ENVIRONMENTAL PRODUCT DECLARATION

of multiple products, based on the average results of the product group

MURA

AUSTRALASIA EPD®

EPD INTERNATIONAL EPD SYSTEM

ECO PLATFORM EPD VERIFIED

In accordance with ISO 14025:2006 and EN 15804:2012 + A2:2019/AC:2021 for: Mura

Programme:	The International EPD® System www.environdec.com
Programme operator:	International EPD AB
Regional Programme operator:	EPD Australasia Ltd
EPD registration number:	EPD-IES-0016546
Publication date:	2025-03-20
Valid until:	2030-03-20
Geographical scope:	Global
Version:	001

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at http://www.environdec.com

All products within this EPD were previously covered through EPD S-P-01162, which expired on 2023-09-24

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WOVEN IMAGE®

GENERAL INFORMATION

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CEN STANDARD EN 15804+A2:2019/AC2021 SERVES AS THE CORE PRODUCT CATEGORY RULES (PCR)

Product Category Rules (PCR): PCR 2019:14; Construction products (EN 15804+A2) (1.3.4)

UN CPC code: 54

PCR review was conducted by: The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com for a list of members.

Review chair: Claudia A. Peña, University of Concepción, Chile
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Independent third-party verification of the declaration and data according to ISO 14025:2006: EPD verification by individual verifier

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Procedure for follow-up of data during EPD validity involved third party verifier:
☐ Yes
☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

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VALUES & BENEFITS OF AN EPD

WHAT IS AN EPD?

An Environmental Product Declaration (EPD) is a standardised and verified way of quantifying the environmental impacts of a product based on a consistent set of rules known as a Product Category Rules (PCR). This is a specific EPD. The EPD owner has the sole ownership, liability, and responsibility for this EPD.

An EPD provides robust transparency information on the material flows and environmental impact that happen during the life of a product. It is akin to the ingredient and nutrition label on food, but an EPD provides information on raw material extraction, energy use, emissions to air, soil and water use and waste generation.

Because this EPD is EN15804-compliant and third-party reviewed, it is recognised by sustainability rating schemes across the globe.

Green Star (Australia): EPDs may be used by project teams using the Design & As Built and Interiors rating tools to obtain Green Star points under the following credits in their legacy tools:

Materials > Product Transparency and Sustainability.

Materials > LCA: By providing data for an EN 15978 compliant whole-of-building whole-of-life assessment.

Innovation Challenge > Responsible Carbon Impact: by providing embodied carbon impacts (i.e. data on Global Warming Potential) which can be used in the calculation and reduction of the total embodied carbon impacts of a project.

EPDs are also recognised for credits under the Materials category in the Infrastructure Sustainability (IS) rating scheme of the Infrastructure Sustainability Council of Australia (ISCA).

LEED (US): Using EPDs to disclose and reduce product impacts contributes to several LEED credits including: Building Product Disclosure and Optimisation points for EPD (option 1) and Life-Cycle Assessment (LCA)/Embodied Carbon Optimisation (option 2).

BREEAM (UK): EPD support a projects BREEAM rating with:
Mat 01 Building life cycle assessment. The data presented in the EPD results tables can be used within a building level life cycle assessment to demonstrate how different options have been considered to improve the design. Seven credits are available in this section including two credits for building performance against a benchmark.
Mat 02 Environmental Impacts from construction products. Up to 1.5 credits are available for using at least 20 products in the build that have their own product specific EPD.

EPDs can be used in green building schemes across the world, such as Lotus Interiors (Vietnam) and HQE (UK, Europe, Asia, North America and Middle East).

ABOUT WOVEN IMAGE

Woven Image was established in 1987 after identifying a strong need for design driven interior finishes.

Based in Australia, they fast became a leading international business to business supplier of high-performance acoustic finishes and textiles for a wide range of commercial interiors across workspace, hospitality and education sectors.

Woven Image has offices throughout Australia as well as Singapore, Hong Kong and China and an established network of distributors, resellers and stockists, covering all major global markets.

Resource efficiency, dematerialisation and minimising environmental impacts at the heart of our design thinking and, because of Woven Image's ongoing attention to product life-cycle management and understanding of the importance of delivering responsible and positive product outcomes, they became pioneers in producing high performance acoustic finishes, wallcovering and textiles using recycled materials.

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SUSTAINABILITY

Since our inception and well before it became a global necessity, sustainable design and manufacturing has been part of our DNA. It's who we are, not simply what we do. Now part of CSR, we continue to work towards **building solutions for a better future.**

Going beyond waste reduction, recycling and recycled content, Woven Image understands the importance of valuing and respecting our planet and its resources, and we are on a journey to reduce the environmental and social impacts of our operations and product. We are unequivocally committed to playing our role in meeting the 1.5°C Climate Ambition and a net-zero carbon economy by 2050 through three pillars of action – product stewardship, climate leadership and social responsibility.

CSR's operations span Australia, New Zealand, parts of Asia and Europe, with the scale and expertise to innovate for the sustainable solutions our customers and communities need to build for a better future.

As a trusted supplier of building solutions, CSR are taking on industry challenges to cut carbon emissions and waste, and better manage resources. To set ambition and ignite progress, CSR are committed to 2030 targets across:

1. **Reducing our emissions, waste and water use**
2. **Increasing uptake of renewable energy**
3. **Improving biodiversity outcomes**

CSR TARGETS FOR 2030*

- **50%** of energy from renewables
- **20%** energy reduction per tonne of saleable product manufactured
- **30%** reduction in greenhouse gas (GHG) emissions per tonne of saleable product manufactured

Woven Image's regional production hub produced on average 394.5 MWh of solar energy per annum, supplying on average 54% of the total energy consumption for this manufacturing hub from renewable sources. We are committed to further investment in renewable energy to reduce our scope 2 emissions including the procurement of 100% green energy for our Woven Image Brookvale distribution centre and will continue offsetting our unavoidable operational emissions in partnership with Greenfleet, through regenerative carbon removal projects.

TOWARDS NET ZERO IN THE BUILT ENVIRONMENT

CSR takes a strategic approach to investing in solutions that reduce emissions - from increasing the uptake of renewable energy to exploring emerging technologies across operations. This includes optimising manufacturing plants, energy and process efficiencies and building collaborative partnerships across operations.

*2030 targets baseline is 1st July 2019 to 30th June 2020.

SUSTAINABILITY

REDUCING WASTE AND PRESERVING RESOURCES TO PROTECT OUR ENVIRONMENT

As a major supplier of building solutions, CSR has an important role in becoming a closed loop business to influence a circular economy in the built environment.

Woven Image's approach to product stewardship is underpinned by principles of circularity. Our design team puts resource efficiency, dematerialisation and minimising environmental impacts at the heart of its thinking. This results in products that are not only beautiful, but functional and highly durable, with a timeless aesthetic to ensure their longevity.

The process of working with customers and other relevant stakeholders on end-of-life requirements provides Woven Image with an unmatched opportunity to develop practical Product Stewardship measures that maximise environmental performance in a commercially viable manner. We continue to collaborate in circular R&D and invest in end-of-life recovery programmes for our products, actively encouraging our customers to utilise our take-back scheme.

Being a member of the Australian Packaging Covenant Organisation (APCO) demonstrates CSR's focus on redesigning packaging to minimise plastic use and waste. In collaboration with suppliers, we are committed to monitoring our progress towards our 2025 sustainable packaging targets, where CSR packaging is closed loop (either 100% reusable, recyclable or compostable) and using 50% average recycled content in packaging.

CSR CLOSING THE LOOP GOALS FOR 2030*

75% reduction in solid waste to landfill

30% energy reduction per tonne of saleable product manufactured

^ enhance biodiversity outcomes on CSR sites and developments

CSR continually work to eliminate waste across the business and source the 'right' materials to manufacture building products from natural, reused, re-purposed and recycled materials. Our approach includes working with our team and suppliers to look beyond energy, water and waste to explore holistic environmental management solutions and influence the wider industry to follow circular principles.

*2030 targets baseline is 1st July 2019 to 30th June 2020.

PRODUCT CREDENTIALS

PRODUCTS & APPLICATIONS

Mura is a 1.9mm thick surface finish, suitable for a range of applications including wrapped panels for operable walls, workstation screens and as an acoustic wallcovering. The face side is smooth to the touch, whilst the back has been engineered to provide a texture that moulds to more uneven surfaces, resulting in a more forgiving finish than standard wallpaper. Mura is light weight, easy to cut and adheres with standard wallpaper adhesives. The colour palette co-ordinates with EchoPanel® to offer acoustic solutions for the entire floor-plate.

For specifications and performance details please visit wovenimage.com

MURA wall in colour 454 & desk screen in colour 551

PRODUCT SPECIFICATIONS

Table 1: Mura products included in this EPD

Design	Colour Code	Thickness (mm)	Length (mm)	Width (mm)	Area (m^2)	Weight (kg)	Density (g/m^2)
Mura	101	1.9	6000	1210	7.26	2.54	350
	101	1.9	25000	1210	30.25	10.59	350
	101	1.9	105000	1210	127.05	44.48	350
	106	1.9	6000	1210	7.26	2.54	350
	106	1.9	25000	1210	30.25	10.59	350
	106	1.9	105000	1210	127.05	44.48	350
	124	1.9	6000	1210	7.26	2.54	350
	124	1.9	25000	1210	30.25	10.59	350
	124	1.9	105000	1210	127.05	44.48	350
	167	1.9	6000	1210	7.26	2.54	350
	167	1.9	25000	1210	30.25	10.59	350
	167	1.9	105000	1210	127.05	44.48	350
	269	1.9	6000	1210	7.26	2.54	350
	269	1.9	25000	1210	30.25	10.59	350
	269	1.9	105000	1210	127.05	44.48	350
	274	1.9	6000	1210	7.26	2.54	350
	274	1.9	25000	1210	30.25	10.59	350
	274	1.9	105000	1210	127.05	44.48	350
	330	1.9	6000	1210	7.26	2.54	350
	330	1.9	25000	1210	30.25	10.59	350
	330	1.9	105000	1210	127.05	44.48	350

PRODUCT SPECIFICATIONS

Design	Colour Code	Thickness (mm)	Length (mm)	Width (mm)	Area (m^2)	Weight (kg)	Density (g/m^2)
	349	1.9	6000	1210	7.26	2.54	350
	349	1.9	25000	1210	30.25	10.59	350
	349	1.9	105000	1210	127.05	44.48	350
	365	1.9	6000	1210	7.26	2.54	350
	365	1.9	25000	1210	30.25	10.59	350
	365	1.9	105000	1210	127.05	44.48	350
	384	1.9	6000	1210	7.26	2.54	350
	384	1.9	25000	1210	30.25	10.59	350
	384	1.9	105000	1210	127.05	44.48	350
	402	1.9	6000	1210	7.26	2.54	350
	402	1.9	25000	1210	30.25	10.59	350
	402	1.9	105000	1210	127.05	44.48	350
	442	1.9	6000	1210	7.26	2.54	350
	442	1.9	25000	1210	30.25	10.59	350
	442	1.9	105000	1210	127.05	44.48	350
	444	1.9	6000	1210	7.26	2.54	350
	444	1.9	25000	1210	30.25	10.59	350
	444	1.9	105000	1210	127.05	44.48	350
	447	1.9	6000	1210	7.26	2.54	350
	447	1.9	25000	1210	30.25	10.59	350
	447	1.9	105000	1210	127.05	44.48	350
	454	1.9	6000	1210	7.26	2.54	350
	454	1.9	25000	1210	30.25	10.59	350
	454	1.9	105000	1210	127.05	44.48	350

PRODUCT SPECIFICATIONS

Design	Colour Code	Thickness (mm)	Length (mm)	Width (mm)	Area (m^2)	Weight (kg)	Density (g/m^2)
	468	1.9	6000	1210	7.26	2.54	350
	468	1.9	25000	1210	30.25	10.59	350
	468	1.9	105000	1210	127.05	44.48	350
	484	1.9	6000	1210	7.26	2.54	350
	484	1.9	25000	1210	30.25	10.59	350
	484	1.9	105000	1210	127.05	44.48	350
	487	1.9	6000	1210	7.26	2.54	350
	487	1.9	25000	1210	30.25	10.59	350
	487	1.9	105000	1210	127.05	44.48	350
	495	1.9	6000	1210	7.26	2.54	350
	495	1.9	25000	1210	30.25	10.59	350
	495	1.9	105000	1210	127.05	44.48	350
	542	1.9	6000	1210	7.26	2.54	350
	542	1.9	25000	1210	30.25	10.59	350
	542	1.9	105000	1210	127.05	44.48	350
	551	1.9	6000	1210	7.26	2.54	350
	551	1.9	25000	1210	30.25	10.59	350
	551	1.9	105000	1210	127.05	44.48	350
	550	1.9	6000	1210	7.26	2.54	350
	550	1.9	25000	1210	30.25	10.59	350
	550	1.9	105000	1210	127.05	44.48	350
	573	1.9	6000	1210	7.26	2.54	350
	573	1.9	25000	1210	30.25	10.59	350
	573	1.9	105000	1210	127.05	44.48	350

P R O D U C T S P E C I F I C A T I O N S

Design	Colour Code	Thickness (mm)	Length (mm)	Width (mm)	Area (m^2)	Weight (kg)	Density (g/m^2)
	580	1.9	6000	1210	7.26	2.54	350
	580	1.9	25000	1210	30.25	10.59	350
	580	1.9	105000	1210	127.05	44.48	350
	660	1.9	6000	1210	7.26	2.54	350
	660	1.9	25000	1210	30.25	10.59	350
	660	1.9	105000	1210	127.05	44.48	350
	721	1.9	6000	1210	7.26	2.54	350
	721	1.9	25000	1210	30.25	10.59	350
	721	1.9	105000	1210	127.05	44.48	350
	908	1.9	6000	1210	7.26	2.54	350
	908	1.9	25000	1210	30.25	10.59	350
	908	1.9	105000	1210	127.05	44.48	350

PRODUCT LIFE-CYCLE ASSESSMENT

Table 2: Product characteristics

	Product characteristics
Declared unit	1m² of Mura weighted 0.35kg, manufactured in Australia
Modules included	A1-A3, A4-A5, C1–C4, D
Technical life time	30 years
Geographical coverage	Global
Time period	July to September 2024

SYSTEM BOUNDARY

The scope of this EPD is cradle to gate (modules A1-A3) with optional modules A4-A5, modules C1–C4, and module D.

The scope of this declaration is according to the General Program Instructions (GPI) and four information modules according to ISO 21930 and EN 15804 and supplemented by an optional information module on potential loads and benefits beyond the building life cycle, as given in Figure 1.

The specific system boundary is shown in Figure 2. The following modules have not been declared as they are deemed not applicable for Woven Image products: B1 – material emissions from usage, B2 – maintenance including transport, B3 – repair, B4 – replacement, B5 – refurbishment, B6 – operational energy use and B7 – operational water use.

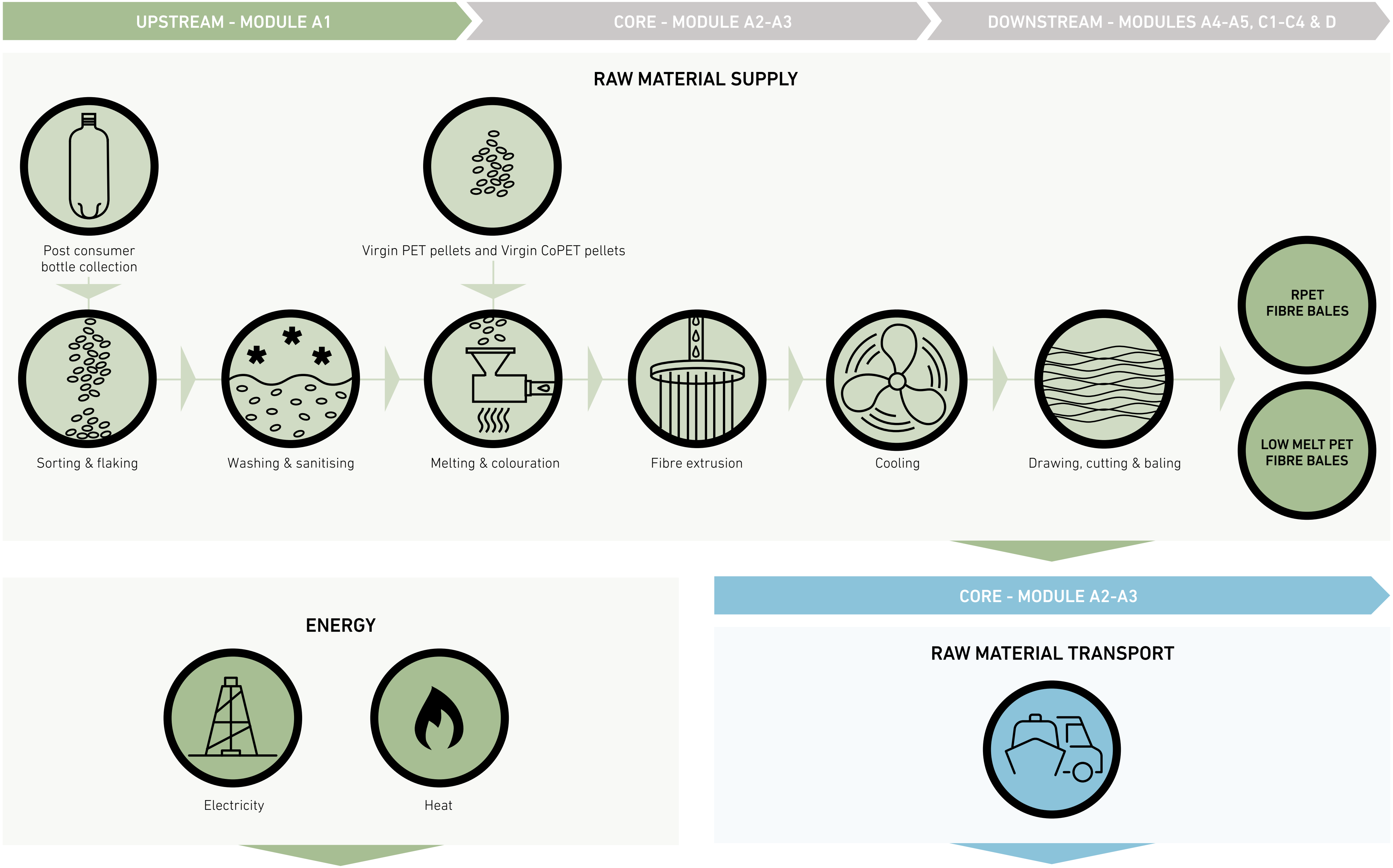
Figure 1: System boundary and scope of study

	Product stage			Construction process stage		Use stage							End-of-Life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse, recovery, & recycling potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	GLO	AU	GLO	GLO	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%					-	-	-	-	-	-	-	-	-	-	-	-

X = module included in EPD I AU = Australia, GLO = Global, ND = Not declared

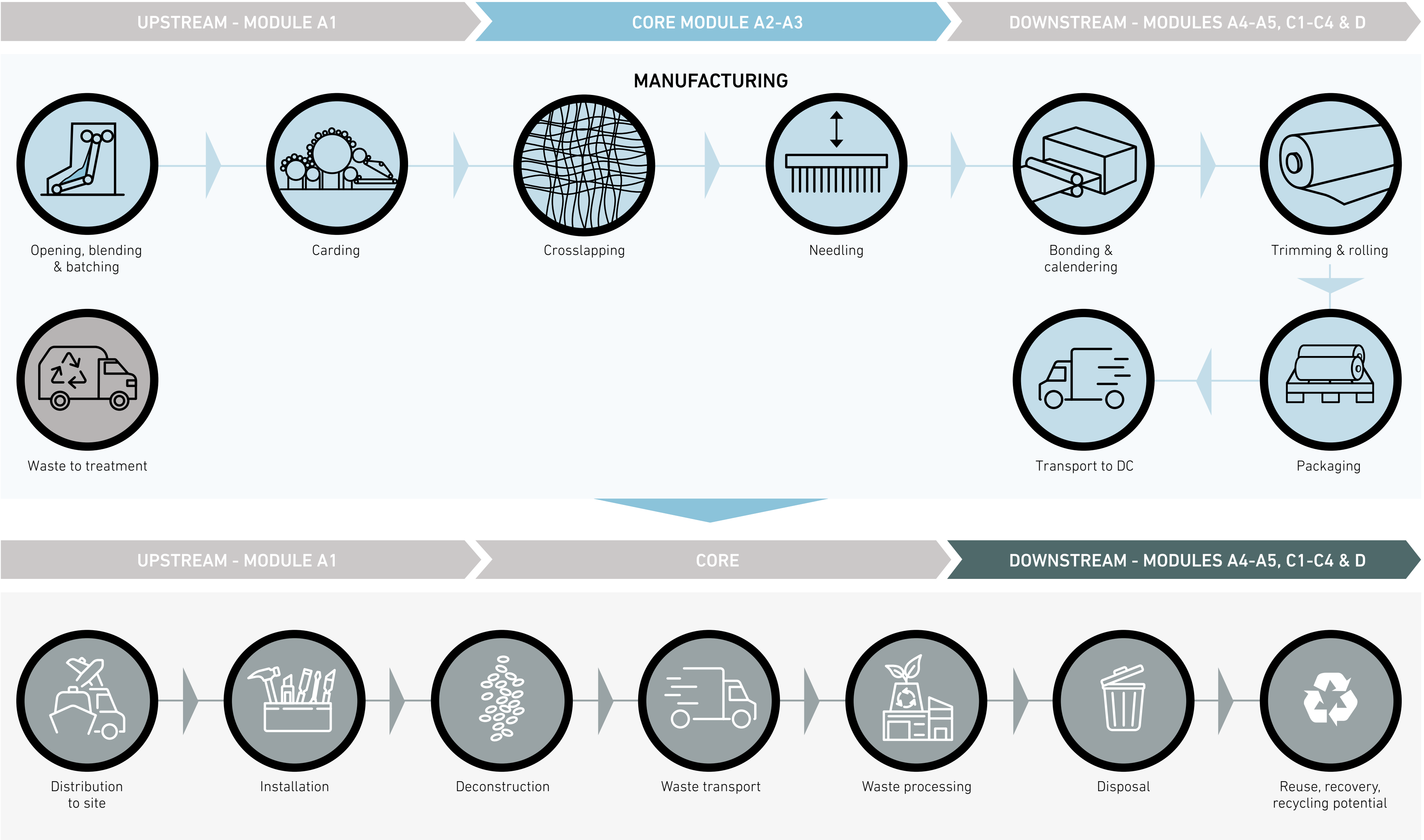
PRODUCT LIFE-CYCLE ASSESSMENT

Figure 2: Mura lifecycle system boundary



PRODUCT LIFE-CYCLE ASSESSMENT

Figure 2 *(continued)*: Mura lifecycle system boundary



PRODUCT LIFE-CYCLE ASSESSMENT

RAW MATERIAL SUPPLY

The primary raw materials used in the manufacturing of Mura are dope dyed post-consumer recycled PET fibre, virgin PET fibre and virgin bicomponent low melt and bicomponent PET fibre.

Details on PET fibre:

- 100% recycled PET fibre is melt spun from collected, sorted, washed and flaked post-consumer water bottles and soft drink bottles. Pigment is added to molten bottle flakes before being pumped through a spinneret under pressure. The extruded polymer is then quenched with cold air and the molten mass is drawn and solidified into filaments before being texturised and cut into staple length.
- 100% virgin PET staple fibre is melt spun from freshly polymerised polyester pellets. Virgin PET is derived from petrochemical sources like ethylene glycol and terephthalic acid and consistently provides quality, strength, and versatility.
- Bicomponent PET staple fibre is melt spun with virgin PET and coPET pellet. When the fibre is extruded 50% virgin PET forms the core of the fibre and 50% coPET the sheath.

MANUFACTURING AND HANDLING

Woven Image's Mura is manufactured in Australia by CSR Martini at the Villawood site, NSW. The primary energy source used in the Villawood site is based on the NSW grid electricity, which are black coal: 75% and photovoltaic: 17% – 0.72kg CO_2 eq./kWh (GWP-GHG).

The manufactured products are transported by road to Woven Image Brookvale warehouse for storage, quality assurance and preparation for distribution. Local electricity mix of Woven Image is based on NSW region, which primary energy sources of energy during the assessment period are black coal: 75%, and photovoltaic: 17% – 0.72kg CO_2 eq./kWh (GWP-GHG). In addition, the purchased GreenPower from a local electricity supplier Next Business Energy, documented as 100% wind is consumed as well. The GWP-GHG of GreenPower is 2.21 E-04 kg CO_2 eq./kWh (GWP-GHG).

Table 3 lists the main materials and packaging used to produce EchoPanel® 12mm. Product packaging is made up of plastics, wooden pallets, and cardboard. The packaging is less than 3% of the weight of the product.

Table 3: Content declaration for Mura

Material input	Percent composition for 1m² of product	Post-consumer recycled material, weight	Biogenic content kg C/m² of product
Polyester (polyethylene terephthalate) fibre	97.8% - 99.8%	60%	0
Pigment	<2.2%	0%	0

Packaging materials	Percent composition for 1m² of product	Post-consumer recycled material, weight	Biogenic content kg C/m² of product
Plastic	0.6%	0%	0
Cardboard	2.3%	0%	3.7E-03

None of the products contain one or more substances that are listed in the 'Candidate List of Substances of Very High Concern for authorisation'. Based on available information and safety data sheets, Woven Image products and their raw materials are not classified as hazardous according to criteria of Safe Work Australia GHS 7.

PRODUCT LIFE-CYCLE ASSESSMENT

DISTRIBUTION

Woven Image's Mura is distributed worldwide through international sales offices, Australian sales offices and international distribution partners. Logistics modes used include road, sea and air.

To enable customised calculations of the A4 transport impact, unit transport impacts for different modes are provided in the Additional Environmental Information section.

Table 4: Distribution mode and average distance

	By road	By sea	By air
Average distance (km)	1114	N/A	12078
Portion	98.2%	N/A	1.8%

INSTALLATION, USE AND DECONSTRUCTION

Mura is installed following the methodology outlined in the Mura Installation Guide. Depending on the client's preference. Woven Image products can be installed using an adhesive or can be mechanically fixed using screws. In this EPD, bead tube adhesive method is used for modelling as it is more comment during the installation. Data was made from the most conservative assumptions based on Woven Image installation methodology, although scissor lifts are not necessary for all installation purposes.

0.1 kg of bead tube adhesive is used for bonding 1m² of Mura.

There is no waste during the installation process because all products are designed to be made-to-fit.

Product packaging is discarded or reused – plastic and metal packaging go to landfill, cardboard packaging goes to recycling, and wooden pallet is reused directly. The reason considering the metal strapping seals to be landfilled is because of the small quantity used per m² of product. The impacts associated with deconstruction are assumed to be negligible and have not been assessed in detail in this study.

END-OF-LIFE

At end-of-life, products are removed, transported to waste processing, and landfilled. There is very limited data available from Woven Image's extended producer responsibility product take-back scheme. For this reason, the conservative assumption is that 100% of the products used in the area outside Europe go to landfill, which corresponds to the final disposition of the product (Module C4). On the other hand, the regulation forces the waste to energy (W2E) of plastic products in Europe, which leads to 100% of the products sent for municipal incineration.

Assuming Mura can be manually deconstructed and the impact for deconstruction (C1) is 0.

C2 (transport to end-of-life) is assumed at a distance of 25km since there was no primary data available.

If 100% of products end up in landfill, the amounts for C3 are 0 and C4 are the weight of the installed product. Otherwise, the amount ends up in C3 is the weight of the installed product.

A second waste to energy scenario has been modelled if Woven Image products are shipped and used in Europe as an alternative to landfill. As per the end-of-life requirements of waste in Europe, 100% of plastic and adhesive are incinerated for energy recovery.

BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY

In Module A5, the packaging cardboard is recycled, which brings a certain benefit to Module D.

For scenario 1 that all products are sent to landfill as it's end-of-life, there is no benefit to Module D due to the product is 100% destined for landfill – no specific market yet exists for waste panels.

In scenario 2, 100% of products end up with energy recovery. Net energy production from PET incineration is 2.97MJ/kg electric energy and 5.81MJ/kg thermal energy suggested by ecoinvent. The avoided products are considered as electricity and heat from natural gas in Europe.

PRODUCT LIFE-CYCLE ASSESSMENT

METHODOLOGY AND COMPLIANCE WITH STANDARDS

The methodology and report format has been modified to comply with:

- ISO 14040:2006 and ISO14044:2006+A1:2018 which describe the principles, framework, requirements and provides guidelines for life cycle assessment (LCA).
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures, which establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations.
- EN 15804:2012+A1:2013; Sustainability of construction works – Environmental product declarations.
- EN 15804:2012+A2:2019; Sustainability of construction works – Environmental product declarations.
- Product Category Rules (PCR) 2019:14, v1.3.4 – Construction products – Hereafter referred to as PCR 2019:14.
- General Programme Instructions (GPI) for the International EPD System V4.0 – containing instructions regarding methodology and the content that must be included in EPDs registered under the International EPD System.
- Instructions of EPD Australasia V4.2 – a regional annex to the general programme instructions of the International EPD System.

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard, and EPDs might not be comparable, particularly if different functional units are used.

It is discouraged to use the results of modules A1-A3 without considering the results of module C.

The best way to compare products and materiality of differences is to place them into the context of a structure across the whole life cycle.

CORE DATA COLLECTION

- The primary data used for the study is based on direct utility bills or feedstock quantities from CSR Martini, TTN and Woven Image's procurement records. Edge used contribution analysis to focus on the key pieces of data contributing to the environmental impact categories. The data was benchmarked against relevant benchmark data in ecoinvent. Edge considers the data to be of high quality for primary data used in this study.
- For the background data, the quality was considered very good when processes chosen were geographically, temporally, and technologically relevant as shown in Table 5 (next page). For data that was based on assumptions, quality was considered fair, unless based on official reports.

BACKGROUND DATA

The primary data used for the study is based on direct utility bills or feedstock quantities from CSR Martini, TTN and Woven Image's procurement records. Edge used contribution analysis to focus on the key pieces of data contributing to the environmental impact categories. The data was benchmarked against relevant benchmark data in ecoinvent. Edge considers the data to be of high quality for primary data used in this study.

For the background data, the quality was considered very good when processes chosen were geographically, temporally, and technologically relevant as shown in Table 6. For data that was based on assumptions, quality was considered fair, unless based on official reports.

PRODUCT LIFE-CYCLE ASSESSMENT

Table 5: Data source, time, and quality

Module	Asset life cycle stage	Geographical coverage	Primary data	Generic data	Primary data quality	Generic data quality
A1	Raw material supply	Australia, Taiwan, Thailand	Source and quantities of materials of feed mix Inputs: electricity, diesel and gas	Extraction of raw materials	Very good	Good
A2	Transport from supplier	Thailand	Transport mode and distance	Fuel consumption embedded in process	Good	Good
A3	Manufacturing	Australia	Inputs: water use Outputs: manufactured product quantities, packaging, waste		Very good	
A4	Transport to customer	Global	Transport mode and average distances to DC from manufacturing sites		Good	
A5	Construction, installation	Global		Packaging disposal/recycling methods and rates – national rates		Good
C2	Transport to waste processing	Global		Transportation to landfill – reprocessing – assumption		Good
C3	Waste processing	Europe		Waste to energy recovery from European standard		Good
C4	Disposal	Global		Waste to landfill scenario and rates from industry data		Good
D	Benefits	Global		Energy recovery		Good

CUT OFF CRITERIA

It is common practice in LCA/LCI protocols to propose exclusion limits for inputs and outputs that fall below a threshold % of the total, but with the exception that where the input/output has a 'significant' impact it should be included. According to the PCR 2019:14 v1.3.4, Life cycle inventory data shall according to EN 15804+A2 include a minimum of 95% of total inflows (mass and energy) per module. Inflows not included in the LCA shall be documented in the EPD. Data gaps in included stages in the downstream modules shall be reported in the EPD, including an evaluation of their significance. In accordance with the PCR 2019:14 v1.3.4, the following system boundaries are applied to manufacturing equipment and employees:

- Environmental impact from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not accounted for in the LCI. Capital equipment and buildings typically account for less than a few percent of nearly all LCIs and this is usually smaller than the error in the inventory data itself.
- For this project, it is assumed that capital equipment makes a negligible contribution to the impacts as per Frischknecht et al. (Frischknecht, 2007) with no further investigation.
- Personnel-related impacts, such as transportation to and from work, are also not accounted for in the LCI. The impacts of employees are also excluded from inventory impacts on the basis that if they were not employed for this production or service function, they would be employed for another. It is very hard to decide what proportion of the impacts from their whole lives should count towards their employment. For this project, the impacts of employees are excluded.
- The transport of scissor lift to and from the installation site is excluded.
- Besides these exclusions, no energy or mass flows were excluded in this LCA report.

PRODUCT LIFE-CYCLE ASSESSMENT

ALLOCATION

According to EN 15804+A2, in a process step where more than one type of product is generated, it is necessary to allocate the environmental stressors (inputs and outputs) from the process to the different products (functional outputs) in order to get product-based inventory data instead of process-based data. An allocation problem also occurs for multi-input processes.

In an allocation procedure, the sum of the allocated inputs and outputs to the products shall be equal to the unallocated inputs and outputs of the unit process.

The following stepwise allocation principles shall be applied for multi-input/output allocations:

- The initial allocation step includes dividing up the system sub-processes and collecting the input and output data related to these sub-processes.
- The first (preferably) allocation procedure step for each sub-process is to partition the inputs and outputs of the system into their different products in a way that reflects the underlying physical relationships between them.
- The second (worst case) allocation procedure step is needed when physical relationship alone cannot be established or used as the basis for allocation. In this case, the remaining environmental inputs and outputs from a sub-process must be allocated between the products in a way that reflects other relationships between them, such as the economic value of the products.

Waste values were provided in lump sums per material, and were allocated to each product according to the percentage of total product produced in one year.

PRODUCT GROUPING

This is an EPD for product presented in table 6. The data presented is based on the grouped average results of 1m^2 of Mura in different colours.

Table 6: Product grouping

Product group	Products in each group	Selected product
Mura rolls	Non-printed	Coloured average

ASSUMPTIONS, CHOICES, AND LIMITATIONS

Table 7: Assumptions or limitations data assessment scheme

Assumption or limitation	Impact on LCA results	Discussion
Raw material data for panel production is based on generic information	Significant	The EN 15804 standard permits generic data for upstream processes, however, this is where the main impacts are for panels across the life cycle. Supplier specific data was only used for shipping and transport of raw materials.
Use of proxy process for PET fibre production	Moderate	Complete data for producing fibre from PET granulate is limited. Extrusion is the primary process and was used for all PET fibres in this assessment. It is assuming that additional manufacturing stages are insignificant, and extrusion is an accurate proxy for PET fibre production.
Average pigment composition	Minor	In the case of coloured Woven Image products, this LCA uses an average pigment composition. This generalisation is justified by the large size of product stock in the Woven Image range if each different colour classified a different product and the fact that the colour stock changes frequently and is often added to.
Exclusion of employees, capital good and infrastructure	Minor	Allowed/required as per EPD rules.
Assumed material for installation	Moderate	Assumptions of what material used for the installation process of the panels referred to the most conservative methodology by Woven Image.
Mixed origins of electricity in installation and deconstruction	Minor	The normalised electricity is modelled based on the distribution of panels. It doesn't reflect the installation, and deconstruction impacts in the specific country. The electricity consumption is listed to help understand the impacts.
Landfill disposal	Moderate	A 100% landfill rate is assumed at end-of-life. There could be instances where the end-of-life sections are sent for energy recovery through incineration. This scenario has been modelled as an alternative solution, applying a 100% waste-to-energy assumption.

PRODUCT LIFE-CYCLE ASSESSMENT

ENVIRONMENTAL IMPACT INDICATORS

The potential environmental impacts, use of resources and waste categories included in this EPD were calculated using the SimaPro v9.6 tool and are listed in Table 8. The characterisation factors applied to the calculation of potential environmental impacts are based on version 3.1 of the reference package for CFs used in the Product Environmental Footprint (PEF) framework (EF 3.1). The impact results of the biogenic carbon and energy resource use are coherent with the guidance and requirement in Annex 2 and Annex 3 – Option A of PCR 2019:14

All tables from this point will contain the abbreviation only. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Table 8: **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Global warming potential – total	GWP-T	kg CO_2 eq. (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Global warming potential – fossil	GWP-F	kg CO_2 eq. (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Global warming potential – biogenic	GWP-B	kg CO_2 eq. (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Land use/land transformation	GWP-L	kg CO_2 eq. (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Ozone depletion potential	ODP	kg CFC 11 eq.	Steady-state ODPs, WMO 2014
Acidification potential	AP	mol H+ eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication – aquatic freshwater	EP-F2	kg P eq.	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication – aquatic marine	EP-M	kg N eq.	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication – terrestrial	EP-T	mol N eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone creation potential	POCP	kg NMVOC eq.	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe
Abiotic depletion potential – elements*	ADPE	kg Sb eq.	CML (v4.8)
Abiotic depletion potential – fossil fuels*	ADPF	MJ net calorific value	CML (v4.8)
Water depletion potential*	WDP	m^3 eq. deprived	Available Water Remaining (AWARE) Boulay et al., 2016 (includes Australia flows calculated using 36 Australian catchments)

* Disclaimer – The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

PRODUCT LIFE-CYCLE ASSESSMENT

RESOURCE USE

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value	Manual for direct inputs[1]
Use of renewable primary energy resources used as raw materials	PERM	MJ, net calorific value	Manual for direct inputs[2]
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value	ecoinvent version 3.9.1 and expanded by PRé Consultants[3]
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value	Manual for direct inputs[4]
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ, net calorific value	Manual for direct inputs[5]
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value	ecoinvent version 3.9.1 and expanded by PRé Consultants[6]
Use of secondary material	SM	kg	Manual for direct inputs
Use of renewable secondary fuels	RSF	mol N eq.	Manual for direct inputs
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value	Manual for direct inputs
Use of net fresh water	FW	m^3	ReCiPe 2016

WASTE PRODUCTION

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Hazardous waste disposed	HWD	kg	EDIP 2003 (v1.05)
Non-hazardous waste disposed	NHWD	kg	EDIP 2003 (v1.05)[7]
Radioactive waste disposed/stored	RWD	kg	EDIP 2003 (v1.05)

1 PERE = PERT - PERM
2 Calculated based on the lower heating value of renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to calculate-EN-15804-A2-indicators-in-desktop-SimaPro
3 Calculated as sum of renewables, biomass; renewable, wind, solar and geothermal, and renewable, water.
4 PENRE = PENRT – PENRM
5 Calculated based on the lower heating value (LHV) of non-renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to-calculate-EN-15804-A2-indicators-in-desktop-SimaPro
6 Calculated as sum of non-renewables, fossil and non-renewable, nuclear.
7 Calculated as sum of bulk waste and slags/ash.

PRODUCT LIFE-CYCLE ASSESSMENT

OUTPUT FLOWS

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Components for re-use	CRU	kg	Manual for direct inputs
Material for recycling	MFR	kg	Manual for direct inputs
Materials for energy recovery	MERE	kg	Manual for direct inputs
Exported energy – electricity	EE - e	MJ per energy carrier	Manual for direct inputs
Exported energy – thermal	EE - t	MJ per energy carrier	Manual for direct inputs

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021[8]
Particulate matter	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising radiation – human health**	Potential human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	Human health effect model
Eco-toxicity (freshwater)*	Potential comparative toxic unit for ecosystems (ETP-fw)	CTUe	USEtox
Human toxicity potential – cancer effects*	Potential comparative toxic unit for humans (HTP-c)	CTUh	USEtox
Human toxicity potential – non cancer effects*	Potential comparative toxic unit for humans (HTP-nc)	CTUh	USEtox
Soil quality*	Potential soil quality index (SQP)	Dimensionless	Soil quality index (LANCA®)

8 This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

* Disclaimer – The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Disclaimer – This impact category deals mainly with the eventual impact of low dose ionising radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

PRODUCT LIFE-CYCLE ASSESSMENT

OUTPUT FLOWS

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Components for re-use	CRU	kg	Manual for direct inputs
Material for recycling	MFR	kg	Manual for direct inputs
Materials for energy recovery	MERE	kg	Manual for direct inputs
Exported energy – electricity	EE - e	MJ per energy carrier	Manual for direct inputs
Exported energy – thermal	EE - t	MJ per energy carrier	Manual for direct inputs

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Table 8 (*continued*): **Life cycle impact, resource and waste assessment categories, measurements and methods accordance with EN15804+A2**

Impact category	ABR	Unit	Assessment method and implementation
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021[8]
Particulate matter	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising radiation – human health	Potential human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	Human health effect model
Eco-toxicity (freshwater)	Potential comparative toxic unit for ecosystems (ETP-fw)	CTUe	USEtox
Human toxicity potential – cancer effects	Potential comparative toxic unit for humans (HTP-c)	CTUh	USEtox
Human toxicity potential – non cancer effects	Potential comparative toxic unit for humans (HTP-nc)	CTUh	USEtox
Soil quality	Potential soil quality index (SQP)	Dimensionless	Soil quality index (LANCA®)

1 PERE = PERT - PERM
2 Calculated based on the lower heating value of renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to calculate-EN-15804-A2-indicators-in-desktop-SimaPro
3 Calculated as sum of renewables, biomass; renewable, wind, solar and geothermal, and renewable, water.
4 PENRE = PENRT – PENRM
5 Calculated based on the lower heating value (LHV) of non-renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to-calculate-EN-15804-A2-indicators-in-desktop-SimaPro
6 Calculated as sum of non-renewables, fossil and non-renewable, nuclear.
7 Calculated as sum of bulk waste and slags/ash.
8 This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

ENVIRONMENTAL PERFORMANCE

LANDFILL SCENARIO

ENVIRONMENTAL IMPACTS

Table 9: **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming potential – total	GWP-T	kg CO_2 eq.	1.19E+00	1.22E-01	3.55E-01	0.00E+00	1.71E-03	0.00E+00	3.74E-02	2.23E-03
Global warming potential – fossil	GWP-Fossil	kg CO_2 eq.	1.20E+00	1.22E-01	3.41E-01	0.00E+00	1.71E-03	0.00E+00	3.74E-02	2.20E-03
Global warming potential – biogenic	GWP-B	kg CO_2 eq.	-1.02E-02	6.93E-06	1.37E-02	0.00E+00	1.02E-07	0.00E+00	2.74E-05	2.94E-05
Global warming potential – land use/land transformation	GWP-Luluc	kg CO_2 eq.	1.17E-03	3.99E-06	4.05E-06	0.00E+00	5.88E-08	0.00E+00	1.47E-06	7.76E-06
Ozone depletion potential	ODP	kg CFC 11 eq.	2.24E-06	1.77E-09	4.65E-06	0.00E+00	2.34E-11	0.00E+00	3.46E-11	3.41E-11
Acidification potential	AP	mol H+ eq.	5.95E-03	4.39E-04	2.62E-03	0.00E+00	5.01E-06	0.00E+00	2.30E-05	2.78E-05
Eutrophication – freshwater	EP-F2	kg P eq.	2.53E-04	1.53E-06	6.48E-06	0.00E+00	3.38E-08	0.00E+00	3.40E-07	5.57E-07
Eutrophication – marine	EP-M	kg N eq.	1.23E-03	1.72E-04	5.28E-04	0.00E+00	1.84E-06	0.00E+00	1.00E-03	7.45E-06
Eutrophication – terrestrial	EP-T	mol N eq.	1.20E-02	1.84E-03	5.72E-03	0.00E+00	1.95E-05	0.00E+00	1.05E-04	7.64E-05
Photochemical ozone creation potential	POCP	kg NMVOC eq.	4.41E-03	6.06E-04	1.56E-03	0.00E+00	7.02E-06	0.00E+00	4.05E-05	2.25E-05
Abiotic depletion potential – minerals and metals	ADP	kg Sb eq.	5.18E-05	5.70E-09	2.28E-08	0.00E+00	1.02E-10	0.00E+00	1.01E-10	4.60E-09
Abiotic depletion potential – fossil fuels	ADPF	MJ	2.11E+01	1.61E+00	3.60E+00	0.00E+00	2.28E-02	0.00E+00	3.51E-02	2.61E-02
Water depletion potential	WDP	m^3	4.34E-01	2.14E-03	3.89E-02	0.00E+00	3.25E-05	0.00E+00	1.50E-04	2.02E-04

ENVIRONMENTAL PERFORMANCE

RESOURCE USE

Table 9 (*continued*): **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ	1.78E+00	2.45E-03	1.27E-01	0.00E+00	3.35E-05	0.00E+00	1.45E-03	2.88E-01
Use of renewable primary energy resources used as raw materials	PERM	MJ	9.60E-02	0.00E+00	-9.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Primary renewable energy – total	PERT	MJ	1.88E+00	2.45E-03	3.11E-02	0.00E+00	3.35E-05	0.00E+00	1.45E-03	2.88E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ	1.27E+01	1.61E+00	3.92E+00	0.00E+00	2.28E-02	0.00E+00	8.09E+00	2.61E-02
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	8.37E+00	0.00E+00	-3.20E-01	0.00E+00	0.00E+00	0.00E+00	-8.05E+00	0.00E+00
Primary non-renewable energy – total	PENRT	MJ	2.11E+01	1.61E+00	3.60E+00	0.00E+00	2.28E-02	0.00E+00	3.51E-02	2.61E-02
Use of secondary material	SM	Kg	2.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	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
Use of non-renewable secondary fuels	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
Use of net fresh water	FW	m³	1.04E-02	7.91E-05	1.25E-03	0.00E+00	1.17E-06	0.00E+00	6.73E-06	5.80E-06

WASTE PRODUCTION

Table 9 (*continued*): **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste disposed	HWD	Kg	4.44E-04	1.08E-05	1.03E-07	0.00E+00	1.53E-07	0.00E+00	1.84E-07	2.01E-07
Non-hazardous waste disposed	NHWD	Kg	7.55E-02	2.58E-04	7.20E-03	0.00E+00	6.00E-06	0.00E+00	4.45E-01	4.44E-05
Radioactive waste disposed/stored	RWD	Kg	1.43E-05	6.22E-08	4.37E-09	0.00E+00	8.18E-10	0.00E+00	2.83E-08	1.72E-08

ENVIRONMENTAL PERFORMANCE

OUTPUT FLOWS

Table 9 (*continued*): **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for reuse	CRU	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
Materials for recycling	MFR	Kg	0.00E+00	0.00E+00	8.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	MFRE	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
Exported energy – electricity	EE - e	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
Exported energy – thermal	EE - t	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

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Table 9 (*continued*): **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 eq	1.20E+00	1.22E-01	3.41E-01	0.00E+00	1.71E-03	0.00E+00	3.74E-02	2.23E-03
Particulate matter	PM	Disease incidence	5.12E-08	4.52E-09	5.18E-08	0.00E+00	1.15E-10	0.00E+00	5.72E-10	3.81E-10
Ionising radiation - human health	IRP	kBq U-235 eq	5.88E-02	3.09E-04	4.85E-05	0.00E+00	4.12E-06	0.00E+00	1.18E-04	6.96E-05
Eco-toxicity – freshwater	ETP - fw	CTUe	3.06E+00	8.14E-01	5.51E+00	0.00E+00	1.20E-02	0.00E+00	1.09E-01	1.23E-02
Human toxicity potential - cancer effects	HTP - c	CTUh	3.82E-10	7.54E-12	9.06E-11	0.00E+00	1.28E-13	0.00E+00	3.97E-13	1.52E-12
Human toxicity potential - non cancer effects	HTP - nc	CTUh	7.96E-09	1.08E-09	6.42E-09	0.00E+00	1.23E-11	0.00E+00	6.63E-11	1.72E-11
Soil quality	SQP	Pt	4.68E+00	4.22E-03	7.73E-03	0.00E+00	8.83E-05	0.00E+00	7.83E-02	1.67E+00

ENVIRONMENTAL PERFORMANCE

EN 15804 + A1

Table 9 (*continued*): **Environmental impact per m² of installed Mura – End-of-life landfill scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming (GWP100a) - A1	GWP100a - A1	kg CO_2 eq	1.20E+00	1.22E-01	3.27E-01	0.00E+00	1.71E-03	0.00E+00	3.76E-02	2.23E-03
Ozone layer depletion (ODP) - A1	ODP - A1	kg CFC-11 eq	1.50E-06	1.40E-09	6.37E-06	0.00E+00	1.86E-11	0.00E+00	2.77E-11	2.96E-11
Acidification - A1	AP - A1	kg SO2 eq	4.12E-03	3.25E-04	2.16E-03	0.00E+00	3.76E-06	0.00E+00	1.66E-05	2.16E-05
Eutrophication - A1	EP - A1	kg PO4 eq	1.22E-03	6.37E-05	1.97E-04	0.00E+00	7.52E-07	0.00E+00	4.24E-04	4.39E-06
Photochemical oxidation - A1	PO - A1	kg C2H4 eq	2.38E-04	1.33E-05	6.98E-05	0.00E+00	2.10E-07	0.00E+00	6.32E-06	9.13E-07
Abiotic depletion - A1	ADP - A1	kg Sb eq	5.18E-05	5.71E-09	2.51E-08	0.00E+00	1.02E-10	0.00E+00	1.06E-10	4.61E-09
Abiotic depletion (fossil fuels) - A1	ADPF - A1	MJ	2.21E+01	1.58E+00	2.98E+00	0.00E+00	2.25E-02	0.00E+00	3.53E-02	7.63E-03

ENVIRONMENTAL PERFORMANCE

WASTE TO ENERGY SCENARIO

ENVIRONMENTAL IMPACTS

Table 10: **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming potential - total	GWP-T	kg CO_2 eq.	1.19E+00	1.22E-01	3.55E-01	0.00E+00	1.71E-03	9.17E-01	0.00E+00	-9.58E-01
Global warming potential - fossil	GWP-Fossil	kg CO_2 eq.	1.20E+00	1.22E-01	3.41E-01	0.00E+00	1.71E-03	9.17E-01	0.00E+00	-9.50E-01
Global warming potential - biogenic	GWP-B	kg CO_2 eq.	-1.02E-02	6.93E-06	1.37E-02	0.00E+00	1.02E-07	5.05E-06	0.00E+00	-5.38E-03
Global warming potential - land use/land transformation	GWP-Luluc	kg CO_2 eq.	1.17E-03	3.99E-06	4.05E-06	0.00E+00	5.88E-08	1.23E-06	0.00E+00	-2.41E-03
Ozone depletion potential	ODP	kg CFC 11 eq.	2.24E-06	1.77E-09	4.65E-06	0.00E+00	2.34E-11	2.31E-10	0.00E+00	-1.55E-08
Acidification potential	AP	mol H+ eq.	5.95E-03	4.39E-04	2.62E-03	0.00E+00	5.01E-06	1.68E-04	0.00E+00	-4.66E-03
Eutrophication – freshwater	EP-F2	kg P eq.	2.53E-04	1.53E-06	6.48E-06	0.00E+00	3.38E-08	7.88E-07	0.00E+00	-8.80E-04
Eutrophication – marine	EP-M	kg N eq.	1.23E-03	1.72E-04	5.28E-04	0.00E+00	1.84E-06	1.15E-04	0.00E+00	-8.19E-04
Eutrophication – terrestrial	EP-T	mol N eq.	1.20E-02	1.84E-03	5.72E-03	0.00E+00	1.95E-05	9.17E-04	0.00E+00	-7.04E-03
Photochemical ozone creation potential	POCP	kg NMVOC eq.	4.41E-03	6.06E-04	1.56E-03	0.00E+00	7.02E-06	2.24E-04	0.00E+00	-2.26E-03
Abiotic depletion potential - minerals and metals	ADP	kg Sb eq.	5.18E-05	5.70E-09	2.28E-08	0.00E+00	1.02E-10	5.02E-09	0.00E+00	-5.44E-08
Abiotic depletion potential - fossil fuels	ADPF	MJ	2.11E+01	1.61E+00	3.60E+00	0.00E+00	2.28E-02	9.60E-02	0.00E+00	-2.24E+01
Water depletion potential	WDP	m³	4.34E-01	2.14E-03	3.89E-02	0.00E+00	3.25E-05	-2.35E-03	0.00E+00	-2.24E-01

ENVIRONMENTAL PERFORMANCE

RESOURCE USE

Table 10 (*continued*): **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ	1.78E+00	2.45E-03	1.27E-01	0.00E+00	3.35E-05	1.09E-03	0.00E+00	-4.62E+00
Use of renewable primary energy resources used as raw materials	PERM	MJ	9.60E-02	0.00E+00	-9.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Primary renewable energy - total	PERT	MJ	1.88E+00	2.45E-03	3.11E-02	0.00E+00	3.35E-05	1.09E-03	0.00E+00	-4.62E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ	1.27E+01	1.61E+00	3.92E+00	0.00E+00	2.28E-02	8.15E+00	0.00E+00	-2.24E+01
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	8.37E+00	0.00E+00	-3.20E-01	0.00E+00	0.00E+00	-8.05E+00	0.00E+00	0.00E+00
Primary non-renewable energy – total	PENRT	MJ	2.11E+01	1.61E+00	3.60E+00	0.00E+00	2.28E-02	9.60E-02	0.00E+00	-2.24E+01
Use of secondary material	SM	Kg	2.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	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
Use of non-renewable secondary fuels	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
Use of net fresh water	FW	m³	1.04E-02	7.91E-05	1.25E-03	0.00E+00	1.17E-06	-1.48E-05	0.00E+00	-1.71E-02

WASTE PRODUCTION

Table 10 (*continued*): **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste disposed	HWD	Kg	4.44E-04	1.08E-05	1.03E-07	0.00E+00	1.53E-07	1.05E-06	0.00E+00	-2.49E-05
Non-hazardous waste disposed	NHWD	Kg	7.55E-02	2.58E-04	7.20E-03	0.00E+00	6.00E-06	1.14E-02	0.00E+00	-2.65E-02
Radioactive waste disposed/stored	RWD	Kg	1.43E-05	6.22E-08	4.37E-09	0.00E+00	8.18E-10	1.41E-08	0.00E+00	-1.64E-04

ENVIRONMENTAL PERFORMANCE

OUTPUT FLOWS

Table 10 (*continued*): **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for reuse	CRU	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
Materials for recycling	MFR	Kg	0.00E+00	0.00E+00	8.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	MFRE	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
Exported energy – electricity	EE - e	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+00	0.00E+00	0.00E+00
Exported energy – thermal	EE - t	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E+00	0.00E+00	0.00E+00

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Table 10 (*continued*): **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 eq	1.20E+00	1.22E-01	3.41E-01	0.00E+00	1.71E-03	9.17E-01	0.00E+00	-9.58E-01
Particulate matter	PM	Disease incidence	5.12E-08	4.52E-09	5.18E-08	0.00E+00	1.15E-10	8.25E-10	0.00E+00	-1.28E-08
Ionising radiation - human health	IRP	kBq U-235 eq	5.88E-02	3.09E-04	4.85E-05	0.00E+00	4.12E-06	5.61E-05	0.00E+00	-6.40E-01
Ecotoxicity – freshwater	ETP - fw	CTUe	3.06E+00	8.14E-01	5.51E+00	0.00E+00	1.20E-02	4.77E-01	0.00E+00	-2.11E+00
Human toxicity potential - cancer effects	HTP - c	CTUh	3.82E-10	7.54E-12	9.06E-11	0.00E+00	1.28E-13	3.17E-11	0.00E+00	-1.51E-10
Human toxicity potential - non cancer effects	HTP - nc	CTUh	7.96E-09	1.08E-09	6.42E-09	0.00E+00	1.23E-11	2.71E-09	0.00E+00	-6.37E-09
Soil quality	SQP	Pt	4.68E+00	4.22E-03	7.73E-03	0.00E+00	8.83E-05	6.57E-03	0.00E+00	-1.13E+00

ENVIRONMENTAL PERFORMANCE

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Table 10 (*continued*): **Environmental impact per m² of installed Mura – End-of-life W2E scenario**

Indicator	ABR	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Global warming (GWP100a) - A1	GWP100a - A1	kg CO_2 eq	1.20E+00	1.22E-01	3.27E-01	0.00E+00	1.71E-03	9.17E-01	0.00E+00	-9.57E-01
Ozone layer depletion (ODP) - A1	ODP - A1	kg CFC-11 eq	1.50E-06	1.40E-09	6.37E-06	0.00E+00	1.86E-11	2.08E-10	0.00E+00	-1.30E-08
Acidification - A1	AP - A1	kg SO2 eq	4.12E-03	3.25E-04	2.16E-03	0.00E+00	3.76E-06	1.16E-04	0.00E+00	-3.95E-03
Eutrophication - A1	EP - A1	kg PO4 eq	1.22E-03	6.37E-05	1.97E-04	0.00E+00	7.52E-07	5.61E-05	0.00E+00	-2.99E-03
Photochemical oxidation - A1	PO - A1	kg C2H4 eq	2.38E-04	1.33E-05	6.98E-05	0.00E+00	2.10E-07	1.47E-06	0.00E+00	-1.72E-04
Abiotic depletion - A1	ADP - A1	kg Sb eq	5.18E-05	5.71E-09	2.51E-08	0.00E+00	1.02E-10	5.02E-09	0.00E+00	-8.25E-08
Abiotic depletion (fossil fuels) - A1	ADPF - A1	MJ	2.21E+01	1.58E+00	2.98E+00	0.00E+00	2.25E-02	1.03E-01	0.00E+00	-1.41E+01

ADDITIONAL ENVIRONMENTAL INFORMATION

Due to the uncertainty surrounding A4 distribution, additional environmental information has been provided detailing the impacts of delivering 1m^2 of packaged product over 100km via different transport modes. This is intended to facilitate customised impact calculations.

Table 11: **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Global warming potential – total	GWP – T	kg CO_2 eq.	5.55E-03	2.35E-04	2.80E-02
Global warming potential – fossil	GWP - F	kg CO_2 eq.	5.54E-03	2.35E-04	2.80E-02
Global warming potential – biogenic	GWP - B	kg CO_2 eq.	3.29E-07	1.26E-08	1.53E-06
Global warming potential – land use/land transformation	GWP - L	kg CO_2 eq.	1.90E-07	7.88E-09	8.79E-07
Ozone depletion potential	ODP	kg CFC 11 eq.	7.57E-11	3.53E-12	4.35E-10
Acidification potential	AP	mol H+ eq.	1.62E-05	6.67E-06	1.20E-04
Eutrophication – freshwater	EP - F	kg P eq.	1.09E-07	1.41E-09	1.54E-07
Eutrophication – marine	EP - M	kg N eq.	5.96E-06	1.53E-06	4.92E-05
Eutrophication – terrestrial	EP - T	mol N eq.	6.32E-05	1.70E-05	5.28E-04
Photochemical ozone creation potential	POCP	kg NMVOC eq.	2.27E-05	4.58E-06	1.64E-04
Abiotic depletion potential – minerals and metals	ADP	kg Sb eq.	3.29E-10	2.53E-12	9.62E-10
Abiotic depletion potential – fossil fuels	ADPF	MJ	7.39E-02	2.89E-03	3.71E-01
Water depletion potential*	WDP	m^3	1.05E-04	2.55E-06	4.56E-04

ADDITIONAL ENVIRONMENTAL INFORMATION

RESOURCE USE

Table 11 (*continued*): **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ	1.08E-04	4.83E-06	5.83E-04
Use of renewable primary energy resources used as raw materials	PERM	MJ	0.00E+00	0.00E+00	0.00E+00
Primary renewable energy - total	PERT	MJ	1.08E-04	4.83E-06	5.83E-04
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ	7.39E-02	2.89E-03	3.71E-01
Use of non- renewable primary energy resources used as raw materials	PENRM	MJ	0.00E+00	0.00E+00	0.00E+00
Primary non renewable energy - total	PENRT	MJ	7.39E-02	2.89E-03	3.71E-01
Use of secondary material	SM	kg	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	RSF	MJ	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	NRSF	MJ	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	FW	m3	3.78E-06	1.09E-07	1.74E-05

WASTE PRODUCTION

Table 11 (*continued*): **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Hazardous waste disposed	HWD	kg	4.95E-07	1.37E-08	2.48E-06
Non-hazardous waste disposed	NHWD	kg	1.94E-05	1.74E-07	2.08E-05
Radioactive waste disposed/stored	RWD	kg	2.65E-09	1.22E-10	1.53E-08

ADDITIONAL ENVIRONMENTAL INFORMATION

OUTPUT FLOWS

Table 11 (*continued*): **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Components for reuse	CRU	kg	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	MFR	kg	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	MFRE	kg	0.00E+00	0.00E+00	0.00E+00
Exported energy – electricity	EE - e	MJ	0.00E+00	0.00E+00	0.00E+00
Exported energy – thermal	EE - t	MJ	0.00E+00	0.00E+00	0.00E+00

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Table 11 (*continued*): **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 eq	5.55E-03	2.35E-04	2.80E-02
Particulate matter	PM	Disease incidence	3.71E-10	5.32E-12	2.11E-10
Ionising radiation – human health*	IRP	kBq U-235 eq	1.33E-05	6.09E-07	7.50E-05
Ecotoxicity – freshwater*	ETP - fw	CTUe	3.88E-02	1.39E-03	1.79E-01
Human toxicity potential – cancer effects*	HTP - c	CTUh	4.14E-13	3.50E-14	1.38E-12
Human toxicity potential – non cancer effects*	HTP - nc	CTUh	3.99E-11	5.71E-13	2.96E-10
Soil quality*	SQP	Pt	2.86E-04	4.02E-06	5.02E-04

ADDITIONAL ENVIRONMENTAL INFORMATION

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Table 11 (*continued*): **Environmental impact of distributing per m² of Mura over 100km by different transport modes**

Indicator	ABR	Unit	By road	By sea	By Air
Global warming (GWP100a) – A1	GWP (A1)	kg CO_2 eq	5.55E-03	2.35E-04	2.81E-02
Ozone layer depletion (ODP) – A1	ODP (A1)	kg CFC-11 eq	6.00E-11	2.79E-12	3.44E-10
Acidification – A1	AP (A1)	kg SO2 eq	1.22E-05	5.39E-06	8.82E-05
Eutrophication – A1	EP (A1)	kg PO4-eq	2.43E-06	5.27E-07	1.71E-05
Photochemical oxidation – A1	POCP (A1)	kg C2H4 eq	6.79E-07	1.51E-07	2.72E-06
Abiotic depletion – A1	ADPE (A1)	kg Sb eq	3.30E-10	2.56E-12	9.65E-10
Abiotic depletion (fossil fuels) – A1	ADPF (A1)	MJ	7.28E-02	2.82E-03	3.61E-01

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