

Integration of simple LCA into complex systems: the CaSIE² project

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1. Introduction

Recent scientific, technical and normative works insist on the relevance of life cycle assessment (LCA) as a methodology to evaluate the environmental performance of buildings. Therefore, LCA is recognized today as a main tool to perform the environmental analyses of the materials, equipment and buildings levels. Though, those systems are complex by nature. They interlock and overlap with one another, making any evaluation a long and fastidious task.

In order to allow a better diffusion of the LCA practices, the building sector have to adapt and to acquire operational decision-making LCA tools, such as the EeBGuide[1] that can be used by all actors while reducing the complexity and amount of work required.

This presentation focuses on the first step of the CaSIE² project and aims at identifying and describing the main issues faced when dealing with the integration of heating, ventilating and air conditioning (HVAC) and electric and electronic equipment (EEE) within building complex systems.

2. Presentation of the CaSIE² project

The CaSIE² project has been launched by the ADEME (French environmental agency) and is led by the CSTB (building sector scientific and technical centre), Bureau Veritas CODDE (LCA consultancy), UNICLIMA and IGNES (professional syndicates). Its goal is to provide a simplified environmental impact calculator for equipment systems, which is able to perform LCA on buildings level. This study will be supported by the ELODIE and EIME software. This tool will be used by the building sector to calculate, decide and communicate on the environmental aspects of their materials, buildings and equipment. Ultimately, it will lead to global optimization of building systems (energy and environment) and provide a decision-aid to define coherent environmental policies towards the definition of energy plus building French regulations.

3. Identification and description of the main issues

In order to achieve this goal, some issues need to be solved. One of the main aspects to deal with is related to the HVAC and EEE. Their integration within building systems is confronted to multiple issues: lack of reliable and compatible data on some equipment, characterisation methods and perimeter compatibility issues, and a reduced accessibility to information about system dimensioning (quantity of nature of installed equipment within a complex system).

3.1. Lack of reliable, compatible data

The HQE performance experiment of 2011 and 2012[2] showed that for many equipment, the accessible data are not meeting the required quality standards for a correct environmental evaluation of building systems. The table 1 below sums the main issues encountered:

<i>Equipment</i>	<i>HVAC</i>	<i>Sanitary installations</i>	<i>Power and communication electrical network</i>	<i>Building and people safety</i>	<i>Lightning</i>	<i>Lift and other indoors transport devices</i>	<i>Local electricity production equipment</i>
<i>Perimeter consistency</i>	Appr.	Appr.	Appr.	Not meeting quality	Not meeting quality	Appr.	Appr.

				standards	standards		
<i>Quantitative types</i>	Project specific	Project specific	Project specific	Rather project specific	Generic	Project specific	Project specific
<i>Environmental data type</i>	Specific	Specific	Specific	Generic	No data	Specific	Generic
<i>Environmental data/quantitative association</i>	Rather coherent	Rather coherent	Rather coherent	No coherent data	No coherent data	Rather coherent	Rather coherent

Table 1: Comparison of equipment data quality

3.2. Methodology compatibility

The recent normative evolution in the European background (EN 15804[3] and EN 15978[4] standards) aims at harmonizing the LCA practice in the building sector in order to quantify the environmental impact of buildings. Though, building materials and electric equipment come from different backgrounds (in France, FDES[5] and PEP ecopassport®[6]). Each of them has had a different purpose and is adapting to EN 15804 standard at a different rate (through the DHUP directive[7] and the XP C08-100[8]). The CaSIE² project determines if, and how, these methodologies can be compatible within a same system.

3.3. Reduced accessibility to information about system dimensioning

When assessing complex building systems, the determination of interdependence between the different equipment is crucial. This part highlights the difficulties related to the definition of the HVAC and EEE dimensioning, based on the category of building (individual houses, apartments or offices). This dimensioning is important as it defines the required material, equipment and energy use for a system, and therefore has a major impact on the environmental results.

As an example, the heating system dimensioning is conditioned by the thermal insulation, windows and openings, positioning relatively to the sun, geographical location, climatic conditions, artificial lightning, etc. Some expert rules for HVAC systems sizing have been concatenate into an automatic sizing module SIMBAD Building and HVAC toolbox. [9][10]

4. Conclusion

This preliminary work has enlightened the issues encountered when integrating equipment LCA to assess the complex systems of building. It paves the way to the definition of the requirements for establishing a simple and coherent LCA tool specialized for the building systems.

5. References

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- [3] EN 15804:2012. Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- [4] EN 15978:2012. Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method
- [5] XP P01-64/CN Qualité environnementale des produits de construction - Déclaration environnementale et sanitaire des produits de construction
- [6] PEP ecopassport®. 2011. General Instructions of the PEP ecopassport PROGRAM. Product Environmental Profile For Electrical, electronic and HVAC-R equipments
- [7] XP P01-064:2014. Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction - National addition to NF EN 15804+A1
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