# Carbon Footprint Study for FITT S.p.A. Products

*Products with "knitted" technology*

Spinlife s.r.l.
Tel: + 39 049 8271613
info@spinlife.it – spinlifesrl@pec.it

# Index

# 1. General Information

## 1.1. Company information

FITT S.p.A. (hereinafter referred to as FITT) is an international leader and a company specialising in the creation of complete fluid transfer systems made of thermoplastic materials, both for the construction sector - civil engineering and infrastructure - as well as for the home, garden and hobby markets.

Founded in 1969, for 50 years FITT has been developing technologically advanced solutions that offer stability, safety, extremely high performance levels and ease of use. From its headquarters in Sandrigo (Vicenza), FITT exports to 100 countries, having a total staff of more than 1,100 employees; the FITT group consists of 18 companies, including 9 production plants in Italy and 3 abroad, logistics centres and sales subsidiaries. In 2023, FITT generated a turnover of €298 million.

Starting in 2019, FITT has embarked on a journey to assess the environmental performance of its products through life cycle analysis (LCA), obtaining in early 2020 the EPD for FITT Bluforce and FITT Bluforce RJ products, in early 2021 the EPD for FITT Sewer and FITT Sewer EVO products, in 2023 the EPD for the FITT Batipro and FITT Interpact M1 products and conducting LCA studies for public dissemination for some gardening products (belonging to the FITT Force, FITT Ikon, FITT NTS and FITT Force Pro families).
Since the end of 2023, FITT has also obtained ISO 14067 certification for calculating the Carbon Footprint of its products using a Systematic Approach.
Finally, in 2024 FITT obtained ISO 14064 certification for the organisation's GHG inventory.


Figure 1 FITT headquarters in Sandrigo

## 1.2. Product information

The products covered by this report are all knitted hoses. This technology involves a reinforcement between the layers of the hose such that a wire mesh is generated.
The product codes under study (Table 1) belong to the DAISY (PVC knitted hose), FLORA (PVC knitted hose) and IKON (TPV knitted hose) families.

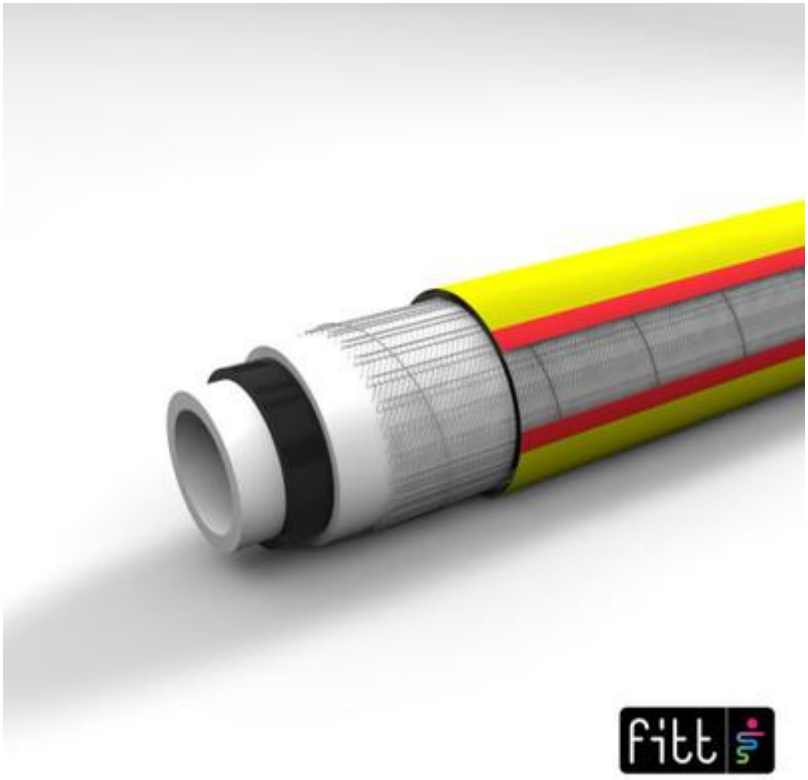


Figure 2 Section of a FITT FLORA knitted hose

All the product codes in these families object of this report are listed below.

Table 1 List of the product codes of the families under study

| Product code | Description | Plant |
|---|---|---|
| 75063.16625.59000 | FITT DAISY 1/2" 25m* | Sandrigo |
| 75063.16630.59000 | FITT DAISY 1/2" 30m* | Sandrigo |
| 75063.16650.59000 | FITT DAISY 1/2" 50m* | Sandrigo |
| 75063.30625.59000 | FITT DAISY 3/4" 25m* | Sandrigo |
| 75063.30650.59000 | FITT DAISY 3/4" 50m* | Sandrigo |
| 75063.42925.59052 | FITT DAISY 1" 25m* | Sandrigo |
| 75063.42950.59052 | FITT DAISY 1" 50m* | Sandrigo |
| 77042.16615.59035 | FITT FLORA 1/2" 15m KIT IT* | Sandrigo, Monsampolo |
| 77042.16615.59037 | FITT FLORA 1/2" 15m IT* | Sandrigo, Monsampolo |
| 77042.16625.59037 | FITT FLORA 1/2" 25m IT* | Sandrigo, Monsampolo |
| 77042.20615.59035 | FITT FLORA 5/8" 15m KIT IT* | Sandrigo, Monsampolo |
| 77042.20625.59037 | FITT FLORA 5/8" 25m IT* | Sandrigo, Monsampolo |
| 77042.42925.59037 | FITT FLORA 1" 25m IT* | Sandrigo |

| Product code | Description | Plant |
|---|---|---|
| 77042.42950.59037 | FITT FLORA 1" 50m IT* | Sandrigo |
| 74006.02910.59031 | FITT IKON LIME 10m GUN 1/4 plt | Sandrigo |
| 74006.02910.59048 | FITT IKON LIME 10m GUN BOX | Sandrigo |
| 74006.02915.59026 | FITT IKON LIME 15m GUN 1/4 plt | Sandrigo |
| 74006.02915.59046 | FITT IKON LIME 15m GUN BOX | Sandrigo |
| 74006.02920.59031 | FITT IKON LIME 20m GUN 1/4 plt | Sandrigo |
| 74006.02920.59048 | FITT IKON LIME 20m GUN BOX | Sandrigo |
| 74006.02925.59031 | FITT IKON LIME 25m GUN 1/4 plt | Sandrigo |
| 74006.02925.59048 | FITT IKON LIME 25m GUN BOX | Sandrigo |
| 74007.02910.59031 | FITT IKON BLUE 10m GUN 1/4 plt | Sandrigo |
| 74007.02910.59048 | FITT IKON BLUE 10m GUN BOX | Sandrigo |
| 74007.02915.59026 | FITT IKON BLUE 15m GUN 1/4 plt | Sandrigo |
| 74007.02915.59044 | FITT IKON BLUE 15m GUN BOX | Sandrigo |
| 74007.02920.59031 | FITT IKON BLUE 20m GUN 1/4 plt | Sandrigo |
| 74007.02925.59031 | FITT IKON BLUE 25m GUN 1/4 plt | Sandrigo |
| 74007.02925.59048 | FITT IKON BLUE 25m GUN BOX | Sandrigo |
| 74008.02910.59031 | FITT IKON AQUAMARINE 10m GUN 1/4 plt | Sandrigo |
| 74008.02910.59048 | FITT IKON AQUAMARINE 10m GUN BOX | Sandrigo |
| 74008.02915.59026 | FITT IKON AQUAMARINE 15m GUN 1/4 plt | Sandrigo |
| 74008.02915.59044 | FITT IKON AQUAMARINE 15m GUN BOX | Sandrigo |
| 74008.02920.59031 | FITT IKON AQUAMARINE 20m GUN 1/4 plt | Sandrigo |
| 74008.02920.59048 | FITT IKON AQUAMARINE 20m GUN BOX | Sandrigo |
| 74008.02925.59031 | FITT IKON AQUAMARINE 25m GUN 1/4 plt | Sandrigo |
| 74008.02925.59048 | FITT IKON AQUAMARINE 25m GUN BOX | Sandrigo |
| 74009.02910.59031 | FITT IKON LAVANDA 10m GUN 1/4 plt | Sandrigo |
| 74009.02910.59048 | FITT IKON LAVANDA 10m GUN BOX | Sandrigo |
| 74009.02915.59026 | FITT IKON LAVANDA 15m GUN 1/4 plt | Sandrigo |
| 74009.02915.59044 | FITT IKON LAVANDA 15m GUN BOX | Sandrigo |
| 74009.02920.59031 | FITT IKON LAVANDA 20m GUN 1/4 plt | Sandrigo |
| 74009.02920.59048 | FITT IKON LAVANDA 20m GUN BOX | Sandrigo |
| 74009.02925.59031 | FITT IKON LAVANDA 25m GUN 1/4 plt | Sandrigo |
| 77042.16650.59037 | FITT FLORA 1/2" 50m IT* | Monsampolo |
| 77042.20615.59037 | FITT FLORA 5/8" 15m IT* | Monsampolo |
| 77042.20650.59037 | FITT FLORA 5/8" 50m IT* | Monsampolo |
| 77042.30625.59037 | FITT FLORA 3/4" 25m IT* | Monsampolo |
| 77042.30650.59037 | FITT FLORA 3/4" 50m IT* | Monsampolo |

## 1.3. Product Category Rules (PCR)

For the purpose of conducting this study, no reference is made to any PCR or sector studies, as these are not available for the type of product analysed.

## 1.4. Study information

The following standards were applied when conducting this study:

- ISO 14040:2006+A1:2020 Environmental management – Life cycle assessment – Principles and framework;

- ISO 14044:2006+A2:2020 Environmental management – Life cycle assessment – Requirements and guidelines;
- ISO 14067:2018 Environmental management – Carbon footprint – Principles, requirements and guidelines

# 2. Objectives of the study

The objective of this study is to assess the potential environmental impacts related to greenhouse gas emissions (Carbon Footprint), as described by UNI EN ISO 14067:2018, associated with the life cycle of the hoses under study.

This analysis, based on the integration of internationally recognised models for the management of environmental aspects, the analysis and quantification of the environmental impacts of a production system and the systematic approach of data collection and calculation model construction (ISO 14040, ISO 14044 and ISO 14067), are aimed at quantifying potential environmental impacts in terms of Carbon Footprint.

The study was developed by applying the company's CFP Systematic Approach, verifying that the products under study fall within its scope. The contents of this study may be the subject of Business to Business (B2B) or Business to Consumer (B2C) communication, in accordance with ISO 14026.

The results presented in this report refer uniquely to the practices and assumptions made by FITT. They were therefore not calculated to be compared with those of other companies, as even for similar products, any differences in methodological choices, assumptions, data quality and choice of databases may produce non-comparable results.

# 3. Purpose of the study

## 3.1. Declared unit

In this study, in line with the requirements of ISO 14067, the entire life cycle of products will be considered, except for some intermediate stages. For this reason, a *declared unit* is used. The stated unit is equal to 1m of a piping system, including sales packaging and any accessories.
The reference flow is equal to the entire sales unit divided by the length of the hose under study (§1.2).

## 3.2. System boundaries

The system boundaries include the entire life cycle of the analysed products, following a *"from cradle to grave"* approach. It is emphasised that the construction, maintenance and decommissioning of infrastructures, understood as buildings and machinery, as well as the occupation of industrial land, have not been taken into account, as their contribution to the environmental impact relative to the functional unit is considered negligible. A diagram of the system boundaries can be found at Figure 3.

The product is manufactured at the Italian factories of FITT S.p.A. (see Table 1 for details on the plants involved and the processes conducted in them).

The following life cycle phases are included in this study:

- **Upstream.** In this module, it was considered:
  - Extraction and production of PVC resin and all other components that are part of the compound for the in-house production of PVC granules;
  - Extraction and production of TPV and TPS thermoplastic elastomers;
  - Extraction and production of the materials that make up the PET yarn used for in-house knitting;
  - Extraction and production of the materials that make up the fittings and nozzle in the KIT;
  - Extraction and production of the materials that make up the finished product packaging;
  - Production of electricity and other fuels used in the upstream phase;
  - Transport of raw materials from the extraction site to FITT's facilities;
- **Core.** In this module, it was considered:
  - Impacts due to the production of electricity and fuels used in FITT's manufacturing processes;
  - Management of waste generated by the production process part of an internal re-granulation cycle;
  - Atmospheric emissions generated by the production process
  - Management of plant waste.
- **Downstream.** In this module, it was considered:
  - Distribution of finished products from the production plant to the end customer;
  - End-of-life management of products.

The interpretation of the results has allowed to identify those processes related to upstream raw material production and end-of-life management as the most important (accounting for more than 80% of the total impacts).

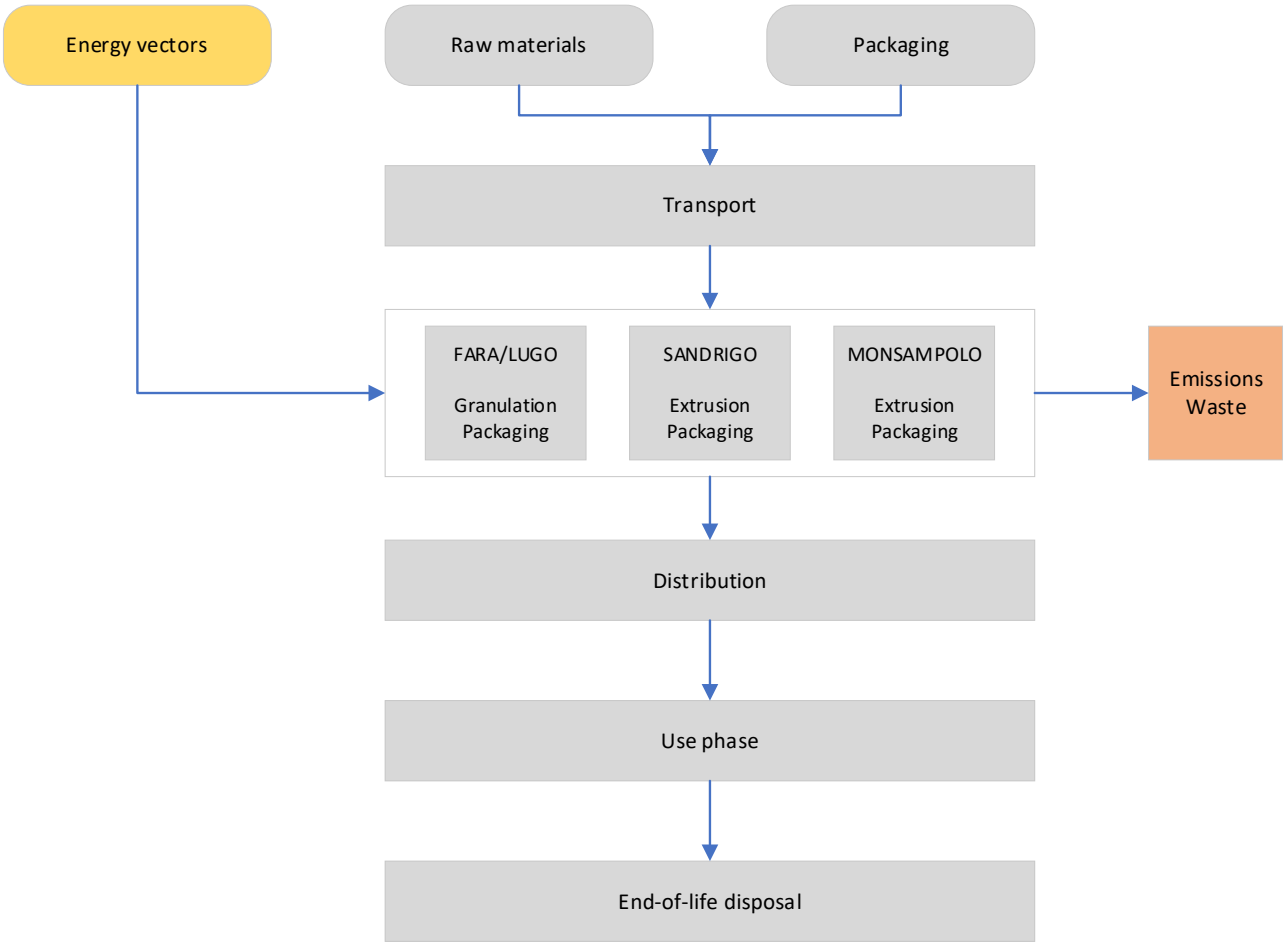


Figure 3 Diagram of the production process of the product under study

## 3.3. Impact category

The methodology chosen to assess the potential environmental impacts of the products in this study is the IPCC method adapted as required by the ISO 14067. Specifically, the IPCC 2021 - GWP100a method is used, in its latest available version.

The impact categories in this method are as follows:

- CF Total: represents the sum of all GHG fluxes below;
- CF Fossil: represents greenhouse gas emissions from fossilised material (e.g. natural gas, diesel, etc.);
- CF Biogenic: represents greenhouse gas emissions from biomass (e.g. combustion or aerobic/anaerobic degradation of biomass, enteric emissions, etc.);
- CF dLUC: represents greenhouse gas emissions associated with the use and transformation of land use by anthropogenic activities;
- CF Aircraft: represents greenhouse gas emissions associated with aviation activities;
- CF Uptake: represents the removals of greenhouse gases of biogenic origin from the atmosphere and incorporated into the raw material.

The CF category iLUC, whose quantification is not mandatory according to ISO 14067, is excluded from the study.

## 3.4. Assumptions and Limitations

In conducting this study, primary data were used wherever possible. Where access to this type of data was not possible, secondary data from the Ecoinvent v3.10 database (Frischknecht R., 2005) and/or highly relevant published articles were used.

In conducting this study, no specific assumptions were made.

## 3.5. Exclusion Criteria

The criterion chosen for the initial inclusion of input and output elements is based on the definition of a 1% cut-off level, both in terms of mass, energy and environmental impact. This means that a process has been neglected if it is potentially responsible for less than 1% of the total mass, primary energy and total impact. Consequently, this threshold value was used to avoid collecting unknown data, but not to disregard data that was nevertheless available. This choice is confirmed by similar LCA studies reported in the literature (Humbert et al., 2009).

The following aspects have been excluded from this study:

- Packaging in which raw materials are transported from the extraction site to the FITT's plants (as demonstrated in previous studies conducted by the company for similar products);
- Manufacture of production equipment, buildings and other capital goods (if not already included in secondary data);
- The energy consumption related to the logistics management of the San Pietro in Gù plant, as motivated by a sensitivity analysis conducted on the "braided" technology.

## 3.6. Allocation process

The need to allocate the flows in and out of a product system between the system itself and other external systems can arise in two cases (Marson et. al., 2023):

- In the case of simultaneous products and in the case of co-products (co-product allocation). This type of allocation was applied to distribute the consumptions of energy and from other flows (general consumption) among the entire production of the various plants. For this allocation, in accordance with the hierarchy proposed by the standard, a physical principle (mass) was adopted. This assumption was analysed by considering the deviation from previous studies, with more precise monitoring of energy consumption. It is considered that the level of uncertainty introduced in this way is acceptable with respect to the objectives of the study. It is also emphasised that company initiatives are currently being planned to improve the quality of this data;
- In the case of subsequent products, i.e. in the case of materials entering a recycling process (end-of-life allocation/allocation procedure of reuse, recycling, recovery). The so-called cut-off end-of-life allocation approach was used for this case study, as it is widely used in LCA studies in the plastics sector.

## 3.7. Data quality requirements

The data required for the study were collected in accordance with the following requirements:

- Time coverage: primary data cover a 12-month period (January 2023 - December 2023);
- Where general data and databases were used, representative versions of the situation in 2023 or, in any case, no older than 10 years were used;
- Geographical coverage: the geographical area of origin of the data relates to the Italian, European or global situation based on the place of origin of the raw materials;
- Technology coverage: the data collected refer to the state of the art of the technologies used for the production of materials;
- Accuracy: the data collected refer to actual consumption and measurements for the period in question;
- Completeness: it can be considered that the measured or estimated mass flow percentage is about 98% of the total;
- Representativeness: the degree to which the data set reflects the actual population concerned is high, since the data are collected directly at the sites of interest. The data collected at the plant relate to production consumption, the product bill of materials, and information on the transport of both raw materials and for finished product distribution;
- Consistency: the methodology of the study is uniformly applied to the different components of the analysis;
- Reproducibility: the data was collected through the use of data collection sheets, which contain all the necessary information that allows even a third party to reproduce the results in the study report;
- Source of data: as previously explained, the data were derived from primary sources (where primary data could not be found, secondary data from internationally recognised databases were used);
- Uncertainty of information: uncertainty concerning data and assumptions was tested by means of an uncertainty analysis.

Where the data used refer to estimates, from specific sites or averages, this is highlighted in the description phase of the inventory analysis.

## 3.8. Critical Review Considerations

Since it is envisaged that the results of the study may be used to support an assertion intended for B2B communication, it is necessary to conduct a critical review as defined by ISO 14067. The objective of the critical review is to verify that the Carbon Footprint study meets the requirements for methodology, data, interpretation and reporting and that it is consistent with the principles and requirements of the ISO 14067 Standards, with a reasonable level of assurance.

# 4. Inventory analysis

The inventory analysis phase includes data collection and processing in order to quantify the input and output elements of the product system under consideration.

## 4.1. BOM

[information withheld for reasons of confidentiality]

## 4.2. Procurement of raw materials

[information withheld for reasons of confidentiality]

## 4.3. Energy carriers and plant consumption

[information withheld for reasons of confidentiality]

## 4.4. Distribution

[information withheld for reasons of confidentiality]

## 4.5. End-of-life scenario

[information withheld for reasons of confidentiality]

## 4.6. Data quality assessment

The quality level of the study data was calculated by adopting the weighted average of three quality parameters:

- Ter - Technological representativeness: the degree to which the data relate to the technology that is actually used in the process under consideration;
- Gr - Geographical representativeness: the degree to which the data relate to the actual geographical location where the processes take place;
- Tir - Temporal representativeness: the degree to which the data refer to as current a time span as possible.

The calculation was applied to all products in the study, considering the average of contributions in the CF Total category. Once the most relevant processes were identified, they were re-proportioned on a 100% basis to obtain the actual weights to be applied to the score (on a scale of 1 to 5) attributed to each of the three parameters.

The scores from 1 to 5 correspond to the quality levels identified in EN 15804 Annex E (Table E.2), in this order: Very Poor, Poor, Fair, Good and Very Good.

The following table shows the weights obtained and the score given to the qualitative parameters in order to be able to proceed with the semi-quantitative evaluation of the quality level of the study.

Table 2 Data quality assessment for the product under study

| Contribution | Ter | Gr | Tir | Medium | Contribution in CF-Total | DQR |
|---|---|---|---|---|---|---|
| Raw materials | 4 | 4 | 4 | 4,00 | 54,4% | 2,18 |
| Packaging | 4 | 4 | 4 | 4,00 | 4,7% | 0,19 |
| Transport in | 4 | 4 | 4 | 4,00 | 2,0% | 0,08 |
| Production | 5 | 5 | 5 | 5,00 | 26,1% | 1,30 |
| Distribution | 4 | 4 | 4 | 4,00 | 3,0% | 0,12 |
| End of life | 4 | 3 | 4 | 3,67 | 9,9% | 0,36 |
| Total | | | | | | 4,23 |

The final DQR (Data Quality Rating) obtained by combining weights and scores is 4.23, corresponding to a quality level of “very good”.

# 5. Analysis of impacts

Table 3 Results from the entire life cycle of the products under study

| Product | CF Total [kg CO2e] | CF Fossil [kg CO2e] | CF Biogenic [kg CO2e] | CF Aircraft [kg CO2e] | CF dLUC [kg CO2e] | CF Uptake [kg CO2e] |
|---|---|---|---|---|---|---|
| FITT DAISY 1/2" 25m* | 0,3194 | 0,3162 | 0,0303 | 0,0000 | 0,0023 | -0,0293 |
| FITT DAISY 1/2" 30m* | 0,3219 | 0,3181 | 0,0303 | 0,0000 | 0,0023 | -0,0287 |
| FITT DAISY 1/2" 50m* | 0,3226 | 0,3195 | 0,0281 | 0,0000 | 0,0023 | -0,0274 |
| FITT DAISY 3/4" 25m* | 0,5599 | 0,5544 | 0,0523 | 0,0000 | 0,0039 | -0,0508 |
| FITT DAISY 3/4" 50m* | 0,5653 | 0,5601 | 0,0523 | 0,0000 | 0,0039 | -0,0510 |
| FITT DAISY 1" 25m* | 0,9401 | 0,9312 | 0,0865 | 0,0000 | 0,0068 | -0,0845 |
| FITT DAISY 1" 50m* | 0,9335 | 0,9248 | 0,0762 | 0,0000 | 0,0068 | -0,0744 |
| FITT FLORA 1/2" 15m KIT IT* | 0,2727 | 0,2692 | 0,0276 | 0,0000 | 0,0028 | -0,0269 |
| FITT FLORA 1/2" 15m IT* | 0,4522 | 0,4455 | 0,0565 | 0,0000 | 0,0060 | -0,0557 |
| FITT FLORA 1/2" 25m IT* | 0,4563 | 0,4495 | 0,0527 | 0,0000 | 0,0060 | -0,0520 |
| FITT FLORA 5/8" 15m KIT IT* | 0,6764 | 0,6678 | 0,0696 | 0,0000 | 0,0075 | -0,0685 |
| FITT FLORA 5/8" 25m IT* | 0,5525 | 0,5441 | 0,0662 | 0,0000 | 0,0074 | -0,0653 |
| FITT FLORA 1" 25m IT* | 1,2245 | 1,2064 | 0,1492 | 0,0000 | 0,0156 | -0,1467 |
| FITT FLORA 1" 50m IT* | 1,2095 | 1,1911 | 0,1490 | 0,0000 | 0,0156 | -0,1461 |
| FITT IKON LIME 10m GUN 1/4 plt | 0,5562 | 0,5397 | 0,0895 | 0,0000 | 0,0004 | -0,0734 |
| FITT IKON LIME 10m GUN BOX | 0,5201 | 0,5170 | 0,0735 | 0,0000 | 0,0004 | -0,0708 |
| FITT IKON LIME 15m GUN 1/4 plt | 0,4257 | 0,4241 | 0,0468 | 0,0000 | 0,0003 | -0,0455 |
| FITT IKON LIME 15m GUN BOX | 0,4215 | 0,4178 | 0,0361 | 0,0000 | 0,0003 | -0,0326 |
| FITT IKON LIME 20m GUN 1/4 plt | 0,3956 | 0,3883 | 0,0647 | 0,0000 | 0,0003 | -0,0576 |
| FITT IKON LIME 20m GUN BOX | 0,3805 | 0,3778 | 0,0575 | 0,0000 | 0,0003 | -0,0551 |
| FITT IKON LIME 25m GUN 1/4 plt | 0,3592 | 0,3578 | 0,0398 | 0,0000 | 0,0002 | -0,0387 |
| FITT IKON LIME 25m GUN BOX | 0,3444 | 0,3424 | 0,0311 | 0,0000 | 0,0002 | -0,0292 |
| FITT IKON BLUE 10m GUN 1/4 plt | 0,5233 | 0,5213 | 0,0750 | 0,0000 | 0,0004 | -0,0734 |
| FITT IKON BLUE 10m GUN BOX | 0,5261 | 0,5215 | 0,0750 | 0,0000 | 0,0004 | -0,0708 |
| FITT IKON BLUE 15m GUN 1/4 plt | 0,4259 | 0,4247 | 0,0441 | 0,0000 | 0,0003 | -0,0431 |
| FITT IKON BLUE 15m GUN BOX | 0,4206 | 0,4172 | 0,0358 | 0,0000 | 0,0003 | -0,0326 |

| Product | CF Total [kg CO2e] | CF Fossil [kg CO2e] | CF Biogenic [kg CO2e] | CF Aircraft [kg CO2e] | CF dLUC [kg CO2e] | CF Uptake [kg CO2e] |
|---|---|---|---|---|---|---|
| FITT IKON BLUE 20m GUN 1/4 plt | 0,3792 | 0,3778 | 0,0587 | 0,0000 | 0,0003 | -0,0576 |
| FITT IKON BLUE 25m GUN 1/4 plt | 0,3604 | 0,3597 | 0,0392 | 0,0000 | 0,0002 | -0,0387 |
| FITT IKON BLUE 25m GUN BOX | 0,3455 | 0,3431 | 0,0313 | 0,0000 | 0,0002 | -0,0292 |
| FITT IKON AQUAMARINE 10m GUN 1/4 plt | 0,5127 | 0,5123 | 0,0647 | 0,0000 | 0,0004 | -0,0648 |
| FITT IKON AQUAMARINE 10m GUN BOX | 0,5155 | 0,5125 | 0,0648 | 0,0000 | 0,0004 | -0,0622 |
| FITT IKON AQUAMARINE 15m GUN 1/4 plt | 0,4283 | 0,4270 | 0,0441 | 0,0000 | 0,0003 | -0,0431 |
| FITT IKON AQUAMARINE 15m GUN BOX | 0,4182 | 0,4160 | 0,0346 | 0,0000 | 0,0003 | -0,0326 |
| FITT IKON AQUAMARINE 20m GUN 1/4 plt | 0,3951 | 0,3938 | 0,0587 | 0,0000 | 0,0003 | -0,0576 |
| FITT IKON AQUAMARINE 20m GUN BOX | 0,3829 | 0,3805 | 0,0572 | 0,0000 | 0,0003 | -0,0551 |
| FITT IKON AQUAMARINE 25m GUN 1/4 plt | 0,3689 | 0,3679 | 0,0623 | 0,0000 | 0,0003 | -0,0617 |
| FITT IKON AQUAMARINE 25m GUN BOX | 0,3521 | 0,3497 | 0,0543 | 0,0000 | 0,0003 | -0,0522 |
| FITT IKON LAVANDA 10m GUN 1/4 plt | 0,5110 | 0,5107 | 0,0646 | 0,0000 | 0,0004 | -0,0648 |
| FITT IKON LAVANDA 10m GUN BOX | 0,5137 | 0,5109 | 0,0647 | 0,0000 | 0,0004 | -0,0622 |
| FITT IKON LAVANDA 15m GUN 1/4 plt | 0,4414 | 0,4398 | 0,0726 | 0,0000 | 0,0004 | -0,0714 |
| FITT IKON LAVANDA 15m GUN BOX | 0,4310 | 0,4266 | 0,0649 | 0,0000 | 0,0003 | -0,0609 |
| FITT IKON LAVANDA 20m GUN 1/4 plt | 0,3758 | 0,3755 | 0,0576 | 0,0000 | 0,0003 | -0,0576 |
| FITT IKON LAVANDA 20m GUN BOX | 0,3785 | 0,3757 | 0,0576 | 0,0000 | 0,0003 | -0,0551 |
| FITT IKON LAVANDA 25m GUN 1/4 plt | 0,2574 | 0,2567 | 0,0622 | 0,0000 | 0,0002 | -0,0617 |
| FITT FLORA 1/2" 50m IT* | 0,4488 | 0,4423 | 0,0436 | 0,0000 | 0,0059 | -0,0430 |
| FITT FLORA 5/8" 15m IT* | 0,5522 | 0,5440 | 0,0682 | 0,0000 | 0,0074 | -0,0674 |
| FITT FLORA 5/8" 50m IT* | 0,4940 | 0,4859 | 0,0585 | 0,0000 | 0,0074 | -0,0577 |
| FITT FLORA 3/4" 25m IT* | 0,6819 | 0,6708 | 0,0876 | 0,0000 | 0,0101 | -0,0866 |
| FITT FLORA 3/4" 50m IT* | 0,6791 | 0,6680 | 0,0836 | 0,0000 | 0,0101 | -0,0826 |

Table 4 Results broken down by life cycle stages of the products studied [kg CO2e - CF Total]

| Product | Raw materials | Packaging | Transport in | Production | Distribution | Use phase | End of life |
|---|---|---|---|---|---|---|---|
| FITT DAISY 1/2" 25m* | 0,1281 | -0,0110 | 0,0205 | 0,1218 | 0,0300 | 0,0000 | 0,0300 |
| FITT DAISY 1/2" 30m* | 0,1281 | -0,0106 | 0,0205 | 0,1238 | 0,0300 (*) | 0,0000 | 0,0300 (*) |
| FITT DAISY 1/2" 50m* | 0,1281 | -0,0098 | 0,0205 | 0,1238 | 0,0322 | 0,0000 | 0,0279 |
| FITT DAISY 3/4" 25m* | 0,2314 | -0,0197 | 0,0340 | 0,2233 | 0,0389 | 0,0000 | 0,0519 |
| FITT DAISY 3/4" 50m* | 0,2314 | -0,0172 | 0,0342 | 0,2233 | 0,0406 | 0,0000 | 0,0529 |
| FITT DAISY 1" 25m* | 0,3854 | -0,0285 | 0,0598 | 0,3553 | 0,0816 | 0,0000 | 0,0866 |
| FITT DAISY 1" 50m* | 0,3854 | -0,0222 | 0,0597 | 0,3553 | 0,0795 | 0,0000 | 0,0758 |
| FITT FLORA 1/2" 15m KIT IT* | 0,1672 | -0,0065 | 0,0114 | 0,0540 | 0,0153 | 0,0000 | 0,0311 |
| FITT FLORA 1/2" 15m IT* | 0,2547 | -0,0078 | 0,0230 | 0,1089 | 0,0225 | 0,0000 | 0,0559 |
| FITT FLORA 1/2" 25m IT* | 0,2545 | -0,0086 | 0,0228 | 0,1106 | 0,0234 | 0,0000 | 0,0522 |
| FITT FLORA 5/8" 15m KIT IT* | 0,4245 | -0,0115 | 0,0304 | 0,1359 | 0,0287 | 0,0000 | 0,0728 |
| FITT FLORA 5/8" 25m IT* | 0,3103 | -0,0121 | 0,0281 | 0,1358 | 0,0272 | 0,0000 | 0,0655 |
| FITT FLORA 1" 25m IT* | 0,6381 | -0,0373 | 0,0579 | 0,3350 | 0,0815 | 0,0000 | 0,1493 |
| FITT FLORA 1" 50m IT* | 0,6381 | -0,0389 | 0,0577 | 0,3350 | 0,0693 | 0,0000 | 0,1482 |
| FITT IKON LIME 10m GUN 1/4 plt | 0,3911 | -0,0525 | 0,0035 | 0,0739 | 0,0391 | 0,0000 | 0,1012 |
| FITT IKON LIME 10m GUN BOX | 0,3911 | -0,0499 | 0,0037 | 0,0739 | 0,0082 | 0,0000 | 0,0932 |
| FITT IKON LIME 15m GUN 1/4 plt | 0,3100 | -0,0357 | 0,0032 | 0,0739 | 0,0127 | 0,0000 | 0,0616 |
| FITT IKON LIME 15m GUN BOX | 0,3100 | -0,0247 | 0,0031 | 0,0739 | 0,0118 | 0,0000 | 0,0474 |
| FITT IKON LIME 20m GUN 1/4 plt | 0,2696 | -0,0426 | 0,0030 | 0,0740 | 0,0193 | 0,0000 | 0,0723 |
| FITT IKON LIME 20m GUN BOX | 0,2696 | -0,0400 | 0,0032 | 0,0740 | 0,0061 | 0,0000 | 0,0676 |
| FITT IKON LIME 25m GUN 1/4 plt | 0,2453 | -0,0295 | 0,0028 | 0,0740 | 0,0145 | 0,0000 | 0,0522 |
| FITT IKON LIME 25m GUN BOX | 0,2453 | -0,0221 | 0,0029 | 0,0740 | 0,0054 | 0,0000 | 0,0391 |
| FITT IKON BLUE 10m GUN 1/4 plt | 0,3911 | -0,0525 | 0,0035 | 0,0739 | 0,0197 (*) | 0,0000 | 0,0877 (*) |
| FITT IKON BLUE 10m GUN BOX | 0,3911 | -0,0499 | 0,0037 | 0,0739 | 0,0197 | 0,0000 | 0,0877 |
| FITT IKON BLUE 15m GUN 1/4 plt | 0,3100 | -0,0329 | 0,0030 | 0,0739 | 0,0145 | 0,0000 | 0,0574 |
| FITT IKON BLUE 15m GUN BOX | 0,3100 | -0,0247 | 0,0031 | 0,0739 | 0,0133 | 0,0000 | 0,0450 |
| FITT IKON BLUE 20m GUN 1/4 plt | 0,2696 | -0,0426 | 0,0030 | 0,0740 | 0,0066 | 0,0000 | 0,0685 |
| FITT IKON BLUE 25m GUN 1/4 plt | 0,2453 | -0,0295 | 0,0028 | 0,0740 | 0,0150 | 0,0000 | 0,0529 |
| FITT IKON BLUE 25m GUN BOX | 0,2453 | -0,0221 | 0,0029 | 0,0740 | 0,0068 | 0,0000 | 0,0387 |

| Product | Raw materials | Packaging | Transport in | Production | Distribution | Use phase | End of life |
|---|---|---|---|---|---|---|---|
| FITT IKON AQUAMARINE 10m GUN 1/4 plt | 0,3911 | -0,0467 | 0,0033 | 0,0739 | 0,0060 (*) | 0,0000 | 0,0851 (*) |
| FITT IKON AQUAMARINE 10m GUN BOX | 0,3911 | -0,0441 | 0,0035 | 0,0739 | 0,0060 | 0,0000 | 0,0851 |
| FITT IKON AQUAMARINE 15m GUN 1/4 plt | 0,3100 | -0,0329 | 0,0030 | 0,0739 | 0,0171 | 0,0000 | 0,0571 |
| FITT IKON AQUAMARINE 15m GUN BOX | 0,3100 | -0,0247 | 0,0031 | 0,0739 | 0,0075 | 0,0000 | 0,0484 |
| FITT IKON AQUAMARINE 20m GUN 1/4 plt | 0,2696 | -0,0426 | 0,0030 | 0,0740 | 0,0226 | 0,0000 | 0,0685 |
| FITT IKON AQUAMARINE 20m GUN BOX | 0,2696 | -0,0400 | 0,0032 | 0,0740 | 0,0090 | 0,0000 | 0,0672 |
| FITT IKON AQUAMARINE 25m GUN 1/4 plt | 0,2453 | -0,0451 | 0,0031 | 0,0740 | 0,0162 | 0,0000 | 0,0755 |
| FITT IKON AQUAMARINE 25m GUN BOX | 0,2453 | -0,0377 | 0,0031 | 0,0740 | 0,0054 | 0,0000 | 0,0620 |
| FITT IKON LAVANDA 10m GUN 1/4 plt | 0,3911 | -0,0467 | 0,0034 | 0,0739 | 0,0077 (*) | 0,0000 | 0,0815 (*) |
| FITT IKON LAVANDA 10m GUN BOX | 0,3911 | -0,0441 | 0,0036 | 0,0739 | 0,0077 | 0,0000 | 0,0815 |
| FITT IKON LAVANDA 15m GUN 1/4 plt | 0,3100 | -0,0516 | 0,0031 | 0,0739 | 0,0230 | 0,0000 | 0,0829 |
| FITT IKON LAVANDA 15m GUN BOX | 0,3100 | -0,0434 | 0,0032 | 0,0739 | 0,0098 | 0,0000 | 0,0774 |
| FITT IKON LAVANDA 20m GUN 1/4 plt | 0,2696 | -0,0426 | 0,0030 | 0,0740 | 0,0043 (*) | 0,0000 | 0,0674 (*) |
| FITT IKON LAVANDA 20m GUN BOX | 0,2696 | -0,0400 | 0,0032 | 0,0740 | 0,0043 | 0,0000 | 0,0674 |
| FITT IKON LAVANDA 25m GUN 1/4 plt | 0,1480 | -0,0451 | 0,0028 | 0,0740 | 0,0154 | 0,0000 | 0,0623 |
| FITT FLORA 1/2" 50m IT* | 0,2548 | -0,0026 | 0,0227 | 0,1088 | 0,0227 | 0,0000 | 0,0430 |
| FITT FLORA 5/8" 15m IT* | 0,3098 | -0,0095 | 0,0284 | 0,1337 | 0,0284 | 0,0000 | 0,0674 |
| FITT FLORA 5/8" 50m IT* | 0,3098 | -0,0073 | 0,0281 | 0,1337 | 0,0281 | 0,0000 | 0,0578 |
| FITT FLORA 3/4" 25m IT* | 0,4262 | -0,0145 | 0,0387 | 0,1836 | 0,0387 | 0,0000 | 0,0867 |
| FITT FLORA 3/4" 50m IT* | 0,4262 | -0,0132 | 0,0385 | 0,1836 | 0,0385 | 0,0000 | 0,0826 |

Values within the "Packaging" life cycle stage are negative due to the materials used being derived from biomass (this uptake from the atmosphere is fully offset by emissions at the end of life considering the complete release of the contained carbon into the atmosphere).

Values with (*) in Table 4 are the object of a manual correction of the result due to the product not being distributed in the reference year. The approach used is that of similarity.

# 6. Uncertainty analysis

The uncertainty analysis was conducted in order to identify the incidence of uncertainty related to the input data on the results of the study. Uncertainty analysis in fact means the systematic study of the propagation of input uncertainty on output uncertainty. If the uncertainty of the process data is specified, e.g. in the form of a Gaussian distribution with a certain standard deviation, which may differ for different sections of the process data, then the uncertainty analysis will produce the standard deviations or confidence intervals for the inventory results (Heijungs et al., 2005).

In a Carbon Footprint study, as in the case of LCA studies, there are at least two types of uncertainty involved: one is the normal uncertainty associated with the determination of a parameter in a given system, and the other refers to the choice of the value of that parameter to represent a value in another similar system (Steen B., 1997). Very often, uncertainty about the quality of a specific input or output cannot be derived from the available information, since there is a source of information that provides the average value, without any indication of the uncertainty of that value.

Therefore, with reference to the Ecoinvent database, a simplified procedure was developed to quantify the uncertainty of these data: this simplified approach involves a qualitative assessment of data quality indicators, based on a pedigree matrix. This matrix was introduced and developed by Pedersen Weidema & Wasnae (Weidema et al.,1996) and is so called (pedigree matrix) since the data quality indicators refer to the history or origin of the data, like a family tree that reports the genealogy (pedigree) of an individual (Weidema et al., 1996).

A probability distribution had to be assigned to each of these processes; since the inventory items found to be significant all came from the Ecoinvent database, the lognormal probability distribution was assumed.

A Monte Carlo simulation was then conducted using a number of runs of 500 as the stopping criterion, whereby a series of values are randomly sampled on the basis of the distribution, and the results of the product Carbon Footprint are recalculated for each parameter.

The statistical results of the uncertainty analysis can be found at Table 5.

Table 5 Results of uncertainty analysis

| GHG flow | CV [%] |
|---|---|
| **CF Total** | 1.89 % |

# Table Index



# Index of Figures



# Bibliography


- Frischknecht, R., 2005. The Ecoinvent Database: Overview and Methodological Framework. International Journal of Life Cycle Assessment, pp. 3-9.
- ISO, 2020. ISO 14040:2006/Amd 1:2020 Environmental management - Life cycle assessment - Principles and frameword, s.l.: s.n.
- ISO, 2020. ISO 14044:2006/Amd 2:2020 Environmental management - Life cycle assessment - Requirements and guidelines, s.l.: s.n.
- Marson, A., Piron, M., Zuliani, F., Fedele, A., Manzardo, A.* (2023). Comparative Life Cycle Assessment in the Plastic Sector: A Systematic Literature Review. Cleaner Environmental Systems, 9;
- AIB (Association of Issuing Bodies). "European Residual Mixes. Results of the calculation of Residual Mixes for the calendar year 2022, 2023
- ISO 14067:2018 Environmental management — Carbon Footprint — Principles, requirements and guidelines;
- Muller, S., Lesage, P., Ciroth, A., Mutel, C., Weidema, B.P., Samson, R., 2016. The application of the pedigree approach to the distributions foreseen in ecoinvent v3. Int J Life Cycle Assess 21, 1327–1337;
- Heijungs, R., Frischknecht, R., 2005. Representing Statistical Distributions for Uncertain Parameters in LCA. Relationships between mathematical forms, their representation in EcoSpold, and their representation in CMLCA (7 pp). Int J Life Cycle;
- Steen, B., 1997. On uncertainty and sensitivity of LCA-based priority setting. Journal of Cleaner Production 5, 255–262;
- Weidema, B.P., Wesnæs, M.S., 1996. Data quality management for life cycle inventories—an example of using data quality indicators. Journal of Cleaner Production 4, 167–174;