Product Carbon Footprint Study Report

Carried out by Green0meter

Company:	PLASTIC GUYS
Product Name:	Recycled plastic panel
Date of Issue:	20-8-2024

Notice

The Product Carbon Footprint study and its report was performed in accordance with the ISO 14067:2018 methodology in a manner consistent with the International Standards on life cycle assessment (ISO 14040 and ISO 14044). This computation relies on the adequacy and completeness of data and information provided by the applicant. User of this study report shall critically evaluate whether provided results are sufficient for intended use.

Product Name	Recycled plastic panel
Standard	ČSN EN ISO 14067
Boundary	Cradle to gate
Functional Unit/Declared unit	1 produced panel
Weight	32 kg
Target Audience(s)	Internal reporting, potential customers
GWP emissions	27.05 kg CO_2e
Emissions Hot Spot	Raw materials extraction & acquisition
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1. GOAL AND SCOPE DEFINITION

1.1. GOAL DEFINITION

The Carbon Footprint study of the product (CFP) described above aims to provide complex information about the total greenhouse gas (GHG) emissions as well as the emission distribution in different stages of product lifetime. Through such analysis, the processes with the biggest contribution can be easily determined. The impact is estimated as a mid-point indicator for Climate Change (CC).

1.2. SCOPE DEFINITION

1.2.1. FUNCTIONAL UNIT

The functional unit for which the study was carried out is 1 panel produced from recycled plastic, weighing 32 kg.

1.2.2. SYSTEM BOUNDARY

The investigated system represents the production of plastic panels from recycled high impact polystyrene. The system boundary is defined from cradle to gate and the calculation includes the following:

- Raw material extraction, production and transport
- Recycled materials acquisition
- Packaging and its transport
- Manufacturing phase

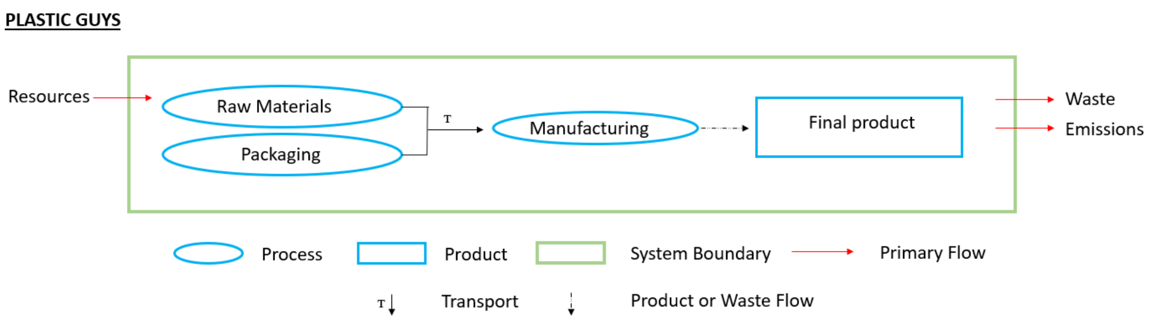

Figure 1: simplified scheme of applied cradle to gate calculation

2. LIFE CYCLE INVENTORY

2.1. DATA COLLECTION

2.1.1. RECYCLING AND RAW MATERIAL ACQUISITION

The company uses recycled granulate to produce new plastic panels. The environmental impacts of the high impact polystyrene regranulate were calculated using open-loop allocation according to EN ISO 14067, assuming that the recycling rate is 80 %. Other input materials such as the silicone oil and packaging materials were treated as virgin inputs.

2.1.2. MANUFACTURING PHASE

This phase describes the acquisition of raw materials used for packaging materials, including their transport to the production site. When packaging the product, 6 m of plastic tape is used to anchor the product to the pallet. For the two existing product packaging scenarios (1 or 20 boards per pallet), the calculation assumed the same probability (50 %). The impact of the manufacturing phase, which consists of ending (using a planer), heated press and CNC machining, is expressed in terms of their electricity consumption. The emission factor of electricity production corresponds to the national mix of the Czech Republic. The environmental impacts of administrative and storage facilities, as well as production facilities, were neglected due to their low significance.

2.1 PRODUCT CARBON FOOTPRINT DATA CALCULATION

Following primary data used in carbon footprint calculations were included:

- Data provided from the company describing consumption of materials and energy

Secondary data used in calculations were provided by following datasets:

- ecoinvent v3.10

The environmental impact has been assessed by the Environmental Footprint 3.1 impact assessment method introduced by the European Commission, where the CC impact category assessment is based on the IPCC model.

2. LIFE CYCLE IMPACT ASSESSMENT

Based on the methodology, modelling and applied assumptions or approximates, the emissions of direct GHG in relative scale to Global warming potential (GWP100) is 27.05 kg CO_2e. Figure 2 and figure 3 show the distribution of GHG emissions.

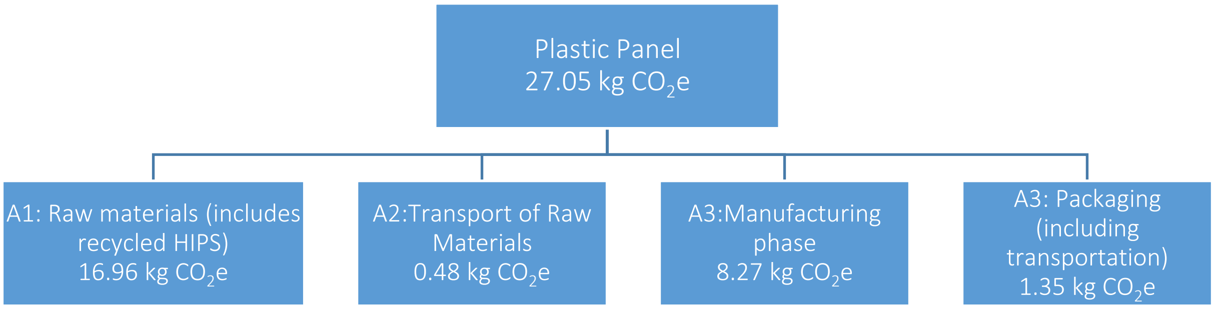

Figure 2: Total GHG emissions distribution per functional unit

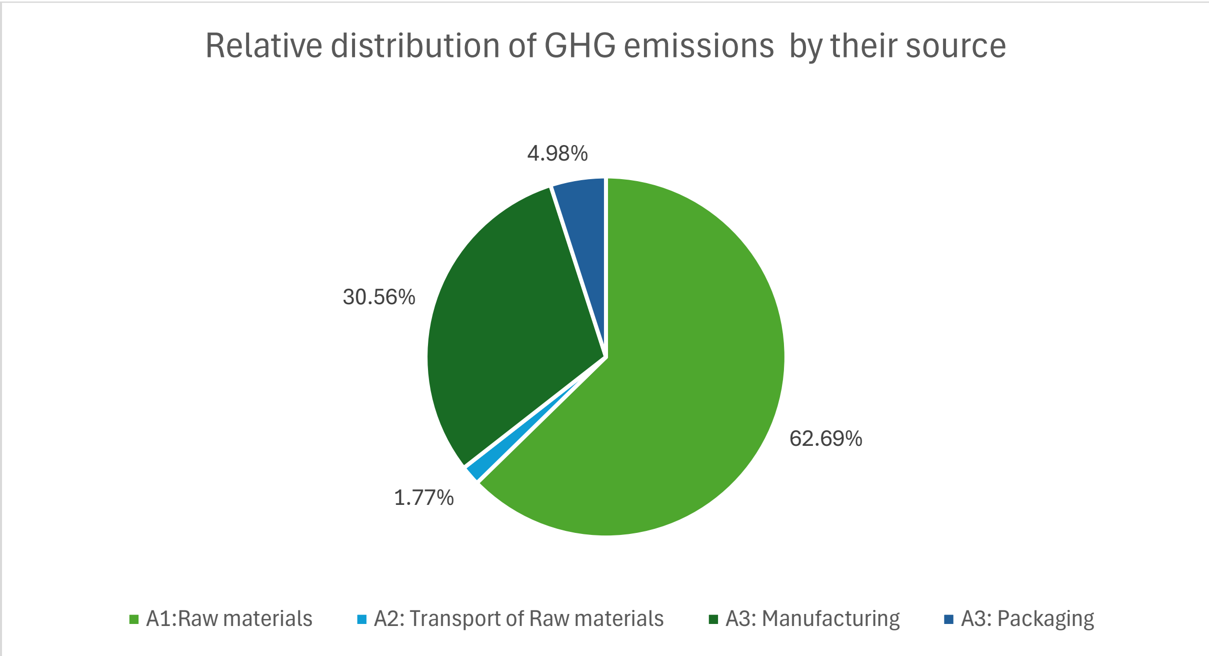

Figure 3: Relative GHG emissions distribution by their source

Table 1: Specific greenhouse gas emissions and sinks

Results per declared unit		
Indicator		Units
Biogenic greenhouse gas emissions	1.7E-02	kg CO_2e
Fossil greenhouse gas emissions	2.71E+01	kg CO_2e
Greenhouse gas emissions from land use	1.01E-02	kg CO_2e
Greenhouse gas emissions from aviation	0.00E+00	kg CO_2e
Total greenhouse gas emissions	**2.71E+01**	**kg CO_2e**

Table 2: Contribution of input and packaging materials and logistics to the overall carbon footprint of the product

	Flows				
	Flows	**Amount**	**Units**	**CF of flow (kg CO2 eq.)**	**Contribution to total CF of product**
Raw Materials	Regranulate(HIPS)	32	kg	1.68E+01	60.54384%
	Silicone Oil	0.038	kg	1.18E-01	0.42574%
	Total (Raw Materials)			1.70E+01	**60.96958%**
Transport of Raw Materials	Transport, regranulate	2512	km*kg	4.77E-01	1.71658%
	Transport, silicone oil	0.161508	km*kg	3.07E-05	0.00011%
	Total (Transport of materials)	2512.1615	km*kg	4.78E-01	**1.71669%**
Manufacturing and					
	Planing with a planer	1	kW/h	6.36E-01	2.28638%
	Heated press	8	kW/h	5.09E+00	18.29106%
	CNC machining	4	kW/h	2.54E+00	9.14553%
	Total (Manufacturing)	13	kW/h	8.27E+00	**29.72298%**
Packaging	Wrapping paper	0.360	kg	3.65E-01	1.31148%
	Interleaving paper	0.135	kg	8.93E-02	0.32108%
	Roofing foil	0.04	kg	1.11E-01	0.39917%
	Plastic strips for anchoring to the pall	3.15	m	9.37E-01	3.36878%
	Metal clips for fixing the tape	0.006	kg	3.84E-02	0.13795%
	Customized pallet	2.4	kg	5.52E-01	1.98496%
Transport of Packaging Materials	Transport, wrapping paper	8.604	km*kg	1.64E-03	0.00588%
	Transport, interleaving paper	3.2265	km*kg	6.13E-04	0.00221%
	Transport, foil	0.956	km*kg	1.82E-04	0.00065%
	Transport, plastic tape	0.4893525	km*kg	9.30E-05	0.00033%
	Transport, metal scissors	0.0504	km*kg	9.58E-06	0.00003%
	Transport, pallet	85.2	km*kg	1.62E-02	0.05823%
	Total	98.526253	km*kg	1.87E-02	0.06734%
	Total (Packaging Material)				**7.59076%**
	Total			**2.78E+01**	**100.00000%**

Figure 4: Comparison with primary HIPS granulate product

3. LIFE CYCLE INTERPRETATION

Important findings and conclusions are as follows:

By using regranulate instead of the primary raw material in the production of the plastic panel, emissions of 99.32 kg CO_2e were avoided (Figure 4).

- The graph below highlights the effect of using regranulate and using virgin raw material in the production of the plastic panel. The comparison shows that **the use of regranulate resulted in an 85% reduction in CO_2 emissions** from 116.16 kg CO_2e to 16.82 kg CO_2e (Figure 4).

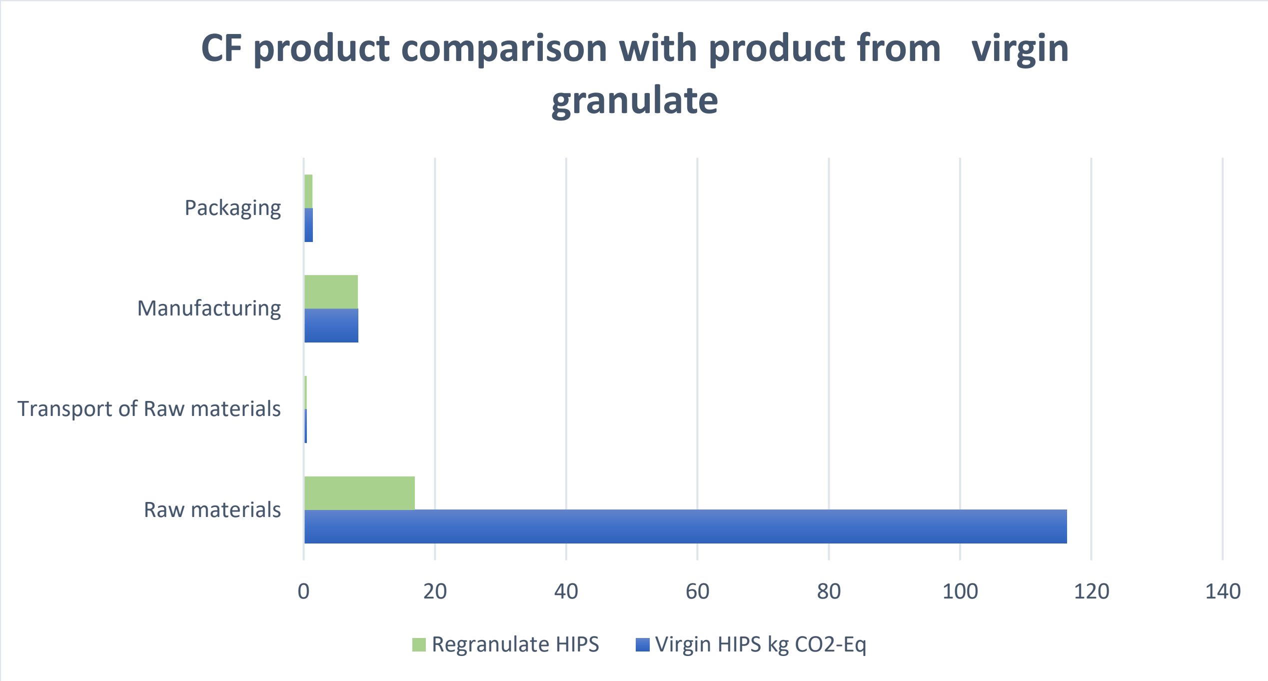

Figure 4: Comparison with primary HIPS granulate product

- The largest share of the total carbon footprint can be attributed to the acquisition of raw materials, where the acquisition of the HIPS regranulate is responsible for 99%
- The transport of raw materials, both production and packaging materials, represents a very low contribution to the total CF of the product
- If plastic shreds were used in the production of the plastic panel instead of regranulate, there would be an **additional 61% reduction in the overall carbon footprint of the product**, to 10.66 kg CO_2e. This reduction would be due to the high recycling rate (98.5%) and the relatively low energy intensity of plastic shredding compared to regranulate production (to make the results more comparable, HIPS was considered as the input material in all scenarios) (Figure 5).

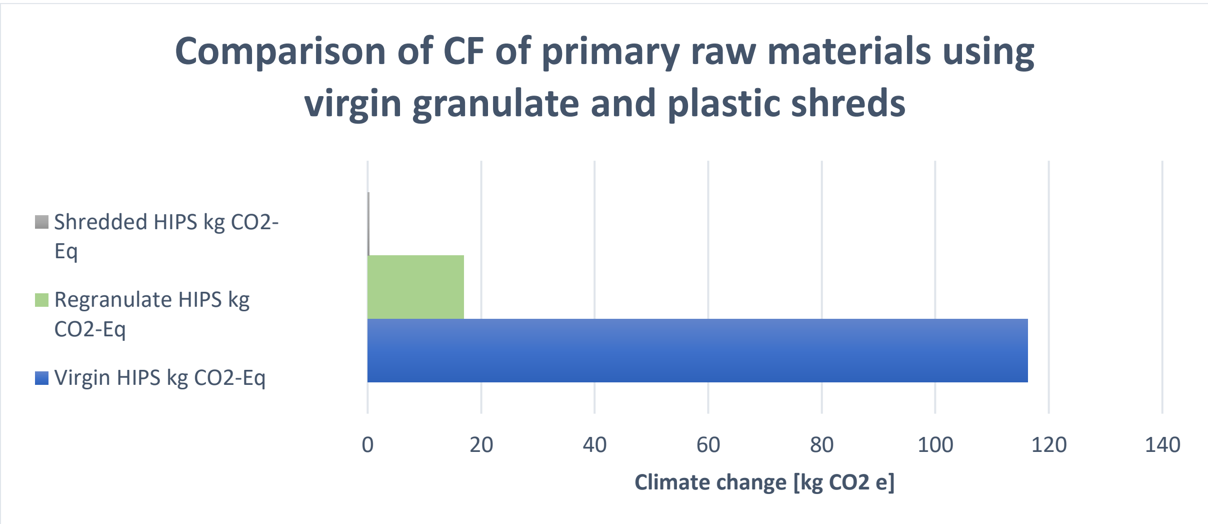

Figure 5: Comparison of emissions for different input materials

- By recovering 32 kg of plastic material and avoiding its subsequent disposal, such as landfilling (sanitary and non-sanitary), incineration in municipal waste facilities or uncontrolled forms of disposal such as open dumps and incineration, **43,9 kg of CO_2e emissions are avoided for each recycled plastic panel produced.**

Please note, the calculated carbon footprint might be highly dependent on the datasets available, which may not be always up to date or 100% in accordance with described flow processes. Also, lowering the impact in the category of climate change may result in higher environmental impact in other categories, which are not measurable by GHG emissions.