



Eco-innovations for waste prevention – Best practices, drivers and barriers



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HIGHLIGHTS

- Material flow eco-innovations as strategic goal of waste prevention programs
- Neglect of barriers in the analysis of incentives for waste prevention
- Assessment of cost cutting potentials

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ABSTRACT

Several studies in Germany aimed at the development of a sound database on existing waste prevention measures by public bodies at the local, regional and federal levels. These results are the starting point for the creation of a national prevention program, which has to be presented by all European Member States until the end of 2013 – due to the revised European Waste Framework Directive.

Based on this empirical foundation, this paper draws conclusions with regard to drivers and barriers for eco-innovations in the field of waste prevention. The analysis shows that an optimized adaptation of information on waste prevention to the needs of specific target groups is still missing but could be a relevant driver. With regard to barriers the results of the study show that waste prevention is by no means always a win-win-situation. Institutional frameworks are missing to coordinate the different interests and for the exchange of experiences that could help to realize learning effects regarding innovation approaches.

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1. Introduction

Defining the prevention of waste as top priority of the waste hierarchy – as confirmed by the revised Waste Framework Directive (WFD, Directive 2008/98/EC) – is much more than a simple amendment of ways on how to deal with waste. It is nothing less than a fundamental change of the socio-technical system of waste infrastructures with all its economic, legal, social and even cultural elements (see [Berkhout et al., 2003](#)) and requires a transition from end-of-pipe technologies towards an integrated management of resources (see [ISWA, 2011](#)). Facing the dimension and complexity of this task it is not surprising that waste prevention as policy approach so far has not gained sufficient relevance within the European Union (see [Gentil et al., 2011](#)). The WFD therefore obligates the Member States to develop national waste prevention programs (NWPPs) as a new policy instrument.

Given the differences between aspirations and reality in waste prevention so far, this paper wants to highlight the challenges of such programs with regard to two questions: what could be specific measures to tackle the generation of waste and what are relevant drivers and barriers for waste prevention?

The focus of this paper is less on the waste management system itself (e.g. landfill bans could of course influence the balance between disposal, recycling and prevention), but on the generation of waste in the first place. Therefore waste prevention is put into the context of eco-innovations in production and consumption that potentially might reduce environmental impacts and at the same time save costs for the different actors alongside the value chain (see [Berkhout et al., 2003](#)).

The paper is structured as follows: [Section 2](#) describes the background of waste prevention and national waste prevention programs and their links to eco-innovations. [Section 3](#) analyzes three specific case studies of waste prevention approaches with regard to drivers and barriers. The final [Section 4](#) draws conclusions with regard to the two research questions developed above and identifies further

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need for research towards a more innovation-oriented approach of waste prevention.

2. National waste prevention programs

2.1. Policy instruments for waste prevention

The amended EU WFD confirmed the prevention of waste as a priority measure to protect the environment with regard to the generation and handling of waste. According to article 29 no. 1 WFD waste prevention shall be fostered by national waste prevention programs that have to be developed by the Member States until December 12th 2013. These prevention programs shall describe existing waste prevention measures and have to set specific waste prevention targets aiming at the decoupling of economic growth and environmental impacts associated with the generation of waste. Some Member States have already developed their national waste prevention program according to these requirements, mostly included in waste management plans or other environmental programs, e.g. in Austria, Finland or Luxembourg.

In Germany a research project funded by the Ministry of Environment and the Federal Environmental Agency has developed scientific and technical foundations for a national waste prevention program (see [Dehoust et al., 2010](#)). The project has collected and analyzed the vast number of public sector measures in Germany, which do already help to avoid waste generation. The analysis focused on public measures, but took also into account legal frameworks or economic incentives for private prevention measures. The German case studies are complemented by corresponding measures from abroad or measures taken from the literature as a basis for the national prevention program. More than 290 different measures have been described, covering all fields of action mentioned in annex IV of the WFD:

- measures that can affect the framework conditions related to the generation of waste,
- measures that can affect the design and production and distribution phase and
- measures that can affect the consumption and use phase.

Based on these results generic instruments as possible elements of the German waste prevention program have been developed in a second research project under participation of the Federal States and other public stakeholders (see [Dehoust et al., 2012](#)). A special challenge for such a program has proven to be the ecologic assessment of generic instruments without a specific context of their implementation. Criteria had to be developed under which conditions such instruments can be used efficiently and have relevant impacts. Generic instruments also leave open the question which measures could be used to address which specific products, which actors, or which material flows.

2.1.1. Goals of waste prevention

An extremely important aspect of waste prevention is that its goal is much more complex than it seems to be: every waste prevention measure has to be based on article 1 of the WFD, which states that the directive “lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use”. NWPPs shall concentrate “on the key environmental impacts and taking into account the whole life-cycle of products and materials [...] and should pursue the objective of breaking the link between economic growth and the environmental impacts associated with the generation of waste” (recital 40 WFD).

In addition to these overall goals the directive describes sub-goals regarding the prevention of waste which can be derived from article 3 no. 12 WFD. The given definition states that waste prevention means

“measures taken before a substance, material or product has become waste, that reduce:

- a. the quantity of waste, including through the re-use of products or the extension of the life span of products;
- b. the adverse impacts of the generated waste on the environment and human health; or
- c. the content of harmful substances in materials and products.”

These sub-goals are no ends in themselves. Rather it is assumed that their implementation normally supports to achieve the main goal of minimizing the adverse effects of waste generation on human health and the environment (see [Dehoust et al., 2011](#)). Nevertheless, this leads to a relativization of the objective to reduce the total amount of waste. The generation of waste has to be put in relation to economic growth and its prevention depends on the comparison with other waste treatment options in terms of environmental protection – taking into account life cycle thinking on the overall impacts of the production and management of waste (see article 4 no. 2 WFD).

Given this variety of potentially conflicting goals, it is important to develop a systemic approach that takes into account these interdependencies in order to choose the targets of a waste prevention program (see [Bel, 2010](#)). By choosing such a chain-approach it is possible to assess which particular measures support each other, to identify the areas in which measures may be missing and how the most efficient combination of measures can be achieved, see [Fig. 1](#).

Taking into account the whole product life cycle highlights that waste prevention is not about waste, but about efficient and innovative ways of handling with resources. In order to increase resource efficiency eco-innovations are needed to optimize the whole chain. Eco-innovation can be a new good or service, process, organizational change, marketing method in a company, but also a wider change with systemic implications for economy and society (e.g. new production–consumption models based on services).

Waste prevention places a particular emphasis on material flow eco-innovation. This captures innovations across the value chains of products and processes that lower the material intensity of production and use while increasing the utility of the new good or service. Material flow eco-innovation moves societies from the extract–consume–dispose system of today's resource use towards a more circular system of use and re-use with less total material requirements overall (see [EIO, 2011](#)).

3. Drivers and barriers

The perspective of waste prevention as an eco-innovation always raises the question why the different actors – producers and consumers – do not seem to have sufficient incentives to avoid waste and all the related costs. In Germany just the personnel costs for waste collection and treatment are about 4 billion Euros per year (see [Eurostat, 2012](#)), about the same amount of money has been invested in waste incineration plants only since 2005 (see [Euwid, 2010](#)). A simple, but still of course relevant answer is that the prices of raw materials still do not reflect the “ecologic truth” ([v. Weizsäcker et al., 1995](#)) and relevant costs are externalized (see [Bleischwitz et al., 2011](#)). But nevertheless we see successes for waste prevention in some cities, regions or countries and at the same time the same instruments seem to fail in different contexts (see [Sharp et al., 2010](#)). Therefore specific barriers like lack of knowledge, insufficient diffusion of innovations, lack of finance or established patterns of consumer behavior seem to exist that so far are not taken into account systematically in the development of waste prevention programs.

The following three specific measures for waste prevention shall be described in order to identify such relevant drivers and barriers for eco-innovation. This is of course by no means an exhaustive list, but the attempt to look at different measures that address companies

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