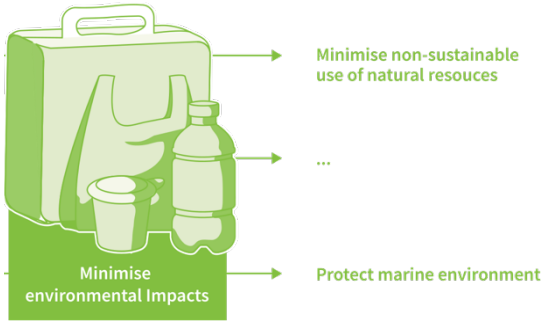
Instruction **Environmental Targets** for Eco Design Projects



Basic Principles

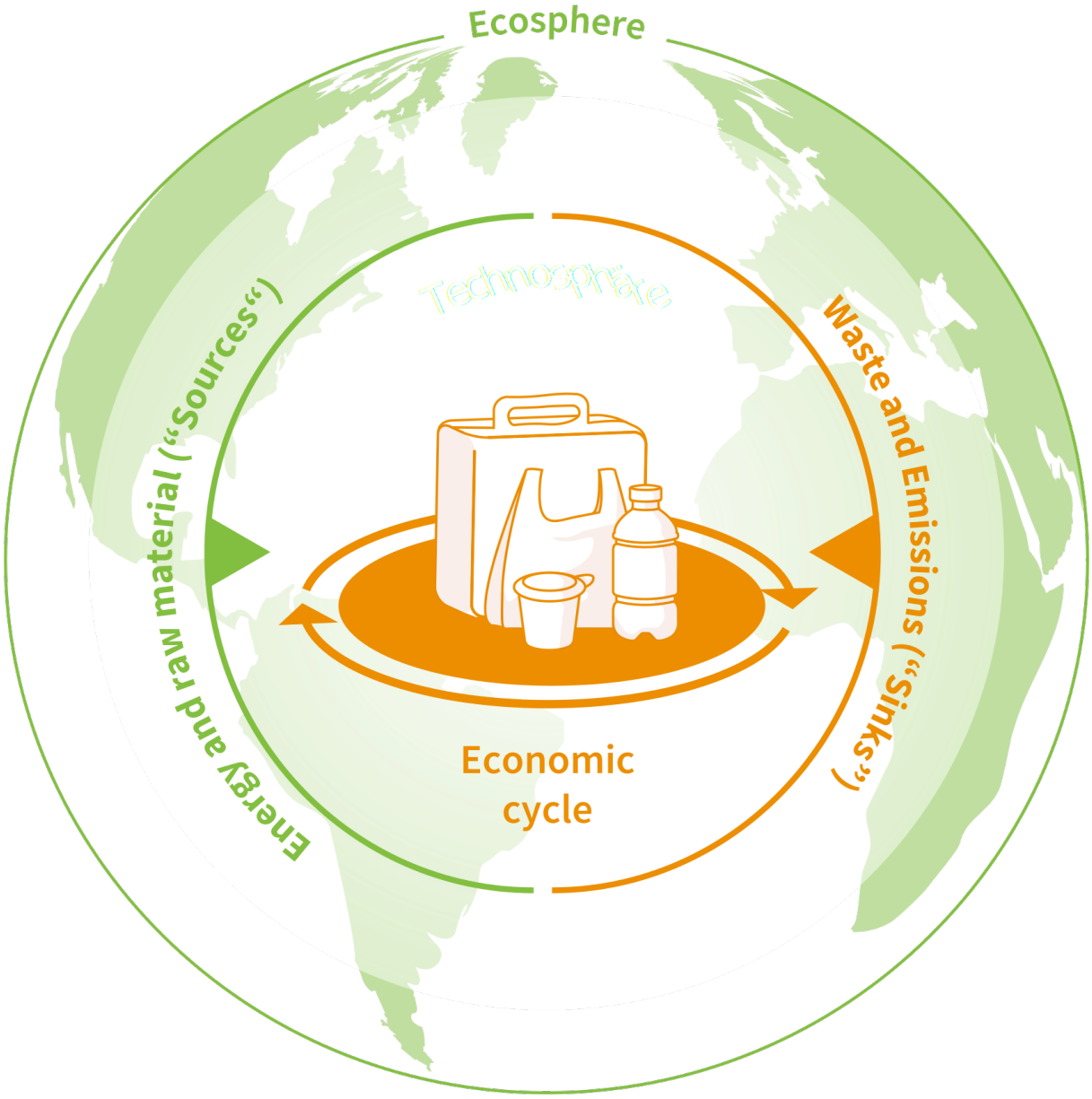
Scope

In order to be able to assess the environmental impacts of products, processes and services, it is important to be aware of important ecological interconnections and to have an overview of various environmental problems and their main causes. This also applies to the topic under consideration here, namely Eco Design of plastic packaging.

Fundamental to this is the understanding that the Earth as an ecosystem is an almost closed system – with two exceptions. These are the continual influx of energy from the sun, which is essential for life and keeps processes on Earth going, and the radiation of energy into outer space. All other processes within the biosphere and the geosphere are in constant exchange with one another and occur as a rule in the form of cyclical processes (water cycle, carbon cycle, nitrogen cycle, sulphur cycle, phosphorus cycle etc). They are in a state of natural balance. These material cycles are the basis for life on Earth.

Human action in the technosphere is embedded in these larger natural material cycles of the ecosphere. Because of the economy's rapidly growing demand for raw materials and energy since the beginning of industrialisation, both the amounts removed from the natural environment and the release of wastes and emissions into the natural environment have increased. This is resulting more and more in the carrying capacity and the function of the ecosphere as a source and a sink being exceeded, and thus in adverse effects on the natural balances in the ecosystems.

These adverse effects are known as anthropogenic environmental impacts. Even if ecosystems are initially able to withstand disturbances, continuing pollution can bring about long-term changes to entire habitats.



The overriding goal of Eco Design is to minimise negative environmental impacts. In order to be able to specifically define relevant goals and select suitable optimisation approaches in Eco Design projects, we need to differentiate between environmental impacts, environmental targets and the corresponding 'measures' (optimisation approaches).

Environmental Impacts

Environmental impacts are effects on the biosphere and geosphere caused by human activities using natural resources. Natural resources include the following: renewable and non-renewable raw materials, the physical space, the environmental media (water, soil and air), biodiversity and flow resources (e.g. sun and wind). Natural resources are used as sources (e.g. extraction of fossil fuels and water) or as sinks (e.g. discharge of wastewater).

The most important environmental impacts will be described briefly below.

- **Climate Change**
  The current warming of the Earth's climate is caused by an increase in anthropogenic greenhouse gases (e.g. carbon dioxide, methane and nitrous oxide) in the atmosphere. Their impact is similar to that of the glass in a greenhouse: they keep the warmth on Earth, causing the global average temperature to rise. Greenhouse gases occur in particular when fossil fuels (mineral oil, coal and natural gas) are burned as well as through agricultural processes (methane and nitrous oxide). The international community of states is committed to the goal of limiting greenhouse gas emissions so that the global average temperature will rise by no more than 2 °C.
- **Acidification of Ecosystems:**
  Acidification means that the pH value of a system (e.g. soil or water body) decreases. A shift in the pH value of precipitation has been observed since the 1970s, whereby it has become ever more acidic ('acid rain'). This has brought about acidification of water bodies, forest dieback and soil acidification, which are caused by acidifying substances such as nitrogen oxides, sulphur dioxides and ammonia, which are emitted from combustion processes (transport and industry) and agriculture. Despite successful reduction of sulphur dioxide emissions, almost half of the ecosystems in Germany are still not protected from damage due to acidification.
- **Overfertilization of Ecosystems (Eutrophication):**
  Eutrophication denotes overfertilization, i.e. an oversupply of nutrients in ecosystems. The substances causing it are nutrients (nitrogen and phosphorus compounds) that are indispensable for building up biomass and thus for preserving intact ecosystems. Excess amounts of these nutrients beyond certain limits have detrimental impacts, however. In the 1970s and 1980s, surface water bodies and ultimately also the (near-shore) seas were exposed to massive pollution from nutrient inputs (especially phosphates). Since then, in particular the development of phosphate-free detergents and thorough treatment of domestic sewage have reduced phosphate pollution. Yet even today the nutrient burden is bringing about critical changes to ecosystems. These are now caused mostly by nitrogen compounds, primarily from agriculture.
- **Biodiversity Losses:**
  Biodiversity is defined as the variety of ecosystems and species as well as genetic variety within species. Species extinction and losses of natural habitats are progressing more rapidly today than ever before. Major drivers include land-use changes, climate change, invasive species and input of nutrients and toxins as well as overuse of ecosystems.
- **Land Use:**
  Land use (e.g. for agriculture, settlements, transport infrastructure and mining) changes habitats directly. The type and extent of land use are decisive factors for the intensity of the intervention. To assess environmental impacts, it is necessary to know the land use type prior to the current one.
  'Land consumption' is the common term for new land uses for human purposes.
- **Water Extraction and Use:**
  Water moves in a natural cycle, alternating between evaporation and precipitation, and is a regenerative abiotic resource. The availability of water varies widely, both locally and regionally. As a rule, it is not used up irreversibly when it is utilised. When

water is used, it may be warmed, extracted from ecosystems or polluted. These effects may have negative impacts on ecosystems. For example, warming lowers the oxygen-binding capacity of water; as a result, species relying on high oxygen concentrations may be displaced or die. The extraction of water from ecosystems can at times cause irreparable damage to them (e.g. wetlands). Discharges of pollutants, in contrast, have various negative impacts on species and ecosystems (e.g. contamination and hormonal changes) by changing the water quality. Moreover, water is used for transport and energy generation. Aquatic ecosystems are changed for these purposes, sometimes actively (e.g. straightening river courses, stabilising river banks, building dams), with correspondingly negative ecological impacts.

The ways in which these environmental impacts take effect are mostly independent of each other, which is why there is no overarching indicator to measure their combined impact. Thus, the core requirement of Eco Design to 'reduce negative environmental impacts' is a complex and multidimensional goal.

Environmental Targets

While, from a scientific point of view, complex interactions do not permit a hierarchy among the most varied environmental impacts, such priorities are regularly set either explicitly or implicitly in the socio-political debate. Climate change mitigation, for example, draws on broad social consensus and clear political targets with quantitative indicators.

Another topic increasingly at the centre of public debate is the goal of reducing marine littering, i.e. the increase in plastic waste in the marine environment due to careless discharges of plastic waste. In a strict scientific sense, marine littering is not in itself an environmental impact, but a visible overload of the natural marine environment's function as a sink. The actual environmental impacts result from the adverse effects on the marine web of life.

Thus, 'reducing marine littering' is an environmental policy 'action objective' which serves the 'impact goal' of protecting the living marine environment.

The same applies to the two environmental policy action objectives 'increasing resource efficiency' and 'intensifying recycling', which are also the subject of many current discussions. Neither is an end in itself. Instead, they serve to 'reduce natural resource use'

and thus reduce/prevent environmental impacts resulting from excessive natural resource use.

Concerning the natural environment as a source, the environmental impacts to be prevented involve in particular those linked to intensive resource extraction, including destruction of natural habitats, adverse impacts on freshwater resources and threats to biodiversity. In terms of the natural environment as a sink, it is about impacts resulting from overburdening the capacity to take up greenhouse gases or other harmful emissions, e.g. eutrophication of water bodies and soils as well as toxic impacts on flora and fauna.

Every systematic implementation of an Eco Design project requires actively setting specific goals (see Step 1 of the proposed management process). These should involve environment-related action goals that are operationalised further when the Eco Design strategy for the project in question is developed.

There is no 'right' or 'wrong' when specific targets for an Eco Design project are set. Yet the selected action goals should fulfil the following requirements:

- **relevant**
  – they address environmental impacts actually caused by the life cycle of the packaging and the packed good in question;
- **influenceable**
  – the environmental impacts addressed by the (action) goals can be changed by modifying the packaging (at the system or packaging level) and
- **communicable**
  – they should be able to be communicated in terms of their relevance and improvements achieved with regard to the various target groups (customers and stakeholders).

When selecting and defining targets, one should also consider that many companies have defined their own environmental policies at the corporate and/or brand level or have formulated environmental messages. The explicit or implicit goals defined there should also be taken into account when deriving goals, for the sake of consistency and, consequently, also credibility. Before they are taken on unchanged in the Eco Design strategy of a packaging project, it should be reviewed whether they meet the requirements mentioned above with respect to this project.

Eco Design Approaches and Measures

Specific changes of packaging design either at the packaging level (e.g. thinner layers of packaging and thus a lower amount of material used) or at the system level (e.g. introduction of a multi-use system and thus also a lower amount of material used, as a result of multiple use cycles) implement the overarching action goals (in this case, for example, the goal of reducing resource use).

In other words, depending on perspective, these are possible Eco Design approaches or Eco Design measures which are being put into practice. These two terms are usually used synonymously.

Implementation Using the Guideline Elements

Assigning Eco Design Approaches to Action Areas and Life-Cycle Stages

Since directly associating Eco Design approaches/measures with both environmental impacts and the environment-related action goals (is bound to) fail because of the multidimensional nature of the impacts and the complexity of potential action goals, a different path was chosen in these guidelines to support Eco Design projects.

Instead, four 'design for ...' elements were defined which link broader fields of action (to which various specific action goals can be assigned) to specific design approaches/ measures along the life cycle of packaging (in concrete terms: planning, procurement, use and disposal).

The following figure provides an overview of this:

This structure makes it possible to proceed very pragmatically when selecting the specific optimisation approaches to be reviewed in an Eco Design project.

Procedure for Selecting the Strategy Elements to be Applied

For one thing, action goals de facto often emerge from environmental-policy or socio-political debates about certain aspects of various life cycle phases. This is the case, for example, in

the current discussions about reducing littering or increasing recyclability, as well as in those about the conditions under which bio-based plastics are grown. Here, the strategy element belonging to the relevant life cycle phase is to be applied very specifically, i.e. the relevant optimisation approaches are to be reviewed using the checklists developed.

For another thing, corporate environmental policies in particular include either 'hard' quantified reduction targets (e.g. 'We seek to reduce the CO2 emissions from our business activities by x per cent.') or 'softer' development targets (e.g. 'We take responsibility for sustainable management of the natural environment.'). In both cases, it is immediately clear which strategy elements are to be prioritised.

However, the strategy elements that have to be used in every optimisation review can also be listed in relation to typical corporate packaging-related environmental goals. They are indicated with an X in the following matrix. Furthermore, additional strategy elements should also be reviewed in these cases to avoid counterproductive negative impacts in other areas that may result from one-dimensional optimisation. These strategy elements to be considered as well are indicated with an (X).

Typical Environmental Targets	OPTIMISED RESOURCE USE	SUSTAINABLE SOURCING	ENVIRON-MENTALLY SOUND USE	RECYCLING
Reducing the Carbon Footprint	X	(x)		X
Reducing material use	X		(x)	(x)
Avoiding littering			X	
Improving recyclability	(x)			X
Using recycled material	X	(x)		
Using biobased material	(x)	X		(x)

Thus it becomes clear even at this stage that it is appropriate in many typical cases in practice to use at least two or three strategy elements when reviewing the optimisation of the environmental characteristics of packaging.

For this reason, regardless of how businesses have defined their potential thematic areas of focus, it is possible to call on practitioners to review the potentials for optimisation in all four strategy elements in truly comprehensive Eco Design projects. Only in this way can a truly holistic approach to Eco Design be put into practice. No particular order for dealing with the individual strategy elements is prescribed, but proceeding along the life cycle makes the process particularly transparent.