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PET BOTTLES RECYCLING POLICY EU AND THE CZECH REPUBLIC



PETE

Introduction

Basics about PET

PET or Polyethylene terephthalate is common plastic used for drinks bottles, jars, plastic film, microwavable packaging.

Plastic bottles were first used commercially in 1947, but remained expensive until the early 60s. Later they became very popular with both manufacturers and consumers due to their lightweight nature and relatively low production costs compared to glass bottles. Today they have almost completely replaced glass bottles, but wine and beer are still commonly sold in glass bottles.

Statistics

Worldwide, approximately 4.53 million tons of PET were collected in 2007. This gave 3.64 million tons of flake. 2.6 million tons were used to produce fibre, 0.3 million tons to produce bottles, 0.37 million tons to produce APET sheet for thermoforming, 0.17 million tons to produce strapping tape and 0.12 million tons for miscellaneous applications.

Petcore, the European trade association that fosters the collection and recycling of PET, reported that in Europe alone, 1.26 million tonnes of PET bottles were collected in 2008 - more than 46% of all bottles. After exported bales were taken into account, 0.803 million tons of PET flake were produced. 0.36 million tons were used to produce fibres, 0.163 million tons to produce more bottles, 0.177 million tons to produce APET sheets, 0.088 million tons for strapping tape and 0.012 million tons for miscellaneous applications.

Consume of PET bottles across EU in tons

| Evolución Consumo Europeo PET | | | | | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Ktm (PCI,Petcore,ANEP) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2010 | 2015 |
| Italia | 420 | 454 | 485 | 504 | 525 | 550 | 650 | 725 |
| Francia | 291 | 316 | 344 | 366 | 395 | 420 | 550 | 660 |
| UK | 253 | 277 | 294 | 312 | 330 | 345 | 420 | 480 |
| España | 151 | 181 | 206 | 229 | 248 | 275 | 385 | 485 |
| Belgica | 117 | 131 | 145 | 162 | 175 | 190 | 250 | 300 |
| Polonia | 99 | 118 | 126 | 136 | 146 | 155 | 210 | 260 |
| Alemania | 72 | 111 | 128 | 171 | 218 | 260 | 500 | 700 |
| Turquía | 77 | 87 | 96 | 104 | 118 | 130 | 180 | 220 |
| Grecia | 48 | 62 | 72 | 82 | 88 | 95 | 130 | 160 |
| Resto (12) | 186 | 207 | 217 | 233 | 245 | 255 | 310 | 360 |
| Total | 1.714 | 1.944 | 2.113 | 2.299 | 2.488 | 2.675 | 3.585 | 4.350 |
| Var. % | | 13,4 | 8,7 | 8,8 | 8,2 | 7,5 | med. 6,8 | med. 4,3 |

Positives about PET

- Easy to use
- Very durable
- Good chemical resistance
- 7.3 times less CO₂ emission during bottles production compared to glass bottle production
- Cheaper transport and again less CO₂ as PET bottles are much lighter
- Good source of combustion/heating energy
→ electricity production

Negatives

- Made of petroleum.
- Depleting resources.
- Degrade very slowly – it takes up to 700 years for a PET bottle to decompose.
- Burning plastic can release toxic fumes
- Manufacturing of plastics often creates large quantities of chemical pollutants.
- Difficult and expensive recycling.
- Accumulation of enormous quantities of plastic trash in ocean gyres.

Recycling

1. Chemical recycling

- Recycling back to initial raw material
- Becomes cost-efficient only when recycling at a plant with capacity more than 50 000 tons/year.
- Difficult to achieve a consistent waste bottles sourcing at one single site.
- Price volatility of collected bottles – currently EUR 500/ton.
- Producing toxic pollutants.

Recycling

2. Mechanical recycling (direct circulation)

- Cost efficient already at plant with capacity of 5 000 to 20 000 tons/year.
- Sensitive to impurities and contamination and material defects.
- Recycled PET can be reused as: fibre, film, performs, and bottle-to-bottle (new PETs)
- Better energy and time efficiency and less expensive than producing virgin PET material – when using the latest recycling technology.

PET recycling EU level

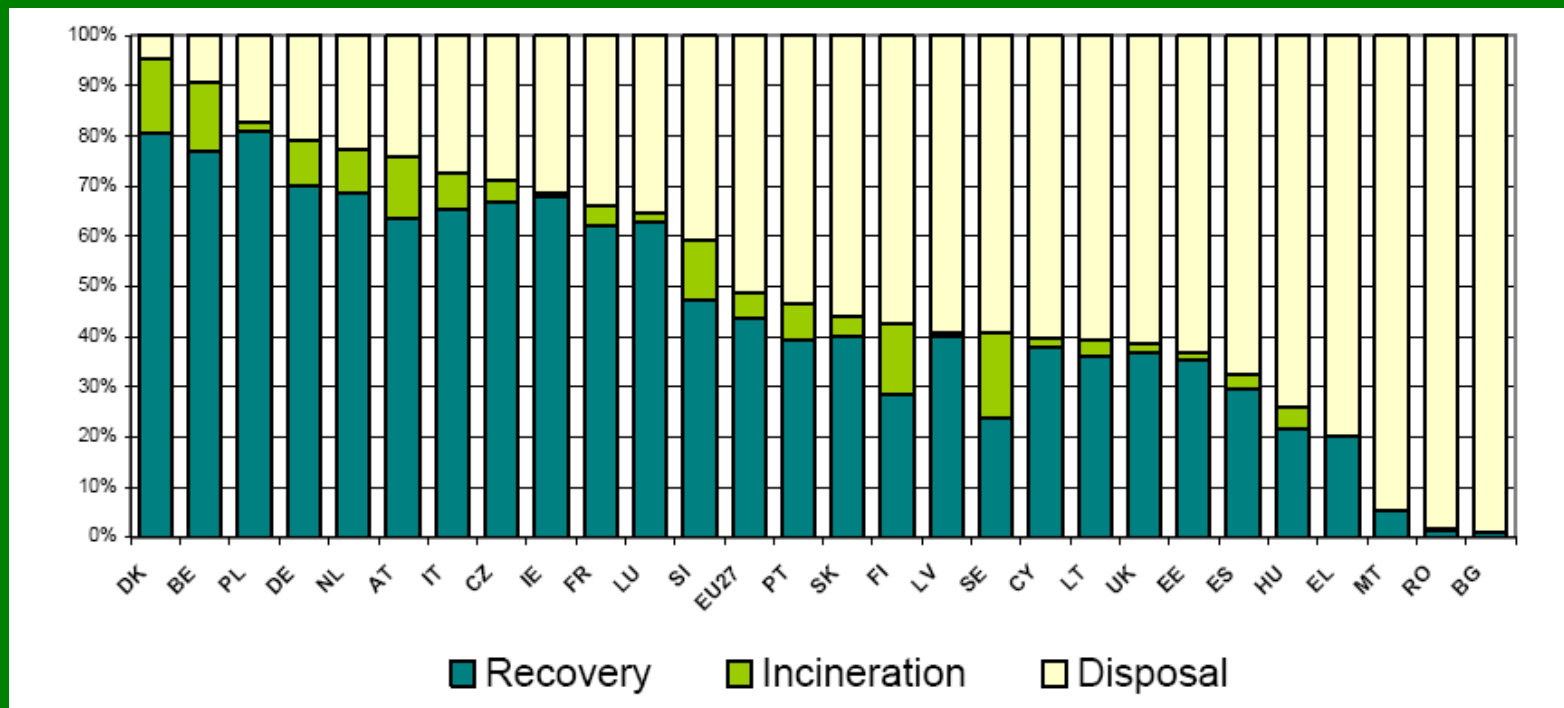
- The EU did not implement a general policy on PET recycling and at the moment there is no policy being discussed.
- The only directive regulating the packaging and waste management on the EU level is the European Parliament and Council Directive 94/62/EC from 1994 updated in 2004. This directive regulates the percentage of waste that must be recycled.

Directive 94/62/EC

REVISION of the Packaging Directive 94/62/EG

| | Old Directive | New Directive (February 2004) |
|--------------------|--------------------------|----------------------------------|
| Deadline for all | to 30.06.2001 | to 31.12.2008 |
| for P, GR, IRE | to 30.06.2005 | to 31.12.2011 |
| for new members | 2005 - 2009 | 2012 - 2015 |
| Recovery | Min.: 50 % Max.: 65 % | Min.: 60 % Max.: - |
| Recycling | Min.: 25 % Max.: 45 % | Min.: 55 % Max.: 80 % |
| Recycling specific | Materials | |
| Glass | Min.: 15 % | Min.: 60 % |
| Paper | Min.: 15 % | Min.: 60 % |
| Metal | Min.: 15 % | Min.: 50 % |
| Plastic | Min.: 15 % | Min.: 22,5 % |
| Wood | Min.: - | Min.: 15 % |

Domestic waste management across EU in year 2006



PET bottles policy in some EU countries

- Following countries have implemented PET bottles returning policy: Germany, Austria, Estonia, Denmark, Netherlands, Norway, Sweden, (Switzerland)
- When a consumers buys a soft drink in PET, a surcharge of up to 0,25 Euro is added to the price. When the bottle is returned the refund is paid back.
- There are 2 deposits: One-way (Einweg) and More-ways (Mehrweg)

Advantages of the system 1

One-way system

- Enables precise recycling as it is vital for the recycling process.
- Increases the recycling quote for PET.

More-way system

- PETs mostly regionally produced → create jobs, boost for the local economy, increases diversity
- Protects resources as one bottle can refilled up to 25 times.
- Energy efficient → GHS reduction.
- Short transportation distances.
- The logo can be combined with environmental labels.

Advantages of the system 2

Both

- Waste reduction (no PETs lying around in parks or around roads).
- Consumers directly improve the environment.
- Consumers are able to return PETs anywhere regardless the purchase location as long as they are returned within country of purchase.
- Reduce the amount of household waste.

PET Policy in the Czech Republic

- Ministry of Environment has conducted 3 independent surveys about effectiveness of PET consumer return policy.
- According to the results the PET recycling quote could be increased to 75%.
- If the legislation proposal is successful, the same policy like in Germany would be implemented in 2012.
- Opponents claim the policy would actually have a negative impact on already high recycling quote of plastics in Czech – consumers currently sort 70% of plastic waste.
- EKO-KOM is the national agency regulating waste management in CR.

PET Policy Spain

- There isn't any consumer PET return policy like in the northern EU states and so far the parliament and relevant agencies are not discussing implementation of a similar policy.
- Recycling quote of plastics in Spain is just 24.5%. The rest of plastics end in landfills.
- In 1996 the first energetic recycling of PET (incineration) was implemented.
- CICLOPLAST is a Spanish national agency that encourage PET recycling in Spain. Cicloplast is focusing mainly on recycling plastics in the agriculture as that's where plastic and its chemical compounds cause most damage.
- Spain is now investing into the chemical recycling sites. Though these sites are not in operation yet.

PET Policy Spain

- The government is also investing into the change of behavior of the public regarding recycling and sorting of domestic waste. The agency overseeing the waste management is Ecoembes.
- Principal objectives of Ecoembes:
 - 1.Reduction of recycling costs
 - 2.Fostering international cooperation
 - 3.Educating children and students

Conclusion

- The negative impact of PETs on the environment is visible all across the world – for ex. Great Pacific Garbage Patch, Atlantic Plastic Debris
- The regulation of PET production and disposal is vital.
- Obviously market has failed to provide optimal output. Hence a regulation – probably on international level – is necessary.
- Another option would be replacement of PETs with bioplastics, which degrades fast and are made of organic renewable sources.
- We believe that anyone using PET bottles is freeriding as there are external cost being created. Plastic waste created by our generation will need to be cleaned at some point in the future.

Appendix 1

PET characteristics One/More-way logos

| PET | |
|--|-------------------------|
| Molecular formula | $(C_{10}H_8O_4)_n$ |
| Density amorphous | 1.370 g/cm ³ |
| Density crystalline | 1.455 g/cm ³ |
| Young's modulus (E) | 2800–3100 MPa |
| Tensile strength(σ_t) | 55–75 MPa |
| Elastic limit | 50–150% |
| notch test | 3.6 kJ/m ² |
| Glass temperature | 75 °C |
| melting point | 260 °C |
| Vicat B | 170 °C |
| Thermal conductivity | 0.24 W/(m·K) |
| linear expansion coefficient (α) | $7 \times 10^{-5}/K$ |
| Specific heat (c) | 1.0 kJ/(kg·K) |
| Water absorption (ASTM) | 0.16 |
| Refractive Index | 1.5750 |
| Price | 0.5–1.25 €/kg |
| source: A.K. van der Vegt & L.E. Govaert, Polymeren, van keten tot kunststof, ISBN 90-407-2388-5 | |



Appendix 2

More details on PET recycling can be found under:

http://en.wikipedia.org/wiki/Polyethylene_terephthalate#Polyester_recycling_industry

or http://www.petrecycling.cz/b2b_buehler.htm

History of plastics

Leonardo Da Vinci invented natural plastic made of animal and vegetable glue combined with organic fibres.

In 1862, Alexander Parkes was responsible for introducing the first man made plastic at the Great International Exhibition in London.

Appendix 4 – Recycling pics

APET Sheet



PET bales



Sources 1

- Arbeitskreis Mehrweg
GbR <http://www.mehrweg.org/content.htm>
- Das DPG Pfandsystem <http://www.dpg-pfandsystem.de/pb/site/dpg/node/210562/Lde/index.html>
- Buhler – PET recycling facilities -
http://www.petrecycling.cz/b2b_buehler.htm
- URRC – PET recycling facilities -
<http://www.rrrc.net/new/pages/>
- NABU Naturschutz Deutschland
<http://www.nabu.de/index.html>
- ANEP – PET http://www.anep-pet.com/pet_usos.php
- EKO-KOM <http://www.ekokom.cz/>

Sources 2

- Global Statistics http://en.wikipedia.org/wiki/PET_recycling#Global_statistics
- Czech Industrial Coalition for Packaging and Environment <http://www.cicpen.cz/>
- CICLOPLAST <http://www.cicloplast.com/prehome.html>
- Ecoembes <http://www.ecoembes.com>
- Eurostat http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Waste_statistics#Waste_generated_by_households