SETAC 18th LCA
Case Study Symposium

4th NorLCA Symposium

Sustainability Assessment in the 21st century
Tools, Trends & Applications

Monday, Posters, RS-03

19:00 - 21:30	Monday, 26 November	Poster Area
RS-03: LCA of energy systems		
Life cycle assessment and geographical dependence study of the environmental impact of a 222kWp gridconnected CdTe photovoltaic system. *Serrano, SL*		MPRS03-01
Comparative life cycle assessment of three battery types. *Koroneos, J*		MPRS03-02
Towards sustainability in new energy technologies: Challenges and method of environmental impacts and costs assessments through CEA's batteries assessment case studies. *Naveaux, E*		MPRS03-03

Monday, Posters, RS-04

19:00 - 21:30	Monday, 26 November	Poster Area
RS-04: Non-carbon footprints		
Water footprint accounting to support raw material selection: The case study of a paper company. *Niero, M*		MPRS04-01
Calculating pesticide emissions for chemical footprinting of kiwifruit. *Dijkman, TJ*		MPRS04-02
Assessing environmental sustainability in architecture through embodied energy ande ecological footprint analysis. *Cerutti, AK*		MPRS04-03
A comparison between environmental indicators. Qualitative analysis and educational aspects in a perspective of environmental sustainability. *Cerutti, AK*		MPRS04-04
Nitrogen footprint vs. LCIA methods - analysis of environmental impact assessment methods from a nitrogen perspective and comparison with the emerging nitrogen footprint concept. *Skenhall, SA*		MPRS04-05

Monday, Posters, RS-05

19:00 - 21:30	Monday, 26 November	Poster Area
RS-05: Life cycle management and stakeholder involvment		
Active co-operation on comparable carbon footprinting in Finnish food sector. *Pulkkinen, IM*		MPRS05-01
Bridging the gap between the sustainability pillars. *Ekvall, T*		MPRS05-02

energetic performance in the wood house with 3326 GJ versus 5801 GJ used by concrete house. Regarding the EF, concrete house consumes 89,9 gha versus 146,8 gha used by a wood house. In this case we have opposite results. Indeed, in order to calculate the EF, we have to consider the impact of all the organic material used. The biggest impact is the one of glue laminated timber buildings, which is much bigger than concrete or brick buildings. The reason is because non-renewable construction materials must be evaluated just for their 'energy land' impact, not for the 'forest'.

In the second study case we analyzed the use of X-lam in construction using both indicators. In this case we evaluated the ecological impact of every phase of the construction process. The result of this suggestion was compared with the results of our first study case in order to evaluate the accuracy of the simplifications used at the building scale. From this investigation we see that the EE of one single X-lam panel rises by 25,9%, otherwise the EF grows up to 15.9 % compared with the one calculated at building scale. Through the direct investigation of these indicators several remarks may be highlighted. First the value of these results together with other architectural indicators, picking the ability of building reading out. Although scenarios are based on experimental data and not on-site surveys, it is possible to assess environmental performance of the considered construction method and to simulate scenarios with the changing of the way to build our houses and cities. Our results confirm that environmental assessment methods are becoming a fundamental tools in the hand of the planner.

MPRS04-04

A comparison between environmental indicators. Qualitative analysis and educational aspects in a perspective of environmental sustainability

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The current situation of exploitation of resources exceeds the regenerative capacity of nature, putting us in a state of 'overshoot '.

The socio-economic metabolism express complex relations between human activities and natural systems: to represent this relationship, and how much nature we are 'consuming', we use the environmental accounting.

Life cycle thinking is becoming a keystone of environmental studies, nevertheless LCA results may be difficult to be understood by non-experts. LCA analyzes the overall impact and takes into consideration a lot of data, that could be simplified through the use of environmental indicators which measure environmental performance of products and processes. In this work we used:

the material flow analysis (MFA), which measures the physical exchanges (in tons) between anthroposphere and environment, activated during the process;

the ecological footprint (EF), which calculates the area of land and water ecosystems required to produce, in a sustainable manner, and to absorb all the resources, always in a sustainable manner, all the emissions generated by a system;

the water footprint (WF), which measures the total volume of used and polluted water useful to produce goods and services;

the carbon footprint (CF), which measures the total amount of greenhouse gas emissions caused directly and indirectly by anthropogenic activity or accumulated during the life of a product;

the eMergy, which expresses all the amount of energy (with only one value, called eMergy value) used, directly or indirectly, to produce a good or a service.

We considered two case studies: in the first we tested with environmental indicators the production of meat for food; it was possible to clarify which aspects of the supply chain could be quantified with the various indicators and how. It became evident, although no quantitative analyzes, environmental impact generated by the production of meat. We tried to imagine alternative scenarios by considering alternative supply chains to evaluate if the results could vary positively with better values of indicators (obtaining, for example, lower values of EF).

In the second case, we developed a pattern of educational program (focused on the production of military aircraft) to highlight - through the use of the tools described above - as issues like the aircraft production are only apparently unrelated to environmental issues. Thanks to the arguments of LCA we were able to estimate the extent of environmental impact on the production of a fighter jet, highlighting how any type of product is related with the environment in at least one phase of its lifecycle, impacting on the nature in a more or less consistent way.

Finally, we identified some aspects of nature that the use of indicators neglects or underestimates: the loss of biodiversity, the greenhouse gas effect, the change of use of land. This analysis allowed us to highlight that only a truly interdisciplinary approach can provide insights on these issues: indicators individually can only highlight some aspects of environmental problems, while a multiplicity of perspectives can address them more adequately, taking into account their complexity.

Finals results are that it is possible to build training projects, designed to show the complexity of reasoning on sustainability, which would allow users of such training to enhance their look into the complex issues related to socio-economic systems.

MPRS04-05

Nitrogen footprint vs. LCIA methods - analysis of environmental impact assessment methods from a nitrogen perspective and comparison with the emerging nitrogen footprint concept

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Nitrogen is part of several reactive substances that have environmental effects when emitted to water and air, such as eutrophication, acidification and photochemical ozone creation. These effects have not received much attention in the recent environmental debate; instead the focus has been on carbon. However, due to the diversity of nitrogen substances created in society, the range of environmental impacts they cause, and the severity of these impacts, nitrogen is once again starting to rise as an important topic in the scientific discourse.

Nitrogen footprint is a newly introduced concept among the environmental footprints. It strives to account for the total nitrogen released during the life cycle of a product or similar. In life cycle impact assessment (LCIA) methods, nitrogen substances are assessed among other substances in several impact categories. The Nitrogen footprint method and the LCIA methods from CML 2001 for Global warming, Eutrophication, Acidification, Photochemical ozone formation and Stratospheric ozone depletion, were analyzed in a case study of Swedish tomatoes grown in greenhouses. The methods were compared and evaluated with regard to how nitrogen species are assessed in the impact categories.

The Nitrogen footprint method does so far not distinguish between different nitrogen species or their potential environmental severity, but recalculates into elemental nitrogen. Therefore the environmental impacts can currently not be identified with this method. The LCIA methods analyzed are more comprehensive as they recognize the environmental impacts induced by different nitrogen species by identifying scientifically derived factors, thereby giving a more comprehensive description of the spectra of impacts. However, it became evident during the study that the LCIA method Stratospheric ozone depletion, does not recognize nitrous oxide (N2O) as an ozone-depleting substance. It was also identified that the assumptions regarding synergies and influences from non-nitrogen substances, and their concentration, to derive the factors in the category Photochemical ozone creation, are coarse and would need refinement to sufficiently describe the potential impact from nitrogen substances.

The Nitrogen footprint concept applied in a broader perspective could be used as a tool to communicate and raise awareness in society of the importance of nitrogen. If the footprint method included environmental impacts from nitrogen emissions, it could be a complement to LCA studies. Conclusively, the Nitrogen footprint could be valuable in bringing the nitrogen perspective back into the environment and climate debates, as well as be used for improving the nitrogen assessment in LCIA methods.