

Ecoprocesses. A need and a requirement

JOSÉ M. BALDASANO

The 1950s and 1960s were characterised by an increasing population and an expanding industry with considerable increase of production scales. In the 1970s the need came up to think of energy as a new factor to consider, of which a more efficient use needed to be conceived. In the 1980s, environmental and security aspects were introduced, but also market needs and their opportunities. In the 1990s, sustainable development came up as one of the emerging needs of the system within a rapid globalisation process. During its first decade, the 21st century has continued globalisation with exponential financial and urban expansion, leading to one of the biggest crises in the system, while the environmental issue of present climate change becomes apparent and generates a clear opportunity to think over the social, economic and energy system.



Introduction

From the beginning of the environmentalist movement in the 1960s and 1970s, both governments and the industry focused their efforts on an **end-of-pipe approach**. In the 1980s, as places where to locate waste treatment plants and landfills were challenged and reduced, the cost of the different waste treatment systems increased and public opinion increasingly opposed to such facilities, the focus originally adopted needed to be changed and evolve, fostering pollution prevention as a new focus to protect the environment as opposed to the initial strategy of pollution control. Authorities from different countries discussed and took measures to reduce the environmental impact of both processes and products. In recent years, basic and applied research projects related with this aim have come up massively at universities and innovation centres.

The strategy of reducing the generation of effluents and raw material and energy consumption as well as to foster to the maximum their reuse and recycling, that is, to adopt a working philosophy allowing to tackle the causes of pollution at their origin, set a context in which minimisation of the environmental impact came up as a key option. All this led to think of the present concept of sustainable development, which involves a new massive change in placing pollution-related priorities on resources. All this is a quantum leap that has not been concluded yet.

In 1979, the European Economic Community defined the concept of clean technology, using three different yet complementary aspects (Murillo, 1989):

- ▶ Less pollutants poured into nature (air, water and soil).
- ▶ Less waste generation.
- ▶ Less consumption of natural resources (raw materials, water and energy).

A more recent definition provided substantial change (UNEP, 1992):

«**Cleaner production** is a means of applying in a continuous manner a preventive and integrated environmental strategy aimed at both processes and products, to reduce the threats for people and the environment. As to processes, it means to use less raw materials and energy, eliminate the use of materials with toxic properties and reduce the amount and toxicity of all emissions and waste before leaving the process. As to products, it means to reduce the impact in all stages of their life cycle, from obtaining raw materials to final disposal. Cleaner production is achieved by means of applying knowledge, improving technology and a change of attitude.»

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There are two new and basic aspects arising from this definition:

- ▶ An environmental strategy of integrated control and prevention without making any distinction between the different receiving media, avoiding pollution transfer from one medium to another (from the atmosphere to the hydrosphere or the lithosphere), that is, a multi-medium preventive strategy.
- ▶ It not only means to focus on the process phase but also to extend it both up and down to all phases a product life cycle is made of, that is, adopting a strategy based not only on the process but especially also on the product.

In the industrial context, there has been progressive, non-linear awareness-raising in environmental and energy matters. In the beginning, this was limited to the factory management framework, to the production unit, i.e. the process based on effluent management forced

by strong pressure of specific environmental legislation within a pattern of assuming it progressively. Attention turned later to the product and associated consumption.

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Adoption of environmental factors in the development of products at companies currently consists of measuring the environmental impact of the process, either partially or globally, from a perspective based on compliance with legislation.

This adaptive process is first based on the analysis of processes in order to be later applied to products. It is aimed at improving the environmental footprint by reducing or replacing components and materials or researching more efficient processes. However, technological innovation not always brings about a product that is necessarily more respectful with the environment.

Definition

A very important aspect is to clearly differentiate between industrial ecodesign, or just ecodesign, and ecodesign in engineering, also known as ecoconception. It is very important to be clear about the differences.

Chart 1. Classification of strategies defining and guiding ecoconception

Strategies	
Choice of materials with less impact	Choice of cleaner materials Choice of renewable materials Choice of materials with less energy demand Choice of recyclable materials
Reduction in use of materials	Weight reduction Volume reduction
Optimisation of production techniques	Use of alternative production techniques Reduction of stages in the manufacturing process Renewable energy consumption Waste reduction Use of less consumables Use of consumables with less impact
Optimisation of distribution systems	Packaging with less weight Reusable packaging Review of transport systems Improvement of logistic systems
Optimisation of the product life cycle	Higher reliability and durability Improved maintenance and easier repair Modular product structure

Source: VAN HEMEL, C.G. (1998). EcoDesign empirically explored Thesis. Delft: Delft University of Technology.



▲ Producing and using processes and products requiring less greenhouse gas emissions is necessary, with an improved decarbonisation ratio.

Industrial design considers the use and user experience as to a product (functions, shape, aesthetics, use, etc.), while ecoconception identifies variations to measure the environmental impact based on new products or to suggest improvements for existing ones. Its ongoing improvement processes verify own factors at companies (image, cost, production, distribution, etc.).

Ecoconception can be defined as «a process of integrating environmental aspects into the conception, development or reconception of a product or service, with the aim of reducing quantitatively and/or qualitatively the negative environmental impact of products or services over their life cycle, while keeping the quality of use and their performance or improving it».

Chart 1 features the strategies defining and guiding this process.

Cooperation between designers, engineers and architects, besides cooperation with experts from the industry and public authorities, is basic to implement and adapt an ecoprocess strategy.

Prediction of demand

In global terms, population growth, the emergence of China, India and other regions in the world like South America –especially Brazil– and the ongoing increase in energy demand is leading to an increasingly urgent and accelerated demand of products labelled «eco». The car

industry is paradigmatic in this respect. It is one of the key sectors in shifting patterns, as regards both its conception and the consequences of its function for users –the electrical car is an emerging reality. Other emerging industries, which however have to fight against strong forces, are energy systems according to a distributed generation and usage pattern.

From a general perspective, the question is to try and produce and use processes and products with less pollutant emissions, less water demand and less waste generation, but especially requiring less greenhouse gas emissions, more specifically CO₂, with an improved decarbonisation ratio, in a more accelerated way and by increasingly demanding standards. In other words, they shall have the least possible CO₂ emissions. The EU policy to this respect is straightforward and decisive. The next meeting in Copenhagen to renew the Kyoto protocol should be a decisive turning point.

We would be terribly wrong if we only thought of industrial processes and products for their application and adaptation. All processes need to be analysed and improved, in all sectors, from agriculture to services. This is not restricted to the industry. In a clear urbanisation process –76% of the European population is urban– all architectural and urban elements are and will be crucial, and big opportunities can be taken or lost there.

Another element to the system that clearly has to determine future progress is how to react to the ongoing increase of energy demand as to power (lighting, household devices, electronic equipment, etc.) and mobility (cars, trains, ships, airplanes, etc.). One significant figure is that computers make for 2% of global primary energy consumption.

Future expectations focus on a process of continuing change at small scale, which has eventually changed the picture completely, rather than quick and miraculous change. The electronic industry is significant in this respect: it is experiencing a process of continuing improvement

and change by which no spectacular fast change is expected.

The question is to produce and use processes and products with less pollutant emissions, less water demand, less waste generation and requiring less greenhouse gas emissions.

Adopting a new technology takes 20 to 25 years on average. This is the case of the gas turbine in power generation through combined cycle power plants, which has increased the thermoelectrical performance by twenty points, from 35% to 55%. This is also the case of self-powered wind generators, which started at 0.5 MW power and reach up to 4.5 MW now, and are still increasing. This means that there is a margin for innovation and use of opportunities as long as there are structures able to decide and educated and well-prepared human resources.

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Identification of strategies

The situation in Catalonia is contradictory. A considerable part of the civil society and public authorities is in a clear process of absorbing ecoprocesses, but there is another part with strong acquired habits leading to clear resistance to change.

Catalonia was once a leader in wind turbines but lost an opportunity. Mini wind generators could be a new one. Also hydrogen could become a future opportunity.

The 1992 Olympic event in Barcelona was used to develop a conceptual pattern of how

to do things and implement a project in an international multi-parameter setting. If we assume the pattern of ecoprocesses as a new paradigm to be applied in all activities done in our society, we can say that we are in front of a new opportunity.

Yet we must not be confused. When talking of ecoprocesses, we are not referring only to the environmental industry (water, air, waste, odours, soil, noise, etc.), i.e. the whole of companies and businesses dealing with prevention or mitigation and correction of problems created in the environment due to human activity, which is by the way increasingly relevant in the Catalan economy (FFA, 2008). Instead, we are referring to all sectors making up our society. We all are stakeholders in this process, although it is obvious that there are some playing a more relevant and specific role.

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All in all, this is a process that needs to be driven by the whole society and not only adopted by a part of it. It is not specifically up to the industry but also to public authorities, the service sector, logistic processes, etc. This process is based on attitudes and knowledge within the relevant values of a society. We need to deepen in a society of values, not just environmental but also ethical ones. We need a society of prepared citizens trained to think for themselves, not just a society exclusively oriented towards consumption.

All this shall be developed in a straightforward internationalisation setting based on a key technological specialisation and differentiation in adopting a solid position vis-à-vis the rest of the world. The global level is where the game is played.

To achieve this, there are two key points: a highly educated and professionally highly prepared society. This obliges us to strengthen the secondary education and university systems as well as specific and technology centres.

There needs to be a decided and widely accepted momentum, but there are serious points that do not allow to be optimistic despite clear improvement having taken place. Many infrastructure projects are still made following completely traditional design patterns, without considering associated environmental costs nor our responsibility, both regarding Catalonia and the global level.

The increase of R&D&I investment at companies and research and technology centres is not enough to assume ecoprocesses as a driver of change and environmentalisation of the system. A drive by the public sector in cooperation with the rest of sectors is needed in visualising a clear and decided effort for new ecoprocesses. Investment in design and processes should be strengthened and given priority with the double goal of improving competitiveness and productivity.

One of the great opportunities and one of the main contributions to the society is strengthening environmental issues in all actions as a further element in development, like in France and Germany, through a decided strategy along these lines to overcome the current economic crisis and be better positioned for the future.

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There needs to be awareness that this continuing progress is slow and complex, it requires a

cooperative framework and synergies as well as decision-taking capacity and leadership. Cities and countries that are a role model have been able to unite their efforts to go into one same direction, setting aside tribal behaviour.

It is a process the evolution of which will be an out-right earthquake that will test the degree of progress of the Catalan society and economy and may generate a better life quality, new jobs and new technological innovation processes. All in all, it will take us to become an increasingly sustainable society.

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