Advancements in life cycle impact assessment and footprint method development

Tomas Rydberg

May 9, 8:35 - 12:45, Hall 100

In recent years, several footprint concepts have been developed and the environmental footprints concept has obtained an increasing interest by both the scientific and political communities. This session gives a platform for impact characterization frameworks and models showing latest developments in typical and new impact categories and impact assessment frameworks, both for mid-point or end-point approaches. Progress in frameworks, models and case studies that allow for the integrated assessment of impacts on humans and/or ecosystems are welcome, especially if mutual learning, capitalisation of knowledge and interaction between the approaches taken in LCA and other field (e.g. RA) are presented. The goal of this session is to present original papers which address impact assessment modelling, enhancing the methodology for assessing impacts at midpoint or endpoint and highlighting research needs towards increased robustness and comprehensiveness.

Increasing the relevance of toxicity assessment in LCA: in the need for a cross fertilization between RA and LCA

Erwan Saouter, Joane Cettier, Peter Fantke, Quentin de Hults

May 11, 8:35 - 12:45, Hall 100

The need to address the impact of the thousands of man-made chemicals that are released every day all over the world on natural ecosystems and human population calls for further methodological development in different science-policy fields. Few decades ago, the solution to pollution was dilution. Nevertheless, due to economic and population growth, ecosystems and people are exposed every day to multiple chemical stressors via multiple pathways and routes. Human and Environmental Risk Assessment (HERA) and Life Cycle Assessment (LCA) are two complementary science-policy fields that address chemical impacts on the environment and humans to answer different questions. While HERA focuses on the determination of the acceptable level of chemicals in the various environmental compartments and food items, the impact assessment phase of LCA aims at characterizing potential impacts on human health and the environment attributable to chemical emissions over the life cycle of products or services. HERA works on one or multiple chemicals and one specific site at a time to establish safe levels; LCA deals with hundreds to thousands of chemicals from multiple sources to determine best-in-class solutions. In order to cope with the high number of chemicals, their potential interactions with biological organisms and with each other, new LCA impact assessment method developments are required to improve the meaningfulness of the assessment of chemical emissions taking into account different mode of actions, different routes of exposure, different end points (endocrine disruptors, etc.), tailored toward meeting the different scopes, spatiotemporal resolutions and data constraint in HERA and LCA. Submissions proposing new approaches of addressing, in LCA context, the complexity of chemical interactions with the natural environment and human are welcome.

Input/output and Hybrid Life Cycle Assessment for supporting the assessment of production and consumption patterns

Michele De Rosa, Jannick Hoejrup Schmidt

May 8, 11:05 - 12:45, Hall 100

A process-based LCA of products or services relies on a bottom-up inventory data collection: this is expensive and time-consuming, because data have to be collected for each process in the life cycle, and provides an incomplete picture of the product systems, because of cut-offs limit the inventory data collection to an incomplete system with predefined boundaries. An alternative approach is a hybrid approach, merging process-based LCA with economic Input/output (IO) databases. IO databases have the advantage to cover the complete economy: data on economic transactions and environmental extensions are consistently collected for all industries in the economy. A Hybrid analysis allows benefiting simultaneously from the high level of completeness (no cut-off) from the IO data and from the high level of detail from the process-based data. Since 2003, SETAC and the broader LCA community have dedicated increasing attention to this methodology but progresses have been slow due to several reason, e.g. i) the heterogeneity between national IO models and the consequent low geographical coverage of the hybrid unit IO models available (FORWAST, US IO-database), ii) an initial knowledge gap between the two scientific fields of LCA and economic models, and iii) a strong tradition in using the process based LCA approach. Recently, the construction of new Multi-Regional IO (MRIO) databases has provided more details on products and industries with a better geographical coverage (e.g. EXIOBASE, the World Input-Output database and GTAP), while largely improving the homogeneity of data. IO databases have been developed in 'hybrid units', i.e. not only monetary units, bringing them closer to traditional process-based data: units of tangible product and waste flows are given in kg and MJ (FORWAST and EXIOBASE). These developments have opened considerable opportunities to Hybrid LCA. In this session, we invite contributions on the integration of industry or process-based data into macroeconomic IO databases that may, for example: 1) Present methodological advancement in Hybrid LCA methodologies (e.g. tiered or embedded approaches); 2) Discuss the opportunities for future LCA applications; 3) Present case-studies based on Hybrid LCA modelling, applied to environmental or socio-economic analyses; 4) Illustrate examples on how to link IO data with other data, such as biodiversity, surveys or GIS data, for LCA analyses; 5) Discuss the uncertainty arising when linking such multiple data sources through sensitivity analyses and the uncertainties introduced by necessary methodological assumptions.

LCA for supporting policy and decision making

Serenella Sala, Marco Cinelli, Paolo Masoni

May 10, 11:05 - 12:45, Hall 100

Sustainability is a multi-dimensional concept, which involves different areas (economic, environmental and social), normative positions, and empirical knowledge. Environmental, economic and social aspects of the society interact in a complex pattern. The cultural, social, political and regulatory contexts affect the assessment of these interactions. Life cycle thinking (LCT) and LCA have a high potential to be used more extensively in supporting policy making, from problem definition up to policy impact assessment and policy implementation. However, when the object of the assessment is moving from products and service to systems and macro-scale, several improvements are needed in order to benefit the most from the LCA application. This require to reflect upon current and future challenges for LCA within the policy domain. The session on LCA and policy builds on this reasoning and aim at providing an overview of the current challenges for a wider adoption of Life Cycle Thinking and LCA in the policy context. Suitable frameworks, methods, and tools for system analysis are need to properly develop sustainable policies on, e.g., bioeconomy, circular economy and resource efficiency, sustainable production and consumption, ecoinnovation etc , policy makers require integrated assessments of current and potential future policies. This session aims at presenting and discussing the role of LCA, LCSA and other methodologies for support of policy development at different scale, from local to country and European level. Which developments are needed to address such complexities? Which indicators? Which targets should be considered? How can scenario modeling further structure the analysis? How results could be presented in order to be comprehensible? We invite contributions that show how LCA could be used for policy support at different scales, what approaches are available for deepening of the analysis, what important aspects cannot be accounted for and, thus, what is needed to better address mechanisms in the analysis, especially in light of inclusion of economic and social aspects. Methodological developments and case studies related to sustainability assessment of policies and systems using life cycle approaches are the main focus. However, we also welcome comparative analyses on how different assessment tools may relate to each other and could be combined with LCA.

LCA of territorial contexts: upscaling the Life Cycle Thinking to business clusters, neighborhoods, urban agglomerations and territorial entities

Nadia Mirabella, Karen Allacker, Serenella Sala

May 8, 14:20 - 16:00, Hall 100

Life Cycle Assessment methodology is a constantly evolving method, which is enlarging its context of application moving from the environmental performance of products and services up to organizations and more complex systems. In fact, besides organizations, larger and complex systems exist and may need a likewise systematic and rigorous analysis adopting life cycle thinking. Territorial entities are a dense reality, they host several hundreds or even thousands of people in small areas. They represent a condense entity with huge amounts of energy, materials, water and wastes which form an intricate input and output network of fluxes whose share of environmental impacts is evident. Insight in these impacts are an important step to evolve towards a more sustainable entity, but is still at its early stage. As LCA is recognized as the most comprehensive method to evaluate the environmental burdens, a further step in order to enlarge the current scope of evaluations is highly desirable. For this reason, territorial LCA studies are increasing in number in the last years as robust methodology for the optimization of resources, reduction of environmental impacts (both direct and indirect) and, ultimately, as support to policy making. The aim of this session is sharing new practices, case studies and methodological developments in the field of LCA for territorial contexts, including all applications related to LCA studies and their integration in the urban metabolism concept, combining LCA and planning tools. The latter for instance can be used to support and improve the data collection and management when applying LCA in territorial contexts. The following topics are therefore encouraged and welcomed in this session: o LCA studies of wide-ranging systems, such as communities, neighborhoods, cities, urban agglomeration and even larger territories. o Integration of LCA with other top-down approaches for territorial contexts, namely Urban Metabolism, Material Flow Analysis, Environmental Input-Output Tables, etc. o Use of the LCA methodology in support of land use and planning policies o LCAs combined with land planning tools such as GIS, BIM, remote sensing, etc. which support the inventory phase o LCAs regarding case studies of industrial symbiosis, circular economy and other large business organizations experiences for environmental efficiency and optimization of resources and the reduction of environmental burdens.

Life Cycle Data and Modeling Developments: challenges and solutions

Simone Fazio, Bruce Vigon, Alessandra Zamagni

May 8, 8:35 - 10:15, Hall 100

Much is happening to mainstream life cycle approaches these days. Given the criticality of well characterized, accurate, and relevant data that are readily exchangeable and interoperable across the globe, this session aims to present the range of ongoing research, development, and applications to support practitioners and decision makers. Included in the session topics are forums and working activities around making data sharable in the international and national arenas from a guidance and standardization perspective. Also included are recent developments in making data public, data review procedures and criteria, nomenclature and flow naming conventions, and ensuring user awareness of data quality characteristics during dataset development and data selection. The latter is often referred to as the documentation of meta-data, and efforts towards agreeing common frameworks on meta-data reporting are also invited to this session. IT infrastructures and solutions to facilitate interoperability and data conversion across different formats/standards are also included. All life cycle based approaches, Life Cycle Assessment (inventory and impact assessment), hotspots analysis, environmental product declarations and labels, and others are accommodated as long as the focus is on databases, data, and meta-data.

The challenges of Life Cycle Sustainability Assessment (LCSA) of energy technologies

Daniel Garrain, Alessandra Zamagni, Vicente Franco Garcia

May 10, 14:20 - 16:00, Hall 100

Providing a safe, clean and sustainable energy supply to all world citizens is one of the greatest challenges of this century. Access to affordable energy services is fundamental to human activities, development, and economic growth. Sustainable energy could be defined as the provision of energy that meets the needs of the present without compromising the ability of future generations to meet their own needs. Then, sustainable energy has two main key components: renewable energy and energy efficiency, which are often named the twin pillars of sustainable energy policy. Europe has adopted more ambitious energy-policy objectives to achieve a low-carbon scenario by 2050. In accordance with this issue, the European Energy Research Alliance (EERA) contributes to coordinate a massive public research effort to develop more efficient and cheaper low-carbon energy systems, as one of the cornerstones of the European Strategic Energy Technology Plan (SET-Plan), a tightly focused strategy which aims at accelerating the development and market uptake of this type of technologies. Within the EERA framework of the Joint Programme on Economic, Environmental and Social Impacts of Energy Policies and Technologies (EERA JP e3s), a specific sub-programme working on "A life-cycle approach for evaluating the sustainability performance of energy technologies" was launched in 2013. The aim of this topic is to combine and upgrade existing capabilities and to develop and share the necessary knowledge and tools to evaluate environmental, social and economic impacts of energy systems, from a life-cycle perspective framed into the new concept of Life Cycle Sustainability Assessment. This sub-programme is divided into the following five work packages. Submissions regarding these topics are welcome: 1. Development of advanced indicators for sustainability performance evaluation: Representative indicators must be selected and/or defined in order to evaluate their impacts on sustainability. 2. Development of a framework for LCSA of energy technologies: Conceptual and methodological structure must be developed, putting together life-cycle tools (LCA, LCC, SLCA, LCSA, MFA, SPA), and attributional (aLCA) and consequential (cLCA) approaches. 3. Energy externalities and advanced Input-Output-LCA methodologies: Methodologies to consider sustainable external costs must be studied. 4. Energy technologies supply chain -from production to consumption/use-: New criteria, methods, standards and tools must be developed which serve as a dynamic decision support dashboard to enable balanced and holistic evaluation of various energy technologies supply chain scenarios with production-consumption paradigm. 5. Critical raw materials: New indicators and method for assessing criticality of raw materials need to be further developed; as they play a significant role in the energy technologies supply chain.

The Role of Metals in Circular Economies: A Life Cycle Perspective

Eric Van Genderen, Chris Bayliss, Ladji Tikana

May 10, 8:35 - 10:15, Hall 100

Regulatory and customer-driven initiatives are increasingly focused on characterizing the environmental impacts of material production (e.g., Product Environmental Footprint), as well as their life cycle burdens and benefits (e.g., Circular Economy). To this end, the chemicals industry is being asked to provide ever greater and more sophisticated information to authorities and to customers and downstream users on the environmental footprints of the materials it produces and markets. Metals, indispensable components of modern societies - underpinning economies, cities and transportation, communication, food and power networks - have complex and multiple life cycles that encompass extraction, processing, manufacturing and fabrication, use, waste management, and recycling. Each step along a metal's life cycle has the potential to present environmental challenges that must be quantified and weighed against societal values, but also potential benefits to societies, economies and biomes that require maximising. Sharing a desire to incorporate sustainability into SETAC's mission and guiding principles, we propose a session to present the state of the science related to life cycle methods, theories and practices for metals. The metals and mining industry routinely conducts life cycle assessment studies, using latest industry data, to monitor and document the potential environmental impacts of their products and their processes. In addition, through the emergence of resource efficiency/circular economy as a driver within materials management, the metals and mining industry has generated information to inform users across value chains. As a result, this session will facilitate information exchange on the quality of material cycles, present challenges associated with cultural barriers for data collection, and illustrate the need for a collective response from all stakeholders. The complexity of metal life cycles is an ideal topic within which to examine comprehensive data collection and interpretation, and expand awareness of life concepts in decision making. The session will examine metal life cycles within the following topics: • Harmonized approaches to LCA for metals • LCA case studies • Assessment and interpretation of environmental impacts • Novel approaches to risk in life cycle assessment of chemical fate and toxicity • Approaches to inclusion of resource availability in LCA and LCSA • Water footprinting • Handprinting • Reuse, Recycling, and Remanufacturing