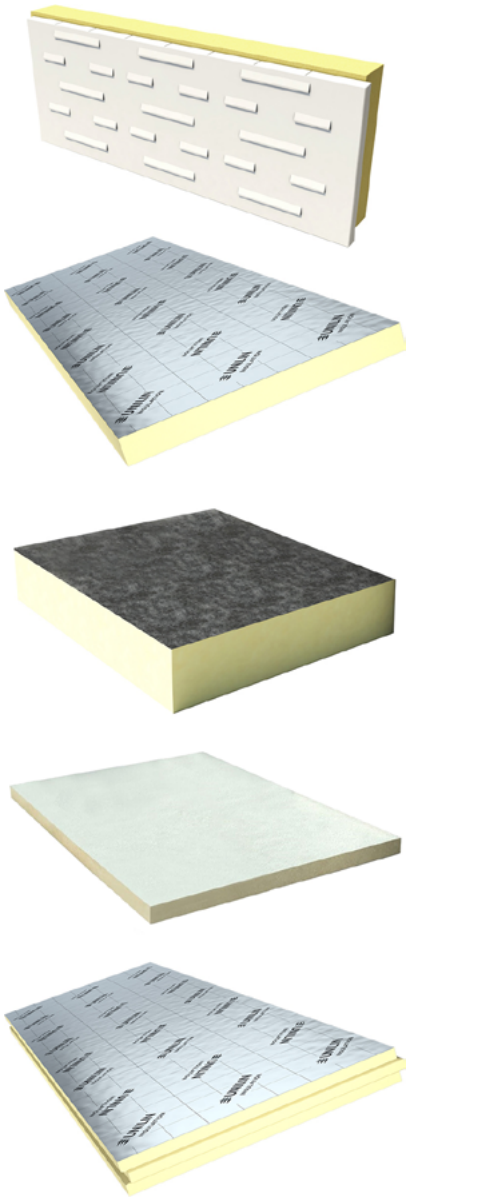
EN 15804+A2 EPD



ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804 + A2
Owner of the Declaration – Unilin Insulation Ireland Limited

Declaration number: EPDIE-21-41
Issue date 3rd November 2021
Valid to 3rd November 2026

EPD Programme - EPD Ireland
Programme Operator - Irish Green Building Council
www.epdireland.org

Unilin Insulation Ireland Ltd

CT/PIR, FR/ALU, FR/BGM, FR/MG, Thin-R

1. General information

PROGRAMME OPERATOR	OWNER OF DECLARATION
Irish Green Building Council 19 Mountjoy Square, Dublin D01 E8P5 info@igbc.ie	Unilin Insulation Ireland Ltd Kells Road, Navan, Co. Mearh, Ireland C15 NP79 T +353 (0) 46 906 6000; info.ui@unilin.com www.unilininsulation.ie
DECLARATION NUMBER	**PRODUCTION SITE**
EPDIE-21-41	Unilin Insulation UK Ltd Park Road, Holmewood, Chesterfield, Derbyshire, United Kingdom, S42 5UY www.unilininsulation.co.uk
ECO PLATFORM EPD	**DECLARED UNIT**
Yes	1m² 100mm CT/PIR R-value 4.75 m²K/W 1m² 100mm FR/ALU R-value 4.5 m²K/W 1m² 100mm FR/BGM R-value 4.0 m²K/W 1m² 100mm FR/MG R-value 4.0 m²K/W 1m² 100mm Thin-R R-value 4.5 m²K/W
APPLICABLE PRODUCT CATEGORY RULES	**DECLARED PRODUCT**
EN 15804:2012+A2:2019 EPD Ireland PCR Part A, Version 2.0, 2021 I.S. EN 16783:2017 Thermal insulation products – Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations	Unilin Insulation UK Ltd PIR insulation products manufactured in Chesterfield, England: CT/PIR 100mm, FR/ALU 100mm, FR/BGM 100mm, FR/MG 100mm, Thin-R 100mm
DATE OF ISSUE	**SCOPE OF EPD**
03.11.2021 Reissue: 09.01.2023 - Changes: owner name and logo from Xtratherm to Unilin Insulation Ireland Limited and products' name due to rebranding	Cradle-to-gate, with options. This EPD applies to products manufactured in Chesterfield, England, and supplied to customers in Great Britain.
DATE OF EXPIRY	**LCA CONSULTANT OR PERSON RESPONSIBLE FOR LCA**
03.11.2026	EcoReview, Kilkenny, Co. Kilkenny, Ireland +353 87 258 9783 / +31 646 264 9327 info@ecoreview.ie / www.ecoreview.eu
TYPE OF EPD: SINGLE OR MULTI PRODUCT	**LCA SOFTWARE AND DEVELOPER IF APPLICABLE**
Multi product EPD	Ecochain 3.2.12
PRODUCT CLASSIFICATION OR NACE CODE	**NAME AND VERSION OF INVENTORY USED**
Thermal insulation products	Ecoinvent 3.6
COMPARABILITY	
Environmental Product Declarations from different programmes may not be directly 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	
The CEN Norm /EN 15804 serves as the core PCR	
Independent verification of the declaration according to ISO 14025	

Internally ☐ Externally ✕

SIGNATURE OF PROGRAMME OPERATOR	SIGNATURE VERIFIER
Pat Barry - CEO - Irish Green Building Council	Chris Foster - EuGeos SRL

2. Scope and Type of EPD

Scope

This EPD is Cradle-to-gate with options. The Modules that are declared are shown in the table below.

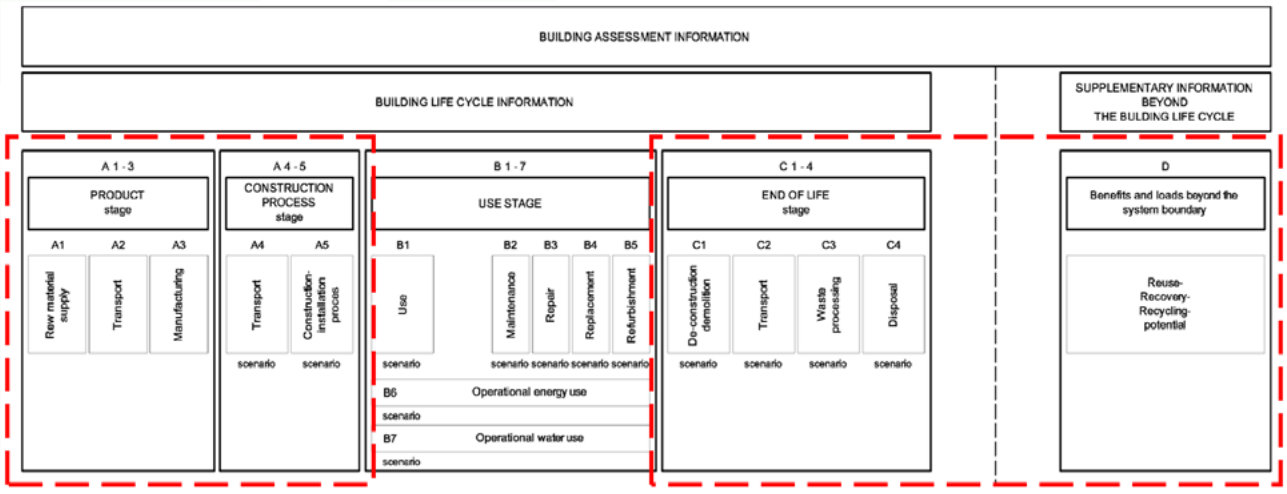
PRODUCT STAGE			CONSTRUCTION ON PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse – Recovery – Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
MDT	MDT	MDT	OP	OP	OP	OP	OP	OP	OP	OP	OP	MDT	MDT	MDT	MDT	MDT

X = Module declared; ND = Module not declared; MDT = Mandatory; OP = Optional.

Declared Units

1m² 100mm CT/PIR R-value 4.75 m²K/W
1m² 100mm FR/ALU R-value 4.5 m²K/W
1m² 100mm FR/BGM R-value 4.0 m²K/W
1m² 100mm FR/MG R-value 4.0 m²K/W
1m² 100mm Thin-R R-value 4.5 m²K/W

System Boundaries



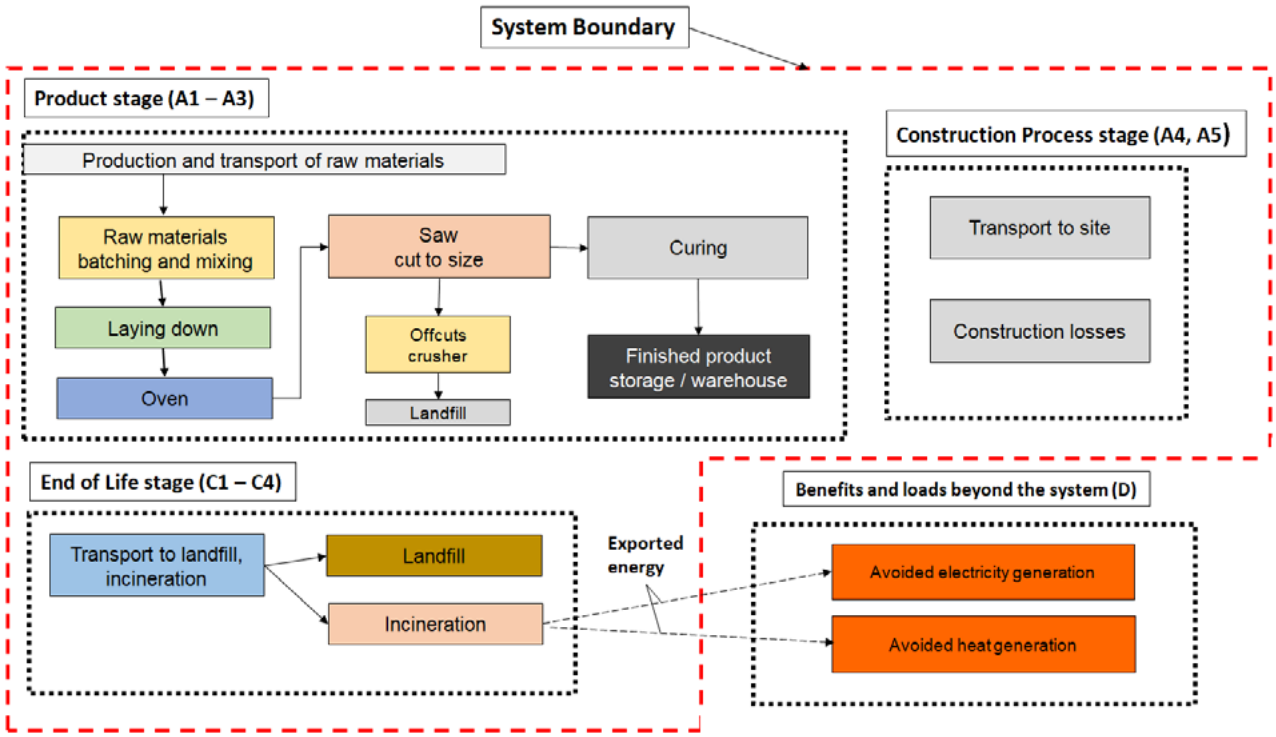
3. Detailed product description

This EPD is for the (Polyisocyanurate) PIR insulation boards: CT/PIR, FR/ALU, FR/BGM, FR/MG, Thin-R, of thickness 100mm, the R values quoted are minimum values and the EPD is calculated on this basis. The PIR boards typically comprise of primary raw materials MDI, polyol, flame retardant, pentane, with the addition of minor amounts of admixtures. Depending on intended use, the board facing elements comprise various combinations of the following materials: paper, foil, hard plastic, mineral glass, bitumen fibre. The primary raw materials are mixed with various catalysts & additives and placed between two layers of facing elements. The insulation products are manufactured in accordance with BS EN 13165:2012+A2:2016 Thermal insulation products for buildings.

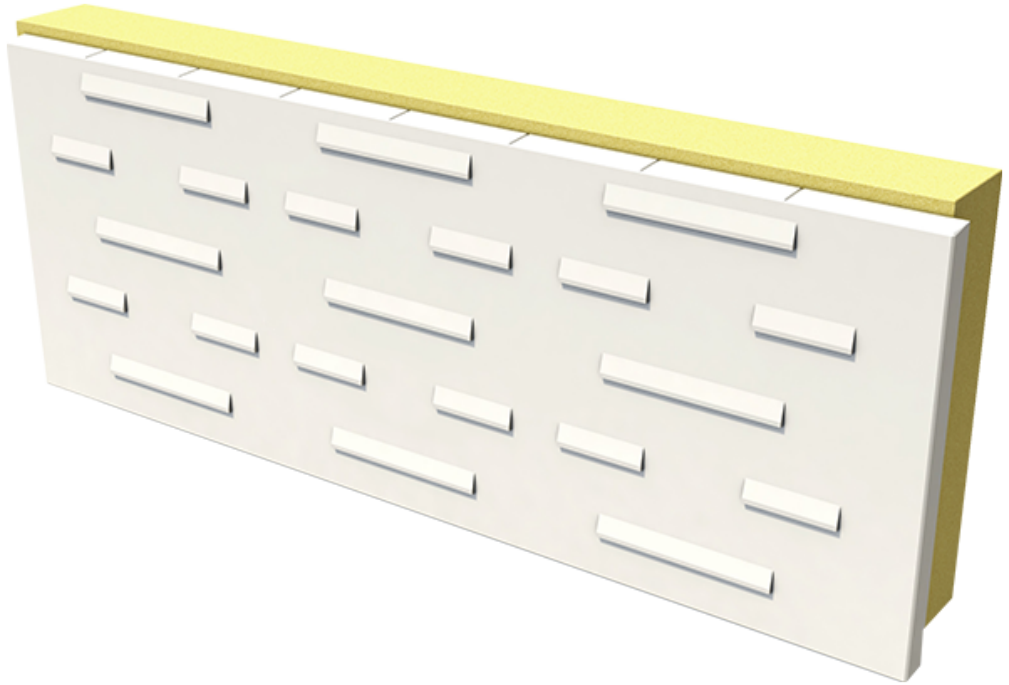
These insulation products are used in cavity walls, steel and timber-frame walls, soffit, floor, pitched and flat roof insulation applications.

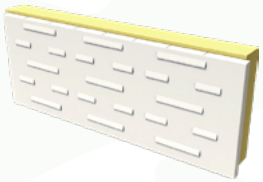
3.1 Manufacturing Process Description

The main raw materials are mixed with various catalysts and additives before being metered onto a moving conveyor. The chemical mix then starts to rise, due to the effects of the blowing agent, to produce the foam. The foam continues to rise until it contacts the top layer of facer material as it enters the oven, where it is then cured under heat to produce the rigid, thermoset foam board. The board exits the lamination oven and then reaches a cross-cut saw which cuts the board into smaller mother-boards. Each mother-board then is transported to a separate area to cure. There is a minor amount of additional cutting to produce speciality boards such as rebated or tongue & groove edges. Finished boards are stored in the warehouse before despatch to customers. Off cuts from the cutting and trimming are compressed on-site and sent to landfill.



CT/PIR





4.1.A. LCA results - CT/PIR

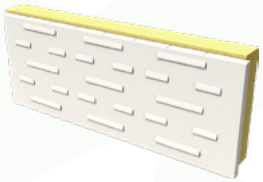
Core environmental impact per 1m² 100mm CT/PIR, R-value 4.75 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	[kg CO_2 eq.]	9.55E+00	2.07E-01	5.17E-01	1.03E+01	6.76E-02	6.69E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.95E-02	2.71E+00	5.44E-01	-2.42E+00
GWP-fossil	[kg CO_2 eq.]	1.01E+01	2.07E-01	3.13E-01	1.06E+01	6.76E-02	6.90E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.95E-02	2.65E+00	3.14E-01	-2.41E+00
GWP-biogenic	[kg CO_2 eq.]	-7.05E-01	1.24E-04	2.03E-01	-5.02E-01	3.63E-05	-3.26E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.20E-05	6.10E-02	2.31E-01	-1.61E-03
GWP-luluc	[kg CO_2 eq.]	1.79E-01	7.82E-05	3.01E-05	1.79E-01	2.40E-05	1.16E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.12E-05	2.09E-05	4.37E-05	-2.84E-03
ODP	[kg CFC-11 eq.]	2.19E-07	4.63E-08	1.89E-08	2.84E-07	1.54E-08	1.89E-08	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.35E-08	1.40E-08	9.24E-09	-2.70E-07
AP	[mol H+ eq.]	1.21E-02	1.18E-03	1.13E-03	1.44E-02	1.94E-04	9.42E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.71E-04	2.28E-03	3.66E-04	-9.08E-03
EP-freshwater	[kg P eq.]	1.19E-04	1.88E-06	2.10E-06	1.23E-04	5.40E-07	8.01E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.75E-07	9.06E-07	1.32E-06	-6.14E-05
EP-marine	[kg N eq.]	6.31E-03	2.32E-04	4.64E-04	7.01E-03	3.84E-05	4.57E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.38E-05	1.27E-03	3.17E-03	-1.70E-03
EP-terrestrial	[mol N eq.]	2.65E-02	2.61E-03	2.05E-03	3.11E-02	4.30E-04	2.03E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.78E-04	1.21E-02	1.23E-03	-2.01E-02
POCP	[kg NMVOC eq.]	1.84E-02	8.24E-04	1.44E-02	3.36E-02	1.65E-04	2.19E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.45E-04	2.88E-03	1.41E-01	-5.29E-03
ADP-minerals&metals[2]	[kg Sb eq.]	1.24E-04	5.01E-06	2.38E-06	1.32E-04	1.86E-06	8.60E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.64E-06	1.23E-06	3.55E-07	-1.62E-05
ADP-fossils[2]	[MJ] ncv	2.58E+02	3.11E+00	6.13E+00	2.67E+02	1.02E+00	1.74E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	8.99E-01	1.40E+00	8.51E-01	-5.58E+01
WDP[2]	m^3 world eq. deprived	4.02E+00	1.08E-02	5.09E-02	4.09E+00	2.89E-03	2.66E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.54E-03	1.65E-01	3.06E-02	-1.00E-01

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.



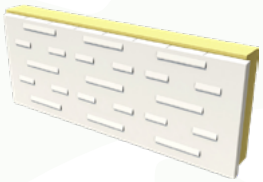
4.1.B. LCA results - CT/PIR

Resource use per 1m² 100mm CT/PIR, R-value 4.75 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	2.47E+01	4.77E-02	8.45E-01	2.56E+01	1.46E-02	1.66E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.29E-02	2.51E-02	3.46E-02	-9.84E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	2.47E+01	4.77E-02	8.45E-01	2.56E+01	1.46E-02	1.66E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.29E-02	2.51E-02	3.46E-02	-9.84E+00
PENRE	[MJ]	1.67E+02	3.30E+00	6.58E+00	1.77E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.54E-01	1.53E+00	9.04E-01	-5.89E+01
PENRM	[MJ]	9.36E+01	0.00E+00	0.00E+00	9.36E+01	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.60E+02	3.30E+00	6.58E+00	2.70E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.54E-01	1.53E+00	9.04E-01	-5.89E+01
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	2.21E+01	3.62E-04	1.60E-03	2.21E+01	1.09E-04	1.43E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.61E-05	5.01E-03	7.98E-04	-1.04E-02

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

ND = Module not declared; INA = Indicator not assessed.



4.1.C. LCA results - CT/PIR

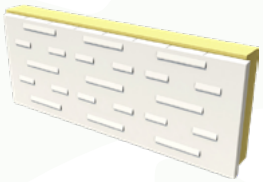
Output flows and waste categories per 1m² 100mm CT/PIR, R-value 4.75 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	1.28E-04	7.40E-06	2.57E-07	1.36E-04	2.68E-06	8.92E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.35E-06	2.67E-06	1.09E-06	-4.55E-05
NHWD	[kg]	7.49E+00	1.34E-01	2.28E-01	7.85E+00	4.97E-02	5.11E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.37E-02	5.01E-02	2.63E+00	-1.46E-01
RWD	[kg]	2.77E-03	2.11E-05	4.01E-07	2.79E-03	6.96E-06	1.82E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.12E-06	2.19E-06	4.50E-06	-4.53E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

CRU, MFR, MER, EEE, EET are not calculated by the EcoChain software.

ND = Module not declared; INA = Indicator not assessed.



4.1.D. LCA results - CT/PIR

Additonal Environmental impact per 1m² 100mm CT/PIR, R-value 4.75 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.86E-07	1.23E-08	2.69E-09	2.01E-07	2.69E-09	4.29E-09	ND	ND	ND	ND	ND	ND	ND	ND	3.78E-09	7.36E-09	5.27E-09	-3.54E-08
IRP[1]	kBq U235 eq	3.71E+00	1.36E-02	2.00E-02	3.75E+00	2.00E-02	4.46E-03	ND	ND	ND	ND	ND	ND	ND	ND	3.93E-03	1.64E-03	3.41E-03	-8.84E-01
ETP-fw[2]	CTUe	3.84E+01	2.46E+00	3.76E+00	4.46E+01	3.76E+00	8.23E-01	ND	ND	ND	ND	ND	ND	ND	ND	7.24E-01	6.88E+00	3.02E+01	-3.52E+01
HTP-c[2]	CTUe	5.69E-08	6.98E-11	7.07E-11	5.71E-08	7.07E-11	2.29E-11	ND	ND	ND	ND	ND	ND	ND	ND	2.02E-11	2.38E-10	2.56E-11	-7.78E-10
HTP-nc[2]	CTUe	9.30E-07	2.51E-09	2.51E-09	9.35E-07	2.51E-09	8.67E-10	ND	ND	ND	ND	ND	ND	ND	ND	7.63E-10	9.33E-09	1.22E-09	-2.60E-08
SQP[2]	dimensionless	1.80E+02	1.98E+00	5.29E-01	1.82E+02	7.15E-01	1.19E+01	ND	ND	ND	ND	ND	ND	ND	ND	6.29E-01	2.19E-01	1.59E+00	-3.06E+01

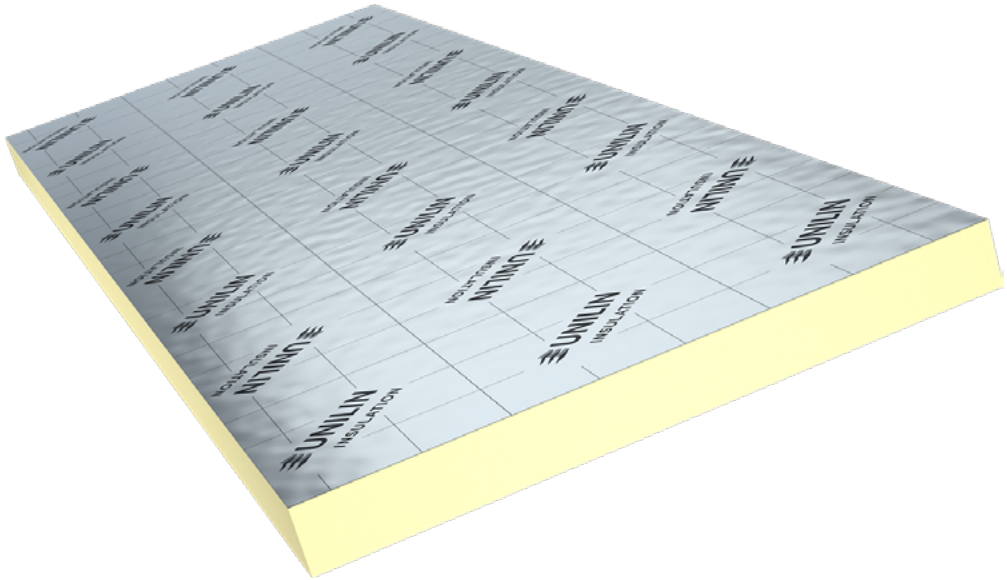
PM = Potential incidence of disease due to PM emissions, IRP = Potential Human exposure efficiency relative to U235, ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c:Potential Comparative Toxic Unit for humans, HTP-nc = Potential Comparative Toxic Unit for humans, SQP = Potential soil quality index.

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

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

FR/ALU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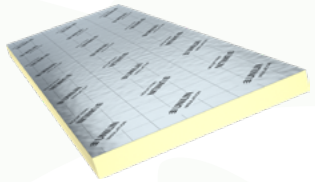


4.2.A. LCA results - FR/ALU

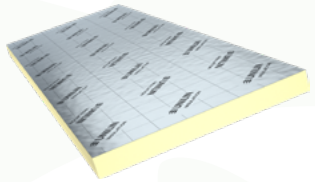
Core environmental impact per 1m² 100mm FR/ALU, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	[kg CO_2 eq.]	9.57E+00	2.06E-01	5.17E-01	1.03E+01	6.74E-02	6.71E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.93E-02	2.69E+00	5.04E-01	-2.42E+00
GWP-fossil	[kg CO_2 eq.]	1.01E+01	2.06E-01	3.13E-01	1.06E+01	6.74E-02	6.89E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.93E-02	2.64E+00	3.12E-01	-2.41E+00
GWP-biogenic	[kg CO_2 eq.]	-6.58E-01	1.23E-04	2.03E-01	-4.54E-01	3.62E-05	-2.95E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.19E-05	5.08E-02	1.92E-01	-1.61E-03
GWP-luluc	[kg CO_2 eq.]	1.75E-01	7.79E-05	3.01E-05	1.75E-01	2.40E-05	1.14E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.11E-05	2.08E-05	4.32E-05	-2.84E-03
ODP	[kg CFC-11 eq.]	2.30E-07	4.61E-08	1.89E-08	2.95E-07	1.53E-08	1.96E-08	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.35E-08	1.39E-08	9.16E-09	-2.70E-07
AP	[mol H+ eq.]	1.21E-02	1.17E-03	1.13E-03	1.44E-02	1.94E-04	9.42E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.70E-04	2.27E-03	3.61E-04	-9.08E-03
EP-freshwater	[kg P eq.]	1.18E-04	1.87E-06	2.10E-06	1.22E-04	5.38E-07	7.93E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.74E-07	9.01E-07	1.31E-06	-6.14E-05
EP-marine	[kg N eq.]	6.27E-03	2.31E-04	4.64E-04	6.97E-03	3.83E-05	4.54E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.37E-05	1.26E-03	3.13E-03	-1.70E-03
EP-terrestrial	[mol N eq.]	2.63E-02	2.59E-03	2.05E-03	3.09E-02	4.29E-04	2.02E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.77E-04	1.21E-02	1.22E-03	-2.01E-02
POCP	[kg NMVOC eq.]	1.83E-02	8.20E-04	1.44E-02	3.36E-02	1.64E-04	2.19E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.44E-04	2.87E-03	1.41E-01	-5.29E-03
ADP-minerals&metals[2]	[kg Sb eq.]	1.30E-04	4.98E-06	2.38E-06	1.38E-04	1.86E-06	8.99E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.64E-06	1.22E-06	3.52E-07	-1.62E-05
ADP-fossils[2]	[MJ] ncv	2.57E+02	3.10E+00	6.13E+00	2.67E+02	1.02E+00	1.74E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	8.97E-01	1.39E+00	8.43E-01	-5.58E+01
WDP[2]	m^3 world eq. deprived	4.02E+00	1.07E-02	5.09E-02	4.08E+00	2.88E-03	2.65E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.54E-03	1.64E-01	3.03E-02	-1.00E-01

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.



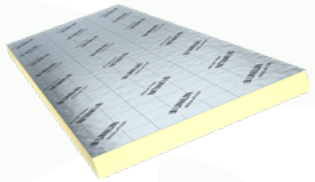
4.2.B. LCA results - FR/ALU

Resource use per 1m² 100mm FR/ALU, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	2.34E+01	4.75E-02	8.45E-01	2.43E+01	1.46E-02	1.58E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.28E-02	2.49E-02	3.43E-02	-9.84E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	2.34E+01	4.75E-02	8.45E-01	2.43E+01	1.46E-02	1.58E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.28E-02	2.49E-02	3.43E-02	-9.84E+00
PENRE	[MJ]	1.67E+02	3.29E+00	6.58E+00	1.77E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.52E-01	1.52E+00	8.97E-01	-5.89E+01
PENRM	[MJ]	9.30E+01	0.00E+00	0.00E+00	9.30E+01	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.60E+02	3.29E+00	6.58E+00	2.70E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.52E-01	1.52E+00	8.97E-01	-5.89E+01
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	2.20E+01	3.60E-04	1.60E-03	2.20E+01	1.09E-04	1.43E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.59E-05	4.99E-03	7.91E-04	-1.04E-02

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

ND = Module not declared; INA = Indicator not assessed.



4.2.C. LCA results - FR/ALU

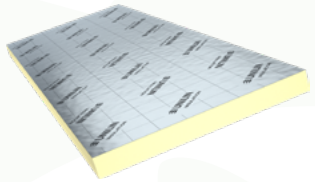
Output flows and waste categories per 1m² 100mm FR/ALU, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	1.34E-04	7.36E-06	2.57E-07	1.41E-04	2.67E-06	9.26E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.35E-06	2.65E-06	1.08E-06	-4.55E-05
NHWD	[kg]	7.47E+00	1.33E-01	2.28E-01	7.83E+00	4.95E-02	5.10E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.36E-02	4.98E-02	2.61E+00	-1.46E-01
RWD	[kg]	2.77E-03	2.10E-05	4.01E-07	2.79E-03	6.94E-06	1.81E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.11E-06	2.18E-06	4.46E-06	-4.53E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

CRU, MFR, MER, EEE, EET are not calculated by the EcoChain software.

ND = Module not declared; INA = Indicator not assessed.



4.2.D. LCA results - FR/ALU

Additonal Environmental impact per 1m² 100mm FR/ALU, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.84E-07	1.22E-08	2.69E-09	1.99E-07	4.28E-09	1.30E-08	ND	ND	ND	ND	ND	ND	ND	ND	3.77E-09	7.32E-09	5.23E-09	-3.54E-08
IRP[1]	kBq U235 eq	3.70E+00	1.36E-02	2.00E-02	3.74E+00	4.45E-03	2.43E-01	ND	ND	ND	ND	ND	ND	ND	ND	3.92E-03	1.64E-03	3.38E-03	-8.84E-01
ETP-fw[2]	CTUe	3.79E+01	2.45E+00	3.76E+00	4.42E+01	8.21E-01	2.89E+00	ND	ND	ND	ND	ND	ND	ND	ND	7.22E-01	6.85E+00	3.15E+01	-3.52E+01
HTP-c[2]	CTUe	5.68E-08	6.94E-11	7.07E-11	5.69E-08	2.28E-11	3.70E-09	ND	ND	ND	ND	ND	ND	ND	ND	2.01E-11	2.37E-10	2.53E-11	-7.78E-10
HTP-nc[2]	CTUe	9.28E-07	2.50E-09	2.51E-09	9.33E-07	8.65E-10	6.07E-08	ND	ND	ND	ND	ND	ND	ND	ND	7.61E-10	9.28E-09	1.16E-09	-2.60E-08
SQP[2]	dimensionless	1.76E+02	1.97E+00	5.29E-01	1.78E+02	7.13E-01	1.16E+01	ND	ND	ND	ND	ND	ND	ND	ND	6.27E-01	2.18E-01	1.58E+00	-3.06E+01

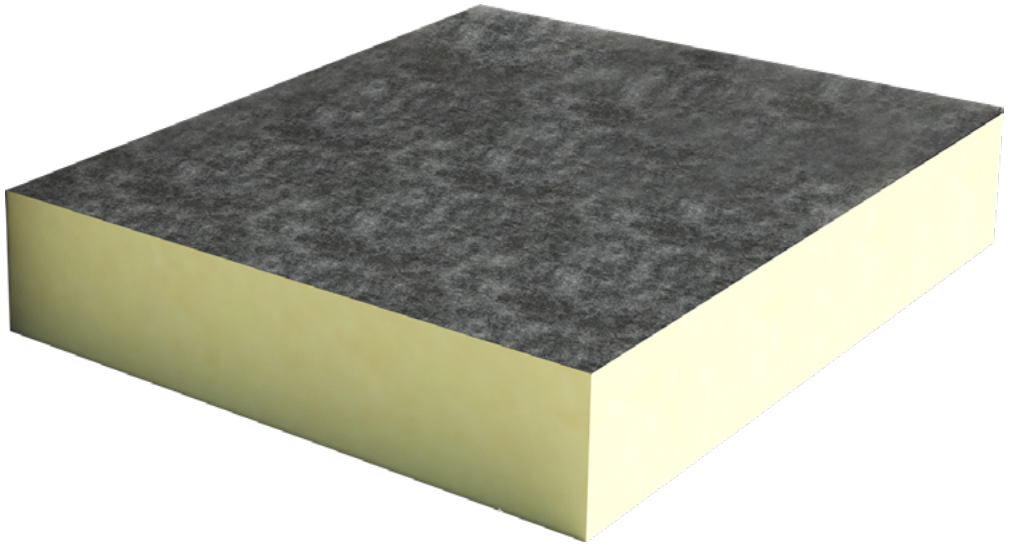
PM = Potential incidence of disease due to PM emissions, IRP = Potential Human exposure efficiency relative to U235, ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c:Potential Comparative Toxic Unit for humans, HTP-nc = Potential Comparative Toxic Unit for humans, SQP = Potential soil quality index.

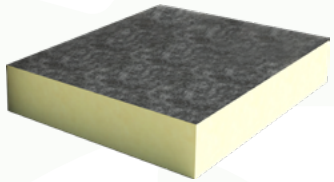
[1] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuelcycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing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

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

FR/BGM





4.3.A. LCA results - FR/BGM

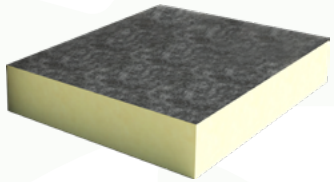
Core environmental impact per 1m² 100mm FR/BGM, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	[kg CO_2 eq.]	1.08E+01	2.62E-01	5.17E-01	1.15E+01	7.21E-02	7.52E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.35E-02	2.74E+00	3.45E-01	-2.34E+00
GWP-fossil	[kg CO_2 eq.]	1.10E+01	2.61E-01	3.13E-01	1.16E+01	7.21E-02	7.56E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.34E-02	2.74E+00	3.45E-01	-2.34E+00
GWP-biogenic	[kg CO_2 eq.]	-4.66E-01	1.61E-04	2.03E-01	-2.62E-01	3.88E-05	-1.70E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.41E-05	4.35E-04	4.08E-04	-1.55E-03
GWP-luluc	[kg CO_2 eq.]	2.05E-01	1.01E-04	3.01E-05	2.05E-01	2.57E-05	1.34E-02	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.26E-05	2.24E-05	4.15E-05	-2.74E-03
ODP	[kg CFC-11 eq.]	4.76E-07	5.81E-08	1.89E-08	5.53E-07	1.64E-08	3.63E-08	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.44E-08	1.46E-08	1.01E-08	-2.63E-07
AP	[mol H+ eq.]	1.79E-02	1.74E-03	1.13E-03	2.08E-02	2.07E-04	1.36E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.82E-04	2.29E-03	3.87E-04	-8.79E-03
EP-freshwater	[kg P eq.]	1.38E-04	2.47E-06	2.10E-06	1.42E-04	5.76E-07	9.26E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	5.07E-07	9.68E-07	1.26E-06	-5.92E-05
EP-marine	[kg N eq.]	7.39E-03	3.42E-04	4.64E-04	8.19E-03	4.10E-05	5.34E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	3.61E-05	1.25E-03	3.01E-03	-1.65E-03
EP-terrestrial	[mol N eq.]	3.75E-02	3.84E-03	2.05E-03	4.34E-02	4.58E-04	2.83E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.03E-04	1.20E-02	1.30E-03	-1.94E-02
POCP	[kg NMVOC eq.]	2.52E-02	1.18E-03	1.44E-02	4.08E-02	1.76E-04	2.66E-03	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.55E-04	2.85E-03	1.40E-01	-5.12E-03
ADP-minerals&metals[2]	[kg Sb eq.]	6.60E-05	6.01E-06	2.38E-06	7.44E-05	1.99E-06	4.89E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.75E-06	1.29E-06	3.77E-07	-1.57E-05
ADP-fossils[2]	[MJ] ncv	2.82E+02	3.92E+00	6.13E+00	2.92E+02	1.09E+00	1.90E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	9.59E-01	1.42E+00	8.99E-01	-5.40E+01
WDP[2]	m^3 world eq. deprived	4.36E+00	1.44E-02	5.09E-02	4.43E+00	3.08E-03	2.88E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.71E-03	1.62E-01	3.35E-02	-9.70E-02

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.



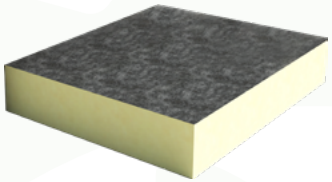
4.3.B. LCA results - FR/BGM

Resource use per 1m² 100mm FR/BGM, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	1.81E+01	6.14E-02	8.45E-01	1.90E+01	1.56E-02	1.24E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.37E-02	2.62E-02	3.28E-02	-9.49E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	1.81E+01	6.14E-02	8.45E-01	1.90E+01	1.56E-02	1.24E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.37E-02	2.62E-02	3.28E-02	-9.49E+00
PENRE	[MJ]	1.88E+02	4.16E+00	6.58E+00	1.99E+02	1.16E+00	1.93E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.02E+00	1.56E+00	9.55E-01	-5.69E+01
PENRM	[MJ]	9.78E+01	0.00E+00	0.00E+00	9.78E+01	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.86E+02	4.16E+00	6.58E+00	2.97E+02	1.16E+00	1.93E+01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.02E+00	1.56E+00	9.55E-01	-5.69E+01
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	2.21E+01	4.68E-04	1.60E-03	2.21E+01	1.17E-04	1.43E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	1.03E-04	4.93E-03	8.62E-04	-1.01E-02

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

ND = Module not declared; INA = Indicator not assessed.



4.3.C. LCA results - FR/BGM

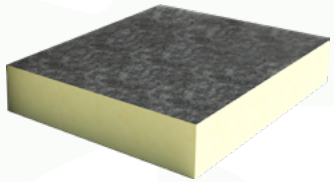
Output flows and waste categories per 1m² 100mm FR/BGM, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	4.13E-05	8.98E-06	2.57E-07	5.05E-05	2.85E-06	3.36E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.51E-06	2.73E-06	1.19E-06	-4.41E-05
NHWD	[kg]	7.58E+00	1.61E-01	2.28E-01	7.97E+00	5.30E-02	5.19E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.66E-02	5.36E-02	2.94E+00	-1.41E-01
RWD	[kg]	2.87E-03	2.65E-05	4.01E-07	2.90E-03	7.42E-06	1.88E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.53E-06	2.41E-06	4.88E-06	-4.37E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

CRU, MFR, MER, EEE, EET are not calculated by the EcoChain software.

ND = Module not declared; INA = Indicator not assessed.



4.3.D. LCA results - FR/BGM

Additonal Environmental impact per 1m² 100mm FR/BGM, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	2.17E-07	1.51E-08	2.69E-09	2.35E-07	4.58E-09	1.54E-08	ND	ND	ND	ND	ND	ND	ND	ND	4.03E-09	7.77E-09	5.69E-09	-3.44E-08
IRP[1]	kBq U235 eq	3.78E+00	1.72E-02	2.00E-02	3.82E+00	4.76E-03	2.48E-01	ND	ND	ND	ND	ND	ND	ND	ND	4.19E-03	1.80E-03	3.60E-03	-8.52E-01
ETP-fw[2]	CTUe	6.26E+01	3.07E+00	3.76E+00	6.94E+01	8.78E-01	4.53E+00	ND	ND	ND	ND	ND	ND	ND	ND	7.72E-01	6.76E+00	5.84E+00	-3.40E+01
HTP-c[2]	CTUe	5.79E-08	8.78E-11	7.07E-11	5.81E-08	2.44E-11	3.77E-09	ND	ND	ND	ND	ND	ND	ND	ND	2.15E-11	2.36E-10	2.53E-11	-7.53E-10
HTP-nc[2]	CTUe	9.70E-07	3.11E-09	2.51E-09	9.75E-07	9.25E-10	6.34E-08	ND	ND	ND	ND	ND	ND	ND	ND	8.14E-10	9.18E-09	8.76E-10	-2.52E-08
SQP[2]	dimensionless	1.66E+02	2.40E+00	5.29E-01	1.69E+02	7.62E-01	1.10E+01	ND	ND	ND	ND	ND	ND	ND	ND	6.71E-01	2.77E-01	1.75E+00	-2.96E+01

PM = Potential incidence of disease due to PM emissions, 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, SQP = Potential soil quality index.

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

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

FR/MG

4.4.A. LCA results - FR/MG

Core environmental impact per 1m² 100mm FR/MG, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	[kg CO_2 eq.]	1.15E+01	2.86E-01	5.17E-01	1.23E+01	7.11E-02	8.03E-01	ND	ND	ND	ND	ND	ND	ND	0	6.26E-02	2.59E+00	3.07E-01	-2.34E+00
GWP-fossil	[kg CO_2 eq.]	1.18E+01	2.86E-01	3.13E-01	1.24E+01	7.11E-02	8.06E-01	ND	ND	ND	ND	ND	ND	ND	0	6.25E-02	2.59E+00	3.07E-01	-2.34E+00
GWP-biogenic	[kg CO_2 eq.]	-4.79E-01	1.81E-04	2.03E-01	-2.76E-01	3.82E-05	-1.79E-02	ND	ND	ND	ND	ND	ND	ND	0	3.36E-05	6.39E-04	3.96E-04	-1.55E-03
GWP-luluc	[kg CO_2 eq.]	2.36E-01	1.12E-04	3.01E-05	2.36E-01	2.53E-05	1.54E-02	ND	ND	ND	ND	ND	ND	ND	0	2.23E-05	2.13E-05	4.05E-05	-2.74E-03
ODP	[kg CFC-11 eq.]	4.13E-07	6.32E-08	1.89E-08	4.95E-07	1.62E-08	3.26E-08	ND	ND	ND	ND	ND	ND	ND	0	1.42E-08	1.43E-08	9.99E-09	-2.63E-07
AP	[mol H+ eq.]	2.21E-02	2.13E-03	1.13E-03	2.54E-02	2.04E-04	1.66E-03	ND	ND	ND	ND	ND	ND	ND	0	1.80E-04	2.24E-03	3.63E-04	-8.79E-03
EP-freshwater	[kg P eq.]	1.68E-04	2.80E-06	2.10E-06	1.73E-04	5.68E-07	1.13E-05	ND	ND	ND	ND	ND	ND	ND	0	4.99E-07	9.28E-07	1.23E-06	-5.92E-05
EP-marine	[kg N eq.]	8.41E-03	4.19E-04	4.64E-04	9.29E-03	4.04E-05	6.05E-04	ND	ND	ND	ND	ND	ND	ND	0	3.56E-05	1.24E-03	2.98E-03	-1.65E-03
EP-terrestrial	[mol N eq.]	4.79E-02	4.71E-03	2.05E-03	5.46E-02	4.52E-04	3.56E-03	ND	ND	ND	ND	ND	ND	ND	0	3.98E-04	1.19E-02	1.28E-03	-1.94E-02
POCP	[kg NMVOC eq.]	3.12E-02	1.41E-03	1.44E-02	4.70E-02	1.73E-04	3.06E-03	ND	ND	ND	ND	ND	ND	ND	0	1.52E-04	2.83E-03	1.40E-01	-5.12E-03
ADP-minerals&metals[2]	[kg Sb eq.]	9.18E-05	6.30E-06	2.38E-06	1.00E-04	1.96E-06	6.58E-06	ND	ND	ND	ND	ND	ND	ND	0	1.73E-06	1.25E-06	3.70E-07	-1.57E-05
ADP-fossils[2]	[MJ] ncv	2.84E+02	4.28E+00	6.13E+00	2.95E+02	1.07E+00	1.92E+01	ND	ND	ND	ND	ND	ND	ND	0	9.45E-01	1.42E+00	8.83E-01	-5.40E+01
WDP[2]	m^3 world eq. deprived	4.61E+00	1.66E-02	5.09E-02	4.67E+00	3.04E-03	3.04E-01	ND	ND	ND	ND	ND	ND	ND	0	2.68E-03	1.59E-01	3.30E-02	-9.70E-02

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

4.4.B. LCA results - FR/MG

Resource use per 1m² 100mm FR/MG, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	1.91E+01	6.84E-02	8.45E-01	2.01E+01	1.54E-02	1.30E+00	ND	ND	ND	ND	ND	ND	ND	0	1.35E-02	2.52E-02	3.21E-02	-9.49E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	1.91E+01	6.84E-02	8.45E-01	2.01E+01	1.54E-02	1.30E+00	ND	ND	ND	ND	ND	ND	ND	0	1.35E-02	2.52E-02	3.21E-02	-9.49E+00
PENRE	[MJ]	2.01E+02	4.54E+00	6.58E+00	2.12E+02	1.14E+00	1.95E+01	ND	ND	ND	ND	ND	ND	ND	0	1.00E+00	1.56E+00	9.39E-01	-5.69E+01
PENRM	[MJ]	8.83E+01	0.00E+00	0.00E+00	8.83E+01	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.89E+02	4.54E+00	6.58E+00	3.00E+02	1.14E+00	1.95E+01	ND	ND	ND	ND	ND	ND	ND	0	1.00E+00	1.56E+00	9.39E-01	-5.69E+01
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	2.21E+01	5.23E-04	1.60E-03	2.21E+01	1.15E-04	1.44E+00	ND	ND	ND	ND	ND	ND	ND	0	1.01E-04	4.84E-03	8.49E-04	-1.01E-02

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

ND = Module not declared; INA = Indicator not assessed.

4.4.C. LCA results - FR/MG

Output flows and waste categories per 1m² 100mm FR/MG, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	5.44E-05	9.51E-06	2.57E-07	6.42E-05	2.81E-06	4.24E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.48E-06	2.72E-06	1.17E-06	-4.41E-05
NHWD	[kg]	7.69E+00	1.69E-01	2.28E-01	8.09E+00	5.22E-02	5.27E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.60E-02	5.06E-02	2.90E+00	-1.41E-01
RWD	[kg]	2.83E-03	2.89E-05	4.01E-07	2.85E-03	7.32E-06	1.86E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.44E-06	2.48E-06	4.80E-06	-4.37E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

CRU, MFR, MER, EEE, EET are not calculated by the EcoChain software.

ND = Module not declared; INA = Indicator not assessed.

4.4.D. LCA results - FR/MG

Additonal Environmental impact per 1m² 100mm FR/MG, R-value 4.0 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	2.56E-07	1.62E-08	2.69E-09	2.75E-07	4.52E-09	1.80E-08	ND	ND	ND	ND	ND	ND	ND	ND	3.97E-09	7.75E-09	5.58E-09	-3.44E-08
IRP[1]	kBq U235 eq	3.77E+00	1.88E-02	2.00E-02	3.81E+00	4.70E-03	2.48E-01	ND	ND	ND	ND	ND	ND	ND	ND	4.13E-03	1.82E-03	3.54E-03	-8.52E-01
ETP-fw[2]	CTUe	8.06E+01	3.33E+00	3.76E+00	8.77E+01	8.65E-01	5.73E+00	ND	ND	ND	ND	ND	ND	ND	ND	7.62E-01	6.74E+00	5.78E+00	-3.40E+01
HTP-c[2]	CTUe	5.90E-08	9.59E-11	7.07E-11	5.91E-08	2.41E-11	3.84E-09	ND	ND	ND	ND	ND	ND	ND	ND	2.12E-11	2.34E-10	2.47E-11	-7.53E-10
HTP-nc[2]	CTUe	1.01E-06	3.34E-09	2.51E-09	1.01E-06	9.12E-10	6.59E-08	ND	ND	ND	ND	ND	ND	ND	ND	8.02E-10	9.06E-09	8.61E-10	-2.52E-08
SQP[2]	dimensionless	1.69E+02	2.54E+00	5.29E-01	1.72E+02	7.52E-01	1.12E+01	ND	ND	ND	ND	ND	ND	ND	ND	6.61E-01	3.04E-01	1.71E+00	-2.96E+01

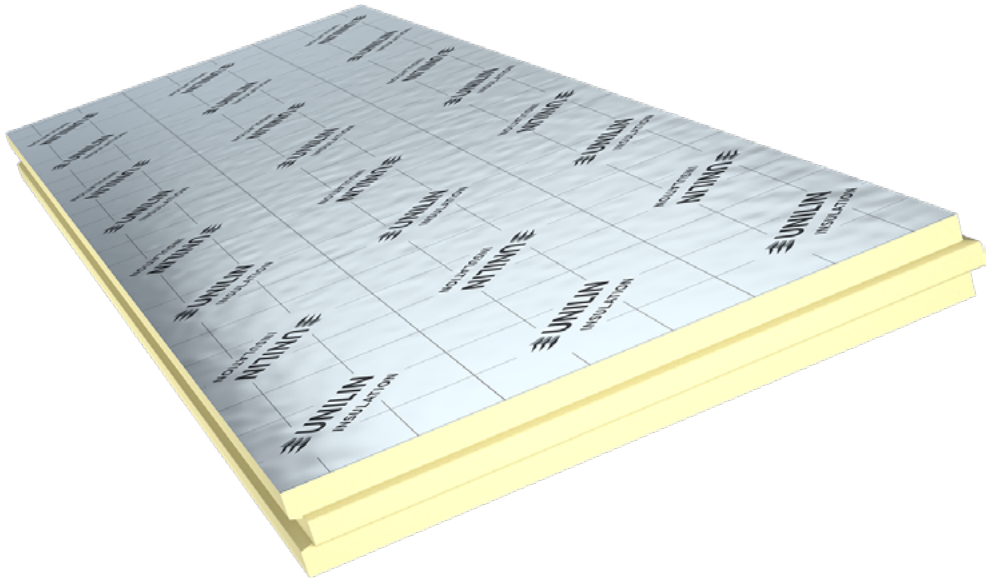
PM = Potential incidence of disease due to PM emissions, IRP = Potential Human exposure efficiency relative to U235, ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c:Potential Comparative Toxic Unit for humans, HTP-nc = Potential Comparative Toxic Unit for humans, SQP = Potential soil quality index.

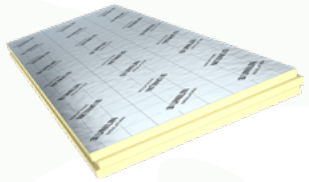
[1] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuelcycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing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

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

Thin-R





4.5.A. LCA results - Thin-R

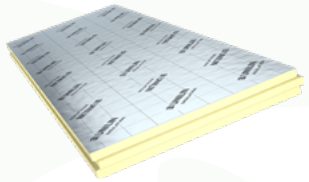
Core environmental impact per 1m² 100mm Thin-R, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	[kg CO_2 eq.]	9.55E+00	2.07E-01	5.17E-01	1.03E+01	6.76E-02	6.70E-01	ND	ND	ND	ND	ND	ND	ND	0	5.95E-02	2.70E+00	5.43E-01	-2.42E+00
GWP-fossil	[kg CO_2 eq.]	1.01E+01	2.07E-01	3.13E-01	1.06E+01	6.76E-02	6.91E-01	ND	ND	ND	ND	ND	ND	ND	0	5.95E-02	2.64E+00	3.13E-01	-2.41E+00
GWP-biogenic	[kg CO_2 eq.]	-7.00E-01	1.24E-04	2.03E-01	-4.97E-01	3.63E-05	-3.23E-02	ND	ND	ND	ND	ND	ND	ND	0	3.20E-05	6.10E-02	2.31E-01	-1.61E-03
GWP-luluc	[kg CO_2 eq.]	1.75E-01	7.82E-05	3.01E-05	1.75E-01	2.40E-05	1.14E-02	ND	ND	ND	ND	ND	ND	ND	0	2.12E-05	2.08E-05	4.35E-05	-2.84E-03
ODP	[kg CFC-11 eq.]	2.33E-07	4.63E-08	1.89E-08	2.98E-07	1.54E-08	1.98E-08	ND	ND	ND	ND	ND	ND	ND	0	1.35E-08	1.39E-08	9.21E-09	-2.70E-07
AP	[mol H+ eq.]	1.22E-02	1.18E-03	1.13E-03	1.45E-02	1.94E-04	9.50E-04	ND	ND	ND	ND	ND	ND	ND	0	1.71E-04	2.27E-03	3.65E-04	-9.08E-03
EP-freshwater	[kg P eq.]	1.19E-04	1.88E-06	2.10E-06	1.23E-04	5.40E-07	8.03E-06	ND	ND	ND	ND	ND	ND	ND	0	4.75E-07	9.04E-07	1.31E-06	-6.14E-05
EP-marine	[kg N eq.]	6.31E-03	2.32E-04	4.64E-04	7.00E-03	3.84E-05	4.56E-04	ND	ND	ND	ND	ND	ND	ND	0	3.38E-05	1.26E-03	3.16E-03	-1.70E-03
EP-terrestrial	[mol N eq.]	2.67E-02	2.60E-03	2.05E-03	3.13E-02	4.30E-04	2.05E-03	ND	ND	ND	ND	ND	ND	ND	0	3.78E-04	1.21E-02	1.23E-03	-2.01E-02
POCP	[kg NMVOC eq.]	1.84E-02	8.24E-04	1.44E-02	3.37E-02	1.65E-04	2.19E-03	ND	ND	ND	ND	ND	ND	ND	0	1.45E-04	2.87E-03	1.41E-01	-5.29E-03
ADP-minerals&metals[2]	[kg Sb eq.]	1.24E-04	5.00E-06	2.38E-06	1.32E-04	1.86E-06	8.61E-06	ND	ND	ND	ND	ND	ND	ND	0	1.64E-06	1.22E-06	3.54E-07	-1.62E-05
ADP-fossils[2]	[MJ] ncv	2.58E+02	3.11E+00	6.13E+00	2.67E+02	1.02E+00	1.74E+01	ND	ND	ND	ND	ND	ND	ND	0	8.99E-01	1.39E+00	8.48E-01	-5.58E+01
WDP[2]	m^3 world eq. deprived	4.06E+00	1.08E-02	5.09E-02	4.12E+00	2.89E-03	2.68E-01	ND	ND	ND	ND	ND	ND	ND	0	2.54E-03	1.64E-01	3.05E-02	-1.00E-01

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.



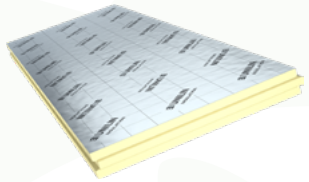
4.5.B. LCA results - Thin-R

Resource use per 1m² 100mm Thin-R, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	[MJ]	2.47E+01	4.77E-02	8.45E-01	2.56E+01	1.46E-02	1.66E+00	ND	ND	ND	ND	ND	ND	ND	0	1.29E-02	2.50E-02	3.45E-02	-9.84E+00
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	2.47E+01	4.77E-02	8.45E-01	2.56E+01	1.46E-02	1.66E+00	ND	ND	ND	ND	ND	ND	ND	0	1.29E-02	2.50E-02	3.45E-02	-9.84E+00
PENRE	[MJ]	1.67E+02	3.30E+00	6.58E+00	1.77E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0	9.54E-01	1.53E+00	9.02E-01	-5.89E+01
PENRM	[MJ]	9.36E+01	0.00E+00	0.00E+00	9.36E+01	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.60E+02	3.30E+00	6.58E+00	2.70E+02	1.08E+00	1.76E+01	ND	ND	ND	ND	ND	ND	ND	0	9.54E-01	1.53E+00	9.02E-01	-5.89E+01
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m³]	2.20E+01	3.62E-04	1.60E-03	2.20E+01	1.09E-04	1.43E+00	ND	ND	ND	ND	ND	ND	ND	0	9.61E-05	5.00E-03	7.96E-04	-1.04E-02

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

ND = Module not declared; INA = Indicator not assessed.



4.5.C. LCA results - Thin-R

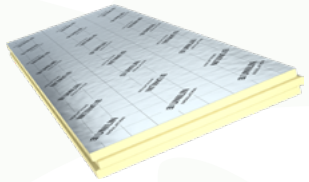
Output flows and waste categories per 1m² 100mm Thin-R, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	1.29E-04	7.39E-06	2.57E-07	1.36E-04	2.68E-06	8.93E-06	ND	ND	ND	ND	ND	ND	ND	0.00E+00	2.35E-06	2.66E-06	1.09E-06	-4.55E-05
NHWD	[kg]	7.47E+00	1.34E-01	2.28E-01	7.83E+00	4.97E-02	5.10E-01	ND	ND	ND	ND	ND	ND	ND	0.00E+00	4.37E-02	5.00E-02	2.62E+00	-1.46E-01
RWD	[kg]	2.77E-03	2.11E-05	4.01E-07	2.79E-03	6.96E-06	1.81E-04	ND	ND	ND	ND	ND	ND	ND	0.00E+00	6.12E-06	2.19E-06	4.49E-06	-4.53E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

CRU, MFR, MER, EEE, EET are not calculated by the EcoChain software.

ND = Module not declared; INA = Indicator not assessed.



4.5.D. LCA results - Thin-R

Additonal Environmental impact per 1m² 100mm Thin-R, R-value 4.5 m²K/W

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.86E-07	1.23E-08	2.69E-09	2.01E-07	4.29E-09	1.32E-08	ND	ND	ND	ND	ND	ND	ND	ND	3.78E-09	7.34E-09	5.26E-09	-3.54E-08
IRP[1]	kBq U235 eq	3.71E+00	1.36E-02	2.00E-02	3.74E+00	4.46E-03	2.43E-01	ND	ND	ND	ND	ND	ND	ND	ND	3.93E-03	1.64E-03	3.40E-03	-8.84E-01
ETP-fw[2]	CTUe	3.88E+01	2.46E+00	3.76E+00	4.50E+01	8.23E-01	2.95E+00	ND	ND	ND	ND	ND	ND	ND	ND	7.24E-01	6.86E+00	3.02E+01	-3.52E+01
HTP-c[2]	CTUe	5.68E-08	6.97E-11	7.07E-11	5.70E-08	2.29E-11	3.70E-09	ND	ND	ND	ND	ND	ND	ND	ND	2.02E-11	2.37E-10	2.55E-11	-7.78E-10
HTP-nc[2]	CTUe	9.28E-07	2.51E-09	2.51E-09	9.33E-07	8.67E-10	6.07E-08	ND	ND	ND	ND	ND	ND	ND	ND	7.63E-10	9.30E-09	1.22E-09	-2.60E-08
SQP[2]	dimensionless	1.79E+02	1.97E+00	5.29E-01	1.82E+02	7.15E-01	1.18E+01	ND	ND	ND	ND	ND	ND	ND	ND	6.29E-01	2.18E-01	1.59E+00	-3.06E+01

PM = Potential incidence of disease due to PM emissions, 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, SQP = Potential soil quality index.

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

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

ND = Module not declared; INA = Indicator not assessed.

5. Calculation rules

The measurement of environmental impacts in this EPD uses the LCIA methodologies recommended for PEF3.0. The indicator values for polyol and MDI are from Plastics Europe Ecoprofile (GaBi); and the impact assessment results of these materials were calculated using OpenLCA. As this EPD is based on Ecoinvent database, there can be a lack of consistency between GaBi and Ecoinvent indicators such as toxicities, ozone depletion and hazardous waste disposal, although there is good agreement on global warming potential.

The process descriptions and quantities in this study are reproducible in accordance to the reference standards that have been used. The references of all sources, both primary and public sources and literature, have been documented in the LCA report. The 'polluter pays' and 'modularity' principles have been followed.

In addition, to facilitate the reproducibility of this LCA, a full set of data records has been generated which can be accessed via the Ecochain LCA tool. This data portfolio contains a summary of all the data used in this LCA, and correspondingly, in the Unilin Insulation Ireland Ltd Ecochain account.

Cut-off criteria

The cut-off criteria of section 6.3.6 of EN15804 +A2 have been followed.

Data Quality

The dataset is representative for the production processes used in 2019. The data Quality Level, according to Table E.1 of EN 15804 +A2, Annex E, is 'very good'.

Allocations

Allocation of electricity types and amounts to the various manufacturing processes has been provided by Unilin Insulation Ireland Ltd , along with production waste and direct emissions; allocation of impacts to the products is based on the product composition mass.

6. Scenarios and additional technical information

The product and data used in this EPD are based on the being manufactured in, and transported to customers within the UK geographic region.

C1. De-construction demolition

It is assumed the insulation panes are removed manually from site, thus no energy or materials are required for Module C1.

C2. Transport

In the transport phase C2, it is assumed that the removed materials travel 50km to landfill and 250km to incineration, as applicable. Transport vehicle type: Freight lorry 16-32 metric ton, EURO6.

C3. Waste processing

Based on feedback supplied by Unilin Insulation Ireland Ltd , it is assumed that 30% of the material at end of life is processed, by being burned in an incineration plant.

C4. Disposal

Based on feedback supplied by Unilin Insulation Ireland Ltd , it is assumed that 70% of the material at end of life is disposed of in landfill.

D. Reuse – Recovery – Recycling potential

It is assumed that of the mass of material incinerated, 40% of this mass is converted to energy. It is assumed that in calculating this energy amount, that the efficiency of the incineration in converting NCV to energy is 70%.

Of this energy, it is assumed that 82% becomes electricity, and 12% becomes heat (based on UK energy statistics, from "UK energy from waste statistics - 2020", Tolvic Consulting).

Declaration of biogenic carbon content at the production gate

The weight of packaging is << than 5% of the mas of the products, and is not declared below.

Biogenic carbon (kg per declared unit)	Unit	CT/PIR	FR/ALU	FR/BGM	FR/MG	Thin-R
Biogenic carbon content in product	kg C	0.19	0.18	0.13	0.13	0.19
Biogenic carbon content in packaging	kg C	ND	ND	ND	ND	ND

ND = Module not declared.

7. Mandatory additional information on release of dangerous substances to indoor air, soil and water

None of the substances contained in the product are listed in the "Candidate List of Substances of Very High Concern for authorisation", or they do not exceed the limit for registration with the European Chemicals Agency.

8. Other optional additional environmental information

N/A.

9. References

1. ISO 14040 Environmental management - Life cycle assessment – Principles and Framework', International Organization for Standardization, ISO 14040:2006.
2. ISO 14044 Environmental management - Life cycle assessment - Requirements and guidelines', International Organization for Standardization, ISO 14044:2006
3. ISO 14025 Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures', International Organization for Standardization, ISO 14025:2006.
4. I.S. EN 15804:2012+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products', EN 15804:2012+A1:2013.
5. Product Category Rules: Part A, Version 2.0. Implementation and use of I.S. EN 15804:2012 and CEN TR 16970:2016 in Ireland, EPD Ireland, IGBC, 17/08/2021.
6. I.S. EN 16783:2017 Thermal insulation products – Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations.
7. Ecochain, 2017version 3.3, dated 10/09/2021, web: http://app.ecochain.com.
8. I.S. EN 13165:2008, Thermal insulation products for buildings. Factory made rigid polyurethane foam (PUR) products. Specification.
9. PEF methodology final draft.pdf (europa.eu)
10. UK Energy from Waste Statistics - 2020. Tolvic Consulting. (https://www.tolvik.com/published-reports/view/uk-energy-from-waste-statistics-2020/)