KVS leading climate action

Life Cycle Assessment

Polysilver

by Polybid

Publication date:

In accordance with ISO 14040/44 and EN 15804+A2 the PCR of Construction Products.

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General Information

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Declarations of LCA

The LCA owner has the sole ownership, liability, and responsibility for the LCA.

The LCA is based on the standard EN 15804+A2. LCAs of construction products may not be comparable if they do not comply with this standard. Only LCAs which are based on the PCR of construction products EN 15804+A2 and comply with the rules of this standard can be compared.

Product Information

Products included in this LCA:

- Polysilver- Expandable polystyrene boards with graphite additive for insulation. The boards have a better thermal conductivity and fire resistance qualities. Can be applied for walls both on the interior and exterior, ceilings, roofs, and other constructed surfaces.

Name of Product	Material	Polysilver
Raw Materials	EPS	90-100%
	Additives	0-10%
Packaging Materials	Polyethylene cover	<0.5%
Thickness [cm]		2-5
Weight of product [kg]		Per 1 m^2- 0.4-1
Dimensions [cm]		62x125, 60x125
UN CPC	369 – other plastics products	

Specification:

Name of Product	Polysilver
Thermal Conductivity [W/m²C°]	0.031
Reaction to Fire Class	E
Compressive Stress at 10% Deformation	65-100
Color	Gray
Density [kg/m³]	20

Life Cycle Assessment Calculation Rules

Declared Unit: The declared unit is 1 m^2 of Polysilver, r=1.

Type of LCA: Cradle-to-gate with modules C1- C4, D.

Declared Modules: A1-A3, C1-C4, D.

Goal and Scope: This LCA evaluates the environmental impacts of the production of 1 m^2 of Polybid's Polysilver EPS board from cradle to gate with modules C1- C4, D.

Reference Service Life (RSL): The Reference Service Lives of the product is at least 50 years.

Cut–off Criteria: All raw materials for the manufacturing of the declared EPS board, the required energy, water consumption and the resulting emissions are considered in the life cycle assessment. That way, components with a share of even less than 1% are included. All neglected processes contribute less than 1% to the total mass.

Allocations: Overall and in general, allocations were avoided whenever possible. Nevertheless, allocations were made in the general energy and water usage. Reuse, recycling and recovery allocations were not applied, but the recovery of EPS loss in the manufacturing process was taken into account.

Assumptions and Limitations:

- Approximated generic data has been used for additives which were not found in the Ecoinvent database, in addition to other databases and to research that was carried out.
- Generic data of larger areas have been used for some materials and processes inputs.
- Part of the raw material EPS data was modeled from an LCA supplied by the manufacturer.[1]
- In cases of multiple suppliers for one raw material a proportional share was taken into account.
- Assumptions were made regarding the transportation for all materials required for manufacturing and packaging the product. Average data of the distance was included.
- The primary energy of raw materials was calculated for all renewable and non-renewable raw materials that had LHV value sources.

Geography: The study represents the manufacturing of the Polysilver in Polybid's manufacturing factory located in Mishmar HaNegev, Israel.

Time Representativeness: The data is representative for the year 2022 and was collected for 12 months from January to December. The electricity data was collected in 2023 for the months January to October.

Software: Simapro 9.4.0.3.

Foreground Data: The LCA is based on production data e.g., material flows and energy consumption, provided by Polybid.

Background Data: For modelling the LCA, Ecoinvent (v3.8-2021) and USLCI data (The Federal LCA Commons, U.S. Department of Agriculture) were used. Since there are hardly any datasets available for Israel, background data for larger area which Israel is included in was used for the life cycle inventory. For electricity data, an Israeli dataset was prepared according to the data of 2022 from the official report of the Israel electricity authority [1]. For water use data, an Israeli dataset was prepared according to the data of 2020 from the report of the National Water Institution of Israel [2].

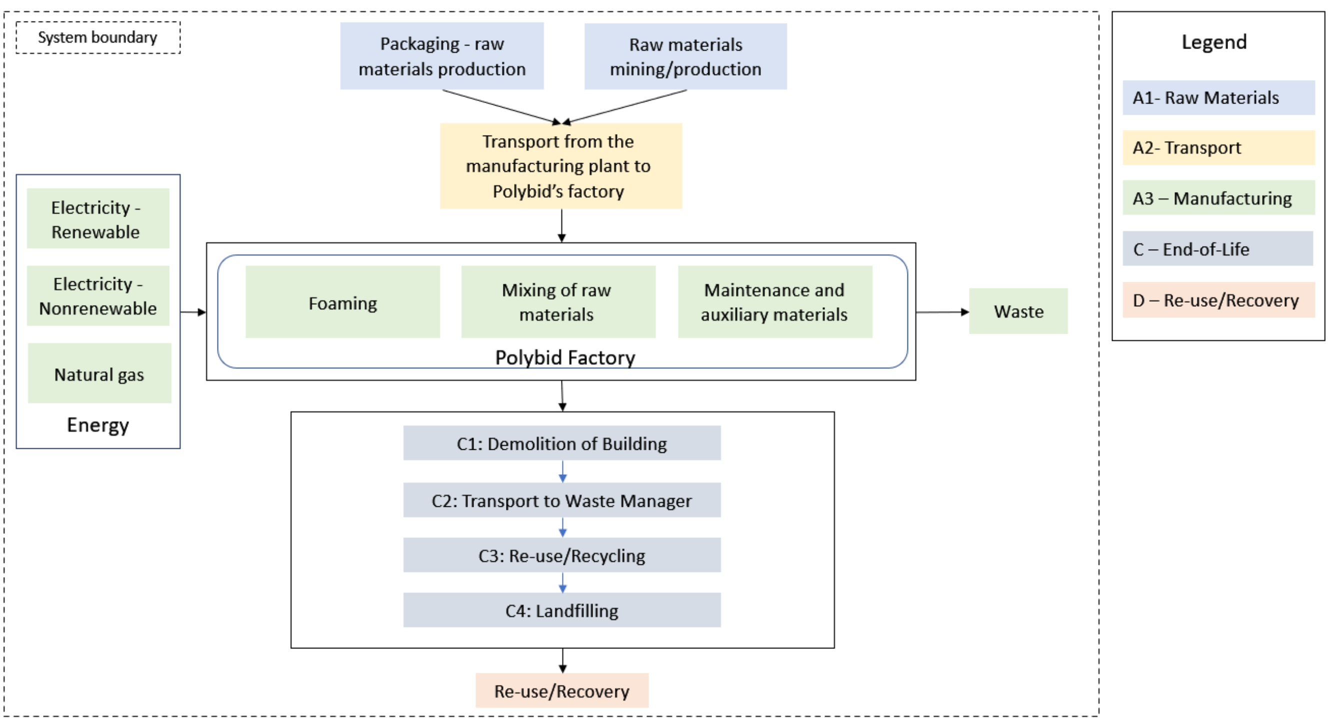
PCR: EN 15804+A2 and 2019:14 for construction products, version 1.3.2.

Impact Model Applied: EN 15804 + A2 method.

Standards Applied: ISO 14040/44.

System Boundaries

The general life cycle of EPS Boards is as shown in the following figure:



Life Cycle Modules (stages)

The modules chosen for the LCA (X - module included in LCA, MND - module not declared):

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	**Transport**	**Manufacturing**	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	**De-construction demolition**	**Transport**	**Waste processing**	**Disposal**	**Reuse-Recovery-Recycling-potential**
A1	**A2**	**A3**	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	**X**	**X**	MND	MND	MND	MND	MND	MND	MND	MND	MND	**X**	**X**	**X**	**X**	**X**

Within this Life Cycle Assessment, the following processes are considered:

<u>Product Stage (A1-A3):</u>

Module A1 – Supply of raw materials: The declared EPS boards consist mainly of polystyrene and a small amount of additives. The raw materials supply includes raw material extraction/production that are taken into account in this study. The raw material of packaging, polyethylene is also included in this module.

Module A2 – Transport of raw materials: The polystyrene is produced abroad in various countries in Asia and Europe. Accordingly, transport distances are varied and done by ships and trucks. Further raw materials are supplied from manufacturers within Israel**.**

Module A3 – Manufacturing: The manufacturing includes mixing polystyrene granules with pentane and exposing them to steam, which causes their expansion. The expanded polystyrene is molded into blocks with various sizes and densities. Electricity and natural gas are consumed during the manufacturing process, in addition to maintenance procedures.

<u>End-of-Life stage (C1-C4):</u>

Module C1 – De-construction: Demolition of the EPS boards takes place with the whole demolition of the building/construction. Thus, it is assumed that energy used for the demolition of the EPS boards has minor significance and the environmental impact of this module is set to be zero.

At the end-of-life, in the demolition phase 100% of the waste is assumed to be collected as mixed construction waste.

Module C2 – Transportation: Transportation distance to the closest disposal area is estimated as 50 km by a 16-32 tonne lorry, which is the most common.

Module C3 – Waste processing: According to interviews with industry executives that manage the construction waste in Israel (GREENMIX, Negevecology), and research on the waste sector in Israel, there is no any significant processing of the construction waste and especially not for the EPS boards, therefore the environmental impact of this module is set to be zero. There is processing of polystyrene packaging from municipal waste in an RDF facility, therefor there is a possibility for the conditions to change in the upcoming years.

Module C4 – Disposal: it is assumed and modeled that 100% of the EPS boards will be landfilled in the Israeli landfills of construction materials.

Resource Recovery stage (D):

Module D – Reuse-Recovery-Recycling potential: Module D is set to be zero since the is no reuse, recovery or recycling of the products.

Exclusion of Modules

Modules A4-A5, B1-B7 are not mandatory and excluded from this LCA according to the PCR of construction products EN 15804+A2.

Environmental Impacts

All characterization models, characterization factors and methods used are as defined in the PCR of construction products EN 15804+A2 Annex C Tables C.1-C.4.

The Environmental Impacts of the Polysilver

The Impact Assessment - for 1 m^2 of Polysilver, d=3.1 cm, 20 kg/m3							
Impact Category	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Climate change - Fossil	kg CO2 eq	1.86E+00	0	5.05E-03	0	3.16E-03	0
Climate change - Biogenic	kg CO2 eq	5.10E-03	0	4.36E-06	0	3.18E-06	0
Climate change - Land use and LU change	kg CO2 eq	1.92E-04	0	2.02E-06	0	3.06E-06	0
Climate change - Total	kg CO2 eq	1.87E+00	0	5.05E-03	0	3.17E-03	0
Ozone depletion	kg CFC11 eq	4.31E-08	0	1.17E-09	0	1.32E-09	0
Acidification	mol H+ eq	8.57E-03	0	1.43E-05	0	3.01E-05	0
Eutrophication, freshwater	kg P eq	1.12E-05	0	3.60E-08	0	2.97E-08	0
Eutrophication, marine	kg N eq	1.74E-03	0	2.85E-06	0	1.06E-05	0
Eutrophication, terrestrial	mol N eq	1.86E-02	0	3.18E-05	0	1.16E-04	0
Photochemical ozone formation	kg NMVOC eq	6.54E-03	0	1.22E-05	0	3.35E-05	0
Resource use, fossils	MJ	4.92E+01	0	7.65E-02	0	9.06E-02	0
Resource use, minerals and metals	kg Sb eq	2.51E-06	0	1.79E-08	0	7.40E-09	0
Water use	m3 depriv.	8.32E-01	0	2.33E-04	0	4.10E-03	0
Climate Change - GHG	kg CO2 eq	1.87E+00	0	5.05E-03	0	3.17E-03	0
Disclaimer 1	This impact category deals mainly with eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effect 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.						
Disclaimer 2	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.						

Indicators Describing Resource Use – for 1 m^2 of Polysilver, d=3.1 cm, 20 kg/m3							
Parameter	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	9.96E-01	0	1.09E-03	0	7.17E-04	0
PERM	MJ	0.00E+00	0	0.00E+00	0	0.00E+00	0
PERT	MJ	9.96E-01	0	1.09E-03	0	7.17E-04	0
PENRE	MJ	2.66E+01	0	7.65E-02	0	9.07E-02	0
PENRM	MJ	2.25E+01	0	0.00E+00	0	0.00E+00	0

PENRT	MJ	4.92E+01	0	7.65E-02	0	9.07E-02	0
SM	kg	0.00E+00	0	0.00E+00	0	0.00E+00	0
RSF	MJ	0.00E+00	0	0.00E+00	0	0.00E+00	0
NRSF	MJ	0.00E+00	0	0.00E+00	0	0.00E+00	0
FW	m3	1.74E-02	0	8.66E-06	0	9.77E-05	0

Waste Categories and Output Flows – for 1 m^2 of Polysilver, d=3.1 cm, 20 kg/m3							
Parameter	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	kg	4.70E-05	0	2.00E-07	0	1.38E-07	0
NHWD	kg	9.44E-02	0	4.01E-03	0	6.20E-01	0
RWD	kg	1.96E-05	0	5.17E-07	0	5.96E-07	0
CRU	kg	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0

Abbreviations of Indicators

GWP-fossil	Global warming potential of fossil fuels
GWP-luluc	Global warming potential of land use and land use change
GWP-biogenic	Global warming potential of biogenic carbon
GWP-total	Global warming potential total
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
	Eutrophication potential, fraction of nutrients reaching marine end compartment
EP-marine	Eutrophication potential of accumulated exceedance, the oversaturation of an eco-system with non-organic nutrients
EP-terrestrial	
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADP –minerals & metals	Abiotic depletion potential for minerals and metals
ADP-fossil	Abiotic depletion potential for fossil resources
WDP	User deprivation potential, deprivation weighted water consumption
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	Renewable primary energy resources used as raw materials
PERT	Total use of renewable primary energy resources
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	Non-renewable primary energy resources used as raw materials
PENRT	Total use of non-renewable primary energy resources
SM	Use of secondary material
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water
HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EEE	Exported electrical energy
EET	Exported thermal energy

Critical Review Report

External Critical Review

of an LCA report entitled: “Life Cycle Assessment of EPS boards Polyboard, Polyfloor, Polysilver”

Author of Critical Review Report

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SUMMARY AND RECOMMENDATION

The Life cycle assessment report "Life Cycle Assessment of EPS boards, Polyboard, Polyfloor, Polysilver" developed by Shai Ben Aharon and Eden Shukrun conforms to the ISO 14040 standard. Furthermore, the data collection and modelling methods are described clearly and correspond to the state of the art. Finally, the report is well-written, transparent, and consistent.

According to ISO 14040, the critical review process ensures that:

- The methods used in the LCA study are consistent with the international standard;
- The methods used in the LCA study are scientifically and technically valid;
- The data used are appropriate and reasonable concerning the goal of the study;
- The interpretations reflect the limitations identified and the goal of the study;
- The study report is transparent and consistent.

Several questions were asked about the study's implementation in the verification framework. All these questions were satisfactorily answered, and LCA models were demonstrated.

Prague, March 20th, 2024

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