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Università Bocconi
GREEN
Centre for Geography, Resources, Environment, Energy and Networks

Realized by

EUROVETROCAP

This is a tool for the simplified calculation of the environmental performance of the products produced or traded by Eurovetrocap Spa or Zero In Pack Srl. Its aim is to develop a series of actions to increase awareness and skills of the company where competitive opportunities are related to sustainable management, and are inspired by the principles of the "circular economy". With this tool we wish to help our customers understand where the impact of a product is generated, and possible ways in which this may be reduced.

Through collaboration between Bocconi University and the company itself, manufacturer of plastic and / or glass cosmetic containers, it was possible to identify families of products that allow the greatest number of different components to be analysed, namely bottles, pumps, caps and lids, droppers and refill solutions.

The analysis takes into consideration all the processes implemented by the company and its suppliers, in order to assess their environmental impact and identify opportunities for improvement. They are identified as follows: transformation processes (extrusion, injection molding, press-blow moulding, injection-stretch-blow moulding and die cutting) and decorative processes (satin finishing, metallisation, screen printing, hot stamping, painting, pad printing and assembly).
The materials analysed are: glass, aluminium, thermosetting plastics (PP, LDPE, HDPE, PE, PVC, PET), rubbers (synthetic rubber, SAN, ABS) and silicone.

The study consists of an analysis of the environmental impact of the different combinations (in terms of materials and components), on the basis of an LCA (Life Cycle Assessment) "from cradle to grave", or from the extraction of raw materials to final disposal.

The study was carried out both on the basis of primary data (e.g. decorative processes) and on database data, EcoInvent 3.5 (e.g. data sets associated with the production and processing of raw materials, the end-of-life treatment of the packs, etc.). The tool used for the analysis is the SimaPro software, version 9.0.

The analysis adopts the polluter pays principle, this principle establishes that the impacts generated by the recycling process of the material are entirely allocated to the user of the recycled material. For this reason, the impacts related to the recycling process of the product and the distribution packaging of the finished product are zero. For the same principle, the impacts related to energy

recovery are to be attributed: 50% to the waste generator (in our case Eurovetrocap Spa or Zero In Pack Srl Srl), and 50% to the user of the energy produced through the energy recovery process) *. The impacts generated by landfill disposal are entirely attributed to the waste generator (Eurovetrocap Spa or Zero In Pack Srl).

The method used for calculating environmental impacts is the new "EF method adapted"; introduced in conjunction with the development of the PEF methodology, the EF method is used for assessing the impacts of the European Commission's "Environmental Footprint" initiative, the wording "adapted" indicates a version compatible with the datasets already present in SimaPro.

It was decided not to include in the study the data relating to green HDPE "Braskem", polyethylene produced from sugar cane as, according to an LCA analysis, it does not fall in line with the indications of the relevant standards with regard to materials with "green" components. In fact, the analysis in question would show positive impacts (negative values) associated with green HDPE, deriving from: a) CO2 credits associated with the growth of sugar cane; b) credits associated with the production of electricity from the burning of sugar cane processing waste; c) failure to include the end of life phase in the study. It is correct to say that CO2 is absorbed by the growing plant, but the quantities of CO2 absorbed are entirely re-emitted into the atmosphere at the end of life, thus balancing the initial credit. The following is indicated in this regard by the Product Environmental Footprint Category Rules Guidance (Version 6.3 - May 2018):
- credits from 'temporary carbon storage' are excluded. This means that emissions emitted within a limited amount of time after their uptake shall be counted for as emitted "now" and there is no discounting of emissions within that given time frame (also in line with ISO/TS14067). The term 'limited amount of time' is here defined as 100 years, in line with other guiding documents such as in ILCD handbook (JRC 2016) and PAS2050:2011. Therefore, biogenic carbon emitted later than 100 years after its uptake is considered as permanent carbon storage;

- For intermediate products (cradle to gate) the lifetime of the final product is not known. Therefore, no carbon credits shall be modelled at this point in the life cycle. The biogenic carbon content at factory gate (physical content and allocated content) shall always be reported as 'additional technical information.

It should be noted that the following is a Tool for the exclusive use of the Eurovetrocap Spa or Zero In Pack company, designed on the specific characteristics of the latter and designed as an internal management tool, not aimed at obtaining environmental product certification.

* If it is incineration without energy recovery, or with an efficiency below 60%, all impacts are attributable to the waste generator. In this study, a 50% allocation was considered.

The following is a comparison between

Laura 30ml virgin bottle; Laura dispensing pump and ufo actuator virgin material; Nina pp overcap virgin matrial

Laura 30ml recycled bottle; Laura dispensing pump and ufo actuator recycled material; Nina pp overcap recycled matrial

Glass recycled % up to 90%

Pump + overcap, the usage of 100% PP recycled PIR FOOD GRADE material will permit to have a pump where over the 70% of the weight will be from recycled material (for the engine will be used virgin materials)

In our hypotesys , after the use the bottle will be recycled; the accessories burned to recover energy

We've estimated a transport Vs the client via truck considering a distance of 1000km

Virgin set

RISULTATI PER FASE DEL CICLO DI VITA - VERSIONE 1

Categorie di impatto	Unità	Totale	Produzione materie prime	Produzione componenti	Approvvigionamento componenti	Processi decorativi	Packaging di distribuzione	Distribuzione	Fine vita
Climate change	kg CO2 eq	0,005404007	7,42E-04	3,23E-03	6,07E-04	0,00E+00	1,77E-04	4,91E-04	1,61E-04
Ozone depletion	kg CFC11 eq	7,03261E-10	2,38E-12	4,25E-10	1,41E-10	0,00E+00	2,04E-11	1,14E-10	1,35E-12
Ionising radiation, HH	kBq U-235 eq	0,00017748	9,07E-07	9,54E-05	4,12E-05	0,00E+00	6,31E-06	3,33E-05	3,62E-07
Photochemical ozone formation, HH	kg NMVOC eq	2,10873E-05	2,68E-06	1,20E-05	3,23E-06	0,00E+00	5,02E-07	2,62E-06	6,98E-08
Respiratory inorganics	disease inc.	4,20543E-10	2,53E-11	3,08E-10	4,40E-11	0,00E+00	6,61E-12	3,56E-11	6,46E-13
Non-cancer human health effects	CTUh	6,00752E-10	5,64E-12	3,92E-10	9,03E-11	0,00E+00	3,54E-11	7,31E-11	4,05E-12
Cancer human health effects	CTUh	5,94886E-11	6,46E-12	4,22E-11	4,59E-12	0,00E+00	1,77E-12	3,72E-12	7,46E-13
Acidification terrestrial and freshwater	mol H+ eq	3,86447E-05	2,65E-06	2,97E-05	3,07E-06	0,00E+00	7,25E-07	2,49E-06	5,86E-08
Eutrophication freshwater	kg P eq	2,15014E-07	1,45E-08	1,75E-07	8,53E-09	0,00E+00	9,60E-09	6,90E-09	1,39E-10
Eutrophication marine	kg N eq	6,4155E-06	4,62E-07	3,77E-06	1,03E-06	0,00E+00	2,66E-07	8,32E-07	5,74E-08
Eutrophication terrestrial	mol N eq	7,84976E-05	4,98E-06	5,05E-05	1,14E-05	0,00E+00	2,11E-06	9,24E-06	2,40E-07
Ecotoxicity freshwater	CTUe	0,005087225	3,27E-04	1,65E-03	1,51E-03	0,00E+00	1,99E-04	1,22E-03	1,76E-04
Land use	Pt	0,099588571	1,85E-04	6,60E-02	9,44E-03	0,00E+00	1,61E-02	7,64E-03	2,87E-04
Water scarcity	m3 depriv.	0,001237144	2,25E-04	8,98E-04	4,62E-05	0,00E+00	1,91E-05	3,74E-05	1,11E-05
Resource use, energy carriers	MJ	0,085790769	2,40E-02	4,21E-02	9,32E-03	0,00E+00	2,73E-03	7,54E-03	1,05E-04
Resource use, mineral and metals	kg Sb eq	1,11754E-08	5,53E-11	7,48E-09	1,84E-09	0,00E+00	3,04E-10	1,49E-09	7,50E-12
Climate change - fossil	kg CO2 eq	0,005379907	7,41E-04	3,21E-03	6,06E-04	0,00E+00	1,74E-04	4,91E-04	1,61E-04
Climate change - biogenic	kg CO2 eq	2,1343E-05	7,11E-07	1,95E-05	1,62E-07	0,00E+00	8,69E-07	1,31E-07	7,35E-09
Climate change - land use and transform.	kg CO2 eq	2,75681E-06	1,25E-08	7,99E-07	1,75E-07	0,00E+00	1,63E-06	1,41E-07	2,46E-09

Recycled set

RISULTATI PER FASE DEL CICLO DI VITA - VERSIONE 2

Categorie di impatto	Unità	Totale	Produzione materie prime	Produzione componenti	Approvvigionamento componenti	Processi decorativi	Packaging di distribuzione	Distribuzione	Fine vita
Climate change	kg CO2 eq	0,004610957	3,55E-04	2,90E-03	5,72E-04	0,00E+00	1,66E-04	4,63E-04	1,52E-04
Ozone depletion	kg CFC11 eq	6,65002E-10	1,30E-11	3,92E-10	1,32E-10	0,00E+00	1,92E-11	1,07E-10	1,27E-12
Ionising radiation, HH	kBq U-235 eq	0,000172874	1,08E-05	8,56E-05	3,88E-05	0,00E+00	5,95E-06	3,14E-05	3,41E-07
Photochemical ozone formation, HH	kg NMVOC eq	1,79323E-05	1,14E-06	1,07E-05	3,05E-06	0,00E+00	4,73E-07	2,47E-06	6,58E-08
Respiratory inorganics	disease inc.	3,69428E-10	1,32E-11	2,74E-10	4,15E-11	0,00E+00	6,23E-12	3,35E-11	6,09E-13
Non-cancer human health effects	CTUh	5,58372E-10	1,96E-11	3,47E-10	8,52E-11	0,00E+00	3,34E-11	6,89E-11	3,82E-12
Cancer human health effects	CTUh	5,73218E-11	7,00E-12	4,01E-11	4,33E-12	0,00E+00	1,67E-12	3,51E-12	7,04E-13
Acidification terrestrial and freshwater	mol H+ eq	3,35537E-05	1,42E-06	2,61E-05	2,90E-06	0,00E+00	6,84E-07	2,34E-06	5,52E-08
Eutrophication freshwater	kg P eq	1,81345E-07	1,32E-08	1,44E-07	8,04E-09	0,00E+00	9,05E-09	6,50E-09	1,31E-10
Eutrophication marine	kg N eq	5,67975E-06	2,56E-07	3,37E-06	9,70E-07	0,00E+00	2,51E-07	7,85E-07	5,41E-08
Eutrophication terrestrial	mol N eq	6,7698E-05	2,89E-06	4,31E-05	1,08E-05	0,00E+00	1,99E-06	8,71E-06	2,27E-07
Ecotoxicity freshwater	CTUe	0,004746941	3,11E-04	1,50E-03	1,43E-03	0,00E+00	1,88E-04	1,15E-03	1,66E-04
Land use	Pt	0,093277554	2,00E-03	5,97E-02	8,90E-03	0,00E+00	1,52E-02	7,20E-03	2,71E-04
Water scarcity	m3 depriv.	0,000823406	8,73E-05	6,29E-04	4,35E-05	0,00E+00	1,80E-05	3,52E-05	1,05E-05
Resource use, energy carriers	MJ	0,065225181	8,53E-03	3,81E-02	8,78E-03	0,00E+00	2,57E-03	7,11E-03	9,90E-05
Resource use, mineral and metals	kg Sb eq	9,38241E-09	3,83E-10	5,56E-09	1,74E-09	0,00E+00	2,87E-10	1,40E-09	7,07E-12
Climate change - fossil	kg CO2 eq	0,004573467	3,45E-04	2,88E-03	5,72E-04	0,00E+00	1,64E-04	4,63E-04	1,52E-04
Climate change - biogenic	kg CO2 eq	3,48172E-05	9,78E-06	2,39E-05	1,53E-07	0,00E+00	8,19E-07	1,24E-07	6,93E-09
Climate change - land use and transform.	kg CO2 eq	2,67254E-06	1,62E-07	6,76E-07	1,65E-07	0,00E+00	1,53E-06	1,33E-07	2,32E-09

Comparison

Categorie di impatto	Unità	Versione 1	Versione 2
Climate change	kg CO2 eq	5,40E-03	85,32%
Ozone depletion	kg CFC11 eq	7,03E-10	94,56%
Ionising radiation, HH	kBq U-235 eq	1,77E-04	97,40%
Photochemical ozone formation, HH	kg NMVOC eq	2,11E-05	85,04%
Respiratory inorganics	disease inc.	4,21E-10	87,85%
Non-cancer human health effects	CTUh	6,01E-10	92,95%
Cancer human health effects	CTUh	5,95E-11	96,36%
Acidification terrestrial and freshwater	mol H+ eq	3,86E-05	86,83%
Eutrophication freshwater	kg P eq	2,15E-07	84,34%
Eutrophication marine	kg N eq	6,42E-06	88,53%
Eutrophication terrestrial	mol N eq	7,85E-05	86,24%
Ecotoxicity freshwater	CTUe	5,09E-03	93,31%
Land use	Pt	9,96E-02	93,66%
Water scarcity	m3 depriv.	1,24E-03	66,56%
Resource use, energy carriers	MJ	8,58E-02	76,03%
Resource use, mineral and metals	kg Sb eq	1,12E-08	83,96%
Climate change - fossil	kg CO2 eq	5,38E-03	85,01%
Climate change - biogenic	kg CO2 eq	2,13E-05	163,13%
Climate change - land use and transform.	kg CO2 eq	2,76E-06	96,94%

How to read it:

For example for the Climate change, rebasing at 100 the virgin set, the recycled one has an impact of 85,32, so is offering for this parameter a save of 15%

Smart example

To produce 1000 sets of the virgin set you have an impact in terms of climate change equivalent to the impact a medium size car covering 477km

To produce 1000 sets of the recycled set you have an impact in terms of climate change equivalent to the impact a medium size car covering 422km

Thanks

Giampaolo Herrmann

How to read data above
In the first column the values are reported to the value 100. For example, for what concerns the climate change, if the first version has an impact of 100, the second has an impact of 73.66 or 26.34% less than the first.

What does it mean in practical terms?
That producing 1000 sets of the first type involves an impact equivalent to that produced by a car of medium engine size covering 117km.
Using instead the second set involves an impact equivalent to that produced by an average car engine size covering 75km.

Thanks
Giampaolo Herrmann

Brief explanation of relevant impact items

Climate change - Climate change
Ability of a greenhouse gas to influence changes of global average air temperature at soil and subsequent changes in different climate parameters and their effects.
This impact category calculates greenhouse gas (GHG) emissions from oxidation and/or reduction of fossil fuels by their transformation or degradation.
It is measured in kg CO2 eq.

Resource use energy carriers - Depletion of fossil resources
It measures the depletion of fossil resources in terms of MJ.

Terrestrial and freshwater acidification - Terrestrial acidification
Measures the effects of acidifying substances on the environment. Emissions of NOx, NH3 and SOx result in the release of hydrogen ions when gases are mineralised. Protons promote acidification of soils and water, if released in areas where buffer capacity is low, resulting in forest deterioration and acidification of lakes.
It is measured in mol H+ eq.

Respiratory inorganics - Particulate matter/smog caused by emissions of inorganic substances
Calculates adverse effects on human health caused by emissions of particulate matter (PM) and its precursors (NOx , SOx ,NH3).