

Life Cycle Assessment of Products-Environmental Management Tool Study of Implementation in Romania

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In the introductory part of the thesis environmental problems generated by the development of the social and economic systems are presented, from global to local level, as well as concepts and tools of environmental management used to tackle these problems, followed by an exhaustive presentation of Life Cycle Assessment (evolution and present status as a result of the development of ISO-14040 series of standards).

The goal of the thesis is to contribute to the implementation of LCA in Romania. In order to achieve it, the following four case studies representing the main part of the thesis have been analysed:

1. Life Cycle Inventory Study of the production of electrical energy in Romania
2. Life Cycle Assessment Comparative Study of some alternatives for transport in Romania
3. Life Cycle Assessment Comparative Study of some alternatives for the production of thermal energy in Romania
4. Life Cycle Assessment Comparative Study of some alternatives for the production of edible oil in Europe

This precise order of the case studies was necessary because the results of the first case study have been used in the second, the results of first and second in the third and so on...

The first three case studies are related because they deal with the energy carriers of life cycles combined with power plant life cycles (first study), vehicle life cycles (second study) or thermal power plant life cycle (third study). In the fourth case study, on the one hand, the comparison is focused on the achievement of the product from two different plants (sun flower and soy bean), and, on the other hand, the influence of some different locations and some different technological levels (upgraded technology in comparison with an old technology). By the collection or processing of data for these four case studies and a special section dedicated to these LCA data, the thesis initiates the achievement of a LCA database for Romania.

In the three case studies, in which the Life Cycle Assessment is performed (the first case study is limited only to an Life Cycle Inventory representing, in conformity with ISO 14040 standard, an LCA without Life Cycle Impact Assessment), four of the best known methodologies for LCA have been used: Eco Indicator 95, Eco In-

dicator 99, EDIP and EPS. In order to use EDIP methodology, it was necessary to establish some normalization and weighting factors specific for Romania for the regional and local impact categories. For the other three methodologies, global normalization factors have been used (or the factors identified for these methodologies). The results of the application of the four methodologies have shown that LCA studies are replicable, repeatable and can be achieved without insurmountable difficulties.

The results of the four methodologies used in case studies are not identical, due to different characterization, normalization and weighting factors, or sometimes even some different impact categories for each of these methodologies. On the whole, the results show a good equivalence that confirm and increase their credibility.

The improvement of the environmental performance of the product/service can be achieved in two ways: a) by focusing on the most relevant step within the life cycle of a specific product (the comparison of unit processes within the life cycle of a product); b) stimulating environmental-friendly products with the promotion of better alternatives (comparison of products). Both these directions are approached in all the four case studies of the thesis establishing the alternative options that are producing the smallest interventions on the environment and the life cycle steps in which priority interventions are necessary for the reduction of these interventions. Thus, all the studies have shown, for the energy carriers' life cycles, that the emissions on the environment are predominant in the consumption (combustion) step. But the electrical vehicles from the second case study are more polluting than the other vehicles, because the production of electricity in Romania in the preconsumption phase is more pollutant than the processes of preconsumption and consumption of the other fuels.

Representing the first substantial contribution in the field of LCA in Romania, the thesis grounds the implementation of this environmental management technique in the country.

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