Environmental Product Declaration

according to ISO 14025

Interface FLOR

Tufted modular carpet with continuous-dyed polyamide 6.6

Heuga 530, Heuga 580

Contains pre-consumer recycled materials (precoat and backing compound)

LCA -calculation and support:
Gemeinschaft umweltfreundlicher Teppichboden e.V.

Declaration number
EPD-IFF-2011311-E

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

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und Umwelt e.V.

Short version

Umwelt-Produktdeklaration

Environmental Product Declaration

Institut Bauen und Umwelt e.V. www.bau-umwelt.com	Program operator
Gemeinschaft umweltfreundlicher Teppichboden (GUT) e.V. Schönebergstr. 2; 52068 Aachen, Germany; mail@gut-ev.de www.gut-ev.org	Program facilitator
InterfaceFLOR Europe Scherpenzeel, 3925 ZG. The Netherlands www.interfaceflor.eu	Declaration holder
EPD-IFF-2011311-E	Declaration number
Tufted modular carpet having a surface pile of 100% continuous-dyed polyamide 6.6 and a Graphlex® backing system. With pre-consumer recycled content in the precoat and backing compound. This declaration is an Environmental Product Declaration according to /ISO 14025/ and describes the environmental performance of the floor coverings indicated herein. It is designed to foster the development of ecological and healthy 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 official stamp of the Institut Bauen und Umwelt (IBU). It is valid for a period of three years from the date of issue exclusively for the product group indicated and only in conjunction with a valid PRODIS licence. The contents and validity of the licence may be checked online via www.pro-dis.info. The owner of the declaration shall be liable for the underlying information and verifications.	Validity
The declaration is complete and furnishes details of: - the product definition and relevant building-physics-related information - the raw materials and origin of the raw materials - the descriptions of the product manufacture - the information on product processing - the information on the use stage, extraordinary influences and end-of-life stage - the results of the life cycle assessment - the description of the benefits beyond system boundaries	Content of the declaration
12 July 2011	Date of issue
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt)	Signatures
This declaration and the rules on which it is based have been examined in accordance with /ISO 14025/ by the independent Committee of Experts (CoE).	Examination of the declaration
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the CoE) / Dr. Eva Schmincke (CoE-appointed Examiner)	Signatures

Short version

Umwelt-Produktdeklaration

Environmental Product Declaration

Product description

The declaration covers a group of textile floor coverings having the following features:

Kind of manufacture: Tufted modular carpet
Surface pile material: 100 % continuous-dyed polyamide 6.6 ,
Back coating: Graphlex® backing system with pre-consumer recycled content
Recycled content: Pre-consumer recycled content in the precoat and backing compound.

Subject to the weight of the surface pile, tufted modular carpet is classified, in accordance to luxury and use classes, as:

EN 1307 Luxury Classification LC1 and LC2

Use class 33 - Commercial areas with heavy traffic

Range of application

As indicated on the PRODIS label, the textile floor covering may be used in the commercial area. Suitability for additional uses is also indicated on the PRODIS label (www.pro-dis.info).

Scope of the life cycle assessment

The **Life Cycle Assessment (LCA)** was carried out according to /ISO 14040/ seq. in line with the requirements of the IBU guideline for type III declarations. The data reference consisted of specific data provided by InterfaceFLOR (the manufacturer) and its suppliers, of data according to the GUT LCA "Floorcoverings" and of data from the “GaBi 4” database.

The life cycle assessment covers

- Part 1: Production stage including the supply chains (from cradle to factory gate)
- Part 2: Delivery/installation, use
- Part 3: End-of-life stage

Result of the life cycle assessment

Table 1: **LCA results for Tufted Modular Carpet with 100% continuous-dyed PA 6.6 from InterfaceFLOR**

Categories evaluated	Unit per m²	Production stage		Delivery and installation		Use (1 year)	End-of-life stage	
		Heuga 580	Heuga 530	Heuga 580	Heuga 530		Heuga 580	Heuga 530
Primary energy not renewable	[MJ]	190.5	204.6	1.1	1.2	4.1	-51.2	-51.7
Primary energy renewable	[MJ]	10.6	11.0	-0.03	-0.03	0.3	-0.5	-0.5
Abiotic depletion potential (ADP)	[kg Sb-eqv.]	0.08	0.09	$6.5 \cdot 10^{-4}$	$6.6 \cdot 10^{-4}$	$1.2 \cdot 10^{-3}$	-0.02	-0.02
Greenhouse pot. (GWP 100)	[kg CO_2-eqv.]	9.1	10.0	0.31	0.31	0.2	4.4	4.5
Ozone degrad. potential (ODP)	[kg R11-eqv.]	$6.4 \cdot 10^{-7}$	$6.59 \cdot 10^{-7}$	$-5.6 \cdot 10^{-9}$	$-5.6 \cdot 10^{-9}$	$4.5 \cdot 10^{-8}$	$-2.7 \cdot 10^{-8}$	$-2.7 \cdot 10^{-8}$
Acidification pot. (AP)	[kg SO_2-eqv.]	$3.3 \cdot 10^{-2}$	$3.6 \cdot 10^{-2}$	$1.2 \cdot 10^{-3}$	$1.2 \cdot 10^{-3}$	$8.5 \cdot 10^{-4}$	$5.3 \cdot 10^{-3}$	$5.4 \cdot 10^{-3}$
Nutrification (NP)	[kg PO_4-eqv.]	$7.9 \cdot 10^{-3}$	$8.7 \cdot 10^{-3}$	$2.1 \cdot 10^{-4}$	$2.1 \cdot 10^{-4}$	$9.5 \cdot 10^{-5}$	$1.0 \cdot 10^{-3}$	$1.0 \cdot 10^{-3}$
Photochemical oxid. form.(POCP)	[kg ethene-eqv.]	$3.5 \cdot 10^{-3}$	$3.7 \cdot 10^{-3}$	$9.8 \cdot 10^{-5}$	$1.0 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$	$1.3 \cdot 10^{-4}$	$1.3 \cdot 10^{-4}$

The results are based on the life cycle assessment for textile floor coverings
conducted by **Gemeinschaft umweltfreundlicher Teppichboden (GUT) e.V.**, Aachen, Germany
in cooperation with:: **Textile and Flooring Institut GmbH**, Aachen,
critically reviewed by: **Prof. Dr. Walter Klöpffer**, Int. Journal of Life Cycle Assessment, LCA CONSULT & REVIEW, Frankfurt a.M.,
Dipl. Natw. ETH Roland Hischier, Head of unit LCA, EMPA, St Gallen

Verifications and tests

In addition, the following tests are represented in the environmental declaration:

VOC emissions GUT product testing criteria based AgBB scheme for the evaluation of emissions from building products,

Tests for contaminants GUT product testing criteria

0 Product definition

0.1 Product classification and description

Tufted modular carpet having a surface pile made of continuous-dyed polyamide 6.6 and a Graphlex® backing system. With pre-consumer recycled content in the precoat and backing compound.

The declaration covers a group of modular textile floor coverings having the following features:

Kind of manufacture: Tufted modular carpet

Surface pile material: 100 % continuous-dyed polyamide 6.6

Back coating: Graphlex® backing system: Bitumen backing compound containing pre-consumer recycled content

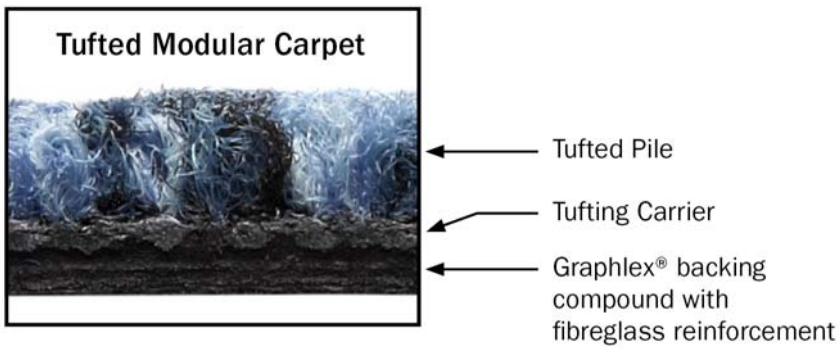
Products in the group: Subject to the weight of the surface pile, textile floor coverings can be classified in accordance with luxury classes (LC1 to LC5) as defined in EN 1307. The group presented in this declaration consists of tufted modular carpet products classified as LC1 and LC2. Names and Prodis licence numbers of the products are listed in table 2.

***Table 2:* Products in the group**

Name	**LC1**	Heuga 580
Prodis licence number		DFBF9C2E
Name	**LC2**	Heuga 530
Prodis licence number		EF74A558

Recycled content: Pre-consumer recycled content in the precoat and backing compound.
Average recycled content out of total weight:
LC1: 57.5 %
LC2: 56.4 %.

This group consists of loop-pile products made with continuous-dyed polyamide 6.6 and backed with Graphlex® backing system.



***Graph 1:* Construction of tufted loop pile**

InterfaceFLOR's tufted modular carpet products with continuous-dyed polyamide 6.6 incorporate pre-consumer recycled content in the precoat and the backing compound. The use of recycled materials avoids waste generation, reduces virgin resource depletion, as well as reduces the embodied energy and the emissions during the

whole life cycle of the product.

0.2 Range of application

According to EN 1307 the product is classified in use class 33:

Use in commercial areas

PRODIS Classiffication: **Heavy** FCSS symbol: G

0.3 Product standard/ Approval

The following standards apply to the present product group:

DIN EN 1307 - Textile floor coverings – Classification of pile carpets
DIN EN 685 - Resilient, textile and laminate floor coverings - classification
DIN EN 14041 - Resilient, textile and laminate floor coverings - Essential characteristics
DIN EN 13501-1 - Classification of building products and building types according to their reaction to fire

The product is approved according to the European technical approval (7-marking) as well as in accordance with the respective national approval principles for building products, e.g. the general technical approval of Deutsches Institut für Bautechnik.
For admission numbers, see the PRODIS marking (www.pro-dis.info).

0.4 Accreditation

All the tufted modular carpet products of this group have been awarded a GUT/PRODIS test label for environment-friendly products. Within the framework of this product testing system, annual controls are made by independent test institutes.

Graphlex® backed carpet tiles products were also tested under the CHPS 01350 Indoor Air Quality requirements by an independent laboratory in California, USA and the results show that they meet the requirements of CRI's Green Label Plus programme.

InterfaceFLOR tufted modular carpets have also been assessed by BRE Global Ltd and the results were certified as part of the certification programme. The BRE Green Guide to Specification (www.greenbooklive.com) lists product assessment results and ratings.

This product group has been produced in factories certified under the ISO 9001 Quality Management System and ISO 14001 Environmental Management System.

0.5 Delivery status

On delivery, tufted modular carpet products with continuous-dyed polyamide 6.6 feature the composition and characteristics described in Table 3.

Table 3: **Characteristics**			
Type of manufacture	Tufted carpet		
Characteristics	**Nominal value**		**Unit**
Pile fibre composition	Continuous dyed polyamide (PA) 6.6		100 %
	Heuga 580	**Heuga 530**	
Effective pile weight	375	400	g/m^2
Total pile weight	555	640	g/m^2
Carrier	PES / PA		100 %
Backing	Graphlex®		100 %
Total carpet weight	4259	4304	g/m^2

1 Material content

1.1 Material content

Table 4 lists the average raw materials contained in tufted modular carpet with continuous-dyed polyamide 6.6 products on delivery as well as their percentage shares in the weight.

Table 4: **Composition and characteristics**

Construction Layer	Material	Mass [%]		Renewable Resource	Availa-bility	Origin
		Heuga 580	Heuga 530			
Total Pile layer	Continuous-dyed polyamide 6.6	13,0	14,9	no	limited	Europe
Carrier	Polyester/ polyamide, nonwoven	2,0	2,0	no	limited	Europe
	Polyester nonwoven post-consumer recycled	–	–	no	abundant	Europe
Precoat Bonding Layer	SBR	3,9	4,2	no	limited	Europe
	Limestone			no	abundant	Europe
	Antistaticum			no	limited	Europe
	Limestone, pre-consumer recycled	13,4	14,4	no	abundant	Europe
Structural Graphlex® Backing	Bitumen	21,7	20,7	no	limited	Europe
	SBR			no	limited	Europe
	Limestone			no	abundant	Europe
	Limestone, pre-consumer recycled	44,0	42,0	no	abundant	Europe
	Glassfleece	0,8	0,8	no	limited	Europe
	Polypropylene, nonwoven	1,1	1,0	no	limited	Europe

1.2 Production of main materials

Polyamide 6.6 (PA 6.6)

Polyamide 6.6 is a thermoplastic material which is made by means of polycondensation from hexamethylene diamine and adipic acid.

Polyester (PES)

Polyesters are polymers containing the ester functional group in their main chain. The term is used for the large family of polyester materials. The type of polyester used in this carpet is referred to as polyethylene terephthalate (PET).

Styrene Butadiene Rubber (SBR-Latex)

SBR is made through polymerisation from the monomers styrene and butadiene.

Styrene Butadiene Styrene (SBS)

SBS is a "block copolymer" made through polymerisation from the monomers styrene and butadiene. This means that the molecules of SBR contain areas of poly-styrene and areas of poly-butadiene.

Antistaticum

A Carbon Antistatic is used, which consists mainly of carbon atoms.

Bitumen

Bitumen is a visco-elastic material, consisting essentially of hydrocarbons and their derivatives. It is obtained by refinery processes from petroleum.

Limestone ($CaCO_3$)

Limestone is a sedimentary rock that consists largely of calcium carbonate. The material is pulverized to be used as filler.

Recycled limestone ($CaCO_3$)

"Recycled limestone" results from waste that occurs as a leftover during limestone production. After drying and pulverizing it is added as filler to the Graphlex® Backing.

Glassfleece

Glassfleece is a nonwoven mat made of long, thin glass fibres. The glass fibres are manufactured by drawing melted glass into thin threads.

Polypropylene (PP)

PP is a thermoplastic plastic material that is formed by means of catalysts through polymerisation of the monomer propene.

2 Product manufacture

2.1 Production process

The production of tufted modular carpet is divided into 4 main partial stages.

Tufting:

Yarn threads are machine-sewn into the carrier material across the entire breadth of the product by means of a multitude of needles arranged next to each other. The yarn on the resulting half-product will appear on the later surface as loops, or cut pile or a combination of the two.

Precoating:

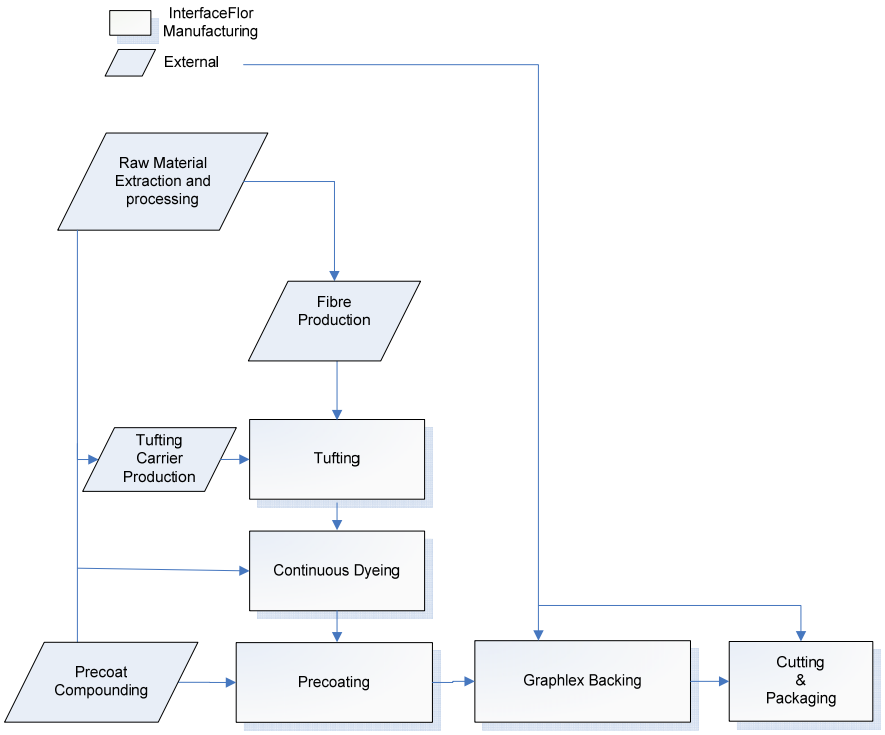
On the back of the tufted raw product, the SBR latex precoat compound is applied in order to anchor the bottom loop (filaments and tufts) of the pile yarn in the carrier layer. This results in a precoated half-product.

Graphlex® Backing finish:

On the precoated half-product a melted hot Graphlex® bitumen compound is applied into which a glass-fibre fleece is laid for dimensional stability. Then, the coating is covered with a PP nonwoven fleece. The finished carpet is solidified in a cooling unit.

Cutting and packaging:

Finally, the rolled tufted and backed carpet is cut into tiles using an ultrasonic cutting machine or a piece die-cutter. Carpet tiles are inspected for quality and packed into boxes for storage and transport to the installation site.



Graph 2: **Manufacturing Process Diagram for Tufted Modular Carpet**
- dyed at half-product level -

2.1.1 Dyeing sub-process

Colouring processes can happen at the yarn manufacturing stage (i.e. yarn dyeing), after tufting (i.e. at half product stage) or after backing (i.e. at finished product stage).

Products in this group are all dyed after tufting (Half-product dyeing) through an aqueous method known as continuous dyeing. In this case the mostly white yarns are first tufted into a half-product before the raw half-product is impregnated with dyestuff solutions, pastes or foams. Subsequently, the dye is fixed, the half-product rinsed, washed and dried. This method is carried as a part of the manufacturing process.

2.2 Health, safety and environmental aspects during production

The applicable basic EU regulations and any stricter national-law provisions at the place of manufacture are complied with. For further details on our production initiatives please refer to section 7.13 “Description of the benefits beyond system boundaries”.

3 Delivery and installation

3.1 Delivery

The carpets are transported from the production plant to the end user almost exclusively by lorry. For the purposes of the life cycle assessment, a lorry with a load capacity of 17,2 t, an average 85% utilisation of its payload and an average transport route of 700 km from the factory gate to the place of installation is assumed.

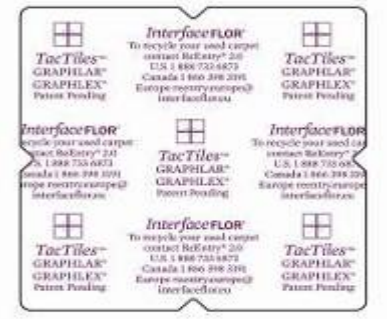
All our suppliers use modern vehicles that comply with emissions standards set out by the EU's Kyoto agreement. For further details on our transport initiatives please refer to section 7.13 "Description of the benefits beyond system boundaries".

3.2 Installation

Installation of tufted modular carpet can be done by use of liquid tackifiers (such as InterfaceFLOR's Graphlokk adhesive) to be spread to the floor where carpet will be installed. However, preferred method of installation is using TacTiles™, our glue-free installation system that does not require liquid adhesive application.

TacTiles™ are PET connectors that go underneath carpet tiles' corners to fix them securely into place – creating a 'floating' floor layer between the carpet and the sub floor. So the carpet tiles are fastened tight to each other, but not stuck to the floor.

Using TacTiles™ installation system avoids the use of full spread tackifier, which prevents damage to the floor, increases ease of removal for maintenance and recycling, and makes installation during occupancy possible. This means greater flexibility and a much simpler and faster installation.



Graph 3: **TacTiles™ installation system**

3.3 Health, safety and environmental aspects during installation

VOCs associated with traditional flooring adhesives are greatly avoided for both the installers and the building occupants by using our glue-free TacTiles™ installation method. Independent testing has been carried out on TacTiles™ and our green-glue Graphlokk to assess the emissions of volatile organic compounds (VOCs) from these installation methods.

Testing was performed following ISO 16000-9 methodology for measurement of the specific emission rate of VOCs from newly produced building products. The results show that while both methods achieve a "below detection" level after 28 days, Tactiles™ only emit one fifth of TVOCs emitted by our own green-glue Graphlokk after 3 days (17µg/m3 vs 78µ/m^3).

This is of particular interest for the wellbeing of installers as well as that of occupants that enter the building shortly after installation or remain in the premises during refurbishment.

3.4 Waste

Installation waste is minimized by several aspects of tufted modular carpet. The modular aspect of the carpet tiles and the design pattern allows for an installation waste between 2 and 3%. The "Non-directional" installation method (i.e. tiles don't need to follow a particular pattern) reduces trimmings to about 1 to 2%.

According to Class 20 01 11 of the "European Waste Catalogue" (EWC) the textile

floor covering and the trimmings to be disposed of may be classified as “municipal solid waste – textiles”, a non-hazardous type of waste.

The German "Technical Guidelines on Municipal Solid Waste" state that disposal on landfills has no longer been possible since 2005. These guidelines are not currently applicable throughout Europe and subject to an application moratorium. In certain countries installation waste can then be sent to landfill, or waste-to-energy incineration. Because of its non-hazardous nature, it can be safely handled through standard municipal waste handling procedures.

However, the preferred method for disposing of installation trimmings is through InterfaceFLOR’s ReEntry take back programme. Through the ReEntry programme, InterfaceFLOR determines locally the environmentally best-way to dispose of carpet waste, depending on local availability of technology and capacity. The main disposal methods under consideration are re-use, recycling, re-purposing and waste to energy. Contact InterfaceFLOR ReEntry for details at reentry.europe@interfaceflor.eu.

3.5 Packaging

Carpet tiles are packaged in recycled cardboard boxes (100% post-consumer recycled cardboard) that can in turn be recycled through the local paper/cardboard recycling facilities.

4 Use stage

4.1 Use

Subject to the marking on the PRODIS label, tufted modular carpet in this group is intended for commercial areas. However, it may be used as well for residential purposes.

Tufted modular carpets with continuous-dyed polyamide 6 have a minimum service life of 10 years, but fashion-related and aesthetic aspects often make that carpet is replaced before. Technically, wear resistance may last much longer. If, in line with the recommendation, the textile floor covering is used in its use class, the service life may be considered independent of the use class.

4.1.1 Cleaning and maintenance

The classical cleaning appliance for the daily and regular care of the textile floor covering is the vacuum cleaner either with or without a brushing device.

In the life cycle assessment, the average cleaning frequency is assumed to be four times a week in commercial areas.

These values are mean values based on experience; the actual cleaning frequency is heavily dependent on the intensity of use and the degree of soiling.

Electrical energy is required to operate the vacuum cleaner.

For intensive cleaning, an additional wet cleaning process is employed. Here, dirt is rinsed out of the surface pile, as a rule by means of a spray extraction cleaner. A cleaning frequency of 1 time in 3 years in residential areas and 3 times in 2 years in commercial areas is recommended and taken into account in the life cycle assessment, the frequency depending on individual factors. The method requires the use of water and a cleaning agent and electrical energy is needed to operate the spray extraction cleaner.

4.1.2 Prevention of structural damage

In order to avoid excessive wear and changes in appearance during the use stage, it should be seen to it that the area of use does not require more than is permissible under the indicated use class of the individual product. Additional suitability indicated by an extra symbol according to /EN 685/ may enlarge the range of application.

4.2 Health aspects during usage

The emissions of the tufted modular carpet on delivery meet the requirements of the GUT test criteria for VOC emissions and contaminants (version 2010). Table 5 shows some basic thresholds. For further information see www.gut-ev.org.

Table 5: **Basic thresholds and criteria GUT**

Component	3 days cut off	Limit value after 28 days	Unit
TVOC (C_6 to C_{16})	250	100	µg/m³
SVOC (C_{16} to C_{23})	30	30	µg/m³
VOC without NIK	100	50	µg/m³
R value	< 1,0	< 1,0	µg/m³
Formaldehyde	10	4	µg/m³
Carcinogenic substances (EU list classes 1 and 2)	not detectable		–

5 Singular effects

5.1 Fire

The performance classes (Euroclasses) are shown on the PRODIS label.

5.2 Water

In the unlikely event that major water quantities are present on the carpet over a prolonged period of time, then this may cause damage to the carpet.

5.3 Mechanical damage

Product is intended for commercial applications with heavy wear. Excessive wear of the textile floor covering during its service life need not be expected if it is employed and properly used, maintained and cleaned in compliance with its declared suitability (PRODIS). Product should be installed according to InterfaceFLOR installation guidelines.

6 End-of-life stage

According to Class 20 01 11 of the ”European Waste Catalogue“ (EWC) the textile floor covering to be disposed of may be classified as “municipal solid waste – textiles” (a non-hazardous waste category). Accordingly, disposal will be carried out in compliance with local waste disposal systems.

6.1 Recycling or re-use

InterfaceFLOR aims at providing customers with the most environmentally friendly end-of-life alternatives to carpet tiles. Since the environmental impacts of transportation to our recycling facilities can sometimes outweigh the environmental benefits of the recycling process, our ReEntry® programmes divert used carpet from landfills by assessing the options and proposing the most adapted and environmentally sound alternative for each region.

Local carpet take-back solutions include, by importance of volume: waste-to-energy solutions (e.g. cement kiln), carpet reutilization (extending its useful life) or repurposing (giving it a new life as something else, as for e.g. insulation, roofing) and carpet recycling (into new carpet backing through our CoolGreen carpet backing recycling technology available in our factory in Shelf, England).

Most ReEntry® programmes include collaborations with reinsertion-through-work NGOs. The financial benefits resulting of the sale of recovered carpet allow our partners to encourage employment initiatives among excluded population. In Europe, ReEntry® is currently available in France, Germany, Ireland, the Netherlands, Switzerland and the UK.

6.2 Disposal

According to the Technical Guidelines on Municipal Solid Waste, disposal on landfills has no longer been possible since 2005.

These guidelines are not currently applicable throughout Europe and subject to an application moratorium. In certain countries installation waste can then be sent to landfill, or waste-to-energy incineration. Because of its non-hazardous nature, it can be safely handled through standard municipal waste handling procedures.

Environmentally preferred disposal for tufted modular carpet with polyamide 6.6 remains through our ReEntry® programmes (see 6.1 for details).

7 Life cycle assessment

7.1 General

The EPD is based on the life cycle assessment 'textile floor coverings' conducted by GUT.

Values for product manufacture, delivery/installation, and end-of-life stage results are shown for each product. The use stage is common for all the products as product construction has no impact on maintenance.

General assumptions and considerations per lifecycle stage are:

- Electricity used during the manufacturing process at the InterfaceFLOR production sites is 100% from renewable sources. These sources can be wind power, hydro power and biomass, the calculation considers a third share each.
  Electricity used in external production sites is considered as an electricity mix EU-15 /GABI 4/.
- For the stages delivery/installation standardised conditions are assumed (see chapter 3). The distance from factory to the customer is assumed to be 700 km. Installation is assumed to be done using our TacTiles™ installation system without the need of any full spread liquid glue. Polyethylene waste from packaging is recovered in a municipal waste incineration plant, cardboard waste is recycled.
- For the use stage, standardised conditions are assumed for cleaning and maintenance (see chapter 4).
- For the end-of-life stage, the calculation considers use of our ReEntry® carpet take back programme for 100% of the installed modular carpet. All of the reclaimed carpet is assumed to be sent to Waste-to-Energy. The distance from the place of de-installation to the waste-to-energy incineration plant is assumed at 30 km.

The basic data used meet the data quality requirements according to chapter 7.6.

7.2 Functional unit

The declaration refers to 1 m² of tufted modular carpet with continuous-dyed polyamide 6.6.

For the assessment of the use stage, the period of one year is taken into consideration. The values for deviating periods of use may be calculated by means of multiplication with the relevant number of years.

7.3 Cut-off criteria

The limit of detail of the individual input streams amounts to one per cent relative to the sum of the input streams and the energy input for the respective process. Substances used in smaller quantities but have a crucial function (e.g. the dye) are assessed as well. The sum of all neglected inputs in one process amounts to not more than 5% of the energy input and input streams.

7.4 Allocation

ISO 14040 defines the allocation as “partitioning the input or output flow of a unit process to the product system under study”. In the present life cycle assessment, no relevant allocations (i.e. partitioning of environmental burdens of a process to several products) had to be made for the product manufacture, delivery, installation and use. Re-Entry take back entails an energy credit note due to the incineration of the textile waste.

7.5 Background data

The background data refer to

/GaBi 4.4/, Database for the calculation of life cycle assessments, service pack 16 and /Ecoinvent/, Data Version 2.0.

7.6 Data quality

For the inventories used, for the general processes and for all production steps, the data used in the inventory analysis were collected indicating their origin, the kind of data recording, the time-related, geographical and technological reference, and their quality was verified.

The product composition and volumes, the manufacturing waste levels, and the process energy use data has been provided by InterfaceFLOR. Original data provided by the GUT member firms and generic data were also used. As background data, European values from the /GaBi 4/ database were referred to.

Inasmuch as the framework of the assessment and the objective of the assessment are concerned, the data sets are complete and reflect representative values of the European carpet industry for the life-cycle-assessment stages production, delivery/installation, usage and disposal.

The consistency and the traceability of the data were verified within the framework of a critical review of the GUT life-cycle-assessment study by Prof. Dr. Walter Klöpffer, Frankfurt a.M., and Dipl. Natw. Roland Hischier, St Gallen.

7.7 System boundaries

The life cycle assessment covers the entire life cycle of tufted modular carpet products with continuous-dyed polyamide 6.6 from cradle to grave.

The **production stage** includes the extraction and manufacture of the raw materials used, their transport to the production facility, the entire production process, the thermal use of the production waste, the packaging, inclusive of the packing material of the final tufted modular carpet with continuous-dyed polyamide 6.6.

The Graphlex® bitumen backing and the precoat of all products in this group contain recycled materials

> /ISO 14021/ defines recycled material as *"Material that has been reprocessed from recovered material …"* and recovered material as *"Material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and recovered as a material input, in lieu of new primary material, for a recycling or a manufacturing process.*

Therefore the LCA impact calculation of recycled material considers only the impact of the recycling processes but not the provision of the raw material.

Recycled limestone in the Graphlex® bitumen backing and the precoat comes from waste that occurs as a leftover during the limestone production. The recycling processes are drying and pulverizing.

The **delivery/installation stage** includes the transport of the packed carpet to the place of installation, its installation, inclusive of the provision of the TacTiles™ installation system, their production and transport to the place of installation, also the thermal use of polyethylene packing material.

The **use stage** covers the cleaning and maintenance of the carpet during the period of one year including the cleaning agents, the extraction of the raw materials, their production and transport. The treatment of the waste water occurring during spray extraction is taken into consideration.

For the **end-of-life stage**, the transport of the de-installed carpet to the ReEntry® programme partner (for Waste-to-Energy disposal) as well as the material and energy input of the waste incineration plant for the thermal use and all emissions are considered.

In all life cycle stages, the respective disposal processes up to final deposition, with the exception of the deposition of nuclear waste, are modelled.

7.8 Note on use stage

The actual service life of a textile floor covering depends on various impact factors such as the allocation of the area of application to the use class, the maintenance and the intensity of usage.
The comparability of textile floor coverings requires, among other things, uniform conditions of usage. For the life cycle assessment the indicators for a defined usage scenario were calculated as annual averages.

7.9 Result of the life cycle assessment (LCA)

The results of the life cycle assessment are shown in table 6 for the product manufacture, the delivery/installation, the use stage and the end-of-life stage.

Table 6: **LCA result for Tufted Modular Carpet with continuous-dyed PA 6 and Graphlex® backing**

Categories evaluated	Unit per m²	Production stage		Delivery and installation		Use (1 year)	End-of-life stage	
		Heuga 580	Heuga 530	Heuga 580	Heuga 530		Heuga 580	Heuga 530
Primary energy not renewable	[MJ]	190.5	204.6	1.1	1.2	4.1	-51.2	-51.7
Primary energy renewable	[MJ]	10.6	11.0	-0.03	-0.03	0.3	-0.5	-0.5

Abiotic depletion potential (ADP)	[kg Sb-eqv.]	0.08	0.09	$6.5 \cdot 10^{-4}$	$6.6 \cdot 10^{-4}$	$1.2 \cdot 10^{-3}$	-0.02	-0.02
Greenhouse pot. (GWP 100)	[kg CO_2-eqv.]	9.1	10.0	0.31	0.31	0.2	4.4	4.5
Ozone degradation pot. (ODP)	[kg R11-eqv.]	$6.4 \cdot 10^{-7}$	$6.59 \cdot 10^{-7}$	$-5.6 \cdot 10^{-9}$	$-5.6 \cdot 10^{-9}$	$4.5 \cdot 10^{-8}$	$-2.7 \cdot 10^{-8}$	$-2.7 \cdot 10^{-8}$
Acidification potential (AP)	[kg SO_2-eqv.]	$3.3 \cdot 10^{-2}$	$3.6 \cdot 10^{-2}$	$1.2 \cdot 10^{-3}$	$1.2 \cdot 10^{-3}$	$8.5 \cdot 10^{-4}$	$5.3 \cdot 10^{-3}$	$5.4 \cdot 10^{-3}$
Nutrification (NP)	[kg PO_4-eqv.]	$7.9 \cdot 10^{-3}$	$8.7 \cdot 10^{-3}$	$2.1 \cdot 10^{-4}$	$2.1 \cdot 10^{-4}$	$9.5 \cdot 10^{-5}$	$1.0 \cdot 10^{-3}$	$1.0 \cdot 10^{-3}$
Photochemical oxid. form.(POCP)	[kg ethene-eqv.]	$3.5 \cdot 10^{-3}$	$3.7 \cdot 10^{-3}$	$9.8 \cdot 10^{-5}$	$1.0 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$	$1.3 \cdot 10^{-4}$	$1.3 \cdot 10^{-4}$

Entire life cycle

The values for the entire life cycle (V_T) may be calculated as follows:

$$V_T = \text{Value}_{\text{Production}} + \text{Value}_{\text{Delivery/installation}} + n \cdot \text{Value}_{\text{Use 1 Year}} + \text{Value}_{\text{End of life}},$$

n representing the number of years of life considered in each case.

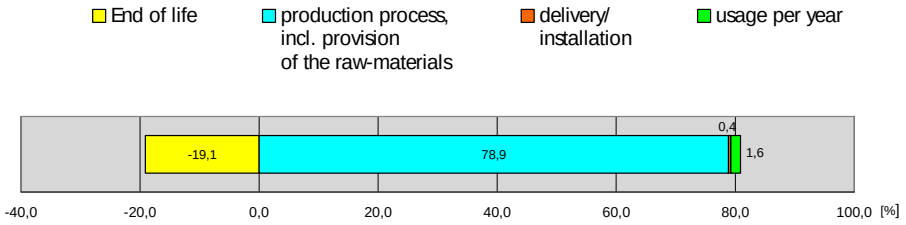
7.10 Life cycle inventory analysis (LCI)

The following chapters will describe in all detail the selected indicators of the life cycle analysis of 1 m² of tufted modular carpet for all life stages, taking into consideration a service life of 1 year.

7.10.1 Primary energy requirement

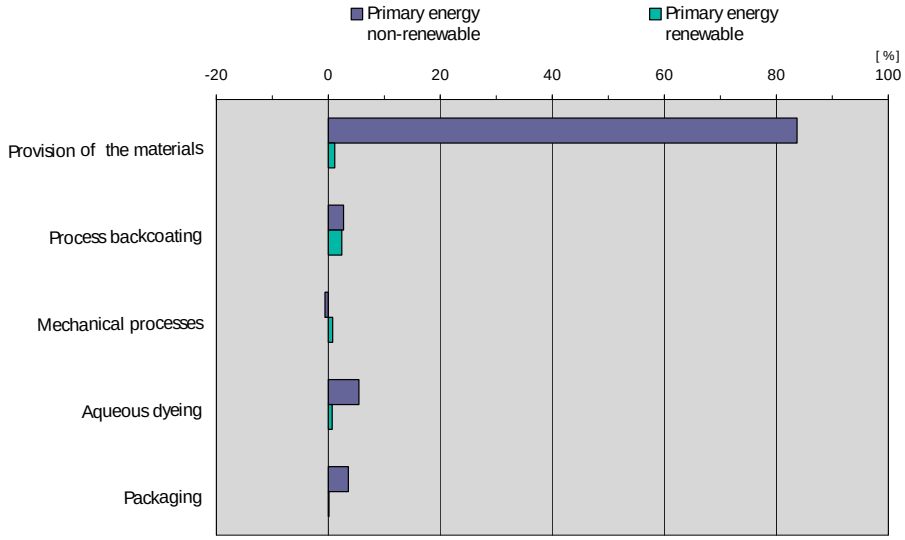
The primary energy here under consideration results from the energy input for all processes and from the energy that is bound in the raw materials as fossil resources (oil).

Graph 4 shows the relative contributions of the life cycle stages product manufacture including the provision of the raw materials, delivery/installation, usage per year and end of life to the primary energy consumption (renewable and non renewable).



Graph 4: **Relative contributions of the life cycle stages to the regenerative and non-regenerative primary energy consumption (Heuga 530))**

Graph 5 differentiates the primary energy used from non-renewable and renewable raw materials for the production stage according to different processes of production. It shows that the predominant contribution to the primary energy consumption results from the provision of the raw materials.



Graph 5: **Relative contributions of different partial processes of production to the primary energy consumption (Heuga 530)**

Provision of the materials refers to all materials that are delivered to the carpet production site. It includes the raw materials, the manufacturing of the product (as yarn, carrier, precoat etc) and the transport to the carpet production site.

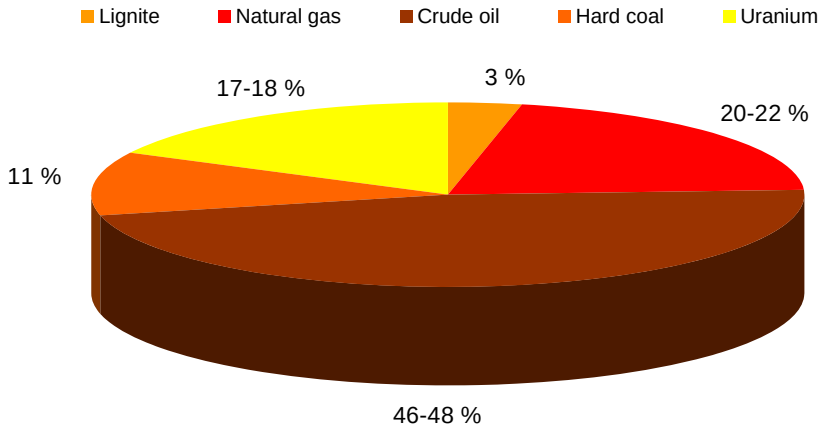
Process backcoating refers to the precoat and the backing-system. It includes the energy input for application and drying, the waste water and the emissions.

Mechanical processes include tufting, cut-off and the thermal use of the production waste. They give rise to energy credit notes resulting from production waste and edge-waste re-use in the waste incineration plant.

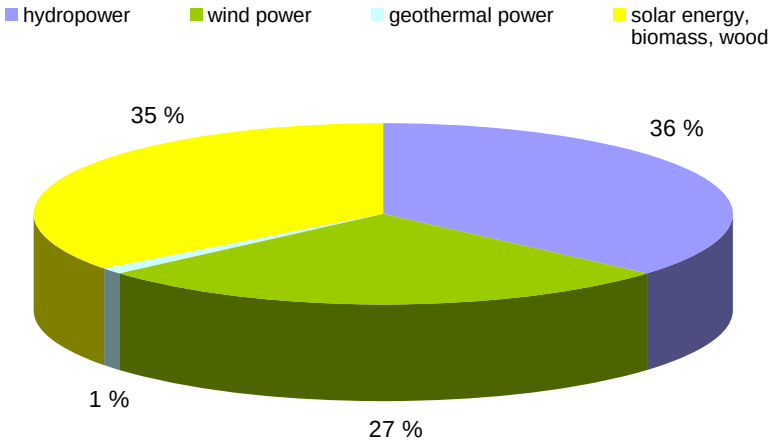
Aqueous dyeing processes include the energy input and waste water treatment.

Packaging includes the provision of the packing materials and their transport to the production site.

Graph 6 and 7 show the respective share of the energy sources in the non-regenerative and in the regenerative primary energy input during the whole life cycle of 10 years.



Graph 6: Shares of the non-renewable energy carriers



Graph 7: **Shares of the renewable energy carriers**

7.10.2 Non-renewable material content

The non-renewable raw materials are fossil or mineral raw materials that are used for energy generation on the one hand and on the other hand are contained as raw material in the product.

The raw materials lignite, natural gas, oil, mineral coal and uranium are primarily used for energy generation; oil is furthermore used as a raw material for the production of polymeric materials. A differentiation of the raw materials according to their use is not made; these materials are recorded in chapter 7.10.1.

Other mineral raw materials are limestone with 0.14 kg/m^2, sodium chloride (rock salt) with 0.03 kg/m^2, clay with 0.02 kg/m², colemanite ore with 0.02 kg/m² and iron with 0.01 kg/m², besides sulphur with 0.02 kg/m².

The non-utilisable ores and rocks, i.e. dead rock, account for 3.4 to 3.8 kg/m², the soil removal necessary for the production of the ores amounts to 0.01 kg/m², raw gravel to 0.09 kg/m².

The values indicated refer to product manufacture. The use of recycled material results in a reduction of non-renewable material content.

7.10.3 Water consumption

Table 7: **Water consumption [m^3/m^2]**

	Heuga 580	Heuga 530
Production	0.37	0.41
Delivery/installation	$2.8 \cdot 10^{-4}$	$2.8 \cdot 10^{-4}$
Usage	0.005	0.005
Disposal	0.015	0.016

Water for production is predominantly consumed during the manufacture of raw materials (94.2 to 94.6 %). The aqueous dyeing method accounts for 2.5 % of the water consumption.

7.10.4 Waste

Table 8: **Waste occurrence [kg/m^2]**

non-hazardous waste				
	overburden/dump material		municipal solid waste	
	Heuga 580	Heuga 530	Heuga 580	Heuga 530
Production	3.51	3.85	$6.5 \cdot 10^{-4}$	$2.2 \cdot 10^{-4}$
Delivery/installation	-0.07	-0.07	$-9.8 \cdot 10^{-6}$	$-9.8 \cdot 10^{-6}$
Usage	0.53	0.53	0.0	0.0
Disposal	-0.57	-0.58	$1.1 \cdot 10^{-3}$	$1.1 \cdot 10^{-3}$
hazardous waste				
	special waste		radioactive waste	
	Heuga 580	Heuga 530	Heuga 580	Heuga 530
Production	$4.8 \cdot 10^{-3}$	$5.2 \cdot 10^{-3}$	$3.4 \cdot 10^{-3}$	$3.7 \cdot 10^{-3}$
Delivery/installation	$2.8 \cdot 10^{-4}$	$2.8 \cdot 10^{-4}$	$-7.7 \cdot 10^{-5}$	$-7.7 \cdot 10^{-5}$
Usage	0.0	0.0	$5.9 \cdot 10^{-4}$	$5.9 \cdot 10^{-4}$
Disposal	$1.5 \cdot 10^{-3}$	$1.5 \cdot 10^{-3}$	$-4.0 \cdot 10^{-4}$	$-4.0 \cdot 10^{-4}$

Dump material is mainly overburden resulting from ore production for the generation of electric power; municipal solid waste essentially is mineral waste.

Hazardous waste includes special waste containing chemicals and toxic waste, and also radioactive waste which consists primarily of residues from ore processing that occur during the provision of electric power.

7.11 Life cycle impact assessment (LCIA)

The environmental impacts resulting from the production of 1 m² of textile floor covering are expressed in impact categories based on the /CML 2002/ method.

The following categories are considered:

Abiotic depletion potential (ADP)

The ADP indicator measures the consumption of non-renewable, non-living (fossil) resources such as metals and minerals which may lead to habitat destruction.The characterisation factor is the potential of abiotic depletion of the extraction of those minerals and fossil fuels and the unit used is kg of antimony (Sb) equivalents per kg of extracted mineral.

Global warming potential (GWP)

For the most frequent substances having an impact on the environment, the parameter GWP (global warming potential) is defined. The climate change was indicated for a time horizon of 100 years. The GWP describes the contribution of a substance to the greenhouse effect relative to the contribution of a like quantity of carbon dioxide (CO_2).

Ozone-layer depletion (ODP)

The depletion of the stratospheric ozone layer is caused primarily by chlorofluorocarbons (CFCs) and some chlorohydrocarbons and bromohydrocarbons. The reference substance used for the ozone depletion is the substance CFC R11, to which the ozone depletion potential (ODP) = 1 is allocated.

Acidification of soils and waters (AP)

The acidification potential indicates to which extent a component has an acidic effect. The acids are soluble in water and may rain down as acid rain. The various emissions within this category are related to sulphur dioxide (SO_2)-equivalents.

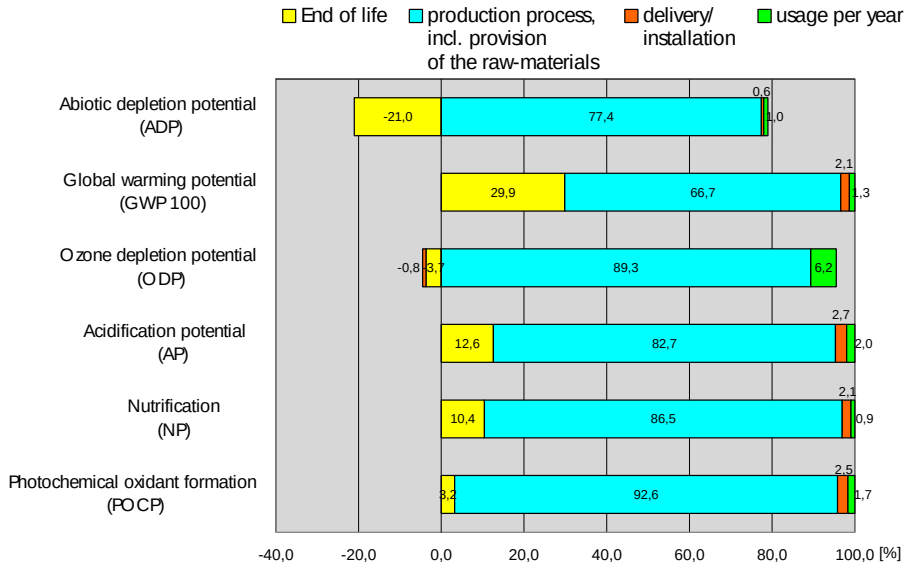
Nutrification (NP)

Nutrification is defined as the effect of excessive input of nutrients into the soil or water. Here, substances are considered that contain either nitrogen or phosphorus. The nutrification potential NP indicates the potential contribution of a substance to the production of biomass. The result is indicated in phosphate equivalents (PO_4).

Photochemical oxidant formation (POCP)

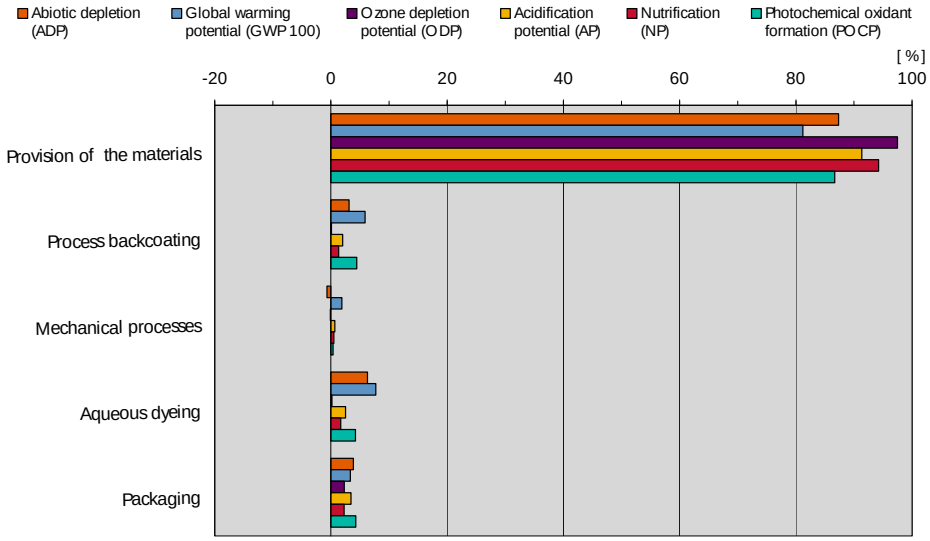
Summer smog is caused by the formation of photochemical oxidants in the lower troposphere. Summer smog is primarily caused through the reaction of hydrocarbons and nitrogen oxides (NOx) under solar radiation. The result is indicated in kilograms ethene equivalents, which is generated in the troposphere.

Graph 8 shows the relative contributions of the life cycle stages product manufacture including the provision of the raw materials, delivery/installation, usage per year and end of life to the impact categories described hereinbefore.



Graph 8: **Relative contributions of the life cycle stages to the environmental impacts (Heuga 530)**

Graph 9 differentiates the share of the environmental impacts for the product manufacture from Graph 8 according to different processes of production (analog to the processes graph 5). For all impact categories, the major part of the contributions results from the provision of the raw materials.



Graph 9: Relative contributions of different processes of production to the environmental impacts (Heuga 530)

7.12 Interpretation

Graph 4 and 8 show that the **production process** (including the provision of the raw materials) accounts for the biggest share in the primary energy consumption and environmental impacts. Closer consideration (Graph 5 and 9) shows that, within this life cycle stage, by far the biggest share is caused by the provision of raw materials and not by the textile-related process steps.
The use of recycled limestone only results in a minor impact reduction.

The **energy recovery** of the textile floor covering (Heuga 530) results in a primary energy credit of 19.1 % (graph 4). The ozone depletion potential (graph 8) also constitutes an energy credit at the end of life because it is crucially dependent on the thermal and electrical energy input. The credit for this energy outweights the input.

In the overall assessment, the life cycle stages **delivery and installation** are of subordinate importance.

In this assessment, a **use stage** of one year is considered. For this period, the impact on the overall assessment is low. It is, however, pointed out that there is a linear rise in this share as the actual service life increases. In case of an assessment considering the entire period of service life, the values for use during 1 year must be multiplied by the years of life considered.

Comparisons with other floor coverings are permissible only if comparable background data and calculation methods are used and if the floor coverings' area of application is the same.

7.13 Description of the benefits beyond system boundaries

Recycled materials

InterfaceFLOR aims at designing products that actively close the loop, thus reducing the need for non-renewable virgin raw materials. InterfaceFLOR products include recycled contents in its raw materials. For example our Graphlex® backing system and our SBR latex precoat contain Pre-Consumer Recycled limestone (percentages vary across manufacturing sites). Certain products are also tufted on a polyester carrier containing recycled materials. InterfaceFLOR is also working pro-actively to increase the use in its products of polyamide fibres that contain recycled content. Unfortunately, polyamide waste is not always reclaimed and recycled. Recovering polyamide from old products and directing it into recycling streams is the only way to effectively increase the size and the availability of recycled polyamide.

Reducing Waste through Design

InterfaceFLOR designs products so that outstanding performance is achieved with less material (less is more principle). One example is the ultra-low tufting styles called Microtuft where total yarn use has been reduced by over 40% when compared to an average carpet tile product.

Cutting carpet to fit the shape of a room inevitably results in waste, but choosing carpet tiles creates just 3-4% waste compared with up to 12% with broadloom carpet. Based on the concept of Biomimicry, or emulating nature when designing products, InterfaceFLOR's random design carpet tiles further reduce installation waste to between 1% and 2% as products can be installed in a non-directional method.

Supply chain management

InterfaceFLOR works with suppliers to ensure they prioritise sustainability and work hard to reduce their own environmental impacts. Supplier evaluation questionnaires are sent to new and strategic existing suppliers to help assess their sustainability engagement, the sustainable features of their products as well as their adhesion to the Supply Chain Policy. We are currently working on several key areas to improve the environmental footprint of the raw materials we use, in particular Nylon yarn, precoat, backing components, namely by developing recycling programmes for used carpet.

Manufacturing improvements

Improving the efficiency of manufacturing operations is at the heart of InterfaceFLOR's Mission Zero sustainability strategy. The improvements achieved on certain performance indicators have been tracked since 1996 in what we call Ecometrics™. The latest Ecometrics™ (compounded globally or per manufacturing site) can be checked at
http://interfaceglobal.com/Newsroom/Ecometrics.aspx

Some other manufacturing improvements include:

- Use of an ultrasonic cutting machine for cutting the carpet tiles. Use of this machine reduces manufacturing waste carpet trimmings by 80%, compared to the traditional die-cutting technology.
- Waste carpet trimmings from manufacturing is recycled and fed into new backing using our Cool Green machine in the UK and sent to Waste to Energy processes like cement kilns in the Netherlands.

Packaging

InterfaceFLOR works on minimizing the packaging used to protect and transport finished products. For example, by substituting a double corrugated cardboard box for a single corrugated box, savings of more than 50 tonnes of cardboard a year can be realized at the factory in the Netherlands alone.

For large projects we can palletize materials prior to shipping (upon request) thus removing the need for cardboard boxes.

Transport

InterfaceFLOR uses outside contractors to deliver finished products. All transport suppliers use modern vehicles that comply with emissions standards set out by the EU's Kyoto agreement. Five of our 14 main international transport providers are certified to environmental standard ISO 14001. A further four have either plans to achieve ISO 14001 or other environmental management systems.

Some transport initiatives include working with suppliers to reduce the environmental impacts by using 'multi-modal' transport (where the most energy efficient type of transport is used for each part of the journey). For example, by switching from truck to barge or train, InterfaceFLOR has cut transport related emissions from the Netherlands to Italy by 70% and from Scherpenzeel to Rotterdam in the Netherlands by 80%. Also by switching from dedicated to grouped delivery in the Netherlands, delivery trucks are now 85-90% full on average, reducing the total number of journeys required.

Maintenance, cleaning, extending product life

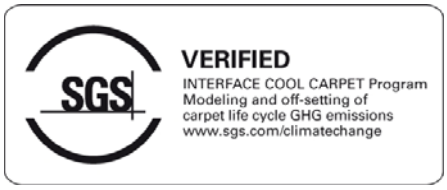
Good maintenance is key to extending the life of carpet tiles. InterfaceFLOR offers advice to periodically clean and maintain our carpet tiles, using the right cleaning products and the right procedures. In some countries, InterfaceFLOR also provides maintenance services. For example, in the Netherlands we offer a service of maintenance for the first two years of life, including periodical maintenance and guaranteed removal of stains.

Product take-back

InterfaceFLOR Europe's ReEntry® Programme is a used-carpet recovery service for any carpet that is being replaced by a new InterfaceFLOR product. ReEntry® guarantees that the carpet will be diverted from landfill and that the most environmentally sound disposal option for each region will be used (see chapter 6.1 above).

Carbon offsetting

Interface and its stakeholders share a common concern for the environment with particular interest in mitigating climate change through the elimination of product-related emissions. They have addressed this concern by creating climate neutral products. The total GHG emissions created during the life cycle of the products (raw material acquisition, manufacturing, transportation, use and maintenance, and end-of-life disposition) are modeled using Life Cycle Assessment methodology. These emissions are then neutralized through the purchase and retirement of an equivalent number of verified emission reduction credits. As a result of this program, all European-made Microtuft and Non-directional products are climate neutral as a standard. All other products can be made climate neutral at no cost upon customer request. This program is verified by SGS Group (http://www.climatechange.sgs.com/home_climatechange_v2/voluntary_activites/cool_carpet_a_climate_neutral_option.htm)



8 Additional Information, verifications and test results

8.1 Emissions

The emissions of the textile floor covering on delivery meet the requirements of the GUT test criteria for VOC emissions (Table 5) and contaminants. For further informations see: www.gut-ev.de.

The emissions of the Tactiles™ Installation System and of Graphlokk tackifier have been measured by TNO Quality Services BV, Enschede, The Netherlands. Testing was performed in august 2010 following ISO 16000-9 methodology for measurement of the specific emission rate of VOCs from newly produced building products.

9 PCR document and examination

This declaration is based on the PCR document “Floor Coverings”, 2008-01.

Review of the PCR document by the committee of experts. Chairman of the CoE: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent verification of the declaration according to ISO 14025: ☐ internal ☒ external
Validation of the declaration: Dr. Eva Schmincke

10 Literature

/AgBB pattern/ Evaluation pattern of the AgBB (Committee for the Health-related Evaluation of Building Products) for VOC; procedure for the health-related evaluation of the emissions of volatile organic compounds (VOC and SVOC) from building products, BAM-Az 2006-3726, version of 2006.

/CML 2002/ Method "Centrum voor Milieukunde", Leiden, NL.

/EC1/ Association for Emission-controlled Installation Materials (GEV) - identification EMICODE EC1: very low emissions

/Ecoinvent/ Datenbase, Swiss Centre for Life Cycle Inventories, Data Version 1.3.

/EN 685/ DIN EN 685:2007-11, Resilient, textile and laminate floor coverings – classification; German version EN 685:2007

/EN 1307/ DIN EN 1307:2008-08, Textile floor coverings – classification of pile carpets; German version EN 1307:2008

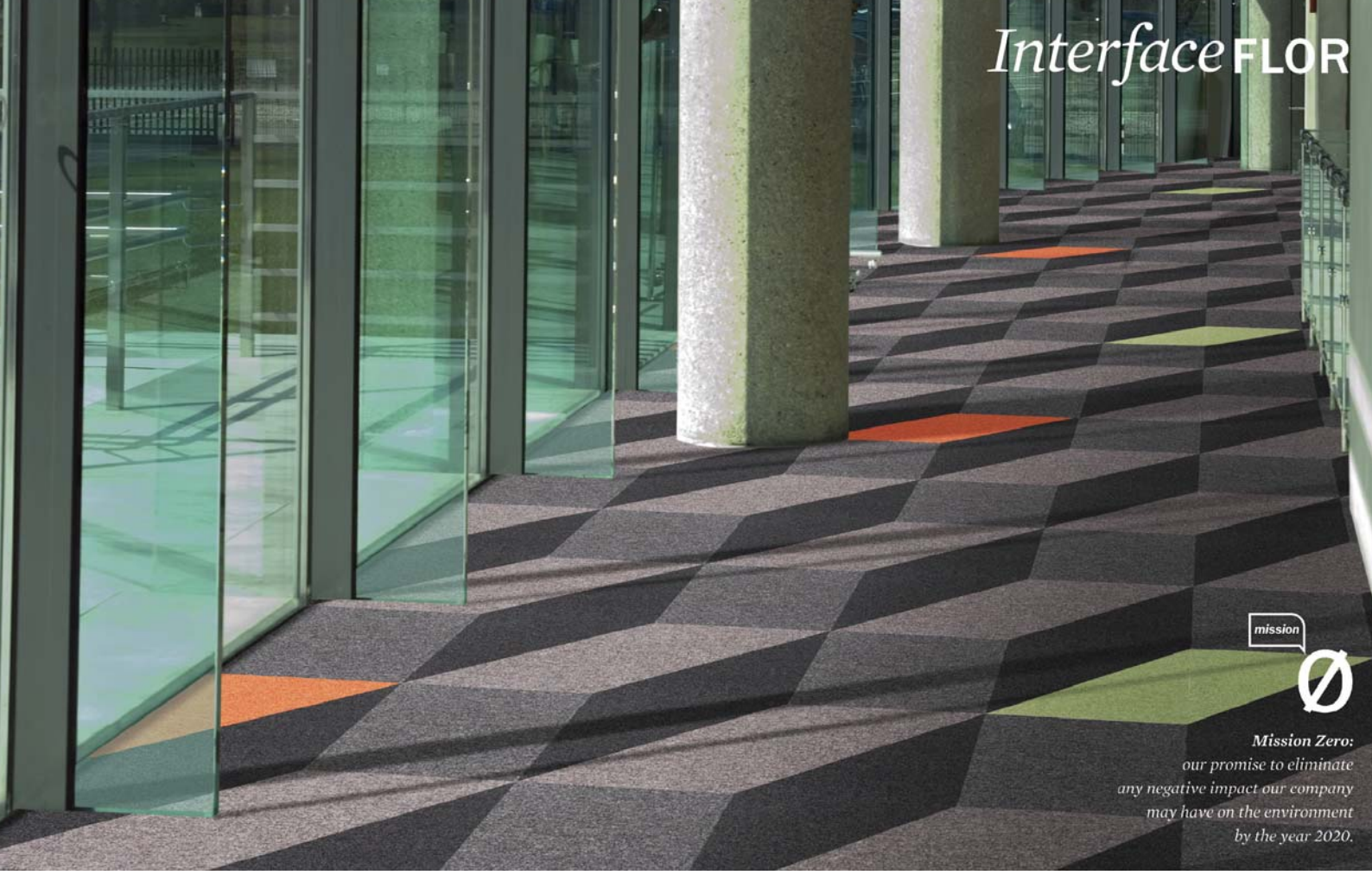
/ISO 14021/ ISO 14021:2001-12, Environmental labels and declarations. Self-declared environmental claims (Type II environmental labelling); (ISO 14021:1999); German version EN ISO 14021:2001

/EN 14041/ DIN EN 14041:2008-05, Resilient, textile and laminate floor coverings – essential characteristics ; German version EN 14041:2004+AC:2005+AC:2006

/GaBi 4/ Software and database for the preparation of life cycle assessments, Faculty of Building Physics (LBP) of the University of Stuttgart and PE International, Stuttgart, Leinfelden-Echterdingen

/ISO 14040/ ISO 14040:2009-11. Environmental management – Life cycle assessment – Principles and frameworks (ISO 14040:2006); German and English version EN ISO 14040:2006

/ISO 14025/ ISO 14025:2007-10, Environmental labels and declarations – Type III environmental declarations – Principles and procedures (ISO 14025:2006); Text in German and English.



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