Plastics – champions of sustainable growth and innovation in Europe

Plastics – the Facts 2012

An analysis of European plastics production, demand and waste data for 2011

PlasticsEurope
Association of Plastics Manufacturers

This report is researched and produced by:

PlasticsEurope

PlasticsEurope represents Europe's plastics producers. It networks with European and national plastics associations and has more than 100 member companies that are responsible for the production of more than 90% of all polymers across the 27 EU Member States, along with Norway, Switzerland, Croatia and Turkey. PlasticsEurope is a leading European trade association with offices in Brussels, Frankfurt, London, Madrid, Milan and Paris.

European Plastics Converters (EuPC)

EuPC is the professional representative body of plastics converters in Europe. Its activities cover all sectors of the plastics converting industry, including recycling. Its main objective is to defend and promote the European plastics converting industry's interests by:

- Voicing industry opinion to European and international institutions, and NGOs
- Maintaining relationships with corresponding European and global organisations
- Conducting surveys, studies and research projects covering all areas of the plastics processing industry

European Plastics Recyclers (EuPR)

EuPR is the professional representative body of plastics recyclers in Europe. EuPR promotes plastics mechanical recycling and an environment that encourages profitable and sustainable business. It provides a platform for members who represent 80% of Europe's recycling capacity and process over 3 million tonnes of collected plastics per year.

European Association of Plastics Recycling and Recovery Organisations (EPRO)

EPRO is the association of national organisations responsible for organising and promoting recycling and recovery in Europe. EPRO provides a unique forum for leading European specialists in plastics waste management to exchange experience and ideas, develop integrated plastics packaging waste strategies and support technological development.

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The data presented in this report was collected by PlasticsEurope, EuPC (the European Plastics Converters), EuPR (the European Plastics Recyclers) and EPRO (the European Association of Plastics Recycling and Recovery Organisations). PlasticsEurope's Market Research and Statistics Group (PEMRG) provided input on the production of and demand for plastics raw materials. Consultic Marketing & Industrieberatung GmbH (Consultic) helped assess waste generation and recovery data. Official statistics from European or national authorities and waste management organisations have been used for recovery and trade data, where available. Research or expertise from consultants completed gaps.

Figures cannot always be directly compared with those of previous years due to changes in estimates. Some estimates from previous years have been revised in order to track progress, e.g. for use and recovery of plastics across Europe over the past decade.

All figures and graphs in this report show data for EU-27 plus Norway and Switzerland, which is referred to as Europe for the purposes of abbreviation. Other country groups are mentioned in detail.

1

Introduction

Plastics are a 21st century material driving the development of pioneering innovations to meet society's biggest challenges. They help improve resource efficiency with smarter, more efficient and sustainable use of natural resources. This is at the core of the European Commission's recently released roadmap which provides guidelines as to how Europe can move towards a greener economy and achieve its environmental targets.

Plastics make a real contribution to meeting resource efficiency targets in many areas, including zero-energy buildings, water saving, sustainable land use, extended shelf-life for products, diversified raw materials, waste as a resource, greener mobility and renewable energies.

Plastics are also highly visible at some of the world's greatest sporting events. This year alone, plastics scored at the Euro 2012 football tournament in Poland and Ukraine: players wore jerseys woven in plastic fibres and boots made largely of plastics to kick balls into goals featuring plastic nets, while spectators sat on plastic seat shells and viewers watched on TVs made using plastics. Plastics were also prevalent throughout the London 2012 Olympic and Paralympic Games.

Plastics – the Facts 2012 is a report on 2011 plastics production, demand and recovery. It provides facts about the plastics market, from development and production, through usage, to the advances made in recovering plastics at the end of their life. The report represents the plastics industry's contribution to the debate around resource efficiency. It takes on key statements from the European Commission's resource efficiency roadmap and explains how plastics can help Europe overcome the effects of a growing world population on an already overburdened environment.

The European plastics industry (EU-27) contributes significantly to the welfare of Europe. Plastics drive innovation, improve quality of life, and facilitate resource efficiency and climate protection. Around 1.45 million people work in more than 59,000 companies that generate an estimated annual turnover of about 300 billion euros in EU-27.

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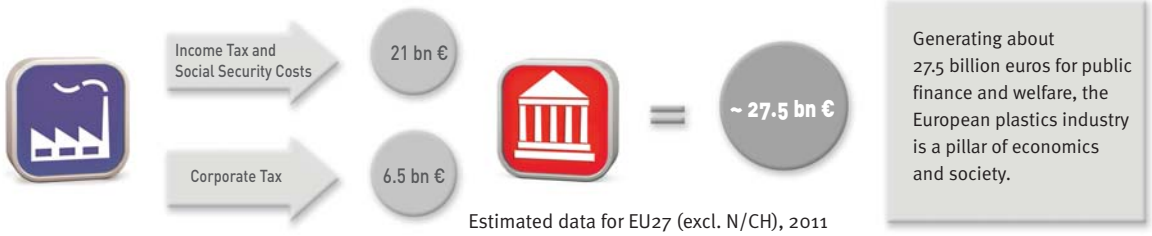
Plastics in and for Europe: the plastics industry is one of the biggest employers in Europe

Industry figures: sales and employment

In 2011, the EU-27 plastics industry continued to build on the growth of 2010. Plastics producers enjoyed a 0.3% increase in their turnover to over 89 billion euros. Converters experienced greater growth with a 1.9% increase to almost 194 billion euros.
The producing sector remained relatively stable over the last years, with a workforce of 167,000 employees and converters employing 1.23 million European citizens. The industry in total employs a workforce of 1.45 million, including 53,000 from the plastics machinery industry.

Worldwide, the sector did not go untouched by the 2008 and 2009 global economic crisis. In 2010 and 2011, it has been recovering consistently. Global plastics production increased by 10 million tonnes (3.7%) to around 280 million tonnes in 2011, continuing the growth pattern that the industry has enjoyed since 1950 approximately by 9% per annum.
Competition in the industry is growing. Plastics markets are increasingly shifting towards Asia which are characterised by over-average growth rates. As a result, the region is also seeing a rise in production capacity. Europe's plastics industry is facing a stricter regulatory framework.



Estimated data for EU27 (excl. N/CH), 2011
Source: Consultic

Figure 1: Development of Sales and Employment in EU-27 2005 – 2011
Source: EU Eurostat

World plastics production

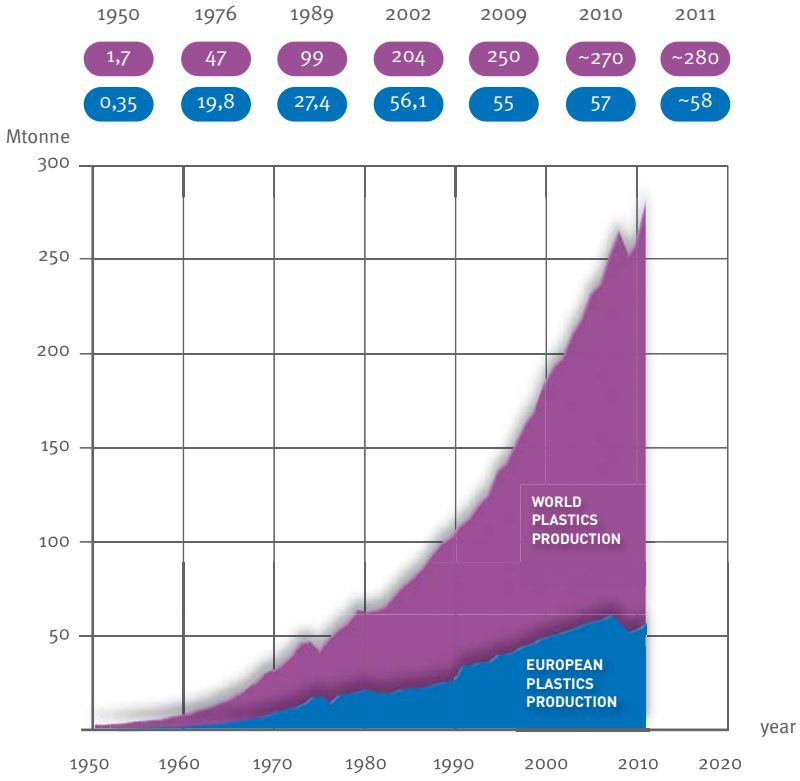


Figure 2: World Plastics Production 1950-2011

Includes Thermoplastics, Polyurethanes, Thermosets, Elastomers, Adhesives, Coatings and Sealants and PP-Fibers. Not included PET-, PA- and Polyacryl-Fibers

Source: PlasticsEurope Market Research Group (PEMRG)

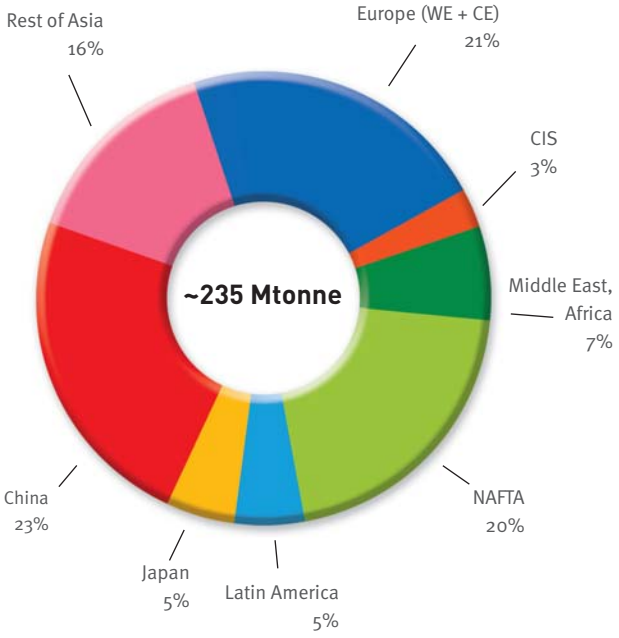


Figure 3: World Plastics Materials Production 2011

w/o Other Plastics (~45 Mtonne)

Source: PlasticsEurope Market Research Group (PEMRG)

European plastics demand

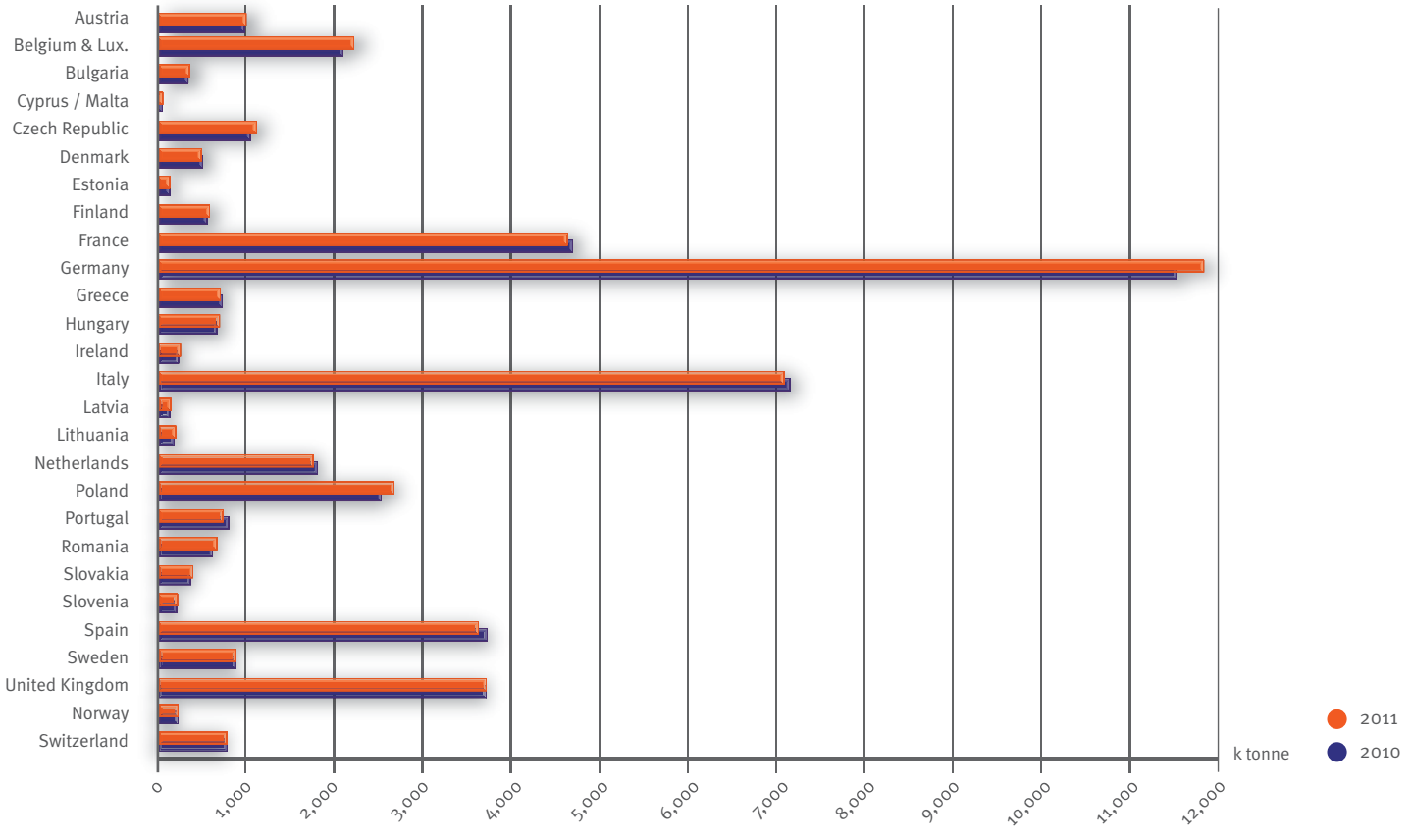


Figure 4: European Plastics Demand by Country (k tonne/year)

Source: PlasticsEurope Market Research Group (PEMRG)

Plastics applications by segments and resin types

Demand from European converters increased by 1.1% from 2010 to 47 million tonnes in 2011. The relative size of end-use applications remained fairly stable compared to previous years with packaging remaining the largest segment and representing more than 39% of the overall demand.

The packaging sector is followed by building & construction (20.5%), automotive (8.3%) and electrical & electronic equipment (5.4%).

While most applications more or less stagnated in 2011 with +/- 2%, automotive grew by almost 10%. Others include various sectors such as consumer and household appliances, furniture, agriculture, sport, health and safety.

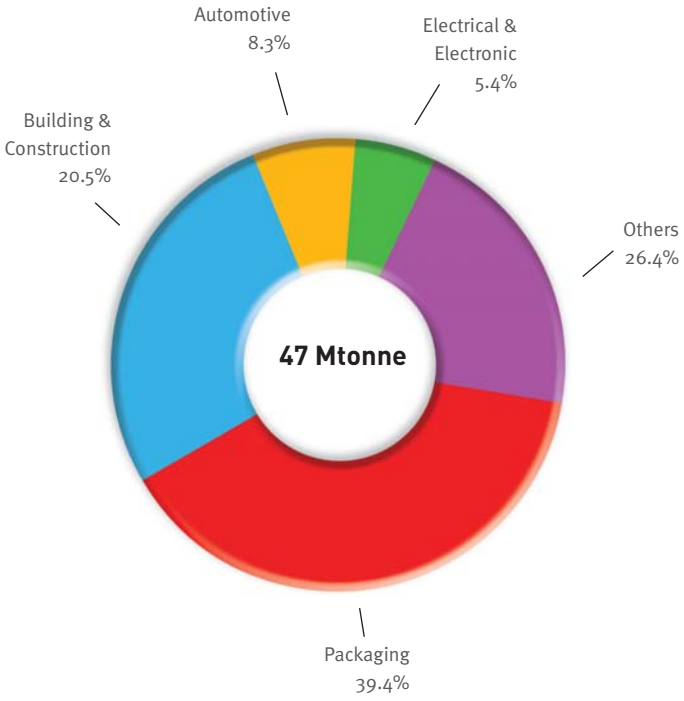


Figure 5: European Plastics Demand* by Segment 2011
Source: PlasticsEurope Market Research Group (PEMRG)
* EU-27+N/CH incl. Other Plastics (~5.7 Mtonne)

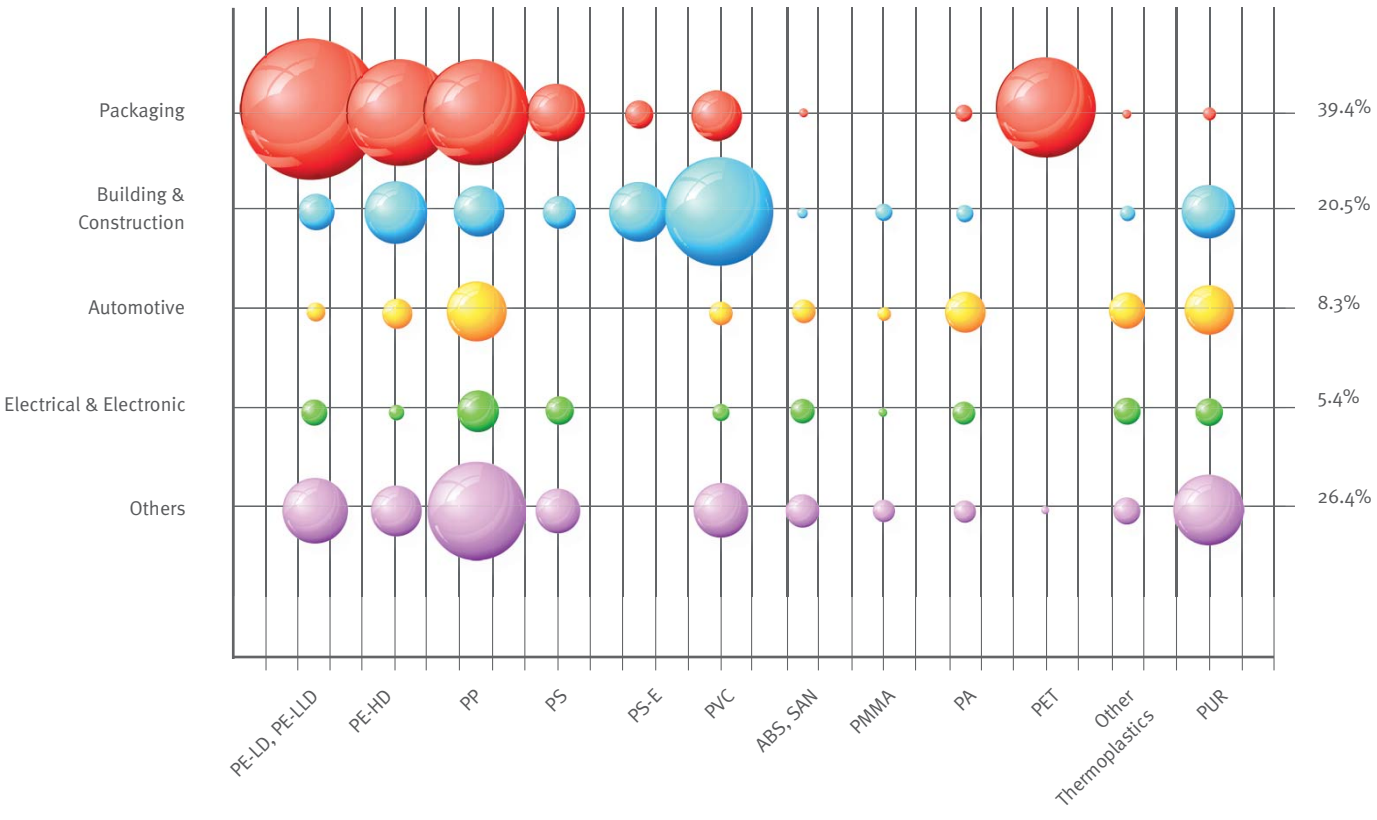


Figure 6: European Plastics Demand* by Segment and Resin Type 2011
Source: PlasticsEurope Market Research Group (PEMRG)
* EU-27+N/CH incl. Other Plastics (~5.7 Mtonne)

Types of plastics

There are different types of plastics with a variety of grades to help deliver specific properties for each application.

The "big six" plastic types that stand out in terms of their market share are:

- polyethylene – including low density (PE-LD), linear low density (PE-LLD) and high density (PE-HD)
- polypropylene (PP)
- polyvinyl chloride (PVC)
- polystyrene solid (PS), expandable (PS-E)
- polyethylene terephthalate (PET)
- polyurethane (PUR)

Together these account for around 80% of the overall plastics demand in Europe. The top 3 resin types by market share are: polyethylene (29%), polypropylene (19%) and polyvinyl chloride (11%).

The growth of different plastic types varied in 2011. Engineering plastics showed the highest growth rate, e.g. polyamide rose by 8%, whereas demand for the "big six" increased between 1.0% and 5.6%. Polystyrene and polyurethane, mainly used for construction and insulation purposes, showed significant growth in 2011.

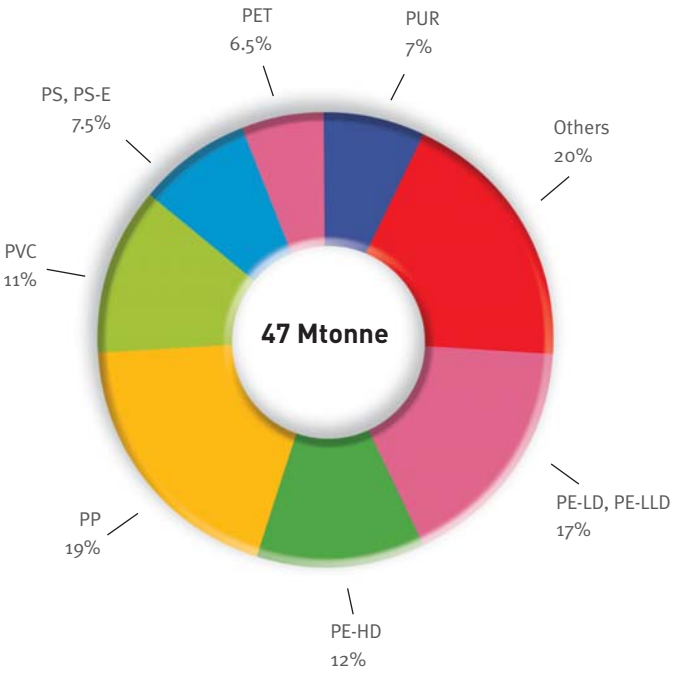


Figure 7: European Plastics Demand* by Resin Type 2011
Source: PlasticsEurope Market Research Group (PEMRG)
* EU-27+N/CH incl. Other Plastics (~5.7 Mtonne)

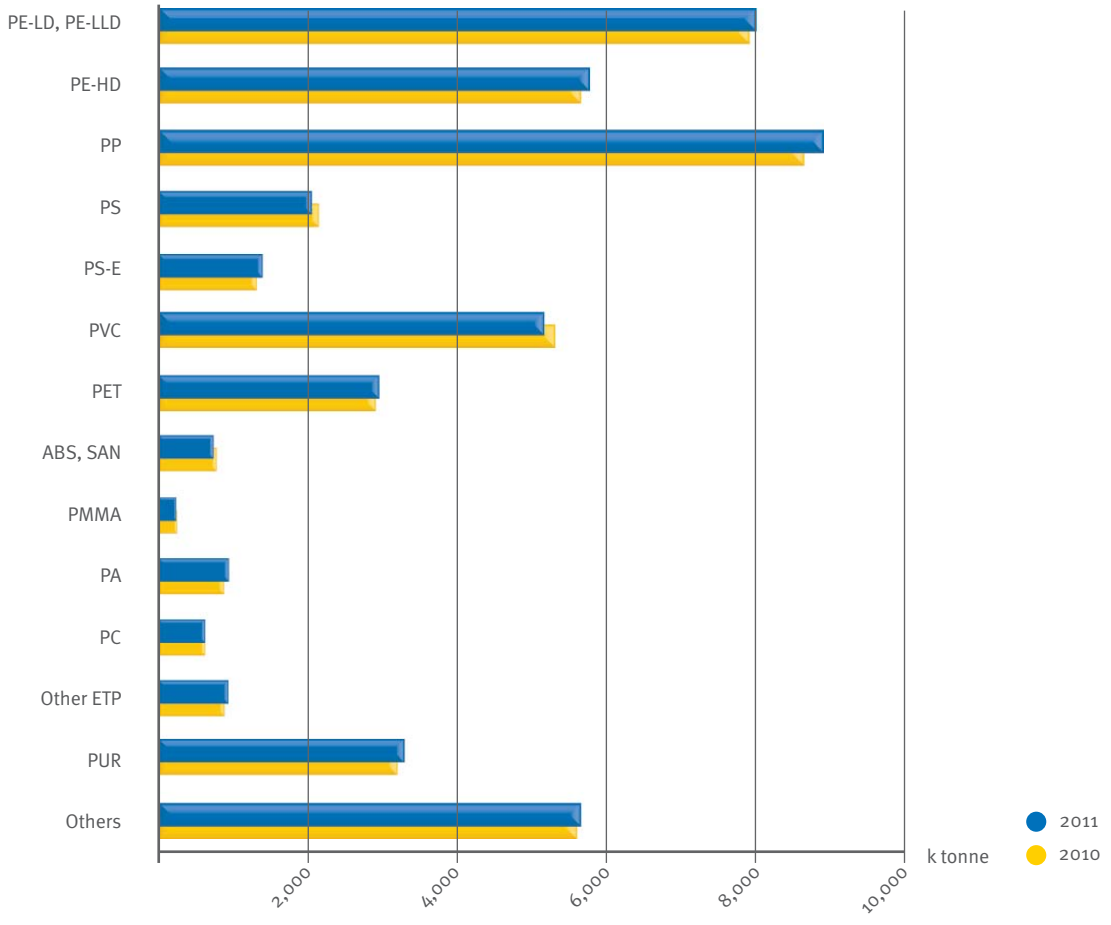


Figure 8: European Plastics Demand* by Resin Type
Source: PlasticsEurope Market Research Group (PEMRG)
* EU-27+N/CH incl. Other Plastics (~5.7 Mtonne)

European imports and exports

The European Union, traditionally an important net exporter of plastics and plastic products, exported approximately 15.5 Mtonne of plastics in primary forms out of the EU-27 in 2011.

While the total exports of plastics products from the 27 EU Member States reached its peak at the end of 2010, record trade surplus of the EU-27 primary plastics industry with non-member countries were reached in 2009. In 2010 and 2011 there was a slightly reduced Extra-EU trade surplus.

The decreasing trend of the Extra-EU trade surplus for Primary Plastics came to a halt in June 2011, at which point the surplus began to grow again.

The biggest export markets for plastics raw material remain China, Turkey, Hong Kong, Russia and Switzerland. EU exports (Extra-EU) of converted products mainly went to the following countries: Switzerland, Russia, USA, Turkey and China.

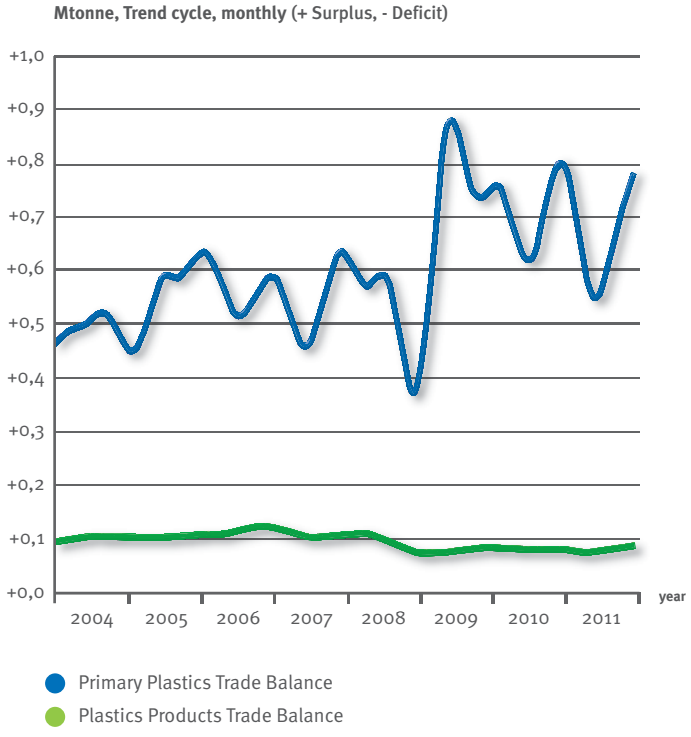


Figure 9: EU-27 Plastics Industry:
Trade Balance with Non-Member Countries (Extra-EU)
Source: EU Eurostat

Plastics value chain

The diagram below (Figure 10) shows the main steps in plastics' lifecycle – from converter demand to disposal and recovery. As mentioned earlier converter demand reached 47 million tonnes in 2011. Out of the plastics consumed in Europe, 25.1 million tonnes ended up in the waste stream in 2011.

In 2011, post-consumer plastic waste levels rose by 2.4% from the year before, which is slightly higher than the increase in demand (+1.1%), due to a growing waste generation from mid- and long-life products.

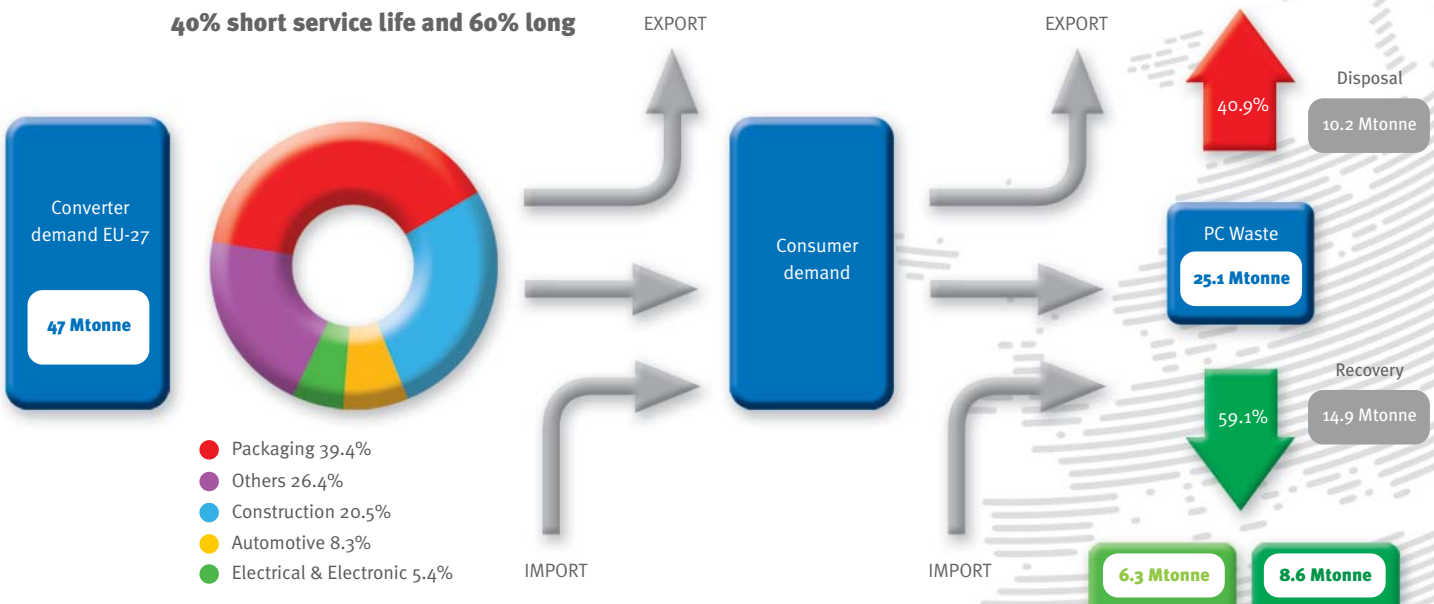


Figure 10: Recovery reached almost 60% in 2011 – and continues to increase (EU-27+N/CH 2011)
The 26.4% Others in Figure 10 refers to agriculture, furniture, household, leisure, sport, medical and machinery applications.
Source: PlasticsEurope Market Research Group (PEMRG), Consultic

3

Analysis of post-consumer waste in EU-27

Thanks to continuous improvement in plastics end-of-life management options and a growing public awareness, the amount of plastics ending up in landfills is constantly decreasing despite an increase of 2.4% in post-consumer plastic waste in 2011.

- The total plastic production in Europe reached 58 million tonnes, up by almost 2% from 2010.
- Demand from the converting/processing industry reached 47 million tonnes, increasing by 1.1% compared to 2010.
- Collected post-consumer waste reached 25.1 million tonnes, increasing by 2.4% from 2010 levels. Out of these, 10.3 million tonnes were disposed of and 14.9 million tonnes were recovered.
- The collected quantities of plastics for recycling increased by 5.7% thanks to stronger activity from citizens, legal changes, growing targets and packaging collection schemes, growing environmental awareness and recycling companies.
- The collected quantity of plastics for energy recovery increased by 4.2%, mainly due to increased use of post-consumer plastic waste as a complementary fuel in power plants and cement kilns.

Overall 4.8% more post-consumer plastics were recycled and collected for energy recovery compared to 2010. Figure 11 below shows the evolution in recycling and recovery rates between 2006 and 2011. Recycling and recovery rates rose more between 2010 and 2011 than the average change for 2006 – 2011. Landfill decreased only slightly due to a growth in the total quantity of waste generated.

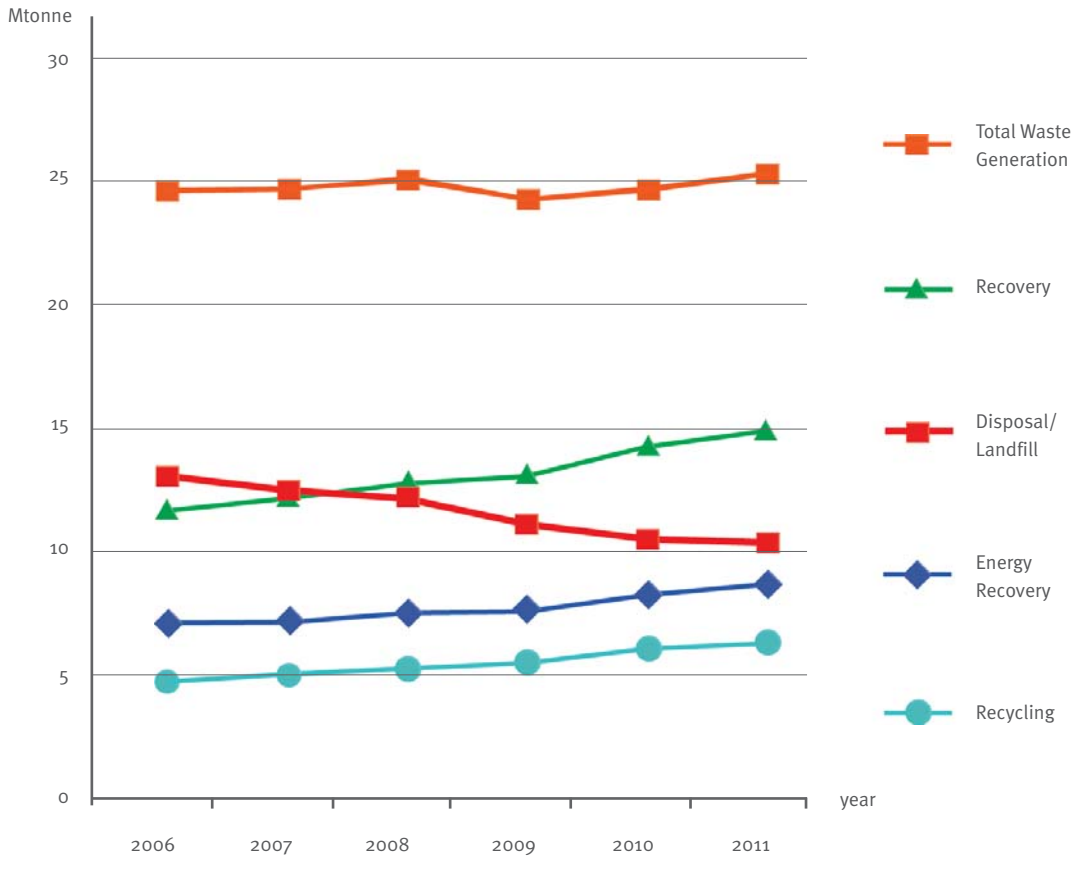


Figure 11: Total plastics waste recycling and recovery 2006 – 2011
Source: Consultic

Comparative analysis of countries of the EU

To capture the full value of plastics waste, it is necessary to combine different waste management options. Solutions vary from one country to another depending on the infrastructure, the national waste management strategy and the available technologies.

Part of the solution to plastics waste management lies in the acceptance by society that resources should be used efficiently and that plastics waste is considered as a valuable resource that should not be wasted on landfills. It is no coincidence that nine best performing European countries (Figure 12) all have tight restrictions on landfilling. If extended to the rest of Europe, such restrictions will create strong drivers to increase recycling and recovery levels towards 100%.

Any strategy aiming at improving waste management should combine both recycling and energy recovery. Our vision is a forward looking resource management approach that:

- Takes into consideration the overall lifecycle impact.
- Stops the disposal of valuable plastics in landfill.
- Follows the Waste Hierarchy by using a mix of recovery options for the best environmental and economic results – in every situation.
- Ensures that the treatment and recovery of waste meets defined environmental standards.

Figure 12 below shows that while recycling performance ranges mostly between 15 to 30% in most countries, energy recovery levels vary between 0 and 75%. Countries which currently landfill valuable end-of-life material have an opportunity to reduce their climate footprint, address their energy deficit and use resources more efficiently through quickly expanding their energy-from-waste and recycling networks.

Overall progress has been achieved in capturing the value from plastics waste. The increase in recycling and recovery rate is approximately 5-6% per year. Many EU Member States need to pursue greater efforts in order to divert their plastics from landfills by 2020.

In Figure 13 (next page) we can see how the increase in recycling and energy recovery rate between 2006 and 2011 varies between EU Member States. The biggest improvement in recovery rate was achieved in Estonia with 45%, followed by Finland at about 30%.

A number of countries have increased their recovery around 15%: Hungary, Slovakia, Germany, Czech Republic, Norway and Lithuania.

Denmark, Switzerland, Malta and Sweden have improved their recovery rate by less than 5% but with a change from energy recovery to recycling in Denmark, Sweden and Switzerland where even in 2006 little plastics went to landfill.

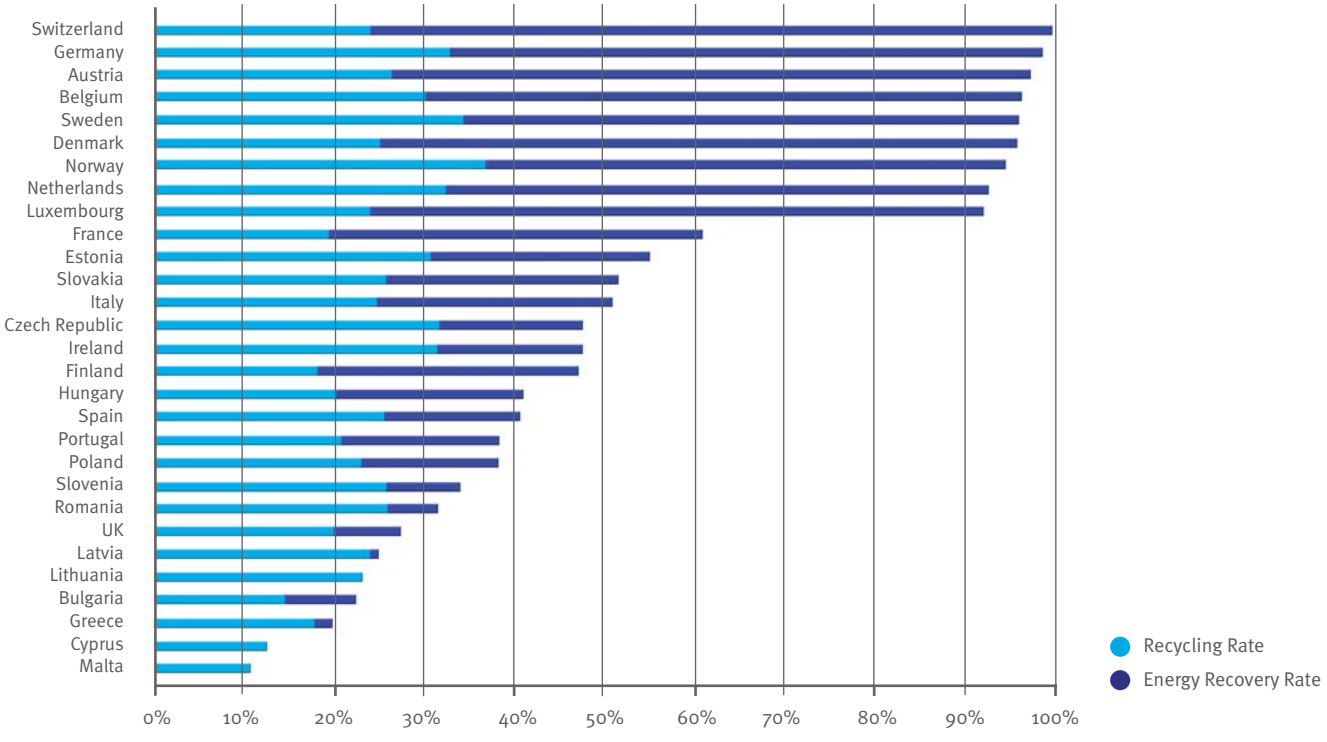


Figure 12: Total Recovery Rate by Country 2011
(Referred to Post-Consumer Plastic Waste)
Source: Consultic

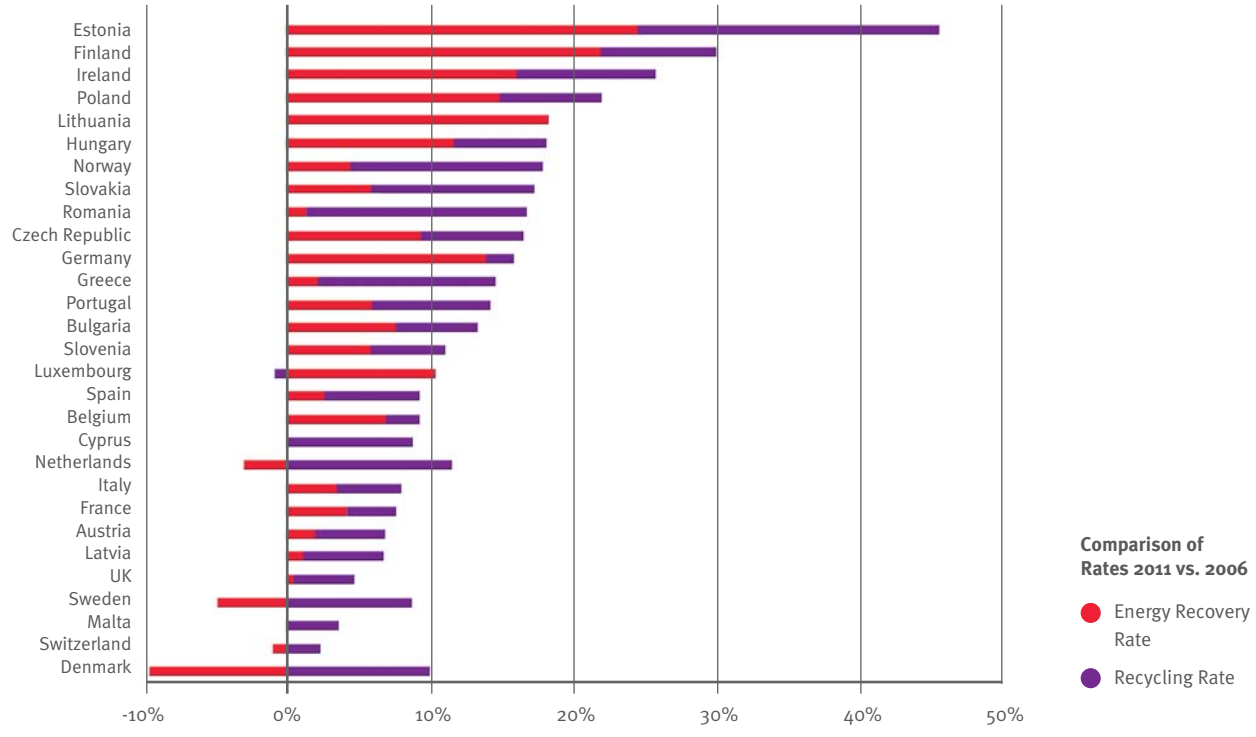


Figure 13: Change in Total Recovery Rate by Country 2006 - 2011
(Referred to Post-Consumer Plastic Waste)
Source: Consultic

Recycling and recovery rates for plastics packaging is higher, 66% compared to 59% for all plastics, reflecting the focused efforts over a longer period to develop recycling and recovery options.

Recycling and energy recovery rates are similar for packaging (33 vs. 33%) whilst energy recovery plays a bigger role for all plastics (25 vs. 34%).
(See Figure 14 below)

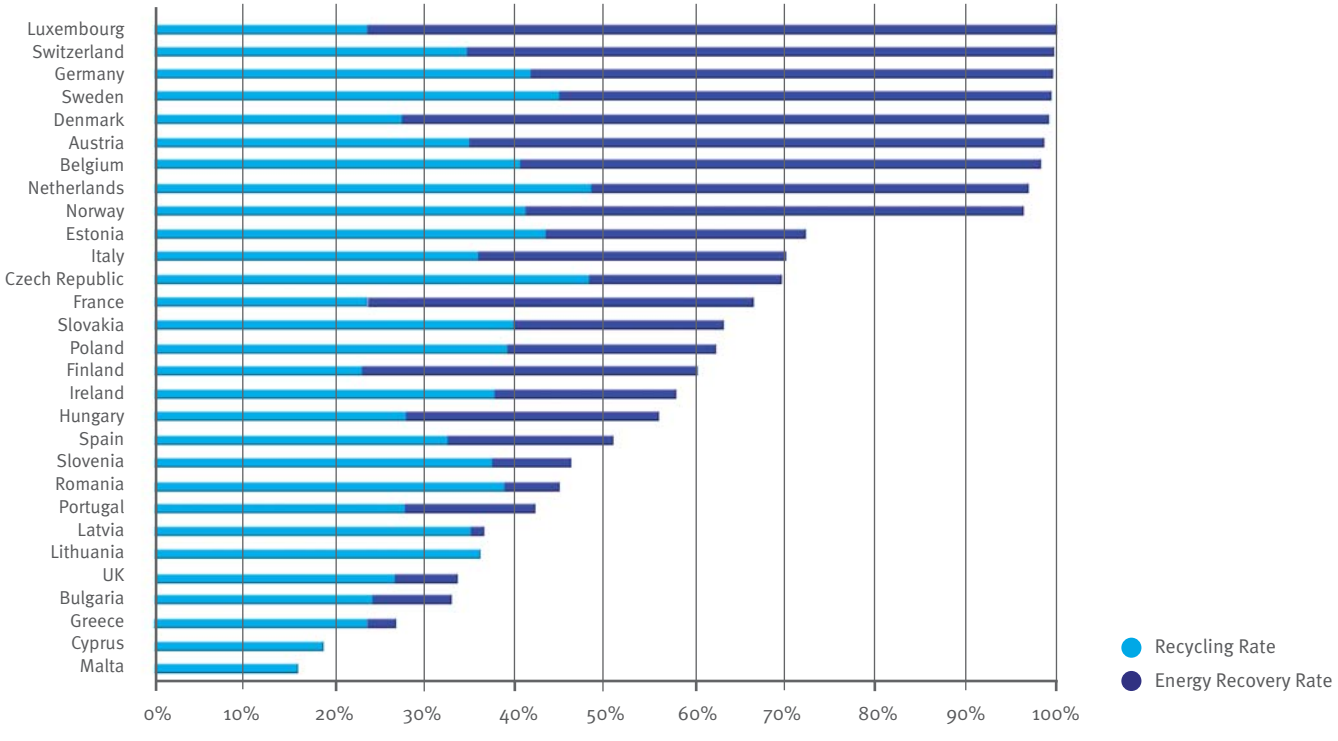


Figure 14: Total Packaging Recovery Rate by Country 2011
(Referred to Post-Consumer Plastic Waste)
Source: Consultic

Snapshot 2012

The European plastics industry continues to navigate through the consequences of the economic recession. After strong growth in all three segments (see Figure 15 below) in 2006 and more constant development in 2007, the effects of the economic crisis are clearly recognisable in 2008 and in the first half of 2009. Economic recovery in all three segments since mid-2009 lasted until the end of 2011. Since then, decreasing trends can be observed.

The first half of 2012 shows still higher production figures compared to the same period in 2011 for the plastics machinery sector, which grew by 3.1% on a year to year basis.

The production of primary plastics saw a drop of -5.7%, while the production of plastics products only dropped by -1.9% compared to first half of 2011.

The production trends for primary plastics, plastics products and plastics machinery decreased in the last months. Especially the primary plastics sector recorded notable declines during the last three months, which is in line with the general slowdown in the economy.

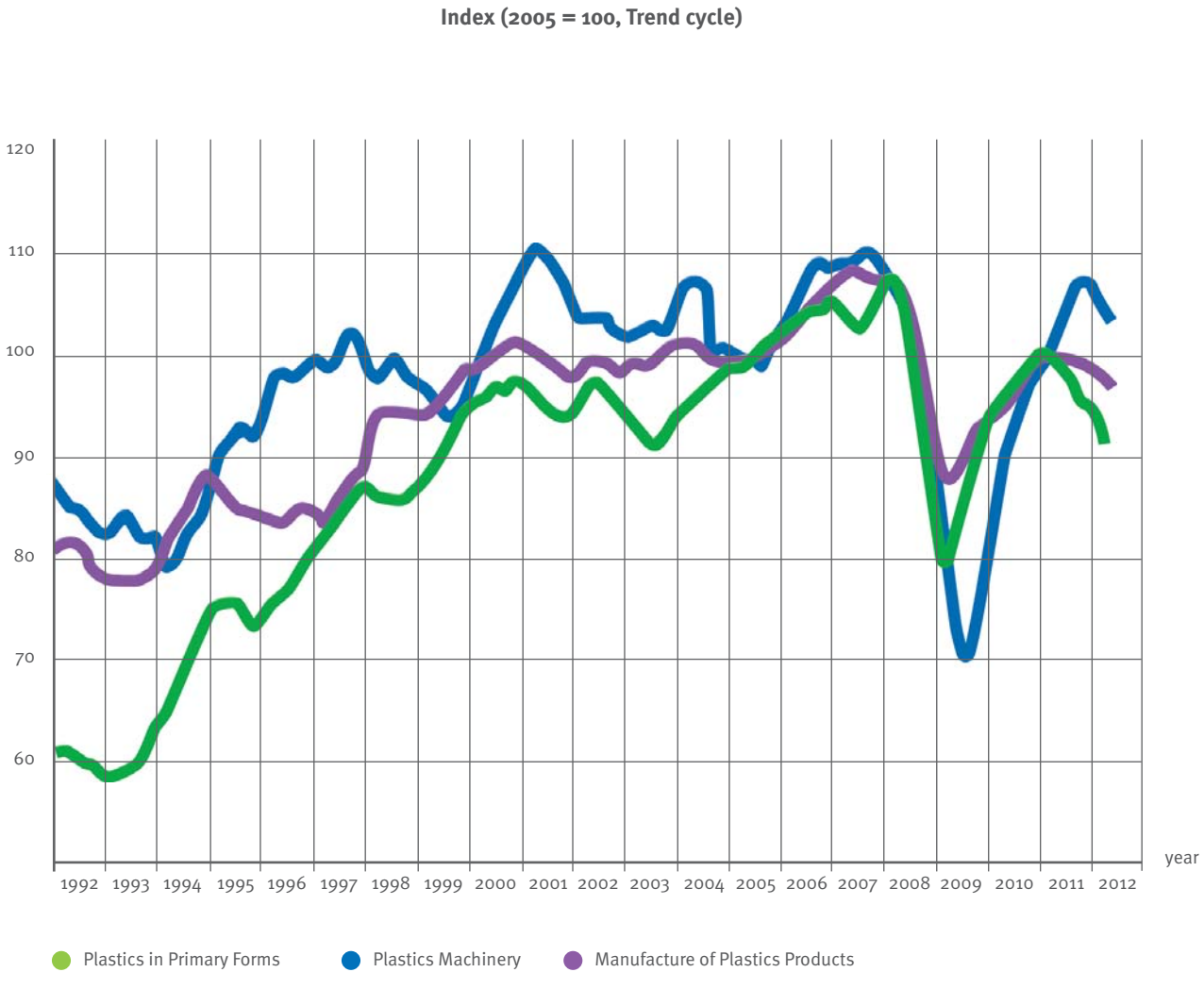


Figure 15: Plastics industry production in EU-27
Source: PlasticsEurope Market Research Group (PEMRG)

Solar panels made of plastics can be adapted to any surface, providing flexible lighting solutions for public places.

4

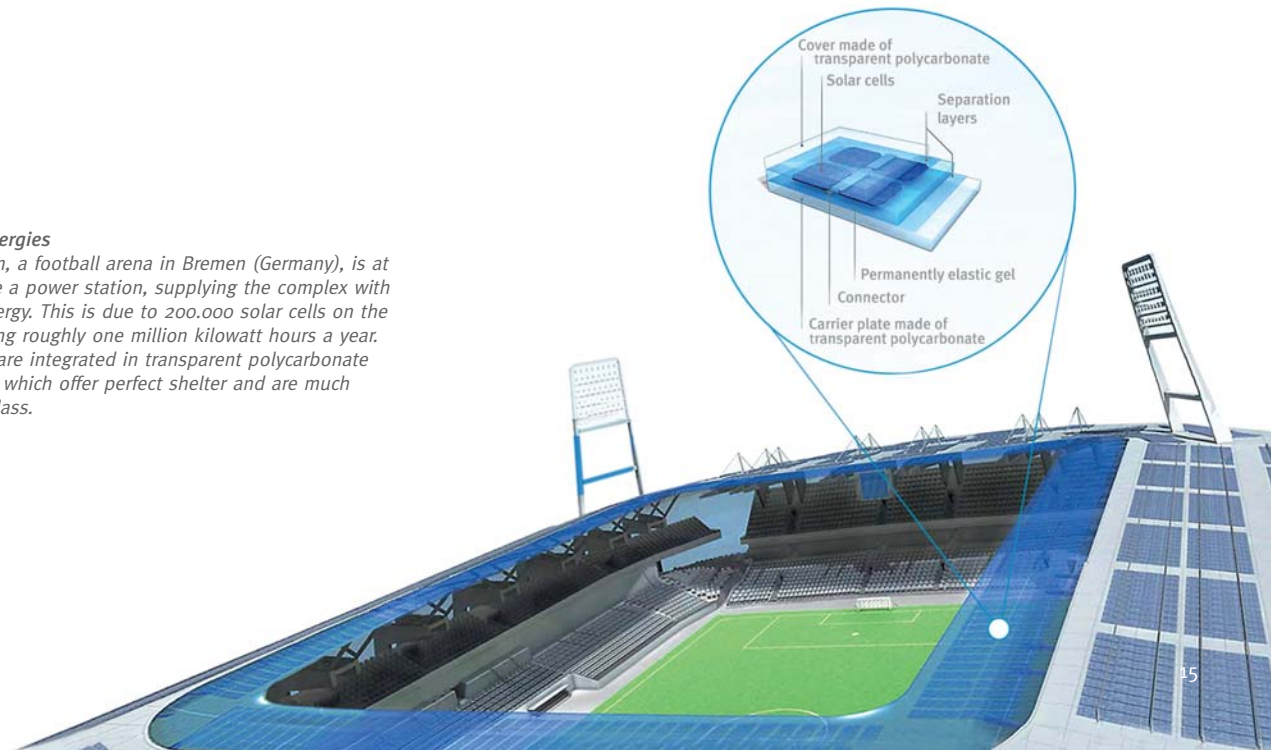
The plastics industry supports the resource efficiency roadmap

Energy supply and CO_2 reduction in building and construction

Today, climate change and energy shortage are key global challenges. The construction industry accounts for 40% of energy consumption and 30% of greenhouse gas (GHG) emissions around the world, mainly as a result of building operation. Energy-efficient construction could make a significant contribution to climate protection as well as leading to cost savings for building operators. Environmental challenges and a trend towards further urbanisation are leading to an increasing demand for sustainable buildings.

The development of sustainable buildings requires the collaboration of industry specialists across multiple disciplines, creating energy-efficient, environmentally-friendly and economically-interesting buildings. Boosting the initial energy demand of a building can be achieved during the design phase, by including thermal insulation, energy-efficient building technologies and the optimisation of energy demand via renewable energies. A smart combination of the technologies allows for primary energy demand to be reduced by up to 90%.

The principles of sustainable construction are applicable globally and to any building type, but have to be adopted locally in order to meet required energy efficiency, environmental and economic targets and guidelines.



Renewable energies
Weser stadium, a football arena in Bremen (Germany), is at the same time a power station, supplying the complex with renewable energy. This is due to 200.000 solar cells on the roof, generating roughly one million kilowatt hours a year. The modules are integrated in transparent polycarbonate plastic sheets which offer perfect shelter and are much lighter than glass.

Using more to save more: the plastics paradox

“EC statement: Better construction and use of buildings in the EU would influence 42% of our final energy consumption, about 35% of our greenhouse gas emissions and more than 50% of all extracted materials. Life-time costs of buildings should increasingly be considered, including construction and demolition waste.”

Not only should new buildings call on best construction practices, but the renovation of public and commercial buildings should also implement these practices to increase their sustainability.
The construction industry has the potential to create up to two million jobs, kick start the economy and provide Europe with a real competitive advantage. Achieving that would mean scaling up Europe’s renovation rate to at least 3% per year focussing on the weaknesses of existing constructions – currently 60% of the energy used by buildings is for heating and cooling.

Plastics can reduce these issues:

- Over its lifetime, just 1.6 cm of rigid plastic foam saves more than 200 times the energy required for its manufacture and provides thermal insulation equivalent to a concrete wall of 1.3 metres.
- According to the Hermes study, 80 million windows are replaced every year in the EU.
  If high-performance windows are installed, there is significant potential for making energy and CO_2 savings.

Plastics are one of the most energy-efficient materials when the entire lifecycle of the material is taken into account. Plastics insulate a building’s interior and exterior, can transfer air, water and sewage efficiently, enable ventilation and pre-heating of fresh air, and are essential to energy-saving household appliances. They are easy to install, versatile, cost-effective, long-lasting, easy to maintain and safe.

PVC window frames are lighter, long lasting and require less energy to manufacture.

Plastics – still strong, 60 years on

Currently more than half of plastics recovered from old buildings avoid landfill through a combination of recycling and waste-to-energy processes. This figure is improving year on year, rising from 57.7% in 2010 to 59.1% in 2011. Sorting is key. In 2011, a Finnish research team developed a robotic recycling technology – the 'Recycler' – that could have a major impact on waste management streams. The Recycler separates waste associated with the construction industry to allow useful materials to be reused. It also removes unwanted materials from the stream.

At the end-of-life phase, plastics in the building and construction sector are reused, recycled or incinerated for energy generation. PS-E (Expanded Polystyrene), for instance, is mechanically recycled. The mechanical recycling process usually starts with grinding PS-E waste. There are then a number of options:

Recycling as PS-E

- Reuse in the production of new PS-E products.
- Use of the pulverised material in other applications.
- Production of insulation construction materials (building blocks, cement).
- Use as ground improvement (drainage, substrate for plants).

Recycling as PS

- Compacting or melting of the grinded PS-E turning it into compact granules (PS) which can be:
  - Processed into injection moulding (utensils) or extrusion products.
  - Used (after extrusion and regassing) to produce PS-E to be used for classic PS-E applications (packaging, insulation).

Plastics for house foundations

Plastics have uses beyond the internal structure of a building. Recycled plastics could, for example, be turned into strong, durable and environmentally-friendly masonry that can be used in building construction. Compared to traditional material bricks, plastics building blocks composed of used PVC and PE-HD are lighter, require 85% less energy to manufacture, emit 95% less CO_2 and use no water during the production process.

Building blocks for low-cost housing made from Thermo Poly Rock (TPR).

Example: Processing of PVC waste and conversion into low-cost housing and modular buildings

PVC waste – that would have gone to landfill – is being converted into innovative low-cost houses.
The Thermo Poly Rock (TPR) material uses waste plastics including PVC to produce a structural material which is waterproof, does not rot, is stronger than the traditional material and has a long durability rating. TPR is being used to manufacture frames for low-cost housing, targeting the sustainable homes market.

(Source: Affresol)

Example: Making concrete from plastics

As an alternative to landfill for end-use plastics, plastic waste is grounded into granular sand. It is then mixed with resin and special thermo set polymers to create a substance that can be poured like concrete, but is stronger, more insulated, waterproof, shatterproof and fire-retardant. The scope of application for this so-called 'synthetic concrete' could be huge. Since any plastic can be used, it also has the potential to divert large amount of plastic waste from landfill.

(Source: La Mode Verte)

Example: PVC waste management

Window collection and recycling schemes exist and are supported across Europe, the aim for the future is for these schemes to cover the entire product portfolio. Schemes also exist for the recycling of end-of-life roofing, waterproofing membranes, PVC flooring, and other post-consumer PVC-coated fabrics.

(Source: VinylPlus)

Responding to society's energy needs

"EC statement: Sustainable energy and technologies are key to reducing our environmental impact."

High energy prices and increased awareness of environmental issues have pushed EU authorities to initiate legislation to encourage a gradual shift from conventional to renewable energy sources. From a public perspective, this can be seen by the increasing appearance of solar panels and windmills. Plastics are used in the construction of both.

The most important parts of today's windmills are the blades, most of which are manufactured using fibre-reinforced plastics (FRP). As the size of modern wind turbines increases with the growing demand for renewable energy, blades of 60 metres, offering an overall diameter of 120 meters are now a reality, but are still considered advanced[1]. As a result, manufacturing costs are rising, mechanical problems are more frequent and transportation is a real challenge. The answer will be found in cost-efficiency and lightness and that means developing innovative solutions using plastics. Plastic rotors can offer a 33% saving on GHGs, a massive 140 times use benefit when compared to production needs. Carbon fibre-reinforced plastics (CFRP) will soon be a standard construction material for wind blades and will help unlock the full potential of wind energy.

1. Source: UpWind

Solar energy is another area for plastics innovation. Usually made of rigid silicon, solar panels could soon be made of plastic photovoltaics. Plastic photovoltaics are less expensive and more flexible, meaning that future solar panels could be similar to wallpaper and be attached to any surface. Imagine opening your handbag or document case and having a solar-powered element that could charge the electronic items within. These solutions would likely be used on a very small scale, but would be highly innovative.

Plastic photovoltaics offer a 25% saving in GHGs and provide a 340 times higher GHG saving in comparison to what they consume during production. Solar cells are also set to evolve. New solar cells made of 98% plastic have recently been developed. These cells are cost-efficient and flexible, and they absorb up to a record 96% of incident sunlight.

Modern wind turbines are made using fibre-reinforced plastics, thereby reaching wingspans of up to 60 metres.

Diversifying to preserve

"EC statement: Europe's open economy relies heavily on imported raw materials and energy. By 2020, scientific breakthroughs and sustained innovation efforts should improve how we understand, reuse and substitute resources."

Plastics account for approximately 5% of worldwide oil consumption. The industry still continues to look for new ways to lower the amount of oil used to produce plastics, which means finding alternative raw materials to meet environmental challenges.

Bio-based plastics account for around 1% of global plastics production. They have experienced a rapid growth over the last decade. In 2011, bio-based polyethylene beverage bottles, yogurt pots and hair-care packaging became widely available. Polyethylene furanoate (PEF) is another example of bio-based plastics used to produce bottles, fibres and films. According to a study published in 2009[1], "the technical substitution potential of bio-based plastics replacing petrochemical plastics is estimated at 90%", demonstrating the huge market options for this material. Packaging, cutlery, textiles, agricultural mulch films, electronic components, toys and even automotive parts can be made from biomass. However, this potential does not take into consideration resource availability, environmental aspects and economic viability which are the main challenges for bio-based plastics producers.

Promising studies indicate other alternative resources to produce plastics. In February 2012, the University of Utrecht discovered an economically-viable way to produce plastics from pruning waste. Promising experiments are currently being conducted in Europe which show that CO_2 emissions could also be converted into plastics, possibly leading to new applications for the future.

1. Study by Li Chen; Prof. Dr. E. Worrell; and Dr. Martin Patel: "Present and future development in plastics from biomass"

Are bio-based plastics the best solution for the environment?

Fossil-fuel savings and reduced CO_2 emissions are broadly considered to be the main advantages of bio-based plastics. According to a study by Utrecht University's Department of Science, PEF – one of the most promising bio-based plastics – would allow for fossil-fuel savings of between 43% and 51%, and reduce CO_2 emissions by between 46% and 54%.

The sustainability of any material lies in its application and a full lifecycle assessment. In some cases, for example, fossil-based mulches can have more favourable barrier and mechanical properties. Bio-polymers feature specific strengths and weaknesses which can be compensated by mixing with other bio-based polymers or common petrochemical plastics.

Bio-based technologies offer many advantages with more to be proven, potential issues to be addressed include the possible adverse effects of land use changes and uncertainties relating to the environmental impact of the waste management phase.

Plastics for a pioneering concept car

Daimler/ BASF Smart Forvision Concept Car

Shaping the cars of tomorrow

"EC statement: Transport means should use less and cleaner energy and their negative impact on the environment should be reduced."

The Smart Forvision is a new concept vehicle combining futuristic design with innovative technologies in terms of lightweight, heat management and energy efficiency. The vehicle comes with transparent organic solar cells, transparent organic light-emitting diodes, all-plastic wheels, new lightweight body components, infrared-reflective films and coatings which all help to reduce the vehicle's energy consumption and so increase its range and comfort. The Smart Forvision shows that electric mobility can make emission-free driving possible.

An EU Regulation on CO_2 and cars states that the EU car manufacturers' fleet average has to be aligned with 130g CO_2/km, partially as of 2012 and completely by 2015. In addition, the integrated approach measures (e.g. eco-innovations) should bring the average emission to 120g CO_2/km.

From 2000 to 2010, automotive CO_2 emissions already decreased by almost 20% in the EU-27[1]. However, new standards for comfort and safety have led to more equipment being added to each vehicle, usually making the vehicle heavier and increasing its CO_2 emissions. Using more plastic materials helps limit the amount of weight a vehicle gains and offers the potential to create light-weight, versatile solutions for automotive manufacturers.

For the future, market penetration of electric vehicles will remain fairly low with just over five million new electric vehicles (most in the EU[2]) expected to be on the roads by 2015. Although these vehicles are environmentally-friendly, they require high-performance batteries to guarantee reasonable autonomy, adding extra weight. Plastics offer solutions as described in the concept car mentioned above. In addition, most head and rear lamps are now made of plastics with the exception of special volume cars.

Plastics not only have an important role to play in vehicle design, but also on the roadways on which vehicles drive; materials made of recycled PET could be used as an alternative to asphalt which, unlike the latter, are porous and therefore allow rainwater to filter through, reducing the risk of accidents and improving road surfaces.

1. Source: European Environment Agency, Monitoring the CO_2 emissions from new passangers cars in the EU
2. Source: European Commission, An Overview of Electric Vehicles on the Market and in Development

Plastic packaging is essential for processing, storing, transporting, protecting and preserving food.

Reducing food waste

Plastic packaging keeps food fresher for longer

"EC statement: Europeans waste 90 million tonnes of food every year. If we carry on using resources at the current rate, by 2050 we will need the equivalent of more than two planets to sustain us. By 2020, scientific breakthroughs and sustained innovation efforts should improve how we safeguard resources, such as actions to optimise the resource efficiency of packaging."

According to the UK's Food Climate Research Network, food production is responsible for 20% to 30% of global GHGs. For example, the production of one kilogramme of beef emits 6.9 kilograms of CO_2. Wasting food is therefore not only morally reprehensible, but also bad for the environment; the resources required for food production are used in vain and organic waste generates methane gases during degradation in landfills.

In the UK, food waste generates 20 million tonnes of CO_2, this is equivalent to 25% of the total CO_2 emissions caused by cars. Studies[1] show that about 40% of food waste is avoidable.

With modified atmosphere plastic packaging, shelf life can be increased from 5 to 10 days, allowing food loss in stores to be reduced from 16% to 4%. Fruits and vegetables, which top the list of food wasted by consumers, can also benefit from longer shelf life thanks to plastic packaging.

In Europe, households are also becoming smaller. Packages of food for five or six people are often no longer appropriate; a consumer only uses what is required and wastes the rest. Portioned plastic packaging eliminates this waste and can be emptied more easily. Plastic caps or zips also keep food fresher for longer.

Researchers are working to find ways to extend the shelf life of packaged food. The plastic packaging of the future may include anti-fungal compounds in its polymeric matrix, new coatings with up to 30-times better protection for beverages or barriers that decrease oxygen transmission to near non-existent levels.

1. FAO Report: Food Losses World Wide, May 2011.

Water and land

Saving every last drop

“EC statement: Water is a vital resource for human health and an essential input for agriculture, tourism, industry, transport and energy. However, availability of fresh water is decreasing and 20% to 40% of Europe’s water is wasted. Water efficiency could be improved by 40% through technological developments. We need efficient irrigation, reduced leakage and better construction and use of buildings.”

Drinking water needs to be properly transported to avoid wastage. Plastic pipes can carry water over long distances for more than 50 years while preventing bacterial contamination. When the water is to be used, plastic drippers provide tailored irrigation. Distribution channels can also be lined with plastics, reducing seepage and speeding up construction. In Reading, UK, seven kilometres of century-old cast-iron pipes are being replaced with plastic pipes to save an estimated 1.5 million litres of water per day from leakage.

In terms of water quality, water can be cleaned using plastic filters, on either an industrial or household level. The latest household water purification systems contain high-performance filter membranes made of plastics which provide ultrafiltration and remove viruses and bacteria from dirty surface water without the need for electricity, chemicals or any complex technology.

Rainwater is stored in reservoirs constructed from or lined with plastics to make it accessible even in areas of infrequent precipitation. In 2011, the plastic pipe industry introduced a highly innovative solution to preserve water resources through infiltration and attenuation. Made of hundreds or thousands of plastic cubes, the new systems can store several thousand cubic metres of water and facilitate its permeation into the ground. Without these applications, the water would simply end up in rivers and seas.

In areas where water scarcity is now at critical levels, plastics enable desalination and agricultural plastic films help to reduce evaporation.

Plastics protect lands and fields

“EC statement: Actions to reduce erosion need to be implemented.”

Land is one of Europe’s most precious resources and plastics can help preserve it. Plastic sheeting is one of the simplest yet most effective erosion control methods available. It can even be removed and reused. For larger areas, plastic nets tied to concrete blocks fitted into the soil near river banks can prevent erosion. These nets are already used in India where erosion is a major concern.

Bio-based plastics can also play a role in erosion control. In the Netherlands, bio-based natural fibre composites have helped reduce coastal erosion. Thanks to artificial reefs constructed with a prescribed deterioration rate, the material has dissolved by the time the protected area is restored.

With a growing demand for agricultural products, Europe needs to increase crop yields while ensuring soil protection. Plastic films allow for increased production in terms of quantity and quality while reducing the need for water, pesticides, fertilisers and energy. This has led to a significant increase in the amount of plastic products used in agriculture; it is estimated that used plastics in agricultural waste in 2011 amounted to more than 1.3 million tonnes. Convenient and environmentally-friendly solutions are required.

Just 46% of the plastics used in agriculture are recovered each year, nearly half of which are recycled. More can be done. In 2012, plastics converters created Agriculture Plastic Environment (APE Europe) to support the development of National Collection Schemes (NCSs). Thanks to voluntary commitments and shared responsibility among producers, distributors and farmers, significant results have already been achieved in Germany, Spain and the UK.

Agriculture films prevent erosion and loss of water.

In the slums of the Philippines, plastic bottles are being recycled by giving them a new purpose as light bulbs. The bottles are filled with filtered water and a bit of salt and chlorine is added.
The water refracts light, the salt slows down evaporation and the bleach prevents mold from growing in the bottle, allowing the mixture to last about two years.
Designed and developed with MIT students, the Solar Bottle Light is now being distributed throughout the Philippines. MyShelter Foundation plans to light up a million homes during 2012.

© MyShelter Foundation

Waste – a valuable resource

“EC statement: In the EU, each person consumes on average 16 tonnes of materials annually, three million of which end up in landfill. Resources should be sustainably managed, with residual waste close to zero, and waste should become one of the EU’s key resources.”

Europe’s plastics industry is taking an active role in helping to reduce the amount of plastics materials that end up in landfill with initiatives across the region aimed at stimulating progress in all types of recycling and recovery options. The plastics industry also believes that an optimum waste collection scheme including co-mingled plastics collection, could potentially yield better result and significantly increase recycling rates provided adequate recycling infrastructure is put in place. In the UK, a new 49MW power plant is being built that will divert non-recyclable waste (household, commercial and industrial) from landfill for the production of renewable energy. It is expected that in the future, the plant will also generate a renewable source of hydrogen for commercial use. Elsewhere in the UK, an open-access facility is pioneering new ways of turning materials such as biomass into high-grade fuels and energy.
A joint venture between ECO Plastics and Coca-Cola Enterprises – Continuum Recycling Limited – will establish a continuous process for reprocessing plastic bottles in Great Britain, the high-quality materials produced will then be used in Coca-Cola bottles. The new facility will increase the amount of high-quality bottle-grade PET produced in the UK to more than 75.000 tonnes a year, doubling the current total. Coca-Cola also use a so-called ‘plant bottle’, constructed of bio-based PET. The company’s aim is to move to sugar-based recycled PET, making it the largest consumer of recycled PET.

Poland is currently undertaking a radical reform of its waste management procedure in order to help stimulate the recycling sector. Independent from that co-incineration of plastic waste in the Polish cement industry has already shown some very strong increase over the last few years, when it more than quadrupled from 2008 to 2011 to over 200 k tonne.

ANAPE, Spain’s national PS-E association, promotes ECO PS-E Centres that collect, grind, condition and recycle waste of Expanded Polystyrene. There is a network of ECO PS-E Centres in various provinces around the country which is continually being expanded to increase the nation’s PS-E recycling figures. ZICLA, a Spanish specialist in green product development with special emphasis in innovation in recycled products uses waste that would otherwise be incinerated or go into landfill to manufacture products, such as traffic separators for cycle tracks, traffic barriers and temporary pavements.
In Spain, recycled waste is transformed into plastic film, using closed-loop schemes. The waste that cannot be recycled is turned into a binder for road asphalt, thereby ensuring that it does not end up on landfill.

In Norway, artificial reefs have been constructed that feature tubes manufactured from recycled PVC.
The reefs are placed along the coast line to create a good habitat to protect native fish species.

Focus: “zero plastics to landfill”

“EC Statement: Best waste management practices should be exchanged between Member States, knowing that in some Member States more than 80% of waste is recovered.”

In May 2011, the European plastics industry urged EU and national decision makers to aim at zero plastics to landfill by 2020. Some EU countries (Sweden, Germany and Luxembourg) already recover more than 90% of their plastics waste. An exchange of best practice could allow for improved performance in countries lagging behind.

Encouraging political decisions have already been made. In May 2012, the Scottish Parliament passed the Waste Regulation Act with the ambitious goal of recycling 70% of all household and business waste by 2025. The Act includes a ban on municipal biodegradable waste or materials collected for recycling going to landfill. It is the first regulation of its kind in the UK.

The plastics value chain has also been conducting studies on collection methods, developed and promoted best practices and launched initiatives across Europe to enhance the recovery and recycling of plastics. These include:

- The new voluntary commitment of the European vinyl value chain, VinylPlus, to further build on the success of Vinyl 2010.
- A two-year programme in France initiated by Eco-Emballages/ ADEME with the support of Valorplast and PlasticsEurope that sees 51 municipalities, 3.7 million inhabitants and 32 sorting centres collecting all plastic packaging from households to increase recycling rates. The programme will be complemented by industrial trials designed to achieve large-scale recycling of rigid PVC packaging. If successful, it will be adopted nationwide in 2014.
- The potential for the extended collection of rigid non-packaging plastics is currently being investigated in Belgium.
- The UK Government has announced ambitious plans to recycle 42% of plastics packaging waste by 2017. UK industry commitments, including the Plastics 2020 Challenge, is working to see how this target can be met.
- A new standard for the recovery of waste materials and their industrial processing into alternative fuels was released in Finland as a result of an initiative by the Finnish plastics industry.

Three industries, one objective

The entire value chain is working on the future of plastics recycling with the aim of making plastics a recognised high-quality secondary raw material. An intensive exchange of information between raw material suppliers, processors and recyclers is already taking place. It will help create packaging designs that already take recyclability into account.

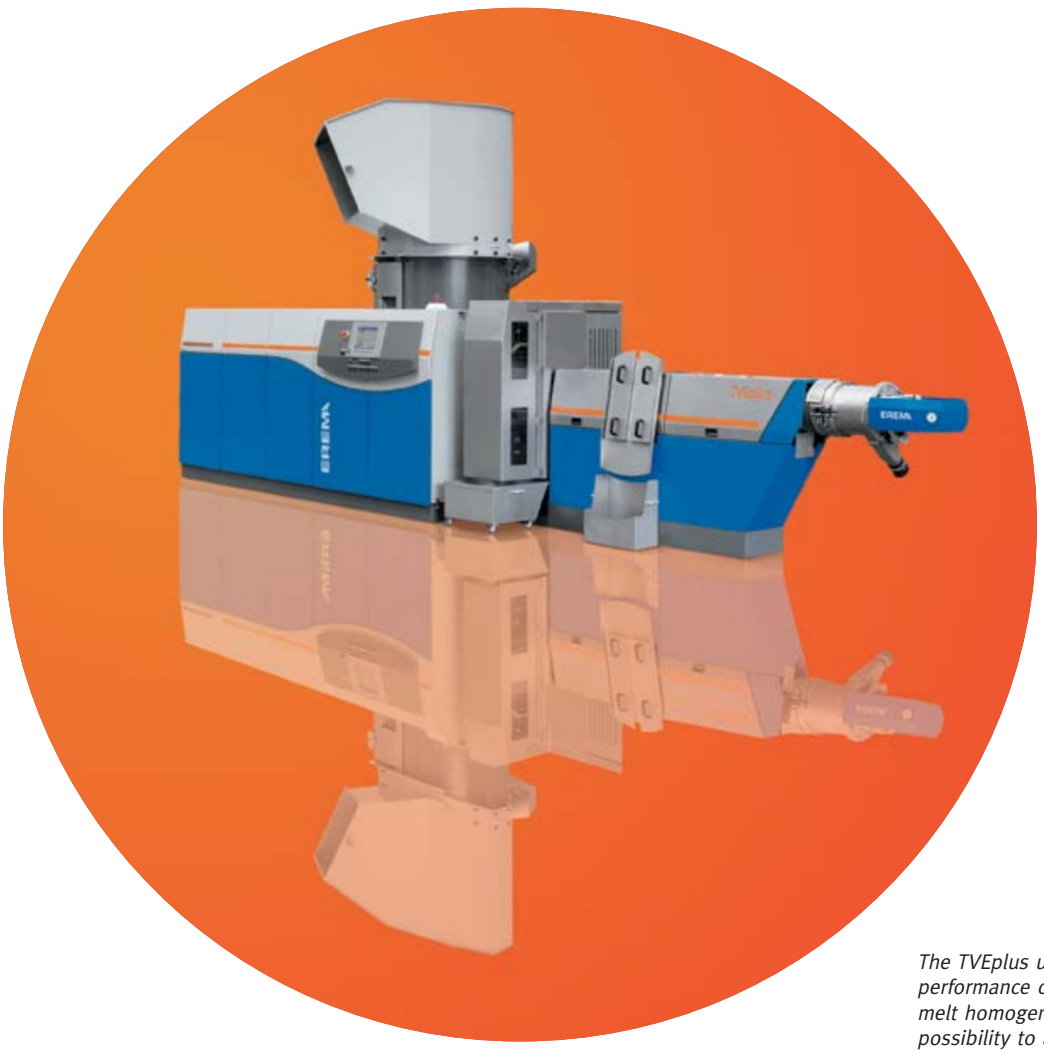
Improved recycling: a key focus for the industry

“EC statement: Product design should integrate a lifecycle approach and Europe should be less dependent on imports of raw materials. By 2020, scientific breakthroughs should improve how we reuse, recycle and safeguard valuable resources.”

Increasingly scarce resources are making the recycling of plastics ever more important. Dedicated design and improved process engineering enable plastics recycling processes to be constantly improved, with new technologies being developed and patents registered.

Film packaging, in particular, has always been a challenge with regards to recycling. The materials are becoming more colourful and chemically sophisticated. Films are often fully printed and in some cases even feature multiple layers. They are also thinner, reducing weight and helping protect resources. Previous recycling technologies struggled to recycle these waste plastics with binding agents and other additives remaining in the result, making them no longer suitable for use in high-quality end products.

New technology is now enabling the recycling of such materials in a single step, turning them into high-quality recycled pellets. An economically viable market is being created for recycled plastic film, suitable for all applications.



The TVEplus unites high-performance degassing, thorough melt homogenisation and the possibility to achieve ultra-fine filtration, thereby setting standards.

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A global initiative against marine litter

"Marine litter has serious consequences for birds and mammals living in and around oceans, seas and rivers around the world."

The European plastics industry signed a global industry declaration on marine litter in March 2011. The declaration brings together 57 plastics associations from across the world and numbers more than 100 concrete projects aimed at tackling marine litter.

Almost half of these projects are in Europe and focus on waste originating from land which is estimated to account for 80% of marine litter. The strategy is four-fold: analysing the impact of plastics in the marine environment, raising public awareness, preventing litter via improved collection and recycling schemes, and cleaning beaches and seas.

The European plastics industry is also co-funding a GESAMP[1] project to undertake a review of current knowledge on the behaviour and fate of micro-plastics. GESAMP helps organise beach clean-ups, prevents pellet losses as a result of its 'Operation Clean Sweep' initiative and raises children's awareness by holding road shows across Europe.

Waste Free Oceans, another industry-led initiative, aims to reduce the amount of floating marine debris on Europe's coastlines by 2020. Using existing fishing trawls and new technology, the initiative engages Europe's fishing community in the clean-up of floating marine litter that is brought back to land for sorting and recycling.

1. The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) is an advisory body that advises the United Nations (UN) system on the scientific aspects of marine environmental protection.

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Glossary of terms

ABS	Acrylonitrile butadiene styrene
APE Europe	Agriculture plastics films producers
CE	Central Europe
CEN	The European Committee for Standardisation
CIS	Commonwealth of Independent States
CNTs	Carbon nanotubes
CO_2	Carbon Dioxide
ECPI	European Council for Plasticisers and Intermediates
ECVM	European Council of Vinyl Manufacturers
EfW	Energy from Waste
EPR	Extended Producer Responsibility
EU	European Union
EuPC	European Plastics Converters
EuPR	European Plastics Recyclers
EuPF	European Plastic Films
EPRO	European Association of Plastics Recycling and Recovery Organisations
ESPA	European Stabiliser Producers Association
E&E	Electrical & Electronic equipment
GDP	Gross domestic product
GPS	Global Positioning System
GPCA	Gulf Petrochemicals and Chemicals Association
HSE	Health, Safety and Environment
IV	Intravenous
k tonne	Thousand Tonnes
Kg	Kilogramme
MBT	Mechanical Biological Treatment
Mtonne	Million Tonnes
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
NAFTA	North American Free Trade Agreement
NGOs	Non governmental organisations
OLED	Organic light emitting diode
PA	Polyamide
PE	Polyethylene
PE-HD	Polyethylene, high density
PE-LD	Polyethylene, low density
PE-LLD	Polyethylene, linear low density
PEMRG	PlasticsEurope Market Research Group
PET	Polyethylene terephthalate
PUR	Polyurethane
PMMA	Polymethyl methacrylate
PP	Polypropylene
PRF	Plastics Recovery Facilities
PS	Polystyrene
PS-E	Polystyrene, expandable
PVC	Polyvinyl chloride
SAN	Styrene-acrylonitrile plastic
SMEs	Small and medium sized enterprises
SRF	Solid Recovered Fuel
UK	United Kingdom
UN	United Nations
WE	Western Europe

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EuPC
European Plastic Converters

Avenue de Cortenbergh 71
1000 Brussels - Belgium

Phone +32 (0)2 732 41 24
Fax +32 (0)2 732 42 18

info@plasticsconverters.eu
www.plasticsconverters.eu

epro
European Association of Plastics Recycling and Recovery Organisations

Koningin Astridlaan 59
1780 Wemmel - Belgium

Phone +32 (0)2 456 84 49
Fax +32 (0)2 456 83 39

info@epro-plasticsrecycling.org
www.epro-plasticsrecycling.org

EuPR
European Plastics Recyclers

Avenue de Cortenbergh 71
1000 Brussels - Belgium

Phone +32 (0)2 742 96 82
Fax +32 (0)2 732 63 12

info@plasticsrecyclers.eu
www.plasticsrecyclers.eu

PlasticsEurope
Association of Plastics Manufacturers

Avenue E. van Nieuwenhuyse 4/3
1160 Brussels - Belgium

Phone +32 (0)2 675 32 97
Fax +32 (0)2 675 39 35

info@plasticseurope.org
www.plasticseurope.org

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