Provisional lifecycle assessment of Rold 12

Knauf's environment policy states that we are an environment-conscious business, with regard to the internal and external environment. Based on the circular concept, we want to help ensure sustainable development in the long run, and are working towards continuous improvement of environmental conditions, and to prevent pollution. We do so by:

- using eco-friendly raw material for the manufacture of our products
- using packaging that can be recycled or reused
- ensure the best possible utilisation of energy, raw materials and packaging
- work to reduce waste
- work to make the maximum use of waste and cut-offs

The authorities and our customers set out requirements for us regarding the environment. At the moment, the authorities directly (or indirectly via tax policy) apply requirements for environment approvals, waste reduction and green accounts, and then there are customer expectations. Ecolabels (Dansk Indeklima Mærkning), simplified environmental goods declarations (Sunda hus), complete lifecycle assessments (LCA) all contribute to environmentally-correct design.

Setting targets.

This report provides a lifecycle assessment of Rold 12, which is based on a previous LCA and EPD. Rold 12 figures are based on an EPD concerning Contur, in which input data calculations are increased with gypsum beadings glued onto the surface, and which therefore increase product weight by 1.9713 kg /m2. As such, the report provides a provisional profile of Rold 12, which will later be covered by a 3rd party EPD.

Limitations.

Geographic limitations.

We opted to look at the situation found in Denmark. Production takes place in Hobro, and therefore data is used for Danish electricity. A major part of our transportation crosses European borders, so transportation data (sea, road) are typical for the European transport industry.

Time limits.

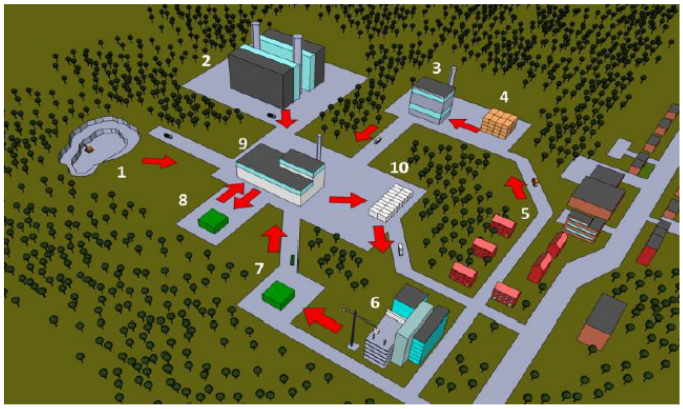
The lifecycle assessment must be regarded as short-term, and will be replaced by a 3rd party EPD.

Functional unit.

1 m² internal horizontal acoustic absorbent for 60 years.
Product weight: 12.6975 kg/m2
Transport weight: 13.0713 kg/m2

Product description, ceiling product.

Rold 12 is suitable for installation on a suspended double T-rail system. The product is made from a cutting board.
It consists of approx. 95% gypsum (a mix of natural gypsum (27.1%), industrial gypsum FGD (52.4%) and gypsum from recycled plasterboard (20.5%), approx. 4% cardboard and approx. 1% other additives (starch, soap, retarder, dispersing agent, glass fibre, edge glue, stamp colour).
Further processing consists of sawing, perforation, bevelling of the edges, gluing an acoustic absorbent on the back (acoustic felt) printing metal clip fittings on the back, painting the front, printing beads (or gluing veneer on beads), cutting beads, gluing beads on the surface and packaging in corrugated cardboard and PE film. A lot of ceiling products are cut to size on the building site, holes cut for installations, etc. Waste on the building site is estimated at 20%. At end of life, recycling is performed in the same way as for plasterboards, although there is an extra fraction for recycling, i.e. the metal clip fittings. Total recycled gypsum from building sites currently amounts to 9.5%.
Internal waste from plasterboards is estimated at 10.5%, which is used for the manufacture of new boards.



1. Quarry, natural gypsum
2. Power station, flue gas gypsum
3. Paper factory, face and back liner
4. Recycled paper
5. Households collecting paper for recycling
6. Building site (A5)
7. Recycled gypsum from building sites (C3)
8. Internal recycling of gypsum
9. Gypsum plasterboard factory (A3)
10. Gypsum plasterboard products at the gate

See also the system boundary table on page 6 for a tabular presentation of the syst boundaries and the modules included.

Other limitations:

- The substances used in the product that account for less than 0.1 of weight % were not taken into account.
- This accounting method complies with the Danish Working Environment Authority's Executive Order on safety data sheets.

Allocation for industrial gypsum FGD gypsum.

Environmental impact from transportation from power stations to the factory is allocated for industrial gypsum. That element of water consumption and related electricity consumption due to extra purity requirements is also included. These requirements mean that clean water is used during the last part of the production process, followed by vacuum-filtering of the industrial gypsum. That a contribution to environmental impact from raw material consumption (lime) and electricity consumption for the desulphurisation process at power stations is not included, is due to desulphurisation of flue gases being due to mandatory requirement, and that this material and electricity consumption will take place regardless of whether industrial gypsum is produced or not.

The alternative to use of industrial gypsum is that it is dumped in landfill sites. However, the positive environmental effect of reducing dumping is not included.

The higher content of free moisture in industrial gypsum compared to natural gypsum means greater energy consumption from pre-drying. This energy consumption is included in the figures used. In the event of major changes in relative composition, energy consumption figures will have to be updated.

Allocation for recycled gypsum.

The first use of gypsum (natural gypsum) is expected to bear the full environmental impact. But allocation is made for the environmental impact that occurs during manufacture, including the energy consumption for crushing, drying, pre-painting and calcination. Transport from source to factory is also included.
Financial factors mean that the recycling percentage is not 100%. This recycling percentage therefore has to be updated regularly as the recycling options are used to a greater degree.
Recycled gypsum from external suppliers is analysed regularly for purity. Contaminated gypsum that fails to meet requirements is not used to make new boards.

Identifying and accounting.

Accounting covers resource consumption and environmental effects, but not working environment effects, as the necessary data has not been gathered.

The accounts are divided into 6 phases, as it is natural for building products to divide the lifecycle assessment into the following phases:

Phase 1:	Production of raw materials
Phase 2:	Production of basic board
Phase 3:	Curing phase
Phase 4:	Building phase
Phase 5:	Use phase
Phase 6:	Demolition/recycling/renewal

Phase breakdown.

Phase	Plasterboard	Extra for ceiling products
Phase 1 raw material phase	Mining and coarse crushing of natural gypsum Mining lime, flue gas filtering and extraction of industrial gypsum Forestry, paper manufacture, use and recycling for gypsum cardboard Cultivation of maize and production of starch Production of 11 minor raw materials and additives Water extraction	Production of clip fitting Production of felt Production of glue Production of paint
Phase 2 production phase - basic board	Drying of raw materials Crushing of natural gypsum Pre-painting of gypsum Calcination of gypsum Casting Drying boards	
Phase 3 curing phase	Sawing Perforation Bevelling/milling Assembly and gluing Painting Drying Cutting beads Gluing beads Labelling/packaging	

Phase 4 building phase	Cutting to size Installation	
Phase 5 use phase	Cleaning (if relevant) Repairing damage (if relevant) Modification for new requirement in building (if relevant)	
Phase 6 demolition phase	Dismantling (sorting) Breakdown Recycling Recycling (crushing, separation, incineration) Alternative use Dumping	

Materials.

Materials	Gr	%
Stucco	11690	92.1
Paper liner	420	3.3
Fibreglass	10	0.1
Other add	10	0.1
Metal clips	270	2.1
Acoustic felt	47.5	0.4
Glue	100	0.8
Paint	150	1.2
Water	0*	0.0*
Sum of Materials	12697.5	100
Packaging		
Polyethylene	49	13.1
Ceiling board	72.7	19.4
Cardboard	42	11.2
Pallet	210.1	56.2
Total	373.8	100

*Water is added to the stucco

Environmental impact

Parame.	Unit	A1,A2,A3
GWP	Kg CO2	4.321772162
ODP	Kg CFC11	1,94044E-05
POCP	Kg C2H4	0.001202324
AP	Kg SO2	0.017828782
EP	Kg PO43	0.003085298
ADPM	Kg Sb	9,50201E-06
ADPE	MJ	72.98731297

GWP: Global Warming Potential
ODP: Depletion potential of the stratospheric ozone layer
POCP: Formation potential of tropospheric photochemical oxidants.
AP: Acidification potential of land and water
EP: Eutrophication potential
ADPM: Abiotic depletion potential for non-fossil resources
ADPE: Abiotic depletion potential for fossil resources

Resource use

Parame.	Unit	A1,A2,A3
RPEE	MJ	14.97900324
RPEM	MJ	11.06938919
TPE	MJ	26.07194432
NRPE	MJ	78.88706189
NRPM	MJ	0.965627568
TRPE	MJ	79.82913757
SM	Kg	1.769960004
RFS	MJ	INA
NRSF	MJ	INA
W	M3	10.66900703

RPEE: Renewable primary energy resources used as energy carrier
RPEM: Renewable primary energy resources used as raw materials
TPE: Total use of renewable primary energy resources
NRPE: Non-renewable primary energy resources used as energy carrier
TRPE: Total non-renewable primary energy resources
SM: Use of secondary materials
RSF: Use of renewable secondary fuels
NRSF: Use of non-renewable secondary fuels
W: Use of fresh water

End of life – Waste

Parame.	Unit	A1,A2,A3
HW	Kg	0.000153087
NHW	Kg	0.017663919
RW	Kg	INA

HW: Hazardous waste disposed
NHW: Non-hazardous waste disposed
RW: Radioactive waste disposed

End of life – Output Flow

Parame.	Unit	A1,A2,A3
CR	Kg	INA
MR	Kg	0.003415024
MER	Kg	0.014013376
EEE	MJ	INA
ETE	MJ	INA

CR: Components for reuse
MR; Materials for recycling
MER: Materials for energy recovery
EEE: Exported electric energy
ETE: Exported thermal energy