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The carbon footprint of your garden decking

Ever wondered about the carbon footprint of your garden decking? The Danish Technological Institute and the Swedish Environmental Institute has compared the CO_2-release of different decking materials. Which material comes out on top? And what is the CO_2-impact of your garden decking compared to your everyday activities such as driving a car?

The ever-increasing focus from consumers and politicians on environmental sustainability, has led to “environ-mental friendliness” becoming an important sales argument for any consumer product along with more traditional parameters such as quality, durability, price, etc. While many products claim to be “environmentally friendly”, “eco-friendly”, “green”, or similar it is not always easy for the consumer to judge the validity of these claims.

Life cycle assessment (LCA)

Life cycle assessment (LCA) is a methodology established to objectively quantify, evaluate and compare environmental impacts from products and processes. To do so, the LCA attempts to establish all inputs and outputs of both materials and energy associated with the production of a given product, for example a garden terrace. As the name implies *life cycle* assessment ideally considers the whole life cycle of the product. Thus, the assessment includes not only materials and energy associated with the actual production but also materials and energy consumed in the use phase i.e. the life time of the product as well as materials and energy used (or recovered) during end-of-life.

A simplified example. Let’s say we wanted to evaluate the carbon footprint i.e. the global warming potential of wood garden decking in CO_2-eqvivalents. To keep it simple, let’s say the raw materials for the terrace are wood and screws. First, we would have to establish all materials and energy consumed in growing and felling the trees as well as cutting and drying the logs and boards at the sawmill. If the boards were to be chemically treated, the impact of the impregnation procedure would be assessed as well. Then for the screws we would do likewise, accounting for all operations from mining of metal or to casting of screws. Then we would look at the energy consumption of transporting the raw materials (boards and screws) from factory gate to the consumer end point. The impact of construction itself would also be evaluated – if for example heavy machinery was to be used, the energy consumption of these would be included in the assessment. For the construction of a wood terrace the impact from this step would be limited.

Next a realistic service life of the terrace will be assumed and all materials needed for maintenance of the terrace during the complete service life would be included. We might want to apply a water based wood coating to the wood at regular intervals. Therefore, we would have to include all impacts of the coating including raw material extraction, production, and transportation to the consumer. If the expected service life of the terrace is longer than the expected life time of the decking material, the decking material will have to be exchanged during the service life and we would have to add the exchanged decking layer to the assessment.

Finally, the end of life phase would be evaluated. We would account for all operations related to disposal of all decking materials. This process would include transportation of materials to a waste processing unit and also account for energy recovery that might result from waste treatment.

The end result would be the complete release of CO_2 resulting from your garden decking over its full life cycle. Simple, right? Of course, nothing is ever simple and typically an LCA is based on a number of assumptions and your result will never be more accurate, than the assumptions you put in. Therefore, LCA results should be viewed as indicative more than a precise result. Nevertheless, LCA is a powerful tool when evaluating the environmental impact of products and processes and may help you choose the 'greener' of all those 'eco-friendly' products.

Carbon footprint of garden decking

In this assessment, we compared the global warming impact (CO_2-eqvivalents) of 5 different terrace decking: NTR Class AB treated pine wood, Siberian larch, Ipé (tropical wood species), wood plastic composites (WPC), and concrete. The wood plastic composite was assumed to contain 50% wood and 50% plastic polymers. Two alternative WPCs were examined – one produced in Germany and one produced in China. The fictive terrace (functional unit) was located in Stockholm and had an area of 30 m^2 (5x6 m). The life time of the terraces is 30 years after which it is de-constructed and disposed of. For all decking materials, the complete terrace was assessed including substructure and foundations if needed.

Data for raw material extraction and production was based on published sources. For concrete and wood plastic composites published industry EPDs were used. For Ipé, Siberian larch, and NTR Class AB treated wood data was based on published LCAs.

For the wooden terraces, maintenance by application of water based product at regular intervals was assumed. Application of water based product by brush every 5 years from year 1, volume needed per application 15 m_2/l = 2 l. No maintenance was considered for the WPC and concrete terraces. The following end-of-life scenarios were calculated for the different terraces; NTR class AB: incineration. Siberian larch, Ipé and WPC: incineration. Concrete: backfilling. Carbonation of concrete – a process in which concrete takes up CO_2 from the atmosphere – was accounted for both in the use phase and at the end of life.

Results show that there is a large difference in the global warming potential of the different terrace options. The Chinese wood plastic composite terrace has by far the largest global warming potential (1867 kg CO_2-eqvivalents). NTR Class AB treated pine wood has the lowest potential (172 kg CO_2-eqvivalents) followed by the ipé terrace (265 kg CO_2-eqvivalents). The global warming potential of the Chinese wood plastic composite terrace is more than 10 times higher, than for the NTR Class AB treated pine wood terrace. The contribution from the Siberian larch (422 kg CO_2-eqvivalents) and the concrete terrace (412 kg CO_2-eqvivalents) is almost identical which is caused by the assumed shorter life span of Siberian larch (15 years) which means that two decking layers are needed in the lifespan of the terrace.

There is a significant difference between the Chinese and the German production scenario. The majority of the difference stems from higher GWP of the Chinese energy mix and transportation form China to Europe.

In general, the study shows the relatively high contribution from transport of materials. Imported wood species such as Siberian larch (from Siberia) and Ipé (from Brazil) does not 'cost' significantly more CO_2 to produce than the NTR class AB treated pine wood, but the CO_2-cost of transportation to Sweden is evident in the final result.

How much is then a global warming potential of 172 kg CO_2-eqvivalents – the life cycle contribution from the NTR Class AB treated pine wood terrace? To compare it with the contribution from one of your daily activities, we've translated the contributions of the different terraces into kilometers of driving an average car. We've defined an average petrol car as a car with an average release of 120 g CO_2/km. The result of the comparison shows that the 172 kg CO_2-eqvivalents from the complete 30 year life cycle of the Class AB treated pine wood terrace corresponds to driving an average car 1433 km. To the author of this article this corresponds to about 2 weeks of driving. Chances are your garden terrace is hardly the biggest CO_2-'sinner' in your life then…

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Putting things into perspective

Decking material	**Origen**	**Area**	**Material lifetime (years)**	**Decking service life (years)**	**Maintenance**	**End-of-life**	**CO_2-eqv.**
NTR Class AB Pine wood	Sweden	30	30	30	Water based wood coating	Incineration	172
Siberian larch	Siberia	30	15	30	Water based wood coating	Incineration	422
Ipé (tropical wood)	Brazil	30	30	30	Water based wood coating	Incineration	265
Wood plastic composite	China	30	30	30	None	Incineration	1867
Wood plastic	Germany	30	30	30	None	Incineration	1296

composite							
Concrete	Sweden	30	30	30	None	Backfilling	412