

ENVIRONMENTAL RESEARCH OF THE  
FEDERAL MINISTRY OF THE ENVIRONMENT,  
NATURE CONSERVATION AND NUCLEAR SAFETY

Project No. (FKZ) 3710 32 310

Report No. (UBA-FB) 001760/E/KURZ

## **Substantive implementation of Article 29 of Directive 2008/98/EC – scientific-technical foundation for a national waste prevention programme**

### **Executive summary**

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On behalf of the Federal Environment Agency (Germany)

**UMWELTBUNDESAMT**

This publication is only available online. It can be downloaded from <https://www.umweltbundesamt.de/publikationen/substantive-implementation-of-article-29-of>. Here, you can also find the complete version (in German) and a German-language summary.

The contents of this publication do not necessarily reflect the official opinions.

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Study completed in: January 2011

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Dessau-Roßlau, June 2013

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## 1 Introduction

Directive 2008/98/EC (EU Waste Framework Directive - WFD) calls upon the Member States to step up efforts to prevent and recycle waste in accordance with the new 5-tier waste management hierarchy. Article 29 WFD obliges the Member States to establish waste prevention programmes. In Germany, the amended Closed Substance Cycle Waste Management Act (Art. 33 Para 1 Sentence 1) stipulates that "the Federation" is to establish by 2013 a waste prevention programme which, in accordance with Art. 33 Para 3 of the Act,

- establishes waste prevention objectives,
- sets out waste prevention measures and assesses the usefulness of the measures listed in Annex 4 or other appropriate waste prevention measures,
- establishes further waste prevention measures as required, and
- determines appropriate specific qualitative or quantitative benchmarks for waste prevention measures adopted, by which to monitor and assess the progress achieved.

The aim of the present research project is to establish the fundamentals for the waste prevention programme, in a process involving the individual *Länder* (states) of the Federal Republic of Germany and the affected public. To this end, the goals of the waste prevention programme are discussed and indicators by which to monitor such goals are formulated. Representative measures established by the precursor project (Dehoust et al. 2010) are consolidated and are placed in relation to the life-cycle stages of products. Proceeding from these examples of measures, the measures coming into question for the programme are selected, characterised and assessed.

## 2 Objectives and indicators

Numerous goals are associated with waste prevention. Attainment of the principal objectives can be supported indirectly by attainment of secondary objectives. Not all prevention measures are equally suited to attain these objectives. The selection of measures therefore proceeds from an assessment of their relevance to environmental impacts.

### 2.1 Principal objectives and secondary objectives

The WFD<sup>1</sup> establishes the following principal objectives for the national waste prevention programme:

- to break the link between economic growth and the environmental impacts associated with the generation of waste<sup>2</sup> and
- to take measures to protect the environment and human health.<sup>3</sup>

Numerous secondary objectives relating to waste prevention that support attainment of the principal objectives are formulated in the WFD. "Prevention" is defined as "measures taken before a substance, material or product has become waste (...)".

The following qualitative and quantitative goals in support of attainment of the principal objectives can therefore be formulated:

1. Reduction of the quantity of waste
2. Reduction of the adverse impacts of wastes
3. Reduction of the content of harmful substances in products and wastes

It is generally presumed that attainment of the secondary objectives simultaneously supports attainment of the principal objectives. However, this is subject to the requirement that they deliver the best overall environmental outcome when considered in a life-cycle perspective. Pursuit of a secondary objective may therefore be abandoned in a specific case if the overall analysis shows that an alternative prevention option delivers a better outcome.

There is a relationship between the quantitative and qualitative prevention of waste and the development of the gross national product. A secondary objective that can be derived from this link is the improvement of the efficiency and quality of production processes and of the environmental impacts attributable to the waste generated by such processes (cf. Table 2-2).

The environmental impacts to be considered are not specified in detail. Art. 13 WFD provides guidance when selecting the impact categories that are to be analysed and are relevant to the environmental impacts arising. The aim here is to ensure "that waste man-

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<sup>1</sup> This study was largely prepared before the adoption of the amended German Closed Substance Cycle Waste Management Act (KrWG: *Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Bewirtschaftung von Abfällen vom 24. Februar 2012, (BGBl. I S. 212)*). This study therefore mainly makes reference to the amended Waste Framework Directive (Directive 2008/98/EC), which was subsequently transposed into German law by the Closed Substance Cycle Waste Management Act. Since 1 June 2012 the Act is the statutory basis for the waste prevention programme in Germany.

<sup>2</sup> cf. Art. 29 WFD and Art. 33 KrWG

<sup>3</sup> cf. Section 6 of the Preamble and Art. 1 WFD



agement is carried out without endangering human health, without harming the environment and, in particular

- a) without risk to water, air, soil, plants or animals;
- b) without causing a nuisance through noise or odours; and
- c) without adversely affecting the countryside or places of special interest."

Table 2-1: Targets in support of principal objectives and secondary objectives

Principal objectives pursuant to Art. 1 WFD	Secondary objectives pursuant to Art. 3 WFD
<p><b>"Prevention or minimisation of the adverse effects of waste generation and management on human health and the environment."</b></p>	<p><b>"Reduction of the quantity of waste"</b>  <b>"Reduction of the adverse impacts of wastes"</b>  <b>"Reduction of the content of harmful substances in products and wastes"</b></p>
<b>Targets</b>	
<ul style="list-style-type: none"> <li>• Reduction of the adverse effects of waste generation and management on human health and the environment in relation to economic output, number of persons employed and overall population.</li> <li>• Reduction of the adverse effects of waste generation and management on human health and the environment overall.</li> <li>• Improvement of the level of information of the public and of stakeholders in industry, commerce, trade and the waste management sector with regard to the adverse effects of waste generation and management on human health and the environment.</li> <li>• Improvement of the level of information of the public and of stakeholders in industry, commerce, trade and the waste management sector with regard to measures to reduce adverse effects of waste generation and management on human health and the environment.</li> <li>• Raising the awareness of the population and of stakeholders in industry, commerce, trade and the waste management sector about taking and supporting measures to reduce the adverse effects of waste generation and management on human health and the environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Improvement of the level of information of the public and of stakeholders in industry, commerce, trade and the waste management sector about the need to reduce waste quantities.</li> <li>• Reduction of waste quantities in relation to economic output, number of persons employed and overall population.</li> <li>• Reduction of overall waste quantities.</li> <li>• Extension of the service life of products.</li> <li>• Increase of the utilisation intensity of products.</li> <li>• Reduction of the content of harmful substances in materials, products and waste.</li> <li>• Reduction of emissions to air, water and soil associated with the generation and management of waste.</li> <li>• Reduction of the impacts on human health associated with the generation and management of waste.</li> <li>• Improvement of the information level of the public and of stakeholders in industry, commerce, trade and the waste management sector about the need and measures to reduce waste quantities, the content of harmful substances in materials, products and wastes and the emissions to air, water and soil associated with the generation and management of waste.</li> <li>• Raising the awareness of the population and of stakeholders in industry, commerce, trade and the waste management sector about the need and measures to reduce waste quantities, the content of harmful substances in materials, products and wastes and the emissions to air, water and soil associated with the generation and management of waste.</li> </ul>

## 2.2 Quantitative and qualitative targets

Under Article 29 paragraph 3 WFD the Member States shall determine appropriate specific qualitative or quantitative indicators for waste prevention measures adopted in order to monitor and assess the progress of the measures. The Member States are therefore under no obligation to formulate quantitative targets.

Arguments in favour of quantitative targets at the level of the national waste prevention programme include the associated binding character of the programme and the better communication of quantitative targets to the public. One approach could be to make specific quantified stipulations for the reduction of waste intensities, characterised by the relation of waste quantities to economic output (e.g. price-adjusted GDP), population figures, employment figures or other such parameters (cf. e.g. Destatis 2010).

However, it is only rarely possible to find a robust substantive basis for deriving specific quantitative targets. There is also a lack of suitable indicators by which compliance could be definitely reviewed and clearly attributed to the individual waste prevention measures or the entire programme. Quantitative targets for waste prevention at the level of national programmes therefore cannot be derived in a technically robust manner. It follows that it is not possible to directly utilise such targets and their degrees of compliance to perform an international comparison of the effectiveness of waste prevention programmes (cf. Article 37 paragraph 4 WFD).

This would require a detailed determination of prevention potential; however, no sufficient data on the current status and boundary conditions are available. Furthermore, it is not possible to perform a causal attribution of the complex cause-effect mechanisms of waste prevention measures, as they overlap with other sectors. The present study thus only sets out qualitative targets – these should, however, be supplemented by quantifiable benchmarks in the course of policy formulation.

The applicability of the targets must be checked for each measure. Through the sum of all individual measures, the waste prevention programme should meet the stipulations concerning the principal objectives in particular (cf. Table 2-1). Each individual measure must meet at least one of the targets. Normally the secondary objectives and the associated targets will complement each other. All measures must pursue the targets while taking account of the principles established by the WFD. In particular, all measures must support or promote attainment of the principal objectives.

## 2.3 Waste prevention indicators

The following section examines specific waste prevention indicators that should be monitored, independently of specific individual measures, for a national waste prevention programme that implements Article 29 paragraph 3 WFD. A distinction is made between indicators of waste prevention success and indicators of the waste prevention process.

The purpose of the indicators is to provide indications, through their development over time, of the success of waste prevention measures and, where appropriate, to identify areas where there is a need for further action. It will generally not be possible to track the success of individual measures directly by means of the indicators. They are rather designed to permit a synoptic overview of the extent to which waste prevention is being implemented effectively as the supreme priority of the waste hierarchy. One constraint

upon all possible waste prevention indicators is that prevention successes indicated by them need not necessarily be causally linked to waste prevention within the meaning of this programme, but can rather be due to general swings in the economy, for instance. The presentation follows a uniform pattern (reasoning, definition, data availability and notes). Operationalisation focuses on absolute per-capita quantities (in relation to population or employment figures). This approach makes it possible to take account of the effects of population trends, while also allowing comparisons at EU level. Table 2-2 gives an overview of the individual indicators.

Table 2-2: Waste prevention indicators

Indicators relating to waste prevention success	Indicators relating to waste prevention approaches
Household waste arisings	Costs as an incentive to reduce waste arisings
Food waste arisings	Reduction in waste arisings attributable to environmental management systems
Construction waste arisings	Relevance of waste prevention to consumers
Reuse of discarded electrical and electronic equipment	Reduction of waste arisings attributable to low-waste procurement
Waste intensity in industrial sectors	
Development of resource productivity	
Hazardous waste arisings	
Packaging waste arisings	

### 2.3.1 Indicator selection

The indicators listed in the left column of Table 2-2 essentially refer to the output streams of key waste fractions. The right column contains indicators guided by the response indicators of the OECD or the output perspective of Arcadis et al. (2010) and relate more to the process of waste prevention. The selection of indicators is based on the selection of effective waste prevention approaches, such as identified by, among others, the precursor study (cf. Dehoust et al. 2010). They also seek to capture the intensity of the incentives provided to prevent waste.

### 2.3.2 Overview and prioritisation

The development of indicators for a waste prevention programme must strike a balance between the need of many actors to receive information on the outcomes attributable to individual measures that is as specific as possible, and, on the other hand, the possibly associated additional effort required to collect and evaluate these data.

It is therefore essential to match the indicators with the Resource Efficiency Programme (ProgRes) of the German Federal Government, which seeks to adopt an internationally pioneering role in the setting of quantitative targets and in the field of indicator development and seeks cooperation in these activities with European partners and institutions (this mainly concerns the resource productivity indicator).

Table 2-3 lists all the indicators and provides an appraisal of data availability. On that basis, it also lists final recommendations concerning introduction of the indicator.

Table 2-3: Overview of indicators

Indicator	Data availability	Prioritisation
Household waste arisings	Data are available in principle	Useful indicator and unproblematic to track
Food waste arisings	Key items of data must be collected from scratch	Urgently required
Construction waste arisings	Data are available in principle	Useful indicator and unproblematic to track
Reuse of discarded electrical and electronic equipment	Data are available in principle, but the bulky waste collection quantities are problematic	Useful indicator
Waste intensity in industrial sectors	Key items of data must be collected from scratch	Useful indicator
Development of resource productivity	Key items of data must be collected from scratch, but this is already under way (e.g. Pro-gress)	Urgently required
Hazardous waste arisings	Data are available in principle, but their development depends greatly upon the statutory setting	Useful indicator
Packaging waste arisings	Data are available in principle	Useful indicator and unproblematic to track
Costs as an incentive to reduce waste arisings	Data are available in principle	Useful indicator and unproblematic to track
Reduction in waste arisings attributable to environmental management systems (EMS)	Data are available in principle, but as yet only for specific EMSs	Useful indicator
Relevance of waste prevention to consumers	Key items of data must be collected from scratch	Urgently required

### 3 Clustering and consolidating measures

In the course of the preparatory work conducted prior to establishing a waste prevention programme for Germany, collected examples of waste prevention measures (cf. Dehoust et al. 2010) were grouped into clusters of measures and were further consolidated. This clustering of examples of measures and the consolidation, based upon the clustering, of possible measures for a nationwide waste prevention programme has several purposes:

- Structuring and streamlining discussions with stakeholders,
- Ensuring relevance to discussions at EU level, which will presumably be structured mainly in line with Annex IV,
- Creating a systematic basis from which to derive suitable indicators of progress,
- Focussing the orientative review upon the intended environmental impacts of the prevention measures.

With the intention of providing a transparent and targeted methodology for the work stage, the step-wise approach outlined below was developed and trialled:

1. Structuring the points of leverage
2. (Review of the existing) assignment of measures to points of leverage
3. Clustering of measures
4. Consolidation of measures

Figure 3-1 gives a schematic overview of the approach.

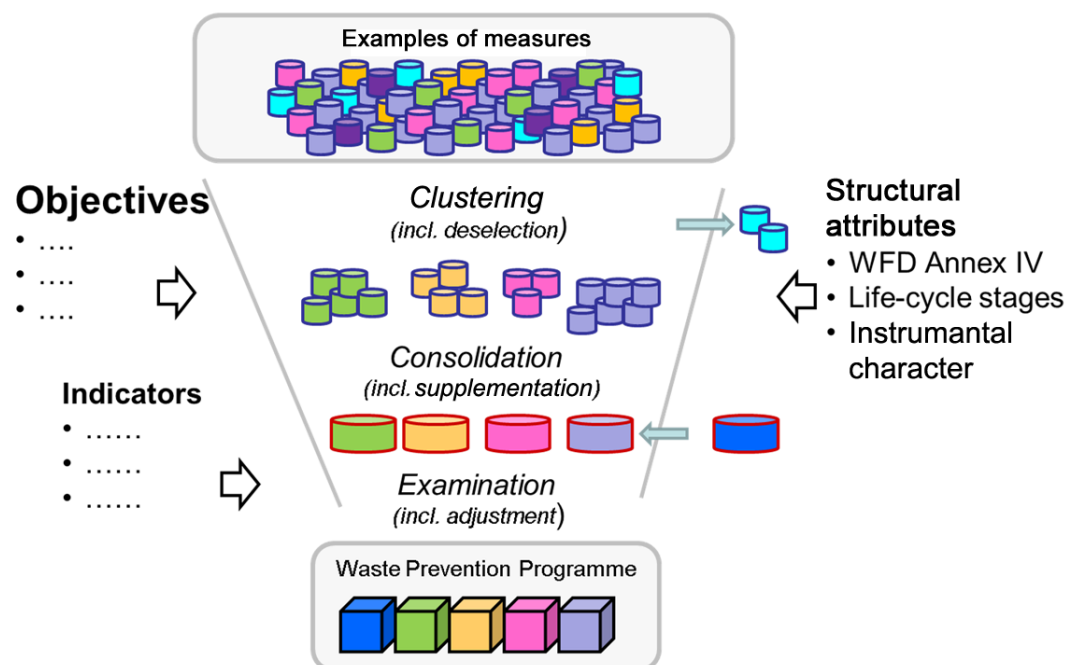


Figure 3-1: Schematic overview of the approach taken to cluster and consolidate measures

This approach takes the approximately 300 examples of measures collected in the precursor project as a starting point for consolidation and clustering. Further examples of measures are included as required.

Using the outcomes of clustering and consolidation, waste prevention measures are then proposed which are suited in principle to be included in a waste prevention programme.

## 4 Assessment of prevention measures

The assessment of waste prevention measures required by Art. 29 paragraph 3 WFD starts from a consideration of the entire life cycle. For the purposes of this study, measures are assessed along the entire value creation chain, from resource extraction through to the final treatment of wastes.

Objectives, targets, means and measures are attributed to individual life-cycle stages. This approach permits an examination of which measures are mutually supportive, in which fields measures are lacking, and how an effective and coordinated interplay can be achieved overall (chain approach).

### 4.1 Assignment of measures

The prototypical course of the life-cycle of a product can be broken down into an array of process stages. The individual prototypical stages provide the basis for points of leverage to which waste prevention measures can be assigned (cf. Figure 4-1).

In specific cases there can be several possible assignments of a measure. Individual stages, such as the use phase, may be further differentiated. Nonetheless, this remaining indeterminacy is unavoidable when structuring processes at the level of abstraction in question here nor is it ultimately detrimental to the purpose pursued by assigning measures to life-cycle stages.

This structuring in terms of the process stages of a prototypical product life cycle permits among other things

- direct identification of interfaces with other policy and regulatory spheres,
- the integration of findings and actions from development and implementation activities that address waste prevention aspects in individual process stages but have not as yet been linked to waste prevention as an overarching issue<sup>4</sup>,
- debate with practitioners operating in the realm of market players.

Following the manner in which the 16 examples of waste prevention initiatives out in Annex IV WFD are structured, points of leverage for waste prevention can be classed in:

- Measures (1-3) that affect framework conditions (Field A),
- Measures (4-10) that affect production and distribution (Field B) and
- Measures (11-16) that affect the procurement, use and discarding of products (Field C).

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<sup>4</sup> An example of this is provided by specific regulations governing substances in production processes which have up to now been discussed and analysed primarily in terms of direct exposure limitation, but not in terms of life-cycle and/or waste aspects.

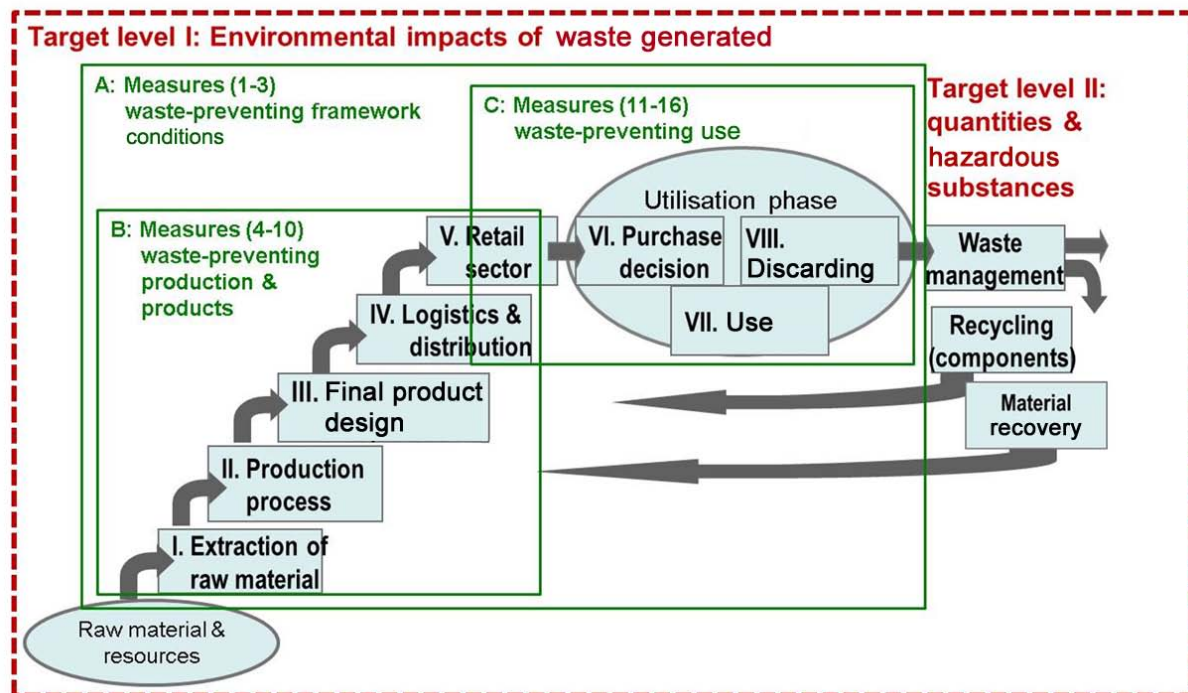


Figure 4-1: Assignment of the fields of measures set out in the Waste Framework Directive (Annex IV) to the points of leverage across the life cycle of products and the target levels of waste prevention

Within the 3 overarching fields of measures A-C and the 16 examples of measures (1-16) subsumed under these fields taken from Annex IV of the Waste Framework Directive, the given examples of measures are further concentrated by combining similar measures.

Such a combination of examples of measures can be guided by their respective "character" in the sense of a regulatory "push-pull" approach. In this approach, measures are classed according to whether they

- set universally binding minimum requirements (usually through regulatory law),
- have a mediating/informing focus and/or
- promote (financially) and/or reward pilot projects or the implementation of good prevention practice.

## 4.2 Assessment method to estimate environmental impacts

As a matter of principle, waste prevention measures always tackle the point at which waste may potentially be generated. They attempt to influence such arisings with regard to their quantity (quantitative approach) and specific contaminant inventory (qualitative approach). The intended or achievable effects are therefore characterised in as great detail as possible for all examples of measures.

Some waste prevention measures focus on directly preventing the environmental pressures associated with waste management. This is particularly the case in Phases I to III (cf. Figure 4-1).

During resource extraction (Phase I) considerable surplus masses arise. The arisings of these mass wastes can potentially be influenced, depending upon the selected resource



deposit and/or the type of extraction and upgrading process. The characteristics of these masses within the waste management process do not present any major recovery potential; generally the masses arising must be disposed of without any particular benefit.

The production of goods (Phase II) is associated with arisings of production-specific wastes. The selection of particularly efficient engineering and strategic solutions can influence the types and quantities of these wastes. These may also be (mineral) mass wastes that are associated with comparatively small potential environmental benefit in their management. However, production processes also give rise to masses that can be returned directly to the production process or can be consigned as "co-product" to – usually high-grade – recovery.

In Phase III, in which product design can be influenced, the above-mentioned waste arisings can be influenced indirectly. Through product design, through a corresponding choice of resources or of procurement sources for semi-finished goods, and through the choice of corresponding production engineering solutions, arisings of surplus masses in resource extraction and arisings of production-specific wastes can be reduced.

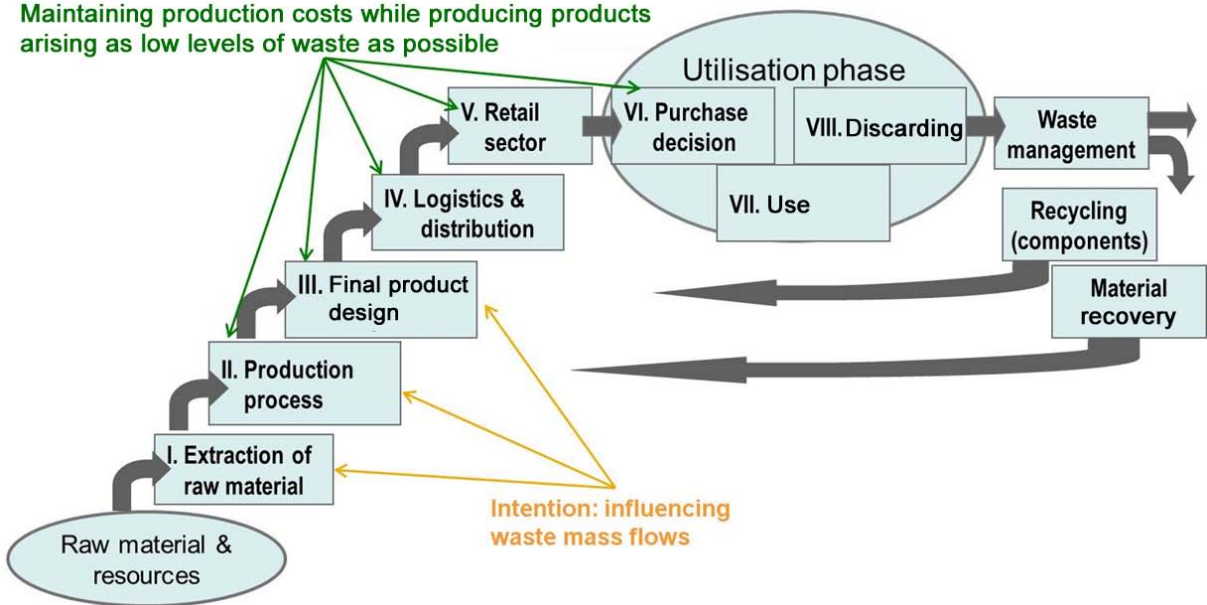


Figure 4-2: Different intentions associated with waste prevention measures

There is also a type of waste prevention measure that can apply to the various phases with the exception of Phase I which, while also seeking to specifically tackle potential waste arisings and to influence these, is concerned less with reducing or preventing the environmental pressures associated with the management (recovery / disposal) of the waste masses. The main aim of such measures is rather to prevent logistics wastes (packagings, damage to vessels or cargoes during transport, surplus quantities) and above all to extend the use phase of products and thus to ensure that the high environmental pressures associated with the production of such products is commensurate to product use, i.e. is offset by correspondingly intensive and/or long periods of product use.

If waste prevention measures succeed in influencing waste arisings in Phases IV, V and VI positively, this delivers the above-mentioned positive effects to a particularly strong de-

gree. For instance, extending the use period prevents manufacturing inputs, and thus also the environmental pressures associated with production and the waste arisings associated with production, especially in Phases I and II.

Furthermore, the wastes arising in Phases III to VI (partly also in II) tend to have characteristics within the waste management process that permit management / recovery that is high-grade and is associated with environmental benefit. On the other hand, with advancing phases of a product and increasing complexity, the effort required to extract recoverable materials can rise or recoverability at the level of materials (as opposed to the level of primary feedstocks) can be called into question fundamentally. Be this as it may, the credits from recovery do generally exceed the debits<sup>5</sup>. To quantify the environmental effect of a waste prevention measure that tackles these stages, both the reduced production inputs and the lost waste material benefits need to be taken into account. For the present study, it was only possible to inventorise the lost waste material benefit in exceptional cases. The environmental benefit arising from the utilisation of wastes is fundamentally smaller than the environmental damage associated with the manufacture of a product that would then arise as waste. The environmental outcome of the waste prevention measure, however, is effectively the net sum that results from setting off the two effects.

A classic life-cycle assessment (LCA) study would provide such an inventory analysis; it was not possible to conduct such an assessment for the purposes of the present study. The following boundary conditions prevent an exact calculation and inventory analysis of environmental impacts:

- The potentially achievable quantitative outcomes of individual waste prevention measures can not be characterised, or at best only in a very rough manner. It is not possible to conduct a (more precise) quantification.
- It was not possible to conduct an inventory analysis of the production inputs within the scope of the present study, particularly for complex and heterogeneous product streams. Data from product LCAs are only available in a few individual cases.
- It is generally the case that a greater number of different management options (i.e. recovery and disposal processes) are available for each of the individual waste fractions. A precise inventory analysis of waste management benefits lost due to prevention would need to consider all of these aspects; this, too, was not possible within the scope of the present study.

Examples serve to explain the basic procedure and to exemplify the environmental outcomes that result from extending the service life and/or increasing the utilisation intensity of selected products. While the measures overall pursue the same or similar goals, it is not possible to determine precisely the contribution made by each individual measure to the (potential) outcome.

Furthermore, such rough assessments could not be carried out for all examples of measures. In some cases only qualitative statements could be made.

The quantitative inventory analysis generally applies the impact category "global warming impact and energy resource conservation" in conjunction with "cumulative material

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<sup>5</sup> As set out, in such cases the benefit delivered by prevention through reuse and other measures to extend service life or increase utilisation intensity is particularly large and is superior to recovery.

requirement". The assessment of the environmental impacts associated with a measure further examines to what extent other environmental effects need to be taken into account if the assessment findings suggest that these may run counter to a positive climate impact.

The environmental assessment of the individual waste prevention measures can thus only be orientative. Its purpose is to provide an indication, as far as possible, of the differences in environmental potential.

### **4.3 Waste prevention potential and environmental impacts of measures to extend product service lives**

A number of selected examples illustrate the positive outcomes that an extension of the utilisation period or service life and increase of the utilisation intensity of consumer goods can have. It is assumed in the assessments that this leads to correspondingly fewer new products being purchased and manufactured.

The following estimates thus provide indications of the waste prevention potential and environmental impacts of the following measures in particular:

- Principal objective: Extension of utilisation period or service life
  - Measures: A 3.1, B III 1.1&2, B III 2.1&2, B III 3.1&2, C VI 3, C VI 4, C VIII 2, C VIII 3, C VIII 6
- Principal objective: Increase of utilisation intensity  
Measures: C VI 5

Ultimately all indirect measures also contribute indirectly to the success of the measures stated.

In addition to the effects presented with regard to climate change mitigation and energy resource conservation, the estimation of which provides a representative indication of the environmental effects associated with several products, the measures deliver for all products savings with regard to further environmental criteria and non-energy resource conservation. Estimates of cumulative resource requirement, in particular, provide an indication of the general level of resource conservation.

Savings of particularly critical resources, such as precious metals and rare earths, are also relevant. It was not possible within the scope of this study to conduct specific inventory analyses for these aspects. A brief characterisation of linkages is provided and a number of representative estimates are performed for

- Washing machines
- Cars
- Printers
- Laptops
- Critical resources.

## 5 Waste prevention measures proposed

The waste prevention measures formulated by consolidating the "clusters" of examples of measures are characterised by means of one or several measures that could be part of a future waste prevention programme.

An example chosen to represent the group of measures will usually not correspond in all points to a measure taken in practice<sup>6</sup>. The measure rather provides an "umbrella" over an array of examples of measures.

When finally reaching agreement on a waste prevention programme and on its implementation and updating, the questions of actors and addressees are pivotal. The formulation of examples of measures therefore involves a clear actor reference (who initiates, who acts).

The examples of measures are characterised in detail in Sections 6 to 8 of the full version of the study. In addition to a textual description, each measure is summarised using a uniform characterisation matrix. The elements of the matrix are summarised prototypically in Table 5-1.

Table 5-1: Uniform characterisation matrix for examples of waste prevention measures

No. and title of example	
Objectives	Link of the measure to the individual target levels and specific targets for action that are to be achieved by means of the measure.
Characterisation	Key framework conditions and cause-effect mechanisms.
Link to measures set out in Study I	Reference to the representative measures defined by the precursor project.
Link to Annex IV WFD	Reference to how the measure matches the catalogue of Annex IV WFD.
Instrumental character	Character of the measure as a waste prevention instrument.
Initiators	Actors who initiate and implement the measure.
Addressees	The addressees targeted by the measure.
Waste prevention potential	Potential estimates made by the authors of this report. These are usually qualitative estimates of the waste quantities that could be affected by the measure on the one hand, and could be prevented on the other. Quantitative statements can only be made in isolated cases.
Environmental impacts	Description of relevant environmental impacts initiated by waste prevention. The focus is placed on climate impact. The environmental impacts are assessed in a representative manner for a number of selected products.
Indicators	Specific benchmarks are stated for the individual measures by which the outcome of a measure can be monitored.
Social impacts	Significant positive or negative social impacts are discussed for the individual measures to the extent that they exceed the normal degree of goal attainment of waste prevention measures. That waste prevention can lead to employment losses due to saved pro-

<sup>6</sup> This is made improbable by the differences between the specific spatial references and other contextual factors in practice.

	duction and waste management effort is trivial and is only mentioned in special cases.
Economic impacts	Significant positive or negative economic impacts are discussed for the individual measures to the extent that they exceed the normal degree of goal attainment of waste prevention measures. That waste prevention can lead to income losses due to saved production and waste management effort is trivial and is only mentioned in special cases.
Conclusion / recommendation	The conclusion assesses the measure as a component of a national waste prevention programme in the view of the authors of this study, and also states, where appropriate, relevant framework conditions or restrictions that must be taken into account when implementing the measure. A recommendation on whether the measure should be included in the programme or not is initially made for each measure without weighing the pros and cons between the measures.

## 5.1 Findings for Field A: General framework conditions

In Field A, i.e. numbers 1-3, the examples of measures listed in Annex IV WFD address the framework conditions of waste generation.

In the view of the authors of this study, these are overarching measures that differ from the measures of Field B (4-10, Annex IV WFD) and C (11-16, Annex IV WFD) in that they do not (only) tackle individual points of leverage (Phases I to VIII in the scheme set out by the authors of this study), but are rather effective in a cross-cutting manner by addressing various points of leverage.

The following 7 measures can be distinguished by their basic character or cause-effect mechanism:

### A General framework conditions

- A 1 Development of waste prevention strategies and approaches
- A 2 Establishment of overarching actor cooperation
- A 3 Waste-preventing design of economic settings
- A 4 Research on waste-preventing technologies and utilisation schemes
- A 5 Supportive programmes and activities to implement waste-preventing strategies and technologies
- A 6 Development and application of indicator systems
- A 7 Concretisation of producer responsibility

## 5.2 Findings for Field B: Design, production and distribution phase

Field B initially addresses resource extraction. Here measures were developed that serve to prevent and optimise the extraction of primary resources.

This is followed by measures addressing the qualitative and quantitative prevention of production wastes in the manufacturing process and the associated production facilities.

Furthermore, final products should of course also be designed in an ecodesign perspective in such a manner that resources are used which are associated with the lowest possible level of waste generation during resource extraction and processing (and environmental pressures in general).

In the past, waste prevention activities have usually focussed on preventing packaging wastes. In the view of the authors of the present study, in many product sectors (such as food, print products, fashion textiles etc.) it is the existing logistics systems that are primarily responsible for surplus quantities arising in the goods distribution process; these systems are particularly environmentally relevant. For it is here that products, some of which are highly refined, become waste without even having been used.

One question was: "How can public-sector measures be formulated that tackle these points of leverage?" The following mechanisms or instruments come into question here:

1. Provision of specific advice,
2. Voluntary agreements or commitments,
3. Requirements under regulatory law,
4. Initiation or support of meaningful labels or marks.

A total of 17 waste prevention measures results for the design, production and distribution phase (Field B):

#### **B I Waste prevention in resource extraction**

- B I 1 Expansion of existing advisory structures to include the aspect of the production of or link to resources extracted in a manner generating minimum amounts of waste
- B I 2 Voluntary agreements with the primary industry
- B I 3 Initiation or support of meaningful marks or labels for primary materials

#### **B II Waste prevention in manufacturing facilities**

- B II 1 Universally binding restrictions at EU level on material inputs to production processes adopted
- B II 2 Adjustment to the state of waste prevention technology of sub-statutory rules and regulations governing installations requiring permits
- B II 3 Provision of support to advance the state of waste prevention technology in facilities
- B II 4 Enforcement of uniform implementation of waste prevention obligations, both in installations requiring permits and those not requiring permits
- B II 5 Institutions and structures to advise facility operators on waste-prevention options
- B II 6 Provision of support for intercompany cooperation on waste prevention
- B II 7 Strengthening of corporate ownership of waste prevention efforts by means of integration into corporate controlling systems

#### **B III Waste-preventing production design**

- B III 1 Introduction and implementation of binding requirements upon waste-preventing product design as a part of implementing measures under the EU Ecodesign Direc-

tive

B III 2 Information dissemination and awareness-raising for waste-preventing product design

B III 3 Adoption of (sub-statutory) rules and regulations in support of waste-preventing or resource-conserving product design

#### **B IV Waste-preventing logistics**

B IV 1 Agreements on voluntary measures to reduce "logistics waste"

#### **B V Waste-preventing retail**

B V 1 Support for voluntary measures by the retail sector to prevent (packaging) waste

B V 2 Provision of information and advice on the prevention of logistics waste

B V 3 Support for low-waste, regional retail

### **5.3 Findings for Field C: Waste-preventing use**

In accordance with their fundamental character, waste prevention measures in this field can be clustered and assigned to the three points of leverage for the use phase of the life-cycle. These include measures that influence purchasing decisions, as well as measures designed to promote general education and public awareness-raising about waste prevention. The third group of measures in this field seeks to promote extended service lives of products through reuse.

In this manner, 17 waste prevention measures were identified for the three points of leverage in the use phase. These are to be assessed with regard to their suitability for the national waste prevention programme in the course of the further process:

#### **C VI Waste-preventing purchasing decisions and uses**

C VI 1 Taxes/levies on packagings and waste-intensive consumer goods

C VI 2 Greater prioritisation of waste prevention aspects in purchasing recommendations

C VI 3 Consideration of waste prevention as a part of meaningful ecolabelling of products

C VI 4 Green / waste-preventing procurement

C VI 5 Promotion of waste-preventing product service systems

C VI 6 Waste-preventing organisation of events in public spaces or public facilities

#### **C VII General education measures and public participation in support of waste prevention**

C VII 1 Inclusion of waste prevention in training curricula for teachers and tutors

C VII 2 Waste prevention in schools and universities

C VII 3 Support for experiential communication approaches undertaken by the public sector

C VII 4 Intensive public participation in waste prevention strategies

**C VIII Waste-preventing discarding**

C VIII 1 Financial incentives and signals for waste prevention

C VIII 2 Support for private and non-profit markets and exchanges for discarded products

C VIII 3 Support for reprocessing structures

C VIII 4 Support for strategies to prevent food waste

C VIII 5 Information and awareness-raising of consumers to promote reuse

C VIII 6 Support for research and development of measures to increase utilisation intensity

C VIII 7 Institution of food wastes as a research priority



## 6 Conclusions

A final comparative assessment was performed on the basis of the previous analyses of the various waste prevention measures, their anticipated waste prevention potentials and the anticipated environmental effects. Legal, economic and social aspects were taken into account as far as possible; in the scope of this study, however, they were not examined in depth and only in specific cases.

The available data do not permit a quantifiable, purely objective prioritisation. As set out, qualified appraisals of waste prevention potential and environmental impacts can usually only be performed at product level and may vary greatly from product to product. It will therefore continue to be only possible for specific implementing measures to conduct an assessment of waste prevention measures that is at least partially quantified. It is to be hoped that a substantially better data availability will be provided in this field by the experience gathered when implementing the waste prevention programme and the individual waste prevention measures and, notably, during their review and evaluation in the coming years.

In the following the measures are grouped in three categories:

- Recommended
- Conditionally recommended / further appraisal needed
- Not recommended

Measures were "recommended" (unconditionally) if they indicate a relevant waste prevention potential or if they have a positive influence on the framework conditions for waste prevention, e.g. through information and awareness-raising or through economic effects. Furthermore, no ecological, social or economic effects should be perceptible in their implementation that could run counter to the measures.

A measure was categorised as "conditionally recommended / further appraisal needed" if the examination revealed that the measure can only exploit its waste prevention potential if

- further supportive socio-economic and statutory preconditions are met or
- other supportive measures need to be taken or
- the effectiveness or the most varied effects of the measure first need to be appraised.

A measure was categorised as "not recommended" if no waste prevention potential could be identified or the associated reduction of environmental pressures is overcompensated by other effects. None of the measures discussed fell into this category.

The following sections summarise the assessments of the authors of this study for the examples of measures proposed. It is to be noted here that the recommendations are made on the basis of the examples of measures, as it is only for these that sufficient concretisation is available.

### 6.1 Field A: General framework conditions

Measures in Field A relate in particular to strategies, approaches, benchmarking, the setting of framework conditions and the provision of research promotion in relation to waste prevention. They aim to raise awareness among and provide advice to stakeholders.

By shaping economic conditions in such a way that external costs tend to be internalised, and through the producer responsibility instrument<sup>7</sup> they lay the groundwork for specific measures in Fields B and C.

Measures to increase product quality and extend warranty periods, which aim in particular to increase the utilisation intensity and service life of products, need to be coordinated closely with measures in Fields B and C that pursue the same purpose.

### **Recommended examples of measures in Field A**

- A 1.1 Development of waste prevention strategies and approaches by state bodies
- A 2.1 Establishment of overarching actor cooperation throughout value chains
- A 4.1 Support for demonstration projects on waste-preventing technologies and utilisation schemes
- A 5.1 Supportive programmes and activities to implement waste-preventing strategies and technologies in product development and production process design
- A 6.1 Benchmarking at the level of public-sector waste management bodies
- A 6.2 Benchmarking at sectoral level

### **Conditionally recommended examples of measures (further appraisal needed) in Field A**

- A 3.1 Development of an implementation strategy for an EU-wide product resource tax  
is recommended under the condition that an appraisal of the achievable governance effect, which yet still needs to be conducted, delivers a positive result and that the introduction of such a tax succeeds in the majority of the EU Member States.
- A 3.2 Removal of environmentally harmful subsidies and public support schemes  
is recommended under the condition that an appraisal, which is required in advance, indicates a relevant waste prevention potential.
- A 3.3 Abolishment of reduced value-added tax rates on meat products  
is recommended under the condition that an analysis of economic and social effects, and of the actually achievable waste reduction potentials, delivers a positive outcome. This recommendation is based in particular on the contribution to climate change mitigation and healthy nutrition.

## **6.2 Field B: Design, production and distribution phase**

### **6.2.1 B I: Waste prevention in resource extraction**

Measures to prevent waste in resource extraction naturally carry particular weight at global level.

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<sup>7</sup> Producer responsibility was classed as Measure A 7, but relates to specific projects in Field B.

The prime instruments here are provision of targeted information and labelling of resources extracted in "environmentally sound" processes, and statutory requirements and/or limits stipulated as conditions of permit award for resource extraction processes in Germany.

#### **Recommended measures in Field B I:**

- B I 1.1 Greater consideration of waste prevention aspects when providing efficiency advice to businesses
- B I 1.2 Extension of existing web-based advisory services to include the aspect of the procurement of low-waste and low-contaminant resource extraction
- B I 2.1 Voluntary agreement with the primary industry in the field of metallic resource processing on the procurement of resources from comparatively environmentally sound and low-waste extraction sites or on the use of secondary resources
- B I 3.1 Labelling scheme for resource-conserving concrete

#### **6.2.2 B II: Waste prevention in manufacturing facilities**

To implement waste prevention measures in relation to production processes, highly effective statutory instruments are already available in the shape of the substance restrictions and approval procedures under REACH, and the options provided by Article 5 para 1 No. 3 and Article 22 para 1 Sentence 2 of the German Federal Immission Control Act (BImSchG). To make use of this regulatory potential close alignment between waste law and other regulatory processes would be needed. In this regard, however, there is a lack of

- an approach towards the uniform concretisation of state-of-the-art requirements in sub-statutory enforcement and action guidance, and
- systematic inventories of the waste intensity of different industrial/commercial processes as a basis for setting priorities in an effective manner.

With regard to producing sub-statutory enforcement and action guidance for waste prevention – which is one of the key points of leverage for waste prevention measures in Field B II – it has become apparent that a more detailed systematic review of the current situation would be desirable from a technical perspective. The orientative assessments carried out are based, of necessity, usually on older market and structure data. An updating of the information base should be carried out here in parallel with efforts to establish and implement specific waste prevention measures.

As concerns integrating material streams within industrial parks with the purpose of preventing waste, the authors of the study found that the measure could deliver theoretical waste-preventing effects. The available pilot experience, however, indicates that the actually realisable potential depends to a very great degree upon the actual (chance) structures at a particular site. It therefore does not appear expedient to make such an integration in the local-spatial context a component of an overarching waste prevention strategy.

With regard to potential synergy effects, various measures should be coordinated closely with measures in Field A:

- Measure B II 3: Provision of support to advance the state of waste prevention technology in facilities with Measure A 4: Research on waste-preventing technologies and utilisation schemes.
- Measure B II 5: Institutions and structures to advise facility operators on waste-prevention options and Measure B II 6: Provision of support for intercompany cooperation on waste prevention with Measure A 2: Establishment of overarching actor cooperation.

### **Recommended measures in Field B II**

- B II 1.1 Initiation of a restriction proposal for cold-set offset printing dyes
- B II 1.2 Support for a restriction proposal for plastics additives (phthalates)
- B II 2.1 Updating of enforcement/action guidance for waste prevention in metal surface treatment through etching and conversion processes
- B II 3.1 Promotion, through the German environmental innovation programme, of the industrial-scale realisation of facility designs with an advanced state of waste prevention
- B II 4.1 Application of Article 22 para 1 Sentence 2 BImSchG to offset printing installations not subject to permit requirements
- B II 5.1 Nationwide expansion and networking of institutions and structures that provide advice to facility operators on Integrated Pollution Prevention and Control, with a focus on waste prevention options
- B II 6.2 Waste-preventing cooperation in value chains
- B II 7.1 Greater focus on waste prevention aspects when implementing ÖKOPROFIT activities

### **Conditionally recommended examples of measures (further appraisal needed) in Field B II**

- B II 2.2 First production of sector-specific enforcement/action guidance for waste prevention in heat-set printing installations  
is recommended under the condition that an appraisal reveals relevant waste prevention potential.
- B II 6.1 Waste-preventing integration of material streams in spatial context (industrial parks)  
is recommended under the condition that an updated information base reveals that there is still a relevant waste prevention potential.

### **6.2.3 B III: Waste-preventing production design**

The implementing measures under the EU Ecodesign Directive can be an effective instrument for universally binding waste prevention efforts. A concerted cross-sectoral approach is key. To be able to make even better use of the implementing measures under the EU Ecodesign Directive as an effective instrument of waste prevention

- an assessment of the service life of products and
- a systematic assessment of aspects relating to problematic substances

should be made a mandatory element of the methodology of the "preparatory studies" under the EU Ecodesign Directive – the Methodology for Ecodesign of Energy-related Products (MEErP).

Moreover, it would be helpful if the empowerment to issue statutory provisions were extended to cover all product groups.

In order to design clusters of measures that are as efficient as possible, measures to promote waste-preventing product design in the context of implementing measures under the EU Ecodesign Directive should be coordinated with approaches to restrict substances used as feedstocks under REACH. The same applies to the dissemination of information on waste-preventing product design, and to the structures established to provide advice to facility operators.

The instrument of producer responsibility established by Article 23 of the German Act for Promoting Closed Substance Cycle Waste Management (KrWG) is also suited in principle to promote waste prevention. This instrument should support and, where appropriate, complement the implementing measures under the EU Ecodesign Directive, which are considered advantageous in view of their direct binding effect across the European Union.

### **Recommended measures in Field B III**

- B III 1.1 Introduction and implementation of binding requirements upon waste-preventing product design as a part of implementing measures under the EU Ecodesign Directive
- B III 1.2 Support for expansion of the EU Ecodesign Directive to further product groups that have waste-preventing potential (exemplified by upholstered furniture)
- B III 2.1 Dissemination of information on waste-preventing product development
- B III 2.2 Efforts to raise awareness of waste-preventing product innovations by means of public awareness activities (competitions, awards).
- B III 3.1 Extension of statutory warranty periods or of liability for defects
- B III 3.2 Giving greater attention to waste prevention aspects when setting quality standards for products

### **6.2.4 B IV and B V: Waste-preventing logistics and retail**

Surplus quantities arising from logistics and logistics-related waste generation are relevant points of leverage for prevention measures. The prevention of logistics wastes requires – partly also because of the very patchy information base at present – very close cooperation with business actors. The optimisation potential of these fields is considered to be high, as is the willingness of retail actors to become active to promote waste prevention. The intensive interface between retail and consumers can also be utilised to disseminate information on waste prevention and raise awareness among consumers.

These life-cycle phases provide an important point of leverage for preventing wastes from foods that are still fit for human consumption. A focus should be placed on promoting regional retail structures. It is advisable to coordinate the various measures closely.

### **Recommended measures in Fields B IV and B V**

- B IV 1.1 Voluntary agreement with the federation of retail establishments on food deliveries to establishments that are tailored more closely to requirements
- B V 1.1 Support for exemplary retail establishments by means of suitable publicity activities
- B V 2.1 Collection, in cooperation with sector associations, of basic data on waste prevention in logistics and dissemination of the data through an Internet platform
- B V 3.1 Campaign to promote sales of regional products, focussing on food

## **6.3 Field C: Waste-preventing product purchase and use, and general education and advice for waste prevention**

### **6.3.1 C VI: Waste-preventing purchasing decisions and uses**

One of the principal objectives of waste prevention overall, and particularly of measures in the field of waste-preventing purchasing decisions and uses, is to increase the utilisation intensity and service lives of products and packagings. The greater the amount of resources consumed to manufacture the products in question, the more effective are efforts to increase utilisation intensity. By promoting green public procurement, the public sector can adopt a model role, while through its high volume of demand it can also assist all further measures.

As regards product labelling, the authors of the present study conclude that the German Blue Angel (*Blauer Engel*) ecolabel scheme is sufficiently established. The alternative of a specific waste prevention label, in contrast, would rather tend to confuse consumers. The measure of giving greater consideration to waste prevention aspects when awarding the Blue Angel label and conducting a dedicated project on this issue is recommended under the condition that an assessment finds that meaningful criteria can be defined for waste prevention and suitable product groups can be identified.

For the waste prevention measures in Field C that primarily target the consumption side, it is essential to coordinate them closely above all with individual measures in Field A. This concerns, in particular, possible taxes or levies on packagings and waste-intensive consumer articles, which must be considered in conjunction with the economic incentive instruments in Field A. For instance, a packaging tax cannot be considered in isolation from a product resource tax. With regard to labelling, it is essential to coordinate activities closely with the initiation or support of meaningful primary material labels. At the same time, these labels should also be applicable to waste-preventing procurement.

### **Recommended measures in Field C VI**

- C VI 1.2 Levy on disposable bags
- C VI 2.1 Internet platform for recommendations on waste-preventing purchasing
- C VI 4.1 Supplementation and concretisation of the public procurement laws, ordinances and administrative guidelines of the Federal and *Land* Governments to include waste-preventing and resource-conserving provisions

C VI 4.2 Promotion and expansion of actor cooperation and information platforms on green public procurement

C VI 5.1 Financial support for waste-preventing product service systems

C VI 5.2 Promotion of waste-preventing product service systems through provision of municipal infrastructure

C VI 5.3 Advisory and research activities, and information and communication campaigns on waste-preventing product service systems

C VI 6.1 Inclusion in municipal statutes of a ban on the use of disposable tableware for events on public premises and in public rooms

### **Conditionally recommended examples of measures in Field C VI**

C VI 1.1 Packaging tax, concretised for the example of beverage containers, recommended under the condition that a legal assessment finds that such tax rates which promise an incentive effect are still permissible.

C VI 3.1 Greater consideration of waste prevention aspects in the award criteria of the Blue Angel ecolabel scheme,

recommended under the condition that an assessment finds that meaningful criteria can be defined for waste prevention and suitable product groups can be identified.

### **6.3.2 C VII: General education measures and public awareness-raising on waste prevention**

Providing information to and raising awareness among children and young people by including waste prevention in curricula and making it a part of everyday school activities are important – they are a precondition to long-term changes in public attitudes to waste prevention. Schoolchildren can act as multipliers in their families, raising awareness there of the issues surrounding waste prevention and resource conservation.

Measures in the field of communication and public participation have a long-term perspective and an indirect effect. While it is difficult to quantify their specific waste prevention potential, overall the relevance of these measures to the successful implementation of more tangible measures is considered to be high. In the field of education measures, in particular, it is important to coordinate various individual instruments carefully within the field in order to deliver maximum waste prevention effects. For instance, the adjustment of curricula should not proceed in isolation from campaigns developed for schools and universities. As efforts to raise awareness among schoolchildren and students of waste-preventing consumption patterns depend upon corresponding goods being available, there should also be coordination with measures in Field B V: "Waste-preventing retail". The measure on public participation in waste prevention strategies calls for close coordination with measures in Field A 1: "Development of waste prevention strategies and approaches".

### **Recommended measures in Field C VII**

C VII 1.1 Review and adjustment of teacher and tutor training curricula to include issues of resource conservation and waste prevention

C VII 2.1 Waste prevention as campaign in schools and universities

- C VII 3.1 Provision of support to municipalities and to environmental and consumer associations to develop and implement experiential waste prevention campaigns
- C VII 4.1 Timely and comprehensive involvement of the public in the design and implementation of waste management measures

### **6.3.3 C VIII: Waste-preventing discarding**

The measures proposed in this field mainly seek to promote second-hand trade and re-processing structures. These measures should be further supported through conducive framework conditions in the shaping of waste charges and through the incentive effects of economic instruments.

The goal is to support actors in this field and to ensure that they are well known and well accepted among consumers. The case of Kringwinkel in Belgium shows that such efforts can substantially increase second-hand sales.

A further form of support is to engage in scientific monitoring and research of the conditions that must be met in order that the second-hand trade can make substantial contributions to extending the service lives of products and advancing the discourse in society and academia on the issues surrounding sustainable consumption patterns.

The measure to develop quality standards for reuse serves to improve acceptance and also to prevent any extension of the service lives of outdated equipment that has very high energy consumption levels or contaminant contents. For instance, refrigeration equipment containing CFC refrigerants should not normally be included in reuse efforts.

Support for research on strategies by which to prevent food wastes is also particularly recommendable in view of the quantity of wastes arising here, the associated environmental pressures, and the fact that such food may be fit for human consumption and should therefore not be wasted.

Various interfaces with measures in Fields A and B arise in Field C VIII; these should be harnessed during implementation. Quality standards for reuse should be coordinated with the general provisions relating to the extension of statutory warranty periods or liability for defects. Support for strategies to prevent food wastes should be coordinated closely with Field B IV (Waste-preventing logistics), as that field also focusses on food waste. There must be an exchange of both fields with the proposed food waste research priority (C VIII 7). In the same vein, research activities designed to increase utilisation intensity need to be coordinated closely with measures intended to promote waste-preventing product service systems.

#### **Recommended measures in Field C VIII**

- C VIII 1.1 Design of charges in line with the polluter pays principle, for instance through weight- or volume-based waste charges, accompanied by advice on waste prevention  

is recommended while noting that the main purpose of this measure is to promote segregated collection and thus waste recycling.
- C VIII 2.1 Technical, organisational and financial support for second-hand exchanges and shops



C VIII 2.2 Reuse of second-hand goods in third countries – creation of environmentally and socially acceptable framework conditions

is recommended while noting that a key priority of the measure is also to create socially and environmentally acceptable working conditions in the materials recycling sectors of the countries of the "global South".

C VIII 3.1 Support for repair networks

C VIII 3.2 Development of quality standards for reuse

C VIII 4.1 Support for the distribution of surplus food to the needy

C VIII 4.2 Support for approaches to prevent food wastes in the supply chain

C VIII 5.1 Concerted action at all levels of government to mark the European Week for Waste Reduction

C VIII 5.2 Nation-wide information platform on the benefits and opportunities of reuse

C VIII 6.1 Support for research & development on measures to extend service lives

C VIII 7.1 Support for research on the prevention of food wastes

#### 6.4 Interplay of measures

It is important to realise that it is not individual measures that will deliver a successful waste prevention outcome, but rather the targeted interplay of an array of measures. As shown repeatedly in this study, there are measures that are mutually supportive and complementary – for these it is generally not purposeful to weigh them against each other, as they will only deliver the desired outcomes in combination.

In the following, the representative interplay of numerous examples of measures is illustrated for the case of the various measures and examples of measures that are helpful and necessary to extend product service lives and intensify their utilisation intensity before they finally become waste – a key waste prevention objective:

First of all, there is a need for measures that help to research the basic data and linkages (e.g. *A 4.1: Support for demonstration projects on waste-preventing technologies and utilisation schemes*, *C VIII 6.1: Support for research & development on measures to extend service lives* as well as *C VIII 7.1: Support for research on the prevention of food wastes*).

Moreover, the information must be made available, and awareness-raising and advisory services must be provided – for consumers (e.g.: *C VI 2: Greater prioritisation of waste prevention aspects in purchasing recommendations*, *C VI 3: Consideration of waste prevention as a part of meaningful ecolabelling of products*; *C VIII 5: Information and awareness-raising of consumers to promote reuse*), producers (e.g.: *B I 1.1: Greater consideration of waste prevention aspects when providing efficiency advice to businesses*, *B III 2: Information dissemination and awareness-raising for waste-preventing product design*) and retailers (*B V 1: Agreements on voluntary measures to reduce "logistics wastes"*, *B V 3: Support for low-waste, regional retail*).

In order that the information on waste prevention is effective in the long term, it is important to anchor it in education and training (*C VII 1: Inclusion of waste prevention in training curricula for teachers and tutors, C VII 2: Waste prevention in schools and universities*).

Creating framework conditions that support and promote longer product service lives is just as important as efforts to raise awareness. Such conditions include economic instruments by which external costs are internalised (e.g.: *A 3.1: Development of an implementation strategy for an EU-wide product resource tax*) thus making resource consumption more expensive and thus also indirectly increasing the cost of waste generation compared to the labour factor. The purpose of this is to make repairs profitable again compared to new purchases. This equally requires a tightening of the stipulations on waste prevention under the Ecodesign Directive (*B III 1: Introduction and implementation of binding requirements upon waste-preventing product design as a part of implementing measures under the EU Ecodesign Directive*) or on product quality improvements (*B III 3.2: Giving greater attention to waste prevention aspects when setting quality standards for products*) or on extended warranty periods (*B III 3.1: Extension of statutory warranty periods or of liability for defects*) in Germany.

In order that consumers with raised awareness are in a position to actually behave in such a manner that wastes are prevented, attractive products and services must be established in connection with innovative utilisation schemes (*C VI 5: Promotion of waste-preventing product service systems*) and second-hand trade (*C VIII 2: Support for private and non-profit markets and exchanges for discarded products, C VIII 3: Support for reprocessing structures*).

Experience has shown that exchange of the necessary facts and information among the various players in the production and supply chain is a key determinant of success if any fundamental changes in product design are to be achieved (as is usually necessary for any substantial extension of service lives). Such intensified communication often requires support, especially in sectors characterised by small and medium-sized enterprises (*A 2: Establishment of overarching actor cooperation*).

To organise the interplay of the measures well and to advance it strategically, state bodies should develop and institute strategies and schemes (*A 1.1: Development of waste prevention strategies and approaches by state bodies*), should act as models of best practice (*C VI 4: Green / waste-preventing procurement, C VI 6: Waste-preventing organisation of events in public spaces or public facilities*) and, through timely and broad involvement of the public (*C VII 4: Intensive public participation in waste prevention strategies*), should help to increase the awareness and acceptance of measures. Financial incentives can amplify signals promoting waste prevention (e.g. *C VIII 1.1 Design of charges in line with the polluter pays principle accompanied by advice on waste prevention*).

The results of measures should be monitored and communicated in a manner that attracts significant public attention already in the implementation phase (*A 6: Development and application of indicator systems*).

The 58 examples of measures described here are representative of numerous further implementation options. They display the broad range of opportunities to promote waste prevention and underscore that a substantial potential to reduce wastes is indeed available.

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