HOWE

SixE Armchair

Figure 1 HOWE SixE Armchair

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

For over 80 years they have 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 resource use.

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

It is also how interior design and furnishings 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/.

This Environmental Product Declaration (EPD) discloses potential environmental outcomes compliant with ISO 14025 for business to business communication. The declared unit is the SixE Armchair with mono shell in polypropylene, polymer coated galvanised steel frame chair made by HOWE in Denmark in 2014 and sold under a 10 year warranty for interior use.

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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/ or contact: certification1@globalgreentag.com

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1. DETAILS OF THIS DECLARATION

Program Operator	GreenTag Global Pty Ltd, hereafter called Global GreenTag noted at www.globalgreentag.com	**EPD Number**	HOW-003-C-2013
		Date of issue	June 26th 2015
		Validity	June 26th 2018
Reference PCR	Compliant with PCR: GGT Furniture for Interior Applications 2014		
Time	Made in 2013, sold 2014 to 2016 for 20 years use		
Geography	Made in Denmark imported for use in Australasia		
Application	Indoor residential, commercial, educational and ecclesiastical seating		
Functional unit	Acquisition, manufacture, use and disposition/chair		
Ecolabel Global GreenTag[CertTM]	LCARate Silver Streamlined GreenRate Level A		

2. PRODUCT CHARACTERISATION

Definition	HOWE SixE Armchair
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. BASE MATERIAL ORIGIN AND DETAIL

Table 1 lists key components by function, type, key operation, source and mass share.

Table 1 Base Material (%w/w)

Function	Component	Production	Origin	Amount
Frame	Galvanised	mine, smelt, refine, roll, pickle, coat form	Europe	<45
Arm rest	Galvanised	mine, smelt, refine, roll, form, weld, coat	Europe	
Fixings	Galvanised	mine, smelt, refine, roll, form, pickle, coat	Europe	
Coating	Polyurethane	drill, refine, polymerise, blend, uv-cure	Europe	>4.0<5.0
Seat & Arm	Polypropylene	drill, refine, polymerise, blend, form	Europe	>50 <55
Plastic Shell	Polypropylene	drill, refine, polymerise, blend, form	Europe	
Stacking DUP	Polypropylene	drill, refine, polymerise, blend, form	Europe	
Stack Rubber	TPE	drill, refine, polymerise, blend, form	Europe	>0.1 <0.3
Glides	Polycarbonate	drill, refine, polymerise, blend, form	Europe	>0.1 <0.3

4. 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	Mill off-cuts are not reused. Fabrication scrap of 5% is assumed to recycling.
Cleaning & Maintenance	The recommended cleaning and maintenance raises no ecosystem or human health concerns. Care and maintenance guides are on company websites.
Scenario	Weekly hand wash with light detergent with cloth wiping is assumed.
Recycling	Home mill, fabrication and installation scrap is not reworked into new product.
Re-use	Product in good condition (60%) is reused twice in subsequent 40 years.
Disposal	60% product is assumed reused, 20% is recycled and 20% landfilled.

5. 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	The LCI results and ESCAP raised no red light concerns in emissions to water[1].
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[2] quality credits. No other potential in-use impacts on environment or health are known.

6. 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®:

- Office Interiors V[3]1.1 IEQ-11 Volatile Organic Compounds: Tenancy Fitout Items, IEQ-12: Formaldehyde Minimisation, Mat-4 Chairs
- Education V1: IEQ-8 Volatile Organic Compounds Tenancy Fitout Item, Mat-13 Loose Furniture
- Healthcare V1: Mat-13: Loose Furniture
- Interiors V1: Sustainable Products, Indoor Pollutants
- Public Building V1: Mat-13: Furniture
- Design and As Built V1: Sustainable Products, Indoor Pollutants

GBCA Disclaimer

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1 according with national standards in ANZECC Guideline For Fresh & Marine Water Quality (2000)
2 in accordance with national standards and practice
3 where V =Version

7. RESULTS

Table 2 shows the product Life Cycle Assessment (LCA) Eco-Indicator 99 results for 20 years of use.

Table 2 Potential Impact Results

Evaluation Category	Unit	Result
Product mass	kg/item	6.14
EcoIndicator 99	ecopoint	1.37
Embodied Water	kl	296.06
Carbon Dioxide Emissions	kg CO_{2e}[4]	16.64
Gross Energy and Feedstock	MJ	24.43
Ecosystem Quality Damages	PDF*m^2*yr	1.88E-04
Human Health Damages	DALY	1.28E-03
Ozone Depletion	kg $R11_e$	1.98E-09
Fossil Fuel Depletion	$MJ_{surplus}$	24.43
Mineral Resource	$MJ_{surplus}$	2.01

Table 3 lists product Global GreenTag Sustainability Assessment Criteria (SAC) scores prior to weighting and then used to determine the GreenTag EcoPOINT[5]. Lower scores show greater environmental and social outcome benefits with fewer impacts and damages for sustainability. SAC scores are normalised against products that perform the same function and results with:

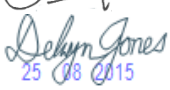
- 1.0 = worst base business as usual (BAU)
- 0.0 = neutral no improvement and
- -1.0= net positive benefit

Table 3 Normalised GreenTag EcoPOINT & SAC Scores

Category Potential	Results (-1 to +1)
Building Synergy	1.00
Health & Ecotoxicity	0.25
Biodiversity	0.61
LCA Score	0.47
Greenhouse Emission	0.75
Social Responsibility	0.40
GreenTag EcoPOINT	0.55

8. VERIFICATION OF THIS DECLARATION

This EPD was approved on August 25th 2015 according to requirements of ISO14025 8.1.3b.

Role	Signature	Name	Position
LCA Review		Shloka Ashar	Global GreenTag Lead Auditor
PCR Review Chair		Delwyn Jones	Evah Institute CEO & Assessment Director
Internal EPD Review		David Baggs	Global GreenTag CEO & Program Director

[4] where e= equivalent
[5] http://www.ecospecifier.com.au/knowledge-green/glossary.aspx#greentagecopoint

9. LIFE CYCLE ASSESSMENT METHOD

LCA Author	The Evah Institute as described at www.evah.com.au
Study Period	Factory data was collected from 2010 to 2012
Communication	Business to business
Scope	Cradle to grave
LCA Method	Compliant with ISO 14040 and ISO 14044 Standards
LCIA method	EcoIndicator 99 Life Cycle Impact (LCIA) Assessment
System Boundaries	The LCA covers all operations in the system boundary depicted in Figure 2. It includes water, waste and emissions for all intermediates used to make and pack product as well as after sale delivery. Some background operations are not shown but all known operations were tracked to the cradle and included.
Phases	The study covered all known stages and phases including resource acquisition, fuel use, power generation, manufacture, packing, freight, installation, use and disposal.
Processes	All known water, fuel & energy use, resource acquisition, power generation, manufacture, transport, installation and landfill processes are included. All waste and emissions for all intermediates used to make product depicted and supply chain operations shown in Figure 3 are included.
Scenarios	Use, cleaning, maintenance plus disposition and re-use were scenario-based using Facility Management Association denoted and published typical operations.
Assumptions	Use is to typical Australian Facility Management Practice.

10. LCA SYSTEM PHASES

All cradle to grave phases and stages that the LCA covered are depicted in Figure 2.

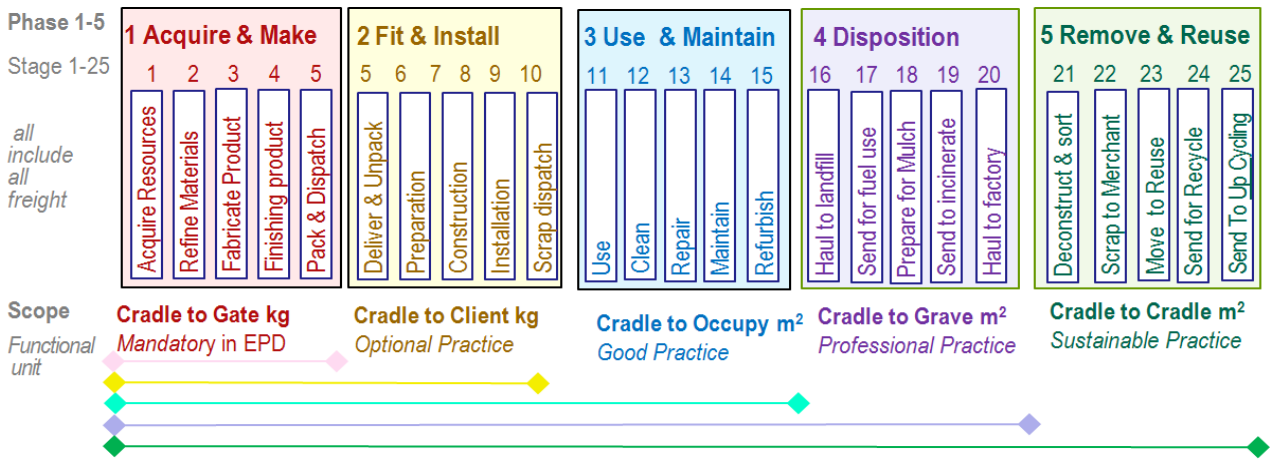


Figure 2 Phases and Stages Cradle to Grave

11. SUPPLY CHAIN MODELLING

Industry supply chain databases cover all known domestic and global scope 1 and 2 operations. 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.

They exclude scope 3 burdens from:

- Building capital facilities, churn updates and equipment; Noise and dehydration as well as
- Incidental activities and travel of employees engaged on-site in production facilities.

A flow chart in Figure 3 shows key product supply chain operations from cradle to disposition.

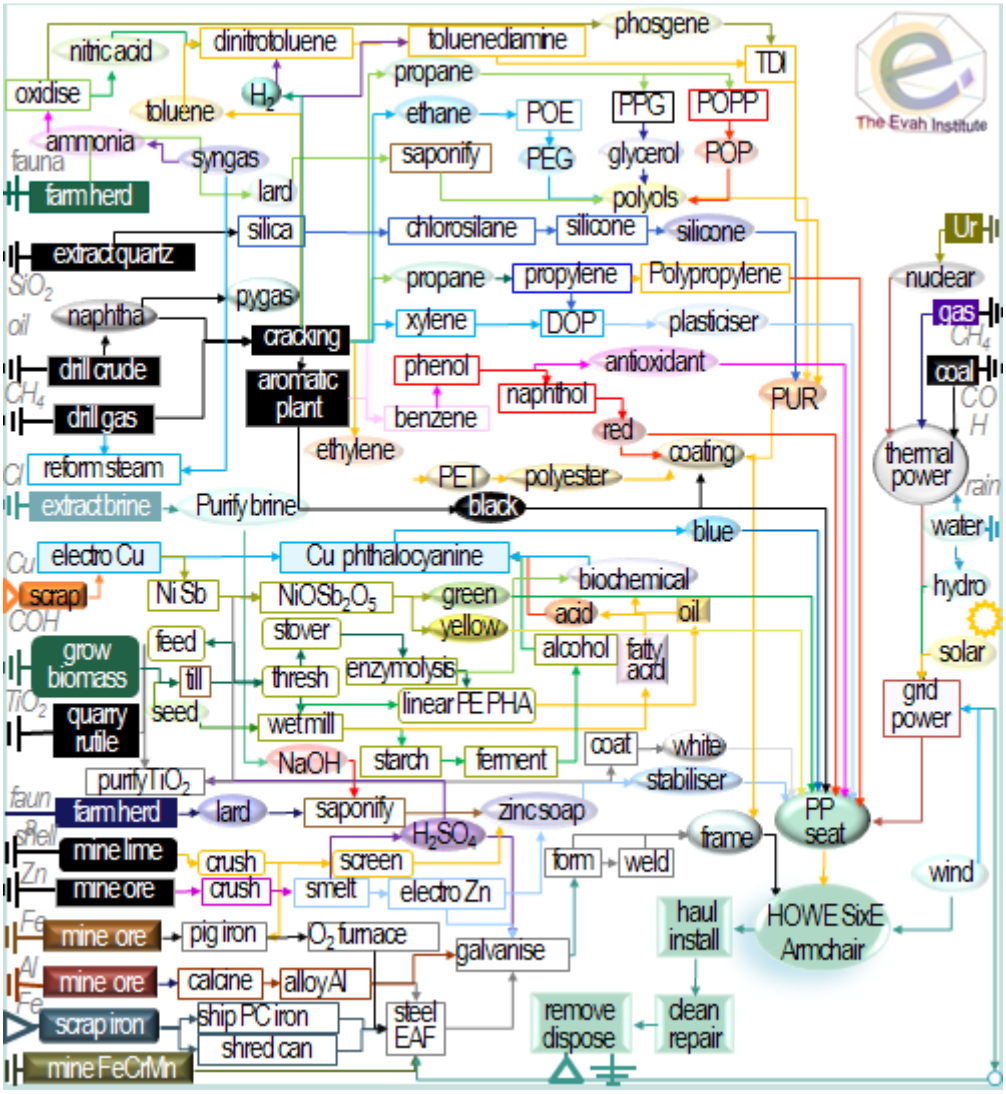


Figure 3 Major Product Operations

12. DATA SOURCES REPRESENTATIVENESS AND QUALITY

Metadata on corporate locations, logistics and technology used is documented along with market share, management systems, standards and commitment to improved environmental performance. The data employed for modelling the state of art of each operation includes all known:

- 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 has been sourced from clients, their Annual Reports and research papers since 1995. Background data is sourced from the International Energy Agency, IBISWorld, USGS Minerals, Franklin Associates, Boustead 6, Plastics Europe, CML2, Simapro 8, EcoInvent 3 and NREL USLCI model databases. Information about manufacturers' operations is also sourced from:

- Supply chain mills, their technical manuals, corporate annual reports and sector experts;
- Manufacturers development license applications, specifications, websites;
- Library, document, NPI and web searches, review papers, building manuals and
- Global Industry Association and Government reports on Best Available Technology (BAT).

As most sources do not provide estimates of accuracy a pedigree matrix of uncertainty estimates to 95% confidence levels of Geometric Standard Deviation[2] (σ_g) is used to define quality as in Table 4[6]. Data sets with uncertainties in any of these qualities greater than >±30% are not used.

Table 4 Data Quality Uncertainty (U) for 2014

Metric σ_g	U ±0.01	U ±0.05	U ±0.10	U ±0.20	U ±0.30
Temporal	Post 2013	Post 2009	Post 2005	Post 2000	Pre 1999
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% confidence	>95%	>90%	>80%	<70%
Certainty	Very High	High	Typical	Poor	Unused >±0.30

The Evah 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 information[7] for each dataset noted, checked and updated;
- Consistency to Evah guidelines[8] 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 the active databases are updated annually. As each project is modelled the systems and databases are updated and audited by external certifiers

[6] Evah Institute data quality control system accords with UNEP SETAC Global LCI Database Quality 2010 Guidelines
[7] Jones D G (2004) LCI Database for Australian Commercial Building Report 2001-006-B-15 Icon.net, Australia
[8] Evah Tools, Databases and Methodology Queensland, Australia at http://www.evah.com.au/tools.html

13. ASSUMPTIONS FOR SUPPLY CHAIN MODELLING

Industry sector inventory data is also developed to represent business as usual as well as BAT practices with operations covering industry supply chains and infrastructure in Australia and overseas. Environmental performance is evaluated across sectors by mining, farming, fishery, forestry, freight, infrastructure, manufacture and other process technology type plus their license conditions.

Australian building sector rules and Evah assumptions applied are defined in Table 5.

Table 5 Scope Boundaries Assumptions and Metadata

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 2011 to 2014
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 2012 to 2015
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 2014, GGT 2014, Boustead 2013, Simapro 2014, IBIS 2013, EcoInvent 2014,
Data mix	Power grid and renewable shares updated to latest IEA 2014 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	Evah Institute 2014; Global Green Tag Researchers 2014;IBIS 2014
Data Generator	Manufacturers, Evah Institute 2014; GGT 2014; Meta: IBIS 2012, Other pre 2014
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 stocksΔ, industry stockpilesΔ, 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 e.g. North Sea, UAE, SE Asia, Canada or Russia
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 & EcoInvent 3
Validity Checks	Are made versus Plastics Europe, Ecobilan, GaBi & or Industry LCA Literature

14. REFERENCES FOR THIS LCA & EPD

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ISO 9001:2008 Quality Management Systems Requirements
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
ISO/TS 21931-1:2010 Sustainability in building construction: Framework for assessment, Part 1:
ISO 21932:2013 Sustainability in buildings and civil engineering works -- A review of terminology

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US EPA (2014) Database of Sources of Environmental Releases of Dioxin like Compounds in U.S http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=20797 p 1-38, 6-9, USA