

Summary report

Product Environmental Footprint (PEF) analysis

Synthetic turf sports surface

Synthetic turf system name	
Manufacturer/supplier	
Date of report	



1 Introduction

Product Environmental Footprint (PEF) is a method of life cycle assessment (LCA) developed by the European Commission. PEF provides a standardised way of quantifying the environmental impacts of products (goods or services) by considering their entire life cycle, from raw material extraction to final waste management.

PEF Category Rules (PEFCR) describe how a PEF analysis should be undertaken for a specific product sector. The Category Rules for synthetic turf surfaces (*Synthetic Turf Product Environmental Footprint Category Rules - 2024 edition*) have been developed by the EMEA Synthetic Turf Council (ESTC) in cooperation with the European Commission. The Rules are available at [ESTC Product Environmental Footprint](#). The PEF analysis detailed in this report has undertaken in accordance with these Category Rules.

Results are calculated for the production life cycle (cradle- to-gate) and the complete life cycle including use and end of life disposal (cradle-to-grave).

The Product Environmental Footprint methodology describes 16 impact categories that need to be assessed during each life cycle stage of a product's life. The results for these are tabulated in Section 5 of this report.

The PEF methodology also allows the key impact categories for a specific product group to be defined. During the development of the PEFCR for synthetic turf surfaces, the following six impact categories were identified as being the most significant:

Acidification	An EF impact category that considers the environmental impact caused by the acidifying of substances in the environment, which can lead to forest decline and lake acidification.
Climate change¹	An aggregated EF category that assesses the potential for greenhouse gas emissions.
Particulate matter	An EF impact category that assesses the adverse effects on human health caused by the emissions of particulate matter and their precursors (e.g. NO _x , SO _x , NH ₃).
Resources used (fossil fuels)	An EF impact category that assesses the use of non-renewable fossil based natural resources (e.g. natural gas, coal, oil).
Resources used (minerals & metals)	An EF impact category that assesses the use of non-renewable abiotic natural resources (e.g. minerals and metals).
Water use	An EF impact category that assesses the use of water during the life of a synthetic turf surface, and how that use affects the aquatic ecosystem.

¹ Note: the sub-indicators 'Climate change – biogenic' and 'Climate change – land use and land transformation' are not reported separately because their contributions to the total climate change impact, based on the PEF CR benchmark results, are less than 5% each."

The PEF values for the six key impact categories are reported in Section 3 of this report.

Addition impact categories

The potential for microplastic pollution during the use and end-of-life phases of a synthetic turf surface has been identified as an additional relevant environmental concern, outside of the mandatory impact categories of a PEF analysis. Therefore, the *Synthetic Turf PEFCR*, requires the mass of potential microplastic leakage (polymeric infill and fibre debris) from a synthetic turf surface to be assessed and reported. The Category Rules describe how this is done and the results obtained are given in Section 3.

Overall Single PEF Score

The PEF methodology also for an overall weighted result to be reported as a *Single PEF Score*. Weighting is a step that aids the interpretation and communication of a PEF analysis. The PEF results are multiplied by a set of weighting factors, which reflect the perceived relative importance of the impact categories being considered. This allows weighted EF results to be directly compared across impact categories, and also added together, to obtain a single overall score. The *Single PEF Score* is expressed in units of Environmental Footprint Points (EF Points). The *Single PEF Score* is also given in Section 3 of this report.

Product description

Section 4 of this report describes each of the components used to make the synthetic turf surface, and the location(s) in which they are produced. In some cases, the component may be produced in more than one location. If any of the components or production locations change, this report does not apply to it.

Notes:

1. The information detailed in this report is based on data supplied by the manufacturers of the various components making up the synthetic turf surface. Those supplying the data assume full responsibility for its accuracy and the results reported.
2. For a PEF analysis to comply with the category rules, it has to be independently verified by an external auditor. Details of this reports verification are given in Section 2.9.
3. The synthetic turf sports system described in this report should comply with European Standard EN 15330²: Parts 1 – 6, and any applicable sports' governing body standards.

Representative product

The development of the *Synthetic Turf Product Environmental Footprint Category Rules* required the PEF analysis of a 'representative product' to identify the most relevant impact categories, life cycle stages, processes and elementary flows, etc. The representative product could either be a real product or a virtual product, based on European averages. For synthetic turf, a virtual product was selected, and it was based on the largest market sector a football turf surface.

² EN 15330: Surfaces for sports areas — Synthetic turf and needle-punched surfaces primarily designed for outdoor use

The PEF values for this representative product can be used as benchmark against which real products can be compared. The PEF report for the representative product can be downloaded from [ESTC Product Environmental Footprint](#).

System boundaries

System boundaries define the aspects included or excluded from the study. The system boundaries defined in the PEFCR for synthetic turf are:

Raw material acquisition and pre-processing Yarn production Primary backing production Stabilising infill production Shockpad production	Manufacturing Turf carpet production Performance infill production Stabilising infill production Shockpad production	Distribution stage Turf carpet Performance infill production Stabilising infill Shockpad
Use stage Installation Operation	End of life Turf carpet Performance infill Stabilising infill Shockpad	

Figure 1 shows the principal life cycle stages of a synthetic turf surface.

ESTC consumer guide to interrupting a PEF report

ESTC has produced a guide to interrupting a PEF report and understanding the relevance of the PEF data. This is available at [ESTC Product Environmental Footprint](#).

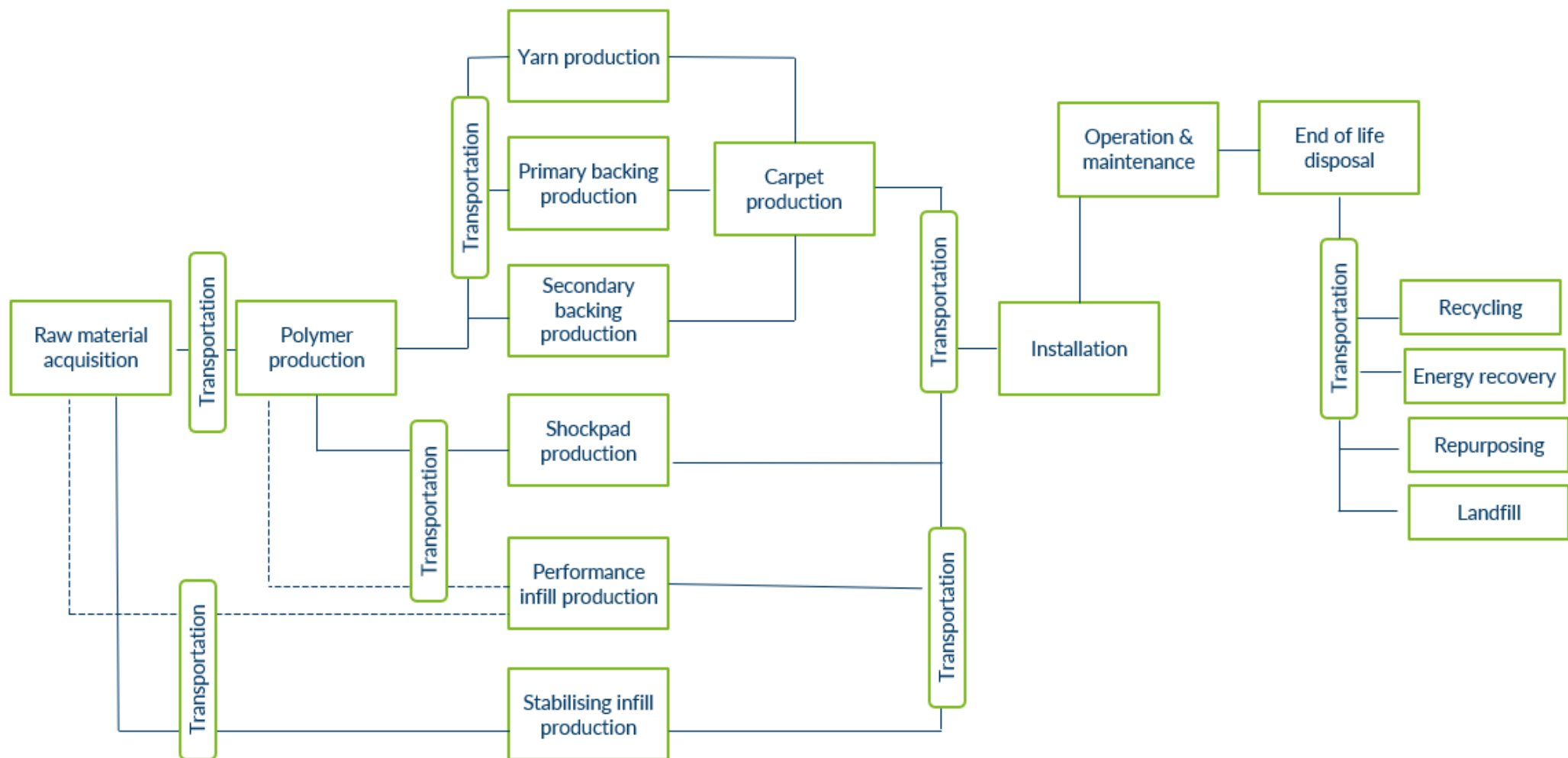


Figure 1 – principal life cycle stages of a synthetic turf surface

2 Report details			
2.1	Product name: (add hyperlink to product website)		
2.2	Application (describe intended sport application(s))		
2.3	Date of report:		
2.4	Company commissioning this PEF study:		
2.5	Geographical scope: (default is EU+EFTA+UK)		
2.6	Functional unit (FU):	Area	1 m ²
		Primary sport's use (football, hockey, tennis, etc)	
		Service life (assuming correct levels of use and maintenance)	Eight years
2.7	Summary report prepared by:	Name	
		Position	

2.8 Period of report validity

This report remains valid for a period of five years from the date of publication of the PEF Category Rules (June 2024), or until the Category Rules are next updated, whichever comes sooner.

2.9 Report verification

To comply with the requirements of the PEF CR for synthetic turf surfaces a PEF analysis needs to be independently verified; this is requirements of the European Commission. The verifiers is also required to confirm that this summary report accurately details the information generated by the PEF analysis.

Verification company	
Verifier's name	
Verification report number / hyperlink	

3 Summary of results per functional unit

	EF category	Unit	Life cycle results	
			cradle-to-gate	cradle-to-grave
3.1	Single PEF Score	EF Pts		
3.2	Acidification	mol H ⁺ eq		
3.3	Climate change ³	kg CO ² eq		
3.4	Particulate matter	Disease inc.		
3.5	Resources used (fossil fuels)	MJ		
3.6	Resources used (minerals & metals)	kg Sb eq		
3.7	Water use	m ³ depriv.		
3.8	Potential microplastic loss to the environment – mandatory additional information			
3.8.1	Estimated potential fibre debris loss to the environment	kg/functional Unit		
3.8.2	Estimated potential polymeric infill loss to the environment	kg/ functional Unit		

³ Note: the sub-indicators 'Climate change – biogenic' and 'Climate change - land use and land transformation' are not reported separately as their contribution to the total climate change impact, based on the PEF CR benchmark results, were less than 5% each."

4 Synthetic turf product declaration ⁴					
4.1	Synthetic turf system name				
4.2	System supplier				
4.3	Synthetic turf carpet product name / code				
4.4	Shockpad product name (if applicable) and supplier				
4.5	Stabilising infill product name (if applicable) and supplier				
4.6	Synthetic turf carpet				
4.6.1	Method of manufacturing				
4.6.2	Manufacturing location(s)				
4.6.3	Percentage of production for each manufacturing location				
4.6.4	Pile height (mm)				
4.6.5	Total carpet weight (g/m ²)				
4.6.6	Tufts/m ²				
4.6.7	Filaments/m ²				
4.6.7	Pile weight (g/m ²)				

⁴ If multiple single components are used in the synthetic turf surface or the PEF analysis is based on components manufactured in more than one location, details of each must be listed.

4.7	Synthetic turf pile yarns				
4.7.1	Manufacturing location(s)				
4.7.2	Percentage of production for each manufacturing location				
4.7.3	Pile yarn polymer				
4.7.54	Pile profile / shape				
4.7.5	Pile yarn dtex				
4.7.6	Pile thickness (µm)				
4.8	Primary backing				
4.8.1	Product name				
4.8.2	Manufacturing location(s)				
4.8.3	Percentage of production for each manufacturing location				
4.8.4	Primary backing weight (g/m ²)				
4.9	Secondary backing				
4.9.1	Product type				
4.9.2	Manufacturing location(s)				
4.9.3	Percentage of production for each manufacturing location				
4.9.4	Wet application weight (g/m ²)				

4.10	Performance infill (if used) ⁵				
4.10.1	Product type				
4.10.2	Production location				
4.10.3	Application rate (kg/m ²)				
4.11	Stabilising infill (if used) ⁵				
4.11.1	Product type				
4.11.2	Production location				
4.11.3	Application rate (kg/m ²)				
4.12	Shockpad (if used) ⁵				
4.12.1	Product name				
4.12.2	Product description				
4.12.3	Manufacturing location(s)				
4.12.4	Percentage of production for each manufacturing location				
4.12.5	Shockpad thickness (mm)				

⁵ Some synthetic turf sports surfaces do not contain performance infill or stabilising infill. Some may not incorporate a shockpad

5 Characterized results per impact category and life cycle stage per functional unit

	Impact category	Unit	Complete life cycle	LCS 1.1	LCS 1.2	LCS 1.3	LCS 1.4	LCS 1.5	LCS 1.6	LCS 2.1	LCS 2.2	LCS 2.3
				Yarn production	Primary backing production	Secondary backing production	RMA & PP ⁶ for perform. infill	Sand acquisition	RMA & PP for shockpad	Turf carpet production	Perform. Infill production	Shockpad production
5.1	Acidification	mol H+ eq										
5.2	Climate change	kg CO ² eq										
5.3	Ecotoxicity, freshwater	CTUe										
5.4	Particulate matter	Disease in.										
5.5	Eutrophication, marine	kg N eq										
5.6	Eutrophication, freshwater	kg P eq										
5.7	Eutrophication, terrestrial	mol N eq										
5.8	Human toxicity, cancer	CTUh										
5.9	Human toxicity, non-cancer	CTUh										
5.10	Ionising radiation	kBq U-235 eq										
5.11	Land use	Pt										
5.12	Ozone depletion	kg CFC11 eq										
5.13	Photochemical ozone formation	kg NMVOC eq										
5.14	Resource use, fossils	MJ										
5.15	Resource use, minerals, and metals	kg Sb eq										
5.16	Water use	m3 depriv.										

⁶ RMA = raw material acquisition PP = pre-production

	Impact category	Unit	LSC 3.1	LCS 3.2	LCS3.3	LCS3.4	LCS 4.1	LCS 4.2	LCS 5.1	LCS 5.2	LCS 5.3	LCS 5.4
			S&D ⁷ of Turf carpet	S&D of performance infill	S&D of stabilising infill	S&D of shockpad	Installation	Operation (Use)	EOL of turf carpet	EOL of performance infill	EOL of stabilising infill	EOL of shockpad
5.17	Acidification	mol H+ eq										
5.18	Climate change	kg CO2 eq										
5.19	Ecotoxicity, freshwater	CTUe										
5.20	Particulate matter	CTUh										
5.21	Eutrophication, marine	kg N eq										
5.22	Eutrophication, freshwater	kg P eq										
5.23	Eutrophication, terrestrial	mol N eq										
5.24	Human toxicity, cancer	CTUh										
5.25	Human toxicity, non-cancer	CTUh										
5.26	Ionising radiation	kBq U-235 eq										
5.27	Land use	Pt										
5.28	Ozone depletion	kg CFC11 eq										

⁷ S & D = storage and distribution