Environmental
Product
Declaration
In accordance with ISO 14025 for:

Leva Chair

From

Foster + Partners

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-02272
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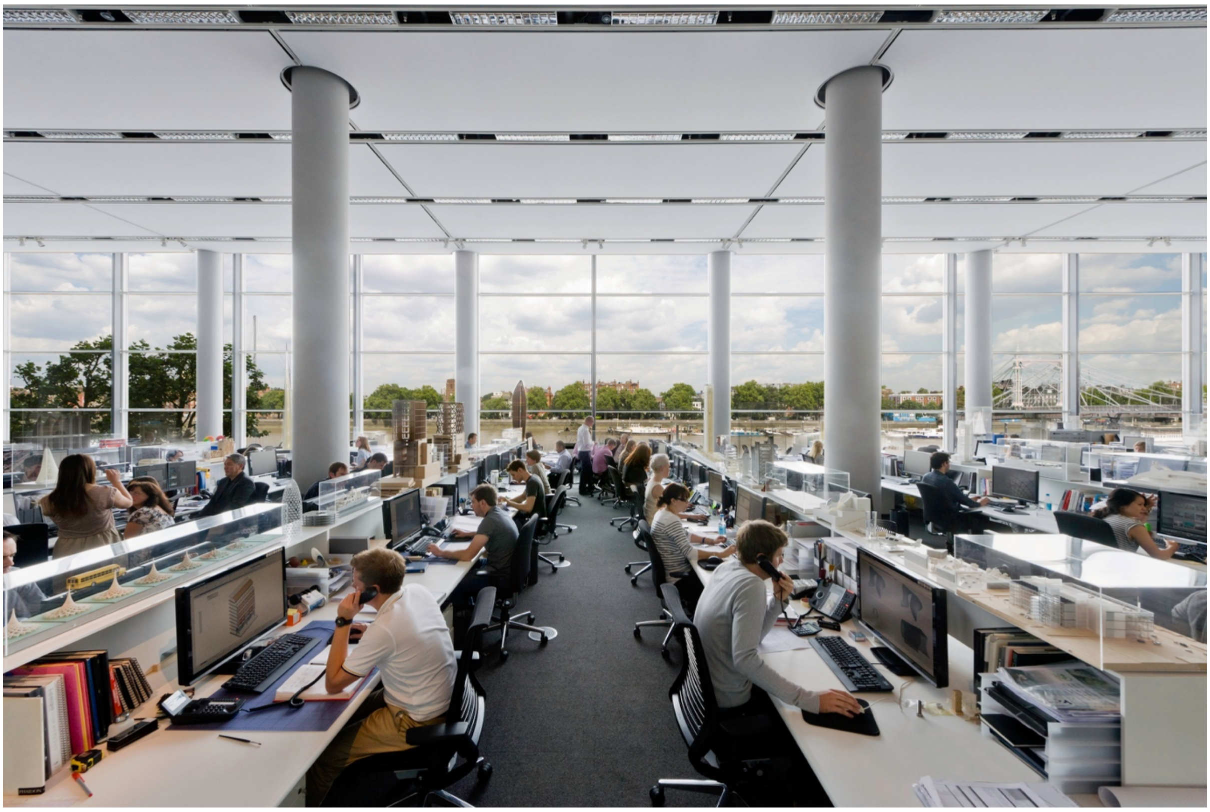
Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): Seats - Product Group Classification: UN CPC 3811. 2009:02, version 3, valid until: 2024-04-17. With reference to: BS EN 15804:2012+A2:2019 Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products.
PCR review was conducted by: Leo Breedveld, 2B Srl, breedveld@to-be.it
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Dr Hudai Kara, Metsims Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable.

Company information



OWNER OF THE EPD	Foster + Partners, London, Riverside, 22 Hester Road, London, SW11 4AN, United Kingdom, +44 20 7738 0455, london@fosterandpartners.com
NAME AND LOCATION OF PRODUCTION SITE	Mattiazzi srl, Via Sotto Rive, 19/2, 33048 San Giovanni Al Natisone UD, Italy
PRODUCT-RELATED OR MANAGEMENT SYSTEM-RELATED CERTIFICATIONS	Mattiazzi srl, has a certified quality management system achieving ISO 9001 and has a certified environmental management system achieving 14001 certificates

DESCRIPTION OF THE ORGANISATION:
Foster + Partners is a global studio for sustainable architecture, engineering, urbanism and industrial design, founded by Norman Foster in 1967. Since then, he, and the team around him, have established an international practice with a worldwide reputation. With offices across the globe, we work as a single studio that is both ethnically and culturally diverse. The Foster + Partners Industrial Design team frequently works as an integral part of the overall studio, designing specific building elements, but also developing products at a commercial and domestic scale in collaboration with industry partners. The practice's integrated approach to design is underpinned by sustainability and a desire to help regenerate the natural world.

Product information

PRODUCT NAME	Leva Chair
PRODUCT IDENTIFICATION	Ergonomically-designed timber chair with curved back support and arm rests. Available in plain wood, wool or leather upholstery options.
UN CPC CODE	38112 Seats, primarily with wooden frames.
GEOGRAPHICAL SCOPE	Global.

PRODUCT DESCRIPTION
Leva is the first timber chair designed by Foster + Partners. Manufactured by Mattiazzi, it combines craftsmanship with sophisticated machinery to create a comfortable and ergonomically designed chair. Capitalising on the tactility of timber, the gentle ergonomically-designed curve on the seat creates a comfortable cushion that encourages you to sit back and relax. The design draws on the imagery of an oar, the steam-bent arms – made of a single piece of machined timber – are slightly inclined, widening in the middle to form the backrest for support. Its seemingly simple shape is the result of complex surfacing that optimises the chair for mass production, while allowing for a carefully crafted finish.

The sparing use of material is rooted in the idea of sustainability – to do more with less. Made of ash sustainably sourced from Eastern Europe, the chair is designed to reduce the amount of waste generated during its manufacture. Any timber discarded during the machining process is used to fuel the heating system at the factory, supplementing the photovoltaic panels on the factory roof.

The Leva Chair has won several awards for its ecologically sensitive design.

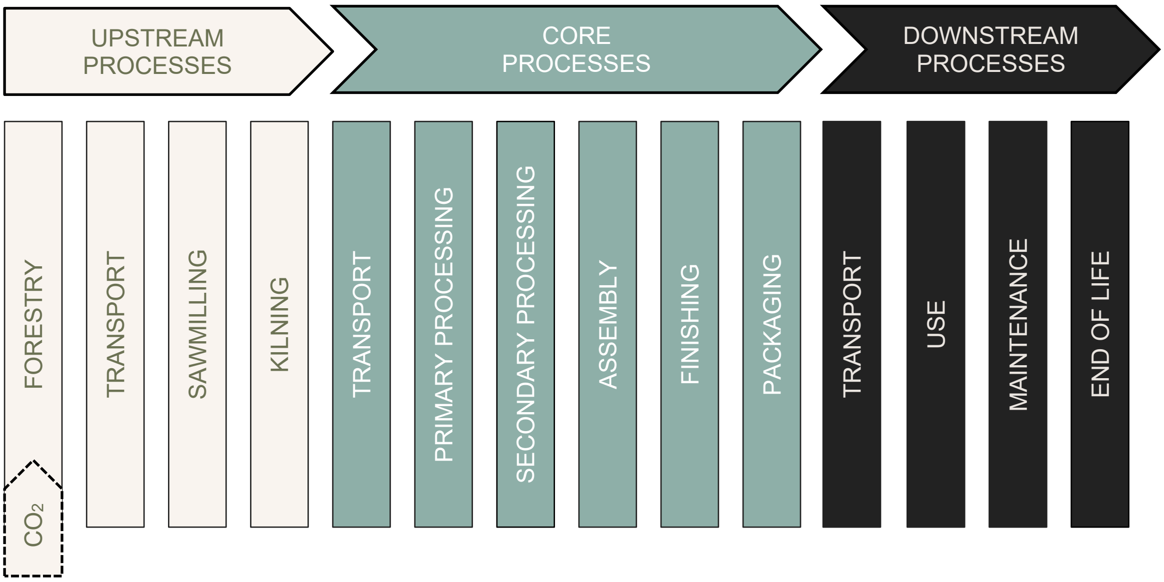
LCA information

FUNCTIONAL UNIT / DECLARED UNIT	The declared unit is the production of one chair
REFERENCE SERVICE LIFE	The expected life of these chairs is 100 years. A minimum 15 years lifetime has been assumed for these calculations as per the PCR
SCOPE	Global
SYSTEM BOUNDARIES	Cradle to Grave
TIME REPRESENTATIVENESS	Data Provided for year 2019
EXCLUDED LIFECYCLE STAGES	None
LCA PRACTITIONER	Renuables Dr. Andrew Norton, Renuables Ltd www.renuables.co.uk

SCOPE

This cradle-to-grave EPD is applicable globally. For the representation of results, and reflecting the different sources of data used, the life cycle of products is divided into three different stages:

- Upstream processes (from cradle-to-gate)
- Core processes (from gate-to gate)
- Downstream processes (from gate-to-grave)



DESCRIPTION OF PROCESS

- Sawn and kiln-dried timber arrives at the site and is held in stock until required.
- Primary processing
    - The timber is cross-cut into lengths.
- Secondary Processing
    - Steam bending.
    - Chair legs are machined into blanks and turned.
    - Chair seats are cut to size and profiled on a CNC machine, if they are to be upholstered these are sent to a nearby factory to be upholstered in leather or wool.
- Assembly
    - The finished chair seats are then assembled with the legs and back.
- Finishing
    - The finished pieces are oiled or stained by hand.
- Packaging
    - The product is then packaged ready for shipping.

SCENARIOS AND ASSUMPTIONS

End of Life: The default production lifetime of 15 years as specified in the PCR is applied. However, as our products are of high quality and made to last at least 100 years and all the constituent components can be recycled, it is most likely that the products will be still be in use or recycled. The End of Life assumption is that 100% of the chairs will be recycled/reused after 15 years.

Waste Management: All timber offcuts are used to provide heat onsite or at neighbouring facilities. Although renewable energy certification may be provided, it has not been assumed to replace fossil fuels and so no benefits are calculated.

Transport: For this EPD, we have assumed that delivery is from the manufacture plant in Italy to London with a distance of 1681km (with 45 km as cross channel ferry).

Content declaration

PRODUCT CONTENT

Product Variation	Chair Weight kg	Wood kg	Stain kg	PU Foam kg	Wool Cloth kg	Leather kg
wooden seat unstained	6.60	6.60				
wooden seat stained	6.60	6.60	0.05			
upholstered in wool Steelcut Trio 3 unstained	6.49	5.50		0.98	0.02	
upholstered in wool Steelcut Trio 3 stained	6.49	5.50	0.03	0.98	0.02	
upholstered in wool Basel unstained	6.50	5.50		0.98	0.02	
upholstered in wool Basel stained	6.50	5.50	0.03	0.98	0.02	
upholstered in leather Pure unstained	6.71	5.50		0.98		0.24
upholstered in leather Pure stained	6.71	5.50	0.03	0.98		0.24
upholstered in leather Shade unstained	6.80	5.50		0.98		0.32
upholstered in leather Shade stained	6.80	5.50	0.03	0.98		0.32

SPECIFIC MIXTURES USED (TOTAL QUANTITIES LESS THAN 0.1% BY CHAIR WEIGHT)

Glue - Aqueous, modified adhesive based on polyvinyl acetate (CAS: 9003-20-7) containing: butyl glycollate Conc. <5% (CAS: 7397-62-8)
Stain - Water based wood stain containing: Propan-2-OL Conc. 1-4% (CAS: 67-63-0), Ethanediol Conc. 0.5-1% (CAS: 107-98-3), 1-Methoxy-2-Propanol Conc. 0.2-0.4% (CAS: 107-98-2)
Acrylic topcoat – Solvent based transparent matt acrylic topcoat containing: Ethylbenzene Conc. 2.5-10% (CAS: 100-41-4), Xylene Conc. 25-50% (CAS:1330-20-7), Ethyl Acetate Conc. 10-25% (CAS: 141-78-6), n-Butyl Acetate Conc. 25-50% (CAS: 123-88-4) and Polyethylene Conc. 2.5-10% (CAS:9002-88-4)

SUBSTANCES OF HIGH CONCERN.

No substance included in the Candidate List of Substances of Very High Concern for authorisation under the REACH Regulations is present in the furniture.

BIOGENIC CARBON CONTENT

As per EN 15804 A2 the quantities of stored biogenic carbon in the constituent components of the chair and packaging is presented here:

	Biogenic carbon content in (kgC)			
Variations	Wood	Upholstery	Total in Product	Packaging
Wooden seat	3.04	0.00	3.04	0.97
Upholstered in wool Steelcut Trio 3	2.53	0.02	2.55	0.97
Upholstered in wool Basel	2.53	0.04	2.57	0.97
Upholstered in leather Pure	2.53	0.10	2.63	0.97
Upholstered in leather Shade	2.53	0.14	2.67	0.97
NOTE: 1 kg biogenic carbon is equivalent to 44/12 (or 3.667) kg of CO_2 removed from the atmosphere*				

**Further details of this benefit and how specific calculations of temporary carbon storage benefits can be made are provided in the "Additional Information" section of the EPD under the heading "Note on carbon sequestration in timber and biogenic materials".*

PACKAGING

Distribution packaging: Packaging for distribution requires 2.2kg of cardboard box, 0.2kg of polystyrene foam and 0.2kg of polyethylene bagging

SOURCES OF MATERIALS

- FSC certified ash is sourced from neighbouring countries, 80% from Croatia and 20% from Switzerland.
- For furniture items with upholstery, leather is supplied by Sorensen Leather in Denmark and wool cloth is sourced from Kvadrat, also in Denmark.
- The Sorensen leathers used, “Shade” and “PURE” both reach the following technical specifications: PCP: According to EU Council Directive 76/769/EEC, AZO dyes: According to EU Council Directive 76/769/EEC, Chrome VI: The leather does not contain chrome VI REACH: According to European Community Regulation on chemicals and their safe use (EC 1907/2006)
- The Sorensen Leather “PURE” has also been awarded the ECARF Seal of Quality and also meets the high standards of IVN Natural Leather.
- The Kvadrat wools “Basel” and “Steelcut Trio 3” both comply with EU ecolabel "The Flower" scheme.
- The upholstered pieces are upholstered in a neighbouring factory in North-West Italy.
- Electricity is supplied by a mix of own solar panels and grid electricity.
- Heating is supplied by wood offcuts as biomass heating in winter when required.

Environmental performance

DATA SOURCES

- This EPD is based upon an underlying LCA of the Mattiazzi manufacturing facility, with operational data obtained for the year 2019.
- Ecoinvent 3.4 (2019) data was accessed with Simapro 9.0.0.30 (2019) software for the background data.
- All relevant inputs and outputs have been considered in the LCA.
- An electricity grid mix based upon the Italian grid mix was used.
- Lower heating value was used for energy content of wood. This data was obtained from the Phyllis 2 database.
- Cut-off criteria were based upon input flows being less than 1% of the total individually, subject to the sum of all flows being less than 5% of the total, and subject to verification that the impacts associated with such flows were not of a magnitude to affect the reported data significantly (less than 5% in total).

POTENTIAL ENVIRONMENTAL IMPACT

This EPD contains environmental information about the specified products, in the form of quantitative indicator values for a number of parameters, which encompass calculated environmental impact potentials, resource and energy use, and waste generation.

CHARACTERIZATION FACTORS

All impact categories for the International EPD System Seating PCR are displayed as per the EPD template (2020) or as updated on the Environdec website noted below, using methodologies stated in the PCR CML baseline for the GWP, AP, EP, POCP, ADP elements, ADP-fossil resources, AWARE for water scarcity potential, USEtox for human toxicity and ecotoxicity, ReCiPe for land use. Lower heating value was used for primary energy resources renewable/non-renewable used as raw materials, this data was obtained from the Phyllis 2 database for natural materials or from material suppliers own testing.

Title	Unit	Methodology
Acidification (fate not incl.)	kg SO2 eq	AP, CML 2001 non-baseline (fate not included), Version: January 2016.
Eutrophication	kg PO4--- eq	EP, CML 2001 baseline (fate not included), Version: January 2016.
Photochemical oxidant formation	kg NMVOC	POFP, LOTOS-EUROS as applied in ReCiPe 2008
Water use	m3	AWARE Method: WULCA Recommendations on characterization model for WSF 2015, 2017.

Additional core and additional impacts categories from the construction product PCR are also displayed as per EN15804 A2 using recommended methodologies:

Title	Unit
Acidification terrestrial and freshwater	mol H+ eq
Eutrophication freshwater	kg P eq
Eutrophication marine	kg N eq
Eutrophication terrestrial	mol N eq
Respiratory inorganics	disease inc.
Ionising radiation, HH	kBq U-235 eq
Ecotoxicity freshwater	CTUe
Human toxicity, cancer	cases
Human toxicity, non-cancer	cases
Land use	species.yr

DISCLAIMERS

Due to the harmonisation with the proposed EC Product Environmental Footprint (PEF) initiative some of the newer indicators used in the construction product EPD standard EN15804:A2 carry the following disclaimers:

- Ionising radiation, HH

"*This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator*"

- Abiotic depletion (elements)
- Abiotic depletion (fossil fuels)
- Water use (scarcity)
- Ecotoxicity freshwater
- Human toxicity, cancer
- Human toxicity, non-cancer
- Land use

"*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator*".

NOTE REGARDING RESULTS PRESENTED

Wood staining was found to contribute less than 0.6% to any impact category result for any of the upholstery combinations, as such all products presented are as a "worst case" stained variation. Both variations of the leather and wool upholstery options are presented as they notably affect the environmental impact of the product.

Un-Upholstered

Environmental Impacts					
Impact category	Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
GWP - fossil	kg CO2 eq	3.66E+00	9.88E+00	9.98E-01	1.45E+01
GWP - biogenic	kg CO2 eq	-3.67E+01	2.49E+01	3.66E-04	-1.19E+01
GWP - land use and transform.	kg CO2 eq	3.99E-02	2.40E-02	2.86E-04	6.42E-02
Global Warming Potential TOTAL	**kg CO2 eq**	**-3.30E+01**	**3.48E+01**	**9.99E-01**	**2.73E+00**
Ozone layer depletion (ODP)	kg CFC-11 eq	4.31E-07	1.16E-06	2.00E-07	1.79E-06
Acidification (fate not incl.)	kg SO2 eq	2.36E-02	5.07E-02	4.63E-03	7.90E-02
Eutrophication	kg PO4--- eq	6.82E-03	1.79E-02	6.19E-04	2.53E-02
Photochemical oxidant formation	kg NMVOC	3.47E-02	3.25E-02	3.14E-03	7.03E-02
Abiotic depletion (elements)	kg Sb eq	8.10E-06	2.44E-05	1.81E-06	3.43E-05
Abiotic depletion (fossil fuels)	MJ	5.04E+01	1.36E+02	1.64E+01	2.03E+02
Water use	m3	8.04E-01	7.27E+00	1.25E-01	8.19E+00
Use of Resources					
PER - Renewable - as energy Carrier	MJ	5.49E+02	2.98E+02	1.86E-01	8.47E+02
PER - Renewable - as raw materials	MJ	3.61E+02	-2.43E+02	0.00E+00	1.18E+02
PER - Renewable - TOTAL	MJ	9.10E+02	5.56E+01	1.86E-01	9.65E+02
PER - Non-Renewable - as energy Carrier	MJ	5.82E+01	1.71E+02	1.77E+01	2.47E+02
PER - Non-Renewable - as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PER - Non-Renewable - TOTAL	MJ	5.82E+01	1.71E+02	1.77E+01	2.47E+02
Secondary Material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Waste Production and Output Flows					
Hazardous waste	kg	1.02E-04	4.96E-04	9.30E-06	6.07E-04
Bulk waste	kg	1.26E+00	1.31E+00	3.96E+00	6.54E+00
Radioactive waste	kg	4.02E-02	2.45E-02	3.99E-04	6.51E-02
Output Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	6.60E+00	6.60E+00
Materials for energy recovery	kg	0.00E+00	1.36E+01	0.00E+00	1.36E+01
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	2.43E+02	0.00E+00	2.43E+02
Additional Indicators As per EN 15804					
Acidification terrestrial and freshwater	mol H+ eq	2.68E-02	6.45E-02	3.40E-03	9.47E-02
Eutrophication freshwater	kg P eq	1.05E-03	3.66E-03	8.72E-05	4.80E-03
Eutrophication marine	kg N eq	8.78E-03	1.18E-02	7.53E-04	2.13E-02
Eutrophication terrestrial	mol N eq	9.51E-02	1.59E-01	8.23E-03	2.63E-01
Respiratory inorganics	disease inc.	1.11E-06	5.08E-07	8.91E-08	1.71E-06
Ionising radiation, HH	kBq U-235 eq	3.72E-01	1.41E+00	8.30E-02	1.86E+00
Ecotoxicity freshwater	CTUe	4.54E+00	7.10E+00	3.38E+00	1.50E+01
Human toxicity, cancer	cases	2.08E-07	4.65E-07	3.69E-08	7.10E-07
Human toxicity, non-cancer	cases	1.03E-06	1.87E-06	4.36E-07	3.34E-06
Land use	species.yr	2.13E-07	1.19E-08	7.33E-10	2.25E-07

Upholstered in Wool

Kvadrat "Basel"

Environmental Impacts					
Impact category	Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
GWP - fossil	kg CO2 eq	8.67E+00	9.85E+00	9.83E-01	1.95E+01
GWP - biogenic	kg CO2 eq	-2.70E+01	1.79E+01	3.61E-04	-9.03E+00
GWP - land use and transform.	kg CO2 eq	1.96E-01	2.40E-02	2.82E-04	2.20E-01
Global Warming Potential TOTAL	**kg CO2 eq**	**-1.81E+01**	**2.78E+01**	**9.84E-01**	**1.07E+01**
Ozone layer depletion (ODP)	kg CFC-11 eq	3.77E-07	1.16E-06	1.97E-07	1.73E-06
Acidification (fate not incl.)	kg SO2 eq	5.94E-02	5.07E-02	4.59E-03	1.15E-01
Eutrophication	kg PO4--- eq	1.66E-02	1.79E-02	6.10E-04	3.51E-02
Photochemical oxidant formation	kg NMVOC	4.40E-02	3.24E-02	3.10E-03	7.95E-02
Abiotic depletion (elements)	kg Sb eq	1.29E-05	2.43E-05	1.79E-06	3.90E-05
Abiotic depletion (fossil fuels)	MJ	1.22E+02	1.35E+02	1.61E+01	2.73E+02
Water use	m3	5.86E+00	7.26E+00	1.23E-01	1.33E+01
Use of Resources					
PER - Renewable - as energy Carrier	MJ	4.23E+02	2.30E+02	1.83E-01	6.54E+02
PER - Renewable - as raw materials	MJ	2.73E+02	-1.75E+02	0.00E+00	9.83E+01
PER - Renewable - TOTAL	MJ	6.96E+02	5.56E+01	1.83E-01	7.52E+02
PER - Non-Renewable - as energy Carrier	MJ	1.49E+02	1.71E+02	1.74E+01	3.37E+02
PER - Non-Renewable - as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PER - Non-Renewable - TOTAL	MJ	1.49E+02	1.71E+02	1.74E+01	3.37E+02
Secondary Material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Waste Production and Output Flows					
Hazardous waste	kg	8.59E-05	4.95E-04	9.17E-06	5.90E-04
Bulk waste	kg	1.21E+00	1.38E+00	3.94E+00	6.53E+00
Radioactive waste	kg	1.96E-01	2.45E-02	3.93E-04	2.21E-01
Output Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	6.50E+00	6.50E+00
Materials for energy recovery	kg	0.00E+00	9.77E+00	0.00E+00	9.77E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	1.75E+02	0.00E+00	1.75E+02
Additional Indicators As per EN 15804					
Acidification terrestrial and freshwater	mol H+ eq	7.82E-02	6.45E-02	3.35E-03	1.46E-01
Eutrophication freshwater	kg P eq	1.72E-03	3.66E-03	8.59E-05	5.47E-03
Eutrophication marine	kg N eq	1.85E-02	1.18E-02	7.42E-04	3.10E-02
Eutrophication terrestrial	mol N eq	2.57E-01	1.59E-01	8.11E-03	4.25E-01
Respiratory inorganics	disease inc.	1.56E-06	5.05E-07	8.78E-08	2.16E-06
Ionising radiation, HH	kBq U-235 eq	3.49E-01	1.41E+00	8.17E-02	1.84E+00
Ecotoxicity freshwater	CTUe	8.35E+00	7.01E+00	3.33E+00	1.87E+01
Human toxicity, cancer	cases	3.94E-07	4.65E-07	3.65E-08	8.95E-07
Human toxicity, non-cancer	cases	1.21E-06	1.88E-06	4.34E-07	3.52E-06
Land use	species.yr	1.76E-07	1.19E-08	7.23E-10	1.88E-07

Upholstered in Wool

Kvadrat “Steelcut Trio 3”

Environmental Impacts					
Impact category	Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
GWP - fossil	kg CO2 eq	8.53E+00	9.85E+00	9.82E-01	1.94E+01
GWP - biogenic	kg CO2 eq	-2.72E+01	1.79E+01	3.61E-04	-9.30E+00
GWP - land use and transform.	kg CO2 eq	1.40E-01	2.40E-02	2.82E-04	1.64E-01
Global Warming Potential TOTAL	**kg CO2 eq**	**-1.86E+01**	**2.78E+01**	**9.83E-01**	**1.02E+01**
Ozone layer depletion (ODP)	kg CFC-11 eq	3.72E-07	1.16E-06	1.97E-07	1.73E-06
Acidification (fate not incl.)	kg SO2 eq	5.27E-02	5.07E-02	4.59E-03	1.08E-01
Eutrophication	kg PO4--- eq	1.43E-02	1.79E-02	6.10E-04	3.28E-02
Photochemical oxidant formation	kg NMVOC	4.36E-02	3.24E-02	3.09E-03	7.90E-02
Abiotic depletion (elements)	kg Sb eq	1.26E-05	2.43E-05	1.79E-06	3.87E-05
Abiotic depletion (fossil fuels)	MJ	1.21E+02	1.35E+02	1.61E+01	2.73E+02
Water use	m3	5.57E+00	7.26E+00	1.23E-01	1.30E+01
Use of Resources					
PER - Renewable - as energy Carrier	MJ	4.22E+02	2.30E+02	1.83E-01	6.52E+02
PER - Renewable - as raw materials	MJ	2.73E+02	-1.75E+02	0.00E+00	9.83E+01
PER - Renewable - TOTAL	MJ	6.95E+02	5.56E+01	1.83E-01	7.51E+02
PER - Non-Renewable - as energy Carrier	MJ	1.48E+02	1.71E+02	1.74E+01	3.36E+02
PER - Non-Renewable - as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PER - Non-Renewable - TOTAL	MJ	1.48E+02	1.71E+02	1.74E+01	3.36E+02
Secondary Material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Waste Production and Output Flows					
Hazardous waste	kg	8.51E-05	4.95E-04	9.16E-06	5.90E-04
Bulk waste	kg	1.18E+00	1.37E+00	3.94E+00	6.50E+00
Radioactive waste	kg	1.40E-01	2.45E-02	3.93E-04	1.65E-01
Output Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	6.49E+00	6.49E+00
Materials for energy recovery	kg	0.00E+00	9.77E+00	0.00E+00	9.77E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	1.75E+02	0.00E+00	1.75E+02
Additional Indicators As per EN 15804					
Acidification terrestrial and freshwater	mol H+ eq	6.75E-02	6.45E-02	3.35E-03	1.35E-01
Eutrophication freshwater	kg P eq	1.61E-03	3.66E-03	8.58E-05	5.35E-03
Eutrophication marine	kg N eq	1.67E-02	1.18E-02	7.42E-04	2.92E-02
Eutrophication terrestrial	mol N eq	2.11E-01	1.59E-01	8.10E-03	3.78E-01
Respiratory inorganics	disease inc.	1.49E-06	5.05E-07	8.77E-08	2.08E-06
Ionising radiation, HH	kBq U-235 eq	3.44E-01	1.41E+00	8.16E-02	1.83E+00
Ecotoxicity freshwater	CTUe	7.95E+00	7.00E+00	3.32E+00	1.83E+01
Human toxicity, cancer	cases	3.90E-07	4.64E-07	3.65E-08	8.91E-07
Human toxicity, non-cancer	cases	1.20E-06	1.88E-06	4.34E-07	3.51E-06
Land use	species.yr	1.71E-07	1.19E-08	7.22E-10	1.83E-07

Upholstered in Leather

Sorensen “Shade”

Environmental Impacts					
Impact category	Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
GWP - fossil	kg CO2 eq	1.67E+01	9.89E+00	1.03E+00	2.77E+01
GWP - biogenic	kg CO2 eq	-2.79E+01	1.79E+01	3.74E-04	-9.93E+00
GWP - land use and transform.	kg CO2 eq	7.78E-02	2.40E-02	2.94E-04	1.02E-01
Global Warming Potential TOTAL	**kg CO2 eq**	**-1.11E+01**	**2.78E+01**	**1.03E+00**	**1.78E+01**
Ozone layer depletion (ODP)	kg CFC-11 eq	7.44E-06	1.17E-06	2.06E-07	8.81E-06
Acidification (fate not incl.)	kg SO2 eq	9.08E-02	5.08E-02	4.71E-03	1.46E-01
Eutrophication	kg PO4--- eq	3.05E-02	1.79E-02	6.36E-04	4.91E-02
Photochemical oxidant formation	kg NMVOC	7.39E-02	3.25E-02	3.23E-03	1.10E-01
Abiotic depletion (elements)	kg Sb eq	4.48E-04	2.44E-05	1.87E-06	4.74E-04
Abiotic depletion (fossil fuels)	MJ	2.29E+02	1.36E+02	1.68E+01	3.82E+02
Water use	m3	1.17E+03	7.27E+00	1.27E-01	1.18E+03
Use of Resources					
PER - Renewable - as energy Carrier	MJ	4.47E+02	2.30E+02	1.91E-01	6.77E+02
PER - Renewable - as raw materials	MJ	2.73E+02	-1.75E+02	0.00E+00	9.83E+01
PER - Renewable - TOTAL	MJ	7.20E+02	5.56E+01	1.91E-01	7.76E+02
PER - Non-Renewable - as energy Carrier	MJ	3.05E+02	1.71E+02	1.82E+01	4.95E+02
PER - Non-Renewable - as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PER - Non-Renewable - TOTAL	MJ	3.05E+02	1.71E+02	1.82E+01	4.95E+02
Secondary Material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Waste Production and Output Flows					
Hazardous waste	kg	1.30E-03	4.96E-04	9.56E-06	1.81E-03
Bulk waste	kg	1.72E+00	1.46E+00	4.00E+00	7.18E+00
Radioactive waste	kg	7.85E-02	2.45E-02	4.11E-04	1.03E-01
Output Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	6.80E+00	6.80E+00
Materials for energy recovery	kg	0.00E+00	9.77E+00	0.00E+00	9.77E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	1.75E+02	0.00E+00	1.75E+02
Additional Indicators As per EN 15804					
Acidification terrestrial and freshwater	mol H+ eq	1.12E-01	6.46E-02	3.50E-03	1.80E-01
Eutrophication freshwater	kg P eq	5.11E-03	3.66E-03	8.95E-05	8.86E-03
Eutrophication marine	kg N eq	2.72E-02	1.18E-02	7.73E-04	3.98E-02
Eutrophication terrestrial	mol N eq	2.94E-01	1.60E-01	8.45E-03	4.62E-01
Respiratory inorganics	disease inc.	1.94E-06	5.09E-07	9.17E-08	2.54E-06
Ionising radiation, HH	kBq U-235 eq	3.78E+00	1.41E+00	8.53E-02	5.27E+00
Ecotoxicity freshwater	CTUe	2.88E+01	7.15E+00	3.48E+00	3.94E+01
Human toxicity, cancer	cases	1.73E-06	4.66E-07	3.76E-08	2.24E-06
Human toxicity, non-cancer	cases	4.51E-06	1.89E-06	4.41E-07	6.84E-06
Land use	species.yr	1.83E-07	1.19E-08	7.53E-10	1.95E-07

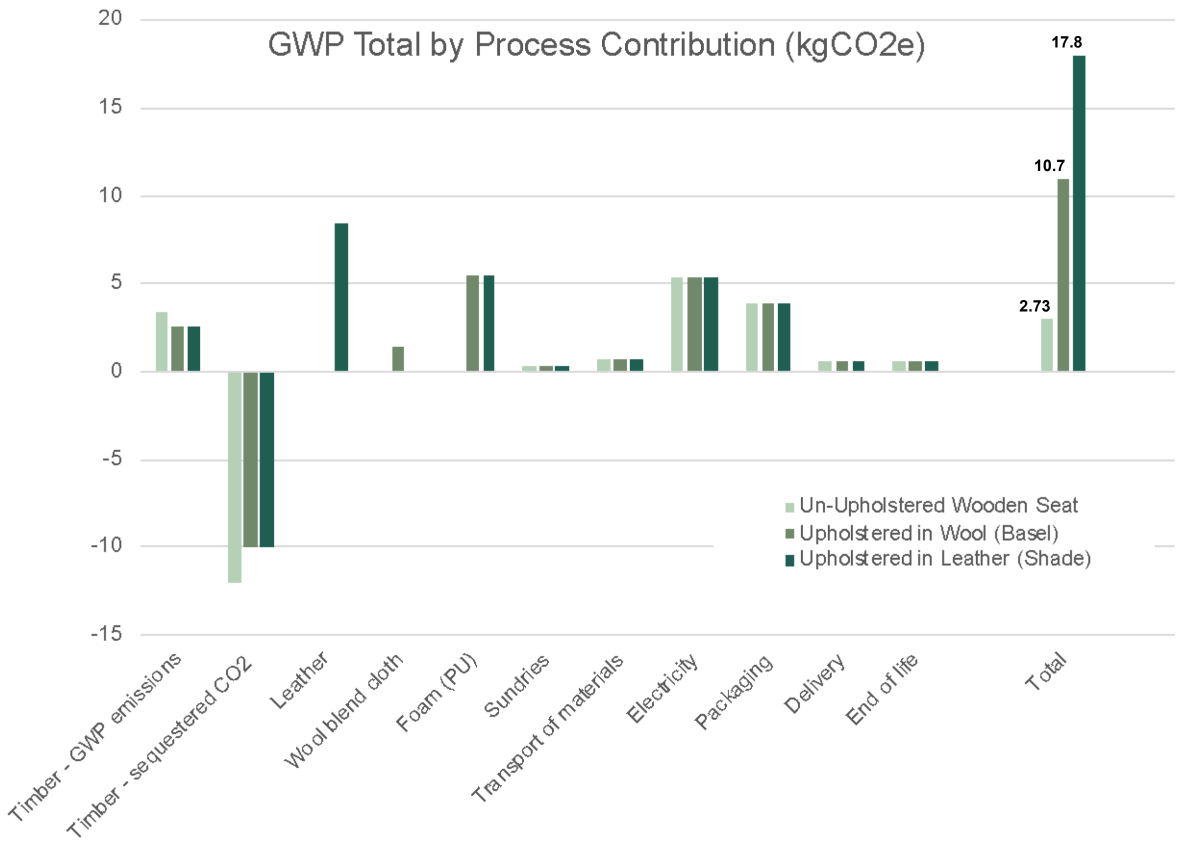
Upholstered in Leather

Sorensen “Pure”

Environmental Impacts					
Impact category	Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
GWP - fossil	kg CO2 eq	1.45E+01	9.88E+00	1.01E+00	2.54E+01
GWP - biogenic	kg CO2 eq	-2.78E+01	1.79E+01	3.70E-04	-9.91E+00
GWP - land use and transform.	kg CO2 eq	6.52E-02	2.40E-02	2.91E-04	8.95E-02
Global Warming Potential TOTAL	**kg CO2 eq**	**-1.33E+01**	**2.78E+01**	**1.02E+00**	**1.56E+01**
Ozone layer depletion (ODP)	kg CFC-11 eq	5.55E-06	1.16E-06	2.03E-07	6.92E-06
Acidification (fate not incl.)	kg SO2 eq	7.71E-02	5.08E-02	4.68E-03	1.33E-01
Eutrophication	kg PO4--- eq	2.50E-02	1.79E-02	6.28E-04	4.36E-02
Photochemical oxidant formation	kg NMVOC	6.55E-02	3.25E-02	3.19E-03	1.01E-01
Abiotic depletion (elements)	kg Sb eq	3.32E-04	2.44E-05	1.84E-06	3.58E-04
Abiotic depletion (fossil fuels)	MJ	2.00E+02	1.36E+02	1.66E+01	3.53E+02
Water use	m3	8.63E+02	7.27E+00	1.26E-01	8.70E+02
Use of Resources					
PER - Renewable - as energy Carrier	MJ	4.39E+02	2.30E+02	1.89E-01	6.70E+02
PER - Renewable - as raw materials	MJ	2.73E+02	-1.75E+02	0.00E+00	9.83E+01
PER - Renewable - TOTAL	MJ	7.12E+02	5.56E+01	1.89E-01	7.68E+02
PER - Non-Renewable - as energy Carrier	MJ	2.63E+02	1.71E+02	1.80E+01	4.52E+02
PER - Non-Renewable - as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PER - Non-Renewable - TOTAL	MJ	2.63E+02	1.71E+02	1.80E+01	4.52E+02
Secondary Material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-Renewable secondary fuels	MJ net cv	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Waste Production and Output Flows					
Hazardous waste	kg	9.78E-04	4.96E-04	9.45E-06	1.48E-03
Bulk waste	kg	1.56E+00	1.44E+00	3.98E+00	6.98E+00
Radioactive waste	kg	6.58E-02	2.45E-02	4.06E-04	9.07E-02
Output Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	6.71E+00	6.71E+00
Materials for energy recovery	kg	0.00E+00	9.77E+00	0.00E+00	9.77E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	1.75E+02	0.00E+00	1.75E+02
Additional Indicators As per EN 15804					
Acidification terrestrial and freshwater	mol H+ eq	9.46E-02	6.46E-02	3.46E-03	1.63E-01
Eutrophication freshwater	kg P eq	4.12E-03	3.66E-03	8.85E-05	7.87E-03
Eutrophication marine	kg N eq	2.35E-02	1.18E-02	7.64E-04	3.61E-02
Eutrophication terrestrial	mol N eq	2.47E-01	1.59E-01	8.35E-03	4.15E-01
Respiratory inorganics	disease inc.	1.78E-06	5.08E-07	9.06E-08	2.38E-06
Ionising radiation, HH	kBq U-235 eq	2.86E+00	1.41E+00	8.43E-02	4.35E+00
Ecotoxicity freshwater	CTUe	2.30E+01	7.11E+00	3.43E+00	3.36E+01
Human toxicity, cancer	cases	1.37E-06	4.65E-07	3.73E-08	1.88E-06
Human toxicity, non-cancer	cases	3.62E-06	1.89E-06	4.39E-07	5.95E-06
Land use	species.yr	1.77E-07	1.19E-08	7.45E-10	1.90E-07

Additional information

STAGES IMPACTS



With regards to upholstery, the weight of the wool and leather choices was found to make a difference in environmental impact. In terms of the two wool choices a difference of 2% in total GWP was shown highlighting the influence of the wool in the overall impact. Leather presents a larger influence with the heavier variation resulting in a 20% increase in impact, though any potential improvement in longevity was not considered in this LCA study due to the constraints of the PCR RSL of 15 years.

In all un-upholstered cases the GWP fossil is dominated by the electricity usage in the various neighbouring factories where solar energy or certified green energy is not used, followed by the impact of the timber and packaging. The quantity of carbon stored in the product very nearly outweighs the impact of any fossil emissions over the product life cycle and the product is shown to have more carbon stored than emitted prior to shipping.*

For the upholstered variations the GWP total is dominated by the impact of the leather or wool used followed by the PU foam, with leather contributing to a higher overall impact.

In most other impact categories (acidification, abiotic depletion, etc) electricity use dominates the impacts except for leather or wool in the upholstered versions. It is also worth noting that packaging has a relatively large contribution to all categories, only marginally less than the original quantity of wood utilised.

NOTE ON CARBON SEQUESTRATION IN TIMBER AND BIOGENIC MATERIALS

While carbon is stored in timber and in other natural materials, there is a corresponding reduction of atmospheric CO_2. This is a benefit towards mitigating climate change, as the reduced atmospheric CO_2 means less radiative forcing and thus a reduction in global warming. The longer the sequestered carbon is stored in the timber, leather and wool of this product, the greater the climate change mitigation benefit. Measuring the benefit of this temporary carbon storage is therefore dependent on the time the carbon is stored for.

The assumption here is that all the stored carbon is still accounted for at the end of the 15 years assessment. The stored carbon quantities presented in the “biogenic carbon content” section of this EPD can be used if an assessment of the product for a different time period, or without including the benefit of stored biogenic carbon, is required. PAS 2050 and the summary of other methods provided in Brandão *et al* (2013) provide further details of this temporary carbon storage benefit and associated assessment methods.

OUR APPROACH

Foster + Partners Responsibility Framework

The Foster + Partners Responsibility Framework consists of ten themes (Wellbeing, Community Impact, Energy and Carbon, Water, Resources, Mobility and Connectivity, Land and Ecology, Social Equity, Planning for Change and Feedback). The Framework ensures we maintain a responsible approach to creating and evaluating buildings, products and cities, as well as our own operations. The Framework is continuously improved and refined based on feedback received. Our aim is always to improve the efficiency of data acquisition and knowledge transfer.

Measuring Green Performance

In addition, to help us reduce carbon emissions on our projects to meet the demands of the UN Paris Agreement, we have now devised a methodology to quantify them. Our methodology quantifies the total carbon emissions produced by buildings and projects over a typical lifespan, including design and construction stages, fitout and future refurbishment. Our platform can also predict and monitor operational carbon emissions throughout the life of the building. This enables us to make judgements to reduce carbon emissions early in the design process. We are now ready to offer this methodology to all future clients so that their projects can comply with the Paris Agreement. This will be challenging but, with careful analysis and dialogue, we aim to achieve our goal of designing carbon neutral or climate restorative buildings (for more information, please see the Sustainability Manifesto at fosterandpartners.com).

Our CSER Programme

The concept of sustainability has been embedded in the work of Foster + Partners since its inception in 1967. Sustainable design is now a critical aspect of the services that we provide. Our expertise in this area demands that we actively seek to reduce and manage the impact of our own operations. We also recognise that through our work as designers, our projects have a direct impact on the communities that they serve and the wider environment.

We have partnered with the United States Green Building Council (USGBC) to roll out a new data collection and visualisation platform that captures the ongoing performance of buildings in real time. It allows buildings and spaces to compare performance metrics and connect those metrics to green building strategies. The platform also enables incremental improvements and can put a project on track for LEED® or another rating system certification. We can input data across five categories – Energy, Water, Waste, Transportation and Human Experience – which generates a performance score. This score enables us to monitor performance and better inform decisions by measuring improvements and benchmarking our buildings against similar projects, locally and globally.

Involvement with the United Nations

The Paris Agreement, ratified in 2016, creates a multi-dimensional framework for economies to implement carbon reduction policies. Recent Conferences of Parties (COPs) on climate change have marked a turning point, with improved participation in climate negotiations from nongovernment actors, including businesses. We continue to play a role in key global discussions around climate change and sustainability.

Our deepening engagement with the United Nations is demonstrated through our continuous commitment to understanding what the Paris Agreement means for the built environment and sharing this information within the practice and the wider public. We do this via CPD (Continual Professional Development) workshops that we hold for all our staff to attend, as well as research and participation in expert events such as the Living Future Conference. Foster + Partners is a contributor to the debate on climate change and champions progressive sustainability goals in the construction sector.

Stakeholder Engagement
We engage with external organisations, our staff and suppliers to identify the significant impacts of our company and how we can best meet the needs of each relevant stakeholder. Foster + Partners is a member of and actively collaborates with the following organisations:

- US Green Building Council (USGBC)
- Royal Institute of British Architects (RIBA)
- Chartered Institution of Building Services Engineers (CIBSE)
- Waste and Resource Action Programme (WRAP)
- Health and Safety Executive, Working Party Groups
- Centre for Window and Cladding Technologies
- TRADA
- British Standards Institute (BSI)
- New London Architecture (NLA)
- Confederation of British Industry (CBI)

References

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PCR 2009:02, Seats, version 3.0, valid until: 2024-04-17.

ISO 14040: 2006 Environmental management - Life cycle assessment – Principles and Framework

ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines

ISO 14025: 2005 Environmental labels and declarations -- Type III environmental declarations -- Principles and procedure

BS EN 15804:2012+A2:2019 Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products

PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

Brandão M, et al, 2013, Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting, J Life Cycle Assess (2013) 18:230–24