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# Development of scientific and technical foundations for a national waste prevention programme

Summary



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## **Development of scientific and technical foundations for a national waste prevention programme**

### **Summary**

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## **1 Introduction and ambition**

In a new waste hierarchy the amended EU Waste Framework Directive (WFD) confirmed the prevention of waste as a priority measure to protect the environment with regard to the production and handling of waste. Amongst others the Member States are requested to promote waste prevention. According to article 29 paragraph 1 of the Waste Framework Directive the prevention measures have to be planned in terms of waste prevention programs to be created by the Member States until December 12<sup>th</sup> 2013. These prevention programs are to describe existing waste prevention measures and set waste prevention goals. The progress is to be monitored and assessed by targeting appropriate, specific qualitative or quantitative benchmarks for adopted waste prevention measures.

In this project within the Environmental Research Plan (UFOPLAN) the vast number of public sector measures, which do already help to reduce waste in Germany, are presented according to the parameters specified in Annex IV of the Waste Framework Directive and are complemented by corresponding measures from abroad or measures taken from the literature as a basis for the national prevention program in Germany.

The aim of the research project is to provide a well-founded data base on existing measures for waste prevention by public authorities in Germany as well as instruments used on the local, state and federal level - providing the basis for the creation of a national waste prevention program (WPP). Existing national waste prevention measures on the local, regional, national and state level in Germany are recorded and structured considering voluntary, regulatory, and eco-specific instruments.

## **2 Definition of waste prevention measures on the public sector**

In this chapter the concepts of public measures and waste prevention are described.

### **2.1 Public measures**

In this context the authors define measures as targeted actions or activities that are appropriate for achieving the objectives of waste prevention.

Public sector is the collective term for the entire public authorities, in particular the administrative bodies (federal, state, local, community associations) as well as institutions and bodies of public law (Löser 2008). In this context the term is understood in its expanded form, also including public companies.

Public waste prevention measures are defined as measures carried out by the federal government, the Federal States or communities avoiding waste in the public sector itself. On the level of federal states the term includes all measures that are initiated by state authorities, even if they come from district governments. The mu-

municipal level includes local associations together with Federal States, cities and municipalities.

## **2.2 Waste prevention**

To clarify the concept of waste prevention it has to be made clear from the beginning, what is meant by the terms of waste, waste prevention, recycling, reuse and preparation for reuse and how waste prevention is distinguished from recycling.

The definitions and distinctions are carried out on the basis of the Waste Framework Directive (WFD) and are, if necessary, specified for use in this study.

### **Definition of waste**

According to article 3 paragraph 1 WFD waste is defined as any substance or object which its holder discards or intends to discard or is required to discard (no. 1).

### **Waste hierarchy**

In article 4, paragraph 1 WFD ("waste hierarchy") the following order of priority is taken as an underlying order with regard to legislation and policies in waste prevention and management:

- a) prevention;
- b) preparing for reuse,
- c) recycling;
- d) other recovery, for example energy recovery;
- e) disposal.

By applying the waste hierarchy the Member States shall foster those options which provide the best overall environmental performance. If it is justified by life cycle thinking on the overall impacts of the production and management of waste - that is particular according to the results of LCA-material flow analysis - it is obligatory to deviate from the hierarchy for specific waste streams.

### **Waste prevention**

In accordance with article 3, paragraph 12, the term "prevention" includes measures, which are taken before a substance, material or product has become waste and reduce the following:

- a) the amount of waste by reusing the products or extending their life time;
- b) the adverse impacts on the environment and human health of the waste produced



or

c) the content of harmful substances in materials and products.

Under a), the reuse of products and extending their life expectancy are cited as an example of preventive measures to reduce the amount of waste. The list is not to be regarded as concluding. Any use of products, that have not become waste yet, for any other than the original purpose can be regarded as waste prevention provided that the quantity of waste is reduced.

### **Preparing for reuse**

As defined in article 3, no. 16, for the WFD "preparation for re-use" means any recovery method of checking, cleaning or repairing, by which products or components of products that have become waste are prepared so that they can be reused without further pre-treatment.

Consequently, only the preparation for reuse of waste is consistently classified as a measure of waste-management. Since products that are waste can not be reused, as defined in article 3, section 13 of the WFD, but waste can be prepared for reuse as stated in Article 3, paragraph 12 of the WFD, it can probably be assumed that the waste will lose its waste quality by this kind of preparation according to the WFD.

This has to be distinguished from procedures for testing, cleaning and repairing, allowing for the reuse of materials that have not become waste yet. These procedures can be prevention measures, when they meet the criteria of article 3 no. 12 WFD.

### **Reuse**

Article 3 no. 13 describes reuse as "any process in which products or components that are no waste are used again for the same purpose they were originally designed for." This definition restricts the classification for reuse in two ways:

- Only if the materials to be recycled are not waste and
- if they are used for the original purpose,

reuse as defined in accordance with the Waste Framework is involved.

## 2.3 Other terms of reference by the WFD

### Recovery

According to Article 3, paragraph 15 recovery means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function.

### Promotion of reuse

In article 11 (1), the Member States shall take appropriate activities to promote recycling and the preparation for reuse such as

- Promotion of the establishment and support of reuse and repair networks,
- Use of
  - economic instruments,–
  - procurement criteria,–
  - quantitative targets.–

In addition to that article 11 paragraph 2 WFD states requirements for the promotion of recycling, which are not relevant in the context of this study.

## 2.4 Distinction between waste prevention and recycling

In this study legal "grey areas" of the classification of measures as either waste prevention or recycling, e.g. own composting, the plant-internal recycling and reuse of products which already have become waste in a tight interpretation of the definition, have not been resolved, but listed in case of doubt.

## 3 Methodology for the research of waste prevention measures

### Measures in Germany

First, the most relevant ongoing and completed research projects on waste management, resource policy and protection in Germany carried out by UBA, BMU and the BMBF were evaluated in particular with regard to the description of public policies applied and instruments used. This includes completed or ongoing research projects in the area of labelling, information and motivation, accompanying environmental-specific research to product development, green procurement and substitution of dangerous substances.

The Öko-Institute and the Wuppertal Institute based their research on their own extensive preliminary work. In addition to their own experience in the development of

prevention programs on the federal state level, in particular expert interviews with representatives from municipal, waste management companies have been particularly important to provide information on prevention measures.

An additional source for the research of public policies and instruments for waste prevention in Germany were waste management plans of the Federal States in which according to § 29 KrW-/AbfG (at least) since 1999 the aims of prevention are presented every five years. Amongst others concrete specifications in legal environmental requirements affecting quantitative and qualitative prevention of waste have also been described and evaluated.

Another very important source in Germany was a query among the responsible authorities for the issue of prevention in all 16 federal states conducted in agreement with the Federal Environment Agency. This resulted in a vast number of references on current or past projects, which were pursued either via internet research or personal contact with the responsible persons for the project. After the delivery of the interim report to the federal states, there has been a further series of references to specific individual measures that were included in the catalogue of measures.

### **Activities abroad**

For the evaluation of public policies in foreign countries a comparable depth of research as in Germany has not been possible.

However, waste prevention measures from over 20 European and non-European countries have been taken into account thanks to existing contacts and networks of Öko-Institute and Wuppertal Institute (European Topic Centre on Sustainable Consumption and Production, European Environment Information and Observation Network, International Panel for Sustainable Resource Management, UNEP Collaboration Centre on Sustainable Consumption, EUROSTAT etc.). Additionally, relevant EU directives and publications of the state governments and environmental ministries have been evaluated and countries with a special commitment to waste prevention and resource management (eg, Austria, Switzerland etc.) have been particularly considered.

### **Literature research**

In addition governmental measures on waste prevention have been identified in the literature with the help of a structured database research. The selection of research databases consulted both, general and scientific directories as well as subject-specific internet portals.

## **4 Indicators and benchmarks for waste prevention**

Given the large number of identified measures that can be taken by public authorities for waste prevention and the limited financial resources as well as organizational capacities, there is a need for selection and prioritization. Indicators and benchmarks for waste prevention allow comparing the effectiveness of various activities and thus provide an important basis for the creation of a national waste prevention program.

Indicators and benchmarks for waste prevention are an internationally intensively discussed issue. A variety of models that differ significantly in topics, targeted and scope have been developed at various levels (see BIOS 2009, OECD 2000).

With regard to waste prevention the particular problem of trying to measure something that defies direct measurement rises. Statements about the success of a particular waste management activity therefore always require assumptions about the kind and amount of waste would have been generated without the measure. Against the background of the case studies for waste prevention activities previously studied in the project spatial dimensions (local, regional, nationwide), as well as methodically state (effects on individual environmental media) and pressure indicators (environmental impact) can be distinguished, which can be applied for the development of benchmarks.

## **5 Methodical approach for the description of waste prevention measures**

The different researched public waste prevention measures are described in a separated Excel file and summarized in an overview table to enable sorting and filtering by various accessible sources.

A selection of measures is presented in chapter 6.

To ensure a high degree of approximation of the scheme of study with the WFD, the structure is oriented on the system of the 16 bundles of measures specified in Annex 4.

In order to assign kinds of measures, which are not included within these 16 bundles of measure, especially legal measures, an 17th bundle "other measures" was introduced. The following list shows all bundles in a short version:

- Planning - economic instruments to promote resource efficiency,
- Promoting research and development - information - implementation programs,
- Development of indicators for the environmental impact of waste production,
- Promotion of eco-design,

- Information on best available technology,
- Training of licensing authorities,
- Measures in facilities not to be approved,
- Sensitization - funding of specific measures - advice,
- Voluntary agreements - actor cooperation,
- Promotion of environmental management systems,
- Economic instruments, e.g. for purchasing,
- Awareness raising - information,
- Eco labels,
- (Voluntary) agreements with industry and commerce,
- public procurement – promotion of green private sector procurement,
- Informal, economic, logistic or other ways of promoting concrete measures for reuse and repair - networking,
- Other measures

Within the presentation of a bundle of measures, these measures are differentiated also in respect to the initiator of the action, the federal government, states and municipalities:

If the sources contain no data concerning the prevention potential or the success of the measure and also if no comparable data can be derived from other comparable projects, own assessments have not been made in the description of the individual measures.

## **6 Examples of waste prevention measures in Germany and abroad**

In the following subsections, some of the investigated waste prevention schemes which are carried out or are being considered in Germany are listed. The measures are usually undertaken in a multitude of states or municipalities, but only selected individual samples are listed. Since it is not the goal of the study to name all the different initiators of a measure, the listing is only exemplary and not connected to any rating of quality. It either could not and should not be clarified who had first introduced the measure.

## 6.1 Planning - economic instruments to promote resource efficiency

For this set of measures, six measures on the national level, seven measures in the federal states and one in a community have been researched. In addition, one measure was included as a theoretical approach, which would be classified as a measure on the national level.

The measures described here refer to financial incentives and fees, helps to implement legislative requirements and the planning of waste prevention measures, e.g.:

- *Material input tax / resource tax on state level*; incentive to lower material demand by registration and taxation of resource extraction. Concept of the Kathy Bey's foundation and position paper of Die Grünen.
- *Government commission on waste in Lower Saxony*, within the commissions, stakeholders from governments, NGOs and science worked on approaches to prevent and deal with waste.
- *Fifty-Fifty-system for municipal bodies, e.g. schools*, money saved as a result of eco-friendly behaviour shall be available for the local facilities.

### Example from UK:

- *Waste Prevention Framework, UK*; establishment of an inter-sectoral forum on waste prevention, support of eco-design in the production sector in Northern Ireland.

## 6.2 Promotion of research and development - Information - Implementation program

For this set of measures, 20 measures on the national level and seven on the level of the federal states were researched. In particular these are research projects of the BMBF and BMU in order to switch to low-waste production processes and conceptual research on prevention, including:

- *BMBF research program "Neue Nutzungsstrategien"*; research initiative for the promotion and implementation of strategies to restore and reuse used goods, leading to increased resource productivity and avoidance of waste.
- *BMU program to promote investment for demonstration purposes to reduce environmental pollution*; support for high-tech installations especially in small and medium enterprises (SMEs), with a number of detailed projects (see Excel file).
- *Material flows related counting module for hazardous waste, Brandenburg*, development of a tool to easily get an overview of the waste-related costs in

small and medium-sized businesses thus sensitization for the potential of waste prevention measures

### 6.3 Development of indicators for the environmental impact of waste generation

For this set of measures one measure of the federal states has been researched:

- *Development of regional waste balance sheets in the federal states*

#### Example of a European-wide campaign:

- *Campaign "100 kg less waste per capita"; Europe.* The campaign of the European Association ACR+ assumes that in Europe a reduction of 100 kg of waste per capita is enforceable by simple means of prevention.

### 6.4 Promotion of eco-design

For this set 20 measures of the Federation, one of the federal states and two of the communities have been researched. These measures refer in particular to legal requirements of the Federation, which directly or indirectly work towards an eco-design (in particular, prohibited substances for qualitative prevention) and to some consulting programs, including:

- *Product responsibility according to § 22 KrW-/AbfG*
- *Product design for electrical and electronic equipment according to § 4 of the Electrical and Electronic Equipment Law*
- *Prohibition of substances for electrical and electronic equipment according to § 5 of the Electrical and Electronic Equipment Law*
- *Reduction of pollutants in vehicles and vehicle parts in accordance with § 8 AltfahrzeugV*
- *Consulting program for Ecodesign in Hamburg, promotion of research and development projects of small and medium-sized enterprises and them being supported by experts, industrial designers and project engineers for the design and development of environmentally friendly products.*

#### Examples from the U.S.:

- *Electronic Product Environmental Assessment Tool - EPEAT, USA,* Internet portal funded by the EPA - a shopping guide for electronic devices. Only devices meeting prescribed standards are listed.

- *Cradle to Cradle, USA, Europe.* Approach to ecological product design, particularly the abandonment of harmful chemical substances allowing an unrestricted reuse. Involved companies will receive a label and cooperate with each other regarding take back systems. Support from some municipalities especially in the U.S. and in Europe.

## 6.5 Information about best available technology

For this set of measures four measures of the Federation and 18 of the federal states have been researched. Most of the measures are taken from programs under § 5 paragraph 1 BImSchG or have been developed from mostly industry-specific consulting programs for integrated pollution control, also in facilities not obliged to the BImSchG, such as:

- *Consulting Program I to prevent, reduce and recover waste from industry and trade*, consultation for 150 firms in Baden-Württemberg, funded by the waste levy.
- *Industry concepts for plants not requiring an emission control permit*, concepts of the Senate of Berlin for the prevention and recycling of paint and paint sludge from electroplating waste.
- *Cleaner Production (PIUS)*, Internet portal of the federal states North Rhine-Westphalia, Hesse and Rhineland-Palatinate about experiences with projects on resource efficiency, PIUS and Sustainable Business.

## 6.6 Training of the licensing authorities

For this set of measures one measure of the federal states has been researched:

*Seminar for training of trade control officers in Lower Saxony*; implementation of the results of the project "Strategy development of a special waste avoidance and reduction plan for Lower Saxony.

## 6.7 Measures in facilities not covered by the Directive 96/61/EC

For this set of measures three measures of the federal states has been researched, e.g.:

*Implementation program to WHG § 7 in Baden-Württemberg*, enforcement according to water management priorities is complemented by a control system for waste management priorities.



## 6.8 Sensitization - funding of specific measures - advice

For this set four measures of the Federation, 15 of the federal states and four of the municipalities have been investigated. The focus is on the establishment of advisory agencies for waste prevention and resource efficiency and financial support programs, such as:

- *EffCheck - PIUS-analysis*; The EffCheck determines savings for waste, energy, water, materials and emissions in small and medium-sized enterprises.
- *EcoBest benchmarking Project*; Benchmarking program of the environmental alliance of Hesse which measures branch specific standards of corporate environmental and resource protection in the participating companies.
- *Efficiency Agency in North Rhine-Westphalia*, promotion of production and product integrated environmental protection and of environmental management systems by several specific guidance tools: PIUS-Check, Jump-tool product design, resource cost (RKR) and Eco efficiency Check.

### Example from Belgium:

- *Flanders Waste Prevention Plan, Belgium*, concept for incentives for companies, recommendations for local authorities, arrangements with defined target groups, and legal obligations. Aiming at reducing the amount of residual waste per inhabitant to 150 kg per year.

## 6.9 Voluntary agreements - actor cooperation

For this set, three measures of the federation, two measures of the federal states and one measure in a community were researched:

- *Industrial waste coordination committee*; Environmental Alliance Saxony
- *Framework agreements between the government and the foundry industry in Saxony-Anhalt*, reduction of mineral wastes by appropriate internal and external measures.

### Examples from France and the UK:

- *Reduction of direct mail advertising, France*, voluntary agreement under the threat of tax. Aiming at a significant contribution for the reduction of residual waste at 200 kg per inhabitant per year. The potential of unwanted advertising material is estimated at 40 kg per household per year.
- *Courtauld Commitment - Voluntary agreement with leading retailers to reduce packaging waste; UK*. In July 2005, 13 leading retailers signed the

'Courtauld Commitment', a voluntary program to promote innovations in order to minimize packaging waste in households.

## 6.10 Promotion of environmental management systems

For this bundle, two federal measures, four measures of the federal states and one of the municipalities have been researched, aiming especially at the dissemination of environmental management systems EMAS and Ökoprofit, such as:

- *Participation in the European eco-audit scheme EMAS*, the environmental agency Brandenburg is involved in the community scheme for the environmental management system.
- *Ökoprofit*, the environmental management system ÖKOPROFIT is a cooperation project between local authorities and the business community and has been implemented in many European communities.

## 6.11 Economic instruments e.g. for shopping

For this set, six federal measures, two measures on the level of the federal states and eleven measures of the municipalities have been researched. Those relate to financial incentives for eco-friendly behaviour (e.g., promoting the participation in diaper services) and (indirectly) to the avoidance of waste with the help of waste charges based on weight and volume, such as:

- *Subsidies for waste preventing behavior in Dreieich (Hessen)*. Investments improving the environment, inter alia waste prevention, will be subsidized, mainly in private households.
- *Waste fees based on weight with the help of ID Weighing Systems*

### Examples from the Netherlands and Sweden:

- *Carbon Tax on Packaging; Netherlands*; packaging tax based on the climate footprint of packaging materials.
- *Waste incineration tax; Sweden*, the amount of tax for the incineration of household waste depends on the proportion of fossil carbon in the waste and the energy extraction of waste incineration plants. The promotion of waste prevention is an explicit goal.

## 6.12 Awareness raising - Information

For this set of measures, 17 measures of the federal government, 14 of the federal states, and 21 of the municipalities have been researched. These relate in particular to awareness campaigns aiming mostly at consumers and SMEs using Internet portals, partly supplemented by brochures and other waste related information, for example:

- *Overdose - An anti-returnable cans campaign*, "event"-like character, of the BMU, aiming at young people.
- *Using instead of possessing*; investigation and campaign of the Ministry of Environment Baden-Württemberg with the Consumer Direct, concentrating on renting or borrowing instead of buying products.
- *Creation of additional positions for local environmental and waste consultants (including education and training)*

### Examples from the U.S. and Switzerland:

- *Zero Waste Planning, United States*; program to assist municipalities and other constitution to reduce the disposal of waste amongst others by means of waste prevention. The aim was a reduction of 60% by 2008
- *Training of vocational teachers, Austria*; trainers and teachers from different areas were taught in the subject of waste for their different vocational contexts.
- *Solid Waste Authority volunteer program, USA*, programme for volunteer citizens to provide information on prevention, reuse and recycling ("Neighbor-to-Neighbor" and sponsorships for certain regions).

## 6.13 Eco labels

For this set of measures three measures on the national level and one of the federal government have been researched.

- *Promotion of ecological product labels (Blauer Engel)*; Product label for easy and quick orientation during shopping according to environmental criteria established and checked by the Environmental Label Jury, the Federal Ministry of Environment, the Environmental Protection Agency, and RAL GmbH.

## 6.14 Agreements with industry and trade

For this set of measures two measures of the federal states has been researched. Interferences with the package of measures described in chapter 6.9 cannot be ruled out.

- *Voluntary agreement to avoid waste from foundries*, between the State of Baden-Württemberg and all foundries in the federal state. The agreement aims at reducing the land filling of foundry sand by 70% within four years, through the development of internal recycling measures and waste-avoiding technologies.

## 6.15 Public Procurement - promoting private sector procurement

For this set of measures the following measures have been researched: three measures of the federal government. two of the federal states and three measures of the municipality, which only concern the public procurement, including:

- *Public Procurement*, according to § 3 (1) HmbAbfG in Hamburg have to favor environmentally friendly products in the procurement. According to a decree in North Rhine-Westphalia in the public procurement aspects of environmental protection and energy efficiency are to be taken into account.
- *Low-waste management*, competition and program of the city of Dresden which aims at preferring low-waste products with municipal contracts if they are more expensive.

## 6.16 Informal, economic, logistic and other ways of promoting concrete measures to reuse and repair - Networking

For this set of measures, ten measures of the federal government / on the national level, twelve of the federal states and 29 of the municipalities have been researched. Four of the measures of the municipalities lay in the grey area to recycling. Most researched measures affect the promotion of reusable packaging, the reuse of items which would otherwise predominantly end up as bulky waste and construction materials. Examples are:

- *Securing the share of reusable beverage in beverage packaging*, with the help of the guidelines/requirements of the packaging ordinance.
- *Ecomöbel - increasing the rate of recycling old furniture*; cooperation network and Internet platform of different providers for various high-quality and individually designed furniture that is tested on harmful substances, supported from the BMBF.
- *Selection and recovery of state-owned movable property - recovery-liability guidelines*, Hessian recovery policy that orders to check whether movable property no longer needed can be used within the authorities.

- *Establishment of exchange and gift markets*, Online Marketplace to search for offer furniture, appliances, etc. free of charge.
- *Recycling Exchange Ostwestfalen-Lippe*; the working group Recycling e.V. (registered association) is a medium-sized integration business operating under the name "Recycling Market" is running second-hand stores in seven locations. It operates in cooperation and with the support of several municipalities.

#### **Examples from Austria and the UK:**

- *Development/Promotion program "Factory of the Future"*, example: treatment and reuse of single-use medical devices under sustainability aspects, Austria, waste reduction 80% on average.
- *The Real Nappy Campaign, UK*, Manual for switching to reusable nappies and financial support.

#### **6.17 Other measures**

In this category measures are listed that could not be clearly assigned to one of the 16 listed in Annex IV of the WFD.

For other measures 13 measures of the federal government / on the national level, two of the federal states and seven of the municipalities have been researched. They affect mainly legal instruments, e.g.

- *Criteria to determine the state of the art according to Annex III KrW-/AbfG*, including "Use of low-waste technologies" and "Use of less hazardous substances."
- *Incentives for waste prevention in weekly markets and fairs* statutes, the city of Mainz records in the market statutes the waiving of packaging made of PVC, polystyrene foam and aluminium and also the use of returnable container / packaging including the taking back the empties.

#### **Examples from Austria and the UK:**

- *Building Material Control (UK aggregates tax)*, Britain, tax for operators of mining plants (eg quarries) and other organizations commercially mining for building material.
- *Strategy Group Waste Prevention / mass flow management*, Austria; group of all stakeholders involved evaluating waste prevention projects and developing focal themes for the following years.

## 7 Conclusions

The project aimed at providing a compilation of German and international waste prevention measures as a basis of the German waste program. We can draw some preliminary conclusions from the German measures and policies in combination with a comparison of approaches in other countries.

The multiplicity of actions carried out in Germany shows a very broad range of measures and covers almost completely the list of examples in annex IV of the WFD. The collected measures provide a good basis for a nationwide prevention program. Therefore, from the point of view of the authors, the focus should be in particular on good coordination and networking of these individual projects less than on the development of new instruments and measures.

A starting point should be an optimized adaptation of the offer of information to the needs of specific target groups. Information on waste prevention activities can be found in a variety of different places. Partly, actors have started to gather this knowledge. Often there is a lack of opportunities to exchange experiences between stakeholders (producers, retailers, consumers, government, etc.) in order to realize possible learning effects. For the policy makers structures such as the Swedish Waste Council, enabling its participants to exchange experiences in the areas of waste prevention and resource management would also be desirable.

Therefore, one of the important objectives of a national waste prevention program should be to represent a strategic reference framework for the coordination of actions at the federal, state and municipal level.

A common approach - each within its own specific jurisdictions - could certainly generate significant synergies between the different individual projects. In terms of a transition management (Geels 2004), this interaction between the different levels is of crucial importance if substantial changes are to be achieved beyond incremental innovations.

In view of established structures in waste management as well as consumption and production patterns, combined with many years of optimized behaviour and enormous investment in existing infrastructures it is clear that a prevention-oriented policy can not be successful without the involvement of various stakeholder groups: this includes both, the producers, who could substantially contribute to waste prevention by their decisions on product design as well as consumers, who need to be aware of a low-waste consumption pattern and have to be sensitized for waste prevention and resource conservation.

Waste reduction cannot be solved as an isolated problem. In many areas, it requires a change of framework conditions in order to set the necessary incentives for waste prevention. This includes, in particular in the field of qualitative prevention, the prohibitions of further substances, such as successfully implemented in the RoHS directive. But also for quantitative waste prevention deeper interventions are

necessary if basic problems, such as cheap raw materials due to the externalization of environmental costs or the still too cheap disposal of waste should be faced. The chance to revive the issue of waste prevention with a specific program allows to intensify the necessary interaction between different measures and instruments. The success of concrete measures, such as:

- reduction of material consumption in production,
- durable design of products,
- use of low-waste products, with a variety of new approaches to benefit from any product without owning it,
- green procurement,
- extending the product life time by promoting repair and reuse, etc.

depends crucially on the creation of appropriate conditions by the use of legal tools and creating economic incentives, e.g. weight based waste fees in large residential complexes. Equally important is the support through intensive information and motivational programs that usually have to be accompanied even after the introduction of the measures.

Since the success of waste prevention activities can be difficult to measure, the reports rarely contain information on the expected success of quantitative measures. Specific details of the avoided waste are usually found only on concrete activities in specific companies. Therefore a special focus should be on the development of appropriate, meaningful benchmarks, which could also reflect a shift in waste generation into other regions by the import of semi-finished and finished goods/products.

## 8 Literature

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