Environmental Product Declaration

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

Mateenbar Fiberglass Rebars & Dowels

from

Isam M. Khairy Kabbani for Plastic and Insulation Factory Company (IKK Mateenbar)

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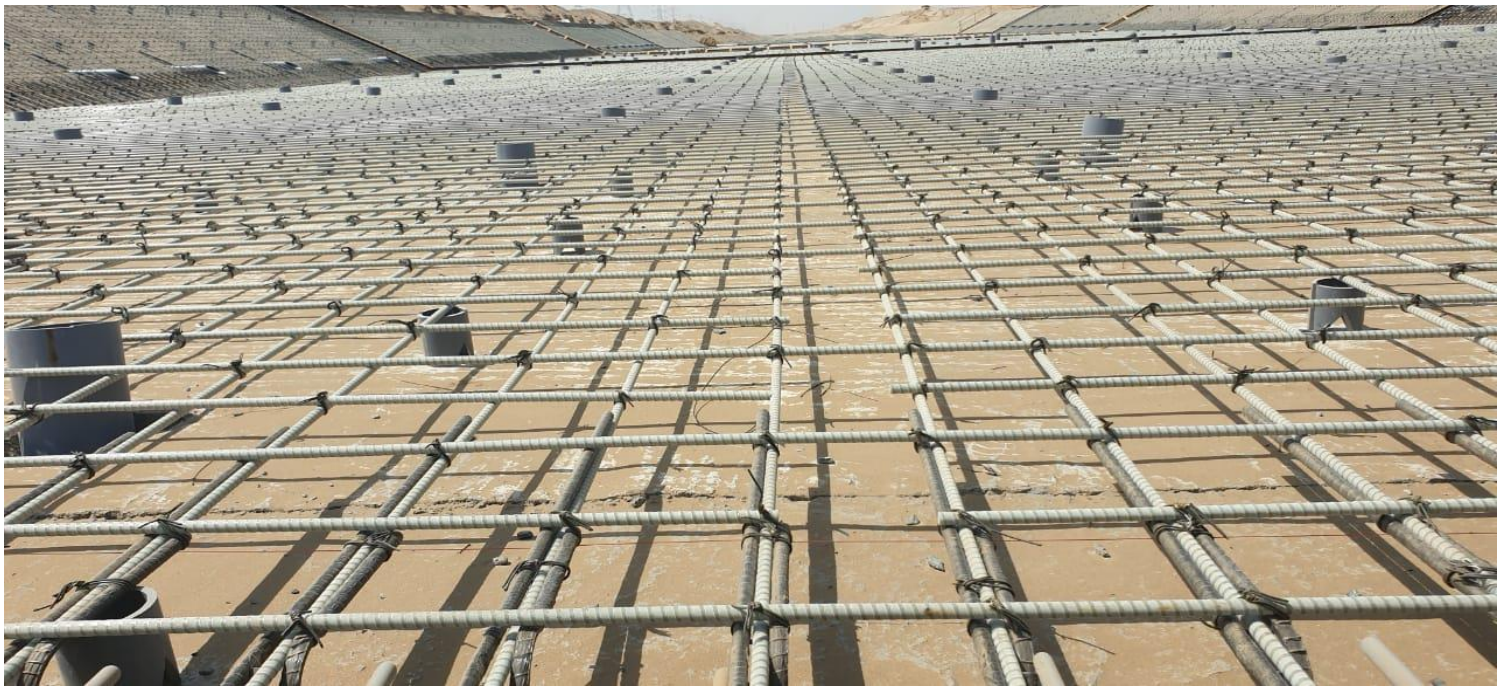
An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com



General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14 Construction products, version 1.3.2
PCR review was conducted by: Martin Erlandsson, IVL Swedish Environmental Research Institute, martin.erlandsson@ivl.se
Life Cycle Assessment (LCA)
LCA accountability: Isam M. Khairy Kabbani for Plastic and Insulation Factory Company (IKK Mateenbar)
LCA and EPD developer: Dr. Rajesh Kumar Singh Thinkstep Sustainability Solutions Pvt. Ltd., a Sphera Company
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Prabodha Acharya, Independent verifier, Mumbai, India Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves 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 characterization factors); have equivalent content declarations; and be valid at the time of comparison.

For further information about comparability, see EN 15804 and ISO 14025.

Company information

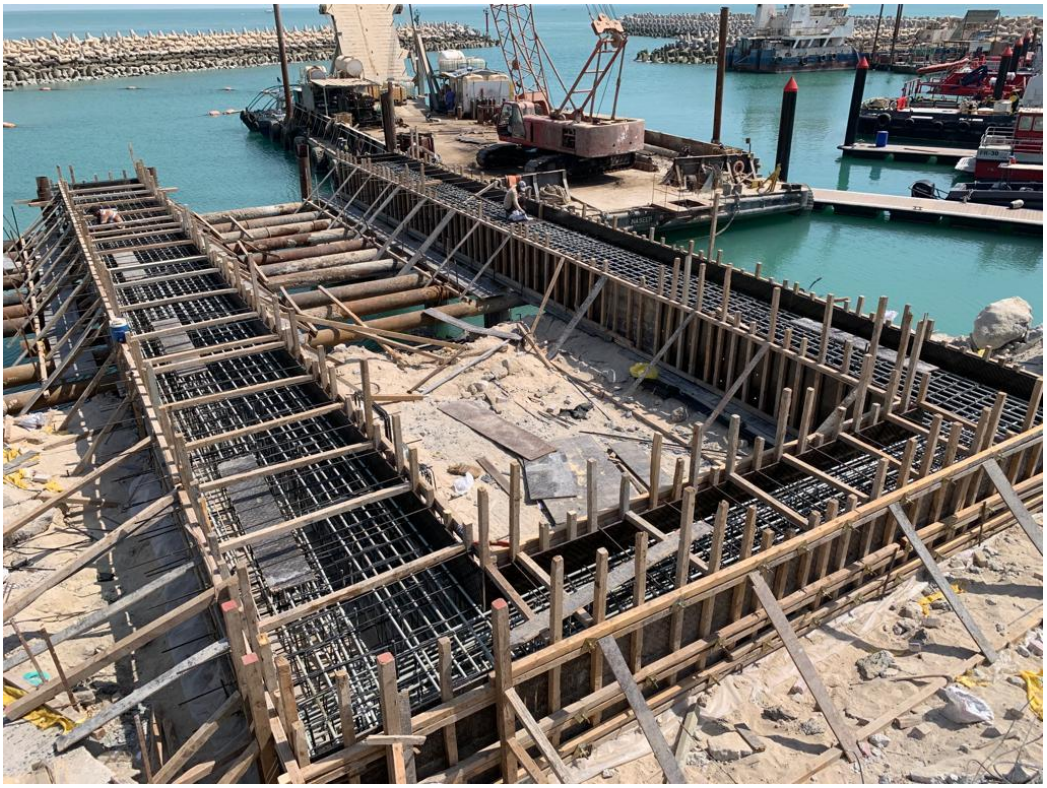
Owner of the EPD: Isam M. Khairy Kabbani for Plastic and Insulation Factory Company (IKK Mateenbar)

Contact: mateenbar@ikkgroup.com

Description of the organization: IKK Mateenbar is a technology group that specializes in the manufacturing of a structurally durable product called Mateenbar Fiberglass Rebars & Dowels, which is used as a sustainable alternative for concrete reinforcement expossed to aggressive environments to eliminate concrete corrosion to achieve longer-lasting structures. IKK MATEENBAR is a partnership between a New Zealand Company called Pultron Composites and a Saudi Company called IKK Group. Mateenbar is produced in a total of three facilities located around the world between New Zealand, USA and Saudi Arabia.

Product-related certifications: ACI CODE-440.11–22, ASTM D7957-17,
SASO Quality mark, ISO 9001:2015.

Name and location of production site(s): 3rd Industrial City, Dammam, Eastern Province, Saudi Arabia.



Product information

Product name: Mateenbar Fiberglass Rebars & Dowels

Product identification: Glass fiber reinforced polymer rebar for the internal reinforcement of concrete structures.

UN CPC code: 36

Geographical scope: Kingdom of Saudi Arabia (SA)

Product description: Mateenbar Fiberglass rebars and dowels are patented products that utilize fiberglass rovings and resin mixtures that are combined through the Pultrusion process to be used as a direct replacement to traditional steel reinforcement in concrete structures. Mateenbar products are designed to be corrosion-resistant, twice as strong, lightweight, and are more sustainable than traditional reinforcement in various applications which include infrastructure, marine, electromagnetic and building structures as shown below:

Infrastructure

- Bridge decks
- Traffic berriers
- Approach slabs
- Roadways
- Flood channels
- Soft-eye for tunnels

Coastal / Marine

- Seawalls / MSE walls
- Reservoirs / dams
- Pavements / sidewalks
- Marine walls
- Precast elements
- Pools

Electromagnetic

- Substations
- MRI rooms
- Transformer base
- Light / heavy rail
- Power stations
- Calibration pads

Buildings

- Foundations
- Desalination plants
- Slab on grades
- Wall panels
- Retaining walls
- Tensions piles

Product information

Declared unit: 1 kg of Mateenbar Fiberglass Rebars & Dowels products listed below, including packaging. The specifications and conversions for different bar types, minimum tensile modulus and size are provided below.

- Mateenbar Fiberglass Rebars & Dowels:
  - Specifications
    - CSA S807 – Specification for fiber-reinforced polymers
      - CSA S807 requirements for D1 bars by keeping at least 80% of their initial tensile strength.
    - ASTM D7957 – Solid round glass fiber reinforced polymer bars for concrete reinforcement
    - ACI 440.6R – Specification for carbon and glass FRP materials for concrete reinforcement
    - CAN/CSA-CSA-S806-12 – Design and evaluation of building structures with fibre-reinforced polymers

Reference service life: The RSL is understood as the period of time until Fiberglass Rebars & Dowels is replaced or restored. The expected service life of Fiberglass rebar & Dowels is approx. 100 years, however, from the conservative perspective, a 50-year RSL was adopted in the study.

The conversion of kilogram to liner meter is provided below:

Diameter (mm)	Weight (kg/m)	Linear Meters per 1 Kg
M6	0.096	10.42
8	0.100	10.00
M10	0.165	6.06
12	0.225	4.44
M13	0.268	3.73
14	0.313	3.19
M16	0.414	2.42
18	0.521	1.92
M19	0.593	1.69
M22	0.776	1.29
M25	1.030	0.97
M29	1.390	0.72
M32	1.603	0.62
37.5	2.272	0.44
40	2.596	0.39
50	4.064	0.25

The technical specifications and material properties for Fiberglass rebar & Dowels product (52GPa) has been mentioned below.

Nominal Diameter	ASTM Bar Designation No.	Nominal Cross-Sectional Area	Product Weight	Guaranteed Ultimate Tensile Strength (F_{fu}*)	Ultimate Tensile Strength	Ultimate Tensile Strain	Modulus of Elasticity (E_f)
mm	#	mm^2	g/m	MPa	MPa	%	GPa
M6	[2]	32	96	950	>1,000	>=1.1	52
8		46	100	950	>1,000	>= 1.1	52
M10	[3]	71	165	950	>1.000	>= 1.1	52
12		104	225	850	>900	>= 1.1	52
M13	[4]	129	268	850	>900	>= 1.1	52
14		149	313	850	>900	>= 1.1	52
M16	[5]	199	414	800	>850	>= 1.1	52
18		242	521	800	>850	>= 1.1	52
M19	[6]	284	593	800	>850	>= 1.1	52
M22	[7]	387	776	800	>850	>= 1.1	52
M25	[8]	510	1,030	800	>850	>= 1.1	52
M29	[9]	645	1,390	800	>850	>= 1.1	52
M32	[10]	819	1,603	800	>850	>= 1.1	52
38		1,068	2,272	800	>850	>= 1.1	52
40		1,256	2,596	750	>800	>= 1.1	52
50		1,963	4,064	750	>800	>= 1.1	52

Ffu*= Tensile strength minus 3 standard deviations (ACI440.1R-2015) M = Metric sizes derived from Table 3 of ASTM D7957
Ef = Design or guaranteed modulus of elasticity of FRP

Bond Strength	Thermal Conductivity	Electrical Resistivity	Density	Fibre Mass Content	Moisture Absorption (24hr at 50 0C)	Glass Transition Temp. (DSC)	Shear Strength
MPa	W/m ^{0}C	Ωm	kg/m^3	%	%	^{0}C	MPa
>10	<1	>200x10^10	2,100	≥80	≤0.1	≥100	≥180

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Glass Fibre	0.85	0	0
Vinyl ester resin	0.15	0	0
TOTAL	1		
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Wooden pallets	0.05	5	0.02
Straps	0.0002	0.02	0
Plastic ties	0.00012	0.012	0
TOTAL	0.05		

	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	**A 1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	**X**	**X**	**X**	ND	**X**	ND	ND	ND	ND	ND	ND	ND	**X**	**X**	**X**	**X**	**X**
Geography	**SA**	**SA**	**SA**		**Global**	-	-	-	-	-	-	-	**SA**	**SA**	**SA**	**SA**	**SA**
Specific dataused	**<90%**			-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Variation – products	**0%**			-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Variation – sites	**Not relevant**			-	-	-	-	-	-	-	-	-	-	-	-	-	**-**

**Not Declared*

This EPD's system boundary has been defined as cradle to gate with options, modules C1-C4, module D. During the End-of-Life phase the dismantled fiberglass rebar & Dowels material is crushed and reused as fine aggregate in concrete on the same site. Therefore, modules C2 & C4 are not showing any impacts.

A1: Raw Material Supply
Production starts with raw materials. Raw material stage includes raw material extraction/preparation and pre-treatment processes before production.

A2: Transportation
Transport is relevant for delivery of raw materials and other materials to the plant and the transport of materials within the plant.

A3: Manufacturing
The pultrusion process is involved in manufacturing of fiberglass rebar & Dowels with basic materials like glass fiber rovings and vinyl ester resin. The electricity for the manufacturing process has been sourced from grid. The GHG-GWP impact for electricity used for manufacturing is 0.826 kg CO_2 eq./kWh. The end products are then packaged to be sold.

A5: Construction / Installation
The installation of the rebars at the construction site.

C1: Deconstruction / Demolition
For module C1 it is assumed that manual demolition has been considered.

C3: Waste Processing
The waste processing involves fine grinding of waste, consuming 0.0018 kWh/kg of electricity.

D: Benefits and Loads Beyond the system Boundary
In this stage, benefits from the recycling of waste were calculate.

Cut-off criteria:

The environmental impact of the product studied has been assessed by considering all significant processes, materials, and emissions. Excluded flows are assumed to have a negligible impact, contributing less than 5% to the cumulative impact assessment categories. The production of capital equipment, facilities, and infrastructure required for manufacture has not been considered.

Data quality and sources:

Data quality is compliant with ISO 14025:2006. All primary data were collected for the year April 2021 to March 2022. All background data come from the Sphera Managed LCA Content 2023.2 databases.

Allocation:

No allocation has been applied.

Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804

The environmental performance of the functional unit of one kg of Fiberglass Rebar & Dowels are reported below using the parameters and units as specified in PCR 2019:14 v1.3.2.
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. The scenarios included are currently in use and are representative for one of the most probable alternatives.

Environmental Impacts for 1 kg of Fiberglass Rebar & Dowels								
Impact indicators	Unit	A1-A3	A5	C1	C2	C3	C4	D
Climate Change - total	kg CO_2 eq.	2.34E+00	8.12E-02	0.00E+00	0.00E+00	6.06E-04	0.00E+00	-2.01E-03
Climate Change, fossil	kg CO_2 eq.	2.40E+00	1.40E-03	0.00E+00	0.00E+00	5.98E-04	0.00E+00	-2.03E-03
Climate Change, biogenic	kg CO_2 eq.	-6.18E-02	7.98E-02	0.00E+00	0.00E+00	7.16E-06	0.00E+00	2.69E-05
Climate Change, (LULUC)	kg CO_2 eq.	6.88E-04	3.34E-07	0.00E+00	0.00E+00	3.97E-09	0.00E+00	-8.98E-06
GWP-GHG*	kg CO_2 eq.	2.40E+00	1.40E-03	0.00E+00	0.00E+00	5.98E-04	0.00E+00	-2.03E-03
Ozone depletion	kg CFC -11 eq.	5.94E-12	8.09E-15	0.00E+00	0.00E+00	5.00E-17	0.00E+00	-1.32E-14
Acidification	Mole of H+ eq.	1.59E-02	1.34E-05	0.00E+00	0.00E+00	8.75E-06	0.00E+00	-1.02E-05
Eutrophication, freshwater	kg P eq.	4.23E-06	6.51E-09	0.00E+00	0.00E+00	6.66E-11	0.00E+00	-6.40E-09
Eutrophication, marine	kg N eq.	2.36E-03	3.84E-06	0.00E+00	0.00E+00	9.24E-07	0.00E+00	-3.62E-06
Eutrophication, terrestrial	Mole of N eq.	2.57E-02	5.54E-05	0.00E+00	0.00E+00	1.01E-05	0.00E+00	-3.98E-05
Photochemical ozone formation, human health	kg NMVOC eq.	7.50E-03	1.05E-05	0.00E+00	0.00E+00	2.89E-06	0.00E+00	-1.01E-05
Resource use, mineral and metals	kg Sb eq.	2.69E-07	7.60E-11	0.00E+00	0.00E+00	4.37E-13	0.00E+00	-1.75E-10
Resource use, fossils	MJ	3.84E+01	2.07E-02	0.00E+00	0.00E+00	9.08E-03	0.00E+00	-3.23E-02
Water use	m^3 world equiv.	4.30E-01	8.93E-03	0.00E+00	0.00E+00	2.00E-05	0.00E+00	-2.18E-04
Acronyms	**Caption:** GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); GWP-GHG*= global warming potential (greenhouse gases) This indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product with characterization factors (CFs) based on IPCC (2013); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestric = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element); ADPF = abiotic depletion potential (fossil); WDP = water scarcity.							

Resource Use for 1 kg of Fiberglass Rebar & Dowels								
Impact indicators	Unit	A1-A3	A5	C1	C2	C3	C4	D
PERE	MJ	4.30E+00	1.58E-01	0.00E+00	0.00E+00	1.53E-05	0.00E+00	-9.97E-03
PERM	MJ	1.53E-01	-1.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	4.45E+00	5.12E-03	0.00E+00	0.00E+00	1.53E-05	0.00E+00	-9.97E-03
PENRE	MJ	3.61E+01	3.42E-02	0.00E+00	0.00E+00	2.35E+00	0.00E+00	-3.23E-02
PENRM	MJ	2.35E+00	-1.34E-02	0.00E+00	0.00E+00	-2.34E+00	0.00E+00	0.00E+00
PENRT	MJ	3.85E+01	2.07E-02	0.00E+00	0.00E+00	9.08E-03	0.00E+00	-3.23E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m3	1.11E-02	2.10E-04	0.00E+00	0.00E+00	4.66E-07	0.00E+00	-9.30E-06
Acronyms	**Caption:** PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy 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							

*Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator. We discourage the use of the results of modules A1-A3 without considering the results of module C.

Waste Flow for 1 kg of Fiberglass Rebar & Dowels								
Impact indicators	Unit	A1-A3	A5	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	1.60E-09	4.89E-13	0.00E+00	0.00E+00	2.00E-13	0.00E+00	7.95E-13
Non-hazardous waste disposed (NHWD)	kg	1.76E-01	1.92E-03	0.00E+00	0.00E+00	3.61E-07	0.00E+00	-4.29E-02
Radioactive waste disposed (RWD)	kg	3.50E-04	1.16E-06	0.00E+00	0.00E+00	1.58E-10	0.00E+00	-2.20E-06
Components for re-use (CRU)	kg	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for Energy Recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (EET)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acronyms	**Caption:** HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy							

Biogenic carbon content for 1 kg of Fiberglass Rebar & Dowels								
Impact indicators	Unit	A1-A3	A5	C1	C2	C3	C4	D
Biogenic carbon content in product [kg]	kg	2.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in packaging [kg]	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional Environmental Impacts for 1 kg of Fiberglass Rebar & Dowels								
Impact indicators	Unit	A1-A3	A5	C1	C2	C3	C4	D
Particulate matter	Disease incidences	1.37E-07	9.01E-11	0.00E+00	0.00E+00	8.25E-11	0.00E+00	-6.14E-10
Ionising radiation, human health	kBq U235 eq.	3.13E-02	1.85E-04	0.00E+00	0.00E+00	2.67E-08	0.00E+00	-3.60E-04
Ecotoxicity, freshwater	CTUe	1.16E+01	8.66E-03	0.00E+00	0.00E+00	3.23E-03	0.00E+00	-1.57E-02
Human toxicity, cancer	CTUh	6.26E-10	8.79E-13	0.00E+00	0.00E+00	2.10E-13	0.00E+00	-1.30E-12
Human toxicity, non-cancer	CTUh	3.54E-08	4.88E-11	0.00E+00	0.00E+00	1.47E-12	0.00E+00	-1.14E-10
Land Use	Pt	1.34E+01	6.24E-03	0.00E+00	0.00E+00	3.07E-06	0.00E+00	-7.79E-03
Acronyms	**Caption:** PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts							

References

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