

Perspectives on Life Cycle Assessment Application and Research in Thailand

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Abstract

Life Cycle Assessment (LCA) has been initiated in Thailand since the late 1990s with the first life cycle inventory (LCI) of the electricity grid mix and the offering of the first full graduate course. Since then it has come a long way through the development of the national LCI database and application in various research, industry as well as policy initiatives. LCA has been used extensively as an evaluation and decision tool in agri-food products, energy as well as many other sectors. Many graduate studies as well as research and industrial LCA projects have been performed. Related activities include the proliferation of carbon footprint labeling and application in green purchasing initiatives. Industry has been very actively participating in the carbon footprinting applications, some of them extending their interest to full LCAs for environmental performance evaluation and sustainability reporting. More recently, efforts have also been moving in the direction of looking at life cycle impact assessment methods from a Thailand perspective. Also, with interest in LCA from the policy making perspective, a capacity building effort has been initiated to train researchers in conducting LCA-related research on a sustained basis and ensure that Thailand keeps abreast of the international trends and discussions.

Keywords: Carbon footprint; water footprint; Life Cycle Assessment (LCA); research network; Thailand

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1. INTRODUCTION

The development of environmental management started with the realization of health-related problems being related to pollution events. The first steps were taken with the development of waste treatment systems. However, from the point of “productivity” in industry, this was “money down the drain”. Cleaner production techniques were then developed which were much appreciated by industry as they focused on “production” and “cleaner”; both positive ideas. Plus, these helped reduce costs both in terms of reduced usage of materials and energy, and reduced waste management. Initially these focused on single processes, but later embraced systems thinking or a life cycle perspective which came from the realization that a series of optimization solutions for sub-systems in isolation would not necessarily lead to an optimal solution for the whole system. The development of environmental management in Thailand followed a similar path with cleaner production being adopted in the 1990s. The Thai green label was introduced in 1993. This is a Type I label, but included life cycle thinking in the evaluation criteria (<http://www.tei.or.th/greenlabel/>). The first life cycle assessment (LCA) projects were initiated in 1997, and the first graduate course in LCA and ecodesign taught since year 2000. Initially, the LCA research activities were sporadic and isolated, mostly at universities in the form of graduate student projects. However, more concerted efforts were initiated in the early 2000s, first through the LCA/Ecodesign capacity building program supported by the Japanese government through Thailand’s National Science and Technology Development Agency (NSTDA) and then through the initiation of the Thai National life cycle inventory (LCI) database. The “Thai LCA Network” was established in 2001 (www.ThaiLCA.net); starting with members from the academic community and subsequently involving members from the government and industry^[1]. This article briefly covers the development and application of LCA in Thailand with a view to establishing the path which led to successful dissemination of LCA in academia, industry and the government. It can be useful to provide directions to other countries in the region that are keen on developing LCA.

2. National LCI Database Development

As Thailand realized the importance of LCA and the government wanted to promote it to the industry, the limitation of data, particularly background data on basic materials, grid electricity and waste management was noticed as a big handicap. These data were needed to be developed at a national level so that they could be used consistently as general data by all studies. This led to the formation of a

cooperation between five key organizations – the National Metal and Materials Technology Center (MTEC) under NSTDA, the Federation of Thai Industries, the Ministry of Industry, the Thailand Environment Institute and the Thailand Research Fund – with support from academia/universities all over Thailand^[2]. This has led to the development of 726 datasets at the national level comprising 10 sectors including natural gas, refinery, petrochemical products, infrastructure & transportation, construction materials, agriculture & agro-products, basic chemicals, waste management and textiles^[3]. The national LCI database is continually under development with more datasets being added and older datasets being updated.

3. LCA research in academia

LCA has been taught at the graduate level in universities in Thailand since 1999-2000; graduate research has thus also been pursued since then. However, initially most of the research studies were at an individual level with less coordination at the national level. A large number of Masters and PhD projects resulted in publications, particularly in the areas of agriculture^{[4],[5]} and energy^{[6],[7],[8],[9],[10]}. There were, however, studies conducted in other sectors as well, particularly buildings^{[11],[12]} and waste management^{[13],[14],[15]}. Later on, applications of life cycle-based tools such life cycle costing^{[16],[17],[18]} and sustainability assessment^{[19],[20]} were developed and utilized. Starting with basic application-based studies, more advanced studies supporting energy policy^{[21],[22],[23]} and LCA methods^{[24],[25]} are also being developed. Thus it can be said that in the past two decades or so, LCA research in Thailand has really “come of age”. LCA is now being taught in many universities in Thailand under the regular curriculum at the undergraduate and graduate level. Also, academia has not always worked in isolation with graduate research, but quite closely with industry and the government. These efforts have resulted in the spread of life cycle thinking and application of LCA in the industry as well as in policy making as described in the subsequent section.

4. LCA research at the national level

In the past decade or so, LCA has been conducted by some of the larger companies with the help of academicians. Some of the companies tested the tool for some products as a one-off activity. LCA has also been used for making declarations in their sustainability reports as well as for international reporting schemes such as Global Reporting Initiative (GRI), Dow Jones Sustainability Indices (DJSI), Carbon Disclosure Project (CDP), etc. Self-declared labels (Type II) have also been introduced by some reputed companies. However, the full utility of LCA has been less understood and it did not really become

mainstream. In 2008, the first projects on product carbon footprinting were conducted^[26] followed by the development of the national guidelines and label for product carbon footprinting in 2009^{[27],[28]}. Product carbon footprint became quite well accepted by companies, especially those with export interests, due to the perceived market demand for this information. This resulted in the development of training courses, not only for product carbon footprint, but also for LCA for companies as well as trainers and consultants. The product carbon footprint label has so far (until October 2016) been achieved by 1,850 products from 428 companies (<http://thaicarbonlabel.tgo.or.th/>).

More recently, there has also been research movement on water footprint following international trends^[29]. This has led to the development of the so-called “water stress indices” for the 25 watersheds of Thailand^[30] and their application to biofuels policy^{[31],[32]}. Training courses have also been conducted to train the trainers who have further disseminated the knowledge to companies, governmental organizations and academics.

Several projects have been conducted to enhance the competitiveness of agro-industries, most recently including palm oil, sugarcane and cassava^{[33],[34],[35]}. Policy applications include the recently initiated calculation of Green GDP^[1].

5. LCA capacity building

Recognizing the utility and widespread application of LCA in the country, NSTDA initiated the national capacity building program, so called “Food, Fuel and Climate Change (FFCC) Research Network^[36]”. This network, funded by NSTDA and the Thailand Research Fund through the Royal Golden Jubilee PhD program, intended to develop human capacity in the field of LCA, training 10 researchers who would serve as resource for LCA research in the country. One of the goals was also to produce publications in international journals to make LCA research in Thailand visible internationally. The program led to the development of research in several life-cycle based tools such as material flow analysis^[37], ecological footprint^[38], consequential LCA^[39] and social LCA^[40]. This network has been functional for the last several years and has recently been awarded another prestigious grant from NSTDA to continue for the next 5 years starting 2017.

6. Concluding remarks

The development pathway of LCA in Thailand may be similar to other countries in the region that are also seeking to promote the use of LCA. They may still be at a stage where LCA studies are being carried out by universities and research institutes, but not yet organized at a national level. The

establishment of a national coordination is essential for the mainstreaming of LCA. It will help to focus on national needs, help build a national LCI inventory which is essential for conducting LCAs and also help avoid duplication of studies which may waste valuable resources. Establishment of a national organization as a collaborative effort between government, industry and academia would be an important step in this direction. Adequate financial support, at least in the initial years, would be necessary until the activities can become self-sustaining at a more advanced stage. Capacity building in terms of human resources will also be essential so that the research can be up-to-date and acceptable at the international level. Collaboration within the region, via initiatives such as the LCA Agrifood Asia^[2] would also be useful to learn from each other through sharing expertise and experiences, and also working together on issues of mutual interest.

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