# Environmental performance evaluation through the “EcoBlock label”

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## Abstract

Environmental reporting is becoming increasingly important as public opinion demands it. Consumers, constituents, media readers, NGOs, unions or environmental-conscious companies are becoming more aware, thus creating the need of a simplified environmental performance evaluation of products and companies.

This paper describes a method to evaluate environmental performance throughout the supply-demand chain. The EcoBlock method can be used for company performance reporting, supplier performance control, product labelling, simplified Life Cycle Assessment (LCA), and to support policy instruments.

The method is based on a set of pressure indicators: water abstraction, resource extraction, land use, greenhouse gas emissions, polluting emissions to water and to air and waste committed to long-term storage. They can be coherently used to describe the environmental performance of any company or product, making it possible to transmit compatible environmental information from one company to another through the products they trade. This standardized information transfer is the major innovation of the method.

It has been established that the chosen set of indicators can be obtained from typical environmental management system records. When computing the indicators for a product, the following criteria are used: full life cycle is accounted for including raw materials, production process, transport, use and disposal; renewal of natural resources and recycling are fully taken into account; emission data are aggregated based on potential harmfulness as implied by emission standards according to the European Pollution Emission Register.

The method was applied to a number of case-studies in Portugal related to different activities, and to a survey of the construction business, from raw material extraction to on-site construction. These studies showed that companies with environmental management systems can easily compute EcoBlock indicators. For other companies, we have been creating reference sector EcoBlock labels, based on statistical data.

The application of the method will be illustrated through the practical example of the electricity sector in Portugal (from production to distribution of energy).

The comparison between EcoBlock and the reporting guidelines set by Global Reporting Initiative, and World Business Council for Sustainable Development, concludes for a high general compatibility, with shared principles and data. From company reports published according to those guidelines, it is easy to compute EcoBlock indicators.

For some applications the EcoBlock indicators can be aggregated into an index, inspired on the Ecological Footprint metric.

## 1. Introduction

Several instruments and standards have been introduced in the last decades to assess environmental management performance and efficiency of products and companies, such as life cycle assessment (LCA), eco-labels, environmental management systems (EMS) and environmental certificates and register (ISO 14001 and EMAS standards).

Global Reporting Initiative (GRI) has been working on a common framework for environmental, social and economic voluntary reports. It has published guidelines to promote comparability of sustainability reports and to support benchmarking (GRI, 2002). The World Business Council for Sustainable Development has also published a list of selected indicators, focusing on eco-efficiency (WBCSD, 2000).

Existing standards are much more management-directed than environment-directed. The result is that, although there is abundant literature on environmental performance, it is far from standardized and little of it is actually applied on day-to-day management (Melo, 2002).

Many countries have regulations imposing environment-related information on specific categories of products, such as energy consumption in appliances and vehicles. Technical notices will have more or less detailed data, but usually the label on the product only bears qualitative information. Typically, labels and technical notices provide little or no information on environmental effects caused by manufacture, use or disposal of the product. Most eco-labels do not provide quantitative environmental information at all – either the logo is there, or it is not – which makes it difficult to distinguish between two labelled products.

More precise information about environmental effects related to a product can be obtained through LCA, that is commonly used for product and process design and for eco-labeling. However, this method is very expensive because it is data-intensive and time-consuming, thus limiting its use; another limitation is that broader issues such as impact acceptability are not usually taken into account (Curran, 1996; Das, 2005).

The proposed method does not aim to replace traditional LCA, which has been seen as a powerful tool toward environmental improvement, but to increase its use among company's ordinary procedures, such us environmental performance control and selection of suppliers and simple product eco-design like the selection between different techniques or materials to a specific project.

In short, no method currently in use allows an easy comparison of environmental performance of different products and organizations, nor an easy link between company performance and product labelling.

This paper introduces a method for environmental performance evaluation – the EcoBlock method - that can be used to compare both products and organizations, by being used in a standardized manner throughout the supply-demand chain. The method was first proposed by (Pegado, 2001) and has been further developed since (Macedo, 2004).

## 2. The EcoBlock method

### 2.1. General principles

The EcoBlock method aims to answer the following brief: to assess the environmental influence of a company or a product with a quantified and life-cycle oriented approach, following a clear and standardized method in a cost-effective way.

EcoBlock indicators were defined under the following general principles:

- Focus on environmental pressure;

- Restriction to a small number of indicators, covering a wide range of environmental issues;
- Correlation with relevant environmental effects although not pretending to evaluate environmental impacts as such;
- Expression in easily recognisable physical units;
- Ability to describe environmental performance both at product level (goods or services) and at organization level (company or institution);
- Applicability to a wide range of activities and products;
- Data easily gathered from common organization-level EMS or from public record;
- Additive, that is, the sum of indicator values for two separate activities should be equal to the indicator value computed for both activities managed together.

These features are essential to define a method that can be widely applied, standardized and – very important – that allows the transfer of comparable environmental performance information along the supply-demand chain.

The method should be able to support a number of practical applications (Melo, 2003):

- Standardize environmental labelling of products (goods or services);
- Simplify LCA, because comparable environmental information comes attached – as an "EcoBlock label" – to the products acquired to manufacture the product under study (this will not be as accurate as full LCA, but will be enough for many applications);
- Describe the environmental performance of a company under EMS;
- Compare the environmental performance of different activities or sectors;
- Implement environmental performance control of suppliers;
- Compare different solutions for new projects;
- Serve as reference for policy instruments.

## 2.2. The EcoBlock indicators

The literature shows three main types of indicators to assess environment-related performance: management efficiency, environmental impact and environmental pressure. The EcoBlock method adopts pressure indicators because they are environmentally significant and relatively easy to measure and standardize, although they integrate less local or impact information.

The selected indicators are water abstraction, resource extraction, land use, greenhouse gases, polluting emission to water and to air and waste committed to long-term storage. Data to compute EcoBlock indicators can be easily obtained from typical EMS records, such as water and energy use, waste sampling, raw materials listings.

Each indicator is computed from directly measured variables, weighted by an equivalence factor ($f_{eq}$) that convey the environmental significance of each variable. The equivalence factors are always based on objective criteria, preferably technical or legal standards when available, and reject subjectivity.

EcoBlock indicators are given by the following general equation:

$$I = \Sigma\, Q_i \,.\, f_{eq\,i} \quad (1)$$

Where: I is the indicator expressed in equivalent units (e.g. greenhouse gas emissions in kg $CO_2$ eq); $Q_i$ is the measure of a physical quantity of variable i (e.g. emission of a greenhouse gas i); and $f_{eq\ i}$ is an adimensional equivalence factor for variable i (e.g. the warming potential factor for gas i).

Table 1 presents the criteria for equivalence factors for each indicator.

Table 1 – EcoBlock indicators and estimation criteria

| EcoBlock indicators | Criteria for equivalence factors |
|---|---|
| Water abstraction | Regional water resources intensity of use |
| Resource extraction (except water) | Resources availability and renewability |
| Land use | Ecological and social value of territory; role in the water cycle; good or bad agricultural practices |
| Greenhouse gas emissions (GHG) | Global warming potential |
| Polluting emissions to water | Equivalent hazardousness |
| Polluting emissions to air (except GHG) | Equivalent hazardousness |
| Waste committed to long term storage | Disposal conditions and hazardousness |

It should be noted that the EcoBlock set does not include energy consumption as such. This is of course an important indicator, widely used in management performance. However, energy-related environmental impact is widely variable as a function of energy source and, in current energy systems, it is highly correlated to GHG emissions; it can also easily be expressed as EcoBlock indicators. Therefore we use energy as a proxy to compute EcoBlock indicators as appropriate.

It should also be noted that some of the EcoBlock “indicators” are by their nature indexes, because they aggregate different data with sometimes arbitrary (though objective and reasoned) criteria. On the other hand, data contributing to each indicator are of the same type and they are all expressed in equivalent units with physical significance. We opt therefore to call all of them “indicators” for the sake of simplicity.

The EcoBlock method is highly compatible with GRI and WBCSD guidelines. The three systems use environmental performance indicators, especially pressure indicators, and all of them need identical data, allowing companies to reach the objectives of several methodologies with almost the same data. The EcoBlock method has the advantage of simplifying data presentation and comparison because of the reduced number of indicators.

### 2.3. Organization EcoBlock label

Organization (company or institution) total environmental pressures are estimated for a reference period, usually a year, as follows:

$$OEP = AcEP + AdEP \qquad (2)$$

In which OEP is the Organization Environmental Pressure, AcEP is the Acquired Environmental Pressure (from acquired goods and services) and AdEP is the Added Environmental Pressure (from direct pressure, e.g. fuel combustion and pollution from the production process).

All organization´s activities should be taken in account, including manufacture, buildings and infrastructures, maintenance, repair and transportation (Macedo, 2004).

## 2.4. Product EcoBlock label

Total environmental pressure of an organization can be broken down by its products (goods or services). The result is an EcoBlock vector for each product – the product EcoBlock label. The label or environmental technical notice provides information to the consumer or client (as part of a company environmental procedure), supports benchmarking and helps life cycle assessment (Macedo, 2004).

The indicators can report one or more product life cycle phases, including manufacture, transportation, use and final destination. It is important to refer that for each product some indicators are more significant, so it is indispensable to calculate those, while others are less relevant and may be ignored.

# 3. Description of EcoBlock indicators

## 3.1. Water abstraction

This indicator represents the water abstracted from various sources. The equivalence factor translates the exploitation intensity of the local water resource in comparison with a presumed environmentally sustainable abstraction. When no information is available to know what can be considered an environmentally sustainable abstraction, we can use the OCDE standard, which considers that abstraction above 20% of water availability is clearly environmentally unsustainable (OECD, 2003).

An $f_{eq}$ higher than 1 means that water abstraction is above the sustainability threshold, which implies negative environmental consequences.

## 3.2. Resource extraction (except water)

This indicator represents raw materials extraction from nature attending to renewability and availability. Resource extraction $f_{eq}$ is described in the table 2.

Table 2 – Equivalence factor for EcoBlock indicator "Resource Extraction"

| Resource | $f_{eq}$ |
|---|---|
| Resources with a duration of stock of 100 years or more (e.g. agricultural products, limestone) | 1 |
| Resources with a duration of stock of less than 100 years (e.g. primary forest woods, crude oil) | 100/sock duration in years |

Because any resource extraction, be it biomass or mineral, implies some environmental impact, the major criterion is actual availability of the resource rather than theoretical renewability. Scarce resources are penalized. Duration of stock depends on current market, technology, price and demand, and should be averaged for three to five years to avoid yearly fluctuations.

## 3.3. Land use

Land is considered a fixed resource which is not consumed by economic activities but can be degraded as its appropriation for one use may not allow other rival uses. Some uses of land result in irreversible changes in its properties resulting that it cannot be restored to its earlier use. Issues of land use include biodiversity, water retention, pollution, desertification, erosion and degradation of social values. In practice it is difficult to restore land to its former use, at least in the short term.

This indicator represents the area occupied. Both ecological (soil, habitats and life conservation, water regeneration, landscape preservation) and social (heritage, public and utility use) values are considered. $f_{eq}$ is based on equation 3:

$$f_{eq} = 1 - C_{BH} - C_{LW} - C_{AP} \qquad (3)$$

Where: $C_{BH}$ is the biodiversity and heritage coefficient; $C_{LW}$ is the land occupation and water cycle coefficient; and $C_{AP}$ is the agricultural practices coefficient.

$C_{BH}$ is defined according to the IUCN Guidelines for Protected Area Management Categories (IUCN, 2004) or equivalent cultural value (using e.g. UNESCO World Heritage criteria). It can vary from 0 (no classification) to +0.5 (highest protection status – strict nature reserve/wilderness area or world heritage).

$C_{LW}$ is defined according to land occupation, based on the role in the regulation of the water cycle and soil protection. It varies from -4 (built-up ground) to +0.5 (wilderness). Agriculture or urban green areas are attributed a neutral value 0.

$C_{AP}$ is defined according to good or bad agricultural practices, from +0.2 (organic farming) to -2 (practices conducting to high soil erosion).

### 3.4. Greenhouse gas emissions

Greenhouse gases (GHG) emission indicator is based in the global warming potential of several GHG, estimated according to the IPCC guidelines, and expressed in $CO_2$ eq. This indicator is mainly related to energy use.

### 3.5. Polluting emissions to water

Polluting discharges to water can cause eutrophication, can harm human health (e.g. heavy metals) and can also disrupt natural ecological processes. Among the myriad pollutants that might be taken into account, we have chosen the list in the European Pollutant Emission Register (EPER - Commission Decision 2000/479/EC of 17 July 2000), because (i) those are the ones that offer better guarantee of availability of data throughout a larger spectrum of substances, activities and countries, including all most pollutant industries; (ii) there is a focus on conservative pollutants, the ones most important at regional or global level.

In the literature we find many criteria to aggregate water pollution data, but they vary widely in scale, purpose and scope of data. No single method was found to support our goal of aggregating all relevant variables into one index. Although this is a major simplification, we have opted to derive the equivalence factors of different variables from the EPER report thresholds, assuming that lower thresholds correspond to more harmful substances. Each equivalence factor is thus obtained by dividing a reference threshold by the threshold of each variable. The reference variable chosen was TOC, because it is the most common in both quantity of emissions and variety of sources. Thus, e.g. phosphorus has a report limit 10 times less than TOC, so its $f_{eq}$ equals 10.

### 3.6. Polluting emissions to air (except GHG)

This indicator assumes the same logic as the previous one; in this case we have chosen $NO_2$ to be the reference variable, because, again, it because it is the most common in both quantity of emissions and variety of sources.

### 3.7. Waste committed to long term storage

Waste committed to long term storage is estimated considering the average amount of waste (kg eq) left for future generations. This amount does not include the percentage of waste transformed into water and air emissions, except in the case of unknown destinations, illegal or inappropriate disposal.

When waste goes to known and controlled final disposal (landfill, energetic, organic and material valorisation), we have to consider the total weight of waste that will remain for the next generation, after being treated. Adequately stabilized waste (usually treated and land-filled) will have $f_{eq}$ equal to 1.

When the waste is disposed of into an unknown or illegal destination, we assume that its hazardousness is much higher then a known and controlled final disposal. In this case, $f_{eq}$ depends of the waste mixture:

- Inert: $f_{eq} = 5$, representing the increased area occupied by inert waste (e.g. demolition waste), dumped without control, as compared to an appropriate storage;
- Urban waste: $f_{eq}$ is equal to the inverse average fraction of pollution from treatment sewage of percolate water in common raw waste landfills;
- Toxic waste with a known mixture: $f_{eq}$ is applied to its hazard portion. The equivalence factor is equal to the inverse of the threshold value fixed in artº 2º from EWL (Commission decision 2000/532/CE altered by Commission Decisions 2001/118/EC; 2001/119/EC and 2001/573/EC); if mixture composition is unknown, the worst scenario should be assumed.

## 4. EcoBlock Index - aggregation of EcoBlock indicators

When dealing e.g. with consumer information or with supplier environmental performance control, the seven-indicator EcoBlock vector is not enough: a single index is called for. It should be noted that this index will not be as consistent as the seven individual indicators.

To express the EcoBlock global index, we have chosen the “global area” under the Ecological Footprint (EF) concept, because it is rather intuitive and well known, and compatible with the EcoBlock logic of standardizing information.

The major differences between the EcoBlock and EF methods are: (i) the EF has a top-down approach, directed at countries and life-styles, while the EcoBlock is aimed at products and organisations; (ii) the EF does not account for variables that are essential in product and organisation environmental performance, such as pollution, water abstraction or mineral resource extraction (Venetoulis, 2004; WWF, 2004). This differences representing as many difficulties when converting EcoBlock indicators into “global area”.

Here we propose a tentative approach to this difficult issue:

- The “resource” EcoBlock indicators – water abstraction, resource extraction and area – will be converted into global area by assuming that the land available for biological production serves simultaneously those three functions;
- The GHG indicator is directly converted with the world average of carbon capture assumed in the EF method;
- The water and air pollution indicators are converted using the concept of the virtual global area theoretically needed to absorb such pollution, in the same way that it is applied in the GHG indicator. We are aware that part of the pollution is actually absorbed or rendered innocuous by real land, already accounted for; we handle this problem the same way it is handled in the GHG indicator, that is, estimating the fraction of pollution that remains active in the environment;
- The long-term waste storage is converted by relating it to an estimation of land influenced by such storage.

Because mineral extraction and most of the pollution are not accounted for in the EF, when we convert all EcoBlock indicators into "global area", the final result will usually be higher than using the classical EF method. This is, indeed, an intended feature of the EcoBlock global index.

## 5. Case-studies

The EcoBlock method has been extensively tested in Portugal, with several types of case-studies. A national survey was conducted among the construction business in Portugal, covering the whole life cycle of materials and buildings. Results from this survey have been reported before (Melo, 2002).

More recently, we have been creating typical EcoBlock labels in order to provide information on products of general use, such as energy or water, based on statistical data and company environmental reports.

One example is the electricity sector, a supplier of almost every activity. EcoBlock indicators for the electricity production include data from major thermal and hydroelectric power, wind farms and cogeneration power plants in Portugal, plus import of electricity from Spain. For electricity distribution, major pressure come from land use related to aerial and underground electric lines. The environmental pressure of electricity sold to the final consumer, in accordance with the total sells in 2002, is presented in Table 3.

Table 3 – Ecoblock Indicators for electricity in Portugal

| EcoBlock indicator | Pressure per MWh |
|---|---|
| Water abstraction | 0.48 $m^3$ eq |
| Resource extraction | 261 kg eq |
| Land use | 6.5 $m^2$.ano eq |
| GHG emission | 485 kg eq $CO_2$ |
| Polluting emissions to water | 0.06 kg COT eq |
| Polluting emissions to air | 3.6 kg $NO_2$ eq |
| Waste committed to long term storage | 7.1 kg eq |

Also under way is the application of EcoBlock to the banking sector, especially to the credit concession criteria and project-finance.

## 6. Conclusions

EcoBlock indicators have the advantage of being clearly defined, measurable, transparent and verifiable; they recognize upstream and downstream aspects of the activities of an organization.

The major innovation and advantage of EcoBlock method relies on two aspects: (i) the concept of environmental performance transfer over the productive chain, relating complementary data at organization and product level; (ii) an objective method of data aggregation, that allows standardization and diminishes the total number of indicators.

The application of the method becomes more reliable as data availability increases. Therefore, if a company has an environmental management system the effort of estimating indicators is largely simplified. Furthermore, the growing number of publications and data bases related to environment and natural resources issues will, in the very near future, facilitate even more the application of this method.

The method has been successfully applied to a number of case-studies, from construction to electricity or banking. As a complement to detailed case-studies, a more general database is being developed covering typical EcoBlock indicators for different activities. The method is also promising for a number of applications that are as yet not fully tested, including comparable public reporting, simplified LCA, control of supplier environmental performance and criteria for eco-taxation. For some applications, the conversion of the seven EcoBlock indicators into one index will be useful, using the EF concept as a common metric.


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