+01	1.34E+02	-3.24E+03
PERM	MJ	**2.53E+01**	2.17E+01	0.00E+00	0.00E+00	2.17E+01	0.00E+00	3.54E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	**8.22E+06**	1.19E+04	1.50E+01	1.55E+01	1.19E+04	1.95E+01	4.89E+00	4.14E+02	1.38E+03	8.20E+06	8.21E+06	1.58E+01	2.42E+01	1.60E+01	7.84E+01	1.34E+02	-3.24E+03
PENRE	MJ	**2.48E+07**	9.51E+04	1.12E+03	6.15E+01	9.63E+04	1.33E+03	9.58E+01	3.95E+04	3.03E+04	2.47E+07	2.47E+07	5.54E+01	1.56E+03	4.55E+02	8.16E+02	2.89E+03	-1.26E+04
PENRM	MJ	**1.66E+03**	1.63E+03	0.00E+00	0.00E+00	1.63E+03	0.00E+00	3.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	**2.48E+07**	9.67E+04	1.12E+03	6.15E+01	9.79E+04	1.33E+03	1.26E+02	3.95E+04	3.03E+04	2.47E+07	2.47E+07	5.54E+01	1.56E+03	4.55E+02	8.16E+02	2.89E+03	-1.26E+04
SM	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	**2.76E+04**	6.41E+01	1.42E-01	1.83E-02	6.43E+01	2.09E-01	4.53E-02	4.21E+00	1.04E+01	2.76E+04	2.76E+04	4.04E-02	2.23E-01	6.95E-02	6.11E-01	9.43E-01	-2.21E+01

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels;

Biogenic carbon content of the reference product per Declared Unit:

	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
Biogenic carbon content	Kg of C	**9.48E+00**	9.37E+00	0.00E+00	0.00E+00	9.37E+00	0.00E+00	1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Product	Kg of C	**3.01E-02**	3.01E-02															
Packaging	Kg of C	**9.34E+00**	9.34E+00															

Waste category indicators and output flow indicators of the reference product per Declared Unit:

Impact category	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
Hazardous waste disposed	kg	**1.69E+02**	1.31E+00	6.75E-03	1.88E-04	1.32E+00	8.27E-03	5.77E-04	2.77E-01	1.68E+00	1.08E+02	1.10E+02	7.62E-04	9.95E-03	2.55E-03	5.78E+01	5.78E+01	-6.92E-02
Non-hazardous waste disposed	kg	**1.22E+05**	1.11E+03	4.15E+01	1.99E-01	1.15E+03	1.17E+02	3.77E+00	3.44E+02	1.54E+02	1.20E+05	1.20E+05	6.34E+00	7.63E+01	3.46E+00	1.11E+02	1.97E+02	-4.27E+02
Radioactive waste disposed	kg	**5.32E+01**	2.00E-01	3.03E-04	3.82E-04	2.01E-01	4.06E-04	1.24E-04	7.17E-03	2.47E-02	5.30E+01	5.30E+01	4.23E-05	5.08E-04	2.01E-04	7.26E-04	1.48E-03	-2.95E-02
Components for re-use	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	**3.73E+02**	0.00E+00	0.00E+00	3.50E+00	3.50E+00	0.00E+00	1.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+02	0.00E+00	3.50E+02	0.00E+00
Materials for energy recovery	kg	**1.23E+02**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E+02	1.21E+02	0.00E+00
Exported energy, electricity	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

The following tables contain the environmental impacts of the reference product per functional unit ("Supply 1 kW to one electrical vehicle, through a private or semi-public station on a base and running on direct current, during 10 years, following the corresponding use case scenario for active products for private or semi-public stations on a base and running on direct current, as described in PSR0018 and its annex"):

Environmental impacts of the reference product per Functional Unit:

Impact category	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
GWP - Total	kg CO_2 eq.	**4.40E-01**	1.92E-03	2.10E-05	7.10E-07	1.94E-03	2.31E-05	2.64E-06	7.57E-04	3.91E-04	4.37E-01	4.38E-01	1.28E-06	2.80E-05	1.45E-05	4.71E-05	9.09E-05	-2.64E-04
GWP – Fossil	kg CO_2 eq.	**4.05E-01**	1.91E-03	2.09E-05	6.86E-07	1.94E-03	2.31E-05	1.84E-06	7.57E-04	3.89E-04	4.02E-01	4.03E-01	1.35E-06	2.80E-05	1.45E-05	4.68E-05	9.07E-05	-2.67E-04
GWP – Biogenic	kg CO_2 eq.	**3.52E-02**	2.17E-06	1.23E-08	2.22E-08	2.20E-06	1.78E-08	8.06E-07	1.10E-07	1.69E-06	3.52E-02	3.52E-02	-7.43E-08	2.53E-08	6.99E-09	2.19E-07	1.77E-07	5.16E-06
GWP - Luluc	kg CO_2 eq.	**9.54E-05**	5.94E-06	1.19E-08	1.85E-09	5.96E-06	1.09E-08	1.35E-09	1.56E-07	4.19E-07	8.89E-05	8.94E-05	1.50E-09	1.36E-08	5.14E-09	4.13E-08	6.15E-08	-1.81E-06
OD	kg CFC-11 eq.	**1.11E-08**	3.21E-10	4.16E-13	1.67E-14	3.21E-10	5.05E-13	4.05E-14	1.33E-11	1.24E-09	9.55E-09	1.08E-08	1.80E-14	6.09E-13	1.32E-13	2.52E-12	3.28E-12	-5.55E-12
AP	mol H+ eq.	**1.76E-03**	2.47E-05	2.28E-07	2.27E-09	2.49E-05	7.78E-08	6.52E-09	3.05E-06	1.85E-06	1.73E-03	1.73E-03	1.33E-08	9.13E-08	6.43E-08	6.81E-08	2.37E-07	-1.56E-05
EP - Freshwater	kg P eq.	**9.43E-06**	3.13E-07	1.43E-10	1.05E-11	3.13E-07	1.87E-10	2.89E-11	4.59E-09	2.47E-08	9.09E-06	9.12E-06	3.68E-11	2.24E-10	8.58E-11	9.16E-10	1.26E-09	-2.67E-08
EP - Marine	kg N eq.	**2.53E-04**	2.75E-06	6.13E-08	5.11E-10	2.81E-06	2.66E-08	1.83E-09	1.09E-06	3.43E-07	2.49E-04	2.50E-04	1.95E-09	3.10E-08	2.40E-08	1.71E-08	7.41E-08	-3.76E-07
EP - Terrestrial	mol N eq.	**3.08E-03**	3.32E-05	6.72E-07	5.67E-09	3.39E-05	2.85E-07	1.96E-08	1.18E-05	3.61E-06	3.03E-03	3.04E-03	4.87E-08	3.31E-07	2.61E-07	1.89E-07	8.30E-07	-4.97E-06
POCP	kg NMVOC eq.	**1.28E-03**	1.06E-05	2.06E-07	2.23E-09	1.08E-05	1.21E-07	8.80E-09	4.04E-06	1.89E-06	1.26E-03	1.27E-03	6.80E-09	1.36E-07	8.25E-08	7.27E-08	2.98E-07	-2.41E-06
ADP - Elements	kg Sb eq.	**5.46E-06**	8.13E-07	5.38E-11	1.66E-12	8.13E-07	6.23E-11	1.10E-11	2.47E-09	1.12E-08	4.63E-06	4.64E-06	2.44E-11	8.99E-11	3.25E-11	4.99E-11	1.97E-10	-8.60E-08
ADP - Fossil fuels	MJ	**6.31E+00**	2.46E-02	2.85E-04	1.56E-05	2.49E-02	3.38E-04	3.20E-05	1.00E-02	7.69E-03	6.27E+00	6.28E+00	1.41E-05	3.97E-04	1.16E-04	2.07E-04	7.34E-04	-3.20E-03
Water use	m^3 eq. depriv.	**2.58E-01**	4.40E-04	1.03E-06	2.81E-07	4.41E-04	1.62E-06	3.71E-07	3.17E-05	8.81E-05	2.57E-01	2.57E-01	3.57E-07	1.62E-06	3.65E-07	4.60E-06	6.94E-06	-1.05E-04
GWP-GHG	kg CO_2 eq.	**4.10E-01**	1.92E-03	2.10E-05	6.96E-07	1.95E-03	2.31E-05	1.85E-06	7.57E-04	3.91E-04	4.07E-01	4.08E-01	1.37E-06	2.80E-05	1.45E-05	4.69E-05	9.08E-05	-2.70E-04

GWP: Global Warming Potential; OD: Ozone Depletion; AP: Acidification Potential of soil and water; EP: Eutrophication Potential; POCP: Photochemical Ozone Potential; ADP: Abiotic resources Depletion Potential; GHG: Greenhouse gases.

Inventory flows indicators of the reference product per Functional Unit:

Impact category	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
PERE	MJ	**2.09E+00**	3.00E-03	3.81E-06	3.92E-06	3.01E-03	4.95E-06	3.42E-07	1.05E-04	3.50E-04	2.08E+00	2.08E+00	4.02E-06	6.16E-06	4.05E-06	1.99E-05	3.41E-05	-8.24E-04
PERM	MJ	**6.42E-06**	5.52E-06	0.00E+00	0.00E+00	5.52E-06	0.00E+00	9.00E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	**2.09E+00**	3.01E-03	3.81E-06	3.92E-06	3.02E-03	4.95E-06	1.24E-06	1.05E-04	3.50E-04	2.08E+00	2.08E+00	4.02E-06	6.16E-06	4.05E-06	1.99E-05	3.41E-05	-8.24E-04
PENRE	MJ	**6.31E+00**	2.42E-02	2.85E-04	1.56E-05	2.45E-02	3.38E-04	2.43E-05	1.00E-02	7.69E-03	6.27E+00	6.28E+00	1.41E-05	3.97E-04	1.16E-04	2.07E-04	7.34E-04	-3.20E-03
PENRM	MJ	**4.22E-04**	4.14E-04	0.00E+00	0.00E+00	4.14E-04	0.00E+00	7.67E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	**6.31E+00**	2.46E-02	2.85E-04	1.56E-05	2.49E-02	3.38E-04	3.20E-05	1.00E-02	7.69E-03	6.27E+00	6.28E+00	1.41E-05	3.97E-04	1.16E-04	2.07E-04	7.34E-04	-3.20E-03
SM	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m3	**7.02E-03**	1.63E-05	3.61E-08	4.64E-09	1.63E-05	5.31E-08	1.15E-08	1.07E-06	2.65E-06	7.00E-03	7.00E-03	1.02E-08	5.65E-08	1.77E-08	1.55E-07	2.40E-07	-5.62E-06

Biogenic carbon content of the reference product per Functional Unit:

	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
Biogenic carbon content	Kg of C	**2.41E-06**	2.38E-06	0.00E+00	0.00E+00	2.38E-06	0.00E+00	2.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Product	Kg of C	**7.65E-09**	7.65E-09															
Packaging	Kg of C	**2.37E-06**	2.37E-06															

Waste category indicators and output flow indicators of the reference product per Functional Unit:

Category indicators	Unit	Total	A1	A2	A3	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	B2	B4	B6	Use (B1-B7)	C1	C2	C3	C4	End of Life (C1-C4)	Benefits (D)
Hazardous waste disposed	kg	**2.83E-05**	3.32E-07	1.71E-09	4.78E-11	3.34E-07	2.10E-09	1.46E-10	7.04E-08	4.28E-07	2.75E-05	2.80E-05	1.94E-10	2.53E-09	6.48E-10	1.47E-05	1.47E-05	-1.76E-08
Non-hazardous waste disposed	kg	**3.09E-02**	2.82E-04	1.05E-05	5.04E-08	2.93E-04	2.96E-05	9.58E-07	8.73E-05	3.90E-05	3.04E-02	3.05E-02	1.61E-06	1.94E-05	8.79E-07	2.81E-05	5.00E-05	-1.08E-04
Radioactive waste disposed	kg	**1.35E-05**	5.09E-08	7.69E-11	9.70E-11	5.11E-08	1.03E-10	3.15E-11	1.82E-09	6.27E-09	1.35E-05	1.35E-05	1.07E-11	1.29E-10	5.12E-11	1.84E-10	3.75E-10	-7.50E-09
Components for re-use	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	**5.93E-06**	0.00E+00	0.00E+00	8.89E-07	8.89E-07	0.00E+00	5.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.88E-05	0.00E+00	8.88E-05	0.00E+00
Materials for energy recovery	kg	**5.95E-07**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.95E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E-05	3.07E-05	0.00E+00
Exported energy, electricity	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

EXTRAPOLATION FACTORS

In order to cover the diverse products other than the reference products belonging to SIGMA homogeneous environmental family, extrapolation rules have been applied to calculate the extrapolation factors. These extrapolation factors have been calculated following the rules described in PCR-ed4-EN-2021 09 14 and PSR-0018-ed1.0- EN-2021 09 13.

SIGMA EVCIs are intended for the same main functionality, they are regulated by the same product standards and their manufacturing technology is identical: the dimensions of the charging stations are the same for all the products of the family (SIGMA chargers have the same envelope) and their manufacturing processes are the same.

The main differences fall on the number of internal components making up the EVCIs and the number and power of their connexions to the electric vehicle. The following table includes the information of the products of the SIGMA homogeneous environmental family covered by this study:

Product name	Product weight (kg)	Packaging weight (kg)	Connexion to the vehicle
SIGMA 60	472.72	22.60	1 output with a power of 60 kW
SIGMA 90	493.82	22.60	1 output with a power of 90 kW
SIGMA 120	514.92	22.60	1 output with a power of 120 kW
SIGMA 150	536.02	22.60	1 output with a power of 150 kW
SIGMA 180	557.12	22.60	1 output with a power of 180 kW
SIGMA 60D	529.44	22.60	2 outputs with a power of 60 kW
SIGMA 90D	577.12	22.60	2 outputs with a power of 90 kW
SIGMA 60T*	**590.81**	**22.60**	**3 outputs with a power of 60 kW**

Taken into account the difference characteristics of the 8 charging stations of SIGMA family analysed in this study, the extrapolation coefficients for the declared unit (product) level have been calculated for each life cycle stage:

Product name	Manufacturing stage (Modules A1-A3)	Distribution stage (Module A4)	Installation stage (Module A5)	Use stage (Modules B1-B7)	End-of-life stage (Modules C1-C4)
SIGMA 60	0.81	0.81	1.00	0.34	0.80
SIGMA 90	0.84	0.84	1.00	0.51	0.84
SIGMA 120	0.88	0.88	1.00	0.67	0.87
SIGMA 150	0.91	0.91	1.00	0.84	0.91
SIGMA 180	0.95	0.95	1.00	1.00	0.94
SIGMA 60D	0.90	0.90	1.00	0.67	0.90
SIGMA 90D	0.98	0.98	1.00	1.00	0.98
SIGMA 60T*	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

* Reference product

Registration number	JEMA-00001-V01.01-EN	Drafting rules	PCR-ed4-EN-2021 09 14
		Supplemented by	PSR-0018-ed1-EN2021 09 13
Verifier accreditation number	VH45	Information and reference documents	www.pep-ecopassport.org
Date of issue	February 2024	Validity period	5 years

Independent verification of the declaration and data, in compliance with ISO 14025:2006

Internal		External	X	

The PCR review was conducted by a panel of experts chaired by Julie ORGELET (DDemain)

PEP are complaint with XP CO08-100-1:2016 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”

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