Environmental Product Declaration

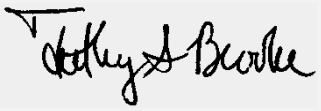
RENCO

MCFR Block

According to
EN 15804
ISO 21930
ISO 14025

1. General Information

Manufacturer Name:	RENCO – Manisa/Turkey Factory Dilek, D565, 45804 Saruhanlı/Manisa, Turkey
Program Operator:	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959, USA
Declaration Number:	EPD 252
Reference PCR:	ISO 21930: 2017
Date of Issuance:	September 1, 2021
End of Validity:	September 1, 2026
Product Name:	MCFR Block
EPD Owner:	RENCO
Declared Unit:	1 kg of MCFR Block
EPD Scope:	Cradle-to-gate (A1, A2, and A3)
Verification:	ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930. ☐ internal ☒ external
LCA Reviewer and EPD Verifier:	Timothy S. Brooke ASTM International



2. Product

2.1 Product Description

The declared product is MCFR Blocks. Mineral Composite Fiber Reinforced (MCFR) are a type of composite material (CM). CM's refer to products made from multiple materials with significantly different physical or chemical properties.

2.2 Application

MCFR Blocks are monoblock elements using in building systems. These blocks stack in a simple interlocking idea and are adhesively joined to form monolithic structures.

2.3 Technical Data

Table 1 provides technical data for MCFR Blocks.

Table 1: Technical Data

Name	Value	Unit
Density	244.00	kg/m^3
Block Size	20 x 20 x 40	cm

2.4 Base Materials

Table 2 provides base materials data for MCFR Blocks.

Table 2: Product Ingredients

Component	Ingredient Name	Value	
MCFR Blocks	PET Recycled Resin	20-25	%
	Calcium Carbonate	30-40	%
	E-Glass Multi End Roving	15-25	%
	Aluminum Hydroxide	10-20	%
	Other	<5	%

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is 1 kg MCFR Blocks produced at Renco's facility in Turkey.

3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. (see also Table 4):

A1 Raw material supply: Extraction, handling, and processing of input materials.
A2 Transportation*:* Transportation of all input materials from the suppliers to the gate of the manufacturing facility.
A3 Manufacturing**:** The preparation processes of MCFR Block units at Renco's manufacturing facility. This phase also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values.

3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

3.5 Background Data and 3.6 Data Quality

Data was gathered for the primary material and energy inputs used in production for calendar year 2020. Table 3 describe each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 3 also includes a data quality assessment for on the basis of the technological, temporal, and geographical representativeness.

Table 3: Secondary Data Sources and Data Quality Assessment

A1: Raw Material Inputs

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
PET Recycled Resin	USLCI 2014: Recycled postconsumer PET pellet NREL/RNA U	Global	2014	**Technology:** very good Process models average global technology **Time:** very good Data is <10 years old **Geography:** very good Data is representative of global conditions.
Calcium Carbonate	IMA-NA Calcium Carbonate Life Cycle Assessment	North America	2016	**Technology:** very good Process models average global technology **Time:** very good Data is <5 years old **Geography:** fair Data is representative of global conditions.
E-Glass Multi End Roving	ecoinvent 3: Glass fibre {RoW}| production | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** very good Data is <5 years old **Geography:** very good Data is representative of global conditions.
ATH Aluminum Hydroxide	ecoinvent 3: Aluminium hydroxide {RoW}| aluminium hydroxide production | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** very good Data is <5 years old **Geography:** very good Data is representative of global conditions.
Peroxide and Zinc Stearate	ecoinvent 3: Chemical, inorganic {GLO}| production | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** very good Data is <5 years old **Geography:** very good Data is representative of global conditions.
Magnesium Oxide	ecoinvent 3: Magnesium oxide {RoW}| production | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** good Data is <5 years old **Geography:** very good Data is representative of global conditions.

A2: Transportation				
Inputs	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Trucking	ecoinvent 3: Transport, freight, lorry 7.5-16 metric ton, EURO3 {GLO}| market for | Alloc Rec, U	Global	2018	**Technology:** very good Process models average global technology **Time:** good Data is <5 years old **Geography:** very good Data is representative of global conditions.
A3: Manufacturing				
Energy	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Electricity	Ortadoğu Enerji	Turkey	2021	**Technology**: very good **Time:** very good **Geography**: very good.
Ancillary Material	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Hydraulic fluid	ecoinvent 3: Diesel {RoW}| diesel production, petroleum refinery operation | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** good Data is <5 years old **Geography:** very good Data is representative of global conditions.
Packaging	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Wooden pallet	ecoinvent 3: EUR-flat pallet {GLO}| market for | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** very good Data is <5 years old **Geography:** very good Data is representative of global conditions.
Plastic packing and film	ecoinvent 3: Packaging film, low density polyethylene {RoW}| production | Cut-off, U	Global	2018	**Technology:** very good Process models average global technology **Time:** good Data is <5 years old **Geography:** very good Data is representative of global conditions.

3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2020.

3.8 Allocation

At Renco's Turkey facility several MCFR products are produced. Since the primary data for manufacturing was only available on a facility level, the environmental load among the products produced is allocated according to its mass. For waste that is recycled, the 'recycled content approach' was chosen. The recycling of waste generated by the product system is cut off.

3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

4. LCA Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics.Table 4 and 5 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system.

Table 4: Description of the System Boundary (x: included in LCA; mnd: module not declared; mnr: module not reported)

Product			Construction Installation		Use							End-of-life				Benefits Beyond the System Boundary		
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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	x	mnd	mnd	mnd	mnd	mnr	mnr	mnr	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd

Table 5. Life Cycle Impact Assessment Results for 1 kg MCFR Blocks						
Environmental Indicator	**Abbrev.**	**Units**	**Total**	**A1**	**A2**	**A3**
Core Mandatory Impact Indicator						
Global warming potential	**GWP**	kg CO2-eq	9.94E-01	9.06E-01	3.23E-02	5.55E-02
Depletion potential of the stratospheric ozone layer	**ODP**	kg CFC-11-eq	6.53E-08	5.41E-08	7.69E-09	3.46E-09
Acidification potential of land and water	**AP**	kg SO2-eq	6.06E-03	5.61E-03	1.96E-04	2.63E-04
Eutrophication potential	**EP**	kg PO4-eq	4.12E-03	3.97E-03	3.88E-05	1.07E-04
Formation of tropospheric ozone	**SFP**	Kg O3-eq	8.74E-02	7.86E-02	5.03E-03	3.80E-03
Abiotic depletion potential for fossil resources	**ADPF**	MJ Surplus	1.17E+01	9.90E+00	4.80E-01	1.30E+00
Fossil Fuel Depletion	**FFD**	MJ Surplus	1.29E+00	1.04E+00	6.95E-02	1.73E-01
Use of Primary Resources						
Renewable primary energy carrier used as energy	**RPRE**	MJ	2.30E+00	8.24E-01	6.37E-03	1.47E+00
Renewable primary energy carrier used as material	**RPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy used as energy	**NRPRE**	MJ	1.31E+01	1.11E+01	5.19E-01	1.50E+00
Non-renewable primary energy used as material	**NRPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy						
Use of secondary materials	**SM**	kg	4.25E-01	4.25E-01	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
Use of non-renewable secondary fuels	**NRSF**	MJ	2.73E+00	0.00E+00	0.00E+00	2.73E+00
Recovered energy	**RE**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mandatory Inventory Parameters						
Use of freshwater resources	**FW**	m3	8.21E-03	7.85E-03	8.31E-05	2.78E-04
Indicators Describing Waste						
Disposed of hazardous waste	**HWD**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of non-hazardous waste	**NHWD**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of high level radioactive waste	**HLRW**	m3	5.25E-10	4.70E-10	5.62E-12	4.91E-11
Disposed of low level radioactive waste	**LLRW**	m3	6.60E-09	4.86E-09	1.30E-09	4.43E-10
Components for reuse	**CRU**	kg	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
Materials for energy recovery	**MER**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (waste to energy)	**EEE**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (waste to energy)	**ETE**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 5. Life Cycle Impact Assessment Results for 1 m3 MCFR Blocks						
Environmental Indicator	**Abbrev.**	**Units**	**Total**	**A1**	**A2**	**A3**
Core Mandatory Impact Indicator						
Global warming potential	**GWP**	kg CO2-eq	2.42E+02	2.21E+02	7.89E+00	1.35E+01
Depletion potential of the stratospheric ozone layer	**ODP**	kg CFC-11-eq	1.59E-05	1.32E-05	1.88E-06	8.45E-07
Acidification potential of land and water	**AP**	kg SO2-eq	1.48E+00	1.37E+00	4.78E-02	6.42E-02
Eutrophication potential	**EP**	kg PO4-eq	1.00E+00	9.69E-01	9.47E-03	2.62E-02
Formation of tropospheric ozone	**SFP**	Kg O3-eq	2.13E+01	1.92E+01	1.23E+00	9.27E-01
Abiotic Depletion Potential for Fossil Resources	**ADPF**	MJ Surplus	2.85E+03	2.42E+03	1.17E+02	3.18E+02
Fossil Fuel Depletion	**FFD**	MJ Surplus	3.14E+02	2.55E+02	1.69E+01	4.22E+01
Use of Primary Resources						
Renewable primary energy carrier used as energy	**RPRE**	MJ	5.62E+02	2.01E+02	1.55E+00	3.59E+02
Renewable primary energy carrier used as material	**RPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy carrier used as energy	**NRPRE**	MJ	3.20E+03	2.70E+03	1.27E+02	3.66E+02
Non-renewable primary energy carrier used as material	**NRPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy						
Use of secondary materials	**SM**	kg	1.04E+02	1.04E+02	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
Use of non-renewable secondary fuels	**NRSF**	MJ	6.66E+02	0.00E+00	0.00E+00	6.66E+02
Recovered energy	**RE**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mandatory Inventory Parameters						
Use of freshwater resources	**FW**	m3	2.00E+00	1.92E+00	2.03E-02	6.77E-02
Indicators Describing Waste						
Disposed of hazardous waste	**HWD**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of non-hazardous waste	**NHWD**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of high level radioactive waste	**HLRW**	m3	1.28E-07	1.15E-07	1.37E-09	1.20E-08
Disposed of low level radioactive waste	**LLRW**	m3	1.61E-06	1.19E-06	3.16E-07	1.08E-07
Components for reuse	**CRU**	kg	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
Materials for energy recovery	**MER**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (waste to energy)	**EEE**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (waste to energy)	**ETE**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. For MCFR Blocks, the raw material supply (A1) is the major contributor to the overall impact across the selected impact categories. This is since A1 incorporates all the upstream extraction and production of the chemical inputs. Transportation (A2) impacts are small in all declared product blocks (0.94 – 11.78%). The manufacturing (A3) is also small for most impact categories (2.61 – 11.16%).

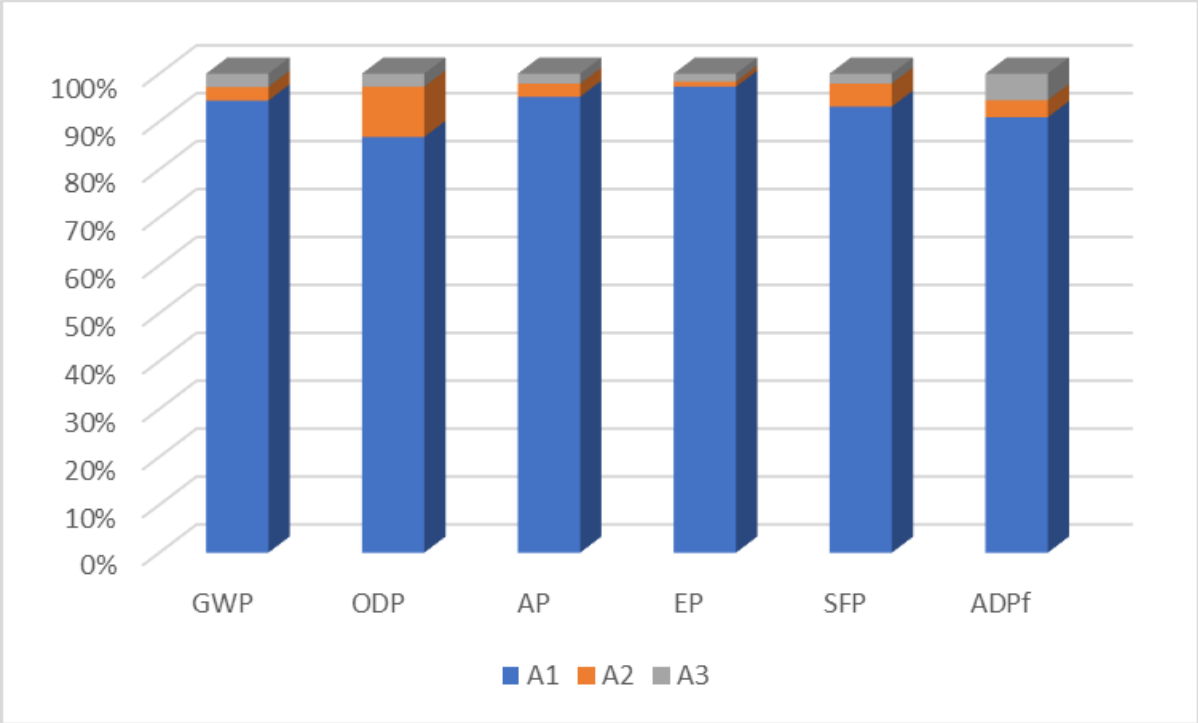


Figure 1. Contribution analysis for MCFR Blocks

6. References

1. Athena Institute: 2020 - A Cradle-to-Gate Life Cycle Assessment of MCFR Products Manufactured by RENCO

2. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.

3. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

1. ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.

2. 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.