ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

VirtuPVT

Naked Energy Ltd

EPD HUB, HUB-0434

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Created with One Click LCA

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Naked Energy Ltd
Address	Unit 80, Basepoint business centre, Metcalf way, Crawley, RH11 7XX
Contact details	info@nakedenergy.com
Website	https://nakedenergy.com/

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR version 1.0, 1 Feb 2022
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Maria Zagorulko, Naked Energy Ltd.
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
EPD verifier	H.N, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	VirtuPVT
Additional labels	-
Product reference	A100141
Place of production	Braintree, United Kingdom
Period for data	2021
Averaging in EPD	No averaging
Variation in GWP-fossil for A1-A3	N/A

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 unit of solar thermal collector with the required installation resources. 1 unit corresponds to 349 Wp of combined electrical and thermal capacities of manufactured VirtuPVT collector.
Declared unit mass	19.993 kg
GWP-fossil, A1-A3 (kgCO2e)	1,2E2
GWP-total, A1-A3 (kgCO2e)	1,22E2
Secondary material, inputs (%)	4.39
Secondary material, outputs (%)	48.6
Total energy use, A1-A3 (kWh)	557.0
Total water use, A1-A3 (m3e)	8,11E-1

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Naked Energy is a British design and engineering business, leading the global innovation in solar thermal and solar PVT with a mission to change energy for good.

PRODUCT DESCRIPTION

VirtuPVT is a hybrid solar module that produces both solar thermal hot water and solar PV electricity simultaneously. The module consists of photovoltaic cells laminated to a heat exchanger inside a vacuum-filled glass tube. It is used to generate heat and electricity and can be installed on building roofs, on building facades and on the ground. It has integrated reflectors, a low profile and a tubular design enabling little to no wastage of space and greater energy capture.
Further information can be found at https://nakedenergy.com/.

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	25.7	Europe
Minerals	52.1	Asia
Fossil materials	22.2	Europe, Asia
Bio-based materials	0	-

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	0.04

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 unit of solar thermal collector with the required installation resources. 1 unit corresponds to 349 Wp of combined electrical and thermal capacities of manufactured VirtuPVT collector.
Mass per declared unit	19.993 kg
Functional unit	-
Reference service life	20 years

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR.

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

The solar thermal collector is made of a number of assemblies consisting of photovoltaic cells, an absorber plate, a glass vacuum tube, copper pipes for water and electrical connectors for use as a PV array. The components are manufactured in different countries and assembled together at one manufacturing facility. Main materials present in the components include borosilicate glass, aluminium, high density polyethylene and copper. The manufacturing process mainly requires electricity for both tools and space heating. The plastic waste produced at the plant is directed to incineration, while glass and metal waste streams are landfilled and recycled respectively. Wastewater treatment is also considered. A wooden pallet, cardboard and packaging film are used as a packaging material for transporting the product from the factory gate.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The transportation distance is defined according to the PCR. When distributed within EU, the average distance of transportation from production plant to building site is assumed to be 250 km by ferry plus 100 km by lorry. When distributed within UK, transportation distance was assumed to be 100 km by lorry. Vehicle capacity utilization volume factor is assumed to be 1, which means full load. In reality, it may vary but as role of transportation emissions in total results is small, the variety in load is assumed to be negligible. Empty returns are not taken into account as it is assumed that return trip is used by the transportation company to serve the needs of other clients. Transportation does not cause losses as product is packaged properly. Environmental impacts from installation into the building include waste packaging materials (A5) and release of biogenic carbon dioxide from wood pallets/cardboard boxes. The impacts of material production, its processing and its disposal as installation waste are also included.

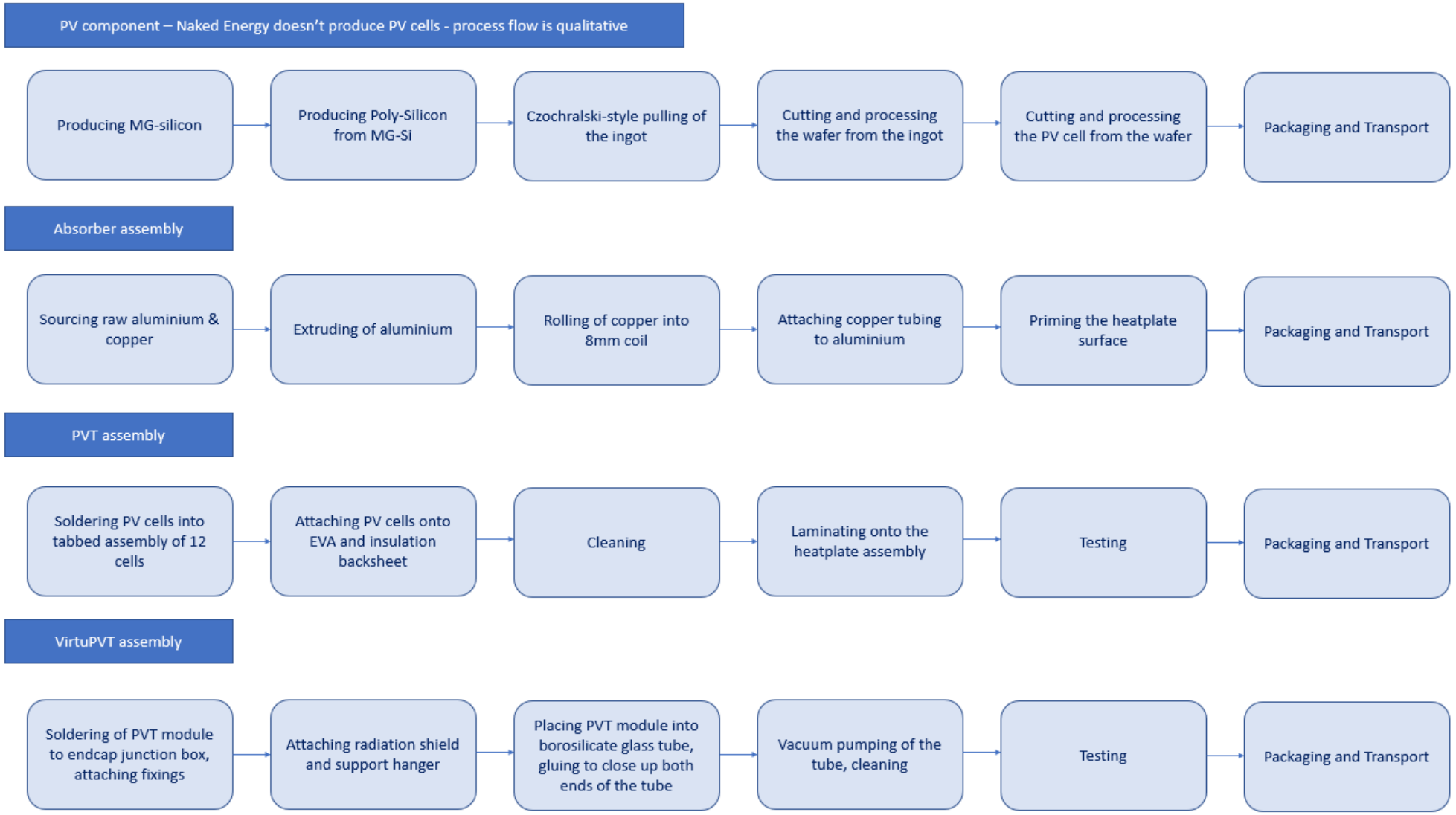
PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase.
Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

Consumption of energy in de-construction process is considered negligible. It is assumed that the waste is collected separately and transported to the waste treatment centre. Transportation distance to treatment is assumed as 50 km on average and the transportation method is assumed to be lorry (C2). Due to the absence of specific data in this study, Table G.4 of EN 50693:2019 Product Category rules for life cycle assessments of electronic and electrical products and systems is used as default values for waste treatment percentages. The sequence of treatment operations occurring to the product shall include de-pollution, fractions separation and preparation (dismantling, crushing, shredding, sorting), recycling, other material recovery, energy recovery and disposal. Module C3 accounts for energy and resource inputs for sorting and treating these waste streams for recycling and incineration with energy recovery with efficiency greater than 60% (assumed). Additionally, waste that is incinerated without energy recovery or landfilled is included in Module C4 while the flow not included in Module D for benefits. Due to the material and energy recovery potential of parts in the end of life product and packaging, recycled raw materials lead to avoided virgin material production, while the energy recovered from incineration displaces electricity and heat production (D). The benefits and loads of incineration and recycling are included in Module D.

MANUFACTURING PROCESS



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging materials	Allocated by mass or volume
Ancillary materials	Not applicable
Manufacturing energy and waste	Allocated by mass or volume

AVERAGES AND VARIABILITY

Type of average	No averaging
Averaging method	Not applicable
Variation in GWP-fossil for A1-A3	N/A

There is no average result considered in this study since this EPD refers to one specific product produced in one production plant.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. Ecoinvent and One Click LCA databases were used as sources of environmental data.

ADDITIONAL TECHNICAL INFORMATION

This section provides additional technical information on the VirtuPVT product.

PRODUCT'S OPERATIONAL ENERGY VP-050-C

VirtuPVT does not require any input of energy to operate.
The key performance outputs for different roof geometries and locations can be found here: https://rb.gy/qksfec.

During the operational lifetime (20 years), the thermal and electrical energy yields (in kWh) can be estimated via the following formulae:

$$Thermal\ yield = \sum_{n=1}^{20} E_{th} \times (1 - 0.005n) \times N$$

$$Electrical\ yield = \sum_{n=1}^{20} E_{el} \times (1 - 0.005n) \times N$$

Where:
E_{th} – geographically estimated thermal energy in kWh produced annually
E_{el} – geographically estimated electrical energy in kWh produced annually (Solar Keymark values can be obtained in product specification sheet)
n – year of service (certified to operate for 20 years in total)*
N – total number of VirtuPVT units installed on site

*Please note that the decrease in efficiency of the thermal and electrical yield is assumed to be a constant 0.5% per annum.

PAYBACK ON EMBEDDED CARBON

Considering the below environmental indicators as well as operational energy performance of each declared unit, carbon payback (CP) on embedded carbon ($kgCO_2eq$) can be calculated via the following formula:

$$CP = \frac{Embedded\ carbon\ of\ 1\ declared\ unit\ in\ \ kgCO_2}{Abated\ carbon\ of\ 1\ declared\ unit\ in\ kgCO_2/year}$$

$$Abated\ carbon = E_{th} \times I_{th} + E_{el} \times I_{el}$$

Where:
I_{th} – carbon intensity of the heat source replaced** ($kgCO_2eq/kWh$)
I_{el} – carbon intensity of the electricity source replaced*** ($kgCO_2eq/kWh$)

** For the estimation of the abated carbon of 1 declared unit, the heat source replaced was assumed to be natural gas with carbon intensity of 0.210 $kgCO_2eq/kWh$

***For the estimation of the abated carbon of 1 declared unit, the carbon intensity of individual country's electricity grid. The table below summarizes the intensities of the grid in the four Solar Keymark locations. (Our World in Data, 2023)

For 1 declared unit of VirtuPVT, the average**** estimated payback on embodied carbon is ~ 3.25 years.

****Abated carbon was taken as an average of our portfolio. Majority of sites are found in Northern Europe. Results may differ depending on location of VirtuPVT installation.

For the four Solar Keymark locations aforementioned variables were calculated and are displayed in the table below:

	Athens		Davos		Stockholm		Würzburg	
Fluid Temperature (˚C)	25	50	25	50	25	50	25	50
Thermal Yield, E_{th} (kWh)	362	217	238	132	177	92	203	107
Electrical Yield, E_{el} (kWh)	103	94	91	83	63	58	70	64
Carbon intensity of grid electricity ($kgCO_2eq/kWh$)	0.448	0.448	0.357	0.357	0.012	0.012	0.314	0.314
Carbon Abatement ($kgCO_2$/year)	122	87.7	82.5	57.4	37.9	20.0	64.6	42.6
Carbon Payback (years)	1.07	1.49	1.59	2.28	3.46	6.55	2.03	3.08

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	1,05E2	6,51E0	1,04E1	1,22E2	5,6E-1	1,85E-1	MND	MND	MND	MND	MND	MND	MND	0E0	1,67E-1	6,64E0	3,54E0	-6,72E1
GWP – fossil	kg CO_2e	1,03E2	6,5E0	1,05E1	1,2E2	5,64E-1	4,1E-2	MND	MND	MND	MND	MND	MND	MND	0E0	1,67E-1	6,64E0	3,52E0	-6,77E1
GWP – biogenic	kg CO_2e	4,3E-1	8,46E-4	-1,37E-1	2,94E-1	3,48E-5	1,44E-1	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	6,75E-1
GWP – LULUC	kg CO_2e	7,56E-1	3,52E-3	1,57E-2	7,75E-1	2,91E-4	2,43E-5	MND	MND	MND	MND	MND	MND	MND	0E0	5,91E-5	1,86E-4	2,07E-4	-1,59E-1
Ozone depletion pot.	kg $CFC_{-11}e$	1,44E-5	1,38E-6	1,08E-6	1,68E-5	1,19E-7	6,08E-9	MND	MND	MND	MND	MND	MND	MND	0E0	3,79E-8	2,44E-8	2,94E-8	-2,77E-6
Acidification potential	mol H^+e	8,78E-1	1,16E-1	3,84E-2	1,03E0	1,24E-2	2,71E-4	MND	MND	MND	MND	MND	MND	MND	0E0	6,81E-4	2,27E-3	1,29E-3	-5,27E-1
EP-freshwater[2)]	kg Pe	5,89E-3	4,67E-5	3,36E-4	6,27E-3	3,26E-6	6,19E-7	MND	MND	MND	MND	MND	MND	MND	0E0	1,39E-6	7,88E-6	3,24E-6	-2,77E-3
EP-marine	kg Ne	1,27E-1	2,99E-2	7,78E-3	1,65E-1	3,12E-3	1,27E-4	MND	MND	MND	MND	MND	MND	MND	0E0	2,02E-4	7,45E-4	5,11E-4	-8,49E-2
EP-terrestrial	mol Ne	1,54E0	3,32E-1	8,95E-2	1,96E0	3,47E-2	1,01E-3	MND	MND	MND	MND	MND	MND	MND	0E0	2,23E-3	8,22E-3	5,1E-3	-1,01E0
POCP ("smog")[3)]	kg NMVOCe	4,24E-1	8,79E-2	2,25E-2	5,34E-1	9,1E-3	3,39E-4	MND	MND	MND	MND	MND	MND	MND	0E0	6,84E-4	2,1E-3	1,46E-3	-2,67E-1
ADP-minerals & metals[4)]	kg Sbe	1,28E-2	1,4E-4	3,14E-5	1,29E-2	8,1E-6	6,38E-7	MND	MND	MND	MND	MND	MND	MND	0E0	4,51E-6	6,48E-6	2,13E-6	-6,81E-3
ADP-fossil resources	MJ	1,43E3	9,08E1	2,54E2	1,78E3	7,69E0	5,12E-1	MND	MND	MND	MND	MND	MND	MND	0E0	2,51E0	2,45E0	2,52E0	-6,75E2
Water use[5)]	m^3e depr.	5,46E1	2,66E-1	5,43E-1	5,54E1	1,89E-2	4,43E-3	MND	MND	MND	MND	MND	MND	MND	0E0	8,09E-3	8,21E-2	5,63E-2	-1,16E1

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	3,76E2	1,09E0	4,46E1	4,22E2	7,35E-2	1,54E-2	MND	MND	MND	MND	MND	MND	MND	0E0	3,55E-2	2,2E-1	1,03E-1	-7,84E1
Renew. PER as material	MJ	0E0	0E0	8,97E0	8,97E0	0E0	-8,97E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	7,56E0
Total use of renew. PER	MJ	3,76E2	1,09E0	5,35E1	4,31E2	7,35E-2	-8,96E0	MND	MND	MND	MND	MND	MND	MND	0E0	3,55E-2	2,2E-1	1,03E-1	-7,08E1
Non-re. PER as energy	MJ	1,24E3	9,08E1	2,52E2	1,58E3	7,69E0	5,12E-1	MND	MND	MND	MND	MND	MND	MND	0E0	2,51E0	2,45E0	2,52E0	-6,73E2
Non-re. PER as material	MJ	2,03E2	0E0	1,54E0	2,05E2	0E0	-1,91E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	-1,02E2	-1,01E2	1,91E0
Total use of non-re. PER	MJ	1,44E3	9,08E1	2,54E2	1,79E3	7,69E0	-1,4E0	MND	MND	MND	MND	MND	MND	MND	0E0	2,51E0	-9,91E1	-9,86E1	-6,71E2
Secondary materials	kg	8,77E-1	0E0	6,24E-4	8,78E-1	0E0	0E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	2,62E0
Renew. secondary fuels	MJ	0E0	0E0	0E0	0E0	0E0	0E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Non-ren. secondary fuels	MJ	0E0	0E0	0E0	0E0	0E0	0E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Use of net fresh water	m^3	7,25E-1	1,28E-2	7,24E-2	8,11E-1	9,55E-4	1,59E-4	MND	MND	MND	MND	MND	MND	MND	0E0	4,29E-4	3,52E-3	3,42E-3	-3,47E-1

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	1,8E1	1,06E-1	7,3E-1	1,88E1	8,12E-3	2,14E-3	MND	MND	MND	MND	MND	MND	MND	0E0	2,55E-3	0E0	3,48E-1	-1,21E1
Non-hazardous waste	kg	3,06E2	4,12E0	1,15E1	3,21E2	2,85E-1	2,11E-1	MND	MND	MND	MND	MND	MND	MND	0E0	1,75E-1	0E0	7,71E0	-1,36E2
Radioactive waste	kg	4,16E-3	6,24E-4	1,93E-3	6,71E-3	5,36E-5	2,81E-6	MND	MND	MND	MND	MND	MND	MND	0E0	1,72E-5	0E0	1,24E-5	-1,18E-3

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0E0	0E0	0E0	0E0	0E0	0E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Materials for recycling	kg	0E0	0E0	1,2E-2	1,2E-2	0E0	4,85E-1	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	9,71E0	0E0	0E0
Materials for energy rec	kg	0E0	0E0	0E0	0E0	0E0	0E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Exported energy	MJ	0E0	0E0	0E0	0E0	0E0	1,03E0	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	7,58E1	0E0	0E0

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with reference standard, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The digital background data for this EPD

Why does verification transparency matter? Read more online
This EPD has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of the data collected and used in the LCA calculations, the way the LCA-based calculations have been carried out, the presentation of environmental data in the EPD, and other additional environmental information, as present with respect to the procedural and methodological requirements in ISO 14025:2010 and reference standard.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

HaiHa Nguyen, as an authorized verifier acting for EPD Hub Limited

12.05.2023

VERIFIED ISO 14025