LCA DATA Cheat sheet

LIFE CYCLE ASSESSMENT (LCA) is a powerful tool for assessing the environmental impacts of products, services, and processes across their entire life cycle—from raw material extraction to disposal. Based on international standards, LCA can provide credible data that supports sustainable strategies, regulatory compliance, and market differentiation.

Understanding the origin and quality of LCA data is key to utilizing LCA studies to their fullest potential. Thus, this Cheat Sheet explains key terms and concepts of LCA data and provides an overview of the most important purposes that LCA data can serve for your business.

1 WHAT ARE LCA DATASETS ABOUT?

Life Cycle Assessment (LCA) datasets provide detailed insights into the environmental impacts of a product. Most LCA datasets in databases cover the entire production process, from raw material extraction to the factory gate where the product is produced. They cover outputs like emissions and waste, as well as potential environmental impacts such as global warming potential and resource depletion. These datasets are crucial for assessing product sustainability up to the point of manufacturing completion.

2 WHAT IS MODELLED?

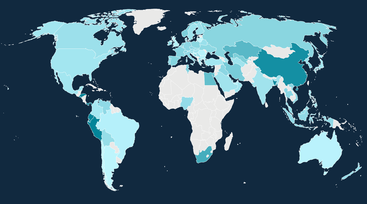
2.1 LEVELS OF GRANULARITY

LCA datasets can vary significantly in terms of their level of specificity or granularity. To demonstrate this, we use Propylene as a case study and focus on the carbon footprint:

Consumption mix datasets

Show the carbon footprint of a product's average consumption in a country, calculated as the weighted average of the climate impact of all local plants and imports. The carbon footprint of propylene, based on consumption mixes, ranges from 1.09 to 3.58 kg CO_2 per kg.

Carbon Footprint of the propylene consumption mix.

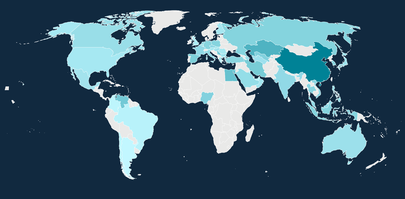


1.09 Carbon footprint of consumption mix (in kg CO_2e/kg propylene) 3.58

Production mix datasets

Show the mass-weighted average emissions of all plants in a country or region producing the same product. By focusing only on local production, it reflects emissions driven by regional production efficiency and technology. The carbon footprint of propylene, using production mixes, varies from 1.33 to 4.17 kg CO_2 per kg across regions.

Carbon Footprint of the propylene production mix.

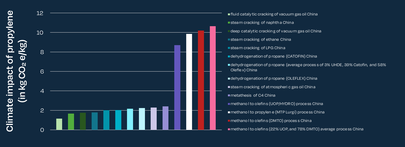


1.33 Carbon footprint of production mix (in kg CO_2e/kg propylene) 4.17

Technology-specific datasets

Represent the mass-weighted average of all plant-specific datasets for a chemical produced using the **same technology** in a specific country or region. In China, for example, the carbon footprint of propylene production, based on technology-specific datasets, varies by a factor of 10 — even within the same country—highlighting significant differences in efficiency and energy sources across production technologies.

Detailed breakdown of the production-related emissions associated with different technologies used to produce propylene in China.



Supplier-specific datasets

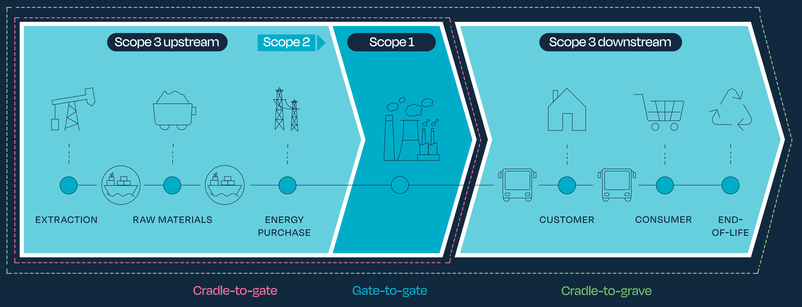
Show the differences in carbon footprints of a chemical for **different suppliers in a country**. They reflect differences in production technologies, raw materials, and energy use. For example, in China, the carbon footprint of propylene can vary by a factor of 11, highlighting the critical role of these datasets in managing supply chain emissions accurately.

Supplier impacts in China.

By leveraging different levels of granularity, companies can gain deeper insights into their supply chains and identify reduction opportunities.

2.2 WHICH LIFE CYCLE STAGES ARE COVERED?

When evaluating the environmental impacts of a product, it is important to understand which life cycle stages are covered. The terms „Cradle to Gate," „Grave," and „Gate to Gate" refer to different segments of a product's life cycle assessment (LCA).



Cradle-to-gate refers to the assessment of a product's environmental impact from the extraction of raw materials („cradle") to the point where it leaves the production facility („gate"), excluding the use and disposal phases, including energy supply (Scope 2) and upstream Scope 3 emissions. It evaluates all relevant processes.

Gate-to-gate refers to the assessment of a product's environmental impact within a specific segment (Scope1) of its lifecycle, focusing on processes occurring within the boundaries of a single facility or production phase. It evaluates the environmental impacts from the entry („gate") of materials into the facility to the exit („gate") of the finished product, excluding upstream and downstream stages.

Cradle-to-grave refers to comprehensive assessment of a product's environmental impact throughout its entire lifecycle, from the extraction of raw materials („cradle") through production and use to its final disposal („grave"). It encompasses all stages and processes a product undergoes, providing a full evaluation of its environmental footprint.

3 | HOW IS THE CALCULATION DONE?

3.1 WHERE DOES THE INPUT DATA COME FROM?

Aspect	Primary Data	Secondary Data
Source	Directly collected from operations or suppliers	Obtained from external datasets and databases
Typical Usage	Company-specific processes/ your foreground system	Upstream and background systems
Specificity	Usually site-specific	Can range from generic to process-specific
Main Advantage	Reflects actual operations	Ensures consistency and transparency
Quality Depends On	Data collection quality and representativeness	Dataset methodology and representativeness

Important: Data quality in LCA is determined by representativeness, completeness, consistency, and methodological robustness – not solely by whether data are primary or secondary.

Primary Data Shares

DEFINITION
Primary share refers to the proportion of data used in LCA or PCF calculations that comes from primary sources versus secondary sources. A higher primary share means that the analysis relies more on directly measured or reported data.

IMPORTANCE
Primary data share is an important quality indicator in LCA and Product Carbon Footprint (PCF) studies, but data quality is not simply a question of "primary" vs. "secondary" data. Primary data is often less comparable, while secondary data from consistent databases can provide better comparability and methodological consistency. Data quality therefore also depends on representativeness, completeness, consistency, and methodological robustness.

3.2 HOW TO ASSESS THE QUALITY OF LCA AND PCF DATA?

Assessing the quality-of-Life Cycle Assessment (LCA) and Product Carbon Footprint (PCF) data is crucial for ensuring the reliability and accuracy of environmental impact evaluations. The quality of datasets is determined based on six key data quality indicators, each rated across five levels, where level 1 represents the highest quality and level 5 the lowest.

Technological representativeness *(TfS requirement)*	Chemicals can often be produced by different production technologies using different reaction pathways and plant designs. Technological representativeness is an indicator for the degree to which the dataset reflects the true population of interest regarding production technologies applied throughout the supply chain.
Geographical representativeness *(TfS requirement)*	Chemical production chains differ among regions and countries. Geographical representativeness describes the degree to which the dataset reflects the true population of interest regarding geography.
Time-related representativeness *(TfS requirement)*	Technical, market, and trade data change over time. Time-related representativeness refers to the degree to which the dataset reflects the specific conditions of the system being considered regarding the time/age of the data.
Completeness	Completeness indicates to which degree all relevant flows are covered by a specific dataset. Completeness refers to both technical flows and elementary flows throughout the production chain.
Reliability	Input data can be obtained from different sources, including measurements, detailed modeling, simplified process calculations, and assumptions. This quality indicator rates the reliability of a dataset based on the underlying data sources.
Methodological Appropriateness and Consistency	Methodological consistency is crucial for comparable LCA results. Therefore, all datasets in the cm.chemicals database are compiled based on the same, consistent methodology described in this document if not stated otherwise. This quality indicator assesses the consistency of the methodology applied, as well as its appropriateness.

3.3 WHAT ARE THE RELEVANT CALCULATION STANDARDS?

In the chemical industry, adherence to established standards is essential for conducting accurate and reliable Life Cycle Assessments (LCA) and Product Carbon Footprint (PCF) calculations. These standards provide the necessary guidelines for methodology and data collection, ensuring consistency and comparability across different assessments. Given the complexity of chemical value chains, which involve numerous production sites and varied processes, standardized approaches are critical.

ISO 14040/14044

ISO 14040/14044 are international standards for Life Cycle Assessment (LCA). ISO 14040 outlines the principles and framework for LCA, including goal definition, scope, inventory analysis, impact assessment, and interpretation. ISO 14044 provides detailed requirements and guidelines for conducting LCA studies, ensuring consistency, transparency, and reliability in evaluating environmental impacts throughout a product's lifecycle. Together, they facilitate standardized and comparable assessments of environmental performance.

ISO 14067

ISO 14067 is an international standard that provides guidelines for quantifying and reporting the carbon footprint of products using life cycle assessment (LCA) methodology. It ensures accurate measurement of greenhouse gas emissions and supports transparent environmental reporting.

Product Environmental Footprint

The Product Environmental Footprint (PEF) is a European Commission standard that provides a harmonized method for measuring and reporting the environmental impacts of products throughout their life cycle. It aims to improve the comparability and reliability of environmental performance data across various product categories.

GREENHOUSE GAS PROTOCOL

The Greenhouse Gas (GHG) Protocol is an international standard that provides guidelines for measuring and managing greenhouse gas emissions from private and public sector operations, supply chains, and mitigation actions. It includes frameworks for both corporate and product-level GHG accounting and reporting.

TOGETHER FOR SUSTAINABILITY

The Together for Sustainability (TfS) initiative is a global organization that enhances sustainability in the chemical industry. It provides a standardized framework for assessing and improving suppliers' sustainability performance, focusing on environmental, social, and governance (ESG) criteria. TfS requires audits and evaluations to ensure consistent, reliable, and comparable assessments across the supply chain, promoting transparency and continuous improvement.

UEIL / ATIEL

UEIL/ATIEL provides guidelines for calculating the carbon footprint of lubricants and other specialty chemicals, ensuring consistent and reliable environmental impact data across the industry.

4 | TYPICAL USE CASES

PRODUCT CARBON FOOTPRINT (PCF)

accounts for the total greenhouse gas emissions generated throughout the entire life cycle of a product. The assessment includes all stages from raw material extraction, production, transportation, and use, to disposal or recycling, but only one environmental impact category.

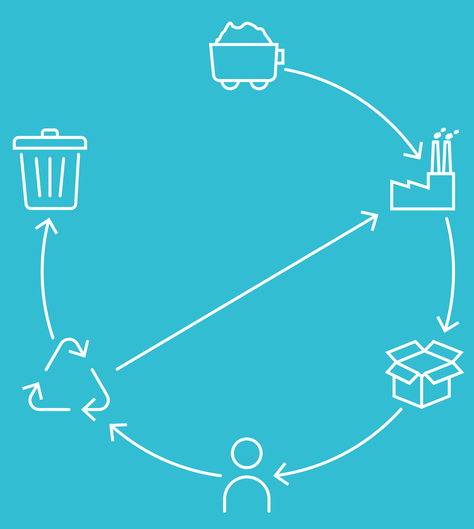
BENCHMARKING

compares a product, service or system to a common alternative. For benchmarking studies, the comparability of data is even more important to avoid comparing apples and oranges and derive correct results and implications. Thus, the standards and guidelines pose special requirements for such comparative assertions, particularly when the goal is to disclose them to the public. Benchmarking studies can be used for the following purposes:

- COMPARE CARBON FOOTPRINT
- IDENTIFY AREAS FOR IMPROVEMENT
- SET GOALS
- ADOPT BEST PRACTICES
- ENHANCE COMPETITIVE ADVANTAGE

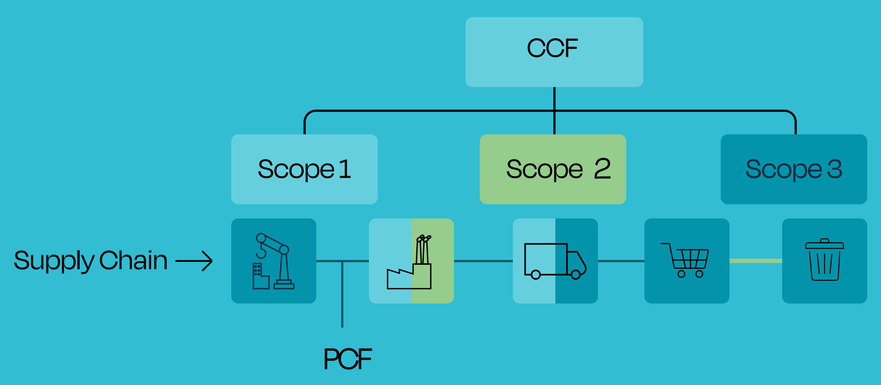
LIFE CYCLE ASSESSMENT (LCA)

is a systematic analysis of the environmental impacts of a product, process, or service throughout its entire life cycle. This includes stages such as raw material extraction, production, transportation, use, and disposal.



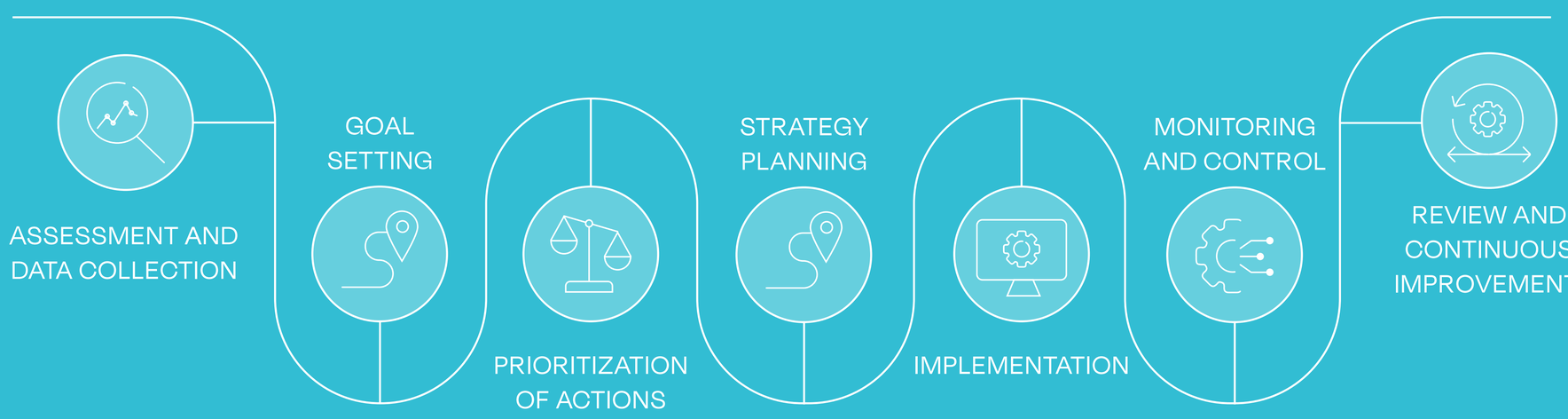
CORPORATE CARBON FOOTPRINT (CCF)

is the total amount of greenhouse gas emissions that a company directly and indirectly produces through its activities. This includes emissions from its own operations, energy production, and the entire supply chain, including upstream (suppliers) and downstream (product use and disposal) activities.



ENVIRONMENTAL STRATEGY

is the development and implementation of plans and actions to reduce an organization's environmental impact. This includes setting sustainability goals, adopting eco-friendly practices, improving resource efficiency, and complying with environmental regulations to enhance long-term sustainability and corporate responsibility.



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LCA DATA? Reach out to us

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