Plastics

Plastics
Imagine the potential

An analysis of plastics consumption and recovery in Western Europe 2000

Published Spring 2002

APME
ASSOCIATION OF PLASTICS MANUFACTURERS IN EUROPE

Plastics a story of continued growth

This is the twelfth year in which APME has commissioned TN Sofres Consulting to undertake an annual survey of plastics consumption and recovery in the European market. It maintains its status as one of the few independent surveys which examines the complete lifetime of plastics – from consumption by processors through to material recovery at end-of-life. This latest report, with data from the first year of the new Millennium, confirms that the great demand for plastics has continued to rise across all industry sectors. It also shows that the amount of plastics recovered is growing so quickly that it is outstripping the increase in consumption.

Report in brief

This report presents the plastics consumption and recovery data from 2000, and highlights ways in which plastics will continue to impact the lives of generations in the years to come. The 20th century saw great progress in plastics' development and use; today's broad family of tailor-made materials allows us to realise the latest technological applications; and the future will see plastics used in increasingly innovative ways. Plastics' almost infinite flexibility and affordability mean that only the imagination of designers limits the ways they can be used. Plastics truly deserve the mantle of material of choice for the 21st century.

Just as importantly, plastics' efficiency allows them to make a real contribution to the vital goals of sustainable development, underpinning the EU's current Thematic Strategies on resource efficiency and recycling. Plastics are well placed to meet the challenges of Europe's Sixth Environmental Action Programme and the associated Integrated Product Policy.

In the year 2000, plastics consumption in Western Europe increased to 36 769 000 tonnes, an increase of 3.4 per cent on 1999. This was higher than that experienced by other materials – a clear indication of the continuing popularity of plastics as a material, and continuing a trend that has been evident for many years.

End-of-life plastics recovery grew so rapidly that it outstripped increasing consumption in tonnage terms, with nearly seven million tonnes of plastics waste being given a second life through mechanical and feedstock recycling and energy recovery in 2000. This compares with 6.3 million tonnes in 1999.

Plastics 2000 headlines

- **Total plastics consumption, including virgin polymers and recycled granulate, continued at a steady trend, rising 3.4 per cent**
- **Per capita consumption of virgin plastics rose 3 per cent to 91.5 kg**
- **36 per cent of total collectable plastics waste was recovered, up from 33 per cent in 1999. In tonnage terms, this represented an increase of 11 per cent**
- **Mechanical recycling of plastics waste increased by 17 per cent in tonnage terms, helped by substantially more export of waste for recycling. Because of increasing consumption, the overall recycling rate was raised only a couple of percentage points to 13 per cent**
- **Energy was recovered from 4 411 000 tonnes of plastics waste in 2000, an increase of 10 per cent on 1999 figures and representing 23 per cent of the total collectable plastics waste**
- **Increased recovery meant that the amount of plastics going to landfill did not increase in 2000 despite increased consumption and therefore also increased waste generation**

Please note that rounding of figures in this report (e.g. to nearest kilotonne or percentage point) may appear to cause slight differences in totals

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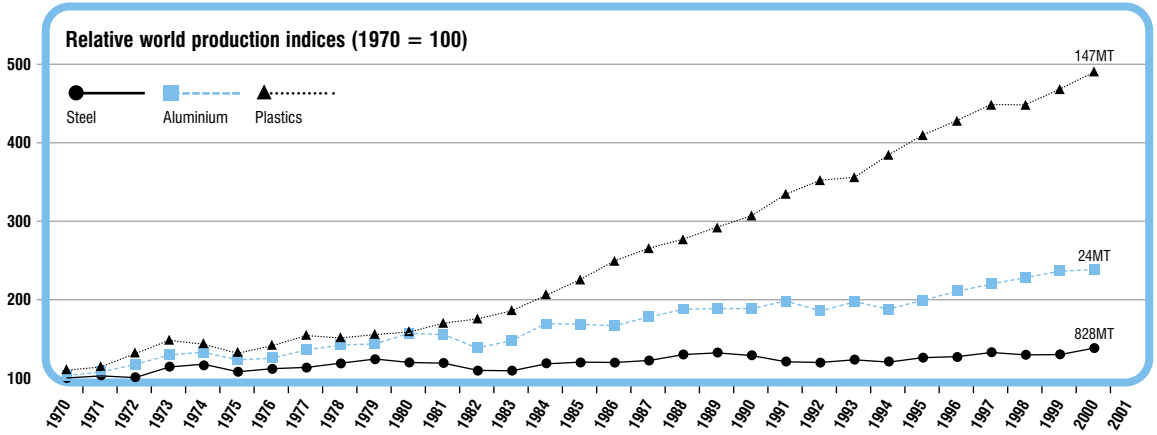


Source: SPMP - CIPAD - IISI - PECHINEY - PARDOS MARKETING

Plastics driving innovation into the future

This report deals with data on existing plastics consumption and recovery patterns. In addition, the start of a new century provides us with an opportunity to look at how plastics may be used in increasingly diverse and innovative applications. Although the plastics industry was one of the great industrial successes of the 20th century, it has been estimated that only a minor part of plastics' potential has so far been realised. Growth in plastics consumption continues to outstrip average annual growth in GDP, and this trend looks set to continue.

Transporting water

Giant plastic water bags could be used instead of water tank ships to transport large quantities of drinking water more easily to areas that need it.

Plastics in electronics

The in-car fibre optic data network is close to reality thanks to plastics. This would allow passengers to surf the internet or watch videos via an optical circuit carrying electronic information around a car as tiny pulses of light. Plastics fibres carry light for around 100 metres or so before it fades. Such distances are more than adequate for cars, and means that this same technology could be used in aeroplanes, or to provide buildings with affordable multimedia digital communications networks.

The electronically communicating label is also another possibility for the future: this label is embedded in plastic film, and is so thin and flexible it would fit in a sheet of paper. One possible use would be in supermarkets, allowing communication between products and a shopper's trolley, thus telling the customer where to find particular items or special offers.

Plastics: A package of innovation

Constant developments are revolutionising the ways that food can be stored. Modified atmosphere packaging (MAP) is an increasingly popular food preservation technique whereby the composition of the atmosphere surrounding the food is different from the normal composition of air. This results in extended shelf life, without the need for additives, and reduced packaging and product wastage.

Plastics in transport

Nuna: car of tomorrow? By winning the 2001 World Solar Challenge in Australia, with an average speed of 91 kph, Dutch-built *Nuna* proved itself as the most effective solar vehicle ever built. This was largely thanks to plastics technologies for its solar cells, first developed for use in space. In addition, lightweight plastics made up over 30 per cent of the car.

Although solar-powered cars for the ordinary consumer remain some way off, the benefits of lightweight plastics in conventional vehicles are already being felt. It is estimated that 12 million of tonnes of oil are saved each year through fuel efficiencies from lightweight plastics vehicle components – leading to a subsequent reduction of 30 million tonnes in CO_2 emissions each year from Western Europe.

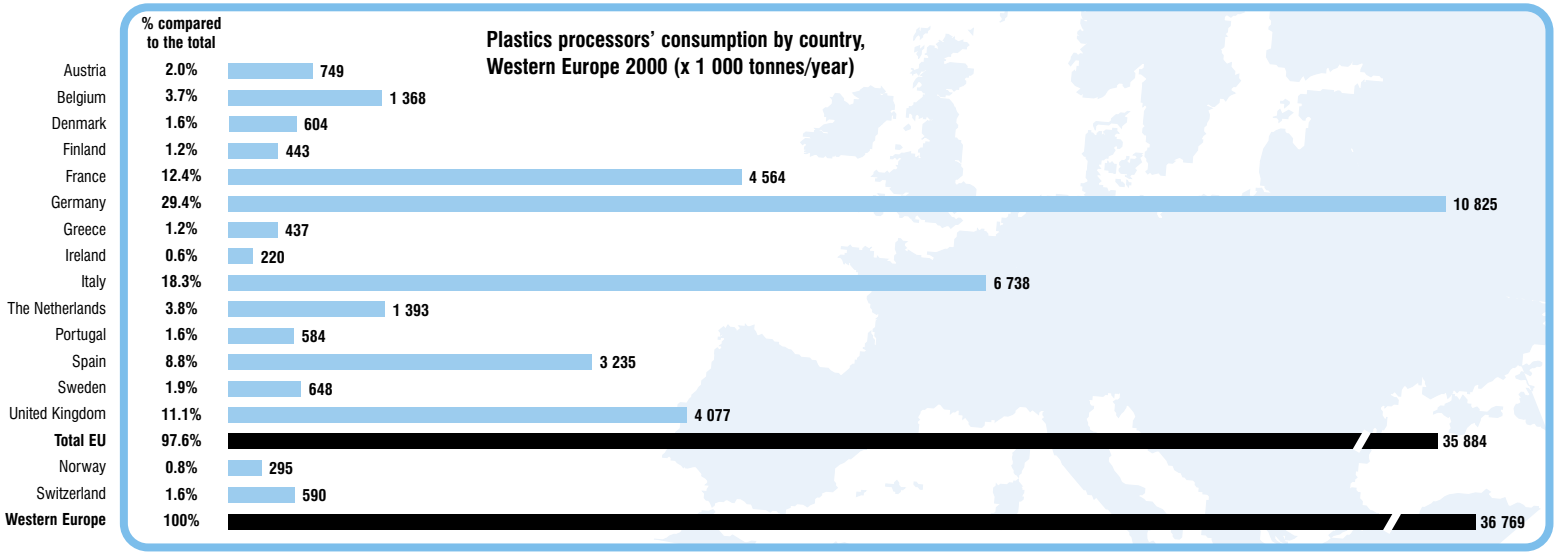
Plastics in health

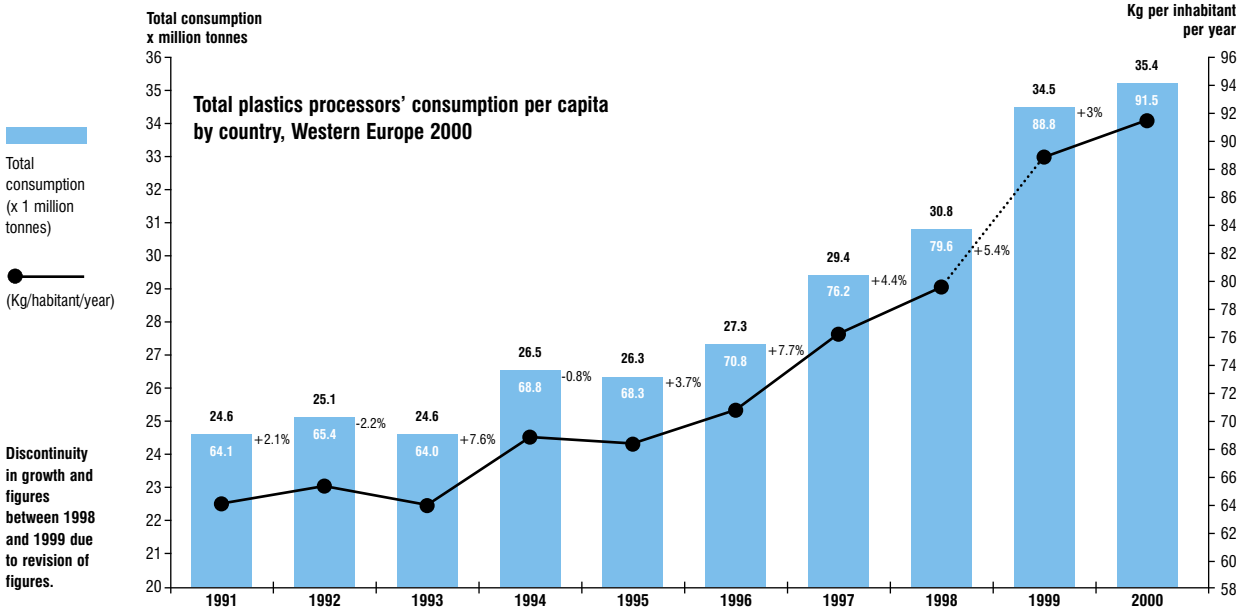
Plastics offer hope to spinal injury victims There are few effective treatments for spinal cord injuries, because spinal cord nerves do not regenerate rapidly, but a team of Canadian researchers restored some movement to paralysed rats by creating a plastics tube that fits around the spinal cord. The tube fits closely around the injured spine and provides a pathway along which neurones can grow.

While this application is a number of years away for humans, medical science is already reaping the benefits of plastics' versatility. Surgical pins made from poly(L-lactide) support fractures before decomposing proportionally to the healing of the broken bone, while spiral implants made of plastics keep arteries clear and can be charged with substances which break down calcium deposits, before they disintegrate themselves.

Consumption in Western Europe

In 2000, the consumption of polymers for plastics applications in Western Europe was 36 769 000 tonnes, an increase of 3.4 per cent from 1999. Each individual in the region consumed on average 91.5 kg of virgin plastics in 2000, up 3 per cent on the 1999 figure.





Discontinuity in growth and figures between 1998 and 1999 due to revision of figures.

Data in this graph refers to consumption of virgin plastics in plastics applications.

Plastics consumption data generally refer to the final market of plastics products consumed by end-users in Western Europe. They may include recycled polymers but exclude non-plastics applications. Fibres, strappings, coatings, woodbondings, elastomers and composite packaging such as LDPE film in cartons for liquid food are considered as non-plastics applications. Furthermore, this data does not take into account the import/export flows of empty and filled packaging.

Consumption in Western Europe

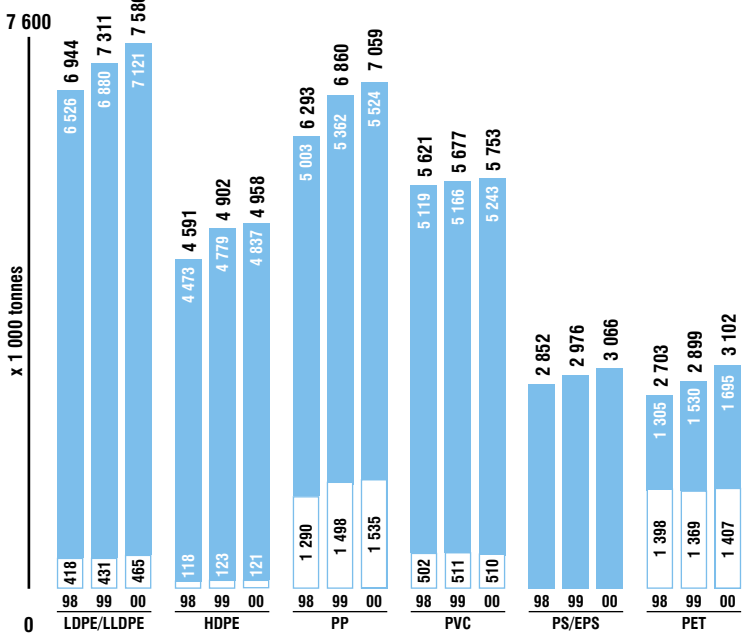
Consumption of thermoplastics in Western Europe 1998 – 2000

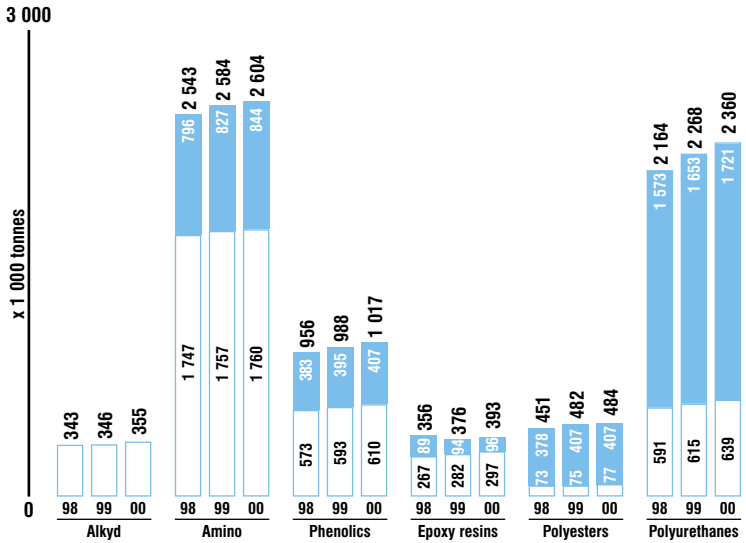
The total demand for thermoplastics across all applications grew by 3.2 per cent in 2000 to 35 776 000 tonnes. Thermoplastics are not only used in the manufacture of many typical plastics applications, such as packaging and automotive parts, but also in non-plastics applications such as textile fibres and coatings. Non-plastics applications accounted for 14 per cent of all thermoplastics consumed.

In 2000, the large-volume, thermoplastic families of polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS & EPS) and polyethylene terephthalate (PET) represented 75 per cent of total plastics consumption in typical plastics applications. Many of these demonstrated substantial growth, in particular PET with 10.8 per cent higher volumes, followed by LLDPE with a 5.5 per cent increase, and PS 3.8 per cent. The growth in PET continued to lead the sector due to the ongoing expansion of the PET bottle market.

Consumption of thermosets in Western Europe 1998 – 2000

Demand for thermosets grew 3 per cent in 2000 to 10 384 000 tonnes. Demand for these polymers in non-plastics applications, such as adhesives, as well as in plastics applications, is rising: growth in plastics applications (4 per cent) slightly outstripped that in non-plastics consumption (2.3 per cent). However the proportions of thermosets used for plastics applications versus non-plastics applications remained steady at 58 per cent and 42 per cent respectively.





Major thermoplastics – primary applications	
Low density polyethylene (LDPE)	Pallet and agricultural film, bags, toys, coatings, containers, pipes
High density polyethylene (HDPE)	Containers, toys, housewares, industrial wrappings and film, gas pipes
Polypropylene (PP)	Film, battery cases, microwave-proof containers, crates, automotive parts, electrical components
Polyvinyl chloride (PVC)	Window frames, pipes, flooring, wallpaper, bottles, cling film, toys, guttering, cable insulation, credit cards, medical products
Polystyrene (PS & EPS)	Electrical appliances, thermal insulation, tape cassettes, cups, plates, toys
Polyethylene terephthalate (PET)	Bottles, textile fibres, film food packaging
Styrene copolymers (ABS/SAN)	General appliance mouldings
Polymethylmethacrylate (PMMA)	Transparent all-weather sheet, electrical insulators, bathroom units, automotive parts
Polyamide (PA)	Films for packaging of foods such as oil, cheese and boil-in-the-bag products, for high temperature engineering applications and textile fibres

TOTAL THERMOPLASTICS 35 776 000 tonnes

Plastics applications

Non-plastics applications

Note: 1999 figures have been revised compared with last year's report to reflect more accurate information now available

Major thermosets – primary applications	
Phenolics	Adhesives, automotive parts, electrical components
Epoxy resins	Adhesives, automotive components, E&E components, sports equipment, boats
Polyurethane (PU)	Coatings, finishes, cushions, mattresses, vehicle seats

TOTAL THERMOSETS 10 384 000 tonnes

TOTAL PLASTICS CONSUMPTION, INCLUDING NON-PLASTICS APPLICATIONS, IN 2000 WAS 46 160 000 TONNES

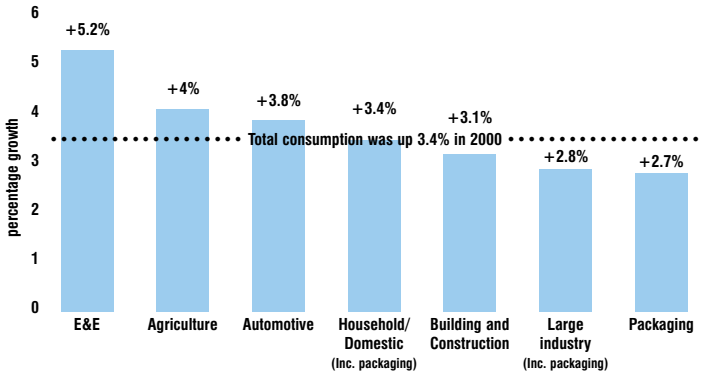
Consumption by industry sector

Demand for plastics in all sectors was up in 2000, continuing the growth trend, and with no significant changes in the relative consumption patterns. Unsurprisingly, the E&E sector shows the highest growth, with countless new inventions and applications using plastics as an integral material. However, growth in plastics packaging consumption – still the largest user of plastics – was markedly less than in all other sectors. This is because the weight of plastics packaging for a given unit continues to decrease: demonstrating that with plastics packaging, *less is more* due to constant innovation – resource efficiency in action. In fact, in all sectors the use of plastics continues to achieve resource and energy savings: it is estimated that the use of plastics as a whole actually saves more oil than is needed for their manufacture.

Packaging

Packaging was still the largest consumer of plastics in 2000, accounting for 13 717 000 tonnes, or 37 per cent of all plastics consumed. Around half of all Western Europe's goods are now packaged in plastics, yet by weight these plastics account for only 17 per cent of all packaging. This means that, thanks to their resource efficiency, although plastics rank first amongst packaging materials in terms of units sold, they are only third if judged on weight. Through constant innovation, the sector growth in tonnage terms in 2000 was 2.7 per cent, much less than other sectors and less than the total plastics consumption increase of 3.4 per cent.

Growth in Plastics Consumption by Sector (Tonnes) 1999-2000



Agriculture

Agricultural plastics continue to account for just 2.6 per cent of the total plastics consumed, or 946 000 tonnes, but they have a vital role to play. Plastics-based agricultural systems provide effective solutions to crop growing: in arid regions, for example, plastics piping/drainage systems can cut irrigation costs by one to two-thirds while as much as doubling crop yield. Growth in tonnes consumed for this sector was high at 4 per cent, as innovative plastics applications were developed to help make the most of natural agricultural resources.

Building and Construction

The building and construction (B&C) industry accounted for 6 940 000 tonnes of plastics in 2000, or 19 per cent of total consumption, a comparable figure to 1999, and remains the second largest user. Plastics' continued popularity for a range of B&C applications is due to their strength, durability, resistance to corrosion and low maintenance. The importance of plastics in modern architecture is shown in landmark constructions such as the Stade de France in Paris, or the Tunnel of Somport linking Spain and France.

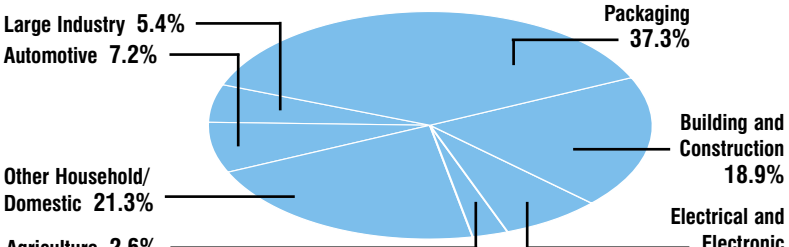
Automotive

Automotive designers nowadays must attempt to meet varying and often conflicting demands. The solution to balancing high performance with reliability, safety and minimum environmental impact often lies in lightweight plastics. Their prevalence in innovative vehicles such as the Smart Car, and the development of automotive fuel cells, demonstrated this. 2000 saw relatively strong growth in this sector, by 3.8 per cent to 2 649 000 tonnes.

Electrical and Electronic

E&E was the sector which enjoyed the highest percentage growth in 2000, with consumption up 5.2 per cent to 2 670 000 tonnes, confirming plastics' status as the material of choice for the 21st century. Plastics provide practical benefits that other materials cannot match, and can be used in applications from microwaves to sheathing for fibre optic cables. In particular, the drive to make E&E devices smaller and lighter means that plastics are the obvious choice while also achieving resource savings.

Plastics consumption by industry sector Western Europe 2000



TOTAL CONSUMPTION, WESTERN EUROPE	36 769 000 TONNES

Plastics waste management increasing diversion from landfill

In the year 2000, growth in recovery not only kept pace with increased consumption, as it had in previous years, but actually outstripped it. Recycling grew by just over four times, and energy recovery increased by just under three times, the rate of consumption increase.

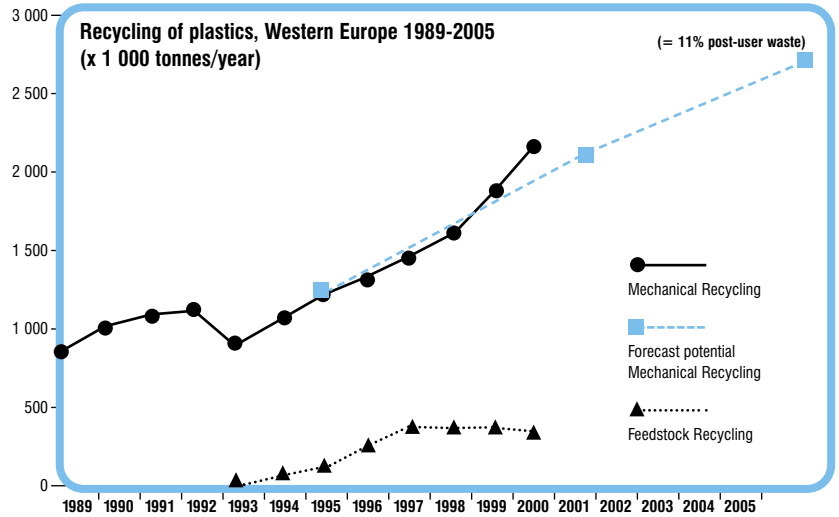
- Total recovery of waste from all plastics applications: 36 per cent
- Total recovery of plastics packaging waste: 46 per cent
- Total recovery across all sectors up by 11 per cent from 1999

It is generally accepted that diverting waste from landfill is the single most important factor in reducing its impact on the environment. Through a combination of recovery options, plastics are well placed to continue achieving increased diversion from landfill, as borne out by the 2000 figures.

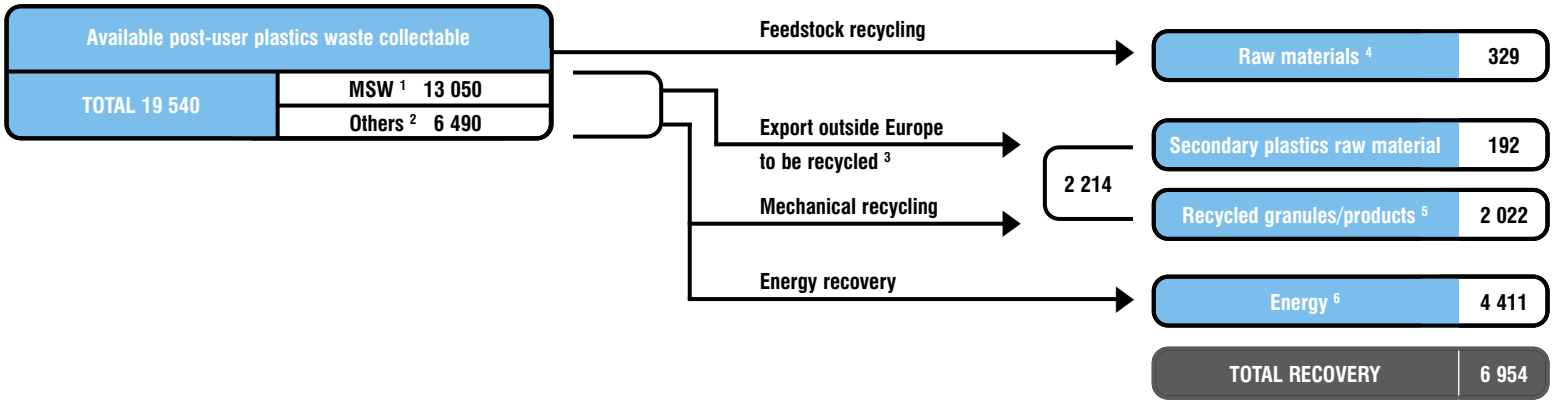
The basic challenge for plastics is for waste recovery to keep pace with growing consumption. In 2000, thanks to improving collection and separation infrastructures, this was achieved and more, ensuring that a decreasing amount of this valuable resource was lost to landfill. Although total post-user plastics waste increased 2 per cent in 2000 to 19 540 000 tonnes, real progress was made in recovery and recycling in particular, so that 11 per cent more was recovered in 2000, while the amount going to landfill and to incineration without energy recovery decreased by 4 per cent from the 1999 total.

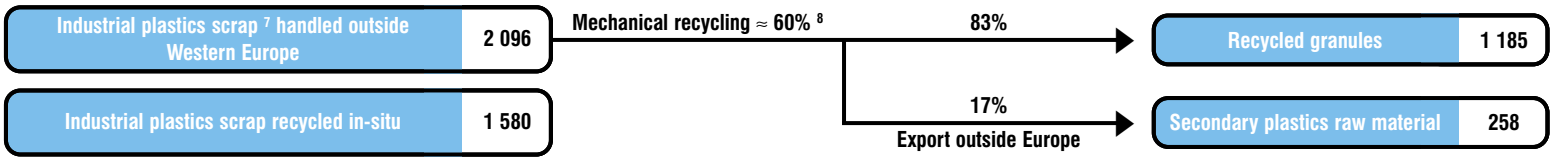
The large volume plastics (L/LDPE, HDPE, PP, PVC, PS, EPS and PET) make up 83 per cent of collectable post-user plastics waste primarily because they often have a short lifespan, as is the case in many plastics applications.

The actual amount of plastics recovered rose by 11 per cent to 6 954 000 tonnes, thereby increasing the proportion of collectable plastic waste recovered to 36 per cent (from 33 per cent in 1999), and outstripping the growth in consumption by more than three times. Within this, there were significant increases for both energy recovery and particularly mechanical recycling.



Plastics waste recovery – breakdown by recovery route (x 1 000 tonnes / year)





1 Households and assimilated **2** Distribution and industry **3** Mainly Asia and Central Europe **4** Parafin, methanols **5** 85% granules, 15% plastic products **6** Of which 150/200 000 tonnes energy recovered in cement kilns **7** Processing, filling, assembling, installing, polymerisation **8** 40% is not recycled

Mechanical recycling

In 2000, there was a 17 per cent increase in the amount of post-use plastics waste recovered through mechanical recycling to 2 214 000 tonnes. This represented 11 per cent of total collectable plastics waste, and resulted in a significant growth in the quantity of recyclate used. The increase – a much larger increase than that in post-user plastic waste quantities – was due to the relatively high price of virgin plastics in

Plastics waste management increasing diversion from landfill

2000 and better collection, especially in Italy, Spain and France. Increased collection also led to increased waste export both within and outside Western Europe. Mechanical recycling is the European plastics industry's preferred recovery route, provided recyclate can replace virgin plastics in an eco-efficient way.

The graph on page 6 (top right) indicates that current plastics recycling levels are keeping pace with the TNO forecast for the quantity of plastics waste capable of being mechanically recycled across Western Europe[1]. There are a number of reasons why it will be difficult to significantly exceed the forecast overall rate of around 11 per cent without resorting to extensive exports. This is due in particular to the imbalance between the waste collectable and the potential end-markets, as well as the presence of large quantities of mixed plastics waste. There is limited demand for recycled plastics in food packaging applications (one of the major outlets for virgin plastics) due to food safety regulations or concerns.

Specifically looking at the targets set by the European Packaging Directive, an average of 21 per cent of post-user plastic packaging waste was mechanically and feedstock recycled, up from 19 per cent in 1999. In particular, progress has been made in Belgium, Italy, The Netherlands and Spain, pushing up the overall average. It is clear that some countries will not meet the minimum 2001 target of 15 per cent of post-user plastics packaging waste to be recycled. If, as proposed, this target is raised to 20 per cent by 2006, probably only half of Western European nations could meet this. In effect, this new target will mean that an additional one million tonnes needs to be recycled, a 54 per cent increase on the current figure. See table on page 10 comparing national packaging recycling rates.

Feedstock recycling

Several different feedstock recycling technologies have been developed and demonstrated to work – for example by BP and by Texaco. Although feedstock recycling has great potential to boost plastics waste recovery levels, in practice the amount of waste treated this way has not changed significantly since 1997 and is limited to facilities in Germany. In 2000, this was down by 5 per cent to 329 000 tonnes. This is mainly due to lack of new investments and economic considerations compared to other recovery options. A constant supply of plastics waste of the quality and quantity needed are important criteria for investment in these technologies.

There has been renewed interest in other methods of feedstock recycling – such as the de-polymerisation of PET to make chemicals which can be used in the production of new plastics. Such technologies would be especially effective for the recycling of multi-laminate bottles which will increasingly appear on the market.

Energy recovery

Because all major plastics are derived from oil, energy recovery is a key recovery option for plastics in order to give them a second life. In the past, there has been much opposition, some of which was justifiable, because of the concern around poor environmental performance and emissions from old incinerators. Today energy recovery is endorsed as an environmentally sound option, and helps provide security of energy supply.

In 2000, 4 411 000 tonnes, or 23 per cent of post-user plastics waste collected in Europe, was reclaimed through energy recovery. This figure is up from 1999 figures, due to the increase in energy recovery capabilities in countries such as Spain. There was also a rapid increase in the use of alternative fuels (RDF/PDF) which are based on plastics and used as fuel for power generation.

Denmark and Switzerland recovered the most plastics waste via energy recovery, at 75 per cent (260 000 tonnes) and 73 per cent (383 000 tonnes) respectively. France recovered the most plastics waste via this route in tonnage terms – almost one million tonnes (approximately one third of its post-user plastics waste).

Recovery in the future, for the future

Energy recovery, alongside mechanical recycling, has a vital role to play in diverting plastics waste from landfill and maximising environmental gain. In APME's study, *Assessing the eco-efficiency of plastics packaging waste recovery*,[2] (published in 2000 and peer reviewed) results indicate that when combined with energy recovery, raising recycling rates from 15 per cent to 50 per cent increases costs by a factor of three, while environmental benefit remains broadly similar. These are indicative trends, but illustrate there is no strict hierarchy between recycling and energy recovery. APME is currently producing eco-efficiency studies for the automotive and E&E sectors, the initial results of which are likely to confirm this hypothesis and provide information for sound decision-making.

In addition to the above, other studies, such as those conducted by the Fraunhofer Institute in Germany, support the environmental benefits of energy recovery. Similarly, a recent study by CE-Delft evaluated the effects of substituting coal with a treated plastics/paper waste fraction for power generation. Not only did the results show environmental gain, but it was concluded to be equivalent in overall environmental terms to the use of biomass as a fuel. It was also found that if the energy were to be recovered from all the separated non-recyclable plastics waste in Europe, this would be equivalent to at least 17 million tonnes of coal.

Completing the recovery picture 1991-2000 (x 1 000 tonnes)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total plastics waste	**14 637**	**15 651**	**16 211**	**17 505**	**16 056**	**16 871**	**16 975**	**18 457**	**19 166**	**19 540**
Mechanical recycling	1 080	1 129	915	1 057	1 222	1 320	1 455	1 614	1 888	2 214
Feedstock recycling	0	0	0	51	99	251	334	361	346	329
Energy recovery	2 138	2 599	2 425	2 348	2 698	2 496	2 575	3 834	3 949	4 411
Total plastics waste recovered	**22%**	**24%**	**21%**	**20%**	**26%**	**25%**	**26%**	**31%**	**32%**	**36%**

While year-on-year figures give a clear indication of overall trends, the scope of data used has changed and there have been improvements in methodology. Figures have been re-evaluated to take such changes into account, however, comparison between years should be treated with care.

1 *Assessing the Potential for Post-use Plastics Waste Recycling - predicting recovery trends in 2001 and 2006.* See Bibliography

2 See Bibliography

Plastics waste in perspective

Despite the growing demand for plastics across all industry sectors, they continue to account for less than one per cent of total waste by weight. While total waste in 2000 stood at nearly 2 764 million tonnes, the plastics fraction contributed just 19.5 million tonnes to this amount, with plastics production scrap from industry adding only just over 2 million tonnes to this. The sector breakdown of this plastics waste has remained broadly constant over time.

Total waste by sector, Western Europe 2000
(x millions of tonnes/% by weight)

Sector	x million tonnes	% by weight
Agriculture	1 042	37.7
Distribution & Industry	373	13.5
Building & Construction	331	12
Municipal Solid Waste	193	7
Automotive	15	0.5
Electrical & Electronic	7	0.2
Others (Mines, sludges, energy production)	804	29.1

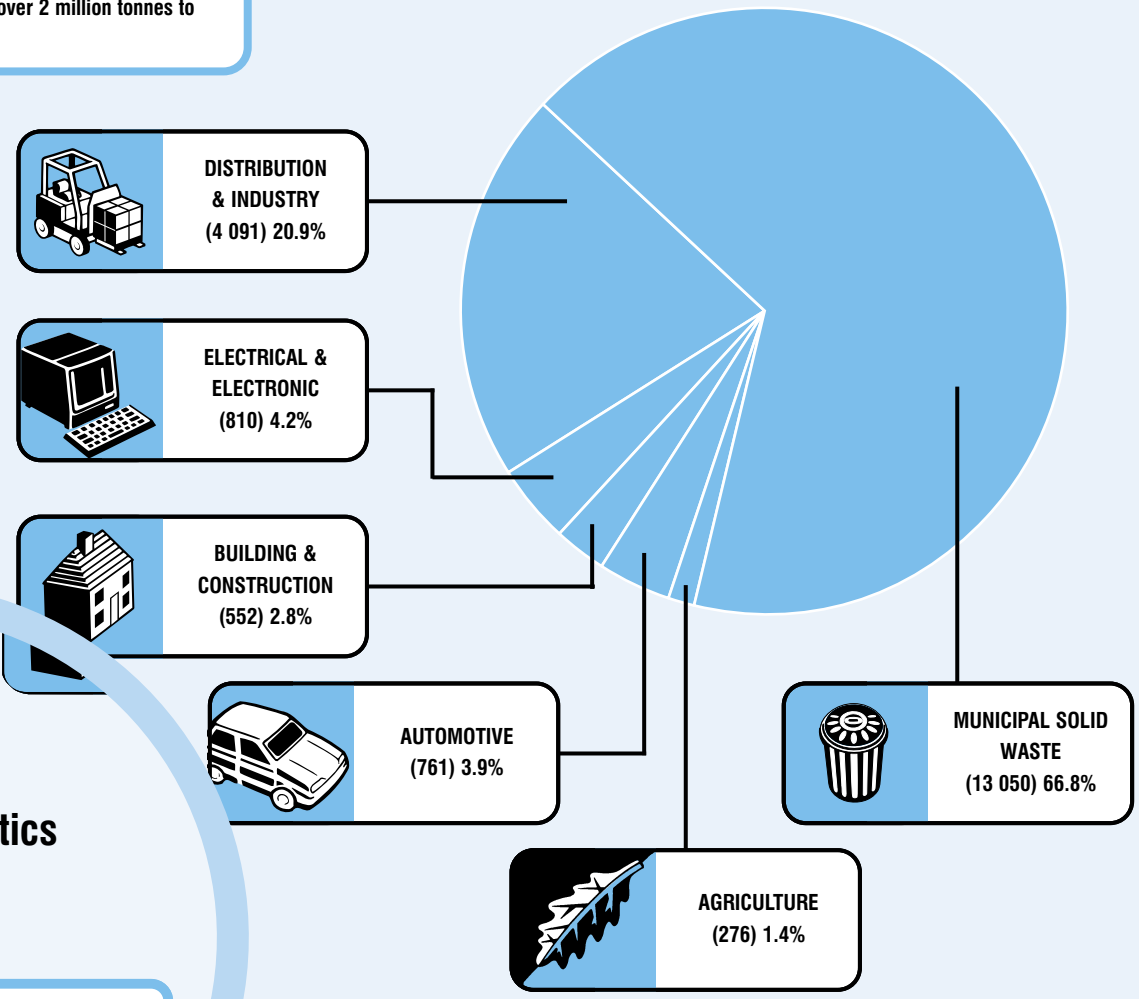
TOTAL WASTE 2 764 MILLION TONNES

of which total proportion of plastics

<1%

TOTAL POST-USER PLASTICS WASTE 19 540 000 TONNES

Total post-user plastics waste by sector, Western Europe 2000 (x 1 000 tonnes/% by weight)

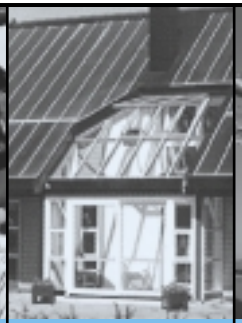


Plastics recovery in action

Continued commitment to minimise the loss of valuable resources at end-of-life has ensured that growth in plastics recovery has outstripped the rise in consumption. As a result of packaging collection systems and municipal incineration schemes, municipal solid waste shows the highest quantities of plastics waste recovered. Feedstock recycling is only operational in Germany and Austria to date. Energy recovery processes involved are: MSW incineration and PDF/RDF combustion, cement kilns and co-combustion plants.

Breakdown by recovery route and by end-use sector, Western Europe 2000 (x 1 000 tonnes)






	Agriculture	Automotive	Building and Construction	Distribution and Industry	Electrical and Electronic	Municipal Solid Waste	TOTAL
Total available plastics waste collectable	**276**	**761**	**552**	**4 091**	**810**	**13 050**	**19 540**
Incineration and landfill	129	674	495	2 317	773	8 198	**12 586**
Energy recovery	~ 0	11	~ 0	540	6	3 854	**4 411**
Feedstock recycling	0	0	0	0	0	329	**329**
Mechanical recycling within Europe	147	76	57	1 069	30	643	**2 022**
Mechanical recycling for export	0	0	0	165	1	26	**192**
% total recovery as a proportion of end-use waste	**53%**	**11%**	**10%**	**43%**	**5%**	**37%**	**36%**

Managing plastics waste by sector

The case studies on this page examine the ways in which innovative methods of recovery are taking place in Europe at the turn of the century. They demonstrate how industry is striving to maximise the resource efficiency of plastics by finding recovery options that are appropriate for the material, specific use and local infrastructure.

Packaging

In 2000, the packaging sector was once again the largest consumer of plastics. In the 1990s, significant efficiencies in plastics packaging were achieved so that today, the weight of packaging for a given article has reduced by 28 per cent over the last ten years.

At the same time, plastics have increasingly substituted more traditional packaging materials so that over the same period there has been an overall reduction in total packaging materials.

In terms of the recovery of plastics packaging waste, comparing recovery in 2000 to 1999, the overall rate increased to 46 per cent from 41 per cent in 1999. Rates for top performing countries rose slightly or remained stable, while those at the bottom end of the ranking made significant progress. Eight countries achieved recovery rates of over 50 per cent in 2000 as evidenced by The Netherlands achieving complete recovery, Switzerland 98 per cent, Denmark 88 per cent, Norway 82 per cent, Germany 74 per cent, Sweden 67 per cent, Austria 66 per cent, and Belgium 62 per cent.[1]

Packaging waste presents a number of challenges for recovery, due to mixed waste streams and the fact that waste is often dirty. As noted on pages 6 and 7 and in the table to the right, challenges still remain for a number of countries to meet the minimum recycling rates. This is due to a number of factors including geography and demography that can have a significant impact on availability of an economic source of plastics waste.

Where plastics packaging recycling is eco-efficient, this is based on best practices, by targeting certain streams for maximum effect such as bottles and industrial or distribution films.[2]

Energy recovery provides an efficient route to recover mixed plastics waste. Overall, it remains clear that to maximise total plastics packaging waste recovery, as with plastics waste from other sectors, a combination of recovery options, tailored to specific locations, is required.

Automotive

It is estimated that about 11 per cent of automotive plastics waste was recovered from both repair shops and end of life vehicles in 2000. 76 000 tonnes of this was recycled, mainly PP from batteries and bumpers, in line with the findings of the TNO/APME report, *Best Practices for the Mechanical Recycling of Post-User Plastics*. This is because large single polymer parts are easier to dismantle and recycle while smaller, multi-polymer parts present a greater challenge.

Plastics packaging waste recycling, 2000

Mechanical recycling rate, %	Country
> 20%	D, A, NL, B
15 - 20%	ESP, I, SWE
10 - 15%	UK, F, FIN, DK
5 - 10%	IRE
0 - 5%	P, GR

TOTAL MECHANICAL RECYCLING (MR) IN 2000 = 1.9M (17.9% rate)

TOTAL ADDITIONAL MR TONNAGE NEEDED BY 2006 FOR 20% PROPOSED TARGET	1.0M (+53%)

Recycling rates as estimated here are measured as a percentage of collectable waste. This in general tends to result in higher figures than if rates were calculated as a percentage of packaging put on the market.

Differences in performance by country also remained, with rates over 10 per cent being found only in Austria, France, Germany and The Netherlands. There is a significant trade flow of cars being exported outside Europe. APME is currently undertaking a study on the eco-efficiency of recovering selected automobile parts made from plastics, the results of which – to be published in 2002 – will point to the ways in which automotive plastics recovery can most effectively be achieved.

Electrical & Electronic

The integrated nature of E&E products, with many small components combining plastics, metals and glass, makes them difficult to handle in waste management terms. The fact that E&E recovery is still an industry under development adds to the challenges facing this sector, and means that total recovery, as a proportion of end-use plastics waste, stood at just 5 per cent in 2000 – equivalent to 37 000 tonnes. Legislation to frame the recovery of E&E products is being discussed at

case study

An innovative European plant for the recovery of plastic packaging

Europe's largest plant to include an integrated system of sorting, recovering and recycling plastics packaging from separated waste opened in Montello (Bergamo), Italy, in September 2001. It can sort and recover about 8 500 kg of plastics packaging waste per hour – the equivalent of 250 000 liquid containers. This is then treated to produce flakes (PET) to be used as a raw material in subsequent industrial processes; treatment capacity is 3 300 kg per hour. In addition, residual scraps are then transformed into refuse-derived fuel (RDF), which is sent for energy recovery. It is estimated that this fully automated plant reduces landfill by 600 000 cubic metres per year.

1 These figures include imports and exports. 2 TNO/APME study, *Best Practices for the Mechanical Recycling of Post-User Plastics.* See Bibliography

Managing plastics waste by sector

case study

The PVC initiative

In 2000, European PVC producers and their industry partners came together to deliver responsible product and waste management over the next 10 years through a Voluntary Commitment.

The first progress report against the challenging targets set within this document was published at the end of March 2001. Both the Voluntary Commitment and first annual progress report are available at www.vinyl2010.org.

A number of Voluntary Commitment projects currently underway will have a positive influence on the environmental impact of the European construction sector. Implementation of new technologies, such as the Vinyloop solvent-based recycling for composite materials, will also help significantly increase recovery rates for end-of-life PVC construction products in the future.

European level and targets for recycling are being set. It is not possible to judge at this stage how feasible the targets will be, but difficulties may be expected with respect to the recycling of small appliances made from many different plastics. The industry believes the best way forward is to aim for the most eco-efficient recovery solution by using the best combination of recovery options subject to specific circumstances. APME is currently conducting a study to identify the most eco-efficient routes of recovery for various E&E equipment, the results of which will be published in 2002.

Building & Construction

In 2000, slightly over 10 per cent (57 000 tonnes) of collectable building and construction waste was recycled for a second life. At a national level, Germany, The Netherlands and Spain significantly exceeded this rate; Germany and The Netherlands each achieved 21 per cent, and Spain 15 per cent. While there is currently little legislation in this area, there are a number of voluntary schemes targeting specific products such as window frames and pipes, which, as single polymer items, are the most practical choices for recycling.

Agriculture

Although soil contamination can lead to higher weight, and thus an over estimation of recovery data, high recovery rates were achieved in this sector during 2000 – 53 per cent for Western Europe. In 2000, seven countries achieved rates of over 50 per cent – Spain, Norway, The Netherlands, Italy, Ireland, Denmark and Finland. There is no legislation affecting agricultural plastics – again all schemes are voluntary. The success in this sector reflects the importance of a regular, easily accessible supply of large quantities of homogeneous plastics waste and suitable end markets, which make plastics economically attractive to recover.

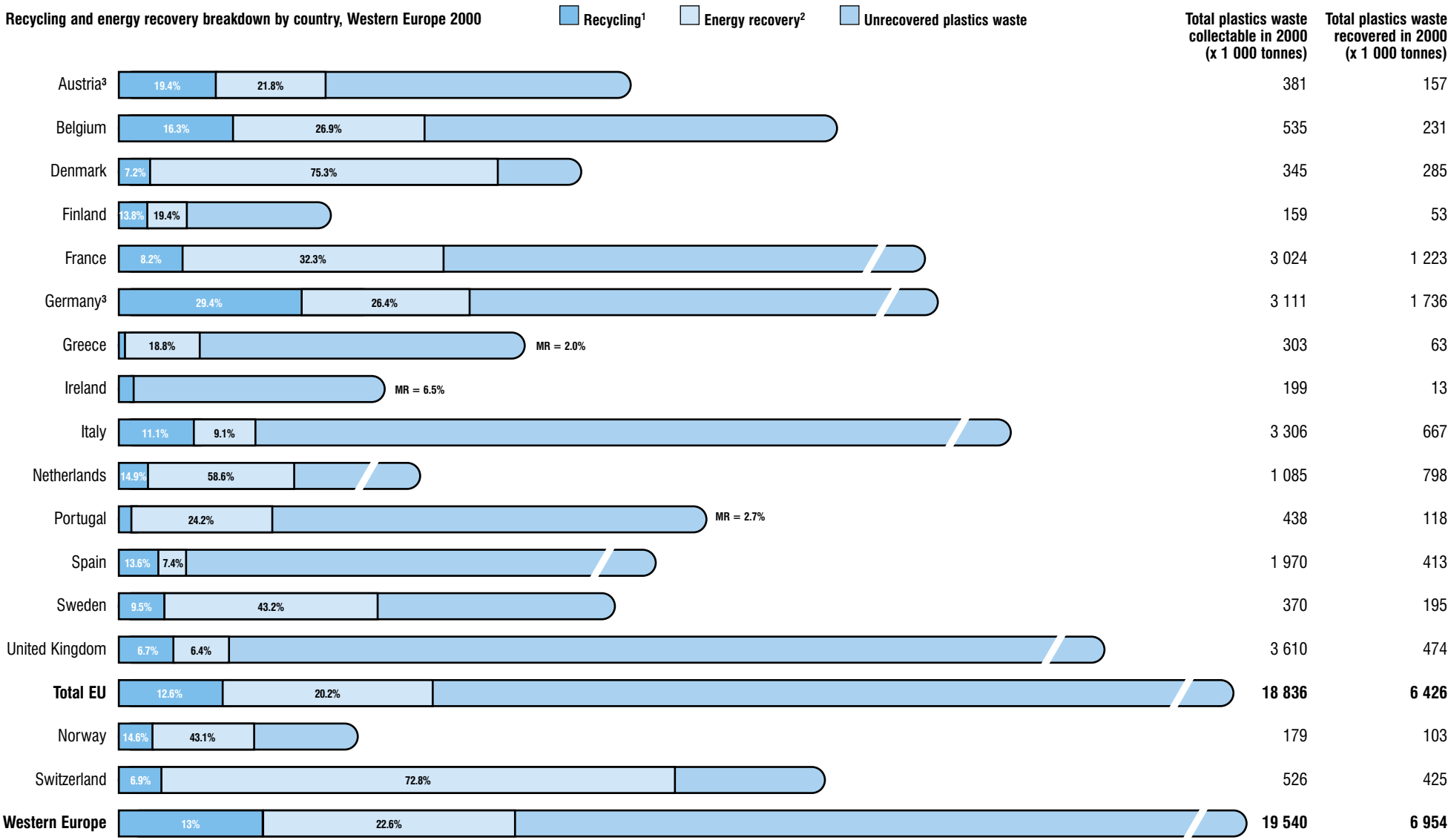
case study

Recycling of plastics packaging waste in The Netherlands

A voluntary agreement between industry and government in The Netherlands shows what it is possible to achieve when it comes to collecting packaging waste in an eco-efficient way. Unlike most other member states, plastics packaging waste from households is generally not separately collected and mechanically recycled in The Netherlands. However, within the framework of the Packaging and Packaging Waste Directive, industry and government have negotiated a voluntary agreement called the Packaging Covenant II. The VMK (foundation for plastics packaging and the environment), which represents the plastics packaging industry, has committed to stimulate and support the separate collection of plastics packaging waste from distribution and industry. In 1998, the first year of the covenant, mechanical recycling was achieved for 14 per cent of all plastics packaging waste (including household waste). In 2000, the mechanical recycling rate further increased to 23 per cent. It is expected that the negotiated target of 27 per cent in 2001 will be met; moreover this voluntary collection and separation of waste has been found to be more cost-effective than using normal waste recovery methods.

For plastics packaging waste from households, the VMK has committed to stimulate and support post-separation from the grey bag waste, and the use of this fraction as a fuel or raw material. The VMK is negotiating new targets to be met in 2005 for The Packaging Covenant III.

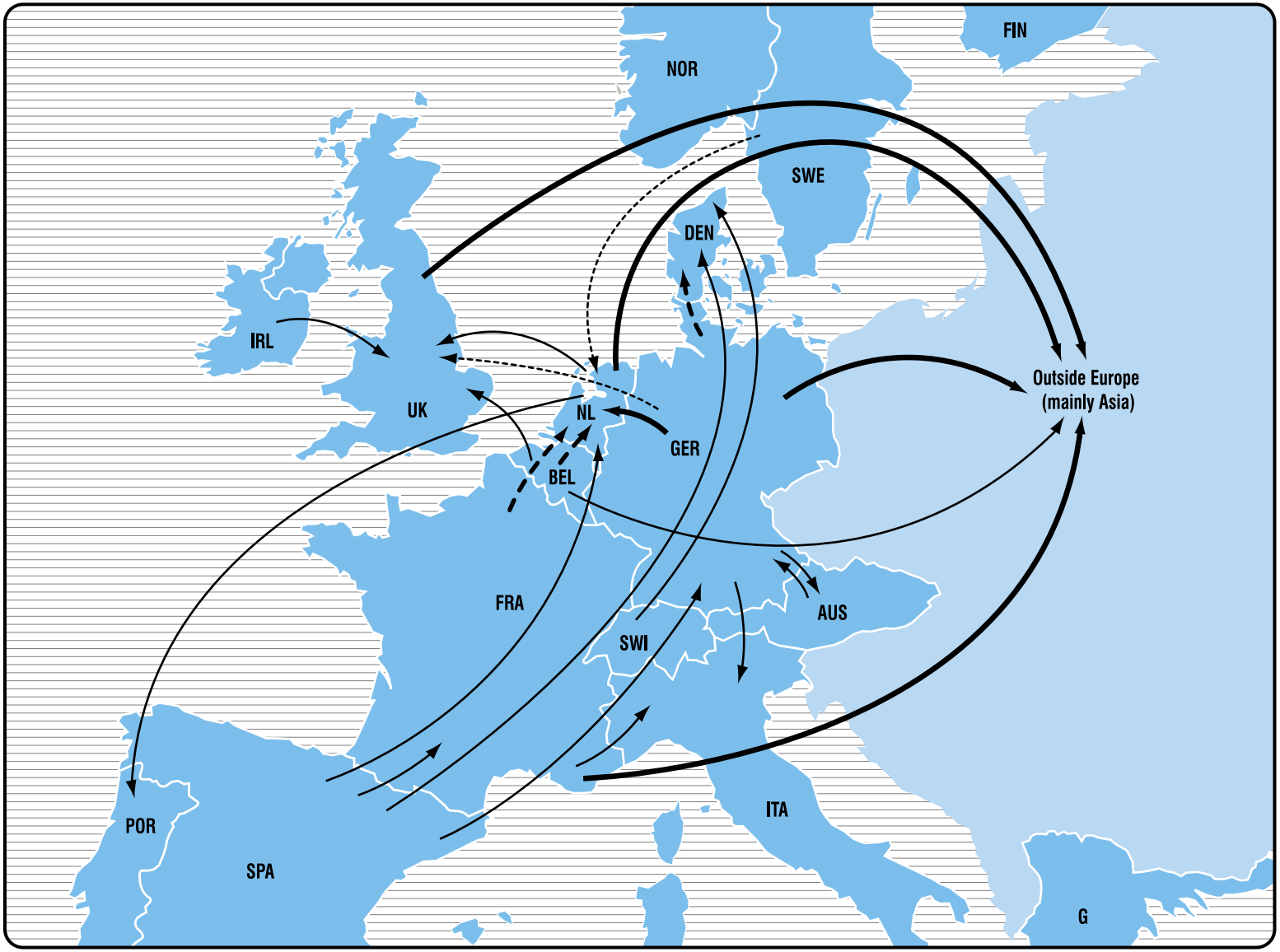
An overview of recovery in Western Europe



1 Recycling ratio = (local waste recycled + waste exported to be recycled) /waste collectable **2** Energy recovery ratio = energy recovery/waste collectable **3** Recycling in Austria and Germany includes feedstock recycling **4** For clarity all figures are rounded to nearest 1 000

Trade in post-user plastics waste

In 1997, we examined, for the first time, the increasingly international nature of the plastics waste management industry. The maps here provide updated indications of the cross-border flows of plastics waste and recycled granulate. Intra-European trade of waste collected for recycling remained at around 15 per cent in 2000, with The Netherlands continuing to be the major receiver of waste from other member states. In 2000, there was at least around 200kt of waste plastics exported outside Western Europe, mainly to Central Europe and Asia, a large increase in tonnage on previous years and 10 per cent or more of the total Western European waste stream. Other sources suggest that such estimates of plastics waste exported for recycling could be much higher than this. In terms of the material that is recycled within Europe, there are also exports of the recycled granulate or products outside Western Europe amounting to some 15 per cent of the total. There is no flow of plastics waste into Western Europe.

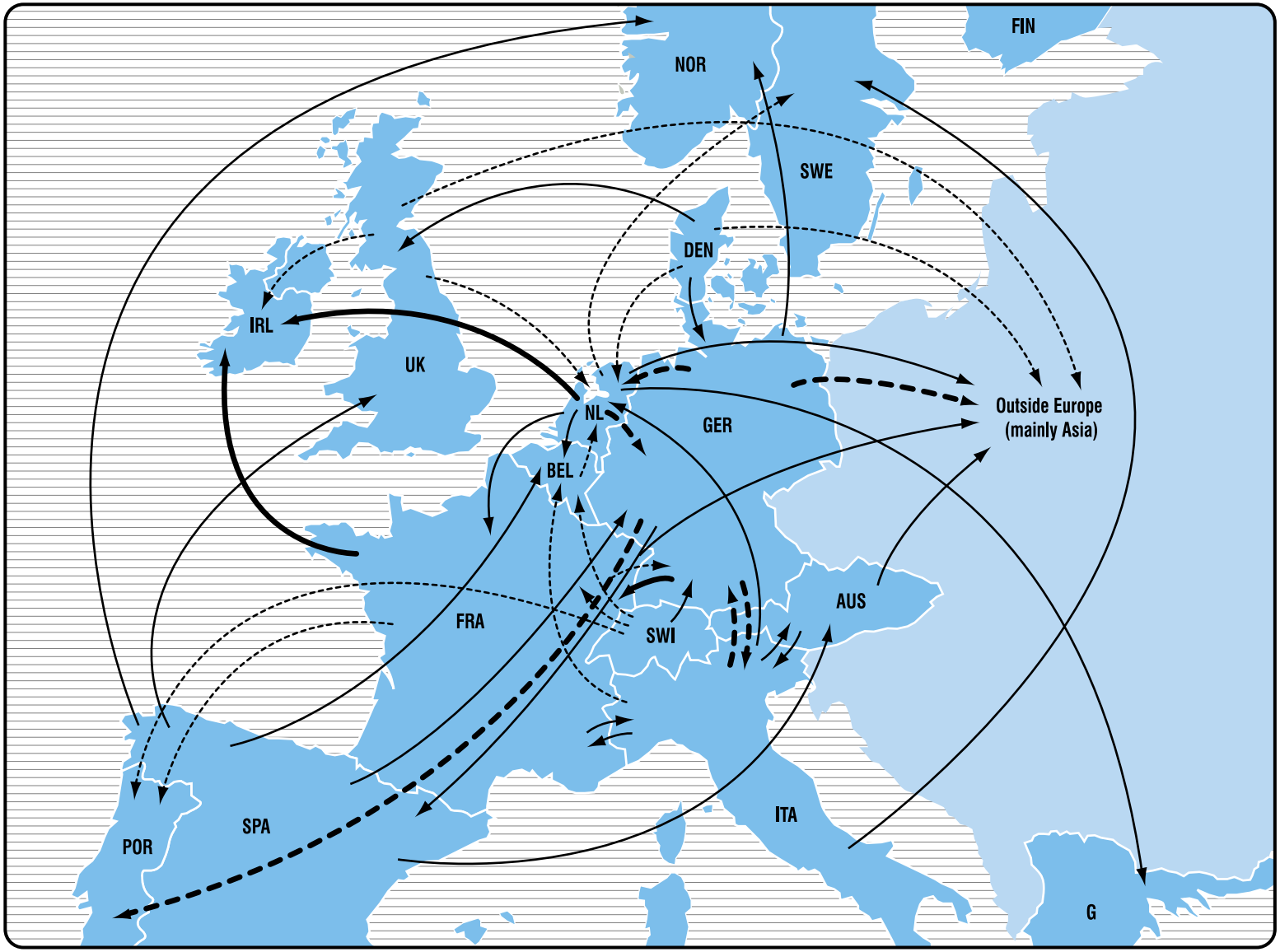


Streams

3 - 5kt/year
15 - 25kt/year
5 - 15kt/year
25+kt/year

Trade in granulate from post-user plastics waste

In addition to the intra-EU trade of recycled granulate across national boundaries, there was a significant tonnage increase of 30 per cent in the amount of granulate being exported outside Europe. This was due to the better price and demand in end user markets outside Europe.



Streams

- 3 - 5kt/year
- 15 - 25kt/year
- 5 - 15kt/year
- 25+kt/year

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Note: Those references marked (*) are available and downloadable from the APME Web site: www.apme.org

The Association of Plastics Manufacturers in Europe (APME) is the voice of the polymer producing industry at the European level. Its membership today includes more than 40 companies representing well over 95 per cent of Western Europe's polymer production, with a turnover of more than 29 billion euro. Combined with the European polymer converting industry and the machinery manufacturers, the plastics industry represents a major contributor to Europe's economic strength employing well over one million people and generating sales in excess of 135 billion euro.

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ASSOCIATION OF PLASTICS MANUFACTURERS IN EUROPE

Data for the report in 2000 was collected through numerous contacts: plastics manufacturers (17), plastics manufacturers associations (17), professional associations (37), Ministries of the Environment (17), environment agencies (20), waste management associations (79), plastics recyclers (240), waste collectors (42), incinerator plants (5), cement kiln groups (2), coal fired plants (2) and other players involved in plastics recovery in the major European countries (consultants, magazines, associations, - (50)).
As a whole, around 500 companies were contacted to update the survey. APME and TN Sofres Consulting would like to thank all contributors for their generous help.

2002/GB/04/02