ECOSIGN

Ecodesign for food packaging

UNIT 2: International and European Standards and Directives for Ecodesign of Food Packaging

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Content unit II, Ecodesign for food packaging

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After learning this unit, the student will be able to:

- Objective 1. Work to limit the weight and volume of packaging to a minimum;
- Objective 2. Reduce the content of hazardous substances and materials in the packaging material and its components;
- Objective 3. Develop reusable or recoverable packaging;
- Objective 4. Ensure a high level of protection of human health and the environment.

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Ecodesign – Notions

- **Ecodesign**, is an internationally recognized approach to reduce the environmental impact of products in their design process. The overall life cycle of a product is the basis on which ecodesign bases its strategies.
- Ecodesign has been developed to incorporate new concepts such as product vision as a system, the life cycle analysis concept (LCA, Life Cycle Assesment) and integration of all stakeholders involved in this system.
- **Cradle to the grave** – Product analysis throughout its lifecycle, from design to waste disposal.
- **Cradle-to-cradle** – It is a sustainable business strategy that imitates the nature regeneration cycle in which waste is reused. In nature, when a tree or an animal dies or creates waste, this waste breaks down and becomes nutritional elements for another process. This is the goal of approaching 'cradle to cradle': creating a cyclic process instead of a linear process, such as the 'cradle to grave' approach. The primary objective of the 'cradle to grave' approach is to reduce waste. The 'cradle to cradle' approach goes a step further and tries to completely eliminate waste. The " cradle to cradle " or '' regenerative design '' indicates the impact the product will have on the environment. Waste is created, but, as in nature, it is used to feed a new process. Using nature as a model, products and systems are designed to re-absorb the waste back into the system and then re-used. This system is called a closed-loop system because waste is not thrown away.

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Ecodesign – Notions 2

- **<u>Producer Responsability</u>**, assumes that through Ecodesign and product achievement, legal responsibility for product life cycle management is guaranteed.
- **Technical nutrients are in principle inorganic or synthetic materials made by humans - plastics and metals - which can be used several times without any loss of quality, remaining in a continuous cycle.**
- **Biological nutrients are organic materials that can decompose in the natural environment, soil, water, etc., without harming them negatively, providing food for bacteria and microbiological life. Organic waste** = eg. food waste, become food for insects and other small forms of life that can feed on them, can decompose and return to the natural environment that we use indirectly for food.
- **Downcycling** is the reuse of materials in the manufacture of other products. For example, a plastic computer case could be transformed into a plastic cup, which can then become a park bench etc .; this process can ultimately lead to waste. In conventional understanding, this system is no different from recycling that uses the same product or material.
- ISO 14040 defines the life cycle of a product as "the consecutive and interconnected phases of a product system, from raw materials, to the acquisition of materials or the generation of natural resources to final disposal"

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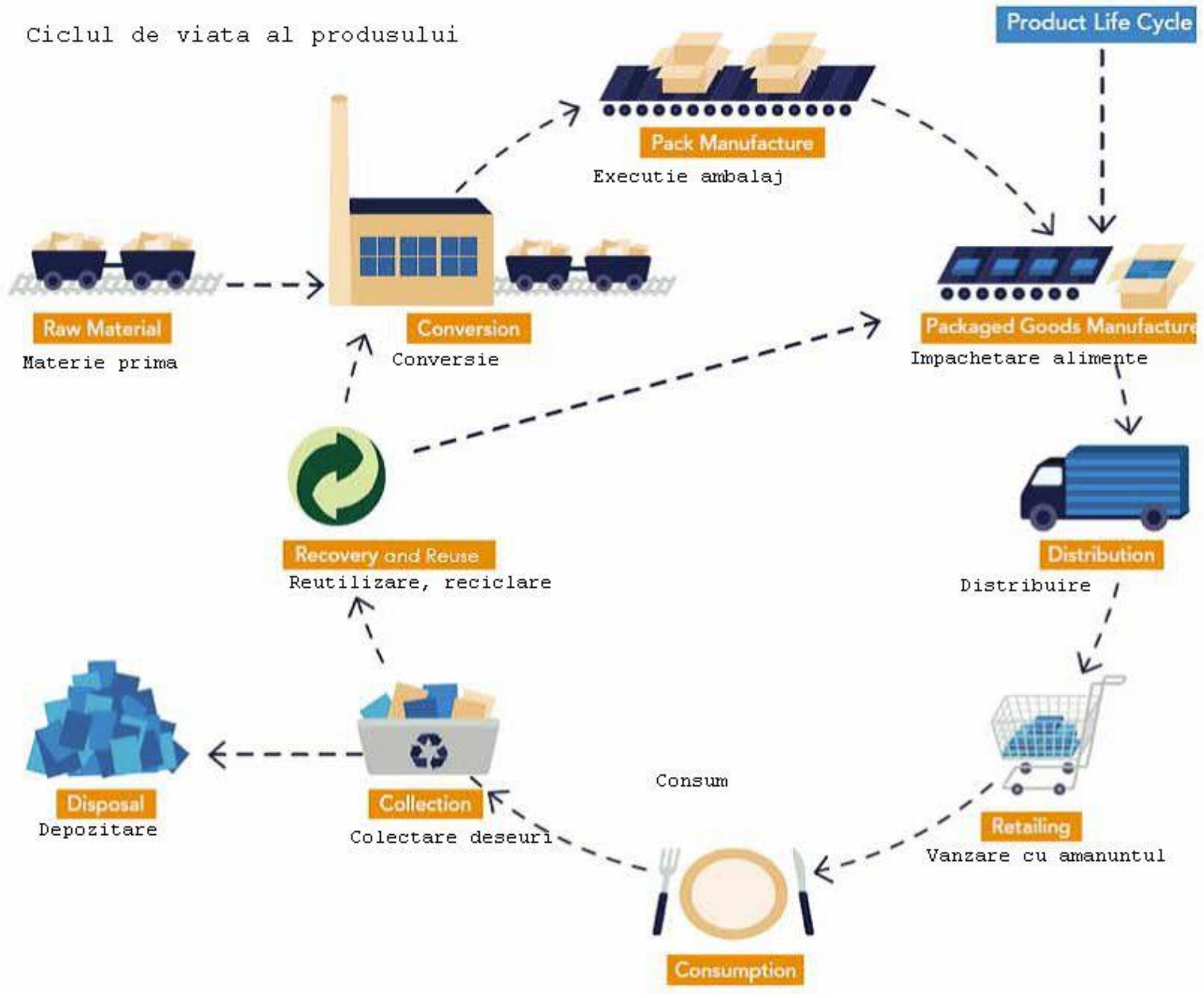
Life cycle phases of packing

- In the design process of a packaging or packaging system, life-cycle packaging must be assessed, starting from the production of raw materials and the use of as much recycled material as possible in the manufacture, transport and disposal of the product , its use to the consumer and ultimately waste disposal.Cerințe din legislație: ambalajul va fi fabricat astfel încât:

- its volume and weight are limited to the minimum necessary to ensure the required level of safety, hygiene and acceptability for both the packaged product and the consumer;
- to allow its re-use or recovery, including recycling, and to minimize the negative impact on the environment;
- to minimize the content of toxic substances and materials and other dangerous substances in the packaging material and its components;
- the total level of lead, cadmium, mercury and hexavalent chromium levels should be less than 100 ppm.



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LIFE CYCLE ASSESMENT – LCA

- Life Cycle Analysis (LCA) is a quantitative determination of how each phase of the packaging life cycle affects the environment to assess the environmental performance of the packaging life cycle.
- The general methodology for determining the LCA of a system or product is the subject of the first module of the course, "Basic Module". The following are the specific LCA characteristics for food packaging systems.
- Depending on the purpose of the analysis, Life Cycle Analysis (LCA) of packing can be done for the packaging itself, for example to find the optimal packaging solution when analyzing more packing technologies or packing systems, including the food to be packaged to determine the overall environmental impact of the system.
- LCA food packaging options may have different objectives such as improvement in the design of future packaging or future packaging systems, or to understand the environmental performance differences of alternative packaging models fulfilling the same function or to compare options end-of-life treatment for different packages. Another emphasis can be put on the relevance of packaging in the life cycle of the product. Some studies focus only on packaging, others take into account the product wich is about to be packaged.
- As shown in the Basic Module, ISO defines four stages in LCA implementation:
  - Defining the purpose and LCA aplication domain
  - Determining the life cycle phases of the packaging system (Life Cycle Inventory - LCI)
  - The Life Cycle Impact Assessment (LCIA - Life Cycle Impact Assessment)
  - Interpretation of results and conclusions

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Defining the scope and LCA aplication domain

- The purpose of the study can directly influence the LCA aplication domain . Thus, a clear definition of the purpose helps to optimize the efforts needed to achieve LCA.
- The scope and aplication domain includes the description of the method applied for the assessment of the potential environmental impacts and the impacts included. The aplication domain must specify the system-product functions and functional unit, considered as the reference unit to which inputs and outputs to and from the system are reported; It also describes the product-system boundaries, product environmental impact allocation procedures for multiple-product systems, life cycle inventory parameters. The measure of performance that the system offers is called a functional unit. Consider, for example, that packaging for 10 liters of milk could be a functional unit. In this case, we have to compare eg. 10 cartons of milk, wrapped in a pack with a bottle of milk and nine washes (assuming we have 9 glass returns).
- It is essential to determine the boundaries of the packaging system. This helps us to define the activities to be included in the analysis. **System borders include the different sub-systems of the packaging system**

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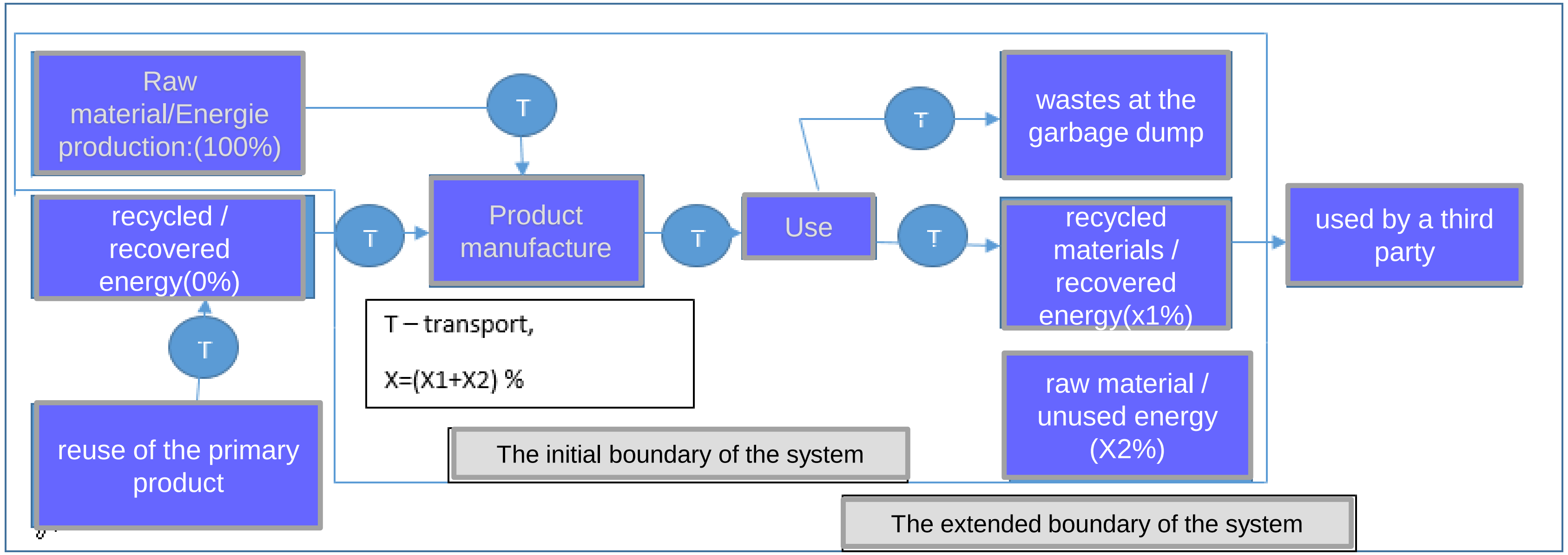
- Generally, the life stages of a packaging system lead to the coproduction of energy and / or materials for use in the system or for other uses. Thus, from a methodological point of view, it is important to allocate coherently and relevant the life cycle component of the packaging, the life cycle of the food product contained in the packaging and the life cycle of products generated by related multifunctional processes
- In cases where the co-products are sold or simply recovered from a third party, it is best to extend system boundaries (see below, where the product is considered to be 100% virgin raw material. The impact of recycling processes and recovery will be allocated to the end-of-life stage of the packaging).



50/50 Allocation method : The 50/50 Allocation Method allocates equal portions of the benefits of recycling at the end of the life cycle and the use of recycled material at the production stage

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Determining the life cycle phases of the packaging system - Life Cycle Inventory Analysis (LCI)

A life cycle inventory is a process of quantification of energy, raw materials, atmospheric emissions, water emissions, solid waste and other emissions for the entire life cycle of a product, process or activity.

- **All stages of the life cycle will be analyzed and any exclusions will be justified**

The subsystems of the packaging system that are being analyzed (which will be enclosed within the boundaries of the packaging system)

- Raw materials, energy and resources (water, energy, chemicals and materials)
- Production of packaging (production and transport of raw materials required for primary, secondary and tertiary packaging, production and transport of raw materials for additional components (eg lid, seal, label, etc.), applied technological process (eg injection, extrusion , thermoforming, fusion, corrugation, foil, drawing, etc.).
- Assembling and packaging, (filling activities, packaging for conveying and transporting the finished product).
- Distribution (handling from the packaging manufacturer to the distribution center, transport from the distribution center to the retailer's warehouse, transport from the retailer's warehouse to the point of sale of the final product, refrigeration during transport and storage.

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The subsystems of the packaging system that are being analyzed (which will be enclosed within the boundaries of the packaging system) (II)

- Use (storage, refrigeration and freezing by the consumer).
- End of life and waste management (end-of-life transport, end of life packaging management, taking into account municipal and / or regional waste management practices, transport (collection), sorting, recycling, reuse, incineration, energy recovery gasification, pyrolysis, energy recovery incineration), waste storage (with and without biogas recovery) and composting; wastewater management.
- Excluded processes (construction and dismantling of production and distribution facilities and capital goods (eg buildings, machinery, roads) The impact of these processes on packaging production is considered negligible, activities related to the marketing of packaging, transport of employees, use of hygiene equipment.
- Accounting for the lost fraction of the packaged product (where loss rates as a result of filling, transport, handling and use are not considered invalid when determining the environmental profile of the packaging or are considered equal in comparative studies.

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Data collection, data sources and LCA computation methods

- Primary data on all the manufacturing steps included in the packaging production system must be collected.
- Specific data must be collected directly from packaging manufacturers, their suppliers and any other related activities.
- Data can also be obtained from industry practice guides and product specifications, from commercial databases, expert assessments, literature reviews, and published study reports. Data should be used with caution and adapted to ensure representativeness.
- Based on the collected data, the LCI-Live Cycle Inventory List is compiled, which includes quantification of inputs of materials, energy or chemicals, as well as material, energy, product, air, water, which are relevant to the product system.
- The Life Cycle Impact Assessment (LCIA) calculation method is available at www.openlca.org/downloads. This comprehensive package of environmental impact assessment methods is formatted for use with all the databases available in OpenLCA Nexus (https://nexus.openlca.org) including, for example, ecoinvent 3, GaBi and ELCD. This package includes normalization and weighting to the extent that this is provided by the method.
- The ecoinvent database (www.ecoinvent.ch/), commonly used in LCA and recognized by the international scientific community, is particularly comprehensive because it covers a wide range of production processes. This database as well as others can be accessed from OPEN LCA Software: http://www.openlca.org, the official reseller for ecoinvent and GaBi databases and also offering free databases for their use in software OPENLCA. Like any software, the use of OPEN LCA requires the acquisition of free resources made available on the site or appropriate training.

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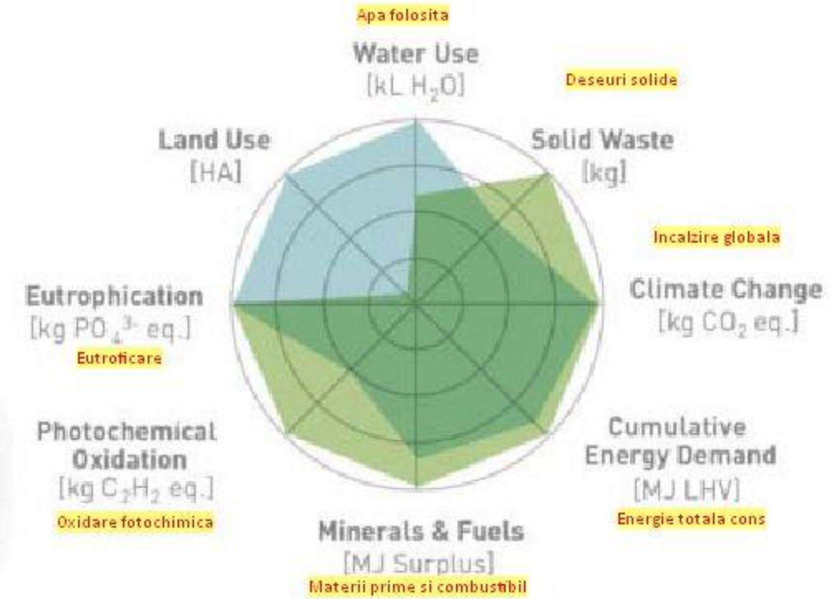
❑ The MET matrix

A MET analysis consists of five steps. The first is a discussion of the social relevance of product features. Then the Life Cycle of the product under study is determined and all relevant data is collected. Matrix data is then used, which includes the life cycle stages of the product in the first column and three other columns: material consumption, energy consumption and toxic emissions. Significant environmental impacts and measures to improve the product are identified.

- ❑ Diagrams allow the user to evaluate the product using a set of environmental criteria and view them. Criteria usually include the use of materials, transport, product use, energy consumption, waste produced, toxicity and longevity. Each criterion is given a value of 0 to 5 (sometimes 1-6 or 1-10), where 0 (or 1) is weak and 5 is excellent.
- ❑ Online calculator for assessing the impact of technological processes.Link: http://cpmdatabase.cpm.chalmers.se/IACalc/IACalcSelect.ASP?IAM=ECO-indicator+default&IAMVer=1999

It is a simplified calculation of the LCA result for some technological processes, including for each classification, characterization and weight. It clearly shows how much each impact stream contributes, and also what inputs and outputs are excluded from the calculations.



Examples of technological processes that can be addressed by this computer: fuels and raw materials, plastics, wood, washing, combustion, incineration, electrical, paint coatings, transport, waste management, etc.

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Thank you!

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