Medium Density Fibreboard (MDF)

Environmental Product Declaration

Daiken New Zealand Limited & Daiken Southland Limited

In accordance with ISO 14025 and EN 15804

EPD registration number:	S-P-01168
Approval date:	2019-01-25
Valid until:	2024-01-25
Geographical scope:	New Zealand

Daiken New Zealand (DNZ) and Daiken Southland (DSL) are manufacturers of some of the world's highest quality premium MDF products. They are renowned for superior colour, consistency and quality, and highly regarded internationally.

Daiken New Zealand is located in Rangiora, Canterbury and Daiken Southland in Mataura, Southland both in the South Island of New Zealand.

Daiken New Zealand Limited (Above)

Daiken Southland Limited (Below)

Sustainability embedded in the business

Both manufacturing facilities have Environmental Management Systems certified to ISO 14001 standard. This certification gives management, neighbours and customers an assurance that the company is not only complying with local or national requirements, but actively pursuing a path of continual improvement.

Responsible wood sourcing.

MDF manufactured by DSL and DNZ is made from exotic plantation-grown Radiata Pine trees from forests located in the South Island of New Zealand. Whenever possible, we source wood harvested from plantations that meet the Forest Stewardship Council's (FSC) environmental, social and economic standards. Product made from this wood carries the FSC certification label. We are also part of Environmental Choice – New Zealand's most trusted multiple criteria environmental labelling programme, which operates to internationally recognised standards and principles.

For further product and company information, including mechanical specifications and product and plant certifications please visit our web site: www.daiken-nz.com

Contributing manufacturing sites

Site	Address
Daiken New Zealand	166 Upper Sefton Road, Ashley RD7, Rangiora 7477, New Zealand
Daiken Southland	301 Pioneer Highway, 4RD Gore 9774, New Zealand

Product description

The range of Medium Density Fibreboard produced by DNZ and DSL are renowned for its superior colour, consistency and quality.

This makes it an excellent product for applications that require consistent performance, stability, durability and a smooth finish.

Offering versatility and machinability, our MDF products are used throughout the world in a variety of ways – from the construction of furniture, cabinetry and shelving, through to the design of children's toys. This makes it ideal for joiners, furniture manufacturers, commercial fitters, builders and renovators, as well as home handymen.

As the first MDF produced in the Southern Hemisphere, in 1976, our products are recognised for innovation and high quality, and also the commitment by Daiken New Zealand and Daiken Southland to meeting the world's most stringent quality and environmental standards. Both production facilities operate with Quality Management Systems certified to ISO 9001 standard.

Currently DNZ and DSL offer to market a wide range of product thicknesses from 2.5 mm to 30 mm and densities from 350 kg/m^3 to 900 kg/m^3. We can supply MDF panels with very low formaldehyde emissions, satisfying international standards like: Japanese F4S, CARB P2 and EPA Title VI, ULEF and AS/NZS Super E0.

Declared Unit

This EPD is valid for a declared unit of 1 m^2 medium density fibreboard (MDF) as specified in Table 1 below, packaged and ready for dispatch to a customer.

Table 1: MDF products included in this EPD

Product type	MDF properties
Thick, uncoated MDF	**Density range:** 350 to 750 kg/m^3 **Moisture content (dry-basis):** 7.5% (range 5.5% to 9.5%) **Average thickness:** 20 mm
Thin, uncoated MDF	**Density range:** 350 to 900 kg/m^3 **Moisture content (dry-basis):** 8.0% (range 6.0% to 11.0%) **Average thickness:** 3.0 mm
Thick, coated MDF	**Density:** 735 kg/m^3 **Moisture content (dry-basis):** 6.5% (range 5.0% to 9.0%) **Average thickness:** 18.0 mm

Product classification

Table 2 shows the classification codes and class descriptions of the products included within this EPD according to the UN CPC (Version 2.1) and ANZSIC 2006 classification systems.

Table 2: Classification codes of included products

Product type	Classification	Code	Category
All	UN CPC Ver.2.1	31441	Medium density fibreboard (MDF)
	ANZSIC 2006	1494	Reconstituted wood products manufacturing

All products included in this EPD are made of locally sourced *Pinus radiata* (Radiata Pine), other softwood planted species may be present in small quantities. Radiata Pine is the dominant species logged in New Zealand and represents over 95% of all harvested timber in the 2016/17 financial year (April 2016-March 2017) (MPI, 2017).

Resin types used in the manufacturing of Daiken's MDF are of the Urea-Formaldehyde-Melamine type. The composition of each product is shown in Table 3.

Table 3 Product composition (%)

	Thin, uncoated MDF	Thick, uncoated MDF	Thick, melamine-coated MDF
Softwood (dry)	82.6	82.5	82.6
Urea formaldehyde	0.836	1.36	1.36
Melamine formaldehyde	-	-	0.460
Melamine urea formaldehyde	8.14	8.79	8.80
Paraffin wax	0.363	0.363	0.363
Lamination paper (dry)	-	-	0.320
Urea	0.607	0.0329	0.0329
Water	7.41	6.98	6.10

System boundaries

As shown in the Table 4, this EPD is of the 'cradle-to-gate' type with options. The options include end-of-life processing (Modules C3-C4) and recycling potential (Module D).

Other life cycle stages (Modules A4-A5, B1-B7 and C1-C2) are dependent on particular scenarios and best modelled at the building level, therefore these modules have not been declared.

Table 4: Modules included in the scope of the EPD

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport of raw materials	Manufacturing	Transport to customer	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to waste processing	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X

X = included in the EPD; MND = not declared (such a declaration shall not be regarded as an indicator result of zero)

Production (modules A1-A3)

Figure 1 shows the basic manufacturing processes for the products included within this EPD. Coated board is produced from uncoated board, with an additional 'laminating' process. Inputs and outputs of each process are calculated as a production-weighted average of the two manufacturing facilities.

Both facilities operate continuous press lines. Daiken New Zealand additionally operates a multi-opening press line. Laminated MDF is only produced at the Daiken Southland facility.

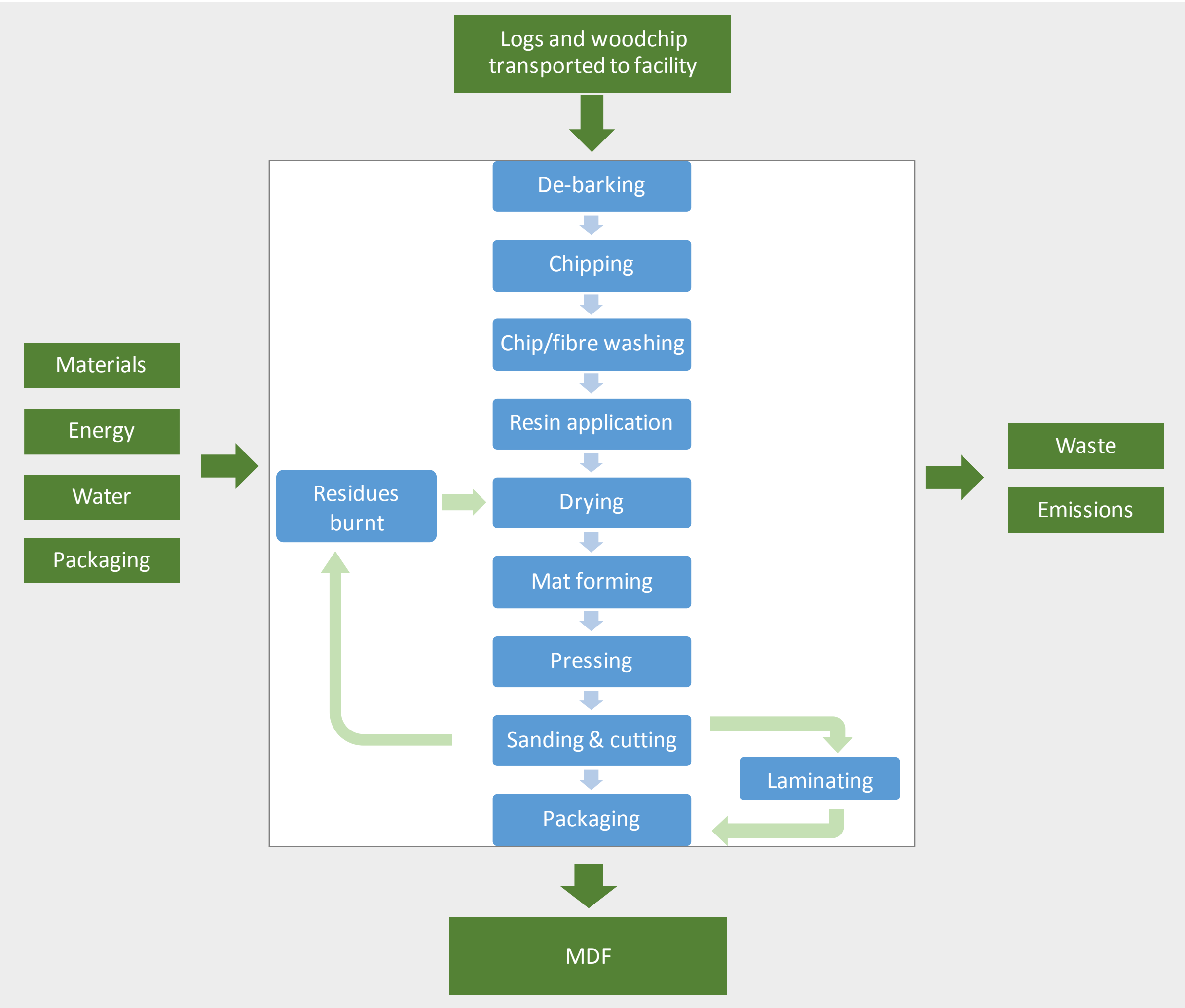


Figure 1: Manufacturing (A1-A3) process flowchart

End-of-life options (modules C3-C4)

At the end of its useful life, a wood product is removed from the building and may end up recycled, reused, combusted to produce energy, or landfilled. In New Zealand, the most common end-of-life method is landfill.

The landfill scenario and two other possible end of life scenarios are described below. Each scenario assumes that 100% of the wood is sent to that scenario. To create an end-of-life mix for a given region or end use, the reader should take a weighted sum of these scenarios. Where no specific data are available, the 'landfill' scenario should be used.

Landfill:

Emissions from landfill are dependent on the Degradable Organic Carbon fraction (DOC_f).

The DOC_f = 0.7% for MDF. This is based on bioreactor laboratory research by Ximines *et al.* (2013).

The impacts associated with the landfill are declared in module C4. All landfill gas that is combusted for energy recovery (module C4) is assumed to occur in a power plant with an electrical conversion efficiency of 36% (Australian Government 2014c, p. 189) and the resulting electricity receives a credit for offsetting average electricity from the New Zealand grid (module D) in line with EN 16485:2014 (Section 6.3.4.5).

The landfill scenario assumes the following for carbon emissions:

- Of the gases formed from any degradation of wood in landfill, 50% is methane and 50% is carbon dioxide (Australian Government 2016, Table 43).
- All carbon dioxide is released directly to the atmosphere.
- 40% of the methane is captured (New Zealand Government, 2015, p. 299).
- Of the 40% captured, one quarter (10% of the total) is flared and three quarters (30% of the total) are used for energy recovery (Carre 2011). Methane is combusted in both processes, resulting in all carbon being released as carbon dioxide.
- Of the 60% of methane that is not captured, 10% (6% of the total) is oxidised (released as carbon dioxide) (Australian Government 2016, Table 43) and 90% (54% of the total)) is released to the atmosphere as methane.
- In summary, for every kilogram of carbon converted to landfill gas, 73% is released as carbon dioxide and 27% is released as methane.

Energy recovery

This scenario includes shredding (module C3) and combustion with the recovered thermal energy assumed to replace thermal energy from natural gas (module D) in line with EN 16485:2014 (Section 6.3.4.5). Note that other options may also be in use within New Zealand, including replacement of coal, replacement of electricity, and replacement of both electricity and thermal energy (via co-generation).

Recycling

MDF may be recycled in different ways e.g. used as landscaping mulch, animal bedding or in particleboard production.. This scenario considers shredding and effectively downcycling into wood chips. Wood waste is chipped (module C3) and assigned credits relative to the avoided production of virgin softwood woodchips from a sawmill (module D). The CO_2 sequestered and energy content of the wood are assumed to leave the system boundary at C3 so that future product systems can also claim these without double-counting (EN 16485:2014, Section 6.3.4.2).

Key Assumptions

Energy

Thermal energy and transport fuels have been modelled using the Australian average as no New Zealand-specific datasets are available (see thinkstep 2018 for documentation). Electricity for production (modules A1-A3) has been modelled with the New Zealand-specific grid mix.

Cut-off Criteria

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary as per the PCR (IEPDS 2017, Section 7.5.4). All other reported data were incorporated and modelled using the best available life cycle inventory data.

Allocation

Upstream data: For refinery products, allocation is applied by mass and net calorific value. Inventories for electricity and thermal energy generation include allocation by economic value for some by-products (e.g. gypsum, boiler ash and fly ash). Allocation by energy is applied for co-generation of heat and power. For materials and chemicals, the allocation rule most suitable for the product is applied (see thinkstep 2018).

Co-products (i.e. different MDF products): Wood particles, resins, waxes and energy are allocated per cubic metre of board produced. Coatings are allocated by square metre applied.

Background Data

Manufacturing data have been provided by Daiken. Upstream data for the forestry stage have been taken from literature data (Sandilands, et al., 2006), and have been updated by Scion (Evanson, 2018) for the most significant items within the forestry inventory, based on the results of a sensitivity analysis.

Data for all energy inputs, transport processes and raw materials are from GaBi Databases 2018 (thinkstep 2018). Most datasets have a reference year between 2014 and 2016 and all fall within the 10-year limit allowable for generic data under EN 15804 (Section 6.3.7).

Representativeness

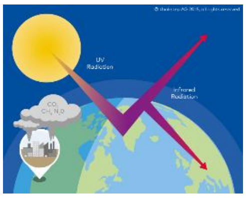
Market representativeness: The EPD is based on detailed data collected by survey from Daiken’s facilities. The EPD is representative of an average MDF product within the specified thickness range produced by Daiken.

Temporal representativeness: Primary data were collected from participating sites for the 2017/2018 financial year (April-March).

Geographical and technological representativeness: The data are representative of the sites surveyed, and the production technologies used by those facilities.

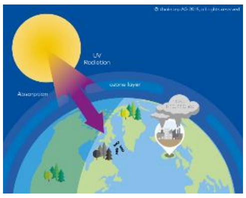
Environmental Impact Indicators

An introduction to each environmental impact indicator is provided below. The best-known effect of each indicator is listed to the right of its name.



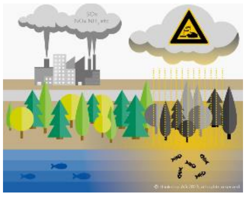
Global Warming Potential (GWP) → Climate Change

A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions increase absorption of radiation emitted by the earth, intensifying the natural greenhouse effect. Contributions to GWP can come from either fossil or biogenic sources, e.g. burning fossil fuels or burning wood. GWP is reported as a total as well as being separated into biogenic carbon (GWPB) and fossil carbon (GWPF).



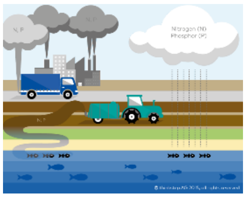
Ozone Depletion Potential (ODP) → Ozone Hole

A measure of air emissions that contribute to the depletion of the stratospheric ozone layer, causing higher levels of ultraviolet B (UVB) to reach the earth's surface with detrimental effects on humans, animals and plants.



Acidification Potential (AP) → Acid Rain

A measure of emissions that cause acidifying effects to the environment. Acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.

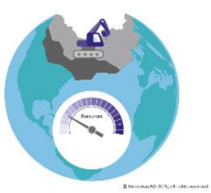


Eutrophication Potential (EP) → Algal Blooms

A measure of nutrient enrichment that may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. It includes potential impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P).

Photochemical Ozone Creation Potential (POCP) → Smog

A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O_3), produced by the reaction of VOCs and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be harmful to human and ecosystem health and may also damage crops.



Abiotic Depletion Potential → Resource Consumption

The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resource elements (ADPE) and non-renewable fossil energy resources (ADPF) are reported separately.

Environmental impacts

The reported impact categories represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. The environmental impact results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

Long-term emissions (>100 years) are not taken into consideration in the impact estimate.

Note that each end-of-life scenario (C3 & C4) assumes that 100% of the product is sent to that scenario. To create an end-of-life mix for a given region or end use, the reader should take a weighted sum of these scenarios. Where no specific data are available, the 'landfill' scenario should be used (see the section 'End-of-life').

Note: Carbon dioxide sequestration: During growth, trees absorb carbon dioxide (CO_2) from the atmosphere through the process of photosynthesis and convert this into carbon-based compounds that constitute various components of a tree. On average, half the dry weight of all wood is made up of the element carbon (Gifford 2000). This is the reason for a negative GWP. More gasses contributing to global warming are removed during tree growth, than emitted during the production phase.

Table 5: Environmental impacts, 1 m^2 of thick, uncoated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
GWP [kg CO_2-eq.]	-12.6	1.66	24.0	24.0
GWPF [kg CO_2-eq.]	9.13	1.11	2.26	2.26
GWPB [kg CO_2-eq.]	-21.7	0.546	21.8	21.8
ODP [kg CFC11-eq.]	1.19E-11	1.45E-13	1.61E-16	1.61E-16
AP [kg SO_2-eq.]	0.0324	0.00335	9.11E-04	9.11E-04
EP [kg PO_4^{3-}-eq.]	0.0102	0.00157	2.11E-04	2.11E-04
POCP [kg C_2H_4-eq.]	0.00867	3.12E-04	7.90E-05	7.90E-05
ADPE [kg Sb-eq.]	1.19E-06	1.24E-07	1.98E-09	1.98E-09
ADPF [MJ]	130	16.1	1.82	1.82

Table 6: Environmental impacts, 1 m^2 of thin, uncoated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
GWP [kg CO_2-eq.]	-2.21	0.258	3.99	3.99
GWPF [kg CO_2-eq.]	1.42	0.167	0.350	0.350
GWPB [kg CO_2-eq.]	-3.63	0.0907	3.64	3.64
ODP [kg CFC11-eq.]	1.60E-12	2.18E-14	2.68E-17	2.68E-17
AP [kg SO_2-eq.]	0.00525	5.09E-04	1.52E-04	1.52E-04
EP [kg PO_4^{3-}-eq.]	0.00160	2.43E-04	3.52E-05	3.52E-05
POCP [kg C_2H_4-eq.]	0.00136	4.92E-05	1.32E-05	1.32E-05
ADPE [kg Sb-eq.]	2.00E-07	1.87E-08	3.30E-10	3.30E-10
ADPF [MJ]	19.9	2.43	0.303	0.303

Table 7: Environmental impacts, 1 m^2 of thick, coated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
GWP [kg CO_2-eq.]	-11.0	1.51	22.2	22.2
GWPF [kg CO_2-eq.]	9.02	1.000	2.16	2.16
GWPB [kg CO_2-eq.]	-20.0	0.506	20.1	20.1
ODP [kg CFC11-eq.]	1.21E-11	1.31E-13	1.48E-16	1.48E-16
AP [kg SO_2-eq.]	0.0312	0.00302	8.37E-04	8.37E-04
EP [kg PO_4^{3-}-eq.]	0.00971	0.00148	1.94E-04	1.94E-04
POCP [kg C_2H_4-eq.]	0.00821	2.84E-04	7.26E-05	7.26E-05
ADPE [kg Sb-eq.]	1.28E-06	1.12E-07	1.82E-09	1.82E-09
ADPF [MJ]	130	14.5	1.67	1.67

Resource Use

The following indicators describe the use of renewable and non-renewable material resources, renewable and non- renewable primary energy and water.

Note: Water consumption: The FW indicator in the EPD results tables reports consumption (i.e. net use) of 'blue water' (which includes river water, lake water and ground water). This indicator deliberately excludes consumption of 'green water' (rain water), as net loss should be interpreted as any additional water loss beyond what would occur in the original, natural system. For plantation softwood forestry, the natural system might be a native forest or a grassland (Quinteiro et al. 2015).

Table 8: Resource use, 1 m^2 of thick, uncoated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
PERE [MJ]	-147	1.54	0.0925	0.0925
PERM [MJ]	228	0	-228	-228
PERT [MJ]	81.2	1.54	-228	-228
PENRE [MJ]	104	16.4	1.82	1.82
PENRM [MJ]	29.1	0	-29.1	-29.1
PENRT [MJ]	133	16.4	-27.3	-27.3
SM [kg]	0	0	0	0
RSF [MJ]	3.84E-09	9.76E-23	2.24E-22	2.24E-22
NRSF [MJ]	4.85E-08	1.15E-21	2.64E-21	2.64E-21
FW [m^3]	0.139	0.00109	1.96E-05	1.96E-05

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 = Net use of fresh water

Table 9: Resource use, 1 m² of thin, uncoated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
PERE [MJ]	-24.4	0.232	0.0154	0.0154
PERM [MJ]	38.1	0	-38.1	-38.1
PERT [MJ]	13.7	0.232	-38.1	-38.1
PENRE [MJ]	15.9	2.48	0.303	0.303
PENRM [MJ]	4.53	0	-4.53	-4.53
PENRT [MJ]	20.4	2.48	-4.22	-4.22
SM [kg]	0	0	0	0
RSF [MJ]	6.48E-10	1.46E-23	3.74E-23	3.74E-23
NRSF [MJ]	8.20E-09	1.72E-22	4.39E-22	4.39E-22
FW [m³]	0.0248	1.66E-04	3.27E-06	3.27E-06

Table 10: Resource use, 1 m² of thick, coated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
PERE [MJ]	-124	1.39	0.0850	0.0850
PERM [MJ]	211	0	-211	-211
PERT [MJ]	86.1	1.39	-210	-210
PENRE [MJ]	105	14.8	1.67	1.67
PENRM [MJ]	27.9	0	-27.9	-27.9
PENRT [MJ]	133	14.8	-26.2	-26.2
SM [kg]	0	0	0	0
RSF [MJ]	9.19E-09	8.78E-23	2.06E-22	2.06E-22
NRSF [MJ]	1.11E-07	1.03E-21	2.42E-21	2.42E-21
FW [m³]	0.154	9.87E-04	1.80E-05	1.80E-05

Waste and Output Flows

The following indicators describe waste generated within the life cycle of the product.

Table 11: Waste categories, 1 m² of thick, uncoated MDF.

Module	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
HWD [kg]	1.51E-07	6.77E-08	2.84E-09	2.84E-09
NHWD [kg]	0.564	14.3	1.32E-05	1.32E-05
RWD [kg]	0.00121	1.27E-04	1.08E-07	1.08E-07
CRU [kg]	0	0	0	0
MFR [kg]	0	0	0	14.4
MER [kg]	0	0	14.4	0
EEE [MJ]	0	0.164	0	0
EET [MJ]	0	0	0	0
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				

Table 12: Waste categories, 1 m² of thin, uncoated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
HWD [kg]	2.35E-08	1.08E-08	4.73E-10	4.73E-10
NHWD [kg]	0.0942	2.38	2.20E-06	2.20E-06
RWD [kg]	1.80E-04	1.91E-05	1.79E-08	1.79E-08
CRU [kg]	0	0	0	0
MFR [kg]	0	0	0	2.40
MER [kg]	0	0	2.40	0
EEE [MJ]	0	0.0272	0	0
EET [MJ]	0	0	0	0

Table 13: Waste categories, 1 m^2 of thick, coated MDF.

	Production	Landfill	Energy recovery	Recycling
	A1-A3	C4	C3	C3
HWD [kg]	1.99E-07	6.16E-08	2.61E-09	2.61E-09
NHWD [kg]	0.699	13.1	1.21E-05	1.21E-05
RWD [kg]	0.00119	1.15E-04	9.88E-08	9.88E-08
CRU [kg]	0	0	0	0
MFR [kg]	0	0	0	13.2
MER [kg]	0	0	13.2	0
EEE [MJ]	0	0.152	0	0
EET [MJ]	0	0	0	0

Recycling, Reuse and Recovery Potentials (module D)

Table 14: Module D, 1 m^2 of thick, uncoated MDF.

	Landfill	Energy recovery	Recycling
Environmental Impact			
GWP [kg CO_2-eq.]	-0.00753	-21.9	-0.363
GWPF [kg CO_2-eq.]	-0.00751	-22.0	-0.351
GWPB [kg CO_2-eq.]	-1.59E-05	0.0355	-0.0111
ODP [kg CFC11-eq.]	-1.85E-17	7.60E-13	-2.54E-15
AP [kg SO_2-eq.]	-2.40E-05	-8.54E-04	-0.00417
EP [kg PO_4^{3-}-eq.]	-3.08E-06	-8.61E-04	-9.55E-04
POCP [kg C_2H_4-eq.]	-1.70E-06	0.00189	-0.00377
ADPE [kg Sb-eq.]	-4.07E-09	-1.80E-06	-8.26E-08
ADPF [MJ]	-0.0930	-413	-1.75
Resource Use			
PERE [MJ]	-0.282	0.125	-78.4
PERM [MJ]	0	0	0
PERT [MJ]	-0.282	0.125	-78.4
PENRE [MJ]	-0.0930	-413	-1.76
PENRM [MJ]	0	0	0
PENRT [MJ]	-0.0930	-413	-1.76
SM [kg]	0	0	14.4
RSF [MJ]	0	186	-1.00E-11
NRSF [MJ]	0	186	-1.27E-10
FW [m^3]	-7.35E-04	0.00684	-0.0116
Wastes and Outputs			
HWD [kg]	-7.95E-11	-8.08E-08	-1.03E-09
NHWD [kg]	-5.46E-05	0.598	-0.115
RWD [kg]	-2.86E-08	4.62E-05	-2.04E-06
CRU [kg]	0	0	0
MFR [kg]	0	0	0
MER [kg]	0	0	0
EEE [MJ]	0	0	0
EET [MJ]	0	0	0

Table 15: Module D, 1 m^2 of thin, uncoated MDF.

	Landfill	Energy recovery	Recycling
Environmental Impact			
GWP [kg CO_2-eq.]	-0.00125	-3.32	-0.0544
GWPF [kg CO_2-eq.]	-0.00125	-3.33	-0.0527
GWPB [kg CO_2-eq.]	-2.64E-06	0.00597	-0.00167
ODP [kg CFC11-eq.]	-3.06E-18	1.06E-13	-3.82E-16
AP [kg SO_2-eq.]	-3.98E-06	2.07E-04	-6.26E-04
EP [kg PO_4^{3-}-eq.]	-5.12E-07	-6.59E-05	-1.43E-04
POCP [kg C_2H_4-eq.]	-2.83E-07	3.65E-04	-5.66E-04
ADPE [kg Sb-eq.]	-6.76E-10	-2.71E-07	-1.24E-08
ADPF [MJ]	-0.0154	-62.0	-0.263
Resource Use			
PERE [MJ]	-0.0468	0.0170	-11.8
PERM [MJ]	0	0	0
PERT [MJ]	-0.0468	0.0170	-11.8
PENRE [MJ]	-0.0154	-62.0	-0.263
PENRM [MJ]	0	0	0
PENRT [MJ]	-0.0154	-62.0	-0.263
SM [kg]	0	0	2.40
RSF [MJ]	0	27.9	-1.50E-12
NRSF [MJ]	0	27.9	-1.91E-11
FW [m^3]	-1.22E-04	9.27E-04	-0.00173
Wastes and Outputs			
HWD [kg]	-1.32E-11	-1.21E-08	-1.54E-10
NHWD [kg]	-9.05E-06	0.103	-0.0173
RWD [kg]	-4.74E-09	6.27E-06	-3.06E-07
CRU [kg]	0	0	0
MFR [kg]	0	0	0
MER [kg]	0	0	0
EEE [MJ]	0	0	0
EET [MJ]	0	0	0

Table 16: Module D, 1 m^2 of thick, coated MDF.

	Landfill	Energy recovery	Recycling
Environmental Impact			
GWP [kg CO_2-eq.]	-0.00697	-19.9	-0.326
GWPF [kg CO_2-eq.]	-0.00696	-19.9	-0.316
GWPB [kg CO_2-eq.]	-1.48E-05	0.0332	-0.01000
ODP [kg CFC11-eq.]	-1.71E-17	6.61E-13	-2.29E-15
AP [kg SO_2-eq.]	-2.22E-05	-4.37E-05	-0.00375
EP [kg PO_4^{3-}-eq.]	-2.86E-06	-6.30E-04	-8.59E-04
POCP [kg C_2H_4-eq.]	-1.58E-06	0.00185	-0.00339
ADPE [kg Sb-eq.]	-3.77E-09	-1.62E-06	-7.44E-08
ADPF [MJ]	-0.0861	-372	-1.58
Resource Use			
PERE [MJ]	-0.261	0.109	-70.5
PERM [MJ]	0	0	0
PERT [MJ]	-0.261	0.109	-70.5
PENRE [MJ]	-0.0862	-372	-1.58
PENRM [MJ]	0	0	0
PENRT [MJ]	-0.0862	-372	-1.58
SM [kg]	0	0	13.2
RSF [MJ]	0	167	-9.03E-12
NRSF [MJ]	0	167	-1.14E-10
FW [m^3]	-6.81E-04	0.00580	-0.0104
Wastes and Outputs			
HWD [kg]	-7.36E-11	-7.27E-08	-9.23E-10
NHWD [kg]	-5.06E-05	0.563	-0.104
RWD [kg]	-2.65E-08	4.00E-05	-1.83E-06
CRU [kg]	0	0	0
MFR [kg]	0	0	0
MER [kg]	0	0	0
EEE [MJ]	0	0	0
EET [MJ]	0	0	0

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