

/05

From biodegradability

to the “second life” of

Mater-Bi: our fundamental

concepts for

sustainability

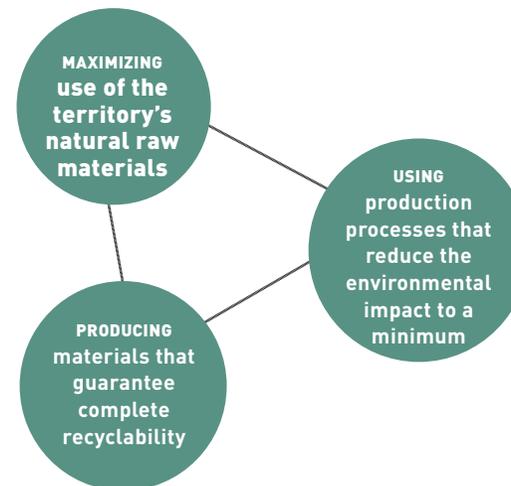
sustainability

of the production chain

Mater-Bi’s second life

Every day, we achieve the sustainability of our production chain, through concrete actions, in various areas.

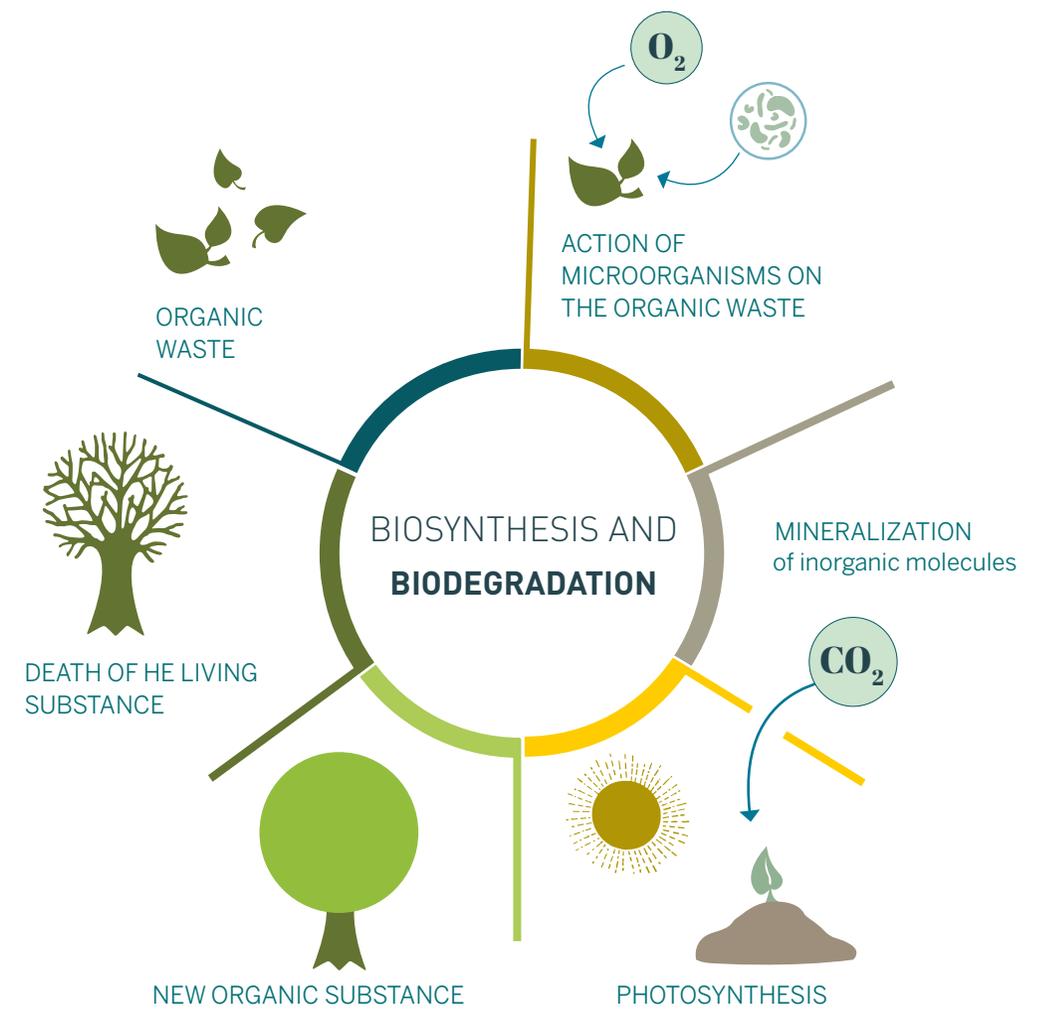
This leads to the “**second life**” of **Mater-Bi**, that is, its usefulness after its primary use, which is guaranteed by the principle characteristics of this type of bioplastic: biodegradability and compostability.



The reference norms for assessing these properties are: in **Europe, the norm EN 13432 - Requirements for packaging recoverable through composting and biodegradation. Test scheme and evaluation criteria for the final acceptance of packaging**, which was produced on the order of the European Commission; **internationally, the norm ISO 18606:2013 Packaging and the environment – Organic recycling**. The two norms provide a reference point for the world’s producers, public authorities, composters and consumers.

* See more at chapter C, Volume II

biodegradability



Biodegradability

This is the ability of a substance of vegetable or animal origin (organic substance), to break down into simpler substances under the action of bacteria and of other microorganisms.

Biodegradability is a property of some natural substances, for example, the leaves in a forest that fall to the ground and turn into humus but also of man-made organic waste. The biodegradation of waste allows it to be reinserted into the natural cycle; making it available once more for a new life.

Biodegradation in a natural environment

Biodegradation, the natural process that allows the recycling of organic materials, can take place in different environments: the soil, rivers, the sea. For many years, we have studied the biodegradation of bioplastics under particular conditions, for example those of the marine environment. Seas and oceans are the point of arrival of a huge quantity of non-biodegradable waste. Of this, in particular it is plastic materials that worry the community, because, after being dragged by the current, they form large accumulations which cause incalculable damage to sea life.

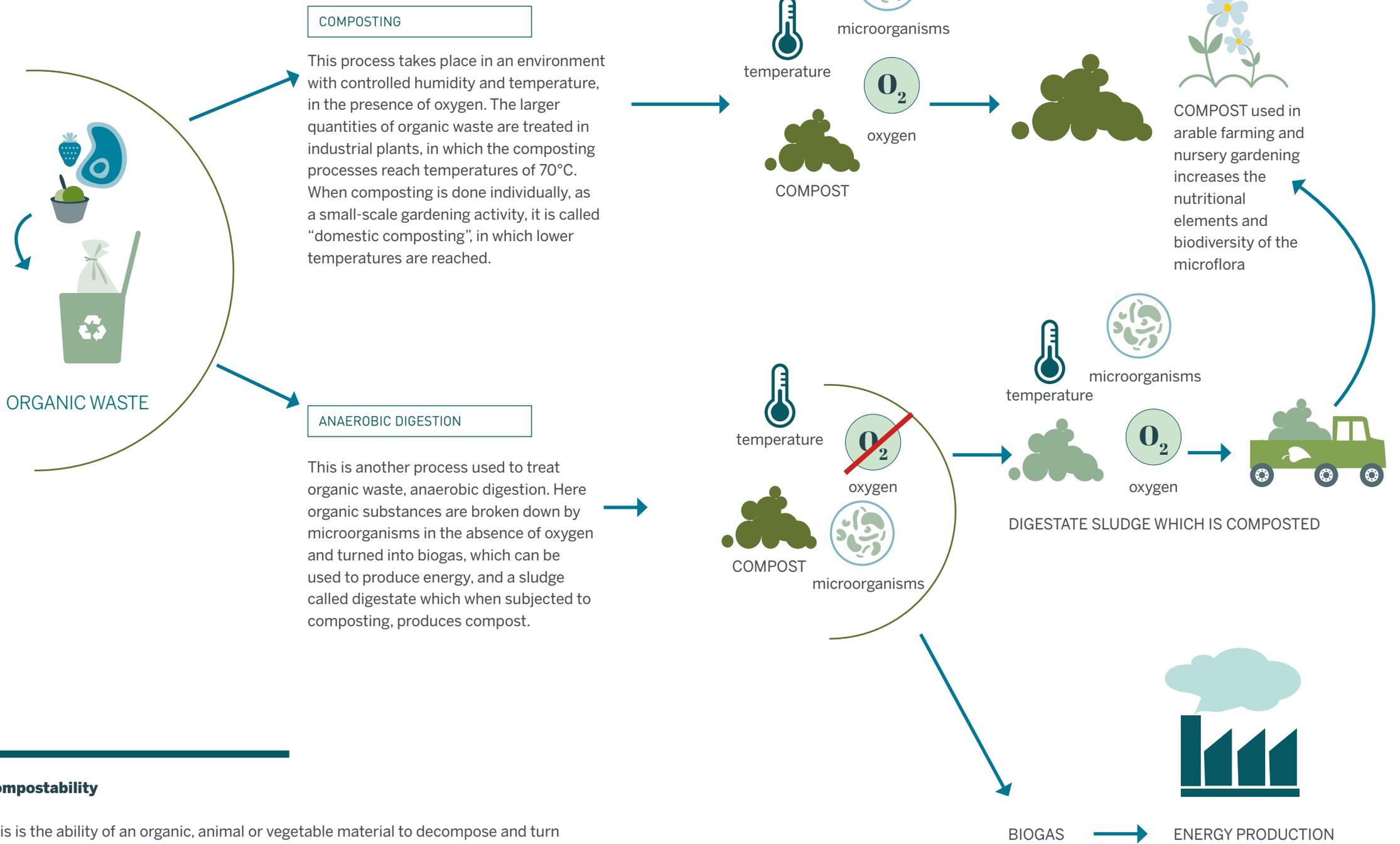
We help spread a culture of a correct management of waste which must be collected and recovered and not abandoned in the environment. At the same time, we study new solutions for applications that have a great probability of spreading (like equipment for fishing or for fish breeding). Mater-Bi was examined in the European Union's pilot program to assess environmental technologies, called ETV (Environmental Technology Verification). In this assessment, it was confirmed that innovative versions of Mater-Bi demonstrate biodegradation in marine environments greater than 90% in one year. Following these results, Novamont was the first company in Italy to obtain the ETV certificate.



* Statement of the logo in Volume II

In the field of methods and processes, ETV (Environmental Technology Verification <http://iet.jrc.ec.europa.eu/etv/>) has been created. Through certification by independent third parties, this pilot program helps companies that have developed innovative environmental technologies to reach the market.

compostability



Compostability

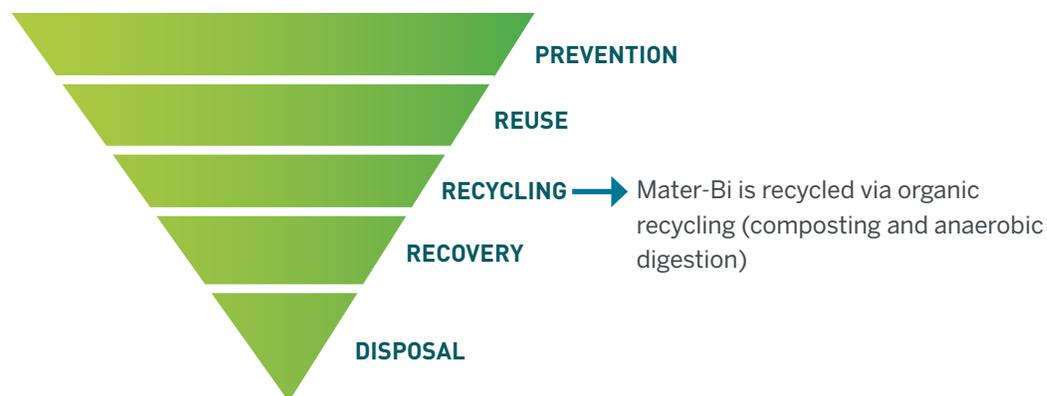
This is the ability of an organic, animal or vegetable material to decompose and turn into a mixture of substances called compost, which is used in agronomy to fertilize and restructure the soil. The process, which leads to the formation of this important soil amendment is called composting.

Improvement of the waste cycle

The production activities of man use enormous resources and the resulting consumption habits generate extremely large quantities of waste. If not correctly managed and exploited to create new value, waste creates environmental pollution and lessens the quality of our lives. For this reason, it is necessary to replace dissipation models with conservation models, which grasp the importance of choosing products that have the lowest environmental and social impact possible, and of correctly managing the separated collection of waste.

WASTE HIERARCHY

Directive 98/2008 – Waste Framework Directive



Renewability

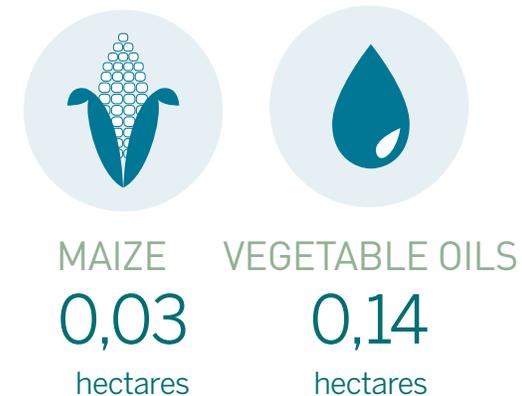
We use new technologies and new industrial supply chains based on the use of renewable raw materials and energy. A resource can be called renewable when it is supplied by natural processes in a quantity that is compatible with its exploitation. Today, most industrial polymers and plastics are produced from non-renewable, fossil resources, which cannot be regenerated at a rate compatible with the speed at which they are exploited.

Renewable raw materials are an essential ingredient of sustainable development. By using them, material resources are saved and environmental loads are considerably restricted.

Mater-Bi contains renewable substances and substances of fossil origin. The former are extracted directly from industrial agricultural crops (e.g. starch), or modified after extraction (e.g. monomers from vegetable oils).

Starch is a substance that is essential in several industrial sectors, for example, paper making, and is produced from maize grown in Europe using standard farming practices. The vegetable oils which we use in our processes are also produced using standard farming practices. The renewable material content of Mater-Bi varies from 30-90% of its weight. The renewable material content is not directly related to the ability to biodegrade; indeed, irrespective of the percentage of renewable material, Mater-Bi is always completely biodegradable and suitable for composting. Beyond this, we seek to use renewable resources as much as possible, and also choose those with the highest levels of sustainability; we do not use soya or palm as a vegetable source and carefully check that all of our renewable biomass resources are grown using sustainable techniques.

The current use of farmland per tonne of Mater-Bi (for film applications) is approximately:



Other substances of natural origin used in smaller quantities (additives) require about 0.01 hectares per tonne of Mater-Bi.

The total weight of the materials used during 2015 was 70,144 t, of which 21,553 t were renewable and 48,591 t were non-renewable. This number includes the raw materials, the materials linked to the process (e.g. lubricants) and the materials used for the packaging.

The data for 2015 cannot be compared with that of the previous years. Further information can be found in the Corrections section in Volume II.

RENEWABLE RESOURCES

- biomass
- solar
- hydraulic
- wind
- geothermal

NON-RENEWABLE RESOURCES

- oil
- nuclear
- natural gas
- coal

CERTIFICATIONS

During 2015, the company obtained ISCC Plus certification, which allows verifying and tracing the origin of the starch. The certification guarantees that the certified raw material was produced without exploiting virgin or deforested land.



ISCC (<http://www.iscc-system.org>) is a system of certifying the sustainability of the renewable raw materials used to produce biofuels, foods, bioplastics and other products.

The sustainability criteria of this certification were taken from the RED (Renewable Energy Directive) and concern:

PRODUCTION

of the biomasses on land not characterized by high biodiversity

REDUCTION

in greenhouse gas emissions

RESPECT

of human rights, of workers and of the right to land

USE

of good farming practices, to protect the soil, the water and the air

Energy

We do not concentrate our attention just on the choice of sustainable raw materials, but also demonstrate our commitment to sustainability with regards to energy consumption. The table below shows energy consumption in 2015.

ENERGY CONSUMPTION INSIDE THE ORGANIZATION

43.417 GJ

methane

122.073 GJ

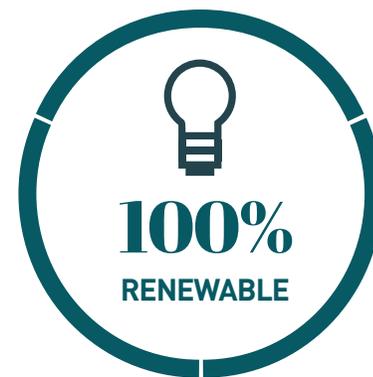
electrical energy

9.968 GJ

steam – only Novara

6.846 GJ

self-produced thermal energy – only Terni



All of the electrical energy that we need for our sites (Novara, Terni and Piana di Monte Verna) comes from renewable sources.

In addition to giving concrete support to this type of energy, we guarantee:

- a reduction in the emissions of greenhouse gases and of other pollutants
- an improvement in the environmental performance of all products made of Mater-Bi.

Protecting biodiversity, the environment and the climate

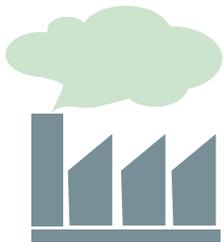
The actions we have undertaken to protect the environment naturally involve aspects such as biodiversity and climate.

Although there is no interaction between our industrial activities on the territory and protected areas or areas that have a high value in terms of biodiversity, we direct our research and development activities towards protecting local areas and by supporting their enhancement.

An example of this is the activities for developing a sustainable production chain and protection of the biodiversity, which has led us to choose crops that have a low environmental load and to adopt ISCC Plus certification.

Our environmental policies are active, also with respect to the climate-altering emissions.

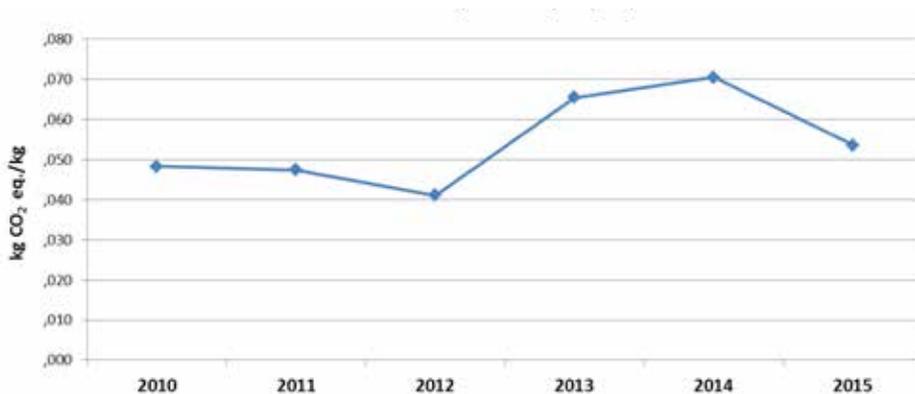
TOTAL EMISSIONS



4286 t

In 2015, the total direct and indirect emissions of CO₂ equivalent, for the sites in Terni, Novara and Piana di Monte Verna.

SPECIFIC DIRECT EMISSIONS OF GREENHOUSE GASES



The graph shows the specific direct emissions of greenhouse gases (fossil CO₂). These were determined as the ratio between the total direct emissions and the overall quantity of Origo-Bi and Mater-Bi polyesters produced in the reference year (2015).

biomass

Organic material, for example a product or waste from agricultural crops and forestation, which can be used to produce objects and materials, or to produce energy, thereby reducing the dependency upon fossil sources. Novamont considers biomass the real wealth of the planet, to be enriched and safeguarded.

INTENSITY OF DIRECT GREENHOUSE GAS EMISSIONS

These are the emissions due to burning natural gas and refluents sent to the combustor.

0,047 t fossil CO₂/t (from methane)

0,007 t fossil CO₂/t (from methane)

0,054 t fossil CO₂/t (from methane)

ALTRE EMISSIONI DIRETTE E INDIRETTE

1,108 t NO_x NITROGEN OXIDES

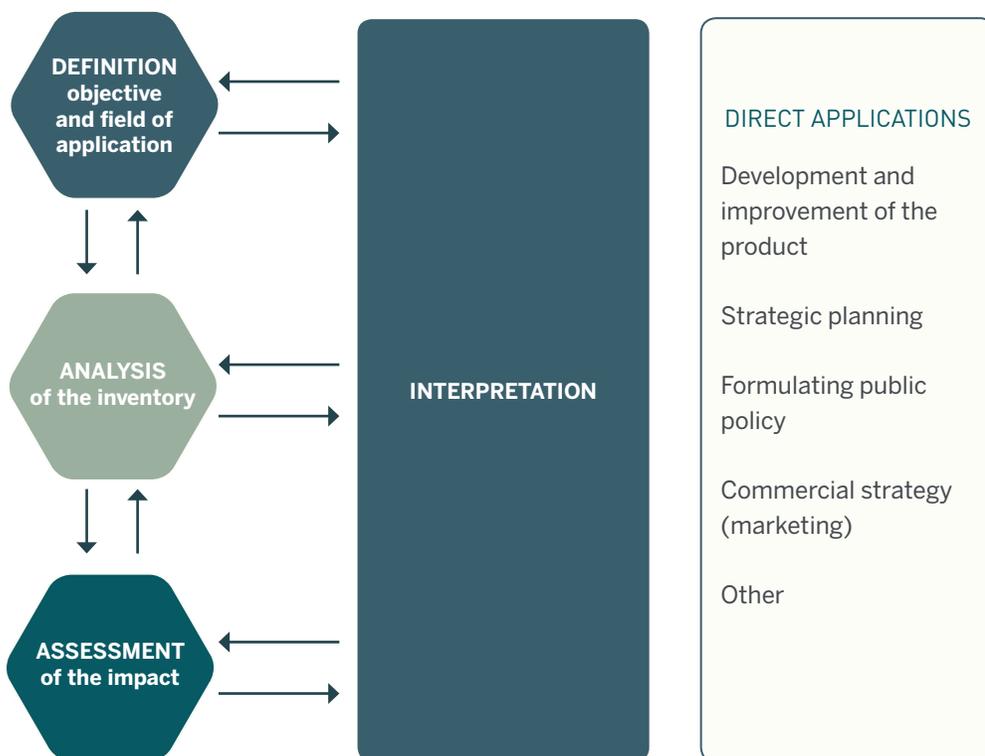
0,36 t PM PARTICULATE MATTER

0,64 t CO CARBON MONOXIDE

3,18 t VOC VOLATILE ORGANIC COMPOUNDS

* See more at page 28, Volume II

LCA PHASES (ISO 14040)



Measuring the environmental impact

To quantify and limit the impacts of our activities, we use Life Cycle Assessment (LCA), which is the main tool in Life Cycle Thinking, a way of thinking of industrial activities based on the life cycle of the product, from selection of the raw materials to its final recycling.

The step forward of LCA lies in the fact that all phases in the production process are considered to be related and dependent

upon each other, which makes it possible to assess the linkage of the impacts and to limit them by improving the efficiency of the whole production process.

At an international level, the LCA method is governed by the norms ISO 14040 and ISO 14044. we have used it since 1998, and are among the first Italian companies to have adopted it.



[biodiversita]

biodiversity

This is the diversity of life, that is, the variety of living beings that populate our planet or one of its specific areas. Biodiversity can be analysed on different levels:

- diversity of ecosystems (natural environments, such as water, woods, mountain spaces, etc.)
- diversity of species (animals, plants, fungi, microorganisms)
- diversity of genetic heritage (variety of wild and domestic species).

For Novamont, biodiversity is an aspect of the territory that should be appreciated and protected, and a priceless heritage from which to draw.