PRESSURE COOKER UNDER PRESSURE: IMPLEMENTATION OF LIFE CYCLE STRATEGIES AND TOOLS IN A MEDIUM SIZED INDUSTRY IN PORTUGAL

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Abstract

This paper concerns the application of a set of life cycle oriented strategies and tools to a pressure cooker manufactured by a medium size company located in Portugal and targeting the international market. The life cycle assessment (LCA) indicated the major environmental problems of this product, which together with the company strategy of appealing the consumer through a 100% recyclable and more ergonomic product, provided the direction for the product and market development.

Besides the LCA, an ecodesign project was carried out for a reference pressure cooker and through the use of several tools, including ecodesign checklists co-developed by LNEG in a previous project, a number of improvement options was generated, leading to the reduction and substitution of raw materials consumption, improved recyclability, better ergonomic features, more eco-friendly packaging and improved user interaction.

A simplified environmental product declaration for the reference product was elaborated, in the framework of the EU Stepwise EPD project, and its marketing asset was evaluated through different communication methods, including phone meetings, website feedback, mailing lists and direct communication with customers in business fairs.

This paper presents the results of this project and the characteristics of the improved product, and reflects upon the use of different life cycle-related strategies and tools in an integrated way; thus, this case study contributes to the understanding of the pros and cons of implementing life cycle strategies and tools in businesses.

Keywords

Life cycle approaches, LCA, ecodesign, EPD, pressure cookers manufacturer.

1. INTRODUCTION

The implementation of life cycle oriented environmental strategies with the aim of reducing the environmental burden of products throughout their life cycle has been central to EU and international environmental policies, reflected in legislation and in voluntary initiatives such as standardization. Many companies are following this trend by applying strategies and practices that consider the whole or part of their product's life cycles. These encompass life cycle assessment, ecodesign, environmental labelling and declarations and green purchasing.

For small and medium sized companies, these instruments are still challenging and their adoption on a voluntary basis depends on the benefits, besides the environmental ones, companies achieve: economic, reputational, etc.

Triggered by the EU Funded Stepwise EPD (Environmental Product Declaration) Project [1], a Portuguese pressure cookers manufacturer (medium sized company located in the north of the country and selling to the domestic and international market) enrolled in a number of LC related initiatives. Besides the EPD, the company was interested in an ecodesign project to fulfil some predefined features of a new model pressure cooker: improved ergonomics and 100% recyclability were considered by top management important market arguments. The usefulness of the EPD as a communication tool for the more environmentally conscious clients was also investigated.

2. LIFE CYCLE ASSESSMENT

The life cycle assessment of the pressure cooker was carried out following the methodology of ISO 14040 [2] and ISO 14044 [3] standards. The LCA software SimaPro 8.03 [4] was used to gather data, model the life cycle of the product, and assess the life cycle environmental impacts.

The object of the study was a 6 litres stainless steel pressure cooker that operates at a pressure of 82 kPa, with 220 mm of diameter and a bayonet-type closing system. The function of the product is to cook faster, by using higher pressure and temperature, and its life time is considered to be 10 years.

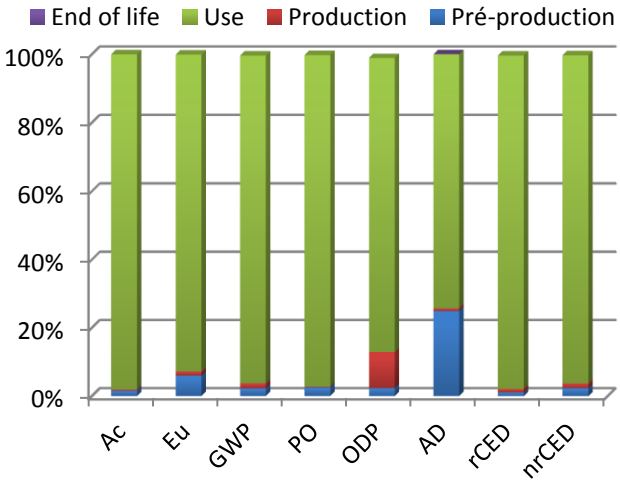
Table 1 quantifies the materials included in the product and packaging. Additionally, the inputs and outputs of the production process, transport distances of raw materials from supplier to company, and of product to distribution centres were also quantified and used as primary data for the study. These primary data was complemented with generic data from databases available in the LCA software: Ecoinvent, BUWAL250, IDEMAT 2001 and ETH-ESU 96.

Table 1: Materials in the pressure cooker

Material	**Weight (kg)**	**w/w (%)**
Stainless steel	2.027	73.1
Aluminium	0.352	12.7
Polymers	0.393	14.2
Product total	2.772	100.0
Packaging	0.469	
Total incl. packaging	3.241	

The LCA study covers all life cycle stages from cradle to grave, including resource extraction (e.g. iron ore, nickel and bauxite), raw materials transport to the production site, production process, distribution transport, use and end of life. The use scenario considered 520 hours of cooking, (30 minutes of functioning, 2 times per week over 10 years). Energy consumption of the cooking process and maintenance of the pressure cooker (replacement of valves and sealers) are included in the model, while washing of the pressure cooker and cooking water are excluded. The end-of-life of the materials includes waste management options such as recycling, landfilling and incineration.

The life cycle impact assessment (LCIA) was performed using the EPD (2013) V1.00 method (based on CML 2001 method) and the results are presented in figure 1.



Legend:	
Ac	Acidification (fate not included)
Eu	Eutrophication
GWP	Global warming (GWP100 years)
PO	Photochemical oxidation
ODP	Ozone layer depletion (ODP)
AD	Abiotic depletion
rCED	Renewable cumulative energy demand
nrCED	Non renewable cumulative energy demand

Figure 1: Results of the LCIA of the pressure cooker

The LCIA reveals that the use phase, specially the energy consumption of the cooking process, has the most significant impacts in all the analysed impact categories. In addition to that, the environmental impacts of the remaining stages are dominated by the use of stainless steel, and its constituent alloys of ferronickel and ferrochromium.

3. LIFE CYCLE COMMUNICATION

The tool used to communicate the environmental profile of the reference product was a simplified Environmental Product Declaration (EPD). According to ISO 14025:2006 [5], an EPD presents quantified environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. Such declarations are based on independently verified life cycle assessment (LCA), life cycle inventory analysis (LCI) or information modules in accordance with the ISO 14040 series of standards and, where relevant, additional environmental information.

Under the assumption that the availability of reliable environmental information about the product would be a marketing asset, especially in more environmentally demanding markets, the company performed various communication and dissemination activities regarding the EPD. Not only was the EPD communicated, but also an explanation of its contents to make the document understandable by non-environmental experts. Such activities consisted of:

- Posting the EPD in the company website together with explanatory information;
- Sending it by e-mail to some 100 clients together with explanatory information and a questionnaire;
- Presentation at phone meetings and in business fairs.

While there was no feedback mechanism related to the EPD information via the website, the company recorded and evaluated the customer response to the other communications. Few answers (28%) and little interest were reported, and there was some concern with cost increase due to the EPD. Two new foreign clients, however, showed commercial interest and engaged in negotiations, stating that the EPD was a positive differentiation point.

4. ECODESIGN PROJECT

The goal of the ecodesign project was to add value to products developed in the company, making them more eco-efficient throughout their life cycle.

The project intended also to link the process of product development with the environmental and quality management systems, in order to promote continuous eco-innovation and synergies between ecodesign and the existing management processes.

The target product was a pressure cooker as described in section 2, distributed at national and international levels (Europe, Brazil, Israel and USA). The targets set by the company at the beginning of the project were: to improve the ergonomic aspects, to be 100% recyclable, to reach new markets and not to exceed the production cost of the reference model.

The project team applied the Functional Analysis method [6,7] to define the functions that the product must fulfil to meet the needs of users and other stakeholders of the value chain. Those functions were subsequently prioritized and the relative cost of each one was assessed, generating a cost/function matrix in which the discrepancies between importance and costs were highlighted.

Besides the Functional Analysis and the life cycle assessment, a number of complementary ecodesign tools were applied in order to develop a new concept and specify it. Such tools included the LIDS Wheel [8], the MET Matrix [8] and Ecodesign Checklists [9,10].

For generating ideas and selecting the ecodesign strategies, a brainstorming session was conducted with the company's team. 64 ideas for improvement were generated, 39 of which were considered adequate for immediate application in the new product. Their further grouping and detailing has led to the following improvement options:

- Use: increase of the functioning pressure (and temperature) of the cooker in accordance with safety standards; more inclusive handling (through symmetrical locking for the left handed, versatility of closure, more intuitive closed/open function and easiness of pouring contents); reduced storage space; indication of the safety minimum and maximum contents levels;
- Materials: replacement of non-recyclable polymers by recyclable ones (the main challenge being the Bakelite® (phenol formaldehyde) handles); decrease of steel consumption through the reduction of the cooker's body thickness in compliance the safety standards;
- Packaging: reduction of packaging volume; 100% recycled packaging material;
- Production: body with matt finish to avoid the polishing process.

5. DISCUSSION AND CONCLUSIONS

This project illustrated a situation where the green marketing objectives of the company (in this case, to have a 100% recyclable product as a flagship) were put into context when the product's environmental profile was determined using a robust methodology such as a quantitative LCA. The study showed that the energy consumption in the use phase was by far more important than the issue of recyclability. Nevertheless, since there was no conflict between solutions for these issues, the design team could propose a concept encompassing these and other concerns through a combination of ecodesign tools and practices that went beyond the initial objectives of the company.

The LCA study had also the purpose of providing the information for the EPD. Not existing an EPD programme in Portugal (except for construction materials, recently launched [11]), the company lacked a formal recognition of the EPD. The main benefits were the internal raising of awareness and know-how on life cycle oriented environmental information, since the market research showing little interest in this environmental communication tool.

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