

Nederlandse Branchevereniging voor de Timmerindustrie (NBvT)  
Nieuwe 's-Gravelandseweg 16  
1405 HM Bussum, the Netherlands

## Environmental Product Declaration

In accordance with EN 15804

- Product name:**
- Fixed wooden window frame, painted, South American hardwood, sustainable forestry, NBvT.
  - Wooden window frame + turn part, hinges and locks, painted, South American hardwood, sustainable forestry, NBvT.
  - Wooden window frame + tilt and turn part, hinges and locks, painted, South American hardwood, sustainable forestry, NBvT.

**Date of Issue:** 8 June 2016

**Validity:** 5 years

**Product unit:** 1 m<sup>2</sup>

### Scope of the Declaration

The type of the EPD is Cradle to grave, intended for possible inclusion in the NMD, as a branch average product. The LCA was carried out by Agrodome. Based on the production data of manufacturers which are representative of the way in which Members of the Nederlandse Branchevereniging voor de Timmerindustrie (Dutch Trade Association for the Timber Industry) fabricate window frames, further referred to as the 'manufacturer'.



## Goal and scope

The aim of the study is to collect accurate and reliable information on the environmental impact 'Cradle to Grave' during the lifespan of the products: South American hardwood<sup>1</sup> fixed window frame, window frame + turn part and the window frame + tilt and turn part. Based on this data, the client can make improvements in the production processes of the products. In addition, the aim is inclusion in the Dutch National Environmental Database (NMD) as a branch average (category-2) product. The target group is, besides the client and its members, especially the manufacturers of a similar product and the group of users of the National Environmental Database (NMD). They can use the information on this product included in the NMD in their calculations and research. In addition, results can be used to inform customers about the environmental impact of the product.

## Product description

### **Reference 'window frame for fixed glass'**

Wooden window frame made from South American hardwood from sustainably managed forests. Including full finish with multiple coats of paint and maintenance. Excluding glazing. Based on the KVT. The size of the frame is 1500x3300 mm in accordance with the functional unit of the NMD. This product is representative for the members of the NBvT that produce window frames.

### **Reference 'window frame with outward opening window'**

Wooden window frame with outward opening window made of South American hardwood from sustainably managed forests. Including full finish with multiple coats of paint, locks and hinges, frames and maintenance. Excluding glazing. Based on the KVT, with a dimension of 2.16 m<sup>2</sup> measured externally. This product is representative for the members of the NBvT that produce window frames.

### **Reference 'window frame with tilt and turn window'**

Wooden window frame with tilt and turn window made from South American hardwood from sustainably managed forests. Including full finish with multiple coats of paint, locks and hinges, frames and maintenance. Excluding glazing. Based on the KVT, with a dimension of 2.52 m<sup>2</sup> measured externally. This product is representative for the members of the NBvT that produce window frames.

## Product Application

Wooden exterior window frames and windows can be used in designs for homes and commercial buildings. The layout and dimensions of the exterior window frames, the outward opening windows and tilt and turn windows is flexible. Outer frames and windows of this type are applied on the outside of a house / building. Inner door application is of course also possible.

The reference product is a prefabricated window frame and / or window of South American hardwoods, wherein the dimensions of the reference products are:

- Window frame for fixed glass: 1500x3300 mm in accordance with the maximum functional unit of the NMD

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<sup>1</sup> South American hardwood is a virtual wood species, based upon the Dutch market share of four regular hardwood species from South America for window frames and facades: sucupira vermelho, angelim pedra, guariuba and louro gamela. (SHR, 2016)

- Window frame with outward opening window: 2.16 m<sup>2</sup> externally measured in accordance with the KVT and falls within the maximum functional unit of the NMD
- Window frame with tilt and turn window: 2.52 m<sup>2</sup> externally measured in accordance with the KVT and falls within the maximum functional unit of the NMD

These window frames and windows are factory painted with several layers. The tilt and turn window and outward opening window are fully equipped with hinges and locks, where necessary rebate and associated frameworks for sealing are used. Implementation is exclusive glazing. For transportation to the site packaging is provided. Implementation includes maintenance.

These window frames and windows of NBvT members are normally manufactured under KOMO-certificate and meets the technical quality requirements that may be imposed on a product made for normal use and for the purpose for which the frame is intended.

## LCA calculation rules

### Functional Unit

#### **Reference 'fixed outer frame' South American hardwood**

A wooden window frame, fixed, painted, for a lifespan of 75 years, produced according to KVT, with external dimensions of approximately 3300 x 1500mm, gross profile size 114x67 mm, inner dimension of 4.33 m<sup>2</sup>, made of South American hardwood, from sustainably managed forest, density 754 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	12,6	kg/m <sup>2</sup>

#### Bill of materials, fixed outer frame

Material	Amount weight
South Am. hardwood, sustainable forestry	96 %
Paint	3 %
Other (glue, dowels, filler)	< 1 %
Wrapping foil	1 %

#### Technical data, fixed outer frame

Name	Value
Density South American hardwood	754 kg/m <sup>3</sup>
Dimension of frame (average (l*w))	3300 x 1500 mm
Dimension profile window frame	67 x 114 mm
Weight (average)	62,2 kg/window frame

#### **Reference 'outer frame with an outward opening window' S. Am. hardwood**

A wooden window frame with an outwards part, painted, for a lifespan of 75 years, including locks and hinges, produced according to the KVT, with external dimensions of 1200 x 1800mm, gross profile size 114x67 mm and 101x68 mm, inner dimension of 1.78 m<sup>2</sup>, made of South American hardwood, from sustainably managed forests, density 754 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	34,1	kg/m <sup>2</sup>

#### Bill of materials, window frame with outward opening window

Material	Amount weight
South Am. hardwood, sustainable forestry	94 %
Paint	3 %
Hinges and locks (steel, stainless steel, aluminium)	2 %
Other (glue, dowels, filler, rubbers)	1 %
Wrapping foil	1 %

#### Technical data, window frame with outward opening window

Name	Value
Density South Am. hardwood	754 kg/m <sup>3</sup>
Dimension of frame (average (l*w))	1800 x 1200 mm
Dimension profile window frame	67 x 114 mm
Dimension profiel window	68 x 101 mm
Weight (average)	73,7 kg/kozijn

#### Reference 'outer frame with tilt and turn window' South Am. hardwood

A wooden window frame with a rotating and tipping part, painted, for a lifespan of 75 years, including locks and hinges, produced according to KVT, with external dimensions of approximately 1400 x 1800mm, gross profile size 114x67 mm and 101x68 mm, inner dimension of 2.11 m<sup>2</sup>, made of South Am. hardwood, from sustainably managed forests, density 754 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	29,2	kg/m <sup>2</sup>

#### Bill of materials, outer frame with tilt and turn window

Material	Amount weight
South Am. hardwood, sustainable forestry	90 %
Hinges and locks (steel, stainless steel, aluminium)	5 %
Paint	3 %
Other (glue, dowels, filler, rubbers)	1 %
Wrapping foil	1 %

#### Technical data, outer frame with tilt and turn window

Name	Value
Density South Am. hardwood	754 kg/m <sup>3</sup>
Dimension of frame (average (l*w))	1800 x 1400 mm
Dimension profile window frame	67 x 114 mm
Dimension profiel window	68 x 101 mm
Weight (average)	73,6 kg/kozijn

#### Reference Life Span

The reference life span of the product is, according to the manufacture, 75 years, when using the advised maintenance scheme. There is no return collect programme.

#### System boundary

This EPD is made for "Cradle to Grave" according to EN 15804

#### Comparability

A comparison or evaluation of EPD data is only possible if all datasets are made following EN 15804 applying the same relevant product category rules and for the same modules.

## LCA-modules

The following data refer to the declared modules and form the basis for further calculations. All provided values refer to the declared product unit.

The European norm EN 15804 is based on four main modules corresponding with the various phases in the lifecycle of a building material: Module A (production and construction stage), Module B (use stage), Module C (End of life stage) and Module D (Environmental effects outside of the system boundary). See figure 1.

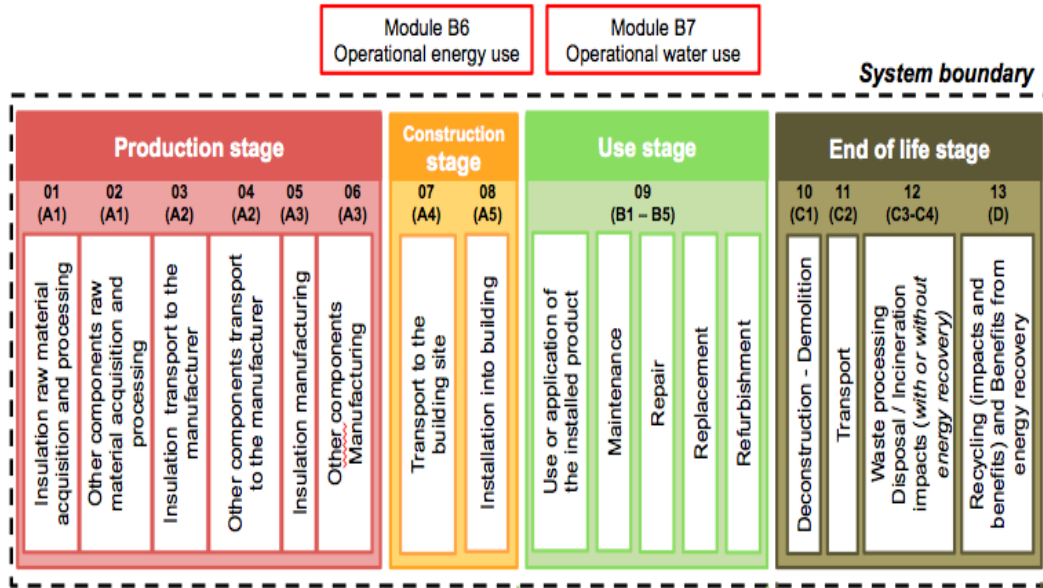


Figure 1: Division of the modules over the lifecycle of a building material as determined in EN 15804.

This EPD gives information about the stages A1-3, A4-5, B1-5, C1-4 and D.

## LCA results

In the table below the results for the various environmental categories are provided for 1 m<sup>2</sup> of **fixed window frame**.

Environmental impact	Unit	A1, A2, A3 + A5	A4	B1	B2	C2	C1, C3, C4 + D
Abiotic depletion, non fuel	kg antimony eq.	1,53E-05	7,07E-07	0,00E+00	1,04E-05	7,82E-07	2,63E-07
Abiotic depletion, fuel	kg antimony eq.	9,54E-02	1,75E-03	0,00E+00	2,76E-02	4,10E-03	-6,01E-02
Global warming (GWP100)	kg CO2 eq.	1,21E+01	2,43E-01	0,00E+00	4,47E+00	1,08E+00	-7,48E+00
Ozone layer depletion (ODP)	kg CFK-11 eq.	1,08E-06	3,90E-08	0,00E+00	5,26E-07	1,07E-07	-5,14E-07
Photochemical oxidation	kg ethylene eq.	4,45E-03	1,79E-04	0,00E+00	4,56E-03	6,35E-04	-8,40E-04
Acidification	kg SO2 eq.	3,57E-02	1,31E-03	0,00E+00	1,20E-02	3,75E-03	-8,26E-03
Eutrophication	kg PO4- eq.	7,61E-03	3,03E-04	0,00E+00	2,14E-03	8,30E-04	-1,74E-03
Human toxicity	kg 1,4- DB eq.	3,26E+00	6,85E-02	0,00E+00	1,22E+00	4,08E-01	-9,47E-01
Fresh water aquatic ecotox.	kg 1,4- DB eq.	9,79E-02	3,00E-03	0,00E+00	9,63E-02	9,49E-03	-1,14E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	6,35E+02	1,23E+01	0,00E+00	2,06E+02	3,66E+01	-4,12E+02
Terrestrial ecotoxicity	kg 1,4- DB eq.	6,40E-02	7,92E-04	0,00E+00	2,82E-02	4,22E-03	-5,86E-03
Total renewable energy	MJ	4,56E+02	5,07E-02	0,00E+00	2,36E+00	1,64E-01	-1,35E+02
Total non renewable energy	MJ	2,11E+02	4,07E+00	0,00E+00	6,52E+01	9,51E+00	7,53E-02
Total Energy	MJ	6,67E+02	4,13E+00	0,00E+00	6,76E+01	9,67E+00	-1,27E+02
Water, fresh water use	m3	1,30E+01	2,95E-01	0,00E+00	8,84E+00	9,65E-01	-3,32E+00
Waste, non hazardous	kg	1,97E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	3,49E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

In the table below the results for the various environmental categories are provided for 1 m<sup>2</sup> of **window frame with outward opening window**.

Environmental impact	Unit	A1,A2,A3 + A5	A4	B1	B2	C2	C1, C3, C4 + D
Abiotic depletion, non fuel	kg antimony eq.	1,46E-04	1,88E-06	0,00E+00	4,17E-05	1,96E-06	8,71E-07
Abiotic depletion, fuel	kg antimony eq.	2,55E-01	4,66E-03	0,00E+00	7,33E-02	1,02E-02	-1,63E-01
Global warming (GWP100)	kg CO2 eq.	3,25E+01	6,45E-01	0,00E+00	1,16E+01	3,20E+00	-2,03E+01
Ozone layer depletion (ODP)	kg CFK-11 eq.	2,91E-06	1,04E-07	0,00E+00	1,39E-06	2,64E-07	-1,39E-06
Photochemical oxidation	kg ethylene eq.	1,30E-02	4,74E-04	0,00E+00	7,13E-03	1,63E-03	-2,24E-03
Acidification	kg SO2 eq.	1,05E-01	3,49E-03	0,00E+00	3,10E-02	9,59E-03	-2,21E-02
Eutrophication	kg PO4- eq.	2,12E-02	8,04E-04	0,00E+00	5,38E-03	2,15E-03	-4,67E-03
Human toxicity	kg 1,4- DB eq.	1,96E+01	1,82E-01	0,00E+00	3,20E+00	1,07E+00	-2,56E+00
Fresh water aquatic ecotox.	kg 1,4- DB eq.	2,79E-01	7,98E-03	0,00E+00	2,42E-01	2,50E-02	-3,02E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	1,72E+03	3,27E+01	0,00E+00	5,27E+02	9,58E+01	-1,12E+03
Terrestrial ecotoxicity	kg 1,4- DB eq.	3,98E-01	2,10E-03	0,00E+00	6,97E-02	1,07E-02	-1,57E-02
Total renewable energy	MJ	1,18E+03	1,35E-01	0,00E+00	6,05E+00	4,12E-01	-3,65E+02
Total non renewable energy	MJ	5,64E+02	1,08E+01	0,00E+00	1,74E+02	2,37E+01	1,11E+00
Total Energy	MJ	1,75E+03	1,10E+01	0,00E+00	1,80E+02	2,41E+01	-3,43E+02
Water, fresh water use	m3	7,97E+01	7,83E-01	0,00E+00	2,28E+01	2,43E+00	-8,96E+00
Waste, non hazardous	kg	4,54E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	8,04E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

In the table below the results for the various environmental categories are provided for 1 m<sup>2</sup> of **window frame with tilt and turn window**.

Environmental impact	Unit	A1, A2, A3 + A5	A4	B1	B2	C2	C1,C3, C4 + D
Abiotic depletion, non fuel	kg antimony eq.	1,47E-04	1,56E-06	0,00E+00	1,69E-04	1,62E-06	6,11E-07
Abiotic depletion, fuel	kg antimony eq.	2,27E-01	3,88E-03	0,00E+00	1,30E-01	4,03E-03	-1,35E-01
Global warming (GWP100)	kg CO2 eq.	3,00E+01	5,37E-01	0,00E+00	1,46E+01	5,58E-01	-1,53E+01
Ozone layer depletion (ODP)	kg CFK-11 eq.	2,45E-06	8,64E-08	0,00E+00	2,32E-06	8,96E-08	-1,07E-06
Photochemical oxidation	kg ethylene eq.	1,23E-02	3,95E-04	0,00E+00	1,22E-02	4,10E-04	-1,04E-03
Acidification	kg SO2 eq.	9,86E-02	2,91E-03	0,00E+00	4,53E-02	3,02E-03	-1,44E-02
Eutrophication	kg PO4- eq.	1,87E-02	6,70E-04	0,00E+00	6,91E-03	6,95E-04	-3,00E-03
Human toxicity	kg 1,4- DB eq.	1,70E+01	1,52E-01	0,00E+00	4,84E+00	1,57E-01	-1,49E+00
Fresh water aquatic ecotox.	kg 1,4- DB eq.	2,48E-01	6,65E-03	0,00E+00	2,83E-01	6,90E-03	-1,29E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	1,51E+03	2,72E+01	0,00E+00	7,47E+02	2,83E+01	-9,05E+02
Terrestrial ecotoxicity	kg 1,4- DB eq.	1,89E-01	1,75E-03	0,00E+00	8,91E-02	1,82E-03	-6,76E-03
Total renewable energy	MJ	9,47E+02	1,12E-01	0,00E+00	8,78E+00	1,16E-01	-3,12E+02
Total non renewable energy	MJ	5,05E+02	9,01E+00	0,00E+00	3,08E+02	9,36E+00	1,01E+01
Total Energy	MJ	1,45E+03	9,13E+00	0,00E+00	3,16E+02	9,47E+00	-2,84E+02
Water, fresh water use	m3	9,39E+01	6,53E-01	0,00E+00	3,11E+01	6,78E-01	-6,41E+00
Waste, non hazardous	kg	3,82E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	2,39E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

## Representativeness production process

These products are made according to the reference production of the NBvT for the Netherlands in 2012, as determined by the section 'Frames' of the NBvT, the information can serve as the industry average for the examined frame.

## Representativeness Geographically

The frames as described in this EPD are made by manufacturers in many production sites throughout the Netherlands. The product is not bound to a specific site of raw materials. Because of the relatively large group of producers and their geographical spread through the Netherlands an average distance to a construction site was used. This distance, the default distance of 150 km used by SBK, is representative of all production locations in the Netherlands and is therefore used for the LCA calculations.

## Qualitative information

The members of the NBvT spend their utmost attention to the manufacture of the products. In the design and manufacture of wooden window frames, both the architect and the manufacturer have to keep into account the quality, function and performance requirements. These are expressed in the National Assessment (BRL) 0801 "Wooden façade elements," the KOMO attestation with product certificate and the Building Act. The companies affiliated with the NBvT producing frames must have the KOMO attestation with product certificate "Wooden façade elements' (BRL0801).

The agent for companies that uses demonstrably sustainable timber or sales timber products is certification. Because all companies from forest manager to final supplier has to be certified, there is a traceable Chain of Custody (CoC). This trade chain makes it clear how the trade flow from tree-felling to finished product is running. All companies affiliated with the NBvT should have a CoC certificate.

By the NBvT the KVT, "Quality of wooden façade elements - Descriptions of materials and semi-finished products and procedures for the composition" are prepared and issued. The materials, processes, finishes and structures included in the various sections of the KVT meet the requirements of BRL 0801.

## Sourcing raw materials

The manufacturer has no fixed supplier for the procurement of raw materials. The products used in the manufacture may be derived from different input suppliers. If the supplier was known, his or her data are used, in other cases the SBK- or Ecoinvent data are used.

## Data quality

During and after the factory visit the manufacturer has given physical and digital documentation and drawings, as well as the quantities of material required for the tested element.

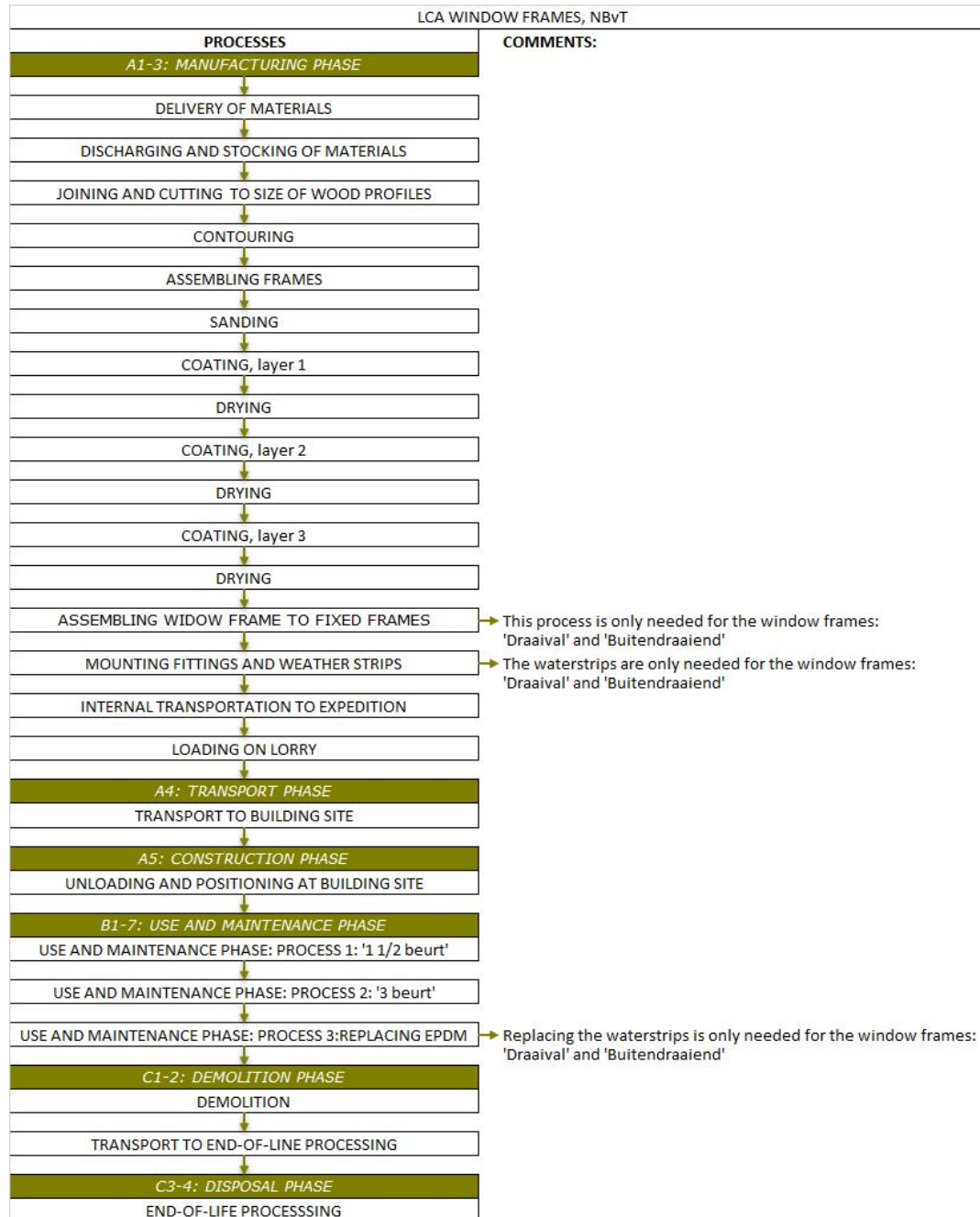
Energy consumption of equipment, and equipment which is needed for the manufacture of the product is based upon the consumption in 2015. Several manufacturers, which together cover the entire range of possible production, have provided documentation to arrive at an industry average.

With the exception of the manufacturing phase, standard values for the further phases are used from the SBK-bepalingsmethode 2.0. This applies, in particular, for transport distances, the processing in the waste phase, and the choice of the transport means. Return transports loaded / unloaded, are according to the manufacturer. In the final phase, the transport has been calculated according to the SBK-bepalingsmethode 2.0.

Production may change over time. In this EPD the information about the production of the element is based on measurements and observations from 2015 and 2016 (energy, waste percentages, amounts net per element, production volume). Data from supply companies are all as recent as feasible.

## Life Cycle Stages

Flowchart for the production of NBvT South American. hardwood window frames



### Product stage (A1-3)

All three types of reference frames follow the same procedure at the factory. The only difference is the locks, hinges and seals that are missing at the fixed frames. Locks, hinges and seals are used with the window frame with outward opening window and the window frame with tilt and turn window variant in a slightly different composition. The South Am. hardwood window frames and parts are made of beams of solid South Am. hardwood. In the factory they are first selected based on quality and the desired sizes are abbreviated. Thereafter, the profiles are applied at their particular location of the part in the window frame. The above processes are largely automatized. The



frames are then assembled and prepared by hand for the painting. The paint spraying is carried out in 3 courses, with recovery of excess paint. There occurs some loss of paint. After drying, the frames, as far as concerns the window frame with outward opening window and window frame with tilt and turn window variants are fitted with hinges and locks and seals. The frames are then put ready for storage or for any glazing. The glazing can take place immediately after the drying process or later on the construction site, because this is done by an external party, glazing is not included in this study. The ready-made frames are wrapped in foil and transported to the warehouse or directly to the construction site.

## Construction stage (A4-5)

### Transport to building site (A4)

Transportation to the site is done with, if possible (usual situation), full loaded trucks. Full return is taken into account. Here is the default value used from the SBK-bepalingsmethode 2.0, 150 km. Selection of the means of transport is made at the declaration of the manufacturer.

### Installation of the product in the building (A5)

On site the casing is placed, it is common that this happens by using already existing equipment such as a crane. This is not separately argued for placement of frames in the line. Therefore, equipment is disregarded. The packaging film (LDPE) is discharged along with other building materials. For this waste the scenario from the SBK-bepalingsmethode is used: 85% combustion, 10% deposit and 5% recycled.

## Use stage (B1-7) .

The products 'fixed outer frame', 'outer frame with an outward opening window' and 'outer frame with tilt and turn window' have a lifespan of 75 years for the proper application of the product. To achieve this life requires structural maintenance. This is done according to the following schedule:

Overall, it is:

- paint job every 10 years, sanding, paint Update
- Rubber to be replaced after 30 years, along with the paint job.
- Major maintenance in 40 years, paint stripping, sanding and new coats of paint

## End of life stage (C1-4)

### Demolition (C1)

Demounting and demolition are assumed to be manually done, no industrial process.

### Transport (C2)

For the transport in EoL-stage the default value is used according to the SBK-bepalingsmethode 2.0. This is 50 km to sorting plant and 100 km from demolition or sorting location to location processing. For the transport a > 16-ton truck is chosen.

### Waste processing (C3-C4)

Waste according to defaults by SBK-bepalingsmethode 2.0. (Appendix B).

## Benefits and loads beyond the system boundary (D)

Benefits and loads involves avoided energy by burning wood. It also includes the recycling and reuse of the lock and hinges. The results are combined with C 1.3 and 4 in Tables 2 and 3.

## Accountability

The LCA study that underlies this EPD has started with a visit to a production plant on October 6, 2015. This manufacturing process is further mapped and data are collected, completed later to get the full picture of the production by the manufacturer and the NBvT.

The LCA was carried out in compliance with the standards of the ISO 14000 series: 14025, 14040 and 14044. The LCA report is checked against the SBK-bepalingsmethode 2.0 version, by SHR in March 2016.

When calculating the environmental impact categories SimaPro version 8.1.1 was used and environmental data from the SBK-based processes database version 1.7, June 2015, and in some cases, where no SBK data were available, the Ecoinvent database, version 2.2.

In making calculations, the long-term emissions (emissions that may occur after 100 years) are not included in accordance with the SBK-bepalingsmethode 2.0. (P.16). The effects of capital goods and infrastructure processes have been included.

## References

### **Agrodome**

LCA report South Am. hardwood frames, turn, turn and tilt for NBvT, May 2016, Agrodome, Wageningen, authors S. Verspeek and F. van der Burgh.

### **EN 15804: 2012-04**

Sustainability of construction works - Environmental Product Declarations - Basic Rules of the product construction.

### **KVT**

[www.kvt-online.nl/](http://www.kvt-online.nl/)

### **SHR**

SHR 1kg South American hardwood, dried 12%, sustainable production, transported from timbertrader in the Netherlands S – Wageningen 2016

### **SHR**

Basic profiles for the Nationale Milieudata base of South American hardwood, Wageningen February 2016

### **SBK**

Bepalingsmethode milieuprestatie voor gebouwen en GWW (Determination method for the environmental performance of buildings and civil engineering works) Version 2.0 final 2014 - Rijswijk, 2014

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## Statement SHR

SHR has reviewed this Environmental Product Declaration on 25 March 2016 and stated that the report complies with the SBK- bepalingmethode 2014 2.0 and the underlying standards. The environmental profiles and product files with this information can be offered to SBK for inclusion in the NMD.