A Contribution from the
BKV Platform for Plastics and Recovery

Plastic –
The Material of Resource Efficiency

From Manufacture to Recovery

BKV PLATFORM FOR PLASTICS AND RECOVERY

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The BKV – Platform for Plastics and Recovery

The BKV is the platform of the German plastics industry for plastics and recovery. The shareholders of the BKV are companies in the plastics manufacturing and processing industry and plastics machinery manufacturers. The relevant associations are also included. The BKV – Beteiligungs- und Kunststoffverwertungsgesellschaft mbH in full, based in Frankfurt am Main – is unique in Europe with its offer of such a shared platform. The plastics industry is facing up to its responsibility for the impact on man and the environment. The platform offers technical information on this and encourages exchanges between industry, politics and society.

Themes: Sustainability of Plastics

Issues relating to plastics recovery are the core theme of the BKV. In the interests of a holistic view, which necessarily includes the entire life cycle of plastics, it also deals with aspects of sustainability over the entire life cycle. What is their contribution to resource efficiency and consumer protection?

Eco-efficient waste management aims at responsible and sensitive dealings with nature and resources. With the material plastic in particular it is worth looking beyond waste. For the best possible success, considering and assessing the entire production chain is essential. The BKV wants to raise awareness of this.

Studies: Facts and Trends

The BKV commissions studies on these subjects – often in cooperation with an association or company. For example, every two years it publishes the Consultic Study "Production, Processing the Recovery of Plastics in Germany" together with PlasticsEurope. Other institutions in the plastics and recovery industry regularly contribute to it. For years, this statistical general overview has been appreciated as a reliable foundation for planning and discussion in politics and business. Furthermore, the BKV regularly takes part in studies commissioned by plastics associations or tecpol GmbH, in which BKV has an interest. These can be about specific issues, such as the ecological assessment of plastics applications, or about new approaches to the sorting and recovery of plastic waste. Expertises of this kind provide profound data and secure arguments for dialogue with politics and business and for the associations with their target groups.

Public Relations: Information and Dialogue

The BKV supports this dialogue with its own public relations. On its internet platform, www.bkv-gmbh.de, it brings together information of sustainability issues, such as resource efficiency and consumer protection and provides background information on the plastics recovery market. Players from politics and business step up to the plate in interviews. A weekly press review, news reports and a regular newsletter "BKV-AKTUELL" keep readers up to date.

Since 2007, the BKV, together with the Oberhausener UMSICHT Institute of the Fraunhofer-Gesellschaft, has been organising an annual congress ZUKUNFT KUNSTSTOFFVERWERTUNG [FUTURE PLASTICS RECOVERY] in Krefeld in which experts from politics, business and academia find out about and discuss topical issues. Symposia on a smaller scale and rounds of discussions on current "hot topics" are also part of the programme of events.

Finally, the BKV publishes the information and expertises it has gathered. It publishes the results of studies and issues brochures on the subjects of plastics recovery and resource efficiency. You are holding an example of this work.

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Introduction: The Focus on Resource Efficiency

The manufacture and consumption of plastics have risen steadily in recent years. They are usually manufactured from mineral oil – a finite resource. Sensitive use of it is therefore the order of the day – not only from a moral obligation vis-à-vis the generations to come, but also for reasons of ecological and – increasingly – economic sense. How efficient are plastics in comparison to other uses of mineral oil?

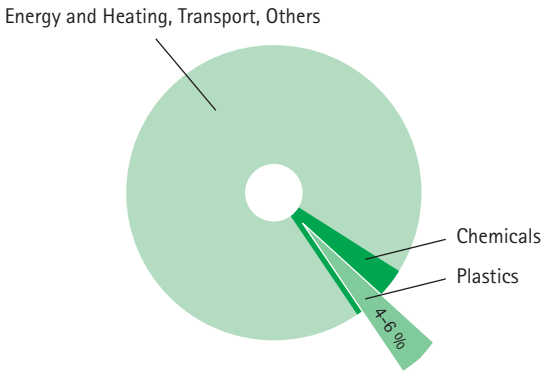
The plastics industry is convinced that plastic is the material of the 21st century. Not only because the material actually enables our modern lifestyle in many ways because of its sheer infinite design and innovative capabilities and makes our lives safer in various ways and, in particular, because plastic is an extremely resource-efficient material.

The efficiency in the manufacture of the material has made tremendous progress in years gone by and can hardly be further increased. Only four to six per cent of the worldwide mineral oil and natural gas consumption are needed for plastics. Traffic and transport swallow up half of the oil, and over 30 per cent are still needed for heating and living. This means that the vast majority of oil resources is burned directly to gain energy from it. Plastic products can still take this route when they have served their purpose – and without any loss of energy.

Plastic products make their biggest contribution to effective resource protection during their usage phase. They can be manufactured with comparatively little material. As building insulation they greatly help to save energy. As car components they help to reduce fuel consumption. As packaging, they protect products and foodstuffs – which have used a great deal of energy in production – against damage or spoilage.

Finally, plastics also contribute to resource efficiency when their first life is over. When packagings, plastic cables and agricultural sheeting have worn out, they can be used again as a valuable resource. Recycling makes plastics waste into raw materials for new plastic products. Energy recovery uses them to produce electricity, steam and process heat. The energy content of the oil from which plastic products are made is also "frozen" in them.

Mineral Oil and Natural Gas Consumption in Western Europe



Source: Plastics*Europe*

Viewed over the whole life cycle – from manufacture and use to final recovery – plastics are extremely resource-efficient – and the most intelligent use of the resource mineral oil. That is what this brochure is about. It is much less about the properties and benefits of plastic products or how they shape and facilitate our modern lives. Products are obviously primarily developed and used for these functions. And that accounts for the actual success story and today's acceptance of the material.

Plastic: The Resource-Efficient Material

Plastics are materials that are simple and cheap to produce with relatively little energy expenditure. Thanks to their diverse possible uses and with an extraordinary potential for innovation, they make an important contribution to the sparing use of non-renewable resources. Mineral oil and natural gas as the feedstock material for the manufacture of plastics are used much more efficiently than if they are burned for direct energy generation. In the form of fuels they provide energy only once. In contrast to this, almost all of the energy from the raw material used to manufacture the plastic product remains in the product. And this can be used again at the end of the product life. The significance of plastics waste as a resource will continue to grow against the background of high energy costs.

Growing Demand

The production figures for 2007 reflect the growing demand for this energy-efficient material. With 20.5 million tonnes, Germany was the biggest manufacturer and, at around 12.5 million tonnes, had the highest demand as a processor from among the 27 EU member states plus Norway and Switzerland. In this economic area, around 65 million tonnes of plastics were manufactured in 2007 (approx. 15 per cent of worldwide production) and 52.5 million tonnes, three per cent more than in 2006, were processed into products. According to estimates, per capita consumption in the western European economic area will rise from today's 100 kilograms to over 130 kilograms per year by 2015.

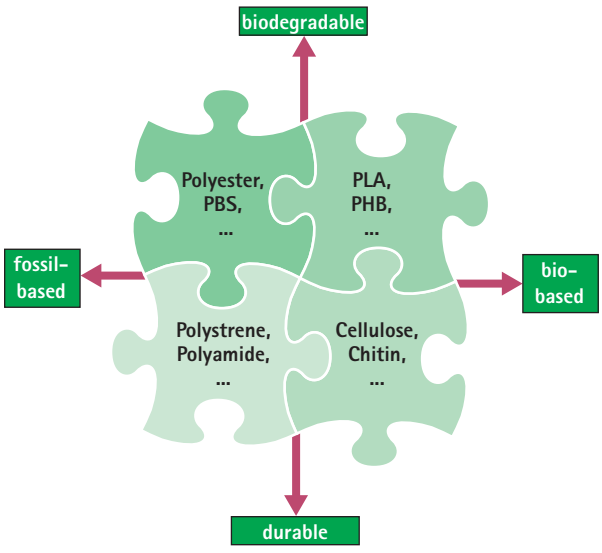
Biodegradable and Bio-Based Plastics

Their market share is still below one per cent, but high growth rates are predicted for them in the future – plastics made from regenerative raw materials (bio-based plastics). One name for them is "bio-plastics", but this term is unclear because it can also refer to biodegradable plastics. But conventional plastics can be biodegradable as well as those made from regenerative raw materials. And not all bio-based plastics are biodegradable.

Plastics made of regenerative materials and biodegradable plastics are one of the innovations that are constantly being developed to open up new applications, and thus markets. For example, they are increasingly being used in agriculture and even in vehicle manufacture. The extent to which they will prevail in the long term depends on their constant availability and the advantages that they can offer, both economically and ecologically. Bio-based or biodegradable plastics do not always mean actual benefits for the environment. For example, in the currently established mechanical recovery processes they are considered to be "pollutants". Their advantages can only be shown by viewing the environmental audit of an individual case – most reliably with a life cycle analysis.

In addition to the conventional recycling routes – materials or feedstock recycling as well as energy recovery – biodegradable plastics waste can be treated by means of composting (aerobically) or fermentation (anaerobically). The recovery method that is actually the most eco-efficient depends on the composition and the quality of the waste.

The Bio-Plastic Family



Manufacture: Low Demand for Raw Materials

The resource demand for the manufacture of plastics is on the low side, at only around four to max. six per cent of the entire amount of mineral oil and natural gas used worldwide. The vast majority (> 80 per cent) is used for energy and heat generation, mainly in the sectors of transporting goods and people and operating heating systems and power plants.

An average of 66 Megajoules of energy is needed to manufacture one kilogram of ethylene, the monomer feedstock for the production of many polymers. Although less energy is needed to manufacture one kilogram of white glass (13 Megajoules), plastic is the material with the much higher yield. The same quantity of plastic results in much more product, as can be seen in the example of drinks bottles: One kilogram of plastic is sufficient for > 20 one-litre bottles; the same quantity of white glass is enough for a maximum of three bottles with the same capacity.

Process optimisation, better planning and capacity utilisation of production facilities with consistent energy consumption, improved product qualities, reduction of residual materials and emissions make it possible for raw materials to be used ever more efficiently. In Germany, between 2000 and 2005 the chemicals industry greatly reduced consumption of oil, coal and gas (oil: by 0.9 to 0.5 million tonnes, coal: by 0.6 to 0.3 million tonnes, gas: by 0.2 to 5.8 million tonnes). The specific energy use (the amount of energy used per product unit) fell by almost 45 per cent between 1990 and 2005. In 1964 a plastics manufacturer needed an average of 1,185 kilograms of raw and auxiliary materials to manufacture 1,000 kilogram of polypropylene. In 1999 the equivalent figure was only 1,009 kilograms.

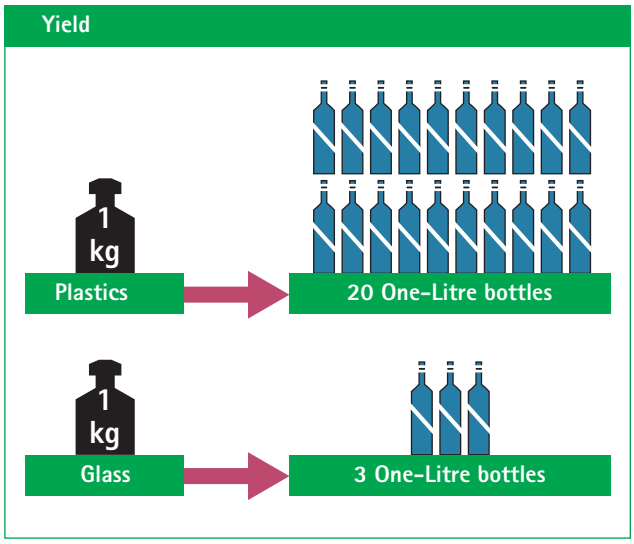
The material plastic does not only show its energy efficiency with its low consumption of raw materials during manufacture. If we analyse the energy efficiency of plastics over all of their life stages and compare them with a scenario in which they were replaced by other materials, mineral oil consumption in Europe alone would rise by 22.4 million tonnes per year.

Processing: Lots of Products from Little Material

Plastics processors are using ever smaller quantities of plastic to manufacture many products. In 1970 the average yoghurt pot weighed ten grams, today it weighs only five grams. And the material coverage of plastics is high: for example, only 100 kilograms of oil products can make 3,500 carrier bags (around 28 grams each) from polyethylene film, 20,000 yoghurt pots from polystyrene or 13,000 medical disposable syringes from polypropylene (approx. 7.5 grams each).

Packing with Plastic: Becoming Easier

Packagings made of plastic cannot be beaten, especially in terms of weight: around 60 per cent of all goods in Germany are packed in plastic – and the trend is rising. But the share-by-weight of this packaging material accounts for only 22 per cent of all packaging materials. Thanks to improved feedstock material and optimised production processes, plastic packagings are becoming more effective: Ten years ago its average weight was 28 per cent higher than today. Today, the packaging for four litres of concentrated laundry detergent weighs only 100 grams and is thus just one third of its 1970 weight.



Wafer-Thin High Performance

In the production of films, which account for a considerable amount of the packagings used in Germany, nowadays we are using ever thinner individual layers, and we thus need less material. The films are mostly only a few hundredths or thousandths of a millimetre thick. A whole tonne of paletted goods can be wrapped by only 800 to 1,400 grams of shrink-wrapping film. The plastic bag that we use to take our shopping home from the supermarket is just 0.015 millimetres thick. Their predecessors a good ten years ago were 0.045 millimetres thick.

Saving with Plastics Packagings

A study conducted by the Gesellschaft für Verpackungsmarktforschung (GVM) [Society for Packaging Market Research] in 2004 provides answers to the question of the savings achieved with plastic packagings when compared with other packaging materials. The results are very clear: plastics greatly reduce the weight of the packagings and seals needed. Without them, alternatives made of paper, card, cardboard, glass, tin, steel, aluminium, wood or cellophane would weigh four times as much on average. Their manufacture requires only two thirds of the energy and production costs are only half as high as for packagings made of other materials.

More Plastic – Fewer CO_2 Emissions

The efficient use of resources, energy and the reduction of greenhouse gas emissions play a major role in the strategic discussions on how the consequences of climate change can be mitigated. The chemicals industry has already made great achievements here. Between 1990 and 2002 the industry succeeded in reducing energy use by four million tonnes of oil units to around seventeen million tonnes. Within fifteen years (1990 to 2005) the companies in this sector cut their CO_2 emissions by an impressive 38 per cent.

The contribution that plastic products can make to energy saving is most noticeable during the usage phase. In this time they usually save much more energy than was ever needed for their manufacture. Viewing the entire life cycle of a dishwasher, for example, clearly illustrates the importance of the usage phase: Around 10 per cent of the entire energy consumption are accounted for production of the machine and only 0.2 per cent for disposal when the machine has come to the end of its life. But almost 90 per cent of the energy consumption is incurred during the usage phase. At this point, plastic products with their energy-saving properties make the greatest contribution to climate protection and to reducing emissions of greenhouse gases.

Plastic Cuts Fuel Consumption

A car today weighs between 900 and 1,400 kilograms, a medium-class car around 1,000 kilograms. Around 15 per cent or 150 kilograms of that are made of plastic, and this trend is rising. According to calculations by the Fraunhofer-Institut für Verfahrenstechnik und Verpackung, the weight-reducing interior and exterior components, such as seats, tyres, bumpers, dashboards or wings mean that cars in Germany use around 500 million litres less fuel and save 1.5 million tonnes CO_2 per year.

The use of plastic components in vehicles not only cuts fuel consumption due to reduced weight. Smoother surfaces, which are possible with plastics, reduce the air resistance and, as a consequence, fuel consumption. In the engine compartment, plastic parts are now used for intake systems, whose smooth inner walls reduce the flow resistance. The consequence: engine power rises and fuel consumption falls.

You can Build on Plastic

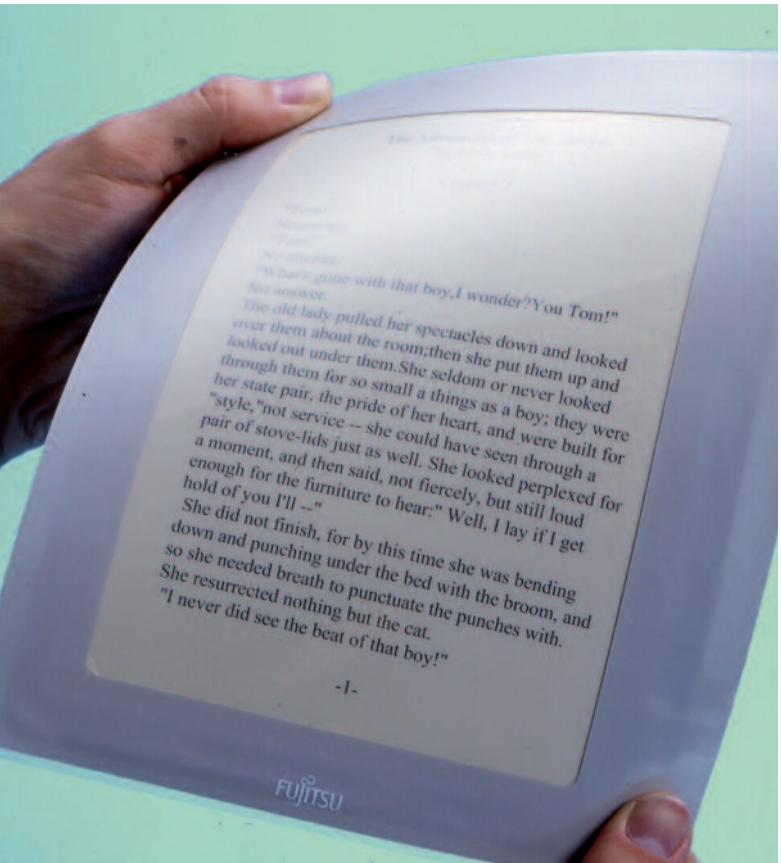
In buildings, plastic products reveal their eco-efficiency enhancing properties in many ways. In houses and apartments, insulation boards not only protect against the influence of the weather, but also against weather damage and thus increase the overall useful life. Corrosion-free water pipes made of plastic ensure optimum protection of drinking water, plastic window frames help to maintain a constant internal temperature. Insulation, pipes and ventilation systems are made of the versatile material. Plastics are extremely energy-efficient in the building sector, especially in thermal insulation. They can be used to enable energy-saving, environmentally friendly living today without great expense. Old buildings can also be converted into low-energy houses by being "clad" from top to bottom with plastic insulation boards.

The average heating oil consumption in Germany is 20 litres per square metre of living space for 75 per cent of all homes. Thanks to insulation with only 20 centimetres of external walls, roofs and cellar ceilings, combined with the installation of highly insulating plastic windows, an 85 per cent reduction in energy consumption to 3 litres per square metre can be achieved. And the development continues: a reduction in the annual heating requirement to below 1.5 litres per square meter is technically possible.

High-Tech Plastics for the Environment

Plastics show an enormous potential for innovation nowadays, often in combination with other materials, such as metal or textile fibres. Hardly any technical further development or innovation is possible without them. Plastics allow products such as mobile phones, games consoles, screens or computers to become ever smaller and lighter. The opportunities to reduce energy consumption with the development of innovative plastic products are far from exhausted.

Plastic Screens: E-Paper
Even today a polymer coating ensures a better optical sharpness on flat screens. In future, conventional screens will probably be completely replaced by thin, energy-saving displays made of plastic. Products that aim at developing displays of this kind are subsumed under the term e-paper. Ultimately, the "screens" should not only be economical, but also flexible, it should be possible to roll them up and write on them repeatedly. As early as 2003, Philips and the American company E-Ink presented a fully working prototype that uses little energy and on which whole books can be saved.



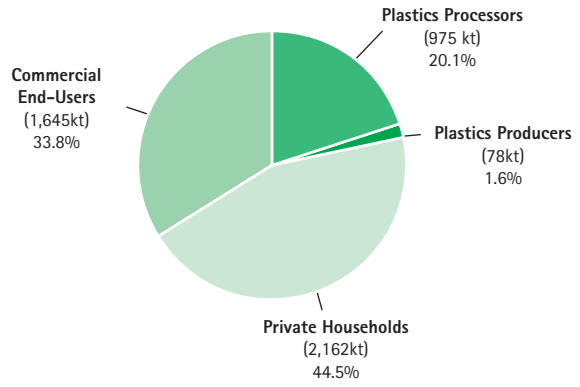
A Fixed Connection: Hybrid Technology
In vehicle construction in particular, components are optimised by the combination of plastic with other materials, such as metal. The products manufactured with this hybrid technology have particularly good mechanical properties with a reduced weight. For example, a steel-polyurethane-steel compound (sandwich plate system) is used as a construction element in shipbuilding. In comparison to conventional steel constructions it has higher stability, better vibration damping and lower weight. Vehicle components produced using hybrid technology save fuel and help to reduce CO_2 emissions.

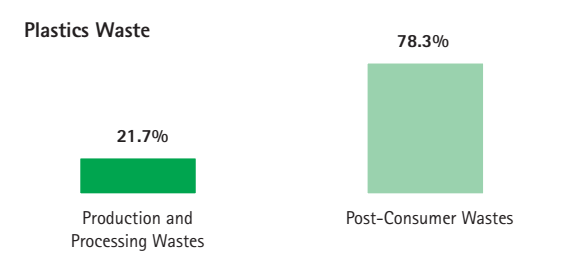
With the Power of the Wind
Towing kites made of high-strength, weather-resistant plastic textiles use wind power on the open seas and form the basis for a pioneering drive system for cargo ships, cruise ships and supertankers. The up to 5,000 square metre towing kites provide up to 6,800 bhp and, if the wind is favourable, reduce fuel consumption by up to 50 per cent.

Recovery: Waste Becomes Raw Materials

Sooner or later, plastic products also become waste. In the case of packagings, this usually happens very quickly; it is often many years for electrical and electronic appliances. Plastic windows appear as waste at the earliest after 30 years, but sometimes only 50 years later. But what all products have in common is that as waste they are a resource that is being used for ecological – and increasingly – economic reasons. In Germany, almost all plastic waste is recovered, either as materials or as energy. The key impetus for this development has been in place in Germany since mid-2005 with an effective landfill ban on untreated waste. In neighbouring European countries, such as Belgium, Denmark, Austria, Switzerland and Sweden similar amounts of waste are recovered and no longer landfilled. However, the gulf in Europe is great. In half of EU member states, the recovery rates for plastics wastes are below 30 per cent. Nevertheless, in 2007 the overall recovery rate for all 27 EU countries plus Norway and Switzerland was 50 per cent.

Where Plastics Wastes are Incurred (Shares in Germany 2007)

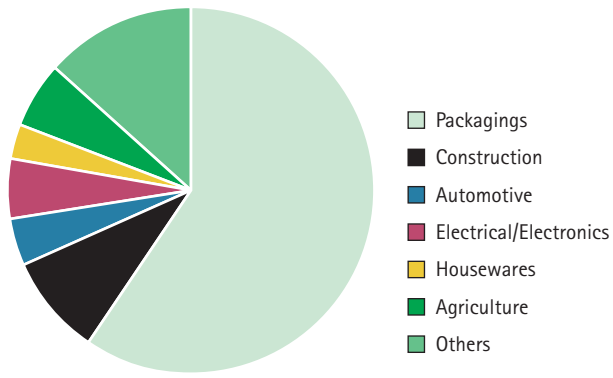




Packagings Dominate Waste

In 2007 the amount of plastic waste in Germany was 4.86 million tonnes. Around one million tonnes of this were wastes that were incurred in the production or processing of plastics and almost 100 per cent of which were recovered. 3.8 million tonnes were incurred by commercial and private end consumers. Since 1994, the amount of waste produced by end consumers has risen

Shares of Plastics Wastes according to Applications (Germany 2007)



by around five per cent per year. Almost 60 per cent of the wastes are packagings, which have a very short useful life by definition, whereas products with a long useful life are rarely found in waste. Although wastes from electrical and electronic appliances are increasing slightly because consumers replace items more quickly than in the past, they still only account for just under six per cent. 95.5 per cent of post-consumer wastes were recovered.

Feedstock Use: Raw Material for New Products

In comparison with other materials, plastics have the advantage that they can be recovered in various ways, depending on their properties: as materials, feedstock or thermally.

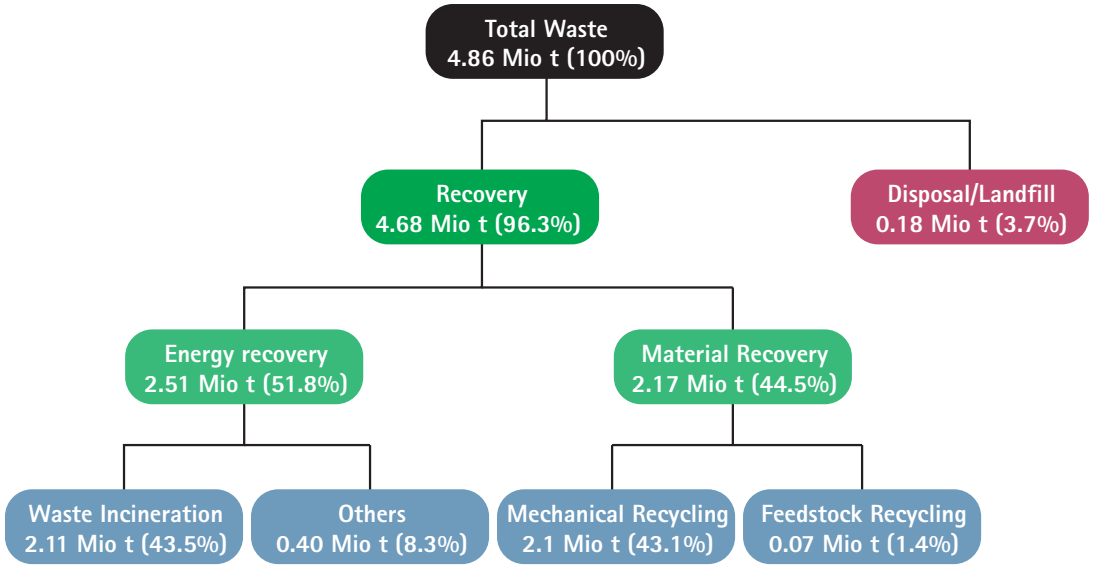
43.1 per cent of all plastics waste were recovered as materials in 2007. This means: the collected plastics are crushed, cleaned and separated according to types and then compounded into new products. In this mechanical treatment, the chemical structure is retained. In the majority of cases, regranulates are manufactured in this way that are used in plastics processing for the manufacture of new products – depending on the application, often with the addition of new material. In times of high prices for raw materials, such regranulates are attractive on the market. The purer and cleaner the plastic wastes, the more they are suited to materials methods. Apart from a few exceptions, where elaborate separation processes for mixed and extremely dirty plastics wastes are worthwhile, these types of waste are not suited to mechanical methods. Feedstock and energy recovery are available for this.

In feedstock recycling, the chemical structure of the plastics is broken up. This results in smaller elements, such as monomers, oils and gases. The feedstock methods originally developed in Germany are synthetic gas extraction and the blast furnace method. However, under current conditions they are only niche markets (in 2007 they accounted for only 1.4 per cent).

Energy Use of "Parked" Energy

With a share of almost 52 per cent, thermal recovery has risen strongly. This includes the quantities thermally recovered in waste incineration plants with energy tapping. Cement and power plants as well as special fuel substitute plants also use the energy stored in waste.

Plastics Wastes in Germany in 2007 (including Production and Processing Wastes)

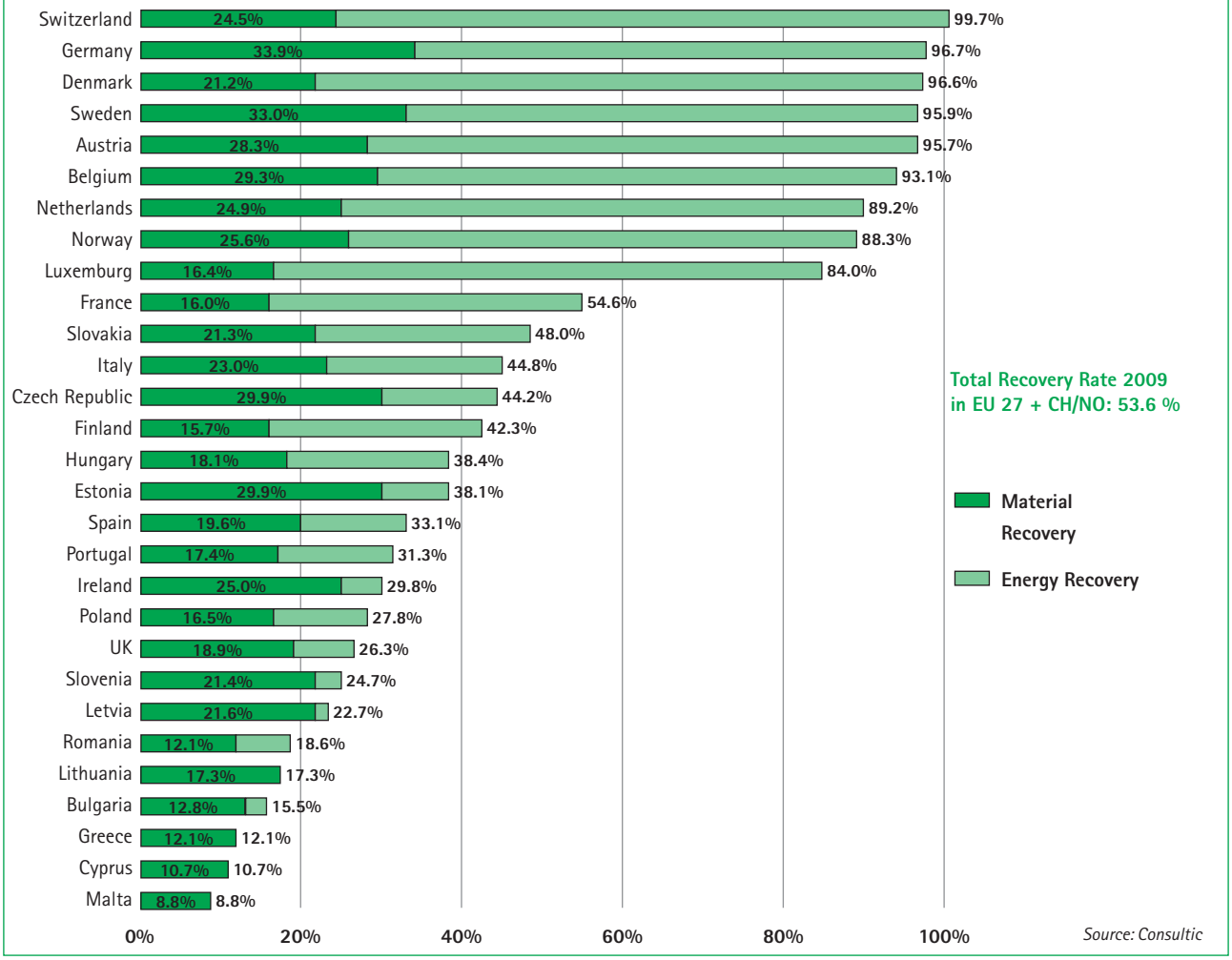


Waste Management Viable for the Future

From the point of view of resource efficiency, landfilling plastics waste is undoubtedly the worst of all conceivable disposal alternatives. Because it squanders valuable resources for raw materials and energy and, at the same time, greenhouse gas emissions are increased. However, in many countries in the European Union this is still the cheapest alternative. Nine EU states, like Germany, are successfully pursuing the goal through legislation of steering waste streams away from landfill and towards recovery. Here, recovery rates of over 80 per cent are already being achieved. At the other end of the extreme, the rate is still below 20 per cent in seven countries. The unused amount disposed of is correspondingly high. Even though the Guideline Directive on Waste is currently striving for harmonisation in Europe, it will still take some time until a "move away from landfill" policy is started and implemented everywhere, especially since this cannot yet have priority in some EU states. But some progress can be seen in joint European action. On average, the recovery rate in Europe was 51.3 per cent in 2007. And although the amount of plastic wastes rose due to the positive economic development, the amounts sent to landfill fell. This means that economic growth and landfill have now been decoupled and waste recovery is increasing.

For recovery that pays equal attention to ecological and economic standards, it is essential to make use of all recovery

Recovery of Post-Consumer Plastics in EU 27 + CH/NO in 2009



Source: Consultic

options. In the case of pure and clean plastics wastes, materials methods make sense if the associated separation work is reasonable, both from ecological and economic aspects. Technical progress in the sorting and separation technology in recent years has made a major contribution to this, but is gradually coming to its limits. Forcing dirty plastic mixes and compounds into material recovery, which has hardly any or no ecological advantages, makes less sense for economic reasons. Here, there are feedstock and thermal methods available, the output of which can make contributions to resource efficiency and cutting CO_2 emissions, either as a chemical raw material or as energy.

The recovery route that is best suited to which waste should not be determined by detailed political regulations, but by its specific properties and market conditions. Defined environmental quality standards thus ensure environmentally sound waste treatment for preparing the substance streams for recovery.

Recovery in Competition: Products and Procedures

Together with tecpol Technologieentwicklungs GmbH für ökoeffiziente Polymerverwertung in 2007 the BKV commissioned a market study that examined in detail the structure of the German disposal industry with respect to plastics wastes. The result was that the study confirmed that plastics wastes in Germany are recovered safely and reliably. It is particularly noticeable that market economic conditions are increasingly characterising recovery. Rising prices for raw materials and energy, for which a high level must be anticipated in the long term, and reliable quality are the background to growing demand for secondary materials. However, they also have to be cheap to be competitive.

These conditions apply to all products, irrespective of whether they result from material, feedstock or energy recovery. Today, disposal companies are usually capable of reacting flexibly to demand and supplying specifically treated materials for substance or energy recovery.

Recyclates from pure waste streams, such as PET drinks bottles or industrial films, are meeting with especially high demand. In 2006, 940,000 tonnes of PET bottles were collected all over Europe and recycled in more than 80 recycling facilities in Germany and Europe. Over 50 per cent of the recovered material are processed into polyester fibres in Europe, which go into the production of clothing, such as fleece jackets, or filling materials (e.g. for cushions). But PET recyclate is also used in bottles, e.g. for cleaning materials or cosmetics, etc. - and even in drinks bottles when treated specially. Disposable PET bottles in Germany now contain an average of 25 per cent recycled PET, some even contain 50 per cent.
The product of the material recovery of plastics wastes are largely regranulates, which are used to manufacture new products. For example, granulates made from waste film are used in wastewater pipes or cable sheathing. Often, regranulates are added to new materials or used with additives, depending on the application.

The technical further developments of recent years, in particular in sorting, mean that material for material recycling can be gained to a limited extent from mixed plastics wastes. The limits primarily come from the comparatively high costs, which have to be covered by the revenue to be earned.

Since the storage of untreated wastes has no longer been possible and the capacities for energy recovery have been expanded, the prices for recovery in waste incineration plants with energy tapping have been falling. In addition, fuel substitute plants are increasingly becoming available, which provide energy for industrial plants with specially treated fuels made from wastes containing high proportions of plastic. From this side, too, demand for cheap and reliably available fuels is increasing.

Three Recovery Routes for Plastics Waste

	Process	Selection Criteria	Product
mechanical	grinding and smelting	pure, clean	Regranulate
feedstock	converting into source materials or chemical	dirty mixed or similar sorts	Chemical raw materials
energy	burning with use as energy	dirty mixed or similar sorts	Energy

The Second Life of PVC

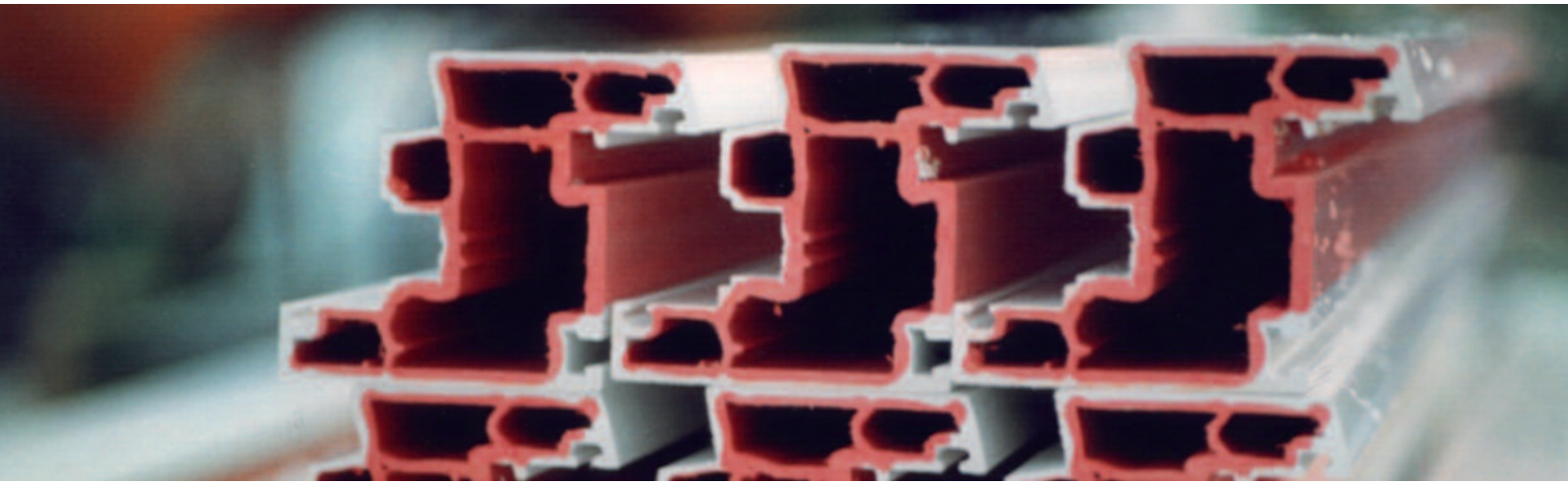
PVC wastes mainly come from the building industry, followed by packagings, furniture, household goods and medical products. Approximately 70 per cent of the PVC produced each year go into building products, where they often perform long-term and energy-saving functions. Since the early 1990s the industry has set up a differentiated, interlinked waste management system with collection points and recovery plants for the floor coverings, roofing membranes, windows, cables, pipes or sheets made of PVC that arise as waste at the end of their product lives.

For example, the Arbeitsgemeinschaft PVC-Bodenbelag-Recycling (AgPR) collects used PVC floor coverings all over Germany and in European neighbours that are then treated for the production of new floor coverings. Roofcollect sends plastic roofing and sealing membranes to recovery and the collection, treatment and recovery of plastic pipes is organised by the Kunststoffrohrverband e.V. (KRV). Finally, Rewindo GmbH operates a successful collection system for used PVC windows and shutters, which are used for the manufacture of new profiles. Around 60 other PVC recoverers and their products can be called up in the "PVC Recycling Finder" run by the Arbeitsgemeinschaft PVC und Umwelt e.V. (AgPU) at www.agpu.com.

According to a survey by the Arbeitsgemeinschaft PVC und Umwelt around 36 per cent of PVC wastes were sent to material recovery in Germany in 2005. Out of a total 505,000 tonnes, 75 per cent ended up in material or thermal recovery. PVC recycling is a growing market.

Window Recycling: Rising Quantities
In total, 23,410 tonnes of old windows and shutters were collected and processed into around 16,500 tonnes of pure PVC recyclate in 2009. By way of comparison: in 2005 the quantity collected was still around 11,000 tonnes and the recycled quantity 7,400 tonnes. The recyclate is returned to the manufacture of profiles. The cycle is closed.

PVC Floor Tiles Join Together Like a Jigsaw Puzzle
Floor tiles are made of old cable sheathing; they are laid with a specially developed click system. Piece by piece, the floor covering can be joined together like a jigsaw puzzle, without any glue. It is suitable for various substrates and can be removed again if necessary.



Recycling: Plastics as a Source of Raw Materials

Feedstock recycling methods crush long-chain polymers into smaller fractions that are used as chemical starting products and are often an integral component of industrial processes. For example, in the manufacture of iron, treated plastic wastes are used as a reducing agent, thus replacing primary oil or coke. And with a gasification process, polymers can initially be broken down into synthesis gas – a mix of carbon monoxide and hydrogen – from which chemical raw materials such as methanol are produced in further stages.
Feedstock recovery makes most sense where small, mixed, dirty or multi-layered compound materials are being used. In the recovery process of scrap cars in particular there are many such organic materials in the so-called shredder residue processing. This arises after the body has been crushed and then broken down into small, fist-sized pieces by the shredder and the organic fraction that also arises is separated from the metallic fraction.

Upon entry into force of the End-of-Life Vehicle Act in 2002, manufacturers and importers were required to take back scrap vehicles free of charge and send them to recovery. The automotive industry and its partners in the plastics industry have done considerable development work to recover plastics waste from scrap vehicles in an environmentally sound and energy-efficient way.

Volkswagen AG developed the SiCon method, which the EU Commission presented with the European Business Award for the Environment in 2006 and which also received the BDI Environment Award. In this method, plastics wastes from scrap cars are treated in such a way that they are subsequently available in the form of "shredder granulate" or "shredder fluff" for use as a reducing agent in a blast furnace or substitute fuel in synthesis gas plants.

Around 50,000 tonnes of plastics waste from collections in the dual disposal systems in Germany are sent to the steel maker voestalpine Stahl GmbH in Linz/Austria for feedstock recycling. Treated plastics wastes are blown into the reduction zone at over 2,000 degrees Celsius, where they replace heavy oil and coal. This results in synthesis gas, by means of which the iron oxide is converted into cast iron in the next step.

A non-metallic smelting furnace used in metallurgic plants is an interesting new development for the feedstock recovery of plastic wastes from electrical household appliances. The recovery of (precious) metals from waste appliances is to the fore here. In this method, plastic wastes, for example from circuit boards, are used as a reducing agent and are thus recycled. Promising trials have been held in in Sweden (Boliden AB) and Belgium (UMICORE Precious Metals Refining).

Generating Energy from Post-Consumer Plastics

Disposal of plastics wastes in landfill is equivalent to squandering resources, because the high energy content of plastic wastes arising among end consumers (post-consumer waste) is not used here. Politicians recognised this and in 2005 with the "Technical Instructions on Waste from Human Settlements" and the landfill ban for residues with more than 5 per cent incandescent heat loss, laid down an effective statutory foundation for the environmentally friendly treatment of plastic wastes in Germany. In the same year, the quantity disposed of fell to an at that time historic low of 460,000 tonnes.

In Germany there are currently two main methods for making use of the energy content of plastic wastes: burning in waste incineration plants with energy tapping and use as a (treated) substitute fuel for cement and power plants.

In an environmental audit conducted in 2007 by the ifeu-Institut für Energie- und Umweltforschung, the North Rhine-Westphalia Environment Ministry examined the ecological contribution of thermal recovery methods to reliable, environmentally sound waste disposal. For both of the options mentioned above, the study came to the conclusion that very positive contributions are already being made due to the high technical standard of the plants. Extrapolated to the whole of North Rhine-Westphalia, the study calculates the ecological advantage to be a net saving of around 1.6 million tonnes CO_2 equivalents.

One example of a plant that could also catch on in Germany is the "Spittelau" thermal waste treatment plant in Vienna. The plant, with a visual design by Friedensreich Hundertwasser, processes up to 260,000 tonnes of domestic waste per year and, at full capacity, generates around 40,000 Megawatt hours of electricity for the neighbourhood heating system and 500,000 Megawatt hours of district heating for the Viennese electricity grid. Due to their high specific energy content, plastics wastes account for 50 per cent of the energy generation with just 10 per cent of the weight of the total material throughput. The flue gases that escape through a 126 metre tall chimney have gone through a highly efficient cleaning process that more than meets the statutory requirements.

Summary: Plastics as a Resource

We are surrounded by products made of plastic in our everyday lives. The use of this modern material is increasing continuously. One of the reasons for this is its innovative potential as a material with which and for which new applications are being developed every day. Many solutions in various industries only become possible due to the use of plastics – often in combination with other materials. On the one hand, the growth of plastic production and processing is due to the fact that plastics are increasingly replacing other materials. This can be seen in packaging in particular.

Plastic products primarily convince with their properties, which make them superior to other products in performing the desired function; they are produced and consumed because they make our lives safer, simpler and more pleasant. But that is not the only reason why plastic is the material of the 21st century; it is also because it complies with the demands for an efficient and sensitive use of finite resources. The most efficient use of mineral oil or natural gas is the production of plastics and processing into products whose energy content will be available to others after a useful service life.

Plastics make their biggest contribution to environmental relief as a product during their useful lives. As packaging, car components or insulating material, they prevent large-scale energy consumption. In the end, they themselves contribute to the further protection of resources as treated recyclate or as fuel. But these last contributions, even though they are valuable, are often much less on balance than the contributions made during the useful life. 90 per cent of the energy consumption are not incurred during production or recovery of the vehicle, but during its use.

Contexts of this kind must be considered in all deliberations that end up in regulations and directives on waste treatment in order to avoid wrong developments. For an efficient use of the resource waste it is basically necessary to avoid landfilling wastes containing plastic. In Germany, and in some other European countries too, we are on the right way. But the aim must be to arrive at a landfill ban across Europe so that resources are not squandered.

Furthermore, it should be left to the market to decide which recovery route wastes take – material or energy. Here, too, we are following a good path in Germany, which should support future adjustments to the legal framework at national and European level and not hinder them.

As a platform for the plastics industry, the BKV, together with the associations, is in favour of this route, which keeps the ecological and economic demands in balance.

Annex

Participating Interests of the BKV

RIGK GmbH – Gesellschaft zur Rückführung industrieller und gewerblicher Kunststoffverpackungen mbH
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E-Mail info@rigk.de, www.rigk.de

On the basis of statutory regulations, fillers, dealers and importers in Germany must accept the return of used, empty packagings from their customers and send them for recovery. A partner – such as RIGK, which currently offers five system solutions – can perform this obligation. Using the nationwide acceptance point network of the system in questions, the waste generator returns the empty packagings or has them collected by RIGK. Depending on the filling material, the packaging is sent for material or thermal recovery.
The BKV is the majority shareholder in RIKG.

tecpol Technologieentwicklungs GmbH für ökoeffiziente Polymerverwertung
Volgersweg 58, D-30175 Hannover
Telephone: +49 (0) 511 84 86 49-3
Fax: +49 (0) 511 84 86 49-49
E-Mail: info@tecpol.de, www.tecpol.de

The BKV also holds a participating interest in tecpol Technologieentwicklungs GmbH für ökoeffiziente Polymerverwertung.
tecpol offers expertise and know-how in the development and establishment of recovery solutions for waste streams rich in plastics for Germany and other European countries – for plastic wastes of all origins and taking account of all promising recovery routes. To do this, tecpol bundles market information, takes part in the development and implementation of eco-efficient recovery solutions and organises the dialogue between the market participants.

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In 2009 the BKV Plattform für Kunststoff und Verwertung together with PlasticsEurope Deutschland, the Gesamtverband Kunststoffverarbeitende Industrie and the Fachverband Kunststoff- und Gummimaschinen im VDMA founded the Wirtschaftsvereinigung Kunststoff. The aim of WVK is to strengthen the German plastics industry in the public perception, to determine joint positions and to take care of the overarching interests of the industry. The WVK is a member of the Confederation of German Industry.

Associations in the Plastics Industry

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Register at www.bkv-gbmh.de if you want to stay up-to-date.

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