Agrodome
Advice & Development

Environmental Product Declaration

According to the EN 15804 +A2

Accoya® wood,
Window frames: 'fixed window' and 'tilt and turn window'

Scope of the declaration

Type of the EPD is Cradle to grave, including modules A - D and has been developed in accordance to the EN 15804 + A2
The LCA was carried out by Agrodome B.V.

Based on production data from Accsys Technologies.

Release Date: 6 May 2022
Validity for: 5 years

Functional unit: 1 m^2

Goal and Target Group

Goal

This declaration covers the environmental effects throughout the lifetime of the product Accoya® window frames 'fixed' and 'tilt and turn'.

Target audience

The EPD can be used for building or building part level assessments by designers, architects, constructors, developers, etc. The EPD is made business-to-business communication and can be used for business-to-consumer communication purposes. The background EPD report is third party verified.

Product description

Accsys is the company that produces Accoya® wood. Accoya® is produced from a patented process called acetylation. Accoya® is extremely dimensionally stable and durable. In this study we focus on Accoya® made from Radiata Pine (species). This wood is sourced from sustainably managed forests in New Zealand. The wood is acetylated at Accsys' manufacturing site in Arnhem, the Netherlands. Accoya® is sold for a variety of applications, which includes outdoor applications.

The LCA calculations are made for:

- Accoya® fixed window frame
- Accoya® tilt and turn window frame

The dimensions of the window frames are based upon the standards as prescribed in the Product Category Rules (PCR) for window frames (EN 17213). The approach for the calculations of these window frames differs from the calculations done in 2016 by Agrodome. The biggest differences are the dimensions used of the frames, which are now based on the PCR for window frames.

Accoya® window frame

The Accoya® wood window frame is made from Radiata Pine grown in New Zealand and is certified as FSC® mix (minimum 70% FSC® and the remainder as controlled wood). The sawn wood is transported to Arnhem where it is acetylated. The acetylation process increases the stability and reduces the impact of natural elements significantly. Warranties are provided up to 50 years above ground and 25 years in ground or fresh water, with a service life of 60 years. However, in practice the lifespan of Accoya® window frames can be expected to be between 77 to 90 years (research source: Heriot Watt University). During acetylation, the hydroxyl groups within the wood are replaced by acetyl groups, which are more chemically stable and attract less moisture. Very little acetic anhydride or acetic acid (the co product from acetylation) residue is present in the final product (<0.5%), making Accoya® a non-toxic product, therefore the wood can be treated like unmodified wood and is able to be burned for biomass at the end of life.

The acetylation process permeates the very core of the product, and as such, Accoya® can be used and created in various dimensions, depending on the application and demands of the end-user.
Partners of Accoya® can make profiles for window frames, decking, cladding, etc. It is possible with a finger joint technique to increase the dimensions of the beam. It is recommended to use stainless steel fasteners in accordance with EN 10088-1, for example fasteners made of A2 or A4 stainless steel.

Fixed window frame

Frames of this type are used in almost all buildings. The Accoya® window frame fixed consists of a prefabricated wooden (Accoya®) built-in window frame with an opening for glazing. This type is used in rooms where light entry is desired, but where no air supply is necessary. It may also be used in combination with window frames where parts can be opened.

The studied window frame 'fixed' has the following external dimension of 1230mmx1480mm with an opening of 1147mmx1377mm. This window frame weights 27,1 kg in total.

Tilt and turn window frame

Frames of this type are used in almost all buildings. The Accoya® tilt and turn window frame consists of a prefabricated solid wooden built-in window frame with a window that is equipped with swivel window fittings so that it is possible to open the window part and leave it open in a fixed position. These types of windows are used in areas where, in addition to the entry of light, the flow of air is desired, such as bedrooms, kitchens, living areas, etc.
The studied window frame 'tilt and turn' has the following external dimension of 1230mmx1480mm with an opening of 1041mmx1271mm. This window frame weighs 48,3 kg in total.

Composition Accoya®, window frame 'fixed'

Material	Share
Accoya® wood	98 %
Paint, glue	2%

Composition Accoya®, window frame 'tilt and turn'

Material	Share
Accoya® wood	98 %
Paint, glue	2 %

Technical data Accoya® wood

Durability	Class I (EN 350)
Density	average 515 kg / m^3, on delivery
Fire resistance class	C (ASTM E84); D (EN14915)
Heat transfer (ƛ)	0,12 W/m·K (EN 12667)
Bending strenght	40 N/mm^2 (EN 408)
Flexibility	8800 N/mm^2 (EN 408)
Hardness (Janka) Harness (Brinel)	side 4100 N, end grain 6600 N (ASTM D143) 2,4 kgf/mm^2

Shrink (wet to 65% RH at 20 °C) Shrink (wet to oven dry)	Radial 0.4% Tangential 0.8% Radial 0.7% Tangential 1.5%
Equilibrium moisture content	3 - 5% at 65% relative humidity, 20 °C

LCA calculation rules

Functional unit

Accoya® fixed window frame

Accoya® window frame made of acetylated Radiata Pine, originating from sustainably managed forests, painted, with a lifespan of 60 years, dimensions: 1230mmx1480mm with opening 1147mmx1377mm, expressed in 1 m²

Name	Value	Unit
Functional unit	1,00	m²
Weight	15,05	kg/FU

Accoya® tilt and turn window frame

Accoya® window frame made of acetylated Radiata pine, originating from sustainably managed forests, painted, with a lifespan of 60 years, dimensions: 1230mmx1480mm with an opening 1041mmx1271mm, expressed in 1 m²

Name	Value	Unit
Functional unit	1,00	m²
Weight	26,5	kg/FU

Reference Service Life

The service life is determined according to EN-350 in relation to the specified use-classes (NEN-EN 335). The durability translates to an expected service life of 60 years. It has a class 1 durability according to EN 350-1 (= highest durability class) and is exceptionally dimensional stable. Therefore, in practice, the lifespan of the Accoya® window frames can be expected to be between 77 to 90 years (research source: Heriot Watt University).

There is no post-consumer take-back program. Considering the longevity of Accoya®, the company has not been in existence long enough for this type of initiative. Accsys has a pre-consumer offcuts take-back reclamation scheme in place, which collects offcuts to be reprocessed into Tricoya® wood chips. This take-back is not included in the study results.

Biogenic carbon storage

Biogenic carbon storage during the lifetime of Accoya® window frames is calculated according to the EN16449, and with 1 kg biogenic carbon as equivalent to 44/12 kg of CO2:

Window frame fixed; 22,87 kg CO2eq/m^2 = 6,24 Kg C/m^2
Window frame tilt and turn: 40,46 kg CO_2eq/m^2 = 11,04 Kg C/m^2

Comparability

A comparison or evaluation of EPD data is only possible if all datasets have been made in accordance with EN 15804 and the same product-related standard properties and modules have been taken into account.

System boundaries

The LCA study was created for "Cradle to Grave" according to the modules below and are the basis for calculations or can be used for further calculations. All declared values relate to the specified functional unit. According to the European standard EN 15804 +A2.

The environmental performance of building materials is categorized in four modules corresponding to different lifecycle phases in the building material; Modules A (production of materials and construction), B (use phase), C (end-of-life phase of the building) and D (loads and benefits outside the system boundary).

Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal		Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☐	☒	☒	☒	☒		☒

For Accoya® window frames, all the modules A1 - D have been examined, except B6 and B7.

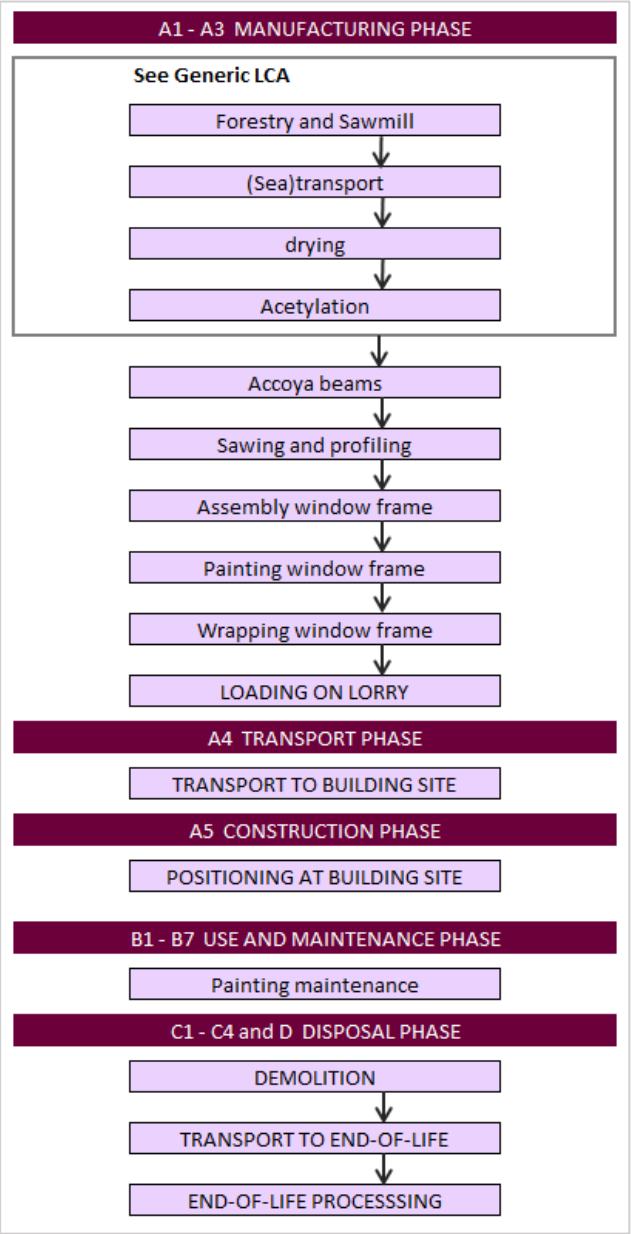
Allocations

There are no allocations for the production of the window frames.
The allocation of the basic ingredient Accoya® wood is reported in the background report for generic Accoya® wood (2022) and is taken into account in the calculations.

Production process

The production process of Accoya® window frame is summarized in the flowchart. This flowchart includes the entire process from the base material to the waste phase.

Flowchart for the Accoya® 'fixed window' and 'turn and tilt window'.



Explanation Flowchart and Life Cycle per phase

Production phase (A1-3)

The Accoya® wood is produced in Arnhem (NL) with Radiata pine from New Zealand. In Arnhem the wood is acetylated. Next, the Accoya® planks are transported to the production site, where it is planed, profiled and cut if needed. The window frame profiles are assembled and glued together. The frames are painted and stored at the factory.

Construction process phase (A4-5)

Transport to the construction site (A4)

For the transport to the construction site calculated values are taken. These calculated values are based upon the market share in volumes for the European market. The calculation is made as the average

weighted transport distance from factory to the building site. The average distance is 539,30 km (based upon 96% of the transports). The transport to the construction site is assumed to be empty return, default value. For the process 'Transport, freight, lorry >32 metric ton, euro5 {RER}| market for transport, freight, lorry >32 metric ton, EURO5 | Cut-off, U' is used.

Processing and construction on the construction site (A5)

On the construction site the Accoya® window frame is placed in position and fixed with stainless steel screws than made airtight with foil and polyurethane expanding foam. For the construction of the window frames only (electric) hand tools are used. The calculation is made including 4% loss on the building site, based upon information from Accsys.

Use phase (B1-7)

The window frames made from Accoya® have a lifespan of 75 years when the product is used correctly.

The window frames made from Accoya® wood has a maintenance scheme with 12 year intervals, which is longer than regular interval because Accoya® wood has lower maintenance than other materials because of the stable properties of acetylated wood. Maintenance is cleaning, sanding and painting, mainly for aesthetic reasons. The Accoya® products do not releases emissions during use.

End-of-life phase (C1-4)

A number of assumptions have been made for the end-of-life phase:

Disassembly and demolition (C1)

The disassembly and demolition takes place manually.

Transport (C2)

Transport phase assumptions: 50 km to sorting installation and 100 km from demolition or sorting location to processing location. For the process 'Transport, freight, lorry >32 metric ton, euro5 {RER}| market for transport, freight, lorry >32 metric ton, EURO5 | Cut-off, U' is used.

Waste treatment (C3-C4)

A weighted calculation, based upon European market shares (volume based) is used for the waste scenario:

Accoya® wood: 27% landfill, 67% incineration and 6% recycling.

Screws: 99% recycling, 1% landfill

Foil: 85% incinerations, 10% landfill and 5% recycling

Expanding foam: 100% landfill

Benefits and loads outside the system boundary (D)

The benefits and loads outside the system boundary relate to combustion in which energy use is avoided. The recycling and reuse of the attachment is also part of the benefits and loads outside the system boundary. The calculated efficiency of heat and electricity recovery from waste material is 25,56% for heat and 13% for electricity, as average for Europe.

LCA results

Core Environmental Indicators per FU (1 m²) EN 15804 + amendment A2, Accoya® window frame 'fixed'

Potential Environmental Impacts	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
CC total (kg CO2 equiv/FU)	3,57E+00	5,84E-02	1,22E+01	6,29E-01	1,91E+00	0,00E+00	3,37E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,96E-01	1,52E+01	4,08E-01	-1,01E+01
CC fossil (kg CO2 equiv/FU)	2,28E+01	5,82E-02	9,68E+00	6,28E-01	1,90E+00	0,00E+00	2,86E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,96E-01	5,24E-01	5,73E-02	-1,18E+01
CC biogenic (kg CO2 equiv/FU)	-1,93E+01	1,22E-04	2,47E+00	1,32E-03	5,58E-03	0,00E+00	2,67E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,20E-04	1,47E+01	3,50E-01	1,74E+00
CC luluc (kg CO2 equiv/FU)	1,36E-02	1,62E-05	9,05E-02	1,75E-04	8,73E-04	0,00E+00	2,42E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	8,24E-05	4,24E-05	1,96E-05	-1,89E-02
ODP (kg CFC 11 equiv/FU)	4,29E-06	1,37E-08	4,67E-07	1,47E-07	1,14E-07	0,00E+00	2,70E-08	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,94E-08	1,01E-08	1,19E-08	-7,46E-07
AP (mol H+ equiv/FU)	1,20E-01	2,41E-04	5,86E-02	2,60E-03	6,62E-03	0,00E+00	3,52E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,22E-03	2,81E-03	3,34E-04	-5,00E-02
EP - freshwater (kg P equiv/FU)	8,46E-04	4,18E-07	1,28E-03	4,51E-06	6,03E-05	0,00E+00	1,21E-04	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,12E-06	2,15E-06	7,90E-07	-9,24E-04
EP - marine (kg N equiv/FU)	2,56E-02	7,37E-05	7,73E-03	7,94E-04	1,69E-03	0,00E+00	3,66E-04	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,74E-04	1,30E-03	3,40E-04	-6,98E-03

EP - terrestrial (mol N equiv/FU)	2,77E-01	8,13E-04	8,52E-02	8,76E-03	1,34E-02	0,00E+00	3,07E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,13E-03	1,49E-02	1,25E-03	-7,98E-02
POCP (kg NMVOC equiv/FU)	8,66E-02	2,61E-04	2,43E-02	2,81E-03	5,39E-03	0,00E+00	1,13E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,32E-03	3,89E-03	4,43E-04	-2,32E-02
ADP Elements (kg Sb equiv/FU)	2,77E-04	1,37E-07	1,06E-04	1,47E-06	1,55E-05	0,00E+00	4,93E-06	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,93E-07	3,00E-07	1,31E-07	-2,39E-05
ADP fossil fuels (MJ/FU)	5,26E+02	9,08E-01	1,92E+02	9,78E+00	2,84E+01	0,00E+00	4,87E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,61E+00	1,02E+00	9,17E-01	-2,25E+02
WDP (m^3 water eq deprived /FU)	3,20E+01	2,89E-03	2,91E+00	3,12E-02	9,17E-01	0,00E+00	2,78E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,47E-02	2,05E-02	3,92E-02	-1,81E+00

CC total = Climate Change total; CC fossil = Climate Change fossil; CC biogenic= Climate Change biogenic; CC-luluc = Climate Change land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

Additional Environmental Indicators per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'fixed'

Additional Impact Categories	Production			Construction process		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PM (disease incidence)	5,19E-07	5,24E-09	1,88E-07	5,65E-08	7,22E-08	0,00E+00	1,63E-08	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,66E-08	2,18E-08	6,33E-09	-1,76E-07
IRHH (kg U235 eq/FU)	1,05E+00	3,98E-03	1,62E+00	4,29E-02	4,68E-02	0,00E+00	1,60E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,02E-02	2,64E-03	3,60E-03	-1,59E+00

ETF (CTUe/FU)	5,11E+02	6,96E-01	1,42E+02	7,51E+00	5,62E+01	0,00E+00	7,89E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,54E+00	2,07E+00	1,11E+00	-1,13E+02
HTCE (CTUh/FU)	1,11E-08	2,16E-11	6,37E-09	2,32E-10	1,05E-08	0,00E+00	5,72E-10	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,09E-10	2,64E-09	3,15E-11	-2,67E-09
HTnCE (CTUh/FU)	2,98E-07	7,49E-10	1,16E-07	8,07E-09	7,73E-08	0,00E+00	6,52E-09	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,80E-09	8,14E-09	8,78E-10	-8,09E-08
Land Use Related impacts (dimensionless)	6,81E+01	1,04E+00	4,16E+01	1,12E+01	4,59E+00	0,00E+00	2,84E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,28E+00	3,21E-01	2,16E+00	-1,95E+02

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit); PM = Particulate Matter (Potential incidence of disease due to PM emissions); IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

Parameters describing resource use_per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'fixed'

Resource Use	Production			Construction		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PERE (MJ/FU, net calorific value)	2,34E+01	1,11E-02	3,57E+01	1,19E-01	1,74E+00	0,00E+00	6,27E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,62E-02	5,43E-02	1,70E-02	-5,60E+01
PERM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT (MJ/FU, net calorific value)	2,34E+01	1,11E-02	3,57E+01	1,19E-01	1,74E+00	0,00E+00	6,27E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,62E-02	5,43E-02	1,70E-02	-5,60E+01
PENRE (MJ/FU, net calorific value)	5,74E+02	9,64E-01	2,02E+02	1,04E+01	3,04E+01	0,00E+00	5,21E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,89E+00	1,10E+00	9,75E-01	-2,39E+02
PENRM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

PENRT (MJ/FU, net calorific value)	5,74E+02	9,64E-01	2,02E+02	1,04E+01	3,04E+01	0,00E+00	5,21E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,89E+00	1,10E+00	9,75E-01	-2,39E+02
SM (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/FU)	8,12E-01	9,69E-05	1,76E-01	1,04E-03	2,28E-02	0,00E+00	7,30E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,92E-04	4,20E-03	9,43E-04	-1,47E-01

PERE = use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

Environmental information describing output flows and waste categories per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'fixed'

	Production			Construction process stage		Use stage							End-of-life stage				
Waste Categories & Output Flows	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (kg/FU)	5,55E-04	2,19E-06	1,94E-04	2,36E-05	1,31E-05	0,00E+00	1,94E-05	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,11E-05	2,64E-06	1,38E-06	-1,14E-04
Non-hazardous waste disposed (kg/FU)	1,71E+00	7,91E-02	1,56E+00	8,53E-01	4,23E-01	0,00E+00	1,31E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,02E-01	6,38E-02	3,65E+00	-6,18E-01

Radioactive waste disposed (kg/FU)	1,12E-03	6,22E-06	1,33E-03	6,70E-05	4,29E-05	0,00E+00	1,58E-05	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,16E-05	2,71E-06	5,44E-06	-1,30E-03
Components for reuse (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Heat (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Core Environmental Indicators per FU (1 m^2) EN 15804 + amendment A2, Accoya® window frame 'tilt and turn'

Potential Environmental Impacts	Production			Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
CC total (kg CO2 equiv/FU)	6,37E+00	1,04E-01	3,61E+01	1,12E+00	1,49E+00	0,00E+00	4,79E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,19E-01	2,57E+01	7,11E-01	-1,74E+01
CC fossil (kg CO2 equiv/FU)	4,07E+01	1,04E-01	3,08E+01	1,12E+00	1,48E+00	0,00E+00	4,07E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,17E-01	2,36E-01	8,96E-02	-2,04E+01
CC biogenic (kg CO2 equiv/FU)	-3,44E+01	2,17E-04	5,17E+00	2,34E-03	5,60E-03	0,00E+00	3,80E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,09E-03	2,54E+01	6,22E-01	3,10E+00
CC luluc (kg CO2 equiv/FU)	2,42E-02	2,89E-05	1,64E-01	3,11E-04	8,76E-04	0,00E+00	3,45E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,44E-04	1,00E-04	3,34E-05	-3,27E-02
ODP (kg CFC 11 equiv/FU)	7,65E-06	2,43E-08	1,54E-06	2,62E-07	1,14E-07	0,00E+00	3,85E-08	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,22E-07	2,07E-08	2,07E-08	-1,29E-06
AP (mol H+ equiv/FU)	2,14E-01	4,29E-04	1,76E-01	4,62E-03	6,60E-03	0,00E+00	5,01E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,14E-03	5,01E-03	5,80E-04	-8,65E-02
EP - freshwater (kg P equiv/FU)	1,51E-03	7,44E-07	3,62E-03	8,02E-06	6,07E-05	0,00E+00	1,72E-04	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,72E-06	4,45E-06	1,36E-06	-1,60E-03
EP - marine (kg N equiv/FU)	4,56E-02	1,31E-04	2,34E-02	1,41E-03	1,55E-03	0,00E+00	5,21E-04	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,55E-04	2,31E-03	5,03E-04	-1,21E-02

EP - terrestrial (mol N equiv/FU)	4,94E-01	1,44E-03	2,64E-01	1,56E-02	1,31E-02	0,00E+00	4,37E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	7,22E-03	2,64E-02	2,17E-03	-1,38E-01
POCP (kg NMVOC equiv/FU)	1,54E-01	4,64E-04	7,34E-02	5,00E-03	5,35E-03	0,00E+00	1,61E-03	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,32E-03	6,91E-03	7,72E-04	-3,99E-02
ADP Elements (kg Sb equiv/FU)	4,94E-04	2,43E-07	3,02E-04	2,62E-06	1,56E-05	0,00E+00	7,02E-06	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,21E-06	7,40E-07	2,28E-07	-4,13E-05
ADP fossil fuels (MJ/FU)	9,39E+02	1,61E+00	6,26E+02	1,74E+01	2,85E+01	0,00E+00	6,94E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	8,07E+00	2,20E+00	1,60E+00	-3,88E+02
WDP (m^3 water eq deprived /FU)	5,71E+01	5,14E-03	7,75E+00	5,54E-02	9,22E-01	0,00E+00	3,96E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	2,57E-02	4,45E-02	6,84E-02	-3,12E+00

CC total = Climate Change total; CC fossil = Climate Change fossil; CC biogenic= Climate Change biogenic; CC-luluc = Climate Change land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

Additional Environmental Indicators per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'tilt and turn'

Additional Impact Categories	Production			Construction process		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PM (disease incidence)	9,26E-07	9,32E-09	5,11E-07	1,00E-07	7,22E-08	0,00E+00	2,32E-08	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	4,66E-08	4,05E-08	1,10E-08	-3,05E-07
IRHH (kg U235 eq/FU)	1,87E+00	7,08E-03	5,41E+00	7,63E-02	4,69E-02	0,00E+00	2,28E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	3,54E-02	6,02E-03	6,27E-03	-2,75E+00

ETF (CTUe/FU)	9,12E+02	1,24E+00	4,25E+02	1,33E+01	5,63E+01	0,00E+00	1,12E+01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,19E+00	3,92E+00	1,77E+00	-1,96E+02
HTCE (CTUh/FU)	1,98E-08	3,83E-11	1,59E-08	4,13E-10	1,06E-08	0,00E+00	8,14E-10	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,92E-10	4,72E-09	5,49E-11	-5,03E-09
HTnCE (CTUh/FU)	5,31E-07	1,33E-09	3,41E-07	1,43E-08	7,73E-08	0,00E+00	9,29E-09	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	6,65E-09	1,39E-08	1,53E-09	-1,41E-07
Land Use Related impacts (dimensionless)	1,21E+02	1,85E+00	1,19E+02	1,99E+01	4,52E+00	0,00E+00	4,05E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	9,25E+00	9,16E-01	3,78E+00	-3,44E+02

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit); PM = Particulate Matter (Potential incidence of disease due to PM emissions); IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

Parameters describing resource use_per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'tilt and turn'

Resource Use	Production			Construction		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PERE (MJ/FU, net calorific value)	4,18E+01	1,97E-02	1,15E+02	2,12E-01	1,75E+00	0,00E+00	8,94E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	9,84E-02	1,16E-01	2,91E-02	-9,82E+01
PERM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT (MJ/FU, net calorific value)	4,18E+01	1,97E-02	1,15E+02	2,12E-01	1,75E+00	0,00E+00	8,94E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	9,84E-02	1,16E-01	2,91E-02	-9,82E+01
PENRE (MJ/FU, net calorific value)	1,02E+03	1,71E+00	6,58E+02	1,85E+01	3,05E+01	0,00E+00	7,42E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	8,56E+00	2,36E+00	1,70E+00	-4,12E+02
PENRM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

PENRT (MJ/FU, net calorific value)	1,02E+03	1,71E+00	6,58E+02	1,85E+01	3,05E+01	0,00E+00	7,42E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	8,56E+00	2,36E+00	1,70E+00	-4,12E+02
SM (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/FU)	1,45E+00	1,72E-04	5,41E-01	1,86E-03	2,29E-02	0,00E+00	1,04E-02	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	8,61E-04	7,64E-03	1,65E-03	-2,54E-01

PERE = use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

Environmental information describing output flows and waste categories per FU (1 m^2) EN 15804 +A2, Accoya® window frame 'tilt and turn'

	Production			Construction process stage		Use stage							End-of-life stage				
Waste Categories & Output Flows	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (kg/FU)	9,90E-04	3,89E-06	5,29E-04	4,19E-05	1,27E-05	0,00E+00	2,76E-05	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	1,94E-05	4,60E-06	2,41E-06	-1,95E-04
Non-hazardous waste disposed (kg/FU)	3,06E+00	1,41E-01	3,61E+00	1,52E+00	3,02E-01	0,00E+00	1,86E-01	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	7,03E-01	1,29E-01	6,38E+00	-1,08E+00

Radioactive waste disposed (kg/FU)	2,00E-03	1,11E-05	4,41E-03	1,19E-04	4,29E-05	0,00E+00	2,25E-05	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	5,52E-05	6,49E-06	9,50E-06	-2,25E-03
Components for reuse (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Heat (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy Energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Representativeness of the production process

Purchase of raw materials

Because Accsys does not have fixed suppliers for additional materials data from the Ecoinvent database, version 3.6 and the NMD database version 3.4 were used.

Data quality

Accsys has handed over the physical and digital documentation , as well as a material statement with the quantities of material required for the tested element. For the generic Accoya® wood the background report that was external reviewed in 2022 is used.

Energy consumption of equipment and equipment required to manufacture the product under investigation is based on consumption figures for 2021.

With the exception of the manufacturing phase, standard values have been used where appropriate in accordance with Ecoinvent 3.6. This applies in particular to transport distances, processing in the waste phase and the choice of means of transport. Return transports loaded/unloaded are as per the manufacturer's instructions.

Production processes can change over time. The information used in this LCA of the production process of the element is based on measurements and observations from 2021/22 (energy, waste percentages, quantities net per element, production volume). Data from supplying companies are all of the most recent date possible.

Accountability

The LCA study was conducted by Agrodome B.V. in 2022.

The data provided by Accsys have been extensively discussed with Agrodome B.V.

The final version of the LCA study has been submitted to SGS for external peer review.

The LCA is carried out according to EN 15804 +A1 and +A2 in compliance with the standards from the ISO 14000 series: 14025, 14040 and 14044.

When calculating the environmental impact categories, Simapro, version 9.0.0.49 and the Ecoinvent database, version 3.6 are used.

When making calculations in Simapro, the long-term effects (emissions that can occur after 100 years) are not taken into account. The effects of capital goods and infrastructural processes are included.

References

ISO 14040
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A1
EN 15804+A1: 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 15804+A2
EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 17213
EN 17213: 2020 : Windows and doors- Environmental Product Declarations – Product category rules for windows and pedestrian doorsets

Sissy Verspeek en Fred van der Burgh, 2022
Background EPD report, Life cycle analysis, Accoya® Wood – window frames: 'fixed' and 'tilt and turn' , Agrodome B.V. Wageningen, the Netherlands

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Declaration Agrodome B.V.

SGS Search B.V. has reviewed the background EPD report on the EN 15804 +A2 and therefore also on the underlying standards.
The EPD background report has been approved by the external reviewer Harry van Ewijk, SGS Search Ingenieursbureau B.V. on 26 April 2022

Disclaimer

Comparisons based on the information from this report are only possible and valid if the starting points of the calculations and data collection are the same and if it concerns the same applications