



40/4 Plastic Barstool

This Environmental Product Declaration (EPD) discloses potential environmental outcomes compliant with ISO 14025 for business to business communication.

The declared product 40/4 Plastic Barstool was made by HOWE in Denmark in 2016 for sale with a 10 year warranty for applications in commercial and residential.

HOWE is an innovative Danish company and pioneer in design and development of multifunctional and space-saving furniture solutions.

For over 80 years HOWE has worked closely with architects and other professional interior designers throughout the world.

They collaborate to create beautiful functional rooms where user comfort and well-being is an absolute focus.

For HOWE it is completely natural to function respectful of surroundings.

The company always strives to maintain equilibrium between people and environments.

Consequently this also reduces greenhouse gas emissions and natural resources.

HOWE's green thinking is not just concerned about protecting the global climate.

It is also how interior design and furnishing affect indoor working space and occupant well-being.

HOWE's operations are certified to ISO 14001 in Environmental and ISO 9001 in Quality Management.

The factory is wind powered to reduce greenhouse gas from product manufacture.

Low volatile organic emissions also enable an environmentally healthy indoor space.

More information is at <http://www.howe.com/>



Figure 1 40/4 Plastic Barstool

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Different program EPDs may not be comparable as e.g. Australian transport is more than elsewhere. **Further explanatory information is found at <http://www.globalgreentag.com/certification1@globalgreentag.com>** or contact: certification1@globalgreentag.com © This EPD remains the property of Global GreenTag Pty Ltd.

HOWE**40/4 Plastic Barstool****1. Details of This Declaration**

Program Operator	GreenTag Global Pty Ltd hereafter called Global GreenTag noted at www.globalgreentag.com
EPD Number	HOW-007-2017
Date issue	20 October 2017
Validity	20 October 2020
Reference PCR	Compliant with PCR: FU:2017 Furniture Products
Time	Made in and sold from 2016 for 20 years use
Geography	Made in Denmark. Uses are assumed as for Australasia.
Application	Commercial and residential building interiors
Functional unit	40/4 Plastic Barstool 20 year use cradle to fate

2. Product Characterisation

Definition	40/4 Plastic Barstool by HOWE used for seating in residential and commercial interiors
Standard	EN 15373:2007 Furniture – Strength, durability and safety – Requirements for non-domestic seating and with ANSI/BIFMA X5.1-2001 Chair test standard.

3. Green Star® Certified Credits

Products are relevant to the Green Building Council of Australia's (GBCA) Green Star® scheme. If required this EPD is evidence the declared product meets the following Green Star® credits. It may be used as evidence in Green Star® submissions for those credits.

The product is certified by GBCA recognised Global GreenTag GreenRate to meet the following credits of Green Star®:

- Design and As Built V1.2: Sustainable Product
- Interiors V1.2: Sustainable Products

GBCA Disclaimer

Green Star® is a registered mark of the Green Building Council of Australia (GBCA). Assessments shall not be reproduced in part at any time. Rating Tools and Technical Manuals are subject to change by the GBCA. This EPD provides Technical Opinion and as such is not endorsed by the GBCA or its agents. Green Star® Technical Manuals give technical details of credit requirements.



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4. Sustainability Assessment Scores

Table 1 lists Global GreenTag Sustainability Assessment Criteria (SAC) scores prior to weighting and then used to determine the GreenTag EcoPOINT¹.

Table 1 Normalised GreenTag EcoPOINT & SAC Scores

Category Potential	Results (-1 to +1)
Building Synergy	1.00
Health & Ecotoxicity	0.25
Biodiversity	0.58
LCA Score	0.17
Greenhouse Emission	0.40
Social Responsibility	0.40
GreenTag EcoPOINT	0.43

SAC scores are normalised against business as usual (BAU) product performing comparable functions under the same category rules.

Lower scores show better environmental and social benefits with fewer impacts and damages. Considering sustainability:

- worst case BAU results = 1.0,
- neutral = 0.0 and
- net positive benefit = -1.0

5. Type 1 Ecolabel

The declared product Type 1 Ecolabel achieved



Gold Streamlined GreenRate Level A



6. Verification of this Declaration

This EPD was approved on 20 10 2017 according to requirements of ISO14025 8.1.3b.

Role	Name	Position	Signature
PCR Review Chair	Murray Jones	Ecquate Pty Ltd CEO	<i>Murray Jones</i> 27-10-2017
LCI Developer	Delwyn Jones	The Evah Institute CEO	<i>Delwyn Jones</i> 27-10-2017
LCIA, LCA Rate & EPD Developer	Mathilde Vlieg	Global GreenTag Researcher	<i>Mathilde Vlieg</i> 31-10-2017
Internal LCA Audit	Shloka Ashar	Global GreenTag Lead Auditor LCI Verifier	<i>Shloka Ashar</i> 31/10/2017
Internal EPD Audit	David Baggs	Global GreenTag CEO & Program Director	<i>David Baggs</i>

¹ <http://www.ecospecifier.com.au/knowledge-green/glossary.aspx#greentagecopoint>



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7. Packaging, Installation, Use & Disposal

Packaging	Cardboard forms & cartons, plastic wrap & strapping on reused pallets.
Service life	Residential and commercial refits vary but 20 year life is assumed typical.
Health Safety & Environment	Apart from compliance to occupational and workplace health safety and environmental laws no additional personal protection is considered essential.
Residual Scrap	No residual scrap is modelled.
Cleaning & Maintenance	The recommended cleaning and maintenance raises no ecosystem or human health concerns. Care and maintenance guides are on company websites.
Scenario	No cleaning modelled.
Recycling	Rejected parts 0.001% sent back to supplier for recycling.
Re-use	This study assumes 60% product is serviceable for reuse over 40 more years.
Disposal	It assumes 30% is recycled. Incineration is rare in Australia so none is modelled.

8. Whole of life Performance

Health Protection	The product does not contain levels of carcinogenic, toxic or hazardous substances that warrant ecological or human health concern cradle to grave. It passed the Ecospecifier Cautionary Assessment Process (ESCAP) and no issues or red light concerns existed for product human or ecological toxicity.
Effluent Waste	The LCI results and ESCAP raised no red light concerns in emissions to water ² . Cradle to grave waste to landfill was non-hazardous.
Environmental Protection	Continuous improvement under the maker’s certified ISO14001 EMS aims to avoid toxics, waste and pollution plus reduce their material and energy use.
Environmental Health Effects	Installed products are certified as having VOC’s compliant with Green Star® IEQ VOC credits for indoor environment ³ quality credits. No other potential in-use impacts on environment or health are known.

9. Base Material Origin and Detail

Table 2 lists key components by function, type, key operation, source and mass share.

Table 2 Base Material

Function	Component	Production	Origin	Amount %
Frame	Galvanised Steel	Mine, smelt, refine, roll, pickle, coat, form	Europe	>50<75
Seat	Nylon 6	Drill, refine, polymerise, blend, form	Europe	>20 <35
Coating	Polymer powder	Mine, digest, drill, refine, polymerise	Europe	>3.0<7.0
Dyes	Color	Mine, digest, refine, polymerise, blend	Europe	>3.0<7.0
Glides	Polycarbonate	Drill, refine, polymerise, blend, form	China	>0.2 <0.5
Pigments	Titania White	Mine, acid digest, refine, coat, blend	China	<0.1

² According with national standards in ANZECC Guideline For Fresh & Marine Water Quality (2000)

³ in accordance with national standards and practice



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10. Life Cycle Inventory Results

Table 3 lists resource use per functional unit, with transport as defined in Figure 2, across four phases:

- cradle to gate including supply, manufacture and upstream;
- design and construction from delivery to site and installation;
- use and operation including maintenance, repair, replacement refurbishment and
- end-of-life from deconstruction, reuse, demolition, recycling and disposal.

Table 3 Inventory of Flows/ Functional Unit (Linear Metre)

Total Input use of	Unit	Result
Embodied Water	kl	1657
Fuel + Feedstock	MJ	636

11. Life Cycle Impact Results

Table 4 shows Life Cycle Assessment (LCA) Eco-Indicator 99 results for 20 years of product use.

Table 4 Potential Impact Results

Evaluation Category	Unit	Result
Product mass	kg/item	10
EcoIndicator 99	ecopoint	1.83
Carbon Dioxide Equivalent Emissions ⁴	kg CO _{2e}	38.5
Ecosystem Quality Damages	PDF*m ² *yr	2.0E-04
Human Health Damages	DALY	2.0E-03
Ozone Depletion	kg R11 _e	1.9E-09
Acidification	kg SO _{2e}	0.74
Fossil Fuel Depletion	MJ _{surplus}	28.2
Mineral Resource	MJ _{surplus}	5.24

12. Life Cycle Benefit Potential

Manufacturers' details confirm that for each declared unit the product has:

- 12% secondary fuel & energy use that saves fuel resources and avoids climate change;

Design for deconstruction avoids issues and offers OH&S benefits at demolition as:

- end-of-life recycling and reuse avoids wasted resources, climate change and landfill;
- recycling benefits supply avoiding health and traffic issues in disposal and landfill;

⁴ Stocker et al (eds.) Climate Change 2013: The Physical Science Basis, CH8, IPCC AR5, Cambridge U Press, UK.



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14. Supply Chain Modelling

Processes to acquire, refine, transport, fabricate, coat, use, clean, repair, reuse and dispose of metal, masonry, ceramic, timber, glass, plastic and composites are modelled. These include those of:

- Mining, extracting and refining resources to make commodities and packaging;
- Acquiring, cultivating, harvesting, extracting, refining produce and biomass;
- Fuel production to supply power and process energy and freight;
- Chemicals use in processing resources, intermediates and ancillaries;
- Process energy, fuel and freight of resources, intermediates and ancillaries;
- Use, cleaning, recoating, repair, recycling, re-use and landfill, as well as
- Infrastructure process energy transformed and material wear loss e.g. tyres.

A flow chart in Figure 2 shows key product supply chain operations from cradle to fate.

While all known operations are included not all are shown.

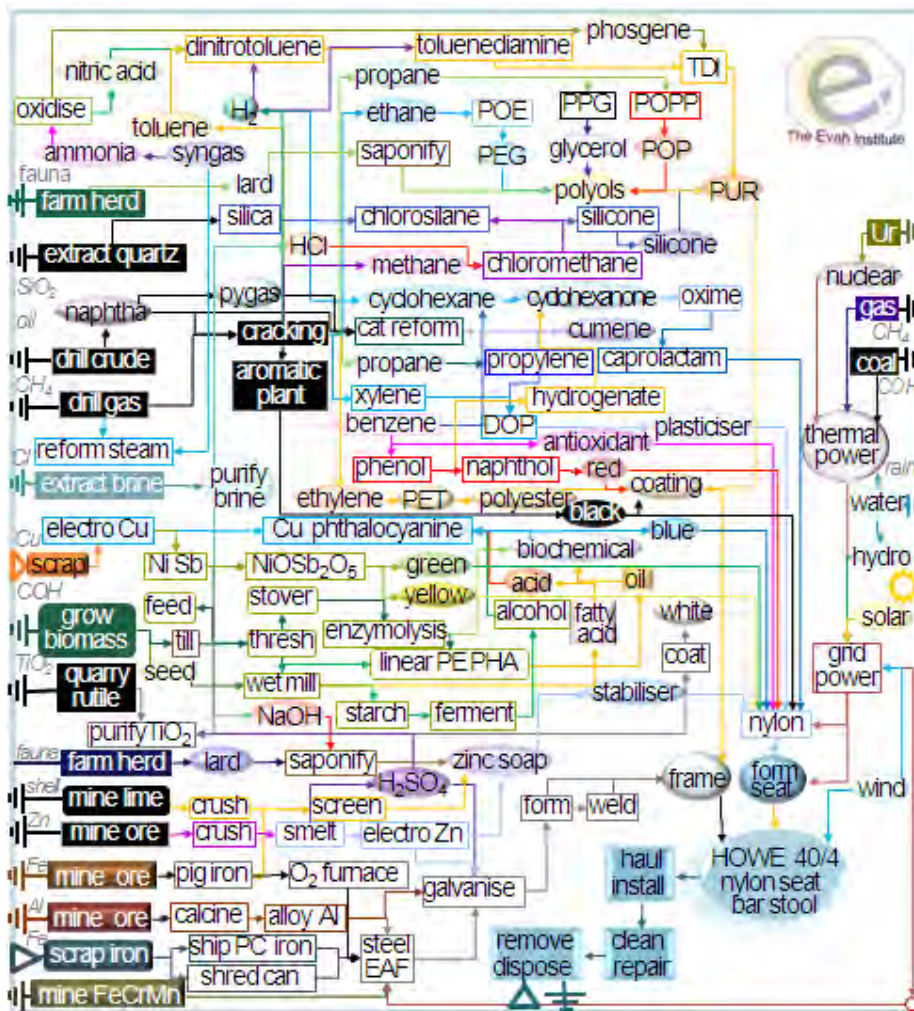


Figure 2 Major Product Operations



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15. Life Cycle Assessment Method

LCA Author The Evah Institute as described at www.evah.com.au

Study Period Factory data was collected from 2012 to 2014

LCA Method Compliant with ISO 14040 and ISO 14044 Standards

LCIA method EcoIndicator 99 Life Cycle Impact (LCIA) Assessment

Scope Cradle to Fate including all supply chain phases and stages depicted in Figure 2.

Phases The LCA covered all known flows in all known stages cradle to end of life fate.

Assumptions Use is to typical Australian Facility Management professional practice.

Scenarios Use, cleaning, maintenance plus disposal and re-use were scenario-based using Facility Management Association denoted and published typical operations.

System Boundaries The LCA covers all operations in the system boundary depicted in Figure 3.

Processes All known processes are included from resource acquisition, water, fuel & energy use, power generation & distribution, freight, refining, intermediates, manufacture, scrap re-use, packing and dispatch, installation, use, maintenance and landfill. All significant waste and emission flows from all supply chain operations involved to make, pack and install the product are included.



Stages	Product			Construction		Use Stage Related to Building							End-of-Life				Benefits & loads beyond system boundary								
	A1	A2	A3	A4	A5	Fabric				Operation			C1	C2	C3	C4	D								
Modules	Raw material supply			Transport		Manufacturing		Transport		Construction		Use	Maintenance	Repair	Replacement	Refurbishment	Operating Energy use	Operating Water use	Demolition	Transport	Waste Processing	Disposal	Reuse potential	Recovery potential	Recycling Potential
Unit Operations	Mandatory for every phase			Mandatory		Mandatory for each and every phase							Mandatory each				Mandatory each								
Cradle to Grave	Mandatory for every phase			Optional		Optional for each and every phase							Optional each				Optional each								
Cradle to Gate+options	Mandatory for every phase			Optional		Optional for each and every phase							Optional each				Optional each								
Cradle to Gate	Mandatory for every phase			Optional		Optional for each and every phase							Optional each				Optional each								
Modelling	Actual										Scenarios														

Figure 3 Phases and Stages Cradle to Grave

Evah industry databases cover all known domestic and global scope 1 and 2 operations. They exclude scope 3 burdens from capital facilities, equipment churn, noise and dehydration as well as incidental activities and employee commuting. The databases exist in top zones of commercial global modelling and calculating engines. Quality control methods are applied to ensure:

- Coverage of place in time with all information⁵ for each dataset noted, checked and updated;
- Consistency to Evah guidelines⁶ for all process technology, transport and energy demand;
- Completeness of modelling based on in-house reports, literature and industry reviews;
- Plausibility in 2 way checks of LCI input and output flows of data checked for validity, plus
- Mathematical correctness of all calculations in mass and energy balance cross checks.

Electricity supply models in active databases are updated annually. As each project is modelled and new data is available the databases are updated and audited by external Type 1 ecolabel certifiers.

⁵ Jones D G (2004) LCI Database for Commercial Building Report 2001-006-B-15 Icon.net, Australia

⁶ Evah Tools, Databases and Methodology Queensland, Australia at <http://www.evah.com.au/tools.html>



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16. Data Sources Representativeness and Quality

Primary data used for modelling the state of art of each operation includes all known process for:

- Technology sequences;
- Energy and water use;
- Landfill and effluent plus
- Reliance on raw and recycled material;
- High and reduced process emissions;
- Freight and distribution systems.

Primary data is sourced from clients, Annual Reports and their publications on corporate locations, logistics, technology use, market share, management systems, standards and commitment to improved environmental performance. Information on operations is also sourced from client:

- Supply chain mills, their technical manuals, corporate annual reports and sector experts, and
- Manufacturing specifications websites and factory site development license applications.

Background data is sourced from the International Energy Agency, IBISWorld, USGS Minerals, Franklin Associates, Boustead 6, Plastics Europe, CML2, Simapro 8, Ecolnvent 3 and NREL USLCI model databases. Information on operations is also sourced from:

- Library, document, NPI and web searches, review papers, building manuals and
- Global Industry Association and Government reports on Best Available Technology (BAT).

For benchmarking, comparison and integrity checks inventory data is developed to represent BAT, business as usual and worst practice options with operations covering industry sector supply and infrastructure in Australia and overseas.

Such technology, performance and license conditions were modelled and evaluated across mining, farming, forestry, freight, infrastructure and manufacturing and building industry sectors since 1995.

As most sources do not provide estimates of accuracy, a pedigree matrix of uncertainty estimates to 95% confidence levels of Geometric Standard Deviation² (σ_g) is used to define quality as in Table 6⁷.

Table 6 Data Quality Uncertainty (U) for 2017

Metric σ_g	U ±0.01	U ±0.05	U ±0.10	U ±0.20	U ±0.30
Temporal	Post 2015	Post 2010	Post 2005	Post 2000	Pre 2000
Duration	>3yr	3yr	2yr	1yr	<1yr
Data Source	Process	Line	Plant	Corporate	Sector
Technology	Actual	Comparable	Within Class	Conventional	Within Sector
Reliability on	Site Audit	Expert verify	Region Report	Sector Report	Academic
Precision to	Process	Line	Plant	Company	Industry
Geography	Process	Line	Plant	Nation	Continent
True of the	Process	Mill	Company	Group	Industry
Sites cover of	>50%	>25%	>10%	>5%	<5%
Sample size	>66% trend	>25% trend	>10% batch	>5% batch	Academic
Cut-off mass	0.01%	0.05%	0.1%	0.5%	1%
Consistent to	±0.01	<±0.05	<±0.10	<±0.20	<±0.30
Reproducible	>98%	>95%	>90%	>80%	<70%
Certainty	Very High	High	Typical	Poor	>±0.30

No data set with >±30% uncertainty is used without notation in the LCA as well as the EPD.

⁷ Evah Institute data quality control system accords with UNEP SETAC Global LCI Database Quality 2010 Guidelines



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17. Supply Chain Modelling Assumptions

Australian building sector rules and Evah assumptions applied are defined in Table 7.

Table 7 Scope Boundaries Assumptions and Metadata 2017

Quality/Domain	National including Import and Export
Process Model	Typical industry practice with currently most common or best (BAT) technology
Resource flows	Regional data for resource mapping, fuels, energy, electricity and logistics
Temporal	Project data was collated from 2015 to 2017
Geography	Designated client, site, regional, national, Pacific Rim then European jurisdiction
Representation	Designated client, their suppliers and energy supply chains back to the cradle
Consistency	Model all operations by known given operations with closest proximity
Technology	Pacific Rim Industry Supply Chain Technology typical of 2014 to 2016
Functional Unit	Typical product usage with cleaning & disposal/m ² over the set year service life
System Control	
Primary Sources	Clients and suppliers mills, publications, websites, specifications & manuals
Other Sources	IEA 2017, GGT 2017, Boustead 2013, Simapro 2016, IBIS 2017, EcolInvent 2016
Data mix	Power grid and renewable shares updated to latest IEA 2017 reports
Operational	Company data for process performance, product share, waste and emissions
Logistics	Local data is used for power, fuel mix, water supply, logistics share & capacity
New Data Entry	VliegLCA, Evah Institute 2016; Global Green Tag Researchers 2017
Data Generator	Manufacturers, Evah Institute 2017; GGT 2017; Meta: IBIS 2017, Other pre 2017
Data Publisher	The Evah Institute Pty Ltd to Global GreenTag and designated client only
Persons input	All contributors cited in Evah & Global GreenTag records or websites
Data Flow & Mix	
System Boundary	Earth's cradle of all resource & emission flows to end of use, fitout or build life
System flows	All known from and to air, land, water and community sources & sinks
Capital inclusions	Natural stocks Δ , industry stockpiles Δ , capital wear Δ , system losses and use
Arid Practice	Dry technology adopted, Water use is factored by 0.1 as for e.g. Mining
Transportation	Distance >20% than EU; >20% fuel efficient larger vehicles, load & distance
Industrial	Company or industry sector data for manufacturing and minerals involved
Mining	All raw material extraction is based on Australian or Pacific Rim technology
Imported fuel	Mix is from nearest sources is e.g. UAE, SE Asia, Canada or New Zealand
Finishes	Processing inputs with finishing burdens are factored in. If not that is denoted
Validation	
Accuracy	10 th generation study is ± 5 to 15% uncertain due to some background data
Completeness	All significant operations are tracked and documented from the cradle to grave
Precision	Tracking of >90% flows applies a 90:10 rule sequentially to 99.9% and beyond
Allocation	%100 to co products on reaction stoichiometry by energetic or mass fraction
Burdens	All resource use from & emissions to community air land, water are included
Plausibility	Results are checked and benchmarked against BAT, BAU & worst practice
Sensitivity	Calculated U is reported & compared to libraries of Bath U RICE & EcolInvent 3.2
Validity Checks	Are made versus Plastics Europe, Ecobilan, GaBi & or Industry LCA Literature



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18. Bibliography

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- ISO 14001:2004 Environmental management systems: Requirements with guidance for use
- ISO 14004:2004 EMS: General guidelines on principles, systems & support techniques
- ISO 14015:2001 EMS: Environmental assessment of sites & organizations (EASO)
- ISO 14020:2000 Environmental labels & declarations — General principles
- ISO 14024:2009 Environmental labels & declarations -- Type I Principles & procedures
- ISO 14025:2006 Environmental labelling & declarations Type III EPDs Principles & procedures
- ISO 14031:1999 EM: Environmental performance evaluation: Guidelines
- ISO 14040:2006 EM: Life cycle assessment (LCA): Principles & framework
- ISO 14044:2006 EM: LCA: Requirement & guideline for data review: LCI; LCIA, Interpretation results
- ISO 14064:2006 EM: Greenhouse Gases: Organisation & Project reporting, Validation & verification
- ISO 15392:2008 Sustainability in building construction General principles
- ISO 15686-1:2011 Buildings & constructed assets Service life planning Part 1: General principles
- ISO 15686-2:2012 Buildings & constructed assets Service life (SL) planning Part 2: prediction
- ISO 15686-8:2008 Buildings & constructed assets SL planning Part 8: Reference & estimation
- ISO 21929-1:2011 Sustainability in building construction Sustainability indicators Part 1: Framework
- ISO 21930:2007 Building construction: Sustainability, Environmental declaration of building products
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19. Reviewers Report Conclusions

The independent LCA reviewer's report by Shloka Ashar confirmed that the LCA project report and addition information addressed the EPD. The verifier was not involved in developing the LCA or EPD and has no conflict of interests from their organisational position. While the report is confidential its conclusions confirmed that documentation according to ISO Standard requirements (in brackets) was provided including evidence from the:

The Evah Institute, the LCA developer:

- a) Recipes of input and output data of unit processes used for LCA calculations ✓
- b) Datasheets of measures, calculations, estimates and emails with sources as in Table 6 ✓
- e) References to literature and databases from which data was extracted as noted in Table 6 ✓
- g) Notes on supply chain processes and scenarios satisfying requirements of this Standard ✓
- i) Embodied Energy shares as used for sensitivity analyses re ISO 14044:2006, 4.5.3.3 ✓
- j) Proof percentages or figures in calculations in the end of life scenario ✓
- k) Notes on proof of % and allocation calculations ✓
- o) All operations covered Vs criteria and substantiation used to determine system boundaries ✓

Product Manufacturer in:

- c) Specifications used to create the manufacturer's product ✓
- d) Citations, references, specifications or regulations & data showing completeness ✓
- f) Specification demonstrating that the building product can fulfil the intended use ✓

The Certifier Global GreenTag on:

- l) Notes and calculation of averages of different locations yielding generic data ✓
- m) Substantiating additional environmental information ISO 14025:2006, 7.2.4 ✓
- n) Procedures for data collection, questionnaires, instructions, confidentiality deeds ✓

Requiring No Evidence:

As the EPD is cradle to grave as well as PCR compliant the independent reviewer did not need to:

- h) Substantiate a few stages as all stages were substantiated ✓
- p) Substantiate alternatives when no other choices and assumptions were applied ✓
- q) Demonstrate consistency for few stages as the same rules in Tables 5 and 6 applied to all. ✓

HOWE

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Further and explanatory information is found at

<http://www.globalgreentag.com/>

or contact:

certification1@globalgreentag.com



Global GreenTagCert™ EPD Program

Environmental Product Declaration

Compliant to ISO 14025

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