

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, Accoya, sustainable forestry, NBvT.
  - Wooden window frame + turn part, hinges and locks, painted, Accoya, sustainable forestry, NBvT.
  - Wooden window frame + tilt and turn part, hinges and locks, painted, Accoya, sustainable forestry, NBvT.

**Date of Issue:** 17 October 2016

**Validity:** 5 years

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

### Scope of the Declaration

The type of the EPD is cradle to grave. The LCA was carried out by Agrodome, based on representative production data of window frame manufacturers of the Nederlandse Branchevereniging voor de Timmerindustrie (Dutch Trade Association for the Timber Industry), 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 during the lifespan ('Cradle to Grave') of various window frames made from modified wood through acetylation ('Accoya wood'):

- Accoya fixed window frame
- Accoya window frame + turn part
- Accoya window frame + tilt and turn part.

Based on the outcomes, the client can make improvements to reduce the environmental impact in the production processes. 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 NMD. Finally, the results can be used to inform customers about the environmental impact of the product.

## Product description

### Reference 'fixed window frame'

Wooden window frame made from Accoya from sustainably managed forests<sup>1</sup>, including full finish with multiple coating. And including maintenance, excluding glazing. The size of the frame is 1500x3300 mm in accordance with the functional unit required in 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 Accoya from sustainably managed forests, including full finish coating, locks and hinges, frames and maintenance, excluding glazing, 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 Accoya from sustainably managed forests, including full finish coating, locks and hinges, frames and maintenance, excluding glazing, 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 private and public buildings. The layout and dimensions of the exterior window frames, the outward opening windows and tilt and turn windows is flexible.

The reference product is a prefabricated window frame made of Accoya, with the following dimensions:

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<sup>1</sup> The Dutch government established an independent committee of experts TPAS (Timber Procurement Assessment System) to determine which sustainable forestry labels comply with the stringent requirements posed by the Dutch government with respect to sustainable forestry. At the moment of writing (2016), FSC, PEFC and Malaysian MTCS have been approved.

- Window frame for fixed glass: 1500x3300 mm in accordance with the maximum functional unit of the NMD
- 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 of coating. The tilt and turn window and outward opening window are fully equipped with hinges and locks, including sealing and excluding glazing. Transportation, packaging and maintenance is included.

These window frames of NBvT members are manufactured under KOMO-certificate and meeting stringent technical quality requirements.

## LCA calculation rules

### Functional Unit

#### **Reference 'fixed window frame' Accoya**

Accoya window frame, fixed, painted, for a lifespan of 75 years, with external dimensions of approximately 3300 x 1500mm, gross profile size 114x67 mm, inner dimension of 4.33 m<sup>2</sup>, made of wood, from sustainably managed forest, density 510 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	8,7	kg/m <sup>2</sup>

#### Bill of materials, fixed outer frame

Material	Amount weight
Accoya, sustainable forestry	94 %
Paint	5 %
Other (glue, dowels, filler)	< 1 %
Wrapping foil	1 %

#### Technical data, fixed outer frame

Name	Value
Density Accoya	510 kg/m <sup>3</sup>
Dimension of frame (average (h*w))	3300 x 1500 mm
Dimension profile window frame	67 x 114 mm
Weight (average)	42,9 kg/window frame

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

Accoya window frame with an outward openings part, painted, for a lifespan of 75 years, including locks and hinges, 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 wood, from sustainably managed forests, density 510 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	23,8	kg/m <sup>2</sup>

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

Material	Amount weight
Accoya, sustainable forestry	91 %
Hinges and locks (steel, stainless steel, aluminium)	3 %
Paint	4 %
Other (glue, dowels, filler, rubbers)	1 %
Wrapping foil	1 %

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

Name	Value
Density Accoya	510 kg/m <sup>3</sup>
Dimension of frame (average (h*w))	1800 x 1200 mm
Dimension profile window frame	67 x 114 mm
Dimension profile window	68 x 101 mm
Weight (average)	51,4 kg/window frame

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

Accoya window frame with a rotating and tipping part (turn and tilt), painted, for a lifespan of 75 years, including locks and hinges, 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 wood, from sustainably managed forests, density 510 kg/m<sup>3</sup> expressed in 1 m<sup>2</sup>.

Name	Value	Unit
Declared unit	1,00	m <sup>2</sup>
Density	21,2	kg/m <sup>2</sup>

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

Material	Amount weight
Accoya, sustainable forestry	83 %
Hinges and locks (steel, stainless steel, aluminium)	10 %
Paint	4 %
Other (glue, dowels, filler, rubbers)	2 %
Wrapping foil	1 %

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

Name	Value
Density Accoya	510 kg/m <sup>3</sup>
Dimension of frame (average (h*w))	1800 x 1400 mm
Dimension profile window frame	67 x 114 mm
Dimension profile window	68 x 101 mm
Weight (average)	51,1 kg/window frame

#### Reference Life Span

The reference life span of the product is, according to the manufacturer, 75 years, when using the advised maintenance scheme. There is no waste collection programme.

#### System boundary

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

#### Temporary carbon storage

Accoya wood is made from fast growing Radiata Pine from certified plantations, which absorbs CO<sub>2</sub> during the growth of the material. As long as the product is in use this carbon is stored in the product. For Accoya this amount is 1,43 kg CO<sub>2</sub> / kg which is not included in the overall LCA results.

## 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.

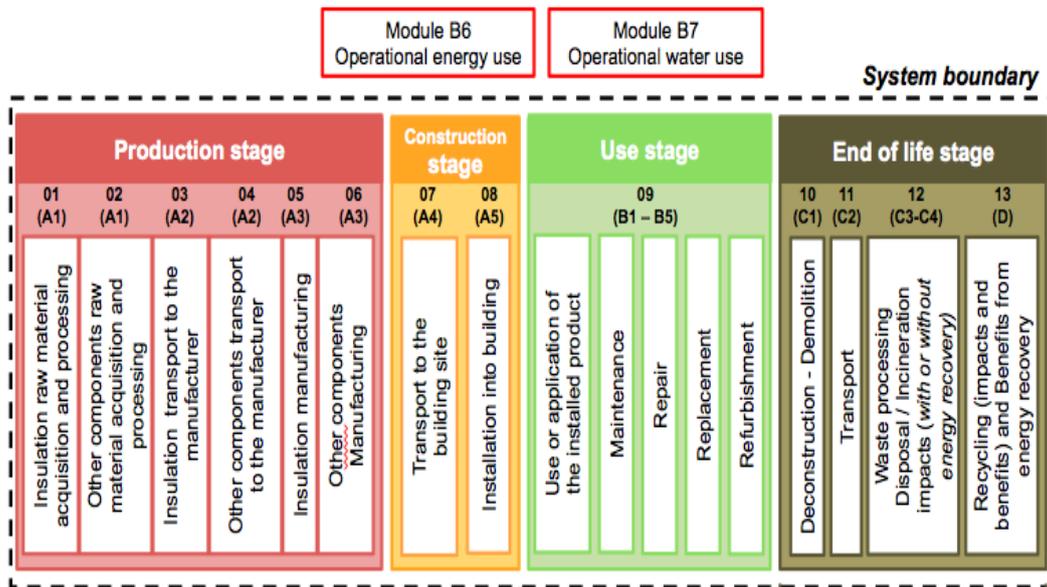


Figure 1: Division of the modules over the lifecycle of a building material as determined in EN 15804.

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.	2,97E-05	4,86E-07	0,00E+00	6,63E-06	7,35E-07	1,91E-06
Abiotic depletion, fuel	kg antimony eq.	1,30E-01	1,21E-03	0,00E+00	1,78E-02	3,79E-03	-3,37E-02
Global warming (GWP100)	kg CO2 eq.	8,76E+00	1,67E-01	0,00E+00	2,89E+00	1,03E+00	-3,98E+00
Ozone layer depletion (ODP)	kg CFK-11 eq.	2,90E-06	2,68E-08	0,00E+00	3,40E-07	1,02E-07	-2,36E-07
Photochemical oxidation	kg ethylene eq.	-1,16E-02	1,23E-04	0,00E+00	3,95E-03	4,84E-04	2,63E-03
Acidification	kg SO2 eq.	5,62E-02	9,03E-04	0,00E+00	7,69E-03	2,96E-03	-3,55E-03
Eutrophication	kg PO4- eq.	2,01E-02	2,08E-04	0,00E+00	1,38E-03	6,22E-04	-8,43E-04
Human toxicity	kg 1,4- DB eq.	6,89E+00	4,71E-02	0,00E+00	7,82E-01	3,15E-01	-3,93E-01
Fresh water aquatic ecotox.	kg 1,4- DB eq.	-1,85E+00	2,06E-03	0,00E+00	6,17E-02	7,87E-03	1,13E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	-5,75E+02	8,46E+00	0,00E+00	1,32E+02	3,28E+01	-2,29E+02
Terrestrial ecotoxicity	kg 1,4- DB eq.	5,54E-02	5,44E-04	0,00E+00	1,81E-02	3,71E-03	1,81E-03
Total renewable energy	MJ	1,58E+01	3,48E-02	0,00E+00	1,51E+00	1,53E-01	-8,64E+01
Total non renewable energy	MJ	2,84E+02	2,80E+00	0,00E+00	4,21E+01	8,83E+00	1,21E+01

Total Energy	MJ	2,99E+02	2,84E+00	0,00E+00	4,36E+01	8,98E+00	-6,94E+01
Water, fresh water use	m3	8,33E+00	2,03E-01	0,00E+00	5,65E+00	8,94E-01	-4,75E-01
Waste, non hazardous	kg	1,61E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	3,52E-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.	2,00E-04	1,27E-06	0,00E+00	3,21E-05	1,34E-06	4,29E-06
Abiotic depletion, fuel	kg antimony eq.	3,33E-01	3,16E-03	0,00E+00	4,90E-02	3,33E-03	-1,06E-01
Global warming (GWP100)	kg CO2 eq.	2,33E+01	4,38E-01	0,00E+00	7,60E+00	4,61E-01	-1,27E+01
Ozone layer depletion (ODP)	kg CFK-11 eq.	7,33E-06	7,03E-08	0,00E+00	9,24E-07	7,41E-08	-8,02E-07
Photochemical oxidation	kg ethylene eq.	-2,69E-02	3,22E-04	0,00E+00	5,57E-03	3,39E-04	1,52E-03
Acidification	kg SO2 eq.	1,72E-01	2,37E-03	0,00E+00	2,03E-02	2,50E-03	-1,25E-02
Eutrophication	kg PO4- eq.	5,08E-02	5,45E-04	0,00E+00	3,48E-03	5,75E-04	-2,88E-03
Human toxicity	kg 1,4- DB eq.	2,61E+01	1,23E-01	0,00E+00	2,10E+00	1,30E-01	-1,36E+00
Fresh water aquatic ecotox.	kg 1,4- DB eq.	-4,45E+00	5,41E-03	0,00E+00	1,55E-01	5,70E-03	2,02E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	8,92E+02	2,22E+01	0,00E+00	3,44E+02	2,34E+01	-7,18E+02
Terrestrial ecotoxicity	kg 1,4- DB eq.	2,68E-01	1,43E-03	0,00E+00	4,50E-02	1,50E-03	8,60E-04
Total renewable energy	MJ	4,28E+01	9,13E-02	0,00E+00	3,94E+00	9,63E-02	-2,59E+02
Total non renewable energy	MJ	7,30E+02	7,34E+00	0,00E+00	1,16E+02	7,74E+00	2,49E+01
Total Energy	MJ	7,73E+02	7,43E+00	0,00E+00	1,20E+02	7,83E+00	-2,19E+02
Water, fresh water use	m3	2,03E+01	5,31E-01	0,00E+00	1,48E+01	5,60E-01	-2,61E+00
Waste, non hazardous	kg	3,72E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	2,22E-01	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.	3,86E-04	1,02E-06	0,00E+00	2,55E-05	1,44E-06	3,35E-06
Abiotic depletion, fuel	kg antimony eq.	2,88E-01	2,54E-03	0,00E+00	3,87E-02	7,36E-03	-8,76E-02
Global warming (GWP100)	kg CO2 eq.	2,42E+01	3,51E-01	0,00E+00	6,00E+00	2,40E+00	-1,05E+01
Ozone layer depletion (ODP)	kg CFK-11 eq.	5,87E-06	5,65E-08	0,00E+00	7,29E-07	1,96E-07	-6,69E-07
Photochemical oxidation	kg ethylene eq.	-1,63E-02	2,58E-04	0,00E+00	4,75E-03	9,71E-04	1,48E-03
Acidification	kg SO2 eq.	2,00E-01	1,90E-03	0,00E+00	1,60E-02	5,92E-03	-1,05E-02
Eutrophication	kg PO4- eq.	4,17E-02	4,38E-04	0,00E+00	2,74E-03	1,26E-03	-2,40E-03
Human toxicity	kg 1,4- DB eq.	4,00E+01	9,91E-02	0,00E+00	1,66E+00	6,51E-01	-1,14E+00
Fresh water aquatic ecotox.	kg 1,4- DB eq.	-3,06E+00	4,35E-03	0,00E+00	1,22E-01	1,63E-02	1,49E-02
Marine aquatic ecotoxicity	kg 1,4- DB eq.	5,56E+03	1,78E+01	0,00E+00	2,72E+02	6,74E+01	-5,95E+02
Terrestrial ecotoxicity	kg 1,4- DB eq.	4,78E-01	1,15E-03	0,00E+00	3,55E-02	7,34E-03	2,66E-04
Total renewable energy	MJ	4,30E+01	7,34E-02	0,00E+00	3,11E+00	3,00E-01	-2,13E+02
Total non renewable energy	MJ	6,39E+02	5,90E+00	0,00E+00	9,17E+01	1,72E+01	1,95E+01
Total Energy	MJ	6,82E+02	5,97E+00	0,00E+00	9,48E+01	1,75E+01	-1,82E+02
Water, fresh water use	m3	2,66E+01	4,27E-01	0,00E+00	1,16E+01	1,76E+00	-2,31E+00
Waste, non hazardous	kg	1,03E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Waste, hazardous	kg	6,17E-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 2015, as determined by the section 'Window frames' of the NBVT. This information can serve as the industry average for the examined frame.

## Representativeness Geographically

The window frames as described in this EPD are made by manufacturers in various production sites throughout the Netherlands. Because of the relatively large group of joinery companies and their geographical distribution through the Netherlands an average distance of 150 km to the construction site was assumed.

## Qualitative information

In the design and manufacture of wooden window frames the members of the NBvT safeguard the highest quality, functional and performance requirements. As expressed in the National Assessment (BRL) 0801 "Wooden façade elements", KOMO certification and the Building Act. The companies affiliated with the NBvT comply with the KOMO certificate "Wooden façade elements' (BRL0801).

All companies affiliated with the NBvT should comply with sustainable forestry and have a Chain of Custody certificate. This supply chain certificate makes it clear how the trade flow from tree-felling to finished product is running, and safeguards sustainable forestry practices.

NBvT-members comply with the quality protocol "KVT" ("Quality of wooden façade elements - Descriptions of materials and semi-finished products and procedures for the composition"). The materials, processes, finishes and structures included in the various sections of the KVT meet the requirements of BRL 0801. The Accoya reference window frames in this EPD follow the KVT.

## Sourcing raw materials

Apart from the Accoya wood, the joinery company has no fixed supplier for the procurement of raw materials. The other products used in the composition of the window frame may be derived from different suppliers. If the supplier was known, specific production data was used, in other cases the generic SBK- or Ecoinvent data are used.

## Data quality

During and after the factory visit the joinery company has provided physical and digital documentation and drawings, as well as the quantities of material required for the assessed window frame.

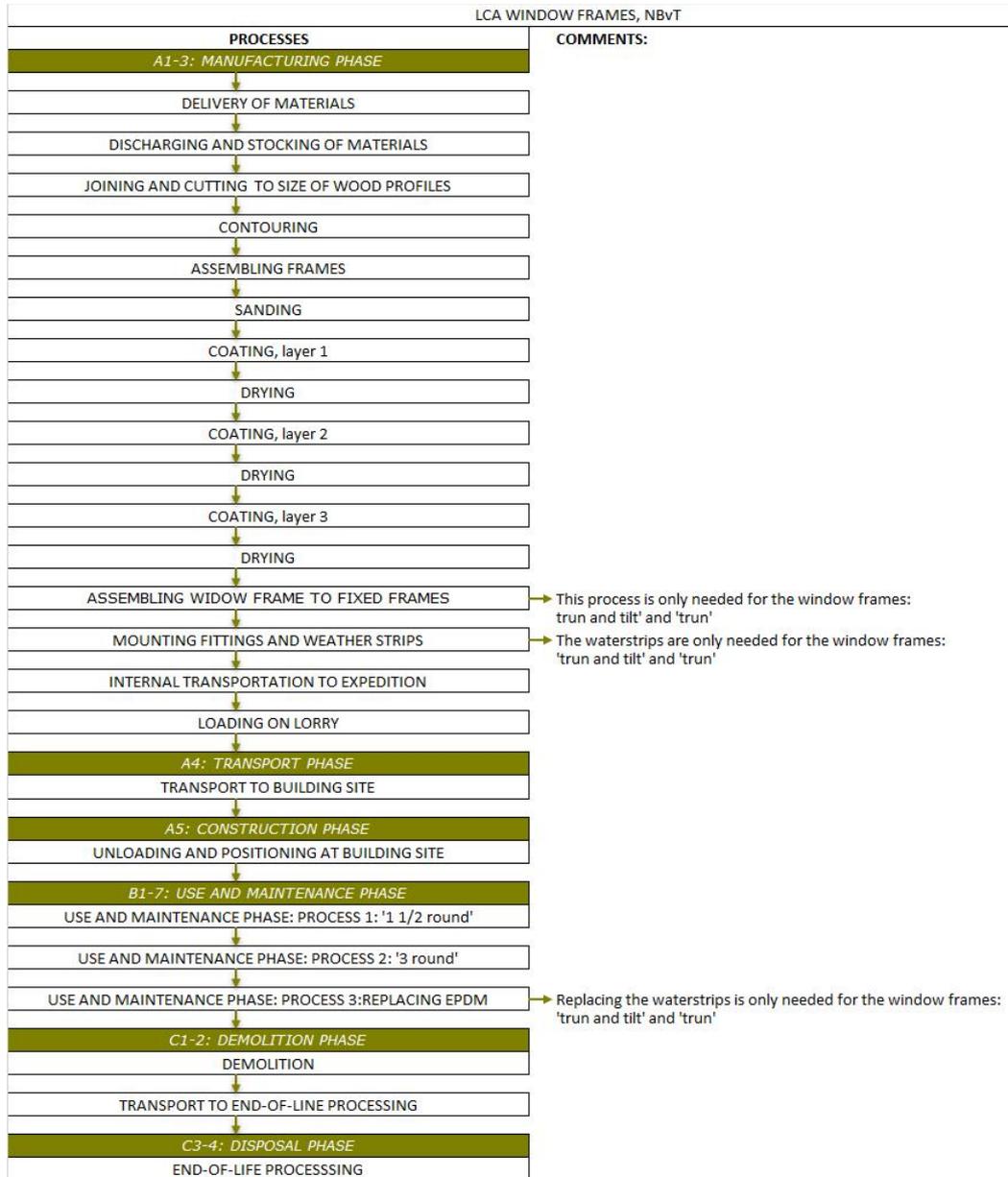
Energy consumption of machinery, and equipment which is needed for the manufacture of the product is based on the consumption in 2015. Several representative joinery companies, have provided documentation to arrive at an industry average.

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 window frame is based on measurements and observations in 2015 and 2016 (energy, waste percentages, amounts net per element, production volume). Data from supply companies are all as recent as possible.

## Life Cycle Stages

Flowchart for the production of NBvT Accoya 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 in a slightly different composition. The Accoya window frames and parts are made of beams of solid Accoya. In the window frame factory, they are first selected based on quality and the desired sizes. Thereafter, the profiles are applied at their particular location in the window frame. The above processes are largely automatized. The frames are then assembled and prepared by hand for the coating. The paint spraying is carried out in 3 rounds, with recovery of excess paint. There occurs some loss of paint. After drying, the window frame with outward opening window and window frame with tilt and turn window are

fitted with hinges, locks and seals. The frames are then put ready for storage or for glazing. The glazing can take place immediately after the drying process or later at the construction site, as 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 usually done with fully loaded trucks, with full return. The default value used in the SBK-bepalingsmethode 2.0, 150 km is applied. Selection of the means of transport is made based on the declaration of the manufacturer.

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

Window frames are positioned with existing equipment such as a crane. Therefore, no separate equipment is required. 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 window frame', 'window frame with an outward opening window' and 'window frame with tilt and turn window' have a lifespan of 75 years. To achieve this lifespan requires structural maintenance. This is done according to the following schedule:

- Coating every 15 years, sanding, paint update
- Rubber to be replaced after 30 years, along with another coating round
- Major maintenance in 40 years, paint stripping, sanding and new coating round.

## 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 final waste processing. For the transport a > 16-ton truck is assumed.

### 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 representative window frame manufacturer of the NBvT, in 2015, further backed up by production data to get the full picture.

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

When calculating the environmental impact categories SimaPro version 8.1.1 was used as well as 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 Accoya frames, turn, turn and tilt for NBvT, June 2016, Agrodome, Wageningen, authors S. Verspeek and F. van der Burgh.

EPD Accoya frames, turn, turn and tilt for NBvT, September 2016, CAPEM, Antwerpen

### **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/)

### **Vogtlander, J,**

Environmental Product Declaration, Accoya Wood - decking, cladding and planed timber for joinery applications, EPD – Norge (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

### **Website Accoya**

[www.accoya.com](http://www.accoya.com)

 <p>CAPEM Cycle Assessment Procedure for Eco-Impacts of Materials</p>	<p><b>Publisher</b> Gitsschotellei 138 2600 Antwerp Belgium</p>	<p>T: +32-(0)32181060 E: info@capem.eu W: www.capem.eu</p>
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## Statement SHR

SHR has reviewed the Dutch Environmental Product Declaration on 2 September 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.