

INTRODUCTION TO CLEANER PRODUCTION (CP) CONCEPTS AND PRACTICE

Prepared by the Institute of
Environmental Engineering
(APINI) Kaunas University of
Technology, Lithuania



Sponsored by UNEP,
Division of Technology,
Industry, and Economics





Team for CP success

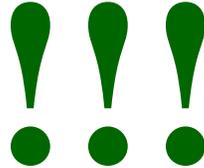
- **Managers, engineers and finance people in industry and commerce**, in particular those responsible for business strategy, product development, plant operations and finance
- **Government officials**, both central and regional, who play an important role in promoting CP
- **Media representatives** who play an important role in disseminating information on good environmental practice

What is waste?

There are literally hundreds words for different types of waste:

- allowance
- BOD
- broke
- contaminated solids
- core loss
- customer returns
- damage
- drainings
- dust
- effluent
- evaporation
- furnace loss
- greenhouse loss
- hidden losses
- leakage
- non-conforming material
- overfill
- packaging
- process loss
- rework
- second quality
- stock loss
- washings
- and etc.





Waste is waste what
ever you call it : take
the opportunity to cut
waste and increase
profits!



Where are you now?

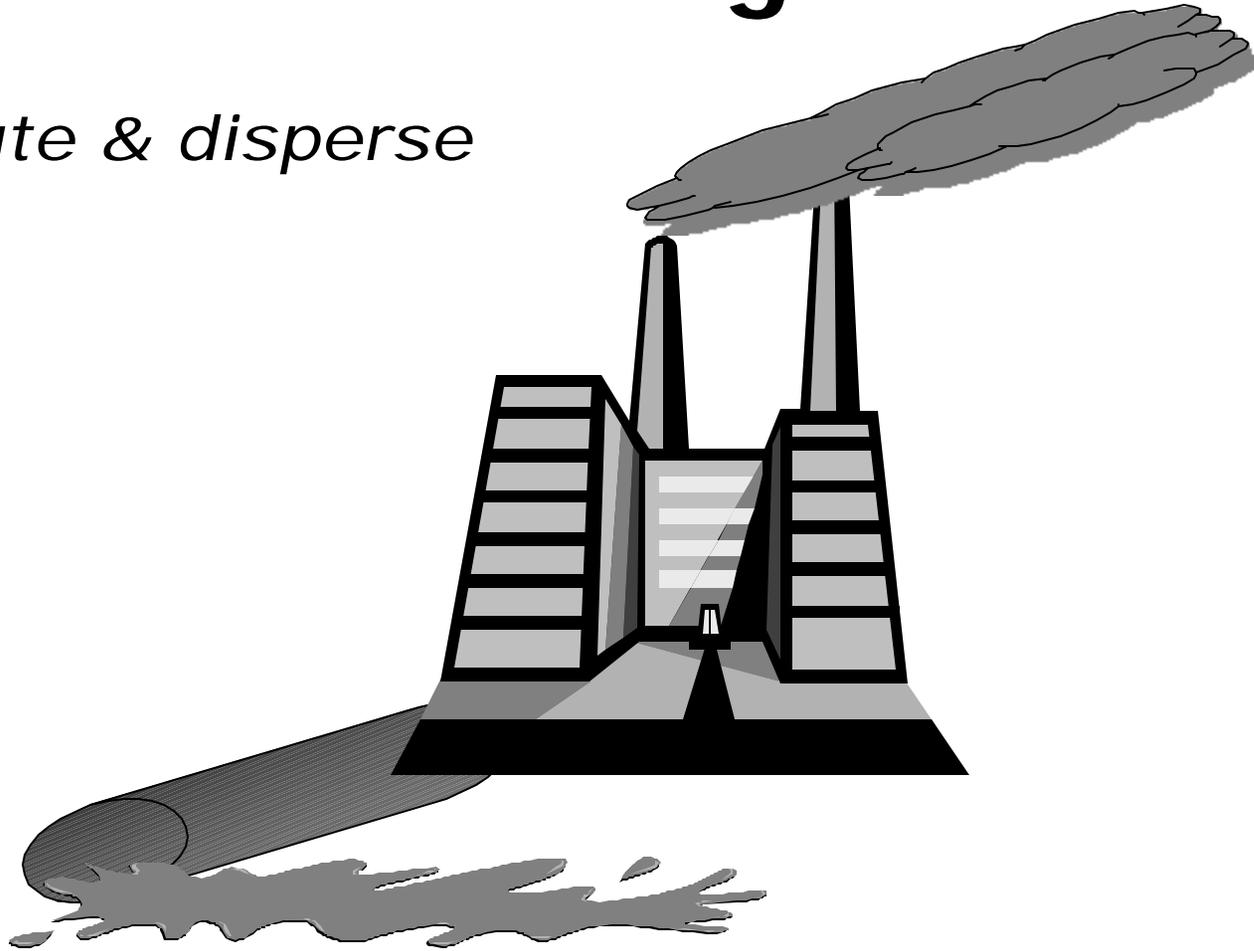
- Only a change in technology would eliminate waste completely
- We are optimising our processes and achieving big cost reductions
- Waste is coming down as we change the way we work



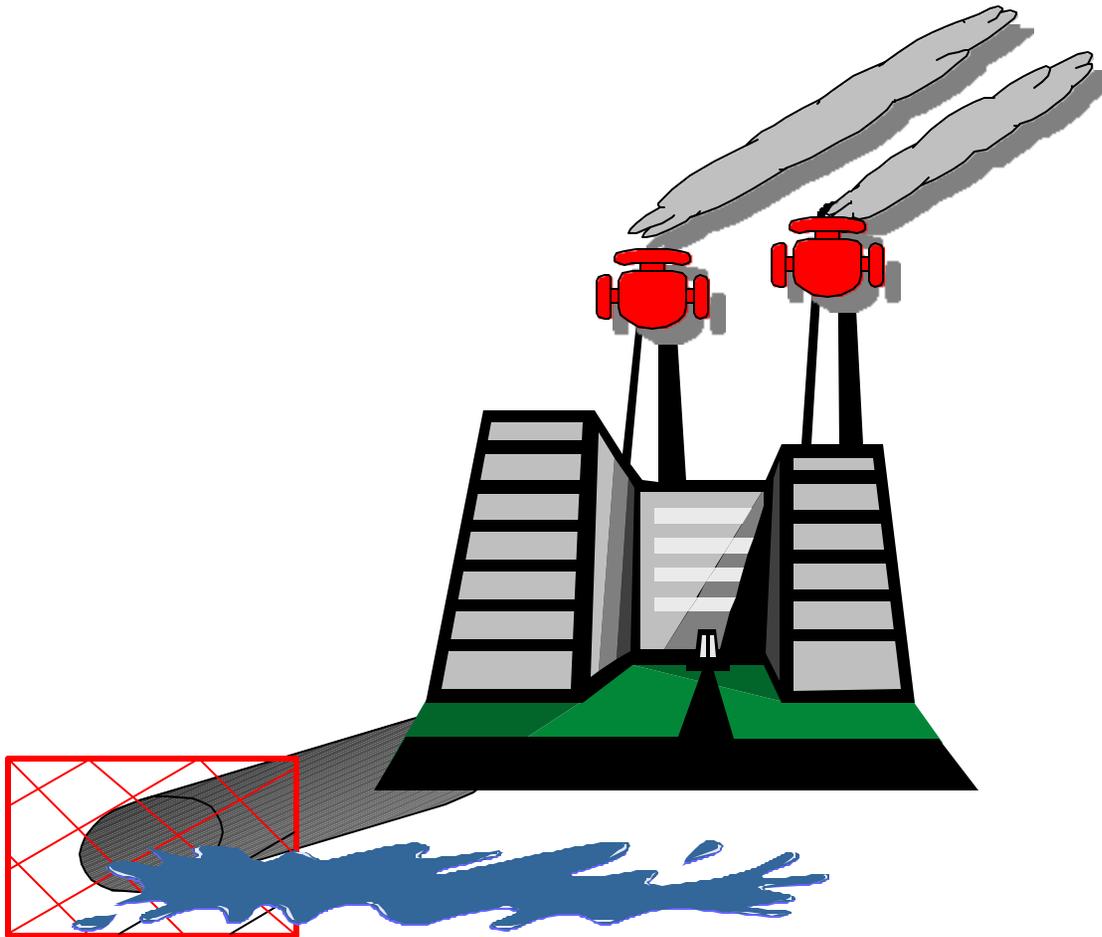
- We have identified our waste and monitoring it
- We plan to reduce waste
- Waste is cost and regulatory issue
- Waste is only disposal issue
- Waste is not an issue

Passive environmental strategies

Dilute & disperse

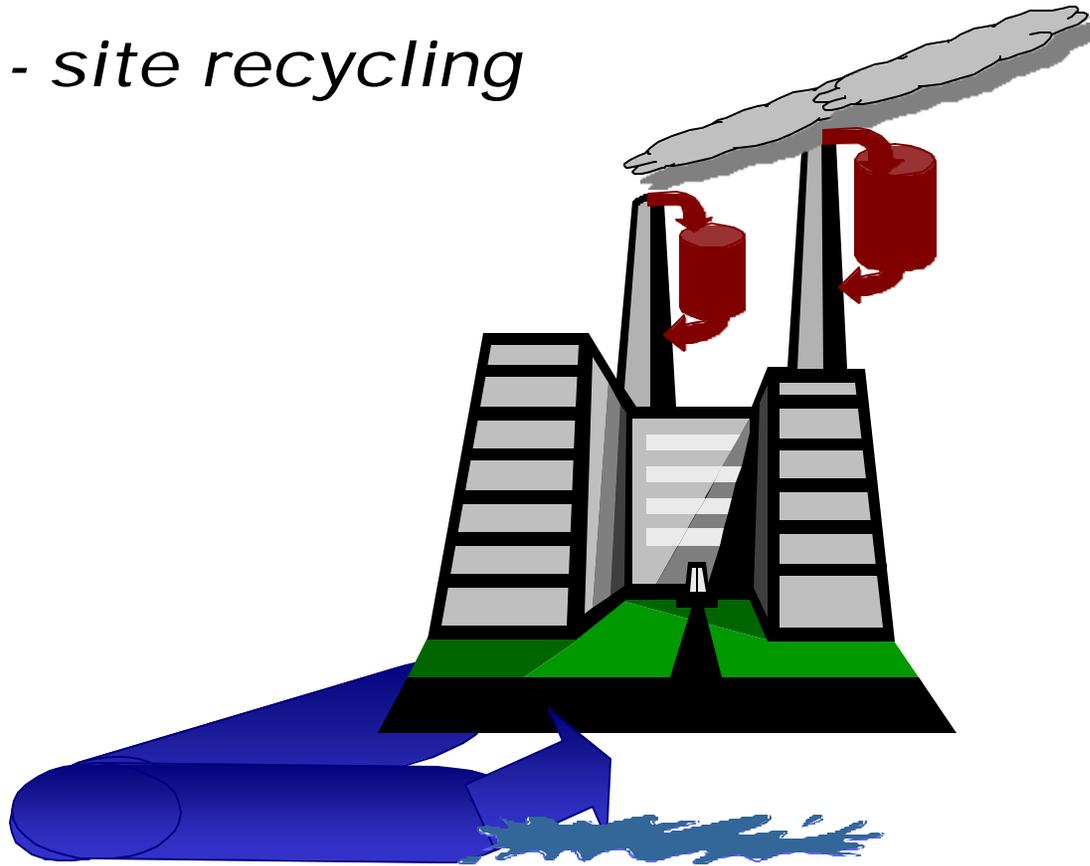


Reactive environmental strategies: end-of-pipe approaches

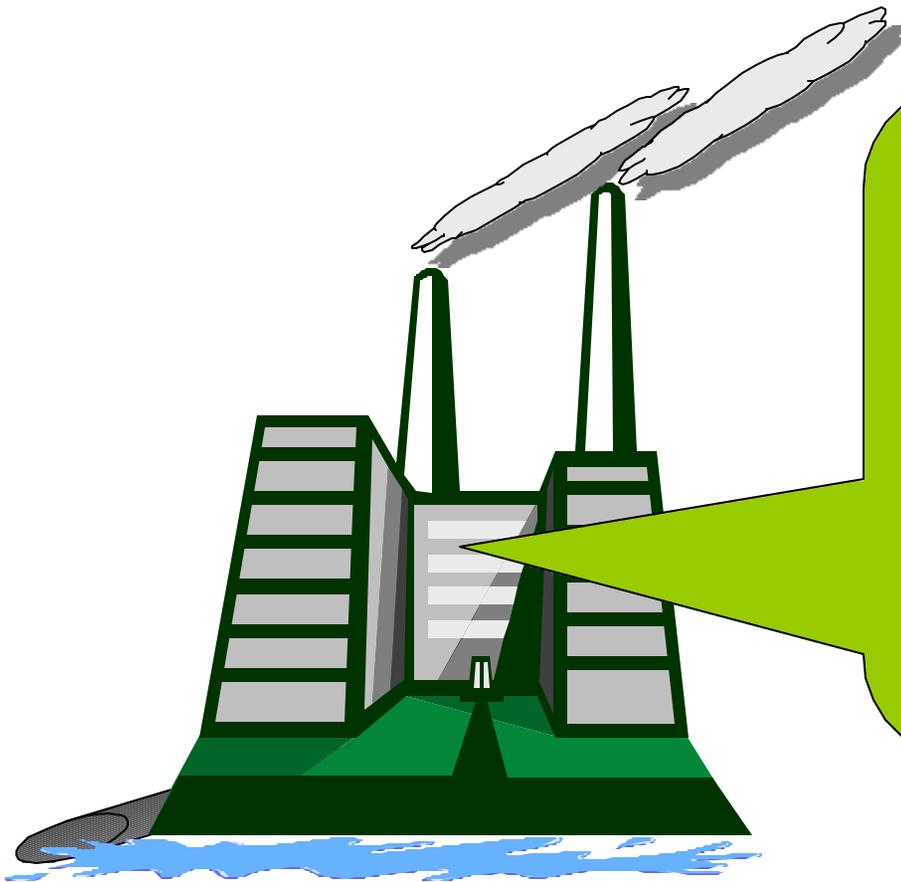


Reactive environmental strategies

On - site recycling



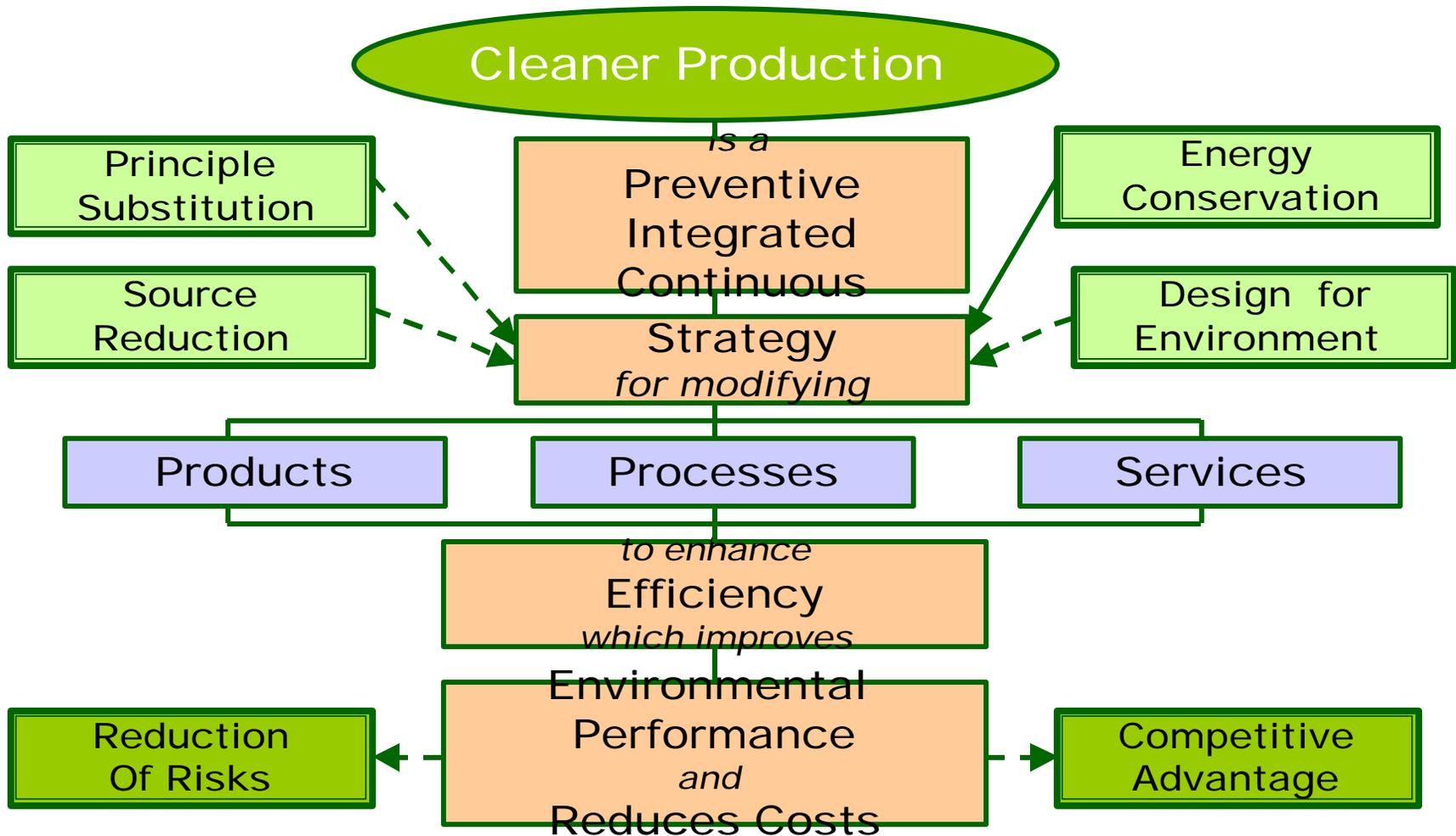
Proactive environmental strategies: Cleaner Production



Prevention of Waste generation:

- Good housekeeping
- Input substitution
- Better process control
- Equipment modification
- Technology change
- Product modification
- Efficient use of energy resources
- On-site recovery/reuse

Cleaner Production Definition



Properly implemented CP :

always

- reduces long-term liabilities which companies can face many years after pollution has been generated or disposed at a given site



Properly implemented CP :

usually

- increases profitability
- lowers production costs
- enhances productivity
- provides a rapid return on any capital or operating investments required
- increases product yield
- leads to the more efficient use of energy and raw materials

Properly implemented CP :

usually (continuation)

- results in improved product quality
- increases staff motivation
- relies on active worker participation in idea generation and implementation
- reduces consumer risks
- reduces the risk of environmental accidents
- is supported by employees, local communities, customers and the public

Properly implemented CP :

often

- avoids regulatory compliance costs
- leads to insurance savings
- provides enhanced access to capital from financial institutions and lenders
- is fast and easy to implement
- requires little capital investment

How CP could be applied in practice?



Cleaner Production practices

1. Good Housekeeping

take appropriate *managerial and operational* actions to prevent:

- leaks
- spills
- to enforce existing operational instructions



Cleaner Production practices

2. Input Substitution

substitute input materials

- by less toxic
- or by renewable materials
- or by adjunct materials which have a longer service life-time in production



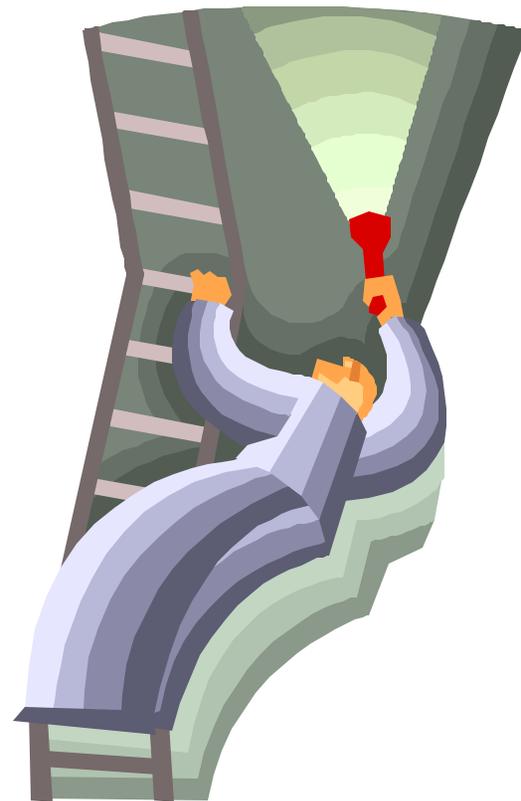
Cleaner Production practices

3. Better Process Control

modify:

- operational procedures
- equipment instructions

and process record keeping in order to run the processes more efficiently and at lower waste and emission generation rates

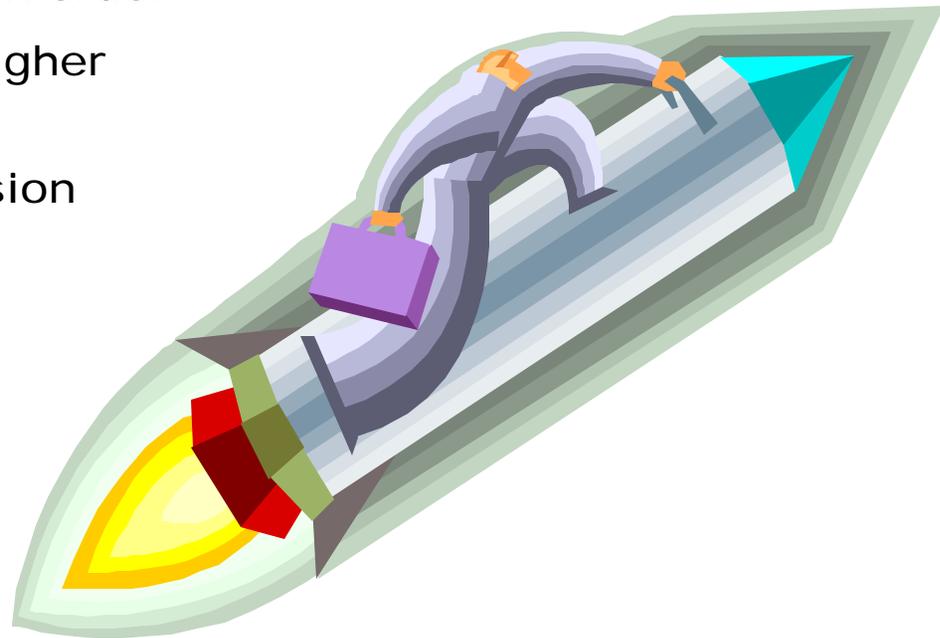


Cleaner Production practices

4. Equipment Modification

modify the existing production equipment and utilities in order:

- run the processes at higher efficiency
- lower waste and emission generation rates



Cleaner Production practices

5. Technology Change

replace of:

- the technology
- processing sequence
- synthesis pathway

in order to minimise waste and emission generation during production



Cleaner Production practices

6. On-site Recovery/Reuse

- reuse of the wasted materials in the same process for another useful application within the company



Cleaner Production practices

7. Product Modification

modify the product characteristics
in order:

- to minimise the environmental impacts of the product during or after its use (disposal)
- to minimise the environmental impacts of its production



Cleaner Production practices

8. Using Energy Efficiently

Reduce the environmental impact from energy use by:

- improved energy efficiency
- by using energy from renewable sources



CP versus End-of-Pipe approach

Cleaner Production

Continuous improvement

Progress towards use of closed loop or continuous cycle processes

Everyone in the community has a role to play; partnerships are essential

Active anticipation and avoidance of pollution and waste

Elimination of environmental problems at their source

Involves new practices, attitudes and management techniques and stimulates technical advances

Pollution Control and Waste Management

One-off solutions to individual problems

Processes result in waste materials for disposal a pipeline with resources in and wastes out

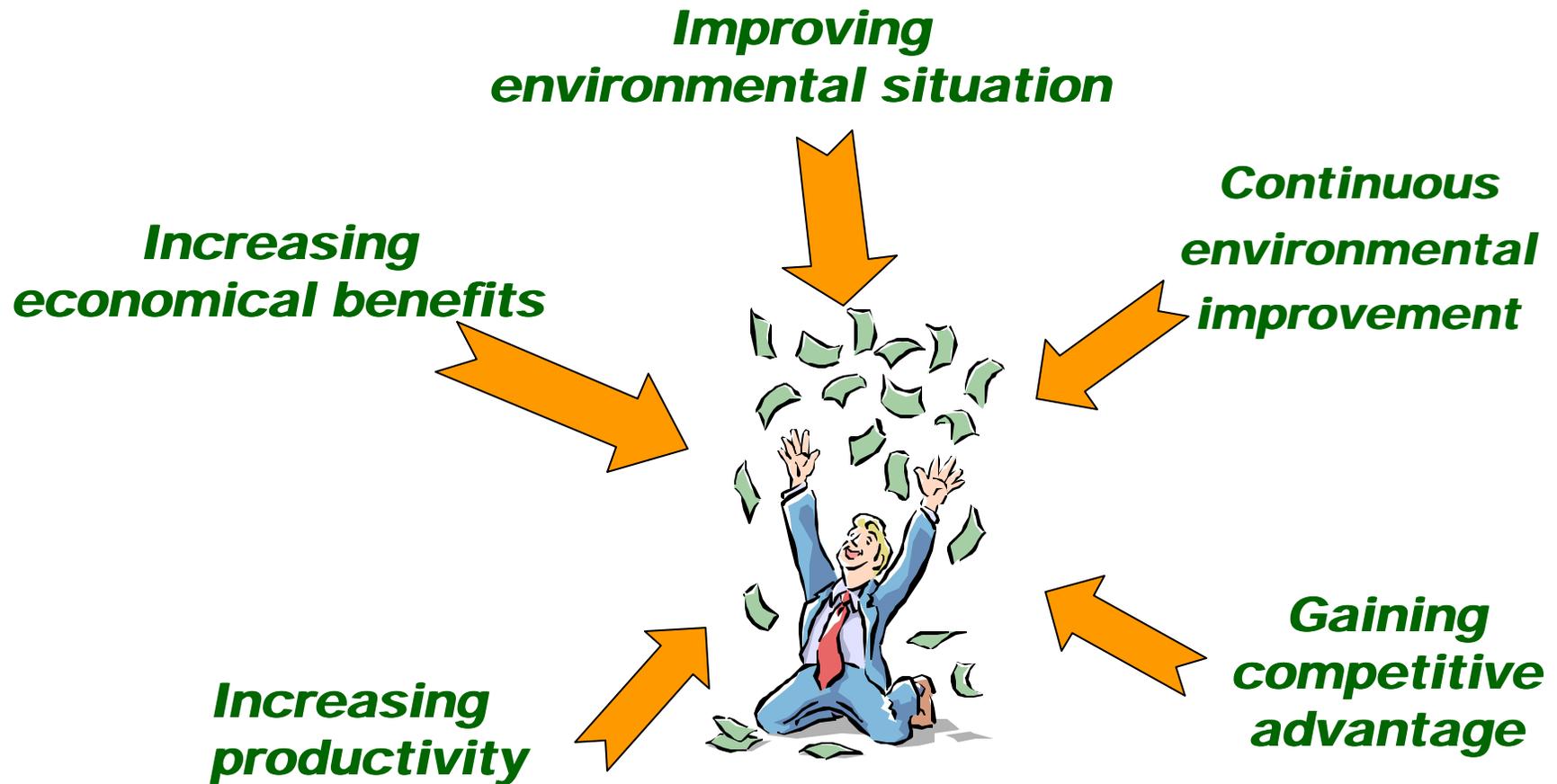
Solutions are developed by experts often in isolation

Reactive responses to pollution and waste after they are created

Pollutants are controlled by waste treatment equipment and methods

Relies mainly on technical improvements to existing technologies

What Are the Benefits of Cleaner Production?



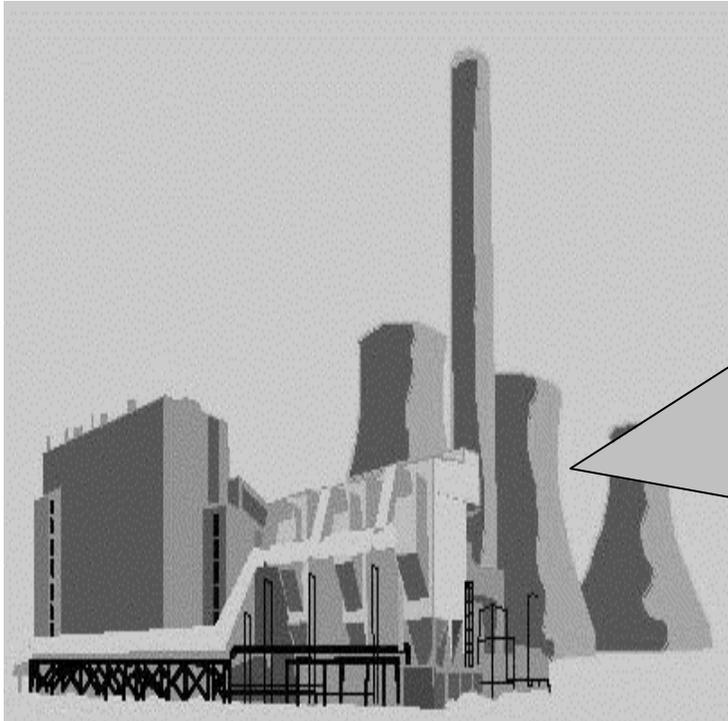
What is not CP?



- ***Off-site recycling***
- ***Transferring hazardous wastes***
- ***Waste treatment***
- ***Concentrating hazardous or toxic constituents to reduce volume***
- ***Diluting constituents to reduce hazard or toxicity***

CP barriers

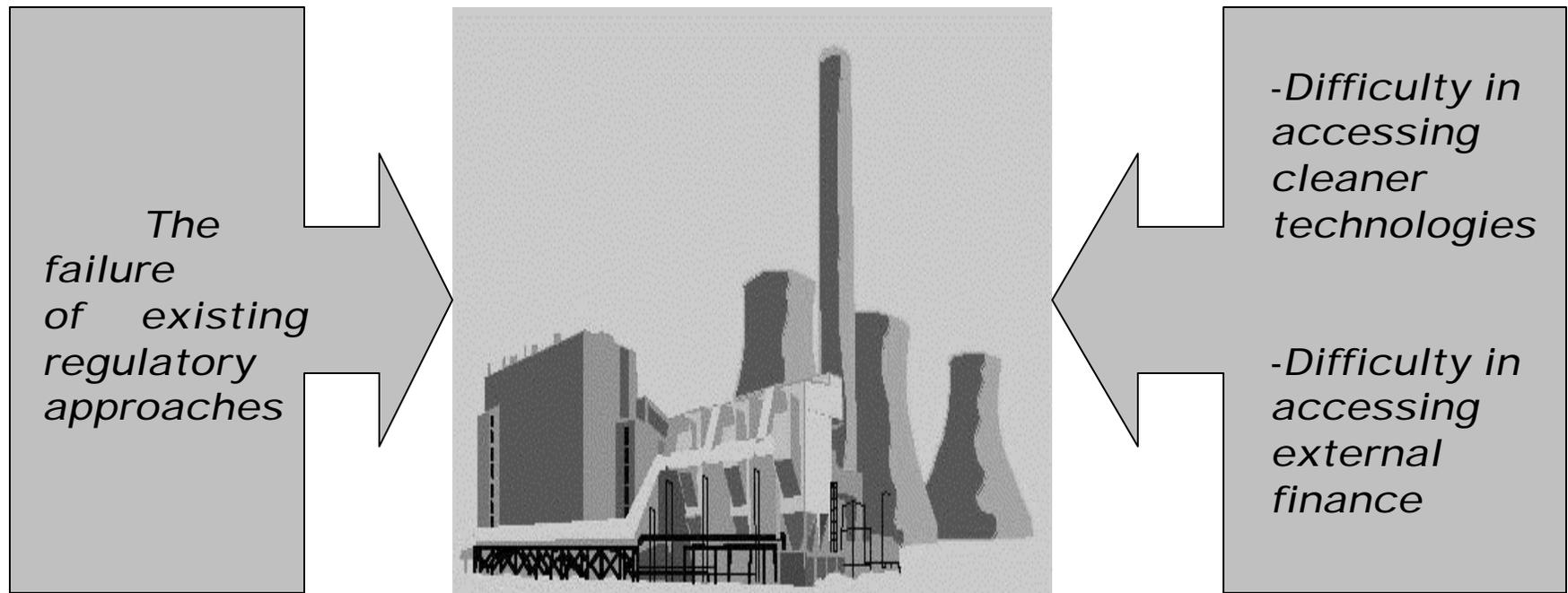
Internal to the companies:



- *Lack of information and expertise*
- *Low environmental awareness*
- *Competing business priorities, in particular, the pressure for a short term profits*
- *Financial obstacles*
- *Lack of communication in firms*
- *Middle management inertia*
- *Labour force obstacles*

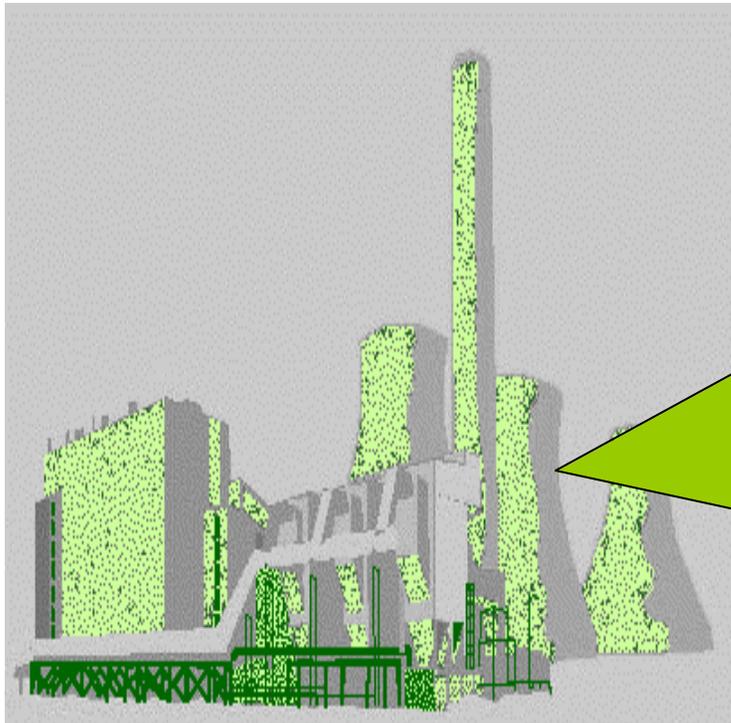
CP barriers

External to the companies:



CP motivators and drivers

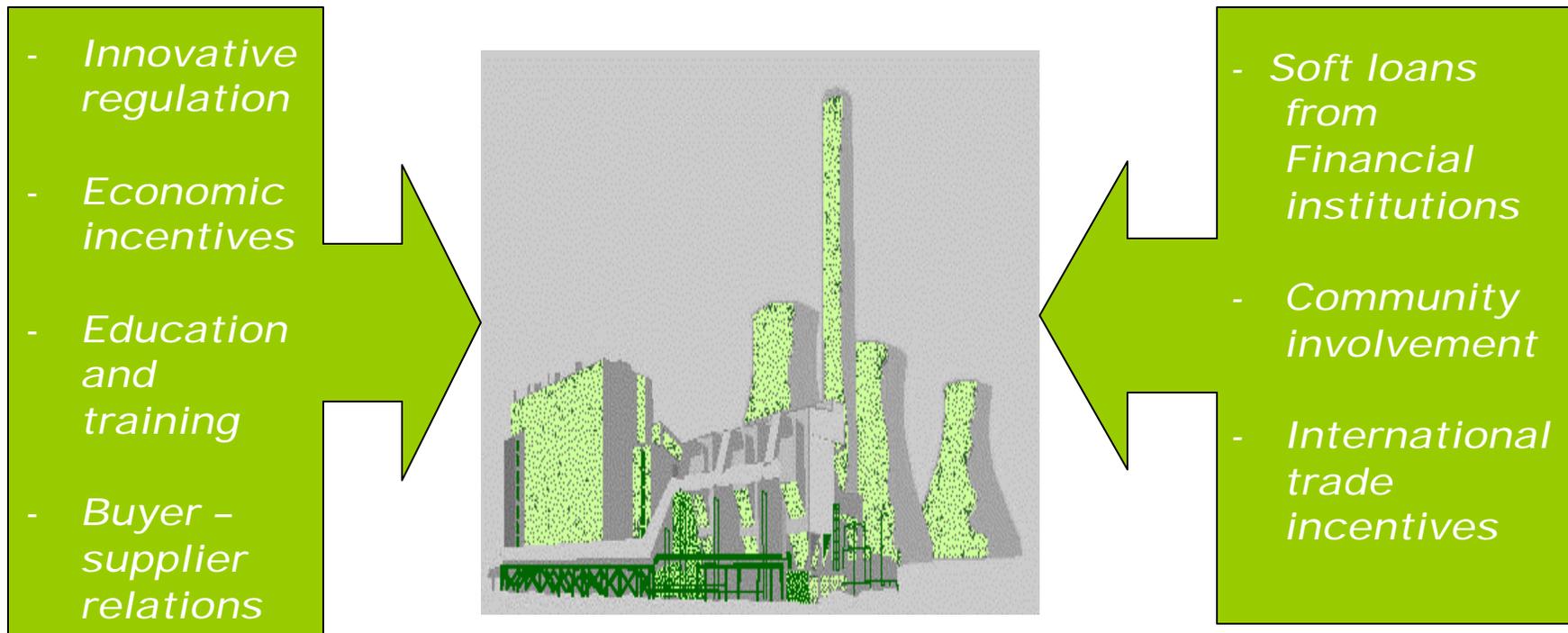
Internal to the companies:



- *Improvements in productivity*
- *Environmental management systems and continuous improvement*
- *Environmental leadership*
- *Corporate environmental reports*
- *Environmental accounting*

CP motivators and drivers

External to the companies:

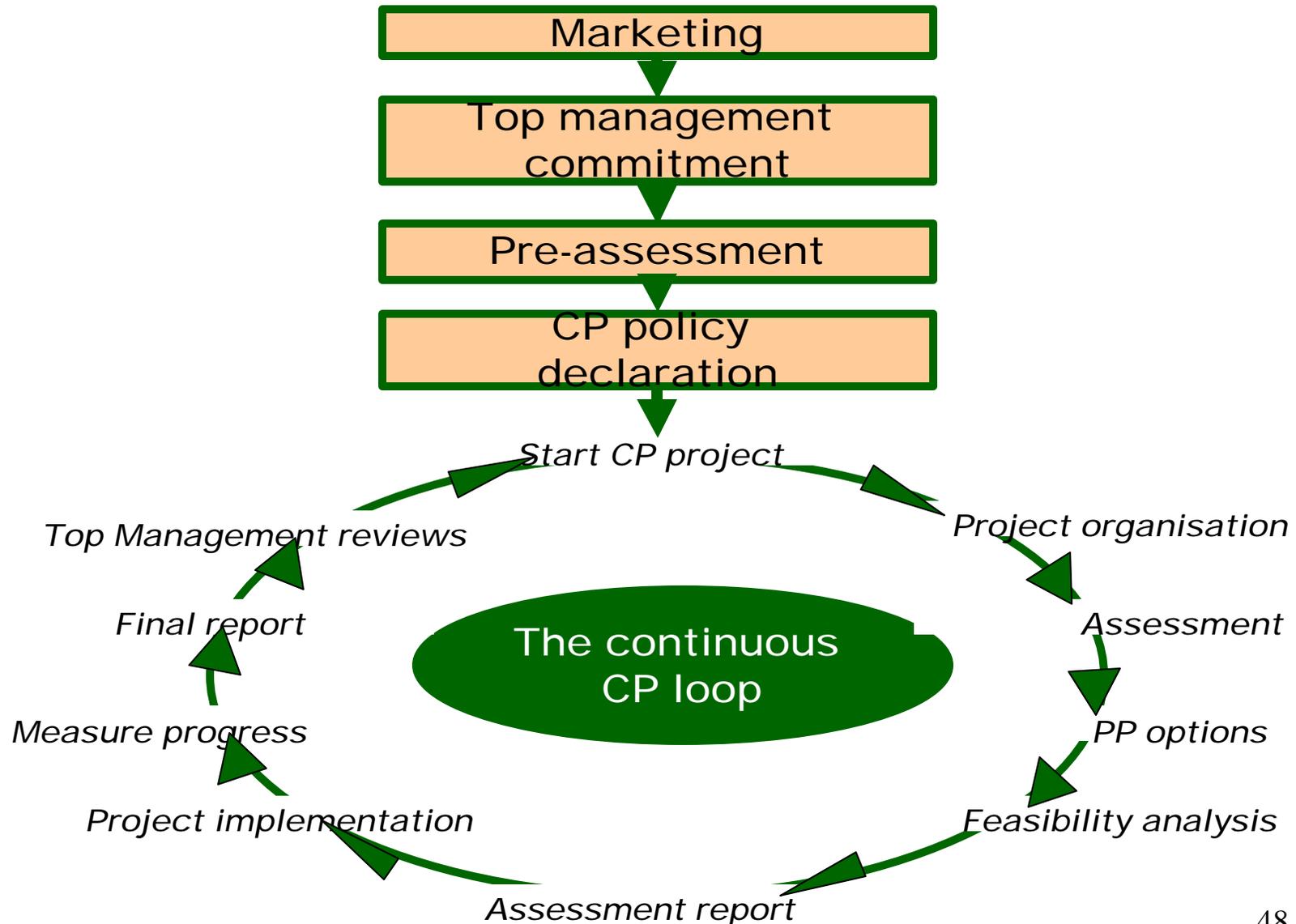


CP attacks the problem at several levels at once, introduction of a industry/plant level program requires

- *the commitment of top management*
- *a systematic approach to CP in all aspects of the production processes*



CP management system



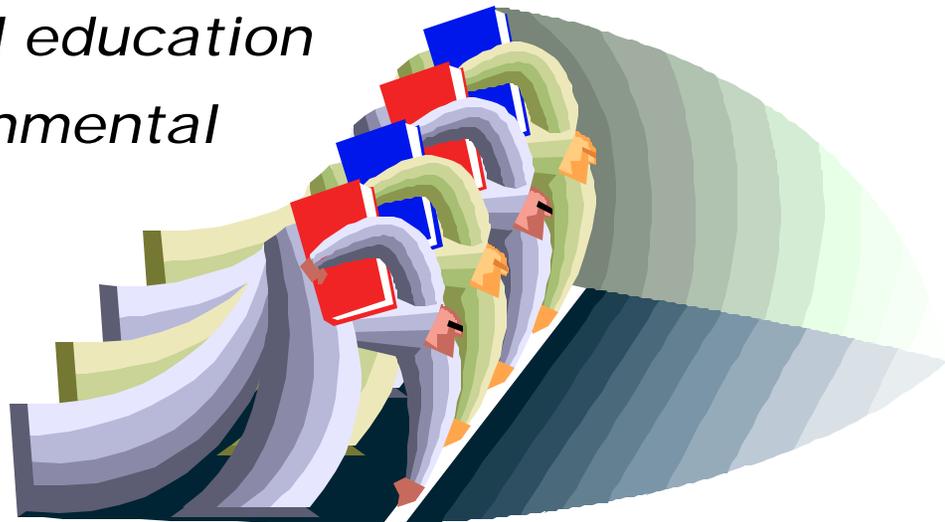
How can governments promote CP?

- *Applying regulations*
- *Using economic instruments*
- *Providing support measures*
- *Obtaining external assistance*



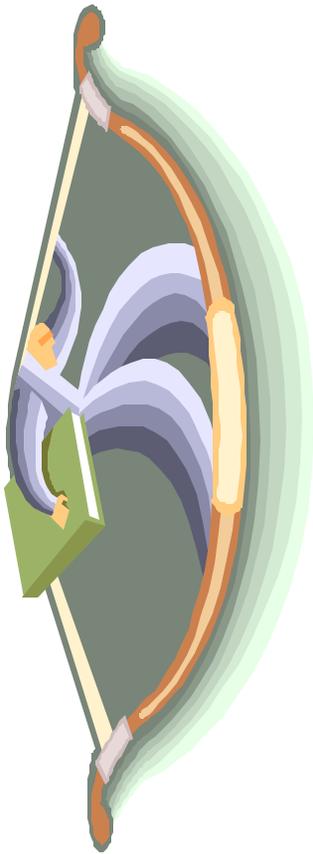
CP applicability for local governments

- *Corporate decision-making*
- *Local environmental management strategies*
- *Community and industry partnerships*
- *Sustainable economic development*
- *Public environmental education*
- *Specific local environmental problems*
- *Local environmental monitoring*



CP and financial institutions

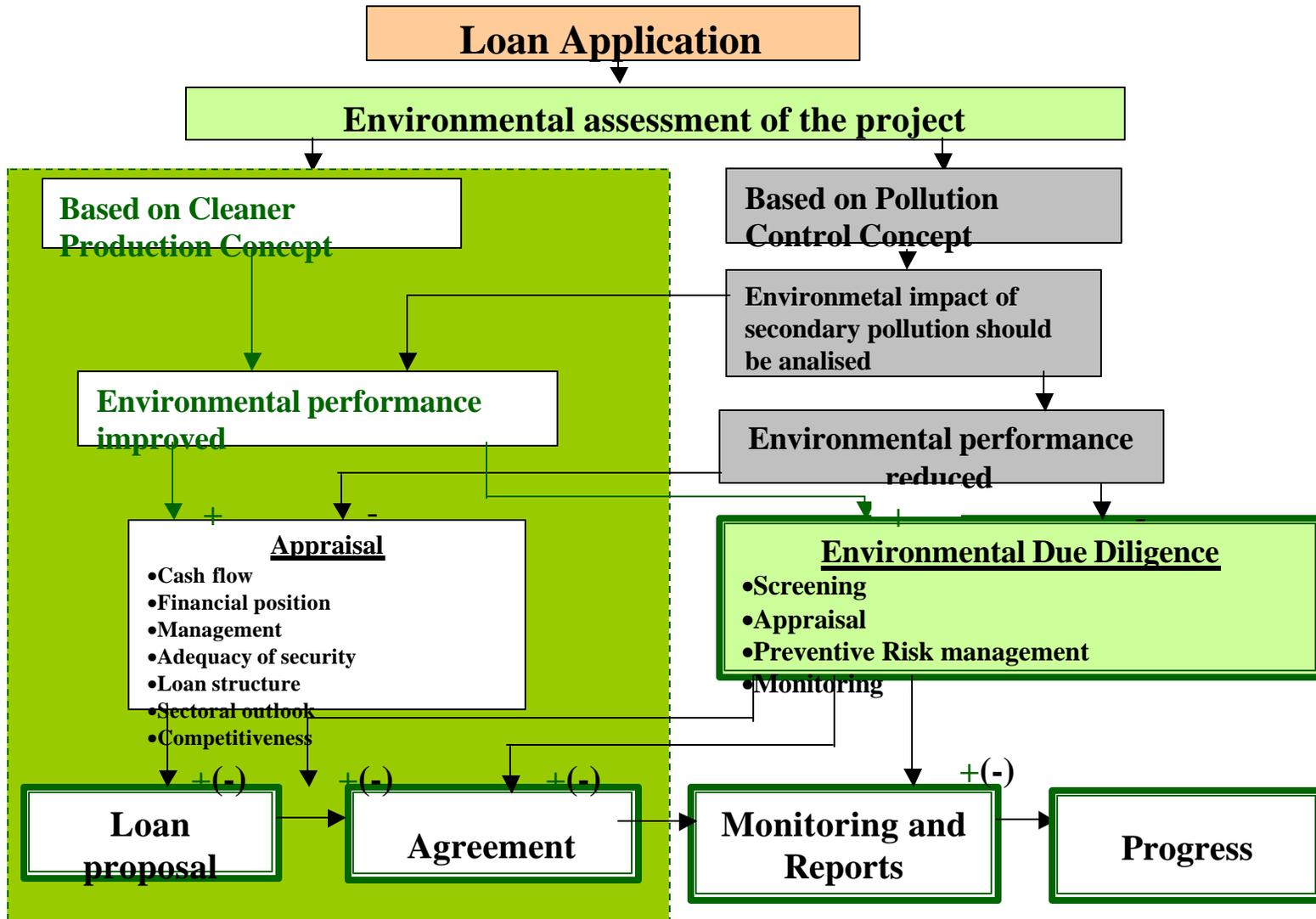
Environmental evaluation will assist financial institution's staff to:



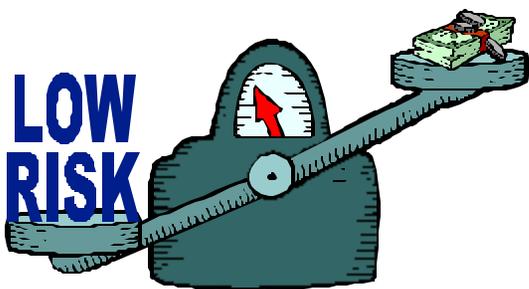
- avoid financing activities included in their exclusion list
- identify the relative environmental risks level and assess client's ability to manage them
- understand the financial institution's exposure to environmental risks and liabilities and to respond adequately
- monitor the env.derived risks of the transactions and respond to changes in the bank's exposure to those risks
- evaluate risks and potential liabilities in foreclosure or re-structuring activities



Environmental Assessment of a Project



Factors Affecting Exposure to Environmentally-derived Risks



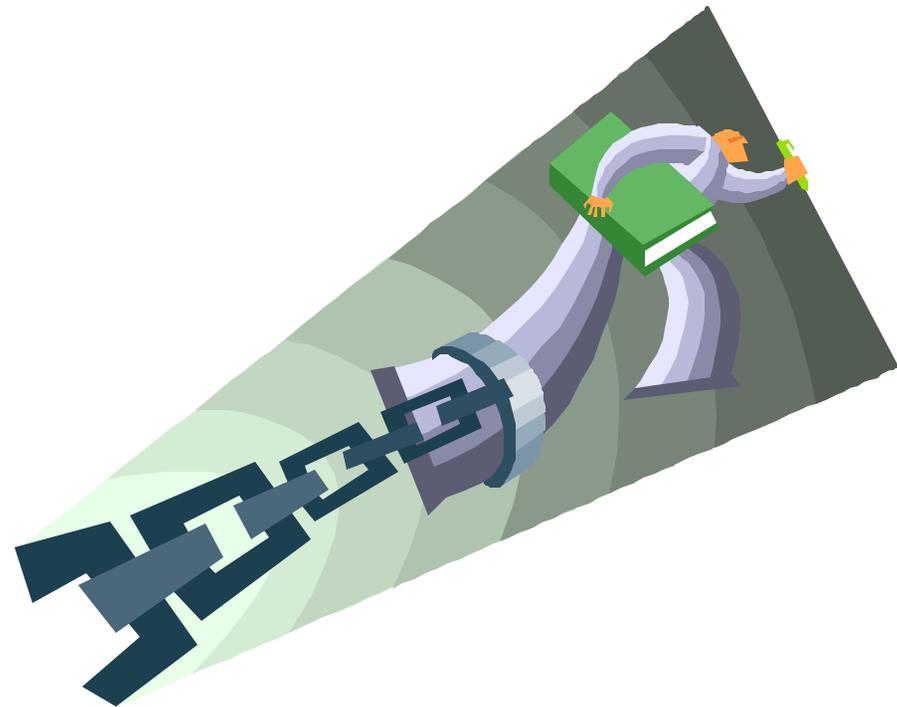
- The nature of environmental risks inherent in business activity of the client
- The size and term of, and the security for, the transaction
- The client's ability and commitment to adequately manage these risks

If CP project is presented to financial institution, it should be clear that company already undertook **voluntary** actions aimed at:

- rationalising the use of raw materials, water and energy inputs, reducing the loss of valuable material inputs and therefore **reducing operational costs**
- reducing the volume and/or toxicity of waste, wastewater and emissions related to production
- improving working conditions and occupational safety in a company
- making organisational improvements
- improving environmental performance by the **implementation of no-cost and low-cost measures from the company's funds**
- reusing and/or recycling the maximum of primary inputs and packaging materials

Other Business Activities the Financial Institutions Should Be Aware

- *Trade finance*
- *Retail banking*
- *Equity investments*



Environmental Investment Opportunities

- *loans to enterprises to finance required or desired investments in technologies resulting in direct and indirect environmental benefits*
- *loans to municipalities to finance investments in environmental infrastructure*
- *loan guarantees to both enterprises and municipalities for “soft” credits from national or regional environmental funds for environmental investments*
- *loans to finance businesses providing environmental goods and services*

What have we learned?

- *The CP approach reduces pollutant generation at every stage of the production process*
- *CP can be achieved through:*
 - *good operating practices*
 - *process modification*
 - *technology changes*
 - *raw material substitution*
 - *redesign and/or reformulation of product*
- *The economic advantages of CP are:*
 - *cost effectiveness*
 - *increased process efficiency*
 - *improved product quality*
 - *cost of final treatment and disposal is minimised*
- *Effluent treatment, incineration, and waste recycling outside the production process are not regarded as CP*



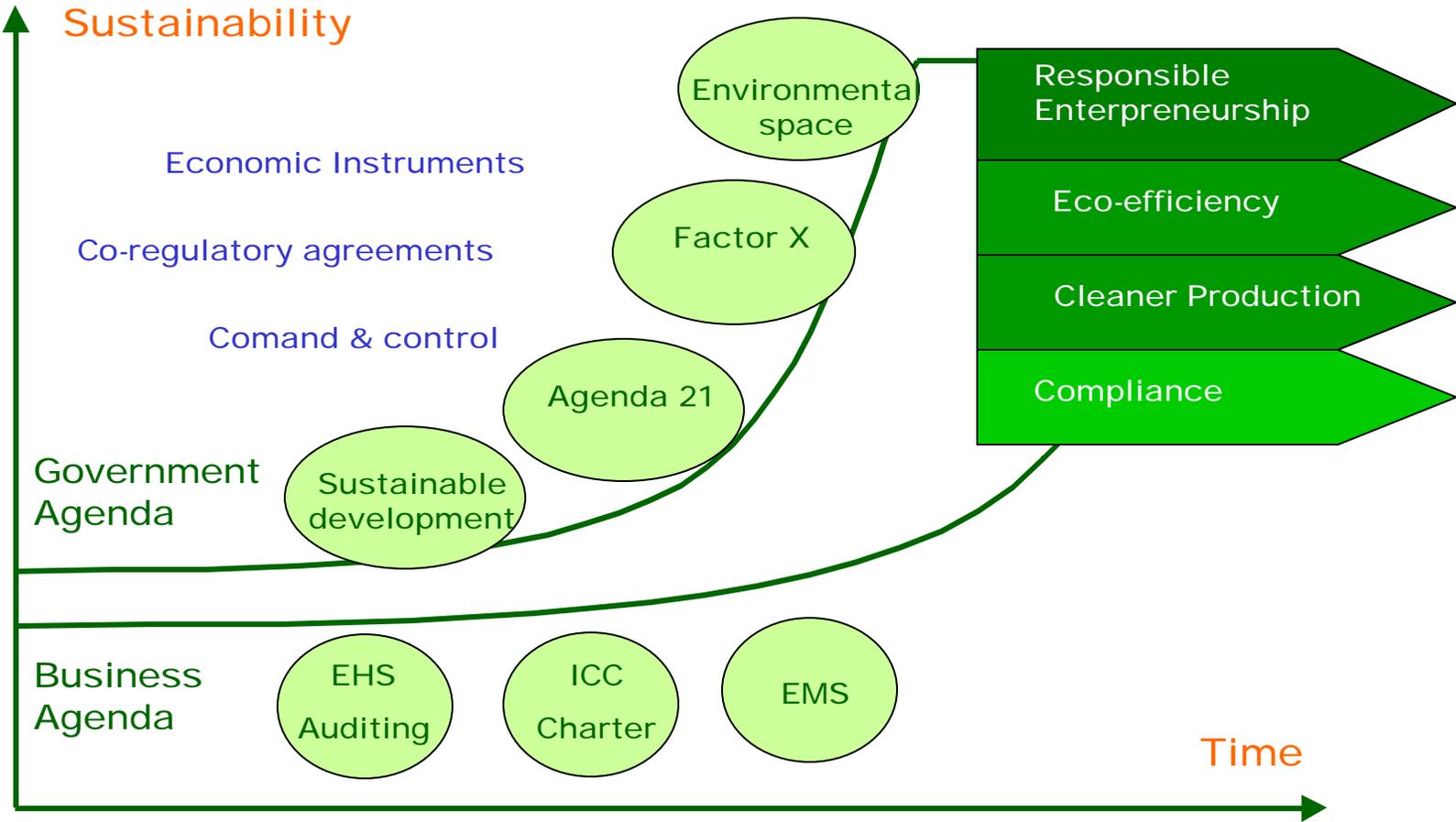
Broader Application of CP

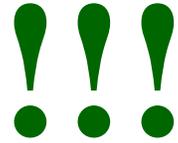
CP is closely linked to:

- Environmental Management Systems
- Total Quality Management
- Health and Safety Management



Cleaner Production and Sustainable Development





CP is
a journey
not a
destination





“An understanding of the business value to be gained from efficient use of natural resources is an important first step toward sustainability:

toward building a world in which resources are managed to meet the needs of all people now and in the future.”

*(**J. Lash**, President of the World Resources Institute)*



CenDES

**Centre for Business Sustainable
Development**

Eco-efficiency and Sustainability

***Recent, on-going and planned
Cleaner Production and Eco-
efficiency Projects
in Portugal***



Some Results of Recent Projects in companies



BENEFITS

- **Financial results**

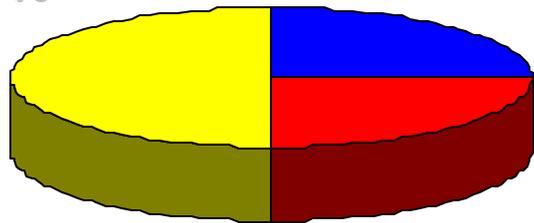
- annual savings > **128 250 Î**
- investment = **1 030 137 Î**

- **Environmental benefits**

- annual savings > **175 000 Î** (4 options)
 - » wastewater discharge = **114 000 m³/year**
 - » sludge produced = **500 t/year**
 - » other wastes > **7 t/year**
 - » water consumption = **89 000 m³/year**
 - » CO₂ emissions = **550 t/year**

Pay-back time

30 - 35 months
50 %

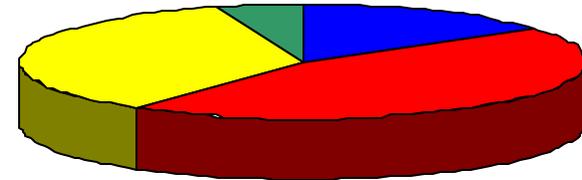


0 - 6 months
25 %

6 - 30 months
25 %

Cleaner Production techniques

35 %
In-site
recycling



5 %
Off-site
recycling

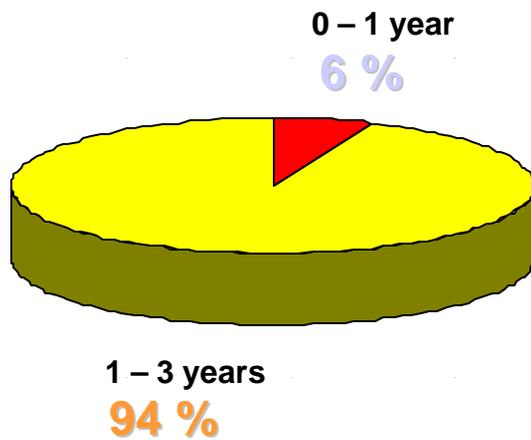
15 %
Good
housekeeping

45 %
Source
reduction

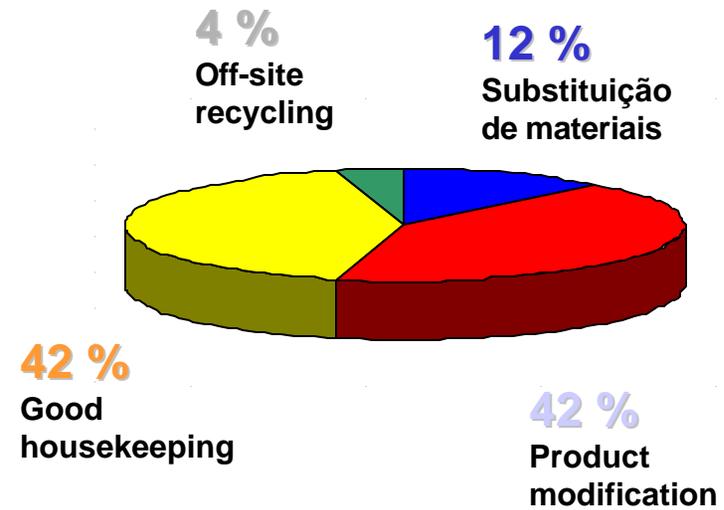
BENEFITS

- **Financial results**
 - *annual savings* = 69 000 Î
 - *investment* = 71 000 Î
- **Environmental benefits**
 - *reduction of*
 - » energy consumption = 88,4 tep/year
 - » water consumption = 1 000 m³/year
 - » raw materials cons.> 12 000 kg/year
 - *reduction of the generation of*
 - » hazardous waste > 3 000 kg/year
 - » wastewater = 1 000 m³/year

Pay-back time



Cleaner Production techniques



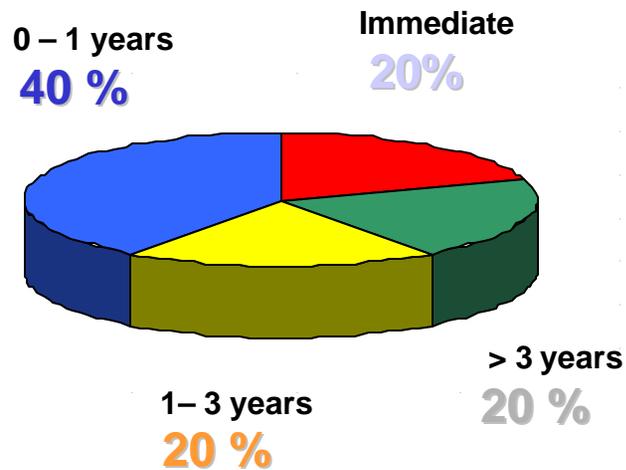


BENEFITS

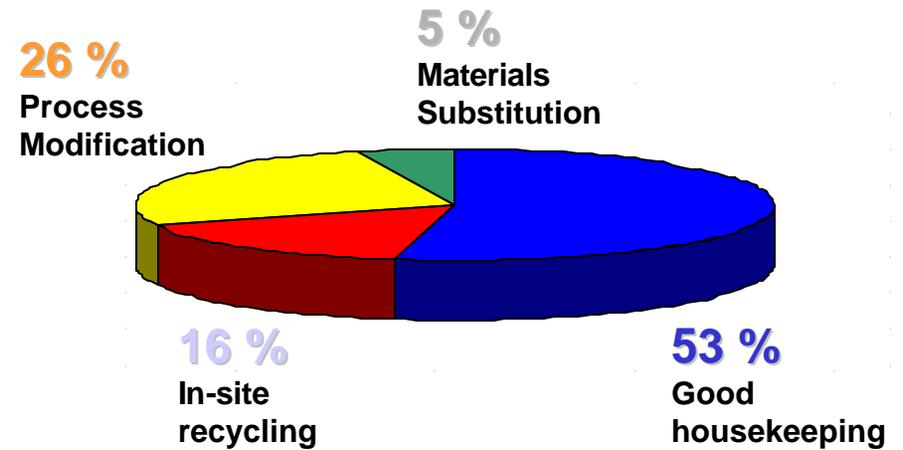
- **Financial results**
 - annual savings: **470 000 €**
 - investments = **145 000 €**
- **Environmental benefits**
 - *reduction of:*
 - » water consumption **4,0 m³/m³ milk proc.**
 - » wastewater discharge **2,46 m³ effluent/m³ milk proc.**
 - » energy consumption **316 tep/year**
 - *production increase of:* **1,25 M liter of milk proc.**
- **social benefits**
 - workers health risks reduction **noise and workplace contaminants (4 options)**
 - more environmental trained people **seminars and training courses**
 - improvement of company's public image
 - donations to charity institutions
 - attitudes changing towards Sustainable Development
 - catalyst to change



Pay-back time



Cleaner Production techniques

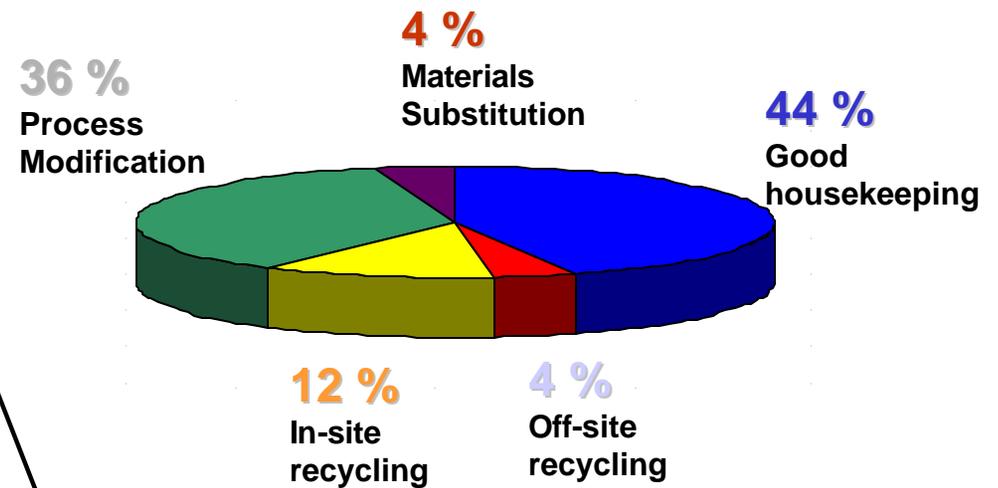
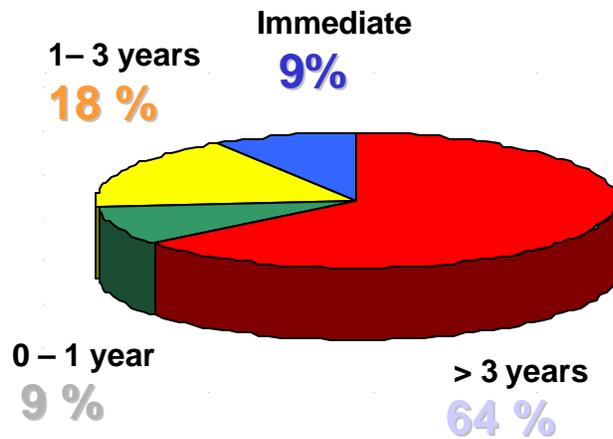


BENEFITS

- **Financial results**
 - annual savings > **65 000 €**
 - investment = **207 000 €**
- **Environmental benefits**
 - *reduction of:*
 - » environmental noise = **5-10 dB**
 - » energy consumption
 - » water consumption > **35 200 m³/year**
 - *elimination of SO₂ e Ni emissions to air*
 - *reuse of CO₂ > 115 800 kg/year*

Cleaner Production techniques

Pay-back time





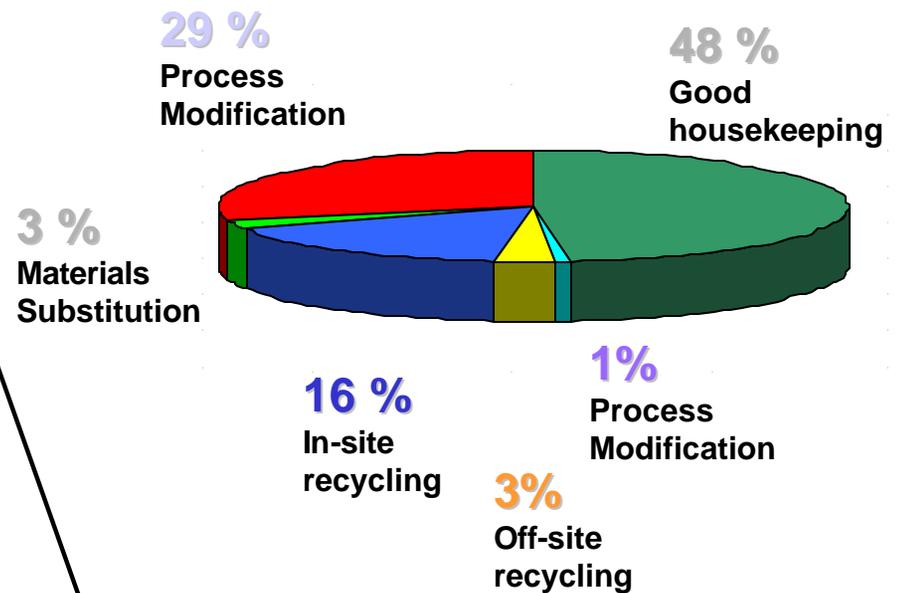
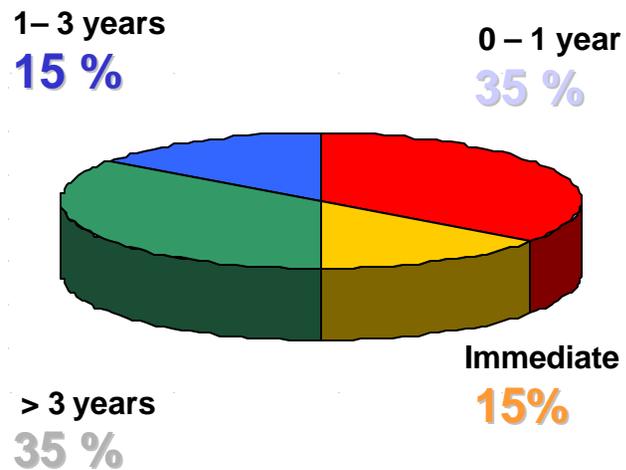
BENEFITS

- **Financial results**
 - annual savings > **255 000 Î**
 - Investment = **110 000 Î**
- **Environmental benefits**
 - reduction of:
 - wastewater = **26 700 m³/year**
 - toxic materials dispersion = **91 t/year**
 - energy intensity = **2%**
 - materials consumption = **92 t/year**
 - water consumption = **26 700 m³/year**



Cleaner Production techniques

Pay-back time





REFRIGE, S.A. (Beverages)

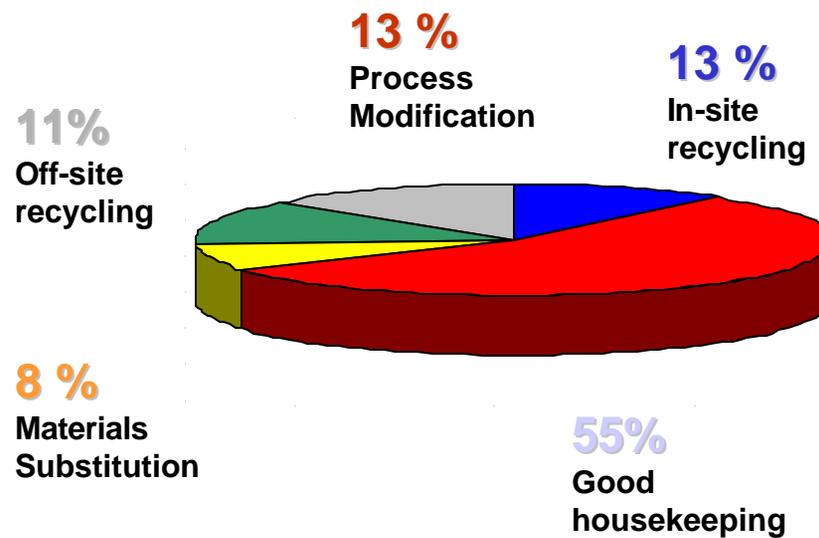


BENEFITS

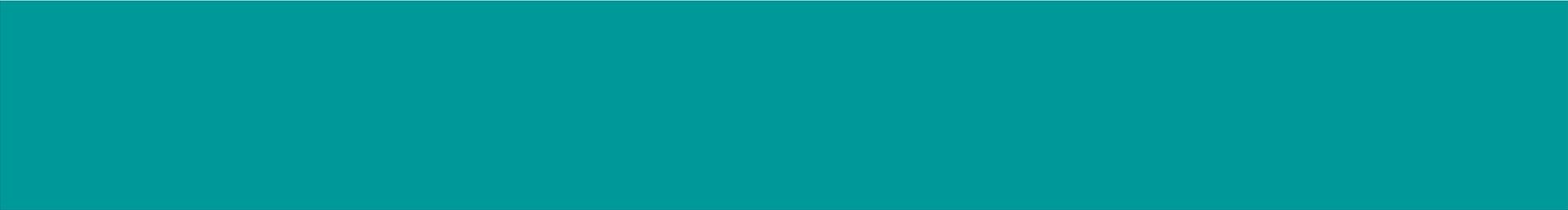
- Financial results
 - annual savings > 65 000 €
 - investment = 405 000 €
- Environmental benefits
 - *reduction of:*
 - » environmental noise = 5-10 dB
 - » energy consumption
 - » water consumption > 35 200 m³/year
 - *elimination of SO₂ e Ni emissions to air*
 - *reuse of CO₂ > 115 800 kg/year*



Cleaner Production techniques



* No data available for the pay-back time



On-going Projects



ProSTove – Eco-efficiency and Sustainable Production Torres Vedras

Partners: INETI/CENDES, AERLIS (Business Association), General Directorate of Industry, Torres Vedras Municipality

Objective: to contribute to sustainability at local level focusing on cleaner production projects implementation in companies (micro economic level) and involving the main stakeholders (meso economic level).

Funding: POE/FSE

Duration: 15 months

SuRViE – Contribute to the Glass Region Sustainability

Partners: INETI/CENDES, VITROCRISTAL, AIC (Association of Crystal Industries)

Objective: to contribute to sustainable business development in the glass region of Marinha Grande, through the implementation of cleaner production strategies in companies.

Funding: POE/FSE

Duration: 15 months

ProSSado – Towards Sustainability

Partners: INETI/CENDES, AERSET, CIES

Cooperation: Setúbal Municipality, Quercus (Environmental NGO), Arrábida Natural Park, Sado Estuary Natural Reserve

Institutional support: DGI (General Directorat of Industry)

Objective: To contribute for sustainability in the Sado region.

Funding: POE/FSE

Duration: 2 years

DEUSA – Sustainable Urban Business Development in Aveiro

Partners: INETI/CENDES, General Directorate of Industry, AIDA, AIA, ABIMOTA and APIFER (Business Associations), IST and UA (Universities).

Objective: To support the implementation of cleaner production strategies in companies located in Aveiro as a contribution to regional sustainable development.

Funding: POE/FSE

Duration: 2 years

E3I – Portuguese Business Eco-Efficiency Initiative

Partners: INETI/CENDES, General Directorate of Industry, WBCSD, EPE

Objectives:

- **To promote the stakeholders dialogue as a mean for companies' eco-efficiency improvement;**
- **Stimulate the companies to adopt and implement eco-efficiency as a leading business concept;**
- **Reinforce business competitiveness;**

Funding: POE/FSE

Duration: 27 months