

Environmental Product Declaration

In accordance with the EN 15804 +A2 and the NMD Bepalingsmethode, v1.1

ISOLENA Premium, sheepwool insulation with Ionic Protect®

Scope of the declaration

Type of the EPD is Cradle to grave, including modules A-D

According to the EN 15804 +A2 and the NMD Bepalingsmethode, version 1.1

The LCA was carried out by Agrodome B.V. (NL)

Based on production data from Isolena Naturfaservliese GmbH

Release Date: 25 October 2024

Validity: 5 years

Functional unit: 1 m²



Goal and target group

Goal

The declaration covers the environmental effects throughout the lifetime of the product ISOLENA Premium, sheepwool insulation with Ionic Protect®.

Target audience

The EPD can be used for building or building part level assessments by designers, architects, constructors, developers etc. The EPD is made business-to-business communication and can be used for business-to-consumer communication purposes. The background EPD report is third party verified.

Product description

The sheepwool for ISOLENA sheepwool insulation with Ionic Protect® is obtained from sheep kept on alpine pastures for milk and cheese production. This sheepwool is not suitable for clothing or other uses, but is suitable for high-grade insulation material. Apart from thermal insulation, sheepwool can also be used for acoustic insulation.

There are several versions available from ISOLENA. All products are produced in the same way. The differences are in the mass volume and the dimensions. At the Dutch market the following versions are available: ISOLENA Optimal, ISOLENA Premium, ISOLENA Optimal Plus, ISOLENA Klemvilt, ISOLENA Stopwol, ISOLENA Kierdichtingsband, ISOLENA Akoestisch Vilt, ISOLENA Schapenwol Viltband, ISOLENA Ondervloervilt. This EPD covers ISOLENA Premium.

The wool is washed and treated without the use of pesticides or salts. By means of the Ionic Protect® treatment method, the wool is protected against moths. This method preserves the properties of the sheepwool. The efficacy is tested and confirmed in the laboratory (EAD/CUAP test).

ISOLENA sheepwool insulation with Ionic Protect® is suited for fitting in roofs, walls, ceilings, facades, timber frame construction and solid and cross layer timber (CLT) constructions. Besides (monumental) residential housing and non-residential constructions, the wool is also applied in tiny houses, boats and campers.

ISOLENA sheepwool insulation with Ionic Protect® comes in rolls of different widths and lengths and is available in different thicknesses (see: <https://www.isolena.com/en/insulation/>).

Function of the product

ISOLENA Premium, sheepwool insulation with Ionic Protect® can be used as thermal and/or acoustic insulation for walls, floors and roofs, in both new buildings or renovation projects. To achieve a comfortable indoor climate. ISOLENA Stopwol can also be used as insulation material to improve the airtightness of a building.

Composition of ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Material | Share |
|-------------------------------------|-------|
| Sheepwool of extensively kept sheep | 100 % |

Table 1: Composition ISOLENA Premium, sheepwool insulation with Ionic Protect®

Technical data ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Name | Value |
|--|------------------------------|
| Thickness element at R = 3,5 m ² k/W | 123 mm |
| Average Weight ISOLENA sheepwool insulation | 2,45 kg/m ² |
| Average Density | 20 kg/m ³ |
| Average Thermal conductivity λ | 0,035 W/mK |
| Vapour diffusion resistance factor μ | 1 |
| Specific heat capacity c | 1760 J/kgK |
| Length-related flow resistance according to EN 29053 | r = 4,1 kPa s/m ² |
| Fire resistance class according to EN 13501-1 | D-s2, d0 |
| Mould growth intensity according to EN ISO 846 | 0 |
| Wool protection | Ionic Protect® |

Table 2: Technical data ISOLENA Premium, sheepwool insulation with Ionic Protect®

Scaling

ISOLENA Premium, sheepwool insulation with Ionic Protect® can basically be produced in many thicknesses and densities. It is proportionally scalable; the product is manufactured with the same composition independently of size.

Environment and health during use phase

ISOLENA sheepwool insulation with Ionic Protect® does not contain concentrations of substances or materials listed in the “Candidate List of Substances of Very High Concern for authorisation”.

Sheepwool is vapour-permeable, moisture-regulating, does not burn and purifies the air. Sheepwool can absorb 1/3 of its own weight in moisture without losing insulation value.

Environmental certificates

ISOLENA Premium, sheepwool insulation with Ionic Protect® has the natureplus seal of approval, license number: **0103-1006-099-1**.

Other certificates

| Certificate No. | Institute | Norm | Title |
|-----------------|---------------------------------|------------------------------------|--|
| ETA-07/0214 | OIB | ETA-07/0214 | Harmonised product standard |
| ETA-07/0214 | OIB | EN 13501-1 | Fire behavior from 18kg/m ³ D-s2,d0 |
| B19227 | HFM Holzforschung München | EN 13501-1 | Fire behavior from 100kg/m ³ C-s2,d0 |
| | | EN 13501-1 | Fire behavior from an acoustic ceiling element with sheep wool insulation OPTIMAL 40mm 18kg/m ³ , B-s1,d0 |
| M84 565 | Müller-BBM | DIN EN ISO 354 DIN EN ISO 11654 | Superstructure test with Heradesign® superfine & ISOLENA sheep wool insulation, sound absorption coefficient according to DIN EN ISO 354 |

| | | | |
|------------------|---------------|------------------------------------|---|
| 21225666-001 | TÜV Rheinland | DIN EN ISO 354 DIN EN ISO 11654 | Assesment of sound absorption according to DIN EN ISO 11654 |
| ECO-P16002-15017 | ECOLABOR.eu | EAD 040005-00-1201 | Superstructure test Vogl & ISOLENA Sheep wool insulation sound absorption coefficient according to DIN EN ISO 354 |
| | | Normbez. | Assesment of sound absorption according to DIN EN ISO 11654 |

Table 3: Certificates for ISOLENA sheepwool insulation with Ionic Protect®

Biogenic carbon storage

Biogenic carbon storage during the lifetime of the product ISOLENA sheepwool insulation with Ionic Protect® is 1,85 kg CO₂/kg product (WUR, 2024), corresponding to 1,24 kg C/m².

Biogenic content in 123 mm ISOLENA Premium, sheepwool insulation with Ionic Protect®, m²

| Biogenic carbon | Share biogenic carbon per m ² |
|------------------------------|--|
| Biogenic carbon in product | 1,24 kg C |
| Biogenic carbon in packaging | 0,08 kg C |

Table 4: Biogenic content in ISOLENA Premium, sheepwool insulation with Ionic Protect®, m²

LCA calculation rules

Functional unit

One square meter of ISOLENA Premium sheepwool insulation, with a lifespan of at least 75 years, with a thickness of 123 mm, a density of 20 kg/m³ and an insulation value of 3,5 m²k/W.

| Name | Value | Unit |
|-----------------|-------|----------------|
| Functional Unit | 1,00 | m ² |
| Weight | 2,45 | kg/FU |

Reference Service Life

The lifespan of the product, as declared by the manufacturer, is at least 75 years when correctly applied as an insulation material. This lifespan corresponds with the lifetime of a residential building in the Netherlands. No maintenance is needed.

Comparability

A comparison or evaluation of EPD data is only possible if all datasets have been made in accordance with EN 15804 and the same product-related standard properties and modules have been taken into account.

System boundaries

The LCA study was created for 'Cradle to Grave A1-D' according to the modules below. All declared values relate to the specified functional unit. The functional unit of the European standard EN 15804 +A2 and the NMD - Bepalingsmethode 'Milieuprestatie Bouwwerken' are identical.

The environmental performance of building materials is categorized in four modules corresponding to different lifecycle phases in the building material; Modules A (production of materials and construction), B (use phase), C (end-of-life phase of the building) and D (loads and benefits outside the system boundary); see Figure 1.

| Product stage | | | Construction installation stage | | Use stage | | | | | | | End of life stage | | | | Beyond the system boundaries |
|---------------|-----------|---------------|---------------------------------|---------------------------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-----------|------------------|----------|------------------------------------|
| Raw materials | Transport | Manufacturing | Transport | Construction installation stage | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☒ | ☒ | ☒ |

Figure 1: Calculated modules ISOLENA sheepwool insulation with Ionic Protect®

For this LCA study, all modules A1-3, A4, A5, B, C and D have been examined, except B6 and B7.

Allocations

There are no allocations of co-products from the sheepwool.

The wool is considered to be a by-product from the sheep farming for grazing, milk and meat production. The economic value of the sheepwool for insulation is much lower than the economic value related to the meat and milk production, resulting in an economic allocation of 0,023%.

Allocation of sheep products in Austria

| Market for sheep products | Allocation (%) |
|----------------------------------|----------------|
| Meat | 0,371 |
| Milk | 99,533 |
| High-quality wool | 0,073 |
| Reject wool for ISOLENA products | 0,023 |

Table 5: Allocation of sheep products

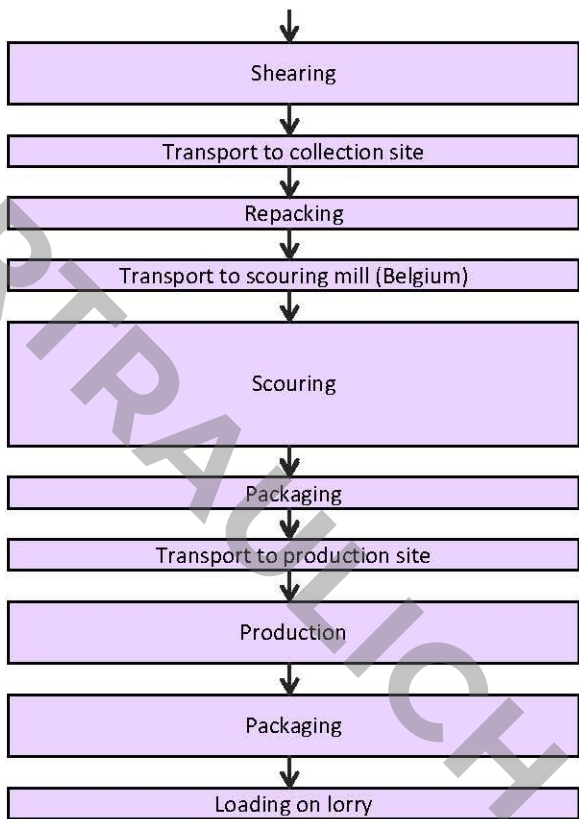
Assumptions, omissions and deviations

Based on the information from the manufacturer, it is assumed that no maintenance is needed during the lifetime of the product.

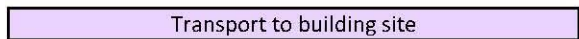
Production process and Flowchart

The flowchart below shows the production process of ISOLENA sheepwool insulation with Ionic Protect®. This flowchart lists the entire production process starting with the operations needed to extract the sheepwool by shearing.

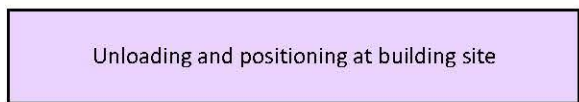
A1 - A3 MANUFACTURING PHASE



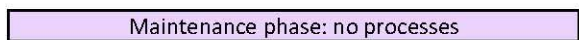
A4 TRANSPORT PHASE



A5 CONSTRUCTION PHASE



B1 - B7 USE AND MAINTENANCE PHASE



C1 - C4 and D DISPOSAL PHASE

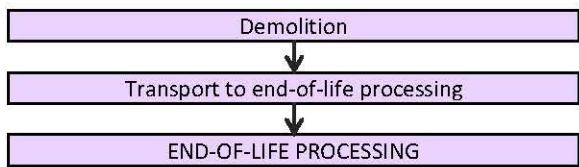


Figure 2: Flowchart ISOLENA sheepwool insulation with Ionic Protect®

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Explanation Flowcharts and Life Cycle per phase

Production phase (A1-3)

The wool comes from sheep that are kept on alpine pastures for milk and cheese production. The sheep are sheared annually and the wool is taken to a collection point in the valley. From there, the wool is transported by lorry to the scouring mill in Belgium (BE-4600 Verviers), where the wool is washed with soda and water. The clean wool then returns by lorry to the factory in Austria, where further production takes place.

In an automated process, the clean wool is prepared into thin layers and treated with ionised plasma, which makes the keratin fibres unfit for consumption by moths and other insects. This process is typical for Isolena and patented: Ionic Protect®. The product is then further processed into insulation material in the desired thickness, it is rolled up, packed in cardboard and plastic film and transported to the warehouse.

Construction process phase (A4-5)

Transport to the building site (A4)

The finished product is compressed for transport from the production site in Austria to the Netherlands, resulting in a density of 160 kg/m³. For volume transport, a correction factor of 1,6 was applied. For the transport movement from Austria to the Netherlands, no empty return is applied. The default from the determination method version 1.1 is used for the transport to the building site, in this case Waizenkirchen, Austria to Utrecht, the Netherlands.

Processing and construction on the construction site (A5)

At the construction site the insulation is fitted; for this only hand tools are used. The 5% sheepwool drop-off from construction and the packaging materials (cardboard and PE foil) are disposed of together with other building materials. In line with the bepalingsmethode, the following waste scenarios and processes were taken into account for the calculations:

Since cork is a wood product, and can be recycled, the waste scenario for clean wood has been chosen.

- Sheepwool: 15% landfill, 85% incineration
- Cardboard: 15% landfill, 85% incineration
- PE foil: 10% landfill, 85% incineration, 5% recycling

Use phase (B1-7)

No emissions occur in the use phase. There is no need for additional maintenance during the use phase.

End-of-life phase (C1-4)

Disassembly and demolition (C1)

Disassembly and demolition takes place manually, there is no industrial process.

Transport (C2)

Transport phase assumptions: the default value according to the bepalingsmethode 1.1 is used. This is 50 km to sorting installation and 100 km from demolition or sorting location to processing location. Selection of the means of transport according to the bepalingsmethode version 1.1 (Chapter 2.6.3.7, p20).

Waste treatment (C3-C4)

For waste processing, the distribution below and the scenarios chosen have been taken into account:

- 5% landfill, 95% incineration

Benefits and burdens outside the system boundary (D)

The benefits and burdens outside the system boundary relate to combustion in which energy use is avoided. Recycling and reuse are also part of the benefits and burdens outside the system boundary. The efficiency of heat and electricity recovery from waste material is 31% for heat and 18% for electricity, according to the fixed values in the NMD bepalingsmethode.

LCA results

Environmental indicators per FU (m²) EN 15804 +A1, ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Potential Environmental Impacts | Production | Construction process stage | | Use stage | | | | | End-of-life stage | | | | D Reuse, recovery, recycling |
|---|---|----------------------------|-----------------|-----------|----------------|-----------|----------------|------------------|-----------------------------------|--------------|---------------------|-------------|------------------------------|
| | A1 Raw material A2 Transport A3 manufacturing | A4 Transport | A5 Installation | B1 Use | B2 Maintenance | B3 Repair | B4 Replacement | B5 Refurbishment | C1 Deconstruction / demolition | C2 Transport | C3 Waste processing | C4 Disposal | |
| ADPE (kg Sb-eq) | 6,38E-05 | 1,26E-05 | 3,33E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,41E-06 | 1,78E-06 | 1,39E-08 | -3,68E-06 |
| ADPF (kg SB-eq) | 1,79E-02 | 3,62E-03 | 9,34E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,07E-04 | 3,04E-04 | 1,49E-05 | -2,40E-03 |
| GWP (kg CO ₂ -eq) | 2,47E+00 | 4,92E-01 | 3,02E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,54E-02 | 8,55E-02 | 9,23E-03 | -3,44E-01 |
| ODP (kg CFC 11-eq) | 2,71E-07 | 8,74E-08 | 1,43E-08 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,82E-09 | 5,99E-09 | 3,21E-10 | -8,21E-08 |
| POCP (kg C ₂ H ₄ -eq) | 1,35E-03 | 2,97E-04 | 7,73E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,34E-05 | 2,99E-05 | 2,89E-06 | -8,10E-04 |
| AP (kg SO ₂ -eq) | 1,17E-02 | 2,17E-03 | 6,61E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,43E-04 | 4,23E-04 | 8,55E-06 | -5,16E-03 |
| EP (kg (PO ₄) ₃ -eq) | 2,90E-03 | 4,25E-04 | 1,69E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,78E-05 | 1,51E-04 | 3,53E-06 | -1,70E-03 |
| HTP (kg 1,4-DB-eq) | 1,19E+00 | 2,26E-01 | 7,33E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,54E-02 | 6,71E-02 | 8,68E-04 | -4,79E-01 |
| FAETP (kg 1,4-DB-eq) | 5,77E-02 | 6,06E-03 | 5,05E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 6,81E-04 | 2,35E-03 | 1,30E-05 | -9,30E-03 |
| MAETP (kg 1,4-DB-eq) | 1,00E+02 | 2,18E+01 | 8,64E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,45E+00 | 1,28E+01 | 5,34E-02 | -1,27E+01 |
| TETP (kg 1,4-DB-eq) | 1,07E-02 | 8,31E-04 | 5,62E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,34E-05 | 2,72E-04 | 2,94E-06 | -3,26E-03 |

ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; GWP = Global warming Potential; ODP = Ozone Depletion Potential; POCP = Photochemical Ozone Creation; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; HTP = Human Toxicity Potential ; FAETP = Fresh Aquatic Ecotoxicity Potential ; MAETP = Marine Aquatic Ecotoxicity Potential; TETP = Terrestrial Ecotoxicity Potential

Table 6 Environmental indicators per FU (m²) EN 15804 +A1, ISOLENA Premium, sheepwool insulation with Ionic Protect®

Core Environmental Indicators per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Potential Environmental Impacts | Production | Construction process stage | | | Use stage | | | | | End-of-life stage | | | | D Reuse, recovery, recycling |
|--|---|----------------------------|-----------------|----------|----------------|-----------|----------------|------------------|-----------------------------------|-------------------|---------------------|-------------|----------|------------------------------|
| | A1 Raw material A2 Transport A3 manufacturing | A4 Transport | A5 Installation | B1 Use | B2 Maintenance | B3 Repair | B4 Replacement | B5 Refurbishment | C1 Deconstruction / demolition | C2 Transport | C3 Waste processing | C4 Disposal | | |
| CC total (kg CO2 eq) | -2,42E+00 | 4,97E-01 | 5,90E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,59E-02 | 4,40E+00 | 2,28E-01 | -3,52E-01 |
| CC fossil (kg CO2 eq) | 2,39E+00 | 4,97E-01 | 2,98E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,58E-02 | 9,02E-02 | 1,32E-03 | -3,50E-01 |
| CC biogenic (kg CO2 eq) ¹ | -4,82E+00 | 0,00E+00 | 2,91E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,31E+00 | 2,27E-01 | 0,00E+00 |
| CC luluc (kg CO2 eq) | 1,97E-02 | 1,82E-04 | 9,88E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,05E-05 | 1,79E-05 | 6,37E-07 | -2,83E-03 |
| ODP (kg CFC 11 eq) | 3,32E-07 | 1,10E-07 | 1,74E-08 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,23E-08 | 6,87E-09 | 4,02E-10 | -8,49E-08 |
| AP (mol H+ eq) | 1,60E-02 | 2,88E-03 | 9,06E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,24E-04 | 5,81E-04 | 1,13E-05 | -8,09E-03 |
| EP – freshwater (kg P eq) | 1,40E-04 | 5,01E-06 | 7,14E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,63E-07 | 1,30E-06 | 2,71E-08 | -2,54E-05 |
| EP – marine (kg N eq) | 4,98E-03 | 1,01E-03 | 2,98E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,14E-04 | 2,52E-04 | 7,30E-06 | -2,37E-03 |
| EP – terrestrial (mol N eq) | 5,26E-02 | 1,12E-02 | 3,16E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,26E-03 | 2,54E-03 | 4,17E-05 | -3,88E-02 |
| POCP (kg NMVOC eq) | 1,13E-02 | 3,19E-03 | 7,00E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,59E-04 | 6,33E-04 | 1,49E-05 | -6,84E-03 |
| ADP Elements (kg Sb eq) | 6,37E-05 | 1,26E-05 | 3,32E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,41E-06 | 1,78E-06 | 1,39E-08 | -3,67E-06 |
| ADP fossil fuels (MJ) | 3,62E+01 | 7,49E+00 | 1,89E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 8,42E-01 | 5,71E-01 | 3,07E-02 | -4,77E+00 |
| WDP (m ³ water eq deprived) | 2,70E+00 | 2,68E-02 | 1,38E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,01E-03 | 3,49E-02 | 1,32E-03 | -3,71E-02 |

CC total = Climate Change total; CC fossil = Climate Change fossil; CC biogenic = Climate Change biogenic; CC-luluc = Climate Change land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

Table 7 Core Environmental Indicators per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

¹ Calculated according to the NMD Stappenplan biogene koolstof, October 2024

Additional Environmental Indicators per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Potential Environmental Impacts | A1 t/m A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | C1 | C2 | C3 | C4 | D |
|--|-----------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| PM (disease incidence) | 1,84E-07 | 4,46E-08 | 1,01E-08 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,01E-09 | 6,00E-09 | 2,13E-10 | -1,09E-07 |
| IRHH (kg U235 eq) | 1,17E-01 | 3,14E-02 | 6,06E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,53E-03 | 1,44E-03 | 1,20E-04 | -1,30E-02 |
| ETF (CTUe) | 4,76E+01 | 6,68E+00 | 2,67E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 7,51E-01 | 3,86E+00 | 3,08E-02 | -7,78E+01 |
| HTCE (CTUh) | 1,32E-09 | 2,17E-10 | 1,31E-10 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,44E-11 | 2,15E-10 | 8,48E-13 | -8,98E-10 |
| HTnCE (CTUh) | 4,49E-08 | 7,30E-09 | 3,12E-09 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 8,21E-10 | 9,42E-09 | 3,30E-11 | -3,25E-08 |
| Land Use Related impacts (dimensionless) | -1,49E+00 | 6,50E+00 | -2,30E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 7,30E-01 | 3,99E-01 | 7,27E-02 | -3,05E+02 |
| PERE (MJ, net calorific value) | -5,94E+01 | 9,38E-02 | 1,11E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,05E-02 | 1,88E-02 | 5,40E-04 | -6,38E+01 |
| PERM (MJ, net calorific value) | 6,16E+01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT (MJ, net calorific value) | 2,17E+00 | 9,38E-02 | 1,11E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,05E-02 | 1,88E-02 | 5,40E-04 | -6,38E+01 |
| PENRE (MJ, net calorific value) | 3,61E+01 | 7,95E+00 | 2,01E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 8,94E-01 | 6,15E-01 | 3,26E-02 | -5,15E+00 |
| PENRM (MJ, net calorific value) | 2,39E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT (MJ, net calorific value) | 3,85E+01 | 7,95E+00 | 2,01E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 8,94E-01 | 6,15E-01 | 3,26E-02 | -5,15E+00 |
| SM (kg) | 1,30E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF (MJ, net calorific value) | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF (MJ, net calorific value) | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW (m ³ water eq) | 6,87E-02 | 9,12E-04 | 3,61E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,03E-04 | 1,32E-03 | 3,21E-05 | -9,33E-04 |

PM = Particulate Matter; IRHH = Ionizing Radiation – human health effects; ETF = Ecotoxicity – freshwater; HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; 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 = Net use of fresh water

Table 8 Additional Environmental Indicators per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

Environmental information describing output flows and waste categories per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

| Potential Environmental Impacts | Production | Construction process stage | | Use stage | | | | | End-of-life stage | | | | D Reuse, recovery, recycling |
|------------------------------------|---|----------------------------|-----------------|-----------|----------------|-----------|----------------|------------------|-----------------------------------|--------------|---------------------|-------------|------------------------------|
| | A1 Raw material A2 Transport A3 manufacturing | A4 Transport | A5 Installation | B1 Use | B2 Maintenance | B3 Repair | B4 Replacement | B5 Refurbishment | C1 Deconstruction / demolition | C2 Transport | C3 Waste processing | C4 Disposal | |
| Hazardous waste disposed (kg/FU) | 1,55E-04 | 1,90E-05 | 8,02E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,13E-06 | 1,07E-06 | 4,73E-08 | -1,26E-05 |
| Non-hazardous waste disposed (kg) | 1,80E+00 | 4,75E-01 | 1,21E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,34E-02 | 1,35E-01 | 1,23E-01 | -1,15E-01 |
| Radioactive waste disposed (kg) | 1,62E-04 | 4,92E-05 | 8,35E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,53E-06 | 1,95E-06 | 1,83E-07 | -1,98E-05 |
| 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 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for recycling (kg) | 3,49E-03 | 0,00E+00 | 3,31E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 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 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy Heat (MJ) | 2,11E+00 | 0,00E+00 | 1,37E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,64E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy Energy (MJ) | 3,64E+00 | 0,00E+00 | 2,37E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,66E+01 | 0,00E+00 | 0,00E+00 |

Table 9 Environmental information describing output flows and waste categories per FU (m²) EN 15804 +A2, ISOLENA Premium, sheepwool insulation with Ionic Protect®

Representativeness of the production process

Purchase of raw materials

The most important raw material, sheepwool, for the product described in this LCA comes from alpine meadows in Austria.

Data quality

For the collection of the process and product data, information is used provided by the manufacturer, Isolena Naturfaservliese GmbH. These data were discussed and checked with ISOLENA in 2024 and are completely up-to-date.

Energy consumption of equipment and equipment required to manufacture the product under investigation are based on consumption figures for 2023. For the materials a choice was made from the available data in the Ecoinvent database, version 3.6, and the NMD database version 3.8, based on the main ingredients.

With the exception of the manufacturing phase, standard values have been used where appropriate in accordance with Ecoinvent 3.6. or NMD. This applies in particular to transport distances, processing in the waste phase and the choice of means of transport. Return transports loaded/unloaded are as per the manufacturer's instructions. In the final processing phase, the transports were calculated according to the Bepalingsmethode version 1.1.

Production processes can change over time. The information used in this LCA of the production process of the product is based on measurements and observations from 2023 (energy, waste percentages, quantities net, production volume).

Accountability

The LCA study was conducted by Agrodome B.V. in 2022-2024.

The data provided by ISOLENA have been extensively discussed with Agrodome B.V.

The final version of the LCA study has been submitted to LBP | Sight for external peer review.

The LCA is carried out according to the most recent versions of EN 15804 +A1 and +A2 in compliance with the standards from the ISO 14000 series: 14025, 14040 and 14044. The LCA report has been tested against the Bepalingsmethode 'Milieuprestatie Bouwwerken', version 1.1 March 2022, including Amendment 4.

When calculating the environmental impact categories, SimaPro, version 9.5.0.2 and environmental data from the NMD-basic processes database, version 3.8 and in some cases, namely where no NMD-data were available, the Ecoinvent database, version 3.6.

When making calculations in SimaPro, the long-term effects (emissions that can occur after 100 years) are not taken into account, in accordance with the Bepalingsmethode version 1.1. The effects of capital goods and infrastructural processes are included.

References

ISO 14040

ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044

ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025

ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A1

EN 15804+A1: 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 15804+A2

EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

Nationale Milieudatabase

Bepalingsmethode Milieuprestatie Bouwwerken, versie 1.1 March 2022.

Caroline van der Laan, Fred van der Burgh and Sissy Verspeek

Background report EPD, Life cycle analysis, ISOLENA sheepwool insulation with Ionic Protect®, Agrodome B.V. Wageningen, the Netherlands, 2024.

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Declaration Agrodome B.V.

LBP|SIGHT has reviewed the LCA background report ISOLENA sheepwool insulation with Ionic Protect®, 2024, according to the Bepalingsmethode 'Milieuprestatie Bouwwerken' versie 1.1. as an external reviewer. This EPD is the summary of that LCA background report, to be used for external communication.

The LCA background report is approved by René Kraaijenbrink, LBP|Sight, xx October 2024.