EeBGuide

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EeBGuide

Operational guidance for Life Cycle Assessment studies of the Energy Efficient Buildings Initiative

SEVENTH FRAMEWORK PROGRAMME

COORDINATION AND SUPPORT ACTION

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CO	Confidential, only for members of the consortium (incl. the Commission Services)	

SEVENTH FRAMEWORK PROGRAMME

E2B EI Energy Efficient Buildings

What is EeBGuide?

The European research project "EeBGuide" develops metrics and guidance for the preparation of Life Cycle Assessment (LCA) studies for energy-efficient buildings and building products. Ongoing research under the framework of the Energy Efficient Building European Initiative creates technologies for an energy-efficient Europe. LCA is used to assess the environmental benefits of new technologies. The EeBGuide manuals and guidance will support LCA practitioners to obtain comparative results in their work.

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Executive Summary

Operational guidance for Life Cycle Assessment studies of the Energy Efficient Buildings Initiative (EeBGuide) is a European Commission funded project aiming to produce expert guidance for conducting Life Cycle Assessment (LCA) studies for energy-efficient buildings and building products under the framework of Energy-efficient Building European Initiative (E2B EI). The EeBGuide guidance document will provide a common methodology supporting reliable assessment and comparison of new efficient buildings and products. It will support LCA practitioners in industry and research.

In order to ensure acceptance by LCA practitioners, the EeBGuide was developed with a strong focus on applicability. Therefore, different case studies were conducted: usual building product, EeB product, new buildings (simple and complex) and existing buildings. The results enabled to show the applicability of the EeBGuide.

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1. Introduction

For each case study, main findings and conclusions are reported.

2. Case study: common product

The guidance document for the application of LCA to a construction product provides specific guidelines and tools that supported the application of the European standard EN 15804 in an easy manner, as these guidelines explain in more detail how to deal with specific issues such as definition of RSL, scope, data and modelling and makes the documentation much easier. For example, the three levels of analysis (i.e. screening, simplified, complete) give practical examples on applications in the construction industry always within the EN 15804 framework, which is very useful to link a robust and complex standard with a real life example. Furthermore, the practitioner is oriented on the important aspects which permit to focus on what is relevant to each level of analysis, avoiding spending time on very detailed and irrelevant issues and enabling reviewers and readers to easily go into depth on particular LCA aspects and to understand what the possible limits of the analysis are.

It would have been desirable to read a shorter documentation as there is a lot of repetition within the Guidance Document that is also reflected in the templates. For the screening template there is a significant part which is not applicable; furthermore, the chart provided in the excel tool is too detailed when only assessing one module group (i.e. A, B, or C).

Both the guidance document and the templates lack of a data collection section where the data quality is assessed according to the ISO 14040 standards. The excel template provides an easy way to describe main relevant aspects of a construction product but it still doesn't provide anywhere a section on data quality assessment.

Something important mentioned in the EN 15804 which is not dealt within the EeBGuide is the selection of allocation methodology and how to define the End of Waste status for secondary materials and fuels. This is an important inconsistency with the standard and it affects the LCA results substantially for construction products. For results obtained within a case study, sensitivity analysis is a good possibility to gain deeper knowledge about what aspects influence the results. EeBGuide so far does not mention under which circumstances sensitivity analysis is important and what parameters should be varied in specific cases (e.g. allocation methodology).

All in all the practical application of EeBGuide eased the effort for conducting the case studies and ensured a consistent report according to the international standards due to the predefined documentation templates. It is recommended that more emphasis is placed on the project aim, goal & scope and data quality sections in the future updates of the Guidance Document; furthermore, the excel templates which

aid on filling in the word templates could be more concise and adaptable for the screening and simplified cases, and the stacked column charts for all cases could be benchmarked against the highest value or shown separately for the LCIA and the LCI indicators as the way they are now provides too much information making the interpretation difficult.

3. Case study: EeB product

For the case study of an energy-efficient product (window element with integrated solar thermal collector) the structure of EeBGuide was very helpful to quickly access the environmental impacts during the life cycle and the most important issues e.g. influence of including an absorber element. Especially the icons helped to find ones way through the guidance document. Also the classification into study types (Screening, Simplified and Complete product LCA study) eases the effort for defining the system boundaries. The regimentations of EeBGuide regarding energy produced on building side and the resulting credits for this made a consistent comparison between the different alternatives possible. The reporting templates also reduced the effort for documentation. Nevertheless, an even more simplified documentation for "Screening" and "Simplified" LCA studies seemed to be desirable. A simplified documentation would then not correspond to the documentation requirements of ISO 14040/14044, but intermediate project reports in very early project phases would be easier to generate out of simplified reporting templates. The focus of the reporting templates is given especially to data, data quality and databases. Often the LCA practitioner does not have any influence on data quality and the choice of different data sets, but has to take LCA data sets that are available. Also the information regarding quality of data is rarely provided by database owners. Therefor it is sometimes not feasible for the LCA practitioners to document this information to the same extend as EeBGuide would require it. Also most of the LCA data used so far do not split up into the lifecycle stages according to EN 15804 and EN 15978. Especially for End-of-Life datasets no distinction between module C and D information can be provided. Mostly aggregated data sets, which include both life cycle stages are available. This fact increases the time spent for adaption of the reporting templates. For result obtained within a case study, sensitivity analysis is a good possibility to gain deeper knowledge about what aspects influence the results. EeBGuide so far does not mention under which circumstances sensitivity analysis is important and what parameters should be varied in specific cases (e.g. allocation methodology).

Generally with regard to studies within the framework of the E2B Initiative it would have been nice to even more fix some of the methodologies (e.g. application of landuse or human toxicity) and not to give the freedom of choice. On the other hand EeBGuide should not try to anticipate upcoming standardization work. This contradiction should be expressed more severe.

All in all the practical application of EeBGuide showed ease of effort for conducting the case study and ensured a consistent report according to the international

standards due to the predefined documentation templates. In order to meet the outcomes of future standardization work EeBGuide should be updated from time to time and new findings from other case studies (e.g. "Complete assessments") should also be implemented.

4. Case study: new buildings

The guidance document for the application of LCA to new buildings provides specific provisions that have been useful for particular aspects of LCA application. For example, in the view of doing the life cycle inventory analysis of buildings, the assessment of energy and water use in the use phase (module B) is strongly influenced by assumptions related to scenario of use (i.e. scenario of occupancy, occupant behaviour, etc.). Regarding this aspect, the operational guidance provides practical rules regarding the scope of the study (i.e. new or refurbishment) and regarding the expected level of precision of the analysis (i.e. screening, simplified, complete). The practitioner is then oriented to important aspects and permits to focus on relevant issues (i.e. issues that strongly influence the way of doing the LCA and therefore the conclusions of building analysis). This aspect is very important in the context of the dissemination of LCA tools and methods in practice.

From a general point of view, provisions of general aspects have permitted to structure the following LCA performing issues through a practical way:

- The definition of context and objectives of the study: What is the level of precision expected for the analysis (i.e. screening, simplified, complete) and how is it translated in fact?
- The definition of scope and system boundaries for the study: Which contributor is recommended to be included into the analysis and how is it shall be assessed?

It is also important to notice that the main assumptions used to perform the study (data and scenario for each module) are given in relation to the description of aspects of the building guidance. This enables reviewers and readers to easily go into depth on particular LCA aspects and to understand what are the possible limits of the analysis.

Concerning provisions of EeBGuide for the interpretation of results, the use of a contribution analysis has allowed understanding the weight of building process and element to total impacts. For the considered case study (simple building) this approach has permitted to estimate the margin of improvement for specific contributors and considered indicators (i.e. for indicator GWP, one of the main levers for the building in term of diminution of impacts appeared to be the contributor products and equipment).

5. Case study: existing buildings

The guidance document has helped to identify which modules of the life cycle of the existing building should or should not be included in the system boundaries. According to the guide, for an existing building, the system boundary should include all stages representing the remaining service life and the end of life stage of the building. Therefore, in both case studies the module B5 (refurbishment) and B6 (operational energy use) were included in the system boundaries. In addition, the end of life stage was included in the case where GaBi software was used, as currently Elodie does not allow to including such modules. When end of life processes were included, only those materials added during the refurbishment were studied, as the existing ones i) belong to the previous cycle of the existing building and ii) a complete list of materials was not available (in terms of quantity and typology of materials used in the construction of the building).

Taking into account this limited system boundaries, the results of both studies were expected (i.e. the use phase had a larger environmental impact that the end of life). So, in the case of existing buildings, LCA could be more useful when comparing different refurbishment options, for example, different types or amounts of insulation materials. In that sense, some processes and even modules could be omitted when not influencing the comparability of the different options (as, for instance, the water consumption of the building if the refurbishment will not affect it). According to the experience gained with these case studies, "simplified" LCA studies, if "complete" are not feasible, can provide sufficient reliability.

In that context, a simplified LCA study allows identifying the outcomes, in terms of environmental impact, of refurbishment works. In addition, it may help to compare different construction options and select those with a best benefit/cost ratio. So, LCA may be useful in decision making process, combined with other tools providing information about the economic and social benefits of the operation.

6. Conclusions

These case studies enabled to apply the guidance document on real-world case studies at both product and building levels. The current version of the EeBGuide provides a very useful document to help practitioners in the different stages of their LCA studies. However, some shortcomings are still presents due to the short timeline of the project (1 year). It would be very beneficial to have a revised document later on accounting for the feedbacks from case studies. Another important aspect is also to adaptation of recommendations for product LCA and building LCA. So far, some aspects are not differentiated and lack in providing a detailed guidance adapted to product LCA or building LCA.