Introduction into Eco-Efficiency – MIPS and LCA

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Eco-Efficiency as Management and Education Practice

- Way to implement sustainability thinking in every day management
- Means decrease in environmental harmfull impact at the same time with the economic savings
- Example with waste-management; less you use material which becomes waste, the less you make costs at the same time

Topic	Content	Indicator	Purpose
Management – Quality and Lifecycle Thinking	Management	% of personnel responsible of environmental actions	– Gives an understanding of the whole life cycle of the event as well as its processes
	Communications	% of sustainable initiatives	
	Financing	% of finance directed to sustainable activities	
	Tendering	% of suppliers using sustainable criteria	– Helps to piece together the different roles in the process and to see the activities taken by the actors
	Education	% of personnel responsible of education	
	Procurement	% of procurement using sustainable criteria	
	Catering	% of procurement using sustainable criteria	
	Clothes, Gears and Other Goods	% of procurement using sustainable criteria	
Impact on Climate Change – Controlling CO_2-emissions	Passenger traffic	tCO_2 / passenger kilometre	– Helps to outline the major sources of emissions and to give ideas to achieve eco-efficient and environmentally sound actions
	Logistics	tCO_2/kilometre	
	Energy	tCO_2/kWh	
	Electricity, Heating and Cooling	tCO_2/kWh	
	Paper	tCO_2/kg	
Material flows and Efficiency	Integrated Waste Management and Waste Prevention	prevented waste / total waste, % reuse and % of recycled waste	– Addresses the main material flows and ways to prevent waste
	Municipal Waste	prevented waste / total waste, % reuse	– Introduces recycling and reuse
	Construction	prevented waste / total waste, % reuse	
Crosscutting Issues	Water	m3, % savings in water use	– Gives understanding of the multidimensionalcharacters of water, paper, chemicals and noise and their extensive environmental impacts
	Paper	kg, % savings in paper use	
	Chemicals	kg, % savings in chemical use	
	Noise	desibels	
	ICT	avoided personel traffic, kilometers	– Helps to identify the possibilities of ICT

Four main categories of Environmental Impacts

I Management

II Impact on Climate Change

III Material Flows and Efficiency

IV Crosscutting Issues

I Impact on Climate Change

To reduce the CO2-emission there are four aspects to focus on:

- energy-saving investments and actions
- use of the renewable energy
- promoting the use of low-emission vehicles and the use of public transport
- compensating the remaining CO2-emissions

CO2 emissions

- CO2-emissions, as all other environmental impacts, are created either directly or indirectly throughout the total life cycle of a product or service.
- Direct CO2-emissions derive from vehicle emissions and from the power plants which provide electricity, heat and cooling for the event.
- To calculate accurate CO2-emissions it is necessary to take into account the whole life cycle.

Calculating CO2 emissions

- Obtain the most accurate, complete and relevant data as possible.
- Describe the methodologies used, or provide a reference to the calculation tools.
- Include information about the compensation or on any emission-reduction projects undertaken.
- Find the appropriate activity data and emission factor.
- Each activity is presented in a specific unit, for example, kilometres travelled or litres of gasoline.
- Emission factors convert activity data to emissions values. The emission factor for one litre of gasoline is, for instance, 2,350 gCO2/l.
- Calculate and report the CO2-emissions in metric tons by using the following formula: activity data x emissions factor = CO2-emissions.

Imastolaskuri – Climate Calculator

www.ilmastolaskuri.fi

2. Energy

Green Energy

- The renewable sources of energy (e.g., **sun, wind, geothermic heat, biofuels, small-scale hydropower**) are clean, environmentally sound and CO2-emission free.
- The construction of the power plants produce environmental loads but, nonetheless, when considering the whole lifecycle of the process, the environmental impacts are low.
- The renewable sources (e.g., onshore wind power systems) could, however, do noise or aesthetic harm.
- The biofuels such as forest processed chips, bark or sawdust are emission free.

Green certificates

- The certificates make sure that people without access to green energy can use it without changing their electricity contracts.
- Certificates can be bought to cover all or some part of the energy use. One certificate covers 1,000 kWh of green energy.
- In the long run, certificates will alter the energy production structures and increase the production of renewable energy.
- The idea of the certificates is to produce renewable energy where it is cost-effective and reduce the losses from the transmission of electricity.
- The only way to achieve immediate decreases in the total CO2-emissions, is to reduce the amount of energy used!

Combined Heat and Power Generation

- Combined generation technology can reduce the environmental load by 30 %
- In combined technology, the extra energy generated is used in heat production.
- In district cooling the energy used for cooling is produced centrally (e.g. public and office buildings).
- District cooling can replace the traditional blower cooling that consumes a lot of energy and environmentally harmful HCFC-chemicals.
- District cooling and heating have many positive impacts: air and structure-borne noise and resonation declines, the need for engineering and utility services room and maintenance decreases and energy use is lower.

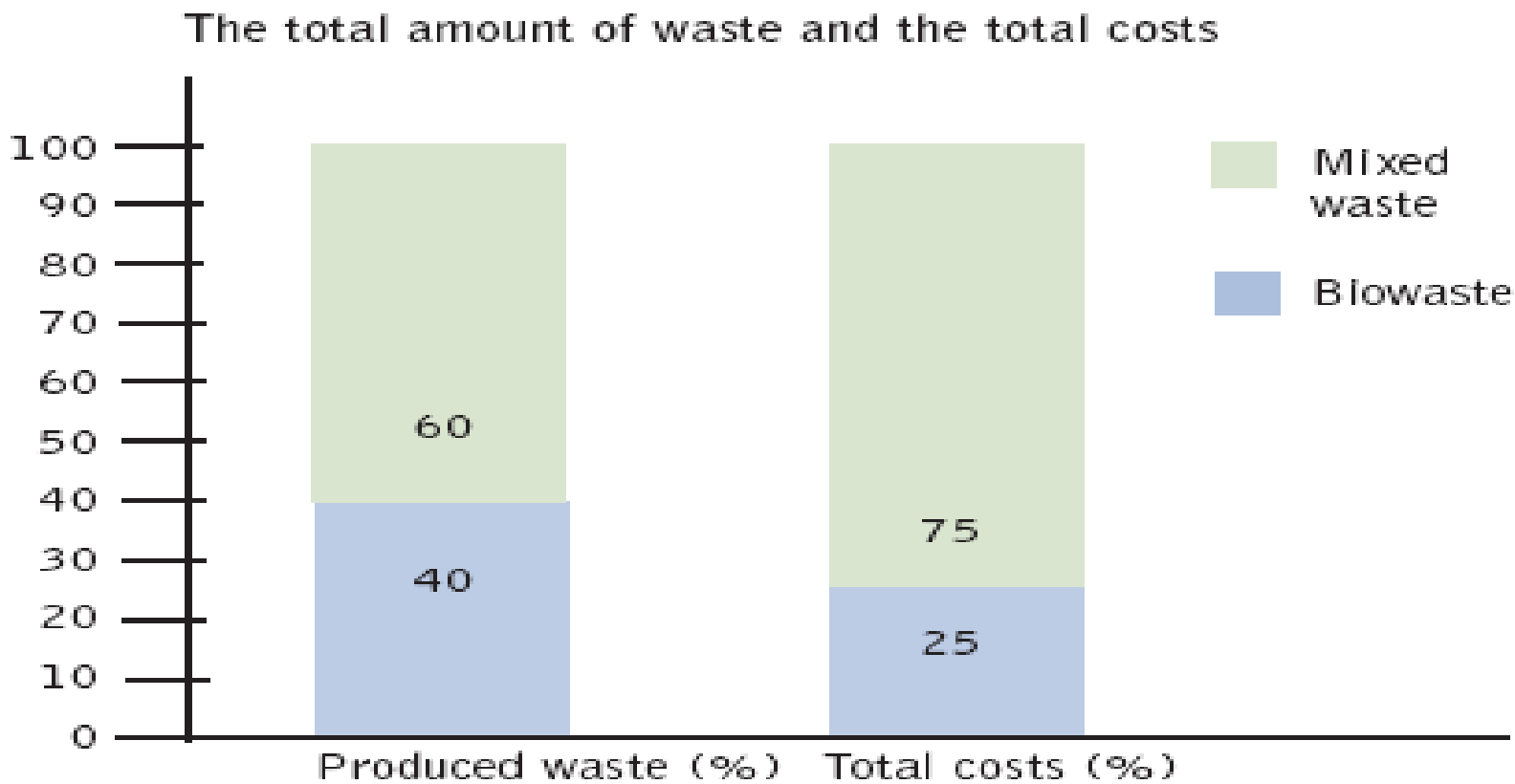
Saving energy – Energy saving plans

- The energy-saving options for office buildings can be evaluated by energy surveys.
- The surveys analyze the energy and water use, functioning of heating, plumbing, ventilation and electrical installations, as well as the possibilities of saving energy and improving facilities.
- The aim of the energy-saving plans is to save energy and enhance the operations that will lead to savings and leave a legacy to the company or society.
- Often the energy-saving plans will act as a part of the environmental programme.

II Material Flows and Efficiency

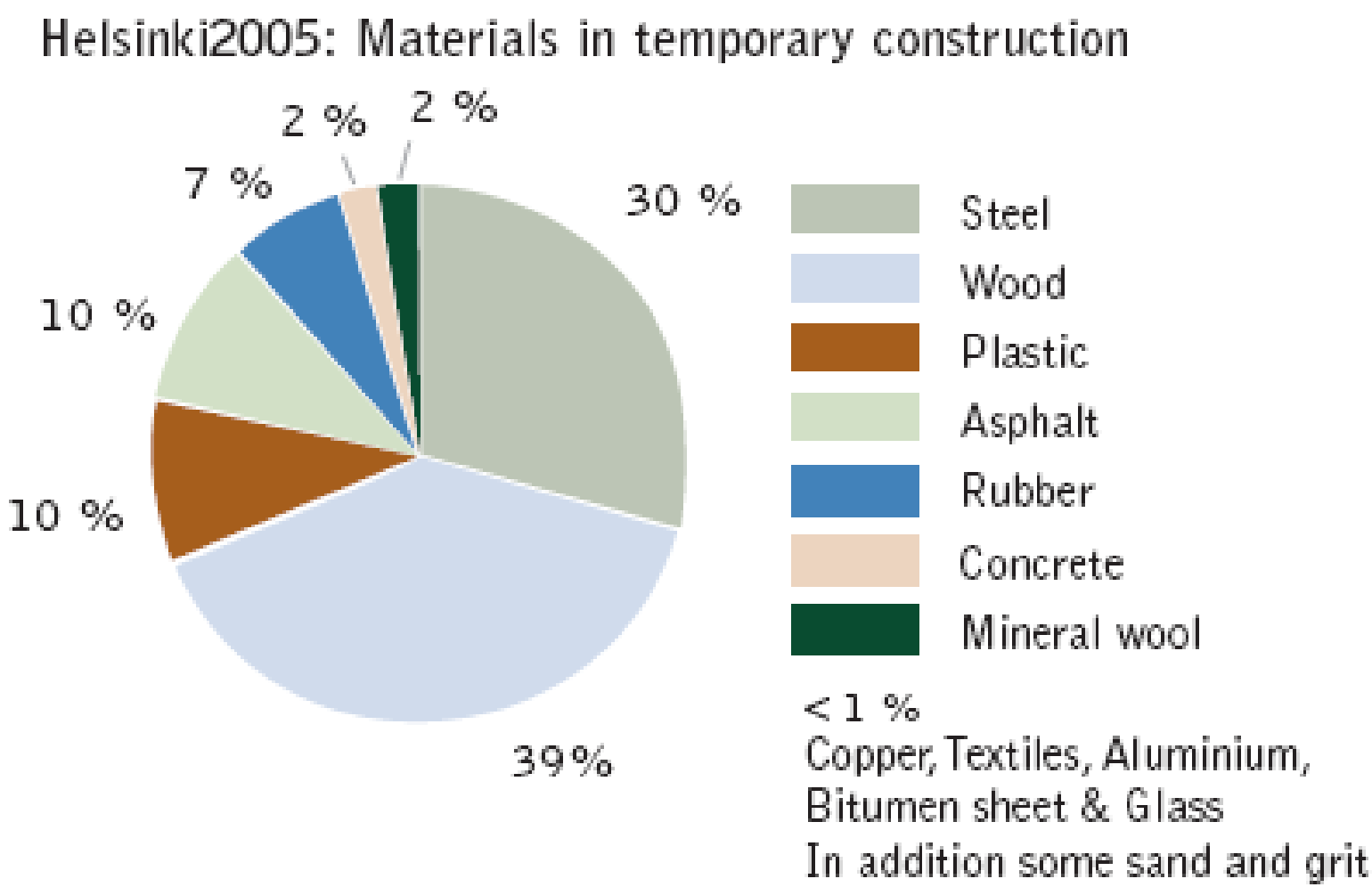
1. Integrated Waste Management and Waste Prevention
2. Municipal Waste
3. Industry processes

Example of Eco-Efficiency Saving by sorting – Helsinki2005

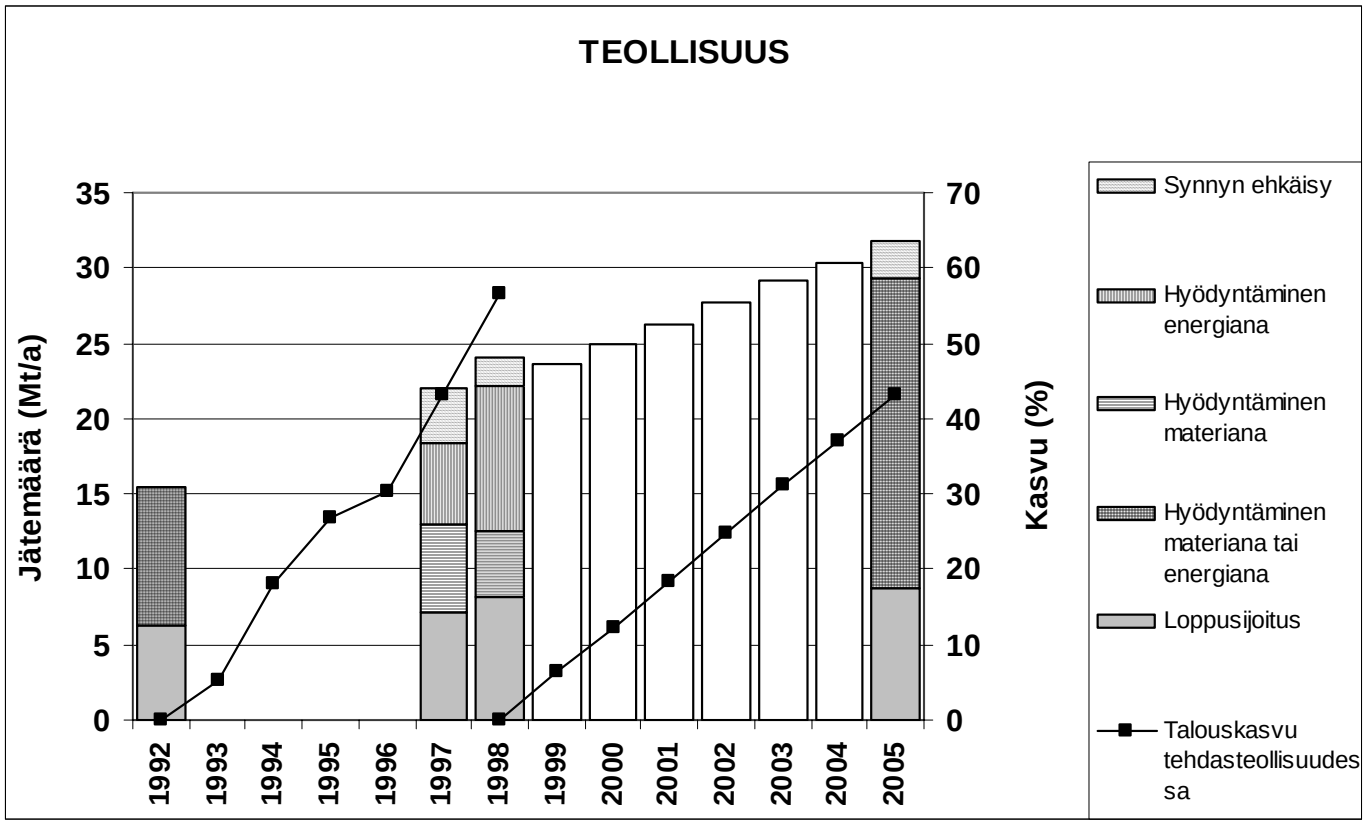


3. Material Flows

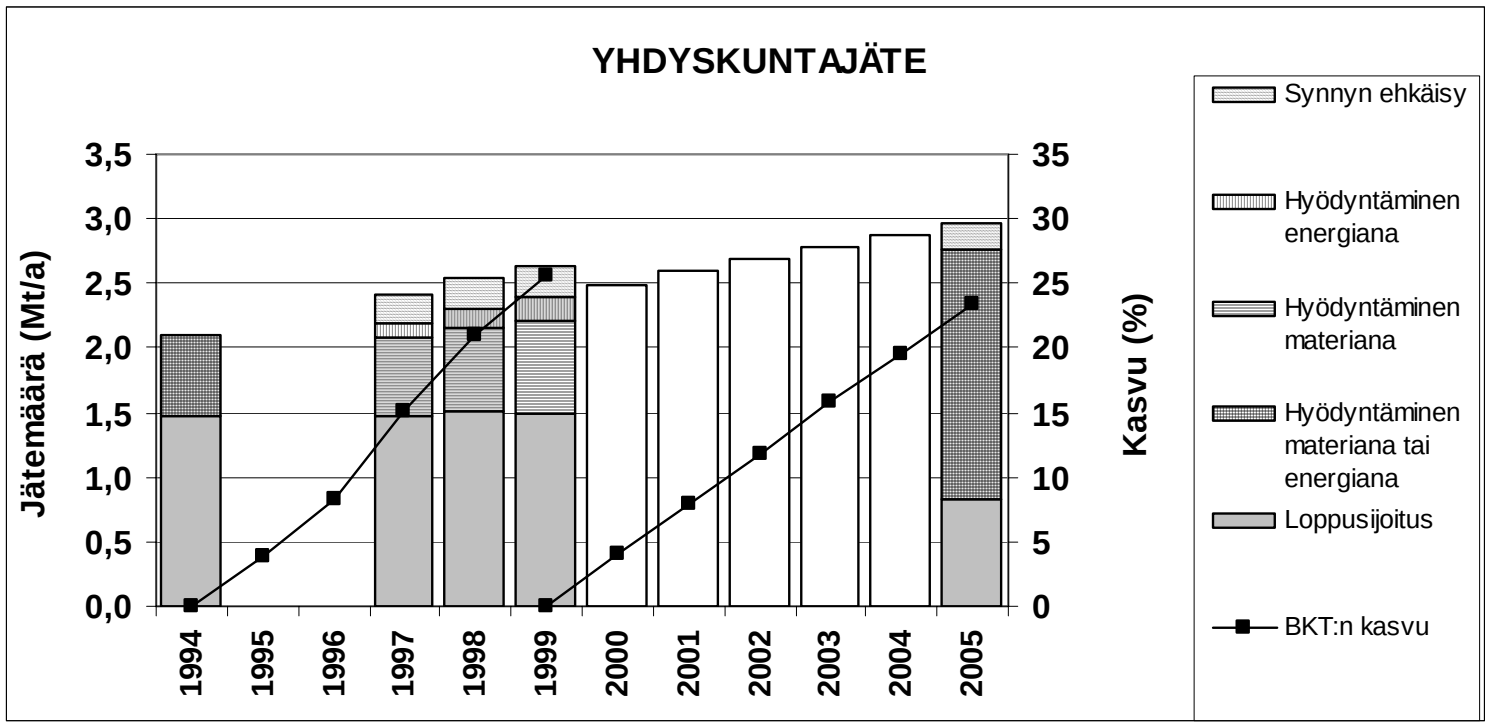
Example of the material flows of Construction Process



Industrial waste and it’s use



Municipal waste and it’s use



IV Crosscutting Issues

Crosscutting Issues

- Crosscutting issues signify the issues that do not have one specific environmental impact but are instead dispersed into the different areas of the environment such as greenhouse gas emissions, water pollutants or hazardous chemicals.
- We need to see the whole lifecycle of the product and see the total environmental impacts.
- We cannot e.g. consider paper production only via its greenhouse gas emissions. We need to also see the impacts on forest and water systems, as well as the indirect changes in these systems.
- Often the crosscutting issues are forgotten, the impacts are only seen narrowly and the interconnections between the impacts are ignored.

Water

- Many of the production phases and actions are deeply based on water resources.
- Indirect water use also needs to be taken into account when analysing environmental impacts.
- Water cannot be separated from the basin and all the environmental, social and economic dimensions that need to be addressed (IWRM)
- The unsustainable use of water may lead to many different environmental problems that also have significant economic impacts – e.g. lowering groundwater tables have led to the subsidence of many cities.
- Mass events, their activities and requisites consume large quantities of water. Thus the need for a wide analysis of the environmental impacts of water use is evident (virtual-water).
- E.g. producing one cup of coffee consumes 140 l of water!

Chemicals

- Chemicals are one of the most important areas when managing the environmental impacts of events.
- Due to the variform state and wide use of the chemicals, their environmental impacts are very far reaching.
- To decrease the environmental impacts, it is important to diminish the use of excess chemicals, and remember to store and use them safely.
- In a big, sporting event, the consumption of chemicals for cooling, ice making (e.g., winter sport events) and cleaning is significant.
- These processes, though, need to be well planned, analyzed and protected.
- The possibilities of less chemical intensive technologies and environmentally sound chemicals need to be analyzed.

Material Input per Service Unit = MIPS

Factor X - principles

What are the underlyeing factors of environmental crisis?

⇒Environmental damages are not only caused by pollution, but also of the use of natural resources

⇒ View has to changed into looking inputs and not just outputs

Factor X - Principles (2)

What are need changes?

⇒The use of the natural resources should be diminished globally by half

⇒(Factor 2).

Current use of the natural resources

- 90 % of natural resources material do not end up to be used in the production
- In industrialized countries over 100t per person yearly is used the non-renewable natural resources (Fresh water: > 500 t).
- E.g to produce a computer is needed 8-14 tons of natural resources

What is MIPS

- MIPS = keino tavoitteen saavuttamiseksi
- ”Material input per service unit”
- MIPS = MI / S
- materiaalipanos palvelusuoritetta kohti

Eco-Efficiency indicator MIPS (1)

- simple, reflects essential aspeects behind environmental load
- is based on general principles used in all processes in products and services
- measurable and comparable

MIPS (2)

- is easy to use and not very costly
- can be combind into economic systems
- can be implemented in every level

  -> producs, serivices, companies, regions, nations, global economy

MIPS – what is ”MI”

- MI is the material input needed for producing the product or service
- Includes as well the energy use’s impact to natural resources
- is calculated in weight units (kg, t)
- form the whole life cycle: taking up the natural resources, production, transportation, packaging, use, re-use, recycling, wastemanagement

MI:n 5 classes

- abiotical resources (non-renewables)
- biotic resources (renewables)
- water
- air (O_2)
- soil

MI – the entity

- list all materials and their amounts
- add waste from internal processes by material
- packages
- use of the energy or electricity
- transportation

How to reduce material input?

- Materials with high MI-value are replaced by materials wiht lower MI value

→use of the natural resources as low as possible

Replacing the materials

- instead of aluminium use steel $\Rightarrow$ Factor 12
- instead of copper use plastic $\Rightarrow$ Factor 93
- instead of boiler oil use natural gas $\Rightarrow$ Factor 2
- instead of coal use wind power $\Rightarrow$ Factor 13
- instead of highway transportation use railways $\Rightarrow$ Factor 1,2
- . . .

MIPS - indicators ”S”

- S is service unit
- S – produced value:
  - ”washing 5 kg of loandry”
  - ”transportation of two persons for 100” (2 hlö x 100 km = 200 passanger km)

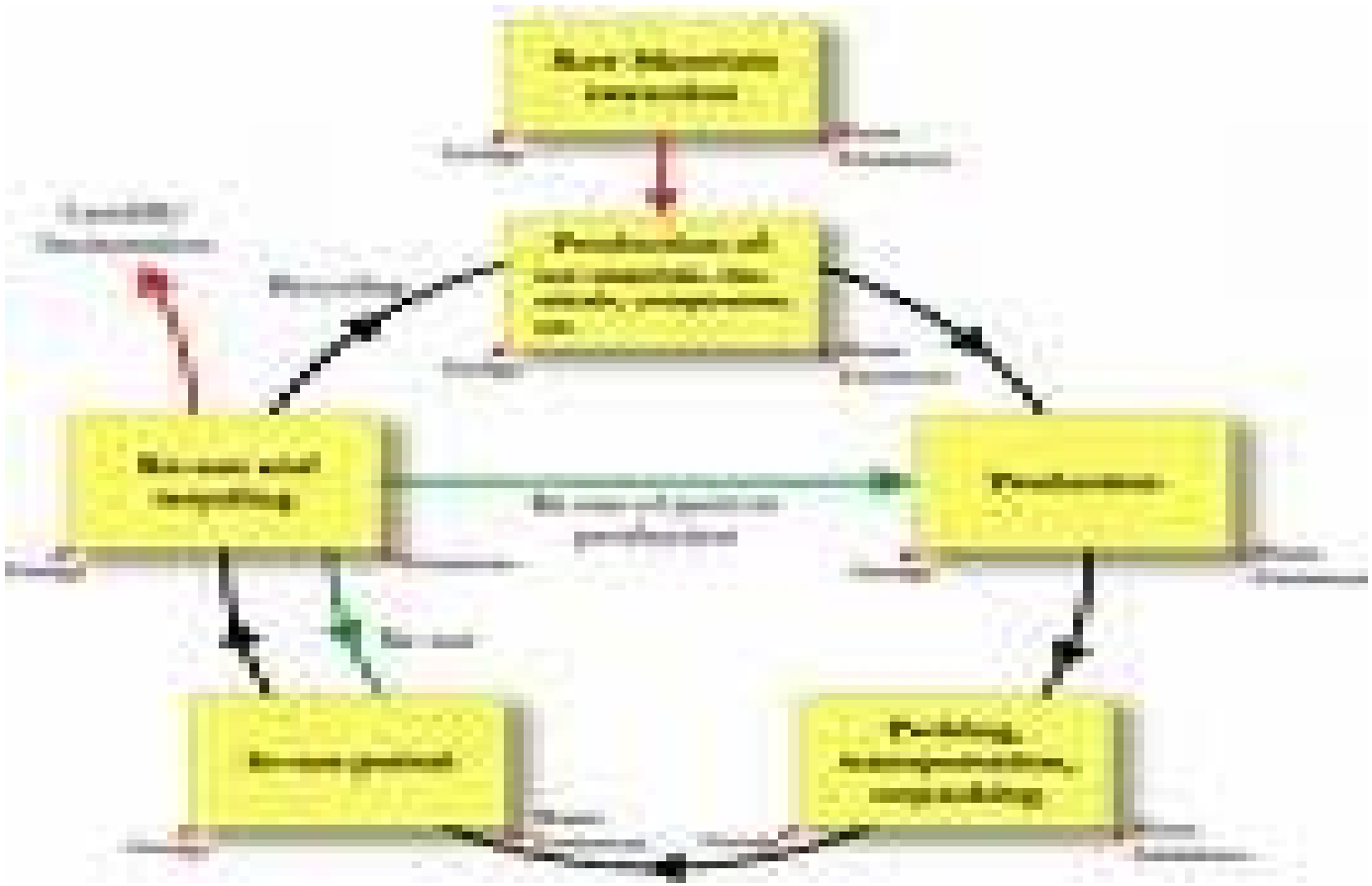
Increasing the service unit

- prolonging the use
- multipurpose
- additional advantages
- re-use after the first round:re-use or recycling

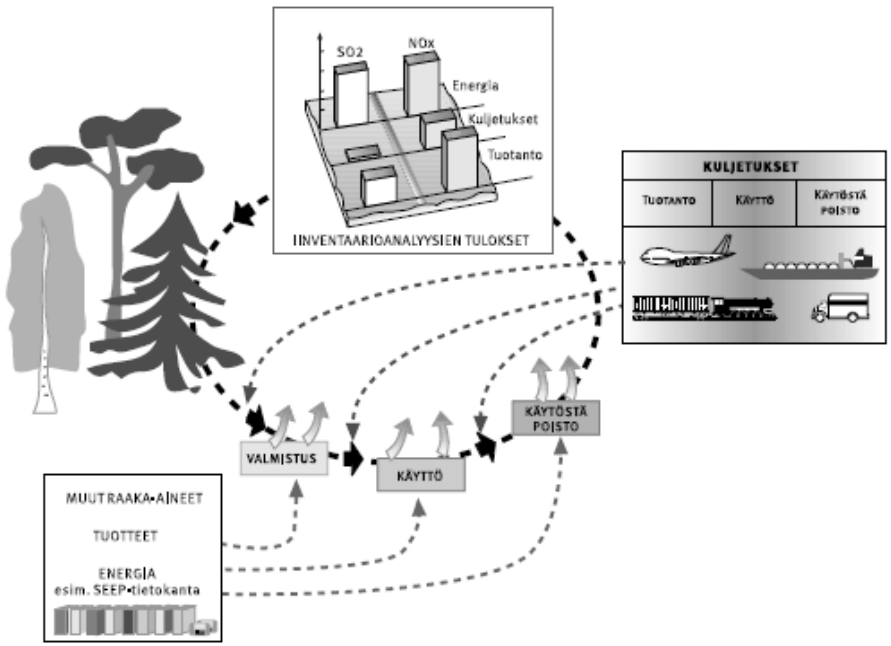
FinnMIPS Reseach Project

- http://www.ymparisto.fi/default.asp?contentid=107909&lan=fi

Life Cycle Assessement = LCA



Forest Industry



Kuva 1. *Elinkaariarviointi kattaa tuotteen elinkaaren aikaisten syötteiden ja tuotosten sekä potentiaalisten ympäristövaikutusten koostamisen ja arvioinnin. Monissa elinkaariarvioinneissa energian ja kuljetusten merkitys on ollut suuri.*

LCA phases

- Extraction and processing of raw materials
- Manufacturing
- Packaging
- Marketing
- Use, re-use and maintenance of the product
- Eventual recycling or disposal as waste at the end of its useful life

Purpose of LCA

- Tool for systematic evaluation of the environmental aspects throught whole life cycle
- Adequate instrument for environmental decision making
- Is standardized by ISO 14040 series

Phases of LCA according ISO 14040

- Goal and scope definition
- Inventory of extractions and emissions
- Imapact assessement
- Interpretation
- http://www.iso.org
- http://www. uneptie.org

Critics

- MIPS
  - definition of service unit
  - biodiversity & hazardous chemicals

- LCA
  - weighting
  - costs

Other e.g. ecological foot print