

# Approaching a Cleaner Production as an Environmental Management Strategy

## Acercamiento a la Producción Más Limpia como estrategia de gestión ambiental

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**Abstract--** In this paper a reflection on Cleaner Production as environmental management strategy and the advantages of it over the traditional approach of treatment at the end of the process. These advantages are mainly related to preventing pollution rather than treat it to avoid its effect preventive approach. Some results of the implementation of this strategy in Cuba are relate.

**Keywords--** Cleaner production, pollution control, pollution prevention, environmental management, Cuba

**Resumen--** En el trabajo se realiza una reflexión acerca de la Producción más Limpia como estrategia de gestión ambiental y las ventajas que de ella se obtiene con respecto al enfoque tradicional de tratamiento al final del proceso. Estas ventajas están relacionadas principalmente con su enfoque preventivo orientado a evitar la contaminación en lugar de tratarla para evitar su efecto. Se refieren algunos resultados de la aplicación de esta estrategia en Cuba.

**Palabras Clave--** Contaminación, gestión ambiental, control de la contaminación, prevención de la contaminación, producción más limpia.

I. INTRODUCTION

In the beginnings of the industrial development on the XVIII century, environmental problems were rarely taken into account, it was believed that the benefits of industrialization far out weighted the inconveniences that it could bring in consequence, and the relationship between it and environmental contamination was also unknown. This situation started to change as industrialization became widespread, and environmental problems evidenced themselves when they started causing health problems, odors, unwanted noise, as well as affecting surroundings aesthetically. In addition, local environmental phenomena, together with regional and global ones, as well as multiple industrial accidents, which brought about considerable ecological disasters, lured the attention of the entire world towards environmental problems [1].

In order to mitigate the impact human activity has had over the environment, diverse Environmental Management strategies have been developed whose historical evolution since World War 2 can be seen on fig. 1.

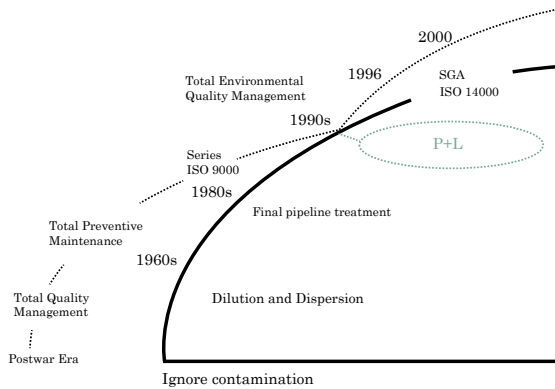


Fig 1. Historical evolution of the environmental management strategies. Source: [2].

Environmental Management has been evolving from a reactive approach oriented towards the control of environmental impact to a preventive approach focused on avoiding the production of contamination.

The paper aims to make a brief description of the concept of Cleaner Production, its development and implementation in Cuba.

II. APPROACH TO CLEANER PRODUCTION:

Cleaner production (CP) has evolved into Resource Efficient and Cleaner Production (RECP), is an important contribution to human sustainability [3,4]; the concept emerged in industrialized countries during the 1990s, as a complement to end-of-pipe techniques. RECP, which builds upon CP, is

the application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment [5], [6]. RECP addresses the three sustainability dimensions (production efficiency, environmental management and human development) individually and synergistically. This concept is closely related to the Circular Economy (CE), which is a sustainable development strategy aiming to improve the efficiency of materials and energy use [7], [8]. Figure 2 notes the most fundamental aspects of this definition.

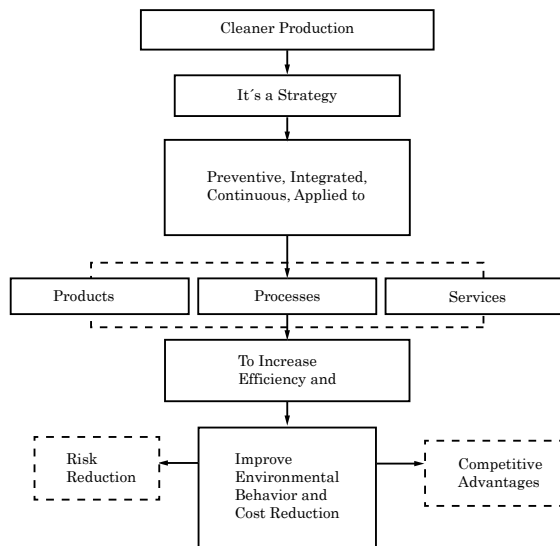


Fig 2. CP Definition. Source: [2].

CP is generally oriented towards reducing environmental impact in the source function as well as in the drainage function, as seen on figure 3. The reduction of the source function is oriented towards the efficient use of consumables, incrementing their performance to reduce its demand. The reduction on the drainage function is focused on the reduction of effluents of all kinds, based on its elimination from its origins, and a reuse strategy inside the process and recycling and external revaluation.

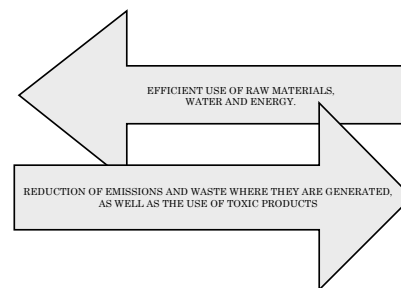


Fig 3. Principles of CP. Source: Self built.

On table 1 a comparison is made between the treatment of End-of-Pipe and CP.

TABLE 1 – COMPARISON BETWEEN THE TREATMENT OF END-OF-PIPE AND CP.

End-of-Pipe Technology	Cleaner Production
How to treat waste and emissions?	Where do the waste and emissions come from?
Represents the reaction	Represents the action
It will generally conduct to additional costs or increases in the consumption of materials and energy.	It can help reduce costs and consumption of materials and energy.
End-of-Pipe treatment using diverse technologies.	Prevention of the generation of waste and emissions at the source.
Environmental protection is made after the processes and products have been developed and is reduced at	Environmental protection is an integral part of the design of products and engineering and constitutes a
Environmental problems are resolved from a technological standpoint.	Environmental problems are worked in all different levels and every
Environmental protection is a topic for subject matter experts.	Environmental protection is a topic for everyone
Risks are increased	Risks are reduced

SOURCE:[9]

One of the peculiarities of CP is that it contradicts the traditional paradigm that environmental care represents a cost to companies, it does not obstruct economic growth, it simply insists that this growth be environmentally sustainable. It should not be considered only as an environmental strategy because it is also related to economic considerations.

The application of CP practices conducts to the achievement of a production of goods and services with the optimal use of natural resources and materials under the current technological and economical limits.

Every action made with the purpose of reducing the consumption of raw materials, water and energy, and to prevent or reduce the generation of residue, can increase productivity and bring economical advantages to the Company.

CP is a “win - win” strategy, with its application you can protect the environment, the consumer and the worker while you improve on the industrial efficiency and increase competitiveness. It’s a philosophy of looking ahead, “anticipate and prevent”.

The first CP program was implemented by the company “3M”, whom established a program called Pollution Prevention Pays (3P) in which economical incentives were established for its employees for

the creativity of the proposal and the development of projects for the reduction of contamination, waste and emissions. In the first 20 years of implementation the results obtained were notorious: 4450 projects were developed by the employees, which resulted in the elimination of more than 1.2 billion pounds of contaminants, and an economical benefit close to 750 million dollars.

Generally, the expected results from the implementation of a CP strategy are:

- Contamination prevention.
- Investment cost recovery.
- Production cost reduction.
- Cost reduction of effluents treatment.
- Reduction of water consumption.
- Energy consumption reduction.
- Raw materials consumption reduction.
- Minimize residue generation.

Many countries have national CP strategies that promote and incentivize its application in different areas, from sector level agreements, demonstrative projects, economic incentives and types of funding as well as tax benefits. An example of this would be the results of a “CP National Strategy” which, with a yearly average investment of U\$22 million, yearly economic benefits of U\$36 million have been achieved, as well as notorious improvements in environmental performance from the sectors that have been intervened [11]-[14].

### III. CP IN CUBA.

The National Environmental Strategy from the Republic of Cuba 2010-2013 clearly establishes the priority that the authorities give to the Cleaner Production strategy “Integral application of the concept of Cleaner Production to increase efficiency and productivity, minimize residue generation and emissions, foster the economizing of hydric resources, energy resources and other types”, which registers with the explicit acknowledgement made on the Article 27 of the Republic’s Constitution in regards to the state’s obligation of watching over the preservation of the environment.

Almost every ministry in the country has plans and strategies for the introduction of CP actions in their productions and services, and have reached varying degrees of results, and they have a high demand of counseling and training in this subject to guarantee its compliance.

The National Network of Cleaner Production established in May of 2001, with the support of the United Nations Industrial Development Organization (UNIDO) and the Austrian government, is led by the Center of Information, Management and Environmental Education (<http://www.redpml.cu>), has contributed to the dissemination of the results obtained by the Cuban industry in the implementation of the CP approach.

The University of Cienfuegos together with the Free University of Brussels, and the Catholic University of Leuven (both from Belgium), developed between 2008 and 2012 the International Project “The creation of a CP center for the socio-environmental development of the province of Cienfuegos”, in which abilities were developed and I+D activities on this subject began. As part of the project it was designed and implemented the first program of Master’s Degree in CP in our country, which has already developed 2 promotions training professionals from the entities that contaminate the most in our territory [13].

Nevertheless, the main example of the application of these CP strategies in our country is the Energy Revolution, through which a national programs of spare use of energy was developed, and it has had spectacular results as shown on figure 4, where it is appreciated the economizing of more than 8 million tons of petroleum in its 6 years of implementation.

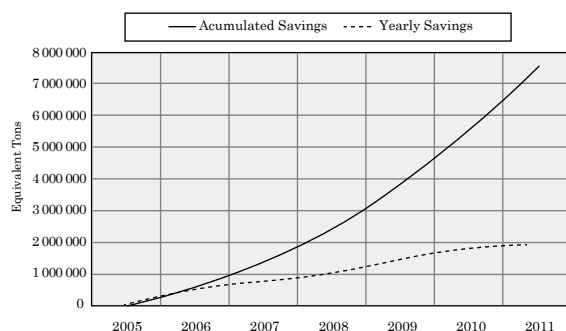


Fig. 4. Results of the national strategy of spare use of energy in Cuba.  
Data source: (ONE 2011)

The identified main barriers to the introduction of CP in our country are [15]:

- Lack of knowledge about the economic and environmental benefits on the application of CP practices.
- Emphasis on the normative and regulatory systems on the output centrals. They are also insufficient and outdated.
- Shortage of material and financial resources. Limited access to cleaner technologies.
- Relative approval from investors of the costs of treatment systems and final disposition.
- Few incentives to change.
- Lack of enough nationwide illustrative examples.

The application of CP strategies in our country constitutes an important and pertinent opportunity that must be taken by slowly overcoming the earlier mentioned barriers; the first steps have already been taken.

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