

LIFE CYCLE ASSESSMENT OF MINERAL WOOL INSULATION

INTRODUCTION

Life Cycle Assessments are being introduced by bodies such as BREEAM to reduce the environmental impact from construction products. This is done by using measures to optimise construction product use and by selecting products with a low environmental impact (including embodied carbon), over the life cycle of the building.

Mineral wool insulation is an extremely popular material amongst construction professionals for its many qualities, such as –

- Fire Stopping (Euroclass A1)
- High Thermal Performance
- High Acoustic Performance
- Ease of Installation/Flexibility

Main Manufacturers 

Common applications – lofts, roofs, cavity walls, solid walls, structure panels and piping.

The following study displays the considerations to be made during the life cycle analysis of mineral wool insulation

1 - PRODUCT STAGE

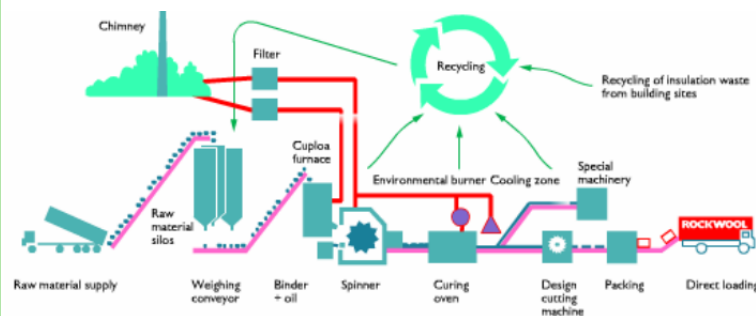
A1 - SUPPLY OF RAW MATERIALS

Typically made up of volcanic rock (typically basalt or dolomite) and is extracted/quarried through the use of plant, leading to fuel consumption. Slag is a byproduct of smelting iron ore and so would not necessarily be considered during the LCA. 3% Resin binder/adhesive and oil is also used to manufacture mineral wool.

A2 - TRANSPORT

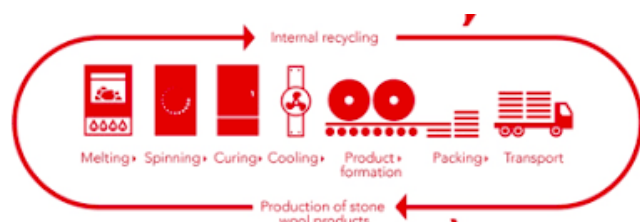
Transport of raw materials extracted from their origin to the manufacturing plant via truck. Energy used from transporting these materials should be considered within the LCA.

A3 - A3 - PRODUCTION



(www.rockwool.co.uk Date Accessed 03.02.2020)

Rock and slag materials are melted in a cupola furnace at approximately 1500°C. The molten mixture is spun to give a mineral wool with a fibre-like structure. Energy is used in the manufacturing process through the consumption of electricity and fuel. Once production is complete, the wool is wrapped in plastic packaging (further energy consumption)



2 - CONSTRUCTION STAGE

A4 - TRANSPORT

Product transported from the plant to stockists/site. These journeys should be considered within the LCA, considering the fuel consumption of the vehicles delivering the product. (The mineral wool is compressed in packaging, so costs and environmental impacts of transport are reduced due to less trips being made)

A5 - CONSTRUCTION/INSTALLATION PROCESS

Installed manually, there is no machine energy expenditure and so this is not included in the LCA. Site waste packaging is then generally assumed to end up in landfill and so costs to incinerate this material is considered within the LCA. Also considered should be an average percentage for waste material, however the installation generates very little waste.

Mineral wool generates very little manufacturing waste (a few %), as materials can be fed back into the manufacturing process. There is virtually no installation waste when it is blown in place on site and ~5% waste from rolls depending on the nature of the installation. (www.smartwaste.co.uk Date Accessed 03.02.2020)

3 - USE STAGE

B1 - USE

There are no costs from the "use" stage of mineral wool as it does not require any energy or fuel.

Mineral wool also generates very little manufacturing waste (a few %), as materials can be fed back into the manufacturing process. There is virtually no installation waste when it is blown in place on site and ~5% waste from rolls depending on the nature of the installation.

B2 - MAINTENANCE, B3 - REPAIRATION, B4 SUBSTITUTION, B5 - RESTORATION

Once installed, it does not typically require maintenance. It is protected from any likely source of damage such as water ingress, and is encapsulated within the building fabric, it should last the lifetime of the building, therefore mitigating the need for reparation, substitution or restoration

"Rockwool has been proven in services for over 60 years, in a wide range of climate and degrees of exposure. It will generally perform effectively for the lifetime of the building, plant or structure" (Rockwool Technical Solutions Consultant)

Almost all available mineral wool products should be CE marked. This indicates the product complies with the relevant EU legislation.

"During manufacture materials are tested regularly and certified independently when they leave the factory. By law they must state a 'declared thermal conductivity' (with the symbol λ_d) as part of their CE mark. This measurement is also called $\lambda_{90/90}$, the thermal conductivity achieved by 90% of the production with 90% confidence, it considers production variance and aging over a projected material life. (www.passivhaustrust.org.uk)

B6 - OPERATIONAL ENERGY USE

There is no operational energy use with the use of mineral wool – it does not require fuel or energy to function as it is simply a material. Mineral wool has a positive effect on the Operational Energy Use of a building in that it drastically increases a buildings thermal performance, leading to less heating requirement and lower energy use. These factors will have a positive effect on the LCA.

B7 - OPERATIONAL WATER USE

Mineral wool does not have an impact on operational water use as no water consumption is required for the operation of the product.

4 - END OF LIFE STAGE

C1 - DEMOLITION/DECONSTRUCTION

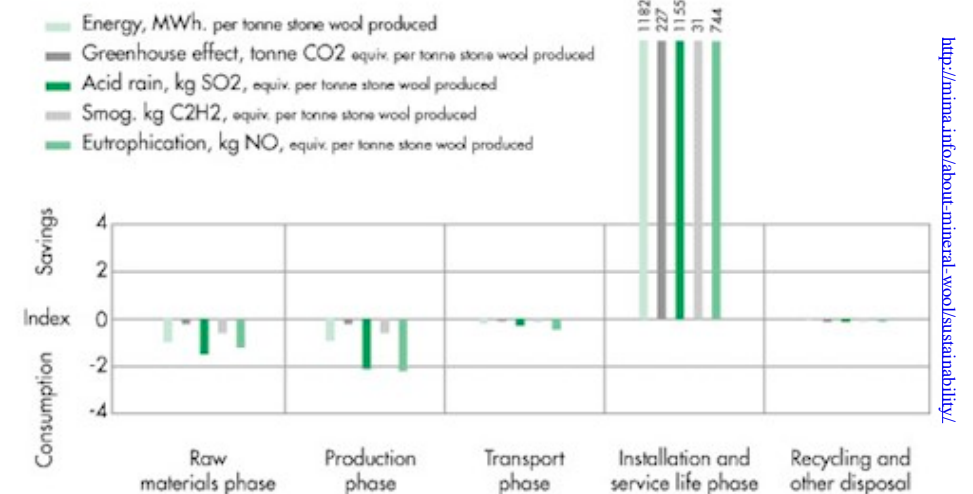
Compared to most construction materials, the demolition/deconstruction of thermal insulation would not have a significant impact on the environment/ LCA.

C2 - TRANSPORT

The transport from the site to landfill should be considered within the LCA (transport of skips on lorries, fuel consumed during transit).

C3 - WASTE TREATMENT/PROCESSING & C4 - DUMPING/DISPOSAL

Some mineral wool is sorted and recycled by mineral wool manufacturers (one example of this is the Rockwool factory in Bridgend, Wales) however this is very rare. Most mineral wool ends up in landfill.



<http://mima.info/about-mineral-wool/sustainability/>

CONCLUSION

Mineral wool seems to have a significantly positive effect on the energy efficiency of a building. Mineral wool is one of a few materials that "help reduce operational energy demand" and so the use of these materials can earn a contractor 4 BREEAM credits

From the graph above, it is quite clear that there are huge benefits to using mineral wool insulation and one huge positive is that it has a positive carbon footprint.

The "Raw materials Phase" (A1) and Production Phase (A3) are clearly the worst phases in terms of CO2 emissions but this is soon balanced out as described on eurima.org (European Insulation Manufacturers Association) where it is stated that "after less than half a year's use, insulation's energy and CO2 balances become positive"

These phases, along with Phase 2, have the most non renewable primary energy demands due to the consumption of coke, gas, fuel and oil being consumed at the plant. Whilst the CO2 emissions during these phases are extensive, the statistics suggest that the positives certainly outweigh the negatives in the long run.

"While the 2016 emissions of CO2 from production of stone wool products for building insulation purposes amounted to estimated 2.1 million tons, the savings from products sold in 2016 as building insulation may lead to potential emissions savings of estimated 155 million tons in the lifespan of the products" (PricewaterhouseCoopers, 2017 - Report on Rockwool)

References

www.rockwool.co.uk
www.passivhaustrust.org.uk
www.smartwaste.co.uk
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mima.info

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