Environmental Product Declaration

According to the EN 15804+A2

Derako International BV

Grill System

Scope of the Declaration
Designed for the products: Grill system

Type of the EPD: Cradle to grave, including modules **A – D**
According to the **EN 15804 + A2**
Based on production data from Derako International BV

The analysis was carried out by **Wildcap, M. Wildschut**
Website: **www.wildcap.nl**
Commissioned by **Derako International BV**.
Website: **www.derako.com**

Release date: September 1st 2022
Valid for: 5 years (September 1st 2027)

Functional unit: 1 m²

Inspired by Nature

DERAKO®
Solid Wood Systems
www.derako.com

Disclaimer

Comparisons based on the information from this report are only possible and valid if the starting points of the calculations and data collection are the same and if it concerns the same applications. Conducted according to the requirements of:

- EN 15804+A2:2019
- EN 15804+A2 standard is the reference for the Products Categories Rules (PCR)
- Supported by NMD Bepalingsmethode Milieuprestatie bouwwerken v1.1 (March 2022) for assumptions and lump sum values only. Not for inclusion in the NMD.
- ISO 14044:2006-10, Environmental management - Life cycle assessment – Requirements and guidelines; EN ISO 14040:2006

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External Review

Eco-Intelligence has reviewed the background report on EN 15804 +A2 and therefore also on the underlying standards. The background report has been approved by Gert-Jan Vroege, Eco-Intelligence. The review statement is included on the last page of this report.

Goal

This EPD is designed for business-to-business communication and can be used for business-to-consumer communication purposes. The target group is, in addition to the client, their customers. Results can be used to inform the customers about the environmental impact of the products. The EPD is not made for inclusion in NMD.

Content

Lifecycle inventory (LCI)

Product description

Derako International BV is an industrial producer and supplier of solid wood wall and ceiling systems based in ‘t Zand, the Netherlands. Derako works exclusively project-based, whereby the architect’s design is the starting point. The system is available in various designs including the open and closed linear system, the multi-panel linear and the grill system. In addition to the standard systems, Derako also has a number of specially developed designs available. Most versions are also suitable for use as exterior ceilings.

Grill system

The Derako grill system consists of solid wooden slats mounted along with aluminium or flexible dowels to form panels. The length of the panel is determined by the structural conditions and ultimately decided by mutual agreement. The grill panels are designed to seamlessly fit into one another with a half-lap dowel joint. In designing a ceiling or wall with the system, there is a great deal of freedom in determining the dimensions of the wooden slats and spacing between them. The grill system is also suitable for curved application (not included in this study). The ceiling created is open in nature. This makes the grill system particularly suited to acoustic spaces. The Derako system included everything between the wood and the back of the rails carrier. This means that the suspension (Nonius hanger) is not part of the scope of this analysis.

The Grill system (Module: X-100-20-90) used in this study is chosen to represent the average system, both on m^3wood / m^2 system and wooden surface area m^2wood / m^2 system. The system configuration represents: a joint of 100mm between the slats, wood dimensions 20mm thickness by 90mm in height. The X represents the amount of slats in a system, not applicable for this study.

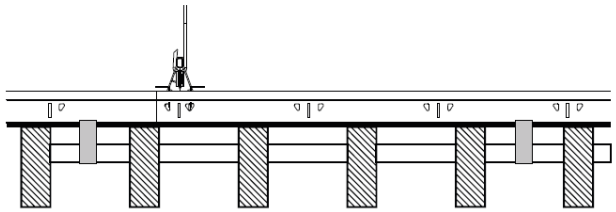


Figure: Derako Grill system, nonius hanger (top of the image) not included in this study.

Declared unit

The Derako International BV suspended ceiling systems are custom projects with a wide range of variabilities, from wood species, finishing to the dimensions of the wooden slats. To create a scale-able EPD, the declared units for the wood, grill and linear systems are therefore presented separately. The systems are calculated back to 1 m^2 and the wood to m^3. Both grill and linear systems and m^3 calculations are based on wooden slats of 90mm (width) by 20mm (thick). Both in terms of surface area (paint) and volume (m^3) this is a fair average in the total Derako line-up. The manufacturing stage of Derako scales better to m^3 of wood processed, as most of the production is wood processing. Therefore the impacts of the production process are included in the Wood (Generic) – Spruce, declared unit. The linear system is often painted 3 sides (front, 2x side), however, for harmonisation with the grill system, 4 sides are used in this calculation.

- Wood, generic & production facility (Scandinavian spruce 460 kg/m^3 | 12% MC)
- Grill system (Module: X-100-20-90)

The total impact of the supplied product should be calculated per m^2. To calculate the total impact of the final product, the m^3 wood per m^2 in the configuration should be added to the declared functional unit (FU) of either the linear or grill system. Materials <1% are not included in this calculation and thus not included in the weight shown below.

Name	Value	Unit
Functional unit (calculated by sum of m^3 and m^2 of system)	**1,00**	**m^2**
Declared sub unit	1,00	m^3
Wood (Generic) – Spruce	517.04	kg/FU
Declared sub unit	1,00	m^2
Grill system (Module: X-100-20-90)	1.60	kg/FU

Reference service life

The expected service life is set to 25 years in accordance with standardised values from the Dutch environmental database. In practice the systems should exceed this service life. Interior suspended ceilings are not covered by the SBR-publication regarding reference service life of building products [SBR, 2011].

Allocations

No process specific allocations have been used outside of the build in processes of the Ecoinvent 3.8 database in the LCA.

Collection of process and product data

For this analysis a detailed the bill of materials is extracted from the manufacturer, supplier information as well as manually weighing individual parts. A company visit took place in 't Zand (Derako International BV). Suppliers communicated their product's material composition for which Ecoinvent is used to determine production process burdens (electricity, water, emissions, etc.). Suppliers are not visited. Production process inputs, utilities, emissions and waste quantities are determined by annual supplier invoices to and from Derako, retrieved from ISO 14001 monitoring.

Data used from 2018-2020, annual values are always used which are most representable, due to invoices regarding bulk waste and purchasing materials, two or three year averages have been used.

System boundaries

The LCA includes the full cradle to grave (A1-D) lifecycle. Although B1-B7 are considered zero due to the lack of maintenance and replacement. All declared values relate to the specified functional units. Plant level data A3 is included in the Wood (generic) FU.

A1 - A3			A4-A5		B1-B7							C1-C4				D
Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport	Construction - Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery, recycling, potential
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Figure 1: Included EN15804 modules

Materials and products

Materials present in the final product.

Wood (Generic) – m³
Wood (Spruce)
Impregnating agent
Waterborne Sealer Color: White
Grill system – m²
Alu Dowel black
API Quick-Lock 24-38 HP Unipro
API Cross-Lock
Dowel clip 12mm
Steel Brads Grill 30

Methodology and calculation

The LCA has been carried out in accordance with EN 15804 +A2, taking into account the standards from the ISO 14000 series: 14025, 14040 and 14044. NEN-EN 16485 is used for general rules for environmental declarations of wood products. EN-16449 is used for calculating the biogenic carbon content in the wood.

When calculating the environmental impact categories, OpenLCA version 1.10.3 and the Ecoinvent database, version 3.8, were used in combination with the 15804+A2 addon.

<1% of the product by weight has been excluded from this LCA.

Additional information

Environment and Health during the use phase

The product is not in contact with humans during use phase. Indoor air quality is laboratory tested on Volatile organic compounds (VOC). The emission levels of volatile substances in indoor air, presenting a risk of inhalation toxicity on a scale of class from A + (very low emissions), according to NF EN ISO 16000-9 (08/2006).

Environmental certificates

International certifications can be found on http://www.derako.com. Derako is certified ISO: 9001:2015; 14001:2015, FSC chain of custody, PEFC chain of custody and Cradle to Cradle©: Silver on the date of drafting this report.

Biogenic carbon storage

Biogenic carbon storage from wood growth is shown in the calculation (A1) but does not impact the final result due to the release of carbon in the waste management phase (C3). Thus, only resulting in temporary carbon storage during the product lifecycle. The carbon content is estimated according to EN 16449. Spruce is used in combination with a moisture content of 12% and set to **754 kg CO2eq per m³**.

Scaling

The product is scalable by m², however deviating far from the used modules (configurations) on which this LCA is based will reduce the accuracy. Prior to scaling, the volume of Wood (m³) should be calculated per m², both declared units should be added together to get the final result per m².

Life Cycle per phase

Raw material supply (A1)

A1 represents the impact of producing the materials used in the production process as well as materials included in the product in their gross weight. Averages for packaging is included in the Wood (generic) functional unit, which is a mix of polyethylene (PE) films and wooden crates from Spruce.

Transport (A2)

The wood is transported by road and the distance is calculated in correspondence to average distances to selected sawmills in Norway, Sweden and Finland. The harvesting of wood to sawmill is set to 100km. Other transport movements are based on average road transport distances retrieved from google maps.

Manufacturing (A3)

Derako shaves and sorts the wood before providing a fire treatment to the wood (fire treatment is not compulsory, but is included in this study). The treated wood is dried and processed to the final dimensions, painted and assembled to linear or grill. The product is then wrapped in foil and packaged in a wooden crate.

Energy consumption is based on annual invoice data for the final production facility of Derako International BV in the Netherlands. Purchased 'green certificates' for renewable electricity are not used, according to 15804+A2. Conversion factors for other materials: Overspray for paint, plastic waste of packaging material are based on annual invoices from waste suppliers and purchasing quantities.

Construction phase (A4-5)

The Derako system is carried and placed by hand. Only some minor hand tools are used for fixing the system to the suspension. In line with NMD lump sum values: 5% waste is used for in-situ material and 15% for the auxiliary and finishing materials. Wood and Aluminium waste for A4-A5 is included in A3 and based on project to customer data from Derako.

Use phase (B1-7)

The product does not need additional maintenance, during their life time, when installed and used correctly.

Disassembly and demolition (C1)

The Derako system is carried and removed by hand. Only some minor hand tools are used for disassemble the system from the suspension.

Transport (C2)

Process used for all transport steps, according to NMD methodology including lump sum values for waste processing transport movements. These transport movements are used in A3, A5 and C2.

Waste treatment (C3-C4)

Waste treatments are detailed per waste stream according to NMD lump sum values, version February_2022-2.

Benefits: Reuse, Recovery, recycling, potential (D)

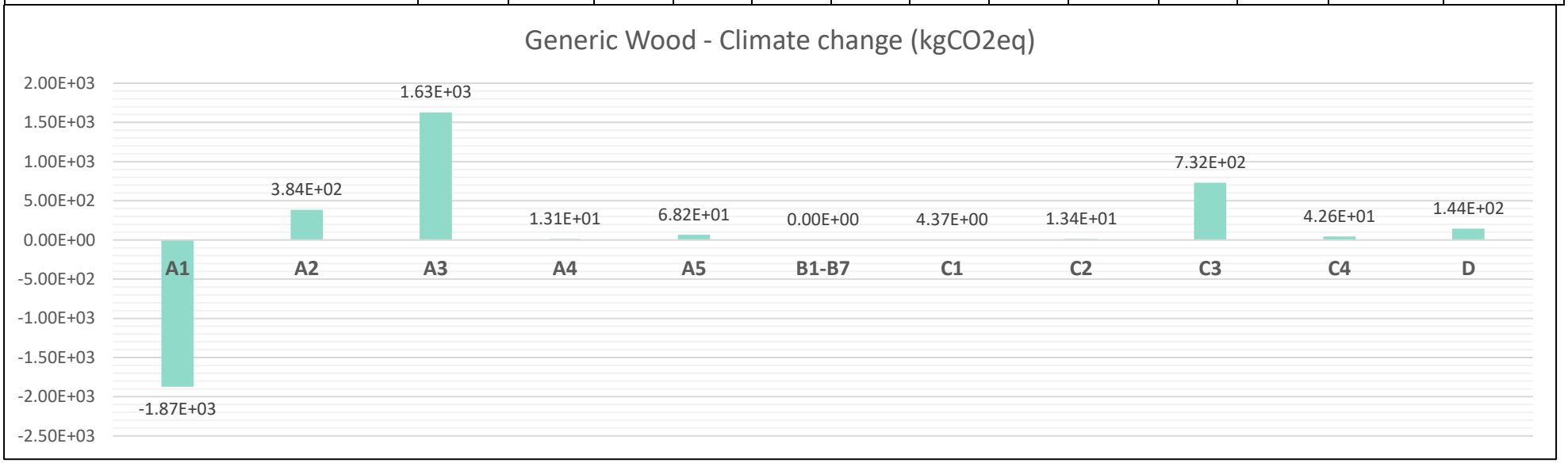
The income and expenses outside the system boundary relate to combustion in which energy use is avoided. For the estimated efficiency of the energy carrier to output, the electric yield MJ is set to 18% on and thermal yield to 31%, according to NMD. The recycling and reuse is also part of the income and expenses outside the system boundary. the net output flow of secondary materials for which the benefits are included in module D in the form of material equivalents.

LCA Results

Generic Wood results (per m³)

Indicator	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT	Unit
EI acidification	1.68E+00	2.17E+00	5.58E+00	7.40E-02	4.43E-02	0.00E+00	2.74E-02	7.60E-02	8.15E-02	2.35E-03	-9.65E-01	**8.78E+00**	molc H+ eq
EI climate change, GWP biogenic	-2.06E+03	6.77E-01	1.07E+03	2.31E-02	4.59E+01	0.00E+00	2.80E-03	2.37E-02	7.24E+02	4.24E+01	1.83E+02	**3.48E-01**	kg CO2 eq
EI climate change, GWP fossil	1.64E+02	3.83E+02	5.63E+02	1.30E+01	2.23E+01	0.00E+00	4.37E+00	1.34E+01	7.70E+00	2.78E-01	-3.78E+01	**1.13E+03**	kg CO2 eq
EI climate change, GWP land transformation	2.51E+01	1.56E-01	1.29E-01	5.32E-03	1.81E-03	0.00E+00	4.46E-04	5.47E-03	2.65E-03	2.90E-04	-4.09E-01	**2.50E+01**	kg CO2 eq
EI climate change, GWP total	-1.87E+03	3.84E+02	1.63E+03	1.31E+01	6.82E+01	0.00E+00	4.37E+00	1.34E+01	7.32E+02	4.26E+01	1.44E+02	**1.16E+03**	kg CO2 eq
EI depletion of abiotic resources - ADPE elements	1.16E-03	1.23E-03	1.30E-01	4.20E-05	1.03E-05	0.00E+00	2.02E-06	4.31E-05	2.03E-05	8.85E-07	-1.03E-04	**1.32E-01**	kg Sb-Eq
EI depletion of abiotic resources - ADPF fossil fuels	7.67E+02	4.64E+02	3.60E+03	1.58E+01	8.50E+00	0.00E+00	2.92E+00	1.62E+01	2.24E+01	9.04E-01	-7.24E+01	**4.83E+03**	MJ
EI eutrophication, freshwater	4.92E-02	2.60E-02	5.07E-01	8.86E-04	4.94E-04	0.00E+00	1.36E-04	9.10E-04	3.37E-03	6.09E-05	-2.19E-02	**5.66E-01**	kg P eq
EI eutrophication, marine	2.76E-01	7.86E-01	4.67E-01	2.68E-02	1.83E-02	0.00E+00	1.14E-02	2.75E-02	4.24E-02	9.75E-03	-2.81E-01	**1.38E+00**	kg N eq
EI eutrophication, terrestrial	2.12E+00	8.59E+00	4.31E+00	2.93E-01	1.95E-01	0.00E+00	1.25E-01	3.01E-01	4.07E-01	8.73E-03	-4.62E+00	**1.17E+01**	molc N eq
EI ozone depletion	1.81E-05	8.98E-05	2.78E-05	3.06E-06	1.44E-06	0.00E+00	9.26E-07	3.14E-06	5.44E-07	8.30E-08	-8.87E-06	**1.36E-04**	kg CFC11 eq
EI photochemical ozone formation	7.91E-01	2.42E+00	1.40E+00	8.25E-02	5.32E-02	0.00E+00	3.44E-02	8.48E-02	9.95E-02	3.07E-03	-7.99E-01	**4.18E+00**	kg NMVOC eq
EI water use, AWARE	1.16E+02	3.02E+01	3.30E+02	1.03E+00	3.02E-01	0.00E+00	1.45E-01	1.06E+00	-4.26E+00	2.92E-01	-7.94E+00	**4.67E+02**	m3
output flows - components for reuse	0.00E+00	0.00E+00	1.18E+01	0.00E+00	1.12E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**1.24E+02**	kg CRU
output flows - exported energy	0.00E+00	0.00E+00	3.18E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.57E+03	**6.75E+03**	MJ EE
output flows - materials for energy recovery	2.29E+00	1.40E+00	4.61E+02	4.76E-02	1.91E+01	0.00E+00	2.16E-02	4.89E-02	4.91E+02	1.82E-03	-3.07E-01	**9.75E+02**	kg MER
output flows - materials for recycling	5.78E+00	4.94E+00	2.34E+02	1.68E-01	1.44E+01	0.00E+00	2.73E-02	1.73E-01	1.67E-01	4.01E-03	-1.24E+00	**2.59E+02**	kg MFR
resources - energy, non-renewable - PENRT	3.09E+03	5.94E+03	7.66E+03	2.02E+02	9.82E+01	0.00E+00	5.91E+01	2.08E+02	7.80E+01	6.69E+00	-5.72E+02	**1.68E+04**	MJ-Eq
resources - energy, non-renewable, use as energy - PENRE	9.57E+02	5.89E+02	4.28E+03	2.01E+01	1.02E+01	0.00E+00	3.30E+00	2.06E+01	2.37E+01	1.06E+00	-1.09E+02	**5.80E+03**	MJ-Eq
resources - energy, non-renewable, use as raw material - PENRM	2.10E+03	5.35E+03	3.38E+03	1.82E+02	8.80E+01	0.00E+00	5.58E+01	1.87E+02	5.43E+01	5.64E+00	-4.62E+02	**1.09E+04**	MJ-Eq
resources - energy, renewable - PERE, use as energy	1.40E+02	6.43E+01	6.65E+02	2.19E+00	9.50E-01	0.00E+00	2.58E-01	2.25E+00	1.13E+00	8.95E-02	-1.71E+01	**8.59E+02**	MJ-Eq
resources - energy, renewable - PERM, use as raw material	2.41E+04	2.03E+01	-5.03E+03	6.92E-01	2.66E-01	0.00E+00	7.53E-02	7.11E-01	5.10E-01	2.83E-02	-6.78E+03	**1.23E+04**	MJ-Eq
resources - energy, renewable - PERT	2.42E+04	8.46E+01	-4.37E+03	2.88E+00	1.22E+00	0.00E+00	3.33E-01	2.96E+00	1.64E+00	1.18E-01	-6.79E+03	**1.32E+04**	MJ-Eq
resources - net use of fresh water - FW	2.91E+00	7.19E-01	8.08E+00	2.45E-02	7.30E-03	0.00E+00	3.44E-03	2.52E-02	-9.76E-02	7.06E-03	-2.06E-01	**1.15E+01**	m3FW
resources - use of secondary materials - SM	3.24E+01	6.03E+00	2.36E+02	2.05E-01	1.44E+01	0.00E+00	4.38E-02	2.11E-01	5.64E-01	9.57E-03	-6.50E+00	**2.84E+02**	kgSM

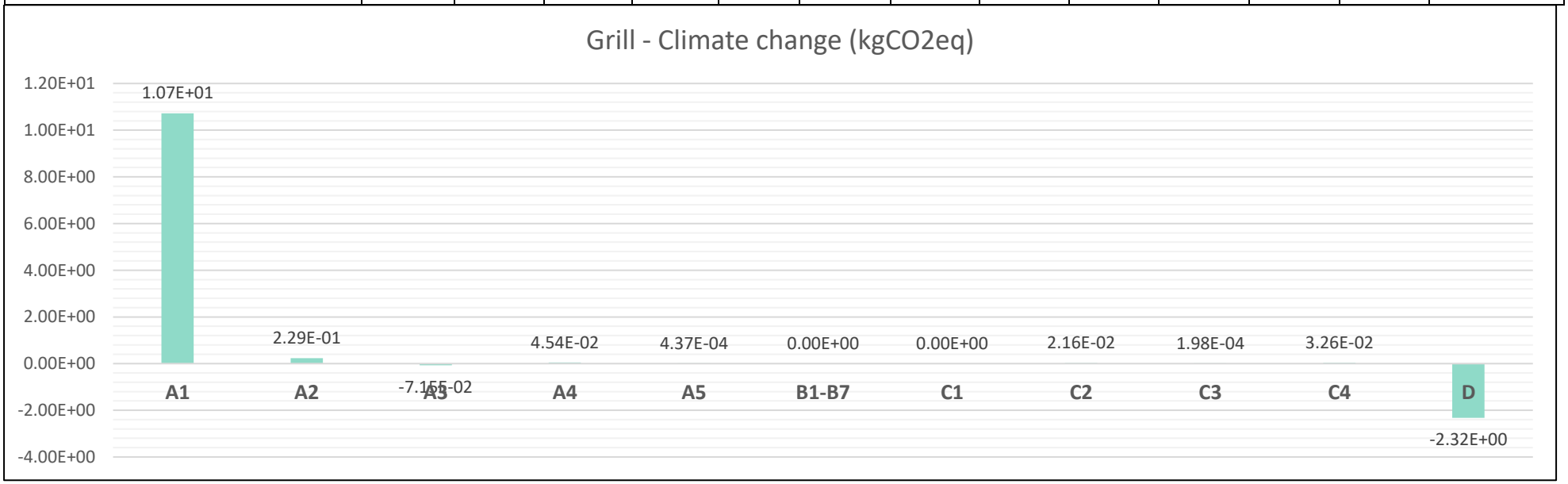
resources -use of non-renewable secondary fuels - NRSF	3.52E+01	6.75E+00	1.03E+02	2.30E-01	5.11E-02	0.00E+00	6.65E-03	2.36E-01	3.53E-02	1.86E-03	-7.95E-01	**1.45E+02**	MJSF
resources -use of renewable secondary fuels - RSF	2.39E+00	1.77E+00	2.33E+01	6.04E-02	2.12E-02	0.00E+00	4.16E-03	6.20E-02	1.24E-02	1.25E-03	-5.95E-01	**2.70E+01**	MJSF
waste - hazardous, disposed - HW	4.28E+02	1.33E+02	3.78E+03	4.54E+00	2.20E+00	0.00E+00	6.40E-01	4.66E+00	6.66E+00	2.06E-01	-2.47E+01	**4.34E+03**	kgHW
waste - non-hazardous, disposed -NHW	6.81E+01	3.91E+02	5.65E+02	1.33E+01	2.20E+01	0.00E+00	4.37E-02	1.37E+01	4.94E+02	2.59E+01	-1.42E+01	**1.58E+03**	kgW
waste - radioactive, disposed - RW	1.13E-01	1.19E-01	4.27E-01	4.05E-03	1.74E-03	0.00E+00	6.80E-04	4.15E-03	9.50E-04	1.27E-04	-2.42E-02	**6.47E-01**	kgRW
Ecotoxicity, freshwater	3.67E+02	2.11E+02	8.56E+02	7.19E+00	1.83E+00	0.00E+00	3.94E-01	7.38E+00	1.02E+01	5.36E-02	-4.15E+01	**1.42E+03**	CTUe
Human toxicity, cancer effects	2.46E-07	1.63E-07	7.93E-06	5.57E-09	7.31E-09	0.00E+00	5.42E-09	5.72E-09	7.84E-07	1.78E-10	-1.11E-07	**9.04E-06**	CTUh
Human toxicity, non-cancer effects	5.97E-06	7.76E-06	1.97E-04	2.64E-07	3.94E-07	0.00E+00	2.42E-08	2.72E-07	4.74E-06	6.70E-09	-2.98E-06	**2.14E-04**	CTUh
Ionising radiation, HH	1.41E+01	3.04E+01	4.24E+01	1.04E+00	4.74E-01	0.00E+00	2.68E-01	1.06E+00	1.47E-01	3.07E-02	-3.21E+00	**8.67E+01**	kBq U-235 eq
Land use	1.63E+03	6.36E+03	2.68E+03	2.17E+02	3.71E+01	0.00E+00	1.55E+00	2.22E+02	1.97E+01	2.29E+01	-1.90E+02	**1.10E+04**	Pt
Particulate matter, HH	1.06E-05	3.45E-05	3.86E-05	1.18E-06	7.00E-07	0.00E+00	4.74E-07	1.21E-06	8.33E-07	4.53E-08	-1.31E-05	**7.51E-05**	disease inc.



Grill results (per m²)

Indicator	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D	TOT	Unit
EI acidification	9.18E-02	1.29E-03	-4.60E-04	3.08E-04	2.53E-06	0.00E+00	0.00E+00	1.22E-04	1.23E-06	1.84E-04	-1.35E-02	**7.98E-02**	molc H+ eq
EI climate change, GWP biogenic	2.47E-01	4.04E-04	4.20E-04	1.04E-03	7.88E-07	0.00E+00	0.00E+00	3.81E-05	4.84E-07	5.76E-05	1.30E-02	**2.62E-01**	kg CO2 eq
EI climate change, GWP fossil	1.05E+01	2.28E-01	-7.18E-02	4.43E-02	4.36E-04	0.00E+00	0.00E+00	2.15E-02	1.96E-04	3.25E-02	-2.33E+00	**8.38E+00**	kg CO2 eq
EI climate change, GWP land transformation	1.90E-02	9.32E-05	-9.63E-05	5.26E-05	1.86E-07	0.00E+00	0.00E+00	8.78E-06	1.48E-07	1.33E-05	-2.56E-03	**1.65E-02**	kg CO2 eq
EI climate change, GWP total	1.07E+01	2.29E-01	-7.15E-02	4.54E-02	4.37E-04	0.00E+00	0.00E+00	2.16E-02	1.98E-04	3.26E-02	-2.32E+00	**8.66E+00**	kg CO2 eq
EI depletion of abiotic resources - ADPE elements	1.94E-04	7.35E-07	-6.41E-08	9.76E-08	1.39E-09	0.00E+00	0.00E+00	6.93E-08	6.67E-10	1.05E-07	-2.03E-06	**1.92E-04**	kg Sb-Eq
EI depletion of abiotic resources - ADPF fossil fuels	9.40E+01	2.77E-01	-7.38E-01	3.00E-01	5.42E-04	0.00E+00	0.00E+00	2.61E-02	6.46E-04	3.94E-02	-2.52E+01	**6.88E+01**	MJ
EI eutrophication, freshwater	4.56E-03	1.55E-05	-2.15E-05	1.20E-05	3.00E-08	0.00E+00	0.00E+00	1.46E-06	2.87E-08	2.21E-06	-7.43E-04	**3.83E-03**	kg P eq
EI eutrophication, marine	1.22E-02	4.69E-04	-7.66E-05	8.14E-05	9.13E-07	0.00E+00	0.00E+00	4.42E-05	4.07E-07	6.68E-05	-2.39E-03	**1.04E-02**	kg N eq
EI eutrophication, terrestrial	2.67E-01	5.12E-03	-7.99E-04	8.78E-04	9.98E-06	0.00E+00	0.00E+00	4.83E-04	4.42E-06	7.30E-04	-2.50E-02	**2.48E-01**	molc N eq
EI ozone depletion	6.36E-07	5.36E-08	-2.07E-09	6.39E-09	1.05E-10	0.00E+00	0.00E+00	5.05E-09	4.60E-11	7.63E-09	-7.62E-08	**6.31E-07**	kg CFC11 eq
EI photochemical ozone formation	3.35E-02	1.44E-03	-2.15E-04	2.46E-04	2.82E-06	0.00E+00	0.00E+00	1.36E-04	1.33E-06	2.06E-04	-7.69E-03	**2.76E-02**	kg NMVOC eq
EI water use, AWARE	6.09E+00	1.80E-02	-9.87E-03	2.50E-02	5.34E-05	0.00E+00	0.00E+00	1.70E-03	-1.23E-04	2.56E-03	-2.87E-01	**5.84E+00**	m3
output flows - components for reuse	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	kg CRU
output flows - exported energy	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-02	**4.40E-02**	MJ EE
output flows - materials for energy recovery	5.00E-01	8.34E-04	-5.46E-05	1.38E-04	1.62E-06	0.00E+00	0.00E+00	7.86E-05	4.42E-06	1.19E-04	-1.98E-03	**4.99E-01**	kg MER
output flows - materials for recycling	7.32E-01	2.94E-03	1.70E-02	6.22E-04	5.70E-02	0.00E+00	0.00E+00	2.77E-04	1.52E+00	4.20E-04	-9.49E-02	**2.23E+00**	kg MFR
resources - energy, non-renewable - PENRT	1.61E+02	3.54E+00	-9.06E-01	8.08E-01	6.95E-03	0.00E+00	0.00E+00	3.34E-01	3.84E-03	5.05E-01	-3.05E+01	**1.35E+02**	MJ-Eq
resources - energy, non-renewable, use as energy - PENRE	1.11E+02	3.51E-01	-7.45E-01	3.37E-01	6.84E-04	0.00E+00	0.00E+00	3.31E-02	7.22E-04	5.01E-02	-2.55E+01	**8.52E+01**	MJ-Eq
resources - energy, non-renewable, use as raw material - PENRM	5.01E+01	3.19E+00	-1.61E-01	4.72E-01	6.27E-03	0.00E+00	0.00E+00	3.01E-01	3.12E-03	4.54E-01	-5.02E+00	**4.93E+01**	MJ-Eq
resources - energy, renewable - PERE, use as energy	1.13E+01	3.83E-02	-3.25E-02	2.46E-02	7.30E-05	0.00E+00	0.00E+00	3.61E-03	4.73E-05	5.46E-03	-8.75E-01	**1.04E+01**	MJ-Eq
resources - energy, renewable - PERM, use as raw material	2.39E+00	1.21E-02	-6.98E-03	1.26E-02	2.35E-05	0.00E+00	0.00E+00	1.14E-03	1.95E-05	1.73E-03	-2.24E-01	**2.19E+00**	MJ-Eq
resources - energy, renewable - PERT	1.36E+01	5.04E-02	-3.95E-02	3.71E-02	9.65E-05	0.00E+00	0.00E+00	4.75E-03	6.68E-05	7.19E-03	-1.10E+00	**1.26E+01**	MJ-Eq
resources - net use of fresh water - FW	1.47E-01	4.29E-04	-2.42E-04	5.98E-04	1.26E-06	0.00E+00	0.00E+00	4.04E-05	-2.82E-06	6.11E-05	-7.07E-03	**1.41E-01**	m3FW
resources - use of secondary materials - SM	1.42E+00	3.59E-03	-6.23E-04	1.19E-03	6.84E-06	0.00E+00	0.00E+00	3.39E-04	1.76E-05	5.12E-04	-3.04E-02	**1.40E+00**	kgSM
resources -use of non-renewable secondary fuels - NRSF	4.60E-01	4.03E-03	-9.20E-05	4.79E-04	7.46E-06	0.00E+00	0.00E+00	3.79E-04	2.93E-04	5.74E-04	-5.67E-03	**4.60E-01**	MJSF
resources -use of renewable secondary fuels - RSF	2.13E-01	1.06E-03	-3.19E-05	2.57E-04	1.98E-06	0.00E+00	0.00E+00	9.96E-05	1.18E-06	1.51E-04	-2.23E-03	**2.12E-01**	MJSF

waste - hazardous, disposed - HW	2.38E+01	7.95E-02	-1.03E-01	6.48E-02	1.53E-04	0.00E+00	0.00E+00	7.49E-03	1.37E-04	1.13E-02	-3.61E+00	**2.03E+01**	kgHW
waste - non-hazardous, disposed -NHW	1.13E+00	2.33E-01	-5.17E-04	2.00E+00	3.43E-03	0.00E+00	0.00E+00	2.20E-02	1.42E-02	3.32E-02	-6.49E-02	**3.38E+00**	kgW
waste - radioactive, disposed - RW	1.05E-02	7.08E-05	-5.11E-06	2.53E-05	1.36E-07	0.00E+00	0.00E+00	6.67E-06	6.41E-08	1.01E-05	-2.09E-04	**1.04E-02**	kgRW
Ecotoxicity, freshwater	3.01E+00	1.26E-01	-3.16E-03	2.09E-02	2.34E-04	0.00E+00	0.00E+00	1.19E-02	6.00E-05	1.79E-02	-1.21E-01	**3.06E+00**	CTUe
Human toxicity, cancer effects	3.62E-08	9.74E-11	-5.21E-11	3.56E-11	1.85E-13	0.00E+00	0.00E+00	9.18E-12	2.97E-13	1.39E-11	-4.08E-09	**3.23E-08**	CTUh
Human toxicity, non-cancer effects	1.03E-06	4.63E-09	-9.19E-09	1.83E-09	8.72E-12	0.00E+00	0.00E+00	4.36E-10	4.11E-12	6.59E-10	-2.44E-07	**7.81E-07**	CTUh
Ionising radiation, HH	1.07E+00	1.81E-02	-8.30E-04	3.89E-03	3.53E-05	0.00E+00	0.00E+00	1.71E-03	1.61E-05	2.58E-03	-3.13E-02	**1.07E+00**	kBq U-235 eq
Land use	2.23E+01	3.79E+00	-8.78E-02	1.21E+00	7.72E-03	0.00E+00	0.00E+00	3.57E-01	7.28E-03	5.40E-01	-3.23E+00	**2.49E+01**	Pt
Particulate matter, HH	1.14E-06	2.06E-08	-5.52E-09	4.66E-09	4.07E-11	0.00E+00	0.00E+00	1.94E-09	4.16E-11	2.93E-09	-1.72E-07	**9.97E-07**	disease inc.



References

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ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A2
EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

NMD v1.1
Stichting Nationale Milieudatabase: Bepalingsmethode Milieuprestatie Bouwwerken version 1.1 (March 2022)

Eco Intelligence

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Derako International BV.
T.a.v. de heer P. van Laar
Postbus 32,
1756 ZG 't Zand

Edam, 8 September 2022

Subject: Review solid wood wall and ceiling Grill system & Linear system

Dear Van Laar,

The LCA-backgroundreport "LCA Background report_Derako International BV_Final.docx", produced by Wildcap, Mr. M. Wildschut, has been sent to me for review.

As NMD accredited reviewer, I have reviewed the report and dossier according to the EN15804 +A2 : 2019. I have commented the former reports in two rounds, the remarks are processed in correct manner.

My conclusion: the methodology, data collection and report meet the requirements EN15804 + A2 : 2019, and the underlaying standards ISO 14040/44, ISO 14025.

Kind regards,

Ir. Gert-Jan Vroege
Eco Intelligence