LCA as a Holistic Environmental Inspection Method

Fundamentals of Life Cycle Assessments (LCA) for Industrial Products

LCA as a Holistic Environmental Inspection Method
In the 2015 Paris Agreement, 194 countries agreed on working towards limiting global temperature rise to well below 2 degrees Celsius. This climate target is highly ambitious and requires a large and rapid transition of industries - away from carbon-intensive infrastructure toward new and sustainable technologies. This transition will be induced by climate policy, and is likely to affect most industries around the world.

To stay competitive in this changing climate policy environment and gain leadership in environmental protection, many industrial companies are required to take decisive measures to reduce their environmental impacts. These measures may include a wide range of activities, from process changes within their respective production sites to shifts in resources or a more sustainable supply chain management. To identify the most suitable activities for a specific company, however, a comprehensive environmental assessment is needed. Such an assessment can be performed by using the widely accepted method “Life Cycle Assessment (LCA).”

At the Institute for Technical Thermodynamics at the RWTH Aachen University, we have been working for several years to improve the methodology of LCA and apply it to many real-life problems. We have developed efficient workflows to identify environmental hotspots within the life cycle of products, and find options for improvement. By this means, our research contributes to practical solutions for the development of more sustainable production processes.

In this workshop, we invite participants from both industry and the public sector to get a comprehensive introduction to the field of Life Cycle Assessment. The aim of the certificate course is to enable participants to apply LCA independently within their own company or organisation, and critically assess LCA studies provided by other LCA practitioners. Based on this knowledge, participants will be able to support environmentally relevant decision-making, and detect environmental improvement potential.

I am looking forward to welcoming you in Aachen.

Yours sincerely,

Prof. Dr.-Ing. André Bardow
Institute for Technical Thermodynamics at the RWTH Aachen University
The Initiators

RWTH International Academy
As the RWTH Aachen University's official academy for further education, the RWTH International Academy offers practitioners and professionals alike the chance to benefit from the wide range of subjects, the practice-oriented training and the contemporary knowledge provided by the university. Ranging from updating previously acquired knowledge to specialised training in specific vocational fields, suitable formats that are individually adjustable are offered.
www.academy.rwth-aachen.de

RWTH Aachen University
RWTH Aachen University is a renowned institution, famous around the world especially for its cutting-edge research and the excellent academic training which is in line with market requirements, particularly in Engineering and the Natural Sciences. Therefore, the RWTH Aachen University has been holding top positions in German university rankings for many years. Whether for its reputation in leading companies, its academic reputation, or its success in research with the highest practical relevance it is prestigious in many regards.
www.rwth-aachen.de

Institute for Technical Thermodynamics (LTT) of the RWTH Aachen University
The Institute for Technical Thermodynamics (LTT) at the RWTH Aachen University, led by Prof. Bardow, focuses on the development and assessment of energy and process systems at all scales of thermodynamics, from single molecules to complex process systems. The work is carried out in the following project groups: Energy Systems Engineering, Sorption Systems Engineering, Model-Based Fuel Design, Measurement Systems Engineering, Laser Diagnostics in Thermo-fluid Dynamics, and Molecular Systems Engineering. The group for Energy Systems Engineering has been engaged in the development of a variety of methods in the field of sustainable engineering for many years. Building on the environmental assessment method LCA, these methods enable the development of more sustainable products in key industrial sectors such as the chemical industry and the energy sector.
www.ltt.rwth-aachen.de

The Lecturers

Prof. Dr.-Ing. André Bardow
Chairman of the Institute for Technical Thermodynamics
André Bardow is the head of the Institute for Technical Thermodynamics (LTT) at the RWTH Aachen University. His research focuses on system-analytical methods and technical components for energy systems, as well as theoretical and experimental research on fluid multicomponent-systems. A main focus is on the application and further development of the method “Life Cycle Assessment” for the evaluation and optimisation of industrial production systems. Prof. Bardow published numerous academic papers with strong international visibility and reputation. In addition, he contributed to multiple industrial research projects on both national and international scales. His work was awarded with the Arnold-Eucken prize and the Covestro Science award for outstanding scientific developments, among others.

Dr.-Ing. Arne Kütelhön
Energy Systems Engineering at the Institute for Technical Thermodynamics
Arne Kütelhön is the team leader of the Life Cycle Assessment team at the Institute for Technical Thermodynamics at the RWTH Aachen University. He has participated in multiple research projects within the chemical and energy industry, and authored academic publications in the field of Life Cycle Assessment. His experience in the environmental sector is further complemented by international research stays (e.g. at the University of California, Santa Barbara) and his previous work at an environmental consulting company in China.

Raoul Meys (M.Sc.)
Energy Systems Engineering at the Institute for Technical Thermodynamics
Raoul Meys is a PhD candidate at the Institute for Technical Thermodynamics at the RWTH Aachen University. He is involved in several projects dealing with the ecological assessment of CO₂-utilisation in the field of polymer production. Besides his dedication to CO₂-utilisation, his research is focused on the life cycle assessment of polymer waste treatment technologies in the light of the emerging Circular Economy concept.
Motivation and Course Outline

Taking on a leading role in environmental protection and thus remaining competitive in a climate-sensitive environment requires many industrial companies to implement key measures to reduce environmental impacts. Suitable activities are determined by a detailed environmental assessment. The so-called “Life Cycle Assessment” (LCA) offers a commonly accepted and highly effective method to that end. Standardised in ISO 14040 and ISO 14044, it stands for a holistic environmental assessment method for goods and services and considers the entire life cycle of these products: from the extraction of raw materials to the final disposal of waste. It also takes into account multiple environmental impact categories, such as global warming, fossil depletion, and human toxicity.

By illustrating the environmental impacts of goods and services, LCA provides the basis for more sustainable consumption decisions and the design of environmentally friendly products and value chains. The use of LCA in industrial practice is therefore crucial for a more sustainable economic development.

Life Cycle Assessment

Goal and scope definition

Life cycle inventory

Flows from / to the environment
- Inputs: resources
  - … kg crude oil
  - … kg coal
- Outputs: emissions
  - … kg CO₂
  - … kg NOₓ

Life cycle impact assessment

Environmental impacts
- fossil resources depletion
- water use
- global warming
- acidification
- others

The chart above shows how Life Cycle Assessment is carried out in four phases:

Phase 1, namely the “goal and scope definition” comprises a clear definition of the question to be answered by the assessment and specifies the system boundaries. In phase 2, the “life-cycle inventory analysis” (LCA), all input- and output-flows of processes within the system boundaries are collected. Subsequently, in phase 3 called the “life-cycle impact assessment” (LCIA), those flows that are exchanged with the environment are characterised in terms of their environmental impact in various environmental impact categories. In phase 4, the “interpretation phase”, the results are summarised and discussed.

Course Profile

Course Objective

The certificate course helps participants to facilitate the use of LCA in practice. They learn to represent and quantify material and energy flows as input or output values in the various life phases of a product, a procedure or a service. Furthermore, they will acquire the skill to apply the tool Life Cycle Assessment for value chain-oriented decisions in process optimization and acquire practical skills to independently conduct simple LCA studies within their organisations. In addition, participants will learn to interpret LCA results and to use LCA-based information to improve the environmental profile of both their company-specific supply chains and the processes within their organisation.

Course Format

In five days of attendance, participants will learn to evaluate analysis results and the corresponding potential for improvement through lectures and the independent performance of an LCA study. The newly-acquired knowledge is complemented by a company visit and introduction to the GaBi software, including a corresponding application exercise. By means of self-studies and group work in different workshops, participants will put their newly-acquired theoretical knowledge into practice. Furthermore, participants will work on a real-life case study (taken from industry) in order to gain practical experience.

Target Group

Executives from industry and the public sector, engineers and/or project managers from the areas of production, environmental management, research and development or strategic management. There is no previous LCA knowledge required.

Examination and Qualification

The course concludes with an examination in the form of an oral presentation, where previously chosen groups will present their findings. Upon successful completion of the course, participants will obtain the official RWTH Executive Certificate, listing both the course aims and the course content.

Your Benefits

- Specific knowledge of methods and tools for the practical application of LCA
- Interpretation of LCA results and usage of LCA-based information to improve environmental profiles of company-specific supply chains and processes
- Strong focus on current challenges and problems taken from real-life examples
- Easily projectable knowledge onto individual vocational fields and companies
- Recognise the optimisation potential of your company and enable yourself to act accordingly
- Learn from best practice examples taken from industry as well as from the interdisciplinary exchange of experiences within our network
- Strong focus on networking and communication amongst participants
### Course Plan

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<td><strong>Introduction</strong></td>
<td><strong>Phase 3 &amp; 4 of LCA</strong></td>
<td><strong>Introduction to a LCA Software</strong></td>
<td><strong>Examination Case Study</strong></td>
<td><strong>Prospects of LCA</strong></td>
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<td>Individual arrival</td>
<td>Phase 3: Life Cycle Impact Assessment</td>
<td>Modelling course: LCI</td>
<td>Independent LCA study based on the data obtained during the company visit</td>
<td>Prospects of LCA</td>
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<td>9 a.m. reception</td>
<td>Overview on and computation of environmental impacts based on LCI results</td>
<td>Modelling course: Allocation</td>
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<td>Wrap-up LCA</td>
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<td>Introduction &amp; expectations</td>
<td>Phase 4: Interpretation and Sensitivity</td>
<td>Modelling course: Life Cycle Impact Assessment</td>
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<td>Life Cycle Assessment: introduction &amp; application fields</td>
<td>Interpretation and communication of Life Cycle Assessment results</td>
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<td><strong>Lunch</strong></td>
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<td><strong>Phase 1 &amp; 2 of Life Cycle Assessment</strong></td>
<td><strong>Excursion Company Visit</strong></td>
<td><strong>Modelling Course: Case Study</strong></td>
<td><strong>CO₂ Avoidance Cost Curves as Decision-making Tool</strong></td>
<td><strong>Examination and Awarding of Certificates</strong></td>
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<td>Phase 1: Goal &amp; Scope Definition</td>
<td>Specific industrial production process in the field of carbon capture and utilisation</td>
<td>Conducting an industry-related LCA case study</td>
<td>Comprehensive communication of LCA results both within the company and towards stakeholders</td>
<td>Examination (group presentations)</td>
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<td>Definition of target and scope of assessment</td>
<td>Portrayal and implementation of LCA in industrial processes of decision-making and introduction to the case study</td>
<td>Example industries: Recycling, Product, Food, Transport, Energy</td>
<td>Group work: preparation for final presentation</td>
<td>Feedback and Awarding of Certificates</td>
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<td>Phase 2: Life Cycle Inventory (LCI)</td>
<td>Theoretical background for data collection, building of an LCI model, software tools &amp; databases</td>
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### Networking

To ensure an open and efficient learning environment, we actively encourage communication amongst participants and lecturers. As part of the programme, we will therefore offer a social event. We want you to get to know and engage with your fellow participants and foster long-term contacts both with lecturers as well as organisers within a relaxed atmosphere.

The ensuing network may be useful both for your professional practice as well as for the purpose of voicing further inquiries.
**Organisation**

**Date of Event**
Please find current dates on www.academy.rwth-aachen.de/ica

**Course Venue**
The course will take place at the RWTH Aachen University research cluster, Campus-Boulevard 30, 52074 Aachen (Germany).

**Course Fees**
The course “Life Cycle Assessment” costs € 3,200. In accordance with § 4 Nr. 21a) bb) USTG (Value Added Tax Act in Germany) the course fees are VAT-free. Course papers, catering and programme are included, whereas lodging and travel expenses must be covered by the participant. Cancellations need to be communicated in written form. If you rescind from the course, the RWTH International Academy will ask for a corresponding cancelation fee. Cancellations made up to 4 weeks before the start of the event will incur a cancelation fee of 50 % of the participation fee. Upon cancelation after this point in time 100 % of the course fees will be charged.

**Application**
To ensure individual learning success and lively discussions between participants and lecturers, the maximum number of attendees is 20. You can register using the online application form on www.academy.rwth-aachen.de/lca

**Accommodation**
We have reserved a hotel contingent in Aachen for course participants and will be happy to provide further details.

**Contact for organisational matters and application**
Kim Schönberg
Programme Coordinator
RWTH International Academy
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further-education@academy.rwth-aachen.de

**Contact for content-related questions**
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**Registration Form**


The participation fee includes the course documents, food during the course and the framework program. The course is exempt from VAT taxation according to Art. 4 Para 21a) bb) USTG.
You can look at the terms and conditions at: www.academy.rwth-aachen.de/en/terms-and-conditions

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Send this registration form by post, by fax or by e-mail to:
RWTH International Academy gGmbH
Certificate Courses & Inhouse Programs
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52074 Aachen
Fax: + 49 241 8092525
further-education@academy.rwth-aachen.de

**Data Protection**
With the registration, you declare your consent of your name and business address being included in the list of participants and these being electronically processed and stored for the purposes of the event organization.