Summary of the results of the life cycle assessment calculations

Life cycle assessment

Greenhouse gas emissions were assessed in kgCO2e (CO2 equivalents) according to IPCC 2013. The functional unit considered is 1 m2 of Skinrock slabs (quartzite and slate), natural stone and ceramic tiles. The system boundaries considered are cradle-to-grave. The ecoinvent database ecoinvent 3.6 as well as other studies and own investigations were used for the assessment.

Results Skinrock records total

The processes that contribute most to the CO2 emissions during the whole life cycle of Skinrock panels are the processing of the stone into the panels (approx. 50%), followed by the assembly of the panels (approx. 43%). This is due to the fact that several materials (chemicals) have to be used, the production of which has the greatest impact on the environment.

From extraction of the rock to disposal, quartzite skinrock slabs emit 19.2 kgCO2e/m2, while slate skinrock slabs emit 18.1 kgCO2e/m2. Details of the total emission results of Skinrock panels can be found in Table 1.

Overall comparison Skinrock and natural stone and ceramic tiles

In order to compare the Skinrock slabs with natural stone and ceramic tiles, an average value between quartzite and slate slabs was used (a total of 18.5 kgCO2e/m2). In Table 2, the production of the raw materials, their transport as well as the processing into the final product were summarised under the term "production". The total CO2 emissions over the entire life cycle of natural stone slabs amount to 39.1 kgCO2e/m2 , while for ceramic tiles the figure is 25.0 kgCO2e/m2. This means that Skinrock slabs cause on average 52% and 25% less CO2 emissions than natural stone and ceramic tiles respectively.
ceramic tiles.

Processes considered in detail:

Stone extraction

When extracting the stone for the production of Skinrock slabs, the diesel consumption of the cutter and crane brakes as well as the infrastructure was taken into account. Since less diesel is consumed per stone for slate than for quartzite, slate slabs also produce fewer emissions per area.

Transport of the stone to the production plant

The origin of the quartzite stone was reported as 85.7 % India and 14.3 % Brazil. For the slate stone, 75 % of the transport was from India and 25 % from Portugal. In addition to the distances, the amount of slab area per kg of stone was also considered. Since more slabs can be produced per weight of slate stone, fewer emissions are generated for it than for quartzite slabs.

Processing

Several processing steps are necessary to turn the rock into skinrock slabs. The following parameters were taken into account to calculate the emissions generated during processing: Electricity consumption of the machines, materials used (LPG and O2 gas; gelcoat; resin; CSM; fabric), water consumed, wastewater generated, disposal of processing waste and the infrastructure of the production site. The processing step that has the largest impact is the application of the materials, accounting for 96% of the total CO2 emissions during processing. The application of resin (unsaturated polyester) contributes the most (58-64%), followed by the application of Gelcoat (23-25%). For more details on the processing results, see tables 3a and 3b.

Production of natural stone slabs and ceramic tiles

In the production of the comparative products, the extraction of the raw materials, their transport and further processing are evaluated. The final product, natural stone, goes through the processes of cutting, grinding and polishing. The ceramic tiles are manufactured using the slurry process. Specific data sets from ecoinvent 3.6 were used for the production of the comparative products. A study by the German Natural Stone Association (DNV - https://www.natursteinverband.de/nachhaltigkeit/studie-boden-innen.html) was used to consider the weight per unit area of these products.

Assembly

Different materials are used in the assembly of Skinrock panels on different surfaces. The material that has the greatest impact during assembly is Skinrock 2K PU, which accounts for 99.4% of the total CO2 emissions from assembly. This can be explained by the fact that a larger quantity of it has to be applied and its production is also highly polluting. For the production of Skinrock 2K PU, 88% polyol and 12% isocyanate were assumed, as stated in the production declaration. Further details on the composition results can be found in Table 4.

In order to take into account the materials and their respective quantities for the production of the comparative products, the DNV study was used. However, the results were not taken from this study and were calculated accordingly.

Packing

The entire life cycle of the packaging was considered: Production of the raw materials, processing of the packaging, its use phase (how often it is reused) and its disposal. The same packaging was assumed for the comparison. However, for natural stone and ceramic tiles, a factor corresponding to their weight per unit area was taken into account. As far as the CO2 emissions of the packaging are concerned, the wooden box, although reused five times, contributes the most with 92%.

Distribution

For the distribution of the Skinrock records, all 15 countries and their respective shares were considered. All transport from the production site in Shah Alam, Selangor, to the capitals of the individual countries was by truck and ship (except in Malaysia, where only truck was used). The same transport distances were used for the comparison with natural stone and ceramics. In addition, the weight per unit area of the different slabs was taken into account during transport. Therefore, slabs with a higher weight per unit area have higher distribution emissions.

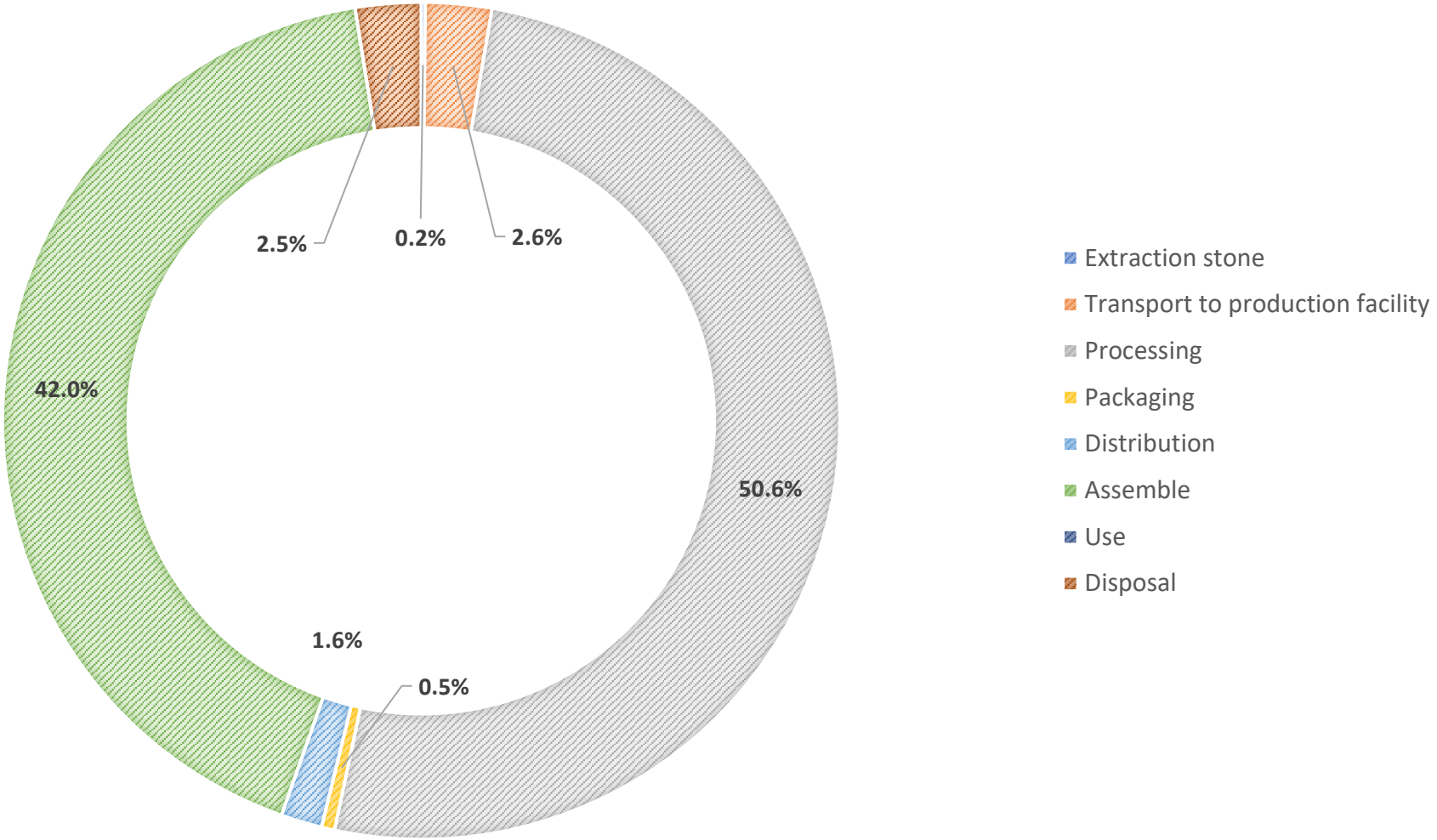
Use phase

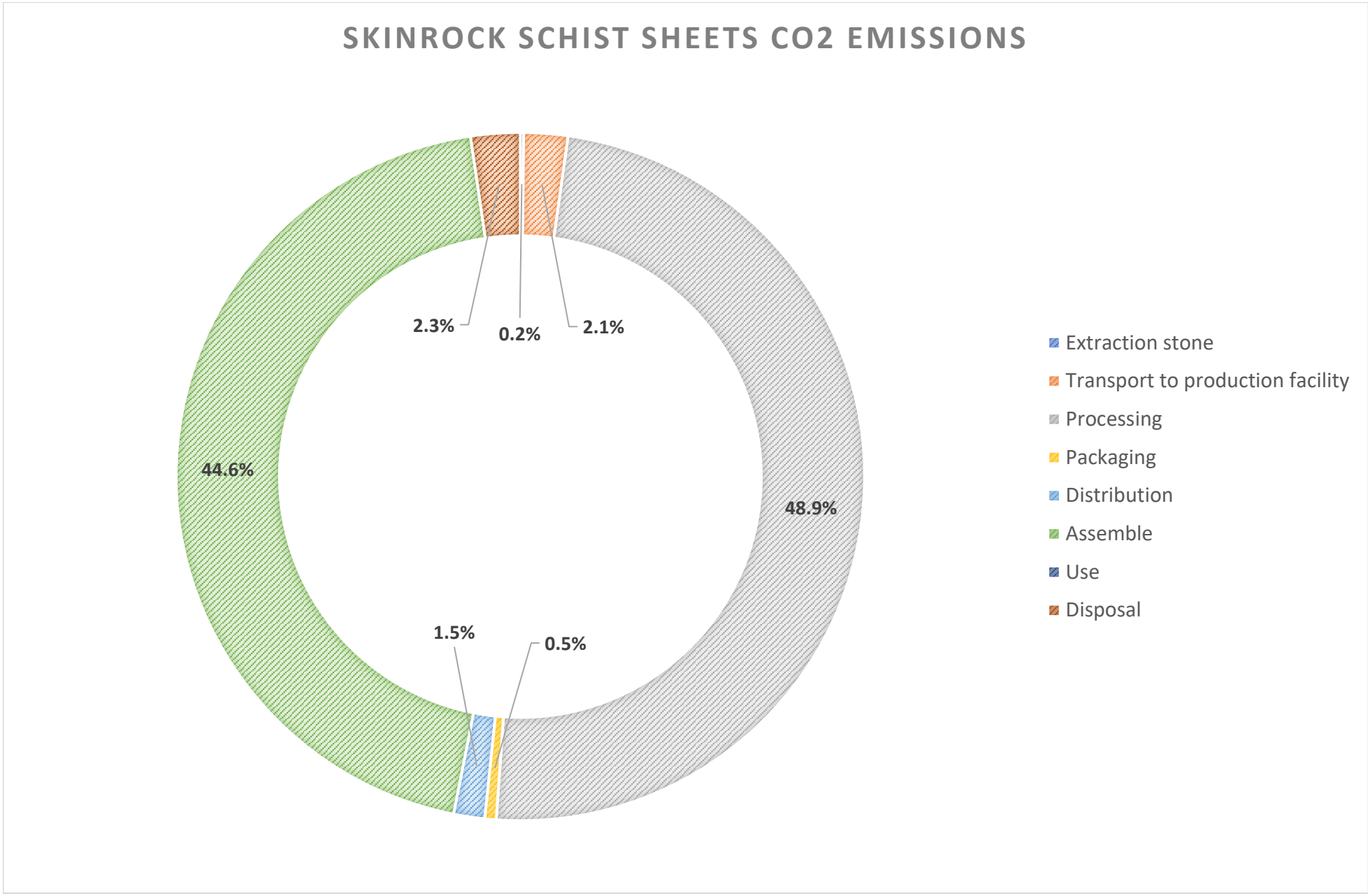
The service life of the Skinrock panels and the natural stone and ceramic tiles was assumed to be 50 years. It was assumed that emissions during the use phase are negligible, i.e. they were assumed to be zero.

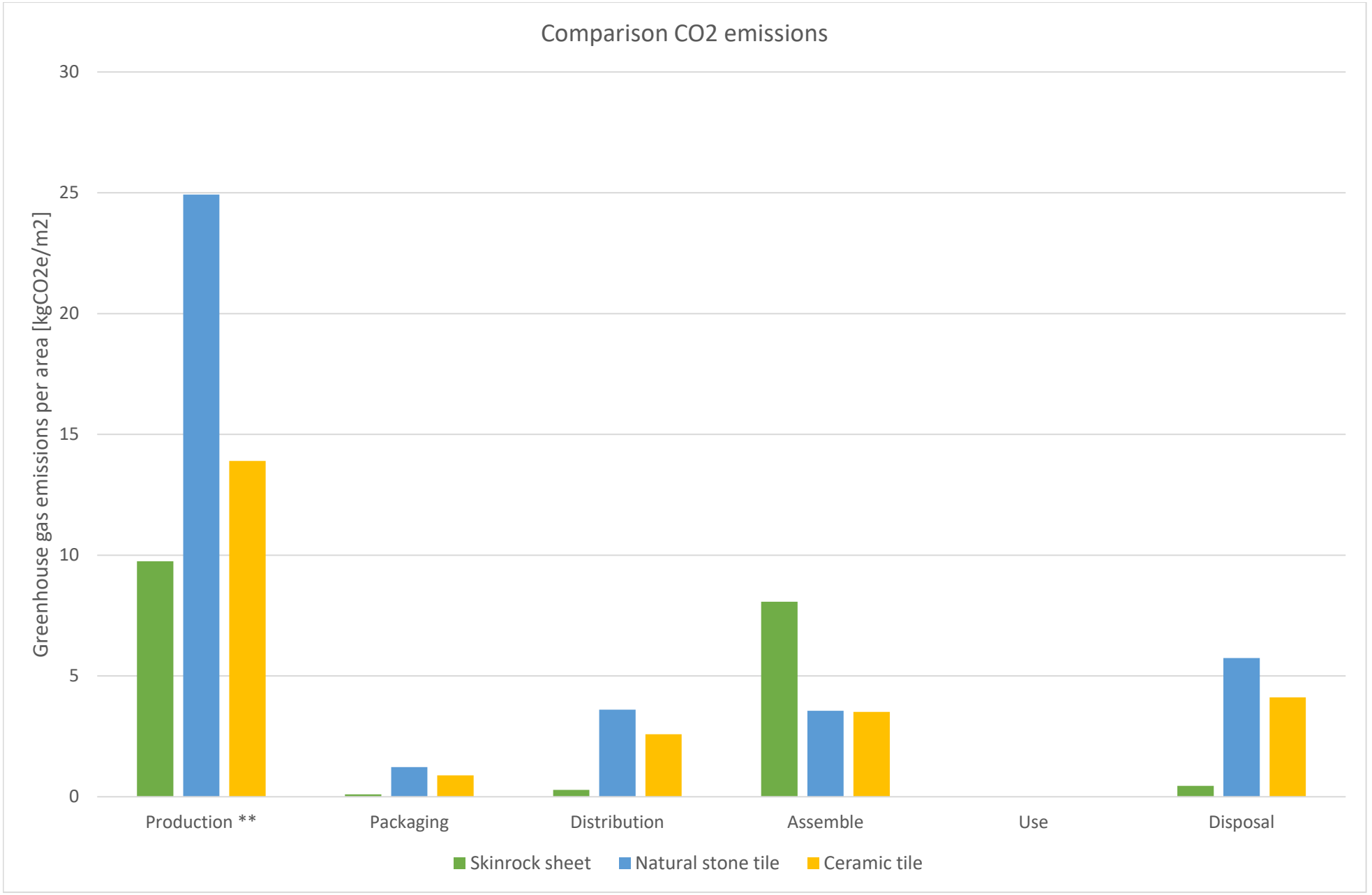
Disposal

After a useful life of 50 years, all products must be disposed of properly. The same emission factor for disposal was applied to all four products compared. Thus, the weight per unit area of each product determines the disposal emissions.

SKINROCK QUARTZITE SHEETS CO2 EMISSIONS




SKINROCK SCHIST SHEETS CO2 EMISSIONS
2.3%
0.2%
2.1%
44.6%
48.9%
1.5%
0.5%
Extraction stone
Transport to production facility
Processing
Packaging
Distribution
Assemble
Use
Disposal


Comparison CO2 emissions
Greenhouse gas emissions per area [kgCO2e/m2]
30
25
20
15
10
5
0
Production **
Packaging
Distribution
Assemble
Use
Disposal
Skinrock sheet
Natural stone tile
Ceramic tile