PROCEEDINGS

Indian Conference on Life Cycle Management (ILCM 2015)

14-15 September, 2015

FICCI, New Delhi, India

ILCM Secretariat

FICCI Quality Forum

Federation of Indian Chambers of Commerce and Industry

Federation House, 1 Tansen Marg, New Delhi 110001, India

T: +91-11-23487211/23487239/23487240

F: +91-11-23320714

E: ilcm@ficci.com

Table of Contents

About ILCM

Indian Conference on Life Cycle Management (ILCM) is a flagship event instituted by FICCI to promote Life Cycle Thinking among various stakeholder groups in India-government, industry, academia as well as non-government organizations. It is the only forum in India that focuses exclusively on Life Cycle Management and related topics including Life Cycle Costing, Sustainable Consumption and Production, and Sustainable Public Procurement. The platform is all the more relevant as technical issues relevant to the host country drive the ILCM agenda.

ILCM has been endorsed by Ministry of Environment, Forests and Climate change, Department of Public Enterprises, Ministry of Heavy Industries & Public Enterprises, Government of India, and is fully integrated with global developments through support from the UNEP SETAC Life Cycle Initiative. Encouraged by the success of the past conferences, the fourth edition of ILCM 2015 is scheduled on 14-15 September, 2015. ILCM 2015 will demonstrate a balance of theoretical discussions, case studies and technical workshops.

Theme and Focus Areas

Encouraged by the excitement previous ILCM Conferences have generated, the ILCM platform is striving to take ILCM 2015 to another level.

Conference Program revolves around the following thematic streams:

1. Incorporation of Life Cycle Thinking in Government guidelines/policies on Sustainability
2. Realization of business benefits through LCA/M
3. LCA data needs and database development approaches
4. Decoupling resource use from economic growth

ILCM 2015 Committees

Scientific Committee

Name	Organization	Country
Andreas Ciroth	Green Delta	Germany
Atsushi Inaba	AIST	Japan
Bernard Mazijn	Institute of Sustainable Development	Belgium
Greg Thoma	The Sustainability Consortium	USA
Henry king	Unilever	UK
Llorenc Mila Canals	UNEP	France
Martina Prox	ifu Hamburg	Germany
Matthias Finkbeiner	Technical University of Berlin	Germany
Parakrama Karunaratne	University of Peradiniya	Sri Lanka
Sanjeevan Bajaj	FICCI	India
Shabbir H Gheewala	The Joint Graduate School of Energy and Environment	Thailand
Sonia Valdivia	World Resources Forum	Switzerland
Stefanos Fotiou	UNEP	France

FICCI Organizing Committee

1. Archana Datta
2. Arjun Kumar
3. Rhythem Malik
4. Sakshi Bhargava
5. Sanjeevan Bajaj
6. Sohini Gupta

Session wise abstracts

Sessions	Presenters Affiliation
Session 1: LCA in Sustainable Manufacturing practices – Case Studies	
Lifecycle Assessment of Biofuels under EU REDD Directive	SABIC Research and Technology Centre Pvt. Ltd.
Understanding the impacts of printing through LCA	HP India
Realization of business benefits through LCA/M	VE Commercial Vehicles
Life Cycle Assessment of a Steel Ring Product in the Value Chain	Mahindra Sanyo Special Steel Pvt. Ltd.
Comparative LCA of Bio-Glycol Ethers & Conventional Glycol Ethers Production With Emphasis on database management	India Glycols Ltd.
Session 2: Realization of Business benefits through LCA/M	
Gaining an Environmental Competitive Advantage through the Use of ISO LCA Tools and Labeling Standards	NSF International (USA)
The importance of the Product Social Impact Assessment for improving sustainability performance of a product	BMW Group (Germany)
Evaluating the effectiveness of occupancy sensors in net energy conservation: An integrated building life-cycle energy study	Indian Institute of Science
Positioning Life Cycle Sustainability Assessment (LCSA) as a tool on sustainability reporting: a biofuel based case study	Chalaka Fernando, LCADesNet (Sri Lanka)
Session 3: Incorporation of LCT in Government guidelines/policies on Sustainability	
Life Cycle Thinking to inform scaling up sanitation in India	Unilever India
Policy options for integrating LCA into environmental legislation	TU Berlin (Germany)
European Commission's PEF (Product Environmental Footprint) applied to plastic piping systems	TEPPFA (Belgium)
Life Cycle Assessment (LCA) on Paper - Environment and efficiency towards a paperless Government	National Environment Commission - Bhutan
Session 4: LCA Data needs and database development approaches	
Developing methodologies and databases for Environmental Hotspot Analysis: An Ongoing Research Project in Japan	Waseda University (Japan)
International Collaboration on consensus, tools and capacity for enhanced access to and Interoperability of LCA Data	UNEP (France)
Life Cycle Inventory (LCI) Development for Iron Ore Mines	TATA Steel
A new, comprehensive database for social LCA: PSILCA	GreenDelta (Germany)
LCA data needs and database development approaches	Simapro software development India Pvt. Ltd
Session 5: LCT in Sustainability Assessment and Management	
Decoupling economic growth from resource use – Why Material Flow Cost Accounting is a good start for Small and Medium Sized Enterprises in taking a Life Cycle Perspective	ifu Hamburg (Germany)

ACIDLOOP Project	ASSIST
Role of LCA of Solid Waste Management in Sustainable Development: a review	Indian School of Mines
Session 6: Development & application of national/regional LCI databases	
Challenges for consistent National LCI database development	Life Cycle Strategies Pty Ltd (Australia)
Life Cycle Inventories for Emerging Economies; Challenges, Opportunities, and way forward	Ecoinvent Centre (Switzerland)
Indian National Life Cycle Database-Requirements-Implementation -Purpose-Benefit	thinkstep AG (Germany)
The importance of Lifecycle Inventory in the development of management tools: Nigeria as a case study	Niger Delta University (Nigeria)
Enhancing CSR Using LCA-based software to measure monitor and report the impacts of company procurement	Sphere-E
Session 7: LCA in promoting eco innovation and sustainability: Education, Research and Application	
LCA of Biochar application as a soil amendment for maize production	University of Peradeniya (Sri Lanka)
LCA of arc welding and gas welding processes	Birla institute of Technology and Science, Pilani
System thinking and life cycle assessment for development of sustainable urban water systems	IIT Roorkee
LCA of Suburban Railway	Indian Institute of Technology Bombay
Material Flow Analysis (MFA) for Water Conservation: A case study of Ganga River basin in Uttar Pradesh, India	TERI University
Session 8: Worldwide trends in LCA/M	
The launch of the Guidance on Organizational LCA and its road testing	TU Berlin (Germany)
SuBoot – Sustainability Bootstrap project	GreenDelta (Germany)
Communication and collaboration as essential elements for mainstreaming Life Cycle Management	Forum for Sustainability through Life Cycle Innovation (Germany)

Session 1: LCA in Sustainable Manufacturing practices – Case Studies

I. Lifecycle Assessment of Biofuels under EU REDD Directive

Author: Rajesh Mehta
Organization: SABIC Research and Technology Centre Pvt. Ltd., Bangalore, India

Today, there is increasing attention on sustainability of biofuels, especially their GHG reduction potential versus fossil fuels. Thus, it becomes critical to quantify the greenhouse gas (GHG) savings from production and use of different biofuels. In 2009, European parliament passed renewable energy directive (RED 2009/28/EC) aimed at promotion of the use of renewable sources of energy. RED has laid down mandatory national target of 10% share of energy from biofuels in transport petrol and diesel consumption by 2020. Besides, RED has laid down a sustainability criterion for biofuels and bio-liquids. All biofuels to be sold in EU should fulfill this sustainability criterion to qualify them as sustainable biofuels. RED states that GHG emission saving from the use of biofuels and bioliquids shall be atleast 35% in 2010, 50% with effect from 1 January 2017 and 60% with effect from 1 January 2018 for installations where production started on or after 1 January 2017. Clearly, not all biofuels production pathways and manufacturers will meet RED criteria for biofuels. Cradle to use phase life cycle assessment of six different biofuels manufactured and marketed in EU are covered in this study. The six biofuels studied were- biogas from animal manure and bio-waste, bio-methanol, bio-ethanol, bio-MTBE, and bio-ETBE. This study conforms to RED methodology for quantification of GHG savings arising out of production and use of biofuels. As directed by the RED, GHG savings from production and use of biofuel are compared against fossil gasoline. Results from our study showed that GHG savings vary significantly between biofuels and this helps in differentiating biofuels. Also, a particular biofuel may fail to meet the RED sustainability criteria due to various reasons such as type of production process, fuel type used for production, electricity mix, plant location etc. Therefore, choice of energy source used by the biofuel manufacturer is critical for certain biofuels to meet the sustainability criteria.

Keywords: *biofuels, lifecycle assessment, biomethanol, bioethanol, biogas, SimaPro, renewable energy directive.*

II. Understanding the impacts of printing through LCA

Authors: Dr. Tom Etheridge[1], Upasana Choudhry[2]
Organization: [1] Hewlett-Packard, Global Supply Chain Lifecycle Assessment Program Manager;
[2] Hewlett-Packard; Asia Pacific and Japan Environmental Management, India Country Manager

HP is a world leader in the use of environmental analysis tools like Life Cycle Assessment (LCA) and the GreenScreen chemical assessment method to help build better products. However, conducting a LCA specific to a particular imaging products is challenging for several reasons, the two most difficult being product complexity and substantial variation from product to product. To address these issues, HP collaborated with PE International (now thinkstep) to create a unique, modular LCA model that allows rapid, complete life cycle assessments to be performed on HPs imaging products. We have used this model to evaluate more than 150 imaging products, including inkjet printers, laser jet printers, and scanners that span HP product portfolio, giving us insight into the key contributors of carbon footprint both on the individual product level and the platform or printer-class level. We discovered that some key contributors, such as paper, are highly impactful in all printing systems while others, such as cartridges, vary based on printer class and usage. This information is now being used by product design engineers to help guide their decisions and to help HP set meaningful, fact-based carbon reduction goals.

This talk will discuss how HP uses this LCA tool to find and evaluate the environmental hot spots in its vast imaging products portfolio, both within a specific product category and across the portfolio as a whole and how those impacts vary across the portfolio. We will also show how HP uses this information to report its global carbon and water footprints.

Keywords: *Life Cycle Assessment; IT products; challenges; business opportunities; collaboration; data collection*

III. Realization of business benefits through LCA/M

Author: Mr.Vijay Jaiswal
Organization: Senior Manager, Product Development, VE Commercial Vehicles, Indore

Introduction

With India emerging as one of the biggest global automotive markets, the need is to develop products delivering high value to the consumer during their complete life cycle while still having minimum impact on environment. The aim of this study is to suggest an approach for developing products with minimum impact on the environment while still meeting high growth demands.

Material & Methods

The method here is derived from three different aspects of a product lifecycle, namely design & development, product usage and end of life. The threefold approach considered here builds upon common design principles based on modularity concept along with material advancements and simple solutions to the routine recycling problems.

Result

The study here builds a clear correlation between material selection and lesser environmental impact during the product usage duration. It also correlates design methodologies and part labeling with enhances maintainability and simplified product recyclability. The product features resulting from these methods also gives the manufacturer a clear competitive edge and technical knowhow for future product developments.

Discussion

The LCA here starts with lightweight yet high strength material selection resulting in reduced vehicle weight and improved FE thus reducing emission while improving overall product life. Besides, the modular design approach results in an optimum component level breakup for improved maintainability while reducing the amount of material to be replaced or discarded during the product life. The third approach is of component labeling to allow easy segregation and application of recycling methods as per distinct material properties while also reducing the risk of recycling contamination.

Conclusion

The paper seeks to set a roadmap for the automobile industry to minimize the impact on environment through focused material selection, judicious use of resource use through design, and easy recyclability of the product at the end of its life of the product

References: Report on Life Cycle Assessment: Issues for the Automotive Plastics Industry-By Brett C. Smith and Michael S. Flynn, December, 1993, University of Michigan Transportation Research Institute

IV. Life Cycle Assessment of a Steel Ring Product in the Value Chain

Authors: Ramchandra Rane[1], Dr. Rajesh Kumar Singh[2]
Organization: [1] Mahindra Sanyo Special Steel Pvt. Ltd.,
[2] Thinkstep, India

Introduction

Mahindra Sanyo Special Steel Pvt. Ltd has embedded product sustainability in its business strategy. This guides the organization to continually improve the environmental performance of its products through adoption of clean technology and process improvements that enhances the economic capital.

The company thus strives to achieve responsible growth that connects its brand and vision to become the most admired, successful and socially responsible special steel manufacture in India. This project undertakes the life cycle assessment of its ring product in accordance with the ISO 14040 & 14044 guidelines for environmental performance. The product has a complex trans border value chain in India and Europe being ultimately used by a reputed and responsible auto manufacturer in Europe.

Aim

The aim of the project was to carry life cycle assessment of the ring product, identifying improvement opportunities over gate to end of use phase. To Identify and categorize various emission sources, boundaries and processes according to the standard protocols of ISO 14040/44.

Conclusion

The study provides a fair understanding of the environmental impacts during the various life cycle stages of the product. It helps in identifying the hot spots in the value chain where the improvement activities can be prioritized and planned. The major environmental impact arises out of energy intensity of the steel melting process and input raw material mix. The major focus areas identified are optimization of the energy consumption, improvement in the yield and improving use of recycled inputs. The study till now encompasses supply chain and gate to gate boundaries. Further scope for carrying out LCA in the value chain up to the use phase is planned. The study highlights the importance of the product stewardship by a steel manufacturer in order to build responsible supplier base for global OEMs.

V. Comparative LCA of Bio-Glycol Ethers & Conventional Glycol Ethers Production with Emphasis on database management

Authors: Dr. R. K. Sharma[1], Sarang Khati[1]
Organization: [1] India Glycols Limited

Industries can focus sustainable development, by looking at its **Energy Usage**, **Carbon Footprints (CFP)** and **Life Cycle Assessment (LCA)** of products by integrating all as Life Cycle Management System.

Environmental impact evaluation is a major issue that faces by every nation today. Corporate sustainability initiatives have grown in number, scope and size in recent years. Stakeholders are aware that consumption of manufactured products may have effect on resources and the environment. These effects occur at every stage in a product's life cycle-from the extraction of the raw materials from the ground through the processing, manufacturing, and transportation phases, ending with use and disposal or recycling. The effects can either be direct (such as air emissions produced from transportation) or indirect (such as the pollution and impact on waterways from the production of electricity used in the manufacturing process). LCA can be best suitable methodology in this case as it quantifies these direct and indirect effects of various environmental impacts of the products.

Life Cycle Assessment aims at specifying the environmental consequences of products or services from cradle to grave/gate. In ISO 14040, LCA is defined as the "compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle".

The LCA is carried out by India Glycols Limited (IGL) for Bio-Glycol Ethers at cradle to gate level with following ISO 14044:2006 and ISO 14040:2006 standards. IGL is the first organization worldwide generates products as Glycol Ethers through bio route and carried out LCA study of Bio-Glycol Ethers. IGL is continuously working for sustainable developments.

The following aspects of the study's data quality are described

- Representativeness of the data in the study, which includes an assessment of the temporal, geographical, and technological coverage of the model;
- Reproducibility – the qualitative assessment of the extent to which information about the methodology and data values allows an independent practitioner to reproduce the results reported in the study;
- Precision – the measure of variability of the data values for each data category expressed;
- Completeness – the percentage of flow that is measured or estimated;
- Sources of data

The input materials for Bio- Glycol Ethers' production are Bio-Ethylene Oxide and Bio-Ethanol obtained from sugarcane molasses. On the other side, the input materials for conventional Glycol Ethers' production are Ethylene Oxide (Petro route) and Ethanol (Petro route/ Bio route). Life Cycle Assessment as per IPCC 2013 GWP 100a single issue methodology shows that CFP (CO_2eq) of Bio- Glycol Ether (Bio-Ethylene Glycol Mono Ethyl Ether) is lower than conventional Glycol Ether (Ethylene Glycol Mono Ethyl Ether) through petro route. Life Cycle Assessment as per ReCiPe methodology shows that most of the important relevant parameters as climate change, agriculture land use occupant, metal depletion, ozone depletion, fossil depletion, radiations etc. of Bio-Glycol Ethers are lower than conventional Glycol Ethers.

The core application of LCA concerns product related decisions support. It can be hotspot identification in product systems, product development, product comparison, green procurement and market claims. However, LCA is also, next to other tools, important for technology choices, setting technologies into a product related chain perspective.

Session 2: Realization of Business benefits through LCA/M

I. Gaining an Environmental Competitive Advantage through the Use of ISO LCA Tools and Labeling Standards

Author: Dr. John Shideler
Organization: NSF International Introduction

Introduction

Organizations today strive to differentiate their goods and services on multiple value criteria, including environmental impact. To understand environmental impacts, organizations use Life Cycle Assessment (LCA) tools that are recognized internationally. Benefits gained from the application of LCA may include product improvement, better strategic planning, marketing advantages, and the ability to influence public policy.

Materials and Methods

LCA is typically performed on the basis of the ISO 14040, ISO 14044, and ISO/TS 14067 standards[1,2,3]. These standards provide information that organizations can use both internally, for planning and improvement, or externally, in marketing campaigns or to influence the scope and extent of laws and regulations. Communication of LCA information typically is conducted using the ISO 14020 series of environmental labeling standards[4].

Results

Creating Product Category Rules (PCRs) for goods and services marketed either domestically or internationally benefits organizations by standardizing the process for LCA data collection and analysis. Industry should play a key role in PCR development in order to ensure a level playing field among the providers of similar goods and services. The product category definition/description includes the function and use of the product and its technical performance. The PCR constitutes a "rule book" for how an organization collects, assesses and reports LCA data relevant to its product. For example, the PCR may require the reporting of information about product content, including the presence of materials and substances that can negatively impact human health and the environment.

Conclusion

Organizations using LCA to analyze their goods and services may decide to use in-house expertise for LCA or outsource it to external parties. They may choose which "Program Operator" to use for the development of PCRs, for the administration of EPDs, and for the third-party verification of their LCA results. Benefits include improved supply chain management and satisfaction of customer requirements.

Reference

[1] ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework. International Organization for Standardization, Geneva, Switzerland.

[2] ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines. International Organization for Standardization, Geneva, Switzerland.

[3] ISO/TS 14067:2013, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication. International Organization for Standardization, Geneva, Switzerland.

[4] See ISO 14020:2000, Environmental labels and declarations – General principles. International Organization for Standardization, Geneva, Switzerland; ISO 14021:1999, Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling). International Organization for Standardization, Geneva, Switzerland; ISO 14021:2011, Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling) Amendment 1. International Organization for Standardization, Geneva, Switzerland; ISO 14024:1999, Environmental labels and declarations – Type I environmental labeling – Principles and procedures. International Organization for Standardization, Geneva, Switzerland; ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures. International Organization for Standardization, Geneva, Switzerland.

II. The importance of the Product Social Impact Assessment for improving sustainability performance of a product

Authors: Marzia Traverso[1] and Peter Tarne [1]

Organization: BMW Group, Knorrstrasse 147, 80788 Munich, Germany

The sustainability assessment along the product life cycle is playing a meaningful role for reaching a sustainable production and consumption. According to the three pillars concept of sustainability, environmental, social and economic impact should be assessed along a product life cycle.

The environmental life cycle assessment (LCA) of a car, according to the ISO 14040:2006, is regularly used at BMW Group as decision making tool for the development of product from the concept design to the start of production. Strategic targets and actions to improve the environmental performance of a car along its life cycle are identified and established already in the earliest strategic phase and monitored along the vehicle development process.

To improve the sustainability performance we need to consider all materials, components and processes that are involved to produce a vehicle. If the LCA of a so complex product like a car is possible it is because software and database are available. The social life cycle assessment (SLCA) presents still a lot of challenges such as: lack of data and a harmonized methodology.

Since 2013, BMW Group together with other eleven companies and Pré Sustainability have founded the Roundtable for Product Social Metrics in 2013. This initiative aims to develop a feasible and practicable methodology for assessing positive and negative social impacts of a product. A handbook to support LCA practitioners in assessing social performance quantitatively and qualitatively was published in September 2014. The pilot projects carried out during the roundtable and the rising interest on the Product Social Impact assessment (PSIA) from suppliers has showed that the PSIA and the Roundtable can play a meaningful role for the harmonization and standardization of the SLCA.

Benefits and challenges of the implementation of the qualitative and quantitative methodologies, developed in the Roundtable, at automotive company are going to be presented and discussed.

III. Evaluating the effectiveness of occupancy sensors in net energy conservation: An integrated building life-cycle energy study

Authors: Tarun Kumar[1] and Dr. Monto Mani[2]
Organization: [1]Phd Research Scholar, SuDesi Lab, CPDM, Indian Institute of Science, Bangalore
[2]Associate Professor & Associate Faculty, Centre for Sustainable Tech., & Centre for Product Design & Manufacturing, Indian Institute of Science, Bangalore

Occupancy sensors are also known as motion sensors and/or proximity sensors that reduce energy consumption by switching off energy appliances, such as those for illumination and comfort (ventilation/air conditioning). While there is evidence of immediate energy saving by the adoption of such measures, one needs to carefully discern the effectiveness of such measures over the life-cycle involved in the adoption of occupancy sensors. Two dimensions of occupancy sensors use need careful investigation. The first is the life-cycle energy involved with the use of a motion sensor vs the energy that is actually conserved by its adoption. The second is the impact of frequent switching (on/off) on the performance and life of the appliance/gadget.

Life-cycle application energy integrates the life-cycle energy study associated with a gadget vs the energy saving accruing due to its adoption. Here one must note that the assessment is valid for the service life of a motion sensor and/or that of the appliance/gadget, whichever is shorter. Further, net life-cycle application energy would vary depending on the specific appliance being connected, e.g. Luminaires, Fans and Air conditioners. In this paper luminaires have been studied for their adoption in typical office buildings. The study would compare the effectiveness of occupancy sensor in reducing net energy consumption computed over its life span and that of the appliances. This paper also includes behavioral studies on energy use and conservation. The integration of occupancy sensors in the use phase of the building has also been investigated for a comparison on the net energy utilization with and without the sensor.

IV. Positioning Life Cycle Sustainability Assessment (LCSA) as a tool on sustainability reporting: a biofuel based case study

Authors: Chalaka Fernando[1] and Ajith De Alwis[2]

Organization: [1]Doctoral Student, University of Moratuwa, Katubedda, Sri Lanka; Secretary, LCADeSNet Sri Lanka

[2]Senior Professor in Chemical & Process Engineering, University of Moratuwa, Katubedda, Sri Lanka

Introduction

Sustainability reporting has increased significantly in each corporate sector. This research aims to explore possibility of using LCSA for sustainability reporting, taking biofuel as a case study. Globally, transportation accounts for 25% of energy demand and nearly 62% of oil consumption[1]. Bioethanol and biodiesel are the most modern biomass-based transportation fuels [2]. Biofuels are both promoted and challenged on sustainability aspects, hence sustainability reporting is an integral part of sustainable biofuel processing.

Materials & methods

A global research survey was performed on biofuel sustainability researches - 112 papers were shortlisted and analysed on both environment and social life cycle impacts of biofuels. The latest and mostly used Global Reporting Initiative (GRI) 4 guidelines[3] on sustainability reporting and UNEP publication 'Towards LCSA'[4]- the LCSA guidance document are selected and studied. Three sets of findings are mapped on focusing biofuel processing.

Results

Climate change, eutrophication and photochemical, acidification and resource depletion are found as biofuel related environmental hotspots which require corporate attention. Apart from above sustainability reporting has demanded on safety, health, social responsibility, good governance, economic performances. Results have shown social and environmental issues as main concerns while health and safety and working conditions are also highlighted.

Discussion and Conclusion

Performing a LCSA, integrating (environment) life cycle assessment, life cycle costing and social life cycle assessment (SLCA) will support more than 80% of indicators GR4 sustainability reporting in the case of biofuel processing. Defining SLCA indicators (during materiality review) will increase coverage and efficiency of sustainability reporting. It is also required to define the scope and boundary based on stakeholder interest; however these require periodical update for reporting. Strong support base for sustainability reporting can be highlighted as a complimentary benefit of LCSA and also as a sustainability assessment model.

Reference

1. Biofuel UK, "http://biofuel.org.uk/uses-of-biofuels.html," 2010. [Online]. Available: http://biofuel.org.uk/uses-of-biofuels.html. [Accessed 15 July 2015].
2. A. Demirbas, "Progress and recent trends in biofuels," *Progress in Energy and Combustion Science,* vol. 33, no. 1, pp. 1-18, 2007.
3. Global Reporting Initative, "https://www.globalreporting.org" [Online]. Available: https://www.globalreporting.org/standards/g4/Pages/default.aspx. [Accessed 10 July 2015].
4. UNEP, "Toward Life Cycle Sustainiity Assessment: Making informed choices on products," UNEP, Paris, 2012.

Session 3: Incorporation of LCT in Government guidelines/policies on Sustainability

I. Life Cycle Thinking to inform scaling up sanitation in India

Authors: Dr. Nicole Unger[1], Dr. Michal Kulak[1] and Dr. Nimish Shah[2]

Organization: [1]Unilever – Safety and Environmental Assurance Centre, Sharnbrook, UK

[2] Unilever – Safety and Environmental Assurance Centre, Bangalore, India

Introduction

More than 2.5 billion people across the world lack access to improved sanitation and global health organisations have called for urgent steps to eradicate open defecation. In India the Swaccha Bharat Abhiyaan (Clean India Mission), launched in 2014, envisages construction of 110 million toilets over the next 5 years. This sanitation crisis requires a joint effort including industry. As part of the 'Unilever Sustainable Living Plan' Unilever has set a target to enable 25 million people to gain improved access to toilets by 2020. For decision makers such large scale interventions need to be informed by robust, life cycle based assessments. This paper presents the findings of a life cycle assessment comparing different ways of providing improved sanitation at scale in India. It highlights the methodological challenges and provides guidance to decision makers.

Method

Life cycle inventories of relevant sanitation systems and scenarios in India are presented, and the relevant material flows and environmental impacts calculated. Also considered are potential value streams that could be reclaimed from the solid waste and aqueous fractions.

Results

Typical attributional life cycle assessments focus on a simple functional unit of a product or service (e.g. one toilet use) and up-stream inputs (e.g. water provision for flushing) and down-stream outputs (e.g. disposal of wastewater) are treated as a background processes. It is assumed that the necessary infrastructure exists and any additional demand can be accommodated. However, for large-scale interventions such as providing millions of toilets in India this assumption no longer holds and it is necessary to include the additional infrastructure demands (e.g. collection systems, mass of concrete) as foreground processes (i.e. it is subject to change).

Discussion and conclusion

The implications of the wider sustainability impacts of major sanitation commitments are highlighted and the trade-offs illustrated.

II. Policy options for integrating LCA into environmental legislation

Authors: Matthias Finkbeiner[1], Annekatrin Lehmann[1], Clare Broadbent[2] and Russ T Balzer[3]

Organization: [1] Chair of Sustainable Engineering (SEE), Department of Environmental Technology, Technische Universität Berlin, 10623 Berlin, Germany.

[2] World Steel Association, Rue Colonel Bourg 120, B-1140 Brussels, Belgium

[3] World Auto Steel, Sycamore Creek Drive Suite A, Springboro, OH 45066, USA

Life Cycle Thinking and environmental protection are on the political agenda. However, so far nearly all environmental regulations deal with one LC phase only. As LCA approaches are developed and used by industries worldwide since many years and because we think that environmental legislation should be based on LCA, we started to explore and develop policy options for integrating LCA into policy.

The presented study (2013-2015) includes the identification and prioritization of policy options, the description of its technical requirements and characteristics and the development of implementation scenarios. As an example CO_2 legislation in the automotive industry is chosen, but the principal approach can be transferred to other environmental regulations and sectors as well.

It was found that theoretically a broad range of options for implementing LCA in policy exists (e.g. mandatory, voluntary, process- or performance based ones) and that practically some of them are already implemented in EU legislation. A deeper analysis of technical requirements (e.g. methodology, models, data) of four selected policy options revealed that some are the same for both voluntary and mandatory policies and that sometimes voluntary policy has the most strict requirements. It was shown that those characteristics (e.g. strengths, weaknesses, acceptance) which generally have the highest relevance regarding CO_2 reduction and also require the greatest efforts for implementation seem to be related to a mandatory-performance option. Moreover, we found, that robustness and credibility can principally be guaranteed by all policy options and that acceptance strongly depends on the stakeholder perspective.

The study identified promising policy options without having indicated a clear analytical, scientific overall preference for one single option. We learned that technical implementation strongly depends on the implementation level and that solutions for most technical requirements are already available, but that a consensus on their proper setting is missing. Results of a broader stakeholder dialogue in Europe, the US, Japan and China are used for refining the policy options and specifying implementation scenarios for integrating LCA into policy.

III. European Commission's PEF (Product Environmental Footprint) applied to plastic piping systems

Authors: Claudia Topalli[1] and Tony Calton[2]
Organization: [1] Deputy General Manager, TEPPFA
[2] General Manager, TEPPFA

Introduction

In 2013 The European Commission published in the Official Journal a legislative package consisting of a proposal and new methodology to assess the environmental footprint of products (PEF) and organisations (OEF). Unlike existing ISO or EN standards/methods this proposal has a horizontal approach which can be applied to all kinds of products, materials and organisations.

A 3 years pilot phase was also initiated to test the proposed PEF methodology, starting in November 2013 till December 2016.

PEF is seen in Europe as a game changer because it proposing comparisons and benchmarking as one of the main objectives. While the idea is not to exclude any product variants, it will allow comparison and create environmental competitiveness with the development of products with lower environmental impact.

Method

The European Plastics Pipes and Fittings Association, TEPPFA has many years' experience of LCA studies assessing the environmental impact of several plastic piping systems based on EN 15804 as well as ISO 14040 and ISO 14044 series of standards. For this reason TEPPFA was selected to lead one of the PEF pilot projects.

The aim of this project is to carry out life cycle assessment (LCA) studies from the cradle to the grave using the PEF methodology to establish a benchmark for hot & cold water supply pipes within the building. The study for the benchmark is conducted using average industry data, further studies on specific products using primary data will then be carried out to compare to the benchmark. Ideally this would also allow stakeholders to have a better view on the advantages and disadvantages from an environmental point of view of a pipe system in plastic compared to its main competing non-plastic materials.

Results

The benchmarking exercise has now been concluded and draft categories rules have been developed, which will now be used for product specific supporting studies.

Keywords: *Plastic pipe systems, life cycle assessment (LCA), environmental product declaration (EPD), European sector approach, sustainable construction and housing, Product Environmental Footprint PEF, Organisation Environmental Footprint OEF, European standards, ISO standards, environmental sustainability.*

About TEPPFA

TEPPFA stands for The European Plastic Pipes and Fittings Association. It is a trade association representing the key manufacturers and national associations of plastic pipe systems. TEPPFA is actively involved in the promotion of plastic pipe systems for all applications.

References

1. ISO 14025, (2006), Environmental labels and declarations -- General principles.
2. ISO 14040, (2006), Environmental management – Life cycle assessment – Principles and framework.
3. ISO 14044, (2006) Environmental management – Life cycle assessment – Requirements and guidelines.
4. (pr)EN 15804: Sustainability of construction works – Environmental product declarations – core rules for the product category of construction products (draft, 2008).
5. (pr)EN 15942: Sustainability of construction works – Environmental product declarations – Communication format – Business to Business (draft, April 2009).
6. Final Product Environmental Footprint and Organisation Environmental Footprint methods (2013) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013H0179&from=EN
7. More about TEPPFA EPD's http://www.teppfa.eu/sustainability-a-environment/-epd.html
8. Top actively contribute to the PEF pilot phase: https://webgate.ec.europa.eu/cas/login?loginRequestId=ECAS_LR-1869360-BKwrVNO2zhDvTzKphyNWS2Pl9nn0da6BFdxSFDyszHAnBll8zWXoDzfFAliCb2U9vOYPjcIl9ApiCJyfEs4zdSr0-Jj71zxYb8yrgUKrVGdv47O-wt9dUVaOdF6wrUO6epzhW9NylWbzwKIfaiJ6cp251Kf0

IV. Life Cycle Assessment (LCA) on Paper - Environment and efficiency towards a paperless Government

Author: Chencho Tshering
Organization: Program Officer, Policy and Programme Services, National Environment Commission, Royal Government of Bhutan

Introduction
Paper production has ranked among the most resource-intensive and highly polluting of all manufacturing industries. In Bhutan, Public Offices are one of the major sources of waste paper, consuming over 177.67 tons of paper in FY 2011-2012. It is clear that the only effective way to significantly reduce the negative environmental consequences of paper production, use and disposal is by being more economical with our use of paper products.

The aim of this study is to provide a justification for developing detailed guidelines to guide the implementation of paperless initiatives across the Royal Government of Bhutan (RGoB). We looked at the current state of paper use, investigate potential environmental and economic gains, reviewing legislation and provided recommendations for moving towards a paperless office.

Methodology
We collected detailed information for three public offices[1] in Bhutan and compiled a paper use profile for the average user of each of these organizations. We also defined a best-case scenario, based on benchmark numbers. For the LCA we used CMLCA software together with the ecoinvent 2.2 database. Additional life cycle inventory data was obtained on-site and through literature research. The economic analysis was based on a simple cost/benefit calculation. A combined indicator (e.g. CO2 emissions saved per $) for comparing the scenarios is looked-for.

Results
Despite the fact that there is a wide variation in paper use across the three investigated public offices (*ranging from 17, 1 to 7, 2 to 4, 7 reams of paper per person, for the Cabinet Secretariat, MoIC and the NECS respectively*), implementing paperless would yield significant benefits for each one. From an environmental point of view, we can expect a significant improvement of performance on both climate change and emissions of toxins into water. The latter is tied mostly to the act of printing, rather than the use of paper in itself. With regards to cost savings, the annual direct savings per person were calculated to be Nu. 11.600 on average, the majority of this being due to improved efficiency of printing. Using a cash flow analysis we calculated that the NECS, which represents the worst-case scenario when it comes to printer-use, could save almost Nu. 6 Million by adopting networked printers. Going paperless will also yield indirect savings through efficiency improvements, but a detailed analysis is beyond the scope of this report.

References

[1] Cabinet Secretariat, Ministry of Information and Communication (MoIC) and National Environment Commission Secretariat (NECS)

Session 4: LCA Data needs and database development approaches

I. Developing methodologies and databases for Environmental Hotspot Analysis: An Ongoing Research Project in Japan

Authors: Yasushi Kondo[1], Norihiro Itsubo[2], Kiyotaka Tahara[3], Shinichiro Nakamura[1]
Organization: [1]Waseda University, Japan
[2]Tokyo City University, Japan
[3]National Institute of Advanced Industrial Science and Technology (Aist), Japan

Introduction

Demand for multi-criteria methods of LCA has recently been growing, to measure life-cycle environmental performance of products[1]. In particular, comprehensive databases are desired because they are indispensable to a wide spread use of LCA with multi-criteria methods. With this background, we started a research project for the development of methods and databases for environmental hotspot analysis, which is a three-year project for 2014 to 2017 funded by Japan Science and Technology Agency (JST).

Method

The project consists of two parts. One is the development of methods for environmental hotspot analysis through case studies of 100 products and services. Our method for life-cycle inventory analysis is a hybrid multi-regional input-output analysis (MRIO)[2] in which the Japanese IO table is in the waste input-output (WIO) framework[3]. The method for life-cycle impact assessment is LIME3, an update and global-scale and multi-regional extension of LIME2 (life cycle impact assessment method based on endpoint modeling)[4]. The other part of this project is the development of comprehensive databases for hotspot analysis. Data on environmental emission are compiled based on IDEA (Inventory Database for Environmental Analysis)[5]. Data on disaggregated waste flow like animal and food waste, paper waste, iron and steel scrap, non-ferrous metal scrap, slag and sludge are compiled in the WIO framework.

Discussion

The results of environmental hotspot analyses of 100 products and services will be used for benchmarking the life-cycle environmental performance of a product. LCA practitioners can focus on the processes and impact categories which are found hotspots in our analyses. This is expected to contribute to reducing time and cost necessary for LCA studies in industry, and thus further promoting green procurement. At the meeting, we will share our experience in developing database and halfway results of the ongoing project.

References

1. S. Manfredi et al. (2015) Int J Life Cycle Assess 20(3), 389–404
2. Tukker, E. Dietzenbacher (2013) Econ Syst Res 25(1), 1–19
3. S. Nakamura, Y. Kondo (2002) J Ind Ecol 6(1), 39–63
4. N. Itsubo et al. (2012) Int J Life Cycle Assess 17(4), 488–498
5. K. Tahara et al. (2008) Development of inventory database IDEA based on process analysis. Proceedings of the 8th International Conference on EcoBalance, Tokyo, Japan

II. International Collaboration on consensus, tools and capacity for enhanced access to and Interoperability of LCA Data

Authors: Ms. Anne-Claire Asselin[1], Dr. Llorenç Milà I Canals[1], Dr. Bruce Vigon[2], Dr. Guido Sonneman[3], Dr. Andreas Ciroth[4], Dr. Sau Soon Chen[5], Dr. Jitti Mungkalasiri[6], Dr Nongnuch Poolsawad[6], Mr. Tiago Braga[7], Dr. Cecilia Leite[7]

Organization: [1] UNEP-DTIE, 75009 Paris, France
[2] SETAC, Pensacola, FL 32502, USA
[3] University of Bordeaux, 33400 Talence, France
[4] Greendelta, 13349 Berlin, Germany
[5] SIRIM Berhad, 40700 Shah Alam, Selangor, Malaysia
[6] MTEC/NSTDA, Pathum Thani 12120, Thailand
[7] IBICT, 70070-912 Brasilia, Brazil

Context

Reliable information is instrumental for decision making towards more sustainable consumption and production (SCP) practices, and data are one the key building blocks of the United Nations 10YFP framework of programs on SCP. Regarding Life Cycle Assessment (LCA), data already exist in some countries in private and public databases. The “Global Guidance Principles for LCA databases (GGP)” have defined guidance on how databases should be developed and maintained. However there are still improvements to be made in terms of practical implementation of those principles, global interoperability of the databases, and global capacity building to achieve international standards.

Activities

In this context, many significant activities are being undertaken globally, often with UNEP as a common partner providing coordination and often a mediation role, with the objective to achieve global collaboration and consensus.

The Global Network of Interoperable LCA databases is a global governmental initiative with the ambition that by 2017, users around the world access the majority of the LCA databases seamlessly in various LCA software. Three working groups are already making progress on "nomenclature", "metadata descriptors" and "network technology and architecture".

The UNEP/SETAC Life Cycle Initiative is currently developing conformance criteria to the GGP in order to facilitate dialogue among different databases on the key elements required to reach improved interoperability. Significant efforts are also being devoted by the Life Cycle Initiative to capacity building on the GGP, in order to ensure that new LCA databases are designed for interoperability from the start.

Finally, UNEP also contributes to supporting developing countries in building LCA databases, by facilitating the national debate between stakeholders to create a roadmap towards the creation of a national LCA database. For more advanced countries that already have a database in place, UNEP also support capacity building on new datasets creation, format conversion, and dataset review.

All these activities are driven by the objective of defining international **consensus**, practical **tools** and **capacity** in order for global LCA users and practitioners to seamlessly access expanded LCA data, and assess their "fitness for purpose".

III. Life Cycle Inventory (LCI) Development for Iron Ore Mines

Authors: Mr. Kumaraguru Rajasekar, Ms. Sonali Dilip Kamble
Organization: TATA Steel

Introduction

LCI is one of the most challenging and important phase in the overall LCA study. Currently, there is no much information available on datasets for iron ore mining operations. Steel companies need to depend on global average data which are predominantly represented by companies from Australian and Western countries. These average datasets will not reflect the actual impacts for Asian companies. Tata Steel anticipated this need and initiated the LCI development project for its captive iron ore mines in India.

The core aim of this paper is to share the methodology, approach and challenges in creating and validating the LCI database for iron ore mines.

Materials and Methods

ISO 14044 Environment Management[1] standard deals with the Requirements and Guidelines for conducting Life Cycle Assessment. Our LCI development project for iron ore mines aligns with Section 4.3 of the standard which details about conducting a LCI study.

Scope of this project stretches from “Cradle to Gate” of mines including transportation of final ore to the steel production site. Core processes that are covered in this project include mining, beneficiation, heavy machineries management, logistics and support systems.

Approach

Conclusion

This project will serve as a basis for conducting cradle to gate LCA study for our steel products. Though the LCI project will be validated through available resources, currently there is a lack of data transparency in comparing and benchmarking the results. WorldSteel[2] is working on LCI database for steel industries across the globe still very limited data are available for iron ore mining.

A National level database with India specific values could be helpful in comparing and identifying the areas of improvement. This could also help companies to set ambitious targets to reduce the environmental impact.

References

1. ISO/FDIS 14044 (2006) Environmental management — Life cycle assessment — Requirements and guidelines Management environmental – Analyse du cycle de vie
2. World Steel Association - http://www.worldsteel.org/

IV. A new, comprehensive database for social LCA: PSILCA

Authors: Andreas Ciroth and Franziska Eisfeldt
Organization: GreenDelta, Germany

Goal and background

The demand for more transparency along supply chains in order to have a choice between more or less sustainable products is growing. However, while Environmental Life Cycle Assessments (E-LCA) are comparatively easy to carry out, the social impacts of products along their life cycles are hard to uncover. A database which contains transparent and comprehensive information about the social impacts of products does not yet exist. If nothing else, because social data is often of qualitative nature and, therefore, difficult to access, organize and evaluate.

Scope

Bearing these problems in mind, GreenDelta is developing a database – PSILCA – that aims to be a comprehensive and up-to-date foundation for S-LCA containing global data for every industry sector. In order to make S-LCAs of different products comparable, a rather broad set of quantitative and qualitative social indicators will be covered by the database using the subcategories proposed in the UNEP/SETAC guidance book as a starting point. The assessment of indicators is transparently based on performance reference points that can be adapted to individual requirements, by the user. External input about the further development of PSILCA is provided by an expert and user group.

The completely new database shows how social data can be organized, assessed and finally used for social LCA or Life Cycle Sustainability Assessment. Another field of application is to investigate social impacts independently, in order to detect potential social risks in product life cycles. Furthermore, positive social impacts hidden in product supply chains can also be revealed by applying PSILCA.

Conclusion

In the presentation the methodology, composition and intended usage of the database will be outlined, based on a case study for guitars. Possible improvements and forms of use will be discussed, such as, for example, the combination of the PSILCA approach of S-LCA with E-LCA.

V. LCA data needs and database development approaches

Author: Mr. Sunil Kumar

Organization: Head, Simapro software development India Pvt. Ltd

Introduction

Accurate, reliable and consistent database are backbone of every LCA study. But finding consistent and transparent India specific LCI data for life cycle assessments is difficult. LCA being in its early stage in India, the Government and industry do not collect data / information from the point of view of LCA study requirement. Also electricity production, Oil and gas production, goods and public transportation through rail, public transport through buses etc. are generally under a Govt. controlled company. Because of different culture, manufacturing methodology data availability changes even in same company which has plants at many locations. And finally diversity and vastness of India is unfortunately not very helpful. And last but not the least – Non availability of financial support. All these call for a specific plan.

Methodology adopted for creating India specific LCI

We, at SimaPro India, decided to conform ecoinvent unit process data to suit Indian conditions by editing the processes with as much information as we could find. We started by editing electricity production unit processes. Then we moved on to Oil & Gas processes. Slowly we focused on other sectors like plastics, food, bio-fuels, textiles, chemicals ……the journey continues.

Conclusion

The methodology adopted was very time consuming but it did not burden us financially and thus we have been able to sustain this. Hopefully we will have 200 unit processes that will be very Indian [about 90%].

Session 5: LCT in Sustainability Assessment and Management

I. Decoupling economic growth from resource use – Why Material Flow Cost Accounting is a good start for Small and Medium Sized Enterprises in taking a Life Cycle Perspective

Author: Mrs. Martina Prox

Organization: *Ifu Hamburg, Max-Brauer-Allee 50, 22765 Hamburg, Germany*

Introduction

The contribution will give insights in the latest developments and experiences with Material Flow Cost Accounting (MFCA) in small and medium sized enterprises (SMEs), public efforts to promote MFCA in different regions and the links with Life Cycle Approaches.

Life Cycle Assessment in SMEs

Typically, SMEs start to work on Life Cycle topics following external requirements e.g. life cycle information demands by business-to-business clients or governments for public purchasing. Therefore taking a life cycle perspective is less motivated by the potential improvements that can be reached in the production system, but by the fulfilment of external information requirements.

Material Flow Cost Accounting in SMEs

SMEs apply MFCA specifically to detect inefficiencies by quantifying the true costs of wastage and inefficiencies in product systems. As an internal method, MFCA is a material and energy flow oriented accounting approach, which is used within an environmental management accounting framework in line with ISO 14051:2011 (ISO 2011). Encouraged by the Ministry of Economy, Trade and Industry (METI) in Japan more than 300 cases of MFCA implementation have demonstrated that MFCA reaches convincing and quick results in all sizes of companies (METI 2010). German experiences show that 50% of the saving potentials found can be realized with less than 10 000 € investment. So it can be observed that Governments as well as Industry Association are taking efforts to encourage the implementation of MFCA to support resource efficiency policies.

Extending MFCA to the supply chain prepares for taking a full Life Cycle Perspective

Understanding the technical reasons for losses during the application of MFCA practitioners often find that a loss occurring internally is caused by a property of the material that is influenced by the supplier or by property of the final product required by the customer (Viere et al. 2007 and METI 2010). Therefore, MFCA has been extended to the supply chain in practice and an additional ISO standard (ISO/CD 14052) for this extension of MFCA is under development (ISO 2015).

Conclusions

For companies using MFCA it's a natural step to extend their perspective a long the life cycle and start to collaborate with supply chain partners. Due to the common focus on supply chains, there are possibilities for integrating LCA data with MFCA analysis (Möller and Prox 2008), in particular with regards to information sharing since both tools have similar data needs. While LCA is focusing on the environmental impacts, MCFA is able to serve as motivation for cost reduction targets.

References

1. ISO 2011. "ISO 14051:2011: Environmental Management – Material flow cost accounting – General framework". Geneva, Switzerland.
2. ISO 2015. "ISO/CD 14052:2015: Environmental management – Material flow cost accounting – guidance for practical implementation in a supply chain; internal Working Draft of WG 8 of ISO TC207". Geneva, Switzerland.
3. METI - Japanese Ministry of Economy, Trade and Industry 2010. "Material Flow Cost Accounting MFCA Case Examples", METI, Tokyo, Japan.
4. Möller A. & Prox M. 2008. "From Material Flow Cost Accounting to MFA and LCA", The challenge of creating social and technological innovation through system-thinking. Proceedings of the Eighth International Conference on EcoBalance 2008. Tokyo, Japan.
5. Viere, T., Schaltegger, S. & von Enden, J. 2007. "Using Supply Chain Information for EMA – the Case of a Vietnamese Coffee Exporter". Issues in Social and Environmental Accounting, Vol. 1, Issue 2.

II. ACIDLOOP Project

Authors: Mr. Sathappan S[1], Mr. Rajkamal P R[1], Mr. Parthiban V S[1]

Organization: [1] Asia Society for Social Improvement and Sustainable Transformation (ASSIST)

Introduction

ACIDLOOP is a four year project funded by the European Union. The overall objectives of the project are (a) Improved urban environmental quality in the urban regions of North, West and South India (b) Improved living conditions in the target regions (c) improved production technologies. Specifically the 4-year action aims to introduce technology innovation as well as resource efficiency in the metal finishing Small and Medium Enterprises (SMEs) that would lead to improved environmental quality and combat pollution through advanced water treatment measures and energy efficient processes.

The project is implemented by a consortium of seven partners Namely Adelphi, AREC, ASSIST, BFI, SIAM, Stenum Asia and TERI. Each partner takes care of a set of activities assigned to them. A total of 96 companies are selected for the project across India. ASSIST is responsible for the consulting of 23 the companies in the Southern region.

Methodology

As mentioned earlier the project period is 48 months hence the timeline for each activity was decided well in advance. The very first activity of the project was to select the target groups from three zones - north, south and west. Hence some cities from each zone was selected (i.e.) Chandigarh, Mohali and Faridabad from the north, Pune, Ahmedabad and Vadodara from west and Chennai from South. In this phase, the concepts to be covered was introduced and the companies discussed their specific issues and gaps. Customers of metal finishing SMEs were also invited to participate in this activity; applications were received from interested companies and few companies were selected based on the predefined criteria.

Then the staffs from TERI, STENUM Asia, ADELPHI India office and ASSIST were trained on the resource efficiency techniques including the adapted tool kit and the closed loop technologies. All staff visited partners BFI in Germany and AREC in Austria for this training.

After the trainings the trained consultants form each region were asked to visit the interested companies and collect their resource consumption and production data in a standardized format for review and shortlisting of the companies.

Finally a total 96 companies were shortlisted for the project across all the regions. The selected companies were visited by the international experts from AREC and Adelphi. During the International expert visit the existing processes and the resources consumed were studied and recommendations were given to cut down resource use, improve the product quality and thereby reduce waste generation at the source. Visit reports were prepared by the local experts responsible for each company and handed over to all the companies. The local experts are following up with the companies on the implementation of the recommended actions and are capturing the resource saving realized out of the implementation.

Results & Conclusion

The results of the implemented actions are captured in the form of case studies and the impact of the project will be measured using the Impact Assessment Sheets (IAS) which will show the difference in the resource consumption in percentage of a previous reference year to that of the current year.

At the end of this project there would be an average reduction of 15% of water and energy saving in all the participating companies. Closing ceremony will be held were the companies would showcase their implementations.

III. Role of LCA of Solid Waste Management in Sustainable Development: A review

Authors: Yadav, P[1] and Samadder, S. R[2]

Organization: [1]Junior Research Fellow (JRF), Department of Environmental Science & Engineering, Indian School of Mines, Dhanbad, India.

[2] Assistant Professor, Department of Environmental Science & Engineering, Indian School of Mines, Dhanbad, India

Sustainable solid waste management is generally regarded as symbolizing recovery of more valuable products from the waste with less energy and space consumption as well as reducing the emissions of pollutants. The initial step of sustainable solid waste management is the reduction of the amount of waste generated. Secondary techniques tackle recovering the materials and energy from the waste to make it reusable. Environmental sustainability addresses resource conservation and pollution concerns. Life cycle assessment (LCA) is an emerging environmental management tool that attempts to predict the overall environmental impacts of solid waste from cradle to grave. LCA helps decision makers to select the appropriate waste management options and observe environmental impacts of the whole system. LCA acts as a decision support system ultimately helping in environmental management. This paper summarizes the methodology for applying LCA for solid waste management and also presents the disadvantages and benefits of the application of LCA in waste management. LCA offers a system map, that sets the stage for a holistic approach for integrated solid waste management, and then by comparing such system maps for different options for different products or waste management systems, environmental improvements can be made by considering the impacts of indirect inputs and emissions. LCA model is useless without accurate, relevant and accessible data. Collection and accuracy of data is the biggest challenge in the application of LCA for solid waste management.

Keywords: *Environmental Impacts, Environmental Sustainability, Integrated Waste Management, Life Cycle Assessment, Pollutants.*

Session 6: Development & application of national/regional LCI databases

I. Challenges for consistent National LCI database development

Author: Mr. Timothy Grant
Organization: Director, Life Cycle Strategies Pty Ltd.

The development on national Life Cycle Inventory (LCI) data sets is a positive development for LCA globally. National or regional data development makes sense when collecting data however when building LCI supply chains the national data structure breaks down when major items are required from overseas suppliers.

The traditional approaches to deal with this has been to either assume overseas production is the same as domestic production, or to make minor modifications to domestic data sets to represent overseas production.

The Australian Life Cycle Inventory database (AusLCI) is one such national LCI database developed by Australian LCA Society (ALCAS) which has undertaken both of these approaches. When imports are less than 20% it is ignored and modelled as domestic production. Where imports represent a greater share either overseas inventories can be used on local inventories can be adjusted to best represent overseas production. However in recent additions to the database a different approach has been taken to embed overseas data sets within the AusLCI. Local Australian PCV production is entirely from imported vinyl chloride monomer. The monomer is well represented in the US LCI database as a series of unit processes. The aim in AusLCI is to present unit process data sets which provide the greatest level of consistency and transparency to users so 22 unit processes from US LCI is included in the AusLCI dataset.
Another challenge include efficient ways to publish datasets in the transparent and importable way so it would be available for different users. Open LCA is now being used as the hosting platform for the database from where it can be exported into other software.

ALCAS are now grappling with how to include EPD data in the national database when background models are not publically available.

II. Life Cycle Inventories for Emerging Economies; Challenges, Opportunities, and way forward

Author: Dr. Amir Safaei
Organization: International Project manager, Ecoinvent Centre

Scope

International trade is a major contributor to the global economic development, and trade from emerging economies is expected to grow in the coming years. However, some consumers have major concerns over the sustainability of supply chains. Such concerns can trigger a preference for local products and *partially* disrupt the international trade. This in turn can limit the access of suppliers in emerging economies to “green” markets.

Life Cycle Assessment (LCA) can be employed to assess and mitigate the environmental impacts of supply chains. An LCA is built on the basis of sound Life Cycle Inventory (LCI) data. Yet, there is a comparative lack of accurate LCI data for emerging economies, and employing existing LCI data of other regions might not reflect the situation in emerging economies and is not always accepted. Therefore, producers in countries with high data availability have advantages when it comes to fulfilling environmental regulations requiring LCAs and in consumer communication. This underlines the importance of developing and utilizing regional LCI databases. At the moment, LCA and LCI creation are less widespread in emerging economies, and thus less studies exist to build background data for an LCI database. The creation of LCI databases requires a certain “critical mass” of data for the database to be fully useful, i.e. sufficient activities and background data to avoid significant gaps in process chains due to lack of data that might inhibit a thorough analysis, introducing errors in the results.

Aims and conclusions

Creating regional LCI databases by integration into existing global databases proves to be an efficient mean to develop regional databases, by simplifying data collection for inexperienced users, and by forming the local datasets based on global background data with higher uncertainty, until local inputs become available. We explore the challenges of setting up regional LCI databases, discuss ecoinvent’s strategies to overcome those challenges, and demonstrate the lessons learned in creating LCI databases for emerging economies.

III. Indian National Life Cycle Database-Requirements-Implementation -Purpose-Benefit

Authors: Dr. Martin Baitz[1], Dr. Rajesh Kumar Singh[2], Mr. Ritesh Agrawal[2]
Organization: [1] thinkstep AG, Germany
[2] PE Sustainability Solutions Pvt. Ltd. India, a 100% subsidiary of thinkstep AG, Germany

Introduction

Several significant national market drivers are steering Indian businesses to adopt sustainability as a responsible way of doing business. This is increasingly gaining momentum as India's National Voluntary Guidelines on Socio-Economic and Environmental Responsibilities of Business brought out by the Ministry of Corporate Affairs recommends businesses to provide goods and services that contribute to sustainability throughout their lifecycle. Accordingly, Securities and Exchange Board of India (SEBI) encourages conducting Life Cycle Assessment (LCA) and report on 3 products/ services and reductions in environmental impacts. Global Reporting Initiative (GRI) on sustainability reporting also encourages organizations to conduct materiality assessment to evaluate the environmental impacts across their value chain. The Carbon Disclosure Project (CDP) promotes supply chain performance through comprehensive Scope 3 GHG reporting. The Confederation of Indian Industry (CII) GreenCo rating system also endorses the lifecycle approach by allocating points to conducting lifecycle assessment and demonstration evidence of improvement. The increasingly adopted LEEDv4 green building rating system in India has also assigned points for conducting building LCA and using building products with Environment Product Declaration. In view of these drivers, no country in the world having sustainability on the national agenda not having already a national database or working on it or planning it.

Requirements

National data need to be tailored to be fit for Indian purposes. The driving forces in politics and business in India must be satisfied. Due to global supply and value chains the data must link into international data networks and based on international standards. Application in Indian businesses calls for regular updates and maintenance. Organizations entering the topic should experience intuitive and easy access. Data management routines need to be organized, standardized and automated to keep operation cost low and quality high. Data sources and data supply needs to be organized over an intelligent platform to enable the combination and secure use of public and confidential information sources from internal and extern sources for all relevant Indian applications and demands.

Aim

This paper discusses the attributes of the thinkstep 2015 release of the Indian Life-Cycle database and its features and benefits. Over 20 years of life cycle expertise by thinkstep is captured in GaBi Databases, which always feature the most accurate Life Cycle Inventory profiles based on industry borne data. Based on this experience an Indian specific database was developed and made available. The new Indian database – like all of the established GaBi databases - is designed to address conformity, consistency and interoperability by using established methods, all globally used LCA formats and consistent nomenclature. The database quality will be preserved by professional maintenance, audited development and update routines, suitable documentation and third party reviews. The database aims to cater to all relevant national demands and initiatives as well as alignment with international activities and networks. The content will be also be developed and expanded over time in accordance to emerging standards and will aim to address evolving user demands. To support training and adoption, thinkstep will also offer GaBi databases and software for free to academic users for teaching purposes.

Conclusion

The Indian database in an important step in the Indian sustainability journey and can promote lifecycle thinking, support the government to drive and guide policy, the academia to innovate in their research and the organisations to run responsible businesses and decision support to gain benefit for all involved Indian stakeholders.

Keywords: *Life Cycle National Databases, Database Development / Maintenance / Management*

IV. Importance of Lifecycle Inventory in development of management tools: Nigeria as a case study

Authors: Prof. Ifeolu Adewumi

Organization: Department of Civil Engineering, Niger Delta University, Wilberforce Island, Nigeria

Introduction

Despite nearly two decades of global modeling of Life Cycle Assessment/Management (LCA/LCM), majority of developing countries in Africa are yet to appreciate the relevance of the tools in the promotion of good practice and improvement of the health and environment of communities where most of the businesses/industries operate. Nigeria in particular, despite being the largest economy in Africa has lagged behind because most of the Researchers in the Academia have not seen the need to adopt existing tools in their work or develop appropriate tools that will reflect on their local experiences.

Materials and Methods

Even as the World transits from the erstwhile seven Millennium Development Goals (MDGs) to the present 17 Sustainable Development Goals (SDGs), essential data and inventory that will make such LCA/LCM soft tools easier to develop are still scanty across Africa. Efforts are on through a European Union Commission funded project, the Switch Africa Green Project, coordinated by UNEP through the African Roundtable on Sustainable Consumption and Production (ARSCP)'s Experts and Subject Matter Specialists to promote flagship programs of the SAG project in six countries within the next two years through selected MSMEs in each country. This paper uses another funded project and other published works by the author to show the relevance of Inventories in serving as baseline data for LCA and LCM.

Results and Discussion

By using graphics and data to compare Business-As-Usual (BAU) situation with Life Cycle Thinking (LCT) management of specific social, economic and environmental problems in each or any of the MSMEs taken from the Nigerian environment data, the LCT models on all three key issues of social, economic and environmental improvement offer improvements than the BAU models. To majority of MSMEs, the strength of adoption of LCA/LCM tools in developing economies relies on economic justification, even where social and environmental improvements are obvious.

V. Enhancing CSR Using LCA-based software to measure monitor and report the impacts of company procurement

Author: Unmesh Brahme
Organization: Board Member, International Institute of Sustainability Professionals

Materials & Methods

The presentation will point to possible processes for: 1) Analyzing the relative functionality of products; 2) Assessing data comparability; 3) Determining data quality. He will include a demonstration of the Sphere-E software that builds on ISO product standards and offers solutions for ranking, benchmarking and visualizing LCA data of comparable quality and scope.

Results

The presentation will address the challenges of using LCA data in the evaluation of products with a focus on issues identified in a Business for Social Responsibility report that states: **"**There is little guidance for buyers on how to compare different products, weigh the different data and other factors, and integrate these considerations into their decision making…" He will include an example of a system under development that addresses these issues - the Sphere-E Software.

Discussion

The presentation will relate his discussion of the challenges and opportunities in using product LCA data in CSR reports to new expectations on sustainability reporting in the global marketplace. He will relate these to the challenges addressed in the BSR report and to his experience in interconnected sustainability domains across multiple organizations.

Conclusion

As most enterprises allocate 65% of their annual operating expenses to the procurement of products and services, inclusion of their environmental impacts will enhance significantly the value of CSR reports. Yet use of LCA data in this manner requires close attention to LCA data comparability and LCA technical methodologies.

Session 7: LCA in promoting eco innovation and sustainability: Education, Research and Application

I. LCA of Biochar application as a soil amendment for maize production

Authors: Mr. Weerasingha H S H, Dr. Karunaratne D G G P, Mrs. Ariyarathna S M W T P K
Organization: Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya, Sri Lanka

Biochar produced through the pyrolysis of organic wastes such as bagasse, rice husk and sawdust has been in use for generations as a soil amendment to increase the crop yield. Biochar has also received a renewed attention as a means of carbon sequestration that would reduce GHG emission. Use of biochar to increase the soil fertility reduces the synthetic fertilizer usage resulting in economic and environmental benefits. However, most of the pyrolysis methods employed in the production of biochar result in emission of substances that are harmful to human health. These conflicting indicators highlight the need for employing a holistic approach, such as life cycle assessment, to assess the overall impact of biochar application as a soil amendment. Therefore, the objective of this work is to assess the overall environmental impacts of the use of biochar in maize cultivation under different crop yield scenarios and under deferent biochar production methods using life cycle assessment as a tool. Three different biochar manufacturing methods; traditional kiln, retort kiln and top-lit updraft (TLUD) stove methods were evaluated. The results are compared with the conventional maize cultivation method, where application of chemical fertilizer is the norm. In addition, an economic evaluation is carried out to identify the conditions under which biochar application is most favorable.

The results indicate that traditional biochar production methods have higher health impacts while TLUD stove resulted lowest environmental and health impacts. Overall benefits of biochar use can be obtained by using appropriate technology for char production with an energy recovery system and applying biochar in farmlands that result in increase in yield. However, if the biochar application results in drop in the maize yield below 10% compared to conventional farming, application of biochar does not result in overall benefits.

II. LCA of arc welding and gas welding processes

Authors: Prof. (Dr.) Kuldip Singh Sangwan[1*], Prof. (Dr.) Christoph Herrmann[2], Mr. Vikrant Bhakar[1], Mr. Jakob singer[2], Ms. Patricia Edege[2]

Organization: [1]Department of Mechanical Engineering, Birla institute of technology and science, Pilani, Rajasthan, India

[2]Institute for Machine Tools and Manufacturing Technology, Technical University of Braunschweig, Germany

Introduction

The increasing problems of resource depletion, pollution, landfill scarcity has made business and government to pay attention towards the life cycle assessment(LCA) concept of the production processes[1][2]. LCA can be applied to reflect and alleviate environmental burdens of any product or process. Welding is one of the widely used processes in manufacturing industry[1]. Every welding process differs from each other in terms of energy and material consumption, also in environmental impact generation. According to Yeo and Neo [3]approx. 0.5-1% of the consumables in arc welding are converted into particulate matter, gases and emissions. On global level, the pollutants released through welding process are in tonnes and a large amount of energy is consumed for the same.

Materials and Method

The present study aims at assessing the life cycle environmental impact of a welding training process generally used in training the undergraduate degree students at an Indian university campus in term of climate change, human toxicity, human health, etc. Approximately three million students are enrolled for the technical education throughout India[4][5] and it imitates the importance of the study. Material and energy flow modelling is carried out utilizing software Umberto NXT universal with Ecoinvent v3.0. The environmental impact generated due to training of one student in welding shop at workshop of an university has been taken as functional unit for this study. Possible and typical process-specific data were collected by performing time study at the workshop. To model the environmental impact of welding training process, both primary and secondary data have been combined. Environmental impact assessment was carried out using both CML 2001 and Impact 2002+.

Results and discussion

It is found that in the production of machine/equipment (manufacturing phase) copper and mild steel are major polluter, in use phase mild steel is dominant and in disposal copper is a major contributor. This study recommends for advanced learning technologies for different welding processes using software based simulation and training of both students and employees.

Keywords: *Welding process; Life cycle assessment; environment impact; energy consumption*

References

1. J. Um, A. Gontarz, and I. Stroud, “Developing Energy Estimation Model Based on Sustainability KPI of Machine Tools,” *Procedia CIRP*, vol. 26, pp. 217–222, 2015.
2. C. R. V Coelho and S. J. McLaren, “Rethinking a product and its function using LCA - Experiences of New Zealand manufacturing companies,” *Int. J. Life Cycle Assess.*, vol. 18, no. 4, pp. 872–880, 2013.
3. S. H. Yeo and K. G. Neo, “Inclusion of environmental performance for decision making of welding processes,” *J. Mater. Process. Technol.*, vol. 82, no. 1–3, pp. 78–88, 1998.
4. V. Bhakar, V. V. K. Uppala, a. K. Digalwar, and K. S. Sangwan, “Life cycle assessment of smithy training processes,” *Procedia Eng.*, vol. 64, pp. 1267–1275, 2013.
5. AICTE, “Statistics of Intakes seat in Engineering and Technology,” *All India Council of Technical Education, New Delhi*, 2013. [Online]. Available: http://www.aicteindia.org/downloads/Intakeseats.pdf retrieved on 23, January 2013. [Accessed: 23-Jan-2013].

III. System thinking and life cycle assessment for development of sustainable urban water systems

Authors: Mr. Vineet Kumar Rathore[1], Mr. Lokendra Thakur[1], Dr. Prasenjit Mondal [1], Dr. Niranjan Bagchi [2]

Organization: [1] *Department of Chemical Engineering, Indian Institute of Technology, Roorkee 247667, Uttarakhand, India*

[2] *Environmental consultant*

India occupies 2.4% of the world's land area but supports over 17.5% of the world's population[1]. The level of urbanization in India has increased from 27.81% to 31.16 % during year 2001 to 2011[2]. It can also be predicted that the increasing trend of urbanization will continue in India for next few decades, which will significantly change the land use and affect flooding in many ways[3,4].

Further, in India population may cross the 1.5 billion mark by 2050 whereas the annual availability of fresh water may reduce to 1140 m^3 which was 5177 m^3 in 1951[5]. An estimated 38354 million litres per day (MLD) sewage is generated in major cities of India, but the sewage treatment capacity is only of 11786 MLD. Similarly, only 60% of industrial waste water is treated[6]. Therefore, it is very clear that in near future Indian cities will be experiencing acute water problems and their sustainability will be affected. To tackle the situation we need to develop strategy to handle any water related problem considering the long term impacts on the whole system (system thinking) in spite of its immediate remedy (liner thinking). Implementation of life cycle assessment of water related activities can help to ensure the sustainability of the city.

Few literatures are available on the management of water problems of some specific urban sites around the world using systems thinking using life cycle assessment. Different indicators have been developed to assess the risk. The present paper provides state of the art information on the application of systems thinking for the management of urban water systems and their sustainability. It explains the procedures and mechanisms, different indicators like sustainability indicator and life cycle indicator, software etc.

References

1. https://en.wikipedia.org/wiki/Demographics_of_India
2. http://indiafacts.in/india-census-2011/urban-rural-population-o-india/
3. http://www.infostat.sk/vdc/epc2006/papers/epc2006s60134.pdf
4. http://pubs.usgs.gov/fs/fs07603/
5. *CWC. 2010. Water and related statistics. Water Planning and Project Wing, Central Water Commission, India.*
6. R Kaur, SP Wani, AK Singh and K Lal, Wastewater production, treatment and use in India, http://www.ais.unwater.org/ais/pluginfile.php/356/mod_page/content/111/CountryReport_India.pdf

IV. LCA of Suburban Railway

Authors: Shinde Amar Mohan[1], Anil Kumar Dikshit[2] and Rajesh Kumar Singh[3]

Organization: [1] *Research Scholar, Centre for Environmental Science and Engineering, Indian Institute of Technology Bombay, Mumbai, India*

[2] *Professor, Centre for Environmental Science and Engineering, Indian Institute of Technology Bombay, Mumbai, India*

[3] *Managing Director, Thinkstep Sustainability Solutions Pvt. Ltd., Mumbai, India*

Introduction

In present study, life cycle assessment has been performed for Mumbai Suburban Railway System, the highest passenger carrying suburban railway system in the world, carries 80 lakhs passengers daily. It operates 2813 train services daily in three different corridors spread over 318 route kms[1,2].

Materials and methods

The scope of this assessment includes life cycle environmental impacts of (i) Infrastructure i.e. construction and maintenance of railway tracks, power supply installations, passenger amenities like platforms and foot over bridges (ii) Rolling stock i.e. manufacturing and maintenance of self-propelled electric multiple units (EMU) comprising of trailer coaches and motor coaches and (iii) Operation phase i.e. traction and non-traction electricity consumption. GaBi software has been used to identify environmental impacts in terms of Global Warming Potential, Ozone Depletion Potential, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential. Life cycle inventory results are normalized in terms of per passenger kilometer travelled as a functional unit[4-7].

Result and discussion

The results show that operation phase has the largest environmental impact for Global Warming Potential and Ozone Depletion Potential due to emissions from electricity production. Whereas Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential have a significant influence from remaining two phases. Electric components like transformer in motor coach are major contributor for ozone depletion potential.

Conclusions

This assessment provides the broader perspective to assess environmental impacts and explores the potential opportunities for policy makers and operators to reduce them across all life cycle phases of suburban railway mobility.

References

1. MRVC, (2013), "Mumbai Suburban Rail Passenger Surveys and Analysis", Report prepared by Mumbai Railway Vikas Corporation Ltd. (MRVC), Public sector Undertaking under Ministry of Railways, Govt. of India.
2. MMRDA, (2012), "Basic Transportation and Communication Statistics for Mumbai Metropolitan Region", Report prepared by Transport and Communication Division, Mumbai Metropolitan Region Development Authority (MMRDA), Mumbai.
3. Gabi 6, (2015), "Product Sustainability Software and Database for Life Cycle Engineering", Thinkstep AG, Stuttgart, Germany.
4. TERI, (2010), "Final report - Life Cycle Analysis of Transport Modes (Volume I)", The Energy and Resources Institute (TERI), New Delhi, Project code 2011UD02.
5. Kimball, M., Chester, M., Gino, C. and Reyna, J., (2013), "Assessing the Potential for Reducing Life Cycle Environmental Impacts through Transit-Oriented Development Infill along Existing Light Rail in Phoenix", Journal of Planning Education and Research, 33(4) 395-410.
6. Chester, M. and Horvath, A., (2012), "High-Speed Rail with Emerging Automobiles and Aircraft Can Reduce Environmental Impacts in California's Future", Environmental Research Letters, 7 034012.
7. Chester, M., Pincetl, S., Elizabeth, Z., Eisenstein, W. and Matute, J., (2013a), "Infrastructure and Automobile Shifts: Positioning Transit to Reduce Life-Cycle Environmental Impacts for Urban Sustainability Goals", Environmental Research Letters, 8 015041.

V. Material Flow Analysis (MFA) for Water Conservation: A case study of Ganga River basin in Uttar Pradesh, India

Authors: Anshika Kandhway[1] and V C Goyal[2]
Organization: [1]M.Sc. (Env. Studies & Resource Management) Student, TERI University, Delhi
[2]Head, Research Management & Outreach Division, National Institute of Hydrology, Roorkee

Material Flow Analysis (MFA) is a multidisciplinary approach which adverts to systematic analysis of flows and stocks of materials within and across a system. Unlike other tools which focus on quantity of the materials being utilized in the system, MFA concept talks about the fate and impacts of various materials entering and leaving the system. In many conventional techniques for identifying the constituent of water pollution, statistical or modeling methods are employed to identify the main pollutants for a particular region. MFA utilizes the available data and environmental statistics to establish a stationary model which can help to determine the origin and dynamics of pollution in the most presentable way. The MFA technique has been used in many countries for laying policy frameworks for water management practices.

In the present study, MFA was performed for a stretch of Ganga River flowing across Uttar Pradesh using the available data for the year 2011. The discharge of wastewater from different point sources is a major cause of deterioration of river water quality. In this study, the sub-basin of Ganga river in Uttar Pradesh is considered as a system, and the principal pollutants present in the discharged wastewater from the selected industrial sector (covering chemical, distillery, food, dairy & beverage, sugar, paper & pulp, textile, bleaching & dyeing, and tannery) were studied.

A qualitative assessment of identified sub-systems, namely, Industry, Sewage Treatment Plants and Sewage drains was conducted using Principal Component Analysis (PCA) and subsequently, the flows were quantified using graphical representation and line diagrams. The main contributors of pollution load were identified in the wastewater from the various sewage drains of Bijnor, Kanpur, Allahabad and Varanasi towns. The major parameters of pollution in sewage water turned out to be BOD, COD, Total Suspended Solids (TSS) and BOD load for Bijnor; BOD, COD and BOD load for Kanpur; BOD, COD, TSS, Total Dissolved Solids (TDS) and BOD load for Allahabad and COD, BOD and TSS for Varanasi.

The MFA results suggested that the water consumption and wastewater generation values for Sugar industry were 278.4 MLD and 85.7 MLD, whereas for Pulp & Paper industry, the values were 96.3 MLD and 68.1 MLD, respectively. In case of Kanpur, Allahabad and Varanasi, the assessment yielded that the sewage treatment plants are less efficient as compared to the overall wastewater generated. Using a similar analysis for the complete river basin, MFA can be successfully applied to enhance the knowledge for existing action plans, projects and activities. The MFA is a promising technique and need detailed exploration for use in the river conservation and rejuvenation efforts in India.

Session 8: Worldwide trends in LCA/M

I. The launch of the Guidance on Organizational LCA and its road testing

Authors: Dr. Julia Martínez-Blanco[1], Dr. Llorenç Milà-i-Canals[2], Dr. Atsushi Inaba[3] and Dr. Matthias Finkbeiner[1]

Organization: [1] Chair of Sustainable Engineering (SEE), Department of Environmental Technology, Technische Universität Berlin, 10623 Berlin, Germany.

[2] UNEP-SETAC Life Cycle Initiative, 75009 Paris, France.

[3] Department of Environmental and Energy Chemistry, Kogakuin University,Tokyo, Japan.

While LCA was originally considered for products, its benefits and potential might be extended for organization assessment[1]. In this context, the ISO/TS 14072[2] was published last year and the Guidance on Organizational Life Cycle Assessment[3] was recently launched by the UNEP/SETAC Life Cycle initiative. Nearly 70 participants of the flagship working group have been drafting and validating the guidance document over the past two years[4].

O-LCA is a compilation and evaluation of the inputs, outputs and potential environmental impacts (considering a multi-impact approach) of the activities associated with the organization adopting a life-cycle-perspective. O-LCA includes not only the facilities of the organization but also upstream and downstream activities. This methodology is capable of serving multiple goals, like identifying environmental hotspots throughout the value chain, tracking environmental performance over time, supporting strategic decisions, and informing corporate sustainability reporting.

The guidance document[3] is intended to accompany ISO/TS 14072 and go in greater detail on the capabilities of O-LCA and on providing support regarding the methodological framework. It is a comprehensive document with 6 chapters and almost 150 pages. Recommended reading itineraries are included for LCA practitioners, decision makers, methodology developers, consumers and other stakeholders[5].

O-LCA is envisioned for organizations of all sizes, both public and private, in all sectors, and all over the world. The first steps toward full O-LCA application are already taking place, and eleven experiences of the so-called "First Movers" of O-LCA illustrate the process and benefits that the methodology could bring to organizations. Eight sectors and four regions are represented in the case studies.

We would like to encourage the LCA community and also organization's managers and policy makers to apply and spread the methodology[5]. The next step is to road test the guidance document in order to proof the potential of the methodology, add more experiences, promote its further use, and test the clarity of the document[6].

References

1. Martínez-Blanco J, Inaba A, Finkbeiner M (2015a) Scoping organizational LCA—challenges and solutions. Int J Life Cycle Assess 20(6): 829–841
2. ISO (2014) ISO/TS 14072: Environmental management — Life cycle assessment — Requirements and guidelines for Organizational Life Cycle Assessment. Geneva, Switzerland.
3. UNEP (2015) Guidance on Organizational Life Cycle Assessment. Life-Cycle Initiative, United Nations Environment Programme and Society for Environmental Toxicology and Chemistry, Paris, France, http://www.lifecycleinitiative.org/wp-content/uploads/2015/04/o-lca_24.4.15-web.pdf
4. Martínez-Blanco J, Inaba A, Finkbeiner M (2015b) Halfway point in the flagship project "LCA of organizations" by UNEP/SETAC Life Cycle Initiative. J Life Cycle Assess Jpn 11:1–7
5. Martínez-Blanco J, Inaba A, Quiros A, Valdivia S, Milà-i-Canals Ll, Finkbeiner M (2015c) Organizational LCA: the new member of the LCA family—introducing the UNEP/SETAC Life Cycle Initiative guidance document. International Journal of Life Cycle Assessment, dx.doi.org/10.1007/s11367-015-0912-9
6. http://www.lifecycleinitiative.org/activities/phase-iii/lca-in-organisations/

II. SuBoot – Sustainability Bootstrap project

Authors: Ciroth, A. [1], Hildenbrand, J. [2], Cinelli, M. [3], Dragi, V. [4], Gjorgjioski, V. [4]

Organization: [1] GreenDelta, Germany;

[2] Swerea, Sweden;

[3] Warwick University, UK;

[4] IJS, Slovenia

Suboot is a new project to massively increase data availability for sustainability. It is built around three key ideas:

1) Consumers are willing to consider sound, reasonable information about the sustainability of products, provided at point of sale, but this information needs to be easy to understand, easy to obtain, and reliable. This information is currently not available.
2) Businesses can increase their revenues and market shares if they focus on green and ethically produced goods. Collecting sustainability-related information is today too time consuming, this needs to change.
3) There are many sources for sustainability information available, which are "untapped" today.

Aim of suboot is to system to massively collect life cycle and sustainability data from primary sources, and make it available in supply chains and to end users: empowering consumers by providing life cycle sustainability information at the point of sale.

Scope

To address these points, the suboot project offers the following, interlinked solutions:

1) Peer-to-peer bootstrapping: collecting relevant sustainability information along the supply chain, by suppliers
2) A comprehensive "shell model" sustainability label, including information about social impacts, over the entire life cycle
3) Bottom up user feedback
4) Products at point of sale are identified by their barcodes
5) A data module is established to collect data from external, non-life cycle sources, and to create valid life cycle assessment data sets to be used in addition to the peer-to-peer datasets

Conclusion

The suboot system will be presented and discussed on a practical case, a water bottle bought from a retailer.

III. Communication and collaboration as essential elements for mainstreaming Life Cycle Management

Authors: Philip Strothmann[1], Jodie Bricout[2], Guido Sonnemann[3] and Jim Fava[4]

Organization: [1]1Forum for Sustainability through Life Cycle Innovation, Berlin, Germany

[2]CD2E, Lille, France

[3]University of Bordeaux, Bordeaux, France

[4]thinkstep, West Chester, United States

Over the past two decades, ISO, SETAC and the UNEP/SETAC Life Cycle Initiative have significantly helped the life cycle community to mature, mostly by focussing on advancing methodological issues and building capacity. However, in order to mainstream Life Cycle Management (LCM) and thus have a tangible impact on the world, the Life Cycle Community has to get out of the small niche in which it is still operating and become significantly more visible.

To achieve this objective, two major challenges for mainstreaming LCM need to be overcome that are intrinsically linked: collaboration and communication. In order to radically increase the take up of Life Cycle based approaches in business and government, life cycle professionals need to enhance global collaboration among themselves, and to users of life cycle information, as well as with others and communicate to a wider set of stakeholders. To facilitate this process, a home for the community is needed that enables it to become one coherent and clearly identifiable stakeholder but also acts as a central information and networking hub within the community. It should also be rooted in a shared set of ideas and principles to ensure coherent advocacy efforts throughout the world.

The presentation will provide an analysis of existing gaps and challenges to mainstream LCM and possible ways to overcome them. It will also provide an outlook on the progress of the Forum for Sustainability through Life Cycle Innovation, which has been developed to respond to the identified challenges and thereby complement existing activities.

Poster Presentations

I. Chemical Industry Enabling Avoided Emissions - Life Cycle Perspective

Authors: Raviteja Pabbisetty, Ananda K. Sekar, Rajesh Mehta, Ashok Menon
Organization: SABIC Research and Technology Centre Pvt. Ltd.

Over the years, manufacturing industry, more specifically chemical industry has been perceived to be the key contributors to environmental pollution & related impacts. Based on IPCC[1] statistics (2007), about 19% of global carbon dioxide emissions are attributable to manufacturing industry. Besides, there is a common perception that any manufacturing process that consumes fossil resources is unsustainable. While this may be partly true given the fact that fossil resources are finite on the globe, it still requires an extended analysis.

In recent years, the evolution of life cycle thinking has enabled us to take a system-level outlook on such topics in order to quantify the net changes in emissions enabled by these products during manufacturing, use & final disposal by the end-user. Avoided Emissions is one such life cycle concept developed by WBCSD[2] along with ICCA[3]. Avoided emissions are a measure of the reductions in GHG[4] emissions enabled over the life of a product, when compared to a market dominant incumbent product servicing the same application.

This paper will present an outline on the evolution of the life cycle concept of Avoided Emissions & how it can be an effective methodology to quantify net environmental benefits or liabilities of any product from a GHG perspective. The paper also discusses few example case studies.

1. Intergovernmental Panel on Climate Change
2. World Business Council for Sustainable Development
3. International Council of Chemical Associations
4. Green House Gas

II. Decoupling integrated wastes management technologies for developing economies: methane harvesting as target

Authors: Engr Toscanini D. Seimodei[1], Prof Ifeolu K. Adewumi[1,]
Organization: Department of Civil Engineering, Niger Delta University, Nigeria

Introduction

Most developing countries are faced with the challenge of reducing the cost of management of municipal solid wastes and livestock and sanitation wastes, where cost of collection of wastes is more than 60% of the cost of wastes management. Possibility of methane harvesting from open dumps was studied.

Methodology

Tombia open dump in Yenagoa, Nigeria was used in this study. The concentrations of methane (CH_4) at the surface and varying depths (0.5 m, 1.0 m, 1.5 m, 2.0 m, 2.5 m and 3.0 m) within the decaying, unsorted organic wastes in the dumpsite were measured. A hand auger was used in boring randomly selected locations on the dumpsite while standard air emissions monitoring instruments were used to determine the concentrations. The biogas yield was compared with an earlier report on dry fermentation of municipal solid wastes and livestock manure in bunker-like digesters that uses minimum water for its operation[1].

Results and Discussion

The concentrations of measured CH_4 in the open dump increased with depth from a mean surface concentration of 1.42 mL/m^3 to an optimum concentration of 7.57 mL/m^3 asymptotic at a depth of 1.0 m below the uncompacted surface. This implies aerobic activity in open dumps extends to 1.0 m below the top layer. This aerobic region hinders full degradation of organic wastes.

Conclusion

Only negligible CH_4 yield could be up-cycled from Open dump sites when compared with data from sanitary landfills or from dry fermentation system. Open dumps also release substantial gaseous and particulate emissions to the environment than in sanitary landfills. Since dry fermentation system uses minimal water, it will be useful in arid countries with high water stress. Apart from obtaining biogas (CH_4) and organic fertilizer other valuable materials are recoverable and this will help in poverty reduction and youth empowerment in developing economies.

Keywords: Sustainable Wastes Management; End of Life Materials Reuse; wastes-to-energy in developing economies; Biogas Utilization; decommissioning of open dumps