Environmental evaluation of companies. Identification of key elements

Jolliet, O., Della Croce, F. and Margni, M.
EPFL- Ecole Polytechnique Fédérale de Lausanne, Environmental Sciences and Technology ENAC-GECOS, CH-1015 Lausanne Switzerland. olivier.jolliet@epfl.ch, http://gecos.epfl.ch/lcsystems.

1. Abstract
The increasing pressure from governments, NGO's and the public opinion that companies have to face concerning their environmental performances, lead to the need for an effective and systematic methodology to rapidly assess company impacts and legal compliancy. This paper presents Green-e, a life-cycle assessment (LCA) based methodology aimed to become a standard within companies environmental analysis. The methodology allows to rapidly assess firms life-cycle impacts based on an integrated company-product approach that allows to capture direct as well as indirect burdens. It allows to switch from a company to a product perspective and to merge the two in order to capture a broadest range of impacts. Green-e has been translated into an Internet based tool, aimed to provide companies with quantified and reliable results without the usual excessive and time taking support, through a simple and clear interface and using most common readily available company data. The associated life-cycle costing helps companies to identify economically advantageous improvement opportunities. The tool also includes a legal compliancy module that enables companies to quickly analyse their legal responsibilities focusing on essential laws only. The present paper summarizes the main methodological features and illustrate it through the practical examples of a a pharmaceutical company.

2. Introduction
In recent years we have witnessed an increasing pressure, from governments, public opinion and the activities of NGOs for environmental protection. Several instruments have been introduced in the last decades as frames for the environmental improvement of products, services and companies: life-cycle assessment (LCA), life-cycle thinking (LCT), design for the environment, eco-labels, environmental management systems (EMS), environmental certifications (ISO 14001, EMAS) etc. A large consensus is taking place on the idea that any action toward environmental improvement must be supported by a life-cycle approach but at the same time LCA remains too complex and expensive. This is the reason why most of the time many of the mentioned environmental tools are supported by weak and qualitative diagnosis that are not able to identify real priorities for action. In addition to that LCA is commonly used and perceived as a tool for the environmental assessment of products, whereas an integrated company-product approach enables to consider an enlarged system, to identify a greater number of improvement opportunities and it can be applied both for companies certifications and products labeling. The following questions remain open:

1. How to assess the environmental impacts of a company or a product with a quantified and life-cycle oriented approach as required by most of the current environmental certifications and labeling processes?
2. How to do so following a clear and reproducible standard approach in a time-efficient way?
3. How to switch from a product perspective to a company perspective and vice versa?
4. How to take into account the related economic and legal aspects in order to identify the most economically advantageous improvement opportunities?

The Swiss Federal Institute of Technology (EPFL) through the EPFL Industrial Ecology and Life Cycle Group, and Ecointesys Consultants SA developed and tested a new life-cycle based methodology aimed to become a standard within companies environmental assessment.

3. Methodology
The tool is composed of four main modules, 1. CO_2 and primary energy, 2. impact of toxics 3. life cycle costing and 4. legal compliance

The environmental burdens modules (1 and 2) are based on an innovative approach that merges the strengths of life-cycle assessment (LCA) with a more company-oriented and comprehensive vision of firms environmental burdens. The methodology allows to rapidly assess firms life-cycle impacts and costs with an integrated company-product approach. It is possible to switch from a company to a product perspective and to merge the two in order to capture the broadest range of inputs and outputs (see next chapter for more details).

The environmental burdens and life cycle costing modules are based on a system composed of the following processes or life cycle steps (see figure 1): Suppliers of company inputs, company site processes, product use-phase and waste disposal

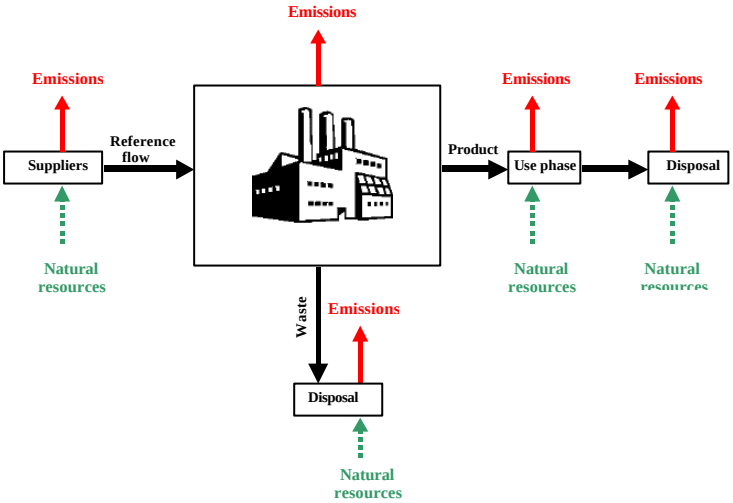

Figure 1. Green-e system

For each step, Green-e enables to quantify emissions and natural resources consumption indicators related to a wide range of what we may call "tangible" inputs and outputs (matter and energy). This is done based on state of the art databases and most common company data such as raw materials and energy inputs, transportation data, wastes etc. The mentioned databases are mostly composed of process LCA coefficients (impacts per unit of company inputs and outputs calculated using process LCA).

But how to asses the impacts of other "intangible" inputs such as legal services, banking, consultancy, research and development etc.? Green-e includes a section where it is possible to asses the impacts of those inputs based on the related company expenses and input-output life cycle assessment (IO-LCA). The IO-LCA is a method based on the monetary flows induced in the economy and through all the supply chain by a product, process or activity. It allows quantifying energy consumption and pollutant releases that are linked to these monetary transactions according to the sectors (industries) to which these transactions are related (Chris T. Hendrickson et al., 1998; Norris, 1996). Green-e offers the possibility to choose among 60 different services and to attribute company expenses to these services to assess the related environmental burdens based on IO-LCA.

Non-renewable primary energy consumption and CO_2 emissions have been chosen for the first indicators. Other criteria pollutants emissions are used as indicators for the toxic impacts and the DALY (Disability Adjusted Life Years) unit has been chosen for impact assessment (Murray et al. (1996).

The Green-e interface

The objective of this methodology assessment is to provide companies with a transparent and easy-to-use tool to be used without excessive support. The required data (flows of materials, energy, transportation, wastes and money) are entered by the user through a very simple and immediate interface divided into six modules, corresponding to the six life cycle steps mentioned above. It is possible to introduce an unlimited number of physical and monetary inputs, wastes, processes and products. For each additional entry a pop-up menu automatically appears.

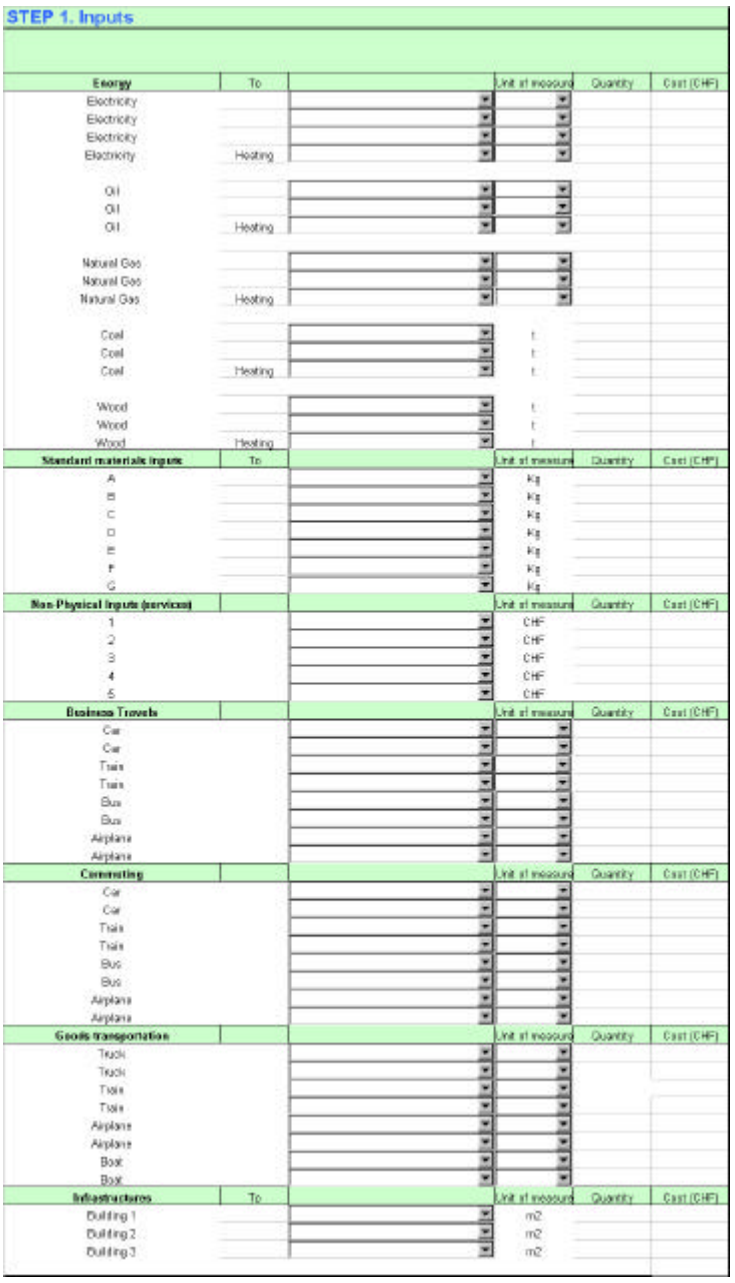

Figure 3. Green-e interface

Each pop menu guide the user through the arborescence of flow categories allowing to do consequent choices among different lists that lead to the final choice of an input or waste output (i.e.:energy -> electricity ->Swiss electricity mix; transportation ->persons transportation ->cars ->Swiss average diesel car etc.). It is also possible to choose the more suitable unit of measure for flows. Processes and products are defined by the user and additional rows are added automatically.

Figure 2 shows the Green-e interface. Green-e allows the user to instantly visualize the Process LCA, IO-LCA and Human Damage coefficients beside the results for each flow, in order to guaranty the maximum transparency.

For each of the company inputs and outputs, Green-e keeps track of the related expenses; while analyzing results, this economic information helps to find, among all the possible impact reductions options, those that also represent interesting financial economies. Nevertheless, further economic investigations have still to be done based on these preliminary considerations. The legal compliance module is based on a series of questions to which the user is asked to answer by yes or no. This allows companies to rapidly identify the key environmental laws that are of particular interest for their specific activities, avoiding expensive, time taking and useless legal investigations.

Applications and test: Case study of a pharmaceutical company

The methodology has been developed in collaboration with several industrial partners and successfully tested to a university, a public transportation company, a pharmaceutical company and others. The users found the tool extremely useful and clear, particularly those who had very little experience.

Green-e has been used to assess the environmental performances of a pharmaceutical company. Figure 3 shows non-renewable primary energy consumption, CO_2 emissions and expenses for the chosen set of processes. The use of the company financial accounts helped not forgetting important processes such as sales men travels, which turned to be a key aspect of the analysis, together with products packaging. The same graphic shows that these aspects are also characterized by high costs, and their minimisation automatically leads to significant financial economies. CO_2 emissions due to waste treatment are also significant; it is possible to “zoom” on a particular process to analyse it more in detail. The incineration of special chemical wastes (solvents) is responsible for most of the CO_2 emissions linked to waste treatment.

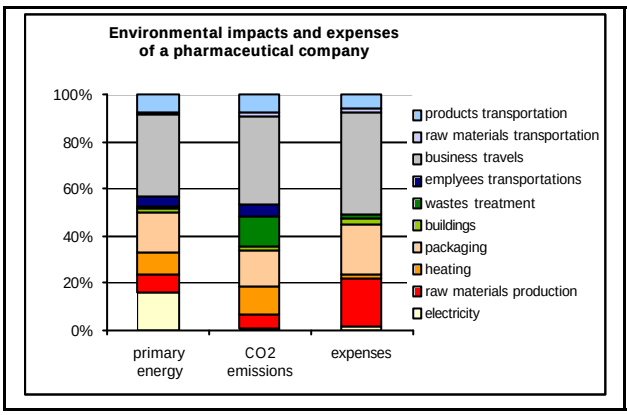

Figure 3. Environmental impacts and expenses of a pharmaceutical company

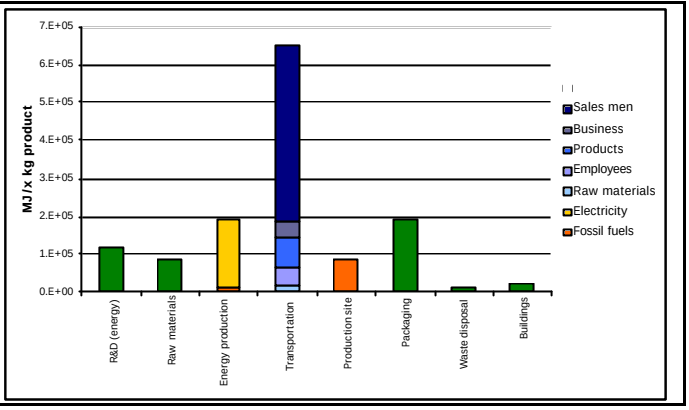

Figure 4. Primary energy consumption related to the life cycle steps

Green-e allows to set priorities for action. Classical input reductions such as paper and water economies are actually negligible in this particular case and the company is now able to concentrate on significant impacts and costs only.

Figure 4 shows the non-renewable primary energy consumption of the company according to the life cycle steps. This type of representation is also useful to show that most environmental impacts can occurs outside the company site and that a life cycle based analysis is necessary.

Conclusion

The proposed approach enables to identify the relevant company aspects in an environmental-financial interface and enables the decision maker to take the right decision with an efficient use of economic resources. Green-e has been successfully tested to some industrial partners in the public and private sectors giving reliable and reproducible results. The presented examples clearly showed that the reductions of impacts have to be considered outside the classical company boundaries and that decision-makers should realize that a consistent environmental management has to be based on a life cycle perspective. Not performing an analysis in a life cycle perspective could lead to an inefficient assessment and loss of credibility.

The innovative features of the Green-e methodology are the following:

1. It is adapted to the company needs (data availability, easy to use, clear results, no important support needed)
2. It is flexible (company but also product oriented, possibility to split the risults and to associate them to different processes or products, ISO 14001, EPR, IPP, labels)
3. It is based on a life -cycle approach (direct and indirect burdens as required by the mentioned tools)
4. It is a quantified methodology (same indicators for all the processes, ISO TR 14032)
5. It allows to capture the burdens of intangible inputs as services (IO-LCA)
6. It is able to takes into account the economic interests of the company together with the legal environment of the company (legal compliancy module, for a complete environmental assessment)