GLOBAL SUSTAINABLE
ENTERPRISE SYSTEM

Handbook Sustainable Footprint Standard

Three impact levels. One holistic, verified and accredited standard plus online platform. Turning the sustainable performance and governance of your products and projects from a complex burden, into an opportunity.

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Websites: www.gses-system.com
www.gse-standard.com

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Preliminary remarks

"How sustainable are the components, products that an organization supplies and purchases? And how can this be communicated in Business-to-Business and Business-to-Consumer relationships?"

To measure the sustainability performance of an organization, it is crucial to also look at the products and projects. The Global Sustainable Entreprise System (GSES System) has developed the Sustainable Footprint for this purpose, which shows 3 values:

- **Circular Footprint:** helping you to make your products and projects more circular. This enables you to give form and substance to the Circular Economy (CE) and to contribute towards the realization of the five CE transition agendas in the Netherlands.
- **Environmental Footprint:** with this approach you can define and reduce the environmental impact of your products and projects. This enables you to contribute to a cleaner planet and a better climate.
- **Health Footprint:** this footprint allows you to factor in the healthiness of a product. On the one hand regarding the harmfulness and toxic properties of the product, and on the other hand harmful substances that are NOT present in the product.

The three footprints are complementary and together form the **Sustainable Footprint**

They are the foundation of the Global Sustainable Enterprise System, GSES®. On the online GSES platform, you can find the **Bill of Materials calculator** that serves as the basis for the Sustainable Footprint.

The Circular Footprint and Environmental Footprint was initially developed by Gert-Jan Vroege of Eco Intelligence and GSES System, among others. Together with the market and various industries such as Offshore, GWW, Textiles, Packaging and Manufacturing, we have been able to normalize the Sustainable Footprint Standard. The core of the Circular Footprint is the calculation method that has been expanded and refined by SGS Search at the request of GSES System.

The Sustainable Footprint enables you to calculate the integral sustainable footprint of your products and projects.

We are eager to be part of building a sustainable society with you!

Global Sustainable Enterprise System

Contents

1. Sustainable Footprint in GSES House of Sustainability

This “Sustainable Footprint Handbook” complements Handbook "GSE-Standard and GSES System Handbook". GSE-Standard consists of several components that together form the ‘House of Sustainability’; the Sustainable Footprint Standard forms the foundation of this house. The ‘House of Sustainability’ shows how the multi-level, holistic approach of GSE-System works.

GSE-Standard measures organizations and their supply chain companies on two levels – combined covering all facets of sustainability:

1. The organizational level (6 pillars)
2. The product/project level (3 pillars)

Each pillar of the House can be measured, verified and certified separately. All components together enable the organization to take steps towards socially responsible and circular entrepreneurship, while at the same time contributing to the realization of the UN Sustainability Goals.

The six pillars on the organizational level (the ‘Enterprise Standard’ – and upper part of the ‘House of Sustainability’) are:

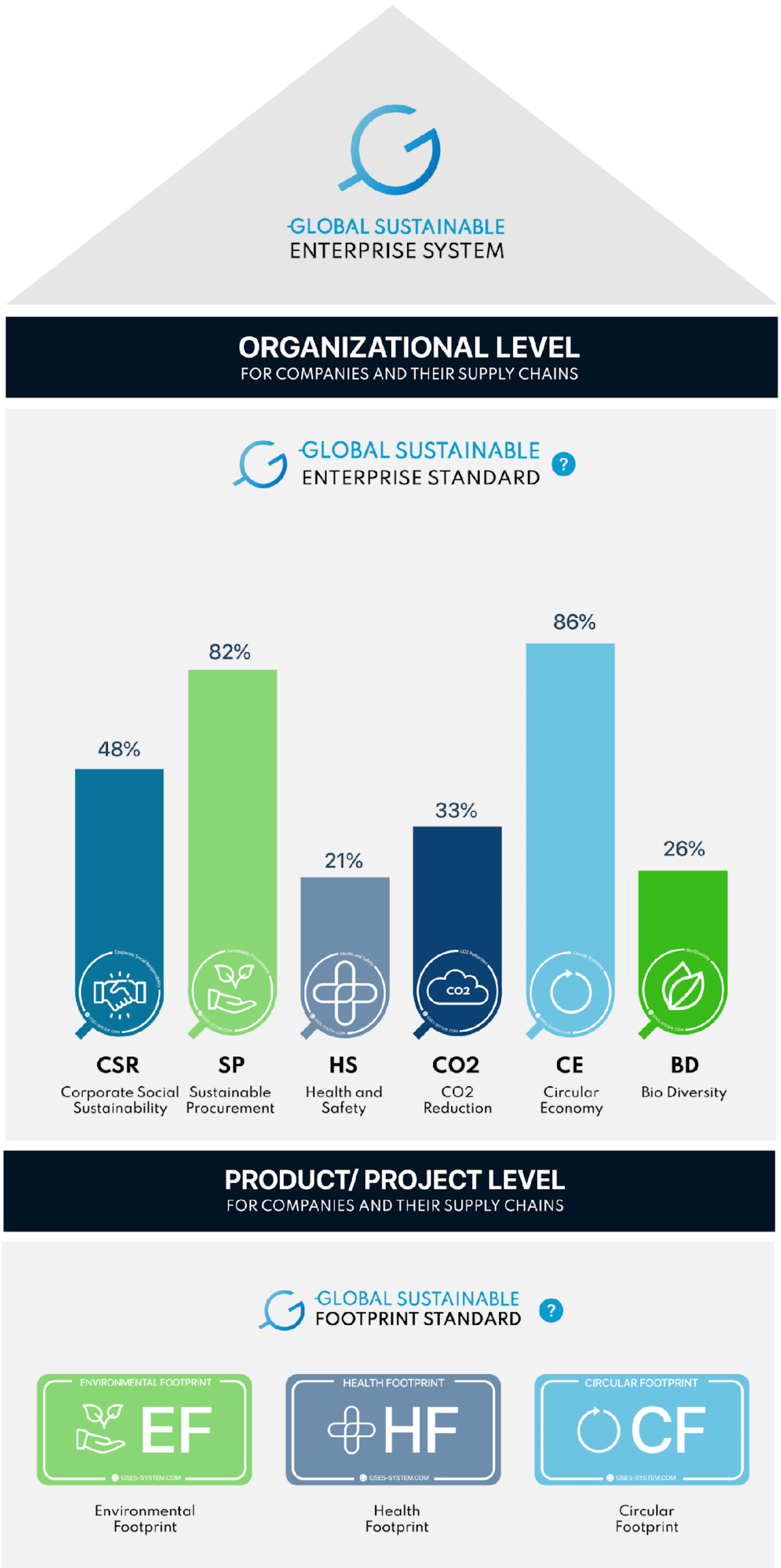
1. Corporate Social Responsibility (CSR)
2. Social Responsible Procurement (SP)
3. CO2 Reduction (CO2)
4. Circular Economy (CE)
5. Health & Safety (HS)
6. *Biodiversity (BD)*

The three pillars on the product/project level (the ‘Footprint Standards’ – and foundation of the ‘House of Sustainability’) are:

1. Environmental Footprint
2. Circular Footprint
3. Health Footprint

The approach includes:

1. The GSE Meta Standard in which existing and new certificates, quality marks and labels for sustainability are laid out
2. The supply chain analysis on an organizational level
3. And contribution to the UN Sustainability Goals


GLOBAL SUSTAINABLE
ENTERPRISE SYSTEM
ORGANIZATIONAL LEVEL
FOR COMPANIES AND THEIR SUPPLY CHAINS
GLOBAL SUSTAINABLE
ENTERPRISE STANDARD
48%
82%
21%
33%
86%
26%
CSR
Corporate Social Sustainability
SP
Sustainable Procurement
HS
Health and Safety
CO2
CO2 Reduction
CE
Circular Economy
BD
Bio Diversity
PRODUCT/ PROJECT LEVEL
FOR COMPANIES AND THEIR SUPPLY CHAINS
GLOBAL SUSTAINABLE
FOOTPRINT STANDARD
ENVIRONMENTAL FOOTPRINT
EF
HEALTH FOOTPRINT
HF
CIRCULAR FOOTPRINT
CF
Environmental Footprint
Health Footprint
Circular Footprint

2. Introduction of the Sustainable Footprint

The Sustainable Footprint shows the sustainability performance of products, residual materials, raw materials and projects. It consists of 3 footprints for circularity, environmental impact and health that can be certified separately.

Examples of products are:

- consumer goods, building materials, clothing, nutritional products, luxury goods, electronics, etc.
- services where material is used, i.e. cleaning, delivery of goods (packaging), products as a service such as office furniture, etc

Examples of projects are:

- construction and infrastructure projects, e.g. new buildings or renovations of bridges, roads, buildings, housing, work and living environments.

2.1 Validation and certification

The three footprints can be certified by independent certification bodies, by means of document validation (desk review/1st phase audit) and/or external audit. The organization can choose which footprints on which products and projects would be suitable for certification.

More information about the validation and certification process can be found in the 'Global Sustainable Enterprise System Handbook'.

2.2 Business to business (B2B) and business to consumer (B2C) Transparency

The validated and **certified footprints** are presented on the GSES ScoreCard on the Sustainable Footprints overview. The organization can decide for itself which products and projects footprints will be published in the **Sustainability Codex**, the open international database.

For B2B situations, this means that customers, suppliers, business partners, NGOs and governments can have a direct insight into sustainability performance. The same applies to B2C situations, where consumers will be able to compare and make informed choices.

Customers and (end) users can scan the **QR Code** on a product or its packaging, to see to what extent the product is circular, environmentally friendly or harmful to their health.

2.3 Supply chain certificate

The parties and supply chain partners who help with filling in the Bill of Material (BoM) calculator for their own component or semi-manufactured product can - if the organization chooses to do so - be listed on the Sustainable Footprint certificate as a sustainable supply chain partner. This is often an incentive for suppliers to participate in enquiry procedures.

2.4 Explanation of Circular Footprint & Environmental Footprint

The Circular Footprint (CF) is part of the product certification standard of the GSES System - Sustainable Footprint Standard. Next to the Circular Footprint, the Sustainable Footprint Standard consists of the Environmental Footprint (EF) and the Health Footprint (HF). The three topics (CF, EF and HF) give a comprehensive picture of the sustainability performance of a product, the production process and the supply chain.

The CF focuses entirely on the use of materials in a product and its circular performance. The calculation method is based on both material usage (input side) and post-use processing (output side). The calculation in weight does not take into account the specific flow of material. The circular performance of the input and output side result in a circularity score.

With the CF, the Sustainable Footprint Standard of GSES allows for a pragmatic start for calculating and certifying a circularity score for products. Hence, it fills a gap because there is no standard / calculation method for the circularity of products yet. The CF method is very accessible, in principle anyone would be able to use the Excel model of the calculation method provided by GSES or the online calculation tool on the GSES platform (BoM calculator) to calculate the CF score. That is because only the flows of materials are included.

Circular Footprint Standard - CF is based on existing standards:

- MCI index of the Ellen MacArthur Foundation
- Cradle to Cradle standard
- Platform Circulair Bouwen (CB) ’23 standard (Circular Construction ’23 standard)
- Meetmethodiek losmaakbaarheid (method for calculating separation index), Dutch Green Building Counsel (DGBC), nov 2019

The following aspects are taken into account in a quantitative analysis:

- Input side: use of recycled, biological and reclaimed materials.
- Output side: effective recycling/reclaiming and the possibility of composting biological material.
- Separation index: the ability to separate parts or materials after use to make refurbishment, re-use or material mono-streams possible

The following aspects are taken into account in a qualitative analysis:
The following aspects are additional CF-indicators and/or are taken into account at an organizational level by means of the GSES CE pillar or as an informative statement:

- Use of scarce materials.
- Product lifespan.
- Circular business strategy, is subject at organizational level through the CE pillar of the GSES
- Improvement strategy

Certification of the CF score comes with the obligation to obtain the EF certification within 2 years. This will give an even more complete picture of the sustainability performance. In addition to the EF certification, there is also the obligation to ensure company-wide circularity (CE pillar) within 2 years.

Circular Economy on an organizational level (CE pillar based on BS 8001)

In order to do so, the company must certify circularity management within the GSES System by means of the Circular Economy pillar at an organizational level, which is based on BS 8001. The CE pillar at organizational level includes circular business models, raw material procurement, supply chain transparency with regard to CE. For this pillar, see the GSES handbook (Global Sustainable Enterprise Standard 2.2).

OPEN SOURCE and continuous improvement

The CF is in a standardization phase. It is linked to international developments in the field of measuring circularity and input from all industries and sectors, so that the latest insights and findings are taken into account.

Environmental Impact

If the impact of energy and other environmental emissions is also to be considered, then the EF must be determined. This EF method is based on life cycle assessment (LCA). The EF is based on the:

- ISO 14040/44
- ISO 14025
- European PEF

2.5 Introduction Circular Footprint

The Circular Footprint (CF) is based on the Ellen MacArthur Foundation (Circular Indicators, An Approach to Measuring Circularity) and Cradle-to-Cradle (Material Reutilization), but goes a few steps beyond that. For instance, the Circular Footprint is scalable, generic and overarching.

The distinction between components in the supply chain and the product/project itself, makes it possible to determine the circularity index in complex chains.

The Circular Footprint method takes into account:

1. Scalability,
2. Production waste/loss,
3. Renewable resources,
4. Recycled content,
5. Recycle passport,
6. Evidence based, i.a. purchase receipts,

The Circular Footprint method is a generic method applicable to all sectors for relevant products and projects.

2.6 Introduction Environmental Footprint

The Environmental Footprint (EF) is based on the Life Cycle Assessment (LCA) method. The EF shows the environmental effects of the CO2 footprint, water footprint and transportation distances in the chain, as well as other environmental impacts.

The establishment of an EF revolves around the **Bill of Material (BoM)** on the GSES platform. With basic information, an LCA expert can start the remainder of the assessment. At the moment, the preparation of an LCA requires specialized knowledge and software. The European Commission is currently simplifying the process of preparing an LCA. In addition, more and more software tools are being released to make LCAs more accessible. As soon as there are good solutions for the (partially) independent preparation of LCAs, this will be included in the GSES System.

As stated, the EF is based on the European Union's LCA calculation method called **PEF: Product Environmental Footprint.**

The PEF method is a framework of requirements and principles to determine the environmental impact of products at a general level. The European Commission aims to develop more detailed specifications for product groups in order to standardize the key methodologies in LCA research.

When all the rules of the game are adhered to, it will be possible to compare the results. Ultimately, this will ensure transparency for manufacturers and consumers. The process of formulating rules is as follows: definition of the product category, structuring and analysis of data, interpretation and eventually communication.

The Environmental Footprint method is a generic method applicable to all sectors for relevant products and projects.

2.7 Introduction Health Footprint

The Health Footprint (HF) will focus on the product and not on processes. The focus and KPIs are aimed at the harmfulness to health of used substances, during the usage phase of a product.

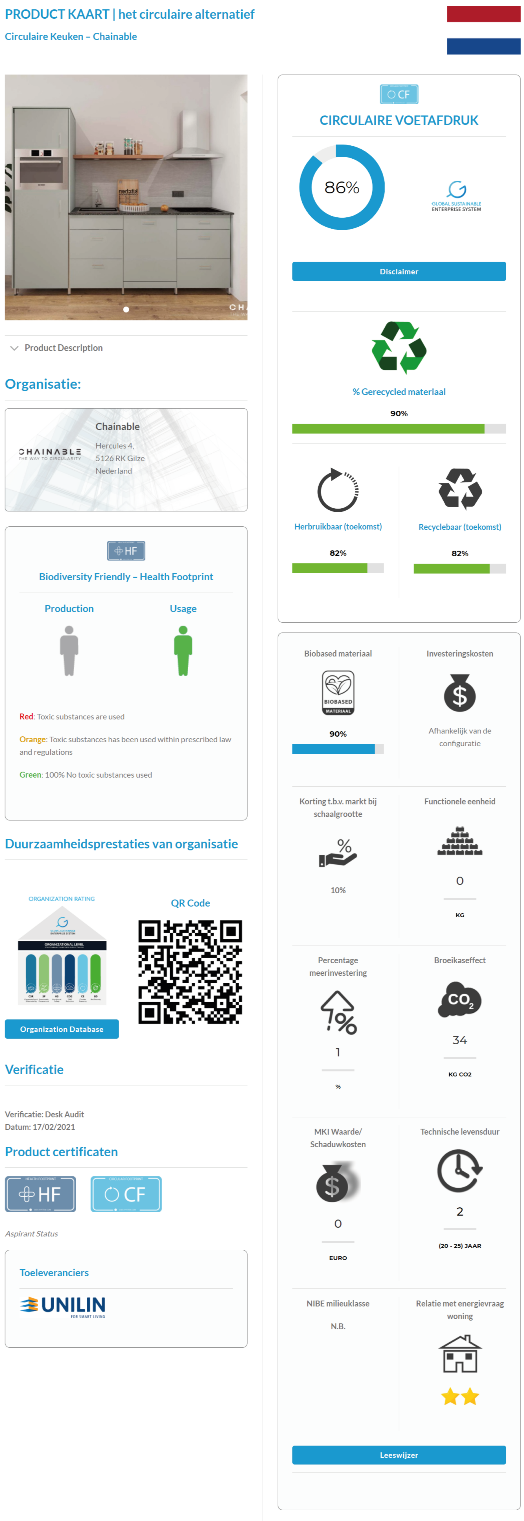
The focus will be on substances that are LEED compliant and BREEAM toxic compliant. This should be included in the Bill of Material of products. These are, on the one hand, toxic substances that are in the product and on the other hand, substances that are NOT in the product.

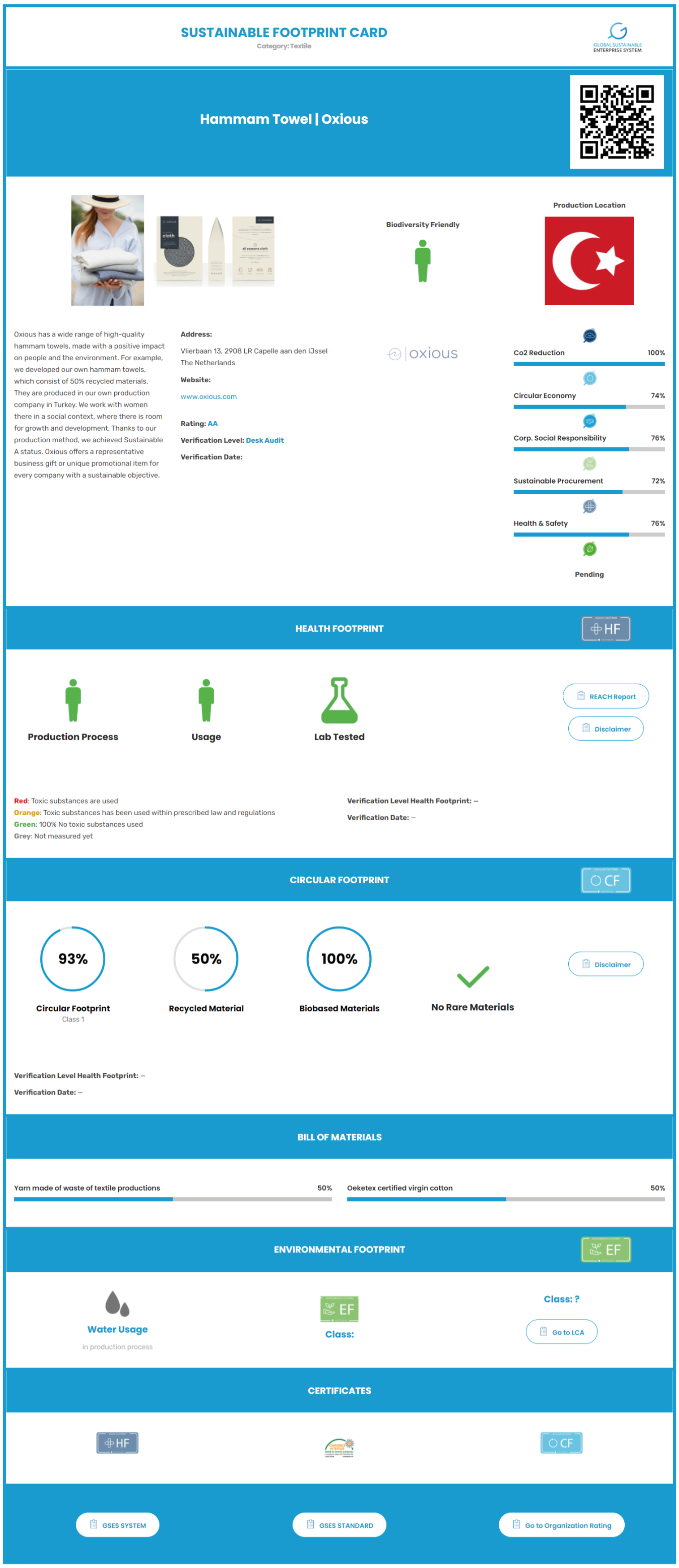
There is also a connection with the European REACH list (prohibited substances). In addition, the ambition is to record whether substances of the list of Substances of Very High Concern (SVHC, European list, Dutch version) and CMR substances (carcinogenic, mutagenic, or toxic for reproduction) are present or not.

The Health Footprint takes into account:

1. Toxic substances (LEED, REACH),
2. GMO,
3. Pesticides,
4. Bill of Material substance list,and in research:
5. CMR (carcinogenic, mutagenic, or toxic for reproduction) substances,
6. Substances of Very High Concern (SVHCs)

2.8 Example of a Sustainable Footprint Scorecard





SUSTAINABLE FOOTPRINT CARD
Category: Textile

GLOBAL SUSTAINABLE ENTERPRISE SYSTEM

Hammam Towel | Oxious

Biodiversity Friendly

Production Location

Oxious has a wide range of high-quality hammam towels, made with a positive impact on people and the environment. For example, we developed our own hammam towels, which consist of 50% recycled materials. They are produced in our own production company in Turkey. We work with women there in a social context, where there is room for growth and development. Thanks to our production method, we achieved Sustainable A status. Oxious offers a representative business gift or unique promotional item for every company with a sustainable objective.

Address:
Vlierbaan 13, 2908 LR Capelle aan den IJssel
The Netherlands

Website:
www.oxious.com

Rating: AA
Verification Level: Desk Audit
Verification Date:

oxious

Co2 Reduction	100%
Circular Economy	74%
Corp. Social Responsibility	76%
Sustainable Procurement	72%
Health & Safety	76%

Pending

HEALTH FOOTPRINT HF

Production Process — Usage — Lab Tested

REACH Report
Disclaimer

Red: Toxic substances are used
Orange: Toxic substances has been used within prescribed law and regulations
Green: 100% No toxic substances used
Grey: Not measured yet

Verification Level Health Footprint: –
Verification Date: –

CIRCULAR FOOTPRINT CF

93%	50%	100%	✓
Circular Footprint Class 1	Recycled Material	Biobased Materials	No Rare Materials

Disclaimer

Verification Level Health Footprint: –
Verification Date: –

BILL OF MATERIALS

Yarn made of waste of textile productions	50%
Oeketex certified virgin cotton	50%

ENVIRONMENTAL FOOTPRINT EF

Water Usage
in production process

EF
Class:

Class: ?
Go to LCA

CERTIFICATES

HF — CF

GSES SYSTEM — GSES STANDARD — Go to Organization Rating

3. Circular Footprint (CF)

3.1 Circular Economy

A circular economy is often characterized as an economy designed as a restorative and renewable system, aimed at maximizing the value in all stages of products, components and materials and eliminating waste.

This means that the goal is to give products and materials the longest lifespan possible, to facilitate optimal reuse and repair of products and to recycle them after use in such a way that the materials can be re-used for other products/projects.

See Health Footprint

The Health Footprint (HF) is focused on the product and production process. The KPIs are aimed at the hazardousness to health and environment of used substances, during the production and usage phase of a product.

The HF is based on existing chemical substance regulation and additional restricted substances lists per sector. In de HF the existence hazardous substances are counted. Exposure routes are no part of this certification. The existence of hazardous substances above threshold in a component of a product will hold the certification.

The Health footprint is based in de Bill of Material and contents of each component. This can be based on ingredient list, recipe or if ingredients are unknown a laboratorial test.

8.1 HF Certification

For HF the following items of certification apply

HF certification	Class 1	Class 2	Class 3
REACH compliant	•	•	•
Verified Bill of Material	•	•	•
List of all substances per component (> 1000 ppm)	75%	90%	100%
The list (of product) does not contain an item on the sector restricted substances list	•	•	•
Budgeted improvement strategy to extend analyses to 100% of product weight	•	•	
Re-certification every 3 years	•	•	•

8.2 Reach Compliancy

Most likely you are user of chemical substances (and not produce chemicals). With the REACH regulation, the client is a downstream user. As a downstream user the following steps needs to done:

1. Identifying critical substances for your business
2. Checking the registration status of the substances and looking for alternative suppliers, if necessary
3. Checking that your uses are covered in the registration, particularly if you use a substance in a novel way
4. If no supplier has registered the substance you really need, consider importing it directly

Also see: https://echa.europa.eu/regulations/reach/downstream-users/other-issues-affecting-downstream-users/registration-and-downstream-users

For auditor

- Check if these steps are taken and registered.

8.3 Verified Bill of Material and list of substances

For constructing a Bill of Materials see *paragraph 5.2 Verified Bill of Material*. After constructing the BoM a list of substances has to be made. The following steps has to be done:

1. Select the class of certification 1 to 3
2. Select the components that add up the mass to:
    a. 75% for class 1 certification
    b. 90% for class 2 certification
    c. 100% for class 3 certification

    If the product has a low number of components i.e. two components and none is >75%, then they will add up to 100%. Only class 3 could be selected in that case.
3. Make a list of all substances >1000ppm per component. Ask the supplier for the Material Safety Datasheet for the information of all substances. If it is not possible to collect this data, a laboratorial test has to be made. The substances to analyze in the case of a laboratorial test is determined by the selected list in *paragraph 8.3 Verified Bill of Material and list of substances*

For auditor

- Check if the completeness of the substances list

8.4 Sector restricted substances lists

Every sector has its own focus on hazardousness substances. At this point GSES is evaluating dedicated lists for the different sectors. Until that is done, GSES is following the REACH regulation for substances of very high concern (SVHC).

The criteria are given in article 57 of the REACH Regulation. A substance may be proposed as an SVHC if it meets one or more of the following criteria:

- it is carcinogenic;
- it is mutagenic;
- it is toxic for reproduction;
- it is persistent, bioaccumulative and toxic[5] (PBT substances);

- it is very persistent and very bioaccumulative (vPvB substances);
- there is "scientific evidence of probable serious effects to human health or the environment which give rise to an equivalent level of concern"; such substances are identified on a case-by-case basis.

For the updated list of SVHC see : https://echa.europa.eu/candidate-list-table

HF certification is not possible, if a substance from this list is present > 1000pm in one or more components of a product.

For auditor

- Check list substances with the SVHC list from on the ECHA site.

8.5 Budgeted improvement strategy

This applies to class 1 and 2 HF certification.

The client must describe the steps that are taken to increase the components that are analyzed form 75% and up for class 1 and 90% and up for class 2 certification.

This is an optimization rule that the GSES System applies and that also fits in with the approach of the five CE transition agendas in the Netherlands, in order to continuously increase and maximize the contributions to the circular economy.

The auditor has to verify the following in relation to improvement strategy.

- Assess the completeness of strategy and budget for it
- At re-certification: performance of improvement

9. Sustainable Footprint Standard - Meta Standard (Data)

The GSE Standards recognize and align other standards, frameworks and certificates that are already out there. That is why we created the Meta Standard also on product level.

Upload the certificates including data that you already have or have achieved from your product and get your aspirant rating within 5 working days in a digital rating card including QR code.

Circular Footprint:

- LCA
- PEF
- C2C certificates
- MPS
- FSC
- GOTS
- Global Recycled Standard
- Recycled Claim Standard 100
- Recycled Claim Standard Blended
- Responsible Wool Standard
- PEFC

Environmental Footprint:

- LCA
- PEF
- C2C certificates
- MPS
- BlueSign
- Energy Star
- Green Seal

Health Footprint:

- Global GAP
- Planet Proof
- C2C Health certificates
- MPS
- FSC
- PEFC
- GOTS
- Oeko-tex
- Organic Content Standard 100
- Recycled Claim Standard 100
- Recycled Claim Standard Blended

APPENDIX A: principles of the CF for further explanation, principles of the Circular Footprint.

3.2 Definition circular economy and circular footprint

There are many definitions of Circular Economy in circulation worldwide. ISO started on a new international standard in February 2019 and will provide clarity in this respect. In this handbook the following definition is used:

“A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.” [Source: Ellen MacArthur Foundation; also included in BS 8001 and ISO 20400].

“The Circular Footprint is an indication for the product of its potential to fit into the Circular Economy.”

3.3 Relationship with the GSES pillar Circular Economy

The GSES System includes a Circular Economy pillar. Because there is no international ISO standard yet, this pillar is based on the only available standard for Circular Economy, namely BS 8001 from the United-Kingdom: BS 8001:2017: Framework for implementing the principles of the circular economy in organizations - Guide, British Standards Institution (BSI), 2017.

It is important that the connection is made between applying the principles of BS 8001 and demonstrating the level of circularity of the products with the Circular Footprint method. The GSE-Standard pillar Circular Economy supports the organization at a business operations level.

3.4 Goal of the Circular Footprint calculation method

The goal of the Circular Footprint calculation method is to provide a generic, practical and scalable method that significantly reduces the complexity of circularity. Circularity of a product is a term that is not easily defined in an unambiguous and short way. Products are often composed of multiple materials and product chains are usually complex. In order to calculate circularity, information is required about the entire product composition, the use of any semi-finished products, and preferably the origin of the raw materials used.

Various operations take place in the product chain by adding, processing or combining raw materials. These operations in the product chain may result in waste, which may be surplus material or defective and/or rejected products. After the use of a product, there are often several possibilities to reuse the product or parts of the product, reuse the material used, or recycle or dispose the product by dumping or incineration (with energy recovery).

3.5 Scope

With the help of the Circular Footprint, everyone can determine the degree of circularity of products and projects from a wide range of industries. The methodology is designed in such a way that it can be applied worldwide.

(End) users of products, raw materials and projects can use a QR-Code to check the degree of circularity. The QR Code is linked to a database in which information about products raw materials and projects is included. The information in the database can also be consulted via the QR code or NFC tags.

The CF calculates and shows the percentage of circular non virgin materials in a product and project, as well as their circular processing at the end of the product and project life cycle. The CF is a generic method applicable to all sectors.

The CF index is a calculation based on the mass of materials only. It does not address environmental impacts such as energy used and emissions to the atmosphere, soil or water. For an indication of environmental effects, the "**Environmental Footprint**" (EF) is defined later on in this handbook. The CF and EF together provide an overview of circularity and environmental effects.

3.6 Preconditions CF calculation method

The CF calculation method is based on the following preconditions:

- **Generic:** the method can be applied generically to all products.
- **Practical:** can be used by people who have no experience with methods such as life cycle assessments (LCA) or Cradle to Cradle certification.
- **Expandable:** the method can be expanded and refined at a later stage. Complexity may increase in the future, for example when important information for circularity becomes more accessible.
- **Open source:** the CF calculation method is freely accessible to everyone. A community will be established to share improvements with each other and future adjustments will be formulated by an expert panel. This in line with prcedures of the ISO17065 standard.

4. CF Terminology and definitions

4.1 Definitions for product composition

Definitions are very important when establishing a calculation method. After all, in order to have comparable results, it is crucial to use the same basic principles. The table below lists the elements that are important for the construction of a product. The structure consists of four hierarchical levels, and with this structure all products can be defined within the CF calculation method.

CF- element	Definition Circular Footprint element
Product	• A product consists of one or more components and/or materials; • The connection between a component, material or chemical substance and the product can be separable or fixed. Separable means that it is easy to separate from the product, either mechanically or manually; • A product always has a full "life cycle". This is how a product distinguishes itself from other elements. The life cycle consists of the supply phase, the production phase, the usage phase and the "end-of-life" phase; • Processing in the end-of-life phase may comprise of reusing the entire product or parts of it, or comprise of recycling or final disposal (incineration/dumping). *For example, the same product can be processed differently after use: a garment can be re-worn, the fabric can be turned into another product, or it can be pulverized for recycling or incinerated;* *In example A paint manufacturer will have a different view on this definition of a product. After all, he/she makes a "paint product". But in the definition of CF, paint is not seen as a product, but as a component. Paint on as such does not have a life cycle until the end of the life phase. Paint is applied on a product, than it becomes part of a product with a use phase.* *The distinction of "product" from other elements is important because a product has the end-of-life phase after the usage phase. The end-of-life phase is important for calculating circularity.*

Component (or part)	• A component is applied in or to a product; • It has no usage phase and end of life phase on its own, it has a function in a *Product*; • It consists of several components and/or materials; • A component is by definition not a homogeneous mass; • The connection between the different components and/or materials can be detachable or fixed. Other forms for a (product) component are: • Semi-finished product • Sub-assembly • Product part • Material (as further specified below) *Let's illustrate this with hinges and locks. Hinges and locks are of no use on their own, so they are not a product with their own usage phase. It consists of a combination of metals, plastics and lubricants, so it is not a homogeneous mass (no material, see below). The same goes for denim, car tires, bicycle frames, paint etc.*
Material	• Material is a homogeneous mass consisting of one or more materials and/or chemical substances; • The connection between the compositions of a material is fixed; it cannot be separated by hand or mechanically into the original materials or chemicals. *For example, a metal alloy, plastic, natural materials such as wood, yarn, glass, paint, glue, sealant, etc.* • Just like a component, the material does not have a usage phase or a disposal phase of its own.
Disassembly	• Parts that formed when a product is dismantled after use or during maintenance, when components are separated. • Disassembling may be easy, but may also require using (specific) tools and in extreme cases by destructively removing other components and/or materials (e.g. grinding/sawing). *It is possible to connect components of a product inseparably. For example, steel and a paint coating; two components/materials during the manufacturing process, but a complete disassembly at the end-of-life phase. The connection has consequences for the end-of-life processing. A disassembly is therefore not necessarily the same as the components that make up a product.* *For example: a bicycle frame is constructed from a steel frame, solder and paint. In the production process, these three separate components are combined. During demolition, these three components are either impossible or not easy to separate. At the moment it is common practice that the solder and paint will be lost during the processing of scrap, only the steel remains. This is why component and disassembly are separated.*

Chemical substance	• A chemical is a substance that has a uniform chemical composition: a chemically "pure substance"; • From a chemical standpoint, a pure substance differs from a compound or component in that a pure substance can only be separated by breaking up the bonds between atoms. • A pure substance can either consist of the atoms of one chemical element: a simple substance, for example, iron, silicon or cobalt, or of the chemical bond between the atoms of two or more elements: a compound substance, for example, water or polyethylene. • A chemical has a CAS (Chemical Abstracts Service) number.

Terms for product elements that are not part of CF are indicated in the table below:

Element	Definition element
System	A system is a combination of a large number of products. A building, an infrastructural work, a complex machine (such as a agricultural machinery, airplanes or cars).
Matter	Matter is a collective term for materials

4.2 Definitions for circular values

Each component and material of which a product is composed, has a set of circular values. These values indicate the origin or the possibilities for circular processing. The following terms are used in the Circular Footprint:

Circular value	Explanation of circular value
Virgin material	Raw material that has not previously been used or consumed. These are materials that have been obtained directly from nature in their raw form, such as wood and iron ore.
Reused component	Component that has already been used in a product, or that is waste that resulted from production and that has not undergone any waste processing. For example, making a bag from the fabric of a used pair of jeans.
Recycled material	Material that has previously been used in a product, or that is waste that resulted from production and that has undergone waste processing. This waste processing can be mechanical, thermal or chemical. Recycled material is produced before or after the usage phase (pre- or post-consumer). When production waste is recycled, this is labelled as post-consumer recycled material.

Sustainable renewable material	Sustainable renewable material: A material of biotic origin that has been grown and/or managed in a demonstrably sustainable manner. Other terms are renewable and bio-based material. The following conditions must be met for sustainable renewable raw materials: • The cultivation period must be shorter than the period of use; • The use of raw materials must not be competitive with the food chain; • The renewable material must be proven to be sustainably produced. This evidence can come from certificates such as FSC, PEFC and OEKO-TEX®.
Non-sustainable renewable material	Non-sustainable renewable material: A material of biotic origin that has not been grown and/or cultivated in the sustainable manner described above. Non-sustainable renewable material is considered to be a virgin raw material.
Reused product	A product that has been reused in its entirety. If a part has been repaired or replaced, the product has been refurbished.
Recycled content	The extent to which a product, component or material incorporates raw material originating from a waste stream.
Recyclability	The possibility to recycle all or part of a disassembly at least once. There are materials that cannot be recycled at the moment, such as a plastic chips with a layer of aluminum.
Compostable	A material is compostable if it decomposes under certain conditions in a short period of time (usually a few months) and provides nutrients to ecosystems in the process. Evidence of compostability is provided by a suitable ASTM, ISO, CEN, or DIN standard. (e.g. the ASTM D6400-04 for plastics). Compostable is not the same as biodegradable. Even the plastic soup in our oceans is biodegradable eventually, but that takes much longer.
Unrecoverable waste	Waste stream containing material that has been incinerated or dumped, also known as final disposal.
Secondary material	Raw material of non-primary material, such as recycled, reclaimed and compostable material.
Disassembly	Indication that the different materials that make up a product can be separated. It must be possible to separate materials manually or mechanically.
Securing reutilization	The way in which the manufacturer organizes and/or guarantees the re-use or recycling of products or materials.
Environmental impact	A change in the environment due to an emission of a substance or its extraction. With an LCA, the overall environmental impact of a production chain is determined. Currently known environmental effects include climate change, ozone depletion, smog formation and acidification.
Carbon footprint	The total emission of greenhouse gases expressed in CO2 equivalents that takes place during the entire product chain of a product, including extraction, production, usage and end-of-life processing. Usually this refers to the entire chain up to the finished product.
Embodied energy	The total energy consumption (usually fossil energy) that takes place throughout the product chain up to the finished product (until usage phase).
Product lifetime	The time a product can fulfil its desired purpose.

5. Circular Footprint certification

5.1 CF certification

The certification/validation of the Circular Footprint for products and projects consists of the following requirements:

CF certification	**Class 1**	**Class 2**	**Class 3**
Verified Bill of Material	•	•	•
Calculation of CF or CFx index	•	•	•
CF or CFx score	>50%	>75%	>90%
Separation index (at this time for building products only)		>60%	>80%
Substantiation of the product lifespan	•	•	•
Supply security risk for materials per component		•	•
Recycle passport		•	•
QR codes and NFC tags for the waste processor		•	•
CF Improvement strategy	•	•	•
Sustainable chain of custody		•	•

The requirements are explained here below. To obtain certification, the CF has to be externally audited. To find an accredited auditor please contact GSES.

5.2 Verified Bill of Material

With the Excel tool that can be downloaded from the GSES platform, the organization can compose its own Bill of Materials (BoM) for products and projects and provide its substantiation. This makes it possible to validate and assess all relevant data for the Sustainable Footprint, so that a verified Bill of Material can be shown.

The following fields have to be completed in the BoM for each component:

Circular Footprint:

1. Identification of component(s)
2. Supplier (s)
3. Unit
4. Weight per unit
5. Amount of units
6. % recycled content
7. % reused content
8. % renewable content

9. % production scrap
10. % recyclable / re-use
11. % compostable
12. substantiation of all input data

Packaging must be added to the BoM when a product needs a packaging, in example for liquid, gas, powder, paste, kit, protection (i.e. food)

Please note that two options exist: certification the CF or CFx. The CF has to be certified for all products. As explained here above, a product is a finished product with a use phase. The CFx has to be certified for a component. A component has no use-phase for itself, it is a part

Auditing the BoM

The BoM must be audited for all CF-classes. To check if the BoM is complete and correct, the auditor must conduct one of these verifications:

1. Verification by technical drawing
2. Verification by a print from the manufacturer's ERP database (recipe, BoM)
3. Visual inspection of the product or component
4. Check of the total weight of the product or component, in comparison to the sum of the weights of the BoM.

5.3 Calculation of CF or CF_x index

The CF index is a calculation applicable to the whole product or project lifecycle. The CF index takes the following into account:

1. composition of the product/project
2. processing of losses during production
3. final processing in the end-of-life phase

The calculation has to be conducted with the Excel tool. The Excel tool can be downloaded from the GSES platform.

The calculation consists of four elements:

CF_{in} Circular Footprint index of the input-side of all components for a product. CF_{in} is calculated by adding the information of the materials origin (virgin, recycled content, renewable, reused) of all materials in the BoM. If a supplier already has calculated and audited CFx, then the CFx score can be directly added.

CF_{out} Circular Footprint index of the output-side of all disassembly's of a product. A The CF_{out} must be calculated for a product. It ranges from CF_{out} 0% (not circular, all materials are wasted to landfill or incineration) to CFx 100% (completely circular, all materials are re-sed, re-cyled or composted).

CF The final CF index is composed with the CF_{in} and CF_{out} indexes. It ranges from CFx 0% (not circular, exists totally of virgin material and all dis-assemblies are incinerated or burnt) to CF 100% (completely circular, non-virgin material used and all dis-assemblies are recycled, re-used or composted).

CFx Circular Footprint index for a component, such as materials, parts, sub-assemblies, chemical substances as described here above. It ranges from CFx 0% (not circular, exists totally of virgin material) to CFx 100% (completely circular, non-virgin material used).

In CFx and CF_{in} scrap (the production losses) percentage and waste processes of the scrap are considered. The underlying formulas for calculating the CFx, CF_{in}, CF_{out} and CF index are discussed in

APPENDIX B calculation CF index of this document.

For suppliers that manufacture components (non-products)

Input for CFx Index (non products)	
Step 1: **Prepare an overview with weights**	Create a complete bill of materials for the component material, assembly, semi-finished product or product. On the worksheet "CFx calculation", enter all components that make up the product (in column B). Enter information about the supplier(s), the unit used, the weight per unit and the number of units per product.
Step 2: **Ask the supplier for the CFx calculation**	If the supplier has made a CFx calculation himself, this value must be applied. Select "yes" in column J " CFx from supplier known" and enter the value. This will disable the input for the percentage of recycled, reused or sustainable renewable raw materials. → Cut-off: all materials, assemblies, semi-finished products that, if added up, are less that 1% of the total weight can be cut–off from the calculation.
Step 3: **Proof of secondary raw material**	Ask your supplier about the percentage of recycled, reused or renewable raw materials that make up the component. **You should also ask for substantiation documents.** To do this, create a folder with files and refer to the file name in this Excel. → If the percentages are not known, then conservative sector-average percentages can be applied. If different sources mention different percentages, then the lowest value (worst case) must be used. Sources for sector averages are: • ELCD, EcoInvent or Gabi database • Check raw materials on https://www.grondstoffenscanner.nl/ (also in English) • Sector associations
Step 4: **Enter production losses**	Enter for each component of the BoM the production losses that occur during your own production process. Also specify how the production losses are processed: made available for recycling, reuse (e.g. in your own process) or composting. Add supporting documentation for this processing to the folder, and refer to the file name.
Input for CF Index	
Step 5: **Calculate CF_{in}**	First, establish the CF_{in} by completing the same steps hereabove for all component of the product (step 1 to step 4.) → Also enter the components used during the maintenance phase. → Also enter packaging when the product can't be handled without packaging (liquid, gas, powder, paste, kit, protection (i.e. food)).

Step 6: **Calculate CF_{out}**	Make a complete list of disassemblies (see above for the definition of disassembly). Also enter the weights and quantities.
Step 7: **Processing disassemblies in end-of-life scenario's**	Enter how the disassembly is processed: the percentage that is reused, recycled or composted. This can initially be based on the average percentage in the specific region where processing takes place, e.g. in a country. If there is a deviation from the average, this must be substantiated and proven by documentation.
Step 8: **Calculation of CF**	The CF-index is calculated automatically when CF_{in} and CF_{out} are completed.

Auditing the CF/CFx calculation

The auditor has to verify the following to certify the CF/CFx calculation.

- The correct Excel tool is used;
- The complete BoM is filled in
- The correct percentages are filled in
- Substantiation documents are provided

5.4 Separation index

In this version, the separation index must be calculated for building products only. The separation index is 100% based on the method provided by the Dutch Green Building Council (DGBC) "Circular Buildings, meetmethodiek circulariteit". https://www.dgbc.nl/publicaties/circular-buildings-een-meetmethodiek-voor-losmaakbaarheid-26 . Both the separation index for the connection LIc and the separation index for the composition LIc has to be calculated. For a whole project these indexes have to be calculated weighed by MPG.

For building products the separation index in mandatory. Due to the complexity of the calculation, please contact GSES for advice.

Auditing separation index

The auditor has to verify the following to certify separation index.

- Calculation of index done by accredited consultant

5.5 Product lifespan

The lifespan of the product at intended must be reported on the Sustainable Footprint Card. Information about the instructions for enhancing the lifespan must be included in the QR code.

Auditing lifespan

The auditor has to verify the following in relation to the lifespan.

- Substantiation of the lifespan

5.6 Supply security risk for materials per component

Determination of the supply security risk must be done by the Resources Scanner (https://www.grondstoffenscanner.nl/). A login is needed (free). The assessment has to be done in the following steps:

- Determine the HS-code[1] of each component
- Assess each (6 digit) HS-code on the Resources Scanner
- List all high supply security risk Raw Materials that are coming up in de assessment with name and supply security rate
- The number of raw materials with a high supply security risk has to be noted on the score card

Auditing Supply security risk

The auditor has to verify the following in relation to the lifespan.

- All materials in all components are assessed
- Take a sample 10% of the materials to check it on Resources Scanner

5.7 Recycle Passport

The recycle passport contains at least the following information:

1. Description of the process for circular processing after the usage phase
2. The Separability/Disassembly strategy of a product/project must be stated in the Recycle Passport,
   either separately or in the Recycle Manual section for the waste processor/demolisher.
3. Recycle Manual for the waste processor/demolisher
4. Upload informative videos and photos of the product/project (optional).

The auditor has to verify the following in relation to the recycle passport.

- Assess the completeness of passport

5.8 QR codes and NFC tags for the waste processor

The waste processor can scan the NFC tags in textiles and electronic devices for example, directly on the conveyor belt. The NFC tag and/or QR code takes the waste processor to the recycle passport of the relevant product/project and the BoM.

Thanks to the recycle passport, the waste processor can see two things:

- List of materials of the product.
- How to disassemble components for recycling or re-use.
- How to recycle components correctly.
- Conditions to compost materials, if applicable.

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[1] Harmonized System code used by customs. i.e. for Dutch users look on the chamber of commerce site (
See https://www.kvk.nl/advies-en-informatie/internationaal-ondernemen/importeren/hoe-bepaal-ik-een-goederencode)

The auditor has to verify the following in relation to the QR codes and NFC.

- Assess existence of system for the product

5.9 Circular Footprint improvement strategy

The client must describe the steps that are taken to increase the CF or CFx index. The plan must be SMART and must be verifiable and budgeted.

In order to maintain the CF certification, the CF or CFx index must increase **every three years**, if possible. If it is not possible to increase the CF score, the participant must be able to justify this so that the certification can be maintained.

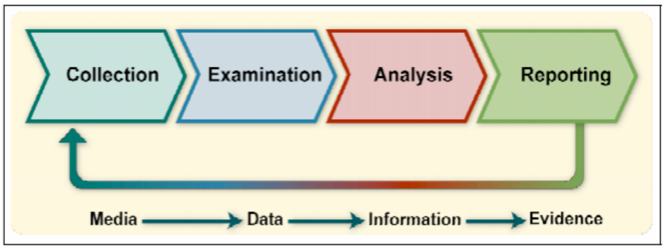
This is an optimization rule that the GSES System applies and that also fits in with the approach of the five CE transition agendas in the Netherlands, in order to continuously increase and maximize the contributions to the circular economy.

The auditor has to verify the following in relation to improvement strategy.

- Assess the completeness of strategy and budget for it
- At re-certification: performance of improvement

5.10 A Sustainable Chain of Custody

The client can use the GSES System online platform to invite chain partners to establish a Bill of Materials for a component or semi-manufactured product and thus participate in the GSES System platform. In this way, a contribution is made to an unambiguous quality in the chain, one that is transparent and sustainable.



5.11 CF Report

After conducting the items of CF certification, a CF-report must be made by the applier. This report must consist the following sections.

CF-report:

- Bill of Material with all components of the non-product or product
- Description where the BoM is based on ;
- CF(x)-calculations results;

- Substantiation documents for percentages (recycled content, reused content, renewable content, waste scenario’s) in appendix;
- For building materials: separation index
- List of raw materials per component with high supply security risk
- Substantiation of the product lifespan
- CF Improvement strategy
- Recycle passport
- List of suppliers who are involved in the chain of custody
- The auditor has to note that all items are reviewd and has to make the conclusion for the CF Classification

The complete CF-report must be sent to the GSES organization.

6. The Environmental Footprint (EF)

6.1 EF Certification

The 'Environmental Footprint' (EF) determines the environmental impact (including emissions to the environment and energy and raw material consumption) and the life cycle of a product or project.

The life cycle analysis (LCA) covers the chain of extraction of raw materials, transport, production, use and disassembly processes, and the removal, recycling and disposal of the materials used.

The LCA with its validation classification can be displayed on the Sustainable Footprint ScoreCard if an LCA has been established using the Life Cycle Assessment (LCA) method. The LCA method is based on the ISO 14040 and ISO 14044 standards supplemented by LCA standards for certain product categories (PCRs, Product Category Rules). For construction products the LCA-method is EN 1804:2019

The EF aims to be fully in line with the development of the European Commission's Product Environmental Footprint (PEF). This European footprint PEF is currently (2019) in a transition phase. A PCR (a so-called PEFCR) is still in place for a limited number of sectors. However, the fundamental document of the PEF is ready and applicable. The EF in this certification follows the development of the PEF and is adjusted if necessary.

EF certification	**Class 1**	**Class 2**	**Class 3**
Verified Bill of Material	•	•	•
LCA according to standards (ISO14040/44, PCR)	•	•	•
LCA externally reviewed		•	•
Global Warming Potential of production lower than market average		•	•
Weighed (single point) score lower than market average			•
Re-certification every 3 years	•	•	•

6.2 LCA Terminology

For the Environmental Footprint, a number of terms are used, for which it is customary to abbreviate them as follows:

Term	Description
EF	Environmental Footprint
LCA	Life Cycle Assessment. Compilation and evaluation of all inputs, outputs and potential environmental impacts of a product system throughout its life cycle.
PEF	Product Environmental Footprint. EU standards for formulating LCAs

Term	Description
PCR	Product Category Rule. Specific LCA rules for product sectors, such as textiles or construction work.
PEFCR	Product Category Rule in accordance with the European PEF system. In addition to the rules, a dataset with LCA data is also made available.
EPD	Environmental Product Declaration. LCA report in accordance with a PCR verified by a recognized LCA expert.
LCI	Life Cycle Inventory. The first phase in formulating an LCA. In this phase, all data are collected.
LCIA	Life Cycle Impact Analysis. The second phase in the formulation of an LCA, in which the environmental interventions are distinguished and assigned to environmental impact categories.
Stichting NMD	Stichting NMD, organization that manages the Dutch Determination Method Environmental performance of works (building and civil engineering works) based on a the full lifecycle assessment EN 15804:2019 (modules a, B, C and D) verified by a recognized LCA expert.
MKI	Milieu Kosten Indicator. Single score of the environmental performance in accordance the method of weighing in the Dutch Determination Method Environmental performance of works

6.3 LCA Related standards

The following standards are related to the Environmental Footprint:

Standard	Description
ISO 14040	Environmental management Life cycle assessment Principles and framework
ISO 14044	Environmental management Life cycle assessment Requirements and guidelines
ISO 14025	Environmental labels and declarations Type III environmental declarations Principles and procedures
EN 15804	Sustainability of construction works Environmental product declarations Core rules for the product category of construction products
PEF	Product Environmental Footprint, the European framework for uniform formulations of LCAs
Stichting NMD Determination and Assessment method	a) Determination Method Environmental performance of works (building and civil engineering works) b) Requirements for obtaining MRPI®-EPDs for the Dutch market and inclusion of data in the Dutch National Environmental Database (NMD)

7. Conducting an LCA for the Environmental Footprint

When formulating an LCA, the following steps are taken:

1. Determining goal and scope,
2. Life Cycle Inventory (LCI), data collection and LCA modeling phase,
3. Life Cycle Impact Analyses (LCIA), assigning environmental interventions to environmental impacts,
4. Life Cycle Impact Interpretation, review of the results,
5. Reporting.

7.1 Setting the goal and scope

In setting the goal and scope, the author defines what the LCA is used for, for whom it is intended and what the scope of the study is.

Some examples of LCA objectives are:

- Preparation of an LCA for the EF;
- Preparation of an LCA for an EPD;
- Preparation of an LCA to be included in an Environmental Database;
- Project-specific LCA for a tender;
- LCA for internal use, e.g. for sustainable product innovation.

There may be specific standards prescribed for each purpose. These standards are not necessarily the same.

EF does not prescribe a specific objective as in the above examples. The preparation of an EF can serve all these objectives.

Selecting a PCR

In this phase, the author decides which standards will be used. The Product Category Rules (PCR) must be selected on the basis of the described objectives. If no PCR document has been prescribed, the following order must be used to select one:

1. PCR from the European PEFCR, if available.
2. PCR for the product that is applicable in your country.
3. PCR from a European EPD operator (e.g. Environdec, IBU, EPD system, Norge-EPD).
4. If no PCR is available, the generic document of the latest version of PEF should be used.

For Building Products to be used in the Netherlands the use of the Requirements for obtaining MRPI®-EPDs for the Dutch market and inclusion of data in the Dutch National Environmental Database (NMD) is obligated. See website https://milieudatabase.nl/

Determining system boundaries (scope)

The system boundary (scope) determines which data should be inventoried and which should not. In LCA terms: which inputs and outputs are part of the assessment. The system boundary and specific subdivision are determined by the selected PCR. The following rules apply to the system boundary at all times, regardless of the regulations in the PCR:

- The LCA for a product for EF must always be a Cradle to Grave LCA. For non-products a Cradle to Gate LCA is allowed.
- All "upstream", "usage" and "downstream" phases should be included, even if there are some optional elements in the PCR.
- The benefits and costs of recycled material outside the system boundary must be assessed and reported. If this is not described in the PCR, then the EN 15804 standard must be respected.

Determining declared and functional unit

The functional unit is determined by the PCR and is by definition linked to the application of a product in practice. The declared unit is the unit on which the LCA is calculated. This may differ from the functional unit for practical reasons.

Lifespan

The lifespan is important for the usage phase. In the Cradle to Grave LCA, the maintenance processes for the entire life cycle must be determined. If one decides to deviate from the sector average lifespan, this must be substantiated.

7.2 Life Cycle Inventory (LCI)

In the EF, there is no deviation from the standards of the PCR or higher-level standards ISO 14040/44 and ISO 14025 for the Life Cycle Inventory (LCI) phase. Follow the instruction from these standards.

7.3 Life Cycle Impact phase

The calculation rules (also called assessment method) are determined by the selected PEFCR or PCR. If no calculation rules are provided, then the rules that are currently in force in the PEF apply.

In the Life Cycle Impact Assessment (LCIA) phase, the inventory is processed in specific LCA software and all consumption and emissions are assigned to environmental categories. The following software can be used:

- SimaPro by Pré Consultants
- OpenLCA by OpenLCA.org
- GaBi by ThinkStep
- EcoChain/Mobius by EcoChain Technologies

Allocation of input and output

For the allocation rules, the selected PEFCR or PCR is leading;

For the calculation of the benefits and costs of recycled material outside the system boundary, the module-D approach of the most recent version of EN15804 should be used.

Reference database

The reference database that is used is initially based on the selected PEFCR or PCR. If no reference database has been defined, the most recent version of ELCD, EcoInvent or Gabi can be used.

7.4 Impact assessment

The impact assessment for the EF is derived from the PEF. This method is mandatory, regardless of any other impact assessment methods described in the selected PCR. By prescribing the PEF method, the EF certification creates a level playing field and comparability for both the characteristics and weighting factors.

Characterization

The midpoints and the associated characterization method are described in the document "Supporting information to the characterization factors of recommended EF Life Cycle Impact Assessment methods" (European Commission, 2018). Read more at: https://eplca.jrc.ec.europa.eu/permalink/TR_SupportingCF_FINAL.pdf .

The following environmental impact categories must be reported and the following methods must be used:

Environmental impact category	Unit	Method PEF
Climate change (total)	Kg CO2-eq	Baseline model of 100 years of the IPCC based on IPCC 2013
Ozone depletion	Kg CFC 11 eq.	ReCiPe2008
Particulate matters	Kg PM10	UNEP (2016)
Ionizing radiation	kBq U235	Frischknecht et al, 2000
Photochemical ozone formation	kg NMVOC eq	Van Zelm et al 2008 as applied in ReCiPe2008
Acidification	mol H+ eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication, terrestrial	mol N eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Eutrophication, freshwater	kg PO4 eq.	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication, marine	mol N eq.	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Land use, soil quality index	Pt	LANCA (as in Beck et al. 2010 and Bos et al., 2016)
Water use	m3 world eq. deprived	Available WAter REmaining (AWARE) Boulay et al., 2016
Resource use, minerals and metals	kg Sb eq.	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Resource use, fossils	MJ, net calorific value	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.

Weighing

The weighting method is described in the document "Development of a weighting approach for the Environmental Footprint" (European Commission, 2018). Read more at: https://eplca.jrc.ec.europa.eu/permalink/2018_JRC_Weighting_EF.pdf
The set is applied without toxicity-related impact categories, see table 32 on page 34 of the document.

Environmental impact category	Final weighing
Climate change (total)	22.19
Ozone depletion	6.75
Particulate matters	9.54
Ionizing radiation	5.37
Photochemical ozone formation	5.10
Acidification	6.64
Eutrophication, terrestrial	3.91
Eutrophication, freshwater	2.95
Eutrophication, marine	3.12
Land use, soil quality index	8.42
Water use	9.03
Resource use, minerals and metals	8.08
Resource use, fossils	8.92

Reporting in accordance with these PEF impact categories and the weighting system, will generally result in relatively little effort when preparing or modifying an EPD or LCA. The LCI (Life Cycle Inventory) is the same for each method. The modelling of the inputs in an LCA software tool as well. The LCA expert only has to select the correct method(s) and report the results (maybe separately).

Future developments of the PEF will be adopted in the EF method in consultation with the board of experts.

For Building Products to be used in the Netherlands it is mandatory to use the LCIA Method that is provided by by the Stichting NMD.

7.5 Life Cycle interpretation

The Life Cycle Interpretation must meet the requirements of the selected PEFCR or PCR. If no PCR is selected, it must comply with the rules of PEF.

To determine if the score GWP and Weighed Score is lower than the market average:

- Calculate the market average with the best fitting reference out of the reference datable in use
- If no reference is found, collect EPD's of similar products or product with the same function. Calculate the averages from these EPD's.
- Discuss the differences in GWP and weighed score and concluded the performance.

Reporting

The report must meet the requirements from the selected PCR. If no PCR is selected, it must comply with ISO 14025 and ISO 14040. The corresponding LCA background report (with potentially business-sensitive data) does not have to be made public.

7.6 Environmental Footprint, LCA review

An external critical LCA review is mandatory for Environmental Footprint classification 2 and 3. For more information, please visit: www.gses-system.com.

Review has to be done according ISO14025 or the used PCR.

8. Health Footprint

The Health Footprint (HF) is focused on the product and production process. The KPIs are aimed at the hazardousness to health and environment of used substances, during the production and usage phase of a product.

The HF is based on existing chemical substance regulation and additional restricted substances lists per sector. In de HF the existence hazardous substances are counted. Exposure routes are no part of this certification. The existence of hazardous substances above threshold in a component of a product will hold the certification.

The Health footprint is based in de Bill of Material and contents of each component. This can be based on ingredient list, recipe or if ingredients are unknown a laboratorial test.

8.1 HF Certification

For HF the following items of certification apply

HF certification	**Class 1**	**Class 2**	**Class 3**
REACH compliant	•	•	•
Verified Bill of Material	•	•	•
List of all substances per component (> 1000 ppm)	75%	90%	100%
The list (of product) does not contain an item on the sector restricted substances list	•	•	•
Budgeted improvement strategy to extend analyses to 100% of product weight	•	•	
Re-certification every 3 years	•	•	•

8.2 Reach Compliancy

Most likely you are user of chemical substances (and not produce chemicals). With the REACH regulation, the client is a downstream user. As a downstream user the following steps needs to done:

5. Identifying critical substances for your business
6. Checking the registration status of the substances and looking for alternative suppliers, if necessary
7. Checking that your uses are covered in the registration, particularly if you use a substance in a novel way
8. If no supplier has registered the substance you really need, consider importing it directly

Also see: https://echa.europa.eu/regulations/reach/downstream-users/other-issues-affecting-downstream-users/registration-and-downstream-users

For auditor

- Check if these steps are taken and registered.

8.3 Verified Bill of Material and list of substances

For constructing a Bill of Materials see *paragraph 5.2 Verified Bill of Material*. After constructing the BoM a list of substances has to be made. The following steps has to be done:

4. Select the class of certification 1 to 3
5. Select the components that add up the mass to:
    a. 75% for class 1 certification
    b. 90% for class 2 certification
    c. 100% for class 3 certification

   If the product has a low number of components i.e. two components and none is >75%, then they will add up to 100%. Only class 3 could be selected in that case.
6. Make a list of all substances >1000ppm per component. Ask the supplier for the Material Safety Datasheet for the information of all substances. If it is not possible to collect this data, a laboratorial test has to be made. The substances to analyze in the case of a laboratorial test is determined by the selected list in *paragraph 8.3 Verified Bill of Material and list of substances*

For auditor

- Check if the completeness of the substances list

8.4 Sector restricted substances lists

Every sector has its own focus on hazardousness substances. At this point GSES is evaluating dedicated lists for the different sectors. Until that is done, GSES is following the REACH regulation for substances of very high concern (SVHC).

The criteria are given in article 57 of the REACH Regulation. A substance may be proposed as an SVHC if it meets one or more of the following criteria:

- it is carcinogenic;
- it is mutagenic;
- it is toxic for reproduction;
- it is persistent, bioaccumulative and toxic[5] (PBT substances);
- it is very persistent and very bioaccumulative (vPvB substances);
- there is "scientific evidence of probable serious effects to human health or the environment which give rise to an equivalent level of concern"; such substances are identified on a case-by-case basis.

For the updated list of SVHC see : https://echa.europa.eu/candidate-list-table

HF certification is not possible, if a substance from this list is present > 1000pm in one or more components of a product.

For auditor

- Check list substances with the SVHC list from on the ECHA site.

8.5 Budgeted improvement strategy

This applies to class 1 and 2 HF certification.

The client must describe the steps that are taken to increase the components that are analyzed form 75% and up for class 1 and 90% and up for class 2 certification.

This is an optimization rule that the GSES System applies and that also fits in with the approach of the five CE transition agendas in the Netherlands, in order to continuously increase and maximize the contributions to the circular economy.

The auditor has to verify the following in relation to improvement strategy.

- Assess the completeness of strategy and budget for it
- At re-certification: performance of improvement

9. Sustainable Footprint Standard - Meta Standard (Data)

The GSE Standards recognize and align other standards, frameworks and certificates that are already out there. That is why we created the Meta Standard also on product level.

Upload the certificates including data that you already have or have achieved from your product and get your aspirant rating within 5 working days in a digital rating card including QR code.

Circular Footprint:

- LCA
- PEF
- C2C certificates
- MPS
- FSC
- GOTS
- Global Recycled Standard
- Recycled Claim Standard 100
- Recycled Claim Standard Blended
- Responsible Wool Standard
- PEFC

Environmental Footprint:

- LCA
- PEF
- C2C certificates
- MPS
- BlueSign
- Energy Star
- Green Seal

Health Footprint:

- Global GAP
- Planet Proof
- C2C Health certificates
- MPS
- FSC
- PEFC
- GOTS
- Oeko-tex
- Organic Content Standard 100
- Recycled Claim Standard 100
- Recycled Claim Standard Blended

APPENDIX A: principles of the CF

Two methods were at the heart of the development of the CF method:

1. Circular Indicators, An Approach to Measuring Circularity by the Ellen MacArthur Foundation[2](EMF);
2. Cradle to Cradle (C2C) product certification scheme[3].

The CF is adhering to these globally accepted methods as much as possible and will continue to do so.

The CF calculation method has four principles, these are:

1. The end product or project is the key starting point
2. Circular value is only determined for material flows
3. Within the GSES System methodology, economic values (circular business models) are not considered at a product or project level, but at an organizational level. This fits within the Circular Economy pillar of the GSES System House of Sustainability. The circular business model is indicated on the Recycle Passport of the product or project.
4. Processing in the first cycle may not obstruct the circularity of the second cycle.
5. The principles are explained in greater detail in this chapter.

Principle 1: End product is the key starting point

The CF calculation method focuses on end products. The CF index is calculated on the basis of the product or project. The reason for this is that designers are the ones who make choices that affect circularity. Designers and procurers of a manufacturer decide whether or not to use recycled materials, whether or not to make a product dismountable, or whether to choose materials that are not harmful, so that they can be safely used in new products after being used in a product. In other words, their choices determine the CF index score.

[2] Ellen MacArthur Foundation (2015), An Approach to Measuring Circularity

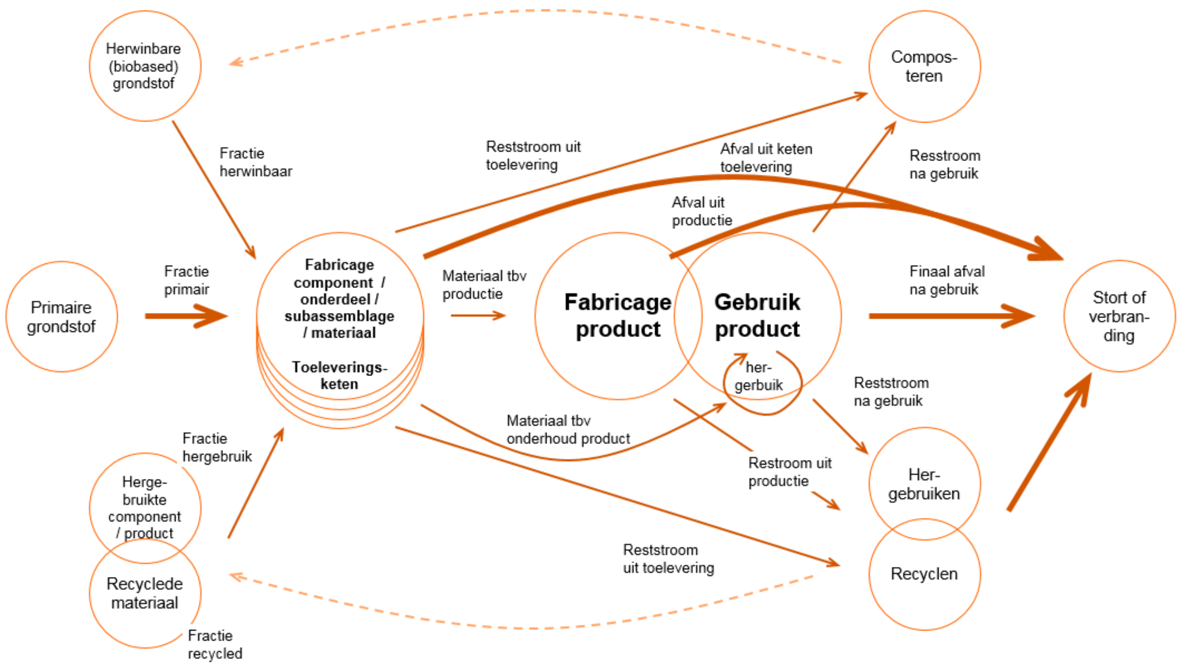
[3] Cradle to Cradle Products Innovation Institute (2016), Cradle to Cradle Certified[tm] product standard version 3.1

A complete CF index can only be determined for a product

As stated in the definitions, for a product to be considered a product, there must be a usage and end-of-life phase. Each product has an input side of component(s) and material(s), and a processing side with reuse, recycling and/or waste scenarios. It may be necessary to add material during use.

For example, a window frame must be painted several times during its lifetime. In the CF calculation method, this means that for materials and components (not products) only circular values can be calculated for the input side. The CF index contains two sides: a supply side and a processing side. The supply side is part of the supply chains, the processing side is part of the waste processing, recycling and re-usage chains.

The scope of the CF calculation method is shown in the following figure:



The thicker lines represent the fractions of raw materials (in components and materials) of primary origin and the flows that go to the ultimate waste processing (dumping and incineration). The thinner lines represent streams consisting entirely or partly of secondary raw materials that are still in the chain for potential recycling or reuse.

The dotted lines represent streams for recycling, reuse and composting.

Principle 2: Circular value only determined for material flows

In the CF calculation method, the focus is on minimizing the use of primary raw materials and minimizing the eventual disposal (incineration and dumping) of materials. For both, the ultimate goal is to be zero. In doing so, the focus is entirely on mass.

The CF calculation method does not take environmental impacts into account
The environmental effects in the chain, such as water stewardship, renewable energy, greenhouse gas emissions, the CO2 footprint, etc. are included in the Environmental Footprint, which is part of the Sustainable Footprint. The Circular Footprint focuses only on the mass of the (re)used materials (raw materials), bio-based materials and the scarcity of metals.

High-grade or low-grade recycling?
Because GSES System applies a generic and holistic approach to sustainability, there is no high or low-grade recycling, only simply recycling. What is waste for one sector and has already passed through all R phases, is still of use to another sector. That is the integral and ambitious closed loop of cycles in short and long chains, in the short and long term.

Recently, there have been developments in determining whether a certain processing technique (recycling) is of high or low quality. In these (high-grade) calculations, the environmental effects are taken into account; that calculation consists of an mLCA (the "m" stands for multi cycle). This involves calculating the environmental impact of a recycling technique and which primary material is avoided. There are a number of reasons for not including environmental impacts and the associated mLCA method:

mLCA does not take into account that secondary material can also be avoided. However, this does happen in the circular economy;

1. In the case of mLCA, a **system expansion**[4] takes place, which is usually arbitrary or difficult to determine. *Take for example plastics in marker posts along the road or outdoor furniture, which are difficult to process. Which primary raw material is avoided? Hardwood? Primary plastic? Concrete? Steel? In what proportions? In which quantity: mass or volume? The author's experience is that it is almost impossible to determine all that.*
2. Technical solutions are available for the energy challenge (environmental impact that is part of mLCA). There is still much to be done to achieve the energy and climate targets, but this involves implementing solutions. Things are different with regard to materials or mass; the

[4] **System expansion** means that in calculating the environmental impact of product A, the environmental impact of another product B is taken into account. For example: steel is produced in blast furnaces and this results in blast furnace slag cement as a by-product. This means that less "ordinary" Portland cement can be produced. The calculation determines which environmental effects of the production of B (Portland cement) are avoided with the production of A (steel) with B (blast furnace slag cement) as a by-product. This association of two different production lines is called system expansion.

topic of circular chains is still highly innovative. A calculation method for materials alone, despite its connection to energy and environmental effects, is a great necessity;

3. The establishment of an mLCA does not meet the accessibility criterion of CF calculation.

Principle 3: Economic values are not considered

In the circular economy, systems are introduced where we talk about "usage" rather than "possession". These systems, which imply a change in ownership, have an impact on economic values and chains.

In this "economy of usage", manufacturers want to regain their materials because of their economic and ecological value. In the Circular Footprint, the economic value is included on an informative basis in the section Recycled Passport.

Within the GSES System, the circular business models are factually evaluated and validated by means of a document validation or an external audit of the GSES pillar Circular Economy at an Organization level.

Principle 4: Processing in first cycle may not obstruct circularity of second cycle

The CF index is calculated over two cycles. The reason this is done is to check that a processing technique does not obstruct a subsequent circular cycle.

Take for example, an item of clothing. Clothes that are collected after they have been used and then transported to another country for reuse, e.g. in Africa. At first, this seems to be a good solution for circularity. However, it is unknown what happens to the garment in question after being reused. If it is incinerated or dumped there, the final disposal takes place in the second cycle and thus means end-of-life. In that case, the second cycle is not circular, although a potential extra life cycle would have been possible. The same applies to processing in the automotive industry. Clothing is pulverized and used a soft or hard insulation material in cars, this seems a good example of circularity at first. However, when a scrap car is processed, the material is no longer recovered but incinerated. Currently, there are efforts to recover the materials and turn them into sheet piles, but this is not yet common practice. The second cycle is therefore not circular. This way, it is easily demonstrated whether a certain processing technique is high-grade.

Comparison of CF principles with Ellen Macarthur Foundation

The foundation for the CF index is derived from the circularity index of the Ellen MacArthur Foundation (EMF) and the Cradle to Cradle standard. The differences between the CF and EMF are:

- The distinction between product components in the supply chain and the product or project itself, makes it possible to determine the index in complex chains. The CF index can be determined for a (product) component. This index can be passed on in the chain, so that ultimately the total CF index for the product can be determined. In this way, the calculation of the CF index is scalable and it becomes possible to calculate a CF index for complex systems. This is not possible with the EMF and C2C standards;
- CF takes production waste and losses into account;
- Compared to EMF, CF takes recoverable and compostable material into account;
- The CF only mentions life span for informational purposes. EMF also uses lifespan in its calculations. The reason why lifespan is only included informatively in the Circular Footprint is that claims relating to lifespan are difficult to prove. It also very much depends on the user. In order to be able to maximize the lifespan of projects and products, a lifespan classification is issued on the Sustainable Footprint certificate. (See 5.6 Correction rules).

Comparison of CF principles with Cradle to Cradle (C2C)

The differences between the Circular Footprint and C2C are:

- The Cradle to Cradle standard covers 5 categories: Material Health, Material Reutilization, Renewable Energy, Water Stewardship and Social Fairness. The CF only addresses the Material Reutilization category of C2C. The Environmental Footprint covers Water Stewardship and Renewable Energy. The Health Footprint measures Material Health, among other things. In the GSES System, Social Fairness is embedded in the CSR pillar at an organizational level.
- C2C values the performance at the end of the cycle "W" twice; CF and EMF once;
- In C2C, certain forms of biodegradation are permitted.

APPENDIX B calculation CF index

In this chapter explains the underlaying CF formula's. These formulas are used in the Excel model that is provided on the GSES website.

Elements in the calculations of the CF index

This section describes the formulas for calculating the CF index. The formulas are explained with simple examples. In this section some elements of the standard formula are explained.

M Mass percentages, this is used for determining weighted contributions
V Virgin, mass percentage of primary raw materials in material, component or product
F Fraction, the fraction of secondary materials in material, component or product
W Waste, mass of material that is ultimately discarded (incinerated or dumped)
C Circular, the fraction that will be recycled, reused or composted

x Component, used to indicate whether it is a material or component
d Disassembly, part of a product that is processed after use
i Identifier, used as a counter for material and components

n Renewable, is used to indicate that the material is renewable
r Recycled, is used to indicate that the material is recycled
u Reused, is used to indicate that the material is reused

CF Circular Footprint index of a product, calculated indicator from 0% to 100%, where 100% is fully circular and 0% is not circular. The CF index is calculated composed with CF_{in} and CF_{out}

CFx Circular Footprint index for non-products, such as elements such as materials, parts, components, chemical substances as described in section 0.

CF_{in} Circular Footprint index of the input-side of all components for a product. The CF_{in} can be calculated with CFx that are supplied by the suppliers and/or additional components calculations.

CF_{out} Circular Footprint index of the output-side of all disassembly's of a product. The CF_{out} must be calculated for a product. It ranges from CF_{out} 0% (not circular, all materials are wasted to landfill or incineration) to CF_{out} 100% (completely circular, all materials are re-sed, re-cyled or composted).

Procedure for calculating CF_x index for a material or component

Firstly, the CFx index for the supply chain is determined, i.e. for each component and material used in a product. This index can be calculated by the manufacturer, but it is preferable for the supplier to provide the information. Each step must take into account the contribution of production waste and losses, and their processing.

The procedure for calculating the CFx index is as follows:

1. For each component and/or material, the primary proportion (Vi) is determined;
2. The total V of the whole product component or material (x) is determined by a mass weighted addition;
3. For each component and/or material, the final disposal (Wi) is determined regarding production waste;
4. The total W of the whole product component or material (x) is determined by a mass weighted addition;
5. These data can be used to determine the CF for the particular component or material;

Determination of primary share of V

With:

Mx	=	Mass percentage of a component or material
Vx	=	Mass percentage of primary raw materials of a component / material
Fr	=	Fraction of recycled sources
Fu	=	Fraction of reused sources
Fn	=	Fraction of renewable sources

For each component or material (i), the primary share of raw materials is calculated:

$$Vi = Mx(i) * (1-Fr(i) - Fu(i) - Fn(i)) \qquad (f1)$$

For the total product, the primary raw material score is then:

$$Vx = \sum_i V(i) \qquad (f2)$$

If *Vx* = 0, then the component or material consists for 100% of reused, recycled or renewable material(s).
If *Vx* = 1, then the component or material the product consists for 100% of primary material(s).

Example:

Two types of yarns are used for a textile material. One yarn (1) of 60% cotton and 40% polyester, the second yarn (2) of 50% polyester and 50% recycled PET. The first yarn is twice as heavy (67% to 33%). There are two materials that are used, so i = 2

Yarn 1 V_1 = 67% * (1 - 0% - 0% - 60%) = 26,8%

Yarn 2 V_2 = 33% * (1 - 50% - 0% - 0%) = 16,5%

Textile $V_X = V_1 + V_2$ = 26,8% + 16,5% = 43,3%

Without production waste, the CFx is:

$$\boldsymbol{CFx}(\boldsymbol{textile}) = \mathbf{1} - \frac{\mathbf{43,3\%}}{\mathbf{1}} = \mathbf{56,7\%}$$

Calculation of the share of end-of-life disposal of production waste Wx

For production waste, the waste percentage for each material is used to calculate the mass percentage of final disposal (Wx).

With:

Mw = Percentage production waste

Wx = Production waste that is eventually discarded
Cr = Circular fraction of recycled sources
Cu = Circular fraction of reused sources
Cn = Circular fraction of renewable sources

*W = Mw(i) * Mi * (1 – Cr(i) – Cu(i) – Cn(i))* *(f3)*

$Wx = \sum_i W(i)$ *(f4)*

Example:

If during the production of "yarn 1", 10% of the waste is generated for producing the textile, of which 80% will be incinerated and 20% will be recycled.

*Wx = 10% * 67% *(1 – 20% - 0% -0%) = 5,4%*

NB. If waste of the product (textile) occurs, e.g. because of trim margins, then production waste must be related and distributed to the material / components from it was made of.

Determination of CFx index for a component or material (x)

Now we know the values of Vx and Wx, we can determine the CFx.

$Mw = \sum_i Mw(i) * M(i)$ *(f5)*

$CFx = 1 - \frac{Vx+Wx}{1+Mw}$ (f6)

For component (x) in the textile example, the CFx calculation would be:

$$CFx(textile) = 1 - \frac{43{,}3\% + 5{,}4\%}{1 + 10\% * 67\%} = 54{,}4\%$$

Because the production waste of "yarn 1" is 10%, of which only 20% is recycled, the CFx index decreases from 56.7% to 54.4%.

Calculation CFx for complex composite components and materials

The previous section defined the formula for a relatively simple component (textile) with two types of yarn. Components or materials can be considerably more complex. It is also possible that the supplier has determined his CFx already. Existing CFs can be incorporated in this case. The idea is that suppliers should each determine their own CFx, so that the manufacturer of a component or an end product can make use of the CFx calculations in the upward stream of the chain.

The formula for combining existing CF calculations is as follows:

$$CFx = \sum_i Mx(i) * CFx(i) \qquad (f6)$$

Where i stands for each component or material that is part of the component or material for which the CFx is calculated.

Calculation CF_{in} for production of product

The next step is the production phase of a product. The calculation of CF_{in} for this is similar to that of a composite component, as described in section 0. Then production waste and processing are incorporated, as described in section 0.

Determining CF_{in} index for a product

First, the CFx's are determined, in which all the components and materials of a product are aggregated.

$$CFin = \sum_i Mx(i) * CFx(i) \qquad (f6)$$

Example: A zipper made of steel is added for the production of a pair of jeans. 60% of the steel is of secondary origin. We assume that there is no production waste for the zippers, and suppose that the zipper has a 5% share in the weight of a pair of jeans.

$$CFx(zipper) = 1 - \frac{40\% + 0\%}{1 + 0\%} = 60\%$$

$CFin_{(jeans)}$ = 95% * 54,4% + 5% * 60% = 54,7%

The addition of a 60% recycled zipper increases the CF_{in} from 54.4% to 54.7%.

Calculation of production waste contribution

For production waste, the waste percentage for each material is used to calculate the mass percentage of end-of-life disposal (Wx). This is similar to section 0.

$W = Mw(i) * Mi * (1 – Cr(i) – Cu(i) – Cn(i))$ *(f3)*

$Wx = \sum_i W(i)$ *(f4)*

Example:

The production of a pair of jeans leads to a 20% production waste of textile material (e.g. trim margins), of which 80% will be recycled.

*Wx = 20% * 95% * (1 – 80% - 0% -0%) = 3,8%*

To obtain a total CF_{in} (for the production input of jeans) in which the production waste is added to the calculated total CF_{in}

$Mw = \sum_d Mw(i) * M(i)$ *(f5)*

$CFin = 1 - \frac{1 - CPFx + Wx}{1 + Mw}$ *(f7)*

In the jeans example, this would result in:

$$CFin = 1 - \frac{1 - 47{,}6\% + 3{,}8\%}{1 + 20\% * 95\%} = 52{,}8\%$$

The index decreases due to the addition of the production loss of 20%, but of which 80% is recycled, so the CF_{in} index increases from 48.6% to 52.8%.

Calculation CF_{out} for usage and end-of-life of product

The calculation for the usage and end-of-life phase is similar to the foregoing calculations. However, there is no production waste. The total of mass to be processed is per definition 1. The entire product is processed in residual flows (recycling, component recycling, composting or final disposal).

NB Material used for maintenance is currently not covered. This will be added later, similar to the above method.

In contrast to the production phases (of product, components and material), processing is calculated per disassembly (d).

With:

CPout = *Circular index output side*
Md = Mass percentage per disassembly

Wd	=	Final waste fraction per component (d)
Cr	=	Circular fraction of recycled sources
Cu	=	Circular fraction of reused sources
Cn	=	Circular fraction of renewable sources

$$Wd = M(d) * (1 - Cr(d) - Cu(d) - Cn(d)) \quad (f8)$$

$$CPout = \sum_d W(d) \quad (f9)$$

$$CF = 1 - \frac{1 - CFin + CPout}{2} \quad (f10)$$

A jeans example. Suppose the denim is pulverized and 90% of it is suitable for re-spinning yarn. And suppose that the zipper is lost during the pulverization process and the small metal parts are no longer usable. The residual stream is incinerated and the metals are too small for recycling. That would result in:

W_{denim} = 95% * (1 – 0 – 90% - 0%) = 9,5%

W_{zipper} = 5% * (1 – 0 – 0 – 0) = 5%

CP_{out} = 9,5% + 5% = 14,5%

$$CF = 1 - \frac{1 - 52{,}8\% + 14{,}5\%}{2} = 69\%$$