



■ how mediterranean industries can introduce

Best Available Techniques (BATs)
Best Environmental Practices (BEPs)
Cleaner Technologies (CTs)



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Printed on chlorine-free paper

Editing: Regional Activity Centre for Cleaner Production (RAC/CP)

Layout: R&P Asociados

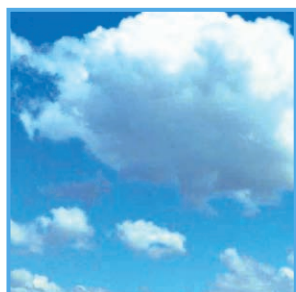
Legal Deposit: B-51867-2004

November 2004

Prepared and printed with the support of
UNEP/MAP in the framework of MCSD activities

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The Regional Activity Centre for Cleaner Production (RAC/CP) of the Mediterranean Action Plan has prepared this brochure within the framework of the follow-up activities of the **Mediterranean Commission on Sustainable Development (MCSD)**. In particular, in relation to some MCSD recommendations such as:

- Promote and support the establishment of resource centres and other relevant sources of expertise at national and local levels
- Introduce sustainable standards within companies and transfer of knowledge by means of developing methodological tools

In this context, RAC/CP has prepared this informative brochure addressed to civil servants of public administrations and concerned ministries as well as technical experts dealing with industrial activities, with the purpose of introducing them on the best available techniques and best environmental practices, and with the aim of being a support tool for the National Action Plans prepared for implementing the Strategic Action Programme to Address Pollution from Land-Based Activities.

Notably, this brochure presents briefly a **methodology to facilitate the identification and application of best available techniques, best environmental practices and cleaner technologies in the industries of the MAP countries**: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Morocco, Serbia and Montenegro, Slovenia, Spain, Syria, Tunisia and Turkey.

For further details on the methodology presented, the reader is encouraged to refer to the document prepared by the RAC/CP *Guidelines for the Application of Best Available Technologies (BATs), Best Environmental Practices (BEPs) and Cleaner Technologies (CTs) in Industries of the Mediterranean Region*. MAP Technical Reports Series No. 146, UNEP/MAP, Athens, 2004.



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1 WHY INTRODUCE BATs, BEPs AND CTs?

The Framework



There are many reasons to introduce best available techniques, best environmental practices and cleaner technologies in our Mediterranean industries, and the framework already exists claiming their implementation.

The countries of the Mediterranean basin decided as early as the 1970s to join their efforts to preserve their common environment: first only the sea, afterwards extending the coverage area to the entire watershed area draining into the Mediterranean sea (the hydrologic basin). The Mediterranean Action Plan (MAP) was born together with a legal system to improve the Mediterranean environment: the Barcelona Convention and its Protocols.

However, controlling pollution exclusively was not sufficient to ensure a proper environment, since economic interests prevail in our modern society. Therefore, the Mediterranean Action Plan has extended its scope to sustainability, in order to deal with the sources of pollution by seeking consensus solutions with the agents concerned, such as industry. No one doubts industry contributes to development and generates economic wealth in the Mediterranean, as much as one third of all economic activity, in fact. But we cannot forget that it generates pollution as well.

It is within this framework that cleaner production, a strategy seeking to benefit both the environment and the enterprise, appears in the Mediterranean Action Plan with its many synonyms: eco-efficiency, pollution prevention, best available techniques, best environmental practices, etc. In this regard, the legal system of the Mediterranean Action Plan promotes cleaner production along with the concepts above as the means to address industrial pollution.

Especially important for industry is the **Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities**: the **LBS Protocol**. The new version of this Protocol promotes specifically cleaner production, establishing that **the Mediterranean countries have to take into account in their action plans, programmes and measures the best available techniques and the best environmental practice including, where appropriate, cleaner production technologies**. In addition, the Protocol provides thorough definitions of and criteria for the best available techniques and best environmental practices.

With the aim of facilitating the implementation of the LBS Protocol, a Programme was formulated and adopted by the Mediterranean countries in 1997: the **SAP** or **Strategic Action Programme to Address Pollution from Land-Based Activities**. For industry, the SAP sets specific targets and deadlines to eliminate pollution (hazardous waste, BOD, ...). But even more important is the fact that the SAP requires the Mediterranean countries to formulate a **National Action Plan** in which they describe how they will achieve these targets at the national level.

And finally, taking into account the ideas emanating from the Rio and Johannesburg summits, we cannot forget that industry constitutes an essential part of the sustainability machinery. Something that the Mediterranean Commission on Sustainable Development has taken into account by creating a specific working group on Industry and Sustainable Development, promoting pollution prevention and best available techniques, and that the **Mediterranean Strategy for Sustainable Development** will have to integrate in this process of advancing towards the sustainability of our Mediterranean region.

2 THE PRINCIPLES TO FOLLOW

The principles

Eco-efficiency as an Opportunity for Mediterranean Industry

Eco-efficiency consists of providing products and services with a competitive price that satisfy human needs and provide quality of life, while progressively reducing ecological impact and the consumption of resources during the product life-cycle, below an appropriate threshold according to the estimated carrying capacity of the environment.

Eco-efficiency is understood as a management philosophy that integrates two sustainability concepts: **ecology** and **economy**. That is, eco-efficiency promotes environmental improvement while providing economic benefits. Eco-efficiency improves the efficiency of procedures and habits carried out at the company: **it reduces the consumption of resources and energy as well as environmental impact, it offers many opportunities to the company such as economic savings and competitive advantages, and enables creativity and innovation when developing a new public image.**

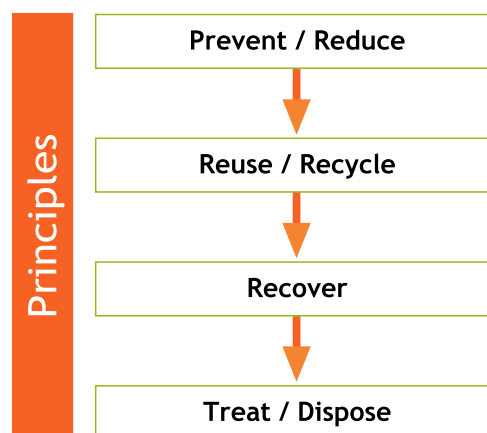
Cleaner Production as a Tool to Improve Eco-efficiency in a Company

According to the United Nations Environment Programme (UNEP), cleaner production is the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase overall efficiency and reduce risks to humans and the environment.

- With regard to production **processes**, cleaner production includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes.
- With regard to **products**, the goal of the strategy is to reduce negative impacts during the life cycle of a product, from the raw materials extraction to its ultimate disposal.
- With regard to **services**, this includes incorporating environmental concerns into designing and delivering services.

Cleaner Production requires changing habits, responsible environmental management and evaluating technology options.

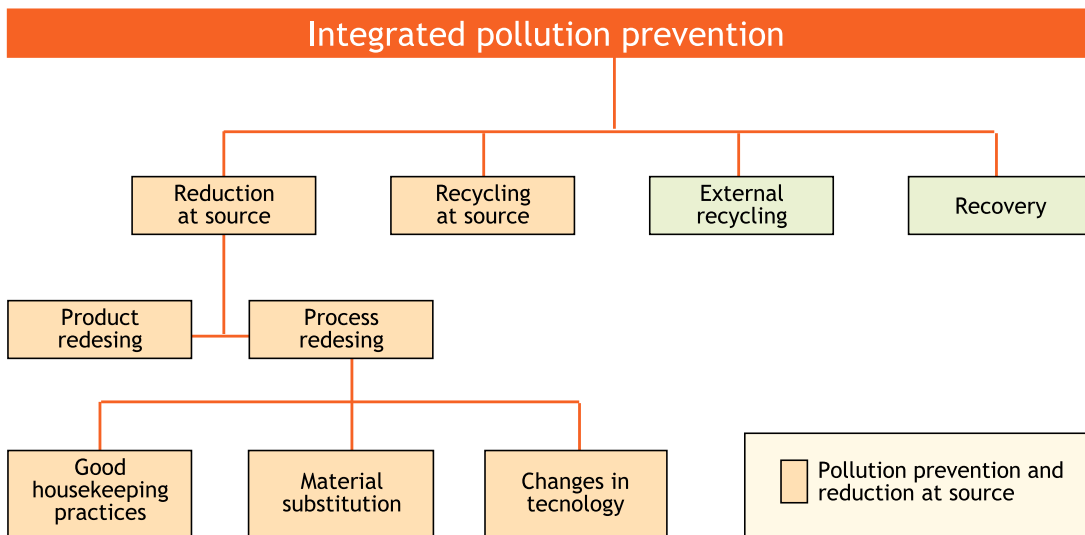
From the point of view of cleaner production, **the rank of priorities** when approaching environmental management in a company should follow the sequence:



2 THE PRINCIPLES TO FOLLOW

The principles

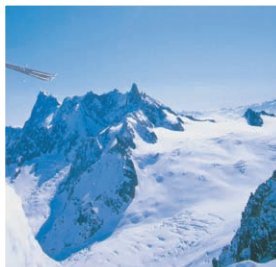
The following diagram sets out clearly how a company can introduce cleaner production in its activities.



Integrated Pollution Prevention and Control

Applying integrated pollution prevention and control to industry (understanding the environment as a whole that comprises water, air and soil) implies the need to take preventive measures when it is suspected with good reason that an activity may harm the environment, even if there is no absolute proof (**prevention principle**), or when it cannot be avoided by prevention, reducing emissions into the atmosphere, water and soil, and waste generation, favouring an equilibrium between human activity and economic development (**control principle**). This is the same rank of priorities as the one described previously with cleaner production. Specifically, **these principles are applied through the introduction of BATs, BEPs and CTs in industries.**

The integrated approach takes into account the emissions of a company into the atmosphere, water and soil, including solid waste, with the objective of environmentally **evaluating the activity as a whole** and thus, achieving a high level of protection of the environment.



3 WHAT ARE BAT, BEP and CT?

Definitions

The terms **best available technique (BAT)**, **best environmental practice (BEP)** and **cleaner technology (CT)** all have a similar meaning. In order to avoid misunderstandings and highlight their differences, these concepts are defined below.

BAT (BEST AVAILABLE TECHNIQUE) is defined in the revised version of the LBS Protocol as the latest stage of development (state of the art) of processes, of facilities or of methods of operation that indicate the practical suitability of a particular measure for limiting discharges, emissions and waste.

Further clarifications on the term BAT are provided both by the revised version of the LBS Protocol and the IPPC Directive¹, as given below.

“best”: shall mean most effective in achieving a high general level of protection of the environment as a whole.

“available” techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the member state of MAP in question, as long as they are reasonably accessible to the operator.

“techniques”: shall include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

BEP (BEST ENVIRONMENTAL PRACTICE) is defined in the revised version of the LBS Protocol as the application of the most appropriate combination of environmental control measures and strategies.

The BEPs are the set of individual and group habits, that through the performance of each and everyone of the persons that make up an organization, enable carrying out a correct environmental management. The BEPs bring the industry closer to the global sustainability concept and therefore, to the individual sustainability of the company.

CT (CLEANER TECHNOLOGY) may be thought of a subset of Cleaner Production activities with a focus on the actual manufacturing process itself, in which raw materials and energy are used in the most rational way and on the integration of better production systems, in order to minimize environmental damage and maximize production efficiency from many or all inputs.



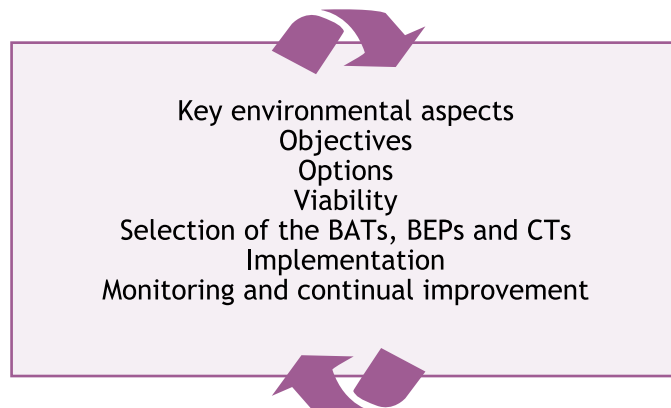
¹ Council Directive 96/61/EC, of 24th of September, concerning integrated pollution prevention and control (IPPC)

4 HOW TO INTRODUCE BATs, BEPs AND CTs IN A COMPANY

In order to facilitate the introduction of BATs, BEPs and CTs in Mediterranean companies, the Regional Activity Centre for Cleaner Production (RAC/CP) published a document entitled **Guidelines for the Application of Best Available Techniques (BATs), Best Environmental Practices (BEPs) and Cleaner Technologies (CTs) in Industries of the Mediterranean Region**. This document presents a step-by-step methodology useful for any type of company (new facilities or existing ones,...) wishing to improve its performance environmentally and in general, by applying BATs, BEPs and CTs. Within the Mediterranean Action Plan, it was decided that this methodology should be the one promoted in the Mediterranean countries when introducing BATs, BEPs and CTs.

The methodology consists of **7 basic stages** that have to be carried out following a specific sequence to achieve a reliable result. These stages are:

- 1- Determination of the key environmental aspects of the company
- 2- Definition of the specific objectives of the company
- 3- Identification of options to address the key environmental aspects successfully
- 4- Assessment of the options identified
- 5- Selection of BATs, BEPs and CTs for the given company
- 6- Implementation of the BATs, BEPs and CTs
- 7- Monitoring and continual improvement



Each stage is described here only briefly. To obtain more information, the reader is encouraged to refer to the document *Guidelines for the Application of Best Available Techniques (BATs), Best Environmental Practices (BEPs) and Cleaner Technologies (CTs) in Industries of the Mediterranean Region*.



4.1 Determining the Key Environmental Aspects

The objective of this first stage is to identify the key environmental aspects of the company's activity and which ones can be improved.

We understand environmental aspects to be the causes of the environmental impacts produced as a consequence of the production processes and the auxiliary activities in the specific industry or sector in general.

4.1.1.- Key Environmental Aspects of the Sector

Every sector exerts a specific pressure on the environment, different from the rest. Therefore, it could be interesting for the company to be aware of these pressures as a starting point for identifying its own environmental aspects. The key environmental aspects of any industrial sector can be roughly divided into two main blocks:

- **Consumption of resources:** mainly raw materials, water and energy.
- **Generation of waste flows:** waste water, emissions into the atmosphere, solid waste, discharge into soil and subsoil, ...

How can you identify the key environmental aspects of the sector? You can do bibliographic research; some of the information resources available are given below as an example:

- **Sector studies of the Regional Activity Centre for Cleaner Production (RAC/CP) for:**

Tanning of Hides and Skins	Textiles	Food Preserving	Biotechnology
Dairy Products	Olive Oil	Logistics Services	Textiles
Surface Treatment	Used Oils	Printing and Allied Industries	

- **The Best Available Techniques Reference Documents (BREFs) associated with the IPPC Directive**

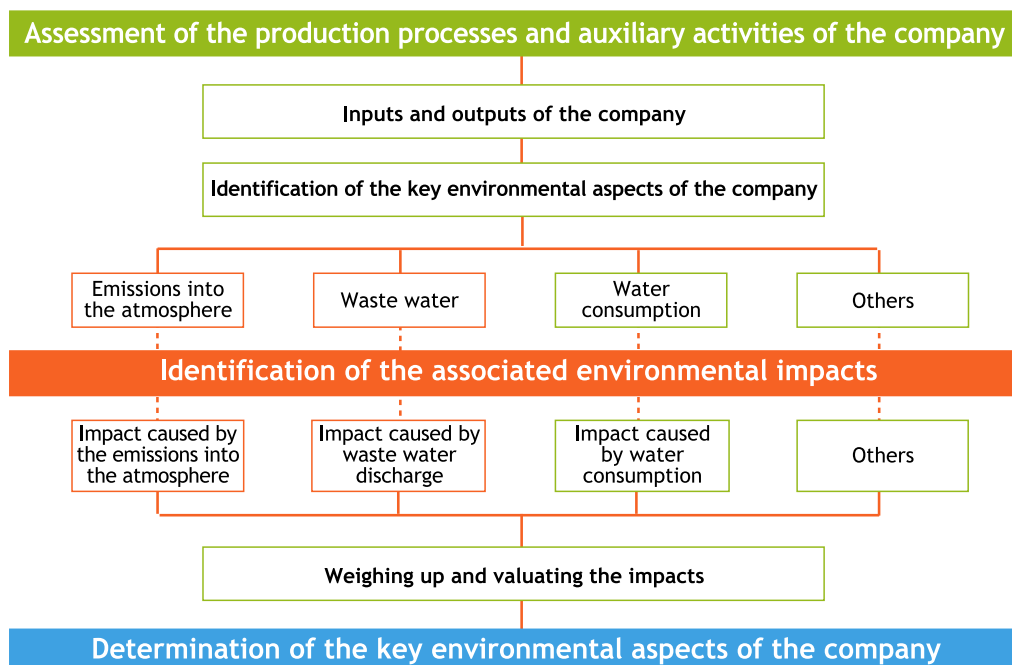
Cement and Lime Production	Polymers	Ceramics
Non-Ferrous Metal Processes	Organic Fine Chemicals	Smitheries and Foundries
Speciality Inorganic Chemicals	Refineries	Waste Incineration
Intensive Livestock Farming	Cooling Systems	Glass Manufacture
Ferrous Metal Processing	Iron and Steel Production	Chlor-Alkali Manufactur
Large Volume Organic Chemicals	Large Combustion Plants	Food, Drink and Milk Processes
...		

4.1 Determining the Key Environmental Aspects

4.1.2 Key Environmental Aspects of the Company

How can the key environmental aspects of a company be identified? By assessing the production processes and auxiliary activities of the company, identifying and assessing (quantitatively or qualitatively) the environmental aspects associated.

If determination of the key environmental aspects has been carried out recently and the results have been documented, repeating this process might not be necessary.



Assessment of production processes and auxiliary activities of the company:

It involves a diagnosis of the current situation of the company from the environmental point of view (*where are emissions into the atmosphere generated?, why?, ...*).

To that end, it is recommended to draw up flow charts of the company's activities showing inputs and outputs of materials and energy. The objective of this diagnosis is not a detailed assessment of the activities of the company; the company can select categories of activities, products or services to identify the environmental aspects most likely to cause a significant impact on the environment.

The fieldwork to obtain the necessary information to carry out this analysis should roughly consist of the following steps:

- Compilation of general data: company files, waste flow analysis, consumption data ...
- Interviews with persons in charge of the process, operators, ...
- Surveys of key personnel
- Inspection of the activity and visits to the premises

Identification and assessment of the associated environmental impacts:

The next step is to identify the environmental impacts associated with every environmental aspect of the company and, finally, determine which are the most important ones in order to establish the key environmental aspects of the company (water consumption, energy consumption, ...).

4.2 Definition of the Specific Objectives of the Company

The goal of this stage is to define the specific objectives that the company wishes to meet by implementing the BATs, BEPs and CTs, once identified the key environmental aspects. **The specific objectives** are the aims or results where the company will have to address its activities.

These objectives have to be **acceptable** (established by consensus), **precise** (as specific as possible), **viable** (neither too ambitious nor too easy to meet) and **consistent** with the objectives of the other areas of the company. At the same time, they have to be linked to the key environmental aspects of the company.

When defining the objectives, the following issues should be taken into account: time (short, medium or long-term objectives), beneficiaries, degree of priority, ...

The **expected result** is a list of objectives that the company aims to achieve by implementing the BATs, BEPs or CTs.

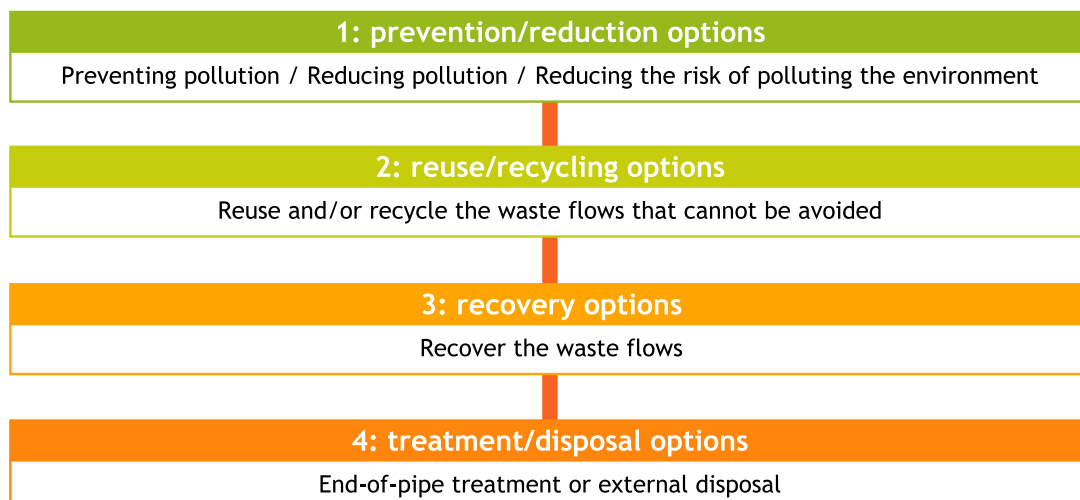
4.3 Identification of the Options to Address Successfully the Key Environmental Aspects of the Company

The objective of this stage is to obtain a list of the options selected to address successfully the environmental impacts of the company that have been detected previously.

Once the company's key environmental aspects and objectives have been determined, the company has to identify the options (techniques, practices or technologies) available to prevent or reduce at source the environmental impact generated by the company's activity.

4.3.1.- Priorities of the Environmental Policy

The identification of the options to address the key environmental aspects of the company should give priority to minimisation (product redesign, good housekeeping, material substitution, changes in technology, recycling at source) instead of end-of-pipe treatments, by following the hierarchy as shown in the figure:



4.3 Identification of the Options to Address Successfully the Key Environmental Aspects of the Company

4.3.2.- Description of the Options

Once the options are identified, a general description of each should be included in the final list with technical information, suppliers, flow charts and quantification of benefits, among others. Some resources are a starting point to this step (BREF documents, sectorial studies...) as well as the collaboration of an external expert familiar with these resources.

The **expected result** at this stage is a list of the options available to address the key environmental aspects, justifying the reasons why they are recommended.

4.4 Assessment of the Options Identified



The objective of this stage is to assess the options identified, as quantitatively as possible, in order to facilitate the company's decision of whether to introduce an option or not. The aim is to determine which are the viable options for a given company, under environmental, technical and economic criteria.

The techniques, practices or technologies will be assessed first following environmental criteria. The options that do not entail significant environmental benefits will be rejected. For the environmentally viable options, a technical assessment will then be performed. The options considered technically viable will subsequently go under an economic assessment, to determine their feasibility in terms of investment and benefits.

4.4.1.- Environmental Assessment

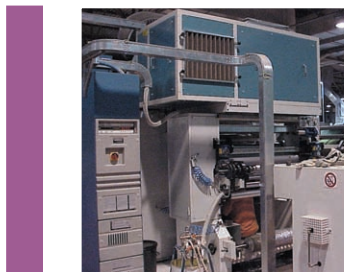
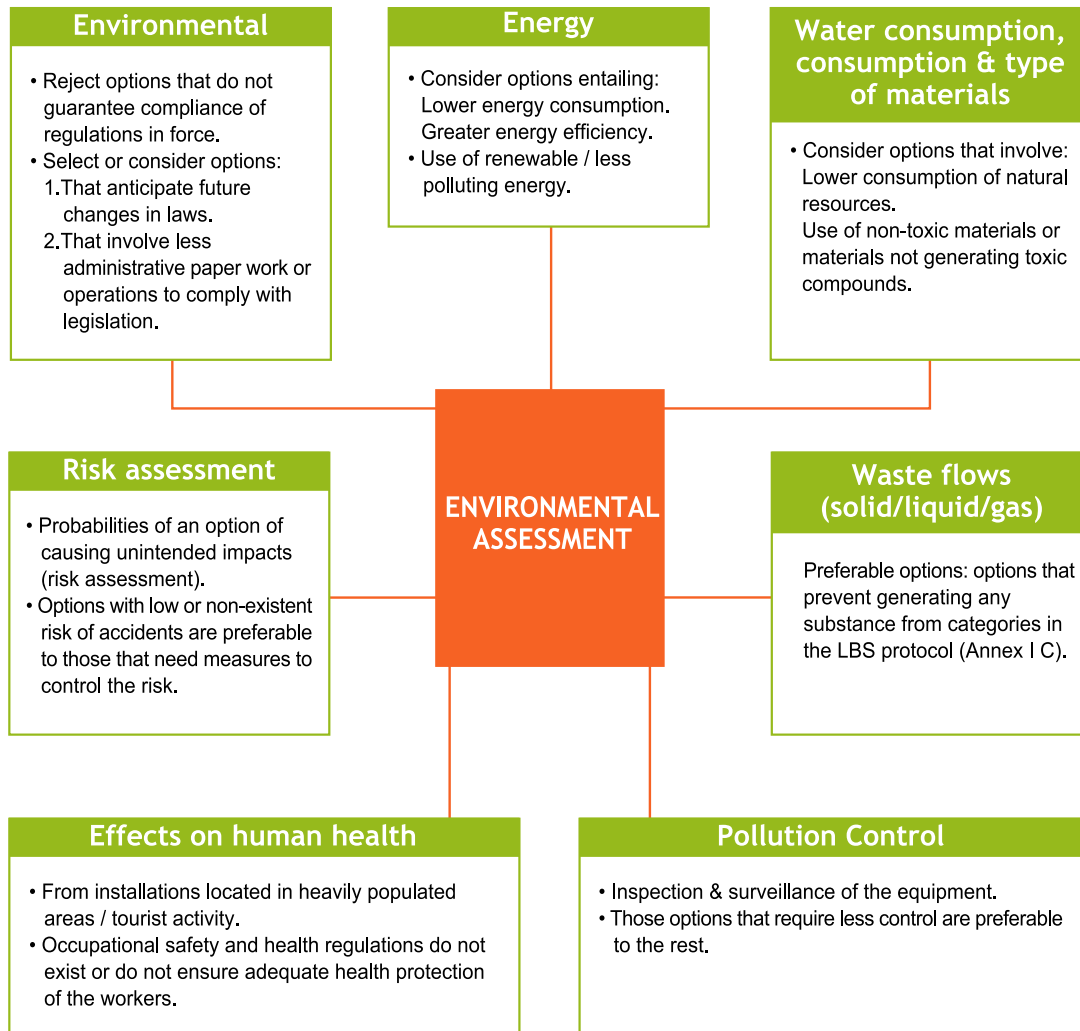
The environmental assessment aims to prevent an option from being a mere transference of pollution from one medium to another (cross-media effects), which is precisely what the integrated pollution prevention and control principle tries to avoid.

The environmental assessment of each option should provide the company with information about the positive and negative changes which can take place regarding the initial situation (reduction in the generation of waste, minimisation of water consumption, ...).



4.4 Assessment of the Options Identified

The following aspects should be taken into account when carrying out the environmental assessment:

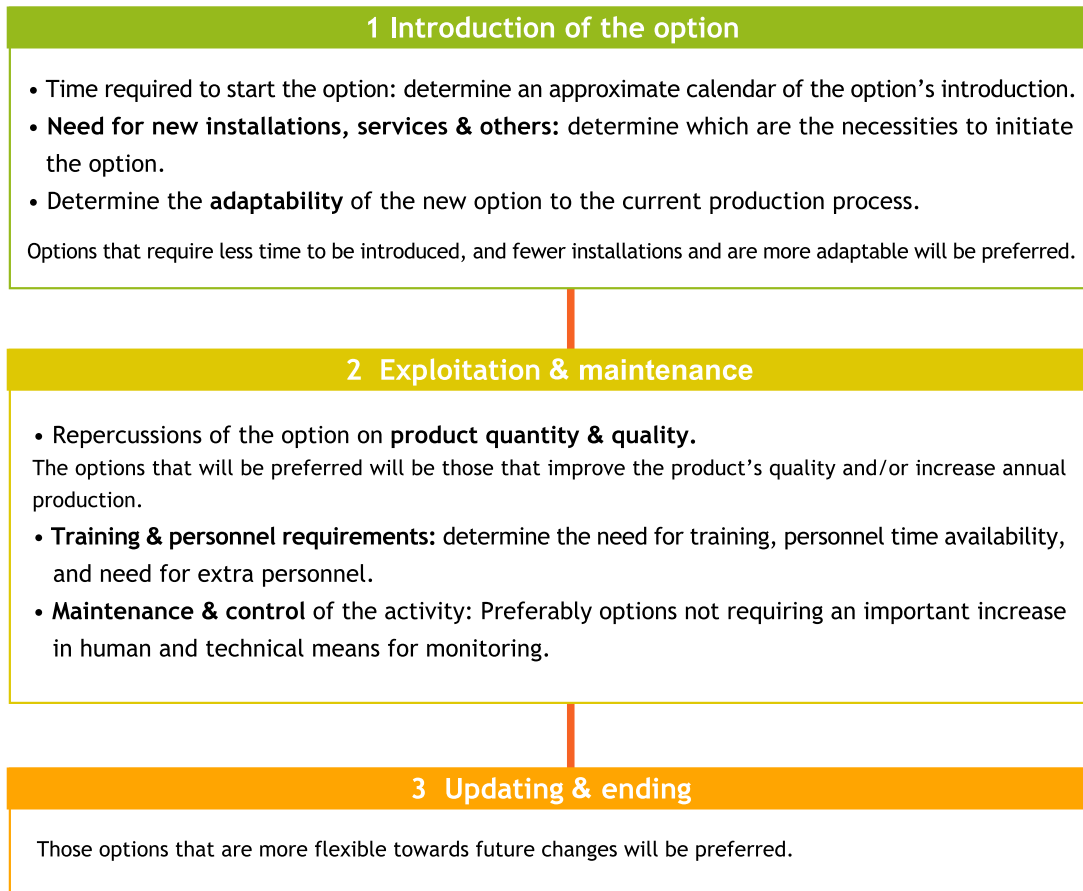


4.4 Assessment of the Options Identified

4.4.2.- Technical Assessment

The technical assessment of the options enables the company to determine what effect applying an option will have on the development of their daily activity and also to know whether equipment, installations or training of the personnel is required.

The following stages (from 1 to 3 in the figure) will be studied when carrying out the technical assessment:



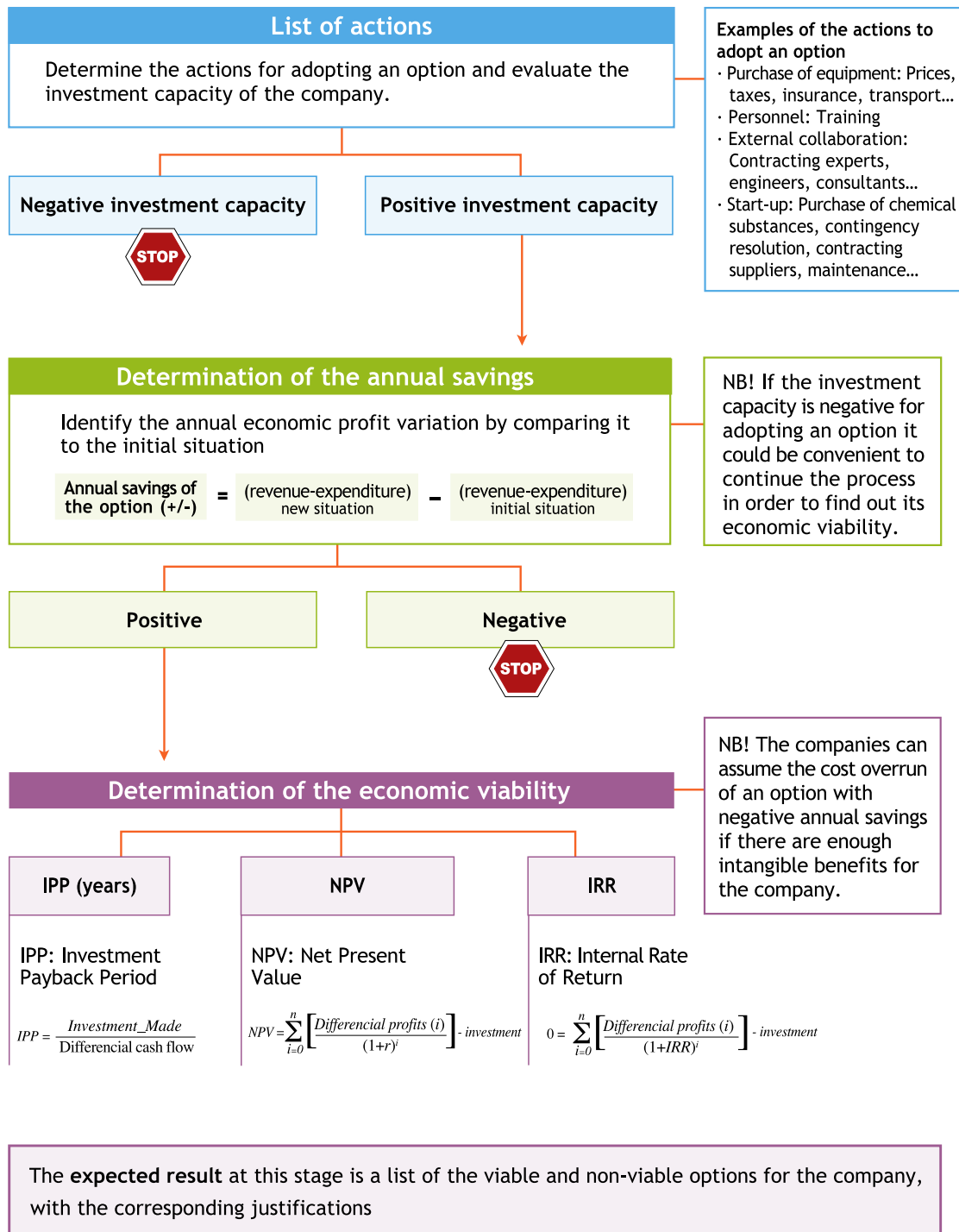
For the options that prove technically viable, the company will carry out an economic assessment.



4.4 Assessment of the Options Identified

4.4.3.- Economic Assessment

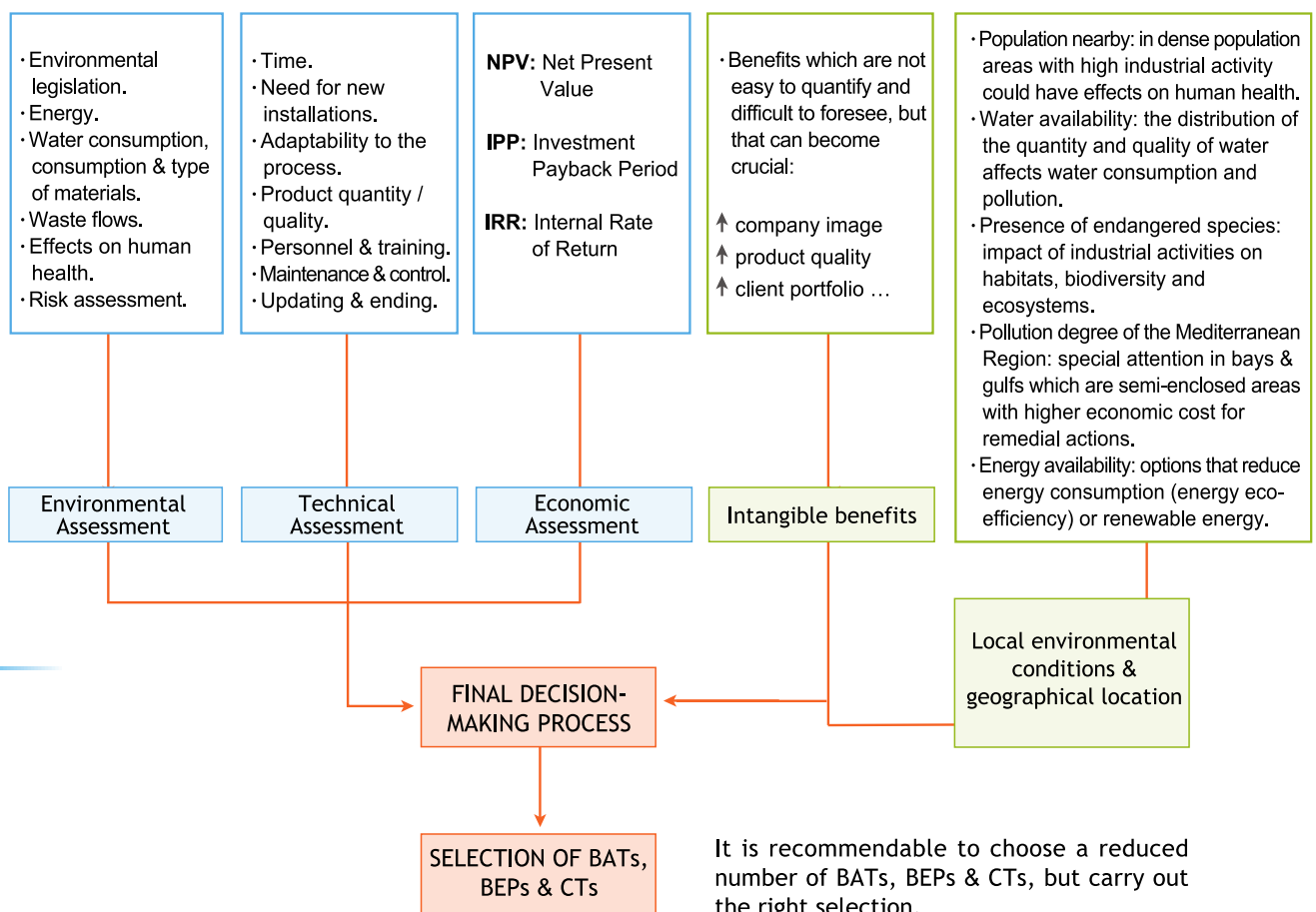
The ultimate **objective** of the economic assessment is to quantify the company's possible profits as a consequence of the implementation of a specific option (BAT, BEP or CT), as compared to its initial situation. The different phases of an economic assessment are:



4.5 Selection of BATs, BEPs & CTs for the company

So far, the company has identified its key environmental aspects, defined the objectives to be achieved by applying the BATs, BEPs and CTs, and the techniques, practices and technologies have been assessed under environmental, technical and economic criteria. Now the company has to choose the techniques, practices and technologies that constitute the BATs, BEPs and CTs for their particular case.

At this stage, apart from the basic criteria evaluated at the assessment stage, other general criteria need to be introduced to facilitate the selection of the options entailing more benefits to the environment as well as to the company. These new criteria are the intangible benefits, the local environmental conditions and the geographical location.



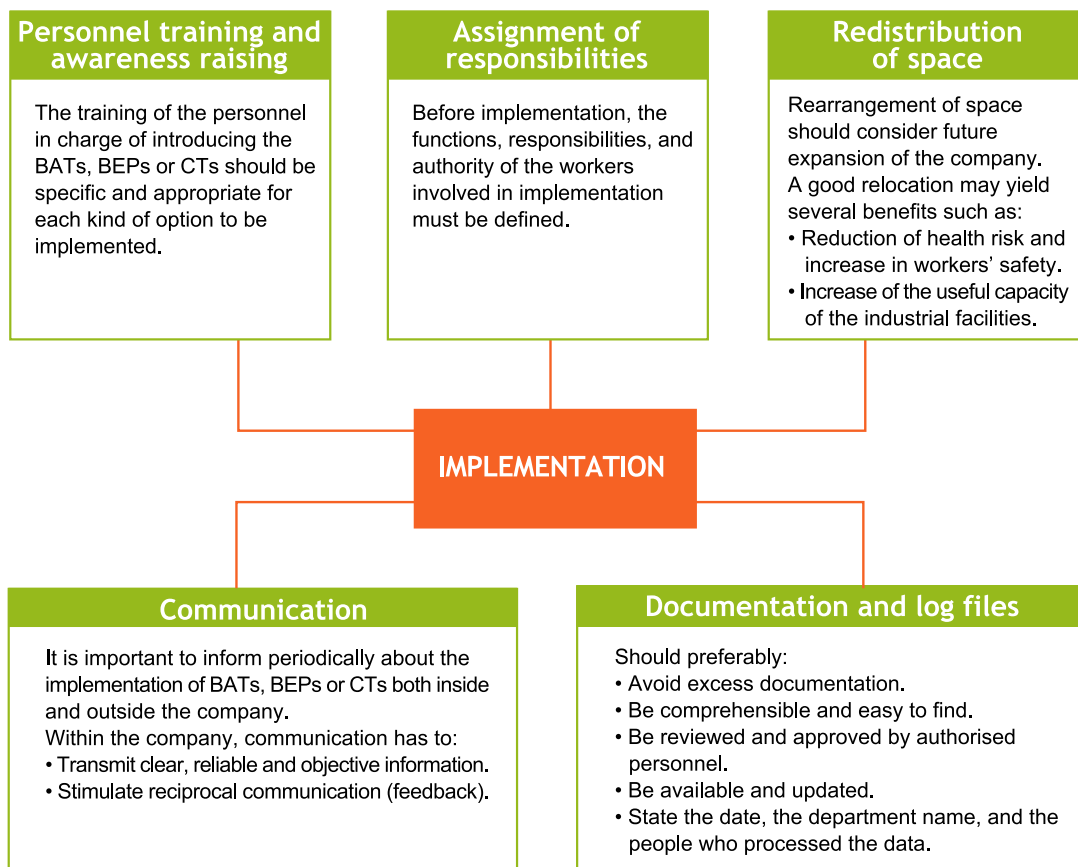
The **expected result** at this stage is a list of the options (either techniques, practices or technologies) identified as the Best Available Techniques (BATs), Best Environmental Practices (BEPs) and Cleaner Technologies (CTs) for the company in question.

4.6 Implementation of BATs, BEPs & CTs in the Company

The **objective** of this stage is to prepare the ground and ensure a successful implementation of the BATs, BEPs and CTs.

Once the BATs, BEPs and CTs have been chosen, the company will have to look at several factors that might contribute to their successful implementation. Among others, the company will have to assign responsibilities, train employees, design a communication strategy for the actions (for both internal and external purposes), plan space redistribution, adequately manage the documentation prepared, and carry out trials and tests, if necessary.

Aspects to be taken into account for a successful implementation:



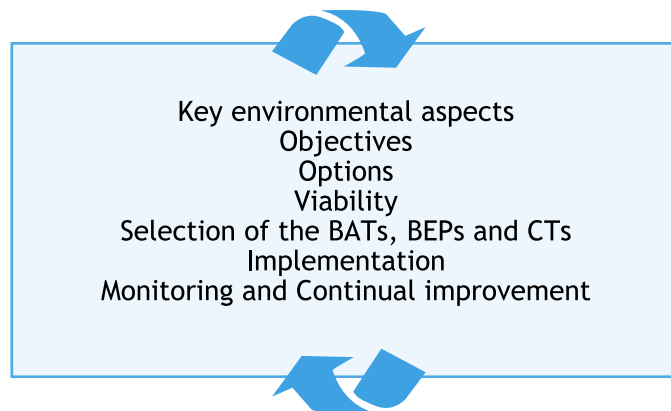
At the end of this stage, the company will have done the groundwork to ensure successful implementation of the BATs, BEPs or CTs. Namely, the company will have appointed the employees in charge of the implementation process and their responsibilities, carried out eventual personnel training, designed a communication strategy and the documentation system to be used, studied space redistribution, and performed eventual trials and tests.

4.7 Monitoring and Continual Improvement

The **objective** at this stage is to carry out periodic monitoring of the BATs, BEPs and CTs introduced in the company either to verify the degree of accomplishment of the expected results or for redefining the BATs, BEPs and CTs if they have been unsuccessful.

Even though the options have been defined and introduced in the company, the methodology presented is not a one-time procedure. The integration of the environment in the company is a process in constant evolution, due to the appearance of new options for preventing and reducing pollution at source. What is currently considered as BAT, BEP or CT of a company for certain production processes may change with time, according to technological, economic and social progress as well as changes in scientific knowledge.

The implementation of BAT, BEP and CT is associated with a continual improvement process where results have to be assessed and the BATs, BEPs and CTs of the company may be redefined:



Verification of the results

The periodic monitoring of the BATs, BEPs and CTs operation will enable verification of the degree of accomplishment of the expected results. The verification process should be:

- When possible, measurable (when the options were chosen with quantitative criteria). In this case, the results have to be expressed either in environmental or economic units.
- Evaluated qualitatively (when the options were chosen for qualitative aspects)

Production will have to be monitored as well in order to assess the implications of implementing the BATs, BEPs and CTs.



4.7 Monitoring and Continual Improvement

Examples of indicators for the pursuit and process of continual improvement:

Units	Examples
Environmental units	<ul style="list-style-type: none"> • Energy consumption (J per kg of product). • Water consumption (m³ per kg of product). • Emission rate of CO₂ per production unit at a given time. • Annual generation of industrial wastes (kg per annual turnover, €). • ...
Economic units	<ul style="list-style-type: none"> • Maintenance cost of the waste water treatment plant (€) per kg of product. • Maintenance cost of the emissions control facility (€) per kg of product. • Cost of the complete management of wastes (€) per kg of product. • Cost of the environmental sanctions (€) per kg of product. • ...



The results obtained should be communicated to all workers of the company, either to encourage them in case of positive results or to inform that the BATs, BEPs and CTs are not exploited correctly.

The BATs, BEPs and CTs of the company can be redefined when:

- There are deviations with respect to the expected results.
- More innovative options appear.
- Improvements introduced yield new viable and suitable options.
- Legislation changes resulting in new requirements.

The **expected results** at this stage are:

- The accomplishment degree of the expected results is verified.
- The necessities to redefine the BATs, BEPs or CTs are identified.
- The continuous improvement of the environmental situation of the company is assured.

5 RESOURCES AVAILABLE

The following resources may be helpful when carrying out the methodology presented:

MOED: Minimization Opportunities Environmental Diagnosis¹: It assesses an industrial activity to detect potential opportunities for preventing and reducing pollution at source, and has the objective of providing the company with enough data to shift its policy towards cleaner techniques, practices and technologies that are technically and economically viable.

GHPP: Good Housekeeping Practices Programme²: This methodology is specifically for the BEPs and does not consider the identification of other types of options. In this methodology, identification of the BEPs is carried out through a brainstorming session by key personnel and external experts.

LCA: Life Cycle Assessment: The LCA basically consists of a group of techniques which are articulated in an objective and systematic procedure for identifying, classifying and quantifying the pollution loads or environmental impacts and the material and energy resources associated to a product, process or activity from its conception to its elimination, going far beyond the industrial activity itself.



BREFs: Best Available Techniques Reference Documents: The BREFs are reference documents compiling the existing techniques in each industrial sector that is regulated by the IPPC Directive and determines the BATs for each sector. The available BREFs can be consulted on the official website of the European IPPC Bureau: <http://eippcb.jrc.es>

RAC/CP sectorial studies: These identify the pollution prevention opportunities in certain industrial sectors. Some of the sector studies that have been published concern tanning of hides and skins, food preserving, dairy products, printing and allied industries, olive oil, used oils, textiles and surface treatment. The sector studies elaborated by RAC/CP can be consulted on its website: <http://www.cema-sa.org>

Expert support: The process of selecting the BATs, BEPs and CTs of the company may require, during all stages defined in the methodology, the collaboration of experts who are know well the existing industrial activities, practices and technologies for pollution prevention. In this sense, RAC/CP has identified experts and together with their curricula vitae, compiled them in the **Mediterranean experts database** of RAC/CP, which may be consulted on its website: <http://www.cema-sa.org>

¹ This methodology has been developed by the Centre for the Enterprises and the Environment (Department of Environment and Housing, Government of Catalonia) and has been published and disseminated in the Mediterranean by RAC/CP.


² Methodology, published and disseminated in the MAP countries by the RAC/CP (Good Housekeeping Practices Programme - Design and Application in Industry, 2001).

6 A CASE STUDY: Overspray Reduction in Paint Application

Overspray Reduction in Paint Application	
Industrial sector	Paint application
Associated manufacturing process	Painting of pieces: The parts prepared to be painted are hung on the frame and go into the painting booth. Inside the booth, a base coat is applied, then a coat of paint and finally a coat of varnish. The painting booth has a closed water circuit to prevent the paint leaking to the exterior. Before the CT implementation, the paint was sprayed with conventional guns installed in the booth.
Key environmental aspects	Raw materials consumption: With the conventional spray guns, the percentage of paint transfer to the surface is not very good, because the paint comes out at high pressure and an important part of the paint rebounds (overspray) and does not stick to the surface of the part. Therefore, excess paint is consumed. Solid wastes: The excess paint is collected with the booth's water curtain. These booth waters are treated before going back into the system to eliminate traces of raw material collected as sludge.
Description of the CT applied	HVLP guns (High volume/low pressure): The difference between the HVLP spraying process and the conventional one is that the former uses a large volume of paint and air at low pressure in order to atomise the paint. The reduced outlet pressure of the paint and the low speed of the particles increases the efficiency of coating transfer and reduces overspray by up to 30-40%.

	Parameter	Old process	New process
	Environmental assessment	Raw materials consumption	425.55 ton/year
Booth sludge management		284.70 ton/year	199.29 ton/year
Technical assessment	CT implementation required stopping the painting installations. The spray guns were therefore changed and the process adjusted during the summer. There were no more technical requirements that affected the decision to implement the CT.		
Economic assessment	Parameter	Old process	New process
	Raw materials consumption	2,300€/year	1,610€/year
	Booth sludge management	51,000€/year	36,000€/year
	Annual savings	15,690€/year	
	Investments	30,320€/year	
Final balance	Payback period	2 years	
	The savings obtained by reducing the consumption of the main raw material convinced the company to apply the same CT to the rest of their factories.		



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