A web-based tool for efficient carbon footprint calculations: Lux screen CO2

Paula Hild[1,*], Mélanie Guiton[1], Julien Pieropan[1], Bianca Schmitt[1] and Enrico Benetto[1]

[1] Public Research Centre Henri Tudor (CRPHT) / Resource Centre for Environmental Technologies (CRTE), 66 rue de Luxembourg, PB 144, 4002 Esch-sur-Alzette, Luxembourg

*paula.hild@tudor.lu

Abstract Several commercial software tools for Life Cycle Assessment (LCA) are already available on the market and recently included ad-hoc extensions to calculate carbon footprints. Unfortunately, these software tools are often too complex and require too much specific expertise to be used by SMEs, consultants and others. For companies without any experience in the field of environmental assessment, the analysis of company related CO2 emissions within a regional context is often an impossible task. The presented easy-to-use CO2 screening tool, adapted to their needs, was designed to support these companies. The web-based tool, 'Lux screen CO2' is able to assess and report site related direct and indirect greenhouse gas emissions, including the whole supply chain of the company and food related impacts of the company restaurant.

1 Introduction

In April 2006, Luxembourg's government established the first action plan for the reduction of CO2 emissions at national level [1]. Different public actors were identified as responsible for the awareness raising, training of and giving advice to industries, SMEs and consultants in the field of environmental technologies, environmental assessment and renewable energies.

In October 2008, the Resource Centre for Environmental Technologies (CRTE) of the Public Research Centre Henri Tudor (CRPHT) launched with other partners the MyClimateLux project to inform companies and individuals about the CO2 emissions of their activities (e.g. mobility, energy consumption, food) and to provide the opportunity to compensate their greenhouse gas emissions (www.myclimatelux.lu). Two years of analysis of extended corporate environmental assessments within the framework of the project identified a high demand for a quick accounting tool for CO2 emissions that considers regional and

geographical characteristics (e.g. emission data). The lessons learned out of these corporate environmental assessments are presented in the first part of this paper. In the second part, a review of existing accounting tools for corporate and site related environmental assessments are discussed to develop the needs for an easy to use tool for non-experts in the field of Life Cycle Assessment (LCA). Then, the paper will describe in a third part the structure of the CO2 tool and will elaborate on the impact of its implementation in the Luxembourg context.

2 Feedback from corporate environmental assessments in Luxembourg

The past experiences in corporate environmental assessments showed that the quality of data provided by the company may drive to consequent opposite tendencies of the results. Figure 1 below shows the results from the corporate Carbon Footprints of two companies from the tertiary sector. For confidentiality issues, the companies are named A and B.

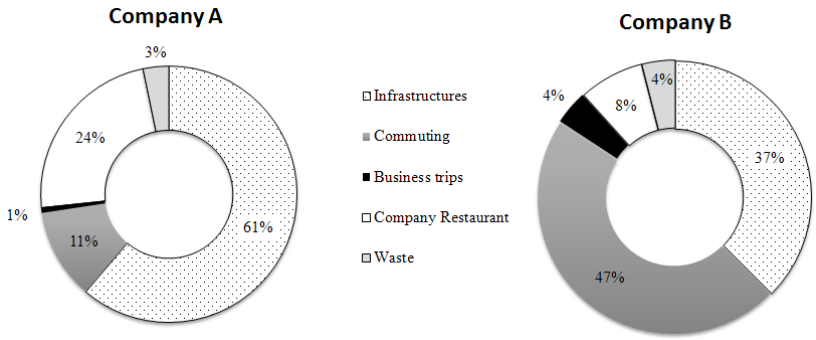

Figure 1: Corporate carbon footprint studies

The main differences between company A and B are coming from the daily transport of the employees (commuting: 11% Company A, 47% Company B), the energy consumption (infrastructures: 61% Company A, 37% Company B), and the food and beverage consumption (company restaurant: 24% Company A, 8% Company B). These differences are partly due to the quality of the input data, the Carbon Footprint (CF) from company A was mainly performed considering average consumption data, benchmark data, whereas the CF from Company B is based on company-specific figures. Additionally, in the case of the daily transport of employees, the location of the company and its connection to the public

transport system has an impact on the results. The relative contribution of the commuting is generally less important than the energy related emissions as it is the case e.g. for Company A. These activities account only for 11% to the total greenhouse gas (GHG) emissions, because nearly 40% of the employees come by foot, bicycle, bus or train to work. In the case of Company B, 47% of the total GHG emissions are due to commuting activities what reflects that more than 80% of the employees have to come by car to work because no public transport connections are available. In the case of Company A, the energy consumption of the infrastructure has with 61% a higher contribution to the total emissions than in the case of Company B (37%). In the tertiary sector, the energy consumption is generally the most important source of the corporate GHG emissions, or at least one of the most important. Finally, the contribution of food and beverage consumption related GHG emissions is in the case of Company A with 24% three times higher than for Company B (8%). For this category, it seems that the average data used by company A might be overestimated.

The concrete case study of two companies from the tertiary sector in Luxembourg demonstrates the importance of data quality in performing corporate environmental assessments. The contribution of the different activities to the total corporate GHG emissions can change substantially when the assessment is performed with company-specific figures (Company B) compared to average consumption data (Company A), by what the effectiveness of corporate CO2 reduction plans can be considerably reduced. The 'Lux screen CO2'-tool developed by the CRPHT is guiding the company through the corporate carbon footprint assessment, provides average corporate consumption data for Luxembourg as a proxy while at the same time encouraging the companies to collect company-specific data too.

3 Review of corporate carbon footprinting tools

Several commercial software solutions to conduct comprehensive LCA studies are available on the market (e.g. Simapro, GaBi, Umberto). They recently included plug-ins to calculate carbon footprints (assessment of CO2 and other greenhouse gas emissions). Unfortunately, the use of LCA software is not intuitive enough and demands high knowledge and expertise. For companies in Luxembourg without any expertise in the field of environmental assessment, the analysis of company related CO2 emissions within a regional context was not possible with the tools on the market.

Another commercial solution supporting the calculation of greenhouse gas emissions of organizations in compliance with ISO 14064 [2] is the 'Bilan Carbone®' developed by the French Agency for Energy Management and the Environment (Ademe). Methodological reports are freely available [3, 4], but the use of the excel tool is only allowed for trained practitioners. This means that companies interested in a first overview of their corporate GHG emissions do not have access to this tool. It seems that a stepwise approach would be more appropriate for companies which are getting started to develop competences in the field of activity related environmental impacts assessments. For these companies a web based tool like 'Lux screen CO2' may definitively be much user friendlier and easier to handle.

4 'Lux screen CO2'-tool description

In order to enable companies with an easy access to the tool, 'Lux screen CO2' is web based (see Figure 2).

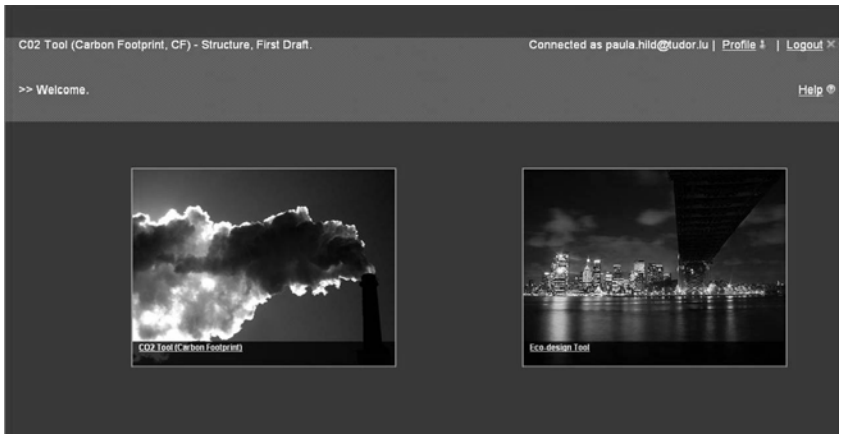

Figure 2: 'Lux screen CO2'-tool screenshot

In a first step, companies register themselves by entering few information concerning their identity and activity. From that step on the user can connect directly to the features of the tool through the identification window.
The aim of 'Lux screen CO2' is to allow users (independently to their expertise in the field) to easily perform a corporate Carbon Footprint. Providing average consumption data, the tool makes a first corporate assessment based on few input

data possible (e.g. the number of employees and the work space). Additionally, the data input phase is supported with explanatory and technical information (e.g. definitions, hints were to find the corresponding data in the company). Then, the results are directly displayed in graphs to visualize the contribution of the total GHG emissions over the different activities (e.g. infrastructures, commuting, business trips, waste).

The data required to perform the Carbon Footprint calculation are filled in by the user. Before the data input starts, the user is invited to give some general information about the scope (framework) and the goal of the study (the objectives intended to be achieved). The assessment of one or more sites can be differentiated, therefore the display of the results can be related to the whole company or for instance to one specific building (or production site) of the company. The user is guided through four different tabs in order to provide step by step the different input data necessary to calculate the direct and indirect GHG emissions related to the activities of the site or the company under study, for one reference year.

Figure 3: 'Lux screen CO2'-tool topics overview

The first tab (see Figure 3, tab 'Infrastructures') is related to the energy consumption of the building/site/company infrastructures, i.e. mainly heating and/or cooling of buildings, electricity consumption, and all the energy required by the production processes (in the case of a production site). The user enters for instance the total annual energy consumption for heating with respect to the fuel type (coal, gas, oil and electricity). The GHG emissions linked to the production and the combustion of these fuels are instantly calculated and are displayed to the user as "intermediate results" in numerical form, associated with a bar graph. The second tab (see Figure 3, tab 'Transports') is related to the energy consumption of the transport activities, differentiated in type and means of transportation. Therefore, it is possible to assess the GHG emissions due to the commuting of the employees, the business trips by bus, car, train, tramway or plane, and the company's car fleet. For each transport category, 'Lux screen CO2' asks for the average travel distance and the contribution by means of transportation. The third tab (see Figure 3, tab 'Restauration') is dedicated to the data related to the

consumption of food and beverages in the company restaurant. The annual consumption of the main food categories is required in kg. Finally the fourth tab (see Figure 3, tab 'Déchets') is related to the generation of waste with differentiation of paper, glass, and household waste streams. The tool automatically calculates with an average quantity of waste per employee and working day, and sets the annual GHG emissions related to the waste treatment.
Within the 'Lux screen CO2'-tool, the Carbon Footprint calculations are linked to the ecoinvent 2.2 database, using the IPCC 2007 valuation method for the data related to infrastructures, transport and waste treatment. Some of these data are specific to the Luxembourgish context. The factors related to food and beverage consumption are issued from the Danish LCA food database [5], further updated with ecoinvent 2.2 data.

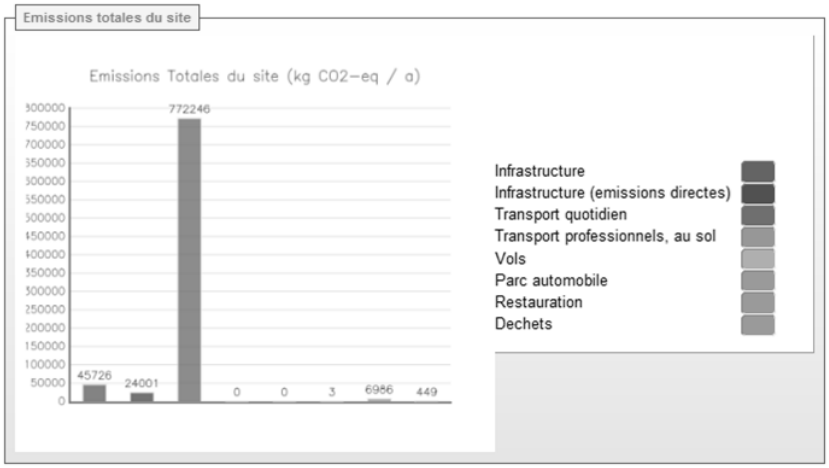

Figure 4: 'Lux screen CO2'-tool results presentation

Finally, the global results presentation can be performed in two ways. The first way provides the GHG emissions reported for each of the four sub-categories previously described (see Figure 4). The yearly GHG emissions are expressed in kg CO2 equivalents; each sub-category is represented by one bar. The second way displays the results following the ISO 14064-1:2006 standard, specifying principles and requirements for the quantification and reporting of greenhouse gas (GHG) emissions and removals, at the organization level. Three operational scopes are respected, and the 'Lux screen CO2'-tool displays the emissions sources related to each scope. Since companies are more and more confronted to this

standard, the results presentation in compliance with ISO 14064 can be very useful for benchmarking at national and international level.
The tool is able to detect inconsistency as well in the data entries as in the calculated GHG amounts. In the case of a wrong data entry, an error message invites the user to correct the entry, in the case of a data inconsistency; the user is advised to contact the expert team from CRPHT in order to get some support. In parallel an alert message is sent to the expert team.
The tool has been implemented with HTML (Hypertext Markup Language) and Javascript language. HTML allows to develop Web pages and Javascript is used to enrich the HTML functionalities, and to control the data entry in HTML forms. CSS (Cascading Style Sheets) language was used to define the design of the HTML document, such as the color definition, the typography, and the position of the elements.

5 Conclusions and further developments

Using the 'Lux screen CO2'-tool, the assessment of corporate GHG emissions can be performed with average consumption data or with company-specific figures. The final Carbon Footprint results are easy to interpret and are detailed enough to identify the hotspot activities of a company, site or building under study in terms of GHG emissions. These results should allow building an action plan for the company, in order to improve its corporate Carbon Footprint.
Further development of the tool includes: design improvements, the consideration of the whole supply chain, data import and export facilities, data storage, user profile management. Currently, in a first step, the selection of significant case studies is ongoing for testing the 'Lux screen CO2'-tool. Actually, the demand is high from companies selling environmental friendly products or offering green services, such it is the case for instance for building promoters and facility managing companies. In a second step, the assessment of the selected company sites regarding their GHG emissions will be done using the 'Lux screen CO2'-tool. It is foreseen that the companies will be supported in this testing phase by consultants. The aim of this approach is twofold: First, to promote the tool to a maximum of actors in Luxembourg (companies and independent consultants); second, to support the companies in establishing and implementing an action plan for the reduction of the corporate GHG emissions.

6 References

[1] Umweltministerium Luxemburg, *Nationaler Allokationsplan 2008-2012*, Gouvernement du Luxembourg, 2006.

[2] ISO, *Greenhouse Gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*, ISO, 2006.

[3] Ademe, *Methodological Guide (Version 5.0): Objectives and Principles for the Counting of Greenhouse Gas Emissions*, Ademe, 2007.

[4] Ademe, *Emission Factors Guide Version 5.0 Emission Factors Calculation and Bibliographical Sources Used*, Ademe, 2007.

[5] Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N, LCA food data base, 2003, www.lcafood.dk.