BARILLA SUSTAINABLE PACKAGING DESIGN
AND ITS INTEGRATION IN THE EPD® PROCESS

Extended abstract

Luca Ruini¹, Michele Amigoni¹, Luca Petruccelli²*, Stefano Rossi²

¹Barilla G.R. Fratelli S.p.A
²Life Cycle Engineering

Background

Barilla, in February 2011, was the first food company to perform environmental impact calculation in an easy, quick and reliable way and to provide certified and published results according to the Process Certification Clarifications guidelines for International EPD® System. Since 2004 packaging of Barilla products are designed with the support of the tool "LCA packaging Design" that performs streamlined Life Cycle Assessment (LCA) of different packaging solutions and evaluate environmental burden in terms of CF (Carbon Footprint) WF (Water Footprint) and EF (Ecological Footprint) at the first designing phases. This tool is linked to the EPD system LCA Database, which stores the most updated and verified data available coming from Barilla's suppliers and international LCA databases. Particular attention is made in the analysis of the Italian waste management system, aiming at reducing the impact of production as well as increasing the overall recyclability of packaging at disposal stage.

The overall recyclability of Barilla's packaging is increased from 85% in 2008 to 96% in 2012, and the 41% of recycled materials. Within 2014 the 98% of the packaging will be recyclable.

Introduction

The approach developed for the evaluation of packaging design is strictly linked to the EPD® process system (Ruini et al., 2012) and it is based on the Life Cycle Assessment methodology; using the following three main elements:

1. The packaging specific data;
2. The LCA database;
3. The packaging system.

The packaging specific data are elaborated by the packaging system using the LCA database. The packaging specific data are collected in specific LCA spreadsheet, called "LCA packaging Design" tool, that is able to elaborate LCA indicators of several packaging alternatives. The aim of the tool is to allow packaging designer to evaluate different packaging alternatives and to support decision making with environmental data.

1. Packaging specific data

Represents all the information related to the description of the packaging of the product that are: packaging component typology (e.g. bottles, trays, etc); material (e.g. glass, polypropylene, etc); percentage of recycled content; shaping process (e.g. thermoforming, etc); component mass; input transport carriers; distance of supplier.

These information shall be detailed for each component of the packaging (bill of material) and split per CU (Consumer Unit), HU (Handle Unit) and PU (Pallet Unit). Moreover further information shall be defined to the whole packaging system, which are: transport efficiency, as ratio of CU per PU; country of disposal.

* Author to whom all correspondence should be addressed: email: petruccelli@studiolce.it
Components information are required to elaborate environmental burden of material production and transport, while packaging system information are essential to elaborate the end of life scenario (the share of the packaging mass delivered to different disposal treatment i.e. landfill, recycling and incineration).

2. LCA Database

The database is organized among different data modules groups linked to the packaging specific data. Raw materials: includes information about packaging materials (e.g. cardboard manufacturing for American box production);
- **Shaping process**: environmental performances related to the shaping of raw material to obtain packaging components (e.g. Thermoforming for the plastic trays);
- **End of life scenario**: includes data about the disposal of packaging materials. Information are detailed per country and material (e.g. The Italian recycling of PET plastic is about 62%). The module is updated yearly when new information is available. Sources of information are national consortium for the packaging waste management and available country statistics.
- **Packaging waste disposal treatment**: contains information about environmental burden due to the disposal of the packaging material.
- **Transports**: data on the main means of transport used for the Barilla’s purposes

Each data module stores the environmental aspects related to material and process, main hypothesis applied, as requested by the ISO 14040 series (functional unit, system boundaries, data quality, data collection and treatment, allocation and cut-off rules) (ISO 14040, 2006; ISO 14044, 2006). All data modules are internally verified and are ready to be used for both EPD and packaging R&D purposes.

3. Packaging system

The packaging system is the elaboration architecture that allows to link packaging specific data to LCA database in order to elaborate packaging environmental impact in a cradle to cradle perspective. An example of packaging process system is reported in Fig. 1.

![Fig. 1. Example of packaging component impacts calculation](image)

Thanks to the elaboration architecture every specific data is related to the LCA database by means of specific algorithms. The spreadsheet tool developed for Barilla's designers contains also automatic check to avoid basic input data errors, e.g. the respect of mass balance, uniformity of comparison among alternatives. The tool allow packaging designer to input only data about packaging and perform LCA without being experts.

4. Relation between sustainable packaging design and EPD Process

The relation between the "LCA Packaging Design" and the EPD system is essentially the database, both processes are supplied by the same data sources, therefore results reliability could be considered the same. The EPD process aims at evaluating impacts of the whole Barilla's product while the "LCA Packaging Design" is focused on packaging analysis, especially for benchmarking different packaging solutions of the same product.

![Fig. 2. Scheme of the Barilla EPD Process System (“funnel process”) and the packaging ecodesign process](image)
Case studies

The case studies presented in this paper are about bakery products, the first is about the analysis of a new component for Ringo snack, while the second is about the analysis of two alternative solutions of multilayer flow pack. Both case studies report the analysis of former and new packaging version of the same product. New solutions analyzed are currently available on the market and the environmental analysis supported the decision about their substitution.

1. Ringo Snack Case study

The case study is about the change of materials of the Ringo Snack flow pack. The substitution realized is from a multilayer of PP (polypropylene) and metalized PET (polyethylene terephthalate) to a new metalized PP film. Since the new packaging is made by single material it has been recognized recyclable by the COREPLA (the Italian consortium for the recycling of packaging plastic waste) (COREPLA, 2012). Moreover the mass of the new solution is lower than the former of about a 13%.

<table>
<thead>
<tr>
<th>Bill of material per Consumer Unit</th>
<th>Former version</th>
<th>New version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass per CU [g]</td>
<td>1.21</td>
<td>1.05</td>
</tr>
<tr>
<td>OPPcoex film [%]</td>
<td>41%</td>
<td>35%</td>
</tr>
<tr>
<td>OPPcoex Met film [%]</td>
<td>-</td>
<td>48%</td>
</tr>
<tr>
<td>PET Met film [%]</td>
<td>38%</td>
<td>-</td>
</tr>
<tr>
<td>Adesive + Ink [%]</td>
<td>21%</td>
<td>17%</td>
</tr>
</tbody>
</table>

The benefits elaborated by the system are -17% Carbon Footprint, -13% Water Footprint and - 26% Ecological Footprint. The benefits come mainly from the change of material, nevertheless the recyclability is increased from a 0% to a 8%. In fact as single material the flow pack is considered as plastic film by the COREPLA system, therefore the potential recycling is assumed as 8% according to their data (COREPLA 2012).

In order to clearly explain to customer the change of material, a specific label highlighting the recyclability of the new component was added in the packaging graphics (see figure 3).

![Fig. 3. Icon to communicate recyclability of packaging component (Italian version)](image)

2. Flow pack of Mulino Bianco biscuits

The second case study, as the first, it is about the biscuits packaging of Mulino Bianco. Here the changes of material aimed at improving the recyclability of the packaging. In this case the bakery pack is made of heterogeneous multilayer composed of paper and metalized plastic film. The two solutions have the following variables: Percentage composition of the two materials; Packaging mass.

All the other components of the packaging system are considered out of the scope of the analysis (e.g. HU and PU). It is important to underline that COMIECO (Italian consortium for the recycling of paper packaging) was involved in the project and recognized the new packaging solution as fully recyclable because of the lower presence of plastic. In order to keep the same performance of the former the mass of the new solution was increased, as shown in Table 2. The reported figures are elaborated as weighted mass of three different references of sales. The weighting factor is based on 2011 sales volume.

<table>
<thead>
<tr>
<th>Bill of material per Consumer Unit</th>
<th>Former version</th>
<th>New version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average packaging mass [g]</td>
<td>14.8</td>
<td>15.7</td>
</tr>
<tr>
<td>Coated paper for flexible packaging [%]</td>
<td>79%</td>
<td>85%</td>
</tr>
<tr>
<td>OPP coex met film [%]</td>
<td>21%</td>
<td>15%</td>
</tr>
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In this case the cradle to grave comparison of the two solutions does not discover remarkable environmental impact differences. Results highlight indicators in reverse trend. The higher mass of the new packaging increases the impact of WF and EF, mainly influenced by paper production, while the CF decreases because of the less quantity of plastic. Moreover the recyclability of the new solution increases saving GHG emissions from landfill and incineration. The recycling scenario of the new packaging is significantly influenced by the change of material,
because packaging paper are characterized by high recycling rates (e.g. about the 80% of packaging paper is actually recycled in the Italian territory) (COMIECO 2012). The new packaging is able to save about 12 grams of paper per CU. Widening the boundaries of the analysis from a cradle to grave to cradle to cradle analysis, the benefits of the new design becomes evident. Elaborating the potential benefit of the recycling, by evaluating the potential recycling as avoided impacts of substitution of virgin paper, the benefit are about -40% CF and WF, -25% for EF.

Despite the former case the benefit are highlighted only if benefits of the end of life are included. This kind of assessment increases the uncertainty of the analysis because the actual use of the recycled paper coming from recycling process is actually unknown. In this case the benefits are elaborated by assuming the substitution of paper with the same quality of the packaging itself.

Results and discussion

The results of the case studies showed how it is possible to perform LCA to assess the potential environmental benefits of new packaging solution at the first design step. This solutions were elaborated using data comes from verified and certified database, that increased the reliability of results, and support decision making. Moreover for the second case study the results obtained by the spreadsheet tool started detailed LCA study on packaging scenario to confirm results. In both case studies data about waste scenario were critical, and the real benefits of new design solution come from the detailed analysis of the recycling system of packaging waste.

Concluding remarks

The two case studies shown how the EPD process and packaging design approach are related by means of the environmental database that contains the entire life cycle inventory required for the elaboration of the environmental burdens. Packaging suppliers are continuously asked to provide their own data in order to keep updated the DB module The methods developed allow designers to ease LCA analysis by input only data about packaging, while all the information about production and disposal are available in the tool.

Keywords: EPD System, packaging, streamlined LCA, sustainability tool

References