Economic capital at the expense of environmental capital?

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IHE, Delft, The Netherlands

What is economic capital?

What is environmental capital?

Economic *vs.* environmental capital

Economic capital - the sum of the values of production goods: production means, knowledge (human capital), market share, customer relations, resources, transport, location, etc.

Economic *vs.* environmental capital

Environmental capital - the sum of the objective and subjective values of nature and environment: clean air, clean water, space, silence, natural resources, etc.

Thesis - 1

Without changes directed at the cleaning of the industrial sector, the destruction of environmental capital will continue until the self-destruction of the economic capital

Thesis - 2

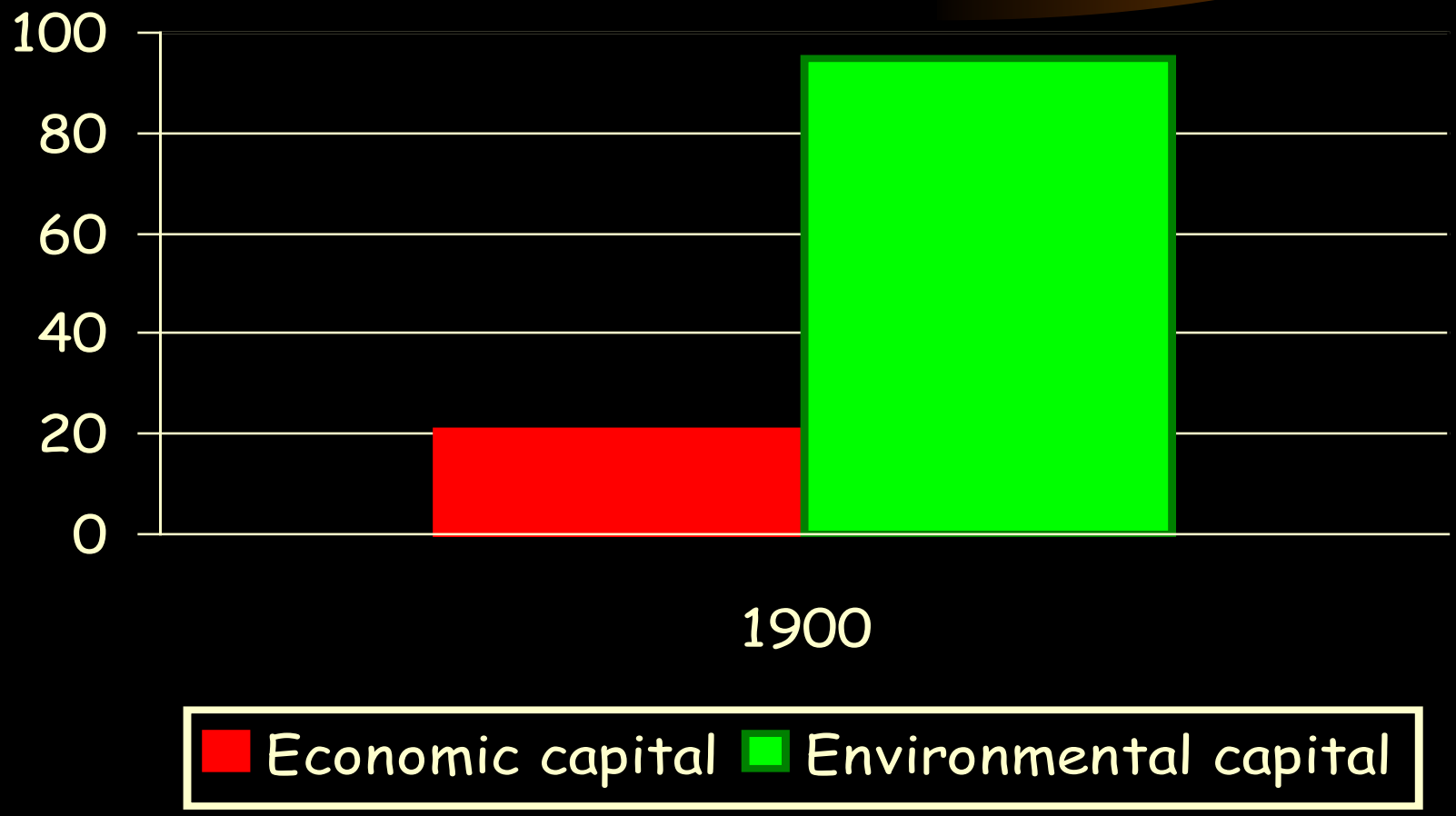
The cleaning up of the industry permits a high level industrial development and, at the same time, a minimal reduction of environmental capital

Economic *vs.* environmental capital

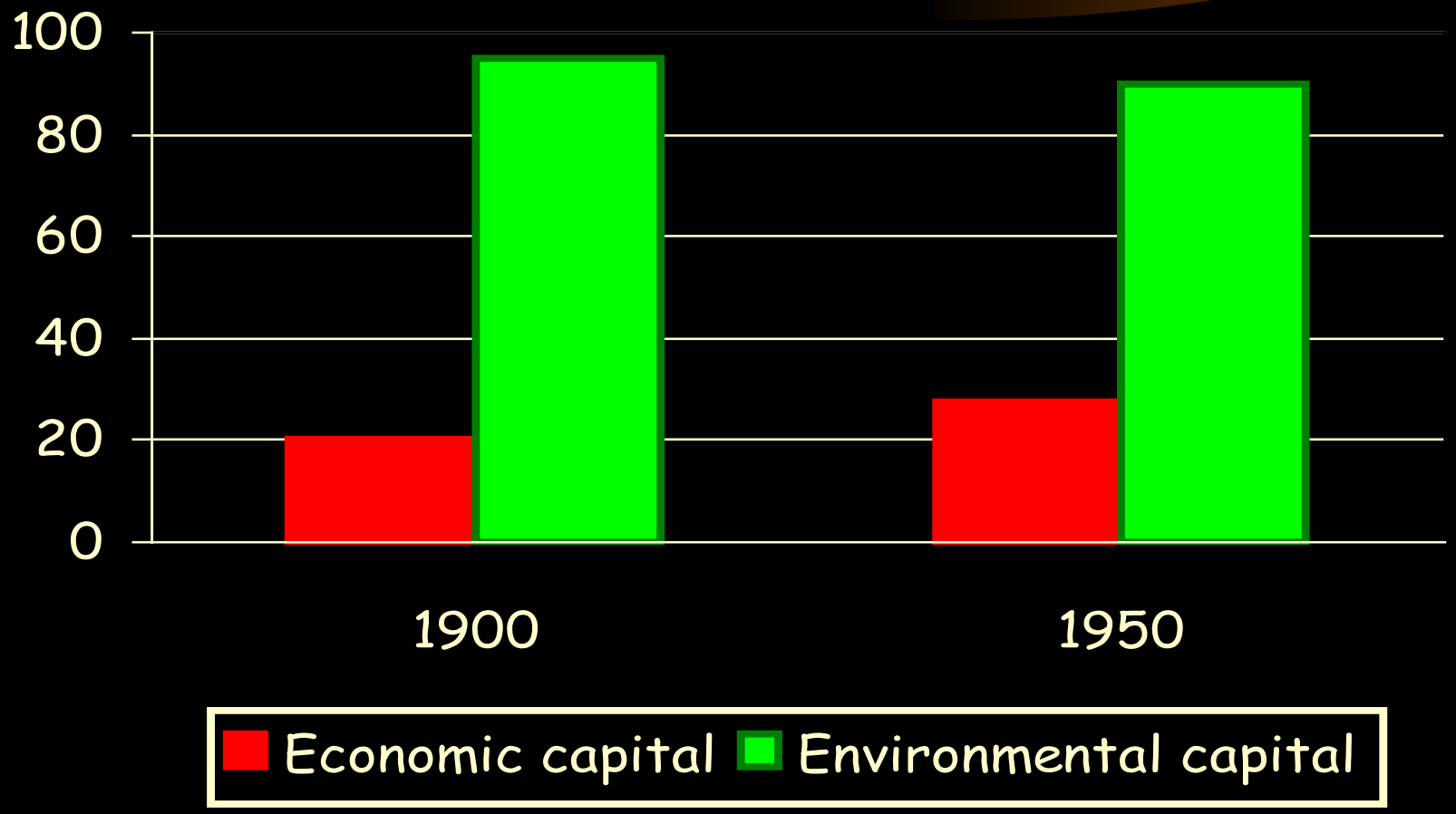
Economic capital
at the expense of
environmental capital?

Yes, of course …….!!

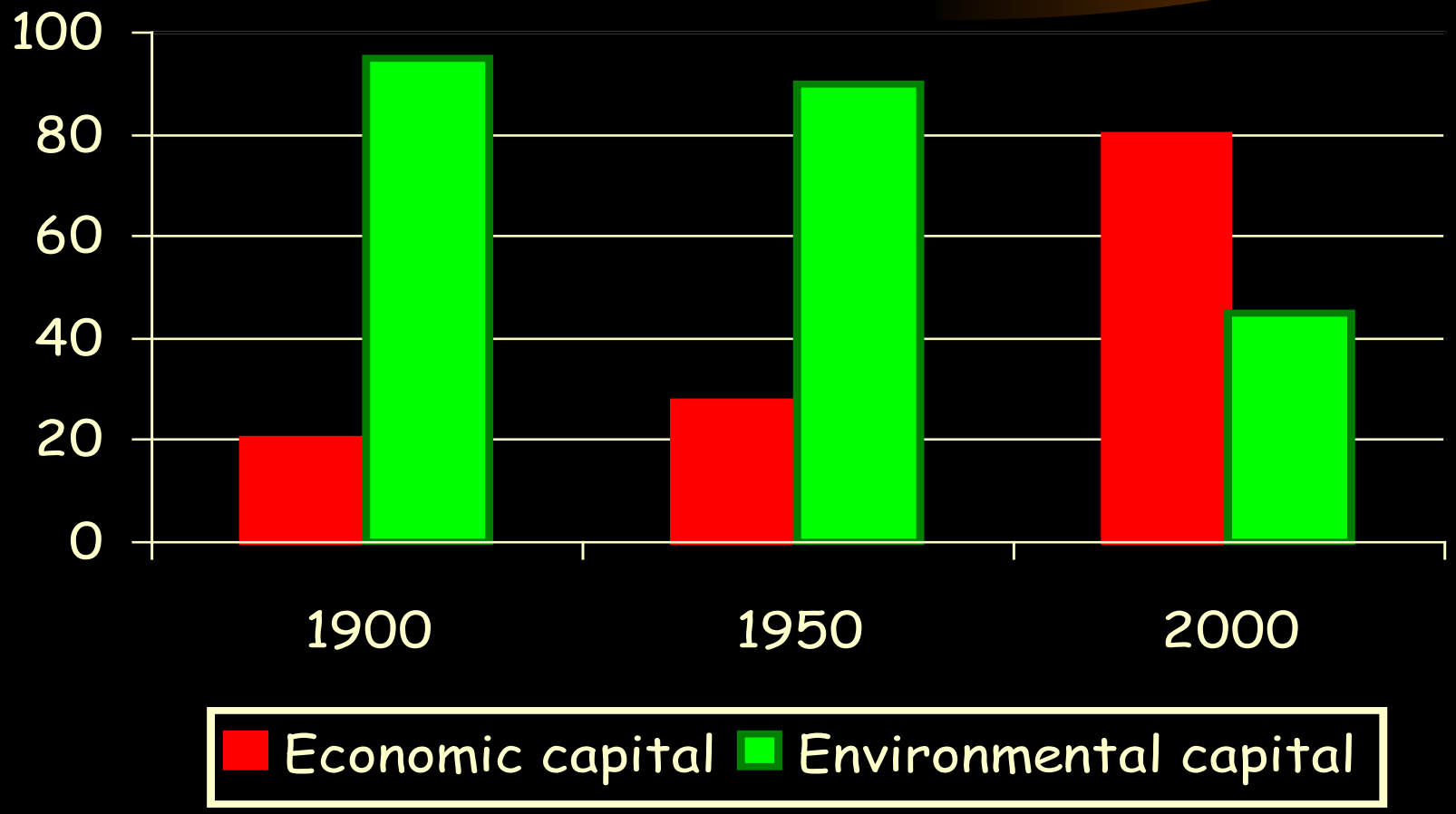
Economic *vs.* environmental capital



Economic *vs.* environmental capital



Economic *vs.* environmental capital



Economic *vs.* environmental capital

How are economical or environmental capital altered and how are these alterations linked?

Our interest is limited

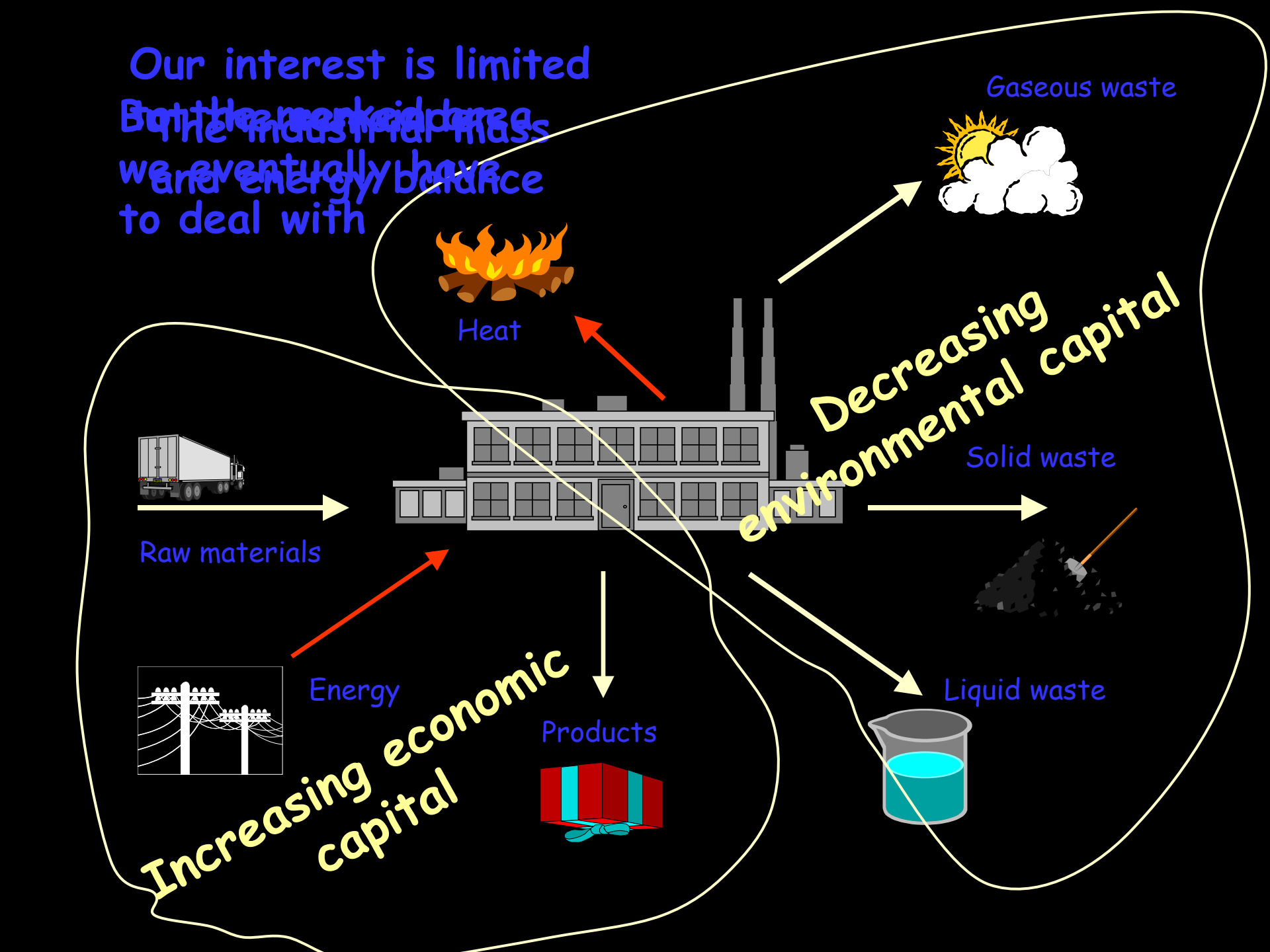
But the market does

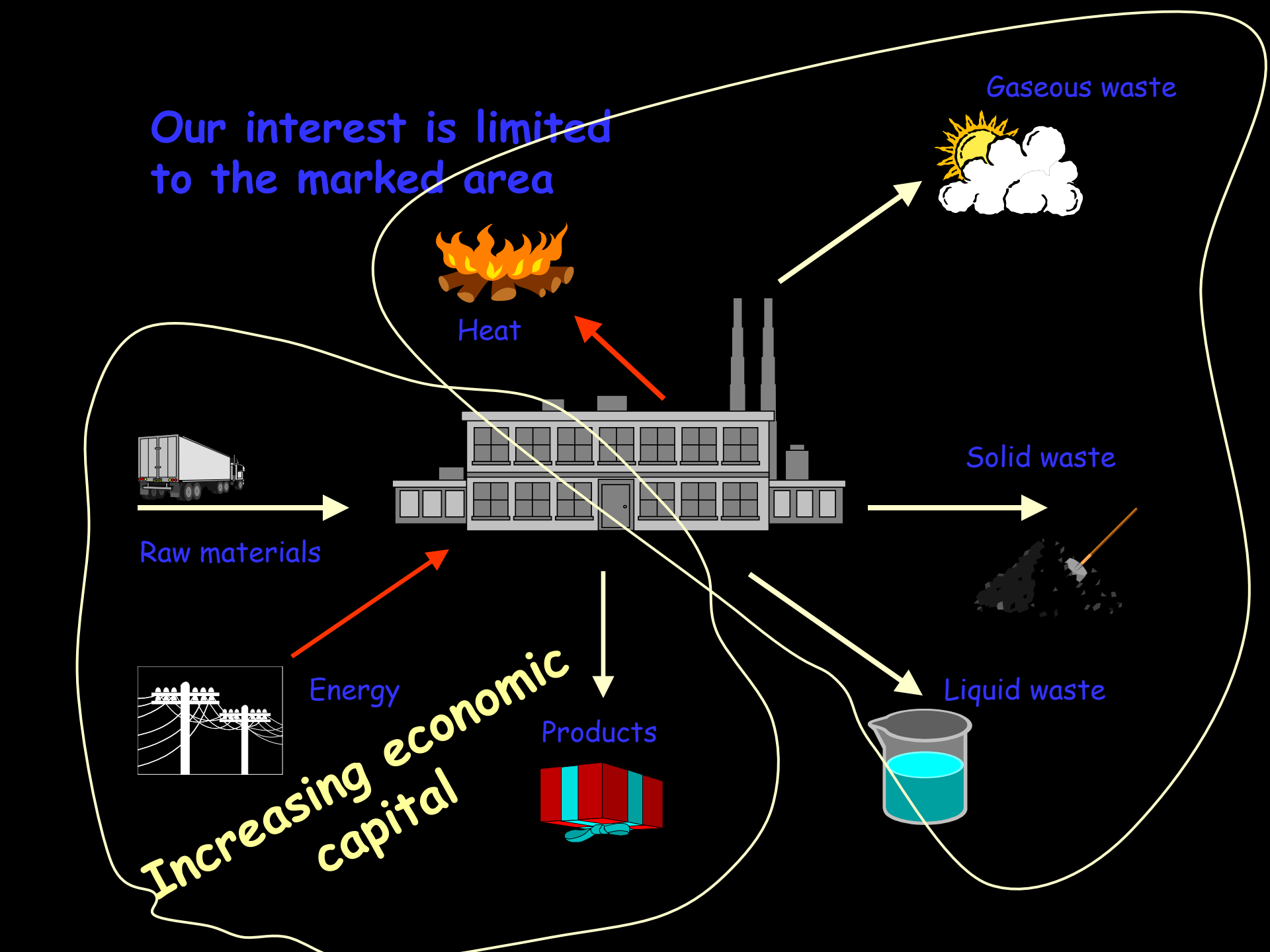
to the industrial mass

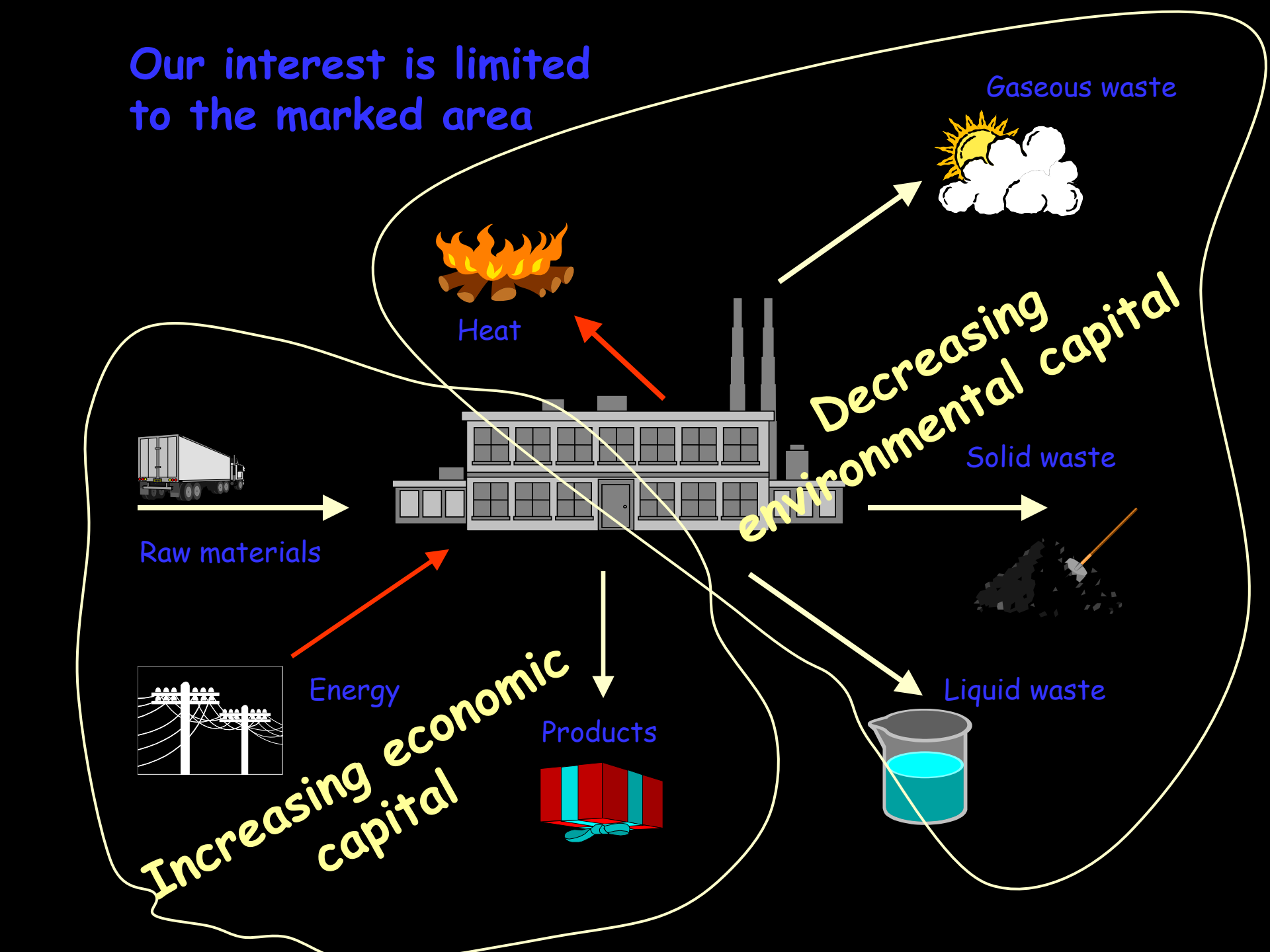
we eventually have

and energy balance

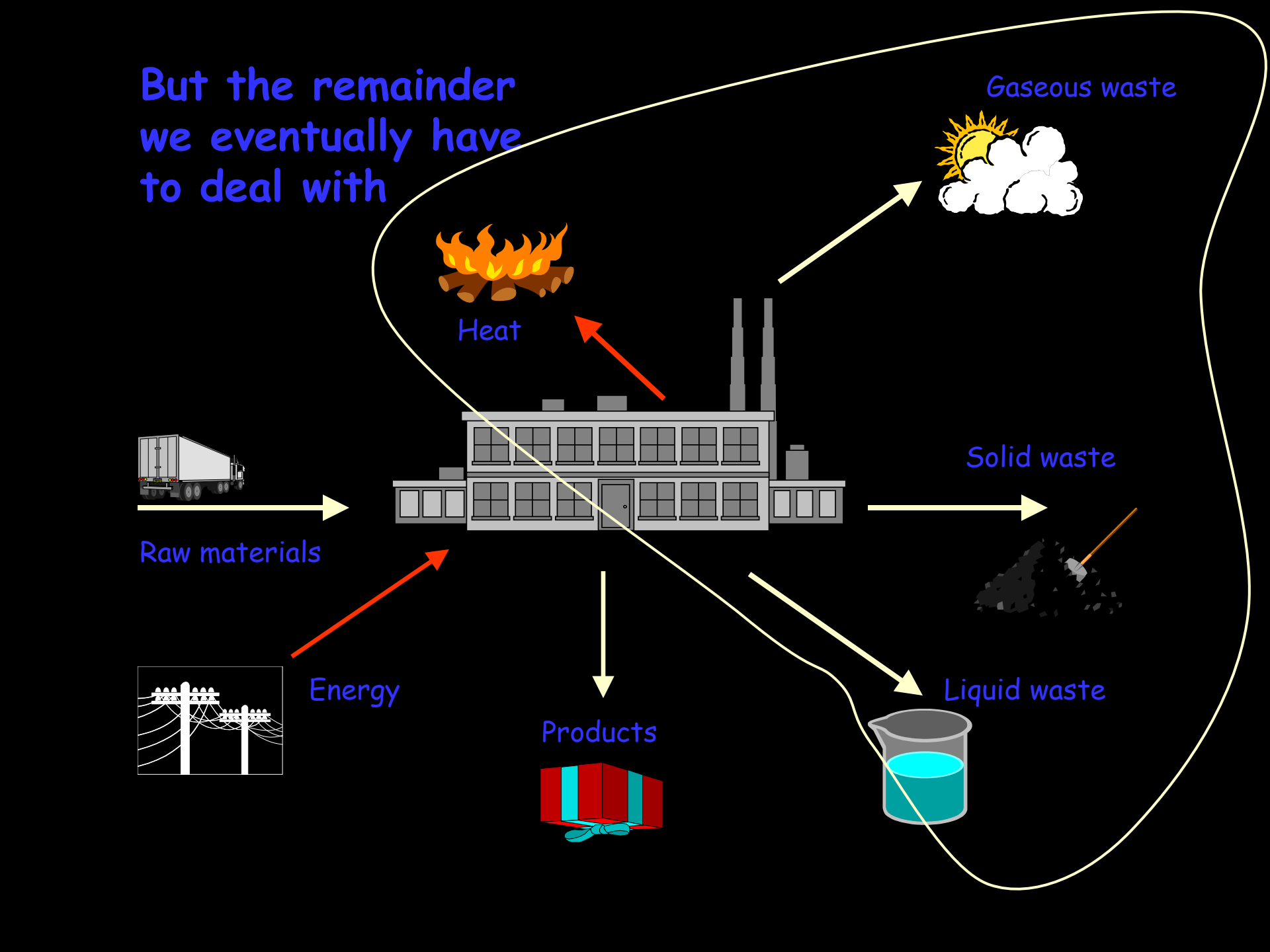
to deal with

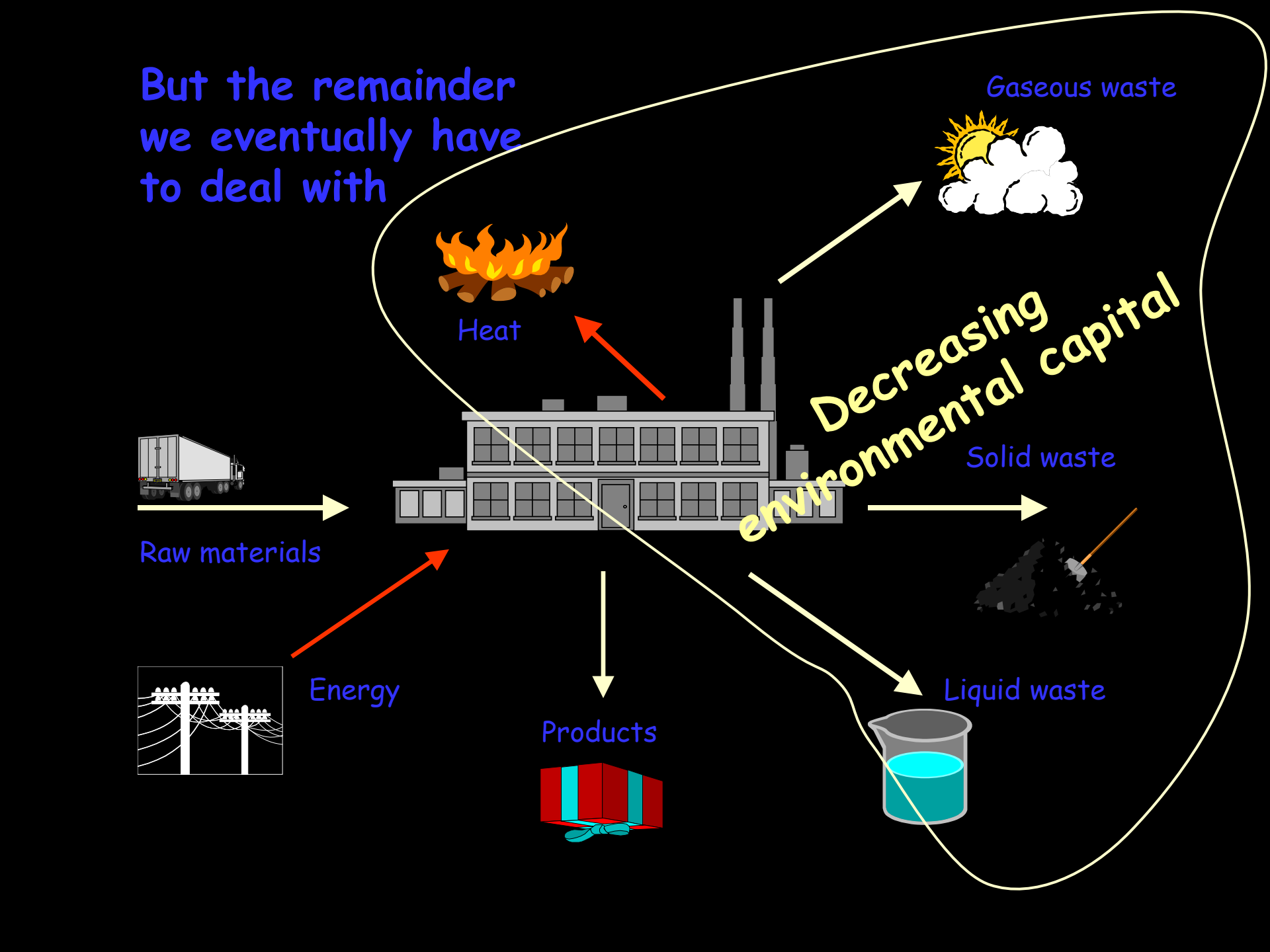



Our interest is limited to the marked area
Gaseous waste
Heat
Raw materials
Solid waste
Energy
Products
Liquid waste
Increasing economic capital


Our interest is limited to the marked area
Gaseous waste
Heat
Decreasing environmental capital
Solid waste
Raw materials
Energy
Products
Liquid waste
Increasing economic capital

But the remainder we eventually have to deal with




But the remainder we eventually have to deal with
Gaseous waste
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Decreasing environmental capital

Consequences of present day industrial production on environmental capital:

depletion of resources - **mining, clean water/air/soil, soil minerals, ..**

dilution of resources - **metals, organics, nutrients, ..**

pollution of resources - **water/air/soil, ..**

damage to resources - **chemicals into stratosphere**

Decreasing environmental capital

How is the industry involved in the destruction of, dilution of, pollution of and damage to natural resources?

Eco-responsibility

Global warming - How business is involved?

- By burning fossil fuels in power stations, furnaces and heating systems.
- By allowing the evaporation or release of certain chlorinated solvents and CFC's.
- By operating processes, maintaining buildings and running transport systems which do not employ the most effective means of saving energy.

Eco-management Guide, 1998

Eco-responsibility

Acid Rain - How business is involved?

- By using electricity generated from fossil fuels and resisting the active support for renewable energy sources.
- By burning fossil fuels in factories and heating systems.
- By its dependence upon road transport.
- By operating inefficient buildings and processes, which increase energy consumption.

Eco-management Guide, 1998

Eco-responsibility

Waste - How business is involved?

- By producing environment unfriendly products (dyes, synthetic fibres, paints and plastics - chemical industry) and by producing most of the EU's hazardous waste (sludge containing heavy metals - metal platers)
- By concentrating on cures and treatments for waste ("end of pipe" solutions) rather than preventing its creation.
- By not investigating methods for recycling and re-use of waste, including paper and other office wastes.

Eco-management Guide, 1998

Decreasing environmental capital

Consequences of present day industrial production on environmental capital:

depletion of resources - **mining, clean water/air/soil, soil minerals, ..**

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damage to resources - **chemicals into stratosphere**

Decreasing environmental capital

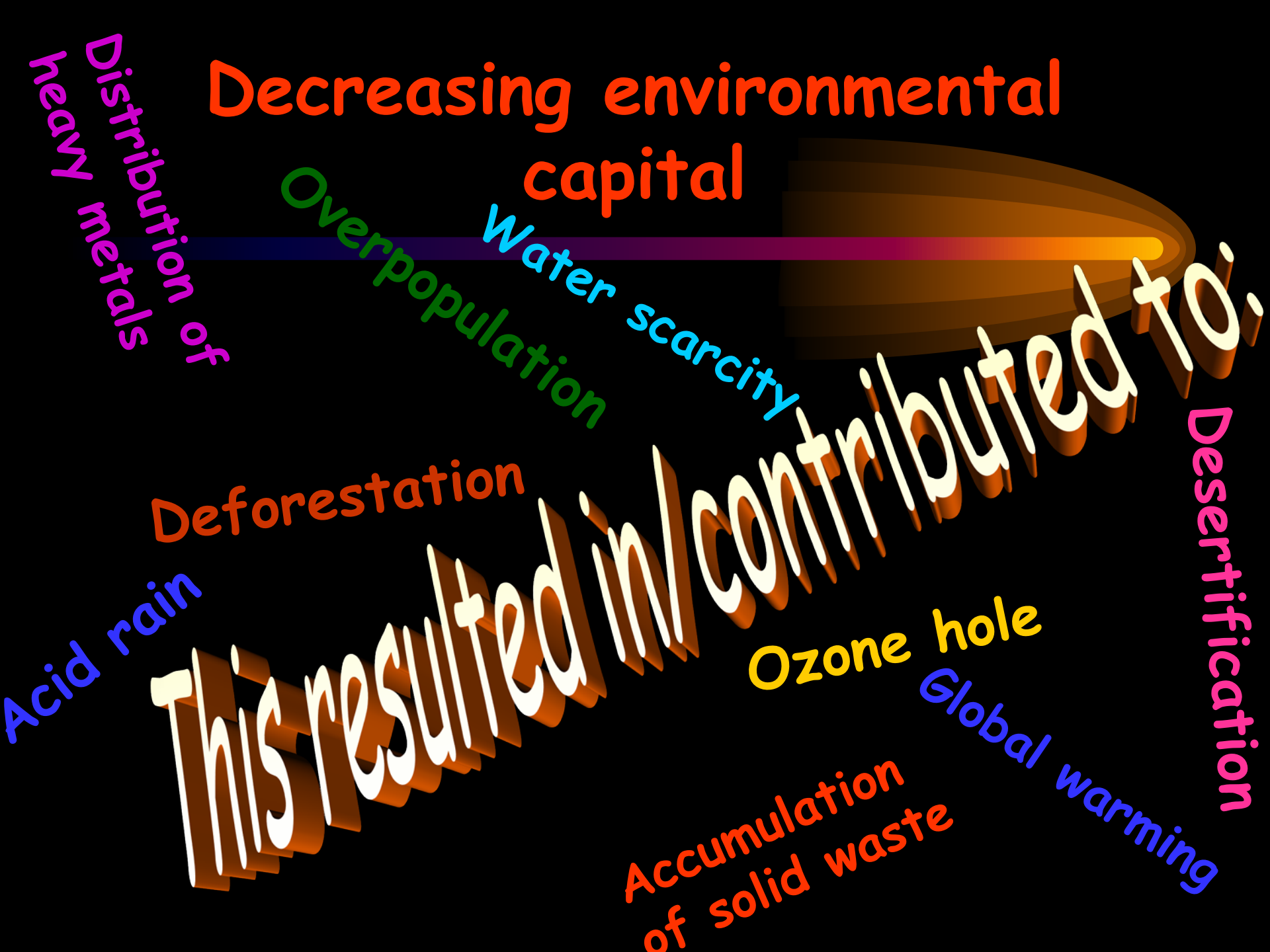
Conclusion:

Economic development

→ enlarges the industrial capital

but, at the same time,

→ destroys environmental capital

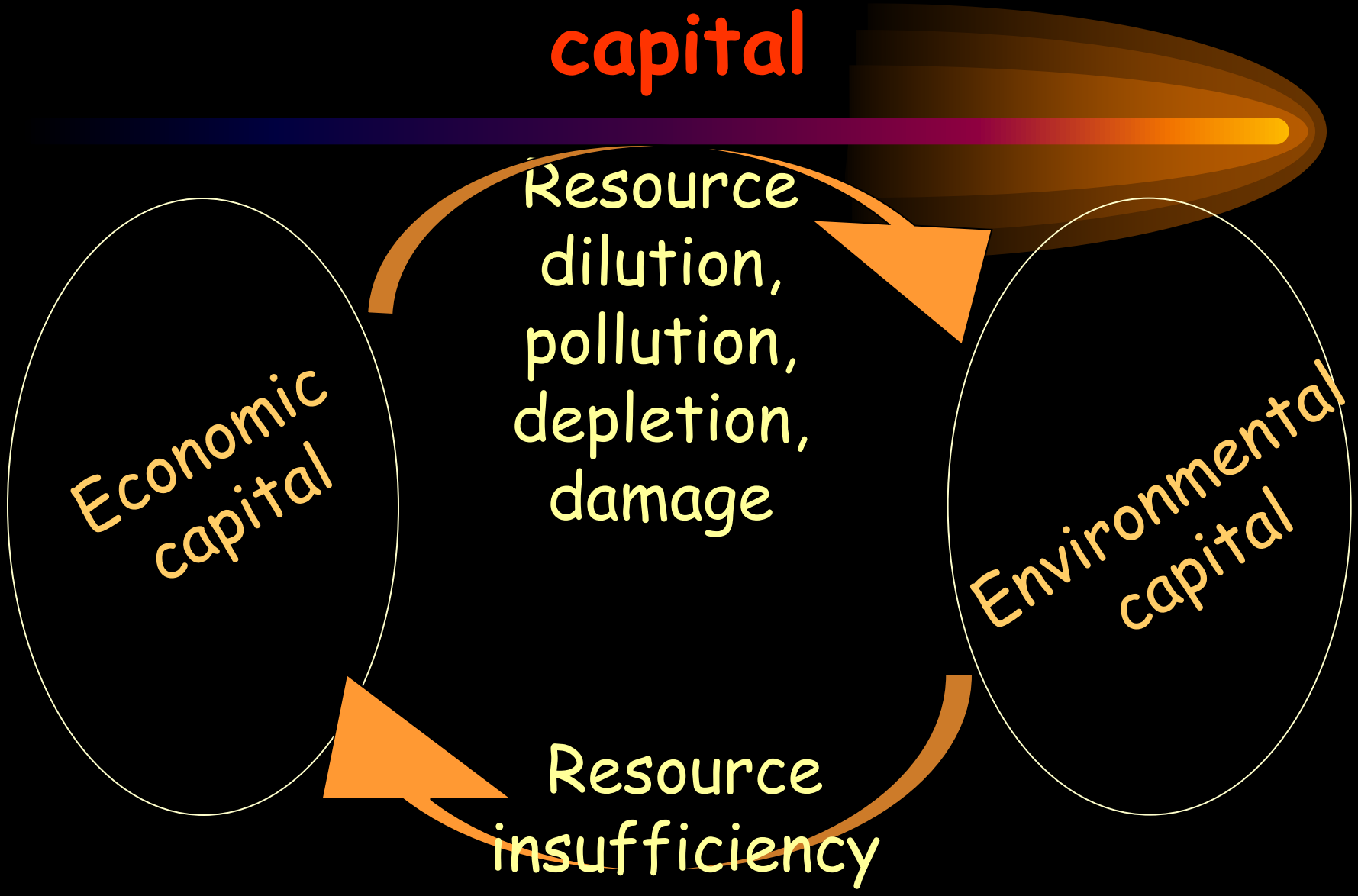

Decreasing environmental capital
Distribution of heavy metals
Overpopulation
Water scarcity
This resulted in/contributed to:
Deforestation
Acid rain
Ozone hole
Desertification
Global warming
Accumulation of solid waste

Economic *vs.* environmental capital

Can we continue decreasing our environmental capital for the sake of improving our economic capital?

NO → *improving our industrial capital requires an healthy environment*

Economic *vs.* environmental capital



Economic *vs.* environmental capital

Examples of diminishing economic capital due to reduced environmental capital:

Moving industry in Holland due to traffic congestion (Holland)

Submitting the fish industry to quota (Holland)

Disappearance of textile industry due to water pollution (India)

Disappearance of agriculture due to soil depletion (Kenya)

Economic *vs.* environmental capital

Popular wisdom:

end-of-pipe waste treatment

Waste treatment - How business and governments responded?

In 1992 the US spent US$ 100 billion, the EU US$ 30 billion on '*end-of-pipe*' treatment.

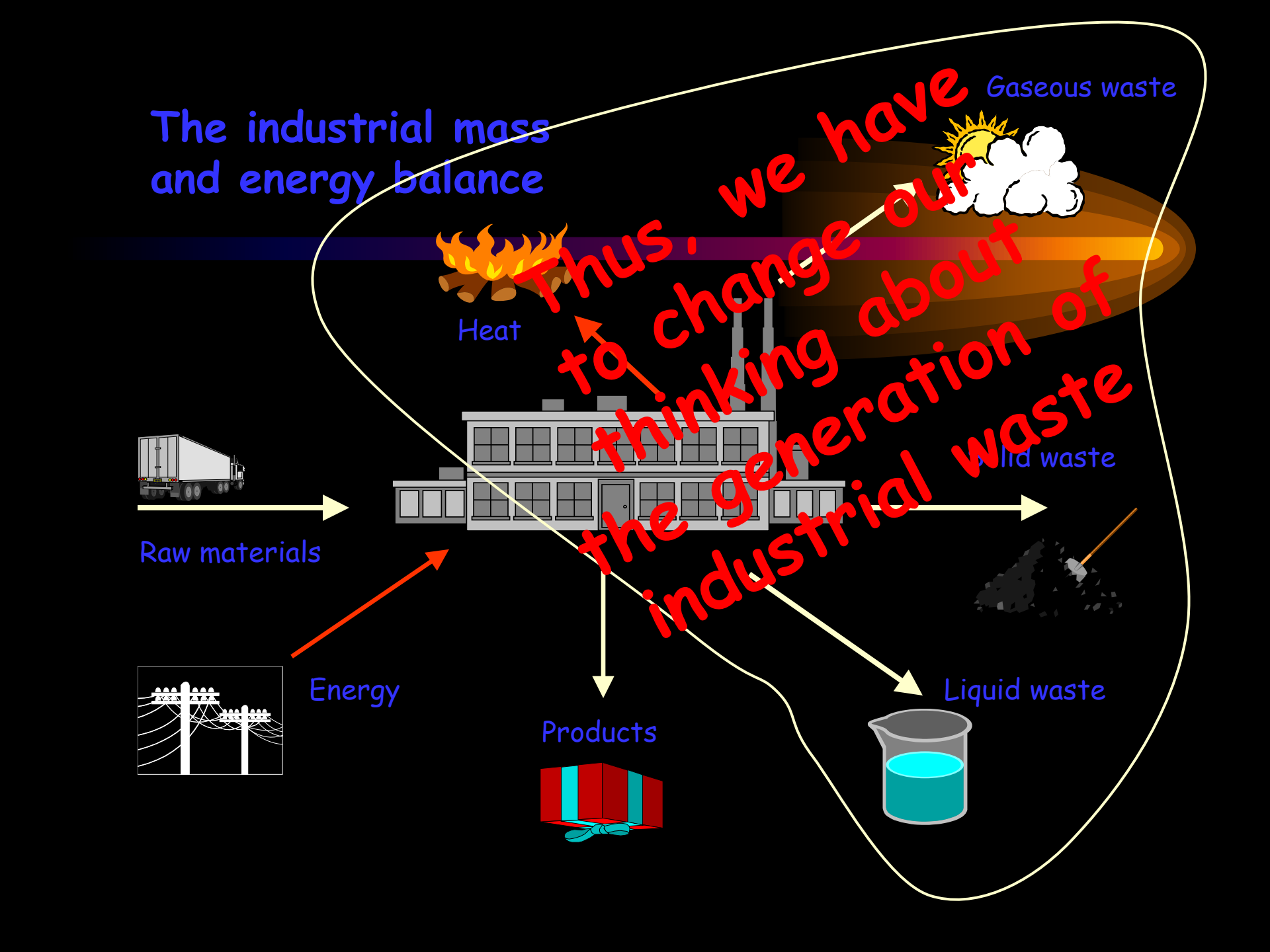
HOWEVER: There is very little direct financial return to the industries that incur this expenditure

Ecological Sustainable Industrial Development, UNIDO, 1994

Is end-of-pipe treatment effective?

Depletion of resources:	Not effective
Dilution of resources:	Not effective
Pollution of resources:	Effective
Damage to resources:	Not effective

The industrial mass and energy balance



Thus, we have to change our thinking about the generation of industrial waste

It is time we begin to see the possibility to develop a new life style, with new methods of production and new patrons of consumption, a life style designed for sustainability

E.F. Schumacher

Eco-efficiency

Let's change the subject, let's talk about industrial efficiency

Eco-efficiency

Industrial efficiency, η, usually expressed as:

$$\eta = \frac{(\$)\ (\text{products generated})}{(\$)\ (\text{raw materials used} + \text{waste generated})}$$

Eco-efficiency

Conventional wisdom - to increase efficiency, increase production:

$$\eta = \frac{(\$)\ (\text{products} + \text{more products generated})}{(\$)\ (\text{raw materials used} + \text{waste generated})}$$

['eco' = 'economic']

Eco-efficiency

Cleaner production wisdom - to increase efficiency, reduce waste generated:

$$\eta = \frac{(\$)\ (\text{products generated})}{(\$)\ (\text{raw materials used} + \text{reduced waste generated})}$$

['eco' = 'ecologic']

Eco-efficiency

Contemporary thinking:

to increase ecological efficiency

improve management

this is mostly also good for the economical efficiency

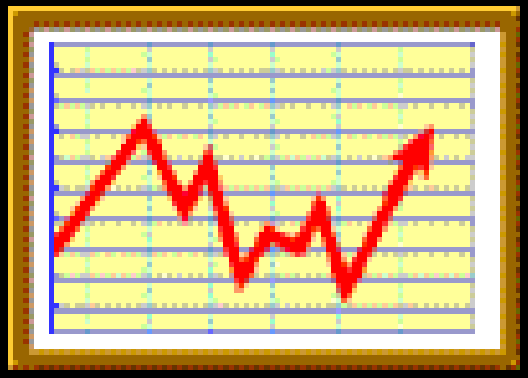
Improving management *for improving Eco-efficiency*

Few industrial managers are familiar with precise process conditions in their facilities. This relates for example to:

- material quantities and flows,
- energy consumption,
- process details,
- workers health and safety conditions

Improving management *for improving Eco-efficiency*

How can an industrial process work eco-optimal if familiarity with important operational details is missing?



Improving management *for improving Eco-efficiency*

Example

Extrusion of PVC at Plastigama,

Guayaquil, Ecuador

Improving management *for improving Eco-efficiency*

First understand, then improve the eco-efficiency of your enterprise

=

CLEANER PRODUCTION

What is Cleaner Production?

The practical *application of knowledge, methods and means*, so as to provide the most *rational use of natural resources and energy*, and to *protect the environment* (First UN seminar organized by the ECE, 1976)

What is Cleaner Production?

Elements

- '… application of knowledge, methods and means …'
- '… rational use of resources and energy …'
- '… protection of the environment…'

What is Cleaner Production?

Avoiding the unwise of resources

1 - through demand management

taxing gas consumption/air transportation *AND* reducing cost of public transport

focussing on AND providing nearby employment, recreation, shopping

taxing disposable goods *AND* stimulating reusability/durability

What is Cleaner Production?

Avoiding the unwise of resources

2 - through materials choice

oil-based lubricants *vs.* water-based lubricants

Chromium sulfate tanning *vs.* vegetable tanning

hardwood *vs.* softwood

carbon-based energy *vs.* renewable energy

What is Cleaner Production?

Avoiding the unwise of resources

3 - through least impact design

coffee makers with a thermos can rather than a can that needs heating

electrical appliances without stand-bye mode

cars that run over 30 km per liter of fuel

What is Cleaner Production?

Avoiding the unwise of resources

4 - through least impact utilization

using public transport in stead of private car

switching off lights when not needed

shopping at a nearby location rather than far away

What is Cleaner Production?

Avoiding the unwise of resources

5 - through reuse, recycling, recovery

reusing glass bottles, clothing, (waste-)water, …

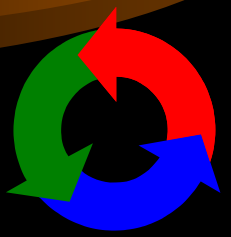
recycling plastics, paper, metal scrap, engine oil, …

recovering metals from sludge, batteries, compost from organic waste …

What is Cleaner Production?

Avoiding the unwise use of resources

6 - over entire life cycle



includes environmental effects *during* production, *during* product use and *after* disposal

shoes - Chromium release after use

tires - particles on pavement and in disposal sites

car wrecks - maximizing reusability

Cleaner Production
good business?

- better choice of resources:
- less in-process spillage:
- more reuse/recycling:
- more recovery:
- less 'end-of-pipe' waste:
- less observable pollution:
- better public image:

Cleaner Production
good business? Examples

- 3M Corporation - USA
- Printing firm - Norway
- Química y Textiles Proquindus - Peru
- Cerveceria Suramericana S.A. - Ecuador
- Plastigama S.A. - Ecuador

Cleaner Production
3M Corporation

Pollution Prevention Pays (PPP) program Worldwide
1975 - 1990 (15 years)

- 126,000 tons of air pollutants
- 16,600 tons of sludge
- 6,600 m^3 of wastewater
- 409,000 tons of solid/hazardous waste
- 210,000 barrels of oil annually

- US $ 506,000,000 in 15 years

Cleaner Production
Química y Textiles Proquindus

Action	Cost (US$)	Savings (US$/y)	Payback period
Replace leaking steam traps	700	47,000	1 week
Modifying rinsing procedures	400	45,000	< 1 week
Replace sulphate with NaCl	none	7,500	immediate
Repair leaks in wool laundries	50	3,700	< 1 week
Repair leaks on Zonco washer	none	2,200	immediate
Filter sulphuric acid continuously	700	300	2.5 years
TOTAL	1,850	> 100,000	

Cleaner Production
Norwegian printing industry

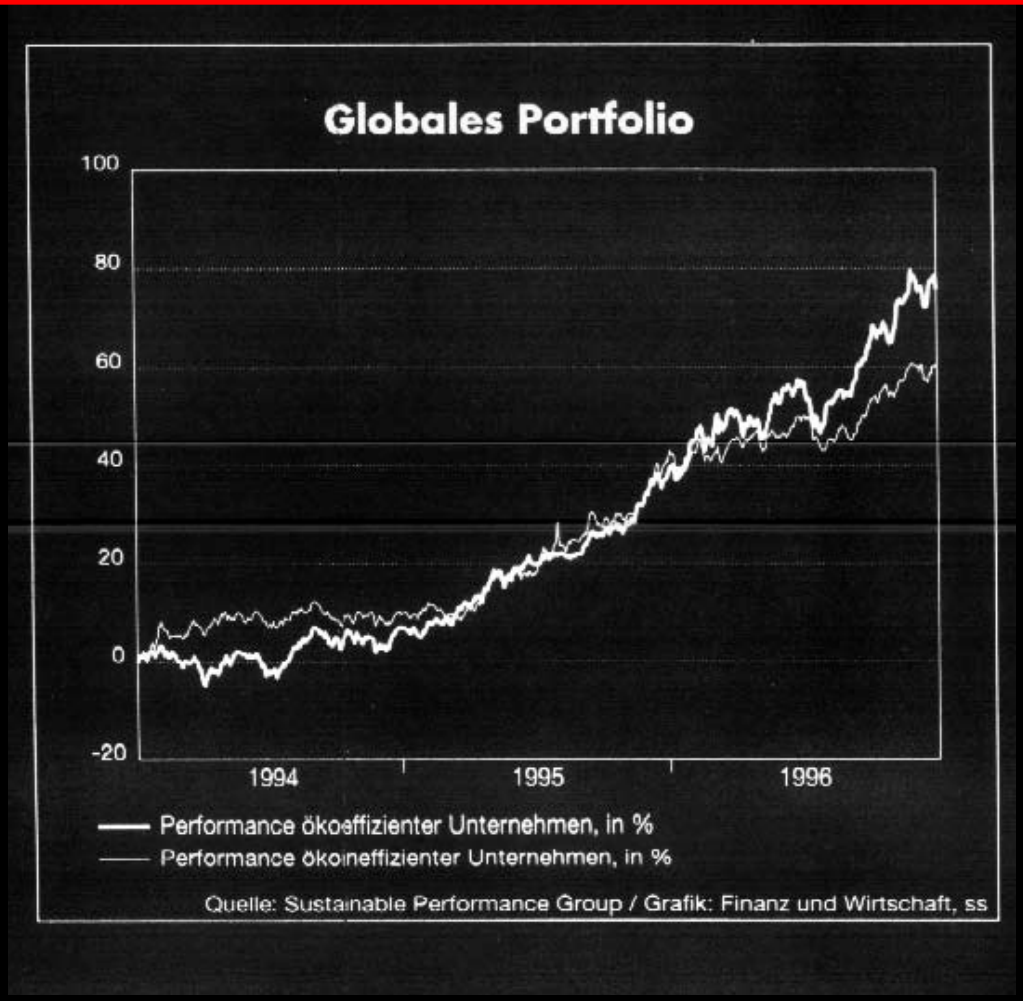
Approach	Measure	Costs (NOK)
Dilution	• 23 km pipeline • 1.5 m Ø	• investment: 100 M
Pollution Control	• wastewater treatment plant	• investment: 32 M • operation: 8 M/y
Pollution Prevention	• procedural and technical changes	• investment: 8 M • savings: ❖ 5 M/y on chem's ❖ 10 M/y on energy ❖ 8 M/y increased productivity

Cleaner Production

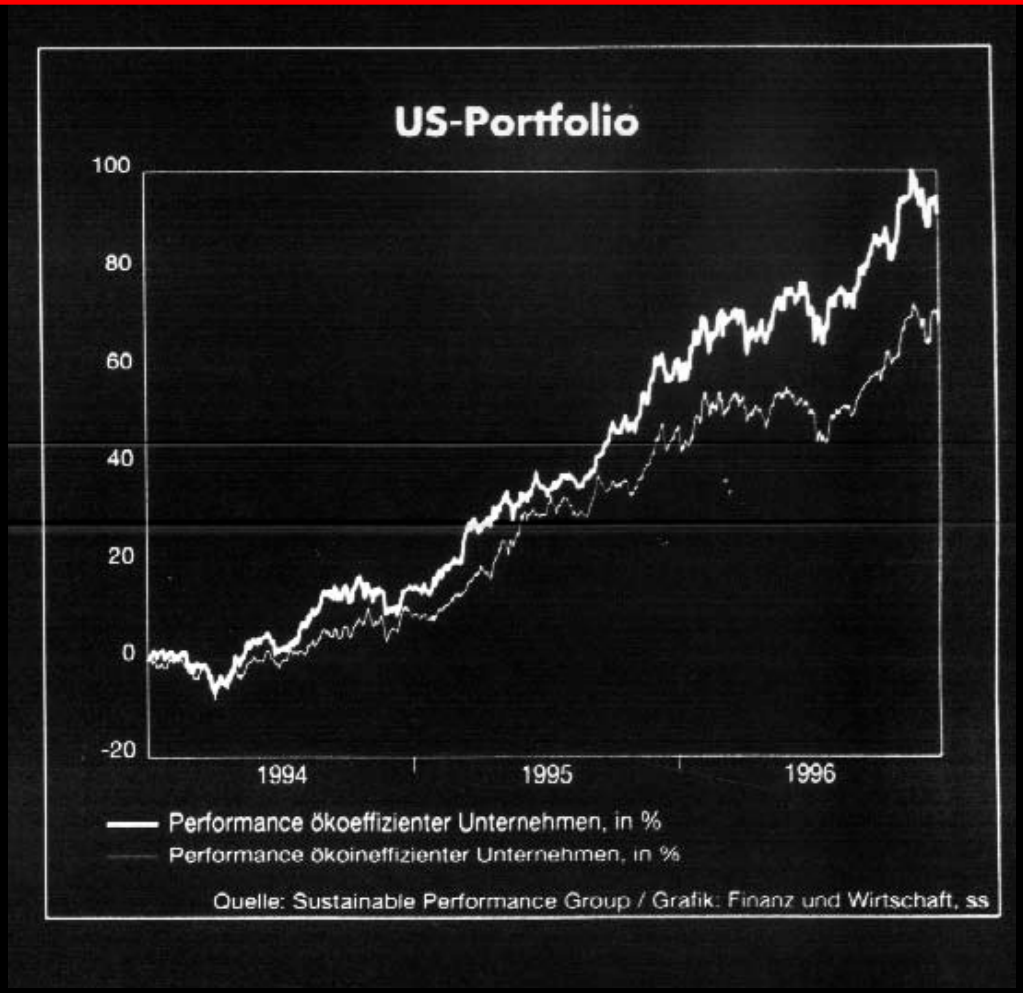
Ex IV - Two enterprises in Ecuador

ENTERPRISE	MEASURE	INVESTMENT COSTS (US$)	PAY-BACK PERIOD (MONTHS)
Cerveceria SA	Reuse of Wastewater Effluent	7,400	3.5
Cerveceria SA	Reutilization of Filtration Material	7,681	2.3
Plastigama SA	Various small corrective material expenditures	9,100	5.7
Plastigama SA	System for the management of raw and composite material	900,000	9

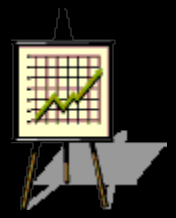
Financial performance of global industry - w & w/o CP



Financial performance of US industry - w & w/o CP



Cleaner production
Why?



Financially mostly attractive,

Good for Public Relations,

Good for the environment,

Good for enterprise spirit,

etc.

A closer look at costs

Costs of producing a product:

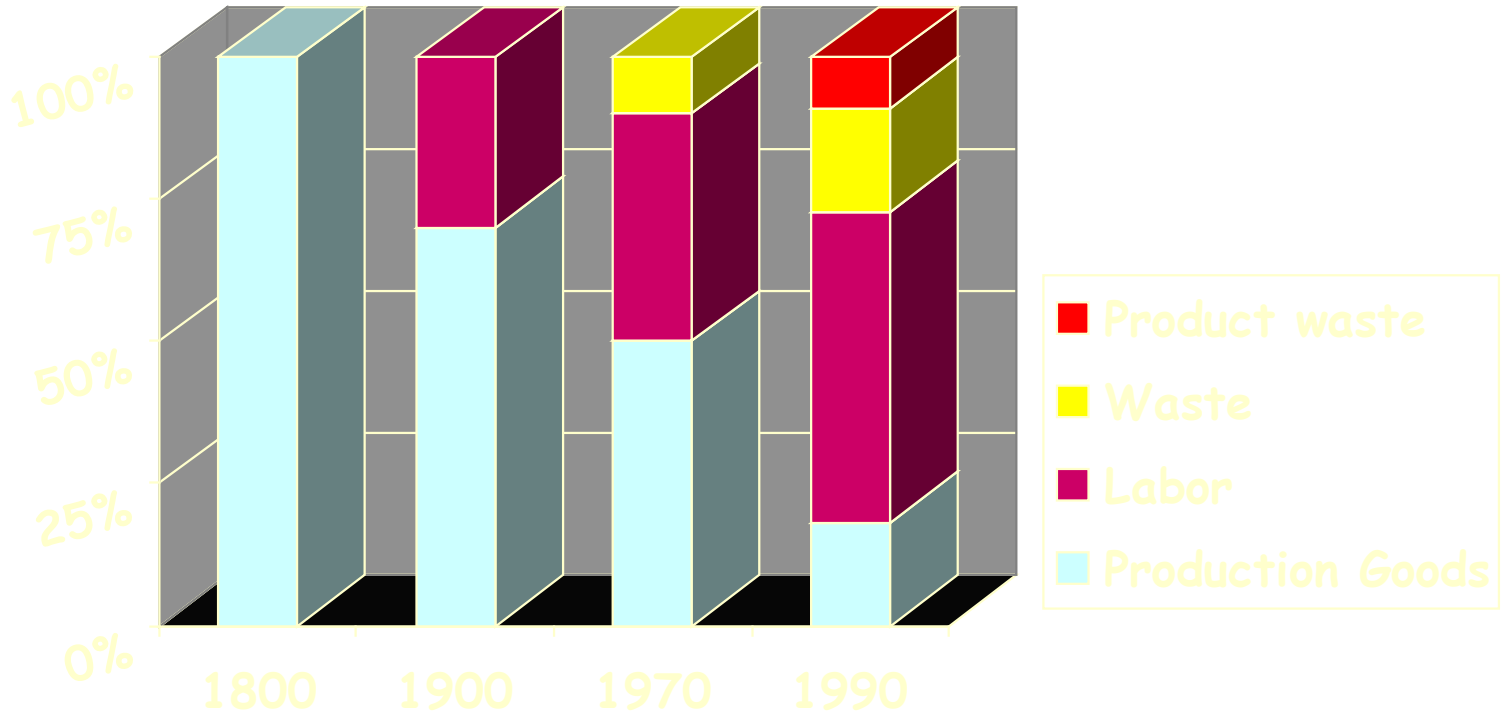
o raw material costs, energy costs, equipment oocosts (production goods)

o labor costs

o costs for dealing with liquid, gaseous, solid oowastes during production process

o costs for dealing with the product after its oouseful life (product waste)

A closer look at costs



Relative cost factors in industrial production

Reducing environmental capital - non-industrial causing agents