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ASSOCIATION OF CITIES AND REGIONS FOR RECYCLING AND SUSTAINABLE RESOURCE MANAGEMENT

Quantitative Benchmarks for Waste Prevention

A guide for Local & Regional authorities in support of the new Waste Framework Directive

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*The **Association of Cities and Regions for Recycling and sustainable Resource management** (ACR+) is an international network of members who share the common aim of promoting the sustainable consumption of resources and management of waste through prevention at source, reuse and recycling. ACR+ currently has more than 90 members, mainly local and regional authorities as well as national networks of local authorities representing around 750 municipalities. ACR+ also welcomes other key players in the sustainable resource-product-waste management, such as NGOs, academic institutions or private organisations, as partner members.*

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Introduction

INTRODUCTION

The new waste framework directive emphasizes a clear preference for waste prevention over all other municipal waste management practices. The best way to manage municipal waste is to simply not generate it in the first place, so that it doesn't need to be collected, treated, or disposed of. Furthermore, waste prevention benefits greatly outweigh those of recycling, incineration, and land filling in terms of reducing energy use, greenhouse gas emissions, and other environmental impacts. Waste prevention makes sense – environmentally economically and…financially.

Generation of waste, currently estimated at about 600kg/inh/y (EU 27), is continuing to increase across EU. It is clear that the current situation is not sustainable but that absolute decoupling is needed in order to reduce the societal throughput of materials while maintaining or even increasing welfare.

One of the big challenges with waste prevention involves trying to put some quantitative targets and to quantify the results of waste prevention efforts. While recycling tonnages and landfill or incineration input can be weighed on a scale, it is very difficult to measure something that has not been generated in the first place.

This is the reason why ACR+ developed this guide. It consists of a systematic effort to capture, in a European context, the quantities of waste that, through voluntary actions, have been or could be prevented/ diverted from the municipal waste stream. Benchmarking is nothing more than the current research into the performances achieved by local and regional authorities in their waste prevention activities allowing for comparison of best practices with a goal to assess and improve own performances.

This ACR+ guide is based on the analysis of waste prevention examples for 5 main different waste streams (bio-waste, packaging waste, paper waste, bulky waste and other municipal waste) that encompasses the concept of the "quantitative European benchmark" which is 100kg/inh/y less waste.

The cases treated in chapter's 3 to 7 show that often very significant reduction of certain waste streams can be reached if a large fraction of the consumers participate.

Most case studies offer quantitative results in various, but easy understandable, units. However, given the limitation of information and data, a number of case studies are selected only to explore the methodological framework and to illustrate the possible innovation impacts of waste prevention.

While we have attempted to identify as many interesting cases as possible in Europe and elsewhere, this guide merely opens the door to the topic of quantitative targets, indicators and benchmarks in the field of municipal waste.

CHAPTER 1

What's new about prevention within the new waste framework directive?

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1.1. New legal concept

1.1.1. Prevention scope

Following article 3 of the new Waste Framework Directive 2008/98, as of 19 November 2008 "Prevention" is defined as any measure taken before a substance, material or product has become waste, which reduces:

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

It is interesting to note that there was no specific definition of prevention in the “old directives” (Directive 75/442, 91/186 and 2006/12) but the concept covered the development of:

- ➔ clean technologies
- ➔ clean products
- ➔ appropriate techniques for waste disposal.

These last categories of actions appear now to be excluded from the prevention scope. With the new waste framework directive, the scope of “prevention” is clearly limited to those actions which are possible “before a product becomes a waste”.

This aspect is very important because the word “prevention” is sometimes used to cover all kinds of “waste disposal prevention” actions. With the new legal concept, recycling and other recovery actions are clearly viewed as inferior levels in the waste hierarchy.

Another interesting observation is to note that explicitly some part of re-use is under the legal definition of prevention. Following the directive 2008/98, "Re-use" means “any operation by which products or components that are not waste are used again for the same purpose for which they were conceived”. We shall comment further (in §2) on the exact relation between prevention and reuse.

1.1.2. Differentiation in waste prevention

Within the scope of the new legal concept of prevention, the initial differentiation can be made between quantitative and qualitative waste prevention on the one hand and between product (clean product) and plant related (clean technology) prevention on the other hand.

Quantitative waste prevention means partial or complete renunciation of the use of materials or processes that causes the waste.

Qualitative waste prevention means substituting environmentally harmful materials with more environmentally friendly materials.

Product-related waste prevention includes measures:

- ➔ that permit multiple uses of a product or product components by making it easier to dismantle them or;
- ➔ that extend product life and/or increase the ease of repair or;
- ➔ that change the form of a product so that production wastes, the volume of post-use waste and/or potential hazardous substances are reduced.

The concept of extended producer responsibility introduced by article 8 of the directive 2008/98 opens the door for some preventative measures of this kind.

Plant related waste prevention covers measures which change production processes or plant technology to the extent that less waste or less hazardous waste is produced during the manufacturing process.

This differentiation clearly shows that producers, distributors and consumers each have a determinant role to play in waste prevention.

1.1.3. Focus of this guide

The focus of this Guide will be on consumers/citizens and voluntary measures which can be introduced by public authorities to reduce the flow of municipal waste. However, we are convinced that a good waste prevention policy needs also regulatory, organizational and economic measures.

1.2. New legal waste hierarchy

According to the exact wording of the new waste framework directive the following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

1. Prevention
2. Preparing for re-use
3. Recycling
4. Other recovery, e.g. energy recovery, and
5. Disposal

CHAPTER 1

1.3. The scope of the first levels of the hierarchy

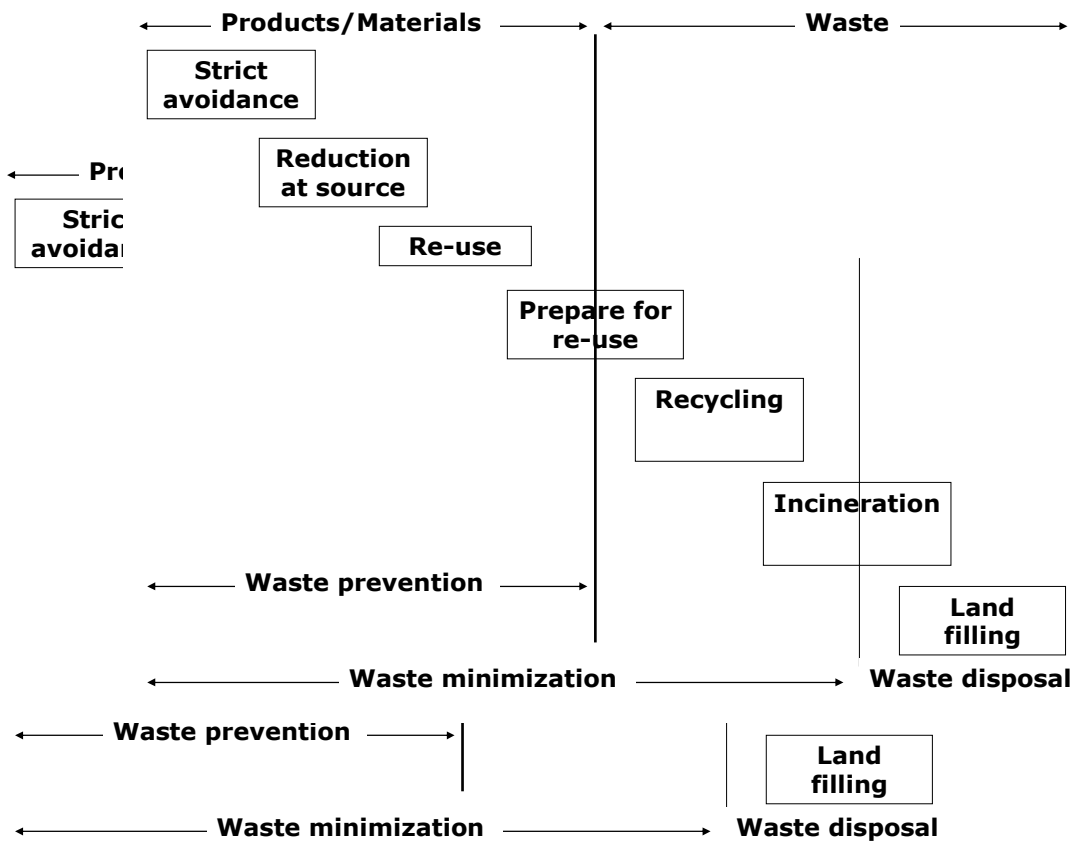
When defining waste prevention the OECD makes a clear(er) distinction between strict waste avoidance, reduction at source and product reuse.

These activities are based on a life-cycle concept which includes production, consumption and distribution processes. For instance, they shall induce a change of input materials, change of purchase, technological changes, changes in design, better operating practices, product changes, introducing re-use of refill systems and…..

The above distinction is useful in order to explain that not all waste prevention activities have similar benefits as shown in the following paragraphs.

The following scheme and definitions is based on an OECD diagram[1] but has been adapted by ACR+ for the purpose of being more distinctive and detailed when taking into account the EC hierarchy and definitions.

The main adaptations refer to broadening the level to which the OECD definitions apply (adding consumers to producer's level) as well as making a distinction between re-use and prepare for re-use.



[1] OECD, Strategic waste prevention – OECD reference manual p.38

1.3.1. Strict avoidance

Examples:

At producer level: through eliminating interim packaging for cosmetics and toothpaste, and avoiding materials that are hazardous to humans or to the environment.
At consumer level: by not purchasing unnecessary goods, by buying services rather than goods, by using refill systems and by preventing delivery of unwanted mail.

1.3.2. Reduction at source

Examples:

At producer level: by using smaller amounts of resources to provide the same product or service, for example by reducing foil thickness.
At consumer level: by buying less hazardous goods, by avoiding the purchase of heavily packaged goods and by purchasing goods that are lighter, more compact and more durable.

1.3.3. Reuse

Examples:

Using shopping bags more than once, domestic reuse of containers, and donation of goods to charities.

1.3.4. Preparing for re-use

EC definition: **Preparing for re-use** means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.

Examples:

A slightly damaged radio brought to a reuse center as waste (discard) is sold as a product after repair. A broken bicycle brought to a charity shop as waste can become a product to be sold (or hired) after repair.

1.3.5. Grey zones for specific situations

From a juridical point of view preparing for re-use is not waste prevention. However, it is clearly an operation which is very close to it and which can contribute to waste prevention without using waste treatment technology (except checking, cleaning and repairing). Hence we shall include those operations in the analysis of this guide.

Similarly, some specialists argue that on-site composting (home, community and institutional) is recycling rather than waste prevention. Actually, everything depends on the intention of the holder: in most cases of composting at source, we can consider that there is direct management of an organic matter rather than the management of a waste.

Practically speaking for local and regional public authorities, waste prevention is anything that reduces the need for organized waste collection.

1.4. Obligation of waste prevention programmes

1.4.1. A true obligation

Following the directive 2008/98, Member States must establish waste prevention programmes not later than 12 December 2013. Such programmes shall be integrated either:

1. into the waste management plans or
2. into other environmental policy programmes, as appropriate, or
3. shall function as separate programmes.

If any such programme is integrated into the waste management plan or into other programmes, the waste prevention measures shall be clearly identified.

From our point of view this is not really a very new kind of legal obligation. The “old” directive stated that there was an obligation to elaborate waste management plans taking into account prevention as a first priority.

However, it was difficult to act in justice against Member States on the basis of such a broad legal formulation. As from now, there is no doubt that waste prevention programmes must be elaborated and a clear timeframe has been developed to do so.

1.4.2. Waste prevention programmes procedure

The directive 2008/98 specifies a few procedural aspects concerning the establishment of waste prevention programmes:

Public participation

Member States shall ensure that relevant stakeholders and authorities and the general public have the opportunity to participate in the elaboration of the waste management plans and waste prevention programmes, and have access to them once elaborated. They shall place the plans and programmes on a publicly available website.

Cooperation

Member States shall cooperate as appropriate with the other Member States concerned and the Commission in drawing up the waste management plans and the waste prevention programmes.

Reporting and reviewing

Every three years, Member States shall inform the Commission of the implementation of this Directive by submitting a sectoral report in an electronic form. This report shall also contain information on the progress achieved in the implementation of the waste prevention programmes and, as appropriate, information on measures as foreseen by article 8 on extended producer responsibility.

The report shall be drawn up on the basis of a set questionnaire or outline established by the Commission. The report shall be submitted to the Commission within nine months of the end of the three year period covered by it. The Commission shall send the questionnaire or outline to the Member States six months before the start of the period covered by the sectoral report. The Commission shall publish a report on the implementation of this Directive within nine months of receiving the sectoral reports from the Member States.

In the first report that intervenes by 12 December 2014, the Commission shall review the implementation of this Directive and will present a proposal for revision if appropriate. The report shall also assess the existing Member State waste prevention programmes, objectives and indicators.

Evaluation of plans and programmes

Member States shall ensure that the waste management plans and waste prevention programmes are evaluated at least every sixth year and revised where appropriate.
The European Environment Agency is invited to include in its annual report a review of progress in the completion and implementation of waste prevention programmes.

1.4.3. EC Support

To help the Members States, the European Commission must elaborate on prevention guidelines and shall create a system for sharing information on best practices regarding waste prevention.

Besides, following art.9 of Directive 2008/98, the Commission shall submit:

1. by the end of 2011 :
   - ➔ … an interim report on the evolution of waste generation and the scope of waste prevention
   - ➔ … a product eco-design policy and
   - ➔ … an action plan to change the current consumption patterns
2. by the end of 2014 :
   - ➔ … waste prevention and decoupling objectives for 2020.

1.4.4. Waste prevention programmes content

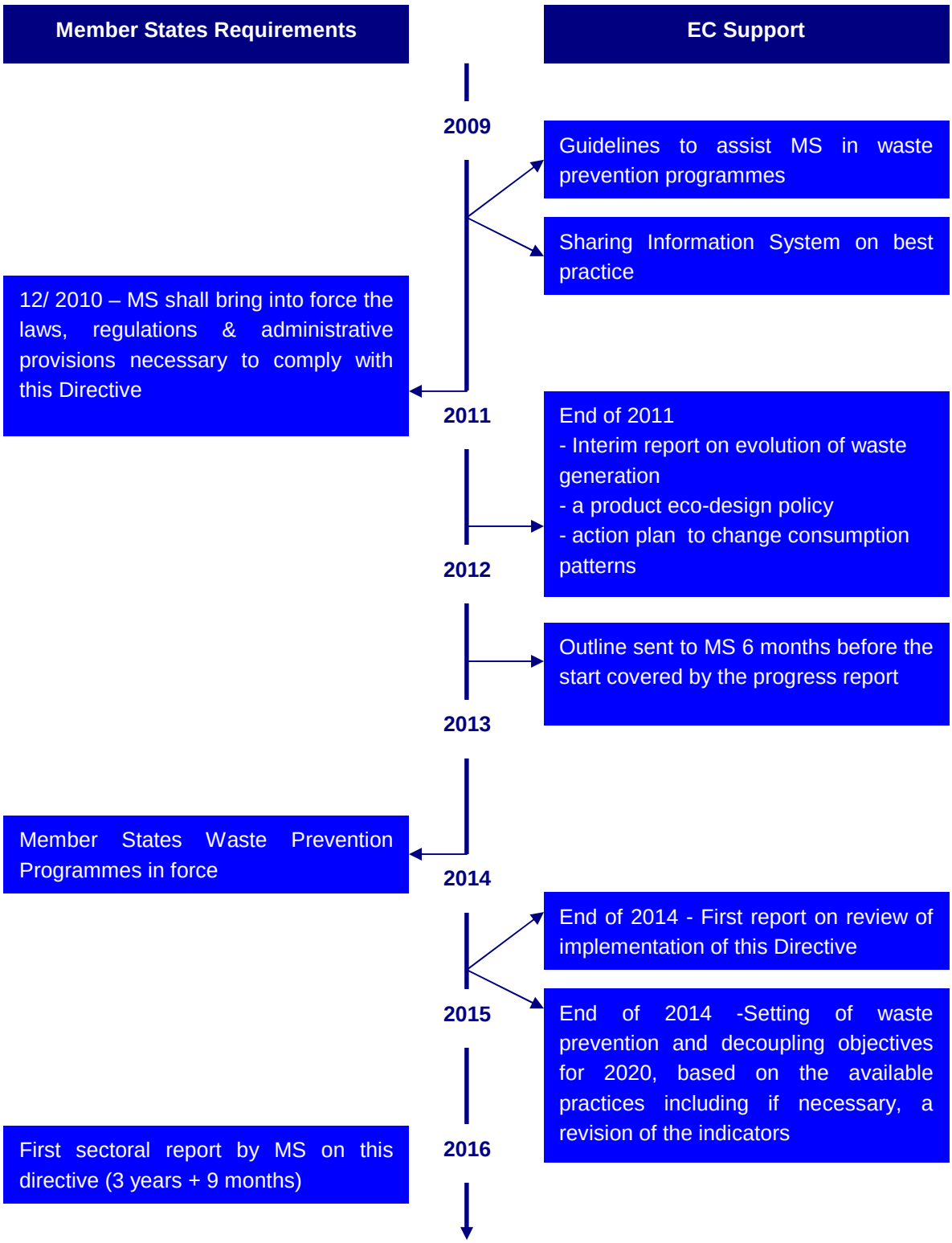
According to article 29, Members States shall determine before 2014:

1. Prevention objectives
2. Appropriate Specific Qualitative or **Quantitative benchmarks**; and may determine quantitative & qualitative targets and indicators for the same purpose.

The aim of such objectives and measures shall be to break the link between economic growth and the environmental impacts associated with the generation of waste.

1.4.5. Agenda

Summarizing, we have thus the following agenda for the coming years:



1.4.6. Examples of waste prevention measures:

Member States are invited to evaluate the usefulness of measures listed in annex IV of the directive 2008/98, including:

- planning measures
- research and development
- indicators of the environmental pressures
- promotion of eco-design
- information on best available techniques
- training of competent authorities
- measures under Directive IPPC
- support to business
- voluntary agreements
- environmental management systems
- economic instruments
- awareness campaigns
- eco-labels
- product panels
- public and corporate procurement
- support to or establishment of accredited repair and reuse-centres.

According to ACR+, these measures can also be presented as in the figure hereunder. It is important to consider and develop appropriate measures in relation to all the existing instruments currently used in various ways by most public authorities.

Organizational, regulatory measures ➔ creation of a specific administration in charge of promoting waste prevention (particularly dematerialization/ eco-consumption) ➔ creation of a public observatory of consumption patterns ➔ creation of eco-counselling services ➔ integration of waste prevention criteria in public procurement tenders	**Economic instruments** ➔ differentiated waste taxation systems ➔ funding of R&D programmes ➔ funding of pilots-projects ➔ funding of networks of prevention actors ➔ incentives for actors performing well in the field of prevention ➔ deposit systems
Voluntary and educational measures ➔ eco-design ➔ voluntary agreements with industry sectors ➔ publication of guides ➔ diffusion of best practices ➔ benchmarking ➔ competitions or shows ➔ development of educational programmes and training ➔ creation of demonstration sites or of exhibitions ➔ setting up of forums of waste chain actors ➔ eco-teams	**Communication campaigns on:** ➔ immaterialized products ➔ eco-friendly products ➔ proper use of products ➔ repair possibilities… ➔ European Week for Waste Reduction (EWWR)

CHAPTER 2

Quantitative benchmarks for waste prevention: what are we talking about ?

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2.1. What are the legal requirements?

Following Article 29 *(of the new Waste Framework Directive):* ***concerning "****Waste prevention programmes" :*
'Member States ***shall determine*** *appropriate specific qualitative or quantitative benchmarks for waste prevention measures in order to monitor and assess the progress of the measures and* ***may determine*** *specific qualitative and quantitative targets and indicators, other than those referred to in paragraph 4, for the same purpose'.*

So, we have three different concepts: benchmarks, targets & indicators. How do they relate to each other?

Benchmarking can be defined as : "systematic research into the performance and the underlying processes and methods of one or more leading reference organizations in a certain field, and the comparison of one's own performance and operating methods with these ''best practices'', with the goal of locating and improving one's own performance".

Translated to the subject of municipal waste prevention this definition could be written as follows:
'Benchmarking for waste prevention measures is a systematic research into the waste prevention activity performances and the instruments used for achieving this by leading Member States (MS), cities and regions, and the comparison of their performances and methods used with these best practices, with the goal of assessing and improving cities and regions' performance'.

Consequently, waste prevention benchmarking

- ➔ is a systematic process - it must have a framework and use a standard set of attributes that are measurable
- ➔ must be performed in a specific area or activity in relation to waste prevention
- ➔ must help to identify and adopt best known practices that can lead to improved performance.

A benchmark is different from the adoption of targets and/or indicators in the sense that it is a reference, comparison method that allows for performance measurement. However, benchmarking is more than just running a comparative analysis or copying strategies. It is a matter of understanding those practices that make organizations the best-in-class and then adapting those practices for own use.

As benchmarks often refer to the comparison of performances towards the setting of targets and indicators it is important to understand what is meant exactly by targets and indicators.

"Targets" can be defined as usually desired or promised levels of performance. They may specify a minimum level of performance, or define aspirations for improvement.' Targets are time bound, they define a "desired", "promised", "minimum" or "aspirational" level of service and they are measured via performance indicators.

"Indicators" specify how the achievement of targets will be measured and verified. They provide the basis for monitoring activity progress (completion of work program tasks, delivery of outputs and progress towards outcome).
Indicators are established in response to the question: 'How do I know whether or not what has been planned is actually happening or has happened?' We look for indications or signs to help us. There are no absolute principles about what makes a good indicator; however the SMART (Specific, Measurable,

Attainable, Relevant, Timely) characteristics for identifying indicators are useful. Where possible, indicators should incorporate elements of quantity, quality and time.

Legally, it's very important to note that the new Waste Framework Directive introduces an obligation to adopt benchmarks "if appropriate" and we can consider - as we shall comment here after – that some quantitative benchmarks are necessarily appropriate in the field of waste prevention.
Contrary to what concerns benchmarks, the final prescription of the new waste framework directive provides purely facultative requirements for targets and indicators. This wording is less ambitious than the content of the initial proposal of the Commission which included legal obligations of targets and indicators.

2.2. What is the rationale behind "waste prevention benchmarks"?

The idea behind benchmarking waste prevention data is to transfer successful know-how, concepts and instruments from one member state to another (or from a regional or local authority to one other)

The fundamental idea behind benchmarking waste prevention programmes is the comparison of cities and regions programmes, including quantitative data as overall waste flows and/or separate waste flows as well as processes and methods put in place to achieve those quantitative results. Its aim is to identifying best practices. Thus, each town and region can determine its position in the performance ranking and can seek to learn and benefit from the best practice.

Benchmarking, furthermore, is not limited to a pure performance measurement but rather focuses on continual improvement. Therefore repeated studies or analysis are required at regular intervals.

In regard to the comparability of data, however, the benchmarking process should take care of many parameters. Waste generation data is not without any link with regard to geographical, demographic, infrastructural factors and social factors, etc. Therefore, a best practice in one member state does not necessarily match the needs of another member state.

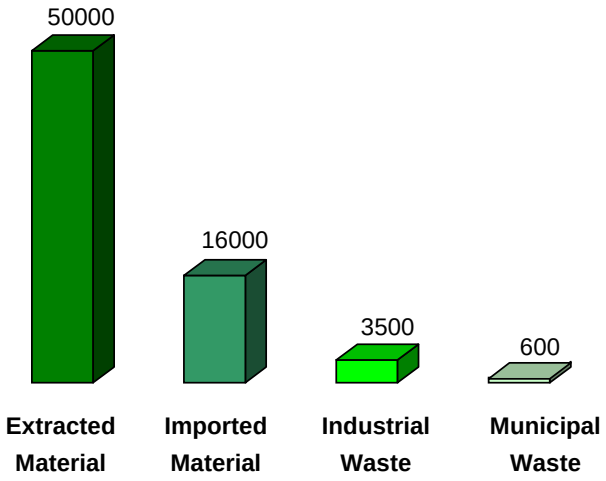
2.3. Upstream versus downstream benchmarking

Several measurement tools are available in order to quantify the environmental benefits of waste prevention and to help develop waste prevention strategies. However, none are ideal. Quantifying the impacts of an individual product (and thus the benefits of not producing it) depends heavily on the assumptions made about production methods, consumer use, and final disposal. Combining estimates of the impacts of many different products to quantify the benefits of reducing a given mass of municipal solid waste compounds the uncertainty.

Because a large percentage of resources and waste impacts of many products occurs upstream of the consumer during resource extraction and manufacturing, waste prevention reduces resource consumption and waste far beyond simply decreasing municipal waste. Waste prevention reduces pollution by avoiding emissions during raw material extraction, manufacturing, transport use, and disposal. Some indicators have been elaborated upon below.

2.3.1. Ecological rucksack

At a European level, in a perspective that covers the entire life cycle, in addition to the estimated 600 kg of municipal waste produced per inhabitant per year, we need to take into account the approximate 3,500 kg/inh/year of waste generated by industries that manufacture the products we consume. We also need to allow for the 17 tonnes per inhabitant per year of raw materials brought into the European territory to supply industry. On top of that, we also have to take into account waste from mines and from preliminary conversion processes that remain in the country where it was produced. In all we can assume that a European citizen consumes an average of 50 tonnes of the planet's resources every year.



In each product or service that we use, we are carrying "in a rucksack" the materials that were moved from their locations in nature to make the goods or services. These are called ecological rucksacks which is the total amount (in kg) of matter that is removed from its natural environment in order to create a product. The final products that the consumers buy (and eventually dispose) represent only a (small) fraction of the total waste generated by household products.

Some products, as presented in the following table, carry an extremely heavy ecological rucksack as compared to others (*Source: ACR+: Resourcities*).

Resources	New
1 kg iron	**2.3 kg**
1 kg zinc	**8 kg**
1 kg steel	**21 kg**
1 kg aluminum	**85 kg**
1 kg copper	**500 kg**
1 kg gold	**540.000 kg**
Products	**New**
Aluminum beverage (33cl)	**1.2 kg**
Toothbrush	**1.5 kg**
Plastic bucket	**26 kg**
Jeans	**32 kg**
Mobile phone	**75 kg**
PC (20 kg)	**1,500 kg**
Gold ring (5 gr)	**2,000 kg**

The above values form the basis for the 'Material Input per Product and Service units (MIPS)'. The MIPS are a basic measure for assessing and comparing the ecological pressure caused by products and services.

For example: the use of food products in Finland[1] is estimated at a total of 840 kg/ person/year. The material input for the food eaten is however 6,000 kg/person/year.

A more detailed view on some food products reveals the following figures (source: Finnish Association for Nature Conservation):

Product	Consumption	Material input	Multiplication factor
Meat & fish	84 kg	1920 kg	**23 x**
Grains & potatoes	142 kg	360 kg	**2.5 x**
Fruits & vegetables	**160 kg**	**780 kg**	**4.8 x**

Meat and fish contribute to 32% of the material input of the food eaten. As such eating lots of meat & fish is not the best environmental option. Switching to a vegetarian diet would decrease the material input with 1,600 kg.

[1] Proceedings of the Nordic Consumer Policy Research Conference 2007

2.3.2. The carbon balance

As an alternative to the ecological rucksack (based on kilograms of materials), the carbon balance could be used in order to show the CO2 emissions related to the production and/or use of products and services.

Product	Unit	Kg equivalent CO2
Paper	1 kg	**1,9 kg**
Meat (imported form New Zealand)	1 kg	**7,5 kg**
Imported American wine	1 bottle	**5 kg**
Mobile phone	1	**1.000 kg**
PC	1	**2.200 kg**
MP3	1	**300 kg**

2.3.3. Ecological footprint

Finally, the ecological footprint is another method which provides us information on the resource impact we have. It represents the land and the sea required in order to feed us, to provide material and energy resources and to absorb the waste and pollution we create. Expressed in hectares, the size of the ecological footprint will, therefore, vary depending on consumption and production habits applicable to a given population. According to WWF (2005), given their life style, Europeans currently need an average of 4.9 ha per person to meet their needs, whereas a fair or sustainable footprint for all the planet's inhabitants would be 2.2 ha per person.

Translated into our consumption behaviour the food we eat as Europeans represents more than 25% of our ecological footprint. Considering further the goods we purchase, representing another 12.5%, we can easily conclude that food and goods represent more than 1/3 of our ecological footprint.

Even though it could be interesting and challenging to look more in detail at benchmarking (upstream) environmental performances of products by industry, this report focuses more on downstream measures which can be implemented by cities and regions in order to benchmark comparable waste prevention initiatives.

2.4. Qualitative and/or quantitative benchmarks?

Toxic chemicals are used to manufacture many common household products. Some are released during production, while the balance remains in the final consumer product and are released later in its lifecycle during use and disposal. Waste prevention reduces production of these goods and the toxic chemicals used to make them.

Quantitative and qualitative benchmarks are interrelated. Rarely can qualitative benchmarks as "decreasing the hazardousness of materials", easily be adopted at a local and regional level. The reason for this is that

discrimination between chemical products and hazardous substances must be based on scientific data that is generally only available at the top level. Another reason for this is the support of the World Trade Organization and the European market for the principle of the free market.

An example of qualitative product improvement is shown in the paper industry. The research is done at European level, as a commitment of the paper industry and for the benefit of all paper producers. Vegetable oil inks replace more and more the mineral oil content to varying degrees. Vegetable oil inks have improved greatly – they match the performance of mineral oils, and some say they are superior. Vegetable oil inks have much lower rates of Volatile Organic Compounds emissions than mineral oil inks. Also, in contrast to mineral oils, vegetable oils are derived from renewable resources, and the inks made from them are more easily removed from waste paper during de-inking. Another plus is that the pigments in the vegetable oil inks do not usually contain heavy metals.

Another striking example are watches. The first watches were just mechanical, powered by the energy stored in a spring which was winded manually by hand. This spring is used to move a number of weighted wheels, which turn the hands. As from 1923 self winding watches, also called kinetic watches, were introduced. The main spring is wound automatically by the natural motion of the wearer's arm, to make it unnecessary to manually wind the watch. Most mechanical watches sold today are self-winding. However, nowadays, the world is overwhelmed, apart from a smaller percentage of high tech electronic watches, with cheap electronic watches with batteries. China and Hong Kong produce together yearly more than one billion electronic watches, each one containing a small battery. There are different kinds of batteries such as silver oxide, lithium,… having a life time varying from 2 to 5 years depending on the quality and use (backlights). So we have moved from virtually nothing to hundred of millions small batteries ending up in the waste stream each year.

2.5. Why do we need quantitative prevention benchmarks?

A hierarchy policy without any quantitative references is inefficient.

The new Waste Framework Directive has set clear waste prevention procedures including reporting and reviewing, monitoring and evaluation and will offer support to Member States on how to develop waste prevention programmes through guidelines and information sharing on best practices.

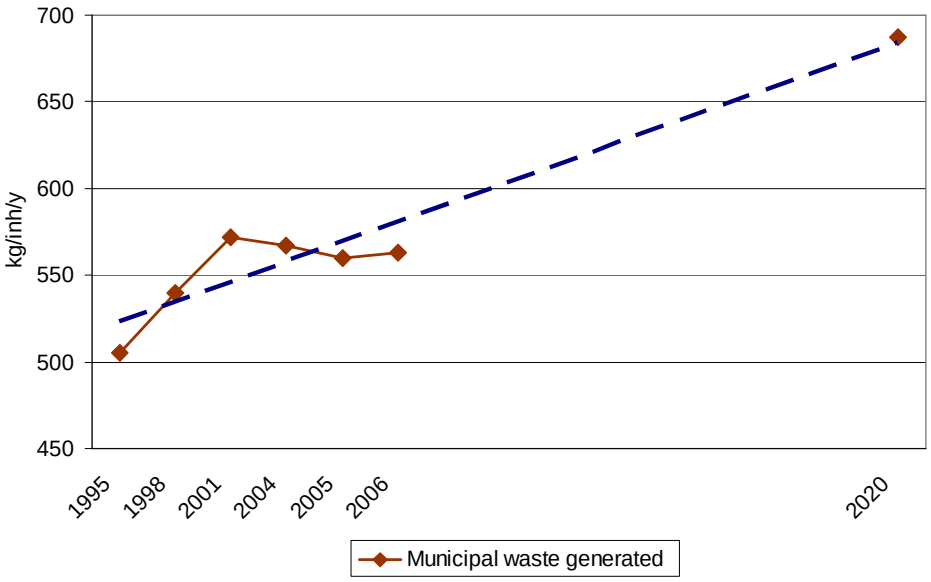
The current provisions with regard to waste prevention programmes in the new Waste Framework Directive are rather flexible, affording the Member States the space to try out different policy options, adjust measures to match national and regional realities and adapt policies in the light of experience.

Although the EC is not so clear concerning quantitative legal obligations, we consider them in any case "appropriate" in relationship with the municipal waste flow.

Currently the EU requires, through EU wide legislation and other instruments, increased recycling levels (50% by 2020) for paper, metal, plastic and glass and decreased municipal biodegradable waste going to landfill (35% of biodegradable waste by 2020 as compared to 2005 levels).

These objectives, however, will not lead to reductions in overall municipal waste generation. On the contrary, as EU economies further develop and consumption patterns do not change, waste volumes are likely to increase over the next 15 years. Looking forward, municipal waste volumes within the EU-15 are expected to grow by 22% by 2020 (EEA). If we do not develop strong waste prevention policies, including quantitative benchmarks, we will end up by 2020 with a figure of 340 million tonnes of municipal waste generated in Europe (EU-27) according to the EEA.

Evolution and prospects (blue broken line) of municipal waste generated for EU 15



We desperately need ambitious objectives in the field of waste prevention. And we should aim not only at stabilising or decoupling waste generation but even decrease the waste generated per person per year as compared to a given year of reference.

2.6. How to quantitatively measure waste prevention?

The most commonly used methods are either estimating the quantity of waste reduced at source or showing the absolute or relative decoupling of total waste generation from Gross Domestic Product.

The first option, estimating the quantity of waste reduced at source, assumes that there is a constant relation between private final consumption and waste generation. The difference between the projected quantity and the actual waste generation is the estimated source reduction. One problem is quantifying something that is not there.

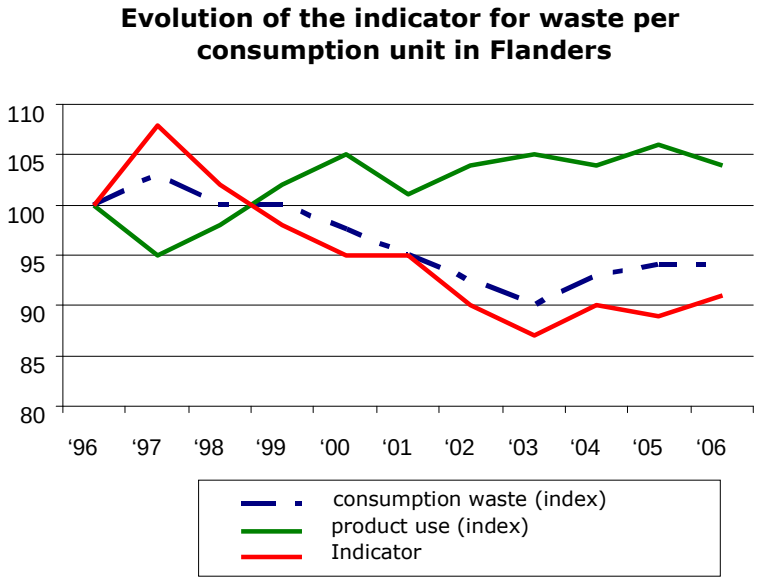
The complexity of factors determining waste generation is high. They include the intensity of industrial activity, demographic changes, technical innovations, and way of living and production and consumer behaviour. Due to this variety of factors it is difficult to treat waste prevention, resource management and product policy separately.

However, the most concrete and practical approach is… **less kg per inhabitant per year**.

The second option assumes a restriction of the growth of the waste supply corresponding to a lower increase compared to the economic growth as expressed in Gross Domestic Product being the market value of all goods and services produced in one year's time. A recent analysis conducted by ETC/RWM[2] finds no absolute decoupling of municipal waste generation and consumption per capita in Europe. Contrary to earlier analyses on the subject, however, it seems that we face a situation of relative decoupling, i.e. municipal solid waste generation is growing more slowly than the Gross Domestic Product. This can be explained by the fact that the Gross Domestic Product is not only an indicator of the expenditures of households but also takes into account expenditures by government and enterprises.

An improved methodology therefore would be to use the category 'household consumptive expenditure (excluding bought services)' separately. This would allow linking the quantity of (certain) products that a consumer buys and wherefore waste is generated and as such an improved measuring instrument for decoupling.

An example of the detailed decoupling (products versus waste) approach is shown in the following graph (Public Waste Agency of Flanders – OVAM)



This graph shows a decreasing trend (as compared to the indicator 'waste per inhabitant' in Flanders) of waste generation per consumption unit (?), stabilized as from 2004. The consumption pattern (product purchasing) however shows an increasing trend, stabilizing as from 2002. The interpretation of these results is important: the decrease in consumption in 2001 is related to a lesser economic growth in Belgium. The reduction of product purchasing in 2006 is more difficult to explain. At the same time in 2006 the amount of waste per consumption unit rises slightly. The indicator (waste produced in relation to consumption units) decreases from 1997 to 2003 and stabilizes as from 2004.

The reasons for this trend should be sought either on consumer side (consumers think "less waste" when purchasing) or on production side (less material input per unit of packaging, more returnable packaging, etc.). Producers are working on material reduction and as waste is expressed in kg, this can have its

[2] ETC,RWM, 2008h/ Mazzanti and Zoboli,2008

influence. But also stimulating some composting at source and PAYT principles has an influence. However, care is required when interpreting such figures: in 2006 there was again a slight increase of waste per consumption unit. Can we then still talk about prevention?

2.6.1. Some national quantitative references

The following examples are a non exhaustive list of either waste reduction objectives or decoupling initiatives taken by various authorities in Europe.

The Danish government (2005-2008) has an overall aim to prevent the loss of resources. The growth in waste must be uncoupled from the economical growth.

Finland's target for waste prevention is that the volume of municipal waste until 2016 will be stabilized and then reduced to the level of the beginning of 2000 (Towards a recycling society – National waste plan until 2016).

The objective of the waste management law in Iceland is to decrease the quantity of waste by preventing generation of waste (Waste management in Iceland 2006).

Norway has an overall national target that the growth of waste amounts should be lower than the economic growth.

Sweden's environmental objectives include that the total quantity of waste generated will not increase (A strategy for Sustainable Waste Management: Sweden's Environmental Objectives).

Flanders waste management plan 2008-2015 intents to produce less municipal waste, even though they may be using identical quantities of materials. On an annual basis Flanders wants to produce as much waste as in 2000, namely 560 kg/inh/year (decoupling indicator).

In the Netherlands the LAP (2008) wants to build on its achievement reached in the period between 1985-2006, whereby the waste generated was decoupled from the gross domestic product. Concretely the amount of household waste generated should not exceed 11 Mtonnes (666 kg/inh/year) in 2015 and 12 Mtonnes (727kg/inh/year) in 2021. The Netherlands estimate that with the achieved (relative) decoupling and objectives for waste prevention it has already achieved the obligation as set in the Framework directive.

The Portuguese government has announced additional measures to achieve targets set by the country's second national urban solid waste plan for the period 2007-2016. This plan is intended to reduce municipal solid waste by 17% over the period. Proposed measures include promoting composting in urban green areas, reducing the amount of junk mail and free newspapers delivered to homes and eliminating non-biodegradable plastic bags.

In France, the working group of the 'Grenelle for the environment' suggest 5 kg/inh/year less municipal waste during the coming 5 years, aiming thus at a 25 kg/inh/year municipal waste reduction in 5 years time. Additionally, a reduction of 1 kg/inh/year of packaging waste is suggested for the same period. The Grenelle law was adopted on 25/07/2009.

CHAPTER 2

2.7. ACR+ promotes a quantitative benchmark of “100 kg less waste per inhabitant”

The concept of municipal waste which extends to household and other «assimilated» waste is not so clear but has the advantage of being rather flexible and easily understood by the public authorities.

The OECD defines “municipal waste” as waste that includes, a part from household waste, waste from institutions and other waste flows such as commercial waste, waste from schools, hospitals, markets, certain firms, parks, road-sweeping and so on.

The “municipal waste” concept as part of a waste reduction campaign is a good choice because:

- ➔ it refers to a reality that is easily perceived by local authorities insofar as this concerns what they collect and process as waste within a given geographical area (with a given budget)
- ➔ it creates a scope for action that is not restricted to households but can be extended to schools, offices, businesses etc. and this results in a greater quantitative and qualitative potential;
- ➔ it represents a statistical reference commonly used throughout Europe.

Some statistics of “kg of municipal waste per inhabitant per year” are available. Depending on the source different figures are found. The most recent Eurostat data (2007) provide us with a figure of 522 kg/inh/year (EU 27). However, the data per country differ considerably with figures as low as 300 kg/inh/year in the Czech Republic and as high as 800 kg/inh/year in Denmark[3]. The reliability of these data is questionable. This has, amongst other things, to do with the limitations of the definition of municipal waste. Differences between countries arise for two main reasons: the differences found in specific categories to be included in this stream (the most relevant being 'household' and ‘similar’ waste, from shops, offices, etc.) and differences found in the calculation system applied in each country.
Hence, ACR+ considers in this report an average of 600 kg of waste generated in Europe per inhabitant and per year.

According to numerous data collected and analyzed by ACR+ working groups, we can consider that, based on this theoretical municipal waste mass of 600 kg in 2009, there is a reduction potential of approximately 100 kg per inhabitant and per year, that is to say more or less 15%.

It must be stressed however that this quantitative reference (or “benchmark”) has to be adapted to each local reality and that it is certainly not our intention to launch a mathematical competition between member states, regions and cities. Indeed, several aspects have to be taken into account:

- ➔ First and foremost, it is important to note that the quantitative reference that we put forward depends on the initial waste quantities as shown in the figure of municipal waste generation for selected European countries, i.e.: - in a town or region that produces 300 kg/inhabitant/year of municipal waste, the theoretical reduction based on the same percentage will be far lower: 300 x 15% = 45 kg/inhabitant/year!
- ➔ Further, we have to accept that a reduction potential is related to the precise composition of the municipal waste flow (which varies considerably depending on the geographic location): it is definitely easier to produce significant quantitative results for some waste flows than for others.

[3] Diverting waste from land fill – Effectiveness of waste-management policies in the European Union, EEA - 2009

➔ Finally, a quantitative prevention target set for a town or region must take into account any preventive actions that may have been undertaken previously.

2.8. "100 kg less waste per inhabitant" in relation with 5 specific waste categories

The "100kg less waste per inhabitant" aims to identify different waste prevention activities by cities and regions and to assess their implementation on the ground to evaluate their potential outcomes. The main objective of the project is to identify the best options to achieve the European benchmark of "100 kg less waste per inhabitant"

The flow of municipal waste can be subdivided into 5 categories which are quantitatively very significant especially from the point of view of waste prevention, that is to say:

1. Organic waste
2. Paper waste
3. Packaging waste
4. Bulky waste
5. Other municipal waste

Chapters 3 to 7 in this report describe preventative actions that can be implemented. The following table tries to give a global idea of the potential of waste reduction which can be achieved overall as well as per main category:

Actions for the 5 flows	**Generation** (kg/hab./y)	**Potential waste reduction** (kg/hab./y)*
1 Bio-waste	**220**	**40**
Green scaping	90	10
Smart gardening		
Act against food waste	30	10
Home, community & on-site composting	100	20
2 Packaging	**150**	**25**
Encouraging refillable/returnable bottles	35	12
Promoting tap water	6	2
Encouraging reusable bags	2	1
Fight against excess packaging	107	10

3	**Paper waste**	**100**	**15**
Reducing unwanted & unaddressed mail		15	4
Encourage dematerialisation through ICT		75	9
Reducing kitchen, tissue and towel paper		10	2
4	**Bulky waste**	**52**	**12**
Promote clothes & other textiles waste prevention		15	4
Promote furniture waste prevention		20	4
Promote WEEE prevention		17	4
5	**Nappies and other wastes**	**78**	**8**
Swap to reusable nappies and incontinence pads		18	2
Other municipal waste prevention strategies		60	6
		600	**100**

** Source: Internal working group ACR+ (2006)*

2.9. CO2 reductions & costs savings as complementary benchmarks

2.9.1. Waste prevention = less CO2

By reducing material consumption, waste prevention avoids significant negative impacts upstream and downstream from the consumer at all lifecycle stages: resource extraction, manufacturing, use and disposal.

Waste prevention saves energy and reduces greenhouse emissions in all phases of a product's life cycle. First, energy use and emissions are reduced through less resource extraction, manufacturing, and transportation. Second, waste prevention reduces greenhouse gas emissions in the disposal phase from landfills, composting, and incineration facilities.

The EPA (US) has estimated materials-specific GHG emissions savings for various MSW management methods, finding that waste prevention reduces emissions during final disposal and manufacturing and avoids lost carbon sequestration (in the case of paper and wood products). In any cases waste prevention yields greater environmental benefits than recycling or energy recovery.

The following table illustrates the net GHG emissions of municipal waste management options compared to landfilling (=baseline management scenario is disposal in a landfill with national average conditions). Alternative scenarios involve source reduction, recycling, composting or incineration. The values in the cells of the matrix are expresses in Million Tonnes Carbon Equivalent per tonne (MTCE/tonne) and represent the incremental change in GHG emissions. For example, source reduction of 1 tonne of office paper, rather than land filling it, reduces GHG emissions by 2.79 MTCE. If an office implements an office paper source

reduction program and annually diverts 10 tonne of office paper (that would otherwise be land filled) to recycling, the GHG emission reductions are: 10 tonnes/year x – 2.79 MTCE/tonne = - 27.9 MTCE/year. The negative values indicate that emissions are reduced.

Table: Net GHG emissions of municipal waste management options compared to land filling (1) (MTCE/ Tonne) according to US EPA WARM model

Selected materials	Source reduction (Current mix of inputs)	Source reduction (2) (100% virgin inputs)	Recycling	Composting	Incineration
Steel cans	- 0.88	- 1.02	- 0.50	NA	-0.43
Glass	- 0.17	- 0.19	- 0.09	NA	0.00
HDPE	- 0.50	- 0.55	- 0.39	NA	0.24
LDPE	- 0.63	- 0.65	- 0.47	NA	0.24
PET	- 0.58	- 0.60	- 0.43	NA	0.28
Corrugated cardboard	- 1.83	- 2.32	- 0.96	NA	- 0.29
Newspaper	- 1.09	- 1.39	- 0.52	NA	0.03
Phonebooks	- 1.49	- 1.49	- 0.49		0.03
Office paper	- 2.71	- 2.79	- 1.31	NA	- 0.70
Mixed metals	NA	NA	- 1.44	NA	- 0.30
Mixed plastics	NA	NA	- 0.42	NA	0.26
Food discards	NA	NA	NA	- 0.25	- 0.25
Carpet	- 1.10	- 1.10	- 1.97	NA	0.10
Personal computer	- 15.14	- 15.14	- 0.83	NA	- 0.06
Clay bricks	- 0.09	- 0.09	- 0.01	NA	- 0.01
Tires	- 1.10	- 1.10	- 0.51	NA	0.04

(1) land filling including CH4 recovery

(2) source reduction is measured by the amount of material that would otherwise be produced but is not generated due a program promoting source reduction.

2.9.2. Waste prevention = costs savings

The increase in the amount of waste to be managed always calls for more collection and processing infrastructures. The costs of these infrastructures increasingly burden regional and local authority budgets. Reducing waste at source constitutes a major financial benefit: we must never forget that investing in prevention is the best way of reducing the budgets that have to be allocated to waste collection and processing.

CHAPTER 2

The economic benefits of preventing waste include:

Reduced waste management costs: waste prevention saves money by lessening the amount of waste that must be collected and processed. It also reduces the costs associated with sorting and operating management facilities such as landfills, incinerators, and materials recovery facilities.

Savings in material and supply costs: reusing or prolonging the lives of products means that these items don't need to be purchased as frequently. Savings in avoided purchasing costs can be significant, especially for companies and government agencies.

Savings from more efficient work practices: waste-reducing work habits (such as using electronic mail in place of paper) can often save time as well as money.

Potential revenues from selling unwanted or reusable materials: through a variety of venues, from waste exchanges to yard sales, it is often possible to earn revenues from the sale of goods that are no longer needed and that would otherwise become waste.

In Europe, the reality of municipal waste management costs reveals major differences between countries and even between cities and regions. These variations are caused by a number of factors: subsidy and/or taxation systems, operations management, producer responsibility strategies etc. However, we can estimate that a 100 kg reduction in waste directly produces a cost reduction that fluctuates between 8 and 25 Euros/inh/year. Accordingly, for a town of 500,000 inhabitants, we can expect savings of 4 to even 12.5 million Euros! In truth, when the need for new waste management infrastructures becomes imperative, public authorities should systematically compare their costs with costs invested in prevention.

The interest for local authorities will be to benchmark and exchange information on costs in order to achieve cross-fertilization. They will get an insight of cost-efficiency of various waste prevention strategies and act accordingly.

Waste prevention will always be cheaper than whatever other waste management option. This has to do with the avoided collection and treatment costs of waste. The following table highlights average waste management costs for residual waste and other waste streams.

Costs (in Euro/tonne) for collection and treatment of residual and other waste streams

Waste streams	Collection costs	Treatment costs
Residual waste	40-100	35-180
Paper	40-120	
Glass	30-70	
Packaging	100-200	
Bio-waste	40-150	

Introduction to Chapters 3 to 7

INTRODUCTION TO CHAPTERS 3 to 7

The following chapters illustrate waste prevention including: strict waste avoidance, reduction at source, and (preparing for) reuse. The focus is mainly on voluntary actions by citizens initiated by public authorities. Results achieved by the featured waste prevention cases support and complement the values presented in the previous chapter. Waste prevention efforts are organized into the following chapters:

Chapter 3: Quantitative benchmarks for bio-waste
Chapter 4: Quantitative benchmarks for packaging waste
Chapter 5: Quantitative benchmarks for paper waste
Chapter 6: Quantitative benchmarks for bulky waste
Chapter 7: Quantitative benchmarks for nappies and other municipal waste

Each chapter can be subdivided into three parts:

1. A general introduction of the featured programs including definitions, the environmental impact of the waste stream, the CO2 impact and finally the quantitative flows for the specified waste stream;

2. Following the general introduction, comments are provided on specific waste prevention strategies, technical problems, and the applicable portion of the waste stream that can be targeted by the strategies described ;

3. Finally different cases per strategy are described containing detailed information on the project, the scale, the scope, quantitative results in various units (kg, tonnes, kg/inhabitant/yr or kg/personnel) as well as possibly information on costs. Where possible a web reference and/or sources are added.

Terminology

Potential quantitative benchmark: corresponds to a reference indicating the potential waste stream reduction that can be achieved when implementing waste prevention actions according to one or more of the strategies. Each benchmark (reference) is based on own (ACR+) research (clusters groups) and analysed case studies.

Assumptions

The following rounded figures have been used to calculate the quantitative flows and applicable waste stream percentages in the different chapters:

- EU 27 population = 500 million
- Average municipal waste generation per inhabitant per year for EU 27 = 600 kg.

So, the total amount of municipal solid waste generated for EU 27 is +/- 300 million tonnes (= 500 million inhabitants x 600kg/inh/year).

INTRODUCTION TO CHAPTERS 3 to 7

Limitations

The search for cases was not easy and very time consuming. Till to-day, very little waste prevention projects/activities set baseline data, targets, indicators and monitoring mechanism which make it challenging for further interpretation. In some cases the results are less evident showing too general units and/or estimated results making the cases less credible. However, these few cases were still included because of their relevance, and their potential for their replication. Also the distinction between 'pilot' and 'roll out' projects should be read with care as a pilot does not necessarily allowing for simple multiplying to estimate the achievable results on a larger scale.

To the reader

In order to come up with a larger and improved database of quantified waste prevention cases and to put forward prevention experiences, ACR+ invites local and regional authorities and others organisations to send us their own or any other quantified data of waste prevention they have experience of.

In order to share your experiences on waste prevention, consult our website: www.acrplus.org and follow the instructions.

CHAPTER 3

Quantitative benchmarks for bio-waste

CHAPTER 3

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CHAPTER 3

3.1. Introduction

3.1.1. Definitions

EC definition**:** "**Bio-waste**" means "biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from processing plants".

ACR+ definitions:

"**Food waste**" means biodegradable kitchen & processing plant waste from households, restaurants, caterers and retail premises composed of raw or cooked pre-consumer and post-consumer waste.

"**Green waste**" means biodegradable garden and park waste from households, public & private green spaces composed of grass, branches and similar waste.

3.1.2. How does bio-waste impact?

The environmental impact of food is significant. Because of the energy and resources used to produce, transform and transport food from producer and supplier to the home, and subsequently to landfill, there is a major carbon impact. Moreover, different studies about energy use indicate that food is the second most energy demanding product group after housing (Engström, 2004).

The amount of food thrown away is a waste of resources as energy, water and packaging used for food production, transportation and storage. All this goes to waste when we throw away perfectly good food. In the UK, around one third of all the food bought ends up being thrown in the bin, most of which could have been eaten. If British citizens were to stop wasting food that could have been eaten, the CO2 impact would be the equivalent of taking 1 in 5 cars off the road (Wrap, 2008).

During the season millions of tonnes of green waste materials are hauled away, buried, or burned each day from households, landscaping and similar operations—trees, shrubs, brush, lumber, to name but a few. The costs of managing this waste—both economic and environmental—can be easily reduced or eliminated with updated landscaping methods including reduce, reuse and recycle strategies.

Even though a large amount of bio-waste still ends up in landfill, considerable efforts have been made by Member States in the last 10 years; this is mainly due to the targets set by the Landfill Directive (99/31/EC) which intends to prevent/reduce the adverse effects of the landfill of waste on the environment. Targets to reduce the total amount (by weight) of biodegradable municipal landfilled are:

- 75% of 1995 figures by 2006 (2010*)
- 50% of 1995 figures by 2009 (2013*)
- 35% of 1995 figures by 2016 (2020*)

* These dates include a 4 year derogation from the target years 2006, 2009 and 2016 offered in the Directive to Member States who landfilled more than 80% of their municipal waste in 1995.

3.1.3. CO2 impacts of bio-waste

Food comprises between 22 and 31% of a household's carbon footprint (EIPRO, 2005). Food products rank among the five most resource and energy demanding product groups (Engström, 2004) at household level. Reducing food wastage decreases potentially the surface needed for food production and as such has tremendous positive impacts on GHG emissions upstream in the food chain.

Almost every material that households use in their garden required energy to produce them. Large amounts of GHG are used in acquiring materials, manufacturing products, and shipping products. Energy is used to produce and ship soil additives, water, tools, machines, plants, paints, and virtually every other material used in landscaping. The constant buying and trashing of products regularly adds GHG to our atmosphere and impacts the climate. By purchasing fewer, more durable goods and locally produced indigenous plants, untold amounts of GHG are saved.

Many green landscaping activities help reduce GHG. Creating compost on site not only reduces the GHG needed to transport green waste to a compost facility or landfill, but it eliminates the need for the production and transportation of (synthetic) fertilizers, peat and often pesticides. Composting improves the quality of soils and as such the CO2 sequestration capacity. Compost also absorbs water, reducing the amount of irrigation necessary and the energy required to transport the water. Strategic planting of vegetation around buildings can reduce indoor heating and cooling needs by creating shade.

Greenhouse gas emissions from bio-waste management in Europe constitute around 3% of the total emissions. However, this figure only includes direct emissions from waste (primarily methane from landfill facilities) and not the total emissions and services associated with society's bio-waste management as a whole.

3.1.4. Quantitative flows of bio-waste

Total amount

Depending on local conditions such as food and drink habits, type of plant growth, seasons and climate, living standard and degree of economic development, bio-waste accounts for 30% to 40% by weight and volume of municipal solid waste. This proportion is much larger (up to 80%) in Mediterranean countries, due to a larger use of vegetables and fruits in the daily diet, as well as to the effect of tourism.

For ease of calculation we use a figure of 37% bio-waste generated as part of the municipal waste stream, accounting for 220 kg/inh/year or a total of 110 million tonnes[1] in Europe. This bio-waste evaluation does not take into account the paper fraction (part of biodegradable waste), described and accounted for in chapter 5.

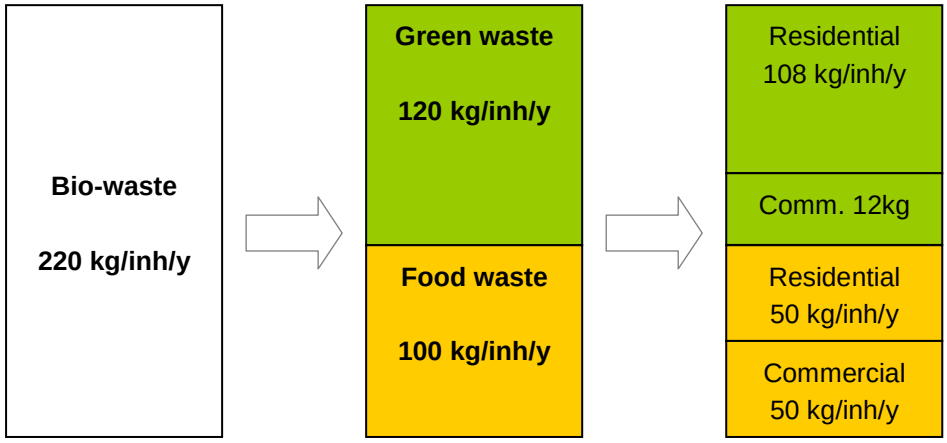
[1] Green paper on bio-waste refers to an amount of between 110 and 140 million tonnes.

CHAPTER 3

Food & green waste generation

Bio-waste can be further subdivided in food waste and green waste. According to an EPA US study[2] green waste and food waste can be accounted for respectively for 55% and 45%. Translated to the European situation, this represents more or less a generation of 60 million tonnes of green waste and 50 million tonnes of food waste or 120 kg/inh/year of green waste and 100 kg/inh/year of food waste. However, these amounts have to be taken as a European average as (much) more food waste and less green waste are generated in Southern regions and vice versa in northern regions. As an example, more than 80% of the bio-waste in Greece is food waste while in Austria the green waste accounts for 35% of the municipal waste compared to only 5% for food waste[3]. The same EPA US study states that food waste is evenly generated between residential and commercial level (50% each) or 50 kg/inh/year each. From the average 50 kg residential food waste generated yearly per inhabitant, estimations based on UK experiences (Love food hate waste campaign) allow to assume that approximately 50% is composed by peelings (uncooked) and the other 50% by cooked food, hence 25 kg/inh/year each. Regarding the commercial sector, most of the food waste represents cooked food.

The green waste generated at residential level amount to 90% or 108 kg/inh/year.



3.2. Bio-waste prevention strategies

We shall describe 5 bio-waste reduction strategies including both separate green & food waste avoidance and minimization strategies as combined green & food waste strategies.

3.2.1. Green scaping

Strategy description: Households, administrations (parks, cemeteries, etc.), schools and universities, hospitals and private business (golf courses, etc.) will avoid and reduce green waste generation through the following non exhaustive list of green scaping techniques:

[2] National Source Reduction Characterization Report for municipal waste in the United States, EPA, 1999
[3] Impact Assessment, 1st Interim Report, ARCADIS, 2009

- Put the right plants, preferably native and adapted plants, in the right places taking into consideration their growing potential. The diversity of the native landscape preserves naturally occurring genetic material and provides better resistance to disease. Furthermore, plants native to a specific region tend to be more robust because they have adapted to the local soil, conditions, and weather patterns
- Use slow growing grasses where possible;
- Allowing for "meadow areas", where a field vegetated primarily by grass is left to grow wild. This concept could be applied to some parts of the different green areas, including household gardens. This differentiated management would not only imply less green waste generation to be collected and treated (eventually disposed) but also will favour and support a richer biodiversity.
- Install low maintenance design features such as lawn edgings and hard surfaces between landscape features reducing weeds, trimming and use of herbicides.

Technical problems: Slow growing grasses are not applicable everywhere and require, specifically when sawing, more attention. Also, a close analyse regarding the effect of slow growing varieties on the local biodiversity (fauna and flora) should be first carried out in order to avoid negative or undesirable interactions.

Costs per tonne diverted: Staff time required to increase public awareness and develop outreach brochures often represents the majority of costs incurred. Costs can vary, according to the intensity, scope and duration of the program, from 1 € to 7 € per tonne diverted.

Cases:

Case 1: Meadow areas in Scotland

Country	RA/LA	Scale	Waste fraction	Results
Scotland	Chester-le-Street	Pilot (54,000 inhabitants)	Green waste	Frequency of cuttings from every 10 days to 1-3 times/year; time & costs savings

Description:

Chester-le-Street District Council, near Durham, carried out a pilot project on green areas. The main aim of the project was to improve biodiversity (plants, insects, birds and mammals) by allowing meadow areas in green lands. This was performed on sites where the frequency of cutting was reduced from every 10 days to 1-3 times per year. The project involved councillors, community councillors and local residents in managing open space for biodiversity. Chester-le-Street marked out the meadow areas on the ground and held open discussions with all the interested parties. Results showed not only that the number of different species increased by as much as three fold, but also that allowing meadow areas saves the time and cost involved in bagging, removal or composting. The changes in grass management reduced the material and labour inputs required for grass cutting.

For more information: http://www.pkc.gov.uk

Case 2: slow growing grass for lawn haters				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Province of Vlaams – Brabant	Roll out (1 million inhabitants)	Green waste	40% less mowing and 50% less grass clippings
Description: The province of Vlaams-Brabant launched a campaign to promote slow growing grasses. 'Barkoel Koeleria Macrantha' is one of the slow growing grasses promoted. Most of the time Barkoel is sold in a mixture with other grasses. This grass, through its deep roots, adapts very well on dryer, calcareous soils. Therefore, Barkoel will retain a nice green colour in summer for a long time. The grass mixture is 20% more expensive but this doesn't weigh against the long term advantages related to the maintenance of the grass. The province of 'Vlaams Brabant' noticed that the mowing frequency decreases by 40% and at each mowing less 50% of grass clippings has to be removed. Combined slow growing grasses with grass cycling allows for even better results (Source: article "Traaggroeiend gras voor gazonhaters en een kleine afvalberg", 2009). **For more information:** www.vlaamsbrabant.be				

3.2.2. Smart gardening

Strategy description: Households, administrations (parks, cemeteries, etc.), schools and universities, hospitals and private business (golf courses, etc.) will minimize the green waste by applying, as a matter of example, the following smart gardening techniques:

- Leaving grass clippings on the lawn, also called grass cycling, after cutting rather than bagging and setting them out for collection. A typical 300 m2 lawn produces more than 150 kg of fresh grass clippings each year. Special lawn mowers (mulch mowers) have been developed for grass cycling even though normal lawn mowers can with simple transformation, sometimes, been converted into a mulch mower
- Use grass, woodchips, compost as mulching[4] materials in between bushes and trees. Shredders do not have to be purchased but can be hired or shared;
- Removing leaves only when necessary; reuse branches as wattle work; wall of branches; insect walls, etc.

Smart gardening programs aiming at minimizing green waste consist primarily of promotion and public education efforts. Press releases, brochures, newspaper advertisements, and radio and television spots are often used to promote smart gardening. Local governments often promote smart gardening by example. In many green public spaces, city workers leave grass clippings on the city's parks and other lawns wherever feasible. Other organizations that often promote smart gardening techniques include schools, community

[4] Mulch is a layer of organic material such as leaves, wood chips, compost or grass clippings that is spread around plants. Mulch stabilizes soil temperature, prevents weeds development, nourishes the soil and retains water. Through grass cycling, grass clippings quickly decompose and release valuable nutrients back into the soil reducing the need for fertiliser (nitrogen) by 25 to 50% and also the need for watering.

groups, garden clubs, landscape businesses and associations, garden centres, as well as lawn mower manufacturers and retailers.

Technical problems: The leaving of grass clippings on the lawn is not harmful when mowing is frequent enough to produce fine clippings or when the mulching mower is used. Still, heavy clippings left on the lawn can block sunlight and effectively smother the lawn. Leaving grass clippings on the lawn very frequently enriches nutrients on the soil but can cause perverse effects such as favouring coarse grass species as they are able to grow rapidly in high nutrient levels, out-competing fine grasses and flowering plants. However, the benefits of grass cycling far outweigh any possible drawback. Mulch should not exceed more than 7.5 cm in landscaping beds and keep about 2.5 cm away from stems and tree trunks.

Costs per tonne diverted: Staff time required to increase public education and develop outreach brochures often represents the majority of costs incurred, but most smart gardening program coordinators do not dedicate all of their time to the program. Additional costs include rebates and the costs of developing and distributing brochures and advertisements. The latest cost is relatively small as it is commonly part of the budget for other recycling and composting efforts taking place in the municipality.
Costs can vary, according to the intensity, scope and duration of the program, from 1 € to 7 € per tonne diverted.

Cases:

Case 3: Maryland ban on disposal of yard trimmings

Country	RA/LA	Scale	Waste fraction	Results
US	Montgomery County	Roll out (960,000 inhabitants)	Green waste	50% yard trimmings reduced (55 kg/inh/year) & $4.38/tonne saved

Description:
The Montgomery County DEP launched its yard trimmings source reduction program over a 2-year period (1994 to 1995), during which it targeted 180,000 single family homes, 250 landscape and lawn service companies, 30,000 multifamily and commercial property managers, conservation groups, homeowner associations, garden clubs, nature centres, public gardens, and nurseries. Through its comprehensive public education efforts to encourage on-site management of yard trimmings, approximately 53,000 tonnes, nearly 50% of the projected total yard trimmings generation, were source reduced in 1995. Indeed, 70% of the resident's grass cycled and 60% composted in 1995. In so doing, the county avoided a $2.5 million expansion of its composting facilities and averted $1 million in annual composting costs. The total cost of the public education program was $232,000 for 1995, indicating a highly cost-effective program. Several of their public education tools have received national and international awards for their innovativeness. The cost effectiveness for the source reduction was $4.38 per tonne in 1995.
For more information: http://www.epa.gov/waste/conserve/rrr/pubs/r99034.pdf

Case 4: Pinellas County grass cycling programme				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Pinellas County	Roll out (930,000 inhabitants)	Green waste	51,227 tonnes diverted or 720 kg/household/year

Description:

In a study conducted from 1990 to 1993, Pinellas County, Florida's Department of Solid Waste Management documented the benefits and waste diversion capacity of grass cycling based on the participation of 200 volunteer residents each year. In return, participants received T-shirts and free fertilizer. Surveys completed after the project's close indicated that residents who grass cycled felt their lawns looked healthier, spent less time mowing, and actually used less fertilizer. To promote grass cycling to the larger community, Pinellas County gave out bumper stickers and lawn signs to establishments that left grass clippings on their lawns. In addition, the county distributed brochures to nurseries and landscaping companies and produced two 30-minute video programs that aired on the University of Florida's public access channel. An annual telephone survey, which polls 500 randomly selected households that have resided in the county for at least 1 year, revealed in 1993 that 61 % of residents engaged in grass cycling—a 41 %t increase from 1990. Based on an average yard size of 450 square meters and an average generation of roughly 720 kg of grass clippings per yard per year, the 1997 telephone survey found that 51,227 tonnes of clippings were diverted through grass cycling that year by approximately 70,000 participating households.

For more information: http://www.epa.gov/waste/conserve/rrr/pubs/r99034.pdf

Case 5: Grass cycling in parks				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Los Angeles	Roll out (all landscaped area's)	Green waste	26 tonnes/ha/year diverted

Description:

The city of Los Angeles has approximately 3,880 ha of landscaped area. This includes amongst other, public parks (80%). These facilities have a blend of warm and cold weather grass including Cassia, Bermuda, Rye and Pop-Annul to maintain a green appearance year around. The standard practice for lawn maintenance is to cut the grass at specified blade height and leave the grass on the lawn. In other words, grass cycling is practised at city's landscaped areas. The public parks are mowed once a week. The grass cycling diversion rate under normal conditions is 26 tonnes/ha/year.

For more information: Grass cycling source reduction study prepared by the City of Los Angeles, 2001 http://www.lacity.org/SAN/solid_resources/pdfs/appendices.pdf

Case 6: Mulching - Dunorlan Park				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Tunbridge Wells Borough Council	Pilot	Green waste	All prunings chipped on site and reused

Description:
Dunorlan Park is a park and grounds in Royal Tunbridge Wells, (West Kent, England).
Totalling approximately 78 acres (31 ha) and containing a 6-acre (24,000 m2) lake. Dunorlan Park is managed by Tunbridge Wells Borough Council. Pruning material is generated in the park in high quantity. Park's bed weed are mulched where possible with own wood chips. According to the management system, both small branches and leaves collected on site are chipped making an excellent mulching material. Chips are stored in the new eco-friendly recycling bays built to be able to use this material on-site.
For more information: http://www.tunbridgewells.gov.uk/

3.2.3. Act against food wastage

Strategy description: Consumers (households, schools, administrations …) and commercial establishments (bars, restaurants, school/university/hospitals canteens…) will avoid and reduce food waste generation and will redistribute edible food to people in need via organisations by applying the following measures:

- ➔ Consumers:
  - improved purchasing behaviour taking into account the real needs and the life time of products
  - improved storage techniques allowing for less food waste
  - food preparation techniques and organization minimizing waste.

- ➔ Commercial establishments as distributors, HORECA can themselves also influence their clients behaviour by:
  - preparing the right portions
  - charge a supplement when food is left on the plate, and
  - selling food close to "use by" or "best before" dates at reduced prices

Technical problems: The primary technical problem for the distribution sector relates to managing adequately the edible food acquisition and selling in order to be able to match the offer with the demand taking into account the societal and consumers' behavioural changes. Secondly, proper handling and appropriate storage of the incoming edible food is required to avoid wastages. Finally, identifying the food close to 'used by date' and 'best before', and making sure those articles are sold first (albeit with or without rebate) or donated to well fare organisations can be implemented.

From the consumers point of view the technical problems are very much interlinked with behavioural attitudes. Consumers should be educated to avoid over purchasing, to make a pre-shop planning, to improve storage, the right portion menu, to reuse the left over's in other meals, etc. To favour behaviour improvement, food waste avoidance should be addressed at early stages such as kindergarten and primary school.

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Commercial establishments (restaurants, cafes, etc.) are also confronted with food wasted from their clients, difficult to control, unless charging, specifically for buffets, a supplement for food left on the plates.

Costs per tonne diverted: The majority of costs corresponds to information and awareness raising actions, including education and specific tips to specific groups (households with or without children, restaurants, cafes, groceries, etc.). If projects involving schools are to be envisaged, opting for a long-term project and a fixed budget allocation should be preferred, in order to be able to reach parents.
Costs involved for food redistribution are mainly due to administrative and logistic issues, i.e. commerce/retailer/supermarket employee working hours, search and contact food redistribution organisations, packing the fresh food to be donated, compatibility registering, moderated to high frequency activity, etc.

Cases:

Case 7: Serving the right portion in restaurants				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Portugal	Porto Greater Region – LIPOR	Pilot	Green waste	Expected: considerably decrease the 20-25kg bio-waste generated per restaurant/day
Description: In the framework of their "Organic Valorization Strategy", the Inter-municipal Service for Waste Management of Grande Porto (LIPOR) is implementing collection schemes for organic waste in Porto Greater Region. This collection scheme focuses on big producers of bio-waste (restaurants and canteens). Portuguese restaurants and canteens are known for serving large portions with their clients leaving food (almost systematically) on their plates as a consequence. It has been estimated that each restaurant produces an average of 20-25 kg of bio-waste/day. Within the waste prevention project designated "Less 100 Kg/inhabit./year", LIPOR is developing a pilot project for restaurants called "Menu Dose Certa" (the right portion menu). The main idea is to propose to the restaurants, the elaboration of menus that do not generate "food waste". For that, information meetings were held regarding the different aspects and possible approaches, allowing communication (ideas and suggestions) between all interested parties. The pilot project was launched in a restaurant ("o Cristal", in Espinho) and the effective quantity of food residues being produced monitored. The monitoring consists in weighting the leftovers of customers' plates and dividing them into three categories (vegetables, carbohydrates and proteins). This distinction gives an idea of the right quantities of these categories to be used in the menu (right portion) and subsequently reduce the "food waste". Strong awareness campaigns will be developed to encourage other restaurants to join this pilot project. The project is currently been adapted and updated. **For more information:** http://www.lipor.pt/				

Case 8: Supplement charged for food waste				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Private: Bossa Nova restaurant	Pilot	Food waste	Decrease leftovers on the plate
Description: As a private initiative, a Brazilian restaurant in Brussels offers self-service traditional Brazilian buffets at small prices (12 €). If food is left on the plates by clients, the restaurant charges a 10 € supplement. This				

strategy helps the restaurant reduce the disposal of their food waste.
For more information: http://www.restaurant-bossanova.be

Case 9: Guidance to avoid food waste

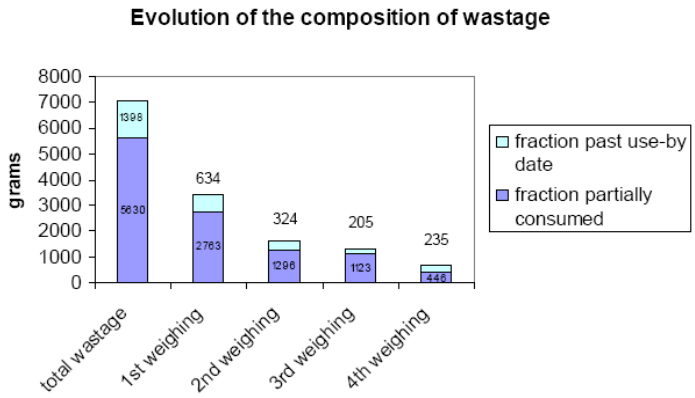
Country	RA/LA	Scale	Waste fraction	Results
Belgium	Brussels	Pilot (6 households)	Food waste	10 kg/inh/year reduced

Description:

Brussels Region has estimated that municipal bio-waste amounts to 120,000 tonnes/year while 90,000 tonnes are issued from households, and the rest from offices (10,000 tonnes), businesses (4,000 tonnes), schools (1,600 tonnes) and parks (15,000 tonnes). From bin analysis, food waste from households has shown to amount to 15,000 tonnes, equivalent to 15 kg/inh/year, or to 12% of the weight of ordinary sacks. Pilot schemes with 6 households generating in average around 12.5 kg/inh/year (or 10% of sacks' weight) were carried out in 2004. In order to avoid food waste, during 3 months citizens were provided with simple recommendations and guidance such as:

- Planned shopping (list, menus, etc.)
- Correct storage of purchases
- Using or freezing leftovers

This resulted in a reduction of 80% of food wastage or 10 kg/inh/year.



For more information: http://www.ibgebim.be

Case 10: Food waste avoidance at Sainsbury's				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Private: Sainsbury's	Roll out	Food waste	20 tonnes/year/store reduced

Description:
UK Sainsbury's supermarket prevents food waste in different ways. To reduce food waste, possibilities envisaged are to sell food close to their "use by" or "best before" dates at reduced prices. Food is also used by canteens or sold to colleagues. Sainsbury's also donates food (6,600 tonnes since 1998, 325 stores). Finally, unavoidable food waste is composted (1,700 tones in 12 years, 23 stores) and landfilled (57,000 tonnes in the same period). To prevent food at the level of their customers, campaigns for educating and inspiring them are also considered. For instance the inspiration campaign "TRY" encourages customers with simple tips to cook meals with 3 ingredients. It also involves defining more clearly how much to cook/eat through packs-portion control and advices for an effective storage (right temperature, right container, right place). In response to the possible food waste effects of promotions, Sainsbury's have refocused their promotions to be fewer and bigger. For instance, they offer "multi-buy" when fresh products are in season (e.g. mix fruit packs).
For more information: http://www.sainsburys.co.uk

Case 11: Commerce donates food to social supermarkets				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Austria	National	Roll out	Food waste	45 kg/commerce/day reduced

Description:
Austria estimates a potential reduction of edible food waste from commerce of about 45 kg/commerce/day. A suggested approach was to design a network between supermarkets and social welfare institutions to donate and distribute the edible food to people in need (Salhofer et al., 2005). This approach is similar to international cooperation such as food banks, food rescue programs or so called "Tafeln". In eight of the nine federal states of Austria so called social supermarkets were established which sell mainly food products to people in need (Only costumers with low income: 893€ for single people and 1,340€ for couples are allowed to shop) at a very low price (approx. 1/3 of the price). The products have been donated by industry and retail and would otherwise be wasted due to different reasons such as damaged packaging, storage surplus, over production, incorrect labelling and others. Since the people have to pay for the products they receive, they do not depend on alms. On the one hand this is an important issue for strengthen the self-confidence of the people, on the other hand the products maintain to a certain value (Schneider and Wassermann, 2005). Unfortunately there is a lack of data about prevented food waste due to the donation of food to people in need for the whole of Austria. But the data from one of the 19 Austrian social supermarkets indicate an amount of 260 tonnes of edible food which was given to people in need in 2007.
In mid July 2009, another 5 social supermarkets opened. Source: Austrian Times.
For more information: http://www.wien.gv.at; http://www.boku.ac.at

Case 12: Food donation - Good Samaritan Law				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Italy	Turin	Roll out (120 schools)	Food waste	> 100 kg/day redistributed

Description:
The Azienda Multiservizi Igiene Ambientale Torino (AMIAT) has started the collection of bread and fruit still edibles from 120 school canteens (31,000 pupils) in Turin for a total of 36 tonnes in an academic year with a total savings exceeding 86,000 € (2007 data). This collection allows the preparation of more than 260 bread portions and 160 fruit portions every day for people in need who go to the canteens managed by ecclesiastic organisations. The law that governs this kind of collection in Italy is called "Good Samaritan Law". AMIAT has started also the collection of other kinds of food still edibles issued from supermarkets (cheese, meat, etc.) with a total of 350 kg collected every day.
For more information: http://www.amiat.it

Case 13: Retailers redistribute surplus fresh food				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	National	Roll out	Food waste	5 million meals provided/year & less 40% disposal costs/pallet

Description:
FareShare is a national organisation in UK that works to minimise food waste by redistributing high quality surplus fresh food collected from over 100 food businesses (retailers, supermarkets, sandwich bars and others). This food is redistributed to a community food network of 300 organisations. In 2005, 2,000 tonnes of food were diverted from landfill disposal and thus contributed to over 3.3 million meals to 12000 disadvantaged people each day in 34 cities and towns across the UK. Saving food waste helped business' to reduce CO_2 emissions by 13,000 tonnes. At present FareSare provide a service in 60 cities and towns across the UK, including London and over 5 million meals are provided on an annual basis. The scheme relies on a network of 280 volunteers who redistribute the collected food to hostels and day centres. Homeless and ex-homeless people are encouraged to participate as volunteers. According to the Food and Drink Federation, the services provided by FareShare have enabled Nestlé UK to reduce its landfilling of surplus food by about 95% between 2005 and 2006. This has also reduced its disposal costs by 40% per pallet[5].
FareShare's own research suggests that 100,000 tonnes of food could be captured and redistributed from the Retail sector alone in the UK.
For more information: http://www.fareshare.org.uk

[5] D. Bellamy – UK FDF. WRAP Conference on Food, Consumers and Resource Efficiency. November 6-7, 2007. London. Powerpoint slide n°15

3.2.4. Home and Community composting

Strategy description: Home & community composting might include outreach, bin subsidization, and educational workshops. Home & community composting programs outreach efforts often include distribution of flyers and brochures, production of videos and radio advertisements, informational displays at local events, public gardens and gardening stores. To encourage greater participation, many programs subsidize (partly) the purchase of bins. Some smaller municipal programs provide education to householders on how to build bins from chicken wire, wood pallets, or other materials. Many municipalities organize training programs such as master composter programs. In these programs, a compost specialist trains a group of volunteers, who themselves become master composters. They in turn train others in the community on proper composting techniques. Other municipalities produce show-and-tell programs. These programs include demonstration gardens and composting education in local school science curricula, which allows children to learn about composting in the classroom and then bring the knowledge home to teach to their families.
Staff needs for a successful home & community composting program depend on the size of the community and on whether bins are being distributed.

Technical problems: The primary technical problems associated with home & community composting include odours and pests. Odours can be emitted when the compost pile is not turned often and anaerobic decomposition occurs. Pests (e.g. raccoons, rats and mice) might enter compost bins if they are not properly enclosed and/or secured.
In order to avoid these problems and ensure that the right materials are composted, technical assistance is essential. If municipalities do not adequately educate and promote continual, correct use of a composting pile, individuals might experience minor problems and refuse to ever contemplate composting again. This, in turn, could impact on other waste diversion efforts attempted by the municipality.

Costs per tonne diverted: The costs of home & community composting programs fall into four categories: staffing, public education and outreach, bin purchasing (subsidies) and bin distribution. Education efforts often continue well into the project, and some municipalities provide home visits and instruction on composting techniques by experts for any interested residents. Frequently, bins are subsidized by grants with homeowners making up the difference. Bins are a significant element of program costs in those communities that provide or subsidize bins.
Municipally sponsored home & community composting program costs can vary significantly. Some programs include significant start-up costs associated with bin subsidization and initial education and outreach programs. In these cases, the costs for initiating the programs are high compared to the amount of waste diverted after the first year. But since bins typically last for 7 years (and some are now even guaranteed for up to 25 years) and only minimal additional funding might be needed from the municipality to sustain the program, program costs decrease over time.
There is a wide range of compost bin prices; the simplest units can be as inexpensive as 10 €, while the largest and most expensive can cost as much as more than hundred €. Prices vary depending on how many bins are purchased at once; most municipalities have been able to obtain bins at wholesale prices by purchasing bulk quantities. In general, backyard composting bin costs range from 25 to 50 €.
Bin subsidy programs tend to cost an average of 12 € per tonne diverted over their useful life, while programs emphasizing education cost an average of 4 € per tonne diverted. The average cost of all home & community composting programs is about 10 € per tonne diverted.

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Cases:

Case 14: Home composting organised by a waste syndicate				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
France	Seine-Saint Denis	Roll out	Green & food waste	1,030 tonnes/year diverted

Description:
The SEAPFA (Syndicat d'Equipement et d'Aménagement des Pays de France et de l'Aulnoye), in the Seine-Saint-Denis department, regroup five municipalities: Aulnay-sous-Bois, Blanc-Mesnil, Sevran, Tremblay-en-France and Villepinte. This syndicate initiated the installation of individual composting units in 1999. Inhabitants can choose their composting units according to financial and aesthetics criteria, while municipalities supports financially 3/4 of the individual composting unit basic price (wooden ones are bought at 58 € and plastic ones at 42 €, and sold to citizens at 12 € and 9€ respectively). Actions to reach the population were: direct mail advertising with the Mayor participation, awareness documents and order forms. Eight months later 1,030 tonnes of fermentable waste were diverted from the waste stream. By taking into account all financial parameters, this operation was amortized over 5 years (*Source:* http://www.ascomade.org).
For more information: http://www.seine-saint-denis.fr

Case 15: Tax break for home composting				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
Italy	Martellago & Santa Giustina	Roll out (26,000 inhabitants)	Green & food waste	77 kg/inh & 102 kg/inh reduced

Description:
Since the mass of organic waste mixed with the municipal waste was 30-35 % of the annual total of around 450 kg/person, initiatives of home composting started in the mid 1990s. A pilot experience carried out in the cities of Martellago and Santa Giustina (Lombardy) were based on the free distribution of compost bins (300, 400 and 600 litres), explanatory brochures and a tax break offered on the remaining portion of waste. A significant level of participation was achieved and the remaining organic waste that required collection was reduced by 70 % (or 102 kg/inh) in Santa Giustina and by 53 % (or 77 kg/inh) in Martellago.
For more information: http://www.cooperica.it

Case 16: Home composting after a landfill disposal ban on yard trimmings and grass clippings				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
US	Massachusetts	Roll-out (6.3 million inhabitants)	Green & food waste	30,000 tonnes/year or ~400 kg/bin/year reduced

Description:
Massachusetts imposed landfill disposal bans on yard trimmings and grass clippings in addition to the municipal leaf and grass composting programs it already had in place. To encourage residents to source reduce by using backyard composting, rather than send yard trimmings for offsite composting at a municipal facility, the Massachusetts Department of Environmental Protection (MADEP) has conducted home composting coordinator training programs since 1991. Workshops are held each year in the spring and fall to educate the general public and to enlist volunteer home composting coordinators. A core of more than 300 trained coordinators present workshops in their communities, set up demonstration sites with materials

supplied by MADEP, distributes compost bins, and serves as local sources of composting information.
MADEP has provided home composting bins and educational materials to 225 communities since 1994 through a state-subsidized grant program. An estimated 78,000 bins were distributed by 1997, reducing disposal by approximately 30,000 tonnes/year. MADEP also sponsors the "Don't Trash Grass" program that encourages residents to grass cycle. The program is supported by workshops and the dissemination of printed materials, videos, and radio programs.
For more information: http://www.epa.gov/waste/conserve/rrr/pubs/r99034.pdf

Case 17: Home composting in Asti

Country	RA/ LA	Scale	Waste fraction	Results
Italy	Asti Province	Roll out (14,000 composters)	Green & food waste	85.71 kg/inh/year diverted

Description:
In 1998 GAIA S.p.A. (Gestione Ambientale Integrata dell'Astigiano), the public company managing urban waste treatment plants in 115 Municipalities of Asti province, adopted a "Experimental project for waste reduction and compost production through home composting" co-financing by Piedmont Region and Asti Province. The strategy was developed thanks to:

- Centralised buying of composter
- Distribution of composters at municipalities
- Preliminary involvement and training of municipalities personnel
- Public awareness campaign through postal mailing, public assembly, etc.
- Training courses to assure a correct composter management and though the compost quality
- Inscription in a public list to obtain fiscal reduction
- Fiscal control
- Major ordinance in order to rule a fiscal reduction

The pilot project ran between 2000 at 2005. During this period three information campaigns were developed. The project, 570,000 € of global costs, gave very positives results: 14,000 composters has been distributed and the global rate of total waste generation increased very slowly in comparison with the regional average (0.12% increasing in Asti Province versus, 1.96% in Piedmont). At the end of project a 3,000 tonnes/year or 214.28 kg/hhold/year (or approximately 85.71 kg/inh/year) were diverted from landfill with a economic save of 2,639,021 €. The project was then extended and is still on going (*Source:* Cooperica).
For more information: http://www.cooperica.it; http://provincia.asti.it

Case 18: Home composting in Milton Keynes

Country	RA/ LA	Scale	Waste fraction	Results
UK	Milton Keynes	Roll out (210,000 inhabitants)	Green & food waste	5% participation rate; 100kg/hhld/year reduced

Description:
Residents of Milton-Keynes (England) for example, can buy home composting bins made of HDPE plastic from the Council (produced in the Council's recycling factory) at close to cost price. An information campaign has been carried out through the Council's "Messenger" magazine, demonstration gardens and through their internet website. As a result, between 1997 and 2003, 11,000 residents bought home composting bins and reduced their waste generation by about 100 kg/hhld/year.
For more information: http://www.milton-keynes.gov.uk/

Case 19: Community composting In Rennes Métropole				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
France	Rennes Métropole	Roll-out (300 households)	Green & food waste	25% participation rate; > 93kg/hhld/year reduced

Description:

In Rennes Métropole the first community composter (serving households of apartments) was installed at the beginning of 2006 in Saint-Jacques-de-la-Lande. For August 2007 there were already 25 of collective composters installed gathering approximately 300 households (representing a participation rate of 30%). At the beginning of 2009, the number of collective composters installed was already 100 (1,150 households – 25% participation rate).

Householders interested in collectively composting their organic waste are put in contact with Eisenia, a contractor who apart from following the installation of composters and the good deterioration process of the compost, promotes commitment between householders interested. Eisenia is also in charge of providing participating households with a "bio-bucket" and composting guides in exchange of a signed participation charter. During a period of 6 months a regular monitoring of the composter is guaranteed by the contractor. After that a "master composter" takes over the management of the site. In Rennes Métropole, the bio-waste fraction of household waste is estimated to 100 kg/household/year. Considering that cost of collection and treatment of waste is approximately 150 €/tonne, the 11,800 households together that participate in the community composting are theoretically avoiding the collection and treatment of 1,100 tonnes of waste i.e. reducing costs of 165,000 €/tonnes/year[6] and reducing bio-waste of more than 93 kg/hhld/year.

For more information: http://www.rennes-metropole.fr/

Case 20: Community composting in Switzerland				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
Switzerland	Zurich	Roll out (370,000 inhabitants)	Green & food waste	12% participation, 100 kg/hhld/year reduced

Description:

In Zurich 970 Community Composting Parks (CCP) have been set up in the urban and sub-urban areas of the city (households with no garden or a community garden). The scale of the community composting parks varies from 2 to 5 households to more than 300 households participating in one CCP. More or less 25,000 of the 190,000 households of Zurich, or +/- 50,000 inhabitants (12% of the population) participate in the programme. Besides community composting, home composting is largely practised by residents with a garden in Zurich. The initiative is almost always taken by the citizens themselves. The costs for setting up a CCP vary from 225 € for a small scale CCP to 1,500-3,000 for medium scaled CCP. Zurich sets aside an annual amount of 50,000 € for running the CCP program; which includes 15,000 € for the wood chippings service, 7,000 € for service delivery, 21,000 € for training, information and sensitization, 1,000 € for periodical chemical analysis of the compost and finally 6,000 € for materials. Participating households will contribute themselves an amount of around 15 € per year for infrastructure and service delivery (including wood chips delivered by the city). Participating households bring +/- 100 kg of bio-waste per year to the CCP. Extrapolated for the total CCP program 2,500 tonnes of bio-waste is diverted yearly from the waste in Zürich (not taking into account the home composting scheme).

For more information: www.erz.ch

[6] From "Le compostage collectif sur le territoire de Rennes Metropole", 2007 transmited by Sylvain SEGAL, Responsable du pôle traitement et prévention des déchets – Rennes Métropole, s.segal@agglo-rennesmetropole.fr

Case 21 : In vessel community composting				
Country	**RA/ LA**	**Scale**	**Waste fraction**	**Results**
Sweden	National	Roll out	Green & food waste	500-700 l/week treated

Description:
Electromechanical compost installations (closed aerated systems) are widely promoted in Sweden. Those installations (3 x 1.2 x 1.5m), set up in nice, well aerated and user friendly separate buildings close to apartments or in the baseline of apartments, compost the bio-waste of more or less 100 households. The compost installation, made of steel and recycled plastic, turns the bio-waste and adds wood pellets automatically to the bio-waste. The bio-waste is decreased in size when added in the system (in order to facilitate the work of the micro-organisms) and compost is produced in 4 to 6 weeks time. Households collect the bio-waste in compostable paper bags and put it in the compost installation. On average between 500 and 700 of bio-waste a week is treated. More than 1,000 such an installations have been installed in Sweden and yearly, between 50 and 70 installations are added. The investment costs are between 18,000 and 20,000 € (2007 figures). Maintenance costs correspond to 1 hour of work by maintenance personnel (including harvesting of the compost).
For more information: www.poseidon.se; www.joraform.se; www.ibgebim.be/

3.2.5. On-site institutional composting

Strategy Description: Institutions, such as universities, schools, hospitals, correctional facilities, green spaces managed by public authorities and military installations, farms, are uniquely suited to composting because they typically generate large quantities of bio-waste materials and have land available for composting. Institutional composting can reduce disposal costs or, as is the case at many universities, provide opportunities for research and development of new compost technologies.

Technical Problems: Institutional composting facilities, including small onsite systems, are often required to undergo the same regulatory and site selection process as large solid waste disposal and processing facilities. These permit requirements probably represent the single largest barrier to widespread composting by this sector.

Costs per tonne diverted: costs for the onsite institutional programs are organized in by low-technology and high-technology options. The weighted average costs range from 22 € to 70 € per tonne diverted for low technology and high-technology operations respectively. Weighted average costs of low-technology and high-technology operations are 40 € per tonne diverted.

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Case 22: On-site composting – Royal Parks				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	London	Pilot	Green waste	100% of green waste reduced

Description:
Since 2002 as part of ISO 14001 registration 'The Royal Parks' (Central London) has formally carried out the composting of green waste in the Central Royal Parks (Hyde, St James's and The Green Parks and Kensington Gardens). The project aimed to demonstrate the sustainable use of green waste arising and to recycle a target of 100% of uncontaminated green waste by the end of 2005, including expired perennial and bedding planting. This objective is part of a wider Royal Parks management objective for all waste generated in The Royal Parks (To identify, quantify and monitor all waste streams and identify opportunities to move each stream up the waste hierarchy: avoid, reduce, reuse, recycle, recover, dispose). At the beginning of the 1990s most green waste in the Central Parks was treated as general waste mostly by landfilling. It was then decided to find ways of composting this for environmental and economic reasons. The project allows within a year to produce a multi-purpose compost used mainly as a mulch in shrubberies and newly planted areas but has more recently been used to mulch below the tree canopy of shallow rooting trees such as Beech, to improve their resistance to hot dry weather. The compost has also been effectively used as a soil conditioner in landscape schemes. The 10,000 trees in the Central Parks are producing approximately 3,000 m3 of compost each year. When conversion to compost is complete at Kensington Gardens park, all compost is returned to the Park. Project Outcomes: Nearly 100% of uncontaminated green waste is treated within all the Central Royal Parks. Cost savings relate to the avoidance of landfill costs and reduction in transport costs as well as the availability of a quality product that can be used to improve the Parks.
For more information: http://www.royalparks.org.uk/

Case 23: On-site composting – Tufts University				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Medford	Pilot	Green waste	44kg/student/year diverted

Description:
Universities often generate large quantities of organic waste. A feasibility study for a composting project at Tufts University in Medford, Massachusetts, estimated that a typical undergraduate generates approximately 30 kg of food scraps annually. The University of Vermont (UVM) implemented a pilot composting program in 1992. During 1993, approximately 17 % of the UVM waste stream was co-composted with manure. Compostable materials diverted from the university's waste stream included 272 tonnes of mixed paper (34 kg per student) and 78 tonnes of food preparation scraps (10 kg per student). Finished compost was used to fertilize animal feed crops.
For more information: http://www.mcgillcompost.com/PDFs/EPA%20orgmatrlsmgt.pdf

Case 24: On-site composting – Massachusetts Schools				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US & Canada	Concord and Conway	Pilot	Food waste	6.8 kg/student/year diverted; Expected: 453.6 kg/patient/year diversion

Description:
Other institutions, such as hospitals and primary and secondary schools, also have the potential for diverting organic materials. Two elementary schools in Concord and Conway, Massachusetts, for example, have started composting food scraps from the lunch rooms in composting bins managed by students. Although this is primarily an educational project for the students, Concord's program diverted an estimated 6.8 kg/student in its first year of operation. A higher technology alternative is in operation at the London, Ontario, psychiatric hospital. This facility recently started using an onsite enclosed in-vessel composting system. The diversion of material is projected to be over 453.6 kg/patient/year.
For more information: http://www.mcgillcompost.com/PDFs/EPA%20orgmatrlsmgt.pdf

Case 25: On-site composting cafetaria				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Canada	Ottawa	Pilot	Food waste	420 litres of compost/week production

Description:
In February 1995, the Canadian Department of Natural Resources (NRCan) in Ottawa implemented a compost operation using a small in-vessel composting system. While its cafeteria alone generated about 54.43 kg/day, NRCan decided to bring in food scraps from other institutions in the region because it had a throughput capacity of 350 kg per day. Wood chips are added as a bulking agent to the food scraps. NRCan pays to have the wood delivered. The in-vessel unit produces 420 litres of compost a week.
For more information: http://www.mcgillcompost.com/PDFs/EPA%20orgmatrlsmgt.pdf

Case 26: On-site composting – YMCA				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	New York	Pilot	Green & food waste	80 tonnes/year treated & $5,200 savings/year

Description:

The Frost Valley Young Man Christian Association (YMCA), a 6,000-acre residential educational and recreational facility in the Catskill Mountains (Claryville, New York), has achieved total onsite composting of the food discards from its kitchen and dining room. When a waste assessment in the late 1980s found food to be the greatest component of the waste stream, Frost Valley began to take steps to implement a static aerobic composting system. Since 1990, the camp's kitchen staff has been collecting all of their food preparation scraps, meat, bones, and paper towels, while guests deposit their leftovers in an unlined can in the dining room. Staff stationed in the dining room during meals educate guests and assist them with proper food recovery procedures. Eventually, the collected food discards are added to a standard feed mixer along with Frost Valley's other organic waste (including yard trimmings and horse manure), mixed with an equal amount of wood chips (which act as a bulking agent), and finally windrow-composted on site after the materials have begun to break down. Frost Valley uses the finished compost in landscaping and gardening projects and in its onsite greenhouse, which demonstrates the benefits of composting to the thousands of visitors that participate in the YMCA's waste reduction education program every year. In 1997, the facility recovered an estimated 80 tonnes of food and other organic discards or 100 % of its estimated generation! Frost Valley realizes a net savings of $ 5,200 annually as a result.

For more information: http://www.mcgillcompost.com/PDFs/EPA%20orgmatrlsmgt.pdf

CHAPTER 3

3.3. Summary

Strategy	Case N°	Case description	Results
Green scaping	1	Meadow areas in Scotland	Frequency of cuttings from every 10 days to 1-3 times/year; time & costs savings
	2	Slow growing grasses for lawn haters	40% less mowing and 50% less grass clippings
Smart gardening	3	Maryland bans	50% yard trimmings reduced (55 kg/inh/year) & $4.38/tonne saved
	4	Pinellas County grass cycling programme	51,227 tonnes diverted or 720 kg/hhold/year
	5	Grass cycling in parks	26 tonnes/ha/year diverted
	6	Mulching in Dunorlan Park	All prunings chipped on site and reused
Act against food wastage	7	Serving the right portion	Expected: considerably decrease the 20-25kg bio-waste generated per restaurant/day
	8	Supplement charged for leaving food on the plate	Decrease leftovers on the plate
	9	Guidance to avoid food waste	10 kg/inh/year reduced
	10	Food waste avoidance at Sainsbury's	20 tonnes/year/store reduced
	11	Commerce donates food to social supermarkets	45 kg/commerce/day reduced
	12	Food donation - Good Samaritan Law	> 100 kg/day redistributed
	13	Retailers redistribute surplus fresh food	5 million meals provided/year & less 40% disposal costs/pallet
Home & community composting	14	Home composting organised by a waste syndicate	1,030 tonnes/year diverted
	15	Tax break for home composting	77 kg/inh & 102 kg/inh reduced
	16	Home composting after a landfill disposal ban on yard trimmings and grass clippings	30,000 tonnes/year or ~400 kg/bin/year reduced
	17	Home composting in Asti	85.71 kg/inh/year diverted
	18	Home composting in Milton Keynes	5% participation rate; 100kg/hhld/year reduced
	19	Community composting In Rennes Métropole	25% participation rate; > 93kg/hhld/year reduced
	20	Community composting in Switzerland	12% participation, 100 kg/hhld/year reduced

Strategy	Case N°	Case description	Results
	21	In vessel community composting	500-700 l/week treated
On-site institutional composting	22	On-site composting – Royal Parks	100% of the green waste reduced
	23	On-site composting – Tufts University	44kg/ student/year diverted
	24	On-site composting – Massachusetts Schools	6.8 kg/student/year diverted; Expected: 453.6 kg/patient/year diversion
	25	On-site composting cafeteria	420 litres of compost/week production
	26	On-site composting – YMCA	80 tonnes/year treated & $5,200 savings/year

In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable bio-waste waste prevention benchmarks:

	Bio-waste generation kg/inh/year (1)	**Potential bio-waste quantitative benchmark kg/inh/year** (2)
Green scaping	90	10
Smart gardening		
Act against food wastage	30	10
Home, community & on-site composting	100	20
	220	**40**
	Total bio-waste quantitative benchmark	**Total bio-waste quantitative benchmark**

(1) The quantities of bio-waste generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

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Quantitative benchmarks for packaging waste

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4.1. Introduction

4.1.1. Definitions

EC definition: **Packaging waste** is material used in the containment, protection, handling, delivery and presentation of goods, that is subsequently discarded. This includes all levels of the production chain, from the primary raw materials producer through to consumer (Source: Eionet).

The EU Packaging Directive 94/62/EC defines "packaging" and "packaging waste" as follows:

- *Packaging:* "shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer". "Non-returnable" items used for the same purposes shall also be considered to constitute packaging.

  "Packaging" is also classified in:
  - *Primary packaging or sales packaging*, "i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase"
  - *Secondary packaging or grouped packaging*, "i.e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics"
  - *Tertiary packaging or transport packaging*, i.e. packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, ship and air containers

- *Packaging waste:* "shall mean any packaging or packaging material covered by the definition of waste in Directive 75/442/EEC, excluding production residues, i.e. any substance or object which the holder disposes of or is required to dispose of in accordance with the provisions of national law in force.

The flow of packaging waste considered here can arise from different sources such as supermarkets, households, hotels, restaurants, retailers, etc.

4.1.2. How does packaging waste impact?

It is understood that packaging provides a physical barrier between products and their external environment ensuring hygienic conditions and reducing the risk of product wastage due to contamination or breakage, and this has been of particular importance both for food and beverage products. It is also needed for safe and efficient product transportation and ease of storage. However, over-packaging has become a reality.

The problem with over-packaging is twofold: it wastes raw materials, and certain of those materials are difficult to recycle and end up in overburdened landfill systems. There's nothing wrong with reasonable

packaging; we all want the goods we buy to be clean and undamaged. But retail packaging has a dual purpose – protecting a product, and getting you to buy it. The latter case is where things get out of hand.

Packaging represents a very important share of the average household's waste, particularly if you not only consider its weight but also its volume. Reasons for this include: smaller households, higher living standards, increasing use of convenience food (ready-made meals) at home and on the move, and higher food hygiene standards. Another reason is "globalisation": packaging is a key component in international trade. Fifty years ago most of what was consumed was produced nearby. Today even basic goods such as water travel halfway round the world to reach us. Last but not least, packaging is (perhaps more and more) a major marketing tool, a vector for brand names and consumer values. Vendors spend big amounts of money fighting for shelf space. Once they have it, they want to be seen, hence the millions of Euro spent annually on the design of over-the-top packaging with high 'shelf appeal'.

The variety of products can partially justify a huge diversity of packaging and a wide range of materials: cardboard boxes, glass jars, plastic bags, plastic film, aluminum wrappers and expanded polystyrene, to name just a few.

The use of packaging generates significant environmental impacts. They are mainly associated with their short life-time (it turns into waste as soon as its contents reach its destination), the littering of roadside and amenity spaces (plastic bags, cans,…), the threat to both countryside and coastal area wildlife[1], the use of natural resources (extraction of the raw materials), the emission of air and water pollution in manufacturing processes, the collection of packaging waste (impacts related to transport) and its subsequent treatment or disposal.

Plastic shopping bags are a typical example: they have a user life span of roughly 20 minutes, yet take 400 years to degrade. As they weigh only a few grams, even a large number of bags do not represent a mass flow which is significant in kilograms, however about 1.8 trillion plastic bags are consumed per year worldwide, i.e. 300 bags/inhabitant or 3 million bags per minute.

On the other side when looking at refillable bottles, there is an environmental impact from the washing and refilling of re-useable bottles. However, the more a bottle is returned for re-use, the more primary resources are saved, especially where transportation distances are minimized.

With regards to disposable crockery & cutlery several impacts can be mentioned. Paper/cardboard, plastics[2] and biodegradable polymers are the materials used nowadays for producing disposable crockery. Wood and crude oil extraction to produce disposable crockery and cutlery, as well as manufacturing and transportation at each stage of the life cycle are at the origin of important environmental impacts including water pollution, chemical emissions into the atmosphere, loss of biodiversity, etc. Bleaching and colour inks often used add to the negative environmental impacts. Disposable crockery wastes also cause a visual form of pollution,

[1] Plastic - especially plastic bags and PET bottles - is the most pervasive type of marine litter around the world, accounting for over 80 per cent of all rubbish collected in several of the regional seas assessed. Plastic debris is accumulating in terrestrial and marine environments worldwide, slowly breaking down into tinier and tinier pieces that can be consumed by the smallest marine life at the base of the food web. Plastics collect toxic compounds that then can get into the bodies of organisms that eat the plastic.

[2] Petrochemicals derivates such as foamed or hard-walled polystyrene (PS), High density Polypropylene (PP) and Polyethylene terephtalate (PET)

since it is often abundant as litter in the outdoor environment. Plastic degrades slowly and burning them can result in toxic fumes.

Sustainable packaging use requires not only packaging optimisation including reducing weight, adapting shape & dimension, reducing/removing layers, increasing recycled content but also, and more important, consumers' changes at lifestyles and consumption habits. This can help to achieve costs and resource efficiency (less energy, less raw materials, less transport), enhance carbon footprint, reduce the number of "food miles" due to transportation and food storing, and enhance citizens' brand perception while responding to consumers demand for less packaging.

4.1.3. CO_2 impacts of packaging waste

Packaging, depending on the type, is a high resource and energy demanding product group throughout its whole lifecycle and as such a significant contributor to greenhouse gases. Some of the packaging is made from renewable materials (cardboard, packaging paper) while others are dependent on non renewable resources such as steel, aluminum (bauxite) and oil.

Packaging CO_2 savings at production level have been achieved and can further been achieved by reducing the weight, designing for less material resource, etc.

For example, the Sustainable Packaging Coalition (SPC) (http://www.sustainablepackaging.org) developed a tool allowing packaging makers to see the life cycle impacts of their design choices, including environmental and energy related issues and guide them to better decisions.

However, avoiding packaging (buying in bulk, using durable shopping bags, purchasing products with minimal packaging, etc.) remains the most appropriate method to reduce CO_2.

The analysis of the figures and trends of economic growth shows that both in the use of primary materials as in industrial production there is a big potential of dematerialisation per unit of product e.g. by material substitution, efficiency improvement and other economic factors. It would also be possible to modify consumer habits!

4.1.4. Quantitative flows of packaging waste

Total amount

There are large variations between Member States in the use of packaging per capita, ranging from 241 kg/capita in Ireland to 95 kg/capita in Greece and even 56 kg/capita in Bulgaria and Slovakia (2006). The average 2006 figure for the EU-27 was 165 kg/capita. The variations within EU-15 countries are difficult to explain, however they also seem to reflect differences in production and consumption patterns. One reason may be different market shares of reusable packaging (Eurostat).

For ease of calculation we shall use a figure of 25% packaging waste generated as part of the municipal waste stream, accounting for a total of 75 million tonnes of the 300 millions tonnes municipal waste generated in Europe, which means an average of 150 kg/inh/year.

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Trends in packaging waste generation per capita vary between the countries. While some countries (e.g. Germany and Portugal) show a relatively constant increase, others (e.g. France, Austria) seem having been able to stabilise and even reverse the increases in generation - albeit often at a high level.

Packaging waste fractions

The packaging waste materials include glass, aluminum, steel, plastics and paper/cardboard and can be quantified as follows (*OECD, 2000*):

	Use	%	Variations	Kg/inh/yr	Million Tonnes
Glass	Glass packaging is typically used for bottles and jars for a wide range of food and beverage products.	8%	3% in Hungary – 13% in France	48	24
Aluminum	Aluminum is primarily used for drink cans.	5%	2% in Denmark to 7% in Austria	30	15
Steel	Steel can (tinplate can sheet) packaging is used in a wide range of applications, including fruit juice, instant coffee and milk modifiers.				
Plastics	Plastics are used in a wide range of packaging applications.	7%	1% in Denmark – 12% in Spain	42	21
Paper/ cardboard	Includes carton board packaging applications such as cereal/ biscuit boxes and corrugated cardboard boxes used for secondary or outer packaging.	5%		30	15
Total		**25%**		**150**	**75**

Within the municipal packaging waste (150 kg/inh/year), the following sub-flows can be identified:

- Non-returnable/non-refillable packaging accounts for a waste stock of more than 17.5 million tonnes or 35 kg/inh/year.
- Plastic water bottles account for 3 million tonnes or 6 kg/inh/year
- Shopping plastic bags account for 1 million tonnes or 2 kg/inh/year.
- Excessive packaging can result in an estimated 53.5 million tonnes or 107 kg/inh/year

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4.2. Packaging waste prevention strategies

We shall comment on four packaging waste reduction strategies: encourage refillable/returnable packaging use, promote tap water, fight against excessive packaging and encourage reusable bags.

4.2.1. Encouraging refillable/returnable packaging

Strategy description: Individual consumers, commerce (supermarkets, canteens, restaurants and hotel) and institutional establishments such administrations, universities, etc., will reduce packaging waste generation through:

- ➔ Requesting that deliveries be shipped in returnable containers (commercial)
- ➔ Preferring refillable/returnable packaging when buying or packing products
- ➔ Preferring product recharges (for products such as detergents, cloth washing liquids, etc.) whereby the original packaging can be recharged directly by the consumer without passing through the external loop of the packaging waste management.

Technical problems: In some cases, increased transportation and handling of reusable packaging leads to increased material and energy use.

Costs per tonne diverted:
Savings are considerable and comprise less raw materials being used, less energy required in the manufacturing process and better use of shelf space in store which can positively impact on sales. Other benefits can include enhancing brand perception and carbon footprint reduction.

Cases:

Case 27: Refillable packaging credits				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Zonhoven	Pilot	Bottles	2.1 kg/cap reduction
Description: Since 2001, the inhabitants of Zonhoven (a municipality of 20,300 inhabitants located in the Belgian province of Limburg in Belgium) receive "credits" when they buy drinks in refillable packaging thanks to an electronic recording system (each household received a savings card). These credits give right to a premium at the end of the year (discount of maximum 8.75 € on the waste tax). The participating retailers have to provide a minimum selection of drinks in refillable packaging: at least one alternative in refillable packaging for milk, yoghurt, chocolate milk, fruit juices, lemonade, coke, water, beer and wine. Total weight of drink packaging decreased from 25.5 kg/cap before the action to 23.4 kg/cap in 2003. **For more information:** OVAM - http://www.ovam.be/				

Case 28: Refillable glass bottles				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Gipuzkoa, San Sebastian	Pilot (21 families)	Bottles	20% less packaging waste

Description:

Through its Waste Prevention Programme, 'Gipuzkoa Foral Diputation's' Sustainable Development Department, has set for 2016 the waste prevention objective of keeping quantities of generated waste to the same level of those of 2006. In this framework at the beginning of 2007 Gipuzkoa has launched the "Yo reduzco mis residuos" (I reduce my waste) into which 21 families participated. The two phases of the project that lasted one month each consisted in:

1. Business as usual: families behaved as usual regarding their waste generation. Wastes were daily weighted and classified to evaluate prevention/reduction potentials for the mixed waste.
2. Information & awareness: first, an information meeting was organised, a guide with practical measures to prevent/reduce waste at home was given to pilot families. Secondly, waste generated was analysed (quantity and type) to measure improvement.

Results showed that food and drink packaging represented about 25% of domestic waste and that 5% was one-way glass packaging. By using more refillable glass bottles, families have been able to reduce by 20% their packaging waste.

For more information: http://gipuzkoaingurumena.net & Memoria "Yo reduzco mis residuos"http://www4.gipuzkoa.net/MedioAmbiente/gipuzkoaingurumena/adj/documentacion/memoria_castellano.pdf

Case 29: Bottles and cans deposit system				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Norway	National	Roll out	Bottles	up to 100% return percentage for deposit systems

Description:

Deposit systems for bottles and cans are well established among Norwegians. The objective of this regulation that has retailers and final consumers as target groups are to contribute to effective return systems for beverage packaging in order to reduce waste. In 2002 there were 10 deposit systems approved by the Norwegian Pollution Control Authority. The condition for approval of a deposit system is a return percentage of a minimum of 25 %. However, many of the systems have a return percentage between 75 and 100 %, showing that deposit systems are seen as being effective with a high level of acceptance (*Source: Eionet*).

For more information: http://www.sft.no

Case 30: Reusable transport packaging				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Austria	National: retailer	Pilot	Transport packaging	3,500 tonnes reduction

Description:

The increase in the rate of reusable transport packaging for fruit and vegetables was registered to be from 44% to 51% at SPAR supermarket in Austria (2005). This result led to a reduction of 3,500 tonnes/year of waste. Assuming that SPAR has a market share of 25%, that the reusable transport packaging portion in

Austria is 40% and that the maximum recovery of reusable transport packaging is 80%, there would be a potential for prevention of transport packaging waste from the fruit and vegetable trade as much as 80,000 tonnes/year.
For more information: http://www.spar.at

4.2.2. Promoting tap water

Strategy description: residents, HORECA and public establishments will reduce waste issued from plastic water bottles by promoting tap water. Promotion of tap water can include:

- target-specific information campaigns
- installation of tap water fountains in schools, administrations, business and public places
- serving tap water as a standard practice in restaurants, canteens, etc. rather than bottled water.
- developing a local tap water brand
- taxation or ban on plastic bottled mineral water

Technical problems: According to the Earth Policy Institute, the world global consumption of bottled water reached 154 billion litres in 2004, an increase of 57% compared to 1999 (98 billion litres). Even in areas where tap water is safe to drink, demand for bottled water is increasing, producing unnecessary garbage and consuming vast quantities of energy. Italians drink the most bottled water per person, at nearly 184 litres in 2004 - more than two glasses a day.

The most commonly used plastic for making water bottles is polyethylene terephthalate (PET), which is derived from crude oil. In contrast to tap water, which is distributed through an energy-efficient infrastructure, transporting bottled water long distances involves burning massive quantities of fossil fuels. Nearly a quarter of all bottled water crosses national borders to reach consumers, transported by boat, train, and truck.
Whereas, bottled water may appear necessary in areas where tap water is of poor quality, it is quite evident that the consumption of bottled water in many European countries appears as a luxury and as an unnecessary waste of scarce resources.

However, citizens' attitude and subsequent behaviour at the moment of choosing the water to be consumed remains a main issue. Information campaigns could address on the one hand the impacts of bottled water (resources, energy, etc.) and on the other hand promote the use of tap water as a safe and healthy alternative.

Costs per tonne diverted: Campaign costs as well as investment costs such as drinking fountains are quite variable. Important savings can be achieved at consumer level since bottled water can be between 240 and 1,000 times more expensive than tap water. Additionally, since less waste has to be collected and treated, municipalities might decrease their waste management bill.

CHAPTER 4

Cases:

Case 31: Water fountains in schools				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Brussels	Roll out (1 million inhabitants)	Bottles	43% waste reduction

Description:
As part of a call for prevention waste projects, the Brussels Region installed water fountains in one of its schools in order to reduce the consumption of one-way bottles. As a result, a 50% reduction in one-way bottles thrown away was obtained. Based on the above project, the Brussels Environment Administration (IBGE-BIM) launched in 2002 a campaign to install water fountains in all the Brussels primary schools. In 2 years time 121 schools participated and 180 water fountains were installed. Support actions were also carried out (teaching support, awareness tools, etc.). This resulted in 43% reduction in waste generation of the relay class (the one specific class where waste reduction was measured).
For more information: www.ibgebim.be

Case 32: Complete ban on bottled water sale				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Australia	Bundanoon municipality	Roll out (2,500 inhabitants)	Bottles	Expected 100% reduction

Description:
Australians spent about $500 million on bottled water in 2008, a 10% increase compared to 2007. A voluntary ban on selling bottled water, supported by the whole community including the retailers, has been triggered in the rural municipality of Bundanoon, SW of Sydney, Australia, by concerns about the carbon footprint associated with bottling and transporting the water. More than 350 residents turned out to vote at the public meeting in the town hall. Only one resident voted against the ban, along with a representative from the bottled water industry, ABC. The reusable bottles will bear the slogan "Bundy on Tap". Free water fountains will be installed in the municipality.
For more information: http://www.bundyontap.com.au; http://www.wsc.nsw.gov.au

Case 33: Taxation on plastic mineral water bottles				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Italy	Piedmont Region	Roll-out (4,4 million inhabitants)	Bottles	CO2 emissions reduction: potentially 2.8% of the Kyoto target for Italy

Description:
In the Piedmont Region of Italy a specific tax on mineral water plastic bottles based on an article of the Financial Law (“Legge finanziaria”) that envisages a tax of 0.7 € per 1000 litres has been adopted with the aim of waste prevention. The tax amounts to 0.5 € per 100 litres. There is no formal law yet but it is under discussion. Lombardy Region has also approved this tax (0.05 € per 100 litres) as well as the Umbrian and the Veneto regions. This last one is the most performing region at national level, having a tax of 480 €/m3 (or 516 €/m2 in mountain) for water extraction against 30 €/m2 as the Italian national average. The International Association for Environmental Communication (AICA) has calculated that the shift-bottled water

to tap water could reduce the CO2 emissions of 1,000,000 tonnes (or 2.8% of the Kyoto target for Italy). Health arguments are also being used to promote tap water.
For more information: www.envi.info; http://www.regione.piemonte.it; http://www.regione.lombardia.it; http://www.regione.umbria.it; http://www.regione.veneto.it

Case 34: Promoting tap water in Tokyo				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Japan	Tokyo	Pilot	Bottles	Potentially high

Description:
Tokyo has launched an ambitious campaign to tell its citizens that tap water is safe to drink. The Tokyo metropolitan government's Waterworks Bureau has set aside 1,870 million yen (~13,942 €) in advertising expenses from which 920 million yen (~6,859,528 €) will be used to finance a campaign to promote the sale of Tokyo's tap water. The amount represents a nine fold increase from the 100 million yen each in the fiscal 2007 and 2008 budgets. For example, they have produced posters and videos to show cast in trains and subway stations, with young actors enjoying a drink of clear, refreshing tap water, and special kids' pages on their internet site. The campaigns also include tours to waterworks related plants and information on the web. Other water-related awareness campaigns related to water leaks from pipes and toilets. The city water campaign is closely tied to Tokyo's bid to host the 2016 Olympics. In fiscal year 2009, the waterworks bureau will spend 200 million yen to expand the use of the commercial message and also to make a separate message aimed at promoting the whole of the capital's water service business, which will use the Olympic bid logos.
For more information: http://www.waterworks.metro.tokyo.jp

Case 35: Reusable plastic bottles filled with tap water at universities				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Catalonia	Pilot	Bottles	10% less plastic dispenser's used

Description:
The Catalan Municipal Waste Management Programme for 2007-2012 proposed an objective involving a 10% reduction in municipal waste generation per inhabitant, (from 1.64 kg/inh/day in 2006 to 1.48 kg/inh/day by 2012). Between 2004 and 2008, under the framework of its strategy, ARC has offered subsidies for municipal waste prevention projects granted subsidies to 834 projects for up to 75% of the total cost of the project. One of the projects supported was the reduction of disposable beverage packaging at the Autonomous University of Barcelona (UAB) which aims to promote the use of reusable packaging and save raw materials within the university community through the design, production and distribution of a reusable plastic bottle which incorporates a glass in its base, called a "gotimplora". In total, 35,000 units were distributed among students, lecturers and management staff at the university.

The glass can be used in dispensers, in coffee machines and machines providing other cold drinks, for which the "no glass" option is activated. Secondly, the glass and the flask can easily be filled at the water fountains systems (public drinking water supply network) within university buildings. According to UAB data, UAB dispensers serve over 1.1 million hot drinks, of which nearly 10% are with the "no glass" option which enables the user to make a purchase using his or her own cup or glass without having to use a disposable plastic cup, which also saves money. The large-scale replacement of disposable containers by the gotimplora could avoid the production of over 25,000 kg of plastics, avoiding the emission of 232.6 tonnes of

CO2 equivalent into the atmosphere.
For more information: http://www.uab.cat; http://www.arc-cat.net

4.2.3. Encouraging reusable bags

Strategy description: Residents and retailers will reduce packaging waste generation through encouraging the use of reusable bags as an alternative of single use paper or plastic bags.
Reusable bags are made of fabric such as canvas, woven synthetic fibres, or a thick plastic allowing multiple uses. Reusable tissue shopping bag requires less natural resources (fuel) and produce less waste and carbon dioxide. In some countries, production and distribution of single-use plastic bags are regulated by law. As an example Belgium has a tax on plastic carrier bags amounting to 3 Euro per kg.

Promotion of reusable carrier bags can be done through:

- free distribution of reusable bags (initially and further sale at accessible prices)
- banning or charging shopping single use bags
- setting a specific levy on single-use plastics bags
- offering discounts when clients bring their own shopping bag
- encouraging setting of retailers' voluntary targets for single use bags reduction
- developing information campaigns

Technical problems: From the commerce point of view, adaptation to the new policy is necessary including staff information and awareness raising, establishing contact and reaching agreements with new bags' providers, etc.
Client resistance can be observed when facing banning or charging of single use bags. Correct information and awareness-raising being offered by staff can contribute to better and quicker acceptance.

Costs per tonne diverted: When switching from single-use to reusable bags retailers might consider some costs such as distributing free reusable bags when launching an awareness campaign. Local authorities might also bear awareness campaign related costs (personnel, graphics, design, etc.) when setting up a campaign on the use of reusable carrier bags, in example in the framework of an anti-litter campaign.

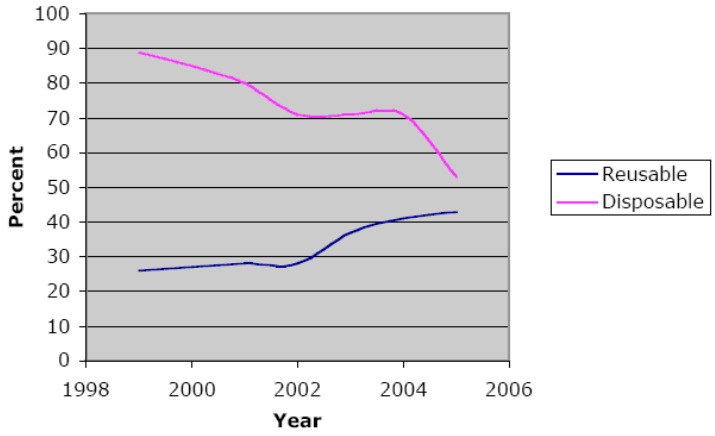
Cases:

Case 36: Reusable bags information campaigns

Country	RA/LA	Scale	Waste fraction	Results
Belgium	Walloon Region	Roll out (3.4 million inhabitants)	Carrier bags	36% less single-use plastic bags use

Description:
The Walloon Region in Belgium carried out information campaigns to encourage the use of reusable shopping bags. The post-survey showed that the information campaigns allowed to reduce the use of single-use plastic bags significantly in a few years (from 89% in 1999 to 53% in 2005) the proportion of population using single-use plastic bags, while the proportion claiming to use reusable bags rose from 26% to 43%.

Use of Reusable and Disposable Bags



For more information: http://www.wallonie.be/

Case 37: Irish levy on plastic bags				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Ireland	National	Roll out	Carrier bags	94% reduction in single-use plastic bags use & 96 million € saved

Description:

A dramatic change in consumer behaviour was observed in Ireland (1.2 billion bags were used annually) with the introduction of a specific levy on single-use plastic bags of 0.15 € per single-use plastic bag after the introduction of a "PlasTax" on plastic bags (HDPE and degradable plastic) by the Irish Government in 2002 (Recycling was not considered a viable option as Ireland lacks the necessary infrastructure). Immediately about 94% reduction in single-use plastic bag consumption was observed (from 340 single-use plastic bags/inh/year to 20 single-use plastic bags/inh/year) corresponding with a very positive impact on the problem of litter (visual nuisance). More than 96 million € were saved by avoiding new waste infrastructure, intensive waste awareness campaigns, etc. A survey showed that households supported the levy with the majority feeling "that the impact of the levy in terms of convenience at checkouts and generally was enhanced". Virtually all respondents indicated that the impact on the environment was positive producing a noticeable reduction in plastics bags "in the environment" (*Convery and MacDonnell, 2003).*

For more information: http://www.environ.ie/en/Environment/Waste/PlasticBags; http://www.gov.ie

Case 38: Voluntary agreements to reduce plastic bags				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Luxembourg	National	Roll out	Carrier bags	Expected 38% increase in use of reusable bags

Description:

Around 750 tonnes/year of single-use plastic bags are consumed in Luxembourg. In order to reduce the quantity of lightweight single-use plastic bags in circulation Luxembourg Environment Minister reached a voluntary agreement with Valorlux (the non-profit Packaging Recovery Agency) for the period2004-2008, to promote reusable shopping bags. Since the signing of the first agreement (January 2004), some 600,000 "eco-sacs" (reusable bags) have been sold. The signatory to the agreement expect to see a 38 % increase of households using reusable bags. A new agreement has been signed for the next period 2008-2012.

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For more information: http://www.environnement.public.lu; http://www.environnement.public.lu/dechets/dossiers/emballages/accord_volontaire_2012.pdf?SID=068090c6d2f4310aecf182d1f7b61100

Case 39: Banning disposable grocery bags				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Edmonds City Council (Washington)	Roll out (39,500 inhabitants)	Carrier bags	NA

Description:
In February 2009, the Edmonds City Council adopted a six-point plan for sustainability that included banning plastic grocery bags. In July (2009), Edmonds voted the ban at retail stores becoming the first city in the state to do it (one of 5 bans enacted in 2009 of a total of 10 plastic carryout bags bans in the US). The ordinance gives retailers one year to use up their existing stock of plastic and retrofit checkout counters to accommodate paper bags. Edmonds estimates its residents carry away some 8 million disposable bags from checkout counters each year i.e. more than 200 disposable bags/inh/year. Bags used inside stores by customers to contain bulk items such as fruits and vegetables, potentially wet products such as frozen foods and meat, nuts, grains, candies or baked goods and other prepared foods are exempt from the green bag fee. Stores can still offer free paper bags. However, if customers remember to bring their own reusable bag, some stores give a small cash rebate (e.g. 5-cents credits/reusable shopping bag)
For more information: http://www.ci.edmonds.wa.us/;
http://www.ci.edmonds.wa.us/Ordinances/2009/Ord_3749.pdf

Case 40: Reusable bags - UK retailers				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	National (retailers)	Roll-out	Carrier bags	83% reduction in single-use plastic bags use

Description:
British retailer Marks & Spencer has cut its disposable plastic bag purchasing by 80% by introducing a surcharge on disposable plastic bags and encouraging the use of reusable bags. Whereas Marks & Spencer used to purchase 460 million bags/ year, it has dropped to 80 million (reduction of 83%). Also, the National Trust (another retailer), has similarly seen its plastic bag usage decline by 85%. National Trust, with its home and garden centres, has reduced its purchases by 1million bags. More than 20 UK retailers overshot their targeted 25 % reduction in plastic bag use by the end of 2008, instead cutting their use by 40%. The new goal is to cut bag use to half of 2006 levels by the end of May. While Marks & Spencer and some others have been charging 5 pence per bag, other retailers are using incentives to switch. For instance, Tesco gives consumers one Green point on its club card for every bag they reuse. The program, launched in August 2006, has cut bag use by half. So far, 3 billion bags have been saved. On the surface, the programs have been a huge success. According to the UK's Waste & Resources Action Programme (WRAP), the total number of bags in circulation fell from 13.4 billion in 2006 to 9.9 billion last year. However, plastic bag use by British consumers still represents 400 bags/ household/ year. The UK Department for the Environment Food and Rural Affairs is now promoting the "get a bag habit" campaign, which tells people to reuse bags rather than stuffing them in drawers. The department figures that retailers' voluntary targets will reduce overall bag use by 5 billion units a year in England, Wales and Northern Ireland. Other retailers working to reduce plastic and paper bag usage in favour of reusable bags include IKEA, Tesco and Macy's.
For more information: www.wrap.org.uk

Case 41: Reusable cloth bags campaign				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Alcalá de Henares Municipality	Roll-out (200,000 inhabitants)	Carrier bags	Single use plastic bags reduction

Description:
Every citizen in Alcalá de Henares, a Spanish municipality in the province of Madrid, was estimated to consumes 300 plastic grocery bags per year. In July 2009, the municipality distributed 5,000 reusable cloth bags for free to its citizens within the "It's fantastic, I am not made of plastic" Campaign framework, which aims to reduce the number of plastic bags that are used in daily shopping. Environment and Trade Alcalá councillors presented the campaign in July with economic support of "la Caixa". Campaigns arguments were: resources wastage (petrol), CO2 emissions and high costs for plastic waste treatment. Also in Madrid, owners of fruit, vegetables, meat and fish stands at “La Cebada” market, begun to distribute reusable cloth bags to its customers aiming to raise awareness between consumers. The first hundred reusable bags have been given for free to the ONG bulletin 'Ecoespaña' readers who received by post after completing a form. 'Ecoespaña' is requesting other markets and supermarkets to encourage similar initiatives. Returnable bags will be further sold at €3.50 by phone.
For more information: http://www.ayto-alcaladehenares.es/; http://www.munimadrid.es/

4.2.4. Fighting excessive packaging

Strategy description: Households, administrations, retailers and consumers in general will reduce packaging waste generation through fighting against excessive packaging.
This can be done, among others, by the following strategies:

- Purchase merchandise in bulk rather than individually packed
- Purchase products in bulk or if not possible prefer products with minimal packaging and/or in concentrated form (avoiding not only tertiary but also secondary packaging when possible)
- Work with suppliers to minimize the packaging used to protect their products
- Encourage providers to use reusable containers for shipping products
- Repair and reuse pallets or return them to suppliers (commerce)
- Reuse foam packing peanuts (polyurethane) and “bubble wrap”, or donate to an(other) organization
- Avoid high void space when packing a product/good
- Reduce the weight of the packaging

In some cases secondary packaging is also susceptible to be avoided without creating a damage risk for the product, such as cardboard boxes for plastic container tubes of tooth paste.
An example of over-packaging is the use of standardised boxes. This can lead to void space in the package, which is both a wasteful use of resources and misleading for consumers. In Korea, over-packaging is being prevented through legislative standards for certain types of packaging. For example, max 15% of void space allowed in the packaging in which processed food is packed.

Technical problems: On the one hand, due to exigencies of modern life styles (lack of time, easy cook, etc.), consumers have the tendency to choose packed products such as fruits, vegetables, bread, ready to eat salads, etc. that could instead be bought in bulk. However these consumer habits/attitudes issues are

also supported by a lot of marketing strategies. On the other hand, the packaging performs a number of useful functions.

Costs per tonne diverted: Costs savings by preventing excessive packaging material can be estimated as the costs of packaging (mainly secondary and tertiary) waste management.

Cases:

Case 42: Packaging waste reduction campaign

Country	RA/LA	Scale	Waste fraction	Results
Italy	Suzzara, Mogliano and Valdagno	Pilot	Packaging	2% packaging waste reduction

Description:

Suzzara (17,000 inhabitants), Mogliano Veneto (26,000 inhabitants) and Valdagno (27,000 inhabitants) have developed a packaging waste reduction campaign with the help of « Achab group » (a communication enterprise). It has been proposed to the commercial sector to adopt at least 3 practices among the following choices:

- reduction of secondary packaging
- promotion of refills or refillable products
- promotion of beverage packaged with deposits
- promotion of reusable, biodegradable or recyclable products
- promotion of food without pre-packaging
- use of reusable boxes for food products
- promotion of products with recyclables packaging
- In case of positive response, a specific promotional material “Ecoacquisti” was provided by the communal authorities. A global communication campaign has also been developed for all inhabitants. For Valdagno, an effective reduction of domestic waste was observed between 2001 and 2002:
- from 111,318 Kg to 110,800 Kg of metal waste
- from 251,323 Kg to 226,369 Kg of plastic waste
- from 1,091,540 Kg to 1,072,510 Kg of paper waste
- from 834,158 Kg to 854,247 Kg of glass waste (including refillable glass)

(*Source: ADEME*)

For more information: http://www.comune.suzzara.mn.it; http://www.comune.mogliano-veneto.tv.it; http://www.comune.valdagno.vi.it; http://www.achabgroup.it

Case 43: Guidelines for avoiding packaging

Country	RA/LA	Scale	Waste fraction	Results
Belgium	Inter-municipality IOK	Pilot	Packaging	67% packaging waste reduction

Description:

An action led by IOK–Afvalbeheer (Inter municipality development company in the Kempen) consisted of giving guidance to avoid packaging. Two personnel members went to a shop purchasing a number of goods. The first one paying no attention at all when purchasing goods, the second one being very selective and purchasing similar goods with less packaging. As a result the person focussing and buying goods with less packaging had less 67% less packaging (by weight) in his trolley.

For more information : http://www.iok.be

Case 44: Dematerialisation: The « mini waste trolley»				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
France	National	Pilot	Packaging	Prevention of 50 kg/person/year

Description:
An experience carried out under the supervision of the French Environment and Energy Management Agency (ADEME) demonstrated that a "reference trolley" containing 83 kg of goods could create between 50 and 100 kg of waste. 50 kg when products that produce less waste are chosen (the « mini waste trolley ») to 100 kg when products containing high waste are chosen (the « maxi waste trolley»). In other words, it is possible to reduce the amounts of waste by 50 kg/person/year by making «crafty» choices in favour of some products (re-usable products, packaging-free products, products under recyclable and lightweight eco-friendly packaging). Preventing 50 kg/person/year waste would also save €888.
For more information: http://www2.ademe.fr/

Case 45: Ban on disposal crockery				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Germany	Munich	Roll-out (1,3 million inhabitants)	Disposable crockery	95% reduction at events

Description:
In 1991 in Germany, the local government of Munich banned the use of disposable crockery (paper plates, plastic cups, plastic forks and knifes) at large-scale public events. They are replaced by reusable items for which consumers pay a deposit that they get back when they return the items. This action significantly reduces the waste generated by events like the Christmas market, Auer-Dult Faire, Oktoberfest and Munich City Marathon. Also, for smaller-scale events (200-300 people), the City of Munich cooperates with MobielSpiel e.V offering the possibility to rent a crockery and dishwasher service. e.g. Oktoberfest (beer festival): waste generated was reduced from 11,000 tonnes in 1990 to 550 tonnes in 1999. Since this event is based on a strong ecological concept, it received the "Eco-Oscar" awarded by the Federal Government of Germany in 1997.
For more information: http://www.muenchen.de/

Case 46: New packaging solutions and technologies				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	National: retailer	Pilot	Packaging	5-25% reduction

Description:
The Food Industry Sustainability Strategy launched in 2006 proposes food and packaging waste reduction targets 3% year-on-year up till 2011 based on a 2006 baseline. Through a voluntary agreement, the Courtauld Commitment (CC), major grocery organizations (92% of the UK grocery market) committed to support the UK Government Agency WRAP in its objectives:

- designing out packaging waste growth by 2008
- delivering absolute reductions in packaging waste by 2010
- helping reduce the amount of food householders waste by 155,000 tonnes by 2010 (2008 baseline) by developing new packaging solutions and technologies (innovative packaging formats, etc.).

The objectives were to achieve packaging reductions of 160,000 tonnes/year by 2008 (with 360,000 to 630,000 tonnes CO2 savings) and 340,000 tonnes/year by 2010 (with 760,000 K tonnes to 1,330,000 tonnes CO2 savings). In 2008, CC has led to zero growth in packaging despite increases in sales and population. The 31 signatories (over 35 major retailers, brands and suppliers in total) have announced results to date ranging from 5% to 25% packaging weight reduction. Various ranges of packaging have been studied and "best in class packaging" identified.

Some retailers have the following specific commitments for the near future:

- Morrison: 15% packaging reduction overall by 2010
- Marks & Spencer: 25% non-glass product packaging by 2012
- Tesco:25% reduction on own label and branded packaging by 2010

Targets also reaches branded products, some of which will be sold across Europe, and thus could bring about reductions in other European countries.
For more information: http://www.wrap.org.uk

Case 47: Packaging eco-design

Country	RA/LA	Scale	Waste fraction	Results
Italy	National: industry and retailers	Roll out	Packaging	Reduction in weight: • Bottles: up to -44 % • Detergents: up to -30% • Carrier bags: -50% • Over packaging: -65%

Description:
In Italy, the following reductions in the application of different types of packaging material have been achieved since 1990:

- Bottles: the weight of 1.5 litre PET bottles was reduced from 45 g to 38 g; the weight of the 0.5 l bottles from 25 to 20 g and the weight of the 1 litre polyethylene (PE) beverage bottles was reduced from 120 g to 67 g (-44% in weight).
- For conventional detergent packaging remarkable weight reductions (up to 30 %) have been achieved.
- Carrier plastic bags have also been improved introducing high density polyethylene (HDPE) bags to replace low density polyethylene (LDPE) bags. This resulted in a weight reduction of approximately 50 %. A reduction of the thickness of polypropylene (PP) for flexible packaging of approximately 14% was achieved.
- The substitution of over packaging (paper) with a considerable saving of raw materials, e.g. in coffee packaging, led to a reduction of weight of 65% by sale unit.

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(*Source: http://scp.eionet.europa.eu*)
For more information: http://www.corepla.it (National Consortium for plastic packaging waste collection, recycling and recovery)

CHAPTER 4

4.3. Summary

Strategy	Case N°	Case description	Results
Encouraging refillable/ returnable bottles	27	Refillable packaging credits	2.1 kg/cap reduction
	28	Refillable glass bottles	20% reduction
	29	Bottles and cans deposit system	up to 100% return percentage for deposit systems
	30	Reusable transport packaging	3,500 tonnes reduction
Promoting tap water	31	Water fountains in schools	43% waste reduction
	32	Complete ban on bottled water sale	Expected 100% reduction
	33	Taxation on plastic mineral water bottles	CO2 emissions reduction: potentially 2.8% of the Kyoto target for Italy
	34	Promoting tap water in Tokyo	Expected: high reduction
	35	Reusable plastic bottles filled with tap water at universities	10% less plastic dispenser's used
Encouraging reusable bags	36	Reusable bags information campaigns	36% less single-use plastic bags use
	37	Irish levy on plastic bags	94% reduction in single-use plastic bags use and 96 million € saved
	38	Voluntary agreements to reduce plastic bags	Expected: 38% increase in use of reusable bags
	39	Banning disposable grocery bags	NA
	40	Reusable bags - UK retailers	83% reduction in single-use plastic bags use
	41	Reusable cloth bags campaign	Expected: Single use plastic bags reduction
Fighting excessive packaging	42	Packaging waste reduction campaign	2% packaging waste reduction
	43	Guidelines for avoiding packaging	67% packaging waste reduction
	44	Dematerialisation: The "mini waste trolley"	Prevention of 50 kg/person/year
	45	Ban on disposal crockery	95% reduction at events
	46	New packaging solutions and technologies	5-25% reduction
	47	Packaging eco-design	Reduction in weight: • Bottles: up to -44 % • Detergents: up to -30% • Carrier bags: -50% • Over packaging: -65%

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In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable packaging waste prevention benchmarks:

	Packaging waste generation (kg/inh/year) (1)	**Potential packaging waste quantitative benchmark (kg/inh/year)** (2)
Encouraging refillable/ returnable bottles	35	12
Promoting tap water	6	2
Encouraging reusable bags	2	1
Fighting excessive packaging	107	10
	150	**25**
	Total packaging waste generation	**Total packaging waste quantitative benchmark**

(1) The quantities of packaging generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

www.acrplus.org

CHAPTER 5

Quantitative benchmarks for paper waste

CHAPTER 5

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CHAPTER 5

5.1. Introduction

5.1.1. Definitions

EEA definition: **Paper waste** is defined as "newspapers, magazines, cartons and other paper separated from solid waste for the purpose of recycling" (*Source: http://www.eionet.europa.eu*)

ACR+ definition: **Municipal "Paper waste**" is defined as waste originating from graphic paper, packaging paper & sanitary paper.

5.1.2. How does paper-waste impact?

Every stage of the paper production and consumption cycle is associated with a range of potential environmental problems.

Most wood fibre, from which pulp and paper are made, comes from natural forests managed for their timber production in North America, Europe, and Asia and from plantations around the world. Half of the trees cut commercially around the world end up in paper products. As demand rises (expected growth of 25% by 2020[1]), pressure on unmanaged forests is likely to increase. In some regions the expanding production and harvesting of pulp wood threatens the last remaining natural forest, their precious fauna and flora, and the people that depend on them.

Pulp and papermaking can be a highly polluting process. Liquid effluents from mills include a range of organic, toxic and chlorinated organic matter that adversely affects water quality and can be lethal to fish. While large-scale paper producers in some industrialised countries have succeeded in achieving closed-cycle bleaching, in which no effluent is discharged, serious pollution problems are still common in small pulp and paper mills in developing countries (IIED, 1996). The processing of pulp and paper also consumes vast amounts of energy.-

Chlorine-whitened paper waste is problematic when incinerated in the presence of organic matter because of its chlorine content, forming toxic pollutants such as dioxins and furans. As paper is biodegradable if may cause problems when land filled as well because of difficult to assess reactions when combined with heavy metals and organic waste[2],.

As an example, for the Franche-Comté Region in France (1 M inhabitants), a yearly quantity of mail box publicity was calculated to be around 42 kg paper/family which represented 20 to 40 kg wood, 200 to 600 litres water, 120 to 240 kWh electricity, inks, adjuvant, colouring agents and of course expenses for collection and elimination[3].

[1] "CEPI 2020 vision paper"

[2] Abfallvermeidung und –verwertung durch das prinzip der produzentenverantwortung

[3] Source: ASCOMADE, Programme Régional. Prévention de la production de déchets : Etat récapitulatif –années 2005 et 2006

5.1.3. CO2 impacts of paper-waste

Forest's contribute greatly to efforts to reduce greenhouse gases in the atmosphere as they absorb the greenhouse gas CO2. Production of paper products from virgin sources, i.e. sources other than recycled ones, consumes trees, a process that both releases CO2 emissions and reduces the amount of CO2 that can be sequestered. Deforestation and land use contribute approximately 20% to 25% of the carbon emissions that cause climate change.

The pulp and paper industry is the third greatest industrial greenhouse gas emitter, after the chemical and steel industries[4].

Global paper production and consumption generates enormous amount of waste, much of which ends up as landfill or in incineration plants (with or without energy recovery). Decomposition of paper (and bio-waste) in land fills in absence of oxygen produces methane, a powerful greenhouse gas that contributes to climate change and global warming. The incineration process also releases CO2 emissions as well as other (toxic) pollutants.

On average, when comparing the manufacturing of 100% recycled content paper to virgin paper, 1 tonne of recycled paper can save 1.32 tonnes of CO2 equivalents. This takes into account the complete life cycle and that the recovered fibre may otherwise be land filled or incinerated. An average of 50% less energy consumption is used when recycling instead of incinerating paper and cardboard over the entire life-cycle. In other words, on average virgin production followed by incineration with energy recovery consumed twice as much energy as recycling (Danish Topic centre on waste). According to the Environmental Defence Fund paper calculator, paper generates three times its weight throughout its lifetime in carbon dioxide and other greenhouse gas emissions.

However the better strategy remains paper waste reduction at source: 1kg paper reduction equals to a reduction of ~2kg CO2 per inhabitant yearly.

5.1.4. Quantitative flows of paper-waste

Total amount : In Europe, between 15% to 20% of the municipal waste bin or 90 to 120 kg/inh/year is non packaging waste paper from which an average 66% is collected selectively. Paper waste represents – along with bio-waste - the most important fraction of municipal waste in Europe.

For ease of calculation we use a figure of 17% paper waste generated as part of the municipal waste stream, accounting for a total of 50 million tonnes of the municipal waste generated in Europe or 100 kg/inh/year. Paper-waste is not considered in the bio-waste fraction described and accounted for in chapter 3. We excluded paper packaging in this chapter as this fraction is accounted for in chapter 5 – Packaging.

Paper consumption : 1 million tonnes of paper is used every day around the world, and paper consumption is escalating. Since the 1960s, world consumption of paper has quadrupled and the use of printing paper has increased six-fold.

[4] OECD Environmental Outlook, p. 218

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Just 10% of the world's population (Western Europe and North America) consumes more than 50% of the world's paper. Europeans and Americans use 6 times as much paper as the world average. In European countries, paper consumption varies quite significantly ranging from 50 to 300 kg/inh/yr, with an average of around 200 kg/inh/yr for CEPI countries[5] (CEPI, 2006).

The following estimated quantities of paper consumption (except the paper packaging fraction), according to the main categories, are proposed:

- Graphics (Newsprint and other graphic papers such as books, magazines, telephone directories, etc.) represents 50% of the total paper consumption or approximately 100 kg/inh/year
- Other paper (Sanitary paper products such as facial tissues and handkerchiefs, table napkins, toilet paper, paper towels) consumption approaches 10 kg/inh/year

Paper waste generation: In order to estimate the paper waste generated, the following method can be used:

- First analysing the quantities put on the market. According to CEPI +/- 100 million tonnes are put yearly on the market in Europe since 2006
- Waste bin analyses: paper waste generated from main sources.

The difference between the quantities put on the market and the waste generated is the "Addition to stock", representing the paper "stocked" by households, offices, commerce and schools (ex. books, archived paper, catalogues).

The quantity of (non packaging) paper waste (graphics and sanitary paper) can be calculated as follows:

- An estimated 10 kg/inh/year addition to stock for graphic paper waste generated by households, offices, commerce and schools leaving an amount of 90 kg/inh/year of graphic waste paper generated
- No addition to stock for sanitary paper is considered to be close to reality. Hence an amount of 10 kg/inh/year sanitary waste paper generated.

This will result in a total (non packaging) paper waste generation of 100 kg/inh/year.

According to the ACR+ Paper Cluster working group: municipal paper waste can be further subdivided according to different target groups:

- households: 45 kg/inh/year
- schools: Primary & pre-school 15 kg/pupil/year; Secondary 19 kg/pupil/year
- offices: 50 kg/employee/year

Regarding the nature of the paper a classification can be done as follows:

- Graphic paper
  - Junk mail = 15 kg/inh/year (no addition to stock)
  - Office waste paper = 75 kg/inh/year (from which 20kg/inh/year corresponds to addition to stock)
- Sanitary waste paper = 10 kg/inh/year (no addition to stock)

[5] Confederation of European Paper Industries (CEPI), gathers 19 countries of which 17 make part of EU 27.

CHAPTER 5

5.2. Paper waste prevention strategies

This information in the following section describes 3 paper-waste reduction strategies for the main sources of municipal paper waste.

5.2.1. Reducing unwanted and unaddressed mail

Strategy description: Households and organisations (primarily) will reduce paper waste issued from unwanted and unaddressed mail (advertisement) through the following strategies:

- Implementation of an no junk mail sticker on the door to avoid unsolicited advertising
- Unsubscribing oneself to any paper format publication/catalogue, etc, not used and avoid joining new mailing lists when completing forms
- Adhering to a free registration Mailing Preference Service (MPS) or directly contacting mail senders, to have the citizen's/organisation's name and address removed of mailing lists
- Information/awareness raising campaigns should not only target households to encourage sticker use but also companies staff who deliver brochures, catalogues, promotions, etc, in order to encourage sticker respect

Technical problems: Citizen's participation rate is, amongst other things, directly linked to sticker's efficiency in rejecting unaddressed mail. This will depend mainly on awareness raising campaigns that are carried out: efficacy of the message transmitted, duration of the action, and application of legal consequences of non-respect by mail distributors (fines for delivering mail to a mailbox containing an anti-pub sticker). Also, free phone call to a "green number" can be implemented for citizen's to denounce the reception of unaddressed email when using the sticker.

Costs per tonne diverted: Costs can be attributed to awareness raising campaign regarding the sticker use and the sticker distribution. This can involve: information page on a website; creation, printing and stickers distribution; distribution staff stipendium; etc. Potential savings for producers are also to be taken into account. Production costs of unwanted graphic paper (junk mail) that ends in the bin are not negligible and can be reduced.

Cases:

Case 48: Fighting advertising paper				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Italy	Dogliani Municipality	Pilot project (4630 inh)	Graphic paper (junk mail)	7.96 kg/family/year reduced
Description: Dogliani is a commune (municipality) of 4,630 inhabitants in the Province of Cuneo in the Italian region Piedmont. In 2006, Dogliani Municipality launched a public awareness campaign on waste reduction. Within the campaign, a no junk mail sticker was implemented and 7.96 kg/family/year (3.57 kg/inh/year) advertising material was subsequently reduced (*Source: www.cooperica.it*). **For more information:** http://www.comune.dogliani.cn.it/				

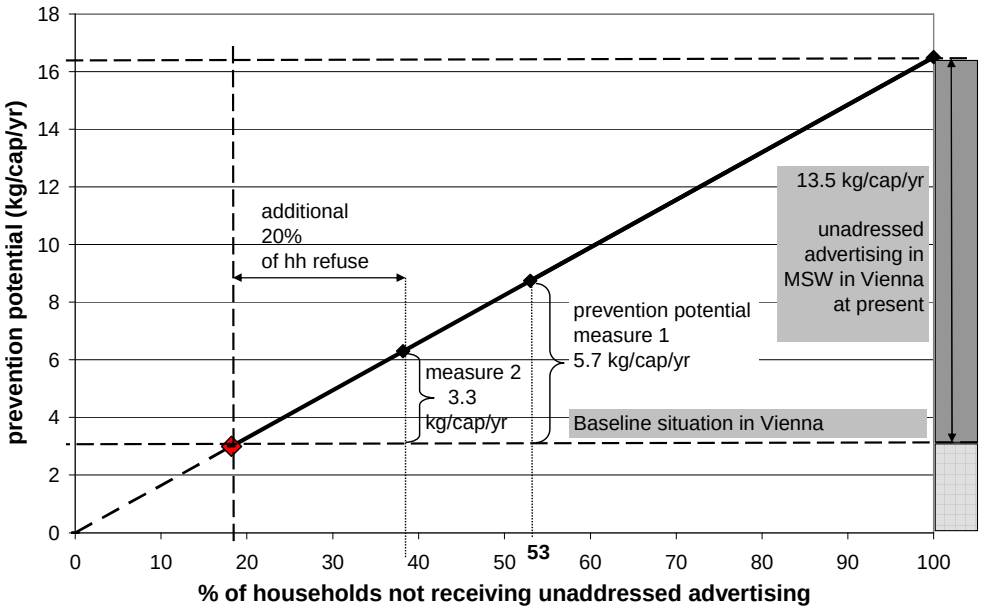
Case 49: Advertising & No junk mail sticker				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Austria	Vienna	NA	Graphic paper (junk mail)	Estimated prevention potential: 3.3 kg/cap/year & 5.7 kg/cap/year

Description:

A research was carried out by Salhofer et al. on paper waste reduction for the city of Vienna (1,7 million inhabitants). Taking into consideration that only unaddressed advertising can be refused (i.e. estimated at 16.5 kg/hh/year), the potential for paper waste reduction of 2 measures were analysed to avoid unwanted advertising material, as a part of the a programme to reduce municipal waste:

- Measure 1"Advertising on request" is equivalent to a prohibition on unsolicited advertising. Advertising should be delivered only to households that wish to receive advertising and formally affirm this.
- Measure 2 "Information on how to avoid unsolicited mail" aims at improving the knowledge of households about the existing possibilities for cancelling the delivery of unsolicited advertising (sticker on the door "Please, no advertising", sticker on the mailbox etc.).

For measure 1, the prevention potential calculated was: 5.7 kg/cap/year and for measure 2: 3.3 kg/cap/year. For the analyses, citizen participation was evaluated through an inquiry among households. The survey revealed that 53% of households were prepared to refuse junk mail, which represented a prevention potential of 21 000 tonnes/yr or 5.7 kg/cap/yr for the City of Vienna.



For more information: "Salhofer et al. Potentials for the prevention of municipal solid waste. Waste Management, Volume 28, Issue 2, 2008, Pages 245-259"

Case 50: Registering with "Mail Preference Service"				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Scotland	Sandwell Metropolitan Borough Council	Pilot	Graphic paper (junk mail)	1/3 reduction of total unwanted mail

Description:

Sandwell (Midlands, Scotland): In order to cut down the amount of unwanted mail, citizens in the UK can register for free with the Mail Preference Service (MPS). This service enables consumers to have their names and home addresses in the UK removed from or added to lists used by the direct mail industry. Between 2001 and 2002, the Sandwell Metropolitan Borough Council launched a campaign called "Junk the Junk Mail" and the effectiveness of the MPS service was tested by the Midlands Coordinating Group on Trading Standards. A survey was carried out and involved selected households before and after registration with MPS. Main sources of unwanted mail were high street stores (29 %) and financial institutions (23 %), 60 % of this being delivered by Royal Mail. The survey found as an impressive achievement of the MPS service the 1/3 reduction of the total unwanted mail. Nowadays, registration with MPS is available for all 290,000 Sandwell inhabitants.

For more information:

http://www.laws.sandwell.gov.uk/ccm/content/councilgeneral/pressreleases/2008-09/sandwell-residents-can-stamp-out-junk-mail.en; Mail Preference Service: http://www.mpsonline.org.uk/

Case 51: Private "Stop Junk Mail" Service				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Private	Roll out	Graphic paper (junk mail)	8 kg/hhld/year reduced

Description:

In the UK, 17.5 billion pieces of junk mail (addressed and unaddressed) are produced every year of which 650 pieces are posted though the average British letter box per year or 1.8 junk mail pieces/day/letterbox. Stop Junk Mail is a self-funded, not-for-profit campaign group giving free and independent advice on how to reduce junk mail. They have created Junk Buster, an application for opting out of unsolicited mail. "Stop Junk Mail" assures that in few clicks it is possible to contact with up to six junk mail opt-out schemes allowing reducing junk mail by some 60% representing 250 pieces or 11 kilos of junk mail per family a year. At the same time it is possible to ask phone directories companies (Yell, Thomson Local and BY) not to deliver their phone directories to a particular address. They also offer letterbox "no junk mail" stickers at the costs of 1 £ each. So far, 5,529 households have used this system to stop junk mail and/or paper directories, saving 1,160,028 pieces or 44,133 kg of unwanted mail per year (8 kg/hhld/year).

For more information: http://www.stopjunkmail.org.uk/

5.2.2. Encouraging dematerialisation through Information & Communication Technologies (ICT)

Strategy description: Administrations, offices and employees working at home can reduce generated paper waste through dematerialization by:

- Copies and printings: replacing old printers with new multifunction printers; Setting copiers and printers to double side printing/copying by default; Tracking staff individual printing quantities; Preferring lower paper weight.
- Faxes: when sending a paper fax, eliminate cover sheets and use fax stick-on labels instead. It is also possible to program the fax machine to eliminate confirmation sheets.
- Word documents: using the menus in Word to send a fax or the Word document without printing first. For editing and reviewing documents, transfer documents on disk or by e-mail and use revision features in word processing software and on-screen editing features when making changes to draft documents.
- Communication: use electronic communications for directories, forms, bulletins, manuals, reports and storage when possible; Use e-mails instead of memos and faxes for announcing meetings and for targeted communications like press releases; Review distribution lists frequently to eliminate outdated recipients.
- Meetings: send preparatory material beforehand by email to avoid printing hard copies of for each participant; encourage the use personal computers for reviewing documents and note-making; Make available blank sides of unneeded single-sided copies and outdated letterhead as draft paper.
- Invoicing: Preferring electronic data interchange (EDI) technologies, like web-based secure credit card transfers and order forms allowing to reduce the need for paper invoices, transaction records and confirmation letters; Printing directly on envelopes rather than using labels.
- Computer printing settings: computer's default settings can be change to allow more text per page such as reducing margins (can reduce paper waste up to 14%), reducing font size (Times New Roman or Arial use significantly less space).
- Reading material (paper, reports, newspapers, e-mails, etc.): Choose electronic form when available.
- Storing information: Storing documents in electronic archives using data compression software saves on filing cabinets and floor space.
- Encourage paper reuse: Using the blank sides of unneeded single-sided copies and outdated letterhead for printing drafts or in-house memos; Using only used paper in the printer tray if printing emails is unavoidable; Set up office systems to pass reports around to multiple readers, rather than copying them.
- Re-use envelopes: by sticking address labels and/or by require the use of reusable envelopes for inter-agency mail. Reusable envelopes or eco-envelopes are designed to serve as a return envelope and to eliminate the need and cost of including a reply envelope in mail that requires payment or correspondence returned from a customer or client. Eliminating the inclusion of a second reply envelope in a mailing will help an organization save money by reducing the cost for the extra envelope, its storage and handling, and the weight of the mailing.
- Information & awareness rising campaigns targeting specific audience (offices, schools, commerce).

Technical problems: Reduce paper waste at offices (administrations and enterprises) may require replacing old by more advanced technology equipment and training.

Moreover, even if employees declare to be able to reduce their number of printings without incidence on their productivity, high quantities are still registered. A survey in 13 countries showed that an average number of

printings per employee per day is: Sweden- 22; France-28; Germany-36; Spain-41 (Ipsos, 2007). According to a previous Ipsos study, in one year printed pages from European employees was reduced in average from 34 (2006) to 31 (2007) printings per day. This shows both the importance of adapting impression policies and targeting employees in awareness raising actions in order to improve reduction rates.

Costs per tonne diverted: Main costs can arise from the need of replacing old technology with more advanced equipment such as printers and copiers that allow double sided printing/coping, getting adequate professional advice and staff training, acquiring specific software to allow print access to employees and to monitor results.

Taking certain measures such as (outlaw underutilized printers and personal printers, improve ratio printer per user, adapt the equipment to the print policy, implement a print policy, network connect all devices, use technology to reduce paper usage, etc.) can generate cost savings estimated at roughly 40 % in the 1st year and up to 52% in the next 3 years if a new print policy is defined based on the specific case and on a better adapted technology (*Source: Osiatis presentation in the ACR+ Paper Waste Cluster Meeting).*

Cases (office paper in offices):

Case 52: Office dematerialisation

Country	RA/LA	Scale	Waste fraction	Results
Belgium	Brussels	Pilot (25 organisations)	Office paper	18% less paper consumption & €75 - €250 savings per employee/year

Description:

At the end of 2003, the Brussels Administration for Environment (IBGE-BIM) initiated a "Program of office dematerialisation actions" aiming to reduce office paper and energy consumption.

Pilot plans and mini-audits in order to determinate paper consumption and its origins were carried out in 25 volunteer organisations of the private & public sector.

Before the intervention, the amounts of paper used per full-time equivalent and per year were:

Average	10,000 A4 /FTE/year (=54 kg)
Large enterprises:	36 kg/FTE/an
Small enterprises:	66 kg/FTE/an
Medium-sized enterprises:	108 kg/FTE/an

Proposed interventions included the following measures:

1. The individual choices of members of staff (training & awareness rising) e.g. reduce font size, reduce margins, reduce line spacing, printing both sides and 2 sheets per page, the document could be reduced to 4 pages.
2. Organisational choices of the organisation, such as virtual internal procedures, rationalise the distribution of external information and set default parameters such as procedures as memos, minutes, press releases, order forms, invoices, archiving, etc.; Develop home-work; decentralise services, etc.
3. Technological resources (office equipment, software and consumable purchases).

After the intervention (most enterprises applied only the 1st measure), all organisations were classified according to their potential of improvement as follows:

- Case with major potential for improvement (11 out of 25): Average savings between 21 and 25 % &

5000 sheets (=25 kg = €250 in savings/FTE/year)

- Case with limited potential and already low consumption (10 out of 25): Average savings of 15% & 1500 sheets (=7.5 kg = €75 pers./year).

Results showed that following simple recommendations to reduce paper consumption, the 25 organisations in the sample group studied reduce an average of 18% paper consumption (weighted average). This represented savings of 75 tonnes of paper and of €775,000 for those 25 companies alone (€75 - €250 savings/employee/year). In the longer term, through organisational measures, the intervention could lead up to 30 % reduction.

For more information: http://ibgebim.be

Case 53: Administration dematerialisation

Country	RA/LA	Scale	Waste fraction	Results
Spain	Manresa City Council	Pilot (One city council)	Office paper	7% paper reduction

Description:

In 2007, the Territorial Area of Manresa City Council (Catalonia) commanded a research study to "Ent, Environment and Management"[6] to analyse the sources of paper waste and to evaluate the effectiveness of paper waste reduction by introducing an ICT technology on working procedures of the administration and by implementing some other measures related to a rational use of paper. It finished in 2008. The follow-up (results after the application of suggested measures) is done by the City Council itself.

The methodology consisted of contacting to all levels of the administration, with special attention to the IT and Purchasing department. The next step was to identify the potential for reducing paper waste in each area.

Two main flows of paper were identified: the internal use of paper (printed or copied documents by workers, registers, certificates, applications and other documents) and the external one (tendering and communication materials). The external use of paper is 3 times bigger than the internal use.

The measures implemented to prevent paper waste were:

1. Optimised ICT Use: a) the use of a Workflow system for internal procedures, digital signature. In the last 4 years it has greatly contributed to a global saving on paper consumption (in 2008 it was up to 5.6%, with an upward trend in 2009). b) Digitalise registers: Avoiding all printings was not possible, but in those cases a minimized format was applied to printings. c) Digitalise sendings: that printed documents were only given to those who specifically asked for them, sending them by e-mail or placing them on the city council website. d) Digitalise external contract documents: make compulsory the use of documents double-sided printed; digitalization of tendering processes.
2. Office Devices (Printers & Photocopiers): pre-configurate double-sided printing function in all the printers that allow it & progressive substitution of old printers by others with this function.
3. Edition of Communication Materials (paper generated represents 3 times the internal consumption): a) to reduce the number of copies to 15%, resulting in paper savings estimated at 29.20 kg/employee (29% of the external paper consumption), b) to define a publication standard format & reduced paper thickness.

The reduction potential for each measure was calculated as follows:

MEASURES		Paper saved (kg/employee)
ICT use	Digital invoicing	0.25
	Digitalise registers	0.25
	Digitalise external contract documents	4.74
Edition of communication material	15% Reduction of the n° of copies	29.20
TOTAL		34.44

As a conclusion, Manresa City Council has already achieved 7% paper reduction regarding the internal use (total reduction potential = 10%) after implementing ICT measures. The most effective measure regarding the internal use was the substitution of printers by other printers with double-sided function. Ensuring the pre-configuration of the double-sided printing function has also had an important effect with no cost. The application of measures had not only an effect on paper waste prevention, but it also represented economic savings. For external use, it was the reduction of the number of printed publications (*Source: Ent Environment and Management presentation at ACR+ Cluster Paper Meeting*).

For more information: www.ajmanresa.cat; http://www.ent-consulting.com/projectes/manresa.htm

Case 54: Reducing paper weight

Country	RA/LA	Scale	Waste fraction	Results
International	ONG	N/A	Office paper	Estimated 14% to 20% less paper consumption

Description:

According to WWF International, in its "Guide to Buying Paper" (2007), paper waste can be reduced through reduce excessive paper consumption. This is also a way of reducing individual environmental footprint. The reduction can be done by switching to the lowest weight that meets offices functional requirements. Changing from 80 to 70 grams per m2 reduces consumption by 14%, while moving from 100 to 80 grams per m2 cuts consumption by 20%.

For more information:

http://www.panda.org/how_you_can_help/greenliving/at_the_office/reducing_paper/paper_toolbox/

Case 55: New printing policy				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
France	Rhône Department	Pilot	Office paper	20% office paper reduction; 52% costs savings

Description:

The general council of 'Rhône Department' contracted Osiatis services (IT service management consultancy company) to help setting a policy in order to reduce paper waste. The 3-phases project to reduce waste lasted 18 month:

1. ASIS Analysis: During the first 3 months an analysis of the current situation was carried out to evaluate the budget involved, the print behaviour (through a software to record who prints, in what quantity and type), the reasons for printing (interview with users) and printer locations.
2. Rationalisation out established the following measures to take (Define and implement a Print Policy for users): Action plan after the analyses was carried: Outlaw underutilized printers and personal printers; Improve ratio printer per user (1 peripheral per 5 à 8 users); Implement a print policy (improve usage); Adapt the equipment to the print policy (easy access to recto/verso, mode draft, …); Network connecting all devices (needed to monitor usage); Use technology to reduce paper usage (identification per badge, scan to mail, fax …); Use recycled paper; Enforce print policy (implement a tool to enforce the print policy); Track progress and communicate progress to users
3. Managed Print Services: A new print policy was defined based on better adapted technology and providing better service to employees. This phase also included training of employees, reinforcing best practices to reduce paper wasted and adequate management of consumables.

Results: Costs were reduced by 52% and the volume of pages printed and copied by 20%. This was done through: rising double sided printing from 7.4% to 40%; prohibition of colour printing email and web pages; rising the printing draft mode use from 0.2% to 20%; reducing email and web pages printing from 15.6% to 5% and reducing pdf printing from 14.1% to less than 10%.

For more information: www.osiatis.be

Case 56: ICT to reduce administration paper waste				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Finland	Helsinki Municipality	Roll-out	Office paper	28% reduction in 5 years

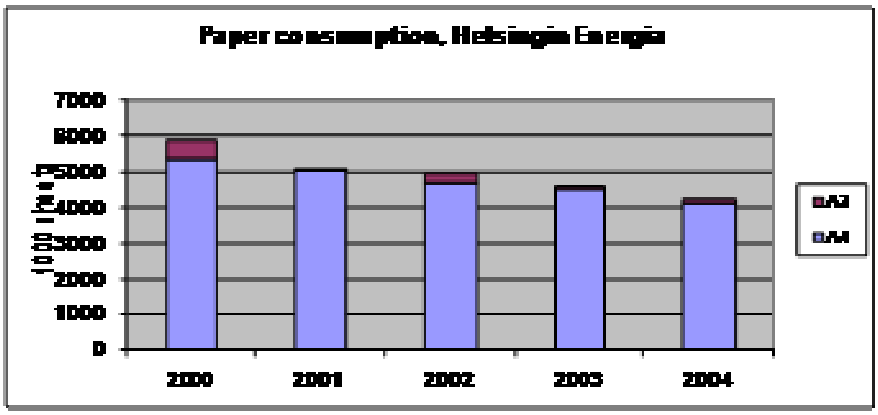
Description:

The Helsinki administration (Helsingin Energia) reduced paper waste after specific instructions for printing and copying, by using electronic invoicing and electronic forms. This not only saved paper but also space via the use of CDs to stock information. The used 'model' contains both instructions requiring strategic decisions and appropriate tips for all kinds of employees. First of all, it recommends the organisation of an "environmental group", i.e. responsible persons of different units of a company who will organise and coordinate waste prevention activities, defines the goals, informing the personnel, reporting etc.

The model includes:

- An initial office assessment of paper consumption and wasted
- The establishment of barometers (=indicators such as "Consumption of copy paper kg/man-year") to help measurement of prevention evolution
- Interactive checklists distribution: a list of measures that can help the environmental group to sort out the different themes and another list that allows employees to do self-control by indicating if the office situation regarding a specific measure has to be improved
- Tips & instructions to reduce paper waste

The Public Works Department and Environment Centre of City of Helsinki are both users of this model.



For more information: http://www.ytv.fi/ENG/waste/frontpage.htm

Case 57: Double-side Printing – EWWR Pilot Edition 2008				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Brussels	Pilot (50 organis.)	Office paper	Paper savings: 33% - 50% 7,300 pag/year & 106 kg CO2 avoided

Description:

The European Week for Waste Reduction (EWWR) aims at raising awareness among a variety of stakeholders about the need to prevent waste. It will take place for the 1st time in November 2009 in the framework of an EU LIFE+ project submitted by ADEME (French Agency for Environment and Energy Management) with ACR+ and the Regions of Brussels, Catalonia and Porto as partners. A pilot edition to

prepare the ground for 2009, took place in November 2008. LIFE+ partners and others organised different events.

The Brussels Administration for Environment launched the "Paper challenge" that contained the simple gesture of preferring double-side printings instead of one-side. A total of 50 organisations participated. Estimated savings in paper were around 567 tonnes of paper (= 1,645 tonnes of CO2 avoided).

Some results measured after 1 week:

- Dexia:
  - 77 % of employees say they think before printing
  - B. 20 % are prepared to think about it

(i.e. awareness raised among 97 % of people during the week)

- Federal government: minimum savings between 33% and 50% paper as an achievable objective
- Silken-Berlaymont Hotel: savings estimated at 7,300 pages/year, i.e. 36.5 kg of paper saved (= 106 kg CO2 avoided)

For more information:
http://www.bruxellesenvironnement.be/Templates/Professionnels/informer.aspx?id=2758&terms=recto-verso&rawsearchtype=1&fragment=true&SearchType=AndWords&langtype=2060

Case 58: Municipal documents dematerialisation

Country	RA/LA	Scale	Waste fraction	Results
Denmark	Kolding	Roll-out	Office paper	10% reduction

Description:

The city of Kolding, in Denmark, encourages dematerialisation of municipal documents with Information and Communication Technologies (ICT): copiers and printers with duplex function are available to all institutions; printed documents are only given to the standing members of the relevant committees and the library, other members receive them by e-mails and other interested parties can find them through the home page of the municipality. These simple measures decreased the paper consumption of the administration by about 10% in 2002. This corresponds to 1,800 kg of paper.

For more information: http://www.kolding.dk/

Case 59: Office paper - Michigan

Country	RA/LA	Scale	Waste fraction	Results
US	Michigan	N/A	Office paper	Estimated: 50% reduction

Description:

According to the US Michigan Department of Environmental Quality, a typical office generates 0.69 kg (1.5 pounds) wastepaper per employee each day (at least 161.4 kg/employee/year). The majority of this wasted paper is from single-side copying and printing. By simply selecting to print on both sides of paper whenever printing businesses will conserve storage space and reduce handling costs. They will also eliminate up to 50% of their paper waste, i.e. almost 0.35 kg/employee/day.

For more information: http://www.michigan.gov/deq

Case 60: The Shrink project pledge				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Private	Pilot (700 employees)	Office paper	23% (320 tonnes) paper reduction Objective: 50% by 2012

Description:

UK finance company Standard Life has committed to reduce its paper use by 50% by 2012, becoming the first company to make a pledge with the Shrink project. The Shrink project is carried out by the European Environmental Paper Network (EEPN), a civil society movement promoting sustainable practices in the pulp and paper industry. They also promote the signature of a pledge (actions such us print documents when absolutely necessary, carry a cotton handkerchief instead of using tissues, etc.) to avoid wasting paper. The pledge aims to cut consumption at home and in the office. They have already made a cut of 23%, saving 320 tonnes of paper.

Though the company pledging scheme 700 employees pledged to "think before printing, if printing to print duplex and two pages to one side". The initiative is supported by a Green Team whose members have communicated the message, and given practical assistance like helping staff to set up local printing functions to print duplex and supporting the implementation of new technologies. The company has both upgraded and reduced the number of printers, cutting the number by half and ensuring that all have duplex facilities and other environmental benefits like energy saving. As well as the environmental benefits, the result is a substantial saving in costs of paper, energy, postage and storage space.

For more information: http://www.shrinkpaper.org/pages/tips-and-tools/shrink-for-businesses.shtml#standardlife ; http://www.standardlife.com

Cases (office paper in schools):

Case 61: Reducing paper waste in schools				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Brussels	Roll-out (1 million inhabitants)	School paper	Objective: 2.5 kg/pupil/year reduction

Description:

In the Brussels Region, the total paper waste generation by pupils is 17,5 kg/pupil/year for secondary school (+/-27 kg/pupil/year in technical secondary schools) and 9,4 kg/pupil/year for kindergarten and primary school. Also, it has shown that centralised consumption (i.e. paper provided by the school itself) accounts for 70% of all paper consumption in schools. In its 4th Waste Prevention & Management Plan (WPMP) for 2009-2014, the Brussels Administration for Environment (IBGE) set a goal to reduce paper waste by 2.5 kg/pupil/year. In order to enhance the durability of a project in a school, IBGE opted to combine two ways of approach: on the one hand, children are met via pedagogical projects (bottom up approach), and on the other hand management of schools are contacted to carry out a paper audit of the school (top down approach). In this way, the whole "school population" is involved, and the chances to succeed are higher. In order to be able to put in practice the knowledge and attitudes, IBGE produced different kinds of tools: Pedagogical textbooks, guidelines for management, tips & tricks, anti-pub stickers, etc. Most of them can be downloaded from their website or ordered by phone or email.

For more information: www.ibgebim.be

Case 62: Reducing paper waste in English schools				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
England	London	Roll-out (250 schools)	School paper	50-90% reduction

Description:
The "Recycle Western Riverside" is an award wining campaign that works with 4 London boroughs and with over 250 schools since 2002. The campaign objectives are to help boroughs increase waste being diverted from landfill and also meet statutory recycling targets. Waste Watch (WW), an environmental charity, intervened helping schools reduce their paper waste. WW uses an education pedagogy that promotes student involvement and participation and combines this with learning activities. The 1st step of the intervention was a whole school assembly which set the context. Bins locations were identified using a map by students. Waste audits were conducted by students. Student's involvement giving them an active role ensures participation in waste prevention campaigns. Waste Watch support schools with: interactive related visits, website featuring teaching resources, student worksheets, training for student and teachers, developing secondary student environmental auditing activities, assessing schools current waste performance in terms of procurement for example, etc. Schools that have participated in the campaign typically achieve an average of 50% reduction in paper waste and in some cases up to 90%.
For more information: www.wastewatch.org.uk

5.2.3. Reducing kitchen, tissue and bathroom towel paper

Strategy description: Households, HORECA (hotel, restaurant and cafes) sector institutional establishments such as administrations, schools, universities, offices, etc. can reduce generated paper waste by:

- Replacing offices/schools/administrations bathroom paper towels by fabric towels or eventually electric hand-dryers
- Preferring kitchen fabric clothes than kitchen multi-use paper towels
- Choosing compostable sponges and clothes
- Reducing paper waste by replacing multi-fold paper towels use by single or double-fold roll paper towels (kitchen and bathroom)

Technical problems: replacing towel paper (kitchen or bathroom) by fabric towels/clothes (in offices, HORECA sector, schools, administrations, …) requires foreseeing a frequent washing scheme/schedule possible to manage internally when single unit towels/clothes are used, or by a company when fabric towels in roll format that require dispensers are installed.
Compostable cleaning clothes require further centralised composting that is easier to achieve if biodegradable waste is collected separately and treated in a compost facility.

Costs per tonne diverted: Cost saving will arise by replacing paper towel, tissues and other paper by more durable material (sponges, cotton fabrics, etc.) at home, at school, in canteens/bars/restaurants and in offices. If we estimate durable material for kitchen and bathroom cost to ~ €1-2 per unit and that 1 unit can outlast at least 15 rolls of kitchen paper that cost of ~ €0.5-1 per unit (roll), savings are of 7-8 folds by choosing durable materials. Depending on brands, choosing a product with a reduce fold may or may not offer a significant price difference, but can reduce to half or even a third the amounts of paper wasted.
When replacing bathroom paper towels by electric hand-dryers, cost will be relocated to the electricity bill.

CHAPTER 5

Cases:

Case 63: Reducing bathroom towel paper in administrations				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Cambridge	Pilot (2,605 employees)	Towel paper (bathroom)	7.5 tonnes reduced (2.88 kg/employee)
Description: The city of Cambridge (England) recently performed a study to calculate the potential paper and cost savings for a paper towel reduction program implemented at its city offices, where it employs 2,605 people. Currently, the city uses multi-fold paper towels. It estimated that in order to switch to (single) roll paper towels it would need to install 135 dispensers, at £35 each, including the labour cost required to install them. The total cost of implementation would be £4,725. Potential cost savings were estimated to be £12,488 per year. The amount of waste prevented would be 150,000 m2 of paper towels or 7.5 tonnes. **For more information:** www.wastewatch.org.uk				

Case 64: Fabric handkerchiefs				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Private	Tips	Tissues (facial)	$100/year average savings
Description: According to Sue Sweeney's advice in "The Monday Garden", paper facial tissues consume between $1 to $3 per week of the food budget or an awesome $50 to $150 a year. The article recommends to replace paper tissues by 100% cotton reusable handkerchiefs, involving a cost of $1/piece. Fabric handkerchiefs lasts for years and for $14, there are enough handkerchiefs for every day; even doing the wash every 2 weeks. **For more information:** http://themondaygarden.com/archives/2006/03/towels_and_tissues_small_steps.html				

CHAPTER 5

5.3. Summary

Strategy	Case N°	Case description	Results
Reducing unwanted and unaddressed mail	48	Fighting advertising paper	7.96 kg/family/year reduction
	49	Advertising & No junk mail sticker	Estimated prevention potential: 3.3 kg/cap/year & 5.7 kg/cap/year
	50	Registering with “Mail Preference Service”	1/3 reduction of total unwanted mail
	51	Private “Stop Junk Mail” Service	8 kg/hhld/year reduced
Encouraging dematerialisation through ICT	52	Office dematerialisation	18% less paper consumption & €75 - 250 savings per employee/year
	53	Administration dematerialisation	7% paper reduction
	54	Reducing paper weight	Estimated: 14% to 20% less paper consumption
	55	New printing policy	20% office paper reduction; 52% costs savings
	56	ICT to reduce administration paper waste	28% reduction in 5 years
	57	Double-side Printing – EWWR Pilot Edition 2008	Paper savings: 33% - 50% 7,300 pag/year & 106 kg CO2
	58	Municipal documents dematerialisation	10% reduction
	59	Office paper - Michigan	Estimated: 50% reduction
	60	The Shrink project pledge	23% (320 tonnes) paper reduction Objective: 50% by 2012
	61	Reducing paper waste in schools	Objective: 2.5 kg/pupil/year reduction
	62	Reducing paper waste in English schools	50-90% reduction
Reducing kitchen, tissue and towel paper	63	Reducing bathroom towel paper in administrations	~ 2 kg/hhold/year reduction
	64	Fabric handkerchiefs	$100/year average savings

CHAPTER 5

In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable paper waste prevention benchmarks:

	Paper waste generation (kg/inh/year) (1)	**Potential paper waste quantitative benchmark (kg/inh/year)** (2)
Reducing unwanted and unaddressed mail	15	4
Encouraging dematerialisation through ICT	75	9
Reducing kitchen, tissue and towel paper	10	2
	100	**15**
	Total paper waste generation	**Total paper waste quantitative benchmark**

(1) The quantity of paper generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

CHAPTER 6

Quantitative benchmarks for selected bulky wastes

CHAPTER 6

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CHAPTER 6

6.1. Introduction

6.1.1. Definitions

EC definition: "**Bulky waste**" means large items of waste material such as electric appliances, furniture, large car parts, trees, etc*. (Source: EEA)*

ACR+ definitions

In the context of municipal waste, "**bulky waste**" refers to a very heterogeneous group of materials classified as bulky due to their large size which prevents most of them (except small appliances) from being accepted by the regular door-to-door waste collection service. In this chapter we will consider the following three main kinds of municipal bulky wastes: furniture, waste from electrical and electronic equipment (WEEE) and textiles, all of them issued from residential, commercial and institutional sources.
We considered that the textile stream includes not only clothes but also shoes (all types of material) and other textiles such as table clothes, blankets, curtains, accessories, etc.

STREAM	SUBSTREAM
EEE	Big (fridges, washing machines, etc.)
	Small (hair dryers, shavers, radios, etc.)
TEXTILES	Clothes
	Shoes
	Others (accessories, etc.)
FURNITURE	(Household, office, school, etc.)

6.1.2. How does bulky waste impact?

Textiles

Textiles need to perform many functions and are made using a wide variety of fibres. Textile products, clothes and home furnishings have an average life span of 7 years, while items of fashion clothing may be discarded after only one season in affluent areas; so the time for discard can be short for many textiles. Growth in volumes nowadays is almost entirely associated with polyester – volumes of natural fibre production and use having remained approximately constant for several years.

The environmental impacts of textile production are not confined to waste. Clothing is more than ever an internationally traded commodity. Today, clothing and textiles represent about 7% of world exports[1] A single pair of jeans has been quoted as containing components or labour from Tunisia, Italy, Germany, France, Northern Ireland, Pakistan, Turkey, Japan, Korea, Namibia, Benin, Australia and Hungary. It has been estimated that a journey of about 40.000 miles is required to bring components and raw materials together to produce a jeans. Environmental impacts related to textiles production occur at every stage of the life cycle of textiles and are linked to the use of natural resources, the consumption of energy, chemicals, water, and

[1] Well dressed? The present and future sustainability of clothing and textiles in the UK, 2006

waste produced by the textile industry: Fibre growth displaces land for crops, leaches nutrients from soil and contaminates soil and water through the use of chemicals such as pesticides, biocides and herbicides. Production cleaning often uses strong chemicals polluting water by detergents, soaps, bleaches (e.g. according to the US Environmental Protection Agency, it can take up to 200 litres of water to produce, dye and finish one kilogram of textiles). Spinning also generates impacts through solid waste (cones and pallets). Garment Production generates waste from off-cuts and health hazard through handling of fabric. Environmental impact associated with clothing also occurs during the "use" due to the need of being laundered.

If textiles are land filled, they can generate environmental and health risks. The decomposition of organic fibres and yarn, such as wool, produces ammonia and methane. Ammonia is toxic in terrestrial and aquatic environments, and can increase nitrogen levels in drinking water. Methane is inflammable and a strong greenhouse gas.

Furniture

The key environmental impacts associated with wood processing and furniture making are: air pollution from adhesives, air pollution from coating materials, waste water, hazardous waste and wood waste.
Adhesives (either synthetic or natural) are used in assembling wooden furniture parts. Adhesives release solvents in the air and damage the environment and health of workers. The air emissions generated from applying coating material (i.e. stains, paints, and finishes) in furniture making can cause potentially serious health problems. Furniture making requires the use of wood preservatives and coating materials all of which contain solvents. Both preservatives and coating material can generate contaminated wastewater as a result of the dripping from the wood surface, leakage from the drums that store these chemicals, and the discard of used formulations. Wood waste in wood processing and furniture making contributes to the problem of unsustainable timber use. Wood waste is largely created by inefficient sawing and cutting of the wood, as well as improper storage practices.

Furniture is often composed of different types of materials such as wood, metal (aluminium, steel) and plastic, each of these materials causing potential environmental impacts during their life cycle since both consume natural gas, oil, and bituminous coal in their manufacture process. Generally speaking, aluminium contributes mostly to different types of waste such as slag and ashes and hazardous waste, whilst plastic contributes to global warming, acidification, nutrient enrichment and human toxicity. However, according to a review from the Australian Government on the environmental impact of furniture, wood (especially from sustainable harvesting practices) has shown to produce a smaller overall environmental impact in comparison with metals and plastics systems[2]. However, natural resources consumption and transport remain the main negative environmental impacts. The processing of the wood and the use of other materials such as glues, impregnating compounds and varnishes add to the environmental impact[3].

Electrical and Electronic Equipment (EEE)

Waste of electrical and electronic equipment (WEEE) is considered the fastest growing waste stream in the EU. The main risks to the environment, human and animal health from WEEE are the potential damage caused when they are discarded and subsequently disposed of: emissions of toxic substances. They can

[2] J. Taylor, "Review of the Environmental Impact of Wood Compared with Alternative Products Used in the Production of Furniture", 2003
[3] Danish Environmental Protection Agency, http://www.mst.dk

contribute to global problems (e.g. climate related impacts) as well as "local" impacts in the EU or developing countries since illegal trade to non-EU countries is still widespread. According to the European Commission, only approximately 1/3 of European WEEE is reported to be treated according to the legislation. The rest goes to landfills or to incineration (13%) and potentially to sub-standard treatment inside or outside the EU (54%)[4].

Environmental impacts are different according to WEEE type and treatment category due to different substances of environmental concern. The most harmful WEEE appears to be cooling and freezing appliances (about 17.7% of the WEEE arising), especially the old ones containing chlorofluorocarbons (CFCs) which destroy the ozone layer. Even in cases where WEEE are recycled, treatment prior to recycling does not take place generally except for certain substances, meaning that residues following recycling could be hazardous when disposed of.
The WEEE Directive (RoHS) outlines the health risks from a range of materials and substances, some of which have been, or are used in the production of EEE such as lead, mercury, cadmium, chromium hexavalent. According to the UNU study[5], impacts include:

- Terrestrial eco-toxicity and ecosystem quality caused by lamps, LCD monitors and TV's, mainly because of their mercury content, and battery packs because of their cadmium content
- Acidification, primarily caused by IT and telecommunication equipments, excluding monitors (CRT and LCD) due to the presence of precious metals
- Eutrophication, mainly caused by LCD monitors and both electrical and electronic tools

6.1.3. CO_2 impacts of bulky waste

Textiles

Greenhouse gas emissions occur at all stages of the clothing life cycle including the growth of raw materials, production stages and use of clothing. Significant amounts of CO_2 emissions are “hidden” in clothing in the form of embodied energy[6]. One kilo of modern textile produces about 20 kilos of CO_2 equivalents (in principle N_2O is also produced in cotton production). Textiles and clothing made of bio-cotton have a better CO_2 balance (CO_2 Monitor[7]).

Each step of the manufacture of textiles and clothing (spinning, dyeing, printing, cutting, sewing and finishing) requires high energy consuming machines. Also during the use of clothes, both drying and ironing consume big amounts of energy. Fossils fuels are burned to create electricity for heating water and air in laundering. All of them indirectly generate CO_2.
Direct CO2 emissions due to transport occur when tissue raw materials are delivered to textile manufacturers, when tissues are sent to clothing manufacturers and when clothing is distributed to shops.

[4] Commission of the European Communities : Proposal for directive of the European Parliament and of the council on waste electrical and electronic equipment (WEEE) (Recast)
[5] UNU, 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment, 2007
[6] Embodied energy or grey energy is the total energy used for making a product for its entire lifecycle and includes: raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.
[7] http://www.co2-monitor.ch/

CHAPTER 6

Furniture

As for textiles, greenhouse gas emissions occurs in all stages of the furniture life cycle. As a raw renewable material, wood harvested in a sustainable manner has a minimal effect on the environment. The impact is derived from logging and transport.
The use of even minor amounts of metal and glass has an impact on wooden furniture since both raw materials are manufactured in highly energy intensive processes, increasing the greenhouse gas effects of furniture production. This impact can be significantly reduced if the production waste and finished products are disposed of by means of reuse or recycling.
Looking at metal for example, each tonne of steel produced generates 2 tonnes of CO_2; apart from 145kg of slag, 230kg of granulated slag, 40kg of noxious gas (CO, sulphurous oxides and nitrous oxides) and approximately 150,000 litres of contaminated water (Lawson, 1996[8]).

EEE

During their production and use phase, EEE can generate large amounts of CO_2 emissions, in accordance with their type and energy consumption type, e.g. around 99kg of CO_2 is generated by a typical mobile phone, compared to 6kg in the raw material phase. The typical phone generates more than 750 times its own weight in carbon dioxide over its lifetime (S. Frey, Giraffe Innovation Limited).

6.1.4. Quantitative flows of bulky waste

Total amount

In a survey of selective collection performances (ACR+, 2005), ACR+ found that 23 selected European municipalities and regions collected between 20 and 80 kg/inh/year of bulky waste with high reuse potential.

A reasonable figure for bulky waste generated as part of the municipal waste stream seems to be approximately 52 kg/inh/year. This accounts for a total of 26 million tonnes of municipal bulky waste generated in Europe or 9% of the total municipal waste stream.
The chapter dealing with municipal bulky waste does not take into account industrial bulky wastes.

Specific Bulky waste types

When subdividing the municipal bulky waste into specific bulky waste types such as textiles, furniture and WEEE, we can make the following estimates:

- Textiles should account for about 7.5 million tonnes or 15 kg/inh/year
- Furniture with high reusable potential should represent about 10 million tonnes or 20 kg/inh/year
- WEEE arising has been estimated between 8.3 and 9.1 million tonnes in 2005 or approximately 17 kg/inh/year in average (Each year, each person in the EU 15 discards an average of 14-24 kg of WEEE and for the 12 new Member States, the average discards are estimated to be 6-12 kg per/inh/year)[9].

[8] Bill Lawson, "Building materials energy and the environment. Towards ecologically sustainable development."The Royal Australian Institute of Architects, 1996.
[9] UNU, 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment, 2007

CHAPTER 6

6.2. Bulky waste prevention strategies

6.2.1. Promote clothes and other textile waste prevention

Strategy description

Residents can reduce textile waste and its environmental impacts (if textile is still in good conditions) through the following considerations:

- Buy less clothes and more durable garments and textile products
- When buying new products, choose those made with the least amount of energy and least toxic emissions, those made by workers paid a credible living wage with reasonable employment rights and conditions.
- Selling/buying textiles in 2nd hand markets
- Donating clothes & other textiles to charities and reuse centres
- Renting, exchanging, lending clothes or other textiles not frequently used instead of buying them (wedding dresses, costumes, table clothes/curtains for big events, etc.)
- Wash clothes less often, at lower temperatures and using eco-detergents, hang-dry them and avoid ironing where possible
- Promoting reuse centres activities
- Repairing or transforming textiles
- Establish cooperation agreements between (primary and secondary) schools and the elderly (geriatrics) who can intervene in cloth repairing and transforming trainings
- Information and awareness rising actions/campaigns by local authorities, schools, NGOs and social organisations on durable textiles, training & workshops opportunities (cloth repairing and transforming).

Technical problems

Repairing/transforming textiles is less known and applicable nowadays by households as it requires time and certain manual skills (and, depending on the case, appropriate equipment and accessories) which has a weak place in our modern lifestyles. However, repairing/transforming textiles could gain a new place in modern societies if mainly primary and secondary schools would include this topic in their teaching programmes.
Another barrier to reuse textile is changing fashion that greatly influences customer's choices. Very often cheap textiles are problematic: not durable, not reusable, or repairable.

An important attention is to be paid to textile storage after the collection in civic amenity centres, street containers and door-to door systems. In order to reuse as much textile collected as possible and avoid more disposal than expected (around 20% of quantities collected are waste), a dry place has to be assured.
Finally, it is essential to perform quality control on second hand textiles exported to developing countries. This should avoid transferring waste which creates subsequent disposal costs.

CHAPTER 6

Costs per tonne diverted

Costs for textile reuse by private/public organisation relate to investment (transport, buildings, etc.) and running (personnel) costs related to the collection, sorting, repair, shop management, etc. When textiles reuse is achieved by the intervention of private/public organisations such as reuse centres and charities, collection systems take place and in consequence collection costs are generated (between €0.10 via textile-containers to €0.50 in door-to-door collection per kg collected). Costs are partly recovered through the sale of the second hand textiles.

Cases

Case 65: Reusing cloth through Roba-Amiga project				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Catalonia	Pilot	Textiles (cloth)	40 % reusable

Description:
"Roba Amiga" is an occupational integration project through the reuse of clothing in Catalonia. Their mission is the selective collection of used clothes for revaluation through reuse and recycling, via an efficient business model which promotes professional integration, thus aiming to increase the benefits of the system and to create a national model. To achieve this, Roba Amiga counts on 800 containers located around Catalonia. The collected textiles are sold in shops called Moda Amiga. Nowadays the Cooperative business focuses on the classification and reuse of textile waste. From the total amount collected, about 40% is reusable (4% directly and 36% exported to Third World countries) and 45% recyclable, leaving a remainder of 15% which is non reusable (mostly cotton kind) and which is disposed off. In order to extend this project, the programme proposes to set up a National Center for textile recycling. They have also been working to reach a voluntary agreement with the main Spanish textile producers and distributors. The objective is to find a method to prevent textiles waste without deficit.
For more information: http://www.robaamiga.cat/

Case 66: Textile reuse promotion campaign				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Basque Country	Pilot	Textiles (cloth)	Expected: 45% reuse of collected textile

Description:
The Spanish association AERESS (Asociación Española de Recuperadores de Economia Social y Solidaria) is composed of 28 Spanish institutions working on self-occupational initiatives, workshops, occupational integration, training and environmental education. They are launching their "Tira del Hilo" campaign which has as a main goal to improve and promote textile reuse and recycling as a way to reduce urban waste. The project involves the creation of a handbook, a video and the organisation of an open technical workshop and 15 events that will introduce the campaign (fashion shows with reused and recycled clothes) with the aim of raising awareness regarding issues such as the origin of clothes, how to make clothes that last longer and the real cost of clothing. From the 8-10 kg/inh/year of textile waste generated in the whole of Spain, Koopera (a group of social initiatives & integration enterprises' cooperatives which aim to fight social exclusion), has calculated that in 2008 in the Basque Country they have collected 2,434 tonnes of textiles from 1,900,335 inhabitants served by 136 councils, or 1.28 kg/inh/year. The campaign's targets are to raise collection quantities to 3 kg/inh/year while maintaining current levels of consumption (8-10 kg/inh/year), to reuse 45% and to recycle 40% (85 % reduction from disposal).
For more information: http://www.aeress.org

Case 67: Clothing rental				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Germany	Private	Roll out	Textiles (cloth renting)	NA

Description:
An interesting idea reportedly under development in Germany is the Second Chance Kostümverleih: costume and clothing rental company. The service providers are the owners and caretakers of clothing. Householders can subscribe to a personal lease-service, which provides them with a wardrobe of clothing over a certain period of time, based on individual preferences. The idea is that environmental benefits will accrue from the optimum redistribution of clothing, getting more ware from an item than would normally occur. This is particularly relevant in areas where people are particularly fashion conscious and change their clothing very regularly. Items can be passed on to people who are happy to wear last season's designs.
For more information: Tischner et al/SusProNet (2002) – Sustainable Product -Service co-design Network. First Draft Report of PSS Review

6.2.2. Promote furniture waste prevention

Strategy description

Residents, offices, schools, associations, administrations and others will be able to reduce their furniture waste by:

- Re-thinking their real needs
- Re-thinking the organisation of the work
- Exchanging (between households, schools, offices)
- Selling/buying in second hand markets
- Donating furniture to others (households, charities, reuse centres and others organisations)

- Renting or leasing from business or reuse centres (e.g. office furniture; household furniture for expatiates, etc.)
- Promoting reuse centres activities
- Promoting modular, easily repairable furniture
- Information and awareness raising actions/campaigns by local authorities, schools, etc
- Organise garage sales (private initiatives supported by local authorities)
- Repairing.

Technical problems

A pre-assessment of the furniture to be collected prior to the collection can be quiet a challenge. Reuse centres collecting used goods have to optimize transport by making sure the furniture to be collected is reusable with or without minor work. If furniture is to be collected at a civic amenity centre care has to be taken to select and store the reusable furniture appropriately, preferably under a roof and protected from humidity. Renting/leasing businesses are not (sufficiently) widespread nor promoted by local authorities. Another barrier is changing fashion that influences customer's choices.

Costs per tonne diverted

Costs for furniture reuse by private/public organisation relate to investment (transport, buildings, etc.) and running (personnel) costs related to the collection, sorting, repair, shop management, etc. When furniture reuse is achieved by the intervention of private/public organisations such as reuse centres and charities, most donated furniture has to be collected, either from door-to-door or at civic amenity centres.

Cases

Case 68: Furniture Reuse Network				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Bristol	Roll out (420,000 inhabitants)	Furniture and EEE	85,000 tonnes diverted/year or up to 60% diversion

Description:
Established in 1989, the Furniture re-use network (FRN) based in Bristol is the UK coordination body for over 400 furniture and EEE reuse organisations. The FRN promotes the reuse of unwanted furniture and other items for the alleviation of hardship, distress and poverty. The sector is small but growing. FRN members reuse over 2.5 million items each year, diverting 85,000 tonnes of waste from landfill, assisting over half a million low income households and providing training and work experience for over 18,000 people. FRN members have achieved diversion rates of 60% for the bulky waste stream by collecting and refurbishing furniture, electrical appliances and bicycles. The reuse of bulky waste is booming since England started including 'tonnes reused' in the national waste indicators (NI 191, 192 and 193) in April 2008. Before this date the Recycling targets for England could include tonnes recycled and some composted, but could not include tonnes reused. Therefore, local authorities did not want to reuse anything as it took valuable tonnes away from their recycling figures. After April 2008 tonnes reused were included in the new waste indicators. Now tonnes reused (under specific arrangements) can also be counted and local authorities became keen to work with reuse centres - a small but significant difference. Currently 33 FRN members have formal contracts to run bulky waste collections on behalf of their local authority, while there are 4 charity-run shops and over 20 containers to collect furniture at Civic Amenity sites. Charity shops on sites

divert up to 250 tonnes per year and provide valuable income for charitable activities locally.
For more information: http://www.frn.org.uk/

Case 69: Sofa Project				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Bristol	Roll out (420,000 inhabitants)	Furniture and EEE	245 tonnes diverted

Description:
SOFA Project was founded in Bristol in 1980 as the 'Shifting Old Furniture Around' project and has flourished ever since. SOFA accepts the donation of beds, dining room furniture, settees, armchairs and electrical items (cookers, fridges, etc.). Specialised staff repair and refurbish the domestic appliances, which are checked and safety tested before sale (and are sold with a guarantee). SOFA works in partnership with several companies and also with several local charities. The Bristol SOFA project collects over 12,500 items every year and passes them on to more than 6,000 low-income households, at affordable prices. In financial year 2007- 2008 SOFA diverted over 245 tonnes of furniture from landfill, saving 661 tonnes of carbon dioxide equivalent emissions. They also reused 250 tones of domestic appliances, saving them from unnecessary recycling, saving an impressive 1850 tonnes of carbon dioxide equivalent emissions.
For more information: www.sofaproject.org.uk

Case 70: Gerona's second hand market				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Gerona	Pilot	Bulky	Target: 20% reduction

Description:
In 2007, with a financial subsidy of €53,000, the Catalan Waste Agency inaugurated an itinerant "exchange" market of second hand goods in Gerona, Catalonia. The target is to exchange goods that citizens bring. The market also has a stand where environmental information is provided. Information about the waste selective collection is offered as well as guided visits to different environmental facilities in order to encourage civil participation in the process of domestic waste collection. An employment agency for persons at risk of exclusion is in charge of the market personnel and the information point. Through this initiative the aim is to reduce waste by 20%, EEE waste by 30 %, clothes by 10 % and scrap by 10 %.
For more information: http://www.girona.cat/mercatintercanvi/

Case 71: Eco-furniture "Ecomoebel" network				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Germany	National	Roll out	Furniture	5% reuse with the potential to rise to 8%

Description:
Ecomoebel is the name of an innovative network for the reconditioning and marketing of used furniture. It is a cooperation-network with many partners, e.g. handicraftsmen, commerce, service providers and scientific organisations, in Dortmund; a city in the industrialized Ruhr area of Germany. Restorers, furniture customers, a waste management organization, scientific organisations, planners, marketing and computer specialists, artists and designers are working together on this idea. The basic idea of the project is to combine the activities and know how of companies, organisations and small trade, acting thus far in an

isolated manner, at regional level.
This idea is supported by the Federal Ministry for Education and Research of Germany. High quality standards for the refurbishment of used furniture guarantee proper ecomoebel. All furniture is analysed for harmful substances, e.g. formaldehyde, and, if necessary, restored with environmentally sound products and substances like glue, oils, wax, lacquers. All results of the tests and all information concerning the restoration, e.g. type of wood or material used (derived timber material, textile, metal), type of fittings, type of wooden surface, is collected in the certificate which forms part of every ecomoebel. The certificate is the basis of the ecomoebel quality signet, which guarantees low polluted furniture with a high quality standard. A consumer who buys an ecomoebel product will normally know more about his furniture than someone who buys new products in a large store. The potential buyer can either pre-select his ecomoebel on the computer screen using the ecomoebel internet platform or go directly to the ecomoebel network partner. If in Germany about seven million tonnes of furniture are discharged every year. Around 5 % of this quantity is reused. It is estimated that the quantity of reused furniture can be increased from 5 % to 6, 7 or 8 %.
For more information: http://www.ecomoebel.de/

Case 72: Renting furniture

Country	RA/LA	Scale	Waste fraction	Results
US	Private	Roll out	Furniture	NA

Description:
Brook Furniture Rental (BFR) offers purchase and rental of furniture. High quality is associated with higher durability and easier reparability than cheap furniture reducing the environmental impact over the time. BFR is committed to using sustainable materials (natural fibres, wool, cotton, linen and hemp). Wood used is fast growing wood, while metals (steel and aluminium) contain high post-consumer recycled materials. The company partners with furniture manufacturers engaged in sustainable forest initiatives and responsible managed forest. Also distribution centres are operated reducing energy use through efficient product flow and smart electrical systems that reduce energy in no active traffic areas.
For more information: http://www.bfr.com

6.2.3. Promote Waste Electrical and Electronic Equipment (WEEE) prevention

Strategy description

Households, educational establishments (schools, academies, etc.), administrations, etc. can reduce their WEEE through:

- Rethinking the real need
- Rethinking the organization of the work
- Buying multifunctional equipment
- Renting or leasing from business or reuse centres (e.g. screens, lamps, telephones, mobiles, beamers, etc. for offices; washing machines, dishwashers, for household and schools or big events)
- Exchanging (between households, schools, offices)
- Selling through specialized internet sites or newspapers (bargain newspapers)
- Donating EEE to others (households, charities, reuse centres and other organisations) where it can be reused directly or repaired for further reuse
- Repairing

- Information and awareness raising actions/campaigns by local authorities, schools, etc.
- Organise garage sales (private initiatives supported by local authorities)

Technical problems

The separate and appropriate storage of potentially reusable WEEE appliances at civic amenity centres is crucial. Reuse actors need to have access to EEE before they become waste. Well trained personnel are a prerequisite for pre-assessment of the EEE in order to make sure most of the EEE appliances can be reused directly or with small reparation.
Reuse also requires the correct functioning of the appliance, including a guarantee similar to those that accompany new equipment. Guarantee systems are been employed by a number of reuse centres, for example, in Belgium proper reparation and thus appropriate working conditions are certified thought quality labels that offer 6 month guarantee for small appliances to 1 year for big appliances, e.g. Revisie (www.revisie.be) and ElectroRev (www.electrorev.be).

Costs per tonne diverted

Costs related to EEE reuse is similar to the costs described under the subchapter textiles. Collection costs however might be higher as most donated EEE has to be collected, either from door-to-door or at civic amenity centres.

Cases

Case 73: Ekorrepara project: reusing EEE				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Basque Country	Roll out	Electrical and Electronic Equipment (EEE)	0.15 kg/inh/year (62.75 tonnes) reused
Description: Ekorrepara is a non-profit cooperative aiming to recover EEE appliances that have been discarded in order to give them a second life. After a thorough review, subsequent repair and quality controls, the cooperative offers items with a warranty and affordable prices. They employ six workers and collect equipment from 72 collection points. From the 1,255 tonnes collected (3 kg/inh/year), in 2008 Ekorrepara revised 6,088 EEE appliances and reused 1,967 i.e. 5% (or 62.75 tonnes = 0.15 kg/inh/year reused) EEE appliances. Two main aspects of the Ekorrepara project carefully considered are product commercialisation and communication about their activities. Commercialisation is carried out on the basis of quality principles (1 year warranty on products, recovery protocol, good customer service, clean products with visible characteristics, etc.). Regarding communication aspects, the project puts an emphasis on information campaigns, guided visits and a client-orientated service (clients with small purchasing power, students, and immigrants). Benefits of the project have been measured in terms of “solidarity” and “institutional benefits”. Solidarity benefits are benefits such as work generation & training for low qualified persons, and access to quality goods by the low income fraction of the population. Institutional benefits have been identified as “the generation of a new dynamic between local authorities and social economy organisations” and the improvement of local authorities’ image regarding the environment. Next steps are to raise the amount of equipment collected to 4 kg/inh/year (at similar consumption levels = 12-15kg/inh/year) and to raise the reuse level to an ideal 10% or 0,3 kg/inh/y). **For more information:** http://www.ekorrepara.com; http://www.aeress.org				

Case 74: Reusing EEE in Flemish reuse centre				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Part of Vlaams-Brabant	Roll out	Electrical and Electronic Equipment (EEE)	250 Tonnes EEE revised, ready for reuse

Description:

The reuse centre Televil representing 5 reuse shops collects bulky waste from part of the province of the Vlaams Brabant province through the establishment of cooperation agreements with municipalities. In 2008, the Kringwinkel Televil collected 3.4 million kg of bulky waste or 7.5 kg per inhabitant annually; from which exactly 1725118.90 kg (66883 appliances; 3.8 kg/inh/year) were EEE. EEE is collected from civilians, retailers and municipal recycling collection sites. Reusable/reparable EEE is separately processed in their workshop and resold. Televil carry out a selection, repairing and cleaning, according to EEE procedures per type. After repair, EEE is distributed to the 5 shops according to sales volume, with a "Revisie" label and a 6 month warranty. In 2008, revised EEE for sale or prepared for reuse accounted for 250,000 kg EEE. For all EEE (in and out of the system) Televil uses what they call a "Tricycle-software" that has been developed specially for reuse centres and allows an administrative follow-up by the means of a bar code that gives access to different kinds of information. This information can be used by workers to evaluate the problem. Also, repaired EEE is registered, including the recording of data such us warranty period, details of the worker who repaired the appliance, etc.

Finally, the remaining (non reusable/non repairable WEEE) is transferred to an organism called Recupel for recycling purposes. In 2008, from the 1.5 million kg (3.31 kg/inh/year) of bulky items sent to be recycled by Televil, 1.475 million kg or 3.25 kg/inh/year were WEEE.

For more information: http://www.televil.eu/

Case 75: Repair centres in Vienna				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Austria	Vienna	Roll out	Electrical and Electronic Equipment (EEE)	25% of WEEE diverted

Description:

The primary objective of repair centres (R.U.S.Z. - Reparatur und Service Zentrum - supported by the city of Vienna) is waste prevention by prolonging a products life. Secondary objectives are information exchange and knowledge accumulation on repair possibilities and strengthening the local economy. For Vienna it is estimated that the R.U.S.Z. repair centre leads to a reduction of 10 ktonnes or 25 % of electronic waste per year. In addition the amount of hazardous waste is reduced, by removing all non-hazardous parts from the electric and electronic waste. In all of Vienna about 14 ktonnes/year of electronic waste is prevented by all repair enterprises, 224 tonnes/year by lending EEE and 157 tonnes by second hand utilization. The R.U.S.Z. can be considered as a successful initiative of the public to provide service while reducing the unemployment, increasing the level of skills and fostering a local decentralized economy.

For more information: http://www.rusz.at

Case 76: Mobile phones chargers harmonisation in the EU				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
EU	all	Roll out	Electrical and Electronic Equipment (EEE)	Expected: waste reduction

Description:

The incompatibility of mobile phones chargers is a major inconvenience for users and also leads to the unnecessary generation of waste. Therefore, the European Commission has requested industry to come forward with a voluntary commitment to solve this problem in order to avoid legislation. As a result major mobile phones producers (Apple, LG, Motorola, NEC, Nokia, Qualcomm, Research in Motion (RIM), Samsung, Sony Ericsson, Texas Instruments) have agreed to harmonise chargers in the EU. In a Memorandum of Understanding ("MoU"), which was submitted to the European Commission end of June 2009, the industry commits to provide compatible chargers on the basis of the Micro-USB connector. In addition new EU standards to ensure continued safe charger use will be developed to facilitate the implementation of the MoU. The first generation of new inter-chargeable mobile phones should reach the EU market from 2010 onwards. The European Commission foresees a positive environmental impact (*Source: EC press release, 06/29/2009*).

For more information: http://ec.europa.eu/enterprise/rtte/index_en.htm

Case 77: Take Back, Leasing and Design for Remanufacture				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
US	Private	Roll out	Electrical and Electronic Equipment (EEE)	27,000 tonnes diverted & $200 million savings

Description:

Xerox launched a programme to "remanufacture" its copiers, printers, scanners and other equipment after becoming concerned of the cost of storing or disposing of equipment returned by lessees and purchasers and the wasted value of end-of-life products stored. The organisation set up its own hierarchy for recovery:

1) distribute refurbished equipment in optimal working order to new customers
2) restore equipment to original state through remanufacturing
3) convert equipment or usable assemblies from equipment into other products
4) dismantle to salvage parts for reuse or as spare parts
5) recycle source materials of non-salvageable parts

Designing new products for remanufacturing resulted in innovative designs that effectively "close the loop" through materials reuse, remanufacture and recycling such as reducing the range of plastics and components, replacing screws with snap-fit fasteners and selecting materials on the basis of whole-life costings. Design for remanufacturing also demands the company to closely work with suppliers to make smarter parts (e.g. better designed and labelled). Remanufactured products have the same "total satisfaction guarantee" (process, appearance and service) as other Xerox products. Through their recovery processes, in 1998 Xerox claimed to reuse 75% of components and recycle up to 98% of materials from end-of-life products. The company also offers a wide array of consumables return programs, partnering with customers to return cartridges, toner containers and waste toner for reuse or recycling, providing take-back services to customers on demand. Xerox's cartridge return program has enabled 65 % of eligible cartridges to be returned for remanufacturing. Remanufacturing programs creates financial savings by avoiding raw material purchases and landfill costs. In 2001, remanufactured equipment accounted for 25% of Xerox's output and 90% of products were remanufacturable at end-of-life.

Although the labour costs involved are double of those of producing new equipment, the company estimates that it saved $200 million in 1999 by reducing its raw material purchases and waste disposal costs - diverting over 27,000 tonnes of materials from landfill.
For more information: http://www.rmit.edu.au ; http://www.ends.co.uk

Case 78: Computer leasing for companies

Country	RA/LA	Scale	Waste fraction	Results
US	Private	Roll out	Electrical and Electronic Equipment (EEE)	16.5 tonnes WEEE prevented annually & ~ €190,000 savings

Description:
An IT company and a multinational agricultural biotechnology corporation have developed a leasing agreement for the supply of computer equipment. This reduces the IT service demands of updating and reconfiguring systems and allows computers to be returned to suppliers for re-use allowing them to regain value from parts. In March 1997, the multinational's production facility in Luling, Louisiana, began leasing computer equipment. It leases high-end computer workstations on a 24 or 36 month programme that ultimately returns the used systems to the IT company for reuse (re-leasing to organisations that don't need the latest technology or sales to secondary market). Leased PCs are covered by a 3-year warranty. 80% of the multinational's computers are committed to leasing, with a system that could have as many as 15,000 PCs in service at one time. This leasing service is also available for individual consumers - home and home offices. Practical benefits of this program include: eliminating disposal & reducing electrical equipment waste, and savings on IT staff since the IT company is in charge of maintenance (3-year warranty), upgrading and reconfiguring. The waste prevented by this program could be more than 16.5 tonnes annually. Waste Wise estimates that the monetary value of waste prevention from this programme could be more than €190,000 annually. Tax advantages for companies can help the development of such services: operating lease payments are often 100% tax deductible in the USA as an operating expense (Source: US EPA 1999, National Source Reduction Characterization Report).
For more information: www.epa.gov

CHAPTER 6

6.3. Summary

Strategy	Case N°	Case description	Results
Promote clothes and other textiles waste prevention	65	Reusing cloth through Roba-Amiga	40% reusable (4% directly; 36% exported)
	66	Textile reuse promotion campaign	Expected: 45% reuse
	67	Clothing rental	NA
Promote furniture waste prevention	68	Furniture Reuse Network	85,000 tonnes diverted/year or up to 60% diversion
	69	Sofa Project	245 tonnes diverted
	70	Gerona's second hand market	Target: 20% reduction
	71	Eco-furniture "Ecomoeble" network	5% reuse with the potential to rise to 8%
	72	Renting furniture	NA
Promote WEEE prevention	73	Ekorrepara project: reusing EEE	0.15 kg/inh/year (62.75 tonnes) reused
	74	Reusing EEE in Flemish reuse centre	250 Tonnes EEE revised, ready for reuse
	75	Repair centres in Vienna	25% of WEEE diverted
	76	Mobile phones chargers harmonisation in the EU	Expected: waste reduction
	77	Take Back, Leasing and Design for Remanufacture	27,000 tonnes diverted & $200 million savings
	78	Computer leasing for companies	16.5 tonnes WEEE prevented annually & €190,000 savings

In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable bulky waste prevention benchmarks:

	Bulky waste generation (kg/inh/year) (1)	**Potential bulky waste quantitative benchmark (kg/inh/year)** (2)
Promote clothes and other textiles waste prevention	15	4
Promote furniture waste prevention	20	4
Promote WEEE prevention	17	4
	52	**12**
	Total bulky waste generation	**Total bulky waste quantitative benchmark**

(1) The quantities of bulky generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

CHAPTER 7

Quantitative benchmarks for nappies and other municipal waste

CHAPTER 7

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CHAPTER 7

7.1 Nappies

7.1.1. Introduction

7.1.1.1. Definitions

ACR+ definitions : "**Reusable nappy/incontinence pads**" refers to nappies (for children use) or incontinence pads (for adult use) made of absorbent layers of fabric cotton and designed to be washed and reused multiple times, in contrast to disposable diapers which contain absorbent chemicals that are thrown away after a single use. Certain reusable nappies or incontinence pads offer certifications as a guarantee that no harmful chemicals have been used in the production process or that they are made of bio-cotton.

7.1.1.2. How do disposable nappies and incontinence pads impact?

While disposable nappies and incontinence pads are made of paper pulp, plastics and subabsorbent chemicals, reusable nappies/incontinence pads are mostly made of natural fabrics.
Associated impacts of disposable nappies/pads are linked to its production and composition, the life-span, as well as the waste treatment:

- Production: they consume much more water (2.3 times more), energy (3.5 times more energy), and renewable raw materials (90 times more) non-renewable raw materials (8.3 times more) than reusable nappies.
- Composition: Disposable nappies/pads basic composition involves about 1/3 wood pulp bleached with chlorine and about 2/3 plastic (including sodium polyacrylate, a polymer able to absorb 80 times its weight in water) without counting the use of additives such as perfume, preservatives and traces of carcinogens substances
- Life-span and waste treatment: Unlike reusable nappies/pads (washable and reusable ~200 times) disposables have a limited life-span of a few hours and normally end-up in landfills (~90 %), thus contributing to environmental pollution. Emissions generated by degradation of component materials affect the O_3 layer and contribute to global warming.

The total quantity of disposable nappies consumed by one child (5,125[1]) requires 67 kg crude oil and represents 4.5 trees and 25 kg plastic[2].
The "Best Foot Forward" LCA results shows that in terms of the environmental footprint the waste surface needed per child and per year when using disposable nappies is impressive: 4,300m2. However if reusable nappies are used instead the environmental footprint is reduced to 2,300m2. Moreover, if reusable nappies are collected and washed by a specialised company, footprint is reduced even more (1,600m2).
When using reusable nappies/pads it is possible to reduce the environmental impact further by using eco-friendly detergent, line-drying rather than tumble drying, avoiding fabric softeners or chemical soaking agents and by using organic and natural fabrics.

[1] Average of OVAM, Belgium figures (4250) and Milton Keynes figures (6000)
[2] A.S. Ourth in "Les couches lavables constituent une alternative moderne, écologique et économique aux couches jetables", 2003

7.1.1.3. CO2 impacts of disposable nappies and incontinence pads

According to the UK Environment Agency's update report on life cycle assessment of disposable and reusable nappies (2008), the average 2006 disposable nappy would result in a global warming impact of approximately 550kg of carbon dioxide equivalents used over the two and a half years a child is typically in nappies. This equates to an estimated total global warming potential of approximately 0.4Mt carbon dioxide equivalents per year.

The use of disposable nappies by an average child over two and a half years is equivalent to between 0.1 % and 12 % of the emissions from one average European person in one year. The production of materials used to construct the disposable nappies being the main driver for the impacts.

However, a weight reduction of 10%, when manufacturing nappies the potential impact on global warming would allow for a reduction of 8%.

7.1.1.4. Quantitative flows of disposable nappies and incontinence pads

Total amounts

A baby uses 5 to 6 nappies per day from birth to the age of 2.5 years, making a total ranging from 4,250[3] to over 6,000[4] nappies/baby. A baby diaper weighs about 50g which in addition to 200g average of excrement increase the waste stream at a rate of more than one tonne per child until he reaches the age of cleanliness. A part from children, the elderly population (primarily) generate considerable amounts of incontinence pads. Depending on the countries/ regions, the quantity of nappies vary from 2.6 % of the total of municipal waste in England, passing by 3% in the Catalonia region of Spain, to 5.5% in the Walloon region of Belgium and even escalating to 7% in Flanders region of the same country.

For ease of calculation we use an average figure of approximately 3% meaning an estimated 9 million tonnes waste (or 18 kg/inh/year) generated every year in Europe of which 2/3 of the nappies and pads quantities originate from children, representing almost 12 kg/inh/year, while 1/3 can be attributed to adults (incontinence pads) representing a bit more than 6 kg/inh/year.

7.1.2. Disposable nappies waste prevention strategies

7.1.2.1. Swap to reusable nappies

Strategy description

Households, kindergarten, nursing homes, hospitals and maternities will be able to reduce and avoid their waste issued from disposable nappies and incontinence pads by replacing them with reusable ones.

[3] OVAM, Belgium (http://www.ovam.be)

[4] Milton-Keynes, UK (http://www.milton-keynes.gov.uk)

According to Ourth (2003), reusable nappies can generate 60 times less solid waste than disposable nappies[5], apart from consuming less energy, water and raw materials at production stage.

Technical problems

Reusable nappies are still seen as an archaic technique that mean the consumption of both time and water. However, current reusable nappies have a greater level of performance as well as being more functional. These improvements relate to a whole range of self-fastening, easy to use designs, water tightness, disposable liner to help dispose of the stool in more hygienic conditions and easiness to wash in machines.

However and according to the UK Environment Agency report[6], the environmental impacts of using reusable nappies can be higher or lower than using disposables, depending on how they are laundered. It is consumers' behaviour after purchase that determines most of the impacts from reusable nappies. This is why adequate information is needed when encouraging the use of reusable nappies.
Cloth nappy users can reduce their environmental impacts by:

- line drying outside whenever possible
- tumble drying as little as possible
- when replacing appliances, choosing more energy efficient appliances (A+
- rated machines are preferred)
- not washing above 60℃
- washing fuller loads
- reusing nappies on other children.

Promoting and enforcing reusable nappies use for above mentioned target groups could be achieved through awareness raising campaigns carried out at local level, making practical information (nappy laundries, washable nappies producers, practical advices for the use) available on administrations websites or by subsidising part of reusable nappies costs.

Costs per ton diverted

In terms of quantities of waste to be managed, authorities are interested in promoting the use of reusable nappies. Disposable nappies (5,000 to 6,000 until the age of cleanness or 2.5 year) cost around €1,800. This figure could be reduced substantially if child carers chose to use reusable nappies, reducing costs to about €400, just over four times less (Source: Ovam).

According to the Spanish ENT Environment and Management[7] (2008) estimations, reusable nappies including initial investments costs (Tax included) for a nursery of 30 children washing once a day, are indicated here below:

[5] Landbank Consultancy cited by A.S. Ourth in "Les couches lavables constituent une alternative moderne, écologique et économique aux couches jetables", 2003

[6] Environment Agency (S. Aumônier, M. Collins, P. Garrett), "Using science to create a better place: An updated lifecycle assessment study for disposable and reusable nappies", 2008

[7] Puig Ventosa I., Calaf Forn M. (2008), "Pañales reutilizables como estrategia de prevención de Residuos », Residuos. La revista técnica del Medio ambiente. Marzo-abril 103:26-36.

	Unitary cost (€)	Total cost/child (€)	Annual cost/child (€)
Nappies	11.60-29	92.8-232	31.87-60.66
Hermetic nappy bins	80.04	8.04	1.11
Containers	40.60	1.35	0.19
Washing machine*	928-3,596	30.93-119.87	4.30-9.91
Dryer*	464-2,900	15.47-96.67	2.15-7.50
Communication campaign	1,740-4,060	58-135.33	6.65-15.51
SUBTOTAL		**206.56-593.22**	**46.27-94.89**
* costs of 8kg capacity washing machine and dryer depend on model (conventional or industrial)			

The ordinary running annual costs (without investments) under the same conditions:

	Unitary cost (€)	units/child (€)	Annual cost/child (€)
Celluloses	0.024	18,900	15.35
Washing* (€/kg)	0.18**-1.51	2,572.5	15.91-129.31
Nappy replacement (10%)	11.60-29	24	9.28-23.20
SUBTOTAL			**40.54-167.86**
* Annual washing costs comparing in situ management (less expensive) and external management ** This cost include water, electricity and detergent but doesn't include working hours			

Thus, the total implementation cost of reusable nappies is estimated to € 86.8 and € 262.75/child/year meaning a cost of € 0.12 to € 0.38 per individual reusable nappy used.

Cases

Case 79: WRAP's Real Nappy Programme				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Scotland	Pilot	Nappies	Target: 2,000 - 4,000 tonnes/year reduction

Description:

In the UK, disposable nappies make up about 2.6% of the annual average household rubbish. At present, about 8 million disposable nappies are thrown away every day. WRAP's Real Nappy Programme, aims to act towards the reduction in the number of disposable nappies buried in landfill sites by promoting the use of real nappies. The Programme is funding 25 nappy projects in England and 15 in Scotland. WRAP has also created an online tool to be used by real nappy schemes to help local authorities and nappy projects to calculate the savings that the use of reusable nappies can bring. A tonnage conversion tool can also be used on-line. Two different ways of use are possible depending on whether the number of babies or the number of households is known. WRAP has also elaborated the Best Practice Hospital Guide and the new Publicity Available Specification (PAS106) for reusable nappy laundries to provide healthcare professionals with a variety of advice and information.

In Scotland, the WRAP's Implementation Plan sets out the tonnage target for the Programme:

- 1 an increased participation from 10,000 to 15,000 householders
- diversion of 2,000 to 4,000 tonnes/year of the household waste quantities.

An interesting initiative run by the Real Nappy Campaign, the "Real Nappy Week", took place from 27th April until 3rd May 2009 across the UK and focused on how using real nappies can save families money.

For more information: http://www.realnappycampaign.com; http://www.goreal.org.uk; http://www.wrap.org.uk

Case 80: Flanders' reusable cloth nappies				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Belgium	Flanders	Roll out (40 municipalities)	Nappies	Estimated: 10% participation rate & 1.35 kg/inh/year less overall waste

Description:
In the Flemish Region in Belgium (more than 6 million inhabitants), 316.2 million disposable nappies are thrown away every year corresponding to 63,236 tonnes. At the rate of 187.50 €/tonne, this represents a financial charge of €11,8 million annually (about €75 /child/year), against €5,5 million per year for the water treatment linked to the washing of reusable nappies (considering nappy use period from 0 to 2.5 years old). This represents savings of 35 €/child/year and lead the Flemish Region government (decree March 23rd, 2003) to grant financial support to municipalities supporting the use of reusable nappies. About forty Flemish municipalities support today the use of washable nappies in different ways. Possibilities are: purchase of reusable nappies at reduced price (ex: €140 instead of €250 in store), bonus for the use of reusable nappies (€150 max) and a combination of these two incentives. Thanks to these interventions, the municipalities manage to persuade 5 to 7 of the parents of new-born babies to use reusable nappies. In Leuven, it was estimated that the participation of 10 % of households using "Reusable cloth nappies" would allow a reduction of 1.35 kg overall waste per inhabitant per year[8].

For more information: http://www.ovam.be/

Case 81: Reusable nappies in Spanish day nurseries				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Spain	Sant Cugat del Vallès (Catalonia)	Roll out (227 children)	Nappies	Target: 270 kg/child/year reduction

Description:
In Catalonia, nappies represent between 3% to 4% of municipal waste and landfill or incineration are the only disposal treatments so far. In the municipality of Sant Cugat del Vallès around 2% of the municipal waste are baby nappies. With the support of the "Agencia de Residuos de Cataluña", Sant Cugat has initiated in March 2007 a pilot project which targets nappies. The pilot project was launched in a municipal day nursery welcoming 30 children and then extended to a second one of 19 children. After few months the experience extended to the rest of the municipal nurseries, i.e. up to 227 children. All nappies used in the nurseries are now reusable. The pilot project involved also the parents: children wear reusable nappies when leave the nursery, and nappies have to be returned the following day in a plastic bag to be washed. Besides, parents received a clean reusable nappy (for free) which has to be put on their child the following day. The municipality established a 5 days per week nappy collection and cleaning service at day nurseries. It is considered that the experience will reduce 150 kg waste per child and per year. The cost of a disposable nappy is around €0.21, while the cost of reusable nappies is approximately €0.43 per use. However, it has been calculated that this cost could be reduced to that of the disposables by cleaning the nappies in situ, avoiding the collection and distribution costs.

For more information: http://www.santcugatobert.net/; http://www.ent.cat/

[8] J.P. Crahay (2006), "Le potentiel de reduction des déchets par l'utilisation de langes reutilisables Dewebe scrl », p.16

Case 82: Reusable nappies at home				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
Germany	Landkreis Schweinfurt	Roll out (116,000 inhabitants)	Nappies	2.4 kg/inhab/year less in residual waste
Description: In the county of Landkreis Schweinfurt (116,000 inhabitants) households are been charged for the disposal of their residual waste. Promotion of reusable nappies along with the introduction of PAYT system allowed the county to reduce nappies from 9.4kg/inh/year to 7kg/inh/year in the residual waste fraction. **For more information:** http://www.landkreis-schweinfurt.de/				

7.1.3. Summary

Strategy	Case N°	Case description	Results
Swap to reusable nappies	79	WRAP's Real Nappy Programme	Target: 2,000 - 4,000 tonnes/year reduction
	80	Flanders' reusable cloth nappies	Estimated: 10% participation rate & 1.35 kg/inh/year less overall waste
	81	Reusable nappies in Spanish day nurseries	Target: 270 kg/child/year reduction
	82	Reusable nappies at home	2.4 kg/hab/year less in residual waste

In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable nappy waste prevention benchmarks:

	Nappy & incontinence pads waste generation (kg/inh/year) (1)	**Potential nappy waste quantitative benchmark (kg/inh/year)** (2)
Swap to reusable nappies and incontinence pads	18	2
	18	**2**
	Total nappy & incontinence pads waste generation	**Total nappy waste quantitative benchmark**

(1) The quantities of nappy & incontinence pads waste generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

CHAPTER 7

7.2. Other municipal waste

7.2.1. Introduction

7.2.1.1. Definition

It follows that after having described in detail the different waste streams there still remains a waste fraction called “other municipal waste”. This is the fraction corresponding to all other waste that has not been described and accounted for in the previous chapters.
This waste fraction is heterogeneous and comprises, depending on how municipal waste is defined, the following non exhaustive list of sub fractions:

- Toys
- Bicycles
- Sport & fitness equipment
- Baby & nursery products and accessories
- Do it Yourself (DIY) tools including home and garden tools
- Wood and similar waste from DIY activities at home
- Tires
- Hazardous waste including used vegetable oils & fats, lubricants, chemicals, paints, etc
- Litter
- etc.

7.2.1.2. Environmental impacts

Each of these fractions has its own specificity with regard to environmental impacts. The main environmental impacts relate to resource extraction, transportation and manufacturing, not too mention the (often) excessive packaging, embedded water, carbon emissions, end-of-life treatment, etc.
Even though most of these waste fractions tend to end up in land fill or in incinerators, here too waste prevention activities can be initiated as described further in the prevention strategies hereunder.

7.2.1.3. Quantitative flows of “other municipal waste”

“Other municipal waste” as described above has been assessed as representing more or less 30 million tonnes per year, or 10% of the total municipal waste generated in Europe per year. This represents a figure of 60 kg/inh/year.

7.2.2. « Other municipal waste » prevention strategies

Strategy description

Consumers, schools, offices, SME and local authorities will be able to reduce the waste they produce through the following strategies:

- Rent or borrow tools such as ladders, chain-saws, floor buffers, rug cleaners and garden tillers
- Rent party/event decorations and supplies such as tables, chairs, centrepieces, linens, dishes, etc.
- Buy durable goods

- Keep appliances in good working order. Follow manufacturers' suggestions for proper operation and maintenance
- Lease products and goods or buy 2nd hand materials from local reuse centres or charities
- Sell and buy at 2nd hand markets (market places as well as via internet)
- Disassembly strategies for partial reuse (DIY activities)
- Donate to charities, social or ecclesiastic organisations and reuse centres
- Promote/encourage repair workshops in reuse centres and schools (books, bicycles, toys) and repair shops (bicycles)
- Information and awareness raising actions/campaigns by local authorities, schools, NGOs and social organisations

Technical problems

On the one hand, while local authorities have a privileged position regarding closeness to citizens, information on leasing, renting and/or reuse options (leasing/ renting companies, repairers, charities, social organisations and reuse centres address guides, different reuse modalities according to the local context, information on economical benefits of reusing, etc.) are not easily found as a whole package on administration's websites or information letters.
Repairing goods is a custom that was widely established up until 30 years ago. This practice however, has been lost in the last decades, for various reasons. Most products are no longer designed for repair. Sometimes repair is even more expensive than buying a new product, at least from a consumers' perspective. However, this vision is short sighted as it does not take into account the environmental impacts for the production of the new product nor the environmental, economic (employment) and social gain when repairing goods.
Finally, the market is overwhelmed with cheap products with a short life time, no longer suitable for being repaired or reused.

Cases

Case 83: Toy libraries in the Greater London area				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	London	Roll out (120,000 families)	Toys	Expected: 5-10 kg/hhold/year reduction
Description: In London toy libraries have been established since 1967. A wide network, serving 120,000 families, has now been developed with many local authorities having at least one within their boundaries. Toy libraries allow parents and carers to take home a range of educational toys and equipment for up to 6 weeks at a time. Membership varies from library to library: some charge a small annual fee whereas others ask for a donation for each item that is borrowed. As children tend to grow out of toys quickly it can make sense to borrow rather than buy. For more expensive, quality toys it can also allows an opportunity to try before you buy. Householders will save money and membership fees should cover a large proportion of the operating costs. 75% of the toy libraries are run by volunteers, many being parents themselves, the remainder by public authorities. It is very difficult to gauge the disposable nature of the toys that have not been bought as a result of toy library membership, i.e. good quality toys can last several years, whereas cheap toys may break within hours. Each participating household might expect to divert 5-10 kg per year. (Source: Key actions to Reduce Waste in London – Appendices, 2008). **For more information:** www.natl.org.uk				

Case 84: The Oxford Cycle workshop				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Oxford	Pilot in expansion	Bicycles	200 bikes/year diverted

Description:
The Oxford Cycle workshop is a not-for-profit business that specialises in salvaging bikes, repairing them and selling them for an average of 80 Euro's. The workshop employs 3 – 4 people and turns around 200 bikes a year. The business is hoping to expand in the near future to employing 5 staff and boost its bike productivity by 100%. Working in partnership with Aspire Oxfordshire (who specialises in training and employment of the homeless and unemployed), the workshop tries to both employ mechanics that have come through Aspire, and runs the Bike Doctor, a mobile repair unit that plays a part in training Aspire mechanics. Apart from Government 'start-up' funding which the business was awarded in 2001, the cycle workshop has no public or private funding, being self-financing.
For more information: NRWF – Household Waste Prevention Toolkit (update 2006), http://www.nrwf.org.uk/documents/NRWFToolkit

Case 85: Redistributing painting				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	National	Roll out (65 reuse schemes in UK)	Painting leftovers	208,000 liters redistributed

Description:
Community RePaint is a UK network of over 65 community-based paint reuse schemes, stretching from Cornwall to Belfast to the Shetland Isles. From 400 million litres of paint sold in the UK in 2006, it is estimated that 80 million litres are unused, stored in homes or thrown away. RePaint collects, sorts and redistributes paint coming from householders, traders, retail outlets and other sources. The paint is given for free (although schemes encourage small financial donations to help cover their costs) to community groups in need through local charity, social services, etc. Individual schemes collect "half-tins" of leftover domestic paint from householders, unsold paint and damaged tins from local DIY outlets, trade centres, painters and decorators. Collection systems include for example dedicated drop-off points at DIY retail stores, drop-off facilities at council offices, customised skips and recycling centres. This paint is then sorted and stored at the scheme's premises and then redistributed. In 2006, the UK network redistributed over 208,000 litres to a total of 11,000 individuals, community and voluntary groups (worth over 800,000 pounds) and created 90 jobs (operation of the network).
For more information: http://www.communityrepaint.org.uk

Case 86: Garden tool re-use project				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Oxfordshire	Roll out (600,000 inhabitants)	Garden tools	4 tonnes reused in 2003-2004

Description:
The Oxfordshire Community Action Group, in partnership with The Recycling Consortium and Oxfordshire County Council, run a Garden tool re-use project, with one central collection point at the Redbridge civic amenity site. From here, the Oxfordshire scrap store, picks up the tools once a week, sort them out into useable tools and scrap, and resells them cheaply (between 0.37 euro and 1.47 euro - covering labour costs) to the local community. The project, set up initially as a pilot, has become very successful with over 4 tonnes of garden tools reused in 2003-2004, without any publicity and involving only one civic amenity site.
For more information: http://www.cagoxfordshire.org.uk/; http://www.oxfordshire.gov.uk/

Case 87: Refurbishing tools and sewing machines				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Aberdeen, Edinburgh, Glasgow and Arbuthnott	Roll out	Hand tools & sewing machines	NA

Description:
"Tools for Self Reliance" (TFSR) is an organisation that provides refurbished hand tools and sewing machines to different communities in Africa. They work with local organisations in Tanzania, Uganda, Ghana, etc. providing them also skills training. Reusing tools helps not only to reduce the waste but also contributes to improve artisans work in developing countries so that they can better participate in the development of themselves and their communities. A small staff and hundreds of volunteers helps to collect and refurbish tools, some of these are volunteers with learning disabilities.
For more information: http://www.tfsr.org

Case 88: Swapping goods to reduce waste				
Country	**RA/LA**	**Scale**	**Waste fraction**	**Results**
UK	Aberdeen, Edinburgh, Glasgow and Arbuthnott	Roll out	Miscellaneous	NA

Description:
In Bunessan, Isle of Mull in Scotland, a Swap Shop was opened encouraging people to donate their unwanted goods and take others in return. A truck service for bulky materials is also provided, as well as a notice-board containing a list of goods people would like. The shop also runs a textile bank for the exchange of textiles, and sends all the unwanted or non usable ones to be recycled. The shop proved such a success that other shop was opened in Craignuire.
For more information: http://www.mict.co.uk/

7.2.3. Summary

Strategy	Case N°	Case description	Results
Other municipal waste prevention strategies	83	Toy libraries in the Greater London area	Expected:5-10 kg/hhold/year reduction
	84	The Oxford Cycle workshop	200 bikes/year diverted
	85	Redistributing painting	208,000 liters of paints redistributed
	86	Garden tool re-use project	4 tonnes of garden tools reused in 2003-2004
	87	Refurbishing tools and sewing machines	NA
	88	Swapping goods to reduce waste	NA

In the light of the waste prevention activities already described, ACR+ has put forward the following easily achievable “other waste” prevention benchmarks:

	“Other municipal waste” generation (kg/inh/year) (1)	**Potential “other municipal waste” quantitative benchmark (kg/inh/year)** (2)
Other municipal waste prevention strategies	60	6
	60	**6**
	Total “other municipal waste” generated	**Total “other waste” quantitative benchmark**

(1) The quantity of “other municipal waste” generated per inhabitant

(2) The estimated potential quantitative benchmarks that can be achieved

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8.1. Conclusions

In this guide, several options for waste prevention are scanned on their potential. Together, these cases provide a certain insight in the possibilities and also the challenges to overcome when directing policy towards waste prevention. And in relationship with that perspective, this ACR+ guide provides a substantial contribution to the new Waste Framework Directive.

The current lack of extensive waste prevention policy experience suggests that European countries may benefit from pursuing intensified information exchange activities, undertaking in depth case studies on the design, implementation, and evaluation of waste prevention programs, and analyzing synergies between waste prevention efforts aimed at improving economy-wide resource efficiency, and waste management. It might therefore be proposed that the principles and approaches discussed in this guide be used as an initial basis for launching such efforts.

Throughout the work undertaken when compiling this guide we identified the following challenges and opportunities:

8.1.1. Challenges

- Resources are being depleted in a dramatic way and subsequently overall municipal waste quantities are still growing (+10% expected by 2020) and require therefore immediate action;
- Waste prevention is not yet a priority among the public, businesses, or some local governments. There is a general lack of public interest, knowledge, or support for waste prevention;
- Waste prevention often takes a backseat to more tangible or high-profile concerns, such as recycling or climate change;
- Waste prevention faces a battle in countering the many pro-consumption messages in the media and a dominant culture of consumerism, supported by millions of Euro's worth of advertising;
- Though waste prevention is inherently efficient, some local governments and organizations may lack the support or political will to exhort their citizens to "buy less stuff", and such messages may be viewed as bad for the economy;
- Each public authority will have to look for own quantitative objectives of waste prevention including indicators to measure actions' evolution and results;
- The challenges of tracking and measuring waste prevention can contribute to misperceptions that such activities are too difficult or vague to be worthwhile, in the absence of clearly documented cost savings and environmental benefits data;
- Lack of sufficient funding resources, including funding and staff time, to set up or expand waste prevention activities.

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8.1.2. Opportunities

- The EC, through its new Waste Framework Directive, developed the following obligations and measures to support authorities in planning, implementing and monitoring waste prevention programs in the future:

  - A legal obligation of “benchmarks…if appropriate”;
  - Minimum quantitative benchmarks are necessarily appropriate for an effective waste prevention policy;
  - Waste prevention programs to be elaborated before 2013;
  - The EC develops guidelines and shares information on best practices;

- Local and regional authorities are the key-actors : they have an important role to play by developing, implementing and validating adequate waste prevention actions adapted to specific local realities;

- Local and regional authorities play also an important communications role in directly addressing the persistent public confusion regarding the distinction between waste prevention and more visible and traditional activities such as recycling. An enhanced public understanding of waste prevention will increase political will for its promotion;

- The benefits of waste prevention programs lie in their potential to prevent waste, increase efficiency, and save natural resources;

- By prioritizing waste prevention activities, organizations can avoid the inevitable costs of solid waste collection and disposal and achieve solid waste management goals effectively;

- The more than 100 cases described and quantified in this guide indicate clearly that the potential for waste prevention is important, feasible and profitable;

- ACR+ promotes an average European quantitative benchmark of 100 kg less per inhabitant and per year or more or less 15% of the average municipal waste generated for the 5 main waste streams identified;

- Reducing waste by 100 kg/inhabitant/year will not only reduce significantly CO2 emissions, but also reduce waste management costs between 8 and 25 Euros/inh/year.

Finally, as it was previously said, this guide focuses on voluntary actions that can be carried out by public authorities and other stakeholders. However, it is necessary to clarify that prevention policies should not be limited to voluntary aspects. Other legal and economical instruments have also to be considered, developed and implemented in the scope of preventing waste.

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8.2. Follow up mechanism

An interesting approach for cities and regions is the possibility to share and discuss their results and consider ways to improve their performances. This is one of the principal objectives of the network organization ACR+, namely developing the expertise of public authorities and encourages practical action in municipal waste management and sustainable consumption.

ACR+ has created and is still developing tools in order to assists its members in sharing information, experiences and good practices. The main tools used are organization of seminars and workshops, technical reports, campaigns and projects, news and information, exchange programmes, and training events.

Specifically within the “100 kg less waste per inhabitant”, launched by ACR+ in 2006, working group clusters around the main municipal waste categories have been established in order to allow for improved knowledge and sharing of good practices in the field of waste prevention and more specifically the comparison of practical experiences and performances.

The results so far have shown that the ACR+ approach is not only assisting our members (and others) to have a better understanding of waste prevention and reduction potentials but has also impacted on their own waste prevention programmes and performances.

ACR+ and its members are paving the way and lead by demonstrating. The European Week for Waste Reduction (EWWR), co-organized by ADEME (France), ACR+ and some cities and regions, will be a further step to show and demonstrate the achievements so far.

8.3. Tips for replication

Base on the analysis developed in this guide, we formulate tips for replication addressed to public authorities on waste prevention policies development and on different aspects of how to benchmark in the context of waste prevention:

8.3.1. Program Planning

- Make a baseline study (current waste generation quantities per waste flow, legal obligations, cost indications, population targeted, scale, etc.);
- Define quantified objectives (per waste flow targeted) and set SMART (Simple, Measurable, Achievable, Reproducible and Timely) indicators;
- Build broad program support during the planning stages by seeking public input, selling the program to those active in the community and building political support;
- Make program participation as convenient as possible. Keep the program easy and user-friendly;
- Consider pilot programs to collect quantified data;
- Do not simply attempt to replicate another community’s program without considering your community’s similarities and differences;

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- Learn from others' experiences. Find out what other communities have accomplished and how they did it;

- Monitor results and express them in a consistent way (Units: ACR+ proposes the use of kg/inhabitant/year as international unit).

8.3.2. Policies

- Develop a local initiative policy requiring residents, businesses, and institutions to participate in waste prevention activities;
- Consider, besides voluntary programs, mandatory measures or specific economic incentives to boost both the quantity and quality of participation;
- Adjust measures to match reality and adapt policies in the light of experience.

8.3.3. Education

- Focus on education that teaches residents how to implement your particular waste prevention system;
- Remember raising overall environmental awareness can boost enthusiasm for waste prevention programs;
- Reaching children can be a way to educate entire households;
- Target educational efforts at new residents and at all ethnicities;
- Support education programs with market research to most efficiently target resources;
- Keep promotional materials simple and use culturally sensitive language and messages;
- Repeat messages in a variety of media;
- One-to-one outreach can be very effective;
- Measure behavior/consumption patterns change ;
- Provide feed back on the results at regular times.

8.3.4. Constant reminders

- Be prepared for resistance to change. Be very clear about the "whys" of a program change to increase buy-in. Anticipate likely questions ;
- Recruit and reward citizen volunteers, who have many skills and can help maintain community motivation;
- Be accessible to residents ;
- Talk to your customers. Solicit input and give feedback on program progress;
- Seek committed staff and administration to ensure program success;
- Know what everything costs ;
- Collect and analyze data to document success;
- Never stop striving to improve; there's always room for improvement;
- Be creative and share your experience.