Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	SIA FLORA
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Registration number:	EPD-Kiwa-EE-358-EN
Issue date:	23.10.2023
Valid to:	23.10.2028

1. General information

SIA FLORA

Programme operator

Kiwa-Ecobility Experts
Kiwa GmbH
Voltastr. 5
13355 Berlin
Germany

Registration number

EPD-Kiwa-EE-358-EN

This declaration is based on the Product Category Rules

EN 17213:2020 Windows and doors – Environmental Product Declarations – Product category rules for windows and pedestrian doorsets (PCR B)

Issue date

23.10.2023

Valid to

23.10.2028

Group Wooden windows IV90

Owner of the declaration

SIA FLORA
Tērvetes iela 85
Jelgava, LV-3008
Latvia

Declared product / declared unit

1 m^2 of product

Scope

The EPD (type "Cradle to gate with modules C1–C4 and module D") covers the results of two products from the group Wooden windows IV90. The results are declared separately for IV90 tilt and turn window and (or) fixed window and IV90 side-hung, tilt and turn window of overlapping design.

Windows of the group Wooden windows IV90 are triple-glazed and have a thermal transmittance of 0,75 – 1 W/(m^2*K). The dimensions (height x width) are made according to the customer's requirements. The calculation is based on the assumption that LCA results are scalable for the desired window dimension. The product is manufactured in Jelgava, Latvia, and marketed internationally.

Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidence.

Verification

The standard EN 15804+A2:2019 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025:2006

☐internally ☒externally

Frank Huppertz
(Head of Kiwa-Ecobility Experts)

Prof. Dr. Frank Heimbecher
(Chairman of the independent expert committee – Ecobility Experts)

Natalia Chebaeva
(External verifier – Ecomatters)

2. Product

2.1 Product description

This EPD covers the group Wooden windows IV90. The windows are inward-opening customized building components with different mode of action (e.g. fixed, top hung, side hung, top swing, side swing). Dimensions (height x width) are adapted according to customer's requirements.

The group Wooden windows IV90 includes the following products:

- IV90 tilt and turn window and (or) fixed window (Figure 1);
- IV90 side-hung, tilt and turn window of overlapping design (Figure 2).

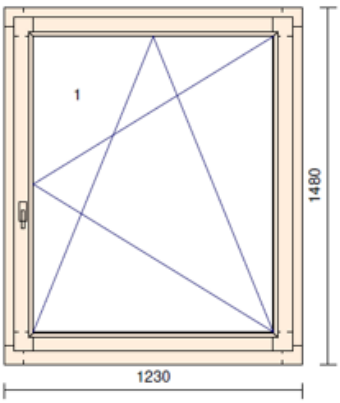

Figure 1: IV90 tilt and turn window and (or) fixed window

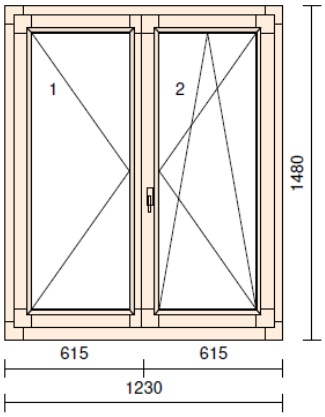

Figure 2: IV90 side-hung, tilt and turn window of overlapping design

The windows included in the IV90 Group are very similar products and go through the same production steps. The width of frame and sash profiles is 80 mm, thickness 90 mm. Windows opening inwards. The bottom of the frame contains cuts for easy installation of internal and external windowsills. Windows which open inwards allows the product to be used in open, tilted and “winter ventilation” mode. The wide range of finishes and available hardware shades allows for maximum customisation of the window design to suit any interior.

A typical wooden window consists of wood framing materials (frame and sash), aluminium profiles, insulated glass unit, fittings (hinges, locks, handles etc.), TPE gaskets and other polymers. Water-based impregnant, primer, paints produced by *Teknos* are used for finishing of windows.

Land or region, in which the declared product system is manufactured, used or handled at the end of the product’s lifespan: Europe.

2.2 Application

The products are used as enclosures for openings in facades of buildings. The indented uses are in domestic and commercial locations.

UN CPC code: 42120

2.3 Placing on the market / Application rules

The harmonized standard for windows and pedestrian doorsets is EN 14351-1. The CE mark is placed on finished products. According to the Construction Products Regulation CPR (EU) No. 305/2011, the essential properties of the products are declared in the CE marking and the Declaration of Performance. The respective national regulations apply to use.

The factory production control of SIA FLORA conforms to requirements of above mentioned standard according to system 3. Factory production control ensures the quality of the products.

Market: Germany and elsewhere. The waste scenarios are calculated for the German market.

2.4 Technical data

The main technical data and declared characteristics for the products are developed based on ITT report (initial test report) in accordance with the relevant harmonized product standard (EN 14351-1). The figures and/or classes shown in the following table apply to the reference on which this EPD is based.

Technical Data – Wooden windows IV90

Characteristic*	**Value**		**Unit**
Type	**IV90 tilt and turn window and (or) fixed window**	**IV90 side-hung, tilt and turn window of overlapping design**	**-**
Glass type	Flat glass, triple glazing	Flat glass, triple glazing	-
Total Weight**	37,05	38,60	kg
Thickness x width	90 x 80	90 x 80	mm
Glass surface**	0,70	0,62	m^2
Heat permeability, window (U_w-value) (EN 10077)	0,75-0,89	0,94-1,0	$W/(m^2*K)$
Safety equipment	n.a.	n.a.	-
Sound insulation	n.a.	n.a.	db
Air permeability (EN 1026)	Class 4	Class 4	-
Water tightness (EN12208)	7A	5A	-
Resistance to wind load, test pressure (EN 12210)	Class C3/B3	Class C2/B3	-
Resistance to wind load, frame deflection (EN 12210)	Class C3/B3	Class C2/B3	-
Dangerous substances	n.a.	n.a.	

Note:

** The indicated technical characteristics may change if changes are made in the configuration of the glass package and in other cases of application of technical solutions, without changing the materials and technology of the product.*

*** Reference size 1m^2*

The construction details and the performance values in accordance with the declaration of performance apply to the specific window unit put on the market by the respective manufacturer with regard to their main characteristics in accordance with harmonised product standard EN 14351-1.

2.5 Base materials / Ancillary

Characteristic	Value		Unit
Type	**IV90 tilt and turn window and (or) fixed window**	**IV90 side-hung, tilt and turn window of overlapping design**	**-**
Wood (pine)	13,223	15,498	kg
Glass	21,499	20,069	kg
Steel	0,973	1,455	kg
Aluminium	0,227	0,257	kg
Plastics (diverse materials)*	0,265	0,393	kg
Paint, impregnant, primer	0,536	0,613	kg
Silicone, glue	0,264	0,271	kg
Argon	0,051	0,048	kg

*Note: * mix of TPE, PVC, PP, PE*

2.6 Manufacturing

The LCA covers 100% of FLORA's production, which refers to its production facility in Jelgava, Latvia. Production includes the following processes:

- Extraction and delivery of raw materials;
- Cutting and profiling;
- Impregnation;
- Assembly of frame;
- Priming and painting of frame;
- Assembly of complete product;
- Packing and delivery.

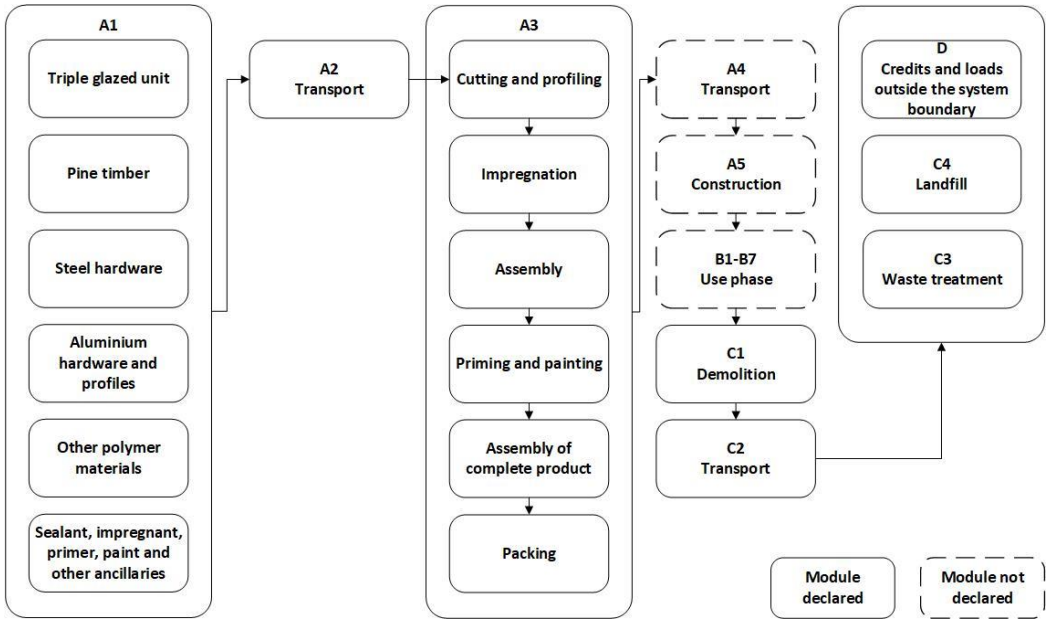

Figure 3: Overview of the production route of a window (A1-A3, C1-C4, D)

2.7 Packaging

The finished product is placed and fixed on pallets in a vertical position. The corners of the product are covered by cardboard. All products on the pallet are covered by packing film. Wrapping the pallet with a wrapping film protects the products from short-term exposure to moisture, transport dust and other adverse effects during transportation. The transportation does not cause any losses as products are secured properly.

2.8 Information on biogenic carbon content

Characteristic	Value		Unit
Name	IV90 tilt and turn window and (or) fixed window	IV90 side-hung, tilt and turn window of overlapping design	-
Product	6,02	7,05	kg C
Packaging	0,00	0,00	kg C

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2.

2.9 Production waste

The data on generated production waste is recorded as accurately as possible. Thus, the generated production waste is allocated per declared unit. There is no production waste for metal materials, because steel and aluminium hardware is delivered of the size as in the drawings (no cutting is made). Other materials such as polymers (diverse material) and aluminium profiles are cut to the required size.

3. LCA: Calculation rules

3.1 Declared unit

In accordance with PCR B (EN 17213), one square meter was chosen as the declared unit for windows representing products from the IV90 Group. Further information for describing the declared unit can be found in the table below.

Declared unit – Group wooden windows IV90

Description	Value		Unit
Type	**IV90 tilt and turn window and (or) fixed window**	**IV90 side-hung, tilt and turn window of overlapping design**	**-**
Declared unit	1	1	m^2
Frame: material type	Pine	Pine	-
Frame: mass	13,223	15,498	kg
Glass: material type	Flat glass, triple glazing	Flat glass, triple glazing	-
Glass: mass	21,499	20,069	kg
Seal: material type	TPE	TPE	-
Seal: mass	0,175	0,304	kg
Hardware and profile: material type	Steel / aluminium	Steel / aluminium	-
Hardware and profile: mass	0,973 / 0,227	1,455 / 0,257	kg
Total mass	37,05	38,60	kg
Configuration	4LowE+20+4+20+4LowE	2*4LowE+20+4+20+4LowE	-
Gas type	Argon	Argon	-
Conversion factor to 1 kg	0,027	0,026	m^2/kg

3.2 System boundary

This Life cycle assessment is made for EPD type "Cradle to gate with modules C1-C4 and module D": The Environmental Product Declaration analyses the Production stage (A1-A3), the End-of-Life stage (C1-C4) and the Benefits and loads beyond the system boundary (D).

In a typical window manufacturing process, the individual components such as framing materials, glazing units, fittings (hinges, locks, handles etc.), impregnant, sealant, primer, paints and other ancillary materials are delivered to the manufacturing site. The processes that are performed at the manufacturing site are: cutting and profiling, impregnation, assembly of frame, treatment and coating, assembly of complete product, packing and delivery. All inputs including raw materials, primary products, energy and auxiliary materials as well as the accumulated waste, are considered in the assessment.

Production stage

A1: This stage considers the extraction and processing of raw materials as well as energy consumption. All installed raw materials of the products were analysed, and the masses were determined.

A2: The raw materials are transported to the manufacturing plant. In this case, the model includes road/ maritime transportation of each raw material. Supplier information regarding the transport

distances and vehicle type were provided by SIA FLORA or chosen from relevant documentation of the background processes.

A3: This stage includes the manufacture of products and packaging. It also considers the energy consumption and waste generated at the manufacturing site. The national electricity mix of Latvia was taken into account.

Assembly stage

A4: Transportation of assembly stage is not declared.

A5: Installation process is not declared. The packaging is not modelled in C-D modules as it is discarded in module A5 which is not declared.

Use stage

B1 to B7: The use of the final product is not within the manufacturer's sphere of influence. Therefore, modules B1-7 have not been considered.

End of life stage

C1: Demolition concerns the removal of the window, whereby no environmental impact is assumed (e.g. emissions to air, water or soil). No information was found in the life cycle databases consulted for the dismantling operations of windows/ doors, nor was there a bibliography regarding the inputs or residues generated during these operations. Then dismantling is assumed at the site (so transport in C1 would be 0 km). Therefore there is no contribution on impact categories of this module. The resulting waste materials and quantities are included in the respective modules.

C2: Transport module concerns transportation to waste processing. All of end-of-life product is assumed to be sent to the closest facilities (C2).

Transport to waste processing (C2)

Name	Vehicle type	Distance
Truck*	Lorry (Truck), unspecified (default) | market group for (GLO)	Landfill:100 km; Incineration: 150 km (energy recovery on site 0); Recycling: 50 km; Re-Use: 0 km

*Note: * For all transports, the environmental profile of a non-specific truck transport was used (conservative assumption): The vehicle operates with diesel, and it provides a fleet average that includes different lorry classes as well as EURO classes. This transport used an average load factor, including empty return trips.*

C3 and C4: At the end-of-life is based on the assumption that all material components after their service life are disassembled to a specific waste flow (e.g. wood, metal, plastic and glass). The individual parts are assigned to the material-specific disposal route – waste processing (C3) for reuse, recovery and/or recycling) or landfill (C4).

End of life (C1-C4)

Name	Value		Unit
	IV90 tilt and turn window and (or) fixed window	IV90 side-hung, tilt and turn window of overlapping design	
Collected separately waste type	37,05	38,60	kg
Collected as mixed construction waste	0,00	0,00	kg
Re-use	0,00	0,00	kg
Recycling	7,59	7,65	kg
Energy recovery (incineration)	13,58	15,94	kg
Landfilling	15,82	14,97	kg

3.3 Estimates and assumptions

All installed raw materials of the product were analysed, and the masses were determined following the allocation and cut-off requirements. Production-specific energy consumption were measured and provided by SIA FLORA.

Since the production process is quite similar for all of the products produced at the manufacturing site, the energy consumption, ancillary materials and production waste is allocated according to the annual production of the elements (total area of produced windows) and then declared per square meter of the product. The total annual production data is recorded to a high standard of accuracy and precision.

The production waste of wood, paint and other mixed production waste is collected separately. Wood waste is thermally recovered at the production site. As the product is marketed internationally, no country-specific waste scenario can be considered. Therefore, the waste scenario of PCR B (EN 17213 Appendix B.3) was adopted. Removing the window does not result in any emissions to air or soil, so the value for module C1 is assumed to be zero.

3.4 Cut-off criteria

The study does not exclude any modules or processes which are stated mandatory in the EN 15804 and applicable PCR. The study does not exclude any hazardous materials or substances included in the Candidate List of Substances of Very High Concern (SVHCs) for authorization with concentrations higher than 0.1% weight by weight. All material flows that contribute to more than 1% of the total mass or energy of the system have been considered in the LCA. It can be assumed that the neglected processes in total contributed less than 5% to the considered impact categories.

The product stage includes materials, energy and waste flows only related to production processes (e.g. energy and water use related to company management and sales activities are excluded where technically possible; production, manufacture, and construction of manufacturing capital goods and infrastructure, other processes which are not directly related to the production of windows).

3.5 Background Data

The Life Cycle Assessment was modelled with the R<THiNK software from NIBE. The background data is taken from Ecoinvent version 3.6 (2019) “Allocation, cut-off” database. Geographical reference space of the background data is Europe or Global. Almost all consistent datasets contained in the Ecoinvent database are documented and can be viewed in the online Ecoinvent documentation. The reference year to collect all input data is 2022. The geographical reference area can be seen in the system description boundary table.

3.6 Data quality

In the operating data survey all relevant process-specific data has been collected. The data relating to the manufacturing phase of the window was determined by SIA FLORA.

Secondary data was taken from the Ecoinvent 3.6 (2019) database. The database is regularly checked and thus complies with the requirements of ISO 14040/44 (background data is not older than 10 years). The background data meets the requirements of EN 15804.

The general rule was followed that specific data from specific production processes or average data derived from specific processes must be given priority when calculating an EPD or Life Cycle Assessment. Data for processes that the manufacturer cannot influence or choose, were backed up with generic data.

3.7 Period Under review

All process-specific data was collected for the manufacturing year 2022. The quantities of raw and ancillary materials as well as energy consumption have been recorded and averaged over the entire operating year 2022.

3.8 Allocation

There are no co-products in the raw material supply and manufacturing phase, therefore no allocation methods were used at this stage (for co-products). Appropriation or attribution of inputs and outputs, e.g. auxiliary materials, energy (utilities), waste have been done on the basis of production volumes in 2022 (reference year), taking into account an area of produced windows. The Life Cycle Assessment was modelled with the R<THiNK software from NIBE. The background data is taken from Ecoinvent version 3.6 (2019) Allocation, cut-off library. Almost all consistent datasets contained in the Ecoinvent database is documented and can be viewed in the online Ecoinvent documentation. Specific information on allocations within the background data can be found in the Ecoinvent database version 3.6 (2019) document.

3.9 Calculation methods

For life cycle assessment, the calculation methods described in ISO 14040 have been applied. The evaluation is based on the phases in the system boundaries.

3.10 Mix of electricity and CO_2-Certificates

The electricity mix (medium voltage) was chosen, using the country-specific market dataset (Latvia) from the background database. Reference year of the dataset 2019, reference year of the electricity mix is at least 2012. The Ecoinvent profile used for the gridmix includes the imported energy and excludes the exported energy.

3.11 Comparability

EPD of construction products may not be comparable if they do not comply with the requirements of EN 15804. Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are considered.

3.12 Reference Service Life (RSL)

According to the standard EN 17213 a reference service life of 30 years is assumed without IGU replacement. This is on the basis that the installation, maintenance and servicing of the product follows the relevant instructions of the manufacturer which are submitted to every customer. It should be noted that the Use stage with modules B1-B7 is not declared.

4. System boundary description and LCA results

This Life cycle assessment is made for EPD type "cradle to gate with modules C1-C4 and module D". The Environmental Product Declaration analyses the Production stage (A1-A3), the end-of-life stage (C1-C4) and the Benefits and loads beyond the system boundary (D).

System boundary description

Description of the system boundary																
Production stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manu-facturer to place of use	Construction-installation process	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**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography																
EU, GLO	EU, GLO	LV, EU	MND	MND	MND	MND	MND	MND	MND	MND	MND	EU	EU	EU, DE	EU	EU, GLO
X=Module declared | MND=Module not declared																

All major materials, production energy use and waste are included for phases A1, A2, A3, C1, C2, C3 and C4. Use stage B1-B7 is not relevant for this type of product and is not declared.

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results for window wooden and window wooden with aluminium cladding are shown separately. The results presented refer to the declared average product.

Disclaimer on ADP-e, ADP-f, WDP, ETP-fw, HTP-c, HTP-nc, SQP: The results of these environmental impact indicators must be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator.

Disclaimer on IR: This impact category mainly addresses the potential effect of low dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposures, nor does it consider radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some building materials is also not measured by this indicator.

4.1 Results of the LCA for IV90 tilt and turn window and (or) fixed window (1 m2)

Results of the LCA: Environmental impact of 1 m^2 window									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804)									
ADP-f	MJ	4,52E+02	4,49E+01	3,83E+02	0,00E+00	8,14E+00	3,26E+00	2,28E+00	-1,47E+02
ADP-mm	kg Sb-eqv.	1,27E-03	7,54E-05	1,34E-04	0,00E+00	1,37E-05	6,49E-06	5,88E-07	8,55E-04
AP	mol H+ eqv.	3,32E-01	1,73E-02	1,74E-01	0,00E+00	3,13E-03	5,34E-03	7,02E-04	-1,80E-02
EP-fw	kg P eqv.	1,19E-03	3,01E-05	3,81E-04	0,00E+00	5,44E-06	9,52E-06	7,18E-07	-9,10E-04
EP-m	kg N eqv.	5,44E-02	6,09E-03	3,13E-02	0,00E+00	1,10E-03	2,24E-03	2,79E-04	-3,31E-03
EP-T	mol N eqv.	6,49E-01	6,71E-02	3,72E-01	0,00E+00	1,22E-02	2,55E-02	2,86E-03	-4,94E-02
GWP-b	kg CO2 eqv.	-2,18E+01	1,38E-03	4,51E+00	0,00E+00	2,49E-04	2,18E+01	1,20E+00	-4,94E-01
GWP-f	kg CO2 eqv.	3,67E+01	2,98E+00	2,44E+01	0,00E+00	5,40E-01	9,59E-01	7,56E-02	-9,94E+00
GWP-luluc	kg CO2 eqv.	1,01E-01	1,09E-03	3,40E-02	0,00E+00	1,98E-04	1,85E-04	1,73E-05	-7,18E-03
GWP-total	kg CO2 eqv.	1,50E+01	2,98E+00	2,90E+01	0,00E+00	5,40E-01	2,28E+01	1,28E+00	-1,04E+01
ODP	kg CFC 11 eqv.	4,08E-06	6,57E-07	3,92E-06	0,00E+00	1,19E-07	5,17E-08	3,39E-08	-8,02E-07
POCP	kg NMVOC eqv.	1,72E-01	1,92E-02	1,06E-01	0,00E+00	3,47E-03	6,71E-03	8,35E-04	-1,04E-02
WDP	m3 world eqv.	9,96E+00	1,61E-01	5,19E+00	0,00E+00	2,91E-02	1,18E-01	1,50E-02	-5,02E-03
Additional environmental impact indicators (EN 15804)									
ETP-fw	CTUe	8,74E+02	4,01E+01	3,50E+02	0,00E+00	7,26E+00	3,80E+01	8,33E+00	-4,27E+01
HTP-c	CTUh	3,72E-08	1,31E-09	2,44E-08	0,00E+00	2,35E-10	5,21E-08	2,92E-11	-9,49E-10
HTP-nc	CTUh	6,62E-07	4,38E-08	2,42E-07	0,00E+00	7,94E-09	1,97E-08	8,27E-10	-4,33E-08
IR	kBq U235 eqv.	1,42E+00	1,88E-01	1,70E+00	0,00E+00	3,41E-02	1,28E-02	9,80E-03	-2,80E-01
PM	disease incidence	3,94E-06	2,68E-07	2,70E-06	0,00E+00	4,86E-08	4,77E-08	1,48E-08	-5,80E-08
SQP	Pt	3,64E+03	3,89E+01	1,33E+03	0,00E+00	7,06E+00	2,37E+00	5,04E+00	-1,42E+01

ADP-e=Depletion of abiotic resources-elements | **ADP-f**=Depletion of abiotic resources-fossil fuels | **AP**=Acidification of soil and water | **EP-fw** =Eutrophication, freshwater | **EP-m**=Eutrophication marine | **EP-T**=Eutrophication, terrestrial | **GWP-b**=Global warming potential – Biogenic | **GWP-f**=Global warming potential – Fossil | **GWP-luluc**=Global warming potential – Land use and land use change |**GWP-total**=Global warming potential |**ODP**=Ozone layer depletion |**POCP**=Photochemical oxidants creation | **WDP**=Water use | **ETP-fw**=Ecotoxicity, freshwater | **HTP-c**=Human toxicity, cancer | **HTP-nc**=Human toxicity, non-cancer | **IR**=Ionising radiation, human health | **PM**=Particulate Matter | **SQP**=Land use

Results of the LCA: Resource use and environmental information of 1 m^2 window									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	3,26E+02	5,64E-01	2,20E+02	0,00E+00	1,02E-01	2,60E-01	3,82E-02	-1,01E+01
PERM	MJ	1,85E+02	0,00E+00	4,90E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	5,11E+02	5,64E-01	2,69E+02	0,00E+00	1,02E-01	2,60E-01	3,82E-02	-1,01E+01
PENRE	MJ	4,68E+02	4,77E+01	3,92E+02	0,00E+00	8,64E+00	3,48E+00	2,42E+00	-1,60E+02
PENRM	MJ	1,70E+01	0,00E+00	1,94E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	4,85E+02	4,77E+01	4,11E+02	0,00E+00	8,64E+00	3,48E+00	2,42E+00	-1,60E+02
SM	kg	4,79E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,11E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	3,04E-01	5,48E-03	1,63E-01	0,00E+00	9,92E-04	8,87E-03	2,69E-03	-2,98E-02
HWD	kg	1,87E-03	1,16E-04	3,90E-04	0,00E+00	2,06E-05	1,44E-03	2,49E-06	1,65E-03
NHWD	kg	5,33E+00	2,84E+00	3,22E+00	0,00E+00	5,16E-01	3,64E-01	1,58E+01	-3,07E-01
RWD	kg	1,64E-03	2,95E-04	1,67E-03	0,00E+00	5,35E-05	1,44E-05	1,53E-05	-3,68E-04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,59E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	-1,52E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-5,95E+01
EEE	MJ	0,00E+00	0,00E+00	-8,81E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-3,46E+01

PERE=renewable primary energy ex. Raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. Raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water | **HWD**=hazardous waste disposed | **NHWD**=non-hazardous waste disposed | **RWD**=radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

4.2 Results of the LCA for IV90 side-hung, tilt and turn window of overlapping design (1 m2)

Results of the LCA: Environmental impact of 1 m^2 window									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804)									
ADP-f	MJ	4,83E+02	4,44E+01	3,91E+02	0,00E+00	8,69E+00	3,86E+00	2,18E+00	-1,73E+02
ADP-mm	kg Sb-eqv.	1,43E-03	7,45E-05	1,40E-04	0,00E+00	1,46E-05	7,60E-06	5,54E-07	9,67E-04
AP	mol H+ eqv.	3,35E-01	1,71E-02	1,76E-01	0,00E+00	3,34E-03	6,33E-03	6,73E-04	-2,11E-02
EP-fw	kg P eqv.	1,33E-03	2,97E-05	3,94E-04	0,00E+00	5,81E-06	1,18E-05	7,27E-07	-1,07E-03
EP-m	kg N eqv.	5,58E-02	6,01E-03	3,16E-02	0,00E+00	1,18E-03	2,63E-03	2,71E-04	-3,90E-03
EP-T	mol N eqv.	6,60E-01	6,63E-02	3,76E-01	0,00E+00	1,30E-02	3,00E-02	2,73E-03	-5,81E-02
GWP-b	kg CO2 eqv.	-2,55E+01	1,36E-03	4,51E+00	0,00E+00	2,66E-04	2,55E+01	1,40E+00	-5,81E-01
GWP-f	kg CO2 eqv.	3,85E+01	2,94E+00	2,48E+01	0,00E+00	5,76E-01	1,32E+00	7,39E-02	-1,17E+01
GWP-luluc	kg CO2 eqv.	1,14E-01	1,08E-03	3,43E-02	0,00E+00	2,11E-04	2,30E-04	1,73E-05	-8,46E-03
GWP-total	kg CO2 eqv.	1,32E+01	2,94E+00	2,94E+01	0,00E+00	5,77E-01	2,68E+01	1,48E+00	-1,23E+01
ODP	kg CFC 11 eqv.	4,25E-06	6,49E-07	3,95E-06	0,00E+00	1,27E-07	6,58E-08	3,23E-08	-9,45E-07
POCP	kg NMVOC eqv.	1,79E-01	1,89E-02	1,07E-01	0,00E+00	3,71E-03	7,89E-03	8,02E-04	-1,22E-02
WDP	m3 world eqv.	1,07E+01	1,59E-01	5,50E+00	0,00E+00	3,11E-02	1,42E-01	1,62E-02	-1,33E-02
Additional environmental impact indicators (EN 15804)									
ETP-fw	CTUe	9,41E+02	3,96E+01	3,57E+02	0,00E+00	7,75E+00	4,21E+01	9,21E+00	-5,05E+01
HTP-c	CTUh	4,82E-08	1,29E-09	2,47E-08	0,00E+00	2,51E-10	6,08E-08	2,84E-11	-1,13E-09
HTP-nc	CTUh	8,00E-07	4,33E-08	2,48E-07	0,00E+00	8,48E-09	2,40E-08	8,21E-10	-5,34E-08
IR	kBq U235 eqv.	1,54E+00	1,86E-01	1,72E+00	0,00E+00	3,64E-02	1,51E-02	9,34E-03	-3,30E-01
PM	disease incidence	4,13E-06	2,65E-07	2,72E-06	0,00E+00	5,18E-08	5,62E-08	1,41E-08	-6,79E-08
SQP	Pt	4,24E+03	3,84E+01	1,34E+03	0,00E+00	7,54E+00	2,84E+00	4,82E+00	-1,67E+01

ADP-e=Depletion of abiotic resources-elements | **ADP-f**=Depletion of abiotic resources-fossil fuels | **AP**=Acidification of soil and water | **EP-fw** =Eutrophication, freshwater | **EP-m**=Eutrophication marine | **EP-T**=Eutrophication, terrestrial | **GWP-b**=Global warming potential – Biogenic | **GWP-f**=Global warming potential – Fossil | **GWP-luluc**=Global warming potential – Land use and land use change |**GWP-total**=Global warming potential |**ODP**=Ozone layer depletion |**POCP**=Photochemical oxidants creation | **WDP**=Water use | **ETP-fw**=Ecotoxicity, freshwater | **HTP-c**=Human toxicity, cancer | **HTP-nc**=Human toxicity, non-cancer | **IR**=Ionising radiation, human health | **PM**=Particulate Matter | **SQP**=Land use

Results of the LCA: Resource use and environmental information of 1 m^2 window									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	3,79E+02	5,57E-01	2,20E+02	0,00E+00	1,09E-01	3,22E-01	3,71E-02	-1,19E+01
PERM	MJ	2,17E+02	0,00E+00	4,90E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	5,96E+02	5,57E-01	2,69E+02	0,00E+00	1,09E-01	3,22E-01	3,71E-02	-1,19E+01
PENRE	MJ	4,97E+02	4,71E+01	3,98E+02	0,00E+00	9,23E+00	4,12E+00	2,31E+00	-1,88E+02
PENRM	MJ	2,10E+01	0,00E+00	2,20E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	5,18E+02	4,71E+01	4,20E+02	0,00E+00	9,23E+00	4,12E+00	2,31E+00	-1,88E+02
SM	kg	7,17E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,93E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	3,30E-01	5,41E-03	1,71E-01	0,00E+00	1,06E-03	1,05E-02	2,56E-03	-3,52E-02
HWD	kg	2,12E-03	1,15E-04	3,96E-04	0,00E+00	2,20E-05	1,63E-03	2,37E-06	1,87E-03
NHWD	kg	6,08E+00	2,81E+00	3,42E+00	0,00E+00	5,51E-01	3,81E-01	1,50E+01	-3,62E-01
RWD	kg	1,76E-03	2,91E-04	1,69E-03	0,00E+00	5,71E-05	1,67E-05	1,46E-05	-4,34E-04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,65E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	-1,52E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-7,00E+01
EEE	MJ	0,00E+00	0,00E+00	-8,81E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-4,07E+01

PERE=renewable primary energy ex. Raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. Raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water | **HWD**=hazardous waste disposed | **NHWD**=non-hazardous waste disposed | **RWD**=radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

5. LCA: Interpretation

The following figures show the percentage of the product phases in the environmental impact categories.

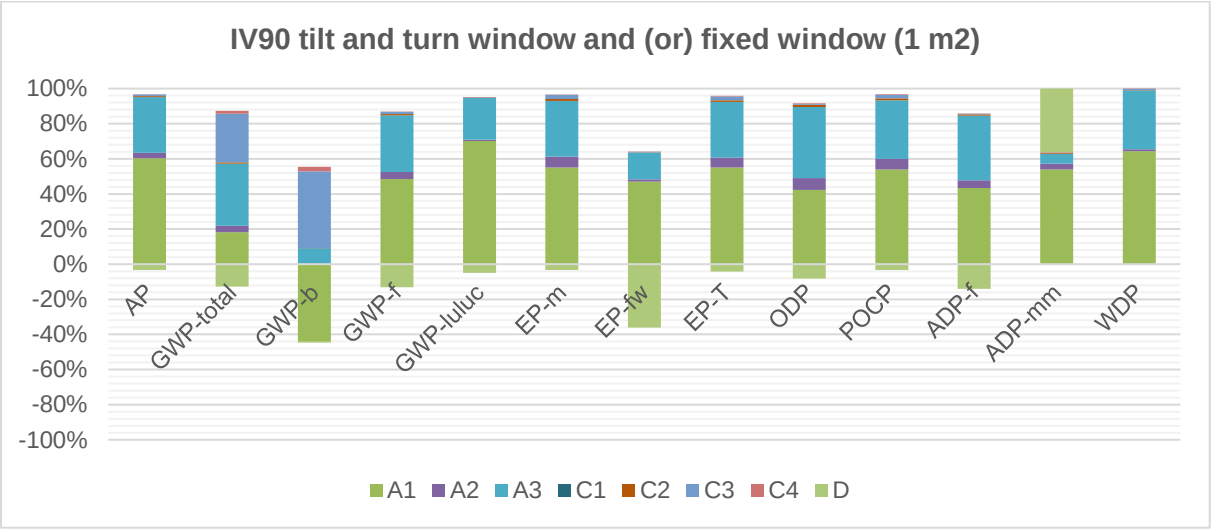

Figure 4: Influence of the modules A1 – A3, C1 – C4 and D on the analysed impact categories of Group IV90 tilt and turn window and (or) fixed window

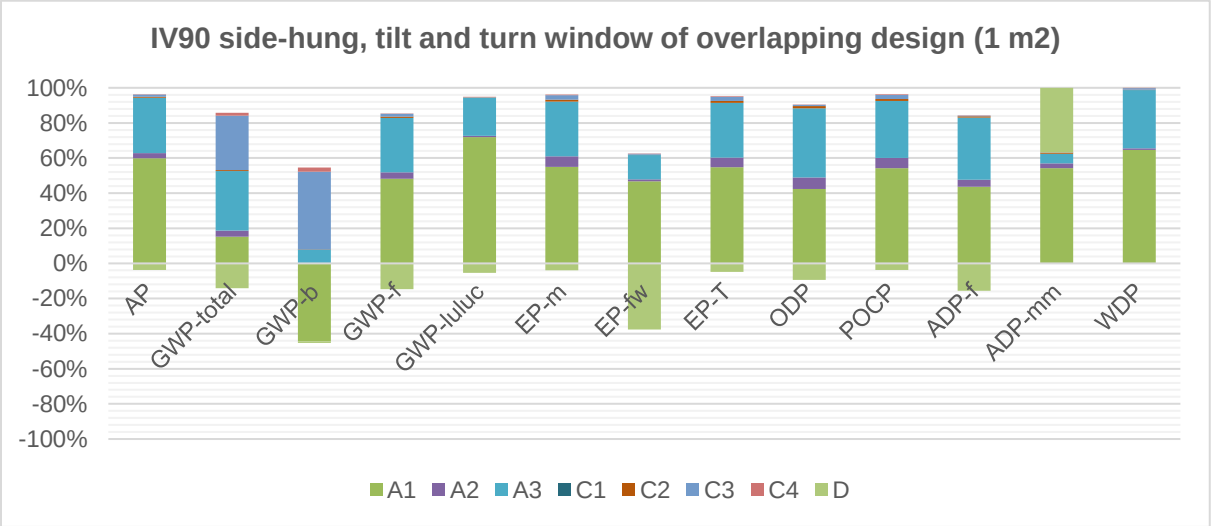

Figure 5: Influence of the modules A1 – A3, C1 – C4 and D on the analysed impact categories of Group IV90 side-hung, tilt and turn window of overlapping design

As shown in the Figures 4 and 5, for most of the environmental impact categories the Raw material supply (A1) during the Production phase has the highest percentages. Followed by the Manufacturing (A3), where the energy consumption and ancillaries were considered. It can also be seen that the benefits in D predominate, represented by the negative percentage values of D. Potential credits come mainly from material recovery (aluminium, glass and steel) and energy recovery (wood and polymers). Energy recovery contributes to negative values of D for Ecotoxicity, freshwater (ETP-fw), Resource use, fossils (ADP-f), Land use (SQP) and Global warming potential (GWP-total).

Negative shares of the environmental impact Global warming potential - Biogenic (GWP-b) can be concluded from the use of the ecological material “wood”. Biogenic carbon uptake in A1 and (release) emissions in C3 are in balance.

The data quality of the background data is considered good. All site-specific data is collected from the year 2022, provided by the manufacturer. Background data is based on LCI database Ecoinvent version 3.6 (2019). Geographic coverage: specific data were collected from area under study, i.e., Latvia, Germany and Europe. Generic data were collected from global average data. Technological coverage: specific data were collected from current window production process under study. Generic data from Europe or Global average with technology aspects were similar with what described in the processes under study, but merits improvement as part of processes were not modelled with specific data.

Overall, the quality of the data can be considered as good. The primary data collection has been done thoroughly. Data quality was calculated using the Data Quality level and criteria according to the PEF approach (Annex E.2 of EN15804+A2). The DQRs range from 2,00 to 3,00 for the most abundant inputs in terms of mass. Better results could be expected if more specific data were used.

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	Publisher Kiwa-Ecobility Experts Voltastr.5 13355 Berlin Germany	Mail Web	DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/themes/ecobility-experts/ecobility-experts/
	Programme operator Kiwa-Ecobility Experts Voltastr. 5 13355 Berlin Germany	Mail Web	DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/themes/ecobility-experts/ecobility-experts/
	Author of the Life Cycle Assessment Inspecta Latvia AS Skanstes iela 54a Riga, LV-1013 Latvia	Tel. Mail Web	+371 67 607 900 latvia@kiwa.com https://www.kiwa.com/lv
	Owner of the declaration SIA FLORA Tērvetes iela 85, Jelgava, LV-3008 Latvia	Tel. Mail Web	+371 63 026 024 flora@flora.lv https://www.flora.lv/