Environmental Product Declaration

according to ISO 14025

BALSAN
Surfaces textiles

Re.Source

- Tufted, loop-pile carpet tiles -

Contains post-industrial and post-consumer recycled materials (fibres, primary backing, felt backing)

LCA calculation conducted in collaboration with Gemeinschaft umweltfreundlicher Teppichboden e.V.

Declaration number
EPD-BAL-2011111-E

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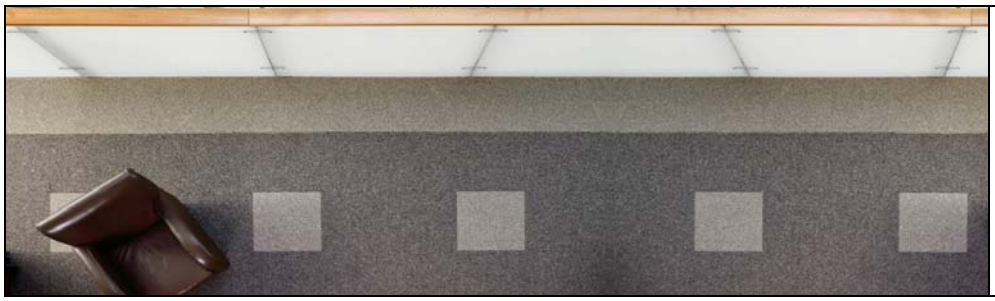
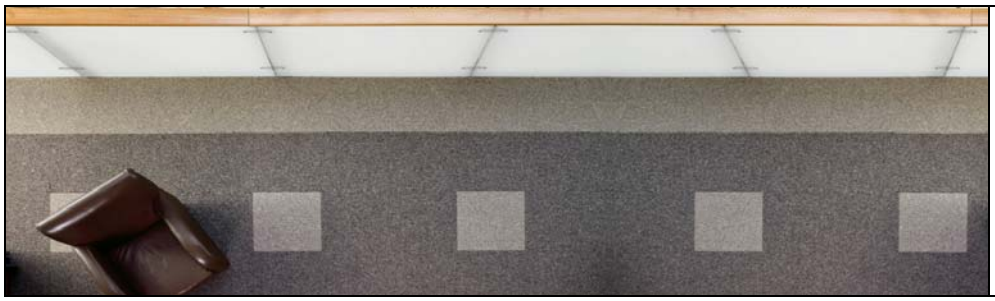


Short version

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**
Balsan Corbilly D 14, F-36330 Le Poinconnet, France www.balsan.com	**Declaration holder**
EPD-BAL-2011111-E	**Declaration number**
Tufted, loop-pile carpet tiles with PA6 fibres made of 100% chemically recycled PA6. **Primary backing consisting of 90 % recycled post-consumer PES.** **"SonicConfort" backing, a textile PES felt containing at least 70 % of post-consumer PES fibres from PES-bottles, in combination with a bitumen based stabilization layer** 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 label of Institut Bauen und Umwelt. 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 declaration holder 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	**Contents of the declaration**
12 October 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 /1/ 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

Kind of manufacture: Tufted, loop-pile
Pile material: 100 % PA6 "Econyl"-yarn made of 100 % chemically recycled PA6
Primary backing: 90 % recycled post-consumer PES
Back coating: Bitumen based finishing with a textile felt containing at least 70 % post-consumer PES from PES-bottles

The textile floor covering is classified as Luxury Classification LC1

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 was carried out according to /ISO 14040/ seq. following the requirements of the IBU guideline for type III declarations. The data reference consisted of specific data provided by Balsan (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 - ReSource**

Categories evaluated	Unit per m²	Production stage	Delivery and installation	Use (1 year)	End-of-life stage
Primary energy not renewable	[MJ]	165.9	2.4	4.1	-60.8
Primary energy renewable	[MJ]	9.6	-0.25	0.3	-0.4
Abiotic depletion potential (ADP)	[kg Sb-eqv.]	0.07	$1.7 \cdot 10^{-3}$	$1.2 \cdot 10^{-3}$	-0.03
Global warming potential (GWP 100)	[kg CO_2-eqv.]	7.7	0.41	0.2	1.1
Ozone depletion potential (ODP)	[kg R11-eqv.]	$1.1 \cdot 10^{-6}$	$-2.2 \cdot 10^{-8}$	$4.5 \cdot 10^{-8}$	$-1.5 \cdot 10^{-7}$
Acidification potential (AP)	[kg SO_2-eqv.]	$2.5 \cdot 10^{-2}$	$1.2 \cdot 10^{-3}$	$8.5 \cdot 10^{-4}$	$-1.4 \cdot 10^{-3}$
Nutrification potential (NP)	[kg PO_4-eqv.]	$4.6 \cdot 10^{-3}$	$3.7 \cdot 10^{-4}$	$9.5 \cdot 10^{-5}$	$-1.2 \cdot 10^{-4}$
Photochemical oxid. form.(POCP)	[kg ethene-eqv.]	$3.0 \cdot 10^{-3}$	$1.5 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$	$-2.6 \cdot 10^{-4}$

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, loop-pile carpet tiles with PA6 fibres made of 100% chemically recycled PA6.
Primary backing consisting of 90 % recycled post-consumer PES.
"SonicConfort" backing, a textile PES felt containing at least 70 % of post-consumer PES fibres from PES-bottles, in combination with a bitumen based stabilization layer

This document refers to **Re.Source** loop-pile carpet tiles manufactured at the following plants:

BALSAN, Corbilly D14. 36330 Arthon, France,
BALSAN, Route de Châteauroux, 36230 Neuvy Saint-Sépulchre, France.

Re.Source carpet tiles are part of Balsan's eco-designed carpet tile collection, which offers improved soundproofing properties and underfoot comfort. With its modular design which is particularly suited to be used in professional service sectors (open space offices, public spaces, etc.) and the hotel business, on new and renovation markets.

Re.Source is a tufted loop pile carpet tile made with 100% solution dyed **Econyl** carpet yarn.

- **Econyl**, produced by Aquafil, Arco, Italy, contains 100% chemically recycled PA6 polymer.
- the **primary backing** is a non woven fleece that contains 90% recycled polyester fibres.
- the **backing "SonicConfort"** is made of PES fibres that at least contain 70% post-consumer recycled polyester fibres produced from recycled PET bottles. The **"SonicConfort"** backing absorbs impact noise (ΔLw=32 dB) and airborne noise (αw=0.30). These acoustic properties enable **Re.Source** carpet tiles to reach a "High performance" level based on the acoustic requirements of the HQE program, and a "very high performance" level according to NF S31-080.

Re.Source carpet tiles are designed (use of raw materials with high recycling content) to optimize its carbon footprint, compared with identical products made of virgin polymer materials.

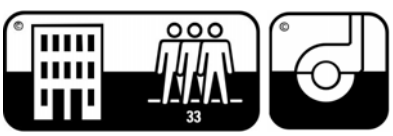
According to EN 1307, its manufacturing process and the corresponding surface pile weight **Re.Source** carpet tile fulfils the requirements for Luxury Class LC1

corresponding FCCS Symbol

The "**SonicConfort"** backing brings also an additional comfort to this luxury level.

0.2 Range of application

Re.Source carpet tile has been assigned use class 33 according to EN 1307 and deemed suitable for the continuous use of swivel chairs:



corresponding FCCS Symbols

0.3 Product standard/ Approval

Ideal for all professional areas with heavy footfall, **Re.Source** carpet tile is rated according to following European standards:

EN 1307: This standard concerns the classification of carpet tiles. It determines the level of usage of these floor coverings according to their resistance to wear and tear and the conservation of their appearance. It also specifies their level of comfort.

CSTB: UPEC rating: U3P3E1C0, reg.no . 336T-007.1

CE marking in accordance with EN 14041

It fulfils the German DiBt requirements and is registered under abZ: **Z-156.601-606**.

0.4 Accreditation

BALSAN's **Re.Source** carpet tile has received GUT-label (environmentally-friendly carpet label) and is registered under the
GUT/**PRODIS licence number *8AEAEDB4***
Content and validity of the licence can be checked online *at www.pro-dis.info*

BALSAN's **Re.Source** carpet tile responds to 8 of the 14 targets defined by the HQE® programme (the HQE® programme was set up by the HQE® Association to describe the environmental quality of a building):

Target 2: Integrated choice of construction processes and products
Target 4: Energy management
Target 7: Management of maintenance
Target 9: Acoustic comfort
Target 10: Visual comfort
Target 11: Olfactory comfort
Target 12: Cleanliness of the internal environment
Target 13: Air quality

Further information is available at the following website:
http://www.balsan.com/en/high-environmental-quality-approach.asp

These accreditations are checked and audited regularly by external bodies.

0.5 Delivery status

Table 2: **Composition and characteristics**	
Nature	Tufted, loop-pile carpet tiles
Dimensions	0,5m x 0,5m
Weight	4200 g/m^2
Composition of the pile	100 % solution dyed nylon (PA6) "Econyl" made from 100 % chemically recycled PA6
Effective pile weight	350 g/m^2
Total pile weight	580 g/m^2
Primary backing	100 % PES made from 90 % recycled material
Backing	Bitumen based finishing with PES-felt "Sonic Confort" containing at least 70 % recycled PES fibres

Product group, PCR:	Textile Floor Coverings, Floor coverings, 2008-01	Issued on
Owner of the declaration:	Balsan, France	12.10.2011
Declaration number:	EPD-BAL-2011111-E	

1 Material content

1.1 Material content

Table 3 lists the raw materials contained in the textile floor covering on delivery as well as their percentage shares in the weight.

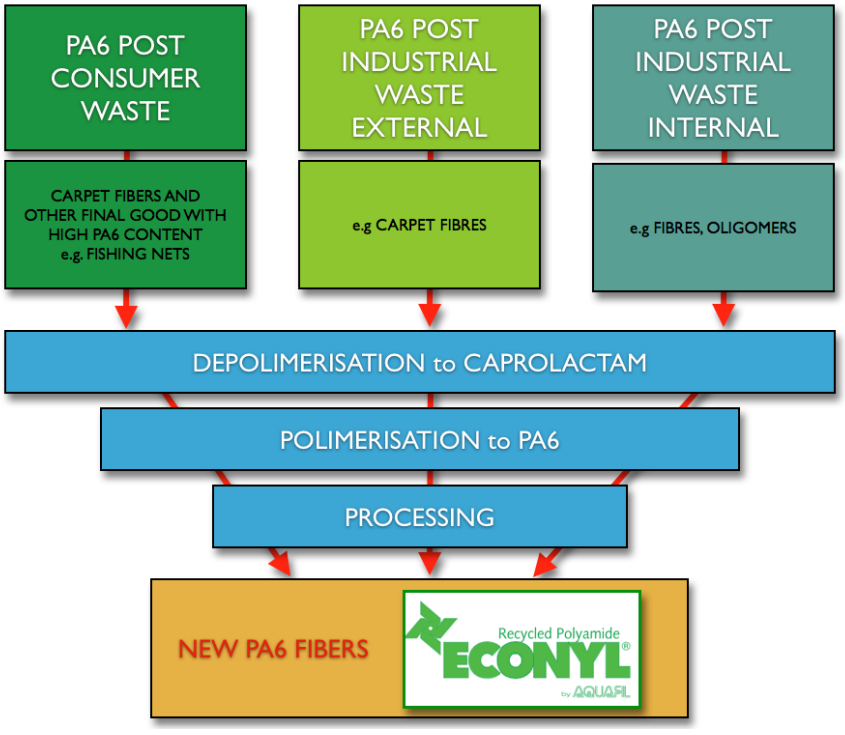
Table 3: **Material content**

Construction layer	Material	Share in weight [%]	Resource renewable	Availability	Origin
Total pile	Recycled PA 6	13.8	yes	abundant	Europe
Primary backing	PET	0.2	no	limited	Europe
	Recycled PET	2.2	yes	abundant	Europe
Precoat	Limestone	14.3	no	abundant	Europe
	SBR latex		no	limited	Europe
Bitumen finish	Limestone	56.8	no	abundant	Europe
	Bitumen		no	limited	Europe
Glass-fibre fleece	Glass fibres	0.8	no	abundant	Europe
Cover fleece	PET	2.1	no	limited	Europe
	Recycled PET (average 82%)	9.8	yes	abundant	Europe

1.2 Production of main materials

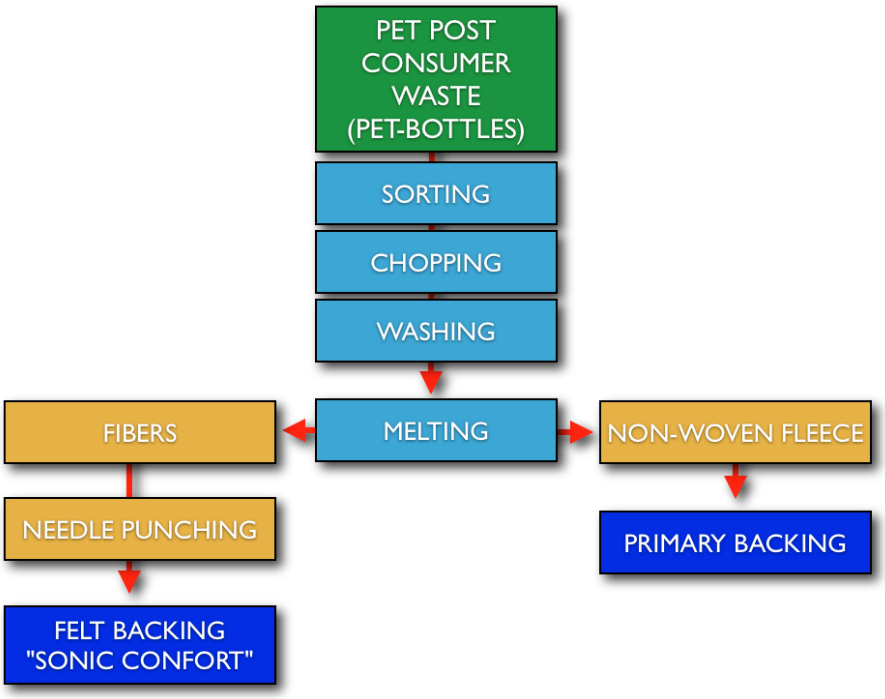
Recycled Polyamide 6 (Econyl by Aquafil)

Post-consumer PA 6 waste, post-industrial PA 6 waste and PA6-oligomer waste from polymer production is depolymerised to Caprolactam. This Caprolactam is then polymerised to new PA 6 granulate which is used for the production of new PA 6 carpet fibres.



Recycled Polyethyleneterephtalate (PET)

Post consumer PET bottles are sorted, washed, chopped into flakes and dried. The flakes are then moulded and extruded to fibres for the production of the felt backing (mechanically needle punched felt) or the nonwoven PET fleece that is used as primary backing.



Limestone (CaCO3)

Limestone is a sedimentary rock, a softer form of white or light-grey lime. Chemically, limestone consists of calcium carbonate. It is added as filler to the latex precoating and bitumen lamination.

Styrene Butadiene Rubber (SBR-Latex)

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

Bitumen

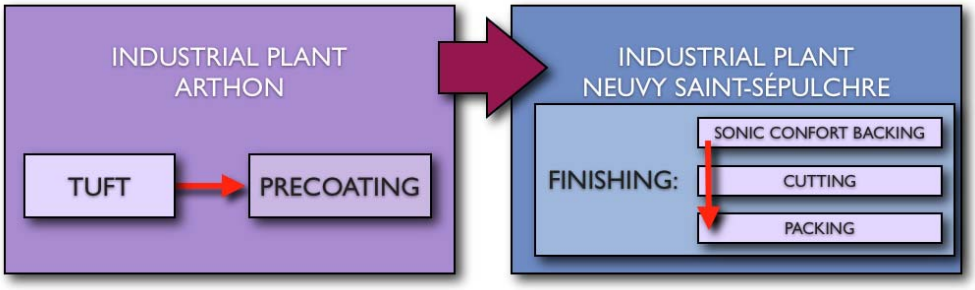
Bitumen counts among the thermoplastic materials and, in addition to the natural occurrences – it is also won through vacuum distillation from petroleum.

Glass fibres

Glass fibres are long, thin fibres consisting of glass. They are manufactured by drawing melted glass into thin threads.

2 Product manufacture

2.1 Production process



Description of the production steps:

Dyeing:

Colouring is done by means of solution dyeing (non-aqueous process).
A colourant in the form of pigments or concentrated dyed granular plastic material (master batch) is added to the spinning mass. This process results in a homogeneously dyed mass. Balsan uses ready dyed Econyl yarn from Aquafil.

Tufting:

Pile threads are machine-sewn into the primary backing (PES non-woven fleece) across the entire breadth of the product by means of a multitude of needles arranged next to each other.

Precoating:

On the back of the tufted a raw product, the x-SBR latex precoat is applied in order to anchor the bottom loop (filaments and tufts) of the pile yarn in the primary backing.

Backcoating

The "SonicConfort"- PET-felt is laminated to the textile use layer, with means of glass fibre stabilized bitumen based coating. Finally, the rolled goods are cut into tiles.

2.2 Health, safety and environmental aspects during production

Balsan's factories in Arthon and Neuvy Saint-Sépulchre were awarded ISO 14001 certification in May 2010.

3 Delivery and installation

3.1 Delivery

Balsan's factories are located in the Indre, in the centre of France, in a protected environment, with two industrial plants, 15 km apart, and perfectly integrated into their surroundings. The central location of the two factories near the Paris region (250 km away), Balsan's historical market, allows the company to limit its transport related greenhouse gas emissions thanks to the short distances it covers.

3.2	**Installation**	**Re.Source** carpet tiles must be installed according to best practice by a professional who is responsible for adhering strictly to standard NFP62-202: Technical specifications sheet for textile floor coverings (see unified technical document DTU 53.1: more information available at http://www.balsan.com/en/advice-laying-carpet-tiles.asp).
3.3	**Health, safety and environmental aspects during installation**	The carpet tiles must be installed on a flat, dry, rigid, clean floor (see DTU 53-1, NF P62-202). If adhesives or tackifiers are used, it is recommended to use only very low VOC emitting products, at least fulfilling the EC1 criteria.
3.4	**Waste**	Cutting edges and other installation residues can be collected and be used for the secondary fuel production. In the Paris region a special collection system for post consumer carpet waste has been installed since 2010 (see also 6 “End of life”).
3.5	**Packaging**	The Carpet tiles are delivered in boxes made of 100% recycled cardboard

4 Use stage

4.1	**Use**	Ideal for use in all professional venues, **Re.Source** carpet tile is also recommended for use in private locations. The estimated service life of **Re.Source** carpet tile lies between 8 and 15 years (even if carpet tiles are often changed earlier for aesthetic reasons, according to trends), as long as it is cleaned and installed according to best practice and Balsan’s recommendations for installation and cleaning.
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 two times a week in residential areas and 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 dry cleaning process is employed. Here, dirt is rinsed out of the surface pile, as a rule by mean of dusting brush or stiff broom. A cleaning frequency of 1 time in 3 years in residential areas and 3 times in 2 years in commercial areas is recommended the frequency depending on individual factors. The method requiresthe use of diluted stain remover and a cleaning agent and electrical energy is needed to operate the dusting brush.
4.1.2	**Prevention of structural damage**	In order to avoid excessive wear and changes in appearance during the use stage, the area of use should not be exposed to more wear than is permissible under the indicated use class. Re.Source is suitable to be used in areas with intensive traffic (use class 33)

4.2 Health aspects during usage

Re.Source carpet tiles fulfil the German AgBB requirements and can be classified as A+ (on a scale of classes going from C: high emissions to A+: very low emissions) according to French regulation for decorative and building products used indoors, taking into account total VOC emissions and 11 individual substances.

Re.Source carpet tile has a TVOC (Total VOC) concentration less than 100 µg/m^3 after 28 days.

The emissions of the carpet tiles on delivery meet the requirements of the GUT test criteria for VOC emissions (Table 4) and contaminants (version 2010).
For further information see: *www.gut-ev.org* or *www.pro-dis.info*

Table 4: GUT **Limit values for volatile organic compounds**

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	-
Formaldehyde	10	4	µg/m³
Carcinogenic Substances EU class 1 + 2	not detectable		-
Additional limits for individual substances see *www.gut-ev.org*			

5 Singular effects

5.1 Fire

The fire protection class is shown on the PRODIS label.
Re.Source is classified as Bfl S_1

5.2 Water

The effect of major water quantities on the carpet tiles over a prolonged period of time may cause damage.

5.3 Mechanical damage

Excessive wear of the carpet tiles during its service life need not be expected if it is properly used, maintained and cleaned in compliance with its declared suitability (see PRODIS label and applied FCCS symbols). Re.Source can be used in offices with castor chairs and is suitable for intensive wear environments (use class 33)

6 End-of-life stage

6.1 Recycling or re-use

On the French market, initiated by UFTM (French Rug and Carpet Union) a collection system, called **Optimum**, for used, post consumer carpet tiles has been installed in 2010. The purpose of this system is to recycle nylon carpet tiles from professional worksites and to optimise the processing of carpet waste and find the best solution for its reuse.

Optimum
Valorisation des moquettes usagées

Further information is available from the following website:
www.moquette-uftm.com/flyer_optimum.pdf

7 Life cycle assessment

7.1 General

The respective results for the product manufacture, the delivery/installation, the use stage, and the end-of-life stage are shown separately.

- **Production stage:** The energy used in the first two product manufacturing steps at the Arthon plant (tufting and coating) is taking from the standard French grid, while at the Neuvy plant for finishing, cutting and packaging 100% renewable energy (hydroelectric power) is used.
  Production waste is recovered in the cement industry.
- **Delivery:** The transport by lorry is considered. For the purposes of the life cycle assessment, a 20 - 26 ton lorry with an average 85% utilisation of its payload and an average transport route of 700 km from the factory gate to the place of installation (European customers) is assumed. The typical distance to French customers is 250 km.

  Installation: Considers the fixing of the tiles. The fixing agent required per m² may be assumed to be 200g.
- **Use stage**: Standardized conditions are assumed for cleaning and maintenance (see chapter 4). A service life of 8-15 years may be assumed
- For the **end-of-life stage**, the calculation considers 70% recovering of the used carpet tiles in the cement industry and 30% thermal recycling in a waste incineration plant.

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

7.2 Functional unit

The declaration refers to 1 m² of tufted carpet tiles.

For the assessment of the use stage, the period of one year is taken into consideration. The values for other periods of use may be calculated by means of multiplication with the relevant factor (see formula in chapter 7.9)

7.3 Cut-off criterion

The limit of detail 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 having 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-use of the used carpet in the cement industry entails an energy and material credit note.

7.5 Background data

The background data refer to

/GaBi 4/ service pack 16, database for the calculation of life cycle assessments 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.

Basis for calculation are original data from Balsan concerning product composition and production factors. Furthermore data provided by the GUT member firms and

generic data taken from the GUT-LCA data were 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 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 the textile floor covering from the cradle to the grave.

The **production stage** includes the extraction and manufacture of all raw materials used, their transport to the production facility, the entire production process and the packaging, inclusive of the packing material of the textile floor covering.

The **delivery/installation** stage includes the transport of the packed carpet to the place of installation, its installation, inclusive of the provision of the fixing agents, their production and transport to the place of installation, also the incineration of the packing material.

The **use stage** covers the cleaning and maintenance of the carpet during the period of one year including the extraction of the raw materials, the cleaning agents, 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 cement plant/ waste incineration plant as well as the material and energy input 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 modeled.

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 5 for the production stage, the delivery/installation stage, the use stage and the end-of-life stage in table 5.

Table 5: **Results of the life cycle assessment**

Categories evaluated	Unit per m²	Production	Delivery and installation	Use (1 year)	End-of-life
Primary energy not renewable	[MJ]	165.9	2.4	4.1	-60.8
Primary energy renewable	[MJ]	9.6	-0.25	0.3	-0.4
Abiotic depletion potential (ADP)	[kg Sb-eqv.]	0.07	$1.7 \cdot 10^{-3}$	$1.2 \cdot 10^{-3}$	-0.03
Global warming potential (GWP 100)	[kg CO_2-eqv.]	7.7	0.41	0.2	1.1
Ozone depletion potential (ODP)	[kg R11-eqv.]	$1.1 \cdot 10^{-6}$	$-2.2 \cdot 10^{-8}$	$4.5 \cdot 10^{-8}$	$-1.5 \cdot 10^{-7}$
Acidification potential (AP)	[kg SO_2-eqv.]	$2.5 \cdot 10^{-2}$	$1.2 \cdot 10^{-3}$	$8.5 \cdot 10^{-4}$	$-1.4 \cdot 10^{-3}$
Nutrification potential(NP)	[kg PO_4-eqv.]	$4.6 \cdot 10^{-3}$	$3.7 \cdot 10^{-4}$	$9.5 \cdot 10^{-5}$	$-1.2 \cdot 10^{-4}$
Photochemical oxidant formation (POCP)	[kg ethene eqv.]	$3.0 \cdot 10^{-3}$	$1.5 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$	$-2.6 \cdot 10^{-4}$

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

$$\text{Value}_{(\text{Production})} + \text{value}_{(\text{Delivery/installation})} + \text{value}_{(\text{use})} \cdot n + \text{value}_{(\text{End of life})},$$

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 detail the selected indicators of the life cycle analysis of 1 m² of textile floor covering 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.

Figure 1 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 (regenerative and non-regenerative).

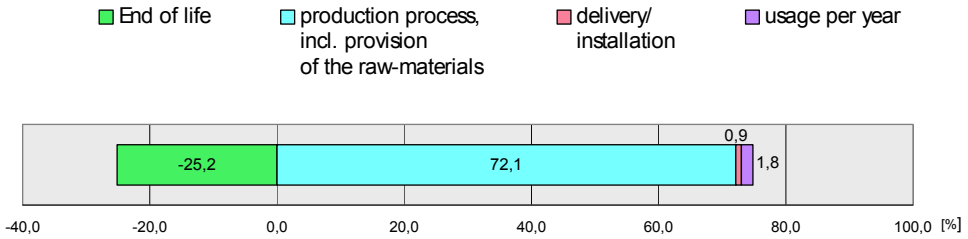


Figure 1: Relative contributions of the life cycle stages to the primary energy consumption (regenerative and non-regenerative)

Figure 2 differentiates the primary energy used from non-renewable and renewable raw materials for the production stage according to different partial processes of production. It shows that the predominant contribution to the primary energy consumption results from the provision of the raw materials for the production of the textile floor covering.
Mechanical processes give rise to energy credit notes resulting from production waste re-use in the cement industry.

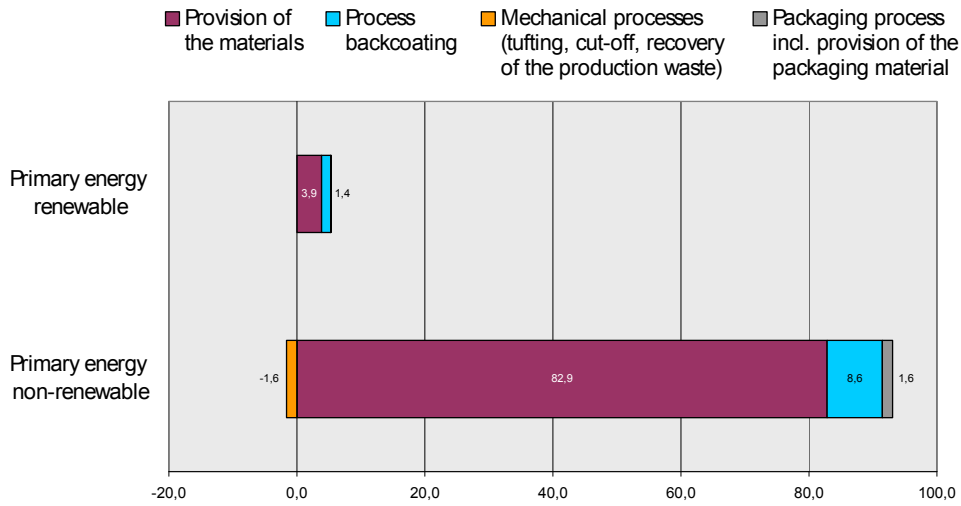


Figure 2: Relative contributions of different partial processes of production to the primary energy consumption during product manufacture

Figures 3 and 4 show the respective share of the energy sources in the non-regenerative and in the regenerative primary energy input. Carpet waste is recovered in cement kilns. The organic matter of this waste is used as a secondary fuel and replaces part of the lignite used for the firing of cement ovens. Lignite is also used for power generation (electricity used in the production process, see energy mix data/ GaBi4/). Using textile floor coverings as secondary fuel overall results in lignite savings.

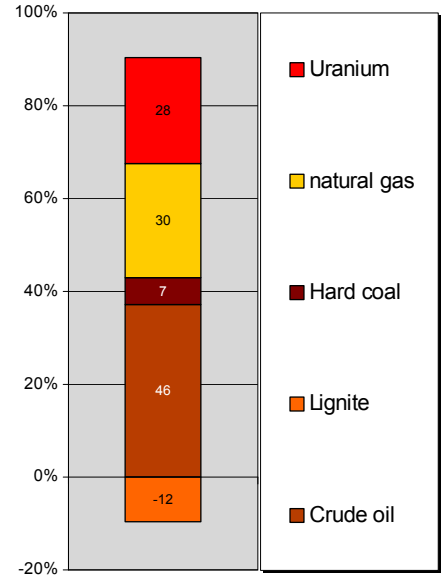


Figure 3: Shares of the non-renewable energy sources

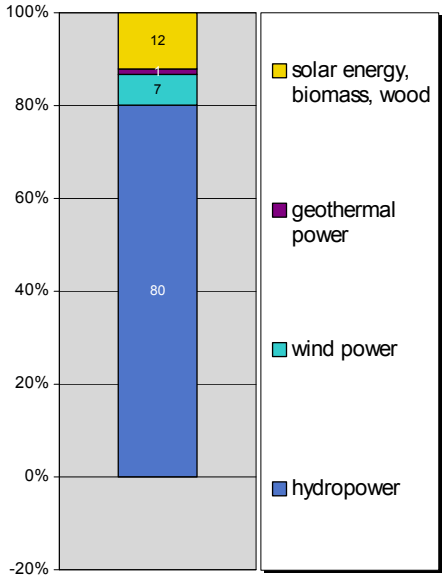


Figure 4: Shares of the renewable energy sources

7.10.2 Non-renewable material content

The non-renewable raw materials used for the production of the carpet tiles 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 2.6 kg/m^2, sodium chloride (rock salt) and clay with each 0.03 kg/m^2, colemanite ore with 0.02 kg/m² and iron with 0.01 kg/m², besides phosphor with 0.03 kg/m^2.

The non-utilisable ores and rocks, i.e dead rock, account for 5.4 kg/m², the soil removal necessary for the production of the ores amounts to 0.2 kg/m², raw gravel also to 0.2 kg/m².

7.10.3 Water consumption

Table 6: **Water consumption [m^3/m²]**

Production	0.08
Delivery/installation	0.004
Usage	0.005
Disposal	-0.017

Water is predominantly consumed during the manufacture of raw materials (94%).

7.10.4 Waste

Table 7: **Waste occurrence [kg/m²]**

non-hazardous waste		
	overburden/dump material	**municipal solid waste**
Production	5.80	0.23
Delivery/installation	-0.15	$2.7 \cdot 10^{-7}$
Usage	0.53	0.0
Disposal	-32.0	$3.3 \cdot 10^{-4}$
hazardous waste		
	special waste	**radioactive waste**
Production	0.02	0.01
Delivery/installation	$2.4 \cdot 10^{-3}$	$-5.3 \cdot 10^{-4}$
Usage	0.0	$5.9 \cdot 10^{-4}$
Disposal	$4.5 \cdot 10^{-4}$	$-8.4 \cdot 10^{-4}$

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 evaluates the exploitation of scarce fossil and mineral raw materials by calculating the ratio of consumption to reserves. The result is indicated relative to the result for antimon (Sb) as Sb equivalent.

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.

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Figure 5 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 for environmental impacts.

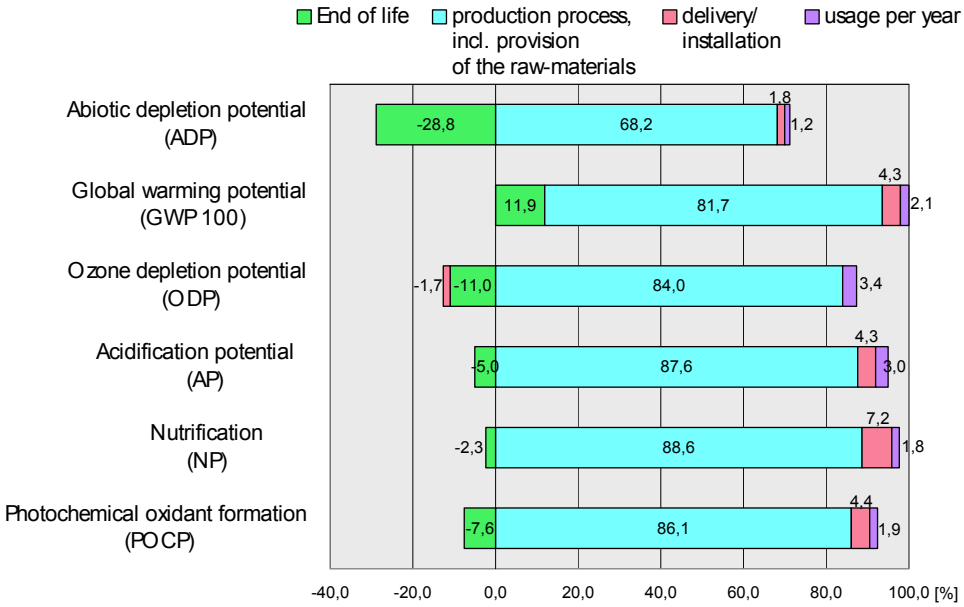

Figure 5: Relative contributions of the life cycle stages to the environmental impacts

Figure 6 differentiates the share of the environmental impacts for the product manufacture from figure 5 according to different partial processes of production. For all impact categories, the major part of the contributions results from the provision of the raw materials. The ADP credit for mechanical processes results from the energy recovery of the production waste in the cement plant.

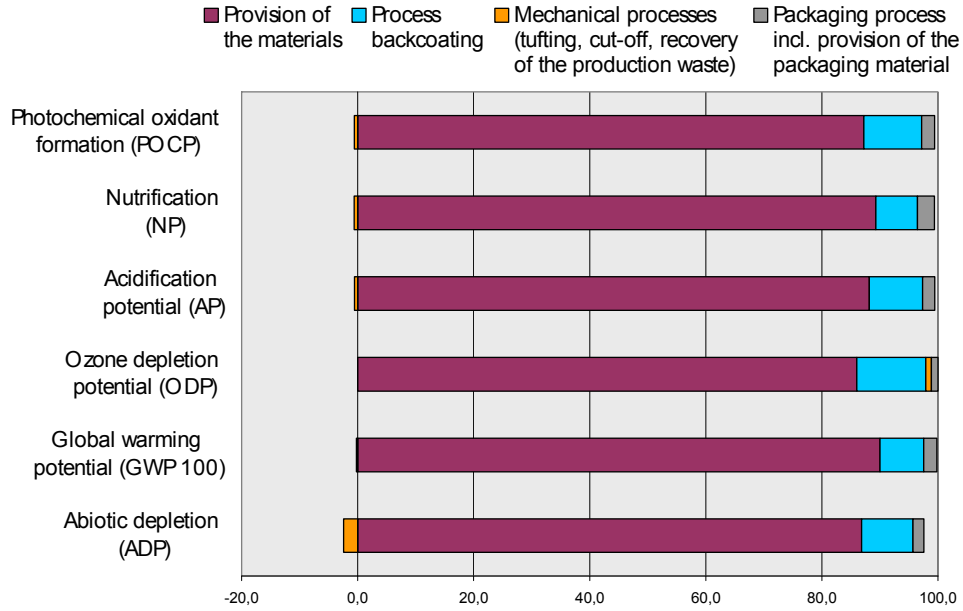

Figure 6: Relative contributions of different partial processes of production

7.12 Interpretation

From Figures 1 and 5 it can be seen that the **production process** accounts for the biggest share in the primary energy consumption and environmental impacts. A Closer consideration (Figures 2 and 6) shows that, within this life cycle stage, by far the biggest share (>80%) is caused by the provision of raw materials and not by the textile-related process steps.

The energetic **re-use** of the textile floor covering results in a primary energy credit of 25.2 % (figure 1). As the ozone depletion potential is crucially dependent on the primary energy input, the result is a corresponding credit note.

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 the use of 1 year (table 5) must be multiplied by the years of life considered.

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 4) and contaminants.

8.2 Acoustic comfort

The sound insulation and sound absorption properties of the **Re.Source** carpet tile are optimal: ΔL_w = 32 dB and α_w = 0,30

9 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/, Database, Swiss Centre for Life Cycle Inventories, Data Version 1.3.

/EN 685/ Resilient, textile and laminate floor coverings – classification

/EN 1307/ Textile floor coverings - classification of pile carpets,

/EN 14041/ Resilient, textile and laminate floor coverings – essential characteristics,

/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, Echterdingen

/ISO 14040/ DIN EN ISO 14040: Environmental management – Life cycle assessment – Principles and frameworks.

/ISO 14025/ DIN EN ISO 14025: Environmental labels and declarations –Type III environmental declarations – Principles and procedures.

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