Introduction

LCA is an objective process to evaluate the environmental burdens associated with a product, process or activity by identifying energy and materials used and wastes released to the environment, and to evaluate and implement opportunities to affect environmental improvements. Though the LCA process is new in India it is expected to dominate the environmental management in the coming years as more industries are paying attention towards better environmental management. With increasing importance of environmental concerns, it becomes important to promote this useful assessment technique in the country.

This article describes case studies on three sectors namely waste paper recycling, steel and coal sectors, using LCA approach. The study made on waste paper recycling could be useful for the paper industry. The studies on steel and coal sectors reflect that there is an urgent need to step up coal blending as most of the Indian coal has high ash content and very low calorific value.

LCA Case Studies

Wastepaper Study

This study demonstrates a simple approach of abridged LCA through a case study of waste paper conducted in Mumbai. In the study, waste paper cycle was divided into four main life stages– generation, collection, utilization and disposal. A survey of major stakeholders involved in the waste paper cycle namely, informal waste-pickers, buyers, wholesalers and paper manufacturers was carried out to know the socio-economic and environmental impact during each stage. The LCA Abridged Matrix Method was applied for Life Cycle Assessment.

Steel Sector Study

This study aims at carrying out the LCA of steel sector in India. Four major integrated steel plants namely Bhilai Steel Plant, Steel Authority of India Limited, Rashtriya Ispat Nigam Limited, Vishakhapatnam and Tata Steel, Jamshedpur, along with the leading national consultants in the field of environmental engineering and steel technologies namely, MECON, Dastur & Co., and NEERI are participating in this study. The main objective of the study is to find out the pollution load per tonne of steel produced and identify the problematic areas, which have to be dealt with. Various steps involved in carrying out the study are - preparation of the system boundary, data collection and validation, life cycle inventory preparation and its interpretation and Impact assessment.

Coal Sector Study

This study focuses on the thermal power generation using Lignite. The power sector in the state of Gujarat is predominated by lignite, which mainly contains more of ash than carbon, and therefore, coal based thermal power stations have very huge ecological footprints from cradle...
to grave. While power sector development is critical to the economy of the state, the associated environmental effects across the life cycle of power generation need to be minimized. This study presents improvement assessment of power generation process at thermal power stations by modifications in the coal blend and combustion technology leading to higher generation efficiencies and lower environmental impacts.

**Results and Discussion**

The LCA is at an early stage in India and only few studies have been carried out till date. The initiatives taken by some researchers need to be promoted to encourage useful research in this area. However, it should be noted that LCA, if conducted at a complex level is a time consuming and costly assessment technique.

The *results from the waste paper study* indicate that while there is a moderate environmental impact of wastepaper during generation, collection and disposal stages, the utilisation stage had a significant impact on environment, especially during manufacturing in paper factories. Although the study does not use a comprehensive LCA approach, it shows that such simple abridged assessment methods for various products and processes could be helpful in delivering the complex LCA models.

The *study on steel sector* shows the upward trend in the environmental performance of Tata Steel as a result of various process improvements. The high coke rate in the blast furnaces has been identified as major reason for high coal consumption. The process gases, which are generated in excess needs to be fully utilized in order to bring down the energy consumption of the plant. Recycling of wastes is found to improve the overall performance of the plant considerably. To make Indian steel sector more energy efficient in-house R&D has to make considerable progress whereby environmental improvement could be handled at a much better pace.

The analysis of environmental costs for technological options in *coal sector study* reveals the preference for Combined Cycle Gas Turbine technology. The existing coal quality at Gandhinagar Thermal Power Station and Ukai Thermal Power Station deviates by 40% for ash content and by 35% for calorific value from the design value. Using the linear programming model, coal blend scenarios were developed. These scenarios indicate that the proper blend ratio can minimize the deviation in Calorific Value upto 7.99% and ash content up to 1.75% from the design value. The study of the failure frequency of the boiler components at these power stations indicate that due to high ash content of the coal fed, incidence of economiser tube puncture has been very high leading to generation losses of upto 3128 hours during last 5 years. The study shows that the emission control equipments installed at power plants are operating inefficiently with PM from the stack deviating upto 194% from the prescribed CPCB norms (150 mg/Nm3). The performance of ESPs has been simulated by developing back propagation neural network model encompassing the impact of 10 parameters. It is estimated that the performance of the installed ESPs can be improved by 75% using appropriate coal blend. Proper maintenance and operations along with an optimum blend of coal can bring down particulate emission levels of all the ESP units substantially.
Other LCA activities

About the ISLCA

Indian Society for Life Cycle Assessment (ISLCA), established in December 1997, is an official publication organ of Int. J. of LCA. The Society provides a neutral forum where all viewpoints of the environmental management issue i.e., technical, scientific, economic, social, and political can be addressed. ISLCA’s Advisory Board includes outstanding researchers having recognition at national and international levels in their areas of expertise. In addition, ISLCA has several annual and life members and volunteers. The objectives of ISLCA are: Capacity building for development of LCA in India through its courses, training programmes, conferences, seminars, etc.; Integrating socio-economic concepts in the LCA; networking with various stakeholders of LCA and representing India in national and international forums on LCA and related areas.

International Conference on EcoBalance and LCA in India

An International Conference on “EcoBalance and Life Cycle Assessment in India” was organised by Indira Gandhi Institute of Development Research, Mumbai on February 13-15, 2002. The Conference was jointly sponsored by the Ministry of Environment and Forests, Government of India; Research Centre for Life Cycle Assessment, Agency for Industrial Science and Technology, Japan; Asian Productivity Organization, Japan; and Industrial Development Bank of India, India.

The major objective of this conference was to communicate the LCA concept and capacity building in India. There has been an encouraging response from participants both within and outside the country and about 200 delegates including researchers, non-governmental organisations, government representatives and business houses participated in the conference. The conference covered concepts, methodology and case studies on LCA. The papers presented in the conference included a variety of topics on economic, technological and policy aspects. Some major sectors addressed in the conference were - Urban Ecosystems, Solid Waste Management, Air and Water Pollution, Marine Ecosystems, GHGs, Forest and Biodiversity, Rural Development, Agriculture, Power, Transport, Petroleum, Oil and Gas, and Mines and Minerals.

Prominent speakers during the Conference were Dr. Atsushi Inaba, Director, Research Center of LCA, AIST, Dr. Bas de Leeuw of UNEP France, Mr. R. Budhiraja, Principal Secretary, Energy and Environment, Govt. of Maharashtra, Mr. S. Shiva Kumar of MOEF, New Delhi and Mr. V. Venkateshwarlu, Executive Director of IDBI, Mumbai. Three experts, Dr. Pongvipa Lohsomboon from Thailand Environment Institute, Dr Reginald Tan from National University of Singapore and Dr. Atsushi Inaba from AIST were deputed to the conference by the Asian Productivity Organisation Japan. In addition, foreign speakers and participants from several other countries namely Australia, USA, The Netherlands, Switzerland, Japan, Italy, Romania, Kenya, Thailand, Egypt, and Singapore contributed to the conference.

The conference outcome was quite satisfactory. Many conference participants, including those from abroad, sent feedback on the conference and their consolidated views rated the conference as an excellent event on LCA in India. The feedback coverage was also reported on the UNEP’s website.

For further details on LCA activities in India, please contact Prof. Vinod K. Sharma of IGIDR, Mumbai (email: vks@igidr.ac.in; website: www.igidr.ac.in/lca).
Conclusions

Given the nature of LCA technique, there is an urgent need to conduct studies jointly by various individuals and organizations. This would allow building LCA models that require data at a micro level and also help to develop complex models in the long run. Close interaction between researchers and policymakers is required at various levels to achieve the targets of methodological developments of LCA technique. The data requirements of a complex LCA are enormous and so is the cost, and therefore, to begin with, simple LCA approaches which identify the inputs and outputs for a detailed study should be encouraged.

The awareness level and methodological development on LCA in India are at low level. And therefore, academic events like Conferences, Training Programmes, Workshops etc. are needed for capacity building in the country. The organization like ISLCA is dedicated for the cause but financial resources are a major hurdle for functioning of full-fledged LCA activities. The international co-operation in the areas of technology transfer and financial assistance is required for rapid progress of LCA in India.

References


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