



# Instruction Design for **Sustainable Sourcing**



## **Basic Principles**

### The Task of Optimisation

The strategy element “Design for Sustainable Sourcing” is related to how precursor materials are acquired and processed before being used in packaging materials. In these processes, relevant negative impacts on the environment might occur such as the non-sustainable use of rare natural resources, the damage of fragile ecosystems, or spoiling of the air, water and soil. Furthermore, how and by whom these processes are performed is often closely interlinked with the livelihood and the working conditions of people inhabiting the geographic sourcing areas concerned. This can involve, for example, conflicts over the use of land for resource extraction as opposed to food production.

From the point of view of a life cycle assessment, conventional (petroleum-based) plastics go hand in hand with a comparatively large CO<sub>2</sub> footprint and the use of non-renewable resources. For this reason, bio-based polymers or other bio-based materials are frequently chosen for Eco design projects in order to reduce the parameters ‘CO<sub>2</sub> footprint’ and ‘use of non-renewable resources’. But precisely with such precursor materials the possible environmental impact areas mentioned above need to be considered carefully.

The use of recycling polymers also contributes to reducing the parameters ‘CO<sub>2</sub> footprint’ and ‘use of non-renewable resources’. Needless to say, even if the other potential environmental impacts mentioned above play no relevant role here, suppliers should provide secondary materials which offer transparency about the origins of the relevant recycling raw materials as well as ensuring high standards in connection with working conditions and environmental protection.



## Optimisation Approaches

Because in practice it is virtually impossible to track all precursor materials back to their origins, these guidelines on “Design for Sustainable Sourcing” focus on the use of

- precursor materials from responsibly managed suppliers and
- sustainably cultivated bio-based materials.

In the context of sustainable sourcing of materials, the link to environmentally oriented goals is important. Today it is possible to observe to some extent that calls for the use of bio-based materials occur without any specific environmentally oriented goals. However, such a lack of a reference framework of goals prevents the operationalisation of optimisation and the weighing up of advantages and disadvantages.

The question of the suitability of alternative precursor materials is also fundamental. In terms of their technical properties, these either i) correspond completely to conventional plastics produced from fossil raw materials or ii) they exhibit deviating technical properties which require appropriate modifications to the packaging design.

Another fundamental issue is the question of clarifying security of supply. Particularly in the field of bio-based plastics, but also in the field of the quality of more expensive recycled materials, many suppliers are currently unable to guarantee a permanent supply of precursor materials at a consistent level of quality.

With regard to the sustainability of sourcing options, individual relevant sustainability aspects must be taken into account:

- **Competition for the use of land:** If the production of precursor materials takes place on land areas that would otherwise be used for the cultivation of food, a competitive situation results which, from the point of view of sustainability, should be prevented. Avoidance of such competition can be demonstrated by appropriate certifications, supplier certificates and other plausibility arguments.
- **Irreversible negative impacts on natural space and biodiversity:** If the production of the precursor materials is based on previously natural areas of relevance to biodiversity, using land for cultivating bio-based raw materials results in a corresponding impairment of biodiversity and thus, in a wider context, an impairment of the ability of the biosphere to regenerate.
- **Permanent negative effects of production on soil and water:** When plant-based raw materials are produced, soil cultivation and the use of agricultural aids (such as pesticides or fertilisers) can lead to a significant impairment of the soil and the water supply – this should be avoided.
- **Demand for fresh water:** The cultivation of plant-based raw materials is often accompanied by a (very high) demand for fresh water, which through related (intensive) groundwater extraction or the use of fresh water resources can, among other things, lead to competition with the drinking water supply or even to desertification. In addition to the cultivation of renewable raw materials, a high demand for fresh water can also result from



its processing as well as from the implementation of recycling processes under 'non-optimised' process conditions.

- **Ensuring current environmental protection-related process standards** (such as those based on best available technology (BAT)): The processing (or recycling) processes involved in the production of precursor materials can give rise to related negative environmental impacts (in particular, emissions into air and water), which can largely be avoided by using appropriate environmental protection technologies. Given the dynamics of how environmental protection technologies are developing, an updated standard of protection must be used as a reference in each case.
- **Fair working conditions:** The production of the precursor materials sometimes takes place in remote regions, where little alternative employment is available. The maintenance of fair working conditions (e.g. in compliance with the relevant ILO core labour standards) is of particular importance for the living conditions of people living there. The existence of evidence of compliance with minimum criteria for these sustainability aspects plays a major role here.

Finally, the possible (sustainable) sources of the precursor material required must be balanced against defined environmental goals. On this basis, an informed decision must be made in connection with sourcing alternative materials.

### Text inset: What bio-based polymers are available?

The main bio-based polymers are:

- **Biopolyethylene:** Biomass-based polyethylene made out of bio-ethanol obtained from the conversion of sugar cane. It encompasses about 30 varieties of the types HDPE, LLDPE and LDPE.
- **Bio-PET:** Polyethylene terephthalate consists of 70 per cent terephthalic acid and 30 per cent monoethylene glycol (MEG). Bio-based PET uses bio-MEG from sugar cane ethanol.
- **Cellulose:** The most common natural polymer, obtained mainly from wood.
- **PLA:** Bio-based polyactide (PLA) is produced from starch or sugary raw materials.
- **Starch blends** (starch polymers): Starch is the most important renewable raw material after cellulose, and accounts for 80 per cent of the biopolymer market. Mainly corn, potatoes, tapioca and wheat are used for starch production.

For an overview of packaging materials based on biopolymers, see the website of the Institute for Bioplastics and Biocomposites of the University of Applied Sciences and Arts in Hanover: <https://www.ifbb-hannover.de/en/information-on-bioplastics.html>.



## Procedure

In the checklist, a **four-step procedure** is set out for reviewing the options of sustainable sourcing.

- 1) A **review of goals related to sustainability** connected to sourcing precursor materials
- 2) The **review of general suitability of alternative precursor materials** (bio-based or recycling-based raw materials) for parts of packaging materials to be determined
- 3) The **review of whether sustainable sourcing is possible** for precursor materials
- 4) Testing the **decision to source sustainable materials** and implementing it in packaging design

This procedure will be explained below.

### Step 1: Checking Sustainability Goals Related to Precursor Material Sourcing

The first step involves checking sustainability-related goals more closely. In many companies or in the case of major brands, there are general purchasing guidelines/instructions related to working and environmental conditions that have to be observed when sourcing (precursor) materials and (also) packaging. In addition, there may be other basic goals for promoting the company or brand image which relate to the implementation of basic sustainability goals.

To the extent that this has not already been done in the general management process (see the checklist “Management of Eco Design in Packaging Design Projects”), these goals should be made explicit for the further implementation of the strategy element.

| Question   | Instructions   | Result           |
|--|--|------------------|
| Are there specific and up-to-date goals or standards for the environment/sustainability-oriented procurement of precursor materials?   | If <b>YES</b> : If this has not already been done elsewhere, document these goals and (if necessary after repeating them in the overarching process) continue with the next item to be checked.<br>If <b>NO</b> : continue with the next item to be checked.         | [Please fill in] |
| Is there a preferred approach based on relevant environment/sustainability goals, such as bio-based materials?   | If <b>YES</b> : document the goals and proceed to the next item to be checked.<br>If <b>NO</b> : formulate the environmental goals that are still missing and (if necessary after repeating them in the overarching process) proceed to the next item to be checked. | [Please fill in] |
| <b>Result:</b> Existing environment/sustainability-related requirements for precursor materials were reviewed for the packaging project and, where not carried out previously, made explicit and documented. |  |                  |



## Step 2: Checking the Suitability of Alternative Precursor Materials (Bio-Based or Recycling-Based Raw Materials)

In a second step, the basic suitability of alternative precursor materials must be determined.

It is necessary to ascertain from the perspective of the technical material properties (from bio-based or recycling-based raw materials) which parts of the initial option(s) for the packaging, alternative precursor materials could be used for. As with all optimisation tests, the point of reference is that the basic core packaging requirements are still fully met. If the different technical properties of the alternative materials lead to a need to modify the design of the packaging, this is no reason to cease further reviews at this point.

The second key question is whether a supply of the required amount of alternative materials can be ensured in the future. The required (consistent) quality may also be a hurdle.

Reviews can be carried out on the basis of the following review questions:

| Question  | Instructions  | Result           |
|---|---|------------------|
| Can the functional requirements of the packaging (or parts of it) also be ensured with the alternative precursor materials without changing the packaging design?   | If <b>YES</b> : document this result (what alternative precursor materials can be used for which parts of the packaging?)<br>Continue.<br>If <b>NO</b> : state reasons and continue to review step 3.   | [Please fill in] |
| Are there suppliers who are a) capable of delivering the precursor materials required in sufficient quantities (at the required level of quality) and b) are able to provide evidence of meeting sustainability requirements? | If <b>YES</b> : document this and proceed to review step 3.<br>If <b>NO</b> : document reasons (result of the review). Assess the possibility/option of establishing an adequate system of supply.<br>If this is also answered in the negative: document reasons (result of the review).<br>Proceed to review step 3. | [Please fill in] |
| <b>Result:</b> One (or more) packaging option(s) tested for the feasibility of alternative precursor material(s) with elaboration of any necessary modifications.   |   |                  |

## Step 3: Determining Whether Sustainable Sourcing of Precursor Materials is Feasible

The third step is to check the feasibility of sustainable sourcing of (precursor) materials. This does not have to be limited to the sourcing of alternative materials. Even with 'conventional' precursor materials as well as additives and auxiliary materials (e.g. additive packages or compounds, coatings and adhesives or printing inks), it may be advisable to conduct a critical review of the sustainability aspects of their supply chains.

With a view to the sustainability goals specified in step 1 for the packaging project, it is thus necessary to specify which (source) materials the test should initially apply to. The following are conceivable, for example:

- a limitation on alternative materials (as a result of step 1)
- a complete test of all materials. For practical reasons, it may make sense to set a relevance threshold (e.g. all materials with a share of the packaging >1% or >5%)



- deliberate selection of materials for which indications already exist that they are problematic from a sustainability perspective. In practice, such indications often result from debates with critical stakeholders.

After this, it is necessary to ask for which of the materials to be tested there are verification systems that check if sustainability aspects are being observed. For many precursor materials, such verification systems are available on the market. However, they differ on which specific environmental requirements or minimum social standards are to be checked and proven. In addition, test intensity as well as transparency and verifiability of proper test result documentation and the question of the independence of the testing can all vary very widely. Consequently, the type of review is also an important differentiator/distinguishing criterion.

A wide variety of sustainability aspects are examined below, and the informational value of existing detection systems checked:

- **competition for land**
- **irreversible negative impacts on natural space and biodiversity**
- **permanent negative impacts of production on soil and bodies of water**
- **demand for fresh water**
- **ensuring current environmental protection-related process standards** (such as those based on best available technology (BAT))
- **fair working conditions.**

For the various materials to be reviewed, the results for each appropriate verification system must be documented (e.g. in tabular form). It should be borne in mind that not all aspects of sustainability are relevant for every alternative material. For example, in the case of recycling materials, the issues of competing land use or negative impacts on the natural area are not pertinent. This should be taken into account when examining the scope of the various available verification systems.

The documentation that emerges in the course of the assessment based on applying the various sustainability aspects to the verification systems available on the market forms the basis for decisions in step 4 (as a 'suitability matrix' of available verification systems).

The review questions on the checklist are repeated below:

| Question  | Instructions   | Result           |
|---|--|------------------|
| Has it been decided which precursor materials should be passed through the following review steps?  | If <b>YES</b> : document the 'list of materials' and continue<br>If <b>NO</b> : agree upon, establish and document a 'list of materials', then continue.   | [Please fill in] |
| What kind of evidence of adherence to sustainability aspects in raw material production and processing is available for the different precursor materials to be tested? | For precursor materials that are to be reviewed, research and list the appropriate verification systems that are available on the market.<br>If no verification systems are available, options for establishing your own verification system (in cooperation with the supply chain) should be assessed and the result (positive/negative) documented.<br>Following this, continue. | [Please fill in] |
| Is there a form of verification that confirms that competition with land use for food production was avoided?   | If <b>YES</b> : make a note of this in the case of the verification systems involved, including the kind of review.<br>If <b>NO</b> : document accordingly.<br>In the event that this is regarded as <b>not relevant</b> :   | [Please fill in] |



| Question   | Instructions   | Result           |
|--|--|------------------|
|  | state reasons and continue.  |                  |
| Is there any verification that confirms that irreversible negative effects on natural space and biodiversity have been minimised?  | If <b>YES</b> : make a note of this in the case of the verification systems involved, including the kind of testing carried out.<br>If <b>NO</b> : document accordingly.<br>In the event that this is regarded as <b>not relevant</b> : state reasons and continue to the next review item.                                | [Please fill in] |
| Is there any verification that confirms that permanent negative effects of production on soils and water have been minimised?  | If <b>YES</b> : make a note of this in the case of the verification systems involved, including the kind of testing carried out.<br>If <b>NO</b> : document accordingly.<br>In the event that this is regarded as <b>not relevant</b> : state reasons and continue.  | [Please fill in] |
| Is there a form of verification that confirms that fresh water consumption was reduced to a level which guarantees long-term regeneration of local drinking water resources?                                 | If <b>YES</b> : make a note of this in the case of the verification systems involved, including the kind of testing carried out.<br>If <b>NO</b> : document accordingly.<br>In the event that/if this is regarded as <b>not relevant</b> : state reasons and continue.   | [Please fill in] |
| Is there a form of verification that confirms that current environmental protection process standards (e. g. in accordance with state-of-the-art best available techniques (BAT)) were/have been guaranteed? | If <b>YES</b> : make a note of this in the case of the verification systems involved, including the kind of testing carried out.<br>If <b>NO</b> : document accordingly.<br>In the event that this is regarded as <b>not relevant</b> : state reasons and continue.  | [Please fill in] |
| Is there a form of verification that confirms that during production and processing of raw materials fair working conditions were/have been maintained?  | If <b>YES</b> : make a note of this for the various precursor materials (alternatives) in the case of the verification systems involved, including the kind of testing<br>If <b>NO</b> : document accordingly.<br>In the event that this is regarded as <b>not relevant</b> : state reasons and continue.                  | [Please fill in] |
| What kinds of verification of the observation of sustainability aspects during production and processing of raw materials are available for the precursor materials to be sourced?                           | List the (kind of) verification systems available for the relevant (quantities) of precursor materials.<br>If no verification systems are available, possibilities/options for establishing your own verification system (in cooperation with the supply chain) should be assessed and the result documented.<br>Continue. | [Please fill in] |
| <b>Result:</b> Documentation of the assessment procedure for possible precursor materials in terms of existing documents and certificates and their scope (the aspects of sustainability that they address). |  |                  |

## Step 4: Decision on Sustainable Sourcing

In step 4, the final decision on sustainable precursor material sourcing is made.

With regard to the environmental goals of the packaging project (see step 1), the technical and economic applicability of alternative materials (see step 2) and the checking of established sustainability certificates (see step 3), it should be specified:

- whether and where alternative materials (bio-based or recycled) are used and
- for which (precursor) materials of the packaging what type of evidence of the sustainable design of the relevant upstream processes is required.

As already explained in step 2, the use of alternative (precursor) materials due to changed technical properties may necessitate a modification of packaging design (e.g. changed surface weights or seal types). These must be carried out and it must be checked whether



this has an impact on other strategic elements (e.g. the 'design for high-quality recycling'), which may need to be rechecked or additionally tested.

The checklist contains the following test questions for this purpose:

| Question   | Instructions  | Result           |
|--|---|------------------|
| Which precursor materials in the new packaging should be sourced while applying what systems for verifying sustainability aspects?   | <b>Selection</b> of the alternative precursor materials and <b>specification</b> of the required verification systems (or different systems for areas where different requirements apply).<br>Documentation of decisions. | [Please fill in] |
| Were the necessary modifications made in the packaging design appropriate for the chosen precursor-material options?   | If <b>YES</b> : end of step 4.<br>If <b>NO</b> : make the required design modifications, and then end step 4.   | [Please fill in] |
| Does any modification of the packaging required as a result of the use of alternative precursor materials necessitate checking other elements of the Eco design strategy (once again)? | If <b>YES</b> : state reasons and (if necessary, once again) check relevant optimisation approaches.<br>If <b>NO</b> : document results and conclude the review process.  | [Please fill in] |
| <b>Result:</b> Selection of alternative precursor materials while accounting for sustainability aspects and specifying appropriate verification systems in the context of sourcing.    |   |                  |