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

MPRS04-02

Calculating pesticide emissions for chemical footprinting of kiwifruit

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Carbon and water footprints for kiwifruit production in New Zealand have recently been published. Aiming to obtain a more comprehensive overview on the sustainability of kiwifruit production, a pesticide footprint is currently under development. Contributing to the development of the pesticide footprint, pesticide emissions from kiwifruit orchards have been modeled using PestLCI 2.0 and Ecoinvent, and subsequently characterized using USEtox in order to calculate their potential human toxicity and freshwater ecotoxicity impacts. The research presented here focused on the spatial variations of emissions and impacts.

PestLCI 2.0 is a Life Cycle Inventory model to estimate pesticide emissions from the technosphere, which was defined as the orchard, to air, surface water and groundwater. In the Ecoinvent approach, it is assumed that all pesticide applied is emitted to the agricultural soil.

The Bay of Plenty (BOP) district is the heart of New Zealand's kiwifruit production. Within the BOP, four climatic regions and four dominant soil types were identified. Combining climate and soil data yielded nine realistic PestLCI scenarios under which kiwifruits are produced. Using these nine scenarios, emissions were calculated for the ten compounds used in kiwifruit production according to the growers' spray logs.

Emissions and impacts calculated with the Ecoinvent approach did not show any spatial variation due to the modeling approach. In contrast, the emissions calculated with PestLCI 2.0 showed limited spatial dependence, but the variations were usually no more than an order of magnitude. Emissions to air were virtually spatially independent because wind drift emissions, the main source of emissions to air, are climate-independent in the PestLCI 2.0 modeling approach. For surface water emissions, dependence was dominated by soil type. For groundwater emissions, the largest variations were attributed to climatic circumstances. The applied characterization factors were not location-dependent. Therefore the same variations observed in the emissions were also found for the potential human toxicity impacts.

MPRS04-03

Assessing environmental sustainability in architecture through embodied energy and ecological footprint analysis

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Several product categories have tried to reinvent themselves molding by the concept of environmental sustainability. Recently the disciplines of Architecture and Building construction were influenced by such ideas and they both have welcomed the environmental sustainability. Nevertheless, it is helpful to proceed with caution in every phase of changing, to prevent that the situation becomes more problematic than the real problem. This is the reason why a lot of environmental sustainability indicators, able to monitor and to show the way to follow to go toward the process, were defined. In the framework of environmental sustainability assessment, Embodied Energy (EE) and Ecological Footprint (EF) have recently applied in Architecture. In this work we tried to explain the potential and the limit of their working method. The main objects are: a) to compare two different typologies of buildings to understand which are the differences in results; b) to show the advantages and disadvantages of using the two indicators, considering the best way to perform the assessment.

Two study cases are analyzed in this work: the first approaches the ecological evaluation, using the EE and the EF, on two different buildings: a) a single family residential welling, built with concrete and bricks, b) a single family residential welling, built with laminar wood system (X-lam). The analysis has tried to pick the difference of environmental impact of the construction out, estimating the consumption of energy and raw materials using in the production of every single piece of the welling shown. The result of EE shows a better

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