Introduction to Life Cycle Assessment methodology and Standards

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Part 1: Introduction to life cycle assessment methodology

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Disclaimer

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Life Cycle Assessment

An industrial environmental management approach to look **holistically and comprehensively** at products, processes, and activities.
Life Cycle Assessment is...

- The identification and quantification of natural resource usage and releases to the environment across all stages of the life cycle;
- The assessment of the potential environmental impacts of these material uses and releases;
- The identification of opportunities to reduce environmental burdens and achieve system-wide improvements.
What is LCA Used For?

The results of an LCA can be used for many purposes, for example:

- Product comparison ("Comparative Assertion" is required by ISO to undergo peer review).
- Develop a baseline of environmental and human health consequences associated with a given product, process or activity.
- Identify opportunities for system improvement.
- Policy development (private and public).
- Provide the basis for eco-labeling.
- Etc.
Goal & Scope Definition:
- Determine the scope and system boundaries

Life Cycle Inventory:
- Data collection, modeling & analysis

Impact Assessment:
- Analysis of inputs/outputs using category indicators
- Group, normalize, weight results

Interpretation:
- Draw conclusions
- Checks for completeness, contribution, sensitivity analysis, consistency w/goal and scope, analysis, etc.
A clearly defined goal:

- Determines the scope of the study
- Sets the boundaries and scale
- Identifies the product or process function
- Sets the Functional Unit (important for comparing equivalent systems).
- Defines the level of data detail & quality
Life Cycle Inventory: Data Selection and Computation

- LCIs are generally a mix of:
  - Primary “foreground” data from the processes that make the product or process unique
  - Secondary “background” data, generally from existing LCI sources
- Data quality requirements should be specified
- Ranges should be collected, not just averages, where possible
- Needs to be comprehensive without “cut-offs” or truncation unless specified by other standard as acceptable
- Application of assumptions, rules of exclusion, etc., must be transparent.
An LCA tool is generally needed …
Some “background” data providers…
Emissions (CO₂, Methane, CFCs, N₂O, etc.)

GhG’s calculated as CO₂-equivalents

MIDPOINT measures Global Warming Potential (GWP)

Increased global warming can lead to ENDPOINTS

- Spread of Disease
- Drought, Crop Loss, etc.
- Increased Severe Weather
- Loss of Species
- Marine Life Damage
- Coastal Area Damage

GWP Characterization Factors:
CO₂ = 1  CH₄ = 25  N₂O = 298
Life Cycle Impact Categories

Interpretation

• Pair LCIA and LCI results with:
  – Data quality score evaluation
  – Sensitivity/uncertainty assessment
  – Scenario analysis

• Describe limitations

• Draw conclusions
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Part 2: LCA Standards

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**Taxonomy of Life Cycle Assessment (LCA) standards**

**Overarching standard**

**Sector & product agnostic standards and Guidance**

**Sector specific Guidance / Product Category Rules**

### Rule and guideline related to

- Definition of product system, function unit and system boundary (minimum list of processes)
- Data sources, quality and guidelines
- Mandatory and complementary impact categories

### Other questions to consider:
- Aim of the standard (Provide guidance and/or support comparability of the results)
- Type of environmental impact assessment (Greenhouse Gases only or other types of environmental impacts)
Taxonomy of LCA standards

Overarching standard

ISO standard 14040 and 14044 series

Corporate / organization standards
- GHG Protocol corporate, scope 2 3 standards
- ISO standards 14064
- EU OEF

Product standards
- GHG Protocol Product LC standard
- ISO standard 14067
- EU Product Environmental Footprint (PEF)

Country specific standards

Global Logistics Emissions Council (GLEC) Framework
Organization Environmental Footprint Category Rules (OEFCR)

Sector & product agnostic standards and Guidance

Sector specific Guidance / Product Category Rules

Organization Environmental Footprint Category Rules (OEFCR)
Product Environmental Footprint Category Rules (PEFCR)

The International EPD® System

The European Commission

wbcasd
ISO 14040 LCA standards

ISO 14040 series is the foundation and leading international standards on life cycle assessment (LCA).

ISO 14040 provides the guidelines and principles for conducting life cycle assessment studies
- The definition of four phase of LCA (goal and scope, life cycle inventory and impact assessment, interpretation)
- reporting and critical review of the LCA,
- limitations of the LCA, relationship between the LCA phases, and conditions for use of value

ISO 14040 describes the ”principles and framework for LCA”
ISO 14044 “specifies requirements and provides guidelines” for LCA.

- All future Standards and Guidance are built according to the ISO standard 14040:2006
- ISO 14040 LCA standard is applicable to LCA studies at products, organization (or country) level
Corporate/ Organization Standards and Guidance (1/2)

Corporate/organizational LCA standards provide requirements and guidance for companies and other organizations to quantiﬁy and report on their environmental impacts.

The GHG Protocol is the most widely used GHG accounting guidance

- GHG Protocol is convened jointly by WBCSD and World Resources Institute (WRI)
- It supplies the world's most widely used GHG accounting standards
  - The Corporate Accounting and Reporting Standard provides the accounting platform for virtually every corporate GHG reporting program in the world
  - 92% of Fortune 500 companies responding to the CDP claim to use GHG Protocol directly or indirectly.
Greenhouse Gas Protocol
Scope 1, 2, 3 and product life cycle

- **Scope 1 emissions** are direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organization.

- **Scope 2 emissions** are indirect emissions from the generation of purchased energy (electricity, steam, heating and cooling) consumed by the organization.

- **Scope 3 emissions** includes all other indirect emissions that occur in a company’s value chain, both upstream and down-stream.

**Sector agnostic standards/Guidance**
ISO 14064

- Provides the principles and requirements at organization level for the quantification and reporting of greenhouse gas (GHG) emissions and removals.
- The ISO 14064 series is GHG programme neutral. If a GHG programme is applicable, requirements of that GHG programme are additional to the requirements of the ISO

European commission Organizational Environmental Footprint (OEF)

- Detailed and comprehensive technical guidance on how to conduct an Organizational environmental study in any sector
- Envisage the development of additional OEFSRs in complement to the more general guidance in order to further increase methodological harmonisation, specificity, relevance and reproducibility for a given sector
- Consideration of other types of environmental impacts in addition to GHG (e.g. acidification)
Product standards and Guidance

- Product standards and Guidance provide general framework and guidance for companies and other organizations to quantify and report on the environmental impacts of products and services. A few existing sector agnostic standards and Guidance for LCA at product level

- All these standards are compliant with ISO 14044:2006
- While these standards provide more specific guidance to calculate products / service environmental footprint (e.g. in terms of definition of system boundary, allocation, life cycle impact assessment methods), they leave significant room for interpretation e.g. in terms of product specific/sector system boundary, data quality and exact allocation rules.
- Such standards (GHG Protocol, PEF) envisage the use of sector- and organization-specific rules to provide more product- and sector-related rules
Product Category Rules / Sector specific Guidance

Product Category Rules (PCRs) complement the product (and corporate) standards by providing product- and sector-specific rules and add further requirements where the product standards provides several choices:

- Functional unit
- Minimum list of processes and life cycle stages (system boundary)
- Data quality guidelines (Data quality (quality and source of data, both secondary and primary)
- Allocation in the case of multi-functional processes
- Mandatory and complementarity impact categories

Product rules support comparability of environmental claims through providing a set of product specific consistent rules

The two main guidance on Product specific guidance are
- Product Category Rules (PCRs) by EPD international
- Product Environmental Footprint Category Rules (PEFCRs) by European commission

There are other sector and product specific recommendation, guidance, and best practices published by industry associations, NGOs.
## Combined standards and guidelines

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• Global Logistics framework (GLEC)  
• Land Sector and Carbon Removal Guidance | Product Category Rules* | Global |
| ISO | ISO 14064: principles and requirements for the quantification, monitoring, reporting, verification and validation of activities to reduce greenhouse gas emissions or of ways to enhance removal, at the organization and project level | ISO 14067 on the carbon footprint of products | ISO 20915:2018 Life cycle inventory calculation methodology for steel products | ISO 22526 parts 1, 2, 3 and 4 on carbon footprint and removals for biobased plastics | Global |

* PCRs mostly include other environmental indicators but the rules can be used for GHG assessment
Country specific standards

- ILCD (EU) on life cycle assessment
- PAS 2050 (UK) on greenhouse gas emissions
- Carbon Footprint of Products and Environmental Product Declaration (Korea)
- EcoLeaf Environmental Labeling Program (Japan)
- BP X30-323 (France) on environmental footprinting

Many country specific standards are adopted and accepted at a global scale, e.g. PAS 2050.