Environmental Product Declaration

according to ISO 14025

Direct Pressure Laminate Floor Covering

EPLF®
European Producers of Laminate Flooring e.V.

Number of declaration
EPD-ELF-2009111-E

Institut Bauen und Umwelt e.V.
www.bau-umwelt.com

Institut Bauen und Umwelt e.V.

Summary

Environmental Product-Declaration

Institut Bauen und Umwelt e.V. **www.bau-umwelt.com**	**Program operator**
EPLF® European Producers of Laminate Flooring e.V. Mittelstr. 50 33602 Bielefeld Germany	**Declaration holder**
EPD-ELF-2009111-E	**Declaration number**
Direct Pressure Laminate Floor Covering (DPL Floor Covering) This declaration is an environmental product declaration according to ISO 14025 describing the environmental performances of the construction products mentioned. It shall promote the development of the sustainable and health-friendly building. In this validated declaration, all relevant environmental data are disclosed. The declaration is based on the PCR document "floor coverings", year 2008-01.	**Declared building product**
This validated declaration authorises the use of the label of Institut Bauen und Umwelt. It exclusively applies for the products mentioned, three years from date of issue. The holder of the declaration is liable for underlying data and supporting documents.	**Validity**
The declaration is complete and furnishes details of: - product definition and relevant building-physics-related information - raw materials and origin of the raw materials - descriptions of the product manufacture - information on product processing - information on the use stage, extraordinary influences and end-of-life stage - results of the life cycle assessment	**Content of declaration**
11. August 2009	**Date of issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of IBU)	**Signatures**

This declaration was independently verified by the advisory board (SVA), according to ISO 14025.		**Verification of the declaration**
		Signatures
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the SVA)	Dr. Eva Schmincke (Verifier appointed by SVA)	

Summary

Environmental Product-Declaration

Product description

This Environmental Product Declaration refers to an average European Direct Pressure Laminate Floor Covering (DPL Floor Covering).

Laminate floorings are made up of a number of layers. On the top side is a decor with a transparent, wear-resistant surface layer; in the middle is a core layer made of wood fibre and on the back side is a backing to provide floor stability. The decorative paper of a laminate floor can be printed with any design at all and gives the floor its individual appearance.

Range of application

The laminate floor coverings meet the requirements of the use classes according to EN 13329. Additional technical characteristics of a specific laminate floor covering can not be taken from this average EPD. This information has to be taken from the technical datasheets of a specific product.

Scope of the life cycle assessment

The Life Cycle Assessment (LCA) was carried out according to DIN ISO 14040 ff. corresponding to the requirements of the Product Category Rules (PCR) for "floor coverings". Specific data from member companies of the EPLF as well as data from the “GaBi 4” LCA software were used as the data base. This life cycle assessment covers the following life cycle stages:

- Production of the raw materials, production of the floor covering including the packaging
- Installation
- Use
- End of life

For all stages the respective energy consumption and transport data are considered.

Results of the life cycle assessment

The results are given for 1m² of laminate floor covering with a minimum thickness of 6 mm and a maximum thickness of 12 mm.

Energy consumption and LCA results for the delivery, installation and use stage are described in the complete version of this EPD.

Category	Unit	Production		End of Life	
		1m² (6mm)	1m² (12mm)	1m² (6mm)	1m² (12mm)
Primary energy of non renewable resources	[MJ]	128.1	191.0	-55.8	-105.3
Primary energy of renewable resources	[MJ]	90.9	176.4	-1.4	-2.6
Global warming potential (GWP)	[kg CO_2-Äqv.]	-0.08	-3.23	5.13	10.2
Ozone depletion potential (ODP)	[kg R11-Äqv.]	8.89E-07	1.33E-06	-2.17E-07	-4.09E-07
Acidification potential (AP)	[kg SO_2-Äqv.]	0.029	0.043	0.0094	0.018
Eutrophication potential (NP)	[kg PO_4-Äqv.]	0.006	0.0099	0.0027	0.0051
Photochemical oxidant formation (POCP)	[kg Ethen-Äqv.]	4.2E-03	0.007	6.6E-05	0.00013

Evidence and verification

Evidence and test results can be taken from the technical data sheets of a specific laminate floor covering (e.g. CE-Labelling, AgBB)

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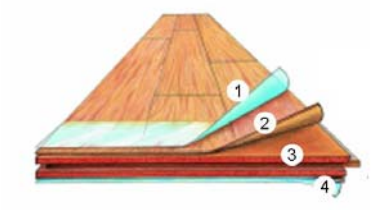
0 Product definition

0.1 Product description

This Environmental Product Declaration refers to an average European DPL floor covering produced by manufacturers that are members of EPLF®.

Direct Pressure Laminate Floor Covering (DPL Floor Covering)



1. Surface layer (Overlay)
2. Surface layer (Decorative paper)
3. Substrate (Core board)
4. Backing (stabilizer layer)

Laminate floor coverings described in this EPD are produced at European DPL floor covering production sites by member companies of EPLF®, they meet the requirements of /EN 13329/:

Laminate floorings are made up of a number of layers. On the top side is a decor with a transparent, wear-resistant contact surface; in the middle is a core layer made of high density wood fibre and on the back side is a stabilizing layer to guarantee floor stability. The decorative paper of a laminate floor can be printed with any design at all and gives the floor its individual appearance.

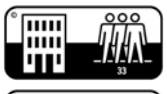
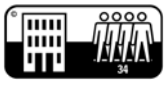
This EPD covers the environmental impact of 1m² DPL floor covering with a thickness of min. 6 mm to max. 12 mm as shown in table 1:

Table 1: Thickness of laminate floor coverings

Characteristics	Value		Unit
	min	max	
Thickness of laminate floor covering	6	12	[mm]

0.2 Range of Application

The laminate floor coverings described in this EPD meet the requirements of the use classes according to /EN 13329/

Level of use	Domestic	Commercial
Moderate		
General		
Heavy and very heavy		 

Technical characteristics of a specific laminate floor covering have to be taken from the technical datasheets of a specific product.

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0.3 Product Standard /Approval

The following standards/approvals apply for the DPL product group:

/EN 13329/ Laminate floor covering –Elements with a surface layer based on amino plastic thermosetting resins- Specifications, requirements and test methods
/EN 685/ Resilient, textile and laminate floor coverings –Classification
/EN 14041/ Resilient, textile and laminate floor coverings –Essential characteristics
/EN 13501-1/ Fire classification of construction products and building elements

0.4 Accreditation

Not relevant for average EPD.

0.5 Delivery status

The scope of delivery conditions for the product group is described in table 2. Specific information of the delivery status for a specific product can be taken from the individual specifications of a floor covering, e.g. marked on the floor covering's packaging.

Table 2: Characteristics of laminate floor coverings

Characteristics	Value		Unit
	min	max	
Thickness of the element	6	12	[mm]
Length of the surface layer	300	2500	[mm]
Width of the surface layer	70	400	[mm]
Length and width of squared elements	250	650	[mm]
Density	800	1200	[kg/m³]

Laminate floor coverings which comply with the requirements of /EN 13329/ shall have the following information clearly marked by the manufacturer, either on their packaging, or on a label or information sheet included in the packaging:
a) reference to /EN 13329/;
b) manufacturer's and/or supplier's identification;
c) product name;
d) colour/pattern and batch number;
e) symbol appropriate to the class of product according to chapter 0.2;
f) nominal dimensions of one floor covering element in millimetres;
g) number of elements contained in a packaging unit;
h) area in square metres contained in a packaging unit.

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1 Material content

1.1 Material content of the product

Table 3 describes the material content of the product in delivery condition.

Table 3: Material content of the product

Component	Material	mass [%]		Renewable resources	availability	origin
		6mm	12mm			
Core	HDF	87,8	93,6	yes	abundant	Europe
Surface layer Overlay	paper	0,6	0,3	yes	abundant	Europe
	resin	2,3	1,2	no	limited	Europe
	corundum	0,5	0,3	no	abundant	global
Surface layer Decor	paper	1,5	0,8	yes	abundant	Europe
	resin	1,9	1	no	limited	Europe
Backing Balance paper	paper	2,2	1,1	yes	abundant	Europe
	resin	3,2	1,7	no	limited	Europe

1.2 Production of main materials

HDF (high density fibreboard)

The core board is an HDF board composed of wood fibres and a thermosetting resin, mainly MUF (melamine-urea-formaldehyde).

Paper

The renewable resource wood is the main raw material for paper production.

Resins

The used amino resins are melamine-urea-formaldehyde resins. Amino resins are thermosetting resins that are cured using heat and pressure. They are made by combining an aldehyde with a compound that contains an amino (-NH_2) group.

Corundum (Al_2O_3)

Bauxite is the mineral resource of corundum. By using Al_2O_3 the surface layer of a laminate obtains abrasion and wear resistance.

2 Production of the floor covering

2.1 Production process

Illustration of the production process of DPL laminate floor coverings:

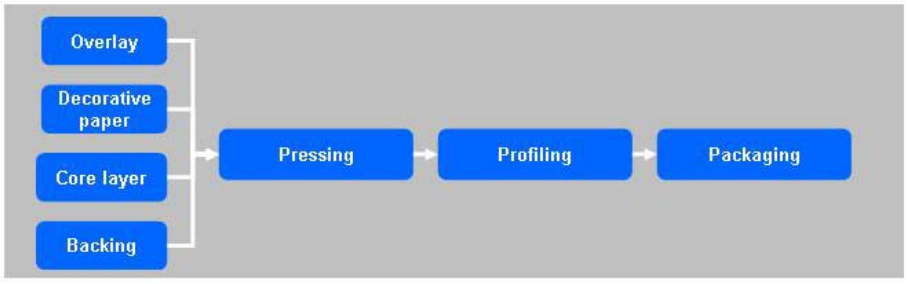

Figure 1: DPL production process

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The main materials for the production of DPL floor coverings are paper, resins and, with a percentage of more than 87%, the HDF core board. The HDF board production is included in the LCA, it is usually purchased and sometimes produced by the manufacturer himself.

Pressing:

The resin impregnated papers (overlay, décor, backing) are pressed under heat with the wood fibre core layer in a single stage process. In this process the resin cures.

Profiling:

The pressed boards are cut to size and equipped with the tongue-and-groove assembly system.

Packaging:

Laminate floorings are generally unit-packed and edge-protected using ribbed cardboard and shrink-wrapped in foil.

2.2 Health, safety and environmental aspects during production

The constitutional valid EU regulations as well as the furthermore provisions of national law in the country of production are observed.

Water: The use of water in the laminate flooring production process is negligible. Where water is needed, it either evaporates or is re-used in the internal water loop.

Soil: There is no impact on soil.

Air: The constitutional valid regulations are observed. The emissions to air are far below the legally required thresholds.

3 Delivery and installation of the floor covering

3.1 Delivery

In general the delivery of laminate floor coverings is carried out on the road by trucks (14-20t truck, 85% load). The average transport distance for the delivery of DPL floor coverings to the end consumer in Europe is approx. 250 km. During storage and transportation, it is important that the packing units are not exposed to wet conditions (rain) and unnecessary exposure to wind and weather should also be avoided.

3.2 Installation

Laminate floor coverings are generally installed floating. This means the floor covering is not fixed to the sub floor using glue, nails etc. The floor covering panels are mainly mechanically assembled glue-less by means of tongue and groove. Underlay material is needed when installing laminate floor coverings in order to achieve a levelling effect, thermal or acoustical insulation or protection against rising dampness. The following underlayment materials are generally used:

- synthetic foams
- renewable materials
- synthetic fibres
- others

Information about the installation of laminate floor coverings can be taken from the Code of Practice - Installation of Laminate Flooring (www.eplf.com). This Code of Practice provides general information. The installation instructions provided by the laminate flooring manufacturer or supplier are binding.

3.3 Health, safety, and environmental as-

Appropriate means for protection against saw dust must be taken.

pects during installation

3.4 Waste

Post-installation laminate floor covering waste may be recycled as wood based products (e.g. furniture, particle boards). When appropriate recycling facilities do not exist, laminate floor covering waste shall be thermally recycled.

3.5 Packaging

Packaging requirements according to /EN 13329/:
Laminate floor coverings shall be delivered in packages designed to protect the corners, edges and surfaces of the product, under normal conditions of transport and handling.
Laminate flooring is accordingly unit-packed and edge-protected using ribbed cardboard and shrink-wrapped in foil. These packaging materials shall be collected separately and be recycled.
Pallets that are used for the delivery can either be re-used (Euro pallets) or recycled as wood.

4 Use stage

4.1 Use of the floor covering

Laminate floor coverings described in this EPD meet the requirements of the use classes mentioned in chapter 0.2

For this area of application, a minimum reference service life of 15 years can be assumed or longer if mentioned in the manufacturer's guarantee conditions. The technical service life can be longer.

4.1.1 Cleaning and maintenance

The regular cleaning of laminate floor coverings should be carried out according to the information on the Data Sheet on Cleaning provided by EPLF (www.eplf.com).

The common cleaning method for laminate floor coverings is damp mopping. Loose dirt should be removed by means of a dry mop or a vacuum cleaner.

To model the environmental impact of the use stage within the scope of sustainable buildings, the cleaning methods and frequencies described in table 4 are considered:

Table 4: Cleaning instructions

Level of use	Cleaning process	Cleaning frequency (times)	Consumption
domestic	Damp mopping	1 per week	water, surfactants
domestic	Vacuum cleaning	2 per month	electricity
commercial	Damp mopping	4 per week	water, surfactants
commercial	Vacuum cleaning	4 per month	electricity

4.1.2 Prevention of structural damage

To prevent structural damage, it is important to choose a laminate floor covering in accordance with the intended use conditions and install it in accordance to the manufacturer's installation instructions (see also chapter 3.2).

4.2 Health aspects during usage

Laminate floor coverings described in this EPD fulfil the requirements according to /EN 14041/ (CE Labelling) and national requirements e.g. /AgBB scheme/ in Germany.

According to the technical position paper of Fraunhofer Wilhelm-Klauditz-Institut Holzforschung in Braunschweig (Germany), laminate floor coverings are in general very low emitting (www.eplf.com) /WKI/.

5 Singular effects

5.1 Fire

The reaction to fire (fire classification incl. smoke development) is determined according to /EN 14041/. The classes of reaction to fire of an individual product can be taken from the CE-labelling of the product on the packaging or the technical data sheet.

5.2 Water

An appropriate DPM (Damp Proof Membrane) needs to be installed under laminate floor coverings in order to hold back potential rising dampness. Exposure to moisture during a longer period of time can lead to irreversible destruction of the material.

5.3 Mechanical damage

Choosing the right floor covering and underlayment in accordance with application area and taking the precautions recommended by the manufacturer should prevent mechanical damage. The cleaning and maintenance instructions of the manufacturer shall be followed.

6 End of life stage

The post-consumer laminate floor covering waste can be classified according to the „European Waste Catalogue“/EWC/. The main category is:
17 construction and demolition wastes / EWC code 170201 wood.

Other classifications according to the local waste management systems are also possible.

6.1 Recycling or re-use

Post-consumer laminate floor covering waste can be recycled as wood based products. When appropriate recycling facilities do not exist, laminate floor coverings shall be thermally recycled.

A reinstallation of laminate floor coverings is possible.

6.2 Disposal

The laminate floor coverings should be recycled or re-used (see 6.1).

7 Life cycle assessment

7.1 General

The LCA covers all life cycle stages from cradle to grave.

7.2 Functional unit

The functional unit is 1 m² laminate floor covering for a reference service life of 15 years.

7.3 Cut-off criteria

The cut-off criteria described in the /PCR/ are applied. Input data for energy usage and mass are sufficiently available and considered in the LCA.

7.4 Allocation

According to /ISO 14044/, allocation is defined as partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems. In case the LCI data of the companies differ, allocation is based on the companies' market shares. For the end of life a thermal recycling of post-consumer laminate flooring waste in a Waste Incineration Plant (WIP) is considered. The respective credit for energy substitution is based on a European electric power and steam mix.

7.5 Background data

The used background data are the International Reference Life Cycle Data System (ILCD) integrated in the GABI software and the /GABI 4/ background database. For thermal and electric energy average European background data are used.

7.6 Data quality

The age of the used data is less than five years. The data of the foreground processes is based on input-output analyses at European production sites (Belgium, Germany and /BASF/-study).

7.7 System boundary

The LCA considers all life cycle stages from cradle to grave.
The **production stage** includes all relevant processes from "cradle to factory gate" within the cut off rules. This includes for example the extraction and manufacture of all raw materials and their delivery to the production site, the manufacturing of floor coverings from raw materials, storage and transports. Packaging is included.

The **installation** includes the delivery of the laminate floor covering to the point of installation and its fitting. For the fitting waste and the packaging material a thermal recycling in a WIP is considered. Underlayment necessary for the fitting is not included.

The **use stage** includes the cleaning of the laminate floor covering for the 15 year reference service life. The cleaning frequencies described in table 4 are considered for an average level of use (90% domestic and 10% commercial), according to the market shares of distribution.

The **end of life stage** includes the transport of the floor covering to the end of life processes. In this LCA thermal recycling of post consumer laminate flooring waste in a WIP is considered. All waste management processes are included in the calculation until final deposition, with the exception of the deposition of nuclear waste, which cannot be modelled due to its extremely long deposition times.

7.8 Note on use stage

The estimated service life of a floor covering depends e.g. on the type of floor covering and the area of application, the user himself and the maintenance of the product. Comparisons of different floor coverings are only allowed, if these parameters are considered in a consistent way.

In the LCA, the results are declared for a 15-year reference service life.

7.9 Results of the assessment

The LCA results are given in the following tables.

7.9.1 Production stage

Table 5: LCI and LCA results for the production stage

Parameter	Unit per m²	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Primary energy, non-renewable	[MJ]	128.1	191.0
Primary energy, renewable	[MJ]	90.9	176.4
Global warming potential (GWP 100)	[kg CO_2-eqv.]	-0.08	-3.23
Ozone depletion potential (ODP)	[kg R11-eqv.]	8.89E-07	1.33E-06
Acidification potential (AP)	[kg SO_2-eqv.]	0.029	0.043
Eutrophication potential (EP)	[kg PO_4-eqv.]	0.006	0.0099
Photochemical oxidation formation potential (POCP)	[kg ethylene-eqv.]	4.2E-03	0.007

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7.9.2 Installation

Table 6: LCI and LCA results for the delivery and installation

Parameter	Unit per m²	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Primary energy, non-renewable	[MJ]	-0.09	1.27
Primary energy, renewable	[MJ]	-0.03	-0.03
Global warming potential (GWP 100)	[kg CO_2-eqv.]	0.24	0.33
Ozone depletion potential (ODP)	[kg R11-eqv.]	-4.69E-09	-4.5E-09
Acidification potential (AP)	[kg SO_2-eqv.]	0.00063	0.00123
Eutrophication potential (EP)	[kg PO_4-eqv.]	1.23E-04	2.26E-04
Photochemical oxidation formation potential (POCP)	[kg ethylene-eqv.]	5.08E-05	1.0E-04

7.9.3 Use stage

Table 7: LCI and LCA results for the use stage

Parameter	Unit per m²	1m² laminate floor covering
Primary energy, non-renewable	[MJ]	1.7
Primary energy, renewable	[MJ]	0.08
Global warming potential (GWP 100)	[kg CO_2-eqv.]	0.25
Ozone depletion potential (ODP)	[kg R11-eqv.]	1.24E-08
Acidification potential (AP)	[kg SO_2-eqv.]	0.00072
Eutrophication potential (EP)	[kg PO_4-eqv.]	0.00019
Photochemical oxidation formation potential (POCP)	[kg ethylene-eqv.]	4.33E-05

The values are given for a **one-year** usage. For the modelling of the whole life cycle these values have to be multiplied with the respective service life.

7.9.4 End of life stage

Table 8: LCI and LCA results for the end of life stage

Parameter	Unit per m²	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Primary energy, non-renewable	[MJ]	-55.8	-105.3
Primary energy, renewable	[MJ]	-1.4	-2.6
Global warming potential (GWP 100)	[kg CO_2-eqv.]	5.31	10.2
Ozone depletion potential (ODP)	[kg R11-eqv.]	-2.17E-07	-4.09E-07

Acidification potential (AP)	[kg SO_2-eqv.]	0.0094	0.018
Eutrophication potential (EP)	[kg PO_4-eqv.]	0.0027	0.0051
Photochemical oxidation formation potential (POCP)	[kg ethylene-eqv.]	0.000066	0.00013

7.10 Life cycle inventory analysis

The following chapters describe the LCI parameters required by the PCR floor covering for 1m² of laminate floor covering. All life cycle stages are considered for a 15-year use.

7.10.1 Primary energy

Figure 2 shows the **renewable primary energy** consumption for 1m² of laminate floor covering subdivided in the different life cycle stages: production, delivery to the point of installation, fitting, cleaning and end of life, for a 15-year reference service life.

The **renewable primary energy** mainly results from the production process. The influence of the other life cycle stages is negligible.

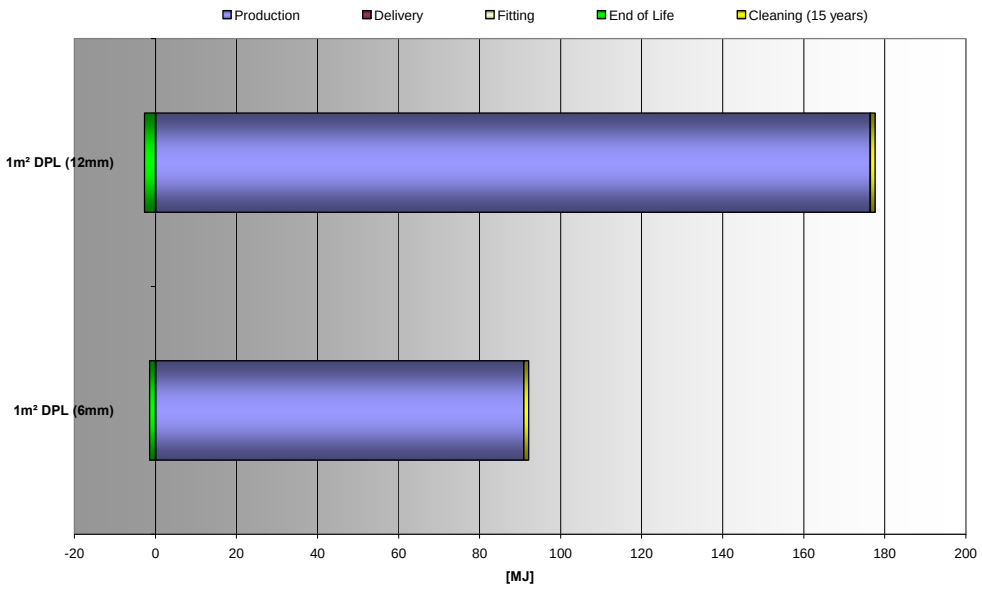

Figure 2: Consumption of renewable primary energy for the whole life cycle (15 years reference service life)

Figure 3 shows the **non-renewable primary energy** consumption for 1m² of laminate floor covering subdivided into the different life cycle stages.

The **non-renewable primary energy** consumption is mainly determined by the production process. Delivery and fitting have only marginal effects. Cleaning per 15 years requires an amount of 26 MJ/m². The credit for the non-renewable primary energy results from thermal recycling (energy substitution) of the post consumer laminate waste.

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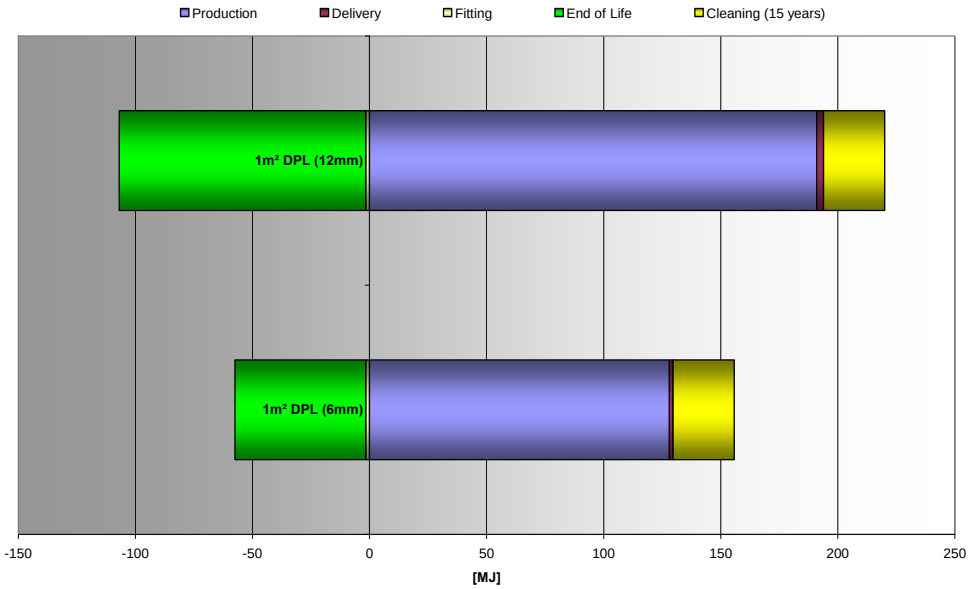

Figure 3: Consumption of non-renewable primary energy for the whole life cycle (15 years reference service life)

In table 9 the balance of consumed primary energy for a 15-year usage and the end of life credit from energy substitution for the laminate floor coverings are listed.

Table 9: Balance of primary energy consumption for whole life cycle (15 years)

Parameter	Unit per m²	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Primary energy, non-renewable	[MJ]	98.3	113.1
Primary energy, renewable	[MJ]	90.7	174.9

Figure 4 breaks down the consumption of **non-renewable** and **renewable primary energy** for the **production stage** of 1m² DPL floor covering.

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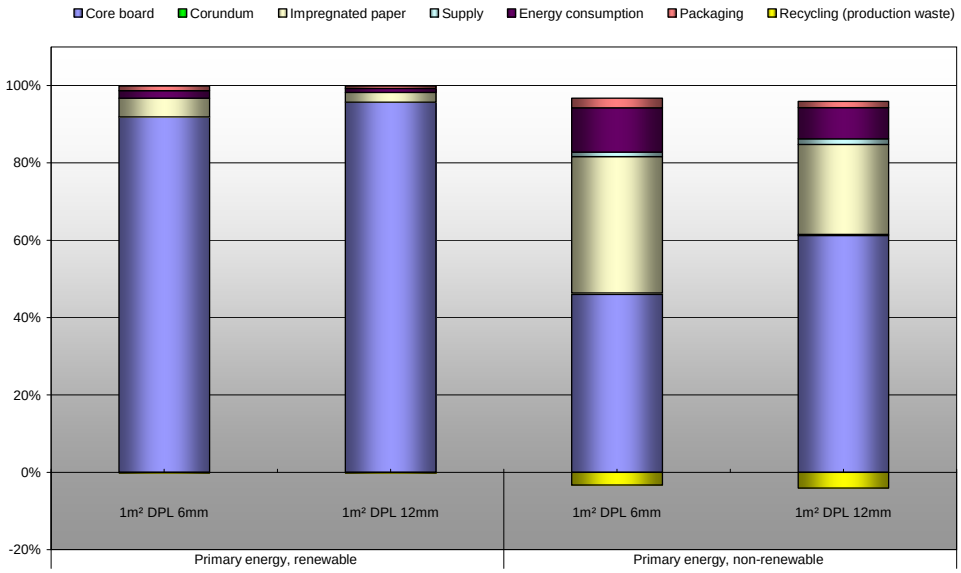

Figure 4: Contribution of production parameters to primary energy consumption

More than 92% of **renewable primary** energy consumption results from the core board, this is mainly the sunlight energy locked into the wood by photosynthesis.

Depending on the thickness of the laminate floor covering, 46% to 61% of the **non-renewable** primary energy consumption results from the production of the core board. For the provision of impregnated paper 25% to 37% are consumed, this share is mainly determined by the resin used for the impregnation (> 90%). The production relevant energy consumption (thermal and electric) has a share of 8 to 12%. Packaging (1%-3%) and corundum (<0.5%) play a secondary role. The thermal recycling (energy substitution) of production waste results in a credit of approx. 3%.

Figure 5 specifies the **non-renewable** resources for the primary energy consumption.

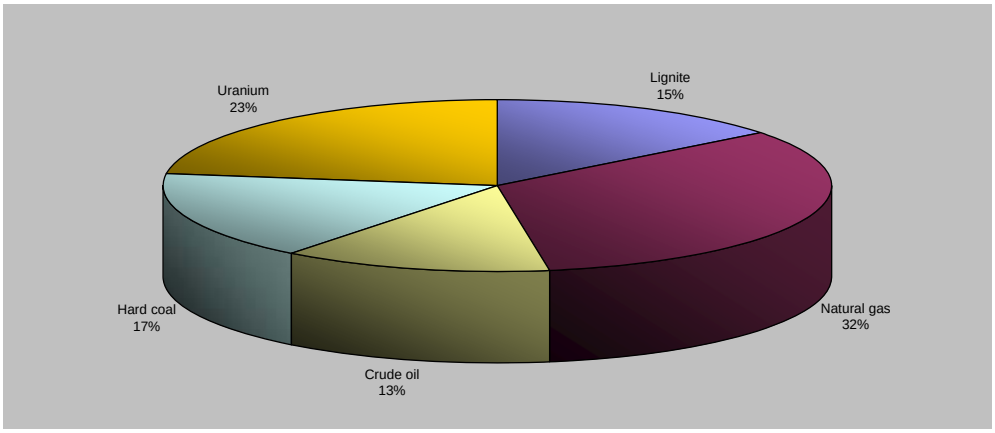

Figure 5: Breakdown of non-renewable resources (15 years reference service life)

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7.10.2 Non-renewable material resources

Non renewable material resources are of fossil or mineral origin. They are either used as energy source or as raw material for the product.

The non-renewable resources used as energy source are described in chapter 7.10.1. The non-renewable mineral resources are >93% overburden, which is in general removed by mining, a background processes for energy generation.

7.10.3 Water consumption

Table 10: Water consumption

Parameter	Unit	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Production stage	[l/m²]	53.6	69.1
Delivery and fitting	[l/m²]	0.2	0.2
Use stage	[l/m²]	18.1	18.1
End of life	[l/m²]	6.9	12.9

The water consumption is the aggregated value of input and output. Water that is used for floor cleaning (approx. 7 l/m² and year) goes back into the water cycle after wastewater treatment.

7.10.4 Waste

Table 11: Waste

Parameter	Unit	1m² laminate floor covering (6 mm thickness)	1m² laminate floor covering (12 mm thickness)
Overburden/Sedimentation			
Production stage	[kg/m²]	13.8	25.3
Delivery and fitting	[kg/m²]	-0.0594	-0.056
Use stage	[kg/m²]	2.5	2.5
End of life	[kg/m²]	-2.4	-4.5
Municipal waste			
Production stage	[kg/m²]	0.0266	0.0322
Delivery and fitting	[kg/m²]	5.00E-08	5.00E-08
Use stage	[kg/m²]	0.027	0.027
End of life	[kg/m²]	4.16E-05	7.8E-05
Hazardous and nuclear waste			
Production stage	[kg/m²]	0.019	0.034
Delivery and fitting	[kg/m²]	0.002	0.002
Use stage	[kg/m²]	0.002	0.002
End of life	[kg/m²]	-0.002	-0.004

7.11 Life cycle impact assessment

The life cycle impact assessment is defined as a phase of life cycle assessment with the objective of understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the Product /ISO 14044/. The following parameters, based on CML 2002 /CML 2002/ are considered /GABI 4/:

Global Warming Potential (GWP 100)
The Global Warming Potential, an indicator that refers to the amount of global warming caused by a substance. The GWP is the ratio of the warming caused by a substance to the warming generated by a similar mass of carbon dioxide. GWP100 translates the quantity of emission of gases into a common measure to compare their contributions - relative to carbon dioxide - to the absorption of infrared radiation in a 100 year perspective.

Acidification Potential (AP)
Acidification potential is the result of aggregating acid, expressed in SO2 equivalents. The AP is an important environmental indicator. Acidification potential translates the quantity of emission of substances into a common measure to compare their contributions to the capacity of releasing hydrogen ions. Acidification originates from the emissions of sulphur dioxide and oxides of nitrogen. In the atmosphere, these oxides react with water vapour and form acids which subsequently fall down to earth in the form of rain or snow or as dry depositions.

Ozone depletion potential (ODP)
The ODP is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11. The ODP of CFC-11 itself is defined to be 1.0. Other ozone-depleting substances have ODPs ranging from 0.02 to 10. Ozone forms a layer in the stratosphere protecting plants and animals from much of the sun's harmful UV-radiation. The ozone levels have declined as a consequence of CFCs and halons released into the atmosphere. A depletion of the ozone layer will increase the UV-radiation at ground level.

Photochemical ozone creation potential (POCP)
Photochemical ozone or ground level ozone is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. Ground-level ozone forms readily in the atmosphere, usually during hot summer weather. Photochemical ozone creation potential translates the quantity of emission of gases into a common measure to compare their contributions - relative to ethylene - to the formation of photochemical oxidants, measured in kg C2H4- Equivalent.

Eutrophication Potential (EP)
Index used to measure nutrient enrichment (eutrophication), which may result in algal blooms, caused by the release of sulphur, nitrogen, phosphorous and degradable organic substances into the atmosphere and water courses.

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Figure 6 shows the percentage of all life cycle stages of 1m² DPL floor covering related to the impact categories.

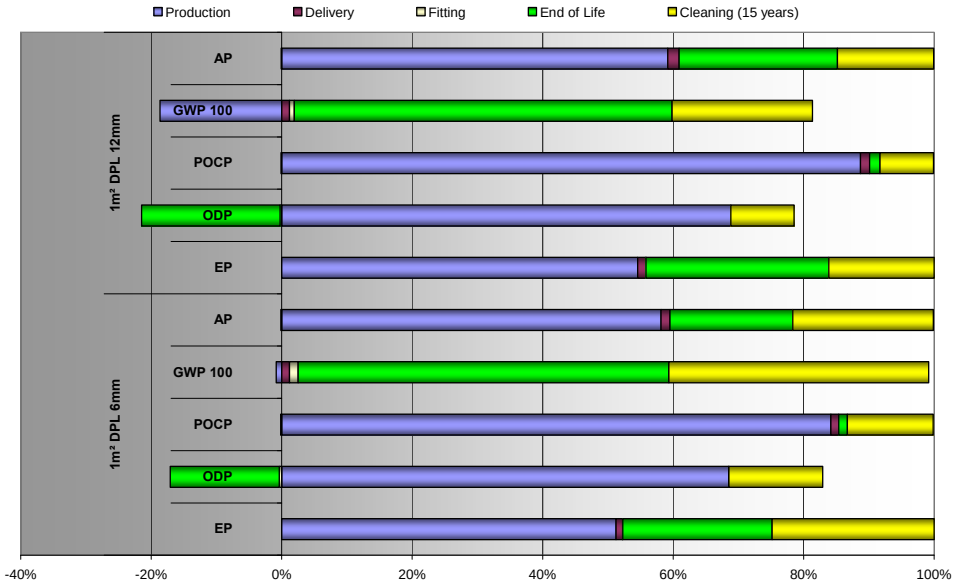

Figure 6: Breakdown of LCA impact categories for all life cycle stages

The balance shows credits for GWP 100 and ODP. The greenhouse gas carbon dioxide is locked in from the air in the course of the tree growth via photosynthesis and stored during the use stage. This carbon dioxide is not released until the end of life through thermal utilisation in e.g. a WIP. Due to the fact, that the core board of laminate flooring is wood based the CO_2 fixation results in a credit for GWP. The credit for ODP results from the thermal recycling and the respective substitution of energy generation from fossil resources. The impacts of delivery and fitting are of little importance. The contribution of cleaning over a 15-year reference service life period is more relevant.

A closer examination of the production stage is given in figure 7. Figure 7 shows the percentage of the different production parameters on the impact categories.

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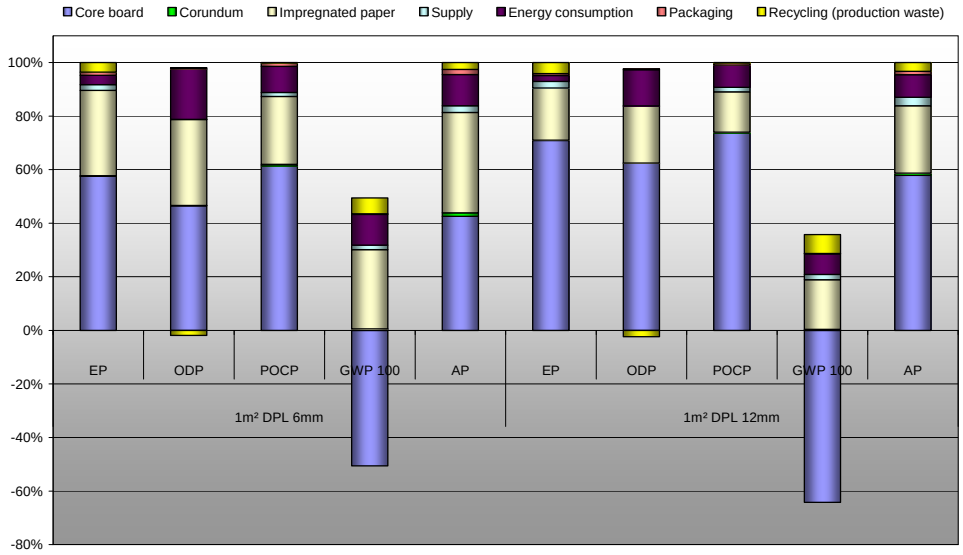

Figure 7: Percentage of production parameters for the production stage

It is obvious that the background data for the production of the core board and the resin impregnated papers determine the impact categories. For the environmental impact of the impregnated paper the used resin is mainly responsible, with a percentage of >90%. The production related energy consumption has a share of 2% to 19% and the recycling of production waste has a share of 1% to 8% in the different impact categories. Packaging, supply and corundum have only marginal effects on the environment.

7.12 Interpretation

The EPD is valid for laminate floor coverings with a minimum thickness of 6mm to a maximum thickness of 12mm and a reference service of 15 years. The LCA results show a linear correlation between the thickness of laminate floor coverings and their environmental impact.

The following instruction should help the user of this EPD to calculate the environmental impact of laminate floor coverings with other thicknesses and service lives. For **the production, delivery, installation** and **end of life stage**, the values of the **6mm** floor covering have to be multiplied with the factors given in table 12.

Table 12: Factors for the calculation of the environmental impact of floor coverings with different thicknesses

Parameter	Factors for different thicknesses				
	7mm	8mm	9mm	10mm	11mm
Primary energy, non-renewable	1,03	1,06	1,10	1,14	1,17
Primary energy, renewable	1,15	1,31	1,46	1,62	1,77
Global warming potential (GWP 100)	1,05	1,10	1,15	1,20	1,25
Ozone depletion potential (ODP)	1,06	1,11	1,18	1,25	1,30
Acidification potential (AP)	1,10	1,19	1,29	1,39	1,48
Eutrophication potential (EP)	1,12	1,23	1,35	1,47	1,59
Photochemical oxid. f. potential (POCP)	1,11	1,22	1,34	1,45	1,57

The environmental impact of the **use stage** is determined by the water and energy consumption for the floor covering cleaning. The values described in table 7 are based on the cleaning instructions mentioned in table 4 per year.

These values (table 7) have to be multiplied with the respective reference service life.

Calculation for environmental impact of 1m² laminate floor covering with variant thicknesses and service lives for the entire life cycle:

$$\sum = (P_{(\text{Table 5})} + I_{(\text{Table 6})} + EOL_{(\text{Table 8})}) * \text{Factor}_{(\text{Table 12})} + US_{(\text{Table 7})} * n$$

P: Environmental impact of **P**roduction
I: Environmental impact of **I**nstallation
EOL: Environmental impact of **E**nd **o**f **L**ife
US: Environmental impact of one year **U**se **S**tage
n: service life in years

For the calculation of the environmental impact of installation waste the values for production (Table 5), delivery and installation (Table 6) and end of life (Table 8) have to be multiplied with the amount of waste (e.g. 3% installation waste, factor 1.03).

8 Additional information, evidence and test

Additional information, specific evidence and test results have to be taken from the technical data sheets of a specific DPL floor covering (CE Labelling, AgBB).

9 PCR Document and Verification

This EPD is based on the PCR floor coverings, 2008-01.

PCR review, was conducted by: Advisory board IBU: Prof. Dr.-Ing. Hans-Wolf Reinhardt (Universität Stuttgart, IWB)
Independent verification of the declaration and data, according to ISO 14025: ☐ internal ☒ external
Third party verification: Dr. Eva Schmincke

10 References

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