EASTMAN

Life cycle assessment at Eastman

Life cycle assessment (LCA) is a holistic approach used to quantify the potential environmental impacts of a product, process or activity throughout its life cycle — from raw material and resource extraction to manufacture, consumer use and end of life. Results from LCA studies can be used to inform decisions at many levels, including material selection, design considerations, and corporate strategy and policy. Eastman developed an in-house LCA team in 2009 and continues to invest in capability development. A wide range of products manufactured at Eastman have been assessed following the LCA framework established in the ISO 14040 and ISO 14044:2006 standards.

Mission

The Eastman LCA team creates long-term value for Eastman, our partners and stakeholders by leveraging our expertise in LCA to drive sustainable choices. LCAs help Eastman steer a sustainable product portfolio and drive resource productivity. Furthermore, LCAs are key to aiding decarbonization efforts and stakeholders' decision-making toward achieving Eastman's sustainability goals.

Goals

The Eastman LCA team provides insight into life cycle impacts to:

- Engage value chain partners in conversations about sustainability, enabling collaboration to reduce cradle-to-gate/grave impacts and maximize brand value
- Guide our product and technology portfolio management and strategy, driving responsible innovation throughout product and process development
- Create a culture within Eastman that promotes life cycle thinking

Team organization

The Eastman LCA team is part of Eastman's global sustainability and decarbonization organization. Most of the team is located at Eastman's global headquarters in Kingsport, Tennessee, USA. The LCA team collaborates with all Eastman businesses as well as functional partners in manufacturing; utilities; process engineering; and health, safety and environment (HSE).

Tools

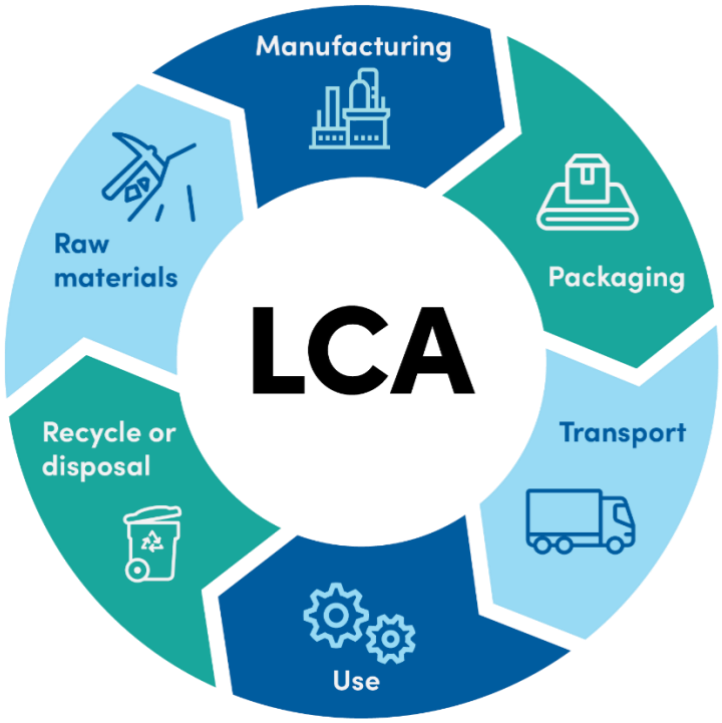
Eastman LCAs are primarily calculated using the Sphera LCA for Experts software (formerly known as GaBi). In addition, Eastman has access to many of the most widely used and accepted LCA databases: Sphera Managed LCA Content (MLC) and ecoinvent.

Standards

The LCAs conducted at Eastman follow the international standards ISO 14040 and 14044:2006. Furthermore, Eastman joined Together for Sustainability (TfS) in 2015. TfS is a joint initiative of chemical companies aiming to promote sustainability practices across the supply chain of the chemical industry. The goal is to harmonize product carbon footprint (PCF) calculations while maintaining compliance with the ISO standards and the Greenhouse Gas Protocol. The purpose of the TfS PCF guideline is to increase transparency toward decarbonizing the chemical industry value chain. Eastman operates complex and highly integrated chemical processes, which require careful consideration of LCA goal and scope, allocation methodologies, recycling, cut-off criteria and more.

Use of external consultants

Most LCAs are conducted internally. If specific expertise is required, Eastman uses consulting firms to assess LCAs, which also supports third-party validation.



Life cycle assessment process

The Eastman LCA process consists of the following steps:

1. LCA goal and scope definition
The LCA goals and scope are defined and agreed on at the start of each study project. Goal and scope determine the level of detail required as well as the functional unit or basis of the study and the system boundary.

2. Data collection and life cycle inventory
Eastman uses its own primary data as much as possible. For processes within Eastman boundaries, data on material and energy usage are collected from manufacturing accounting systems. Data are reviewed with manufacturing engineers and cost analysts to ensure accuracy and completeness. In some instances, engineering expertise and process data are used to adjust distributions of utilities to the individual product level. Thus, allocation/breakdown methods are used to accurately represent all significant material and utility flows into and out of the process. Air emissions are typically based on regulatory permit limits or actual process estimates if available. Data for external flows such as purchased materials are typically collected from published databases if not provided by suppliers. Eastman is careful to select the appropriate database model. In the absence of a published data set for a specific flow, Eastman chooses a proxy or develops a model from literature or process modeling calculations. A life cycle inventory (LCI) is compiled as an input and output table for the studied product or process using the Sphera LCA for Experts software.

3. Life cycle impact assessment
Once the LCI is compiled and the process is built in the Sphera LCA for Experts software, a tool for assessing the environmental impacts of the product is selected. The standard methodology used is the Product Environmental Footprint (PEF), recommended by the European Commission Platform on Life Cycle Assessment (EPLCA). The impact indicators are from the Environmental Footprint (EF) 3.0/3.1. The EF is the most widely used European set of indicators, including photochemical ozone creation potential and eutrophication potential, among others. Additionally, Eastman reports the IPCC AR6 global warming potential indicators (GWP) on a 100-year time horizon, including and excluding biogenic carbon.

4. Documentation of results
Completed LCA studies are documented in internal Eastman technical reports, typically with a confidential security classification. Internal reports include full disclosure of all relevant assumptions, exclusions, allocation methods, sensitivity analyses, data sources and other supporting information. The full LCA report is peer reviewed by the LCA team, manufacturing process experts and other stakeholders prior to finalization. Eastman intends to report PCFs in a format compliant with the TfS standard.

5. Communication with stakeholders
The LCA team works with business, technology and sustainability managers to develop appropriate interpretations and communication of LCA results to both internal and external stakeholders.

6. LCA model retention, maintenance and updates
The LCA team maintains a cumulative master database of all Eastman LCA models. Previously modeled Eastman processes are used for downstream processes that enable Eastman to model the connectivity of our complex stream. Models are updated as needed to reflect current operating conditions.

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LCA modeling of on-site power generation

Energy consumption is typically a major contributor to the cradle-to-gate greenhouse gas footprint of chemical products. Eastman's sites in Kingsport, Tennessee, and Longview, Texas, are heavily integrated and produce their own energy from multiple cogeneration powerhouses on site. Due to integration, the steam and electricity from on-site powerhouses are interconnected. Our product LCAs are based on our own primary data for energy sources. Additionally, in alignment with our 2030 renewable energy procurement goals, products with attributed renewable electricity are modeled using a data set that reflects the character of the renewable energy certificates (RECs) purchased.

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