

2 Introduction

2.1 Method Description

The “Ecological Scarcity Method” (ESM) was developed to make the environmental impacts, which arise during the everyday commercial operation of manufacturing sites or plants, measurable, assessable and comparable. The method was developed by industry in Switzerland between 1987 and 1990 because no reliable assessment method was available but industry and commerce were nevertheless increasingly being expected to address environmental issues. The method has been used ever since. It has constantly been developed, and continuously been further and kept completely up to date with regard to the basis for assessment. In the meantime, it has already gained regulatory status, for example being specified for the purpose of proving entitlement to tax exemptions for particularly environmentally friendly manufacturing, for instance in the production of biofuels. The method assesses all environmental impacts that are considered significant by the environmental authorities, including emissions to the air and surface water, consumption of energy, freshwater and waste generation.

Such an assessment is required, for example, in order to establish whether a manufacturing plant has reduced its overall environmental impact compared to the previous year. It can also be used to answer the question as to which investments in improvements to production facilities will achieve the greatest reduction in environmental impact or what measures can be implemented for a given capital expenditure to achieve the greatest environmental benefit. Being able to answer these questions reliably and traceably and to derive appropriate environmental targets from the answer is of vital significance to entrepreneurial decision making.

The name “Ecological Scarcity Method” was selected because the environment only has a limited capacity to take up pollutants before an intolerable state is reached. In other words, the environment's capacity for pollutants is “scarce” by analogy the same applies to the availability of resources.

In order to describe this scarcity situation as accurately and traceably as possible, the ESM uses the environmental targets set by a country's or geographic region's highest environmental authorities. This approach is intended to ensure that everyone applying the assessment method will use the same data basis, and thus, the same environmental goals for assessment, thereby ensuring that different assessors do not obtain different results for the same situation.

The scarcity situation of the environment with regard to a pollutant thus depends on the difference between the current environmental impact, for instance in tonnes of pollutant per year, and the quantity or “critical environmental impact” which, on the basis of the environmental objectives, is still just about acceptable. Each pollutant

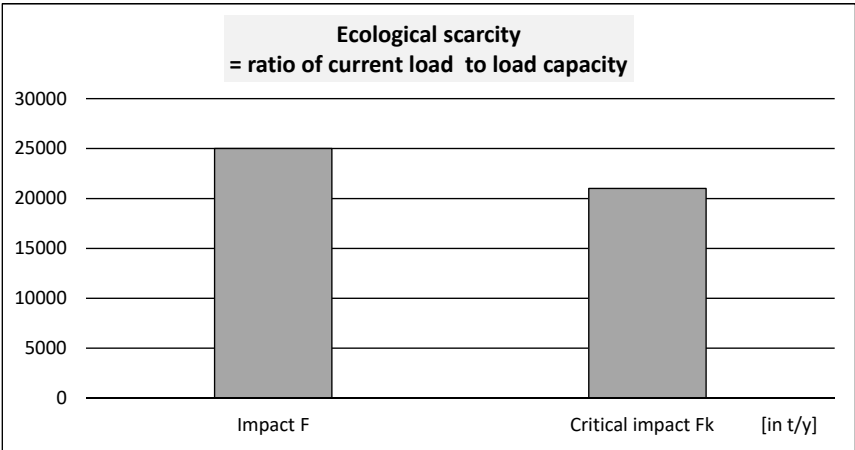


Figure 1: Principle of ecological scarcity

discharge and each consumption of resources takes place against the background of a corresponding scarcity situation. The consequent relative deterioration in the scarcity situation, a ratio, can be added up for all such impacts, giving rise to the total environmental impact, e.g. for a manufacturing site over a specific period.

Before the assessment method can be applied, it is vital for the most important environmental impacts for the country in question, to have been investigated and quantified as completely as possible. Such is the case in many countries and also in the EU as a community of nations. One significant feature of the ESM is that it can be used to assess completely different environmental impacts and to compare them with one another. In a similar way to how, say, apples and pears can be compared with one another, for instance by a freight carrier, because they share a common feature. That is for example their weight in kilograms, which is of importance to the carrier. The feature common to all environmental impacts which enables this comparability is the relative deterioration in the scarcity situation brought about by the particular individual environmental impact under consideration.

A user of the method can then tell directly from the result whether, for example, a site has become “more environmentally friendly” over the course of a year, despite energy consumption having perhaps increased, waste volumes having fallen, greenhouse gas volumes having risen and emissions to water having declined, etc.

Using the ESM, it is possible to environmental impacts, prioritize a budget and define environmental objectives. In brief, the structures for corporate use are largely comparable with those of management cost accounting (Please note that the calculation process used for the ESM is described in greater detail at the beginning of the data section).

2.2 Initial Situation and Aim of the Initiative

The aim of this initiative is to create the basic conditions under which European companies will be able to draw up meaningful, reliable environmental impact assessments. When taking environmentally significant corporate decisions, it is essential for the assessment results to be traceable by third parties. The results must be free of subjective considerations, i.e. they cannot be dependent on the assessor. This is apparent when it is borne in mind that considerable financial resources are often invested in environmental matters; consequently a traceable and reliable basis for decision making must be created. Similarly, environmental management systems, such as EMAS or ISO 14001, require decision making tools for the assessments which permit quantification and comparability.

As with the transfer of the ESM to Germany, Volkswagen AG has again taken initiative with the aim of creating the necessary conditions for a reliable and comparable basis for environmental impact assessments across Europe. The ESM has already been available as a basis for assessment of Swiss conditions for a long time. Since 2014 it is also available for German conditions too, the emphasis here has been placed on surveying, processing and coordinating the targets of European environmental policy. In autumn 2010, SYRCON held an industry seminar on this issue in Darmstadt. Interested companies were welcome to obtain information about the state of environmental impact assessment methods in general and the ESM in particular. The Swiss Federal Office for the Environment also reported on positive practical experience with the ESM in Switzerland on the basis of specific case studies. Technische Universität Darmstadt presented a comparative investigation of environmental impact assessment systems which demonstrated that the ESM was fundamentally suitable for corporate use in Europe, also in the context of environmental management systems. A joint concluding statement from the seminar participants emphasised that, in the light of the clear need for a method of this kind, it would be logical and desirable to transpose the ESM initially to German and then to European conditions as soon as possible.

In December 2014, as part of an initiative by Volkswagen AG, the “Ecological Scarcity Method” was transposed to German conditions as an environmental impact assessment method and German Eco Factors were published (Ahbe *et al.* 2014). By publishing the data, Volkswagen AG made the German Eco Factors available for public use and also for other companies wishing to engage in active environmental management at their sites. In most cases, these business activities are not limited to Germany but extend across Europe or worldwide. This predicates the determination of Eco Factors for the member states of the European Union, as described here. Determining Eco Factors for the member states of the European Union and further selected countries worldwide also forms part of Volkswagen's initiative.

2.3 Objectives for European Data

With regard to environmental policy, the European Union (EU) should be considered to be a geographic unit in which targets for the state of the environment and measures for achieving these objectives are defined and implemented. The Lisbon “Treaty on the functioning of the European Union” of December 2007, specifically articles 191–193, sets out the fundamental principles of common environmental policy.

It should be emphasised that the goals of European environmental policy were drawn up independently of any possible use in this or another environmental impact assessment method and that they can equally be applied for other purposes and methods.

Thus, the basic conditions for determining Eco Factors for the European Union as a geographic region with its own environmental policy and own objectives are in place. It should be noted, however, that differences in terms of objectives most certainly exist between EU environmental policy and environmental policies at the level of the individual member states. It may be that national government targets are stricter or laxer than those at EU level.

What may at first sight appear to be an inconsistency is entirely understandable on closer examination: the assessment method is guided by the applicable geographic affiliation and the resultant environmental policy objectives that apply. Competition between targets at a national government level and at an EU level certainly occurs and results in different basic conditions for calculating the Eco Factors, depending on the geographic and political context.

When transferring the Ecological Scarcity Method to EU member states, depending on location, differing normalisation flows, current flows and critical flows must be expected in comparison with the previous data sets for Switzerland and Germany.

Critical flows are synonymous with environmental policy objectives. The different political circumstances in Switzerland, Germany and the EU are an important factor. In line with instructions, the environmental policy objectives of the EU, where these exist, are used as the benchmark for assessment.

In view of its specific remit, the European Environment Agency (EEA) has also made a substantial contribution to determining Eco Factors for EU member states in the present paper. Thanks to wide-ranging documentation and ongoing data exchange with individual EU countries, robust data sets have been obtained for use in the Ecological Scarcity Method which takes proper account of the necessary neutrality and independence of any particular industry.

The present paper largely refers to EEA with its environmental information and stipulations. Where gaps in data sets were identified or no geographically appropriate targets have been set, an attempt is made to find a solution by suitable approximation methods. Such cases are explicitly stated. Crucially, all interpolations or extrapolations and other determinations take their lead as closely as possible from the stated political

will of the environmental authorities and are free from any subjective influences by those carrying out the study.

The companies that base their environmental impact assessments on the data from this study have an associated expectation that the relevant official bodies will, to the best of their ability, maintain, update, revise and extend the available data set. It would be desirable for greater application of the present data also to lead to an increased readiness by all concerned players to update the data periodically and adapt it to the most recent circumstances.

2.4 Project Implementation

The “Ecological Scarcity Method for the European Union” project is an initiative of Volkswagen AG, which commissioned the engineering consultancy SYRCON Dr. Ahbe, Dr. Popp & Partner in Darmstadt to carry out the project. The project ran from July 2013 until March 2015.

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