



Centrum pro výzkum
toxických látek
v prostředí

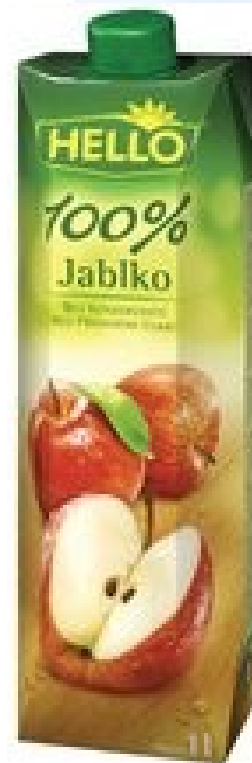
ENV010

LCA - hodnocení životního cyklu výrobků a služeb



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Inovace a rozšíření výuky zaměřené na problematiku životního prostředí na PŘF MU (CZ.1.07/2.2.00/15.0213)
spolufinancován Evropským sociálním fondem a státním rozpočtem České republiky



Co je LCA?

LCA - Life cycle assessment – **hodnocení životního cyklu** – čeho?



Co je životní cyklus výrobku?

- Těžba/získávání surovin
- Doprava
- Výroba
- Užití
- Odpad/recyklace

Jaké aspekty výrobku ve **všech** jeho fázích posuzujeme?

Proč nás tyto aspekty **zajímají**?





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Co je LCA

- snaha modelovat **realitu** – ta je ale velice komplexní
 - modelování **životního cyklu** produktů či služeb a jejich **dopadů**
 - modelování **důsledků těchto env. dopadů** na naše zdraví, zdraví ekosystémů, dostupnost zdrojů atd.
- každý model je však **zjednodušením** reality
 - zjednodušení = pokřivení reality
- **klíčový požadavek** – minimalizujme pokřivení reality



K čemu je LCA?

- **Interní LCA** – firmy chtějí vědět, na čem jsou:

- 1) předejít nečekané **kritice** svých produktů
- 2) lobovat za / proti **legislativě**, nebo alespoň být připraven na důsledky vyplývající z platné / chystané legislativy
- 3) hledat argumenty využitelné v **marketingu** (minimální dopady na ŽP...)
- 4) snížit výrobní **náklady**

- **Externí LCA** – publikovaná

- 1) velmi **málo** společností publikuje plné reporty (po špatných zkušenostech z 80 let) – nyní vlastní časopis
- 2) využití v ekolabelingu (VET=EPD), chystání **legislativy** (státní úřady)
- 3) zjistit, jak které **systémy** vůbec fungují



Využití výsledků LCA - detailněji

- **Benchmarking** – porovnávání a měření produktů s normami (nejlepšími)
- Komplexní pohled na životní cyklus výrobku (porovnávání **funkce** nikoliv produktu)
- **Identifikace fází** s největším příspěvkem k poškození životního prostředí
- Porovnání různých možností určitého produkčního systému vedoucích k **minimalizaci** dopadů na životní prostředí
- Pomoc při návrhu nových výrobků (**ekodesign**)
- Vyhodnocení **zdrojů největších problémů** spojených s produktem, včetně návrhu nových produktů



Životní cyklus – jednotlivá stádia

Co je životní cyklus výrobku?

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Životní cyklus – jednotlivá stádia

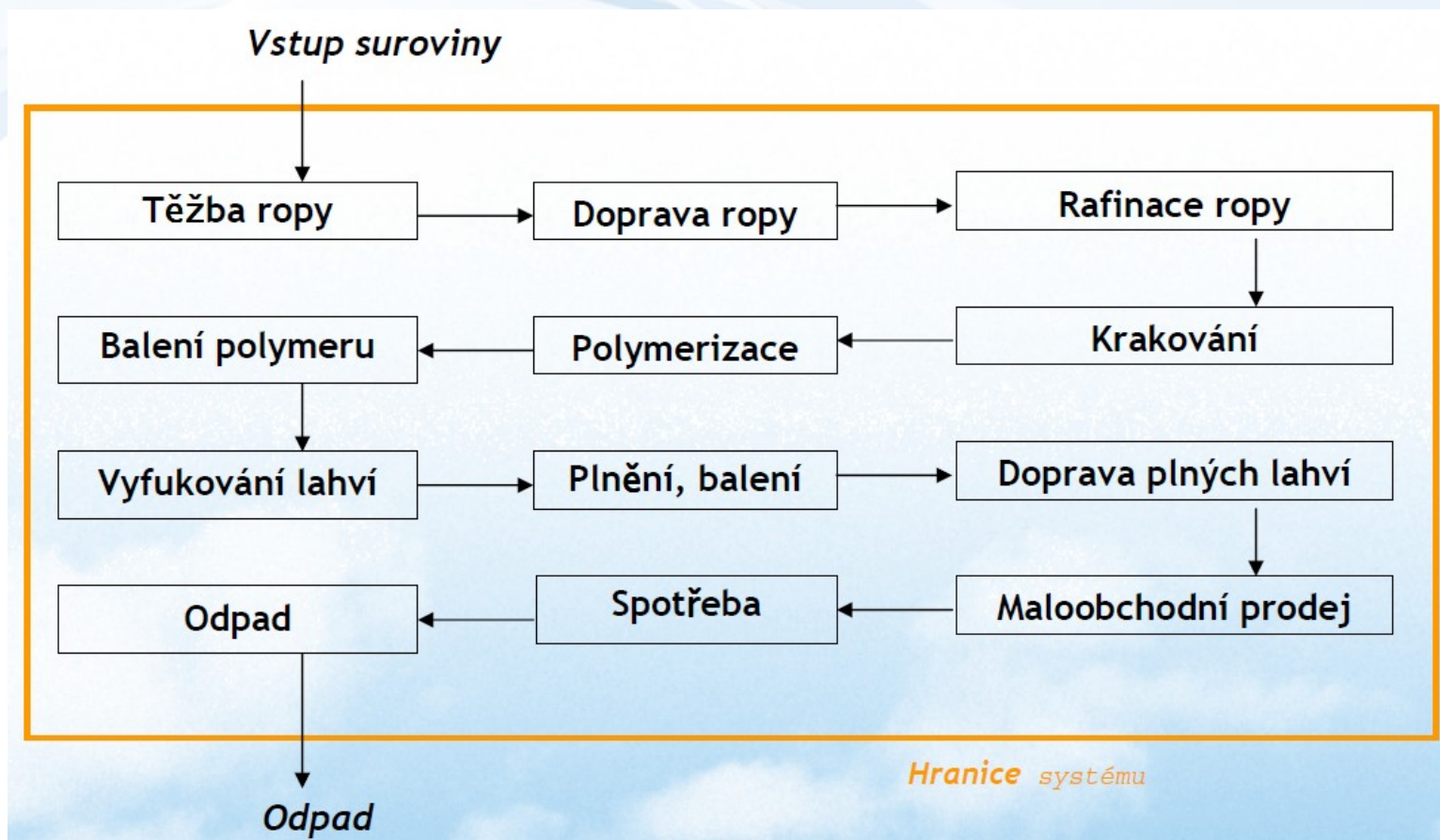
1. Zisk primárních surovin obnov. či neobn. a E
 2. Doprava surovin do místa zpracování na výchozí materiály pro další průmyslovou výrobu – spotřeba E a dalších zdrojů
 3. Výroba produktu = přeměna materiálů a výroba součástí, kompletace součástí na produkt, balení – spotřeba E a dalších zdrojů
 4. Doprava ke spotřebiteli – spotřeba E a dalš. zdr.
 5. Užívání produktu – spotřeba produktu (plnění jeho funkce) – E a materiál na provoz, udržování, opravy, uskladnění
 6. Odstranění produktu – když už neslouží – E nároky, možné zpětné využití (recykl.) – úspora E a materiálu
- každá fáze má důsledky pro ŽP (zátěž), často se liší, nutno zvažovat všechny fáze ŽC

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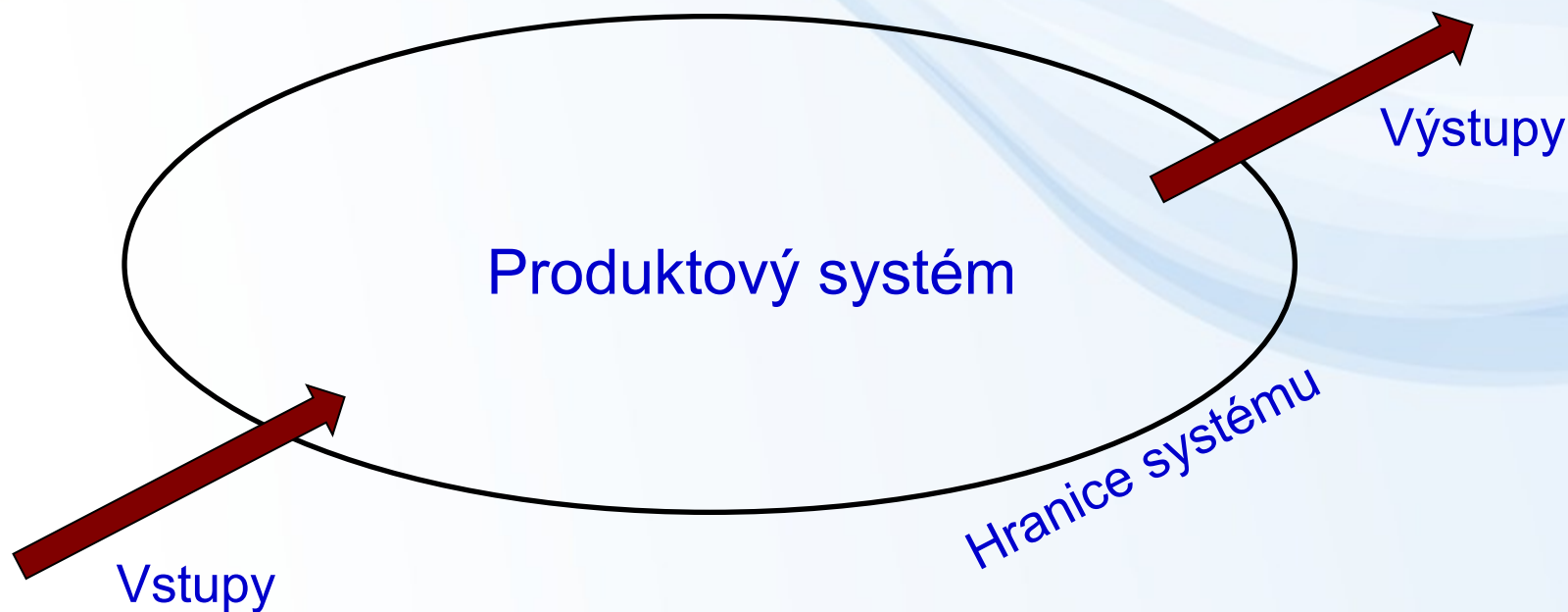


Životní cyklus PET lahví



Produktový systém

Každý životní cyklus určitého výrobku (produktu) je určen svým **produktovým systémem**



- produktový systém – **všechny procesy a operace** podílející se na jednotlivých fázích životního cyklu
- znázorněné vstupy a výstupy se nazývají **elementární toky** = **interakce mezi okolím a produktovým systémem**



Produktový systém

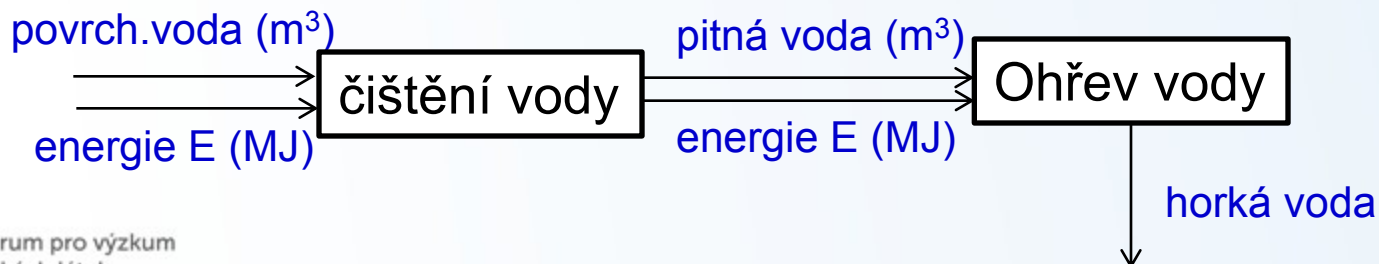
- složen z **procesů a toků**

Procesy (v obdélníku)

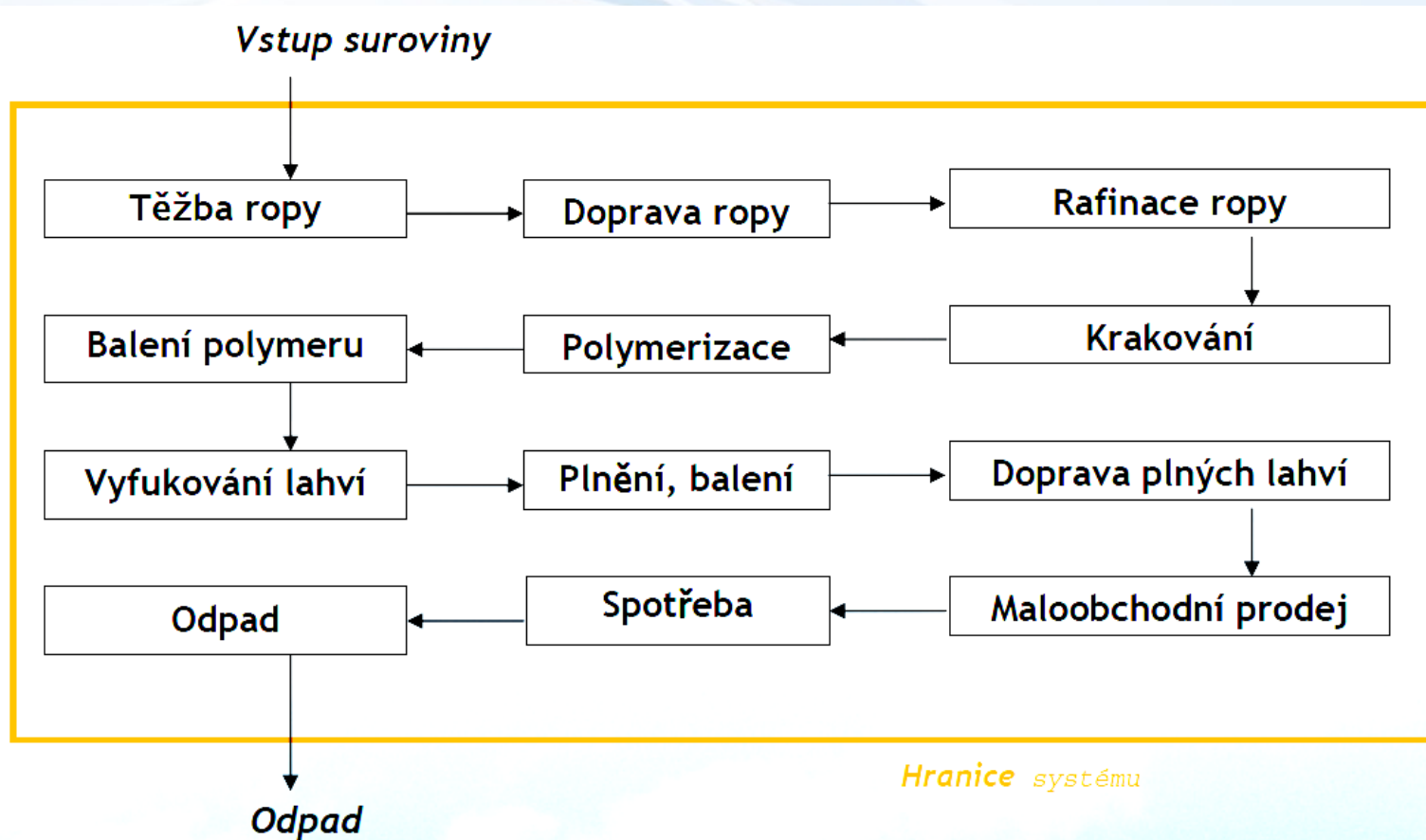
- operace přeměňující vstupy na výstupy
- podprocesy – např. proces přípravy čaje má jaké podprocesy?

Toky (materiálové či energetické) (šipky)

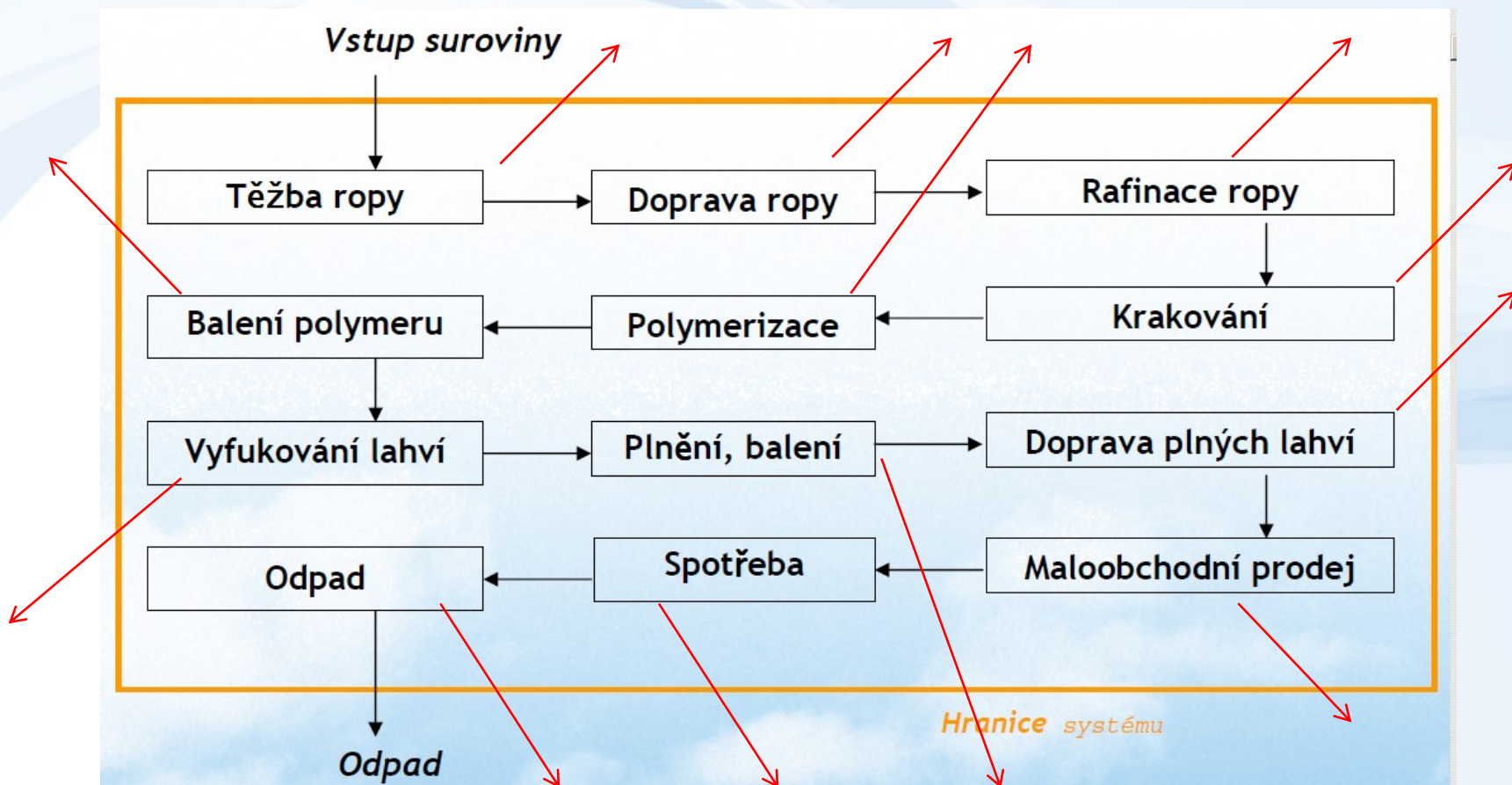
- spojnice procesů, kdy je jeden tok výstupem z jednoho procesu a vstupem do dalšího procesu
- pomocné toky – nedílná součást, nutno brát v potaz
- příklad: *příprava vody na čaj*



Produktový systém PET lahví



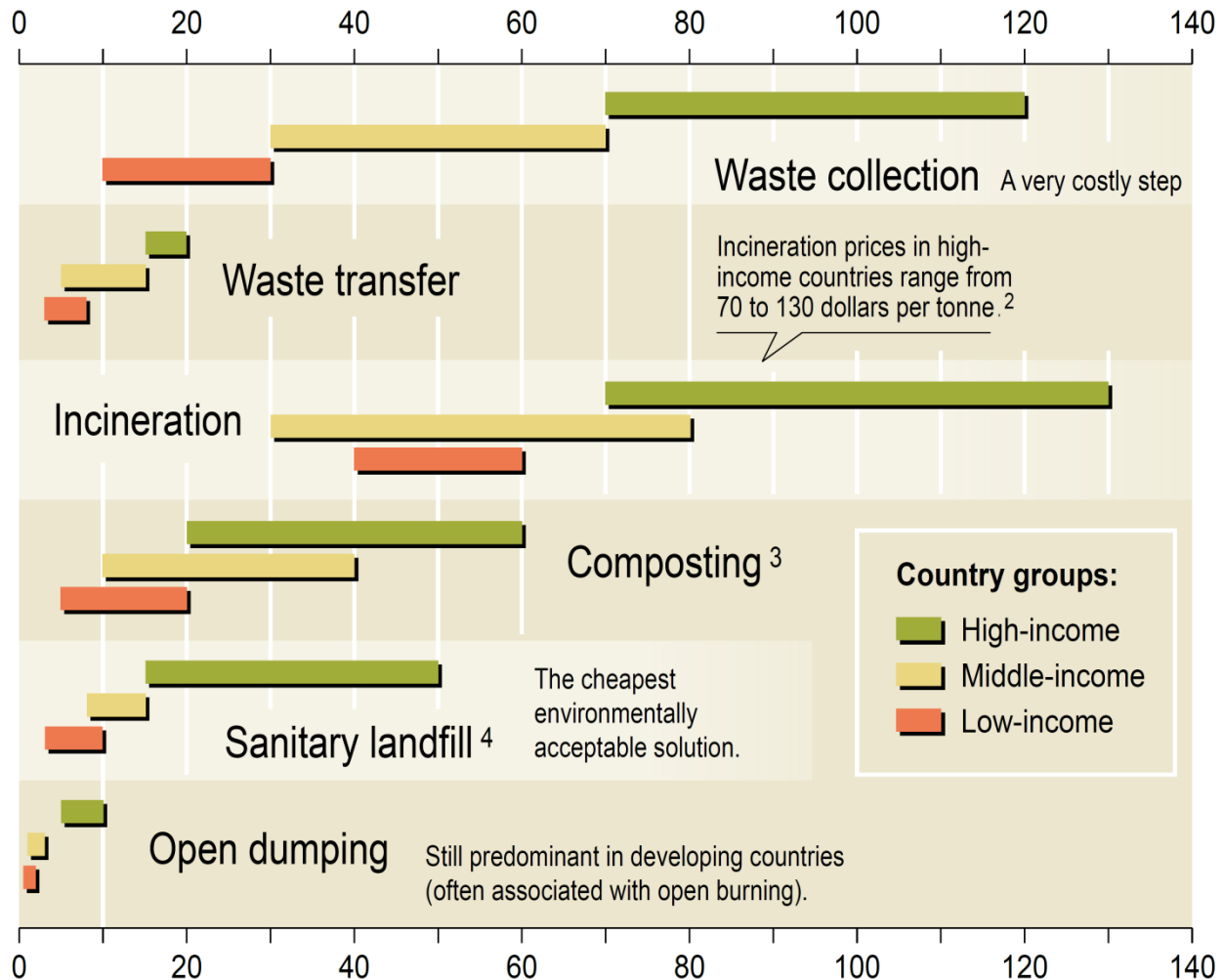
Produktový systém PET lahví





Solid waste management costs

Dollars per tonne¹

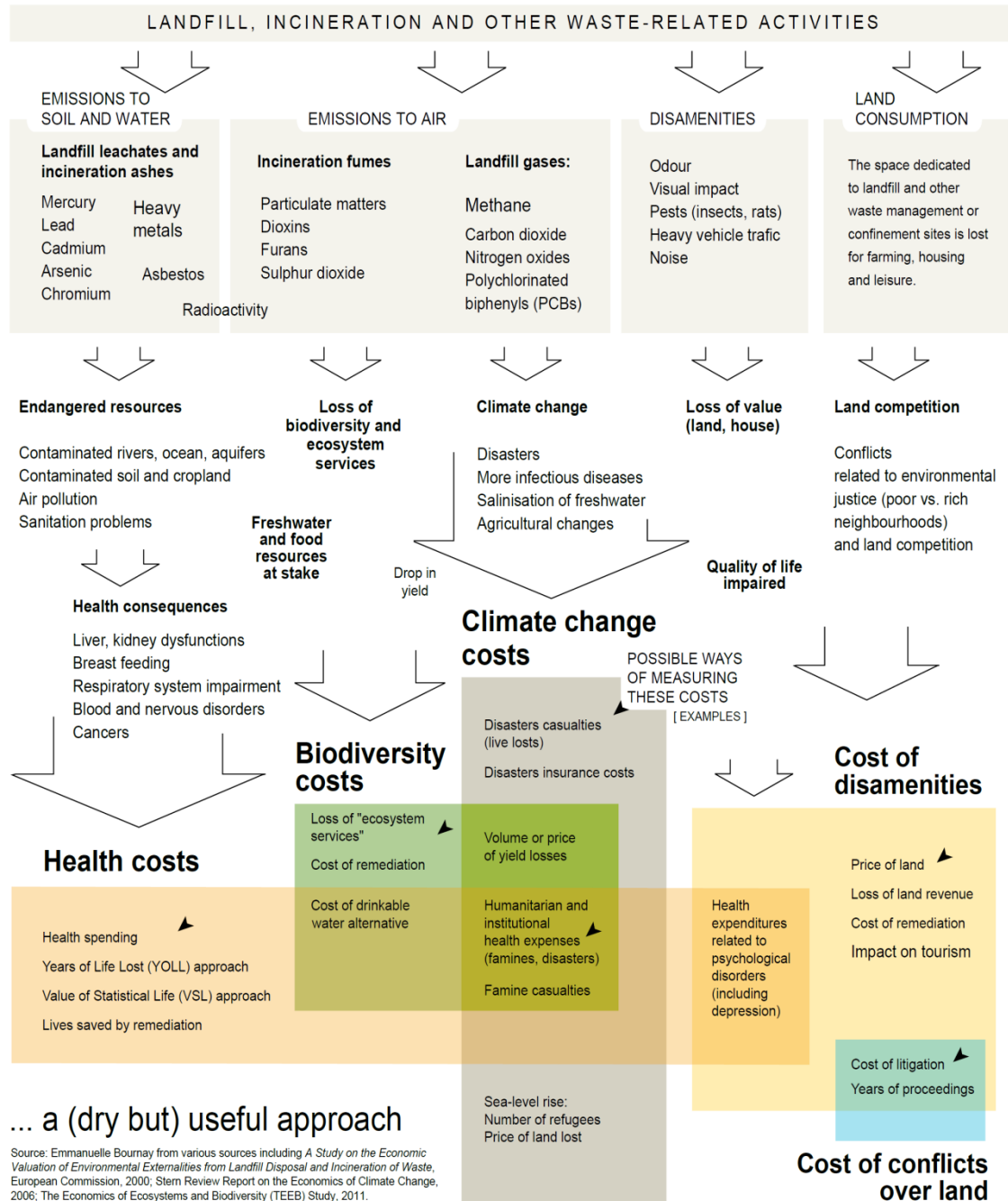


1 - In order to capture economies-of-scale, the study considers cities over 500 000 people or producing more than 250 tonnes of waste a day. 2 - The higher range of costs for incineration is for systems with modern air pollution control. 3 -The higher range of costs for composting is for systems with mechanized classification, pulverization and forced aeration; while the lower range of costs is for systems with hand sorting, trommel screening and simple open air windrows. 4 - The higher range of costs for sanitary landfill is for systems with plastic membranes and full leachate collection and treatment systems; while the lower range of costs is for natural attenuation landfills where site conditions do not require leachate management. Careful site selection can substantially reduce landfill costs.



Waste external costs...

The costs of climate change and biodiversity losses are less intuitive, more difficult to assess, but from a public perspective, they are considerable (and far from negligible for the private sector).



... a (dry but) useful approach

Source: Emmanuelle Bournay from various sources including *A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste*, European Commission, 2000; Stern Review Report on the Economics of Climate Change, 2006; The Economics of Ecosystems and Biodiversity (TEEB) Study, 2011.



Produktový systém DVD

The Life Cycle of a CD or DVD

You listen to them on your stereo, play them in your computer, or watch movies on them. Compact discs (CDs) and their faster cousin, digital video discs (DVDs) are everywhere! Only a few millimeters thick, they provide hours of entertainment and hold huge volumes of information.

Do you ever stop to think about how CDs and DVDs are made, what materials are used, or what happens to these discs when you don't want them any more? Making products like CDs and DVDs consumes natural resources, produces waste, and uses energy. By learning about product life cycles, you can find out how to reduce the environmental impacts and natural resource use associated with products you use every day. When you understand these connections, you can make better environmental choices about the products you use, and how you dispose of them.

Follow the life cycle of a CD or DVD on this poster to learn more about how these products are made and how you can help reduce their environmental impacts.

Disposal

Only dispose of your discs when you have no other choice. Always try to share, donate, or trade your discs or drop them off at an appropriate recycling center. CDs and DVDs that are thrown away waste energy and result in lost valuable resources.

Purchasing Decisions

You constantly make decisions about buying products. One of your decisions probably involves weighing how much you want a product against how much it costs. This poster provides information to help you become a more environmentally aware consumer by describing the materials and energy consumption required to make CDs and DVDs. You should factor this information into your buying decisions and understand that nearly all of your choices have some environmental trade-offs. You might also want to consider whether the information you think you need on disc is actually available on the Internet. If it is, you might not need to buy the disc at all. Thinking about these issues will make you a more informed consumer and will help you make decisions that help to protect and preserve our environment.

Designing for the Environment

For a product to come into existence, it must be designed. And that design can have as much of an impact on the environment as any other step in a product's life cycle. For example, designers can plan for a product to be easily made from recycled materials, thus reducing the need to mine or gather raw materials. Most industries, including high-tech industries, have developed voluntary standards that many manufacturers follow when designing and manufacturing new products. These standards help make products as environmentally sound as is technologically possible. These standards also change as rapidly developing new technologies become available.



1 Materials Acquisition

CDs and DVDs are made from many different materials, each of which has its own separate life cycle involving energy use and waste. They include:

- Aluminum—the most abundant metal element in the Earth's crust. Bauxite ore is the main source of aluminum and is extracted from the Earth.
- Polycarbonate—a type of plastic, which is made from crude oil and natural gas extracted from the Earth.
- Lacquer—made of acrylic, another type of plastic.
- Gold—a metal that is mined from the Earth.
- Dyes—chemicals made in a laboratory, partially from petroleum products that come from the Earth.
- Other materials such as water, glass, silver, and nickel.



2 Materials Processing

Most mined materials must be processed before manufacturers can use them to make CDs or DVDs. For example:

- Bauxite ore is processed into a substance called "alumina" by washing, crushing, dissolving, filtering, and harvesting the materials. Alumina is then turned into aluminum through a process called "smelting." Then the metal is shaped, rolled, or made into a cast.
- To make plastics, crude oil from the ground is combined with natural gas and chemicals in a manufacturing or processing plant.



Fun Fact

More than 55 million boxes of software go to landfills and incinerators; plus people throw away millions of music CDs each year!



As with most stages of product life cycles, even recycling has environmental trade-offs. CD and DVD recycling is now an emerging technology, which means that many companies are not yet capable of recycling these discs. So, while recycling CDs and DVDs saves natural resources, the trade-off comes from the amount of fuel and energy that's consumed to transport discs long-distances to an appropriate recycling facility.



- Automotive industry parts.
- Raw materials to make plastics. (Discs are ground into a gravel-like substance, which is added to compounds that melt it down and convert it to plastic.)
- Office equipment.
- Alarm boxes and panels, street lights, and electrical cable insulation.
- Jewel cases.



3 Recycling

CDs can be recycled for use in new products. Specialized electronic recycling companies clean, grind, blend, and compound the discs into a high-quality plastic for a variety of uses, including:

4 Reuse, Recycling or Disposal

Depending on their condition, discs can be reused or recycled instead of thrown away.

5 Useful Life

CDs and DVDs are created with materials that are extremely stable. If properly stored and handled, most discs will last for decades—and probably centuries. Certain conditions, such as high humidity, or extended periods of high temperature, rapid temperature changes, and exposure to certain types of light, can damage discs and shorten their useful life. Taking care of your discs by keeping them out of direct sunlight and away from heat and water will help them last longer. Not only will you save money, but you will also reduce the discs' environmental impacts by preventing waste.



6 Transportation/Distribution

Once discs are packaged, they are ready to be sent to distribution centers, retail outlets, or other locations. Transportation by plane, truck, or rail requires the use of fossil fuels for energy, which contribute to climate change.



7 Manufacturing

The manufacturing process described here is roughly the same for both CDs and DVDs.

- An injection molding machine creates the core of the disc—a 1-millimeter thick piece of polycarbonate (plastic).

Polycarbonate is melted and put in a mold. With several tons of pressure, a stamp embosses tiny indentations, or pits, with digital information into the plastic mold. A CD-player's laser reads these pits when playing a CD.



- The plastic molds then go through the "metalizer" machine, which coats the CDs with a thin metal reflective layer (usually aluminum) through a process called "sputtering."



- The CD then receives a layer of lacquer as a protective coating against scratching and corrosion.



- Most CDs are screen printed with one to five different colors for a decorative label. Screen printing involves the use of many materials, including stencils, queues, and inks.



8 Packaging

CDs and DVDs are packaged in clear or colored plastic cases (jewel cases) or cardboard boxes—that are then covered with plastic shrink wrap. This packaging can be made from recycled or raw materials. For example, the plastic used can be from recycled bottles or from crude oil and natural gas extracted from the Earth and combined with chemicals.



Fun Fact

The entire process of stamping a CD with digital information takes between 5 and 10 seconds.

Fun Fact

In 1993, when CDs were introduced in the United States, 800,000 discs were sold. By 1999, this number had grown to close to 1 billion!

Fun Fact

Every month approximately 100,000 pounds of CDs become obsolete (outdated, useless, or unwanted).



Použitá literatura při přípravě kurzu ENV010

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- ...a další

