Statement of Verification

BREG EN EPD No: 000766 Issue: 01

This is to verify that the Environmental Product Declaration provided by:

Advanced Electronics Ltd

are in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:
1 Unit of MxPro 5 4-Loop Fire Panel/ MxPro 5 4-Loop Fire Panel (Deep Enclosure) with a service life of 10 Years.

Company Address

Advanced Electronics Ltd.
The Bridges
Balliol Business Park
Newcastle Upon Tyne
United Kingdom
NE12 8EW

Signed for BRE Global Limited — Hayley Thomson, Operator

Date of this Issue	Date of First Issue	Expiry Date
03 March 2026	03 March 2026	02 March 2031

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Environmental Product Declaration

EPD Number: 000766

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2025 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.2 EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems
Commissioner of LCA study	**LCA consultant/Tool**
Advanced Electronics Ltd. The Bridges Balliol Business Park Newcastle Upon Tyne United Kingdom NE12 8EW	BRE LINA A2 / Helena Kesar - Advanced Electronics Ltd.
Functional Unit	**Applicability/Coverage**
1 Unit of MxPro 5 4-Loop Fire Panel/ MxPro 5 4-Loop Fire Panel (Deep Enclosure) with a service life of 10 Years.	Product Specific
EPD Type	**Background database**
Cradle to Grave	Ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☒Internal ☐ External
(Where appropriate [b]) Third party verifier: Flavie Lowres
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Advanced Electronics Ltd.
The Bridges
Balliol Business Park
Newcastle Upon Tyne
United Kingdom
NE12 8EW

Construction Product:

Product Description

MxPro 5 4-Loop Panels (MX-5401, MX-5402, MX5403, MX5404, MX-5401D, MX-5402D, MX-5403D, MX-5404D)

The next-generation MxPro 5 4-loop fire panel is an EN54-2&4 approved solution designed for commercial and industrial applications. Packed with premium features, the MxPro 5 4-loop panel uses open protocol flexibility, allowing connectivity to a variety of devices (e.g. smoke detectors, sounders, etc.) and manufacturer protocols (e.g. Apollo, Argus, and Hochiki). It plays a critical role in a fire safety system and behaves as a central control unit of a buildings fire alarm system, connecting to fire detection devices to detect, analyse, alert, and notify in incidents of a fire.

The Advanced Mx 5 4-Loop panel part number configuration can be defined as, "Mx" signifies part of the Mx range, "5000" signifies the Mx Pro 5 range, "400" signifies the maximum number of loops of the panel, the "0X" signifies the number of loop cards fitted to the panel (e.g. 01, 02, 03), and the letter at the end of the part number "D" signifies the type of enclosure. In the absence of a letter, it is assumed that the part number is using the standard enclosure type for that panel. For example, Mx-5401D is a Mx Pro 5, 4-Loop panel with a deep enclosure and one loop-driver card fitted.

Includes deep enclosure variants and applicable to Axis EN (software), cross-listed and language variants (Language variants or software/firmware changes do not affect the component makeup of the product. Therefore, these changes do not result in any change to the product's environmental impacts).

Scope of the assessment: The LCA analysis has been conducted for one unit of the MxPro 5 4-Loop Panel / MxPro 5 4-Loop Panel (Deep Enclosure), including one loop driver card. To account for panels containing

more than one loop driver card, a separate LCA analysis has been carried out for the Loop Driver Card (MXP-568).

The results for both the panel and the loop driver card are presented in the EPD annex, allowing end users to calculate the total impacts of different panel variants. This approach enables users to add the impacts of additional loop driver cards to reflect the total impacts of the MX-5402, MX-5403, and MX-5404, and similarly apply the approach for the MX-5401 D variants. In addition, the B6 – operational energy use impacts have been calculated separately and included in the EPD.

For example, an MX-5401 can be converted to an MX-5402 by adding the environmental impacts of one additional loop driver card (MXP-568).

The Loop Driver is fitted and is not a standalone product when used. This application / use is dependent on the customer and therefore Advanced do not have visibility of the life cycle stages beyond A3. It is assumed that once fitted, the disposal and use of the product would align with the calculation made for MX-5401, MX-5402, MX-5403, MX-5404 as by this point the Loop Driver card has been fitted (therefore energy consumption stage accounts for this and so does disposal stage).

Technical Information

MxPro 5 4-Loop Panels

The MxPro5 is a Fire Control and Indicating Equipment (CIE) panel, and it conforms the EN 54-2:1997 + AC:1999 + A1:2006/ EN 54-4:1997 +A1:2002 +A2:2006 for the EN market. The panel is normally powered from an 230VAC mains supply, from which it derives power for itself and peripheral equipment. In the event of a mains failure, the panel switches to a 24V DC standby battery (which the panel is responsible for charging and monitoring).

The panel distributes power to external, third-party devices via the loop driver cards, sounder outputs and via an auxiliary power output.

Electrically, the Mx-5401 is made up of a power supply, a base card, a loop card and a display card. The power consumed by these parts is 6.74W during normal operation. This includes the power required to maintain a typical battery (float charging - 0.68W) and a single loop driver card (1.22W) - the base card allows up to 3 additional loop driver cards (MXP-568) to be fitted (Mx-5402, Mx-5403, Mx-5404).

Property	Mx-5401	Mx-5401D
Weight	Mx-5401: 8.06 kg Mx-5402: 8.10 kg Mx-5403: 8.15 kg Mx-5404: 8.19 kg	Mx-5401D: 10.04 kg Mx-5402D: 10.09 kg Mx-5403D: 10.13 kg Mx-5404D: 10.18 kg
Power Consumption (Quiescent Operation)	Mx-5401: 6.74W Mx-5402: 7.96W Mx-5403: 9.18W Mx-5404:10.40W	Mx-5401D: 6.74W Mx-5402D: 7.96W Mx-5403D: 9.18W Mx-5404D:10.40W
Mains Voltage (Applicable for both Mx-540X/D)	230VAC	

For more information, please contact the Advanced Electronics technical team or visit the following webpage *MxPro 5 - 1-4 Loop Fire Alarm Control Panel*

Main Product Contents

Mx5401/D

Material/Chemical Input	Mx5401	Mx5401-D
Steel	85-90%	80-85%
Electronic Components	10-15%	15-20%

The above composition is for the **MxPro 5401/D**. The composition is the same for all products in the range (**MX-5401, MX-5402, MX-5403, MX-5404, MX-5401D, MX-5402D, MX-5403D, MX-5404D**).

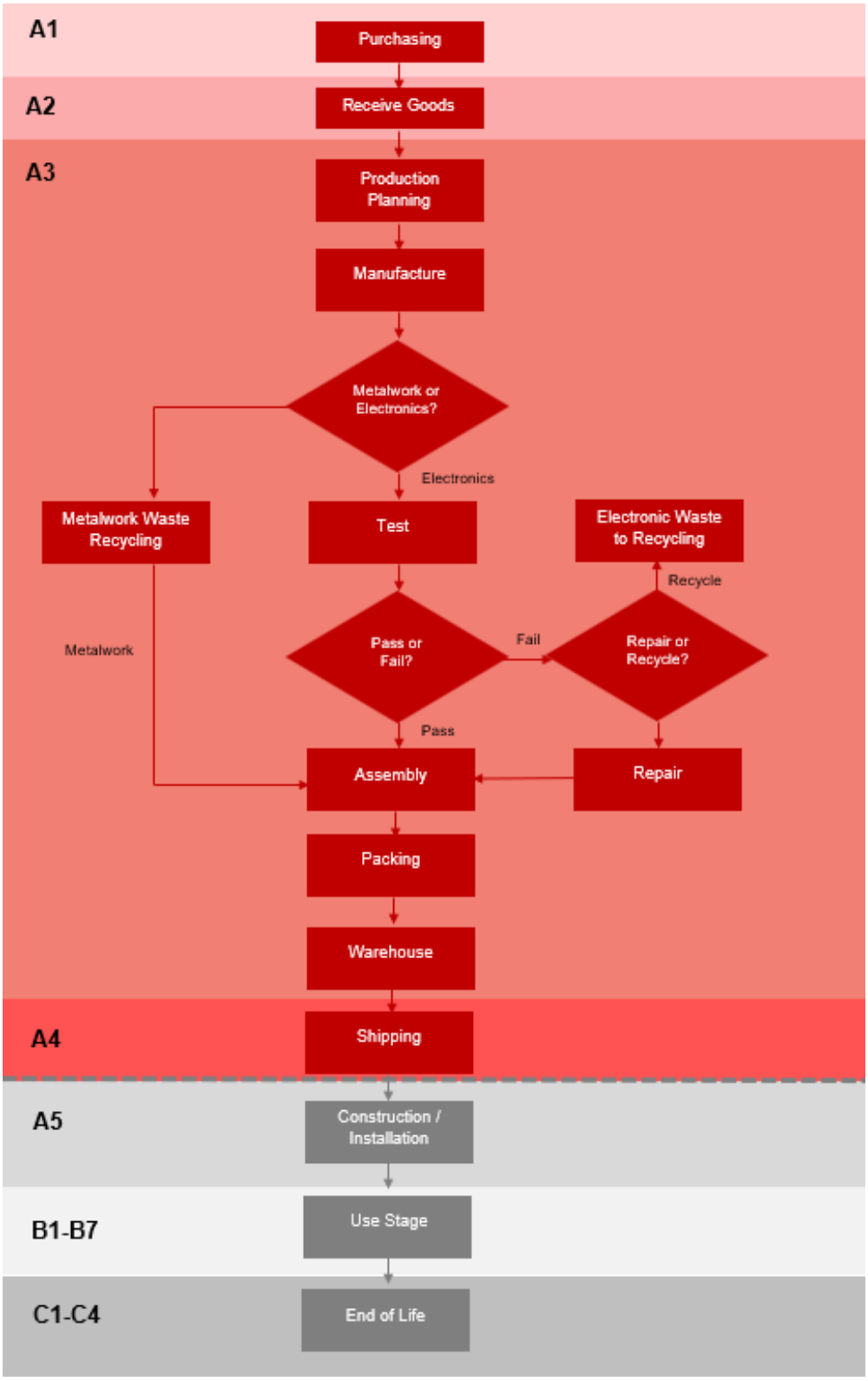
Manufacturing Process

MxPro 5 4-Loop Panels

In accordance with EN 15804, the processes represented in this EPD encompass the product stage (modules A1–A3). The product life cycle begins with the purchasing of raw materials and components, followed by goods receipt, structured production planning, and manufacturing.

Production includes both metalwork fabrication and electronic PCB and panel assembly. Electronic parts are subject to quality testing to ensure product consistency. Products and parts that have completed final assembly proceed to packing, warehousing, and shipping. Each process operates in accordance with Advanced's drawings, standard operating procedures (SOPs), and process flow charts. This process flow is designed to maintain environmental consistency and traceability, supporting reliable environmental impact reporting and conformity with the modular approach outlined in EN 15804.

Process flow diagram



Construction Installation

MxPro 5 4-Loop Panels

The transport distance to the construction site was set at 120 km by road, based on UK manufacturing, as referenced in the Royal Institution of Chartered Surveyors' 2023 Whole Life Carbon Assessments for the Built Environment. This is applicable for language variants and variants with deep enclosures.

To install the product, only specialized tools are necessary. Before proceeding with installation, it is essential to refer to safety, installation, maintenance and commission instructions identified on or with the product.

Loop Driver Card is typically fitted to a panel either during the manufacturing process or at the site of installation.

Use Information

Under normal usage conditions, each product has an expected lifespan of 10 years. It remains inactive (quiescent) for over 99.9% of the time and typically does not require repairs, part replacements, or refurbishments during this period. Routine maintenance testing is generally the responsibility of the designated person at the facility of installation. Frequency of maintenance is assumed to be twice per year.

However, since this product is part of a fire detection and alarm system, regular system maintenance is necessary. In addition to routine testing, Grade A systems must be inspected and serviced at intervals not exceeding six months, following the guidelines set out in BS 5839. This maintenance is typically carried out by an external fire alarm servicing company, where a qualified professional with specialized expertise in fire detection and alarm systems performs biannual inspections and servicing.

For Use Stage calculations, measurements were taken during quiescent mode, with the display dimmed. The calculations show 1 year of power consumption, but the product is designed to assume 10-year life. The electricity consumption data includes the power required to maintain the charge (float charge) a 12Ah 24V lead acid battery, based on the supplier recommended C/500 calculation. The mains voltage was set to 230V AC using a variac. During quiescent operation, based on these assumptions, the power consumption of the Mx-5401 was measured as 6.74W from the wall.

Calculation details: (6.74W/hr x 24) x 365 = 59kWh x 10 = 590kWh

Each loop driver adds 1.22W of power consumption. So as a result:

- Mx-5401 - 6.74W/hour = 59kWh total (per year) = 590kWh (per assumed lifespan)
- Mx-5402 - 7.96W/hour = 70 kWh total (per year) = 697kWh (per assumed lifespan)
- Mx-5403 - 9.18W/hour = 80 kWh total (per year) = 804 kWh (per assumed lifespan)
- Mx-5404 - 10.4W/hour = 91kWh total (per year) = 911kWh (per assumed lifespan)

These calculations are applicable to deep enclosure variants and language variants.

End of Life

At the end of its service life, it will be manually dismantled using specialized tools, ensuring no impacts occur during deconstruction. It is assumed that there is 100% recovery at the products' end of life.

As an electronic product, it will be sent to an authorized treatment facility approved through the producer compliance scheme that Advanced is partnered with. The facility could be located anywhere in the UK, so the transport distance to the waste processing site is assumed to be 120 km by road, in line with A4 assumptions for nationwide processing.

The Mx5401 panel consists of approximately 85–90% steel and 10–15% electronic components, while the Mx5401-D panel consists of approximately 80–85% steel and 15–20% electronic components.

In line with UK regulations, waste arising from these products is classified as WEEE (Waste Electrical and Electronic Equipment) and falls under Category 9: Monitoring and Control Instruments. The current UK target treatment rate for this category is 55% recycling/recovery and 45% landfill.

However, in accordance with the BRE PCR end-of-life scenario guidance for steel components, it is assumed that 95% of the steel fraction is recycled and 5% is sent to landfill.

Life Cycle Assessment Calculation Rules

Functional unit description

1 Unit of MxPro 5 4-Loop Panel/ MxPro 5 4-Loop Panel (Deep Enclosure) with a service life of 10 Years.

System boundary

MxPro 5 4-Loop Panel/ MxPro 5 4-Loop Panel (Deep Enclosure) - This cradle-to-grave Life Cycle Assessment (LCA) encompasses all life cycle stages, including the product stage (A1–A3), use stage (B1–B7), and end-of-life stage (C1–C4 and module D), in accordance with EN 15804:2012+A2:2019 and BRE 2025 PCR (PN 514 Rev 3.2). Furthermore, this EPD aligns with the requirements for electronic and electrical equipment as defined in BS EN 50693:2019, the Product Category Rules for life cycle assessments of electronic and electrical products and systems. LCA study period used for the analysis is 10 years

Data sources, quality and allocation

The inventory phase of this LCA includes detailed information on raw materials, packaging, consumables, and their delivery to the manufacturing facility. It also incorporates energy and water usage during processing, along with general waste production. Additionally, the assessment covers transportation across the entire product lifecycle, as well as impacts related to construction, operation, and final disposal. Upstream activities such as the extraction and processing of inputs are integrated using background datasets from LINA and ecoinvent, ensuring adherence to recognized industry standards and methodologies. All pertinent processes have been included without exception.

For the Life Cycle Assessment (LCA) and Environmental Product Declaration (EPD), Advanced Electronics Ltd. utilised specific primary data extracted from its production operations at the Newcastle Upon Tyne manufacturing factory, modelled using the LINA A2 LCA and the ecoinvent 3.8 database. In accordance with the requirements of EN15804:2012 + A2:2019, the most current available data has been used. The manufacturer-specific data from Advanced covers a period of six months (31/10/2024 – 29/04/2025). Only six months of production data was used for the LCA modelling due to limited data availability and the manufacturer has confirmed that the manufacturing process and the electricity used for the manufacturing remains the same throughout the year.

The LCA analysis has been conducted for one unit of panel MX-5401 and MX-5401 D and the results for these products are included in the EPD. Loop Driver Card MXP-568 results are included in the Annex section of the EPD to enable the results of the other panels

The MX-5401 and MX-5401 D are almost identical, with the main difference being the metalwork. The MX-5401 D is larger in size than the MX-5401 and therefore requires a greater quantity of steel for manufacturing. The internal PCB assembly and loop card assembly are the same for both products; only the steel weight varies, while the electronic components remain consistent across all variants. Consequently, separate LCA analyses have been performed for each product.

The MX-5401/D is available to end users with multiple language options and with the additional loop card. Generally, the MX-5401/D panel serves as the base panel with one loop card. End users can add up to four additional loop cards to the MX-5401/D panel.

In terms of operational energy use, power consumption varies depending on the number of loop cards in the panel. Accordingly, the B6 – operational energy use calculations have been performed, and a separate table with the results has been included. Additionally, power consumption remains the same across all panels regardless of the language variant.

Allocation:

In addition to the 1 Unit of Panel (Mx-5401/D) and Loop Driver Card (MXP-568), other products are manufactured in the production facility. Therefore, the allocation of electricity, fuel, waste, water consumption, and discharge are required. This allocation has been done according to the provisions of BRE PCR PN514 and EN 15804, using the mass production quantity. Site wide values for energy, water and wastewater have been taken from bills. Figures for the raw materials, ancillary materials and packaging were from actual usages.

Upon reviewing the data, it was noted that the Mx-5401 production output is slightly lower than the raw material input. The manufacturer confirmed that this discrepancy is due to how steel waste is accounted for at the production site, as all waste is treated collectively. Therefore, it is not 100% accurate to calculate the steel waste. Additionally, some proxy datasets have been used to account for missing small electronic components and the most appropriate datasets taken from ecoinvent 3.8.

Data quality:

Specific European and the UK datasets have been selected from the ecoinvent LCI for this LCA. The quality level of time representativeness is Very Good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken. All primary supplier data used was third-party verified, and the data quality was certified as 'very good'.

Secondary data was obtained for all upstream and downstream processes outside the manufacturer's control, such as raw material production, where supplier-specific certified data was unavailable. This data was sourced from the ecoinvent 3.8 database. All ecoinvent datasets utilised are carefully selected to be as relevant and precise as possible, incorporating specific elements such as the UK grid for electricity where available.

ISO14044 guidance. Quality Level	Geographical representativeness	Technical representativeness	Time representativeness
Very Good	Data from area under study – very good	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).	There is approximately 2-3 years between the Ecoinvent LCI reference year, and the time period for which the LCA was undertaken.

The data quality assessment presented above has been carried out in accordance with Table E.1 in the Annex section of the BRE PCR EN 15804+A2 V3.2. Specific UK and European datasets have been selected from the ecoinvent LCI for this LCA. Advanced electronics manufacturing plant uses national grid electricity and natural gas for production, so therefore for the LCA modelling the location-based electricity dataset has been used for the LCA modelling (Ecoinvent 3.8. The GWP carbon footprint for using 1 kWh of UK electricity, consumption mix is 0.239 kgCO2e/kWh and for using 1 kWh of UK natural gas, at industrial furnace is 0.232 kgCO2eq.

Cut-off criteria

All raw materials and energy input to the manufacturing process have been included, except for direct emissions to air, water, and soil, which are not measured. The inventory process in this LCA includes all data related to raw material, packaging material and consumable items.

LCA Results – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	6.87E+02	6.82E+02	3.71E+00	1.15E+00	6.29E-05	4.94E+00	9.15E-01
	Transport	A2	2.02E-01	2.01E-01	1.12E-04	9.97E-05	4.46E-08	2.56E-03	1.10E-05
	Manufacturing	A3	1.04E+00	1.54E+00	-5.24E-01	9.43E-03	1.81E-07	7.98E-03	7.74E-04
	Total (Consumption grid)	A1-3	6.88E+02	6.84E+02	3.18E+00	1.16E+00	6.31E-05	4.95E+00	9.15E-01
Construction process stage	Transport	A4	1.61E-01	1.61E-01	1.37E-04	6.31E-05	3.72E-08	6.53E-04	1.04E-05
	Construction	A5	6.13E-02	6.13E-02	1.72E-05	6.54E-06	1.29E-08	3.80E-04	1.08E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.41E+02	1.39E+02	1.27E+00	1.47E-01	1.06E-05	3.10E-01	1.91E-02
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.61E-01	1.61E-01	1.37E-04	6.31E-05	3.72E-08	6.53E-04	1.04E-05
	Waste processing	C3	4.11E-01	4.11E-01	1.35E-04	9.21E-05	8.26E-08	4.13E-03	2.65E-05
	Disposal	C4	6.85E-02	6.84E-02	6.05E-05	7.36E-06	2.32E-09	6.36E-05	2.10E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.70E+01	-2.70E+01	3.92E-02	-3.50E-02	-1.93E-06	-1.84E-01	-2.83E-02

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	9.42E-01	1.01E+01	2.61E+00	2.49E-01	8.70E+03	2.58E+02	3.54E-05
	Transport	A2	6.61E-04	7.31E-03	1.98E-03	5.71E-07	2.90E+00	1.14E-02	1.40E-08
	Manufacturing	A3	4.04E-03	2.49E-02	5.29E-03	7.74E-06	2.31E+01	9.53E-01	1.19E-07
	Total (Consumption grid)	A1-3	9.47E-01	1.02E+01	2.62E+00	2.49E-01	8.72E+03	2.59E+02	3.55E-05
Construction process stage	Transport	A4	1.97E-04	2.15E-03	6.58E-04	5.59E-07	2.43E+00	1.09E-02	1.39E-08
	Construction	A5	1.53E-04	1.68E-03	5.89E-04	5.16E-08	8.11E-01	1.24E-03	8.52E-09
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	9.27E-02	1.03E+00	2.53E-01	8.67E-04	3.70E+03	8.49E+00	2.15E-06
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.97E-04	2.15E-03	6.58E-04	5.59E-07	2.43E+00	1.09E-02	1.39E-08
	Waste processing	C3	1.79E-03	1.96E-02	5.37E-03	6.53E-07	5.61E+00	2.04E-02	1.08E-07
	Disposal	C4	2.23E-03	2.39E-04	8.20E-05	2.32E-08	1.74E-01	7.85E-03	1.25E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.34E-02	-3.65E-01	-1.22E-01	-6.98E-03	-3.31E+02	-8.31E+00	-1.66E-06

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	8.62E+01	6.09E+04	6.02E-07	2.60E-05	3.04E+03
	Transport	A2	1.44E-02	2.13E+00	9.04E-11	2.04E-09	1.56E+00
	Manufacturing	A3	2.29E-01	3.47E+01	8.40E-10	1.99E-08	7.07E+01
	Total (Consumption grid)	A1-3	8.65E+01	6.09E+04	6.03E-07	2.60E-05	3.11E+03
Construction process stage	Transport	A4	1.25E-02	1.90E+00	6.14E-11	1.99E-09	1.67E+00
	Construction	A5	3.63E-03	4.55E-01	8.36E-12	3.11E-10	1.41E-01
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.22E+02	1.61E+03	4.53E-08	1.07E-06	1.38E+03
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.25E-02	1.90E+00	6.14E-11	1.99E-09	1.67E+00
	Waste processing	C3	2.78E-02	3.88E+00	1.38E-10	3.29E-09	7.86E-01
	Disposal	C4	8.12E-04	5.95E-01	6.80E-12	2.25E-10	3.99E-01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.39E+00	-2.03E+03	-7.18E-08	-1.23E-06	-1.38E+02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	9.25E+02	6.88E-05	9.25E+02	8.69E+03	3.69E+00	8.69E+03
	Transport	A2	3.51E-02	0.00E+00	3.51E-02	2.85E+00	0.00E+00	2.85E+00
	Manufacturing	A3	-7.21E+00	2.25E+01	1.53E+01	2.19E+01	4.32E-01	2.24E+01
	Total (Consumption grid)	A1-3	9.18E+02	2.25E+01	9.41E+02	8.71E+03	4.12E+00	8.71E+03
Construction process stage	Transport	A4	3.42E-02	0.00E+00	3.42E-02	2.39E+00	0.00E+00	2.39E+00
	Construction	A5	-2.45E+01	2.46E+01	4.05E-02	1.06E+00	2.41E-02	1.09E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	8.89E+02	0.00E+00	8.89E+02	4.89E+03	0.00E+00	4.89E+03
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	3.42E-02	0.00E+00	3.42E-02	2.39E+00	0.00E+00	2.39E+00
	Waste processing	C3	-1.90E-02	0.00E+00	-1.90E-02	4.75E+00	0.00E+00	4.75E+00
	Disposal	C4	2.82E-03	0.00E+00	2.82E-03	-1.69E+01	1.70E+01	1.71E-01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.04E+01	0.00E+00	-3.04E+01	-3.29E+02	0.00E+00	-3.29E+02

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	3.23E+00	0.00E+00	0.00E+00	6.52E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.82E-04
	Manufacturing	A3	1.50E+00	5.06E-07	0.00E+00	2.29E-02
	Total (Consumption grid)	A1-3	4.73E+00	5.06E-07	0.00E+00	6.55E+00
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	2.71E-04
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	3.05E-05
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	4.16E-01	3.22E-03	0.00E+00	8.11E-01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	2.71E-04
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	5.18E-04
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	1.84E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-2.08E-01

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (Continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	5.99E+01	8.17E+02	2.58E-02
	Transport	A2	3.38E-03	5.00E-02	1.98E-05
	Manufacturing	A3	7.35E-02	2.41E+00	7.79E-05
	Total (Consumption grid)	A1-3	5.99E+01	8.20E+02	2.59E-02
Construction process stage	Transport	A4	2.68E-03	4.76E-02	1.64E-05
	Construction	A5	4.76E-03	9.78E-02	7.11E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	4.98E+00	8.59E+01	3.16E-02
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.68E-03	4.76E-02	1.64E-05
	Waste processing	C3	4.28E-03	-2.02E-02	3.50E-05
	Disposal	C4	3.03E-04	4.36E-03	1.06E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.84E+00	-6.42E+01	-7.95E-04

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued) – 1 x Unit of MX-5401 with the weight of 8.06 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	8.05E-04	5.34E-06	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	1.49E-03	4.39E-09	4.18E-04	0.00E+00	7.80E-01
	Total (Consumption grid)	A1-3	0.00E+00	2.30E-03	5.34E-06	4.18E-04	0.00E+00	7.80E-01
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	3.40E+00	5.79E-08	0.00E+00	9.88E-02	0.00E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	0.00E+00	5.59E-02	2.38E-05	2.57E+00	0.00E+00	0.00E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	6.89E+02	6.84E+02	3.70E+00	1.15E+00	6.29E-05	4.95E+00	9.16E-01
	Transport	A2	2.04E-01	2.03E-01	1.14E-04	1.00E-04	4.50E-08	2.57E-03	1.12E-05
	Manufacturing	A3	1.01E+00	1.51E+00	-5.24E-01	9.41E-03	1.78E-07	7.93E-03	7.72E-04
	Total (Consumption grid)	A1-3	6.90E+02	6.85E+02	3.18E+00	1.16E+00	6.32E-05	4.96E+00	9.16E-01
Construction process stage	Transport	A4	2.00E-01	2.00E-01	1.71E-04	7.86E-05	4.63E-08	8.13E-04	1.29E-05
	Construction	A5	6.13E-02	6.13E-02	1.74E-05	6.58E-06	1.30E-08	3.83E-04	1.09E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.41E+02	1.39E+02	1.27E+00	1.47E-01	1.06E-05	3.10E-01	1.91E-02
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.00E-01	2.00E-01	1.71E-04	7.86E-05	4.63E-08	8.13E-04	1.29E-05
	Waste processing	C3	4.99E-01	4.98E-01	1.58E-04	1.38E-04	9.74E-08	4.93E-03	3.92E-05
	Disposal	C4	1.16E-01	1.16E-01	1.03E-04	1.17E-05	3.57E-09	9.96E-05	3.59E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.21E+01	-4.21E+01	5.35E-02	-5.92E-02	-3.15E-06	-3.01E-01	-4.71E-02

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	9.44E-01	1.02E+01	2.62E+00	2.49E-01	8.72E+03	2.59E+02	3.55E-05
	Transport	A2	6.63E-04	7.34E-03	1.99E-03	5.78E-07	2.93E+00	1.15E-02	1.42E-08
	Manufacturing	A3	4.02E-03	2.47E-02	5.24E-03	7.64E-06	2.24E+01	9.52E-01	1.19E-07
	Total (Consumption grid)	A1-3	9.49E-01	1.02E+01	2.63E+00	2.49E-01	8.74E+03	2.60E+02	3.57E-05
Construction process stage	Transport	A4	2.45E-04	2.67E-03	8.19E-04	6.96E-07	3.03E+00	1.36E-02	1.73E-08
	Construction	A5	1.55E-04	1.70E-03	5.93E-04	5.19E-08	8.15E-01	1.27E-03	8.60E-09
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	9.27E-02	1.03E+00	2.53E-01	8.67E-04	3.70E+03	8.49E+00	2.15E-06
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.45E-04	2.67E-03	8.19E-04	6.96E-07	3.03E+00	1.36E-02	1.73E-08
	Waste processing	C3	2.11E-03	2.31E-02	6.34E-03	1.02E-06	6.79E+00	2.85E-02	1.27E-07
	Disposal	C4	3.83E-03	3.75E-04	1.30E-04	3.75E-08	2.70E-01	1.22E-02	1.95E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-5.38E-02	-5.89E-01	-1.88E-01	-1.21E-02	-5.26E+02	-1.40E+01	-2.56E-06

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	8.63E+01	6.09E+04	6.14E-07	2.61E-05	3.04E+03
	Transport	A2	1.46E-02	2.16E+00	9.12E-11	2.07E-09	1.58E+00
	Manufacturing	A3	2.14E-01	3.45E+01	8.31E-10	1.98E-08	7.05E+01
	Total (Consumption grid)	A1-3	8.65E+01	6.09E+04	6.15E-07	2.61E-05	3.11E+03
Construction process stage	Transport	A4	1.56E-02	2.36E+00	7.65E-11	2.48E-09	2.08E+00
	Construction	A5	3.65E-03	4.60E-01	8.63E-12	3.13E-10	1.41E-01
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.22E+02	1.61E+03	4.53E-08	1.07E-06	1.38E+03
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.56E-02	2.36E+00	7.65E-11	2.48E-09	2.08E+00
	Waste processing	C3	3.49E-02	5.01E+00	1.73E-10	4.46E-09	9.87E-01
	Disposal	C4	1.27E-03	1.00E+00	1.12E-11	3.73E-10	6.25E-01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.05E+00	-3.38E+03	-9.99E-08	-2.03E-06	-2.30E+02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	9.26E+02	6.88E-05	9.26E+02	8.70E+03	3.69E+00	8.71E+03
	Transport	A2	3.55E-02	0.00E+00	3.55E-02	2.88E+00	0.00E+00	2.88E+00
	Manufacturing	A3	-7.31E+00	2.25E+01	1.52E+01	2.12E+01	4.06E-01	2.16E+01
	Total (Consumption grid)	A1-3	9.19E+02	2.25E+01	9.41E+02	8.73E+03	4.10E+00	8.73E+03
Construction process stage	Transport	A4	4.26E-02	0.00E+00	4.26E-02	2.97E+00	0.00E+00	2.97E+00
	Construction	A5	-2.45E+01	2.46E+01	4.05E-02	1.09E+00	4.25E-03	1.09E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	8.89E+02	0.00E+00	8.89E+02	4.89E+03	0.00E+00	4.89E+03
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	4.26E-02	0.00E+00	4.26E-02	2.97E+00	0.00E+00	2.97E+00
	Waste processing	C3	-4.91E-02	0.00E+00	-4.91E-02	5.36E+00	0.00E+00	5.36E+00
	Disposal	C4	4.60E-03	0.00E+00	4.60E-03	-2.90E+01	2.92E+01	2.65E-01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-5.16E+01	0.00E+00	-5.16E+01	-5.24E+02	0.00E+00	-5.24E+02

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	3.51E+00	0.00E+00	0.00E+00	6.54E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.85E-04
	Manufacturing	A3	1.50E+00	1.17E-07	0.00E+00	2.28E-02
	Total (Consumption grid)	A1-3	5.01E+00	1.17E-07	0.00E+00	6.56E+00
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	3.37E-04
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	3.12E-05
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	4.16E-01	3.22E-03	0.00E+00	8.11E-01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	3.37E-04
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	7.29E-04
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	2.86E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-3.52E-01

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	6.02E+01	8.20E+02	2.58E-02
	Transport	A2	3.42E-03	5.06E-02	2.00E-05
	Manufacturing	A3	7.29E-02	2.40E+00	7.35E-05
	Total (Consumption grid)	A1-3	6.03E+01	8.23E+02	2.59E-02
Construction process stage	Transport	A4	3.34E-03	5.93E-02	2.05E-05
	Construction	A5	4.76E-03	9.73E-02	7.14E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	4.98E+00	8.59E+01	3.16E-02
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	3.34E-03	5.93E-02	2.05E-05
	Waste processing	C3	3.55E-03	-6.18E-02	4.03E-05
	Disposal	C4	4.90E-04	7.06E-03	1.64E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.48E+00	-1.02E+02	-1.33E-03

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued) – 1 x Unit of MX-5401D with the weight of 10.04 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	9.64E-04	5.85E-06	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	3.54E-04	1.02E-09	9.71E-05	0.00E+00	7.80E-01
	Total (Consumption grid)	A1-3	0.00E+00	1.32E-03	5.85E-06	9.71E-05	0.00E+00	7.80E-01
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	3.40E+00	5.79E-08	0.00E+00	9.88E-02	0.00E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	0.00E+00	5.59E-02	2.38E-05	2.57E+00	0.00E+00	0.00E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

LCA Results – B6 – Operational energy use calculation for individual MxPro variants

The service life of the MxPro is 10 years. Since the power consumption of the Mx-5401, Mx-5402, Mx-5403, Mx-5404, and all their D variants differs, separate B6 operational energy use calculations have been performed for each panel, and the results are enclosed. This allows the end user to more accurately calculate the impacts of the MxPro loop panel.

Calculation details: (6.74W/hr x 24) x 365 = 59kWh x 10 = 590kWh

Each loop driver adds 1.22W of power consumption. So as a result:

Mx-5401 - 6.74 W/hour = 59 kWh total (per year) = 590 kWh (per assumed lifespan)
Mx-5402 - 7.96 W/hour = 70 kWh total (per year) = 697 kWh (per assumed lifespan)
Mx-5403 - 9.18 W/hour = 80 kWh total (per year) = 804 kWh (per assumed lifespan)
Mx-5404 - 10.4 W/hour = 91 kWh total (per year) = 911 kWh (per assumed lifespan)

Parameters describing environmental impacts

			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
B6 – Operational energy use	MX5401/1D	B6	1.41E+02	1.39E+02	1.27E+00	1.47E-01	1.06E-05	3.10E-01	1.91E-02
	MX5402/2D	B6	1.66E+02	1.65E+02	1.50E+00	1.73E-01	1.25E-05	3.66E-01	2.25E-02
	MX5403/3D	B6	1.92E+02	1.90E+02	1.73E+00	2.00E-01	1.45E-05	4.22E-01	2.60E-02
	MX5404/4D	B6	2.17E+02	2.15E+02	1.96E+00	2.26E-01	1.64E-05	4.78E-01	2.94E-02

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;
ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts

			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
B6 – Operational energy use	MX5401/1D	B6	9.27E-02	1.03E+00	2.53E-01	8.67E-04	3.70E+03	8.49E+00	2.15E-06
	MX5402/2D	B6	1.10E-01	1.22E+00	2.99E-01	1.02E-03	4.37E+03	1.00E+01	2.54E-06
	MX5403/3D	B6	1.26E-01	1.41E+00	3.44E-01	1.18E-03	5.04E+03	1.16E+01	2.93E-06
	MX5404/4D	B6	1.43E-01	1.59E+00	3.90E-01	1.34E-03	5.71E+03	1.31E+01	3.32E-06

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

Parameters describing environmental impacts

			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
B6 – Operational energy use	MX5401/1D	B6	1.22E+02	1.61E+03	4.53E-08	1.07E-06	1.38E+03
	MX5402/2D	B6	1.44E+02	1.90E+03	5.35E-08	1.26E-06	1.63E+03
	MX5403/3D	B6	1.67E+02	2.19E+03	6.17E-08	1.46E-06	1.88E+03
	MX5404/4D	B6	1.89E+02	2.48E+03	7.00E-08	1.65E-06	2.13E+03

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
B6 – Operational energy use	MX5401/1D	B6	8.89E+02	0.00E+00	8.89E+02	4.89E+03	0.00E+00	4.89E+03
	MX5402/2D	B6	1.05E+03	0.00E+00	1.05E+03	5.77E+03	0.00E+00	5.77E+03
	MX5403/3D	B6	1.21E+03	0.00E+00	1.21E+03	6.66E+03	0.00E+00	6.66E+03
	MX5404/4D	B6	1.37E+03	0.00E+00	1.37E+03	7.54E+03	0.00E+00	7.54E+03

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

Parameters describing resource use, secondary materials and fuels, use of water

			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
B6 – Operational energy use	MX5401/1D	B6	4.16E-01	3.22E-03	0.00E+00	8.11E-01
	MX5402/2D	B6	4.91E-01	3.81E-03	0.00E+00	9.58E-01
	MX5403/3D	B6	5.67E-01	4.39E-03	0.00E+00	1.11E+00
	MX5404/4D	B6	6.42E-01	4.97E-03	0.00E+00	1.25E+00

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

Other environmental information describing waste categories

			HWD	NHWD	RWD
			kg	kg	kg
B6 – Operational energy use	MX5401/1D	B6	4.98E+00	8.59E+01	3.16E-02
	MX5402/2D	B6	5.89E+00	1.02E+02	3.74E-02
	MX5403/3D	B6	6.79E+00	1.17E+02	4.31E-02
	MX5404/4D	B6	7.70E+00	1.33E+02	4.88E-02

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life

			CRU	MFR	MER	EEE	EET
			kg	kg	kg	MJ per energy carrier	MJ per energy carrier
B6 – Operational energy use	MX5401/1D	B6	0.00E+00	5.59E-02	2.38E-05	5.87E-01	1.98E+00
	MX5402/2D	B6	0.00E+00	6.60E-02	2.82E-05	6.94E-01	2.34E+00
	MX5403/3D	B6	0.00E+00	7.61E-02	3.25E-05	8.00E-01	2.70E+00
	MX5404/4D	B6	0.00E+00	8.63E-02	3.68E-05	9.07E-01	3.06E+00

CRU = Components for reuse;
MFR = Materials for recycling
MER = Materials for energy recovery;
EE = Exported Energy

Individual product calculation

The major difference between the Mx-5401, Mx-5402, Mx-5403, and Mx-5404 and their D variants is the number of loop cards. The Mx-5401 has one loop card, the Mx-5402 has two, the Mx-5403 has three, and the Mx-5404 has four. Other than this, all metalwork and internal assemblies are identical. The same scenario for Mx-5401D panels

Therefore, the LCA analysis has been conducted for the Mx-5401 and the loop card separately. The calculation method provided below enables the end user to adjust the results to reflect the impacts of the other variants.

1 x Unit of MX-5401-4 fire loop panel individual product GWP Total calculations

Parameters describing environmental impacts							
Product name			**Mx-5401**	**MXP-568 Loop Driver Card**	**Mx-5402**	**Mx-5403**	**Mx-5404**
Product weight (kg/unit)			**8.06**	**0.045**	**8.10**	**8.15**	**8.19**
Number of loop card			**1**		**2**	**3**	**4**
GWP-total			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq
Product stage	Raw material supply	A1	6.87E+02	7.06E+00	6.94E+02	7.01E+02	7.08E+02
	Transport	A2	2.02E-01	3.67E-03	2.06E-01	2.09E-01	2.13E-01
	Manufacturing	A3	1.04E+00	3.17E-01	1.36E+00	1.67E+00	1.99E+00
	Total (Consumption grid)	A1-A3	6.88E+02	7.38E+00	6.95E+02	7.03E+02	7.10E+02
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.61E-01	3.72E-04	1.61E-01	1.62E-01	1.62E-01
	Waste processing	C3	4.11E-01	1.25E-03	4.12E-01	4.14E-01	4.15E-01
	Disposal	C4	6.85E-02	2.72E-03	7.12E-02	7.39E-02	7.67E-02
Module D	Reuse, recovery, recycling potential	D	-2.70E+01	-8.01E-01	-2.78E+01	-2.86E+01	-2.94E+01

1 x Unit of MX-5401-4 Deep closure fire loop panel individual product GWP Total calculations

Parameters describing environmental impacts							
Product name			**Mx-5401D**	**MXP-568 Loop Driver Card**	**Mx-5402D**	**Mx-5403D**	**Mx-5404D**
Product weight (kg/unit)			**10.04**	**0.045**	**10.09**	**10.13**	**10.18**
Number of loop card			**1**		**2**	**3**	**4**
GWP-total			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq
Product stage	Raw material supply	A1	6.89E+02	7.06E+00	6.96E+02	7.03E+02	7.10E+02
	Transport	A2	2.04E-01	3.67E-03	2.08E-01	2.11E-01	2.15E-01
	Manufacturing	A3	1.01E+00	3.17E-01	1.33E+00	1.64E+00	1.96E+00
	Total (Consumption grid)	A1-A3	6.90E+02	7.38E+00	6.97E+02	7.05E+02	7.12E+02
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.00E-01	3.72E-04	2.00E-01	2.01E-01	2.01E-01
	Waste processing	C3	4.99E-01	1.25E-03	5.00E-01	5.02E-01	5.03E-01
	Disposal	C4	1.16E-01	2.72E-03	1.19E-01	1.21E-01	1.24E-01
Module D	Reuse, recovery, recycling potential	D	-4.21E+01	-8.01E-01	-4.29E+01	-4.37E+01	-4.45E+01

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	The transport distance to the construction site was set at 120 km by road, based on UK manufacturing, as referenced in the Royal Institution of Chartered Surveyors' 2023 Whole Life Carbon Assessments for the Built Environment.		
	Fuel type / Vehicle type	Diesel	Lorry, 16-32 tonne
	Distance:	km	120
	Capacity utilisation (incl. empty returns)	%	26
	Weight of the transported products – MX5401	kg	8.06
	Weight of the transported products -MX5401D	kg	10
A5 – Installation in the building	To install the product, only specialized tools are necessary. Before proceeding with installation, it is essential to refer to safety, installation, maintenance and commission instructions identified on or with the product. Furthermore, installation must be done by a competent person and adhere to applicable installation codes and standards, such as BS5839-1 and BS 7671 in the UK. There is no waste during the product installation and only waste from the packaging which has been used during the product packaging at the factory gate.		
Packaging waste	Cardboard	kg	1.24
	Packaging paper	kg	0.22
	Carboard corner	kg	0.28
	Tape	kg	0.0001
	Plastic spare bags	kg	0.00049
B1 – Use stage	Once the product is installed there is no emission to air, water, and soil		
B2 – Maintenance	The product is part of a fire detection and alarm system, for which system maintenance is required. As well as routine testing, Grade A systems should be inspected and serviced at periods not exceeding 6 months in accordance with the recommendations of BS5839. Typically, this responsibility falls to an external fire alarm servicing organisation, in which case a competent person with specialist knowledge of fire detection and fire alarm systems, will visit the fire system for maintenance twice a year. Due to standard and approvals, if a product was not up to standard the maintenance would chance the whole device. No known emissions.		
	Number of maintenance cycles	2	Per year
B3 – Repair	Not applicable - repairing the device could invalidate approvals on the product.		
B4 – Replacement	Not applicable - replacing components, parts of the panel could invalidate the approvals on the product.		
B5 – Refurbishment	Not applicable - refurbishing the equipment could invalidate approvals on the product.		
Reference service life	10 years		

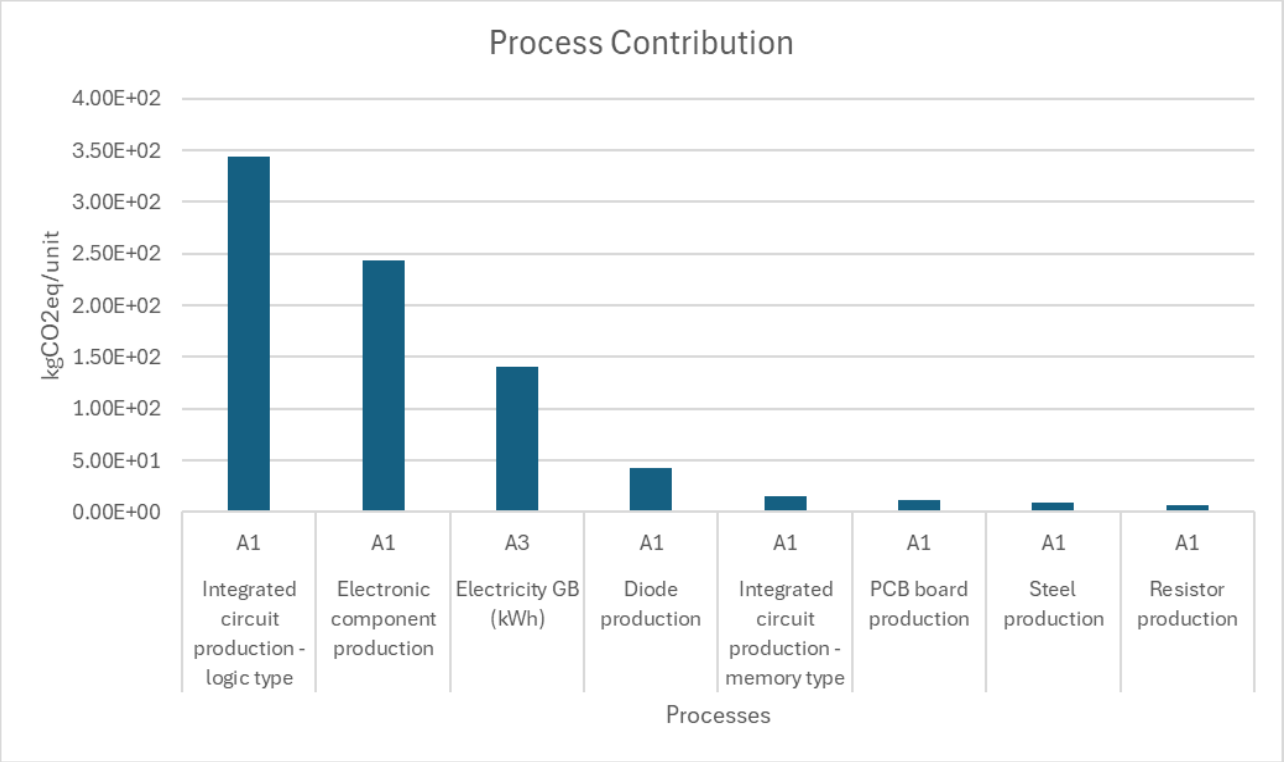
Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Study period	10 years		
B6 – Operational energy use	Calculation details: (6.74W/hr x 24) x 365 = 59kWh x 10 = 590kWh Each loop driver adds 1.22W of power consumption. So as a result: Mx-5401 - 6.74 W/hour = 59 kWh total (per year) = 590 kWh (per assumed lifespan) Mx-5402 - 7.96 W/hour = 70 kWh total (per year) = 697 kWh (per assumed lifespan) Mx-5403 - 9.18 W/hour = 80 kWh total (per year) = 804 kWh (per assumed lifespan) Mx-5404 - 10.4 W/hour = 91 kWh total (per year) = 911 kWh (per assumed lifespan) These calculations are applicable to Mx-5401/2/3/4 deep enclosure variants and language variants.		
B7 – Operations Water use	No water is required to operate the product, therefore no impacts from this module.		
C1 – Deconstruction	At the end of its service life, it will be manually dismantled using specialized tools, ensuring no impacts occur during deconstruction. It is assumed that there is 100% recovery at the products' end of life.		
C2 -Transportation	As an electronic, the product will go to an approved authorised treatment facility partnered with the producer compliance scheme that advanced electronics is partnered with (this may be anywhere in the UK). The transport distance to the waste processing facility was set at 120 km by road, assuming it could take place anywhere nationwide, aligning with A4 assumptions		
	Fuel type/ Vehicle type	Diesel	Lorry 16-32 tonne
	Distance	km	120
C3- Waste processing	In line with the UK regulations, waste from this product is classified as WEEE (Waste Electrical and Electronic Equipment). It is categorized under category 9, Monitoring and Control Instruments, which has a UK target recycling rate of 55%. 14% of the total weight is made of electronics. 86% of the total weight is made of metalwork. By using the BRE PCR end-of-life scenario for steel, 95% gets recycled and 5% goes to landfill.		
MX-5401	55% of Electronic waste to recycling	kg	0.59
	95% of the steel waste to recycling	kg	6.63
MX-5401D	55% of Electronic waste to recycling	kg	1.00
	95% of the steel waste to recycling	kg	7.77
C4- Disposal	Not all products will be recycled at the waste processing facility. According to the UK target recycling rate, 45% of the electronic waste is expected to end up in landfill. 5% of steel waste is assumed to go to landfill based on BRE end-of-life scenario guidelines.		
MX-5401	45% of the electronic waste to landfill	kg	0.49
	5% of the steel waste to landfill	kg	0.35
MX-5401D	45% of the electronic waste to landfill	kg	0.82
	5% of the steel waste to landfill	kg	0.41

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Module D	Module D accounts for the environmental benefits and loads resulting from steel used as raw material in the EAF or BOF and collected for recycling at end of life. These benefits and loads are calculated by excluding the pre-existing recycled steel used in the primary process. The MX5401/D is composed of approximately 80–85% steel and remaining percentage of electronic components. At the end of life, 95% of the steel is recycled. To avoid double-counting when calculating recycling benefits, the share of secondary material is excluded. **MX5401** - In total, in the recovered steel i.e., 6.63 kg of steel, of which 1.80 kg is secondary material which is at 27.1%. Therefore, the recycling benefits are calculated only for the virgin steel content, i.e., 4.83 kg. For electronic components, 55% of the electronic components are recycled at its end of life. Therefore, the recycling benefits are calculated for the electronic component, i.e., 0.59 kg. Any secondary material content from the electronics is less than 1% therefore it considered as a negligible. **MX5401D** - In total, in the recovered steel i.e., 7.77 kg of steel, of which 2.106 kg is secondary material which is at 27.1%. Therefore, the recycling benefits are calculated only for the virgin steel content, i.e., 5.66 kg. For electronic components, 55% of the electronic components are recycled at its end of life. Therefore, the recycling benefits are calculated for the electronic component, i.e., 1 kg. Any secondary material content from the electronics is less than 1% therefore it considered as a negligible. It's also assumed as 100% yield during the recycling process.		
	Mx-5401 - Products Recycled Content (post-consumer)	kg	1.80
	Mx-5401 - Recovered for recycling – Steel	kg	4.83
	Mx-5401 - Recovered for recycling – Electronics	kg	0.59
	Mx-5401D - Products Recycled Content (post-consumer)	kg	2.106
	Mx-5401D - Recovered for recycling – Steel	kg	5.66
	Mx-5401D - Recovered for recycling – Electronics	kg	1.02

Interpretation of results

The bulk of the environmental impacts are attributed to the manufacturing of MX5401 (which has been chosen as a representative product), as covered by information modules A1–A3 of EN 15804:2012+A2:2019. The product is composed of 80–85% steel, with the remaining 15% consisting of electronics made from plastics, nylon, and other materials.

During the interpretation phase, it was noted that the Integrated Circuit (IC) contributes the highest impact during production, followed by electricity consumption for metalworking and electronics assembly.



Annex - MXP-568 Loop Driver Card

Product description:

The Loop Driver Card is designed for use with the MxPro 5 range of analogue addressable panels. It provides control and connection to detector loops. The Loop Driver Card Mxp-568 can be used with Apollo, Hochiki or Argus Vega protocols. The Loop Driver Card Mxp-567 can be used with the Nittan protocol. This product is used with the Mx-540X (MX-5401, MX-5402, MX5403, MX5404, MX-5401D, MX-5402D, MX-5403D, MX-5404D) products. MxPro5 4-Loop and MxPro5 4-Loop (Deep Enclosure) panels are configurable products that can accommodate up to 4 x Fitted Loops Cards (MXP-568). The LCA / EPD is product-specific and is calculated to accommodate all variants of the fitted loop cards (i.e. Mx-5401, Mx-5402, Mx-5403, Mx-5404, Mx-5401D, etc.) and is applicable to language variants and Axis EN (software) variants.

Technical properties:

The Loop Driver Card provides power and communication to fire detectors and sounders installed around a building. The output current varies from 0-500mA depending on the field load, at voltages from 18-35V. The card itself consumes 1.22W of power when measured as part of the system (i.e. power from the wall). A 24V supply is delivered to the card via the main panel PSU (unless there has been a mains failure, causing the panel to be powered by batteries). The Loop Driver Card has its own switch mode power supply to derive the loop voltages independently to the incoming supply voltage.
For more information, please contact the Advanced Electronics technical team or visit the following webpage: MxPro 5 - Loop Driver Cards

MXP-568 Loop Driver Card

Manufacturing process:

In accordance with EN 15804, the processes represented in this EPD encompass the product stage (modules A1–A3). The product life cycle begins with the purchasing of raw materials and components, followed by goods receipt, structured production planning, and manufacturing. Production includes electronic PCB and panel assembly. Electronic parts are subject to quality testing to ensure product consistency. Products and parts that have completed final assembly proceed to packing, warehousing, and shipping. Each process operates in accordance with Advanced's drawings, standard operating procedures (SOPs), and process flow charts. This process flow is designed to maintain environmental consistency and traceability, supporting reliable environmental impact reporting and conformity with the modular approach outlined in EN 15804.

Declared unit: 1 unit of Advanced MXP-568 Loop Driver Card - Apollo (Including CoreProtocol), Hochiki, Argus, AxisEN) with the weight of 0.04472

System boundary

The LCA assessment for the MXP-568 Loop Driver Card is a cradle-to-gate with Module C and D life cycle assessment and encompasses the product stage (A1–A3) and end-of-life stage (C1–C4 and module D), in accordance with EN 15804:2012+A2:2019 and BRE 2025 PCR (PN 514 Rev 3.2). Furthermore, this LCA

aligns with the requirements for electronic and electrical equipment as defined in BS EN 50693:2019, the Product Category Rules for life cycle assessments of electronic and electrical products and systems.

Data quality assessment

The scope of the assessment is to assess the product stage impacts which will help the end user to enable the impacts of the panels with more than one loop card. The inventory phase of this LCA includes information on raw materials, consumables, and their delivery to the manufacturing facility. It also incorporates energy and water usage during processing, along with general waste production. Upstream activities such as the extraction and processing of inputs are integrated using background datasets from LINA and ecoinvent, ensuring adherence to recognized industry standards and methodologies. All pertinent processes have been included without exception. he manufacturer-specific data from Advanced covers a period of six months (31/10/2024 – 29/04/2025). Only six months of production data was used for the LCA modelling due to limited data availability and the manufacturer has confirmed that the manufacturing process and the electricity used for the manufacturing remains the same throughout the year. In addition to the 1 Unit of MXP-568 Loop Driver Card, other products are manufactured in the production facility. Therefore, the allocation of electricity, fuel, waste, water consumption, and discharge are required. This allocation has been done according to the provisions of BRE PCR PN514 and EN 15804, using the mass production quantity. Site wide values for energy, water and wastewater have been taken from bills. Figures for the raw materials, ancillary materials were from actual usages.

Data quality:

Specific European and the UK datasets have been selected from the ecoinvent LCI for this LCA. The quality level of time representativeness is Very Good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken. All primary supplier data used was third-party verified, and the data quality was certified as 'very good'. Secondary data was obtained for all upstream and downstream processes outside the manufacturer's control, such as raw material production, where supplier-specific certified data was unavailable. This data was sourced from the ecoinvent 3.8 database. All ecoinvent datasets utilised are carefully selected to be as relevant and precise as possible, incorporating specific elements such as the UK grid for electricity where available.

ISO14044 guidance. Quality Level - Very Good
Geographical representativeness - Data from area under study
Technical representativeness - Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).
Time representativeness - There is less than 3 years between the Ecoinvent LCI reference year, and the time period for which the LCA was undertaken.

Specific UK and European datasets have been selected from the ecoinvent LCI for this LCA. Manufacturer uses the national grid electricity and natural gas for production, so therefore the national grid electricity dataset has been used for the LCA modelling (Ecoinvent 3.8). The GWP carbon footprint for using 1 kWh of UK electricity, consumption mix is 0.239 kgCO2e/kWh and for using 1 kWh of UK natural gas, at industrial furnace is 0.232 kgCO2eq.

Cut off Criteria - All raw materials and energy inputs to the manufacturing process have been included. Direct emissions to air, water, and soil are not measured and are therefore excluded. The LCA inventory includes all relevant data related to raw materials and consumable items. Packaging is excluded, as the scope of the assessment is limited to the product stage. The loop driver card is sold as part of the MxPro 4–5 loop panels.

End of life:

C1 – Deconstruction: The MXP-568 Loop Driver Card is an additional card that can be added to the MxPro 5 4-Loop Fire Panel / MxPro 5 4-Loop Fire Panel (Deep Enclosure). At the end of life, the loop driver card is assumed to be treated together with the fire panel as panel waste. However, in a worst-case scenario where the loop card becomes faulty or damaged during the service life, a separate end-of-life scenario for the loop driver card has also been included in this document. Its assumed as 100% of the product is recovered from the End of life.

C2 – Transportation: As an electronic, the product will go to an approved authorised treatment facility partnered with the producer compliance scheme that advanced electronics is partnered with (this may be anywhere in the UK). The average transport distance to the waste processing facility was set at 120 km by road, assuming it could take place anywhere nationwide

C3 – Waste processing: In line with the UK regulations, waste from this product is classified as WEEE (Waste Electrical and Electronic Equipment). It is categorized under category 9, Monitoring and Control Instruments, which has a UK target recycling rate of 55%. 14% of the total weight is made of electronics.

- 55% of the waste MXP-568 Loop Driver Card sent to recycling = 0.025 kg

C4 – Disposal: Not all products will be recycled at the waste processing facility. According to the UK target recycling rate, 45% of the electronic waste is expected to end up in landfill.

- 45% of the waste MXP-568 Loop Driver Card sent to recycling = 0.020 kg

Module D:

MXP-568 is made of 100% electronics therefore as per UK WEEE regulations 55% of the electronic components are recycled at its end of life (Any secondary material content from the electronics is less than 1% therefore it considered as a negligible).

It’s also assumed as 100% yield during the recycling process

- Benefits due to recycling of 55% of the waste MXP-568 Loop Driver Card = 0.025 kg

LCA Results – 1 x Unit of MXP-568 Loop Driver Card with the weight of 0.04472 kg/unit and a service life of 10 years.

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	7.06E+00	7.01E+00	3.63E-02	1.20E-02	5.82E-07	9.47E-02	9.35E-03
	Transport	A2	3.67E-03	3.67E-03	3.11E-06	1.45E-06	8.48E-10	1.55E-05	2.36E-07
	Manufacturing	A3	3.17E-01	2.97E-01	1.89E-02	2.47E-04	2.32E-08	5.79E-04	3.43E-05
	Total (Consumption grid)	A1-3	7.38E+00	7.31E+00	5.51E-02	1.22E-02	6.06E-07	9.53E-02	9.39E-03
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	3.72E-04	3.72E-04	3.17E-07	1.46E-07	8.60E-11	1.51E-06	2.39E-08
	Waste processing	C3	1.25E-03	1.25E-03	-3.22E-09	2.29E-06	4.45E-11	6.98E-06	6.20E-07
	Disposal	C4	2.72E-03	2.72E-03	2.39E-06	2.29E-07	6.41E-11	1.89E-06	8.50E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.01E-01	-8.00E-01	6.57E-04	-1.39E-03	-6.79E-08	-6.55E-03	-1.06E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;
ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			EP-marine	EP-terrestrial	POCP	ADP-mineral &metal	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.06E-02	1.18E-01	3.34E-02	2.57E-03	9.04E+01	2.75E+00	4.13E-07
	Transport	A2	4.63E-06	5.07E-05	1.54E-05	1.27E-08	5.54E-02	2.49E-04	3.15E-10
	Manufacturing	A3	2.17E-04	1.84E-03	4.80E-04	1.50E-06	6.88E+00	2.59E-02	3.96E-09
	Total (Consumption grid)	A1-3	1.08E-02	1.19E-01	3.39E-02	2.57E-03	9.73E+01	2.78E+00	4.17E-07
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	4.54E-07	4.96E-06	1.52E-06	1.29E-09	5.62E-03	2.53E-05	3.21E-11
	Waste processing	C3	1.23E-06	1.33E-05	3.41E-06	1.93E-08	1.61E-02	3.52E-04	5.63E-11
	Disposal	C4	9.10E-05	7.08E-06	2.56E-06	7.75E-10	4.99E-03	2.24E-04	3.68E-11
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.12E-03	-1.23E-02	-3.43E-03	-2.95E-04	-1.05E+01	-3.26E-01	-4.73E-08

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	8.80E-01	7.85E+02	5.57E-09	2.84E-07	3.25E+01
	Transport	A2	2.85E-04	4.32E-02	1.41E-12	4.52E-11	3.79E-02
	Manufacturing	A3	2.02E-01	3.41E+00	9.04E-11	2.04E-09	2.31E+00
	Total (Consumption grid)	A1-3	1.08E+00	7.88E+02	5.66E-09	2.86E-07	3.49E+01
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.89E-05	4.38E-03	1.42E-13	4.60E-12	3.86E-03
	Waste processing	C3	1.76E-04	3.48E-02	8.39E-13	4.55E-11	5.04E-03
	Disposal	C4	2.38E-05	2.30E-02	2.44E-13	8.29E-12	1.19E-02
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-9.42E-02	-7.59E+01	-1.20E-09	-4.50E-08	-5.19E+00

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	9.55E+00	0.00E+00	9.55E+00	9.02E+01	1.24E-01	9.03E+01
	Transport	A2	7.79E-04	0.00E+00	7.79E-04	5.44E-02	0.00E+00	5.44E-02
	Manufacturing	A3	1.25E+00	2.17E-01	1.47E+00	8.73E+00	9.24E-02	8.82E+00
	Total (Consumption grid)	A1-3	1.08E+01	2.17E-01	1.10E+01	9.89E+01	2.16E-01	9.92E+01
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	7.92E-05	0.00E+00	7.92E-05	5.52E-03	0.00E+00	5.52E-03
	Waste processing	C3	-2.05E-03	0.00E+00	-2.05E-03	-1.61E-02	0.00E+00	-1.61E-02
	Disposal	C4	9.73E-05	0.00E+00	9.73E-05	-6.91E-01	6.96E-01	4.90E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.21E+00	0.00E+00	-1.21E+00	-1.05E+01	0.00E+00	-1.05E+01

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	1.69E-02	0.00E+00	0.00E+00	6.93E-02
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	6.16E-06
	Manufacturing	A3	7.72E-04	5.29E-06	0.00E+00	1.61E-03
	Total (Consumption grid)	A1-3	1.77E-02	5.29E-06	0.00E+00	7.09E-02
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	6.26E-07
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	9.29E-06
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	5.27E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-8.19E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	6.80E-01	6.66E+00	2.67E-04
	Transport	A2	6.12E-05	1.08E-03	3.75E-07
	Manufacturing	A3	8.58E-03	1.70E-01	5.23E-05
	Total (Consumption grid)	A1-3	6.89E-01	6.83E+00	3.20E-04
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	6.19E-06	1.10E-04	3.80E-08
	Waste processing	C3	-1.11E-04	-2.90E-03	-4.97E-08
	Disposal	C4	1.02E-05	1.47E-04	2.96E-08
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.85E-02	-2.06E+00	-2.98E-05

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	1.08E-02	3.93E-08	4.22E-03	2.47E-03	0.00E+00
	Total (Consumption grid)	A1-3	0.00E+00	1.08E-02	3.93E-08	4.22E-03	2.47E-03	0.00E+00
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

References

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