

# Annex for double skin steel faced sandwich panels with a core made of polyurethane

- Polyurethane sandwich panel 40mm thickness
- Polyurethane sandwich panel 160mm thickness
- 1 kg steel sheet
- 1 m<sup>3</sup> polyurethane core

to the

## ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804+A2/

|                          |                                                                 |
|--------------------------|-----------------------------------------------------------------|
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## General information

This document is a public annex to the EPD with the declaration number EPD-PPA-20240128-CBG1-EN. It contains the LCA results for additional thicknesses of polyurethane sandwich panels (40mm, 160mm).

Additionally, the annex provides separate results for 1 kg of steel sheet used for the panel faces and 1 m<sup>3</sup> of polyurethane rigid foam used as core of the panel..

The LCA data were based on production data from the year 2022.

The annex includes the individual results for steel sheet (1 kg) and PU core (1 m<sup>3</sup>). The PU core declared in this annex includes transportation of chemical components to production site, and production processes. The values for 1kg of steel sheet and 1 m<sup>3</sup> of PU core can be used to estimate the LCA results for products with different thicknesses.

The following formula describes how results for different thicknesses can be estimated:

$$R_x = M_s * R_s + T_c * R_c$$

$R_x$  = Results of different thickness sandwich panel at different indicators

$M_s$  = Mass of steel

$R_s$  = Results of 1kg steel

$T_c$  = Thickness of PU core (in m)

$R_c$  = Results of 1m<sup>3</sup> PU core

The formula shall be used for all indicators and for the following modules : A1-A3, A4, A5, C2, C3, C4 and D.

Additionally, installation and deconstruction impacts (for A5 and C1) are mentioned separately and declared per m<sup>2</sup> of product. The user can directly use these results without scaling. The impacts from installation (A5) shall be summed with the scaled impacts from A5 in the polyurethane core results (EOL of packaging materials).

## General information on sandwich panels

This annex contains the LCA results for:

- Polyurethane sandwich panel 40mm thickness
- Polyurethane sandwich panel 160mm thickness
- 1 kg steel sheet
- 1 m<sup>3</sup> polyurethane core

### Technical data for sandwich panel PU 40

Technical specifications for sandwich panels with a core made of polyurethane are:

- EN 14509
- EN 13165

#### Constructional data

| Name                                                                                                                                                                                              | Value | Unit              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|
| Density of the insulation                                                                                                                                                                         | 36-43 | kg/m <sup>3</sup> |
| Thickness of the element, when the outer layers are flat, this is the overall height of the element (D); on heavily profiled elements, this is the continuous core thickness without profile (dc) | 40    | mm                |
| Thickness of the inner layer                                                                                                                                                                      | 0.5   | mm                |
| Weight                                                                                                                                                                                            | 10.18 | kg/m <sup>2</sup> |
| Thickness of the outer layer                                                                                                                                                                      | 0.6   | mm                |

#### Composition of the sandwich panels

- Steel sheet 85%
- Core material 15%

Technical specifications for sandwich panels with a core made of polyurethane are:

- EN 14509
- EN 13165

#### Constructional data

| Name                                                                                                                                                                                              | Value | Unit              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|
| Density of the insulation                                                                                                                                                                         | 36-43 | kg/m <sup>3</sup> |
| Thickness of the element, when the outer layers are flat, this is the overall height of the element (D); on heavily profiled elements, this is the continuous core thickness without profile (dc) | 160   | mm                |
| Thickness of the inner layer                                                                                                                                                                      | 0.5   | mm                |
| Weight                                                                                                                                                                                            | 16.35 | kg/m <sup>2</sup> |
| Thickness of the outer layer                                                                                                                                                                      | 0.6   | mm                |

#### Composition of the sandwich panels

- Steel sheet 60%
- Core material 40%

#### Technical data for 1 kg steel sheet

- Steel sheet according to EN 10346: S280 GD to S350 GD with organic coating according to EN 10169.

#### Technical data for 1 m<sup>3</sup> PU core

- Rigid polyurethane foam mainly made of isocyanate and polyol
- Density: 36-43 kg/m<sup>3</sup>

### Technical data for sandwich panel PU 160

## 1. LCA: Calculation rules

#### Declared unit

| Product name | Name                                      | Value | Unit              |
|--------------|-------------------------------------------|-------|-------------------|
| PU 40        | Declared unit                             | 1     | m <sup>2</sup>    |
|              | Surface weight of the panel (total value) | 10.18 | kg/m <sup>2</sup> |
| PU 160       | Declared unit                             | 1     | m <sup>2</sup>    |
|              | Surface weight of the panel (total value) | 16.35 | kg/m <sup>2</sup> |
| Steel sheet  | Declared unit                             | 1     | kg                |
| PU Core      | Declared unit                             | 1     | m <sup>3</sup>    |

## 2. LCA: Scenarios and additional technical information

### Information on describing the biogenic carbon content at factory gate

| Product name         | Name                                              | Value | Unit |
|----------------------|---------------------------------------------------|-------|------|
| PU 40                | Biogenic carbon content in accompanying packaging | 0.047 | kg C |
| PU 160               | Biogenic carbon content in accompanying packaging | 0.039 | kg C |
| 1 kg steel sheet     | Biogenic carbon content in accompanying packaging | -     | kg C |
| 1m³ PU core with aux | Biogenic carbon content in accompanying packaging | 1.20  | kg C |

The following technical information is a basis for the declared modules.

### Transport to the building site (A4)

The transport to building site A4 is standardized and can be scaled up to building level. Hence, it is considered to be 100 km.

| Name                                        | Value | Unit |
|---------------------------------------------|-------|------|
| Transport distance                          | 100   | km   |
| Capacity utilisation (including empty runs) | 61    | %    |

### Installation (A5)

The following packaging material is considered in A1-A3: polystyrene, polyethylene foil, cardboard and wooden pallet.

A5 covers the treatment of packaging material at the point of installation. Additionally, installation is done by diesel driven machinery with consumption of 0,233kg/m² panel.

### Installation into the building (A5)

| Product name          | Name                                                | Value | Unit |
|-----------------------|-----------------------------------------------------|-------|------|
| PU 40                 | Output substances following waste treatment on site | 0.172 | kg   |
| PU 160                | Output substances following waste treatment on site | 0.178 | kg   |
| 1kg steel sheet       | Output substances following waste treatment on site | -     | kg   |
| 1m³ PU core with aux. | Output substances following waste treatment on site | 4.34  | kg   |

### End of life (C1-C4)

Deconstruction done by the same machine, as for installation, with same consumption.

| Product name    | Name                            | Value | Unit |
|-----------------|---------------------------------|-------|------|
| PU 40           | Collected separately waste type | 10.18 | kg   |
|                 | Recycling                       | 8.56  | kg   |
|                 | Energy recovery                 | 1.62  | kg   |
|                 | Landfilling                     | -     | kg   |
| PU 160          | Collected separately waste type | 16.35 | kg   |
|                 | Recycling                       | 8.54  | kg   |
|                 | Energy recovery                 | 7.81  | kg   |
|                 | Landfilling                     | -     | kg   |
| 1kg steel sheet | Collected separately waste type | 1     | kg   |
|                 | Recycling                       | 1     | kg   |
|                 | Energy recovery                 | -     | kg   |
|                 | Landfilling                     | -     | kg   |

|                       |                                 |    |    |
|-----------------------|---------------------------------|----|----|
| 1m³ PU core with aux. | Collected separately waste type | 43 | kg |
|                       | Recycling                       | -  | kg |
|                       | Energy recovery                 | 43 | kg |
|                       | Landfilling                     | -  | kg |

### Reuse, recovery or recycling potential (D)

Resulting potential benefits and loads for the metal recycling are declared in module D.

### 3. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

| 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             | X                                   | X        | MND       | MND         | MND    | MND         | MND           | MND                    | MND                   | X                          | X         | X                | X        | X                                               |

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2 1m<sup>2</sup> polyurethane sandwich panel 40mm thickness

| Core Indicator | Unit                               | A1-A3    | A4       | A5        | C1       | C2       | C3       | C4       | D         |
|----------------|------------------------------------|----------|----------|-----------|----------|----------|----------|----------|-----------|
| GWP-total      | [kg CO <sub>2</sub> -Eq.]          | 2,67E+01 | 7,38E-02 | 5,61E-02  | 8,26E-01 | 3,69E-02 | 4,76E+00 | 0,00E+00 | -1,47E+01 |
| GWP-fossil     | [kg CO <sub>2</sub> -Eq.]          | 2,67E+01 | 7,29E-02 | 2,68E-02  | 8,15E-01 | 3,64E-02 | 4,76E+00 | 0,00E+00 | -1,47E+01 |
| GWP-biogenic   | [kg CO <sub>2</sub> -Eq.]          | 2,99E-02 | 2,15E-04 | 2,93E-02  | 3,21E-03 | 1,08E-04 | 3,41E-04 | 0,00E+00 | 1,87E-02  |
| GWP-luluc      | [kg CO <sub>2</sub> -Eq.]          | 1,12E-02 | 6,75E-04 | -5,26E-07 | 7,53E-03 | 3,38E-04 | 7,61E-06 | 0,00E+00 | -6,44E-03 |
| ODP            | [kg CFC11-Eq.]                     | 2,11E-11 | 9,49E-15 | 2,22E-14  | 1,06E-13 | 4,74E-15 | 3,84E-13 | 0,00E+00 | 3,15E-11  |
| AP             | [mol H <sup>+</sup> -Eq.]          | 1,23E-01 | 9,36E-05 | 3,06E-05  | 4,77E-03 | 4,68E-05 | 2,80E-03 | 0,00E+00 | -3,16E-02 |
| EP-freshwater  | [kg P-Eq.]                         | 3,85E-05 | 2,67E-07 | 6,32E-09  | 2,97E-06 | 1,33E-07 | 1,04E-07 | 0,00E+00 | -3,51E-06 |
| EP-marine      | [kg N-Eq.]                         | 3,00E-02 | 3,17E-05 | 1,18E-05  | 2,33E-03 | 1,59E-05 | 1,36E-03 | 0,00E+00 | -8,04E-03 |
| EP-terrestrial | [mol N-Eq.]                        | 3,25E-01 | 3,82E-04 | 1,49E-04  | 2,58E-02 | 1,91E-04 | 1,56E-02 | 0,00E+00 | -8,88E-02 |
| POCP           | [kg NMVOC-Eq.]                     | 9,17E-02 | 8,07E-05 | 3,04E-05  | 6,19E-03 | 4,03E-05 | 3,49E-03 | 0,00E+00 | -2,57E-02 |
| ADPE           | [kg Sb-Eq.]                        | 5,11E-04 | 4,80E-09 | 3,66E-11  | 5,36E-08 | 2,40E-09 | 3,66E-09 | 0,00E+00 | 5,85E-06  |
| ADPF           | [MJ]                               | 3,48E+02 | 9,93E-01 | 3,06E-02  | 1,11E+01 | 4,97E-01 | 1,26E+00 | 0,00E+00 | -1,24E+02 |
| WDP            | [m <sup>3</sup> world-Eq deprived] | 1,31E+00 | 8,81E-04 | 9,53E-03  | 9,83E-03 | 4,41E-04 | 4,69E-01 | 0,00E+00 | 7,22E-02  |

Caption: GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel 40mm thickness

| Indicator | Unit              | A1-A3    | A4       | A5        | C1       | C2       | C3        | C4       | D         |
|-----------|-------------------|----------|----------|-----------|----------|----------|-----------|----------|-----------|
| PERE      | [MJ]              | 2,38E+01 | 7,23E-02 | 1,80E+00  | 8,06E-01 | 3,62E-02 | 2,37E-01  | 0,00E+00 | 8,19E+00  |
| PERM      | [MJ]              | 1,79E+00 | 0,00E+00 | -1,79E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| PERT      | [MJ]              | 2,56E+01 | 7,23E-02 | 1,03E-02  | 8,06E-01 | 3,62E-02 | 2,37E-01  | 0,00E+00 | 8,19E+00  |
| PENRE     | [MJ]              | 3,02E+02 | 9,97E-01 | 2,49E+00  | 1,11E+01 | 4,99E-01 | 4,53E+01  | 0,00E+00 | -1,25E+02 |
| PENRM     | [MJ]              | 4,66E+01 | 0,00E+00 | -2,46E+00 | 0,00E+00 | 0,00E+00 | -4,41E+01 | 0,00E+00 | 0,00E+00  |
| PENRT     | [MJ]              | 3,49E+02 | 9,97E-01 | 3,05E-02  | 1,11E+01 | 4,99E-01 | 1,26E+00  | 0,00E+00 | -1,25E+02 |
| SM        | [kg]              | 1,99E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| RSF       | [MJ]              | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| NRSF      | [MJ]              | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| FW        | [m <sup>3</sup> ] | 5,47E-02 | 7,92E-05 | 2,24E-04  | 8,83E-04 | 3,96E-05 | 1,10E-02  | 0,00E+00 | -7,12E-03 |

Caption: PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of 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 = Use of 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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel 40mm thickness

| Indicator | Unit | A1-A3    | A4       | A5       | C1       | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----------|----------|----------|----------|----------|-----------|
| HWD       | [kg] | 6,61E-06 | 3,09E-12 | 3,24E-13 | 3,44E-11 | 1,54E-12 | 1,11E-10 | 0,00E+00 | -1,87E-09 |
| NHWD      | [kg] | 1,01E+00 | 1,52E-04 | 3,62E-03 | 1,70E-03 | 7,60E-05 | 2,40E-02 | 0,00E+00 | -1,83E-01 |
| RWD       | [kg] | 4,53E-03 | 1,87E-06 | 1,08E-06 | 2,08E-05 | 9,33E-07 | 5,16E-05 | 0,00E+00 | -5,03E-04 |
| CRU       | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| MFR       | [kg] | 6,10E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 8,02E+00 | 0,00E+00 | 0,00E+00  |
| MER       | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| EEE       | [MJ] | 0,00E+00 | 0,00E+00 | 7,05E-02 | 0,00E+00 | 0,00E+00 | 8,23E+00 | 0,00E+00 | 0,00E+00  |
| EET       | [MJ] | 0,00E+00 | 0,00E+00 | 1,66E-01 | 0,00E+00 | 0,00E+00 | 1,47E+01 | 0,00E+00 | 0,00E+00  |

Caption: 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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: polyurethane sandwich panel 40mm thickness

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                          | A1-A3    | A4       | A5       | C1       | C2       | C3       | C4       | D         |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-----------|
| PM        | [Disease Incidence]                                                                                                                                                                                                                                                                                                                                           | 1,91E-06 | 6,85E-10 | 1,76E-10 | 9,51E-08 | 3,42E-10 | 7,77E-09 | 0,00E+00 | -4,51E-07 |
| IRP       | [kBq U235-Eq.]                                                                                                                                                                                                                                                                                                                                                | 5,32E-01 | 2,78E-04 | 1,15E-04 | 3,10E-03 | 1,39E-04 | 8,16E-03 | 0,00E+00 | -2,51E-01 |
| ETP-fw    | [CTUe]                                                                                                                                                                                                                                                                                                                                                        | 1,27E+02 | 7,06E-01 | 1,12E-02 | 7,87E+00 | 3,53E-01 | 4,24E-01 | 0,00E+00 | -2,54E+01 |
| HTP-c     | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 2,45E-08 | 1,44E-11 | 1,28E-12 | 1,61E-10 | 7,22E-12 | 3,27E-11 | 0,00E+00 | -2,31E-08 |
| HTP-nc    | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 3,41E-07 | 7,69E-10 | 1,74E-10 | 1,06E-08 | 3,84E-10 | 1,11E-09 | 0,00E+00 | -6,92E-08 |
| SQP       | [H]                                                                                                                                                                                                                                                                                                                                                           | 5,07E+01 | 4,15E-01 | 1,03E-02 | 4,63E+00 | 2,08E-01 | 2,75E-01 | 0,00E+00 | 4,31E+00  |
| Caption   | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |          |          |          |          |          |          |          |           |

#### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel 160mm thickness

| Core Indicator | Unit                                                                                                                                                                                                                                                                                                                                                                                                               | A1-A3    | A4       | A5        | C1       | C2       | C3       | C4       | D         |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|----------|----------|----------|----------|-----------|
| GWP-total      | [kg CO2-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                       | 3,93E+01 | 1,19E-01 | 1,46E-01  | 8,26E-01 | 5,93E-02 | 1,40E+01 | 0,00E+00 | -1,96E+01 |
| GWP-fossil     | [kg CO2-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                       | 3,93E+01 | 1,17E-01 | 6,99E-02  | 8,15E-01 | 5,85E-02 | 1,40E+01 | 0,00E+00 | -1,96E+01 |
| GWP-biogenic   | [kg CO2-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                       | 2,03E-02 | 3,46E-04 | 7,63E-02  | 3,21E-03 | 1,73E-04 | 1,00E-03 | 0,00E+00 | 3,95E-03  |
| GWP-luluc      | [kg CO2-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                       | 2,00E-02 | 1,09E-03 | -1,37E-06 | 7,53E-03 | 5,43E-04 | 2,24E-05 | 0,00E+00 | -7,73E-03 |
| ODP            | [kg CFC11-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                     | 2,31E-11 | 1,52E-14 | 5,77E-14  | 1,06E-13 | 7,62E-15 | 1,13E-12 | 0,00E+00 | 1,27E-11  |
| AP             | [mol H+-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                       | 1,53E-01 | 1,50E-04 | 7,99E-05  | 4,77E-03 | 7,52E-05 | 8,24E-03 | 0,00E+00 | -3,93E-02 |
| EP-freshwater  | [kg P-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                         | 9,27E-05 | 4,28E-07 | 1,65E-08  | 2,97E-06 | 2,14E-07 | 3,07E-07 | 0,00E+00 | -8,97E-06 |
| EP-marine      | [kg N-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                         | 3,81E-02 | 5,10E-05 | 3,07E-05  | 2,33E-03 | 2,55E-05 | 4,00E-03 | 0,00E+00 | -1,03E-02 |
| EP-terrestrial | [mol N-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                        | 4,09E-01 | 6,13E-04 | 3,89E-04  | 2,58E-02 | 3,07E-04 | 4,60E-02 | 0,00E+00 | -1,14E-01 |
| POCP           | [kg NMVOC-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                     | 1,18E-01 | 1,30E-04 | 7,92E-05  | 6,19E-03 | 6,48E-05 | 1,03E-02 | 0,00E+00 | -3,22E-02 |
| ADPE           | [kg Sb-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                        | 5,37E-04 | 7,72E-09 | 9,55E-11  | 5,36E-08 | 3,86E-09 | 1,08E-08 | 0,00E+00 | 8,45E-06  |
| ADPF           | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                               | 6,78E+02 | 1,60E+00 | 7,97E-02  | 1,11E+01 | 7,98E-01 | 3,70E+00 | 0,00E+00 | -1,95E+02 |
| WDP            | [m <sup>3</sup> world-Eq deprived]                                                                                                                                                                                                                                                                                                                                                                                 | 2,85E+00 | 1,42E-03 | 2,48E-02  | 9,83E-03 | 7,08E-04 | 1,38E+00 | 0,00E+00 | -7,29E-02 |
| Caption        | GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential |          |          |           |          |          |          |          |           |

#### RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel 160mm thickness

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A1-A3    | A4       | A5        | C1       | C2       | C3        | C4       | D         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|----------|----------|-----------|----------|-----------|
| PERE      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,66E+01 | 1,16E-01 | 1,46E+00  | 8,06E-01 | 5,81E-02 | 6,96E-01  | 0,00E+00 | -7,31E+00 |
| PERM      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,43E+00 | 0,00E+00 | -1,43E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| PERT      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,80E+01 | 1,16E-01 | 2,69E-02  | 8,06E-01 | 5,81E-02 | 6,96E-01  | 0,00E+00 | -7,31E+00 |
| PENRE     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5,22E+02 | 1,60E+00 | 3,65E+00  | 1,11E+01 | 8,01E-01 | 1,57E+02  | 0,00E+00 | -1,97E+02 |
| PENRM     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,57E+02 | 0,00E+00 | -3,57E+00 | 0,00E+00 | 0,00E+00 | -1,54E+02 | 0,00E+00 | 0,00E+00  |
| PENRT     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6,79E+02 | 1,60E+00 | 7,95E-02  | 1,11E+01 | 8,01E-01 | 3,70E+00  | 0,00E+00 | -1,97E+02 |
| SM        | [kg]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,09E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| RSF       | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| NRSF      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| FW        | [m <sup>3</sup> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,27E-01 | 1,27E-04 | 5,83E-04  | 8,83E-04 | 6,36E-05 | 3,24E-02  | 0,00E+00 | -1,87E-02 |
| Caption   | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of 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 = Use of 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 |          |          |           |          |          |           |          |           |

#### RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel 160mm thickness

| Indicator | Unit                                                                                                                                                                                                                                                                    | A1-A3    | A4       | A5       | C1       | C2       | C3       | C4       | D         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-----------|
| HWD       | [kg]                                                                                                                                                                                                                                                                    | 7,02E-06 | 4,96E-12 | 8,45E-13 | 3,44E-11 | 2,48E-12 | 3,27E-10 | 0,00E+00 | -5,14E-09 |
| NHWD      | [kg]                                                                                                                                                                                                                                                                    | 1,21E+00 | 2,44E-04 | 9,43E-03 | 1,70E-03 | 1,22E-04 | 7,04E-02 | 0,00E+00 | -3,44E-01 |
| RWD       | [kg]                                                                                                                                                                                                                                                                    | 8,07E-03 | 3,00E-06 | 2,82E-06 | 2,08E-05 | 1,50E-06 | 1,52E-04 | 0,00E+00 | -4,98E-03 |
| CRU       | [kg]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| MFR       | [kg]                                                                                                                                                                                                                                                                    | 1,20E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,35E+00 | 0,00E+00 | 0,00E+00  |
| MER       | [kg]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| EEE       | [MJ]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 | 1,84E-01 | 0,00E+00 | 0,00E+00 | 2,42E+01 | 0,00E+00 | 0,00E+00  |
| EET       | [MJ]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 | 4,32E-01 | 0,00E+00 | 0,00E+00 | 4,33E+01 | 0,00E+00 | 0,00E+00  |
| Caption   | 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 |          |          |          |          |          |          |          |           |

**RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1m<sup>2</sup> polyurethane sandwich panel 160mm thickness**

| Indicator | Unit                | A1-A3    | A4       | A5       | C1       | C2       | C3       | C4       | D         |
|-----------|---------------------|----------|----------|----------|----------|----------|----------|----------|-----------|
| PM        | [Disease Incidence] | 2,24E-06 | 1,10E-09 | 4,60E-10 | 9,51E-08 | 5,50E-10 | 2,29E-08 | 0,00E+00 | -5,39E-07 |
| IRP       | [kBq U235-Eq.]      | 9,09E-01 | 4,47E-04 | 3,01E-04 | 3,10E-03 | 2,24E-04 | 2,40E-02 | 0,00E+00 | -1,04E+00 |
| ETP-fw    | [CTUe]              | 3,28E+02 | 1,13E+00 | 2,93E-02 | 7,87E+00 | 5,67E-01 | 1,25E+00 | 0,00E+00 | -4,18E+01 |
| HTP-c     | [CTUh]              | 2,90E-08 | 2,32E-11 | 3,33E-12 | 1,61E-10 | 1,16E-11 | 9,61E-11 | 0,00E+00 | -2,74E-08 |
| HTP-nc    | [CTUh]              | 5,30E-07 | 1,23E-09 | 4,54E-10 | 1,06E-08 | 6,17E-10 | 3,26E-09 | 0,00E+00 | -9,07E-08 |
| SQP       | [-]                 | 7,28E+01 | 6,67E-01 | 2,68E-02 | 4,63E+00 | 3,33E-01 | 8,08E-01 | 0,00E+00 | -5,88E+00 |

|         |                                                                                                                                                                                                                                                                                                                                                               |
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| Caption | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |
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**RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2 1 kg steel sheet**

| Core Indicator            | Unit                               | A1-A3    | A4       | A5 | C1 | C2       | C3       | C4       | D         |
|---------------------------|------------------------------------|----------|----------|----|----|----------|----------|----------|-----------|
| GWP <sub>total</sub>      | [kg CO <sub>2</sub> -Eq.]          | 2,70E+00 | 7,25E-03 |    |    | 3,62E-03 | 0,00E+00 | 0,00E+00 | -1,70E+00 |
| GWP <sub>fossil</sub>     | [kg CO <sub>2</sub> -Eq.]          | 2,70E+00 | 7,16E-03 |    |    | 3,58E-03 | 0,00E+00 | 0,00E+00 | -1,70E+00 |
| GWP <sub>biogenic</sub>   | [kg CO <sub>2</sub> -Eq.]          | 1,54E-03 | 2,12E-05 |    |    | 1,06E-05 | 0,00E+00 | 0,00E+00 | 3,76E-03  |
| GWP <sub>luluc</sub>      | [kg CO <sub>2</sub> -Eq.]          | 1,09E-03 | 6,64E-05 |    |    | 3,32E-05 | 0,00E+00 | 0,00E+00 | -8,31E-04 |
| ODP                       | [kg CFC11-Eq.]                     | 1,99E-12 | 9,32E-16 |    |    | 4,66E-16 | 0,00E+00 | 0,00E+00 | 5,94E-12  |
| AP                        | [mol H <sup>+</sup> -Eq.]          | 6,42E-03 | 9,20E-06 |    |    | 4,60E-06 | 0,00E+00 | 0,00E+00 | -3,86E-03 |
| EP <sub>freshwater</sub>  | [kg P-Eq.]                         | 2,11E-06 | 2,62E-08 |    |    | 1,31E-08 | 0,00E+00 | 0,00E+00 | -9,00E-08 |
| EP <sub>marine</sub>      | [kg N-Eq.]                         | 1,57E-03 | 3,12E-06 |    |    | 1,56E-06 | 0,00E+00 | 0,00E+00 | -9,72E-04 |
| EP <sub>terrestrial</sub> | [mol N-Eq.]                        | 1,70E-02 | 3,75E-05 |    |    | 1,88E-05 | 0,00E+00 | 0,00E+00 | -1,08E-02 |
| POCP                      | [kg NMVOC-Eq.]                     | 5,01E-03 | 7,93E-06 |    |    | 3,96E-06 | 0,00E+00 | 0,00E+00 | -3,15E-03 |
| ADPE                      | [kg Sb-Eq.]                        | 6,65E-05 | 4,72E-10 |    |    | 2,36E-10 | 0,00E+00 | 0,00E+00 | 7,78E-07  |
| ADPF                      | [MJ]                               | 2,50E+01 | 9,76E-02 |    |    | 4,88E-02 | 0,00E+00 | 0,00E+00 | -1,20E+01 |
| WDP                       | [m <sup>3</sup> world-Eq deprived] | 8,15E-02 | 8,66E-05 |    |    | 4,33E-05 | 0,00E+00 | 0,00E+00 | 3,09E-02  |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| Caption | GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential |
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**RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg steel sheet**

| Indicator | Unit              | A1-A3    | A4       | A5 | C1 | C2       | C3       | C4       | D         |
|-----------|-------------------|----------|----------|----|----|----------|----------|----------|-----------|
| PERE      | [MJ]              | 2,02E+00 | 7,10E-03 |    |    | 3,55E-03 | 0,00E+00 | 0,00E+00 | 2,31E+00  |
| PERM      | [MJ]              | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| PERT      | [MJ]              | 2,02E+00 | 7,10E-03 |    |    | 3,55E-03 | 0,00E+00 | 0,00E+00 | 2,31E+00  |
| PENRE     | [MJ]              | 2,52E+01 | 9,80E-02 |    |    | 4,90E-02 | 0,00E+00 | 0,00E+00 | -1,22E+01 |
| PENRM     | [MJ]              | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| PENRT     | [MJ]              | 2,52E+01 | 9,80E-02 |    |    | 4,90E-02 | 0,00E+00 | 0,00E+00 | -1,22E+01 |
| SM        | [kg]              | 1,85E-01 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| RSF       | [MJ]              | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| NRSF      | [MJ]              | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| FW        | [m <sup>3</sup> ] | 3,05E-03 | 7,78E-06 |    |    | 3,89E-06 | 0,00E+00 | 0,00E+00 | 5,58E-05  |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Caption | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of 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 = Use of 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 |
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**RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 kg steel sheet**

| Indicator | Unit | A1-A3    | A4       | A5 | C1 | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----|----|----------|----------|----------|-----------|
| HWD       | [kg] | 8,47E-07 | 3,03E-13 |    |    | 1,52E-13 | 0,00E+00 | 0,00E+00 | -1,52E-11 |
| NHWD      | [kg] | 1,21E-01 | 1,49E-05 |    |    | 7,47E-06 | 0,00E+00 | 0,00E+00 | -2,16E-02 |
| RWD       | [kg] | 2,58E-04 | 1,83E-07 |    |    | 9,17E-08 | 0,00E+00 | 0,00E+00 | 2,65E-04  |
| CRU       | [kg] | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| MFR       | [kg] | 6,10E-02 | 0,00E+00 |    |    | 0,00E+00 | 1,00E+00 | 0,00E+00 | 0,00E+00  |
| MER       | [kg] | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| EEE       | [MJ] | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| EET       | [MJ] | 0,00E+00 | 0,00E+00 |    |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |

|         |                                                                                                                                                                                                                                                                         |
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| Caption | 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 |
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**RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:  
1 kg steel sheet**

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                          | A1-A3    | A4       | A5 | C1 | C2       | C3       | C4       | D         |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----|----|----------|----------|----------|-----------|
| PM        | [Disease Incidence]                                                                                                                                                                                                                                                                                                                                           | 9,00E-08 | 6,73E-11 |    |    | 3,36E-11 | 0,00E+00 | 0,00E+00 | -5,68E-08 |
| IRP       | [kBq U235-Eq.]                                                                                                                                                                                                                                                                                                                                                | 2,50E-02 | 2,73E-05 |    |    | 1,37E-05 | 0,00E+00 | 0,00E+00 | 2,22E-02  |
| ETP-fw    | [CTUe]                                                                                                                                                                                                                                                                                                                                                        | 4,82E+00 | 6,93E-02 |    |    | 3,47E-02 | 0,00E+00 | 0,00E+00 | -2,41E+00 |
| HTP-c     | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 3,18E-09 | 1,42E-12 |    |    | 7,09E-13 | 0,00E+00 | 0,00E+00 | -2,98E-09 |
| HTP-nc    | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 3,37E-08 | 7,55E-11 |    |    | 3,78E-11 | 0,00E+00 | 0,00E+00 | -7,65E-09 |
| SQP       | [-]                                                                                                                                                                                                                                                                                                                                                           | 2,11E+00 | 4,08E-02 |    |    | 2,04E-02 | 0,00E+00 | 0,00E+00 | 1,38E+00  |
| Caption   | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |          |          |    |    |          |          |          |           |

**RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1m³ PU core with auxiliary processes**

| Core Indicator | Unit                   | A1-A3    | A4       | A5        | C1 | C2       | C3       | C4       | D         |
|----------------|------------------------|----------|----------|-----------|----|----------|----------|----------|-----------|
| GWP-total      | [kg CO2-Eq.]           | 1,43E+02 | 3,12E-01 | 6,81E+00  |    | 1,56E-01 | 9,48E+01 | 0,00E+00 | -3,74E+01 |
| GWP-fossil     | [kg CO2-Eq.]           | 1,39E+02 | 3,08E-01 | 3,26E+00  |    | 1,54E-01 | 9,48E+01 | 0,00E+00 | -3,72E+01 |
| GWP-biogenic   | [kg CO2-Eq.]           | 3,80E+00 | 9,10E-04 | 3,55E+00  |    | 4,55E-04 | 6,80E-03 | 0,00E+00 | -2,01E-01 |
| GWP-luluc      | [kg CO2-Eq.]           | 9,28E-02 | 2,85E-03 | -6,39E-05 |    | 1,43E-03 | 1,52E-04 | 0,00E+00 | -2,39E-03 |
| ODP            | [kg CFC11-Eq.]         | 6,52E-11 | 4,01E-14 | 2,69E-12  |    | 2,00E-14 | 7,65E-12 | 0,00E+00 | -2,82E-10 |
| AP             | [mol H+-Eq.]           | 2,42E-01 | 3,95E-04 | 3,72E-03  |    | 1,98E-04 | 5,59E-02 | 0,00E+00 | -4,55E-02 |
| EP-freshwater  | [kg P-Eq.]             | 5,75E-04 | 1,13E-06 | 7,68E-07  |    | 5,63E-07 | 2,08E-06 | 0,00E+00 | -5,72E-05 |
| EP-marine      | [kg N-Eq.]             | 7,32E-02 | 1,34E-04 | 1,43E-03  |    | 6,70E-05 | 2,71E-02 | 0,00E+00 | -1,34E-02 |
| EP-terrestrial | [mol N-Eq.]            | 7,58E-01 | 1,61E-03 | 1,81E-02  |    | 8,06E-04 | 3,12E-01 | 0,00E+00 | -1,43E-01 |
| POCP           | [kg NMVOC-Eq.]         | 3,69E-01 | 3,41E-04 | 3,69E-03  |    | 1,70E-04 | 6,96E-02 | 0,00E+00 | -3,73E-02 |
| ADPE           | [kg Sb-Eq.]            | 1,81E-05 | 2,03E-08 | 4,45E-09  |    | 1,01E-08 | 7,29E-08 | 0,00E+00 | -2,55E-06 |
| ADPF           | [MJ]                   | 3,83E+03 | 4,20E+00 | 3,71E+00  |    | 2,10E+00 | 2,51E+01 | 0,00E+00 | -6,80E+02 |
| WDP            | [m³ world-Eq deprived] | 1,69E+01 | 3,72E-03 | 1,16E+00  |    | 1,86E-03 | 9,34E+00 | 0,00E+00 | -3,38E+00 |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |  |  |  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|
| Caption | GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential |  |  |  |  |  |  |  |  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|

**RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1m³ polyurethane core with auxiliary processes**

| Indicator | Unit | A1-A3    | A4       | A5        | C1 | C2       | C3        | C4       | D         |
|-----------|------|----------|----------|-----------|----|----------|-----------|----------|-----------|
| PERE      | [MJ] | 1,90E+02 | 3,05E-01 | 1,45E+02  |    | 1,53E-01 | 5,10E+00  | 0,00E+00 | -1,89E+02 |
| PERM      | [MJ] | 1,44E+02 | 0,00E+00 | -1,43E+02 |    | 0,00E+00 | -3,80E-01 | 0,00E+00 | 0,00E+00  |
| PERT      | [MJ] | 3,33E+02 | 3,05E-01 | 1,25E+00  |    | 1,53E-01 | 4,72E+00  | 0,00E+00 | -1,89E+02 |
| PENRE     | [MJ] | 2,46E+03 | 4,21E+00 | 3,11E+02  |    | 2,11E+00 | 1,10E+03  | 0,00E+00 | -6,80E+02 |
| PENRM     | [MJ] | 1,38E+03 | 0,00E+00 | -3,07E+02 |    | 0,00E+00 | -1,08E+03 | 0,00E+00 | 0,00E+00  |
| PENRT     | [MJ] | 3,84E+03 | 4,21E+00 | 3,70E+00  |    | 2,11E+00 | 2,51E+01  | 0,00E+00 | -6,80E+02 |
| SM        | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00  |    | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| RSF       | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00  |    | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| NRSF      | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00  |    | 0,00E+00 | 0,00E+00  | 0,00E+00 | 0,00E+00  |
| FW        | [m³] | 7,95E-01 | 3,35E-04 | 2,72E-02  |    | 1,67E-04 | 2,20E-01  | 0,00E+00 | -1,56E-01 |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  |  |  |  |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|
| Caption | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of 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 = Use of 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 |  |  |  |  |  |  |  |  |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|

**RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:  
1m³ polyurethane core with auxiliary processes**

| Indicator | Unit | A1-A3    | A4       | A5       | C1 | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----------|----|----------|----------|----------|-----------|
| HWD       | [kg] | 1,87E-06 | 1,30E-11 | 3,93E-11 |    | 6,52E-12 | 2,21E-09 | 0,00E+00 | -3,87E-08 |
| NHWD      | [kg] | 1,50E+00 | 6,42E-04 | 4,39E-01 |    | 3,21E-04 | 4,77E-01 | 0,00E+00 | -3,25E-01 |
| RWD       | [kg] | 3,86E-02 | 7,89E-06 | 1,31E-04 |    | 3,94E-06 | 1,03E-03 | 0,00E+00 | -5,27E-02 |
| CRU       | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| MFR       | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| MER       | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 |    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  |
| EEE       | [MJ] | 0,00E+00 | 0,00E+00 | 8,55E+00 |    | 0,00E+00 | 1,64E+02 | 0,00E+00 | 0,00E+00  |
| EET       | [MJ] | 0,00E+00 | 0,00E+00 | 2,01E+01 |    | 0,00E+00 | 2,93E+02 | 0,00E+00 | 0,00E+00  |

|         |                                                                                                                                                                                                                                                                         |  |  |  |  |  |  |  |  |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|
| Caption | 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 |  |  |  |  |  |  |  |  |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|

**RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:  
1m³ polyurethane core with auxiliary processes**

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                          | A1-A3    | A4       | A5       | C1 | C2       | C3       | C4       | D         |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----|----------|----------|----------|-----------|
| PM        | [Disease Incidence]                                                                                                                                                                                                                                                                                                                                           | 3,54E-06 | 2,89E-09 | 2,14E-08 |    | 1,45E-09 | 1,55E-07 | 0,00E+00 | -3,87E-07 |
| IRP       | [kBq U235-Eq.]                                                                                                                                                                                                                                                                                                                                                | 4,06E+00 | 1,18E-03 | 1,40E-02 |    | 5,88E-04 | 1,63E-01 | 0,00E+00 | -8,72E+00 |
| ETP-fw    | [CTUe]                                                                                                                                                                                                                                                                                                                                                        | 2,40E+03 | 2,98E+00 | 1,36E+00 |    | 1,49E+00 | 8,45E+00 | 0,00E+00 | -1,46E+02 |
| HTP-c     | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 4,31E-08 | 6,10E-11 | 1,55E-10 |    | 3,05E-11 | 6,51E-10 | 0,00E+00 | -7,33E-09 |
| HTP-nc    | [CTUh]                                                                                                                                                                                                                                                                                                                                                        | 2,05E-06 | 3,25E-09 | 2,12E-08 |    | 1,62E-09 | 2,21E-08 | 0,00E+00 | -2,32E-07 |
| SQP       | [-]                                                                                                                                                                                                                                                                                                                                                           | 2,30E+03 | 1,75E+00 | 1,25E+00 |    | 8,77E-01 | 5,48E+00 | 0,00E+00 | -1,25E+02 |
| Caption   | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |          |          |          |    |          |          |          |           |

**RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2 1m<sup>2</sup> polyurethane sandwich panel: Additional results from installation and deconstruction**

| Core Indicator | Unit                                                                                                                                                                                                                                                                                                                                                                                                               | A5       | C1       |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| GWP-total      | [kg CO <sub>2</sub> -Eq.]                                                                                                                                                                                                                                                                                                                                                                                          | 8,26E-01 | 8,26E-01 |
| GWP-fossil     | [kg CO <sub>2</sub> -Eq.]                                                                                                                                                                                                                                                                                                                                                                                          | 8,15E-01 | 8,15E-01 |
| GWP-biogenic   | [kg CO <sub>2</sub> -Eq.]                                                                                                                                                                                                                                                                                                                                                                                          | 3,21E-03 | 3,21E-03 |
| GWP-luluc      | [kg CO <sub>2</sub> -Eq.]                                                                                                                                                                                                                                                                                                                                                                                          | 7,53E-03 | 7,53E-03 |
| ODP            | [kg CFC11-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                     | 1,06E-13 | 1,06E-13 |
| AP             | [mol H <sup>+</sup> -Eq.]                                                                                                                                                                                                                                                                                                                                                                                          | 4,77E-03 | 4,77E-03 |
| EP-freshwater  | [kg P-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                         | 2,97E-06 | 2,97E-06 |
| EP-marine      | [kg N-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                         | 2,33E-03 | 2,33E-03 |
| EP-terrestrial | [mol N-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                        | 2,58E-02 | 2,58E-02 |
| POCP           | [kg NMVOC-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                     | 6,19E-03 | 6,19E-03 |
| ADPE           | [kg Sb-Eq.]                                                                                                                                                                                                                                                                                                                                                                                                        | 5,36E-08 | 5,36E-08 |
| ADPF           | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                               | 1,11E+01 | 1,11E+01 |
| WDP            | [m <sup>3</sup> world-Eq deprived]                                                                                                                                                                                                                                                                                                                                                                                 | 9,83E-03 | 9,83E-03 |
| Caption        | GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential |          |          |

**RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel: Additional results from installation and deconstruction**

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A5       | C1       |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| PERE      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8,06E-01 | 8,06E-01 |
| PERM      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 |
| PERT      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8,06E-01 | 8,06E-01 |
| PENRE     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,11E+01 | 1,11E+01 |
| PENRM     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 |
| PENRT     | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,11E+01 | 1,11E+01 |
| SM        | [kg]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 |
| RSF       | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 |
| NRSF      | [MJ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,00E+00 | 0,00E+00 |
| FW        | [m <sup>3</sup> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 8,83E-04 | 8,83E-04 |
| Caption   | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of 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 = Use of 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 |          |          |

**RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1m<sup>2</sup> polyurethane sandwich panel: Additional results from installation and deconstruction**

| Indicator | Unit                                                                                                                                                                                                                                                                    | A5       | C1       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| HWD       | [kg]                                                                                                                                                                                                                                                                    | 3,44E-11 | 3,44E-11 |
| NHWD      | [kg]                                                                                                                                                                                                                                                                    | 1,70E-03 | 1,70E-03 |
| RWD       | [kg]                                                                                                                                                                                                                                                                    | 2,08E-05 | 2,08E-05 |
| CRU       | [kg]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 |
| MFR       | [kg]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 |
| MER       | [kg]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 |
| EEE       | [MJ]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 |
| EET       | [MJ]                                                                                                                                                                                                                                                                    | 0,00E+00 | 0,00E+00 |
| Caption   | 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 |          |          |

**RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1m<sup>2</sup> polyurethane sandwich panel: Additional results from installation and deconstruction**

| Indicator | Unit                | A5       | C1       |
|-----------|---------------------|----------|----------|
| PM        | [Disease Incidence] | 9,51E-08 | 9,51E-08 |
| IRP       | [kBq U235-Eq.]      | 3,10E-03 | 3,10E-03 |
| ETP-fw    | [CTUe]              | 7,87E+00 | 7,87E+00 |
| HTP-c     | [CTUh]              | 1,61E-10 | 1,61E-10 |
| HTP-nc    | [CTUh]              | 1,06E-08 | 1,06E-08 |
| SQP       | [-]                 | 4,63E+00 | 4,63E+00 |

|         |                                                                                                                                                                                                                                                                                                                                                               |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Caption | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”.

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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”.

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

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