Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 +A1

Kvillsfors Fixed frame - EL (with aluminium cladding)

Owner of the declaration:
NorDan AS

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3446-2059-EN

Registration Number:
NEPD-3446-2059-EN

Issue date: 02.05.2022
Valid to: 02.05.2027

The Norwegian
EPD Foundation

Product name:
Kvillsfors Fixed frame - EL
(with aluminium cladding)

Manufacturer:
NorDan AS

General information

Product:
Kvillsfors Fixed frame - EL (with aluminium cladding)

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Manufacturer:
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Phone: +46 (0)10 - 130 00 00

Declaration number:
NEPD-3446-2059-EN

Place of production:
Kvillsfors, Sweden

ECO Platform registration number:
-

Management system:
NorDan AB. Works with EN ISO 9001:2015, ISO 14001:2015

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR NPCR014:2019 version 3.0 Part B for Windows and doors

Org. no.:
NO 979 776 233 MVA

Declaration of responsibility:
The owner of the declaration shall be responsible for the underlying information and evidence. EPD Norway shall not be responsible with regard to manufacturer information, life cycle data and evidence.

Issue date:
02.05.2022

Valid to:
02.05.2027

Declared unit:

Year of study:
2021

Declared unit with option:

Comparability:
EPD of construction products may not be comparable if they are not comply with NS-EN 15804 and seen in a building context.

Functional unit:
1 window measuring 1.23 m x 1.48 m (reference window based on EN 14351-1) with an expected service life of 60 yrs. With alu clad. with an essential parameter U-value = 1,0W/m2K.Conversion factor is 62.36 [Kg/FU].

The EPD has been worked out by:
Roja Modaresi
Norsk Treteknisk Institutt

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:

Gaylord K. Booto PhD., Senior Research Scientist, NORSUS AS
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Fixed window for use in exterior walls of domestic and commercial buildings.

Product specification:
25% of aluminium and 7% of glass is produced from recycled material.

Materialer		kg	%
Pine timber		12.56	20.14
Glue for timber		0.13	0.21
Triple glazed unit	Glass	44.24	70.94
	Spacer	0.48	0.77
	Butyl	0.02	0.04
	Sealant	0.49	0.79
	Absorbent	0.02	0.04
	Argon	0.03	0.05
Paint		0.57	0.91
Aluminium		2.84	4.55
Plastic		0.04	0.06
Gasket		0.28	0.45
Screw/nails		0.05	0.08
Glue		0.04	0.06
Glass list		0.58	0.93
Total weight of the product		**62.36**	**100**
Wood packaging		0.35	
Steel packaging		0.03	
Plastic packaging		0.15	
cardboard packaging		0,4	
Recycled pallete EU 1200*800		3.70	
Total weight with packaging		***66.59***	

Technical data:
Fixed frame window. Triple glazed, 115mm frame with aluminium clad. Uwin 1,0 W/m2K. Manufactured in accordance with ISO 9001:2015, ISO 14001:2015. Certified: Bluesky, SP Sitac “P”,

The total product weight is 62.36 kg. The packaging has an average weight of 4.6 kg.

Market:

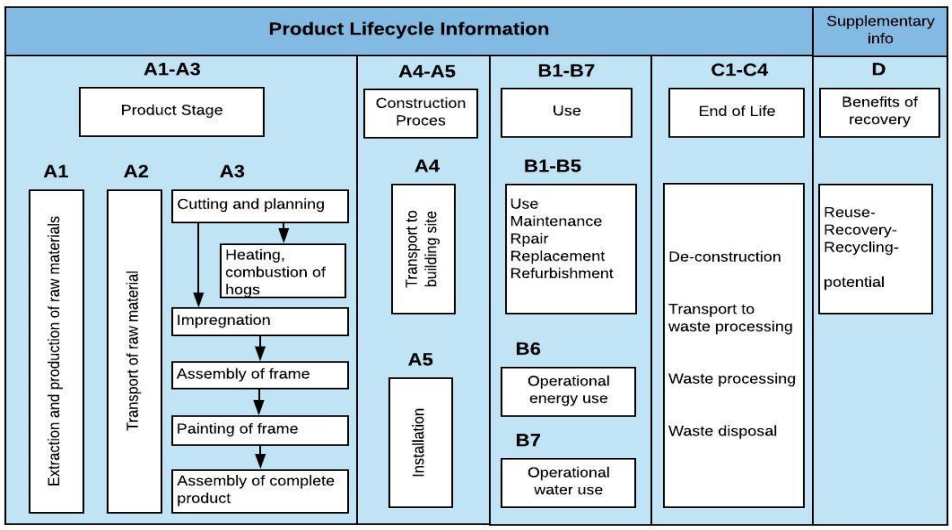
Europe, but scenarios beyond cradle to gate are based on the situation in the Norwegian market.

Reference service life:
The reference service life is 60 years for aluminium cladding timber frame

LCA: Calculation rules

Functional unit:
1 window measuring 1.23 m x 1.48 m (reference window based on EN 14351-1) with an expected service life of 60 yrs. With alu clad. with an essential parameter U-value = 1,0W/m2K.Conversion factor is 62.36 [Kg/FU].

System boundary:
All modules are included. Below is a technical flowchart for the production line at Nordan. Modul D is calculated with energy substitution and explained in the scenarios.



Data quality
Data is representative of year 2020 and was collected in 2021-2022. Data is taken from processes from Ecoinvent 3.1-3.7. Some processes are based on Ecoinvent v3.1 (2014) and v3.2 (2015), but all upstream processes are v3.4 (2017)-3.5 (2018). Remaining data is based on Ecoinvent v3.7 (2020). "Allocation cut-off by classification" adjusted to improve representativeness.

Cut-off criteria:
All raw materails and energy use is included. Where data was available for infrastructure from Ecoinvent, it is included. Example: 'Metal working factory'. In the production process, raw materials and energy of low amounts are not included (<1%). These cut-off rules do not apply to dangerous substances.

Allocation:
Allocation is done in accordance with the provisions of EN 15804. Allocation of energy, water and waste from production is calculated by a physical allocation factor based on the manufacturer input. For waste produced at the manufacturing, the burdens for reuse, recycling and recovery is allocated by using this allocation factor.

Calculations of biogenic carbon:
Sequestration and release of biogenic carbon is included according to EN 16485:2014. This is based on the modularity principle in EN 15804:2012 that specifies that the emissions shall be accounted in the module that they occur. The amount of carbon dioxide sequestrated is calulated in accordance to EN 16449:2014. Timber comes from sustainable forestry and has FSC certified traceability.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD

The transportation from production to construction site is based on a scenario where the product is transported on a large lorry from Kvillsfors, Sweden to Oslo, Norway (500 km) and then to a warehouse which is assumed to be in a 250 km radius from Oslo. Transport from warehouse to a construction site is assumed to be 50 km on a medium truck.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption pr tkm	Fuel/Energy consumption pr km
Truck	53	EURO5, >32 tonn	750	0.023 l/tkm	0.31 l/km
Truck	26	EURO5, 16-32 tonn	50	0.045 l/tkm	0.25 l/km

Installation (A5)

	Unit	Value
Auxiliary	kg	0
Water consumption	m^3	0
Electricity consumption	MJ	0
Other energy carriers	MJ	0
Material loss	kg	0
Output materials from waste treatment	kg	0.53
Dust in the air	kg	0

According to the report from EPD-Norge 'Harmonising the documentation of scenarios beyond cradle to gate, EN 15804' there is no loss on site during construction activities. The window products in this EPD are painted and surface treated in the production and not at the building site. Therefore, there is only 2 items left in this module. 1) Waste treatment of packaging which is considered in the EPD calculations. 1) Energy use during installation. This can be varied depending on the floor, type of building and several other unknown parameters, and therefore ignored in the calculation.

Maintenance (B2)/Repair (B3)

	Unit	Value (alu cladding)
Detergents	kg	9
Water consumption	l	180
Lubricating oil	kg	0.30
Paint	kg	0.55
Transport	tkm	2.95
Glazing unit	kg	45.29
Synthetic rubber	kg	0.28
Transport (IGU)	tkm	13.59

The maintenance scenario included cleaning, painting and change of IGU. Cleaning is performed three times per year. It is calculated with 1,5 dl of detergent and 3 litres of water each year. Windows with aluminium cladding are assumed to be painted 3 times during its lifetime from inside. It is assumed that 5 gr of lubricating oil is used every year for fittings and moving parts. The glazing unit is changed once during the lifetime for the windows with aluminium cladding. No repair is assumed during the product lifetime.

Replacement (B4)/Refurbishment (B5)

	Unit	Value
Replacement cycle*	yr	60
Electricity consumption	kWh	0
Replacement of worn parts	0	0

* Number or RSL (Reference Service Life). The window has RSL of 60 years. Therefore, it is assumed to replace the insulated glass unit after 30 years (See Module B4). There is no need for refurbishment during the product lifetime.

(C1) As there are no data for de-construction, it is assumed no activites in C1 in this study. The windows are assumed to be treated as mixed waste and sent to incineration. The combustible materials are then energy recovered, while glass is assumed to end up in the bottom ash and then landfilled. The metals are usually sorted out of the bottom ash and then recycled, but there is no data of the share which are recycled and therefore standard values from Ecoinvent is utilized.

The transport of window as waste is calculated based on a scenario with 50 km distance.

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption pr tkm	Fuel/Energy consumption pr km
Truck	44	Unspecified	50	0.03l/tkm	0.28 l/km

Windows are assumed to be sorted as mixed construction waste and treated with incineration with energy recovery. However, the manufacturer has documented the recycling potentials for its product in the Construction Product Declaration eBVD Kvillsfors Fast Karm - EL, ID: C-SE556294452901-100 URL: https://www.ebvd.org/BMI/Document/Export/6223/0/Pdf
In the documentation, Chapter 10, the specific material recovery, and energy recovery potential is reported for the product.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	62.36
Reuse	kg	0
Recycling	kg	1.14
Energy recovery	kg	61.22
To landfill	kg	0.00

The benefits beyond life cycle has been modelled based on the output flows from module C3. This includes energy from incineration and scrap metal recovered from the ashes. The amount recovered metal is assumed to avoid production of primary metals in accordance to 6.4.3.3 in EN 15804. The exported energy is substituting Norwegian district heating mix and electricity mix. Inventory processes causing substitution of avoided virgin raw materials has be constructed for each material.

Benefits and loads beyond the system boundaries (D)

	Unit	Value (alu cladding)
Substitution of electricity	MJ	22.1
Substitution of thermal energy	MJ	207.2
Substitution of raw materials	kg	1.5

LCA: Results

Global warming potential in A1-A3 includes sequestration of CO2 as carbon in the wood. This amount is accounted as an emission in module C3. Additionally, it is included sequestration in the wood packaging. This is accounted as an emission in module A5. The flow of biogenic carbon for the system is presented in page 9.

System boundaries (X = included)

Product stage			Construction and 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
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Environmental impact With alu clad

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
GWP	kg CO_2 -ekv	7.55E+01	4.52E+00	6.57E+00	0.00E+00	8.83E+01	0.00E+00	0.00E+00	0.00E+00
ODP	kg CFC11-ekv	9.48E-06	8.79E-07	0.00E+00	0.00E+00	7.10E-06	1.00E+00	0.00E+00	0.00E+00
POCP	kg C_2H_4 -ekv	4.31E-02	5.31E-04	0.00E+00	0.00E+00	2.64E-02	2.00E+00	0.00E+00	0.00E+00
AP	kg SO_2 -ekv	7.20E-01	1.15E-02	0.00E+00	0.00E+00	6.15E-01	3.00E+00	0.00E+00	0.00E+00
EP	kg PO_4^{3-}-ekv	7.18E-02	1.57E-03	0.00E+00	0.00E+00	6.09E-02	4.00E+00	0.00E+00	0.00E+00
ADPM	kg Sb-ekv	1.06E-03	1.18E-05	0.00E+00	0.00E+00	3.57E-04	5.00E+00	0.00E+00	0.00E+00
ADPE	MJ	1.12E+03	7.23E+01	0.00E+00	0.00E+00	1.07E+03	6.00E+00	0.00E+00	0.00E+00

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
GWP	kg CO_2 -ekv	0.00E+00	0.00E+00	0.00E+00	4.35E-01	2.74E+01	5.32E-01		-2.83E+01
ODP	kg CFC11-ekv	0.00E+00	0.00E+00	0.00E+00	7.97E-08	3.71E-08	1.41E-07		-8.53E-07
POCP	kg C_2H_4 -ekv	0.00E+00	0.00E+00	0.00E+00	5.49E-05	2.43E-04	1.22E-04		-9.78E-03
AP	kg SO_2 -ekv	0.00E+00	0.00E+00	0.00E+00	1.38E-03	3.27E-03	2.97E-03		-1.59E-01
EP	kg PO_4^{3-}-ekv	0.00E+00	0.00E+00	0.00E+00	2.27E-04	9.92E-04	5.49E-04		-1.47E-02
ADPM	kg Sb-ekv	0.00E+00	0.00E+00	0.00E+00	1.47E-06	9.44E-07	1.06E-06		-3.95E-05
ADPE	MJ	0.00E+00	0.00E+00	0.00E+00	6.58E+00	6.53E+01	1.27E+01		-2.66E+02

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources.

Resource use with alu clad									
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**
RPEE	MJ	4.2E+02	9.0E-01	0.0E+00	0.0E+00	6.7E+01	0.0E+00	0.0E+00	0.0E+00
RPEM	MJ	2.9E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TPE	MJ	7.1E+02	9.0E-01	0.0E+00	0.0E+00	6.7E+01	0.0E+00	0.0E+00	0.0E+00
NRPE	MJ	1.3E+03	7.4E+01	0.0E+00	0.0E+00	1.1E+03	0.0E+00	0.0E+00	0.0E+00
NRPM	MJ	5.7E+01	0.0E+00	0.0E+00	0.0E+00	-8.7E+00	0.0E+00	0.0E+00	0.0E+00
TRPE	MJ	1.4E+03	7.4E+01	0.0E+00	0.0E+00	1.1E+03	0.0E+00	0.0E+00	0.0E+00
SM	kg	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
RSF	MJ	9.8E-02	0.0E+00	0.0E+00	0.0E+00	9.9E-02	0.0E+00	0.0E+00	0.0E+00
NRSF	MJ	6.3E-02	0.0E+00	0.0E+00	0.0E+00	6.3E-02	0.0E+00	0.0E+00	0.0E+00
W	m^3	1.4E+00	7.8E-03	0.0E+00	0.0E+00	1.1E+00	0.0E+00	0.0E+00	0.0E+00

Resource use with alu clad									
Parameter	**Unit**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**		**D**
RPEE	MJ	0.0E+00	0.0E+00	0.0E+00	9.0E-02	2.2E+02	1.9E-01		-1.3E+02
RPEM	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-2.2E+02	0.0E+00		0.0E+00
TPE	MJ	0.0E+00	0.0E+00	0.0E+00	9.0E-02	5.2E-01	1.9E-01		-1.3E+02
NRPE	MJ	0.0E+00	0.0E+00	0.0E+00	6.7E+00	6.6E+01	1.3E+01		-2.7E+02
NRPM	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-6.2E+01	0.0E+00		0.0E+00
TRPE	MJ	0.0E+00	0.0E+00	0.0E+00	6.7E+00	3.9E+00	1.3E+01		-2.7E+02
SM	kg	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00
RSF	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.4E-01	0.0E+00		-8.6E+01
NRSF	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-01	0.0E+00		-5.5E+01
W	m^3	0.0E+00	0.0E+00	0.0E+00	7.2E-04	1.1E-02	1.2E-02		-4.7E-01

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water.

End of life-Waste with alu clad									
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**
HW	kg	1.04E+00	3.88E-03	0.00E+00	0.00E+00	5.03E+01	0.00E+00	0.00E+00	0.00E+00
NHW	kg	2.99E+01	6.12E+00	0.00E+00	0.00E+00	1.44E+01	0.00E+00	0.00E+00	0.00E+00
RW	kg	6.50E-03	5.05E-04	0.00E+00	0.00E+00	3.35E-03	0.00E+00	0.00E+00	0.00E+00

End of life-Waste with alu clad									
Parameter	**Unit**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**		**D**
HW	kg	0.00E+00	0.00E+00	0.00E+00	3.50E-04	5.21E-03	5.06E+01		-2.57E-01
NHW	kg	0.00E+00	0.00E+00	0.00E+00	4.32E-01	1.31E-01	3.82E-01		-5.29E+00
RW	kg	0.00E+00	0.00E+00	0.00E+00	4.59E-05	1.37E-05	8.07E-05		-3.65E-04

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life- Output flow with alu clad									
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**
CR	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
MR	kg	7.30E-01	0.00E+00	5.80E-01	0.00E+00	2.42E-01	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	4.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	7.18E+00	0.00E+00	0.00E+00	0.00E+00	4.38E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	7.63E+01	0.00E+00	0.00E+00	0.00E+00	3.03E+01	0.00E+00	0.00E+00	0.00E+00

End of life- Output flow with alu clad									
Parameter	**Unit**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**		**D**
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00
MR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E+00	0.00E+00		-1.46E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E+01	0.00E+00		-2.21E+01
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E+02	0.00E+00		-2.07E+02

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = $9{,}0*10^{-3}$ = 0,009

Norwegian additional requirements

Greenhouse gas emissions from the use of electricity in the production phase
National (Sweden) market with low-voltage, including imports, direct emissions, infrastructure and transmission losses, has been used for electricity in the production process (A3). The manufacturer is documented the use of electricity from hydropower with guarantees of origin, which has 6 fold less GWP effect. However, the final result has only be improved by 0.6% in A1-A3 production. Therfore, the national electricity mix is considerd.

Data source	Quantity	Unit
Ecoinvent v3.7 (September 2020)	41	gram CO_2-ekv./kWh

Hazardous substances

- ☐ The product contains no substances from REACH Candidate List or the Norwegian Priority List
- ☑ The product contains substances below 0.1% by weight on the REACH Candidate List
- ☐ The product contains substances from REACH Candidate List or the Norwegian Priority List, see table under Specific Norwegian requirements.
- ☐ The product does not contain any substances on the REACH Candidate List or the Norwegian Priority List. The product can be characterized as hazardous waste (according to the Waste Shift, Appendix III), see table under Specific Norwegian requirements.

Transport
Transport from production site to construction site according to scenario in A4: 750+50 km

Indoor air quality
The product has not been tested for emissions to indoor environments.

Carbon footprint
To increase the transparency of the climate impacts, the GWP indicator has been divided into sub-indicators:
GWP-IOBC Climate impacts calculated according to instant oxidation principle
GWP-BCIP Climate impacts calculated from the net impacts of sequestration and emission of biogenic carbon

Climate impact with alu clad

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5
GWP-IOBC	kg CO_2-ekv	1.03E+02	4.52E+00	0.00E+00	0.00E+00	8.83E+01	0.00E+00	0.00E+00	0.00E+00
GWP-BCIP	kg CO_2-ekv	-2.75E+01	0.00E+00	6.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP	kg CO_2-ekv	7.56E+01	4.52E+00	6.57E+00	0.00E+00	8.84E+01	0.00E+00	0.00E+00	0.00E+00

Climate impact with alu clad

Parameter	Unit	B6	B7	C1	C2	C3	C4		D
GWP-IOBC	kg CO_2-ekv	0.00E+00	0.00E+00	0.00E+00	4.35E-01	6.53E+00	5.32E-01		-2.83E+01
GWP-BCIP	kg CO_2-ekv	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E+01	0.00E+00		0.00E+00
GWP	kg CO_2-ekv	0.00E+00	0.00E+00	0.00E+00	4.35E-01	2.74E+01	5.32E-01		-2.83E+01

Additional information

For the products with different sizes from the declared unit, the environmental impacts must be converted by using a conversion factor. The Norwegian EPD Foundation has published instructions on how to interpret EPDs for windows on its website (www.epd-norge.no) where different calculation methods have been stated. (Document: Bruksanvisninger i hvordan tolke EPD'er – Vinduer)

Bibliografi

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