Man and Materials Flows

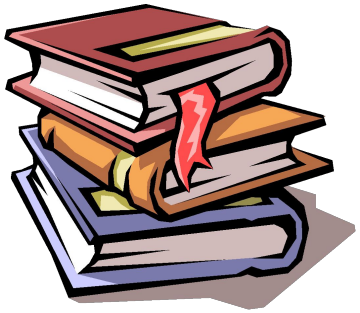
Lecture 3_2

Towards sustainable materials management

Man and Materials Flows

1. Man and Materials Flows
2. Nature's turnover of materials
3. Human-caused material flows
4. Towards sustainable materials management
5. The unbalanced carbon cycle – a global problem
6. Nutrients flows and environmental threats
7. The valuable metals

Literature



1. **Man and Materials Flows.** *Towards sustainable materials management.* ***S.Karlsson*** (Ed.) – Uppsala: BUP, 1997. – 52 p.
2. ***Вайцзеккер Э., Ловинс Э.Б., Ловинс Л.Х.*** Фактор четыре. Затрат — половина, отдача — двойная. – Москва: Academia, 2000. – 400 с. *(Faktor Vier: Doppelter Wohlstand — Halbierter Naturverbrauch, 1995*)

4. Towards sustainable materials management

4.1. Social-ecological principles for sustainability

"Sustainable development -

meeting the needs of present generation
without compromising the ability
of future generations to meet their own needs".

Brundtland Report, WCED, 1987

Big idea to remember:

- It is not enough to focus on waste handling, emission control and waste (residuals) management;
- We must produce an overriding materials strategy involving all important parts of societal mobilizations and turnover of materials;
- We must turn from a waste management to materials management strategy.

Principles for the exchange flows between society and nature,

Holmberg et.al., 1994

1. Substances extracted from the lithosphere must not systematically accumulate in the ecosphere.
2. Society–produced substances must not systematically accumulate in the ecosphere.
3. The physical conditions for production and diversity within the ecosphere must not systematically be deteriorated.
4. The use of resources must be efficient and just with respect to meeting human needs.

Principles 1 and 2

Turnover in balance

Principle 1

Substances extracted from the lithosphere must not systematically accumulate in the ecosphere

Substances from the lithosphere must not be spread in the ecosphere **faster** then

- relevant processes (like sedimentation);
- returning them to lithosphere.

Principle 2

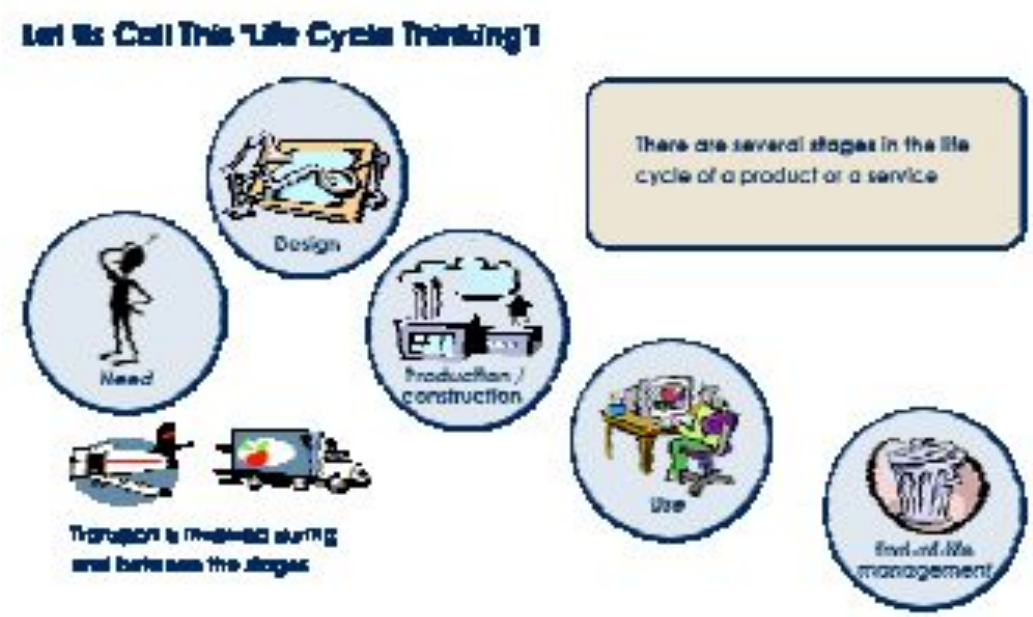
Society–produced substances must not systematically accumulate in the ecosphere

Substances must not be produced **faster** then

- they can be broken down;
- integrated into biochemical cycles;
- Deposited in final deposits in the lithosphere.

Limits often are unknown!!!

Principles 3 and 4
Using the earth carefully



Principle 3

The physical conditions for production and diversity within the ecosphere must not systematically be deteriorated

Society must neither :

- Take more resources from ecosphere than are regenerated;
- nor reduce natural productivity or diversity be manipulating natural systems.

Principle 4

The use of resources must be efficient and just with respect to meeting human needs

Basic human need must be met

with as small an impact as possible.

To achieve SD we need:

1. To increase technical efficiency;
2. To increase organizational efficiency;
3. To introduce a more equitable resource distribution, including more resource efficient life styles in the rich part of the world.


QUANTITY
TYPE
TOTAL

4.2. Adapting materials flows

Anthropogenic materials flows :

- Are too large;
- Involve too many harmful substances;
- Induce to many global impacts:
  - Global warming;
  - Ozone layer depletion;
  - Increasing metal concentration in soil;
  - Decreasing rain forests;
  - Land destruction because of mining.

The "Sustainability equation"

Impact on nature

as a product of **<u>four</u> <u>anthropogenic factors</u>**

Impact on nature = I * m * u * P

$$I = \frac{impact}{material\ \&\ energy\ \ flow};\quad m = \frac{material\ \&\ energy\ \ flow}{utility\ or\ service};\quad u = \frac{utility\ or\ service}{capita};$$

Population

Transmaterialization	Dematerialization	Wealthy society	10^{10}
Mean	Mean	Goal	Given

The "Sustainability equation".

Impact on nature as a product of four anthropogenic factors

shows the dilemma facing mankind

the double challenge inherent in the concept of SD:

1. to develop and reach an acceptable service level from materials/energy flows for growing population
2. While, on other, being able to decrease society's harmful physical impact on nature.

4.5. The solutions – reducing the flow or closing the flow

MATERIALS MANAGEMENT STRATEGIES

15 approaches to efficient materials management

1. Reducing the flow;
2. Slowing down the flow;
3. Closing the flow;
4. Substitute the flow.

1. Reducing the flow – use less material for a service

1. Use the material more efficiently;
2. Increase the quality of the material;
3. Miniaturization – use a smaller equipment;
4. Multifunctionality – let the equipment serve several purposes.

2. Slowing down the flow – make the material last longer

5. Improve the quality to make the equipment last longer;
6. Protect the material in the equipment better;
7. Better maintenance;
8. Reparability – Make the equipment more easy to repair.

3. Closing the flow – use the material again

9. Reuse the goods itself;
10. Recycle materials in the production processes;
11. Recycle materials in consumer goods – true recycling;
12. Cascading or down-cycling of materials.

4. Substitute the flow – use a different, less harmful material

13. Substitute a material for a less harmful one;
14. Substitute a scarce material for a less scarce one;
15. Substitute a non-renewable material for a renewable one.

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