# Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

## *Multiple glued LVL G*

by

***Stora Enso***

| | |
|---|---|
| Programme: | The International EPD® System, www.environdec.com |
| Programme operator: | EPD International AB |
| EPD registration number: | S-P-01731 |
| ECO Platform registration number: | 00001036 |
| Publication date: | 2019-11-12 |
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# Company information

Owner of the EPD:
Stora Enso
Division Wood Products
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www.storaenso.com

Description of the organisation: Stora Enso is a leading provider of renewable solutions in packaging, biomaterials, wood and paper to global markets. Our customers include the packaging, joinery and construction industries as well as publishers, printing houses and paper merchants. Our aim is to replace non-renewable materials by innovating and developing new products and services based on wood and other renewable materials. Our focus is on fibre-based packaging, plantation-based pulp, innovations in biomaterials, and sustainable building solutions.

Stora Enso's Wood Products division is a market-leading provider of innovative wood-based products for construction and interior usages. Our product range covers all areas of urban construction including massive wood elements, wood components, engineered wood products and pellets. All our mills run an integrated management system, which is certified in accordance with Chain of Custody (FSC® and/or PEFC™), quality management (ISO 9001), environmental management (ISO 14001), health and safety (ISO 45001), and energy management (ISO 50001) requirements.

Name and location of production site: Stora Enso Wood Products Oy Ltd, Varkaus, Finland

# Product information

Product name: LVL G by Stora Enso
Product identification: Produced and monitored according to the harmonised standard EN 14374 in Finland
Product description: LVL G by Stora Enso are used for beam elements, column elements or wall applications in buildings. They are multiple glued elements made of structural LVL (Laminated veneer lumber). LVL by Stora Enso, is an advanced wood product developed for the demands of today's building and construction industry. Being one of the strongest wood-based construction materials relative to its weight, LVL is powering a new wave of agile, renewable construction. LVL utilises the natural power of tough Nordic spruce fibres. LVL by Stora Enso is made from 3 mm thick, rotary-peeled veneers that are bonded together under heat and pressure.
Geographical origin: Finland

Use applications:



## Technical information

| Properties | Definition |
|---|---|
| Use | Structural applications; studs, post-and-beam frames, wall, floor and roof panels |
| Maximum width | 3200 mm |
| Maximum thickness | 350 mm |
| Maximum length | 19,9 m |
| Wood species | Spruce (Picea abies) |
| Adhesives | LVL is consisting of multiple layers of veneers that are bonded together with brown phenolic resin. Top face veneer scarf joints are bonded with clear melamine-formaldehyde resin. Multiple (or re-) gluing of calibrated LVL billets to master panels elements with PUR glue. LVL meets the formaldehyde emission class E1 according to standard EN 717-1. |
| Moisture content | 8–10% when dispatched from the mill |
| Density | Mean density 510 kg/m$^3$ |
| Thermal conductivity | λ = 0,13 W/(mK) |
| Specific heat capacity | c = 1800 J/(kg-K) |
| Service class | Service classes 1 and 2 |
| Reaction to fire | D-s1, d0 (EN 13501-1) |

## Product composition

| Materials / chemical substances | kg | % | Notes |
|---|---|---|---|
| **LVL** | | | |
| Wood (picea abies) | 478,3 | 93,5 | Water content 8–10% |
| Phenolic resin | 27,3 | 5,3 | Veneer layers gluing |
| Hardener | 4,4 | 0,9 | Veneer layer gluing |
| Melamine-formaldehyde resin | | < 0,1 | Top veneer layer gluing |
| **Multiple gluing** | | | |
| PUR glue | 1,6 | 0,3 | Multi-layer gluing |

The product does not contain any substances or products that are listed in the “Candidate List of Substances of Very High Concern for Authorisation”.

# LCA information

Declared unit: 1 m³ of LVL with a moisture content of 9%

Reference Service Life (RSL): The RSL is understood as the period of time until the multiple glued LVL is replaced, rebuild, renovated or restored. If properly installed, the service lifetime of the LVL G is equal to the lifetime of the building, and thus 50 years is the default reference service life. Wood products can reach over 100 years' service life in service classes 1 and 2.

Time representativeness: Data for the study was collected from Varkaus LVL mill and represents the year 2018. This data includes raw material, transport distances, fuels, energy consumption, packaging, produced LVL, by-products and waste. Data from ecoinvent 3.5 has been used for generic data. The allocation is performed according to EN15804. Physical, economic and energy allocations have been used.

Database used: Ecoinvent 3.5 (August 2018)

LCA software used: SimaPro 9.0

Description of system boundaries: cradle-to-gate with options

More information: Standards EN 15804 and EN 16485 provide the core product category rules for the assessment. Standard EN 15942 provides the communication format for EPD. Biogenic carbon content of wood is calculated in line with EN 16449 standard.

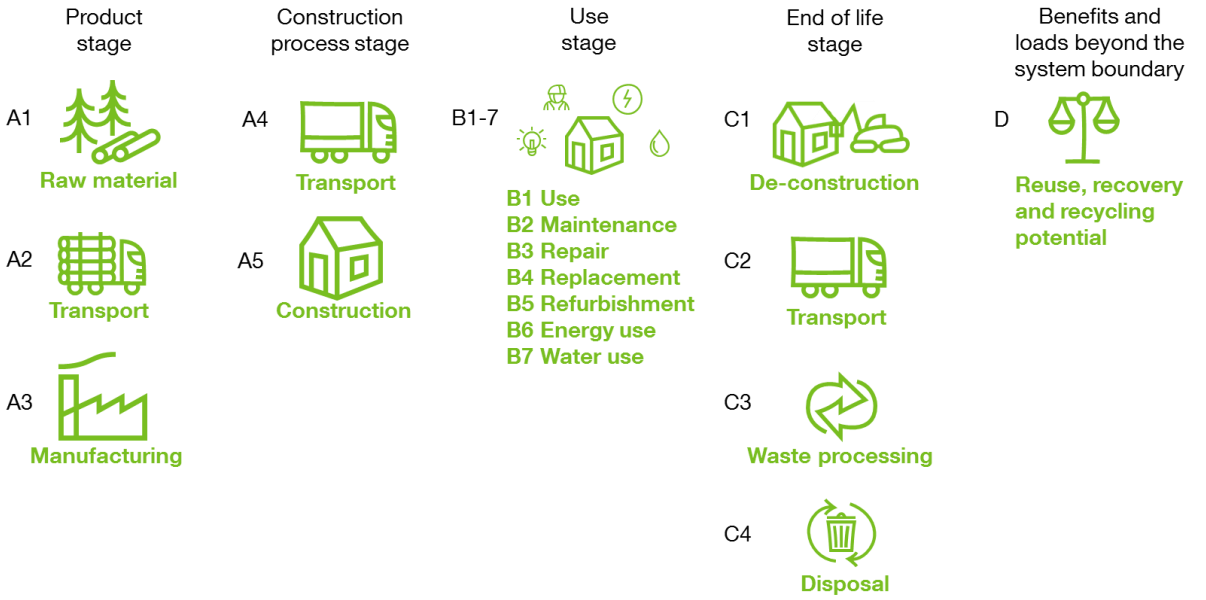
Target group: business to business & business to consumers

Cut-Off Rule: 1%. This rule is based on the assumption that the input flows do not have a major impact on the environmental impacts as a whole.

System boundary:

| **Production** | | | **Con-struction** | | **Use** | | | | | | | **End of Life** | | | | **Loads & Benefits** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material | Transport supply | Manufacturing | Transport | Installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy | Operational water | Deconstruction | Transport | Waste treatment | Disposal | Reuse / Recovery / Recycling |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| x = included | | | NR = module not relevant | | | | | MND = Module not declared | | | | | | | | |

The analyzed system is the complete life cycle of 1 m³ LVL G to be used as structural element in a building. All life cycle stages according to EN 15804:2012 standard are included in the LCA, assuming that there is no maintenance needed over the reference service life.




Product stage:

**A1:** This stage covers the extraction and processing of raw materials, such as forestry operations as well as fuel and glue production. Generation of electricity or heat from primary energy resources are counted. All Stora Enso's wood raw material is sourced through a third-party certified wood traceability system. Stora Enso traceability system is certified according to FSC® and PEFC™ Chain of Custody systems.[1]

**A2:** This stage covers the transportation of the raw materials to the mill. The wood supply operations cover procurement of softwood from Finland. Logs purchased for Varkaus LVL mill are spruce logs transported with trucks.

**A3:** This stage covers the production of LVL and multiple or re-gluing of LVL and by-products. LVL panels are internally further processed to multiple glued LVL G panels. Also packaging materials and the treatment of waste not leaving the factory with the product are counted.


Construction process stage:

**A4:** This stage shows additional information such as average figures from the transportation to the construction sites. The figures show the impact 1m$^3$ of LVL G delivered to an average European customer, which is assumed to be in different locations. In this EPD, the product is transported to the area of Helsinki.

**A5:** Construction process includes such packaging waste, which relates to the delivered product and construction work as lifting and screwing of LVL G panels.

Use stage:

**B1-B7:** There are no environmental impacts expected in the use phase, and at least no harmful substances are released to air, water or ground during the use of the product.

[1] FSC trademark license nr. C125195

End of life scenarios:

Four alternative scenarios have been developed for the end of life stage.

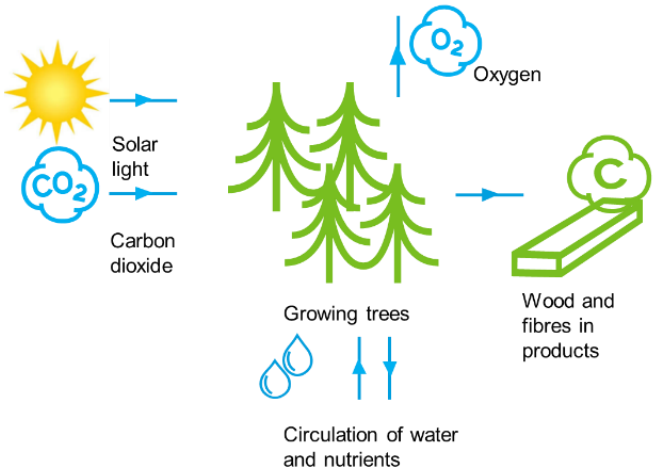
- **Reuse:** LVL G is reused in coherent form. C1: demolition of the building, C2: transportation to the sorting 50 km, C3: preparing for reuse, C4: product for reuse, D: reuse of product, substituting virgin material
- **Recycling**: LVL G chipping for recycling. C1: demolition of the building, C2: transportation to the sorting 50 km, C3: preparing for recycling, C4: chips to recycling, D: recovery of wood chips, substituting virgin material
- **Incineration:** LVL G incineration for energy recovery. C1: demolition of the building, C2: transportation to the sorting 50 km, C3: preparing for incineration, C4: chips to incineration (75% efficiency), D: substitution of natural gas in heat production
- **Landfilling:** LVL G is landfilled. C1: demolition of the building, C2: transportation to the sorting 50 km, C3: preparing for landfilling, C4: landfilling process, D: the methane uptake from landfill partly substitutes natural gas in heat production

Carbon sequestration and storage:

The sequestration of carbon dioxide ($CO_2$) is unique to renewable materials. Biogenic carbon content of a renewable material is an outcome of the $CO_2$ that has effectively been removed from the atmosphere by photosynthesis of growing trees and other plants, and turned into sugars (carbon) and oxygen. The quantity of atmospheric $CO_2$ has thus been reduced. The longer the $CO_2$ is not in the atmosphere but stays stored in a material, the greater the environmental benefit.

Biogenic carbon of wood is calculated according to the EN 16485 and 16449 standards. Half of the dry mass of wood is carbon. In case of LVL the biogenic carbon content is -804 kg $CO_2$ eq./$m^3$.

Each kg of stored biogenic carbon is equal to ~3.67 kg of $CO_2$, which is effectively removed from the atmosphere. Biogenic carbon enters the product system in forest (module A1) and for calculation purpose it is assumed to leave from the product system in the end-of-life stage (module C). This assumption can be made when wood is sourced from sustainably managed forest.




**Sustainable wood**

Stora Enso practises and promotes economically, socially, and environmentally sustainable forest management.

The two most significant forest certification systems recognised by Stora Enso are run by the Forest Stewardship Council (FSC®) [1] and the Programme for the Endorsement of Forest Certification (PEFC™).

**Storing carbon**

Trees absorb carbon dioxide and remove carbon from the atmosphere while growing. Wood products store the captured carbon. This helps reverse the greenhouse effect.

Total carbon storage in the products are increased by re-using and recycling of products. Finally, when biogenic carbon is released back to atmosphere, growing trees will absorb carbon dioxide again.

**Recycling**

Wood is recyclable and a good resource for new fibre-based products or energy generation to substitute fossil materials and energy.

Collection schemes and recycling rates depend on waste legislation, consumer behaviour, point of consumption, local collection system and infrastructure. EU target for building demolition waste recycling is 70% in 2020.

# Environmental performance – product / construction stage

## Potential environmental impact

| PARAMETER | UNIT | A1 | A2 | A3 | TOTAL A1-A3 | A4 | A5 |
|---|---|---|---|---|---|---|---|
| Global warming potential (GWP)* | kg $CO_2$ eq. | -6,64E+02 | 1,28E+01 | 2,13E+01 | **-6,29E+02** | 1,40E+01 | 6,81E+00 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC 11 eq. | 3,04E-05 | 2,54E-06 | 3,15E-06 | **3,61E-05** | 2,82E-06 | 4,61E-07 |
| Acidification potential (AP) | kg $SO_2$ eq. | 8,80E-01 | 3,44E-02 | 9,89E-02 | **1,01E+00** | 3,84E-02 | 1,76E-02 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 2,95E-01 | 7,41E-03 | 4,85E-02 | **3,51E-01** | 8,23E-03 | 7,98E-03 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 8,44E-02 | 2,01E-03 | 1,75E-02 | **1,04E-01** | 2,21E-03 | 1,34E-03 |
| Abiotic depletion potential – Elements | kg Sb eq. | 7,54E-04 | 2,75E-05 | 8,47E-05 | **8,66E-04** | 2,75E-05 | 2,28E-05 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 2,94E+03 | 2,08E+02 | 3,38E+02 | **3,48E+03** | 2,31E+02 | 4,65E+01 |

## Use of resources

| PARAMETER | | UNIT | A1 | A2 | A3 | TOTAL A1-A3 | A4 | A5 |
|---|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value | 3,08E+03 | 2,24E+00 | 1,19E+01 | **3,09E+03** | 2,48E+00 | 1,84E+00 |
| | Used as raw materials | MJ, net calorific value | 9,18E+03 | 0,00E+00 | 0,00E+00 | **9,18E+03** | 0,00E+00 | 0,00E+00 |
| | TOTAL | MJ, net calorific value | 1,23E+04 | 2,24E+00 | 1,19E+01 | **1,23E+04** | 2,48E+00 | 1,84E+00 |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value | 2,62E+03 | 2,12E+02 | 3,92E+02 | **3,22E+03** | 2,35E+02 | 4,80E+01 |
| | Used as raw materials | MJ, net calorific value | 2,17E+03 | 0,00E+00 | 0,00E+00 | **2,17E+03** | 0,00E+00 | 0,00E+00 |
| | TOTAL | MJ, net calorific value | 4,79E+03 | 2,12E+02 | 3,92E+02 | **5,39E+03** | 2,35E+02 | 4,80E+01 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 0,00E+00 |
| Renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 0,00E+00 |
| Non-renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 0,00E+00 |
| Net use of fresh water | | $m^3$ | 2,67E+00 | 0,00E+00 | 0,00E+00 | **2,67E+00** | 0,00E+00 | 0,00E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | A1 | A2 | A3 | TOTAL A1-A3 | A4 | A5 |
|---|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 7,62E-01 | **7,62E-01** | 0,00E+00 | 0,00E+00 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 7,08E-02 | **7,08E-02** | 0,00E+00 | 1,07E+00 |
| Radioactive waste disposed | kg | 1,05E-05 | 5,72E-07 | 3,39E-07 | **1,14E-05** | 6,35E-07 | 9,71E-08 |

### Output flows

| PARAMETER | UNIT | A1 | A2 | A3 | TOTAL A1-A3 | A4 | A5 |
|---|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 0,00E+00 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 6,74E-02 | **6,74E-02** | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 1,07E+00 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | **0,00E+00** | 0,00E+00 | 0,00E+00 |

** A1: biogenic carbon storage in wood -804 kg $CO_2$-eq.*

# Environmental performance – Use stage

## Potential environmental impact

| PARAMETER | UNIT | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---|---|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Depletion potential of the stratospheric ozone layer | kg CFC 11 eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Acidification potential (AP) | kg $SO_2$ eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Formation potential of tropospheric ozone | kg $C_2H_4$ eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Abiotic depletion potential – Elements | kg Sb eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

## Use of resources

| PARAMETER | | UNIT | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---|---|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Used as raw materials | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | TOTAL | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Primary energy resources – Non-renewable | Use as energy | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Used as raw materials | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | TOTAL | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Renewable secondary fuels | | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-renewable secondary fuels | | MJ, net calorific | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Net use of fresh water | | $m^3$ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---|---|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Radioactive waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

### Output flows

| PARAMETER | UNIT | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---|---|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

# Environmental performance – End of Life "Re-Use"

## Potential environmental impact

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 5,36E-01 | 2,19E+00 | 8,04E+02 | 0,00E+00 | -1,72E+02 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC 11 eq. | 9,44E-08 | 4,40E-07 | 0,00E+00 | 0,00E+00 | -3,55E-05 |
| Acidification potential (AP) | kg $SO_2$ eq. | 5,06E-03 | 6,00E-03 | 0,00E+00 | 0,00E+00 | -1,00E+00 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 9,56E-04 | 1,29E-03 | 0,00E+00 | 0,00E+00 | -3,49E-01 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 1,12E-04 | 3,45E-04 | 0,00E+00 | 0,00E+00 | -1,04E-01 |
| Abiotic depletion potential – Elements | kg Sb eq. | 2,69E-07 | 4,29E-06 | 0,00E+00 | 0,00E+00 | -8,62E-04 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 7,68E+00 | 3,60E+01 | 0,00E+00 | 0,00E+00 | -3,44E+03 |

## Use of resources

| PARAMETER | | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value | 6,13E-02 | 3,88E-01 | 0,00E+00 | 0,00E+00 | -3,09E+03 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -9,15E+03 | 0,00E+00 | -1,83E+04 |
| | TOTAL | MJ, net calorific value | 6,13E-02 | 3,88E-01 | -9,15E+03 | 0,00E+00 | -2,14E+04 |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value | 7,77E+00 | 3,67E+01 | 0,00E+00 | 0,00E+00 | -3,18E+03 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -1,08E+03 | 0,00E+00 | -3,25E+03 |
| | TOTAL | MJ, net calorific value | 7,77E+00 | 3,67E+01 | -1,08E+03 | 0,00E+00 | -6,43E+03 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 5,10E+02 | 0,00E+00 | 1,02E+03 |
| Renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Net use of fresh water | | $m^3$ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -2,67E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -7,62E-01 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -7,08E-02 |
| Radioactive waste disposed | kg | 2,10E-08 | 9,92E-08 | 0,00E+00 | 0,00E+00 | -1,13E-05 |

### Output flow

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 5,10E+02 | 0,00E+00 | 1,02E+03 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | -6,74E-02 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

# Environmental performance – End of Life “Recycling”

## Potential environmental impact

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 5,36E-01 | 2,19E+00 | 8,10E+02 | 0,00E+00 | -6,24E+01 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC 11 eq. | 9,44E-08 | 4,40E-07 | 1,10E-06 | 0,00E+00 | -7,58E-06 |
| Acidification potential (AP) | kg $SO_2$ eq. | 5,06E-03 | 6,00E-03 | 5,87E-02 | 0,00E+00 | -4,03E-01 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 9,56E-04 | 1,29E-03 | 1,07E-02 | 0,00E+00 | -1,51E-01 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 1,12E-04 | 3,45E-04 | 1,21E-03 | 0,00E+00 | -5,40E-02 |
| Abiotic depletion potential – Elements | kg Sb eq. | 2,69E-07 | 4,29E-06 | 2,05E-06 | 0,00E+00 | -2,83E-04 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 7,68E+00 | 3,60E+01 | 8,78E+01 | 0,00E+00 | -1,03E+03 |

## Use of resources

| PARAMETER | | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value | 6,13E-02 | 3,88E-01 | 5,13E-01 | 0,00E+00 | -4,62E+03 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -9,15E+03 | 0,00E+00 | -3,07E+01 |
| | TOTAL | MJ, net calorific value | 6,13E-02 | 3,88E-01 | -9,15E+03 | 0,00E+00 | -4,65E+03 |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value | 7,77E+00 | 3,67E+01 | 8,86E+01 | 0,00E+00 | -1,25E+03 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -1,08E+03 | 0,00E+00 | 5,19E+01 |
| | TOTAL | MJ, net calorific value | 7,77E+00 | 3,67E+01 | -9,92E+02 | 0,00E+00 | -1,20E+03 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Net use of fresh water | | $m^3$ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Radioactive waste disposed | kg | 2,10E-08 | 9,92E-08 | 2,46E-07 | 0,00E+00 | -1,79E-06 |

### Output flows

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 5,10E+02 | 0,00E+00 | 5,10E+02 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

# Environmental performance – End of Life "Incineration"

## Potential environmental impact

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 5,36E-01 | 2,19E+00 | 9,90E+01 | 0,00E+00 | -4,28E+02 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC 11 eq. | 9,44E-08 | 4,40E-07 | 2,68E-06 | 0,00E+00 | -6,35E-05 |
| Acidification potential (AP) | kg $SO_2$ eq. | 5,06E-03 | 6,00E-03 | 1,89E-01 | 0,00E+00 | -1,86E-01 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 9,56E-04 | 1,29E-03 | 1,03E-01 | 0,00E+00 | 3,85E-02 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 1,12E-04 | 3,45E-04 | 4,87E-03 | 0,00E+00 | -2,49E-02 |
| Abiotic depletion potential – Elements | kg Sb eq. | 2,69E-07 | 4,29E-06 | 2,46E-05 | 0,00E+00 | 1,07E-06 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 7,68E+00 | 3,60E+01 | 2,50E+02 | 0,00E+00 | -8,25E+03 |

## Use of resources

| PARAMETER | | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value | 6,13E-02 | 3,88E-01 | 1,79E+01 | 0,00E+00 | -7,24E+00 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -9,15E+03 | 0,00E+00 | -1,83E+04 |
| | TOTAL | MJ, net calorific value | 6,13E-02 | 3,88E-01 | -9,13E+03 | 0,00E+00 | -1,83E+04 |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value | 7,77E+00 | 3,67E+01 | 2,98E+02 | 0,00E+00 | -8,25E+03 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | -1,08E+03 | 0,00E+00 | -2,16E+03 |
| | TOTAL | MJ, net calorific value | 7,77E+00 | 3,67E+01 | -7,83E+02 | 0,00E+00 | -1,04E+04 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 9,15E+03 | 0,00E+00 | 9,15E+03 |
| Non-renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 1,08E+03 | 0,00E+00 | 1,08E+03 |
| Net use of fresh water | | $m^3$ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Radioactive waste disposed | kg | 2,10E-08 | 9,92E-08 | 6,51E-07 | 0,00E+00 | -1,38E-06 |

### Output flows

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 5,10E+02 | 0,00E+00 | 5,10E+02 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 1,02E+04 | 0,00E+00 | 1,02E+04 |

# Environmental performance – End of Life "Landfill"

## Potential environmental impact

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 5,36E-01 | 2,19E+00 | 0,00E+00 | 1,03E+03 | -1,77E+01 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC 11 eq. | 9,44E-08 | 4,40E-07 | 0,00E+00 | 2,42E-06 | -2,22E-06 |
| Acidification potential (AP) | kg $SO_2$ eq. | 5,06E-03 | 6,00E-03 | 0,00E+00 | 1,08E-01 | -1,29E-02 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 9,56E-04 | 1,29E-03 | 0,00E+00 | 1,41E+00 | -2,23E-03 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 1,12E-04 | 3,45E-04 | 0,00E+00 | 5,37E-02 | -1,01E-03 |
| Abiotic depletion potential – Elements | kg Sb eq. | 2,69E-07 | 4,29E-06 | 0,00E+00 | 8,16E-06 | -9,36E-07 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 7,68E+00 | 3,60E+01 | 0,00E+00 | 2,01E+02 | -2,85E+02 |

## Use of resources

| PARAMETER | | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value | 6,13E-02 | 3,88E-01 | 0,00E+00 | 4,31E+00 | -8,54E-01 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | -9,15E+03 | 3,41E+02 |
| | TOTAL | MJ, net calorific value | 6,13E-02 | 3,88E-01 | 0,00E+00 | -9,15E+03 | 3,41E+02 |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value | 7,77E+00 | 3,67E+01 | 0,00E+00 | 2,10E+02 | -2,87E+02 |
| | Used as raw materials | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | -1,08E+03 | 0,00E+00 |
| | TOTAL | MJ, net calorific value | 7,77E+00 | 3,67E+01 | 0,00E+00 | -8,71E+02 | -2,87E+02 |
| Secondary material | | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,41E+02 | 0,00E+00 |
| Non-renewable secondary fuels | | MJ, net calorific value | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Net use of fresh water | | $m^3$ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

## Waste production and output flows

### Waste production

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Non-hazardous waste disposed | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,10E+02 | 0,00E+00 |
| Radioactive waste disposed | kg | 2,10E-08 | 9,92E-08 | 0,00E+00 | 5,64E-07 | -7,16E-08 |

### Output flows

| PARAMETER | UNIT | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|
| Components for reuse | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Material for recycling | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,41E+02 | 0,00E+00 |

# Programme-related information and verification

| | |
|---|---|
| **Programme:** | The International EPD® System<br><br>EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm<br>Sweden<br><br>www.environdec.com<br>info@environdec.com |
| **EPD registration number:** | S-P-01731 |
| **Published:** | 15-11-2019 |
| **Valid until:** | 15-11-2024 |
| **Reference year for data:** | 2018 |
| **Geographical scope:** | Finland |
| **Product category rules:** | PCR 2012:01,v.2.2 Construction Products and Construction Services.<br><br>PCR 2012:01-Sub-PCR-E Wood and wood-based products for use in construction (EN 16485). |
| **UN CPC code:** | 314 – Boards and panels |

| | |
|---|---|
| **Independent third-party verification of the declaration and data, according to ISO 14025:2006:** | ☐ EPD process certification ☒ EPD verification |
| **LCA study conducted by:** | Stora Enso – Division Wood Products |
| **Third party verifier:** | Dr. Andrew Norton, Renuables Ltd. |
| **Approved by:** | The International EPD® System |
| **Procedure for follow-up of data during EPD validity involves third party verifier:** | ☐ Yes ☒ No |

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

# References

General Programme Instructions of the International EPD® System. Version 3.0.
PCR 2012:01. Wood and wood-based products for use in construction. Version 2.3.

## Standards

EN 15804:2012 + A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

EN 16485:2014 Round and sawn timber. Environmental product declarations. Product category rules for wood and wood-based products for use in construction

EN 16449:2014 Wood and wood-based products. Calculation of the biogenic carbon content of wood and conversion to carbon dioxide

EN 15942:2012 Sustainability of construction works - Environmental product declarations - Communication format business-to-business

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

ISO 14044:2006 Environmental management. Life Cycle Assessment. Requirements and guidelines.

## Tools and databases

SimaPro 9.0 – LCA software by PRé Sustainability http://simapro.com/
Ecoinvent 3.5 database. http://www.ecoinvent.org/

## Detailed product information

https://www.storaenso.com/en/products/wood-products/massive-wood-construction/lvl

## EPD owner and LCA author

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