Lupin Life Cycle Assessment Study – Summary

Introduction:

In FY25, Lupin conducted Life Cycle Assessments (LCA) of its products using both Cradle-to-Gate and Cradle-to-Grave approaches. These comprehensive studies offered a complete view of emissions across the entire product life cycle—from raw material extraction and manufacturing, through supply chain and usage, to final disposal—based on the defined system boundaries. The assessments were carried out in accordance with ISO 14067 and ISO 14040/44 standards. As on FY 25, Lupin conducted LCA studies for 30 major products.

Goal and Scope of Assessment:

The primary objective was to quantify the environmental impacts associated with product manufacturing and to identify the overall environmental footprint across various stages of the product life cycle.

The Cradle-to-Gate scope focused specifically on emissions from raw material sources, transportation, and production processes.

The Cradle-to-Grave scope focused on capturing emissions across the entire product life cycle. This includes upstream transportation of raw materials, product manufacturing and packaging, as well as the product use phase and end-of-life disposal, all within the defined system boundaries.

The system boundaries of this study included:

Cradle	Involves the extraction, processing, and transportation of raw materials.
Production	Covers the pharmaceutical manufacturing process, including inputs such as raw materials, electricity, steam, upstream transportation, and packaging.
Gate	Marks the point at which the pharmaceutical product exits the production facility.
Grave	Includes downstream activities such as distribution and storage, product usage, and end-of-life disposal.

Methodology

Data Collection:

Comprehensive data collection efforts were undertaken to gather information on energy consumption, material inputs, transportation, and other relevant factors at each stage of the product life cycle. This data formed the basis for a detailed inventory analysis, ensuring accuracy and reliability of results. The assessment followed a rigorous methodology, incorporating industry standards and guidelines to assess their carbon footprint. By systematically evaluating the environmental impacts across the product life cycle, valuable insights were gained to support sustainability efforts and informed decision-making.

Data collection templates were used to collect data required for LCA from Lupin site. The data collected covered both inputs to the pharmaceutical production process, and outflows resulting from the production process.

Information collected included:

- Quantities of raw materials/chemicals or intermediary products (including water) used during processing or manufacture.
- Quantities of electricity, steam which is consumed during processing or manufacturing of the product.
- Distances and modes of transport are used to convey raw materials and intermediary products to the production site.
- Outflows from the production process include emissions into air, water and ground; waste produced; and recyclable material.

Data Analysis:

All data was entered into the SimaPro (System for Integrated Environmental Assessment of Products) software. SimaPro is a highly professional tool for collecting, managing and storing LCA data. It enables to analyses and monitor the environmental impact of products and services Average European values (RER) or global values (GLO) or Rest of World (ROW) from the Ecoinvent dataset were used for materials, energy and transport. Emissions from other inputs such as transport and electricity were included.

Impact Assessment and Conclusion

The outcome of the Cradle-to-Gate and Cradle-to-Grave study includes results across 15 environmental impact categories, expressed in terms of carbon dioxide equivalents (kg CO_2-eq) and other relevant units.

The report presents the data in form of indicators to evaluate the environmental impacts including Ecotoxicity and resource depletion indicators, to measure environmental impacts such as Climate Change/Global Warming Potential (GWP), Ozone Depletion Potential (ODP), Human toxicity (cancer and non-cancer), Dust & Particulate Matter, Ionizing Radiation, Photochemical Ozone Creation Potential, Acidification Potential, Terrestrial, Freshwater, and Marine Eutrophication, Freshwater Ecotoxicity Potential, Land Use, Water Use/depletion, Abiotic Depletion (Minerals & fossils) and Renewable Resource Depletion and Species richness.

- Hotspot Identification: Key contributors to environmental impact are identified (e.g., solvents, packaging) as an outcome of the study.
- Mitigation Measures Identified:
    - Shift to green chemistry and solvent recovery
    - Renewable energy sourcing (solar, wind)
    - Water recycling and zero liquid discharge (ZLD)
    - Sustainable packaging initiatives
    - Green Propellants
- Continuous Improvement: LCA findings are integrated into Lupin's product design, procurement, and manufacturing decisions.