# Environmental Product Declaration & Life-Cycle Analysis

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# ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

## VitriCel

Green Gravels

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Programme: RTS EPD, www.cer.rts.fi/en/

Programme operator: RTS EPD

EPD registration number: RTS_266_24

Publication date: 16.01.2024

Valid until: 16.01.2029

*An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.*

THE BUILDING INFORMATION FOUNDATION RTS · EPD

# GENERAL INFORMATION

## MANUFACTURER INFORMATION

| | |
|---|---|
| Manufacturer | Green Gravels OÜ |
| Address | Radisti tee 1, Soodevahe, 75322, Harjumaa, Estonia<br>Factory location: Krossi tee 6, Järvakandi, Estonia |
| Contact details | timo@gravels.ee |
| Website | www.gravels.ee |

## PRODUCT IDENTIFICATION

| | |
|---|---|
| Product name | VitriCel |
| Place(s) of production | Järvakandi, Estonia |

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

## EPD INFORMATION

| | |
|---|---|
| EPD program operator | Rakennustietosäätiö RTS |
| EPD standards | This EPD is in accordance with EN 15804+A2 and ISO 14025 standards. |
| Product category rules | The CEN standard EN 15804 serves as the core PCR. |
| EPD author | Christof Uisk |
| EPD verification | Independent verification of this EPD and data, according to ISO 14025:<br>£ Internal certification þ External verification |
| Verification date | 16.11.2023 |
| EPD verifier | Mari Kirss, Rangi Maja OÜ |
| EPD number | RTS_266_24 |
| Publishing date | 16.1.2024 |
| EPD valid until | 16.1.2029 |

Jukka Seppänen
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# PRODUCT INFORMATION

### PRODUCT DESCRIPTION

Foam glass gravel is compression-resistant, lightweight, and thermally insulating which makes it useful in different construction areas.

### PRODUCT APPLICATION

In building construction foam glass gravel is used as a filling and insulating material. It is used for the insulation and drainage in the construction of solid floors.

In infrastructure and landscaping it has the same function: it reduces the pressure on fragile grounds and other constructions. Foam glass gravel can be used as a durable thermal insulation material. It is used as a lightweight and/or insulating filling material in:

- street and road construction or repair
- the embankments of bridges and viaducts
- sports grounds and outdoor constructions
- backfilling of retaining walls and port construction
- outdoor pipe insulation etc.

### PRODUCT STANDARDS

- EVS-EN 13285:2018 – Unbound mixtures - Specifications
- EVS-EN 13055:2018 – Lightweight aggregates

### TECHNICAL SPECIFICATIONS

| Parameter | Value |
|---|---|
| Thermal conductivity, dry material [λD] | 0,097 W/mK |
| Thermal conductivity, wet, drained [λ] | 0,107 W/mK |
| Grain size | 10-63 mm |
| Bulk density | 197±10% kg/m$^3$ |
| Volume change during compaction | 15-25% |

### ADDITIONAL TECHNICAL INFORMATION

Further information can be found at www.gravels.ee

## PRODUCT RAW MATERIAL COMPOSITION

| Product material | Weight, % |
|---|---|
| Waste glass cullet | 96-98% |
| Silicon carbide | 0-2% |
| Kaolin | 0-2% |

| Packaging material | Mass, kg |
|---|---|
| Polypropylene | 1.8 |

## SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

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# PRODUCT LIFE-CYCLE

## MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

Foam glass gravel is packed in 1 $m^3$ big bags. Larger quantities are delivered as bulk material. All big bags are returned to the manufacturer and reused in other deliveries.

## TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

Emissions rising in A4 constitute less than 20% of GWP emissions in A1-A3 and are as such excluded from the model.

Module A5 is not declared.

## PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase as there are no use phase emissions.

Air, soil, and water impacts during the use phase have not been studied.

## PRODUCT END OF LIFE (C1-C4, D)

No changes to the material's physical or chemical composition take place during the use phase and as such, are reusable if dismantled with care. All typical applications are available on subsequent uses of the foam glass in Estonia.

Module C1 represents the demolition/deconstruction process, the fuel consumptions for which are assumed to be negligible.

The end-of-life scenario data originates from Estonia, but the potential to reuse foam glass gravel is globally relevant.

It is assumed that 95% of gravel is collected for re-use and the rest is collected with construction waste.

# MANUFACTURING PROCESS

- **Collection:** glass cullet arrives at the facility, where it is sorted and dried;
- **Crushing:** the mostly dry cullet is directed to a large tumbler, where it is crushed into smaller particles depending on the intended use of the current batch;
- **Mixing:** the appropriate amount of silicon carbide is added to the mix;
- **Foaming:** the mixture is directed to a slowly moving belt, where it is dried in 12 sequential heating chambers, where gasses are released and the material achieves its foam-like structure;
- **Sizing:** as the slabs of foam glass gravel fall off the belt, they break apart into easy to transport chunks, where they are gathered and set aside for transportation.
- **Packing:** an excavator is used to fill up large bed truck or the gravel is packed into big bags.


# LIFE-CYCLE ASSESSMENT

## LIFE-CYCLE ASSESSMENT INFORMATION

| | |
|---|---|
| Period for data | 14.02.2022 - 01.08.2023 |

A period longer than one calendar year was chosen to ensure representative data amidst some stops in the production process in 2022.

## DECLARED AND FUNCTIONAL UNIT

| | |
|---|---|
| Declared unit | 1 $m^3$ |
| Mass per declared unit | 197 kg |

## BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate.

| | |
|---|---|
| Biogenic carbon content in product, kg C | - |
| Biogenic carbon content in packaging, kg C | - |

## SYSTEM BOUNDARY

| Product stage | | | Assembly stage | | Use stage | | | | | | | End of life stage | | | | Beyond the system boundaries | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | D | D |
| x | x | x | MND | MND | MND | MND | MND | MND | MND | MND | MND | x | x | x | x | x | x | x |
| Raw materials | Transport | Manufacturing | Transport | Assembly | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstr./demol. | Transport | Waste processing | Disposal | Reuse | Recovery | Recycling |

Modules not declared = MND. Modules not relevant = MNR.

## CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the EN 15804:2012+A2:2019 and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

## ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation.

In this study, as per EN 15804, allocation is conducted in the following order;

1. Allocation should be avoided.
2. Allocation should be based on physical properties (e.g. mass, volume) when the difference in revenue is small.
3. Allocation should be based on economic values.

No allocation was used in this LCA study.

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# ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. Note: additional environmental impact data may be presented in annexes.

## CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP – total[1)] | kg $CO_2$e | 5,69E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 9,26E-01 | 0E0 | 1,23E-01 | -5.41E+01 |
| GWP – fossil | kg $CO_2$e | 5,68E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 9,25E-01 | 0E0 | 1,22E-01 | -5.40E+01 |
| GWP – biogenic | kg $CO_2$e | 7,19E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,58E-04 | 0E0 | 5,83E-05 | -6.83E-02 |
| GWP – LULUC | kg $CO_2$e | 3,10E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,41E-04 | 0E0 | 2,56E-04 | -2.95E-02 |
| Ozone depletion pot. | kg CFC-$_{11}$e | 1,11E-05 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 2,13E-07 | 0E0 | 3,54E-08 | -1.05E-05 |
| Acidification potential | mol $H^+$e | 2,71E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,92E-03 | 0E0 | 1,09E-03 | -2.57E-01 |
| EP-freshwater | kg Pe | 9,74E-04 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 7,57E-06 | 0E0 | 1,10E-06 | -9.25E-04 |
| EP-marine | kg Ne | 4,11E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,16E-03 | 0E0 | 4,20E-04 | -3.90E-02 |
| EP-terrestrial | mol Ne | 4,48E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,28E-02 | 0E0 | 4,61E-03 | -4.26E-01 |
| POCP ("smog")[2)] | kg NMVOCe | 1,45E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 4,11E-03 | 0E0 | 1,30E-03 | -1.38E-01 |
| ADP-minerals & metals[3)] | kg Sbe | 5,62E-05 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 2,17E-06 | 0E0 | 2,52E-07 | -5.34E-05 |
| ADP-fossil resources | MJ | 9,35E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,39E+01 | 0E0 | 2,40E+00 | -8.88E+02 |
| Water use[4)] | $m^3$e depr. | 6,69E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 6,22E-02 | 0E0 | 8,55E-03 | -6.36E+00 |

*1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.*

## ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Particulate matter | Incidence | 2,13E-06 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,07E-07 | 0E0 | 9,76E-08 | -2.02E-06 |
| Ionizing radiation[5)] | kBq U235e | 7,67E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 6,62E-02 | 0E0 | 1,11E-02 | -7.29E+00 |
| Ecotoxicity (freshwater) | CTUe | 4,98E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,25E+01 | 0E0 | 1,69E+00 | -4.73E+02 |
| Human toxicity, cancer | CTUh | 2,85E-08 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,07E-10 | 0E0 | 5,29E-11 | -2.71E-08 |
| Human tox. non-cancer | CTUh | 2,85E-07 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,24E-08 | 0E0 | 1,27E-09 | -2.71E-07 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SQP[6] | - | 2,18E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,60E+01 | 0E0 | 3,51E+00 | -2.07E+02 |

*EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.*

## USE OF NATURAL RESOURCES

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Renew. PER as energy[7] | MJ | 5,24E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,57E-01 | 0E0 | 0E0 | -4.98E+01 |
| Renew. PER as material | MJ | 0,00E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0,00E+00 | 0E0 | 0E0 | 0.00E+00 |
| Total use of renew. PER | MJ | 5,24E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,57E-01 | 0E0 | 0E0 | -4.98E+01 |
| Non-re. PER as energy | MJ | 6,92E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,39E+01 | 0E0 | 0E0 | -6.57E+02 |
| Non-re. PER as material | MJ | 3,00E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | -1,82E+01 | 0E0 | -2.85E+01 |
| Total use of non-re. PER | MJ | 7,22E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,39E+01 | -1,82E+01 | 0E0 | -6.86E+02 |
| Secondary materials | kg | 1,95E02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,86E-03 | 0E0 | 0E0 | 5.85E0 |
| Renew. secondary fuels | MJ | 1,02E-03 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,89E-05 | 0E0 | 0E0 | -9.69E-04 |
| Non-ren. secondary fuels | MJ | 0,00E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0,00E+00 | 0E0 | 0E0 | 0E0 |
| Use of net fresh water | $m^3$ | 2,14E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,80E-03 | 0E0 | 0E0 | -0.2033 |

*PER = Primary energy resources*

## END OF LIFE – WASTE

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hazardous waste | kg | 1,85E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,84E-02 | 0E0 | 3,17E-03 | -1.76E+00 |
| Non-hazardous waste | kg | 4,27E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,03E-01 | 0E0 | 4,04E-02 | -4.06E+01 |
| Radioactive waste | kg | 5,23E-03 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 9,29E-05 | 0E0 | 1,61E-05 | -4.97E-03 |

## END OF LIFE – OUTPUT FLOWS

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Components for re-use | kg | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | 1,87E+02 | 0E0 | 0E0 |
| Materials for recycling | kg | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | 0E0 | 0E0 | 0E0 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Materials for energy recovery | kg | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | 0E0 | 0E0 | 0E0 |
| Exported electrical energy | MJ | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | 0E0 | 0E0 | 0E0 |
| Exported thermal energy | MJ | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 0E0 | 0E0 | 0E0 | 0E0 |

## KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP – total | kg $CO_2e$ | 1,43E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 4,47E-3 | 0E0 | 6,23E-04 | -1.36E-01 |
| ADP-minerals & metals | kg Sbe | 2,80E-07 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,01E-8 | 0E0 | 1,26E-09 | -2.66E-07 |
| ADP-fossil | MJ | 1,50E+00 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 6,71E-2 | 0E0 | 1,22E-02 | -1.43E+00 |
| Water use | $m^3e$ depr. | 2,33E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3E-4 | 0E0 | 4,34E-05 | -2.21E-02 |
| Secondary materials | kg | 1,95E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,86E-5 | 0E0 | 3,70E-06 | 5.85E0 |
| Biog. C in product[8)] | kg C | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | N/A | N/A | N/A | N/A | 0E0 |
| Biog. C in packaging | kg C | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | N/A | N/A | N/A | N/A | 0E0 |

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# ANNEX 1 : ENVIRONMENTAL IMPACTS – EN15804+A1, CML / ISO 21930

| Impact category | Unit | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Global Warming Pot. | kg $CO_2e$ | 5,61E+01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 9,16E-01 | 5,61E+01 | 0E0 | 5.33E+01 |
| Ozone depletion Pot. | kg $CFC_{-11}e$ | 8,98E-06 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,69E-07 | 8,98E-06 | 0E0 | 8.53E-06 |
| Acidification | kg $SO_2e$ | 2,29E-01 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 3,04E-03 | 2,29E-01 | 0E0 | 2.18E-01 |
| Eutrophication | kg $PO_4^3e$ | 6,45E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 6,93E-04 | 6,45E-02 | 0E0 | 6.13E-02 |
| POCP ("smog") | kg $C_2H_4e$ | 1,03E-02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,19E-04 | 1,03E-02 | 0E0 | 9.79E-03 |
| ADP-elements | kg Sbe | 5,51E-05 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 2,10E-06 | 5,51E-05 | 0E0 | 5.23E-05 |
| ADP-fossil | MJ | 9,33E+02 | MND | MND | MND | MND | MND | MND | MND | MND | MND | 0E0 | 1,39E+01 | 9,33E+02 | 0E0 | 8.86E+02 |

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## SCENARIO DOCUMENTATION

### Manufacturing energy scenario documentation

| Scenario parameter | Value |
|---|---|
| Electricity data source and quality | Ecoinvent 3.8: Market for electricity, medium voltage (Europe, Estonia) |
| Electricity $kgCO_2e$ / kWh | 0.88 |
| Heating data source and quality | Ecoinvent 3.8: Market for heat, district or industrial, natural gas (Europe, Estonia) |
| Industrial heating $kgCO_2e$ / MJ | 0.052 |

### End of life scenario documentation

| Scenario parameter | Value |
|---|---|
| Collection process – kg collected separately | 187.15 |
| Collection process – kg collected with mixed waste | 9.85 |
| Recovery process – kg for re-use | 187.15 |
| Recovery process – kg for recycling | 0 |
| Recovery process – kg for energy recovery | 0 |
| Disposal (total) – kg for final deposition | 9.85 |
| Scenario assumptions e.g. transportation | 50 km |

## BIBLIOGRAPHY


ISO 14025:2010 Environmental labels and declarations – Type III environmental declarations. Principles and procedures.

ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

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

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.

Ecoinvent database v3.8 (2021) and One Click LCA database.

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

## ABOUT THE MANUFACTURER

In Järvakandi, the historic glass capital of Estonia, continues the development of the local class cluster. A foam glass gravel factory was established in the industrial area of Järvakandi. It will make an important contribution to solving the glass waste problems of Estonia.

The foam glass gravel factory will recycle circa 11 000 tons of glass waste annually. Initially the factory will produce 60 000 m3 foam glass gravel per year.

## EPD AUTHOR AND CONTRIBUTORS

| | |
|---|---|
| **Manufacturer** | Green Gravels OÜ |
| **EPD author** | Christof Uisk |
| **EPD verifier** | Mari Kirss, Rangi Maja OÜ |
| **EPD program operator** | RTS EPD |
| **Background data** | This EPD is based on Ecoinvent 3.8 (Allocation, cut-off, EN15804) and One Click LCA databases. |
| **LCA software** | The LCA and EPD have been created using One Click LCA Pre-Verified EPD Generator. |

GRAVELS

# VERIFICATION STATEMENT

## VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with EN 15804, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The background report (project report) for this EPD

Why does verification transparency matter? Read more online.

## VERIFICATION OVERVIEW

Following independent third party has verified this specific EPD:

| EPD verification information | Answer |
|---|---|
| Independent EPD verifier | Mari Kirss |
| EPD verification started on | 12.09.2023 |
| EPD verification completed on | 16.11.2023 |

| Author & tool verification | Answer |
|---|---|
| EPD author | Christof Uisk |
| EPD author training completion | 01.02.2022 |
| EPD Generator module | One Click LCa |
| Software verification date | 17 January 2021 |

## THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of

- the data collected and used in the LCA calculations,
- the way the LCA-based calculations have been carried out,
- the presentation of environmental data in the EPD, and
- other additional environmental information, as present

with respect to the procedural and methodological requirements in ISO 14025:2010 and EN 15804:2012+A2:2019.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

Signed,

Mari Kirss

17-01-2024

# Dansk Celleglas, End-of-Life LCA-beregninger

Udfærdiget af: Asger Dollas og Morten Ryberg og Nana Lin Rasmussen

Nedenfor ses opsummerende resultater for LCA-beregninger omhandlende End-of-Life faserne (C1-C4 og D) for Durapor® 10-60mm. Resultaterne indeholder tal for tre undersøgte scenarier, hvoraf Scenarie 1 vurderes som det mest sandsynlige:

Scenarie 1: 90% genbrug, 10% deponi
Scenarie 2: 100% genbrug
Scenarie 3: 0% genbrug, 100% deponi

Resultaterne er udregnet iht. standarderne:

EN 15804:2012+A2:2019 og EN15804:2012+A1:2013

Dette notat er ikke en EPD, som er 3. parts verificeret og godkendt af accepteret EPD programoperatør. Notatet kan derfor ikke bruges som erstatning eller i stedet for en EPD som dokumentation af miljøpåvirkningerne. Notatet giver en indikation af de klima- og miljøpåvirkninger som sker ifm. bortskaffelse af Durapor® 10-60mm Celleglas. Resultatet i notatet kan kombineres med resultaterne fra Green Gravels OÜ EPD RTS_266_24 for at få et mere omfattende og fyldestgørende billede af den klima- og miljøpåvirkning som potentielt sker ifm. produktion og bortskaffelse af Celleglas.

Resultater iht. EN 15804:2012+A2:2019

| **MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **Scenarie** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-total | [kg $CO_2$ ækv.] | 1: 90% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E-01 | -5,02E+01 |
| | | 2: 100% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 0,00E+00 | -5,58E+01 |
| | | 3: 0% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E+00 | 0,00E+00 |
| Caption | **GWP-total** = Global Warming Potential - total | | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra EPD'en Green Gravels OÜ 10-63 mm EPD: RTS_266_24. EPD'en er beregnet efter EN15804:2012+A2:2019. | | | | | | | |

Resultater iht. EN15804:2012+A1:2013

| **MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **Scenarie** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP | [kg $CO_2$ ækv.] | 1: 90% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E-01 | -4,95E+01 |
| | | 2: 100% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 0,00E+00 | -5,50E+01 |
| | | 3: 0% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E+00 | 0,00E+00 |
| Caption | **GWP** = Global Warming Potential | | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra EPD'en Green Gravels OÜ 10-63 mm EPD: RTS_266_24. EPD'en er beregnet efter EN15804:2012+A2:2019. | | | | | | | |

Yderligere resultater kan findes notatets Afsnit 4.

17-01-2024

Udfærdiget af: Asger Dollas og Morten Ryberg og Nana Lin Rasmussen

# Indhold

# 1 Generelt

## 1.1 REKVIRENT

Dansk Celleglas
Industrivej 1
4200 Slagelse
Danmark

Kontaktperson fra Dansk Celleglas:
Søren Refsgaard, sr@danskcelleglas.dk

## 1.2 LCA UDVIKLER

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## 1.3 DATO

Dette notat er udarbejdet i perioden august-september 2023, med en opdatering af ny input data for A1-A3 i december 2023, grundet opdateret EPD for Green Gravels OÜ. Notatet er derfor en version 2 af det originale notat.

Det originale notat fra september 2023 har gennemgået et kritisk review for at sikre at anvendte metoder og data er valide og robuste (det kritiske review for det oprindelige notat kan findes sidst i dette notat). Opdateringen i december 2023 omhandler kun at der er ny EPD fra Green Gravels OÜ og at Modul A1-A3 samt Modul D derfor har ændret sig ift. det oprindelige notat. Metoden og data for beregning af Modul C har dog ikke ændret sig siden det oprindelige notat. Det kritiske review er dog, principielt, kun gældende for det oprindelige notat. Men da den nye EPD med Modul A1-A3 og Modul D har gennemgået en uvildig 3. partsverificering og metoder og data for Modul C har gennemgået et kritisk review, vurderes fremgangsmåde og resultater i dette notat til at være valide og robuste og dermed retvisende for den miljøpåvirkning der er ifm. produktion og bortskaffelse af celleglas.

## 1.4 DEKLARERET PRODUKT

Denne End-of-Life LCA-beregning dækker celleglasgranulat fra Dansk Celleglas under produktnavnet Durapor® 10-60mm. Durapor® 10-60mm er et letfyldsmateriale bestående af genbrugsglas, som ekspanderes til porøst granulat med høj trykstyrke.

**Figur 1 – Venstre: Durapor® 10-60mm celleglas granulat. Højre: Durapor® anvendelse.**

### 1.5 PRODUKTETS ANVENDELSE

Durapor® 10-60mm finder anvendelse i fundamenter, anlægsarbejde. Granulatet er ligeledes meget anvendeligt ved dræningsopgaver og under permeable belægninger (se f.eks. Figur 1 ovenfor).

End-of-life (EoL)-stadiet for denne LCA-undersøgelse er baseret på det danske marked, da dette er hovedmarkedet for Dansk Celleglas. De modellerede EoL stadier vurderes til også at være repræsentative for andre Nordiske land, som Sverige og Norge.

# 2 Formål

Dette LCA-studie er gennemført med det formål at udarbejde beregninger af Modul C (Bortskaffelse) og Modul D (potentielle gevinster eller belastninger ved genanvendelse eller nyttiggørelse) for Dansk Celleglas på Durapor® 10-60mm i henhold til kravene i den europæiske standard EN15804:2012+A2:2019, samt levere et yderligere sæt resultater iht. den ældre standard EN15804:2012+A1:2013, som fortsat anvendes til dokumentation af klimapåvirkning for byggerier i Danmark.

Målgruppen er kunder og andre parter med interesse for miljøpåvirkningerne af Dansk Celleglas' celleglas. Det interne publikum består af medarbejdere i Dansk Celleglas med interesse for miljøaspekter vedrørende det deklarerede produkt. Information indsamlet gennem denne LCA kan bruges som input til strategiske beslutninger i produktionen. Den eksterne målgruppe er primært business-to-business (B2B), men også business-to-consumer (B2C). Denne analyse understøtter ikke sammenlignende påstande, der er beregnet til at blive offentliggjort.

# 3 Afgrænsning

### 3.1 DEKLARERET/FUNKTIONEL ENHED

Den deklarerede enhed er defineret som 1 $m^3$ Durapor® 10-60 mm (197 $kg/m^3$).

**Tabel 1 – Deklareret enhed**

| Navn | Durapor® 10-60 mm | Enhed |
|---|---|---|
| Deklareret enhed | 1 | $m^3$ |
| Densitet | 197 | $kg/m^3$ |
| Omregningsfaktor til 1 kg | 0,0051 | $m^3/kg$ |

## 3.2 SYSTEMGRÆNSE

Dette studie der dækker livscyklusfaserne C1-C4 og D og følger den modulære fremgangsmåde i EN 15804:2012+A2:2019. Dette er illustreret i Figur 2.

Derudover er resultater for Modulerne A1-A3 vist på baggrund af EPD'en for Green Gravels OÜ 10-63 mm EPD: NEPD-2012-889-EN. Modul D er generelt baseret på undgået produktion af ny Durapor. Den undgåede miljøpåvirkning er baseret på EPD'en for Green Gravels OÜ 10-63 mm EPD: NEPD-2012-889-EN, som er lavet efter EN15804+A2 standarden.

EPD'en for Green Gravels OÜ har også angivet resultaterne for miljøpåvirkningerne iht. EN15804+A1, hvilket har gjort det muligt at differentiere mellem resultaterne for de to standarder.

Resultater for A1-A3 og modul D som er baseret på EPD'en for Green Gravels OÜ 10-63 mm er kun lavet for klimapåvirkning i $CO_2$-eq. Det skal noteres at der er mindre forskelle mellem karakterisering af klimapåvirkning (GWP) mellem EN15804+A2 og EN15804+A1, hvorfor resultaterne for GWP er forskellig for de to standarder.

| **Systemgrænse (X = inkluderet i LCA; MND = "module not declared")** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Produkt | | | Bygge proces | | Brug | | | | | | | Endt levetid | | | | Udenfor system grænse |
| Råmaterialer | Transport | Fremstilling | Transport | Indbygning | Brug | Vedligehold | Reparation | Udskiftning | Renovering | Energiforbrug | Vandforbrug | Nedrivning | Transport | Affaldshåndtering | Bortskaffelse | Genbrug og -anvendelse |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X* |

* Dette modul er baseret på modulerne A1-A3 fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24

**Figur 2 - Systemgrænse i henhold til EN 15804:2012+A2:2019**

### 3.2.1 Udeladelse af livscyklusfaser, processer og data

Dette studie drejer sig udelukkende om modulerne C1-C4 og D, hvorfor modulerne A4-A5 og B1-B7 ikke medtages. A1-A3 er medtaget i resultaterne, da disse moduler har direkte forbindelse til modul D (se Figur 2 ovenfor).

### 3.2.2 Flowdiagram

Figur 3 illustrerer systemafgrænsningen for Scenarie 1, hvor 90% af det bearbejdede Durapor genanvendes 1:1 og 10% køres til deponi. Figur 4 illustrerer systemafgrænsningen for Scenarie 2, hvor 100% af det bearbejdede Durapor genanvendes 1:1. Figur 5 illustrerer systemafgrænsningen for Scenarie 3, hvor 100% af Durapor køres til deponi.

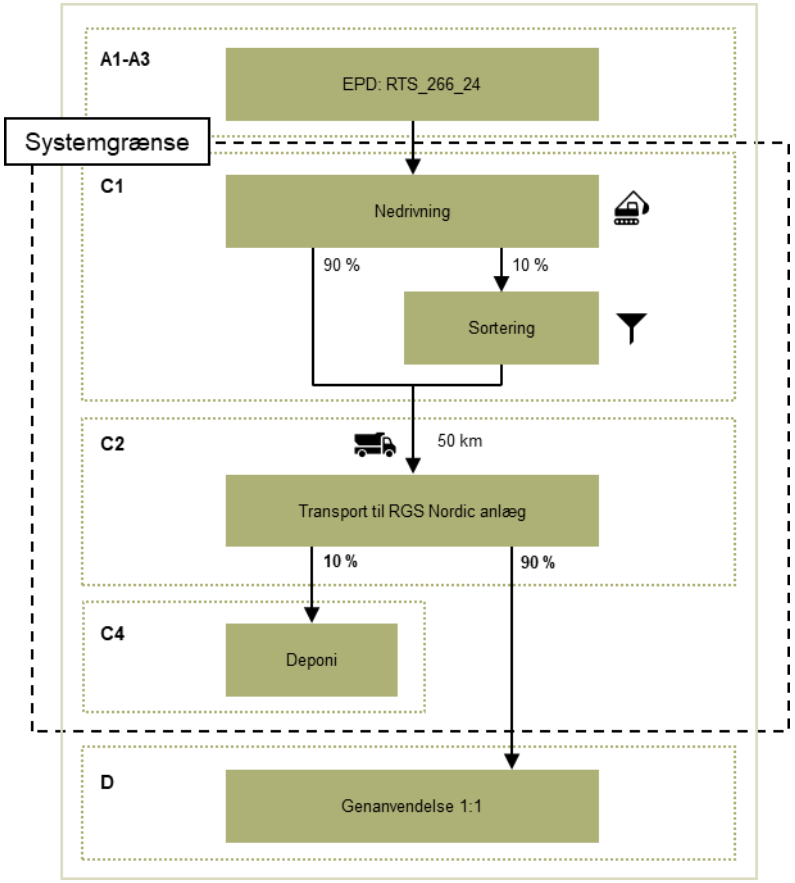
Celleglas har et stort potentiale for genbrug eller genanvendelse, hvilket f.eks. også fremgår af EPD-PCE-20200300-IBB2-EN for FOAMGLAS® som er et lignende produkt, men som reelt har mindre genbrugspotentiale da FOAMGLAS forhandles som "blokke" af celleglas, men Durapor forhandles som granulat. Durapor kan derfor i højere grad genbruges direkte da der ikke er behov for at lave nye "blokke" ud af indsamlet Durapor.

Genindvindingsprocessen af celleglas fra Dansk Celleglas på byggepladser eller vejanlæg er meget enkel, da materialerne er klart adskilt fra de øvrige materialer. Opgravning og læsning af celleglas sker med almindelige gravemaskiner.

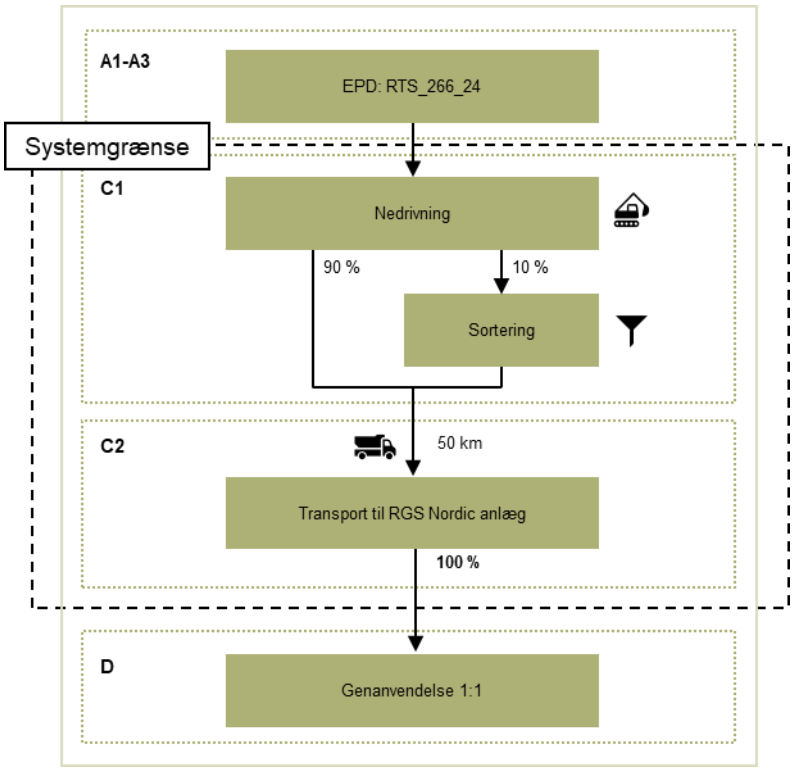
Dansk Celleglas har etableret en returordningsaftale med RGS Nordic. Det betyder at materialer modtages og indsamles på RGS Nordics anlæg i Danmark hvorefter de kan behandles med henblik på genbrug i nye bygge- og anlægsprojekter. Det skønnes at transportafstanden i gennemsnit ikke overstiger 50 km, da RGS Nordic råder over 16 modtagefaciliteter spredt i Danmark.

"Rene" læs af celleglas oplægges i miler for sig selv. Materialer opgravet i randområder der er iblandet jord og evt. andre materialer sorteres på tromlesorterer som f.eks. Doppstadt SM 620 SA. Maskinens sorteringskapacitet svarer til læssemaskinens kapacitet til at føde tromlesortereren, svarende til ca. 75 $m^3$ pr. time.

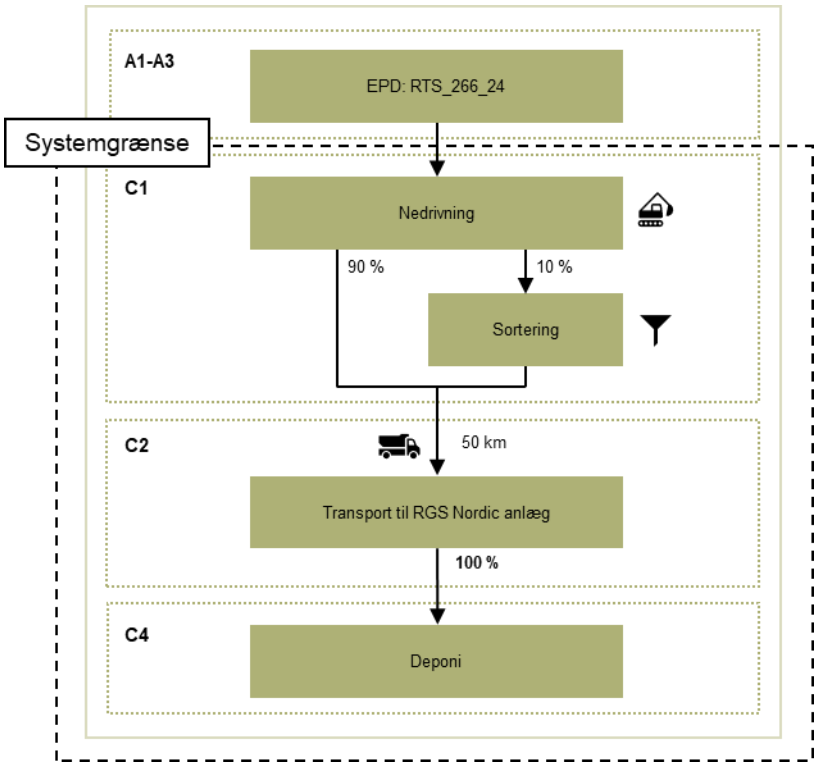
Der er derfor lavet aftaler med affaldsbehandlere som sikre indsamling og håndtering af celleglas med henblik på genbrug af materialet. Scenarie 1 tager højde for at en del af celleglasset måske er forurenet eller at celleglas i randområder ikke i høj nok grad kan separeres fra jord og derfor må deponeres. Principielt kan alt celleglas genbruges direkte, hvilket er dækket af Scenarie 2.




**Figur 3 - Systemgrænse for Scenarie 1: 90% genbrug af Durapor**




**Figur 4 - Systemgrænse for Scenarie 2: 100% genbrug af Durapor**




**Figur 5 - Systemgrænse for Scenarie 3: 0% genbrug af Durapor**

### C1 – Nedrivning

Det antages, at der anvendes en dieseldrevet gravemaskine til at opgrave Durapor. ”Rene” læs Durapor oplægges i miler for sig selv. Durapor, som opgraves i randområder, er iblandet jord og evt. andre materialer og sorteres på en dieseldrevet tromlesorterer, som gennemkører ca. 75 $m^3$ materiale pr. time. Her antages det, at 10% af det opgravede Durapor er fra randområder, som skal igennem tromlesortereren.

### C2 – Transport til affaldsbehandling

Efter opgravning og evt. sortering, køres alt Durapor til et RGS Nordic anlæg, hvor Dansk Celleglas har etableret en returordning. RGS Nordic råder over 16 modtagefaciliteter spredt rundt i Danmark. Det antages derfor at transporten fra opgravning til behandling hos RGS Nordic ikke overstiger 50 km.

### C3 – Affaldshåndtering

Yderligere affaldshåndtering er ikke relevant.

### C4 – Bortskaffelse

I Scenarie 1 køres 10% af Durapor fra RGS Nordic anlæggene til deponi og den resterende andel genbruges og erstatter ny Durapor 1:1. Der regnes med 2% spild under genbrug, som også deponeres.

I Scenarie 2 genbruges 100% af Durapur, som erstatter ny Durapor 1:1. Der regnes med 2% spild under genbrug, som også deponeres.

I Scenarie 3 køres 100% af Durapor fra RGS Nordic anlæggene til deponi.

### D – Genbrug og -anvendelse

Genbrugt Durapor erstatter produktionen af ny Durapor, hvor et spild på 2% medregnes. Der skal altså 1,02 $m^3$ genanvendt Durapor til at erstatte 1 $m^3$ ny Durapor. Den undgåede produktion af ny Durapor indeholder ikke produktionen af glas, da der er tale om 100% genbrugsglas. Den undgåede produktion dækker derfor kun omdannelsen af genbrugsglas til Durapor.

## 3.3 CUT-OFF KRITERIER

### 3.3.1 Ekskluderede processer

Dette End-of-Life studie omfatter kun livscyklusmodulerne C1-C4 og D, hvorfor øvrige moduler ikke er medtaget. Dog er A1-A3 fra EPD fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 illustreret i dette studie, da disse moduler går ind og påvirker modul D (genbrug) direkte.

## 3.4 ANTAGELSER OG FORUDSÆTNINGER

Antagelser og forudsætninger for dette studie er fastlagt på baggrund af korrespondance mellem udførende og kunde samt prædefinerede ”LCA for Experts”-processer.

**Tabel 2 – Antagelser**

| Antagelse | Information |
|---|---|
| Andel af Durapor opgravet fra randområder, som skal sorteres: | 10 % |
| Andel af ovenstående andel, som er jord og andet materiale: | 10 % |
| Anslået densitet for ovenstående jord og andet materiale: | 1500 kg/$m^3$ |

| | |
|---|---|
| Sortering af randområder: | 75 $m^3$ pr. time |
| Transport til distribution: | 50 km |
| Massetab ved 1:1 genbrug: | 2 % |

Der er udført en datakvalitetsvurdering af de benyttede datasæt i LCA'en. Vurderingen er baseret på UN Environmental Global Guidance on LCA database development som angivet i EN15804:2012+A2:2019, Tabel E.1.

# 4 Resultater

## 4.1 LCIA PROCEDURER OG BEREGNINGER

Til beregning af LCIA-resultater er karakteriseringsmodellen angivet ifølge EN 15804:2012+A2:2019. Her er anvendes EF3.1 som er implementeret i LCA for Experts (tidligere GaBi) version 10.7.1.28. Resultaterne for endt levetid er beregnet efter +A2. Herudover er resultaterne også beregnet iht. den tidligere EN15804:2012+A1:2013 standard, hvor LCIA-metoden CML 2001 benyttes. Dette kan lade sig gøre, da Green Gravel OÜ EPD'en (RTS_266_24) også har resultaterne for miljøpåvirkninger herefter.

## 4.2 RESULTATER: SCENARIE 1 (90% GENBRUG)

### 4.2.1 Resultater iht. EN 15804:2012+A2:2019 – Scenarie 1 (90% genbrug)

| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-total | [kg $CO_2$ eq.] | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E-01 | -5,02E+01 |
| GWP-fossil | [kg $CO_2$ eq.] | 5,68E+01 | 1,17E+00 | 2,17E+00 | 0,00E+00 | 2,92E-01 | -5,01E+01 |
| GWP-biogenic | [kg $CO_2$ eq.] | 7,19E-02 | 4,12E-03 | 4,99E-03 | 0,00E+00 | -1,00E-02 | -6,34E-02 |
| GWP-luluc | [kg $CO_2$ eq.] | 3,10E-02 | 1,09E-02 | 2,05E-02 | 0,00E+00 | 9,19E-04 | -2,73E-02 |
| ODP | [kg CFC 11 eq.] | 1,11E-05 | 1,52E-13 | 2,87E-13 | 0,00E+00 | 7,52E-13 | -9,79E-06 |
| AP | [mol H+ eq.] | 2,71E-01 | 6,12E-03 | 3,19E-03 | 0,00E+00 | 2,10E-03 | -2,39E-01 |
| EP-freshwater | [kg P eq.] | 9,74E-04 | 4,28E-06 | 8,07E-06 | 0,00E+00 | 5,96E-07 | -8,59E-04 |
| EP-marine | [kg N eq.] | 4,11E-02 | 2,87E-03 | 1,14E-03 | 0,00E+00 | 5,42E-04 | -3,62E-02 |
| EP-terrestrial | [mol N eq.] | 4,48E-01 | 3,18E-02 | 1,36E-02 | 0,00E+00 | 5,97E-03 | -3,95E-01 |
| POCP | [kg NMVOC eq.] | 1,45E-01 | 8,03E-03 | 2,78E-03 | 0,00E+00 | 1,64E-03 | -1,28E-01 |
| ADPm1 | [kg Sb eq.] | 5,62E-05 | 7,77E-08 | 1,46E-07 | 0,00E+00 | 1,37E-08 | 0,00E+00 |
| ADPf1 | [MJ] | 9,35E+02 | 1,60E+01 | 3,01E+01 | 0,00E+00 | 3,94E+00 | -8,25E+02 |
| WDP1 | [m³] | 6,69E+00 | 1,42E-02 | 2,67E-02 | 0,00E+00 | 3,25E-02 | -5,90E+00 |
| Caption | **GWP**-total = Global Warming Potential - total; **GWP-fossil** = Global Warming Potential - fossil fuels; **GWP-biogenic** = Global Warming Potential - biogenic; **GWP-luluc** = Global Warming Potential - land use and land use change; **ODP** = Ozone Depletion; **AP** = Acidification; **EP-freshwater** = Eutrophication – aquatic freshwater; **EP-marine** = Eutrophication – aquatic marine; **EP-terrestrial** = Eutrophication – terrestrial; **POCP** = Photochemical zone formation; **ADPm** = Abiotic Depletion Potential – minerals and metals; **ADPf** = Abiotic Depletion Potential – fossil fuels; **WDP** = water use | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| SUPPLERENDE MILJØPÅVIRKNINGER FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] |
|---|

| Parameter | Enhed | A1-A3* | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| PM | [Disease incidence] | 2,13E-06 | 6,93E-08 | 2,78E-08 | 0,00E+00 | 2,58E-08 | -1,88E-06 |
| IRP2 | [kBq U235 eq.] | 7,67E+00 | 4,47E-03 | 8,43E-03 | 0,00E+00 | 5,18E-03 | -6,76E+00 |
| ETP-fw1 | [CTUe] | 4,98E+02 | 1,14E+01 | 2,16E+01 | 0,00E+00 | 2,13E+00 | -4,39E+02 |
| HTP-c1 | [CTUh] | 2,85E-08 | 2,32E-10 | 4,37E-10 | 0,00E+00 | 3,31E-10 | -2,51E-08 |
| HTP-nc1 | [CTUh] | 2,85E-07 | 1,03E-08 | 1,95E-08 | 0,00E+00 | 3,49E-08 | -2,51E-07 |
| SQP1 | - | 2,18E+02 | 6,67E+00 | 1,26E+01 | 0,00E+00 | 9,57E-01 | -1,92E+02 |
| Caption | **PM** = Particulate Matter emissions; **IRP** = Ionizing radiation – human health; **ETP-fw** = Eco toxicity – freshwater; **HTP-c** = Human toxicity – cancer effects; **HTP-nc** = Human toxicity – non cancer effects; **SQP** = Soil Quality (dimensionless) | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| RESSOURCEFORBRUG FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| PERE | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 6,42E-01 | -4,62E+01 |
| PERM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 6,42E-01 | -4,62E+01 |
| PENRE | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 3,94E+00 | -6,37E+02 |
| PENRM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 3,94E+00 | -6,37E+02 |
| SM | [kg] | 1,95E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -1,72E+02 |
| RSF | [MJ] | 1,02E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -9,00E-04 |
| NRSF | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | [$m^3$] | 2,14E-04 | 1,27E-03 | 2,40E-03 | 0,00E+00 | 9,95E-04 | -1,89E-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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

Udfærdiget af: Asger Dollas og Morten Ryberg og Nana Lin Rasmussen

| AFFALDSKATEGORIER OG OUTPUTFLOWS FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| HWD | [kg] | 1,85E+00 | 4,96E-11 | 9,35E-11 | 0,00E+00 | 8,59E-11 | -1,63E+00 |
| NHWD | [kg] | 4,27E+01 | 2,44E-03 | 4,60E-03 | 0,00E+00 | 1,97E+01 | -3,77E+01 |
| RWD | [kg] | 5,23E-03 | 3,00E-05 | 5,65E-05 | 0,00E+00 | 4,49E-05 | -4,61E-03 |
| | | | | | | | |
| CRU | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,77E+02 | 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 |
| 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 |
| 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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| BIOGENT CARBON INDHOLD FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | |
|---|---|---|
| **Parameter** | **Enhed** | **Ved fabriksport*** |
| Biogent carbon indhold i produktet | [kg C] | 0 |
| Biogent carbon indhold i medfølgende emballage | [kg C] | 0 |
| Note | 1 kg biogent carbon er ækvivalent til 44/12 kg af CO2 *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | |

### 4.2.2 Resultater iht. EN15804:2012+A1:2013 – Scenarie 1 (90% genbrug)

| MILJØPÅVIRKNING FOR DEKLAREret ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP | [kg $CO_2$-eq.] | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E-01 | -4,95E+01 |
| ODP | [kg CFC11-eq.] | 8,98E-06 | 1,80E-13 | 3,38E-13 | 0,00E+00 | 8,86E-13 | -7,92E-06 |
| AP | [kg $SO_2$-eq.] | 2,29E-01 | 4,25E-03 | 2,28E-03 | 0,00E+00 | 1,67E-03 | -2,02E-01 |
| EP | [kg $PO_4^{3-}$-eq.] | 6,45E-02 | 1,01E-03 | 4,96E-04 | 0,00E+00 | 1,90E-04 | -5,69E-02 |
| POCP | [kg ethene-eq.] | 1,03E-02 | 4,11E-04 | -2,08E-04 | 0,00E+00 | 1,26E-04 | -9,08E-03 |
| ADPE | [kg Sb-eq.] | 5,51E-05 | 7,74E-08 | 1,46E-07 | 0,00E+00 | 1,39E-08 | -4,86E-05 |
| ADPF | [MJ] | 9,33E+02 | 1,57E+01 | 2,96E+01 | 0,00E+00 | 3,78E+00 | -8,23E+02 |
| Caption | **GWP** = Global warming potential; **ODP** = Ozone depletion potential; **AP** = Acidification potential of soil and water; **EP** = Eutrophication potential; **POCP** = Photochemical ozone creation potential; **ADPE** = Abiotic depletion potential for non fossil resources; **ADPF** = Abiotic depletion potential for fossil resources | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

## 4.3 RESULTATER: SCENARIE 2 (100% GENBRUG)

### 4.3.1 Resultater iht. EN 15804:2012+A2:2019 – Scenarie 2 (100% genbrug)

| MILJØPÅVIRKNING FOR DEKLAREret ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-total | [kg $CO_2$ eq.] | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 0,00E+00 | -5,58E+01 |
| GWP-fossil | [kg $CO_2$ eq.] | 5,68E+01 | 1,17E+00 | 2,17E+00 | 0,00E+00 | 0,00E+00 | -5,57E+01 |
| GWP-biogenic | [kg $CO_2$ eq.] | 7,19E-02 | 4,12E-03 | 4,99E-03 | 0,00E+00 | 0,00E+00 | -7,05E-02 |
| GWP-luluc | [kg $CO_2$ eq.] | 3,10E-02 | 1,09E-02 | 2,05E-02 | 0,00E+00 | 0,00E+00 | -3,04E-02 |
| ODP | [kg CFC 11 eq.] | 1,11E-05 | 1,52E-13 | 2,87E-13 | 0,00E+00 | 0,00E+00 | -1,09E-05 |
| AP | [mol H+ eq.] | 2,71E-01 | 6,12E-03 | 3,19E-03 | 0,00E+00 | 0,00E+00 | -2,66E-01 |
| EP-freshwater | [kg P eq.] | 9,74E-04 | 4,28E-06 | 8,07E-06 | 0,00E+00 | 0,00E+00 | -9,54E-04 |
| EP-marine | [kg N eq.] | 4,11E-02 | 2,87E-03 | 1,14E-03 | 0,00E+00 | 0,00E+00 | -4,03E-02 |
| EP-terrestrial | [mol N eq.] | 4,48E-01 | 3,18E-02 | 1,36E-02 | 0,00E+00 | 0,00E+00 | -4,39E-01 |
| POCP | [kg NMVOC eq.] | 1,45E-01 | 8,03E-03 | 2,78E-03 | 0,00E+00 | 0,00E+00 | -1,42E-01 |
| ADPm1 | [kg Sb eq.] | 0,00E+00 | 7,77E-08 | 1,46E-07 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| ADPf1 | [MJ] | 9,35E+02 | 1,60E+01 | 3,01E+01 | 0,00E+00 | 0,00E+00 | -9,16E+02 |
| WDP1 | [$m^3$] | 6,69E+00 | 1,42E-02 | 2,67E-02 | 0,00E+00 | 0,00E+00 | -6,56E+00 |
| Caption | **GWP**-total = Global Warming Potential - total; **GWP-fossil** = Global Warming Potential - fossil fuels; **GWP-biogenic** = Global Warming Potential - biogenic; **GWP-luluc** = Global Warming Potential - land use and land use change; **ODP** = Ozone Depletion; **AP** = Acidification; **EP-freshwater** = Eutrophication – aquatic freshwater; **EP-marine** = Eutrophication – aquatic marine; **EP-terrestrial** = Eutrophication – terrestrial; **POCP** = Photochemical zone formation; **ADPm** = Abiotic Depletion Potential – minerals and metals; **ADPf** = Abiotic Depletion Potential – fossil fuels; **WDP** = water use | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| SUPPLERENDE MILJØPÅVIRKNINGER FOR DEKLAREret ENHED [1 m³ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| PM | [Disease incidence] | 2,13E-06 | 6,93E-08 | 2,78E-08 | 0,00E+00 | 0,00E+00 | -2,09E-06 |
| IRP2 | [kBq U235 eq.] | 7,67E+00 | 4,47E-03 | 8,43E-03 | 0,00E+00 | 0,00E+00 | -7,52E+00 |
| ETP-fw1 | [CTUe] | 4,98E+02 | 1,14E+01 | 2,16E+01 | 0,00E+00 | 0,00E+00 | -4,88E+02 |
| HTP-c1 | [CTUh] | 2,85E-08 | 2,32E-10 | 4,37E-10 | 0,00E+00 | 0,00E+00 | -2,79E-08 |
| HTP-nc1 | [CTUh] | 2,85E-07 | 1,03E-08 | 1,95E-08 | 0,00E+00 | 0,00E+00 | -2,79E-07 |
| SQP1 | - | 2,18E+02 | 6,67E+00 | 1,26E+01 | 0,00E+00 | 0,00E+00 | -2,14E+02 |
| Caption | **PM** = Particulate Matter emissions; **IRP** = Ionizing radiation – human health; **ETP-fw** = Eco toxicity – freshwater; **HTP-c** = Human toxicity – cancer effects; **HTP-nc** = Human toxicity – non cancer effects; **SQP** = Soil Quality (dimensionless) | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| RESSOURCEFORBRUG FOR DEKLAREret ENHED [1 m³ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| PERE | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 0,00E+00 | -5,14E+01 |
| PERM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 0,00E+00 | -5,14E+01 |
| PENRE | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 0,00E+00 | -7,08E+02 |
| PENRM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 0,00E+00 | -7,08E+02 |
| SM | [kg] | 1,95E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -1,91E+02 |
| RSF | [MJ] | 1,02E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -1,00E-03 |
| NRSF | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | [m³] | 2,14E-04 | 1,27E-03 | 2,40E-03 | 0,00E+00 | 0,00E+00 | -2,10E-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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

17-01-2024

Udfærdiget af: Asger Dollas og Morten Ryberg og Nana Lin Rasmussen

| AFFALDSKATEGORIER OG OUTPUTFLOWS FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| HWD | [kg] | 1,85E+00 | 4,96E-11 | 9,35E-11 | 0,00E+00 | 0,00E+00 | -1,81E+00 |
| NHWD | [kg] | 4,27E+01 | 2,44E-03 | 4,60E-03 | 0,00E+00 | 0,00E+00 | -4,18E+01 |
| RWD | [kg] | 5,23E-03 | 3,00E-05 | 5,65E-05 | 0,00E+00 | 0,00E+00 | -5,13E-03 |
| | | | | | | | |
| CRU | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,97E+02 | 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 |
| 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 |
| 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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| BIOGENT CARBON INDHOLD FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | |
|---|---|---|
| **Parameter** | **Enhed** | **Ved fabriksport*** |
| Biogent carbon indhold i produktet | [kg C] | 0 |
| Biogent carbon indhold i medfølgende emballage | [kg C] | 0 |
| Note | 1 kg biogent carbon er ækvivalent til 44/12 kg af CO2 *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | |

### 4.3.2 Resultater iht. EN15804:2012+A1:2013 – Scenarie 2 (100% genbrug)

| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP | [kg $CO_2$-eq.] | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 0,00E+00 | -5,50E+01 |
| ODP | [kg CFC11-eq.] | 8,98E-06 | 1,80E-13 | 3,38E-13 | 0,00E+00 | 0,00E+00 | -8,80E-06 |
| AP | [kg $SO_2$-eq.] | 2,29E-01 | 4,25E-03 | 2,28E-03 | 0,00E+00 | 0,00E+00 | -2,24E-01 |
| EP | [kg $PO_4^{3-}$-eq.] | 6,45E-02 | 1,01E-03 | 4,96E-04 | 0,00E+00 | 0,00E+00 | -6,32E-02 |
| POCP | [kg ethene-eq.] | 1,03E-02 | 4,11E-04 | -2,08E-04 | 0,00E+00 | 0,00E+00 | -1,01E-02 |
| ADPE | [kg Sb-eq.] | 5,51E-05 | 7,74E-08 | 1,46E-07 | 0,00E+00 | 0,00E+00 | -5,40E-05 |
| ADPF | [MJ] | 9,33E+02 | 1,57E+01 | 2,96E+01 | 0,00E+00 | 0,00E+00 | -9,14E+02 |
| Caption | **GWP** = Global warming potential; **ODP** = Ozone depletion potential; **AP** = Acidification potential of soil and water; **EP** = Eutrophication potential; **POCP** = Photochemical ozone creation potential; **ADPE** = Abiotic depletion potential for non fossil resources; **ADPF** = Abiotic depletion potential for fossil resources | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

## 4.4 RESULTATER: SCENARIE 3 (0% GENBRUG)

### 4.4.1 Resultater iht. EN 15804:2012+A2:2019 – Scenarie 3 (0% genbrug)

Udfærdiget af: Asger Dollas og Morten Ryberg og Nana Lin Rasmussen

| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-total | [kg $CO_2$ eq.] | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E+00 | 0,00E+00 |
| GWP-fossil | [kg $CO_2$ eq.] | 5,68E+01 | 1,17E+00 | 2,17E+00 | 0,00E+00 | 2,92E+00 | 0,00E+00 |
| GWP-biogenic | [kg $CO_2$ eq.] | 7,19E-02 | 4,12E-03 | 4,99E-03 | 0,00E+00 | -1,00E-01 | 0,00E+00 |
| GWP-luluc | [kg $CO_2$ eq.] | 3,10E-02 | 1,09E-02 | 2,05E-02 | 0,00E+00 | 9,19E-03 | 0,00E+00 |
| ODP | [kg CFC 11 eq.] | 1,11E-05 | 1,52E-13 | 2,87E-13 | 0,00E+00 | 7,52E-12 | 0,00E+00 |
| AP | [mol H+ eq.] | 2,71E-01 | 6,12E-03 | 3,19E-03 | 0,00E+00 | 2,10E-02 | 0,00E+00 |
| EP-freshwater | [kg P eq.] | 9,74E-04 | 4,28E-06 | 8,07E-06 | 0,00E+00 | 5,96E-06 | 0,00E+00 |
| EP-marine | [kg N eq.] | 4,11E-02 | 2,87E-03 | 1,14E-03 | 0,00E+00 | 5,42E-03 | 0,00E+00 |
| EP-terrestrial | [mol N eq.] | 4,48E-01 | 3,18E-02 | 1,36E-02 | 0,00E+00 | 5,97E-02 | 0,00E+00 |
| POCP | [kg NMVOC eq.] | 1,45E-01 | 8,03E-03 | 2,78E-03 | 0,00E+00 | 1,64E-02 | 0,00E+00 |
| ADPm1 | [kg Sb eq.] | 0,00E+00 | 7,77E-08 | 1,46E-07 | 0,00E+00 | 1,37E-07 | 0,00E+00 |
| ADPf1 | [MJ] | 9,35E+02 | 1,60E+01 | 3,01E+01 | 0,00E+00 | 3,94E+01 | 0,00E+00 |
| WDP1 | [$m^3$] | 6,69E+00 | 1,42E-02 | 2,67E-02 | 0,00E+00 | 3,25E-01 | 0,00E+00 |
| Caption | **GWP**-total = Global Warming Potential - total; **GWP-fossil** = Global Warming Potential - fossil fuels; **GWP-biogenic** = Global Warming Potential - biogenic; **GWP-luluc** = Global Warming Potential - land use and land use change; **ODP** = Ozone Depletion; **AP** = Acidification; **EP-freshwater** = Eutrophication – aquatic freshwater; **EP-marine** = Eutrophication – aquatic marine; **EP-terrestrial** = Eutrophication – terrestrial; **POCP** = Photochemical zone formation; **ADPm** = Abiotic Depletion Potential – minerals and metals; **ADPf** = Abiotic Depletion Potential – fossil fuels; **WDP** = water use | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| SUPPLERENDE MILJØPÅVIRKNINGER FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| PM | [Disease incidence] | 2,13E-06 | 6,93E-08 | 2,78E-08 | 0,00E+00 | 2,58E-07 | 0,00E+00 |
| IRP2 | [kBq U235 eq.] | 7,67E+00 | 4,47E-03 | 8,43E-03 | 0,00E+00 | 5,18E-02 | 0,00E+00 |
| ETP-fw1 | [CTUe] | 4,98E+02 | 1,14E+01 | 2,16E+01 | 0,00E+00 | 2,13E+01 | 0,00E+00 |
| HTP-c1 | [CTUh] | 2,85E-08 | 2,32E-10 | 4,37E-10 | 0,00E+00 | 3,31E-09 | 0,00E+00 |
| HTP-nc1 | [CTUh] | 2,85E-07 | 1,03E-08 | 1,95E-08 | 0,00E+00 | 3,49E-07 | 0,00E+00 |
| SQP1 | - | 2,18E+02 | 6,67E+00 | 1,26E+01 | 0,00E+00 | 9,57E+00 | 0,00E+00 |
| Caption | **PM** = Particulate Matter emissions; **IRP** = Ionizing radiation – human health; **ETP-fw** = Eco toxicity – freshwater; **HTP-c** = Human toxicity – cancer effects; **HTP-nc** = Human toxicity – non cancer effects; **SQP** = Soil Quality (dimensionless) | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| RESSOURCEFORBRUG FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| PERE | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 6,42E+00 | 0,00E+00 |
| PERM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | [MJ] | 5,24E+01 | 1,16E+00 | 2,19E+00 | 0,00E+00 | 6,42E+00 | 0,00E+00 |
| PENRE | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 3,94E+01 | 0,00E+00 |
| PENRM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | [MJ] | 7,22E+02 | 1,60E+01 | 3,02E+01 | 0,00E+00 | 3,94E+01 | 0,00E+00 |
| SM | [kg] | 1,95E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | [MJ] | 1,02E-03 | 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 | [m³] | 2,14E-04 | 1,27E-03 | 2,40E-03 | 0,00E+00 | 9,95E-03 | 0,00E+00 |
| 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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| AFFALDSKATEGORIER OG OUTPUTFLOWS FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| HWD | [kg] | 1,85E+00 | 4,96E-11 | 9,35E-11 | 0,00E+00 | 8,59E-10 | 0,00E+00 |
| NHWD | [kg] | 4,27E+01 | 2,44E-03 | 4,60E-03 | 0,00E+00 | 1,97E+02 | 0,00E+00 |
| RWD | [kg] | 5,23E-03 | 3,00E-05 | 5,65E-05 | 0,00E+00 | 4,49E-04 | 0,00E+00 |
| | | | | | | | |
| CRU | [kg] | 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 |
| 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 |
| 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 | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

| BIOGENT CARBON INDHOLD FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | |
|---|---|---|
| **Parameter** | **Enhed** | **Ved fabriksport*** |
| Biogent carbon indhold i produktet | [kg C] | 0 |
| Biogent carbon indhold i medfølgende emballage | [kg C] | 0 |
| Note | 1 kg biogent carbon er ækvivalent til 44/12 kg af CO2 *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | |

### 4.4.2 Resultater iht. EN15804:2012+A1:2013 – Scenarie 3 (0% genbrug)

| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP | [kg $CO_2$-eq.] | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E+00 | 0,00E+00 |
| ODP | [kg CFC11-eq.] | 8,98E-06 | 1,80E-13 | 3,38E-13 | 0,00E+00 | 8,86E-12 | 0,00E+00 |
| AP | [kg $SO_2$-eq.] | 2,29E-01 | 4,25E-03 | 2,28E-03 | 0,00E+00 | 1,67E-02 | 0,00E+00 |
| EP | [kg $PO_4^{3-}$-eq.] | 6,45E-02 | 1,01E-03 | 4,96E-04 | 0,00E+00 | 1,90E-03 | 0,00E+00 |
| POCP | [kg ethene-eq.] | 1,03E-02 | 4,11E-04 | -2,08E-04 | 0,00E+00 | 1,26E-03 | 0,00E+00 |
| ADPE | [kg Sb-eq.] | 5,51E-05 | 7,74E-08 | 1,46E-07 | 0,00E+00 | 1,39E-07 | 0,00E+00 |
| ADPF | [MJ] | 9,33E+02 | 1,57E+01 | 2,96E+01 | 0,00E+00 | 3,78E+01 | 0,00E+00 |
| Caption | **GWP** = Global warming potential; **ODP** = Ozone depletion potential; **AP** = Acidification potential of soil and water; **EP** = Eutrophication potential; **POCP** = Photochemical ozone creation potential; **ADPE** = Abiotic depletion potential for non fossil resources; **ADPF** = Abiotic depletion potential for fossil resources | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | |

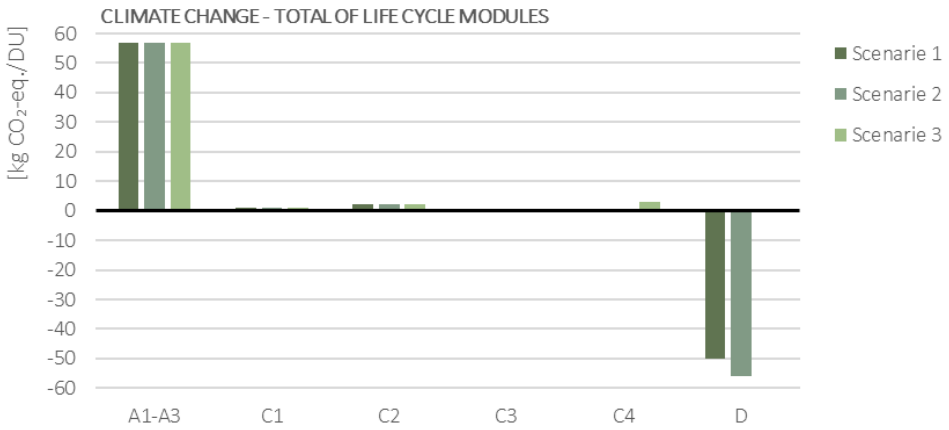
## 4.5 RESULTATER: OPSUMMERING

### 4.5.1 Resultater iht. EN 15804:2012+A2:2019 for alle scenarier

En vurdering af de tre bortskaffelsesscenarier viste at Scenarie 3 med 100% deponi har ca. 67% højere påvirkning for global opvarmning for Modul C1-C4 set ift. Scenarie 1 med 90% genbrug og 10% deponi. Der er altså en betydelig fordel i at kunne genbruge celleglas, fremfor opgravning og deponering. Det understreges des mere af at genbrug kan erstattet nyproduktion af celleglas (vist som Modul D) fra indsamlet genbrugsglas og de afledte miljøpåvirkninger. Hvis vi ser over hele livscyklus (Modul A1-A3 og C1-C4) så er forskellen kun 6%, hvilket skyldes at størstedelen af klimapåvirkninger sker i Modul A1-A3 under produktion af celleglas. Se Figur 6 for grafisk sammenligning af scenarierne.

| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 $m^3$ Durapor® 10-60mm] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **Scenarie** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP-total | [kg $CO_2$ ækv.] | 1: 90% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E-01 | -5,02E+01 |
| | | 2: 100% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 0,00E+00 | -5,58E+01 |
| | | 3: 0% genbrug | 5,69E+01 | 1,19E+00 | 2,20E+00 | 0,00E+00 | 2,83E+00 | 0,00E+00 |
| Caption | **GWP-total** = Global Warming Potential - total | | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | | |

Figur 6 viser resultaterne for GWP-total for alle scenarier. Forskellene mellem de tre scenarier sker i modulerne C4 og D, da de øvrige moduler er ens indtil da (se evt. afsnit 3.2.23.2.2 Flowdiagram). Overordnet set er der kun gevinster forbundet med genbrug af Durapor® 10-60mm, da modul C4 reduceres og modul D øges (negativt).



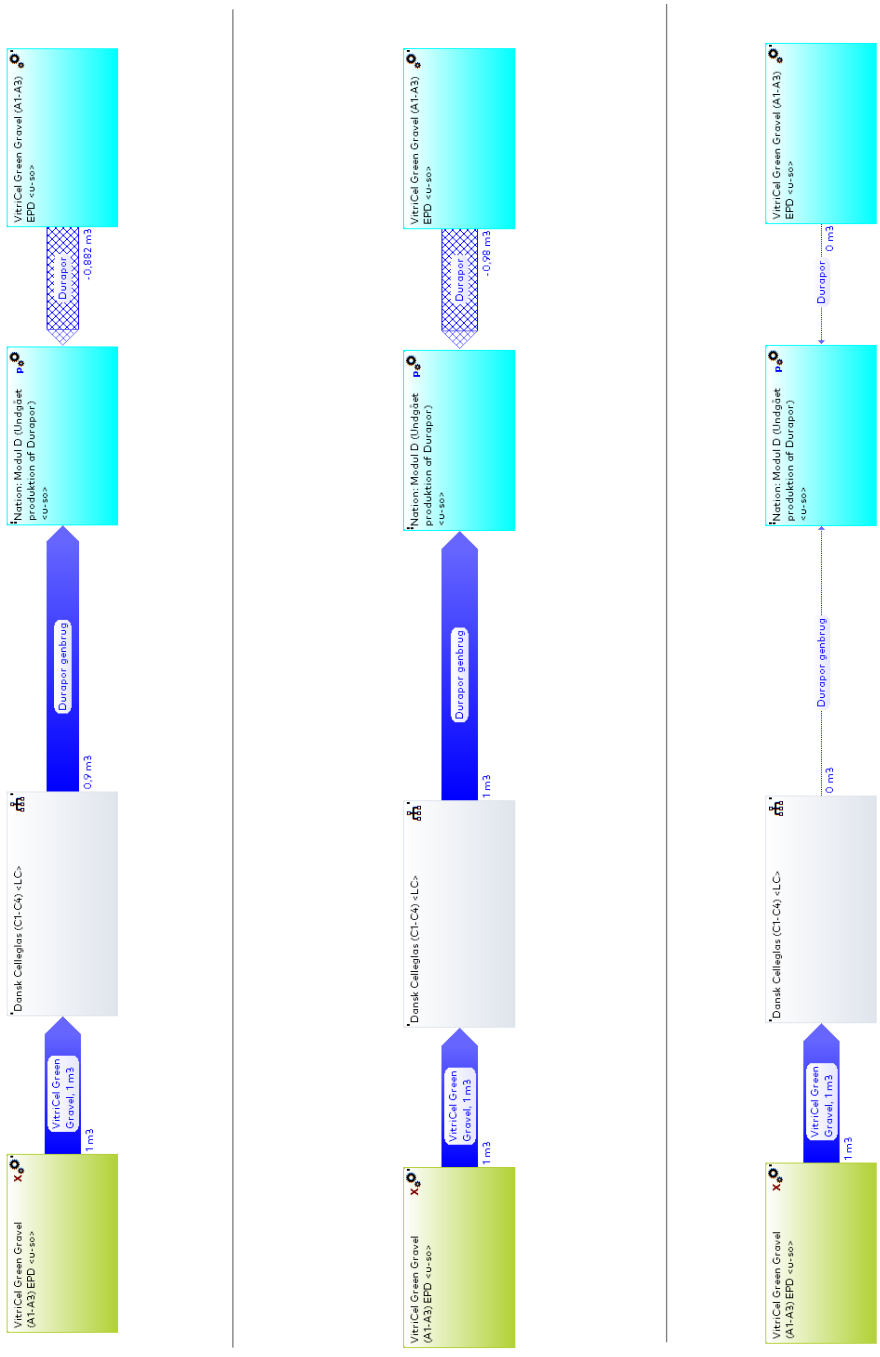

**Figur 6 – GWP-total iht EN 15804:2012+A2:2019 for alle scenarier**

### 4.5.2 Resultater iht. EN15804:2012+A1:2013 for alle scenarier

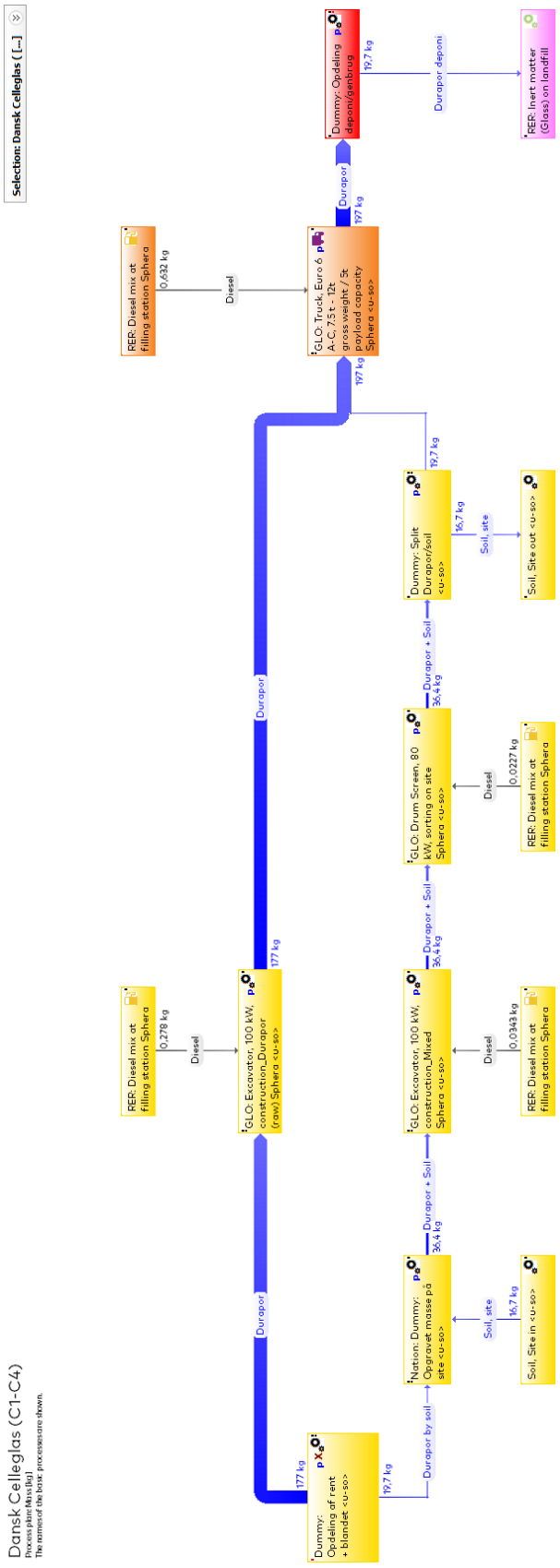
| MILJØPÅVIRKNING FOR DEKLARERET ENHED [1 m³ Durapor® 10-60mm] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Enhed** | **Scenarie** | **A1-A3*** | **C1** | **C2** | **C3** | **C4** | **D** |
| GWP | [kg $CO_2$ ækv.] | 1: 90% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E-01 | -4,95E+01 |
| | | 2: 100% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 0,00E+00 | -5,50E+01 |
| | | 3: 0% genbrug | 5,61E+01 | 1,17E+00 | 2,16E+00 | 0,00E+00 | 2,80E+00 | 0,00E+00 |
| Caption | **GWP** = Global Warming Potential | | | | | | | |
| Disclaimer | *Disse moduler er dækket af modulerne fra Green Gravels OÜ 10-63 mm EPD: RTS_266_24 | | | | | | | |

# 5 Dokumentation

## 5.1 DOKUMENTATION AF LCA-MODEL I LCA-SOFTWARE




**Figur 7 – Plan for End-of-Life, modul-opdelt, (venstre: Scenarie 1, midt: Scenarie 2, højre: Scenarie 3)**




**Figur 8 – Plan for Modulere C1-C4, (Scenarie 1)**


**Figur 9 – Indtastning af NEPD-2012-889-EN (A1-A3)**

# 6 Datakvalitet

Datakvalitetsvurderingen er baseret på UN Environmental Global Guidance on LCA database development som angivet i EN15804:2012+A2:2019, Tabel E.1

| Dansk Celleglas, Durapor | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Material** | **Geography** | **Process name** | **Link** | **Database** | **Geography** | **Ref. Year** | **Geographical** | **Technological** | **Time** |
| **C1 Nedrivning** | | | | | | | | | |
| Nedrivning | DK | Excavator, 100 kW, construction | https://sphera.com/2023/xml-data/processes/9e6d3b0e-cb47-4df3-969b-f23a75a0ae42.xml | Professional Database 2023 | GLO | 2022 | G | G | VG |
| Diesel til nedrivning | DK | Diesel mix at filling station | https://sphera.com/2023/xml-data/processes/99248ee9-3a59-47e4-b1f1-bb79067249ba.xml | Professional Database 2023 | RER | 2019 | G | VG | G |
| Sortering | DK | Excavator, 100 kW, construction* **Adjusted to match a Drum Screen sorting machine* | https://sphera.com/2023/xml-data/processes/9e6d3b0e-cb47-4df3-969b-f23a75a0ae42.xml | Professional Database 2023 | GLO | 2022 | G | G | VG |
| Diesel til sortering | DK | Diesel mix at filling station | https://sphera.com/2023/xml-data/processes/99248ee9-3a59-47e4-b1f1-bb79067249ba.xml | Professional Database 2023 | RER | 2019 | G | VG | G |
| **C2 Transport til affaldsbehandling** | | | | | | | | | |
| Lastbiltransport i DK | DK | Truck, Euro 6 A-C, 7.5 t - 12t gross weight / 5t payload capacity | https://sphera.com/2023/xml-data/processes/427d098c-5e8e-4783-84f9-55ddebb5e1cb.xml | Professional Database 2023 | GLO | 2022 | G | VG | VG |
| Diesel til lastbiltransport | DK | Diesel mix at filling station | https://sphera.com/2023/xml-data/processes/99248ee9-3a59-47e4-b1f1-bb79067249ba.xml | Professional Database 2023 | RER | 2019 | G | VG | G |
| **C3 Affaldshåndtering** | | | | | | | | | |
| **C4 Bortskaffelse** | | | | | | | | | |
| Deponi af Durapor | DK | Inert matter (Glass) on landfill | https://sphera.com/2023/xml-data/processes/ed41d893-edcd-4b2a-b5e4-e1a992a8a04a.xml | Professional Database 2023 | RER | 2022 | G | G | VG |
| **D Potentiale for genanvendelse** | | | | | | | | | |
| Undgået produktion af Durapor | EE | RTS_266_24. Production of Foam glass gravel, Grain size 10-63 mm (A1-A3) | | RTS EPD | EE | 2022/ 2023 | VG | VG | VG |

Det originale notat fra september 2023 har gennemgået et kritisk review for at sikre at anvendte metoder og data er valide og robuste (det kritiske review for det oprindelige notat kan findes sidst i dette notat). Opdateringen i december 2023 omhandler kun at der er ny EPD fra Green Gravels OÜ og at Modul A1-A3 samt Modul D derfor har ændret sig ift. det oprindelige notat. Metoden og data for beregning af Modul C har dog ikke ændret sig siden det oprindelige notat. Det kritiske review er dog, principielt, kun gældende for det oprindelige notat. Men da den nye EPD med Modul A1-A3 og Modul D har gennemgået en uvildig 3. partsverificering og metoder og data for Modul C har gennemgået et kritisk review, vurderes fremgangsmåde og resultater i dette notat til at være valide og robuste og dermed retvisende for den miljøpåvirkning der er ifm. produktion og bortskaffelse af celleglas.

# 7 Review statement

The study has been reviewed for overall compliance with EN15804+A2 with the limitation of not being an EPD, but background information related to EPDs. The review was performed by David Althoff Palm, Dalemarken AB. The reviewer is independent to the study, the LCA-practitioner and the commissioner of the study and is an approved verifier of EPDs in EPD Danmark, EPD Norge and the International EPD System.

The review consisted of checks against EN15804+A2 and general LCA-methodology. The review dialogue is documented in the following section. As the study is not an EPD, only checks considered relevant have been made.

The overall study is well in line with the goal and scope and the intended audience. All comments given have been addressed in a structured way with added explanation and corrections. Results are somewhat limited in that the referenced EPD is based on EN15804+A1 but this is managed in a clear a structured way.

A key discussion within the review was whether the take-back system is proven and operational and it may be that further evidence would be required for this to be the main scenario in an EPD. However, from an overall perspective it is not unreasonable that the take-back will work in practice with a high recovery rate. This together with the inclusion of a worst-case scenario, gives a clear scenario in either case allowing a user of the study to choose a scenario to fit their situation.

To be used in an EPD following EN15804+A2, the study would need to be expanded to include all mandatory impact indicators and any additional rules specified in the General Programme Instructions and PCRs relevant in the chosen EPD-system. The study is clear, short and given its limitations overall consistent with the EN15804+A2 methodology for modules C and D.

# 8 Overview and reply to reviewer comments

| Section | Reviewer comment | Reply to reviewer | Final reviewer comment | Reply to reviewer |
|---|---|---|---|---|
| Section 1 | Who is the target group of the document? And is the market Denmark only? Relates to scenario relevance and data used. 6.3.9, 8.2 | Information about target group has been added in Section 2. Information about the representative market is added in Section 1.5 | OK | |
| Section 3.2 | Cut off and description of modules are OK, but System boundary does not really including A1-A3, only as a basis for the included modules given your statement under 2 Formål. Under system boundaries this is not as clear. I think it would be beneficial to remove the X from A1-A3 and instead further emphasize that module D builds on an existing +A1 EPD. | We have clarified that the main focus of the study is on the EoL impacts (Module C and Module D). We have clarified that impacts related to Module A1-A3, and also used for modeling the potential benefits (Module D) comes from a related EPD that covers these modules, but which is based on 15804+A1. | Now clearly described. Possibly system boundary figures could put A1-A3 outside the system boundary. | We agree with this point and have revised the figures to show that the A1-A3 is outside the scope of this LCA. |
| Section 3.2.2 | Most important comment: Is there documentation for the stated recovery levels of 90% of 100%? 6.3.9 requires scenarios to be representative for one of the most probable alternatives and that it is practical. Is the return operational already with some proven recovery rates? | To address this point, we have elaborated on the description of the measures that Dansk Celleglas have taken to create a system for recycling that will work in practice and, thus, not only in theory. Moreover, we have added a third scenario where 100% of the Celleglas is being landfilled, which can be considered the most conservative. However, through agreements with companies that handle construction waste, it is more likely that the majority of the waste will be collected and re-used as celleglas in new projects. Thus, we have indicated Scenario 1 as the most likely scenario. | As discussed also separately, there is a clear and in principle operational reverse supply chain to accommodate collection and recycling of the product at end of life. With the use of the product being fairly new and with a typically long lifespan, proof of actually returned product for recycling is missing. This means that for an EPD, the main scenario might not be approved without showing a first return of product. However, from an overall perspective it is not unreasonable that the take-back will work in practice with a high recovery rate. This together with the inclusion of a worst case scenario, gives a clear scenario in either case allowing a user of the study to choose a scenario to fit their situation. | |
| Section 3.2.2 - D | It may be of importance to note that since the product in A1-A3 is 100% recycled content (SM) it typically is not allowed to be credited in module D. However since it replaces “itself” based on similarly 100% recycled content it seems reasonable to credit as it has been done here. 6.4.3.3 gives some guidance, but the standard is not entirely clear here. | We agree, the avoided production is the impacts from avoided production of Celleglas, but this does not include avoided production of the glass feedstock | OK | |
| Section 4 | Data quality assessment and documentation is not included for the | We have added an assessment of the data quality of the processes used in the LCA. This | From the EN15804 perspective, please also specify which of the two DQA-methods | The data quality level and criteria of the UN |

| | | | | |
|---|---|---|---|---|
| | database processes used to model module C, which decreases the reliability of the results. Annex E, 6.3.8 incl. subsections | has been added as Section 6 | that is used (EN15804+A2 Annex E) | Environmental Global Guidance on LCA database development was used (EN15804+A2, Table E.1) |
| Section 4.1 | Following 8.2 you should probably include a more detailed reference to characterization as EN15804 refers to EN15804 versions of EF3.1 but most EPD-systems still allow for EN15804 versions of EF3.0 since many tools have not yet updated. These differ a bit for GWP. | We have added this information in Section 4.1 | OK | |
| Section 4.1 | Note that GWPtot does not completely align with GWP in +A1, both for characterization differences and methodological consequences. Only presenting GWPtot is of course also a deviation to the standard (6.5, 7.2.3-7.2.5) | Agree. We have noted that there are differences in characterization between GWP and GWP-tot in the two standards.<br><br>This comparison was done to facilitate the comparison and knowing the issues with this. This would not be done in a full EPD which would be fully based on 15804+A2 | OK | |
| Section 4.2.2 | MFR should not be zero for C-modules as 90-100% (minus 2%) goes to recycling. | Agree, we have added results for this. The results are added to the indicator CRU (Components for re-use) added in C3 as the material is going for Re-use. Thus, we have used CRU instead of MFR. | Fair approach. | |
| Section 4.5.2 | All scenarios | Text in the table has been corrected from “begge” to “alle” scenarier | | |