PRODUCT ENVIRONMENTAL FOOTPRINT CATEGORY RULES

Nougat

Draft version 1.0

September 2018

Il presente documento include indicazioni metodologiche per la conduzione di uno studio LCA secondo quanto previsto dalla metodologia PEF (Product Environmental Footprint) per la valutazione dell'impronta ambientale di prodotto così come definita nella Raccomandazione 2013/179/UE della Commissione e, ove possibile, dalle Product Environmental Footprint Category Rules Guidance, Version 6.3, May 2018.

ll documento, sviluppato nell'ambito del progetto LIFE EFFIGE, è riferito al solo mercato Italiano ed è stato redatto in collaborazione con Dai Carulina Agricola srl. I suoi contenuti sono un contributo agli studi di settore, ma non sono vincolanti rispetto ad altre iniziative in corso o a venire".

This paper include methodological indication for the development of a LCA study according with the PEF (Product Environmental Footprint) methodology in order to evaluate the product environmental foortprint as defined in Recommendation 2013/179/UE of European Commission and, when possible, of *Product Environmental Footprint Category Rules Guidance, Version 6.3, May 2018.*

The paper, developed inside the LIFE Project EFFIGE is focused only on Italian market and it was written in co-operation with Dai Carulina Agricola srl. The paper subjects are a contribution to the sectoral studies but are not binding in relation to other activities currently underway or forthcoming.

Summary

1 Introduction

The present Product Environmental Footprint Category Rules (PEFCR) is developed within the Life EFFIGE Project, aimed to develop new tools for the implementation of PEF in small and medium-sized businesses, helping them to experiment innovative approaches and methods reduce their environmental footprint and making them more competitive on the current market.

The Product Environmental Footprint (PEF) Guide provides detailed and comprehensive technical guidance on how to conduct a PEF study. PEF studies may be used for a variety of purposes, including in-house management and participation in voluntary or mandatory programmes.

The compliance with the present PEFCR is optional for PEF in-house applications, whilst it is mandatory whenever the results of a PEF study or any of its content is intended to be communicated.

Terminology: shall, should and may

This PEFCR uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when a PEF study is conducted.

- The term “shall” is used to indicate what is required in order for a PEF study to be in conformance with this PEFCR.
- The term “should” is used to indicate a recommendation rather than a requirement. Any deviation from a “should” requirement has to be justified when developing the PEF study and made transparent.
- The term “may” is used to indicate an option that is permissible. Whenever options are available, the PEF study shall include adequate argumentation to justify 2. General information about the PEFCR

This PEFCR is valid for products in scope sold in Italy.

The PEFCR is written in English.

This PEFCR has been prepared in conformance with the following documents:

- Product Environmental Footprint (PEF) Guide; Annex II to the Recommendation 2013/179/EU, 9 April 2013. Published in the official journal of the European Union Volume 56, 4 May 2013;

- “PEFCR Guidance version 6.3”, excluding all that parts applicable only from products already covered by existing PEFCR. Deviations from the requirements of Guidance v.6.3 have been made based on older versions of the Guidance and expert judgment.

- ENVIFOOD - *Food and Drink Protocol*, version 1.0, November 20th 2013.

The organisations listed in Table 1 were the Sectorial Technical Group (STG), which is responsible for the development of the PEFCRs for the nougat sector.

Table 1 List of the organizations in the STG

Name of the organization	Type of organization	Name of the members
DAI CARULINA SRL AGRICOLA	Consortium	Pasquale Guiducci
Dolciaria Palumbo	Industry	Angelino Palumbo
Sebaste srl	Industry	Dott. Matteo Rossi Sebaste
Strega Alberti	Industry	Ing. Andrea D’Angelo

2 PEFCR scope

2.1 Product classification

Nougat is the result of activities that are classified *Nomenclature Générale des Activités Économiques dans les Communautés Européennes*/Statistical classification of products by activity (NACE/CPA) Rev.2 under code **10.82** and, in particular:

- **10.82.22.60:** Sugar confectionery and substitutes therefor made from sugar substitution products, containing cocoa (including chocolate nougat) (excluding white chocolate);
- **10.82.22.90:** Food products with cocoa (excluding cocoa paste, butter, powder, blocks, slabs, bars, liquid, paste, powder, granular, other bulk form in packings > 2 kg, to make beverages, chocolate spreads);
- **10.82.23.53:** Sugar confectionery pastes in immediate packings of a net content ≥1 kg (including marzipan, fondant, nougat and almond pastes).

2.2 Representative product(s)

The RPs are virtual products defined on the basis on Italian market share of the different kind of nougat recipes. Nougat is an old product with long history and the innovation in the industry are very small. Therefore no significant differences are in the production process.

The following RP havs been identified:

Representative Product	*Market share*
Nougat	*93.8%*
Croccante	*6,2%*

2.3 Functional unit and reference flow

The functional unit, as approved by the STG, is **1 Nougat at industry gates**.

Table 2 ***Key aspects of the FU***

What?	Nougat
How much?	1 kg of nougat
How long?	until the expiry date

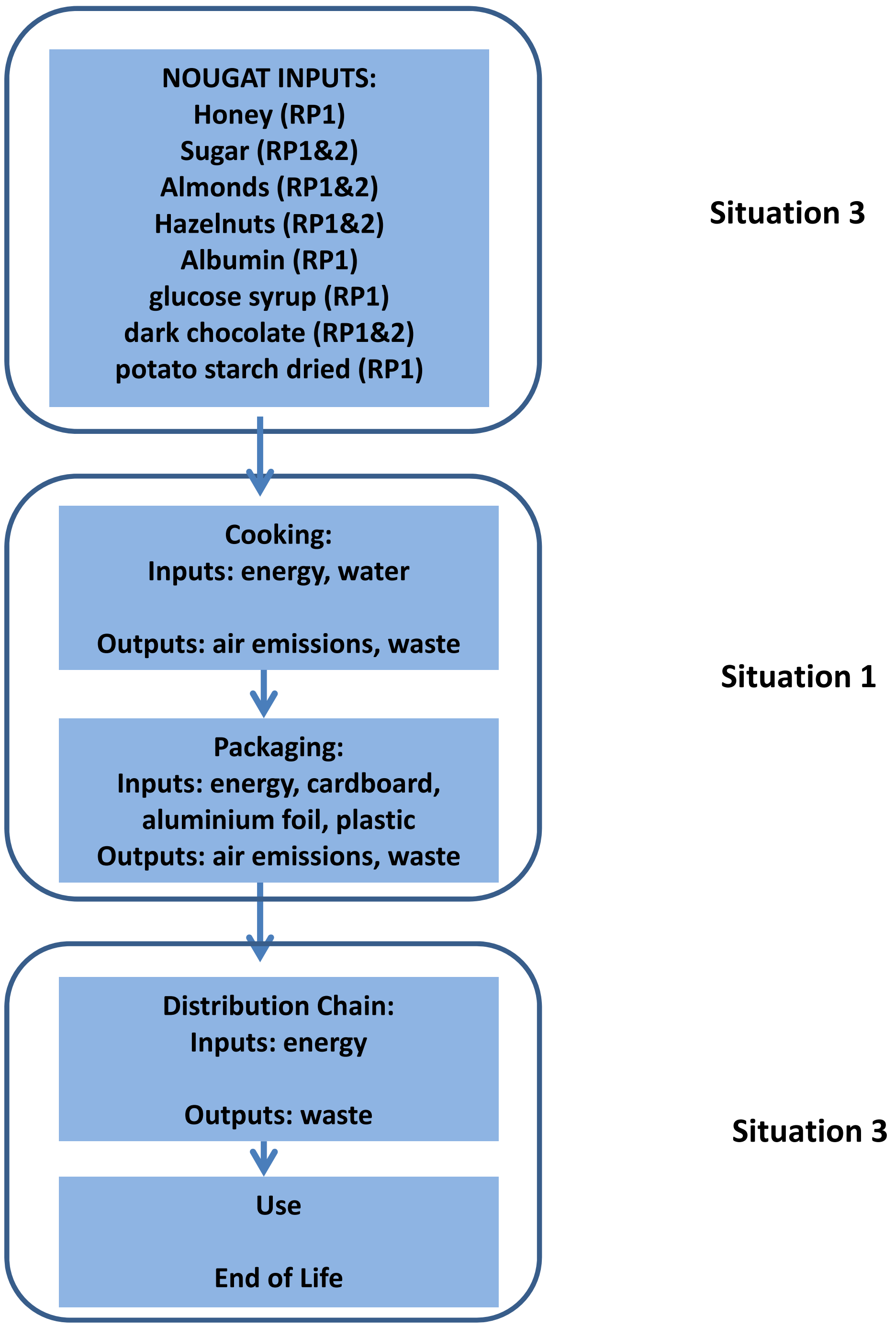
2.4 System boundary

The flow diagram of the entire process includes the following activities:

Table 3 Life cycle stages

Life cycle stage	*Short description of the processes included*
Inputs production – agricultural stage	Production and supply of inputs, including: - Sugar (for nougat and croccante); - Glucose syrup (nougat) - Honey (for nougat); - Chocolate (for nougat and croccante); - Albumin (for nougat); - Almonds (for nougat and croccante) - Hazelnuts (for nougat and croccante) -
Production – cooking stage	Melting of inputs in big pots heated with hot water.

Life cycle stage	*Short description of the processes included*
	From the input side: - Energy sources (electricity, natural gas) - Water; From the output side; - Air emissions - Drainage Water - Waste
Production – packaging stage	Nougat Packaging. From the input side: - Electricity; - Paper and cardboard - PVC; - Pallet wood; From the output side; - Air emissions; - Waste
Distribution Chain	Final product supply: storage and transportation. From the input side: - Electricity; - Fuel; From the output side: - Waste.
Use	Consumption: eat the product (without cooking)
End of Life	Circular Footprint Formula provided in chapter 4.7



Processes in Situation 1 are the processes run by the company applying the PEFCR. Processes in Situation 3 are the ones not run by the company applying the PEFCR and this company does not have access to (company-) specific information.

According to this PEFCR, the following processes may be excluded based on the cut-off rule:

- The production of buildings and equipment.

2.5 EF impact assessment

Each PEF study carried out in compliance with this PEFCR shall calculate the PEF-profile including all PEF impact categories listed in the table below (ILCD Method 2011 for characterisation, normalisation and weighting factors)

Impact category	Indicator	Unit	Recommended default LCIA method	Source of CFs	Robustness
Climate change	Radiative forcing as Global Warming Potential (GWP100)	kg $CO_{2\ eq}$	Baseline model of 100 years of the IPCC (based on IPCC 2013)	EC-JRC, 2017[1]	I
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 $_{eq}$	Steady-state ODPs as in (WMO 1999)	EC-JRC, 2017	I
Human toxicity, cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Human toxicity, non-cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Particulate matter	Impact on human health	disease incidence	PM method recomended by UNEP (UNEP 2016)	EC-JRC, 2017	I
Ionising radiation, human health	Human exposure efficiency relative to U^{235}	kBq U^{235} $_{eq}$	Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)	EC-JRC, 2017	II
Photochemical ozone formation,	Tropospheric ozone concentration increase	kg NMVOC $_{eq}$	LOTOS-EUROS model (Van	EC-JRC,	II

[1] The complete list of the characterization factors (EC-JRC, 2017a) is available at the following link: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtm

Impact category	Indicator	Unit	Recommended default LCIA method	Source of CFs	Robustness
human health			Zelm et al, 2008) as implemented in ReCiPe 2008	2017	
Acidification	Accumulated Exceedance (AE)	mol H+ $_{eq}$	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N $_{eq}$	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)	EC-JRC, 2017	II
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	kg P $_{eq}$	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	kg N $_{eq}$	EUTREND model (Struijs et al, 2009) as implemented in ReCiPe	EC-JRC, 2017	II
Ecotoxicity, freshwater*[2]	Comparative Toxic Unit for ecosystems (CTU_e)	CTUe	USEtox model, (Rosenbaum et al, 2008)	EC-JRC, 2017	III/interim
Land use	• Soil quality index • Biotic production • Erosion resistance • Mechanical filtration • Groundwater replenishment	• Dimensionless (pt) • kg biotic production • kg soil • m^3 water • m^3 groundwater	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)	EC-JRC, 2017	III
Water use	User deprivation potential (deprivation-weighted water consumption)	m^3 world $_{eq}$	Available WAter REmaining (AWARE) as recommended by UNEP, 2016	EC-JRC, 2017	III
Mineral, fossil and renewable resource depletion	Abiotic resource depletion (ADP ultimate reserves)	kg Sb $_{eq}$	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.		III

[2] Long-term emissions (occurring beyond 100 years) shall be excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used

2.6 Limitations

The main limitation are the lack of data on the production of buildings and equipment. This is due also to the long history of the nougat production: in many firms the plants are mix of old and new tools and it is very difficult to make a model of the equipment with a similar differentiation. For example, there are craft production with big pots with more than eighty years and industrial production with production line with more than thirty years old. The same situation there is in the buildings, that in some firms are more than a century year old.

3 Most relevant impact categories, life cycle stages, processes and elementary flows

The most relevant impact categories for the products Nougat and Croccante, in scope of this PEFCR, are the following:

- climate change
- particulate matter
- acidification
- marine eutrophication

For all relevant impact categories, the most relevant life cycle stages for products Nougat and Croccante, in scope of this PEFCR, are the following:

- agricultural production of inputs;
- Production process (for -nougat only).

The most relevant processes for product Nougat in scope of this PEFCR are the following:

Table 1. List of the most relevant processes: nougat

Impact category	*Processes*
Climate change;	Cocoa bean - Input production – agricultural stage; Natural gas – Cooking stage Electricity – Cooking stage
Particular matter	Cocoa Bean - Input production – agricultural stage; Electricity – Cooking stage
Acidification	Albumin - Input production – agricultural stage; Almond - Input production – agricultural stage; Chocolate- Input production – agricultural stage; Electricity – Cooking stage
Marine eutrophication	Cocoa bean- Input production – agricultural stage; Sugar beet - Input production – agricultural stage; Almond - Input production – agricultural stage;

The most relevant processes for product Croccante in scope of this PEFCR are the following:

Table 5. List of the most relevant processes: croccante

Impact category	*Processes*
Climate change;	Cocoa bean - Input production – agricultural stage; Electricity – Cooking stage
Particular matter	Cocoa Bean - Input production – agricultural stage; Electricity – Cooking stage Natural gas – Cooking stage
Acidification	Almond - Input production – agricultural stage; Chocolate- Input production – agricultural stage; Electricity – Cooking stage Natural gas – Cooking stage
Marine eutrophication	Cocoa bean- Input production – agricultural stage; Sugar beet - Input production – agricultural stage; Almond - Input production – agricultural stage;

4 Life cycle inventory

4.1 List of mandatory company-specific data

The following processes shall be modelled using company specific data:

- Consumption and supply of inputs materials;
- Cooking;
- Packaging;
- Distribution Chain
- Use (no mandatory data)
- End of Life

4.2 Mandatory data on consumption and supply of inputs materials life stage

Data collection requirements for mandatory process of Inputs Production life cycle stage: nougat

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	***Specific requirements (e.g. frequency, measurement standard, etc)***	***Unit of measure***	***Default dataset to be used***	***Dataset source (i.e. node)***	***UUID***	***TiR***	***TeR***	***GR***	***P***	***DQR***	
Inputs:											
Yearly Honey consumption	1 year average	ton/year	Honey, industry 330kg package, at farm/RER Economic	EU PEF pilot for beer 3[3]	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported honey per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported honey per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly albumin consumption	1 year average	Ton /year	Proxy from Egg, conventional, indoor system, cage, at	Agribalyse	n/a	n/a	n/a	n/a	n/a	n/a	

[3] Alejandro Pablo Arena, Gabriela Nuri Barón, Roxana Piastrellini, Silvia Curadelli, Bárbara María Civit (2014) Environmental profile of the life cycle of small-scale honey production in Mendoza, Argentina

			farm gate/FR U								
Yearly amount of transported albumin per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported albumin per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Sugar consumption	1 year average	ton/year	Sugar, from sugar beet, from sugar production, at plant/IT Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported sugar per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported sugar per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly almond consumption	1 year average	Ton /year	Almond {GLO}| market for almond | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

Yearly amount of transported almond per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported almond per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly hazelnut consumption	1 year average	ton/year	Proxy from Almond {GLO}| market for almond | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported hazelnut per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported hazelnut per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly dark chocolate consumption	1 year average	Ton /year	Cocoa bean {GH}| cocoa bean production, sun-dried | Alloc Rec, U[4]	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

[4] About the production process the data of the following study are used: "LIFE CYCLE ASSESSMENT OF CHOCOLATE PRODUCED IN GHANA - GEORGE AFRANE - Koforidua Polytechnic - Koforidua, Ghana - AUGUSTINE NTIAMOAH - Department of Chemical Engineering - Kwame Nkrumah University of Science & Technology, Kumasi, Ghana.

Yearly amount of transported dark chocolate per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported dark chocolate per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly potato starch dried consumption	1 year average	ton/year	Potato starch dried, from wet milling, at plant/DE Economic	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported potato starch dried per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported potato starch dried per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly Glucose syrup consumption	1 year average	Ton /year	Sugar, from sugarcane {GLO}| market for | Alloc Rec, U + Enzyme, Alpha-amylase,	Ecoinvent 3 + data from EU PEF pilot for beer	n/a	n/a	n/a	n/a	n/a	n/a	

			Novozyme Liquozyme/kg/RER Copy								
Yearly amount of transported Glucose syrup per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported Glucose syrup per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly water consumption	1 year average	m^3/year	Tap water {Europe without Switzerland}| market for | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

Data collection requirements for mandatory process of Inputs Production life cycle stage: croccante

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	***Specific requirements (e.g. frequency, measurement standard, etc)***	***Unit of measure***	***Default dataset to be used***	***Dataset source (i.e. node)***	***UUID***	***TiR***	***TeR***	***GR***	***P***	***DQR***	
Inputs:											
Yearly Sugar	1 year average	ton/year	Sugar, from sugar beet,	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	

consumption			from sugar production, at plant/IT Economic								
Yearly amount of transported sugar per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported sugar per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly almond consumption	1 year average	Ton /year	Almond {GLO}| market for almond | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported almond per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported almond per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly hazelnut consumption	1 year average	ton/year	Proxy from Almond {GLO}| market for almond | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF,	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	

of transported hazelnut per km travelled on lorry			default/GLO Economic								
Yearly amount of transported hazelnut per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly dark chocolate consumption	1 year average	Ton /year	Cocoa bean {GH}| cocoa bean production, sun-dried | Alloc Rec, U[5]	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported dark chocolate per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported dark chocolate per km travelled on ship	1 year average	Ton km / year	Transport, sea ship, 80000 DWT, 100%LF, long, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly water consumption	1 year average	m^3/year	Tap water {Europe without Switzerland}| market for | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

[5] About the production process the data of the following study are used: "LIFE CYCLE ASSESSMENT OF CHOCOLATE PRODUCED IN GHANA - GEORGE AFRANE - Koforidua Polytechnic - Koforidua, Ghana - AUGUSTINE NTIAMOAH - Department of Chemical Engineering - Kwame Nkrumah University of Science & Technology, Kumasi, Ghana.

4.3 Mandatory data on production cooking life stage

Data collection requirements for mandatory process of Production Cooking life cycle stage: nougat and croccante

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	***Specific requirements (e.g. frequency, measurement standard, etc)***	***Unit of measure***	***Default dataset to be used***	***Dataset source (i.e. node)***	***UUID***	***TiR***	***TeR***	***GR***	***P***	***DQR***	
Inputs:											
Yearly electricity consumption for coocking	1 year average	kWh / year	Electricity, medium voltage {IT}| market for | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly natural gas consumption for cooking	1 year average	m^3 / year	Heat, district or industrial, natural gas {Europe without Switzerland}| heat production, natural gas, at boiler condensing modulating >100kW | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly water consumption for coocking	1 year average	m^3 / year	Tap water {Europe without Switzerland}| tap water production, conventional treatment | APOS, U	Ecoinvent	n/a	n/a	n/a	n/a	n/a	n/a	

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
Outputs:											
Yearly packaging waste: paper and cardboard packaging (EWC 15.01.01)	1 year average	ton / year	Linerboard {RER}| production, kraftliner | Alloc Rec, U Linerboard {RER}| treatment of recovered paper to, testliner | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly plastic packaging (EWC 15.01.02)	1 year average	ton / year	Polypropylene, granulate {GLO}| market for | Alloc Rec, UGlass, secondary, at plant/		n/a	n/a	n/a	n/a	n/a	n/a	
Yearly metallic packaging (EWC 15.01.04)	1 year average	ton / year			n/a	n/a	n/a	n/a	n/a	n/a	
Yearly drainage water	1 year average	MC / year	Wastewater, average {Europe without Switzerland}| treatment of wastewater, average, capacity 1E9l/year | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

4.4 Mandatory data on production packaging life stage

Data collection requirements for mandatory process of packaging life cycle stage: nougat and croccante

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	*Specific requirements (e.g. frequency, measurement standard, etc)*	*Unit of measure*	*Default dataset to be used*	*Dataset source (i.e. node)*	*UUID*	*TiR*	*TeR*	*GR*	*P*	*DQR*	
Inputs:											
Yearly Aluminium foil consumption for packaging	1 year average	ton/year	Aluminium, primary, at plant – IT	Ecoinvent 3 + data from EU PEF pilot for beer	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported aluminium foil per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly plastic consumption for packaging	1 year average	Ton km / year	Polypropylene, granulate {GLO}| market for | Alloc Rec, UGlass, secondary, at plant/ Extrusion, plastic film {GLO}| market for | Alloc	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	

			Rec, U								
Yearly amount of transported plastic per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly cardboard consumption for packaging	1 year average	Ton / year			n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported cardboard per km travelled on ship	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	

4.5 Mandatory data on distribution chain life stage

Data collection requirements for mandatory process of Distribution Chain life cycle stage: nougat and croccante

Requirements for data collection purposes			Requirements for modelling purposes								Remarks
Activity data to be collected	***Specific requirements (e.g. frequency, measurement standard, etc)***	***Unit of measure***	***Default dataset to be used***	***Dataset source (i.e. node)***	***UUID***	***TiR***	***TeR***	***GR***	***P***	***DQR***	
Inputs:											
Yearly electricity consumption for storage	1 year average	kWh / year	Electricity, medium voltage {IT}| market for | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly amount of transported nougat per km travelled on lorry	1 year average	Ton km / year	Transport, truck >20t, EURO5, 80%LF, default/GLO Economic	Agri-footprint	n/a	n/a	n/a	n/a	n/a	n/a	
Outputs:											
Yearly packaging waste: paper and cardboard packaging (EWC 15.01.01)	1 year average	ton / year	Linerboard {RER}| production, kraftliner | Alloc Rec, U Linerboard {RER}| treatment of recovered paper to, testliner | Alloc Rec, U	Ecoinvent 3	n/a	n/a	n/a	n/a	n/a	n/a	
Yearly plastic packaging (EWC 15.01.02)	1 year average	ton / year	Polypropylene, granulate {GLO}| market for | Alloc Rec, U Glass, secondary, at plant/		n/a	n/a	n/a	n/a	n/a	n/a	

4.6 Use stage

No mandatory data are recommended both for nougat and croccante, because they are products eat without cooking and the only waste is the packaging (data are collected in the packaging stage).

4.7 End of Life stage

On end of life of packaging materials, use the CFF formula indicated in PEF Guidance 6.3, with national average value on recycling rate, incineration rate and landfill rate.

PROCESS	**KIND OF WASTE**	**CFF VALUE**
Disposal, aluminium, 0% water, to municipal incineration/CH U (incl energy recovery)	Aluminium	9.8 %
Disposal, aluminium, 0% water, to sanitary landfill/CH U - PEF	Aluminium	18.2 %
Recycling aluminium (PEF) - CFF - IT	Aluminium	57.6 %
Disposal, packaging cardboard, 19.6% water, to municipal incineration/CH U (incl energy recovery) - CFF IT	Cardboard	9.45 %
Disposal, packaging cardboard, 19.6% water, to sanitary landfill/CH U - CFF	Cardboard	10.07 %
Recycling cardboard (PEF) - CFF IT	Cardboard	67.6 %
Disposal, glass, 0% water, to inert material landfill/CH U - PEF	Glass	24.05 %
Disposal, glass, 0% water, to municipal incineration/CH U (incl energy recovery)	Glass	12.95 %
Recycling glass (PEF) - PEF/Integrated formula - CFF IT	Glass	50.4 %
Disposal, packaging paper, 13.7% water, to municipal incineration/CH U - PEF (included energy recovery) - CFF IT	Packaging paper	9.45 %
Disposal, packaging paper, 13.7% water, to sanitary landfill/CH U - PEF	Packaging paper	17.55 %
Recycling packaging paper (PEF) - CFF IT	Packaging paper	58.4 %
Disposal, PE sealing sheet, 4% water, to municipal incineration/CH U - CFF IT	PE	25.2 %
Recycling PE (CFF)	PE	14 %
Waste polyethylene {Europe without Switzerland}| treatment of waste polyethylene, sanitary landfill | Alloc Rec, U - CFF - IT	PE	46.8 %
Disposal, polyethylene terephtalate, 0.2% water, to municipal incineration/CH U (incl energy recovery) - CFF IT	PET	24.15 %
Disposal, polyethylene terephtalate, 0.2% water, to sanitary landfill/CH U - PEF	PET	44.85 %
Recycling PET (PEF) - CFF IT	PET	15.5 %
Recycling PP (PEF) - CFF IT PROXY	PP	14 %
Waste polypropylene {CH}| treatment of, municipal incineration | Alloc Rec, U - CFF IT	PP	25.2 %
Waste polypropylene {CH}| treatment of, sanitary landfill | Alloc Rec, U - CFF IT	PP	46.8 %
Recycling PVC - CFF IT - Proxy	PVC	14 %
Waste polyvinylchloride {Europe without Switzerland}| treatment of waste polyvinylchloride, municipal incineration | Alloc Rec, U	PVC	25.2 %
Waste polyvinylchloride {Europe without Switzerland}| treatment of waste polyvinylchloride, sanitary landfill | Alloc Rec, U	PVC	46.8 %

4.8 Direct elementary flows requirements

Direct elementary flow collection requirements - nougat

Emissions/resources	Elementary flow	Frequency of measurement
Water from well	Water, well, in ground, *COUNTRY*	Yearly consumption
CO_2 to Air, from coocking	Carbon dioxide (from fossil and Carbon dioxide, land transformation)	Yearly emission
Dust to air, from coocking	Particulates, < 2.5 um	Yearly emission
Sulphur oxides to air, from coocking	Sulphur oxides	Yearly emission
Nitrogen oxides to air, from cooking	Nitrogen oxides	Yearly emission

4.9 List of processes expected to run by the company

All processes expected to be run by the company, for which company-specific data are mandatory, are reported in chapters 4.2 – 4.5 List of mandatory company-specific data.

4.10 Data gaps

Unless primary data on input materials and consumables production of appropriate quality (as defined in the PEF Recommendation) are made available from producers, to assure an appropriate overall quality of the PEF study and the comparability of the results, default proxies reported in cap. 5.1. have to be used.

4.11 Data quality requirements

In the screening report there are two categories with poor data in nougat production:

- Acidification;
- Terrestrial eutrophication.

Acidification is one of the most important impact categories, so an improvement of the data will be tried with the PEF on the firms.

In the screening report there are five categories with poor data in croccante production:

- Climate change;
- Ozone depletion;
- Human toxicity, cancer effects;
- Freshwater eutrophication;
- Land use.

This is due to the haxelnut proxy used for the analysis. Also in this case, an improvement of the data will be tried and the hazelnut production chain in the upstream stage will be analysed with more detailed data.

For other data quality requirements, assessment and reporting, see. PEFCR Guidance 6.3, Section B.5.4

4.12 Data needs matrix (DNM)

For the evaluation of all processes required to model the product using the Data Needs Matrix, see PEFCR Guidance 6.3. Section B.5.5.

4.13 Allocation rules

In the Production Plant, data of consumption of energy (power and gas), water and some waste output (drained water and packaging) shall be allocated with respect to the total mass of materials that are processed in the Plant and measured at the production gate .

4.14 Which datasets to use?

The secondary datasets to be used by the applicant are those listed in this PEFCR. Whenever a dataset needed to calculate the PEF-profile is not among those listed in this PEFCR, then the applicant shall choose between the following options (in hierarchical order):

- Use an EF-compliant dataset available on one of the EU nodes or available in a free or commercial source;
- Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the PEF report;
- Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the PEF report.

4.15 Modelling of wastes and recycled content

For modelling of waste and recycled content the Circular Footprint Formula, as described in PEFCR Guidance 6.3, Section B.5.11, shall be applied.

5 Life cycle stages

5.1 Inputs production

Processes related to production inputs acquisition, for which company-specific data are mandatory, are reported in chapter 4.2 List of mandatory company-specific data.

5.2 Manufacturing and supply chain

Processes expected to be run by the company at manufacturing stage, for which company-specific data are mandatory, are reported in chapter 4.3,4.4, 4.5 List of mandatory company-specific data.

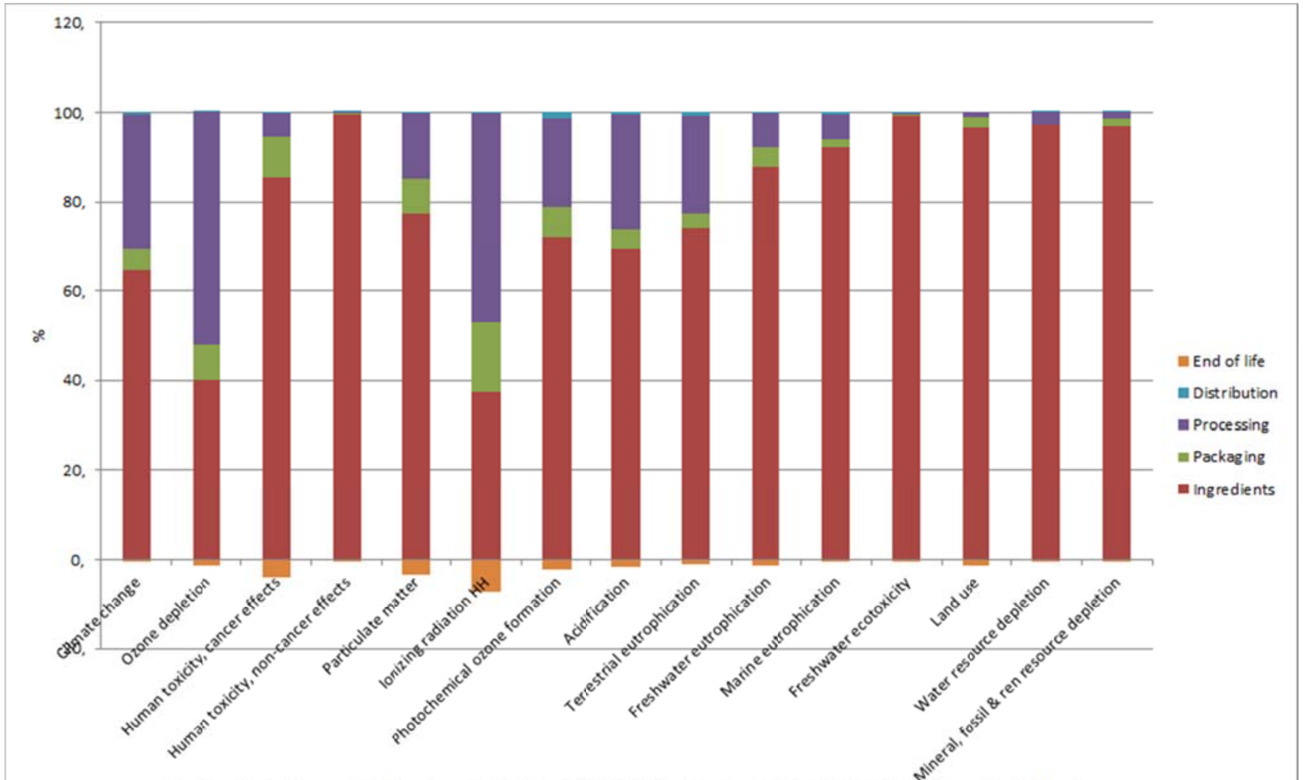
6 PEF results

6.1 Benchmark values

The following table reports the characterized, normalized and weighted LCIA results for 1 kg of nougat.

Characterized results

Impact category	Unit	Total	Ingredients	Packaging	Processing	Distribution	End of life
Climate change	kg CO2 eq	6,30	4,10	0,29	1,91	0,03	- 0,03
Ozone depletion	kg CFC-11 eq	4,38E-07	1,78E-07	3,57E-08	2,31E-07	6,32E-11	-5,99E-09
Human toxicity, cancer effects	CTUh	1,03E-07	9,18E-08	9,93E-09	5,94E-09	2,33E-11	-4,20E-09
Human toxicity, non-cancer effects	CTUh	2,26E-05	2,25E-05	4,89E-08	4,93E-08	5,16E-10	-9,21E-09
Particulate matter	kg PM2.5 eq	3,08E-03	2,48E-03	2,41E-04	4,76E-04	2,76E-06	-1,11E-04
Ionizing radiation HH	kBq U235 eq	1,29E-01	5,21E-02	2,19E-02	6,51E-02	7,69E-05	-1,02E-02
Photochemical ozone formation	kg NMVOC eq	1,44E-02	1,06E-02	1,03E-03	2,89E-03	2,09E-04	-3,26E-04
Acidification	molc H+ eq	3,72E-02	2,62E-02	1,69E-03	9,78E-03	1,66E-04	-6,29E-04
Terrestrial eutrophication	molc N eq	1,16E-01	8,73E-02	3,79E-03	2,58E-02	8,41E-04	-1,32E-03
Freshwater eutrophication	kg P eq	4,95E-04	4,41E-04	2,24E-05	3,90E-05	9,95E-08	-7,24E-06
Marine eutrophication	kg N eq	1,72E-02	1,58E-02	3,36E-04	9,57E-04	7,67E-05	-1,93E-05
Freshwater ecotoxicity	CTUe	66,86	66,44	0,27	0,21	0,01	- 0,06
Land use	kg C deficit	110,37	108,08	2,51	1,16	-	- 1,37
Water resource depletion	m3 water eq	4,88E-01	4,74E-01	1,07E-03	1,35E-02	4,52E-07	-5,23E-04
Mineral, fossil & ren resource depletion	kg Sb eq	5,45E-04	5,31E-04	9,60E-06	6,99E-06	7,26E-09	-3,06E-06



Analizzando 1 p 'Torrone Final Benchmark'; Metodo: ILCD 2011 Midpoint+ (for EFFIGE) V1.05 / EU27 2010, equal weighting / Characterisation / Esclude le emissioni di lungo termine

Normalized results

Impact category	Total	Ingredients	Packaging	Processing	Distribution	End of life
Climate change	6,93E-04	0,000451	3,17E-05	2,11E-04	3,40E-06	-3,55E-06
Ozone depletion	2,03E-05	8,22E-06	1,65E-06	1,07E-05	2,92E-09	-2,77E-07
Human toxicity, cancer effects	0,002805	0,002488	2,69E-04	0,000161	6,31E-07	-0,00011
Human toxicity, non-cancer effects	4,23E-02	0,042141	9,18E-05	9,24E-05	9,67E-07	-1,73E-05
Particulate matter	8,11E-04	0,000651	6,35E-05	1,25E-04	7,25E-07	-2,91E-05
Ionizing radiation HH	1,14E-04	4,61E-05	1,94E-05	5,76E-05	6,80E-08	-9,05E-06
Photochemical ozone formation	4,54E-04	0,000334	3,24E-05	9,10E-05	6,58E-06	-1,03E-05
Acidification	7,86E-04	0,000553	3,56E-05	2,06E-04	3,51E-06	-1,33E-05
Terrestrial eutrophication	6,62E-04	0,000496	2,15E-05	1,47E-04	4,78E-06	-7,50E-06
Freshwater eutrophication	3,34E-04	0,000298	1,51E-05	2,63E-05	6,73E-08	-4,89E-06
Marine eutrophication	1,02E-03	0,000938	1,99E-05	5,67E-05	4,54E-06	-1,14E-06
Freshwater ecotoxicity	0,007622	0,007574	3,05E-05	2,36E-05	1,50E-06	-7,26E-06
Land use	1,48E-03	1,45E-03	3,36E-05	1,55E-05	0,00E+00	-1,84E-05
Water resource depletion	0,006007	0,005835	1,31E-05	1,66E-04	5,56E-09	-6,43E-06
Mineral, fossil & ren resource depletion	0,005396	0,005262	9,50E-05	6,92E-05	7,19E-08	-3,03E-05

Weighted results

Impact category	Unit	Total	Ingredients	Packaging	Processing	Distribution	End of life
Totale	µPt	4,70E+00	4,57E+00	5,16E-02	9,72E-02	1,79E-03	-1,82E-02
Climate change	µPt	4,62E-02	3,00E-02	2,11E-03	1,40E-02	2,27E-04	-2,36E-04
Ozone depletion	µPt	1,35E-03	5,48E-04	1,10E-04	7,13E-04	1,95E-07	-1,85E-05
Human toxicity, cancer effects	µPt	1,87E-01	1,66E-01	1,79E-02	1,07E-02	4,20E-05	-7,60E-03
Human toxicity, non-cancer effects	µPt	2,82E+00	2,81E+00	6,12E-03	6,16E-03	6,45E-05	-1,15E-03
Particulate matter	µPt	5,41E-02	4,34E-02	4,23E-03	8,34E-03	4,83E-05	-1,94E-03
Ionizing radiation HH	µPt	7,61E-03	3,08E-03	1,29E-03	3,84E-03	4,54E-06	-6,03E-04
Photochemical ozone formation	µPt	3,03E-02	2,23E-02	2,16E-03	6,07E-03	4,39E-04	-6,84E-04
Acidification	µPt	5,24E-02	3,69E-02	2,38E-03	1,38E-02	2,34E-04	-8,85E-04
Terrestrial eutrophication	µPt	4,41E-02	3,31E-02	1,44E-03	9,78E-03	3,19E-04	-5,00E-04
Freshwater eutrophication	µPt	2,23E-02	1,99E-02	1,01E-03	1,76E-03	4,49E-06	-3,26E-04
Marine eutrophication	µPt	6,79E-02	6,25E-02	1,33E-03	3,78E-03	3,03E-04	-7,60E-05
Freshwater ecotoxicity	µPt	5,08E-01	5,05E-01	2,03E-03	1,57E-03	1,00E-04	-4,84E-04
Land use	µPt	9,86E-02	9,66E-02	2,24E-03	1,03E-03	0,00E+00	-1,23E-03
Water resource depletion	µPt	4,00E-01	3,89E-01	8,75E-04	1,10E-02	3,71E-07	-4,29E-04
Mineral, fossil & ren resource depletion	µPt	3,60E-01	3,51E-01	6,34E-03	4,61E-03	4,79E-06	-2,02E-03

6.2 PEF profile

The applicant shall calculate the PEF profile of its product in compliance with all requirements included in this PEFCR. The following information shall be included in the PEF report:

- full life cycle inventory;
- characterised results in absolute values, for all impact categories (including toxicity; as a table);
- normalised and weighted result in absolute values, for all impact categories (including toxicity; as a table);
- the aggregated single score in absolute values.