Environmental Product Declaration

as per ISO 14025

Glunz AG
TOPAN® MDF
AGEPAN® Wood Fibreboards

Declaration number
EPD-GLU-2010111-E

Institut Bauen und Umwelt e.V.
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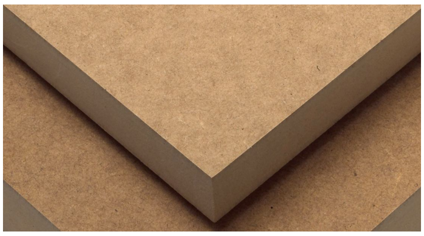

Brief version

Environmental Product Declaration

Environmental Product Declaration

Programme holder

Institut Bauen und Umwelt e.V.

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Institut Bauen und Umwelt e.V.

Declaration holder

Glunz AG
Grecostrasse 1
D-49716 Meppen

TOPAN® AGEPAN® SYSTEM GLUNZ

Ein Unternehmen der Gruppe SONAE INDUSTRIA

Declaration number

EPD-GLU-2010111-E

Declared construction products

MDF

This declaration is an Environmental Product Declaration in accordance with ISO 14025 and describes the environmental features of the construction products outlined here. It intends to promote the development of construction which is compatible with the environment and health.
This validated Declaration discloses all of the relevant environmental data.
The Declaration is based on the "Wood materials" PCR document, version 2009-11.

Validity

This validated Declaration entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V.
It exclusively applies for the products referred to for a period of one year from the date of issue.
The Declaration holder is liable for the details and documentation upon which the evaluation is based.

Content of the Declaration

The **Declaration** is complete and comprises in detail:
- Product definition and physical construction data
- Details on base materials and material origin
- Description of the product manufacturing process
- Information on product processing
- Data on the utilisation status, extraordinary effects and re-use phase
- Results of the Life Cycle Assessment
- Documentation and tests

Issue date

25 March 2012

Signatures

Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)

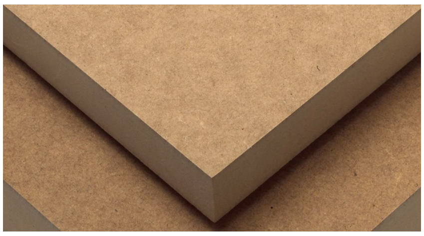
Testing the Declaration

This Declaration and the regulations upon which it is based have been tested by the independent Committee of Experts (SVA) in line with ISO 14025.

Signatures

Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the SVA)

Dr. Frank Werner (inspector appointed by the SVA)



Brief version

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Product description

TOPAN® MDF and AGEPAN® wood fibreboards are wooden panels manufactured in a dry process and availing of various material features thanks to their density and the glue used. The boards are manufactured uncoated, coated, slotted and fully-dyed. Other versions are also available which are even more resistant to fire and moisture.

Area of application

TOPAN® MDF boards are decorative wood materials primarily used in interior construction, in the furniture industry and in the area of trade fair stand and shop construction.

AGEPAN® wood fibreboards are wood construction materials are used for external panelling on walls and roofs as well as interior insulation of roofs, walls and floors.

Life Cycle Assessment Framework

The **Life Cycle Assessment** has been performed in accordance with DIN ISO 14040 ff in line with the requirements of the IBU Guidelines on Type III Declarations. Specific plant data on the products tested as well as data from the "GaBi 4" data base was applied. The Life Cycle Assessment comprises the exploitation of raw materials and energy, the transport of raw materials, the actual manufacturing phase, production and thermal utilisation of packaging as well as the End of Life in a biomass power plant with energy recovery. The Declaration concerns one cubic metre each of uncoated TOPAN® MDF, TOPAN® MDF FF, AGEPAN® DWD and AGEPAN® wood fibre insulation material (hereinafter HFD).

Results of the Life Cycle Assessment

		TOPAN ® MDF			TOPAN ® MDF FF		
Analysis factor	Unit per m³	Total	Production	End of Life	Total	Production	End of Life
Primary energy, non-renewable	[MJ]	-4,527	9,702	-14,229	-5,856	8,832	-14,688
Primary energy, renewable	[MJ]	12,717	12,886	-168.9	13,109	13,284	-174
Global Warming Potential (GWP 100)	[kg CO_2 equiv.]	-205.2	-621.0	415.8	-251	-679.7	429.2
Ozone Depletion Potential (ODP)	[kg R11 equiv.]	8.28 E-06	4.38 E-05	-3.55E-05	4.71 E-06	4.13E-05	-3.66 E-05
Acidification Potential (AP)	[kg SO_2 equiv.]	2.71 E+00	1.53E+00	1.18E+00	2.31E+00	1.09E+00	1.22E+00
Eutrification Potential (EP)	[kg PO_4 equiv.]	5.59E-01	3.35E-01	2.24E-01	3.90E-01	1.58E-01	2.32E-01
Summer smog (POCP)	kg ethene equiv	3.92E-01	4.07E-01	-1.49E-02	2.15E-01	2.31E-01	-1.54E-02
		AGEPAN ® DWD			**AGEPAN ® HFD**		
Analysis factor	Unit per m³	Total	Production	End of Life	Total	Production	End of Life
Primary energy, non-renewable	[MJ]	-4,905	7,396	-12,301	-1,786	2,694	-4,480
Primary energy, renewable	[MJ]	10,979	11,125	-146.0	3,998	4,052	-53.2
Global Warming Potential (GWP 100)	[kg CO_2 equiv.]	-209.8	-569.3	359.5	-76.4	-207.3	130.9
Ozone Depletion Potential (ODP)	[kg R11 equiv.]	3.94E-06	3.46E-05	-3.07E-05	1.44E-06	1.26E-05	-1.12E-05
Acidification Potential (AP)	[kg SO_2 equiv.]	1.94E+00	9.17E-01	1.02E+00	7.05E-01	3.34E-01	3.71E-01
Eutrification Potential (EP)	[kg PO_4 equiv.]	3.27E-01	1.33E-01	1.94E-01	1.19E-01	4.83E-02	7.06E-02
Summer smog (POCP)	kg ethene equiv	1.80E-01	1.93E-01	-1.29E-02	6.57E-02	7.04E-02	-4.70E-03

Created by: PE INTERNATIONAL, Leinfelden-Echterdingen
in co-operation with Glunz AG.

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Documentation and tests

In addition, the following **documentation and tests** are depicted in the Environmental Declaration:

- Formaldehyde to DIN EN 120 Measuring agency: Material- und Prüfanstalt Brandenburg, Eberswalde
- MDI (Diphenylmethane-4.4'-diisocyanate) to BIA 7670 / RAL 76 Measuring agency: Weßling, Altenberge
- Eluate analysis in accordance with DIN EN 71-3. Measuring agency: Material- und Prüfanstalt Brandenburg, Eberswalde
- EOX (Extractable Organic Halogen Compounds) to DIN 38414-17, Measuring agency: Material- und Prüfanstalt Brandenburg, Eberswalde
- PCP (Pentachloorphenol) / Lindane to CEN/TR 14823. Measuring agency: Material- und Prüfanstalt Brandenburg, Eberswalde

Area of applicability

Wood fibreboards and board-shaped wood fibre insulation materials (HFD) of low density are manufactured for the Sonae Group in the following plants:

Glunz AG Werk Meppen, Grecostr. 1, D-49716 Meppen

BHW GmbH Beeskow, Radinkendorfer Str. 71, D-15848 Beeskow

The details and values provided in this document relate to uncoated medium-density and high-density fibreboards as well as wood fibre insulating boards (HFD) of low density produced in the plant in Meppen (see above).

1 Product definition

Product definition

We define MDF as boards represented by our TOPAN® and AGEPAN® brands. TOPAN® MDF boards are wood fibreboards manufactured in a dry process in accordance with EN 316. TOPAN® MDF boards involve the use of urea-formaldehyde (UF) resins as binding agents while TOPAN® MDF FF products rely on formaldehyde-free polyurethane (PUR) adhesives. The gross densities displayed by TOPAN® MDF and TOPAN® MDF FF essentially range between 600 kg/ m³ and 800 kg/m³. Boards with thicknesses of 6 mm to 40 mm are manufactured in various standard formats.

AGEPAN® wood fibreboards are wood fibre insulating materials (HFD) in accordance with DIN EN 13171 and permeable wall and roof boards (DWD) as per Z-9.1-382 which are also manufactured in a dry process. The open woodfibres are sprayed with a formaldehyde-free PUR binding agent and paraffin and pressed to become single-layer boards with a customised gross density profile.

AGEPAN® HFD wood fibre insulating materials display densities ranging between 200 kg/m³ and 300 kg/m³ and can be manufactured at thicknesses of 20 mm to 80 mm. The insulating boards can be attributed tongue and groove profiles or supplied with blunt edges in small and large formats.

AGEPAN® DWD boards are manufactured with a density of approx. 570 kg/m³ with and without tongue and groove profiles in small and large formats and at thicknesses of 12 to 20 mm (typically: 16 mm).

Application

TOPAN® MDF boards comply with the requirements on boards for general purposes used in wet and dry areas; TOPAN® MDF FF boards are designed for areas with increased hygienic and/or health requirements and for applications demanding particular levels of moisture resistance.

TOPAN® MDF and TOPAN® MDF FF boards are primarily used in interior constructions, trade fair stand and shop design as well as in the furniture industry. Mostly painted or coated, they can be found in kitchens, offices, bedrooms and sitting rooms.

Apart from an extensive basic range, special TOPAN® MDF variants are also available such as low-flammable TOPAN® MDF Colour black FR boards and TOPAN® MR boards which display increased resistance to moisture. One board variant revealing particularly creative possibilities is represented by TOPAN® FF TOPAN® MDF Colour boards which combine practically all of the options currently offered by modern MDF boards: formaldehyde-free gluing, increased resistance to moisture, suitability for use in children's toys and all kinds of colours.

In accordance with the Z-9.1-382 technical approval for reinforcing ceiling and wall panels as per DIN 1052:2004-08, AGEPAN® DWD boards can be used at thicknesses of 12 mm to 20 mm. They are also used as rigid underlays in accordance with EN 14964.

Depending on their product features, AGEPAN® wood fibreboards can be used in the areas of application outlined in the DIN 4108-10 standard:

on account of their water-resistant properties, boards featuring a tongue and groove profile can be used as rigid underlays in accordance with ZVDH regulations. Other technical approvals regulate use as:

- effective planking for AGPEAN® DWD boards in accordance with Z-9.1-382
- effective thermal insulation for AGEPAN® THD boards in accordance with Z-9.1-725
- thermal insulation boards in an Exterior Insulation Finishing System (EIFS) in accordance with Z-33.47-673
- thermal insulation material in accordance with Z-23.15-1508.

Product standard / Approval

- EN 316 - Wood fibreboards - Definition, classification and abbreviations
- EN 622-5 – Fibreboards – Requirements on boards manufactured in a dry process (MDF)
- EN 13986 – Wood materials for use in the construction industry
- ISO 16895 – Dry Process Fibreboards Part 1: Classifications, Part 2: Requirements
- EN 13171 - Thermal insulation materials for buildings
- EN 14964 – Underlays for roofing
- General construction inspection approval Z-9.1-382
- General construction inspection approval Z-9.1-725
- General construction inspection approval Z-23.15-1508
- General construction inspection approval Z-33.47-673

Quality assurance

- EN ISO 9001:2008 – DEKRA Certification GmbH, 2009
- PEFC registration no.: PEFC/04-32-O767
- FSC certificate number: IMO COC-021130
- CE marking to EN 13986 and EN 13171

Product group	Wood materials	Created
Declaration holder:	Glunz AG	25-03-2010
Declaration number:	EPD-GLU-2010111-E	

Delivery status, features

Tables 1 - 1: Delivery status, features and application

The physical features of the three product groups concerned are outlined below: TOPAN® MDF, TOPAN® MDF FF, AGEPAN® DWD and AGEPAN® wood fibreboard insulation panels

Product group TOPAN® MDF

This involves boards manufactured in a dry process and glued using a urea-formaldehyde resin. These boards are primarily used for manufacturing furniture.

Parameters	Test standard	Unit	Value	Value	Value	Value	Value
Thickness	EN 325	mm	6-9	>9-12	>12-19	>19-30	>30-40
Density	EN 323	kg/m³	780	750	730	730	720
Transverse tensile strength	EN 319	N/mm²	0.65	0.60	0.55	0.55	0.50
Bending strength	EN 310	N/mm²	23	22	20	18	17
Elasticity module	EN 310	N/mm²	2700	2500	2200	2100	1900
Thickness swelling	EN 317	%	17	15	12	10	8
Material moisture	EN 322	%	5-9				
Thermal conduc-tivity	EN 12524	W/mK	0.14				
Formaldehyde emission class			E1				

Product group TOPAN® MDF FF

These boards are also manufactured in a dry process. They are glued using formaldehyde-free PMDI binding agent and are therefore suitable for customers attaching importance to low-emission products. Increased moisture protection is also achievable.

Features	Test standard	Unit	Value	Value	Value	Value	Value
Thickness	EN 325	mm	6-9	>9-12	>12-19	>19-30	>30-40
Density	EN 323	kg/m³	800	770	770	760	750
Transverse tensile strength	EN 319	N/mm²	0.65	0.60	0.55	0.55	0.50
Bending strength	EN 310	N/mm²	23	22	20	18	17
Elasticity module	EN 310	N/mm²	2700	2500	2200	2100	1900
Thickness swelling	EN 317	%	17	15	12	10	8
Material moisture	EN 322	%	5-9				
Thermal conduc-tivity	EN 12524	W/mK	0.14				
Formaldehyde emission class			NAF, Non-Added Formaldehyde				

Product group AGEPAN® DWD

AGEPAN® DWD protect tongue + groove

Areas of application

- Rigid underlays in accordance with ZVDH regulations
- Statically effective planking as per DIN 1052:2004-08 in accordance with Z-9.1-382
- Exterior wall planking for permeable timber frame walls

Packing units

Parameters	Unit	Values		
Thickness	mm	12	16	16
Calculation measurement	mm	2510 x 635	2510 x 635	2510 x 1010
Covering measurement	mm	2500 x 625	2500 x 625	2500 x 1000
Edge design		Tongue + groove	Tongue + groove	Tongue + groove
Covering measurement per board	m²	1.56	1.56	2.5
Weight per board	kg	11	14.1	22.6
Number of boards/pack		54	40	40
Surface/pack	m²	84	62.5	100
Weight per pack	kg	584	564	904

Technical data

Parameters	Test standard	Unit	Values	
Nominal thickness	EN 325	mm	12	16
Gross density	EN 323	kg / m³	565	
Calculation value for thermal conductivity	DIN 4108-2	W/m*K	0.09	
Diffusion resistance factor µ	DIN 52615		11	
Sd value		m	0.13	0.18
Bending strength	EN 310	N/mm²	11	14
Transverse tensile strength	EN 319	N/mm²	0.18	0.35
Specific thermal capacity	DIN 4108-4	J/kg*K	2100	
Fire performance	EN 13501-1		E	
Building material class	DIN 4102		B2	
Initial moisture	EN 322	%	9 ±4	

Product group AGEPAN® DWD

AGEPAN® DWD protect STD

Areas of application

- Static wall, roof and ceiling panels as per DIN 1052:2004-08 in accordance with Z-9.1-382
- Exterior bracing in the case of timber frame elements

Packing units

Parameters	Unit	Values
Thickness	mm	16
Calculation measurement	mm	3000 x 1247
Covering measurement	mm	3000 x 1247
Edge design		STD
Covering measurement per board	m²	3.7
Weight per board	kg	33.8
Number of boards/pack		48
Surface/pack	m²	178
Weight per pack	kg	1622

Technical data

Parameters	Test standard	Unit	Values
Nominal thickness	EN 325	mm	16
Gross density	EN 323	kg / m³	565
Calculation value for thermal conductivity	DIN 4108 - 2	W/m*K	0.09
Diffusion resistance factor µ	DIN 52615		11
Sd value		m	0.18
Bending strength	EN 310	N/mm²	14
Transverse tensile strength	EN 319	kPa	0.35
Specific thermal capacity	DIN 4108 - 4	J/kg*K	2100
Fire performance	EN 13501-1		E
Building material class	DIN 4102		B2
Initial moisture	EN 322	%	9 ±4

Product group Wood fibre insulation boards (HFD)

AGEPAN® UDP tongue + groove

Areas of application

- Ares of application in accordance with DIN 4108-10 Table 13 DAD-ds / DI-dm / DEO-ds / WAB-ds / WI-dm
- Rigid underlays in accordance with ZVDH regulations
- Exterior roof insulation
- Exterior wall bracing in the case of timber frame walls

Packing units

Parameters	Unit	Values		
Thickness	mm	22	25	32
Calculation measurement	mm	2520 x 610		
Covering measurement	mm	2500 x 590		
Edge design		Tongue + groove		
Covering measurement per board	m²	1.48		
Weight per board	kg	8.95	10.16	13.01
Number of boards/pack		28	25	20
Surface/pack	m²	41.3	36.87	29.5
Weight per pack	kg	251	254	260

Technical data

Parameters	Test standard	Unit	Values
Nominal thickness	EN 823	mm	22 / 25 / 32
Board marking	EN 13171		WF-EN13171-T4-CS(10/Y)300-TR15-WS1.0
Gross density	EN 1602	kg / m³	270
Nominal value of thermal conductivity λ_D	EN 13171	W/m*K	0.051
Diffusion resistance factor µ	EN 12086		5
Sd value		m	0.11 / 0.13 / 0.16
Transverse tensile strength	EN 1607	kPa	≥ 15
Compressive strength	EN 826	kPa	≥ 300
Specific thermal capacity	DIN 4108-4	J/kg*K	2100
Fire performance	EN 13501-1		E
Building material class	DIN 4102		B2
Initial moisture	EN 322	%	9 ±4

Product group Wood fibre insulation boards (HFD)

AGEPAN® THD tongue + groove

Areas of application

- Ares of application in accordance with DIN 4108-10 Table 13
- DAD-ds / DI-dm / DEO-ds / WAB-ds / WAP / WI-dm / WTR
- Rigid underlays in accordance with ZVDH regulations
- Exterior roof insulation
- Exterior wall bracing in the case of timber frame walls
- Can be plastered over in applications which are not subject to approval
- Interior insulation

Packing units

Parameters	Unit	Values			
Thickness	mm	40	52	60	80
Calculation measurement	mm	1890 x 600			
Covering measurement	mm	1875 x 585			
Edge design		Tongue + groove			
Covering measurement per board	m²	1.1			
Weight per board	kg	10.2	13.6	15.2	20.2
Number of boards/pack		22	17	15	11
Number of packs/pallet		2			
Surface/pack	m²	24.2	14.9	16.5	12.1
Weight per pack	kg	224	231	228	224

Technical data

Parameters	Test standard	Unit	Values
Nominal thickness	EN 823	mm	40 / 52 / 60 / 80
Board marking	EN 13171	to 60 mm from 60 mm	WF-EN13171-T3-CS(10/Y)200-TR10-WS1.0 WF-EN13171-T3-CS(10/Y)200-TR7.5-WS1.0
Gross density	EN 1602	kg / m³	230
Nominal value of thermal conductivity λ_D	EN 13171	W/m*K	0.047
Calculation value for thermal conductivity λ	EN 4108-4	W/m*K	0.050
Diffusion resistance factor µ	EN 12086		3
Sd value		m	0.12 / 0.16 / 0.18 / 0.24
Transverse tensile strength	EN 1607	kPa	≥ 10 (to 60 mm) ≥ 8 (from 60 mm)
Compressive strength	EN 826	kPa	≥ 200
Fire performance	EN 13501-1	E	E
Building material class	DIN 4102	B2	B2
Initial moisture	EN 322	%	9 ±4

Product group Wood fibre insulation boards (HFD)

AGEPAN® THD STD

Areas of application

- Ares of application in accordance with DIN 4108-10 Table 13
- DI-dm / DEO-ds /WI-dm / WTR
- Interior insulation for ceilings and walls
- Ideal for installation levels
- Additional insulation of solid wood walls

Packing units

Parameters	Unit	Values		
Thickness	mm	40	60	80*
Calculation measurement	mm	2650 x 600		
Covering measurement	mm	2650 x 600		
Edge design		STD		
Covering measurement per board	m²	1.59		
Weight per board	kg	14.63	21.95	29.27
Number of boards/pack		16	11	8
Number of packs/pallet		1		
Surface/pack	m²	25.4	17.5	12.72
Weight per pack	kg	234	241	234

*Available on request

Technical data

Parameters	Test standard	Unit	Values
Nominal thickness	EN 823	mm	40 / 60 / 80*
Board marking	EN 13171	to 60 mm from 60 mm	WF-EN13171-T3-CS(10/Y)200-TR10-WS1.0 WF-EN13171-T3-CS(10/Y)200-TR7.5-WS1.0
Gross density	EN 1602	kg / m³	230
Nominal value of thermal conductivity λ_D	EN 13171	W/m*K	0.047
Calculation value for thermal conductivity λ	EN 4108-4	W/m*K	0.050
Diffusion resistance factor µ	EN 12086		3
Sd value		m	0.12 / 0.18 / 0.24
Transverse tensile strength	EN 1607	kPa	≥ 8
Compressive strength	EN 826	kPa	≥ 200
Specific thermal capacity	DIN 4108-4	J/kg*K	2100
Fire performance	EN 13501-1		E
Building material class	DIN 4102		B2
Initial moisture	EN 322	%	9 ±4

Product group Wood fibre insulation boards (HFD)

AGEPAN® TEP tongue + groove

Areas of application

- Areas of application in accordance with DIN 4108-10 Table 13
- DI-dm / DEO-ds / DES-sg / WH / WI-dm / WTR
- Dry screed on surface-supporting layer

Packing units

Parameters	Unit	Values		
Thickness	mm	40	60	80*
Calculation measurement	mm	1890 x 500		
Covering measurement	mm	1880 x 500		
Edge design		Tongue + groove		
Covering measurement per board	m²	0.94		
Weight per board	kg	8.65	12.97	17.3
Number of boards/pack		22	15	11
Number of packs/pallet		2		
Surface/pack	m²	20.7	14.1	10.4
Weight per pack	kg	191	196	191

*Available on request; not regular stock

Technical data

Parameters	Test standard	Unit	Values
Nominal thickness	EN 823	mm	40 / 60 / 80*
Board marking	EN 13171	to 60 mm from 60 mm	WF-EN13171-T3-CS(10/Y)200-TR10-WS1.0 WF-EN13171-T3-CS(10/Y)200-TR7.5-WS1.0
Gross density	EN 1602	kg / m³	230
Nominal value of thermal conductivity λ_D	EN 13171	W/m*K	0.047
Calculation value for thermal conductivity λ	EN 4108-4	W/m*K	0.050
Diffusion resistance factor µ	EN 12086		3
Sd value		m	0.12 / 0.18 / 0.24
Transverse tensile strength	EN 1607	kPa	≥ 8
Compressive strength	EN 826	kPa	≥ 200
Specific thermal capacity	DIN 4108-4	J/kg*K	2100
Fire performance	EN 13501-1		E
Building material class	DIN 4102		B2
Initial moisture	EN 322	%	9 ±4

Product group Wood fibre insulation boards (HFD)

KNAUF WF THD T+G

Areas of application

- Areas of application in accordance with DIN 4108-10 Table 13
- DAD-ds / DI-dm / DEO-ds / WAB-ds / WAP / WI-dm
- Thermal insulation material for wooden framework constructions and solid wood walls in the approved WDVS

Packing units

Parameters	Unit	Values		
Thickness	mm	40	60	80
Calculation measurement	mm	1890 x 600		
Covering measurement	mm	1875 x 585		
Edge design		Tongue + groove		
Covering measurement per board	m²	1.1		
Weight per board	kg	10.2	15.2	20.2
Number of boards/pack		22	15	11
Number of packs/pallet		2		
Surface/pack	m²	24.2	16.5	12.1
Weight per pack	kg	224	228	224

Technical data

Parameters	Test standard	Unit	Value
Nominal thickness	EN 823	mm	40 / 60 / 80
Board marking	EN 13171	to 60 mm from 60 mm	WF-EN13171-T3-CS(10/Y)200-TR10-WS1.0 WF-EN13171-T3-CS(10/Y)200-TR7.5-WS1.0
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Calculation value for thermal conductivity λ	EN 4108-4	W/m*K	0.050
Diffusion resistance factor µ	EN 12086		3
Sd value		m	0.12 / 0.18 / 0.24
Bending strength		N/mm²	
Transverse tensile strength	EN 1607	kPa	≥ 10 (to 60 mm) ≥ 8 (from 60 mm)
Compressive strength	EN 826	kPa	≥ 200
Specific thermal capacity	DIN 4108-4	J/kg*K	2100
Fire performance	EN 13501-1		E
Building material class	DIN 4102		B2
Initial moisture	EN 322	%	9 ±4

2 Base materials

Base materials Primary products

TOPAN® MDF boards of 6 mm to 40 mm strength with an average density of 775 kg/m³ comprise (details as a mass percentage per m³ manufactured product):

- Wood chips, primarily pine, approx. 80%

Consumables / Additives

- Water (moisture) approx. 5% to 9% (depending on air-conditioning)
- UF adhesive (urea formaldehyde resin) approx. 11%
- Paraffin wax emulsion 0.5% to 3%

The coating on coated boards comprises:

- Decorative paper with a grammage of 60-120 g/m²
- Melamine formaldehyde resin

TOPAN® FF boards and AGEPAN® boards comprise:

- Wood chips, primarily pine, approx. 90 %
- Water (moisture) approx. 5% to 9% (depending on air-conditioning)
- PMDI adhesive (polymer 4.4' diphenyl methane diisocyanate) 3.5%
- Paraffin wax emulsion 0.5% to 3%

Material definitions

Wood mass: The production of TOPAN® MDF, TOPAN® MDF FF, AGEPAN® DWD and AGEPAN® HFD boards primarily uses fresh wood from forestry thinning measures as well as sawmill residue (mostly pine).

UF adhesive comprising urea formaldehyde resin. This amino plastic adhesive hardens fully by means of poly-condensation during the pressing process.

Paraffin wax emulsion: A paraffin wax emulsion is added to the recipe during gluing for the purpose of hydrophobicity (improving moisture resistance).

Melamine formaldehyde resin: An amino plastic resin for impregnating decorative paper for coating; the resin hardens fully in the press to become a hard and durable surface.

PUR glue hardens fully under pressure and temperature while absorbing moisture, resulting in polyurethane and poly-urea compounds.

Harvesting raw materials and origin of materials

Wood from indigenous, largely regional forestry reserves is used for manufacturing TOPAN® MDF and AGEPAN® wood fibreboards. Wood is procured from forests within a radius of approx. 75 km of the production facility. Short transport routes make a considerable contribution towards minimising CO_2 emissions and the logistics involved in providing raw materials. Wood certified to PEFC is given preference.

PEFC- and FSC-certified finished goods are identified separately by the manufacturer and do not refer to the entire range of products. The binding agents and impregnation resins and/or raw materials for production thereof originate from suppliers located maximum 300 km away from the production facility.

Regional and general availability of raw materials

Wood used in the production of TOPAN® MDF and AGEPAN® wood fibreboards originates exclusively from sustainably managed cultivated forests. These ranges exclusively involve fresh wood gained by thinning and forest maintenance as well as sawmill residue (wood chips). MUF and urea binding agents and impregnating resins as well as paraffin emulsion are synthesised from crude oil - a fossil fuel of limited availability.

3 Product manufacture

Product manufacture

Manufacturing process breakdown:

3.1 Manufacturing TOPAN® MDF boards

1. Debarking the logs
2. Chipping the wood to chips of approx. 3 x 3 cm in size
3. Boiling the chips
4. Defibring in the refiner
5. Gluing the fibres with synthetic resin
6. Drying the fibres to an approx. residual moisture of 2-3%
7. Scattering the glued fibred on a moulding belt
8. Pressing the fibre mat in a permanent hot press under high pressure
9. Distributing the fibre strings among raw board formats
10. Cooling the raw boards in starcoolers
11. Stacking
12. Grinding the top or underside after the air-conditioning phase

3.2 Manufacturing formaldehyde-free glued TOPAN® MDF FF boards

(as above, see 3.1, with the exception of gluing, see 5. above)

5. Gluing the fibres with polyurethane resin

3.3 Manufacturing AGEPAN® DWD rigid underlay boards

Raw boards are manufactured as outlined in 3.2. The density is lower than indicated in 2.2. After manufacturing the raw boards, a tongue and groove profile is milled into some of the boards.

3.4 Manufacturing AGEPAN® HFD boards

As indicated in 3.3 above. The density and pressure to be applied are lower than indicated in 3.3. After manufacturing the raw boards, a tongue and groove profile is milled into some of the boards.

Health protection in manufacturing

Measures for avoiding health risks/problems during the manufacturing process:

Owing to the manufacturing conditions, no special statutory or regulatory measures are required. The MAK (= maximum allowable concentration) values (Germany) are fallen short of at each point of the plant.

Environmental protection in manufacturing

- Air: Waste air generated during production is cleaned in accordance with statutory specifications. Emissions are below those outlined in the TA Air.
- Water/Soil: No contamination of water or soil. Waste water caused by production is treated and directed into the communal sewage system following pre-purification. Wooden sludge incurred during water treatment is used in agriculture as a fertiliser.
- Sound protection analyses have established that all values communicated inside and outside the production facilities are below the standards applicable in Germany. Noise-intensive plant areas such as chipping are encapsulated appropriately by structural measures.

4 Product processing

Processing recommendations	TOPAN® and AGEPAN® boards can be sawn, drilled and milled using standard (electric) power tools. Carbide-tipped tools should be given preference, especially on circular saws. Respiratory protection should be worn when using hand-held equipment without suction devices.
Industrial safety / Environmental protection	The appropriate safety guidelines must be observed when processing and fitting TOPAN® and AGEPAN® boards (goggles, dust mask). The guidelines provided by the professional liability associations must be observed during commercial processing.
Residual materials	Residual materials and packaging: Residual material incurred on the building site (cuttings and packaging) must be collected segregated by waste fraction. The specifications outlined by local disposal authorities and the information provided in section 7. "Re-use phase" must be taken into consideration when disposing of residual materials.
Packaging	Chipboard or MDF boards (waste key number = ASN 170603) and corrugated board (ASN 150101) are used for covering while PET or steel tape packing bands (ASN 170405) and wrapping or shrink film (160506) are used for packing.

5 Condition of use

Contents

Contents in condition of use:

The materials used in TOPAN® and AGEPAN® boards comply with the percentages indicated in section 1. "Base materials", whereby a urea formaldehyde resin or PMDI is used as glue. During compression, the amino plastic resin is cross-linked three-dimensionally as heat is added and moisture emitted by means of an irreversible poly-condensation reaction. The binding agents are chemically and stably bound to the wood. Only low volumes of formaldehyde are emitted (please refer to the Formaldehyde Documentation in section 9.1).

Polyurethane resin is used as a binding agent for the formaldehyde-free glued boards (TOPAN® MDF FF, AGEPAN® DWD and AGEPAN® HFD). Hardening in the press gives rise to poly-urea and polyurethane as water is added, whereby the polyurethane enters a chemical compound with the wood. Full setting of the glue used is ensured by the high pressing temperatures as well as the prevailing moisture content.

Relationships between environment and health

Environmental protection:

According to current indicators, water, air and soil are not exposed to any dangers when the respective products are used as designated (please refer to 9. "Documentation").

Health protection:

Health aspects: According to current indicators, no impairment of health can be anticipated when MDF boards are used as designated. Low volumes of natural wood ingredients can be emitted. With the exception of low, harmless volumes of formaldehyde, emissions of pollutants can not be established (please refer to 9.1 Formaldehyde, 9.2 MDI analysis, 9.3 Eluate analysis, 9.4 EOX Extractable Organic Halogen Compounds, 9.5 PCP/Lindane).

Reliability of condition of use

Reliability of condition of use is defined via the application classes in accordance with EN 622-5, EN 13171 and EN 14964 (please refer to "Product definition" in section 1 as well as Tables 1 to 4).

6 Extraordinary effects

Fire

Fire performance of raw MDF boards > 9 mm thick and > 600 kg/m³:

Classification as fire class D in accordance with EN 13501-1 (see EN 13986 requirements)

Smoke class S2 – normal smoke emissions
d0 – non-dripping

Fire performance of raw thin MDF boards < 9 mm thick:

Classification as fire class D in accordance with EN 13501-1 (see EN 13986 requirements)

Smoke class S2 – normal smoke emissions
d0 – non-dripping

Fire performance of MDF boards with a density of less than 600 kg/m³:

Classification as fire class E in accordance with EN 13501-1 (classification report of the Hoch Test Institute, KB Hoch 090003)

Changing the system condition (burning dripping/falling material): Burning dripping material is not possible as the MDF boards outlined do not liquefy when heated.

Effects of water

No ingredients are washed out which could be hazardous to water. MDF boards are not resistant to permanent exposure to water; damaged areas can however be replaced locally.

Mechanical destruction

MDF board breakage features display relatively brittle performance, whereby sharp edges can arise on the broken panel edges (risk of injury).

7 Re-use phase

Re-use

MDF boards can be collected separately and utilised thermally in the course of conversion or termination of the use phase of a building in the event of selective renaturation.

Further use

MDF boards can be collected separately and utilised for other applications differing from the original application in the course of conversion or termination of the use phase of a building in the event of selective renaturation. This is based on the condition that the wooden boards are not fully glued.

Disposal

Energetic utilisation (in approved systems): Owing to the high heat value of approx. 17 MJ/kg, energetic utilisation for generating process energy and electricity (CHP plants) from board leftovers and boards arising from breakage measures on the building site is preferable to landfilling.

8 Life Cycle Assessment

8.1 Manufacturing MDF boards

Declared unit

The Declaration concerns the manufacture of one cubic metre of average uncoated TOPAN® MDF, TOPAN® MDF FF, AGEPAN® DWD and AGEPAN® HFD board.

The gross density of TOPAN® MDF boards is between 600 and 800 (on average approx. 775) kg/m³; TOPAN® MDF FF boards display a gross density of approx. 800 kg/m³, AGEPAN® DWD boards have a gross density of around 570 kg/m³ and AGEPAN® HFD boards display an average gross density of 244 kg/m³ (all with 3-9% moisture).

The End of Life (EoL) is calculated as further thermal processing in a biomass power plant with energy generation.

System limits

The selected system limits comprise the production of MDF boards including extraction of the raw material to the packaged product at the factory gate (cradle to gate).

The review framework comprises the following details:

- Forest processes for the provision and transport of wood
- Production of all raw materials, primary products and consumables including the associated relevant transport
- Relevant transport and packaging of raw materials and primary products
- MDF board production process (energy, waste, thermal utilisation of production waste, emissions) and provision of energy from the resource
- Manufacturing packaging and thermal utilisation thereof

All of the products examined are produced in the Meppen plant.

The utilisation phase for MDF boards was not examined in this Declaration. As the End-of-Life scenario, a bio-mass power plant with energy recovery (credits in accordance with the substitution approach) was assumed ("gate to grave"). The analysis framework starts at the gate to the utilisation plant. In terms of output, it is assumed that the ash incurred is directed to a landfill.

Performance criteria

All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less than 1 per cent were also considered.

It can be assumed that the total of all neglected processes does not exceed 5% in the effective categories.

Machinery and plants required in the manufacturing process are neglected.

Transport

The relevant transports of raw materials and consumables used are always taken into consideration.

Period under review

The data used refers to the actual production processes of fiscal 1.1.2008 to 31.12.2008. The Life Cycle Assessment was drawn up for Germany as a reference area. This means that apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were used.

Background data

"GaBi 4" – the software system for comprehensive analysis (GaBi 2006) – was used for modelling the lifecycle for the manufacture and disposal of Glunz MDF boards. All of the background data records of relevance for manufacturing and disposal were taken from the GaBi 4 software data base. The upstream chain for forestry has been balanced in accordance with Schweinle & Thoroe, 2001.

Assumptions

The results of the Life Cycle Assessment are based on the following assumptions:

The transport of all raw materials and/or auxiliaries (by truck) is calculated using data from the GaBi data base.

The energy carriers and energy sources used for the production location were taken into consideration as regards energy supply.

All leftovers incurred during production and final manufacturing (trimmings, cuttings and milling leftovers) are directed to thermal utilisation as combustion materials. The credits from energy decoupling of the combustion plants are incorporated in the analysis.

The End-of-Life scenario was assumed as thermal utilisation in a bio-mass power plant.

Data quality

The data concerning MDF boards was recorded directly in the production facility in the Meppen plant. All input and output data was supplied by Glunz and originates from corporate data acquisition and measurements. Importance was attached to a high degree of completeness when collating material and energy flows of environmental relevance with the result that good data representativity can be assumed. The data supplied (processes) has been examined as regards plausibility.

The majority of data for upstream chains originates from industrial sources and was collected under consistent time- and method-based constraints. It is less than 5 years old. The process data and background data used are consistent.

Allocation

Allocation relates to the assignment of input and output flows for a Life Cycle Assessment module to the product system tested (ISO 14040).

No allocations are necessary for the system of manufacturing the MDF boards and associated energy supply under review as residual material is recycled energetically. Incineration is balanced using “GaBi 2006” and energy credits added as for EoL.

Modelled thermal utilisation of the disused MDF board during the End-of-Life process is performed in a bio-mass power plant. Attribution of the thermal energy produced in the power plant is by heating value of the input taking consideration of plant efficiency. The credits for thermal energy are calculated from the “thermal energy from natural gas” while credits for electricity are based on the German power mix. The emissions dependent on input (e.g. CO_2, HCl, SO_2 or heavy metals) were calculated in line with the content composition of the ranges used. Emissions dependent on technology (e.g. CO) are added in terms of waste gas volume.

Information on use phase

The use state and any possible extraordinary effects have not been examined in the Life Cycle Assessment. In the case of system comparisons, aspects relating to the life cycle must be considered depending on use and pressure.

8.2 Depicting the analyses and evaluations

Life cycle inventory analysis

The following section outlines the Life Cycle Inventory Analysis as regards primary energy requirements and waste, followed by the estimated impact.

Primary energy

In assessing energy consumption from renewable and non-renewable resources, the lower heating value was consistently applied. The following Table 8-1 indicates the energy requirements for manufacturing one cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board. The consumption of non-renewable energies for the manufacture of insulation panels (cradle to gate) is 9,702 / 8,832 / 7,396 / 2,694 MJ per m^3, whereby production accounts for approx. 50-59%, the provision of raw materials makes up for 43-50% while transport and packaging account for -1%.

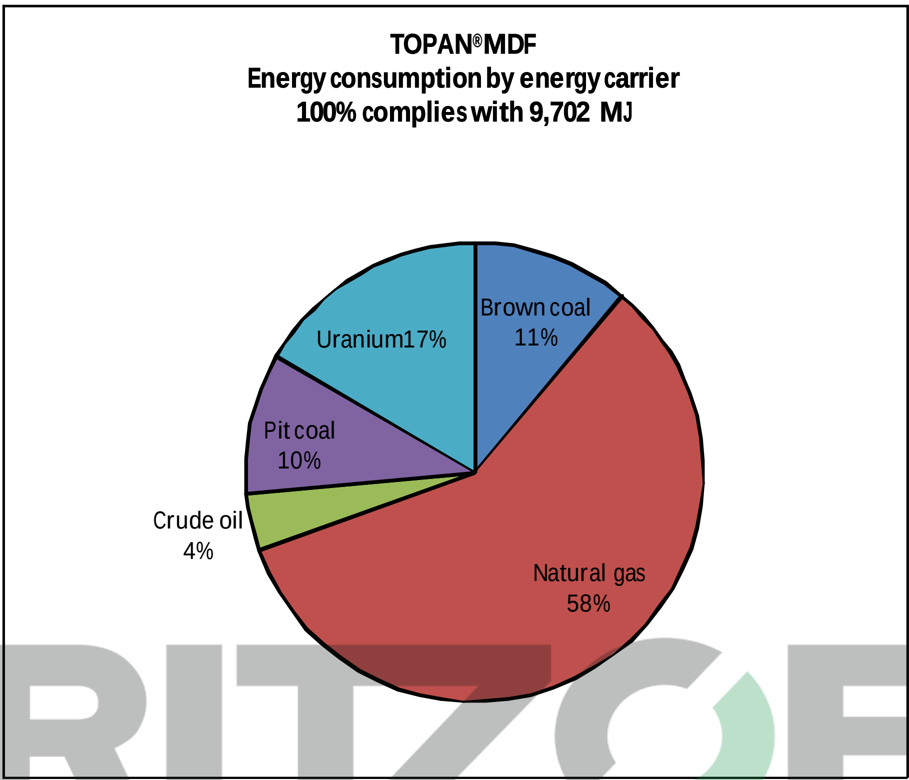
Additionally, 12,886 / 13,284 / 11,125 / 4,052 MJ of renewable energy (mainly solar energy stored in the bio-mass (wood) are used for manufacturing one cubic metre of MDF board.

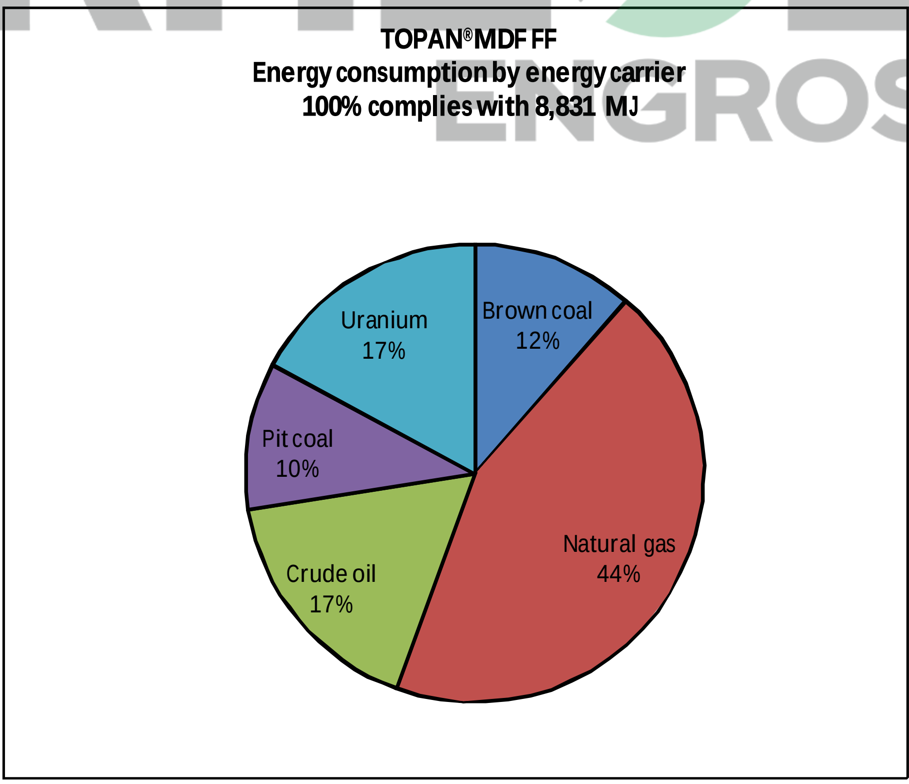
Table 8-1: Primary energy consumption for the manufacture of 1 cubic metre of MDF board

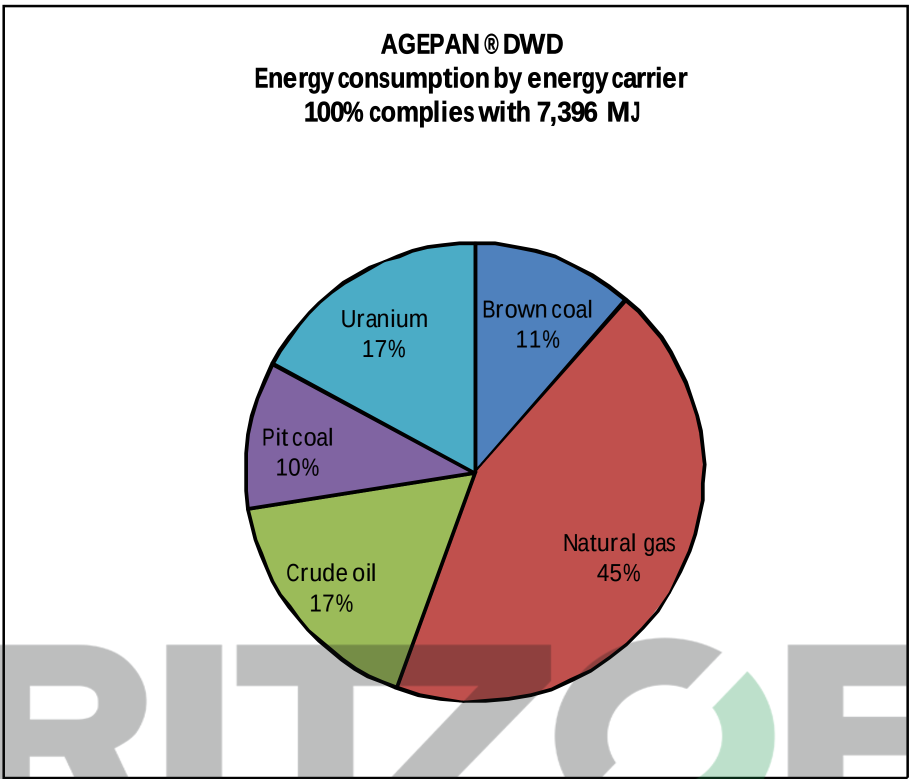
Analysis factor	Unit per m³	Total	Production	End of Life
TOPAN® MDF				
Non-renewable primary energy	[MJ]	-4,527	9,702	-14,229
Renewable primary energy	[MJ]	12,717	12,886	-169
TOPAN® MDF FF				
Non-renewable primary energy	[MJ]	-5,856	8,832	-14,688
Renewable primary energy	[MJ]	13,109	13,284	-174
AGEPAN® DWD				
Non-renewable primary energy	[MJ]	-4,905	7,396	-12,301
Renewable primary energy	[MJ]	10,979	11,125	-146
AGEPAN® HFD				
Non-renewable primary energy	[MJ]	-1,786	2,694	-4,480
Renewable primary energy	[MJ]	3,998	4,052	-53

Closer consideration of the composition of primary energy consumption indicates that the energy stored in the product is converted in the EoL process. This comprises renewable primary energy (stored in the wood) and non-renewable primary energy (stored in the glues). 1 kg of finished MDF board has a lower heating value of approx. 17.5 MJ.

Closer analysis of the non-renewable energy requirements for the manufacture of one cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD MDF reveals that natural gas is used as an essential primary energy carrier which accounts for approx. 45-58% of the primary energy used. Around 10% of energy requirements are covered by pit coal and 11% by brown coal while another 17% is covered by uranium. The share of uranium in primary energy consumption is attributable to the purchase of external power from the public grid as per the respective power mix at the production locations which also incorporates nuclear energy. The remaining 4-17% is covered by crude oil (Fig. 8-1).


TOPAN®MDF
Energy consumption by energy carrier
100% complies with 9,702 MJ
Brown coal 11%
Uranium17%
Pit coal 10%
Crude oil 4%
Natural gas 58%


TOPAN®MDF FF
Energy consumption by energy carrier
100% complies with 8,831 MJ
Brown coal 12%
Uranium 17%
Pit coal 10%
Crude oil 17%
Natural gas 44%



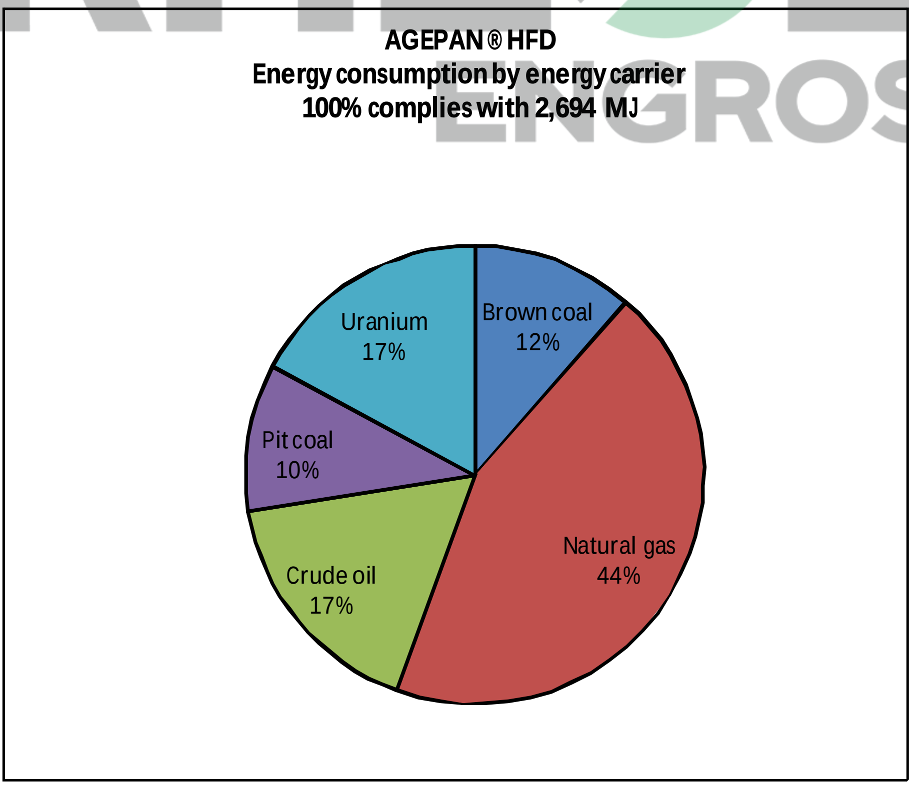
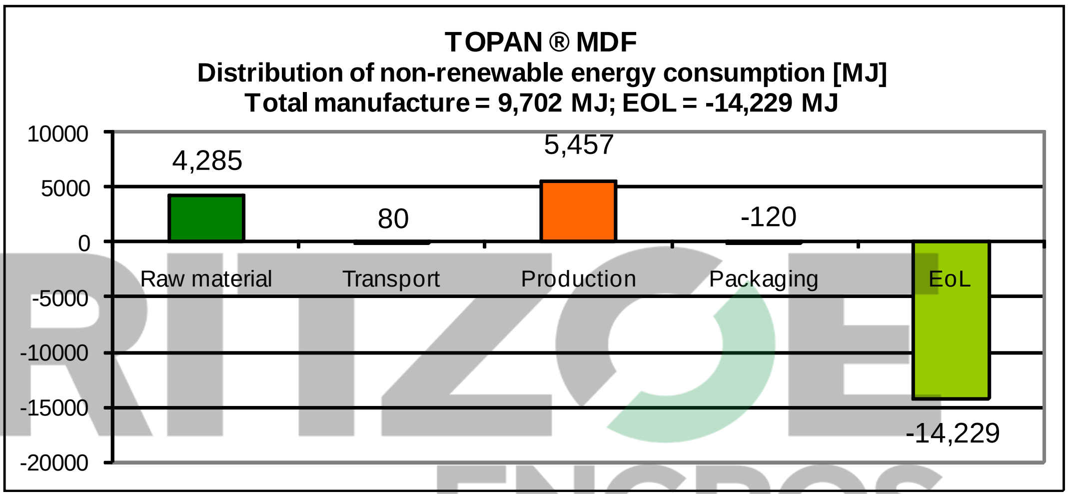
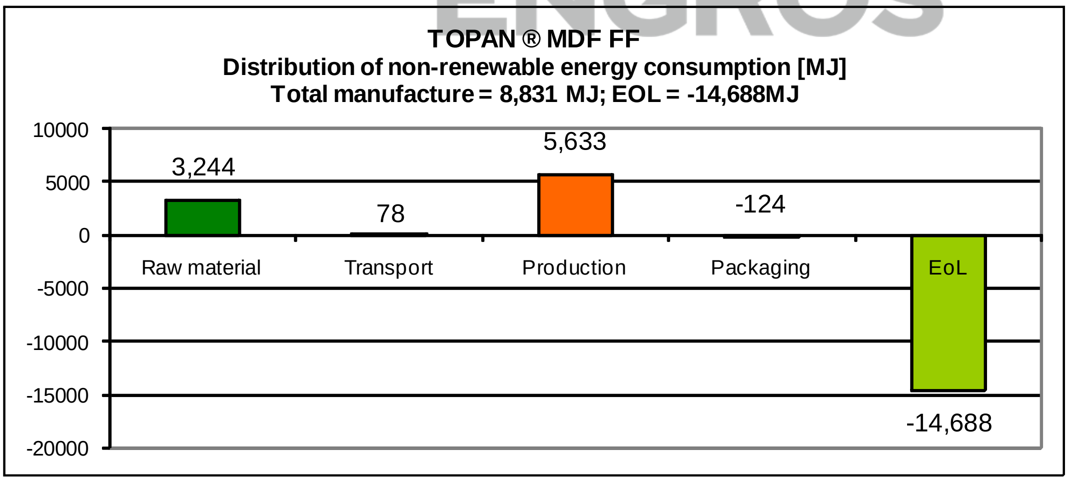


Fig. 8-1: Distribution of non-renewable energy consumption by energy carrier in the manufacture of 1 m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD.

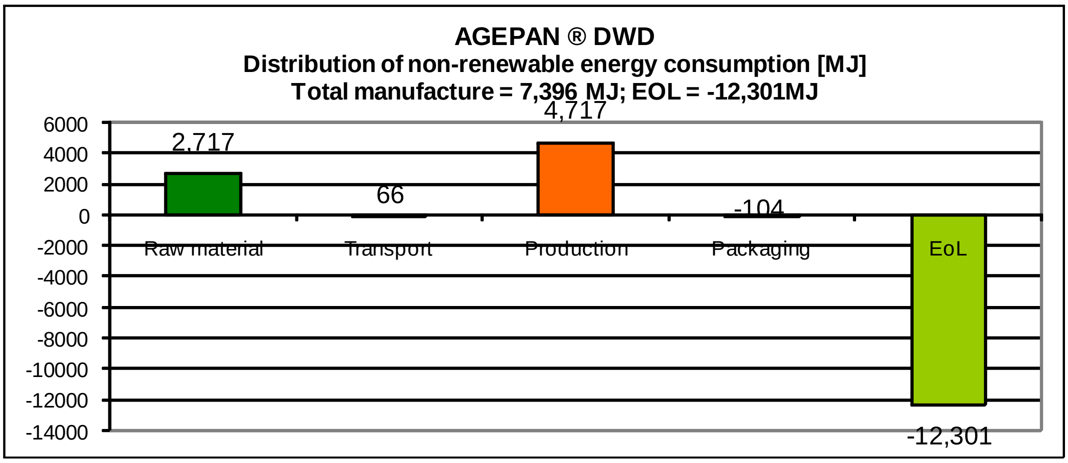
The shares of non-renewable energy carriers comply with Fig. 8-1. Distribution of non-renewable energy carriers across the individual processes is depicted in Fig. 8-2, whereby production accounts for approx. 5,457 / 5,633 / 4,717 / 1,718 MJ, the provision of raw materials accounts for 4,285 / 3,244 / 2,717 / 989 MJ, and transport and packaging account for a total of approx. -40 / -46 / -38 / -14 MJ. This is met by an EoL credit of -14,229 / -14,688 / -12,301 / -4,480 MJ.

Thermal utilisation of packaging and other waste is modelled as average waste incineration for the respective substance fraction with steam conversion and electricity production (metal waste is directed to the recycling circuit, system cut). This gives rise to electricity credits by substituting electricity in the public network in line with the German power mix and a credit for thermal energy as per average production of thermal energy from natural gas per m^3 of finished MDF board produced.





Product group	Wood materials	Created
Declaration holder:	Glunz AG	25-03-2010
Declaration number:	EPD-GLU-2010111-E	



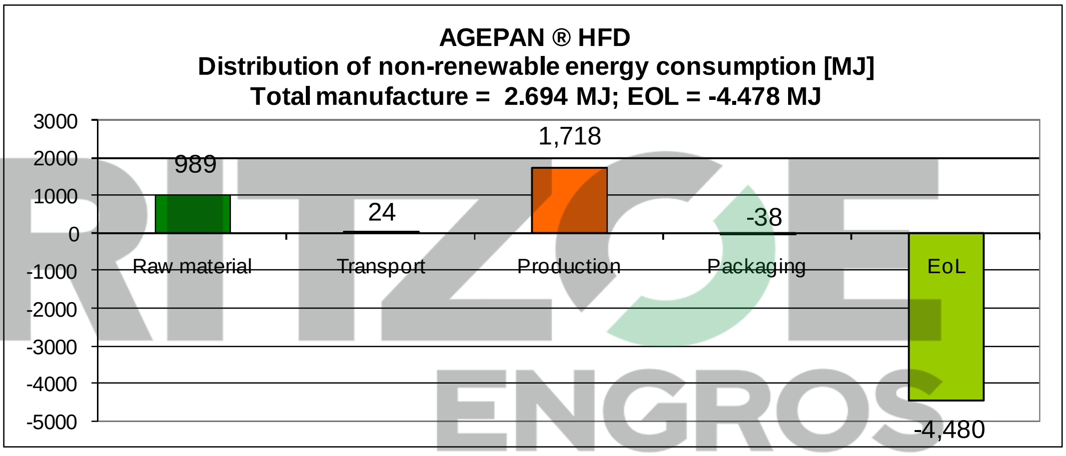
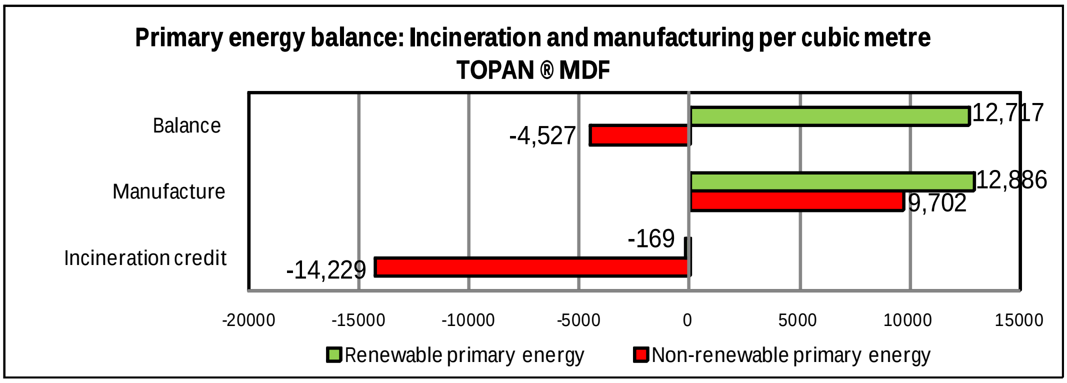


Fig. 8-2: Distribution of non-renewable energy consumption in the manufacture of 1 m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD.

If the manufacturing and End-of-Life processes (incineration of TOPAN® MDF/ TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD boards in a bio-mass power plant) are taken into consideration, it transpires that the energy credit for electricity and thermal energy (credit for German power mix and thermal energy from natural gas in Germany) corresponds with -14,229 / -14,688 / -12,301 / -4,480 MJ non-renewable energy carrier per m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD MDF. Accordingly, the use of non-renewable primary energy when offsetting against manufacture and incineration is reduced from 9,702 / 8,832 / 7,396 / 2,694 MJ/m³ to a value of -4,527 / -5,856 / -4,905 / -1,786 MJ/m³.



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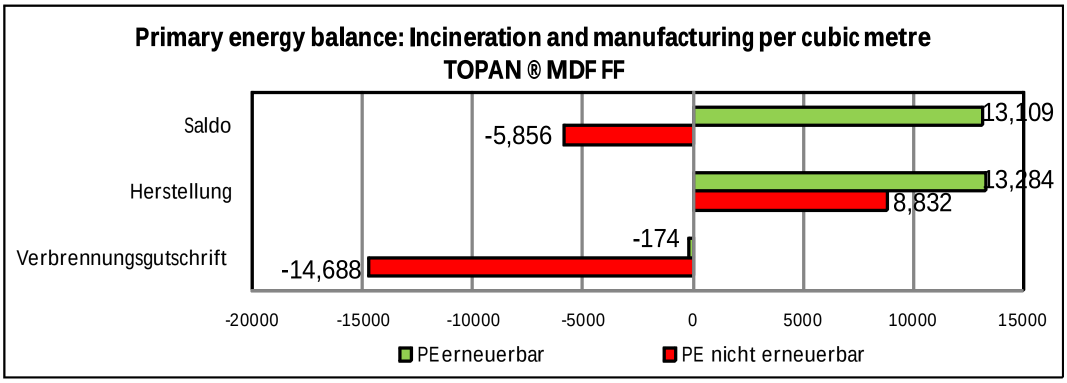
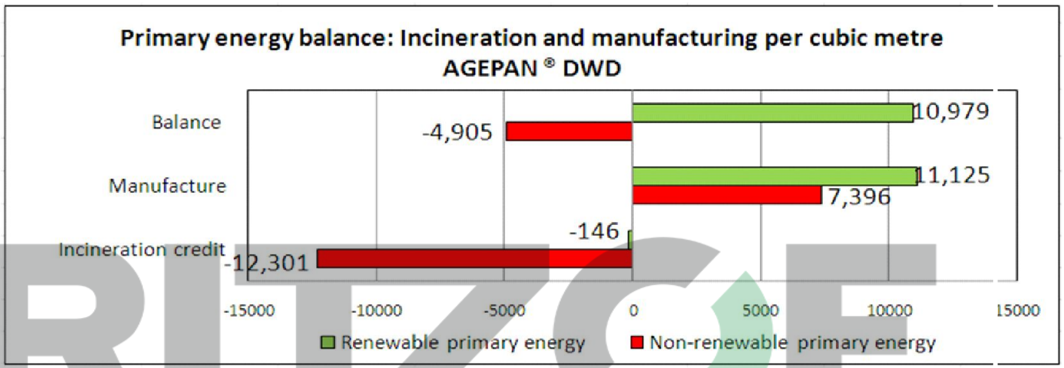




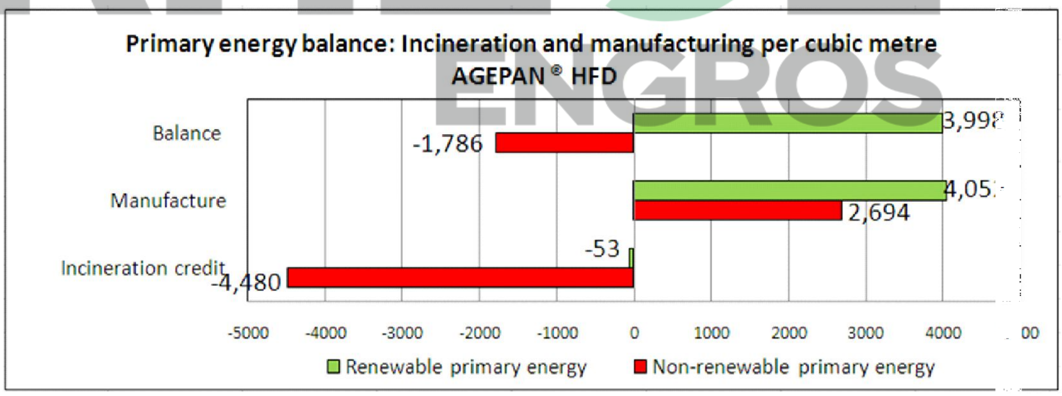
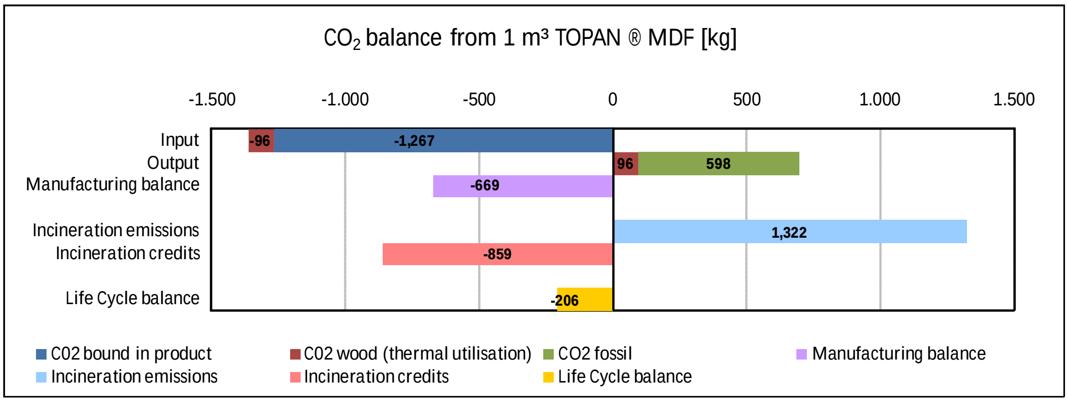
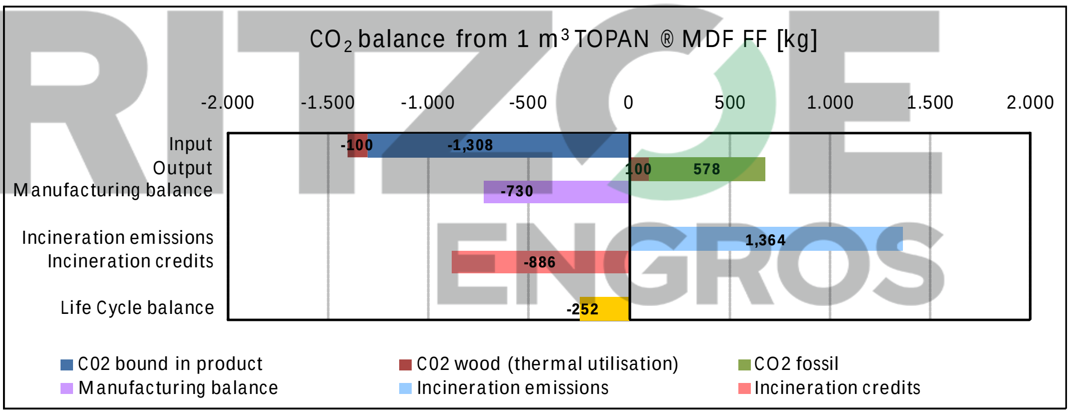


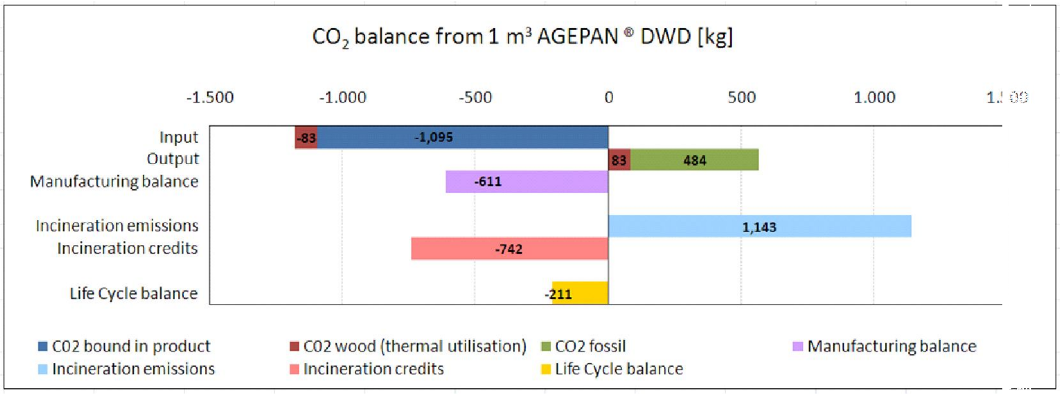
Fig. 8-3: Primary energy balance of renewable and non-renewable energy carriers for the manufacture and incineration of 1 m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD

CO_2 balance

The CO_2 balance in Fig. 8-4 indicates that the manufacture of one cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD causes 695 / 678 / 568 / 207 kg of CO_2 emissions. This is offset by the fact that by manufacturing one cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board, a total of 1,364 / 1,407 / 1,179 / 429 kg of CO_2 from the air are stored in the wood during the course of tree growth for which it is in turn required and remains largely bound across the use phase. The CO_2 bound in 1 cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board is not released again until the end of the life cycle, e.g. during thermal utilisation of the MDF board. If CO_2 absorption (Input bar) is offset against CO_2 emissions (Output bar) during manufacturing, this results in an emissions balance of -669 / -730 / -611 / -223 kg per cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board for the manufacturing phase. During End-of-Life incineration in the bio-mass power plant, the carbon stored in the panel is emitted back into the atmosphere primarily in the form of CO_2. At the same time however, substitution of fossil fuels occurs and therefore of CO_2 from incinerating these fossil energy carriers to the effect of -859 / -886 / -742 / -270 kg CO_2. This energetic substitution effect therefore results in an overall balance of -206 / -252 / -211 / -77 kg CO_2 over the entire life cycle.







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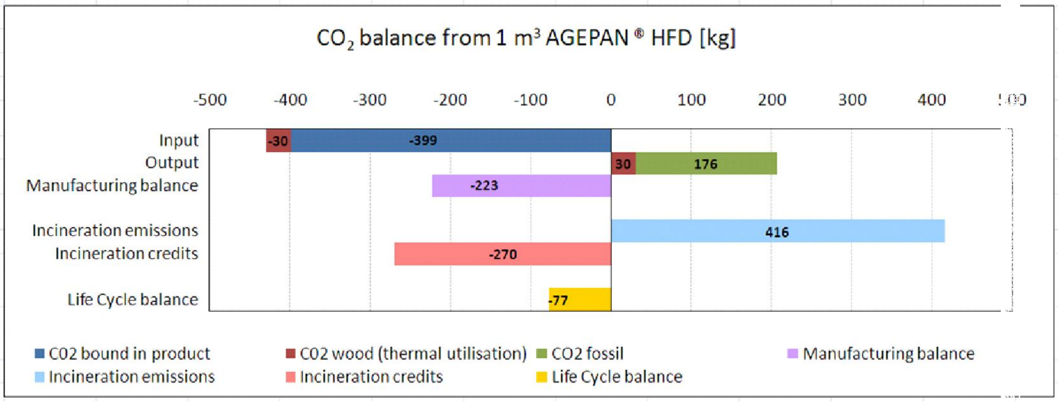

Fig. 8-4: CO_2 balance of manufacturing and End of Life of 1 m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD

Water

Table 8-2 Indicates the water requirements for manufacture, EoL and the total. The volume indicated in cubic metres primarily comprises groundwater and surface water. Water consumption is more than compensated for in the EoL thanks to the substitution effect and is therefore negative in the EoL.

Table 8-2: Water consumption in the manufacture and incineration of 1 m^3 MDF board

Water [m³ / m^3 Topan ® MDF]			
Analysis factor	**Manufac-ture**	**End of Life**	**Total**
Water	4.98	-1.19	3.79
Water [m³ / m^3 Topan ® MDF FF]			
Analysis factor	**Manufac-ture**	**End of Life**	**Total**
Water	4.82	-1.23	3.59
Water [m³ / m^3 AGEPAN ® DWD]			
Analysis factor	**Manufac-ture**	**End of Life**	**Total**
Water	4.03	-1.03	3.00
Water [m³ / m^3 AGEPAN ® HFD]			
Analysis factor	**Manufac-ture**	**End of Life**	**Total**
Water	1.47	-0.38	1.09

Waste

An analysis of waste volumes for the manufacture and end of life of one cubic metre of TOPAN® MDF/ TOPAN® MDF FF/ AGEPAN® DWD/ AGEPAN® HFD MDF board is depicted separately for the three segments: mining waste / excavation waste (including ore treatment residue), municipal solid waste (including domestic waste and commercial waste) and special waste including radioactive waste (Table 8-3).

Table 8-3: Waste incurred in the manufacture and incineration of 1 m³ TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD.

Waste [kg / m³ TOPAN® MDF]			
Analysis factor	**Manufacture**	**End of Life**	**Total**
Landfilling / Excavated waste	1,439.1	-1,240.4	198.7
Municipal solid waste	7.95E-02	0	8.34E-02
Special waste	1.42E+00	-4.90E-01	9,28E-01
Of which radioactive waste	5.76E-01	-4.90E-01	8.56E-02
Waste [kg / m³ TOPAN® MDF FF]			
Analysis factor	**Manufacture**	**End of Life**	**Total**
Landfilling / Excavated waste	1,356.3	-1,280.5	75.9
Municipal solid waste	1.26E-01	0	1.26E-01
Special waste	1.32E+00	-5.06E-01	8.17E-01
Of which radioactive waste	5.43E-01	-5.06E-01	3.69E-02
Waste [kg / m³ AGEPAN® DWD]			
Analysis factor	**Manufacture**	**End of Life**	**Total**
Landfilling / Excavated waste	1,135.9	-1,072.4	63.5
Municipal solid waste	1.06E-01	0	1.06E-01
Special waste	1.11E+00	-4.24E-01	6.85E-01
Of which radioactive waste	4.55E-01	-4.24E-01	3.09E-02
Waste [kg / m³ AGEPAN® HFD]			
Analysis factor	**Manufacture**	**End of Life**	**Total**
Landfilling / Excavated waste	413.7	-390.5	23.1
Municipal solid waste	3.85E-02	0	3.85E-02
Special waste	4.04E-01	-1.54E-01	2.49E-01
Of which radioactive waste	1.66E-01	-1.54E-01	1.12E-02

Pile waste forms by far the most significant quantitative share, followed by special waste and municipal solid waste.

In the case of **pile waste**, mining excavation waste represents by far the most significant share for manufacturing at over 99%. Mining excavation waste is incurred in particular in the extraction of mineral raw materials and coal in the provision of raw materials and energy carriers. Incineration of MDF boards at the end of the life cycle substitutes pile waste in the provision of energy to the extent of 1,240 / 1,281 / 1,072 / 390 kg per cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board.

The most essential influential factors within the **municipal solid waste** segment are represented by unspecific waste and mud. Incineration at the EoL does not effect any change in this segment.

Special waste is essentially waste from upstream stages. “Sludge” and “Special (unspecific) waste” account for the greatest shares of special waste incurred. For each cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board manufactured, 0.57 / 0.54 / 0.45 / 0.039 kg of radioactive waste is incurred, whereby around 98% is accounted for by ore treatment residue which is attributed to the upstream chain of the power mix. Part of this radioactive waste is substituted in the End of Life.

Estimated impact

Table 8-2 below depicts the contributions by manufacturing and incinerating 1 cubic metre TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD MDF to the Greenhouse Warming Potential (GWP 100), Ozone Depletion Potential (ODP), Acidification Potential (AP), Eutrification Potential (EP) and Photochemical Ozone Creation Potential (summer smog potential POCP). The renewable primary energy (PE reg.) and non-renewable primary energy (PE ne) are also outlined.

Table 8-2: Absolute contributions to the effect categories under review by the manufacture and End of Life per cubic metre of finished TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD

		TOPAN ® MDF			TOPAN ® MDF FF		
Analysis factor	**Unit per m³**	**Total**	**Production**	**End of Life**	**Total**	**Production**	**End of Life**
Primary energy, non-renewable	[MJ]	-4,527	9,702	-14,229	-5,856	8,832	-14,688
Primary energy, renewable	[MJ]	12,717	12,886	-168.9	13,109	13,284	-174
Global Warming Potential (GWP 100)	[kg $CO_{2 equiv.}$]	-205.2	-621.0	415.8	-251	-679.7	429.2
Ozone Depletion Potential (ODP)	[kg R11 equiv.]	8.28 E-06	4.38 E-05	-3.55E-05	4.71 E-06	4.13E-05	-3.66 E-05
Acidification Potential (AP)	[kg SO_2 equiv]	2.71 E+00	1.53E+00	1.18E+00	2.31E+00	1.09E+00	1.22E+00
Eutrification Potential (EP)	[kg PO_4 equiv]	5.59E-01	3.35E-01	2.24E-01	3.90E-01	1.58E-01	2.32E-01
Summer smog (POCP)	kg ethene equiv	3.92E-01	4.07E-01	-1.49E-02	2.15E-01	2.31E-01	-1.54E-02
		AGEPAN ® DWD			AGEPAN ® HFD		
Analysis factor	**Unit per m³**	**Total**	**Production**	**End of Life**	**Total**	**Production**	**End of Life**
Primary energy, non-renewable	[MJ]	-4,905	7,396	-12,301	-1,786	2,694	-4,480
Primary energy, renewable	[MJ]	10,979	11,125	-146.0	3,998	4,052	-53.2
Global Warming Potential (GWP 100)	[kg $CO_{2 equiv.}$]	-209.8	-569.3	359.5	-76.4	-207.3	130.9
Ozone Depletion Potential (ODP)	[kg R11 equiv.]	3.94E-06	3.46E-05	-3.07E-05	1.44E-06	1.26E-05	-1.12E-05
Acidification Potential (AP)	[kg SO_2 equiv]	1.94E+00	9.17E-01	1.02E+00	7.05E-01	3.34E-01	3.71E-01
Eutrification Potential (EP)	[kg PO_4 equiv]	3.27E-01	1.33E-01	1.94E-01	1.19E-01	4.83E-02	7.06E-02
Summer smog (POCP)	kg ethene equiv	1.80E-01	1.93E-01	-1.29E-02	6.57E-02	7.04E-02	-4.70E-03

If the manufacturing system limit including the End of Life in a bio-mass power plant is taken into consideration, the significance of the type of utilisation and/or disposal over the entire life cycle becomes apparent from an environmental aspect. The additional emissions incurred as a result and/or any associated substitution effects in the energy supply system are depicted graphically in Fig. 8-5. The End-of-Life share depicted arises by offsetting the emissions produced in the incineration process against the emissions avoided for generating electricity and thermal energy. This involves the difference between the emissions of MDF incineration and the emissions avoided as a result in average energy generation (credits). Thanks to these substitution effects at the End of Life, the requisite volume of non-renewable and renewable energy carriers is reduced, and the Ozone Depletion Potential and POCP are also reduced minimally. All other environmental effect categories display increases as the substituted emissions are lower than the emissions arising in the incineration of MDF boards in the assumed bio-mass power plant.

Product group Wood materials
Declaration holder: Glunz AG
Declaration number: EPD-GLU-2010111-E

Created
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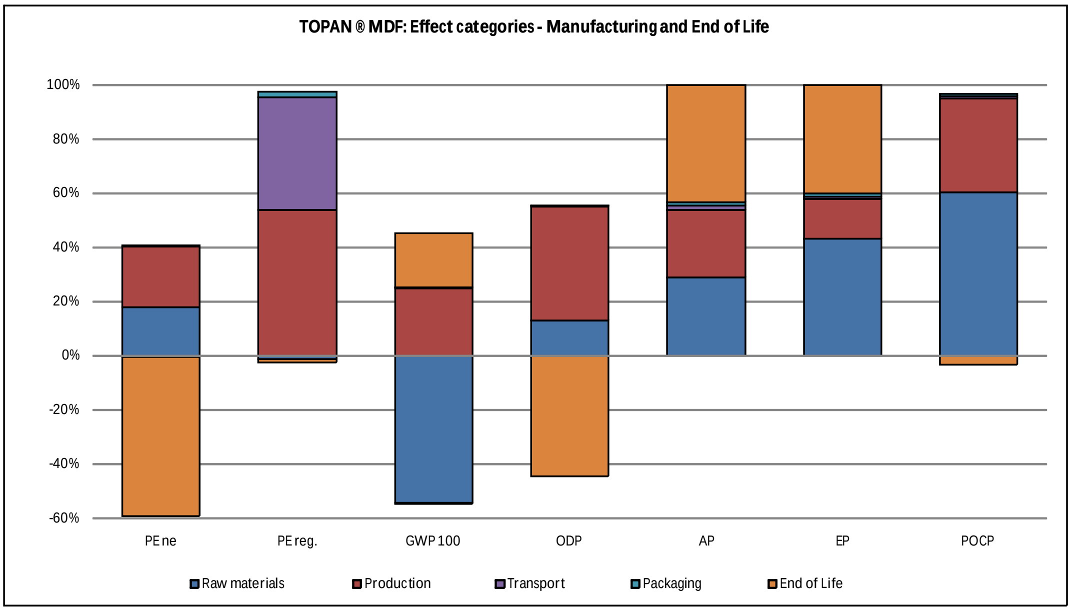

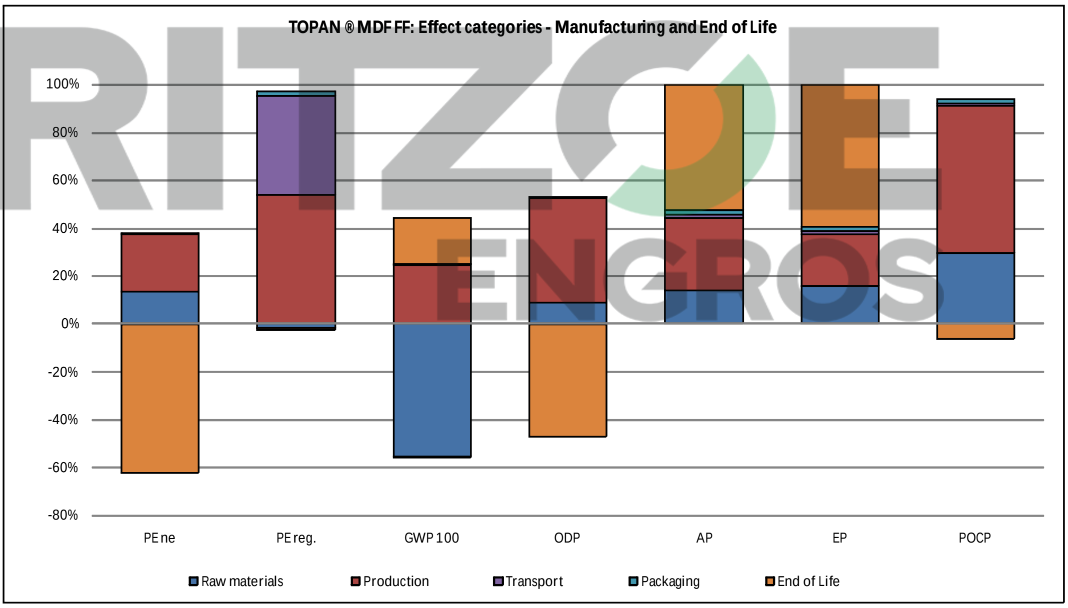

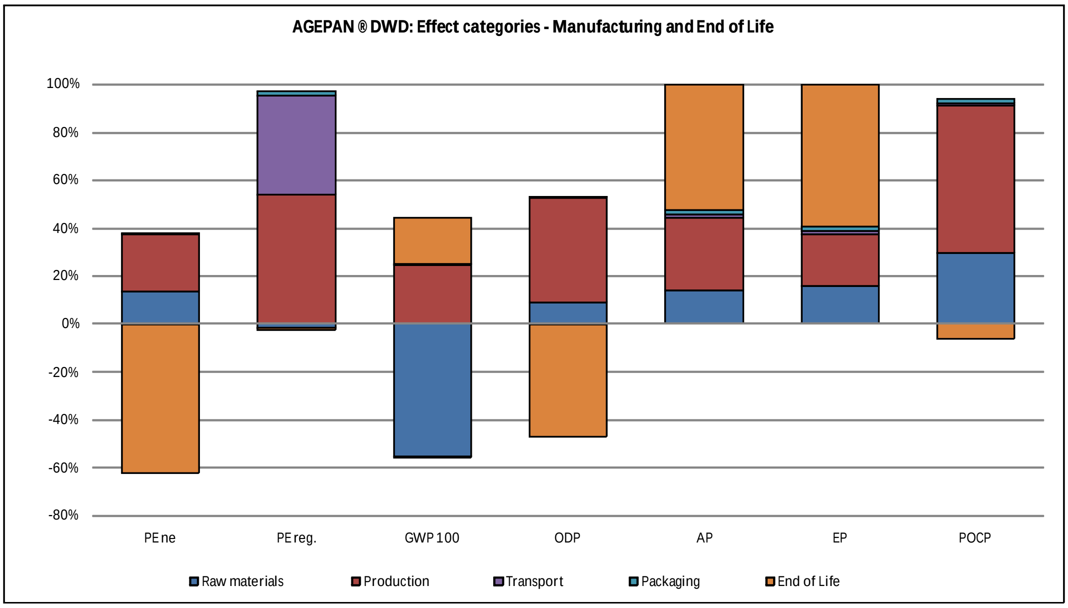

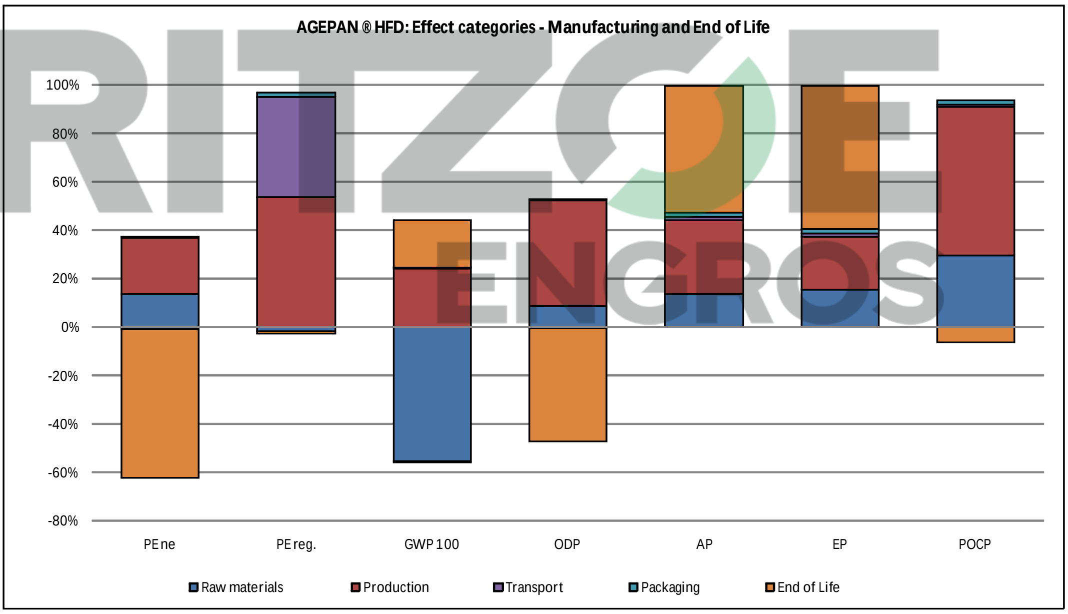

Fig. 8-5: Share of processes in the effect categories – System limit plant gate and incineration of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD boards at the End of Life

The **Greenhouse Warming Potential** is dominated by carbon dioxide in manufacturing. For each cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD, 1,363 / 1,408 / 1,179 / 429 kg of CO_2 are integrated in the sustainable raw materials required for production. This CO_2 integration by using wood is offset by other greenhouse CO_2 emissions in the provision of raw materials, production, transport and packaging. More than 99% of the emissions comprise carbon dioxide. An equivalent of approx. -621 / -680 / -569 / -207 kg of CO_2 is therefore incurred via manufacturing. The emission values at the End of Life are incurred by incineration minus the credit (substitution effects in the power mix as well as in average thermal energy for utilising energy from one cubic metre of finished TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board of 416 / 429 / 360 / 131 kg CO_2 equivalent).

Within the system under review (Manufacturing and End of Life), this therefore gives rise to a greenhouse potential of -205 / -250 / -210 / -76 kg of CO_2 equivalent per cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board.

The provision of raw materials (approx. 15-25%) and production (75-85%) essentially contribute towards the **Ozone Depletion Potential**. For each cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board, a total Ozone Depletion Potential of 4.38E-05 / 4.13E-05 / 3.46E-05 / 1.26E-05 kg of R_{11} equivalent is incurred in production. Substitution of electricity at the End of Life results in an Ozone Depletion Potential value of 8.28E-06 / 4.719E-06 / 3.94E-06 / 1.44E-06 kg of R_{11} equivalent in the system as a whole.

The provision of raw materials (around 30-50%), production (approx. 45-65%) and transport (approx. 2%) primarily contribute to the **Acidification Potential**. For each cubic metre of TOPAN® MDF / TOPAN® MDF FF / AGEPAN® DWD / AGEPAN® HFD board, 1.53 / 1.09 / 9.17E-01 / 3.34E-01 kg of SO_2 equivalent are emitted during the production phase. The EoL results in an Acidification Potential of 2.71 /2.31 / 1.94 / 0.71 kg of SO_2 equivalent in the system as a whole.

The provision of raw materials (30-70%) and production (25-60%) are the most significant contributing factors in terms of the **Eutrification Potential**. The Eutrification Potential is accounted for by 3.35E-01 / 1.58E-01 / 1.33E-01 / 4.83E-02 kg of phosphate equivalent in manufacturing. The EoL further increases the Eutrification Potential taking consideration of the substitution effects to 5.59E-01 / 3.90E-01 / 3.27E-01 / 1.19E-01 kg of phosphate equivalent.

The provision of raw materials contributes approx. 28-58% and production accounts for 40-70% of the **Photochemical Ozone Creation Potential** (POCP near-ground zone formation). All in all, the POCP within the plant gate system limit accounts for 4.07E-01 / 2.31E-01 / 1.93E-01 / 7.04E-02 kg of ethene equivalent. The EoL decreases the POCP by means of energy substitution to 3.92E-01 / 2.15E-01 / 1.80E-01 / 6.57E-02 kg of ethene equivalent.

9 Documentation

9.1 Formaldehyde

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany

Test reports, date: 31/09/7628/05E MDF FF, 12 mm, dated 5 October 2009
31/09/7628/03E Topan MDF boards, to 40 mm, dated 5 October 2009

Result: In terms of formaldehyde content, the MDF boards examined in accordance with DIN EN 120 comply with the requirements of the DIBt 100 "Guideline governing classification and monitoring of wood boards as regards formaldehyde emissions" and correspond with E1 quality, i.e. the formaldehyde emissions in a standardised test area are less than 0.1ppm. The requirements of the German Chemicals Prohibition Regulation (ChemVerbotsV) dated 19 July 1996 are therefore fulfilled.

9.2 MDI

Measuring agency: Wessling Beratende Ingenieure GmbH, Altenberg, Germany

Test report, date: IAL-09-0566 dated 12 January 2010

Result: Test chamber analysis of wooden materials (MDI). The analysis was carried out in accordance with the test guidelines of the RAL Environmental Label 76 (wooden materials). No emissions of monomer MDI and other isocyanates in the test chamber could be detected. The detection limit was 0.1µg/m^3.

9.3 Eluate analysis

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany

Test report, date: 31/09/1322/02 Topan MDF boards, dated 23 September 2009

Result: Migration of heavy metals in accordance with DIN EN 71-3. In accordance with this standard, the concentration of all elements examined was below the limit of 1/10 of the limit value. Limit values: As 1.25 mg/kg, Sb, Cd, Cr, Pb and Hg 2.5 mg/kg, Se 25 mg/kg, Ba 50 mg/kg.

9.4 EOX (Extractable Organic Halogen Compounds)

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany

Test report, date: 31/09/1322/03 Topan MDF boards, dated 23 September 2009

Result: EOX in accordance with DIN 38414-S 17. The concentration of the parameters examined is under the detection limit of 1 mg/kg.

9.5 PCP / Lindane

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany

Test report, date: 31/09/7835/05 Topan MDF boards, dated 20 September 2009

Result: The wood preservative agents pentachlorophenol (PCP) and lindane could not be determined in the board section examined. Limit of determination: 0.10 mg/kg

10 PCR document and examination

This Declaration is based on the "Wood Materials" PCR document, 2009-11.

Review of the PCR document by the Expert Committee. Chairman of the Expert Committee: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent examination of the Declaration in accordance with ISO 14025: ☐ internal ☒ external
Validation of the Declaration: Dr. Frank Werner

11 Literature

Institut Bauen und Umwelt	Institut Bauen und Umwelt e.V. (pub.), Guidelines on formulating the product-specific requirements of the Environmental Product Declarations (Type III) for building products, www.bau-umwelt.com
PCR wood materials	Institut Bauen und Umwelt e.V. (pub.), PCR Wood Materials; www.bau-umwelt.com; valid as at November 2009
GaBi 2006	GaBi 4: Software and data base for comprehensive analysis. PE INTERNATIONAL GmbH, Leinfelden-Echterdingen, 2006
Schweinle & Thoroe	J. Schweinle and C. Thoroe 2001: Vergleichende Ökobilanzierung der Rundholzproduktion in verschiedenen Forstbetrieben (Comparable ecological analysis of roundwood production in various forestries). Information supplied by the German Research Institute for Forestry and the Wood industry, Hamburg No. 204

Standards and legislation

ISO 14040	DIN EN ISO 14040:2006-10, Environment Management – Life Cycle Assessment – Basic Principles and Framework Conditions (ISO 14040:2006); German and English versions EN ISO 14040:2006
ISO 14044	DIN EN ISO 14044:2006-10, Environment Management – Life Cycle Assessment – Requirements and Instructions (ISO 14044:2006); German and English versions EN ISO 14044:2006
DIN EN 120	DIN EN 120:1992-08: Wood materials; Determining the formaldehyde content; extraction process referred to as the Perforator Method; German version EN 120:1992
DIN EN 13171	DIN EN 13171:2009-02: Thermal insulation materials for buildings - Fabricated products made of wood fibres (WF) - Specifications; German version EN 13171:2008
DIN 1052	DIN 1052:2008-12, Design, Calculation and Measurement of Wooden Structures - General design rules and design rules for structural engineering
DIN 4108-10	DIN 4108-10:2008-06, Thermal Protection and Saving Energy in Buildings – Part 10: Application-related requirements on thermal insulation materials - Fabricated thermal insulation materials
DIN EN 13501-1	DIN EN 13501-1:20010-01, Classification of Building Products and Methods by Fire Performance – Part 1: Classification with the results of tests on fire performance by building products; German version EN 13501-1:2007 + A1:2009
DIN 4102-1	DIN 4102-1:1998-05, Fire Performance of Building Materials and Components – Part 1: Building Materials, Terms, Requirements and Tests
DIN 38414-17	DIN 38414-17:2004-03, German standard method for examining water, waste water and sludge - Sludge and sediment (Group S) - Part 17: Determining extractable organically-bound halogens (EOX) (page 17)
DIN EN 71-3	DIN EN 71-3: 2002-11, Toy Safety - Part 3: Migration of certain elements; German version EN 71-3:1994 + A1:2000 + AC:2002-11
DIN EN 316	DIN EN 316:2009-07, Wood Fibreboards - Definition, Classification and Abbreviations; German version EN 316:2009
DIN EN 14964	DIN EN 14964:2007-01, Rigid Underlays for Roofing - Definitions and properties; German version EN 14964:2006

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