



Reasons for very low recycling rate of plastics in U.S. and means for increasing material or energy recovery from plastics.

Jawad A. Bhatti (Adviser: Prof. Themelis)
Earth & Environmental Engineering, Columbia University



The problem :

excessive landfilling of plastic

Of the 251 million tons of material solid waste was generated in 2006, and 11.7% of that was plastic.

Figure 5. Total MSW Generation (by Material), 2006
251 Million Tons (Before Recycling)

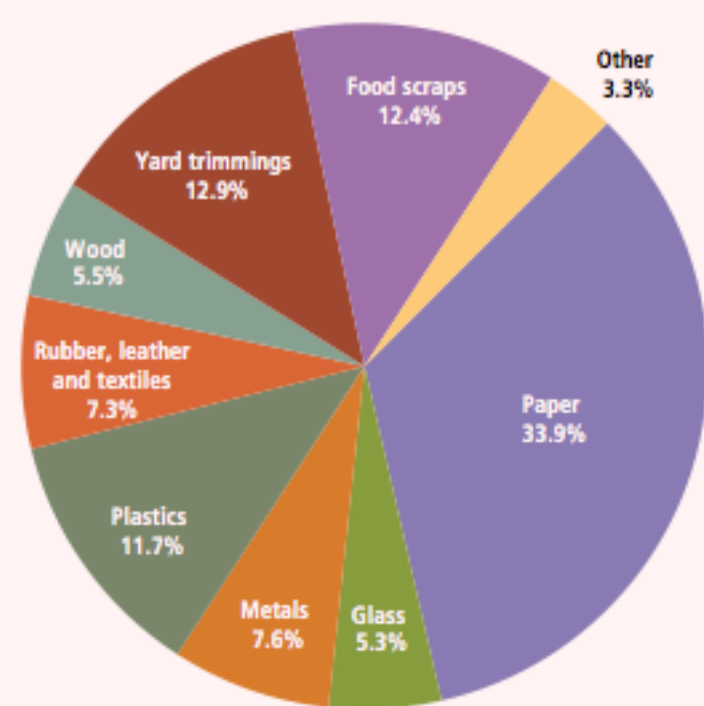
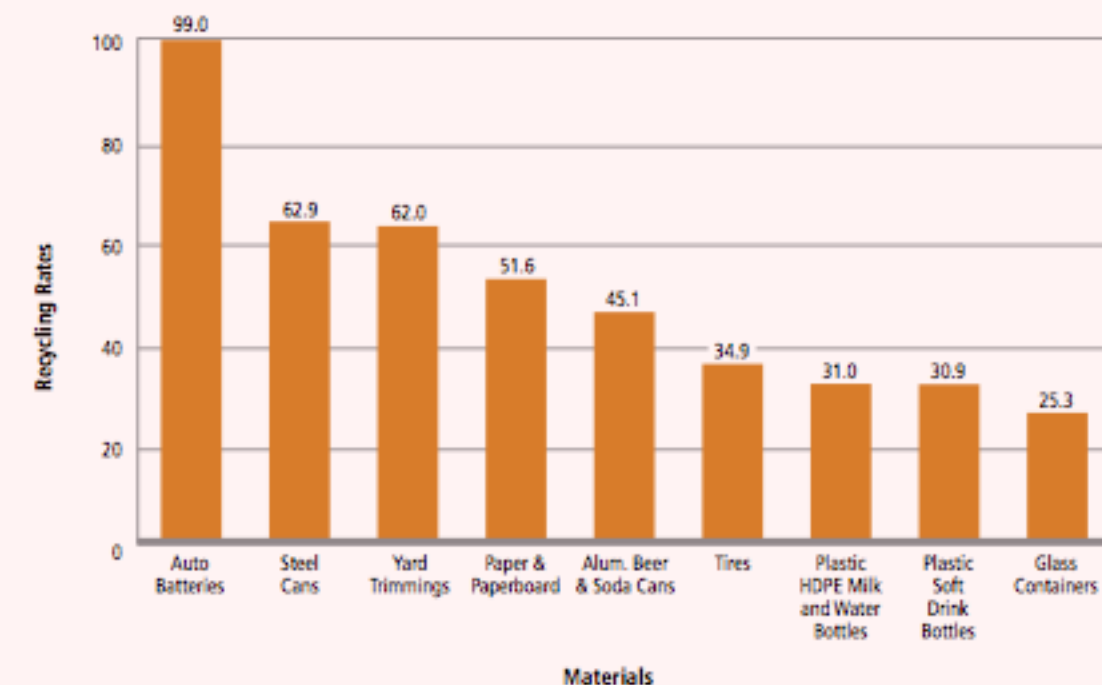


Figure 3. Recycling Rates of Selected Materials, 2006



Some plastics fared better than others; PET plastic soft drink bottles were recycled at a 30.9% rate, and HDPE milk & water bottles were recycled at a 31% rate. However, of the overall 29.5 million tons of plastic waste generated, only about 2 million tons were recovered -- a paltry 6.9%.

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006, Environmental Protection Agency

about plastics

Recycling No.	Symbol	Abbreviation	Polymer Name	Uses once recycled
1		PETE or PET	Polyethylene terephthalate	Polyester fibres, thermoformed sheet, strapping, and soft drink bottles. (See also: Recycling of PET Bottles)
2		HDPE	High density polyethylene	Bottles, grocery bags, recycling bins, agricultural pipe, base cups, car stops, playground equipment, and plastic lumber.
3		PVC or V	Polyvinyl chloride	Pipe, fencing, and non-food bottles.
4		LDPE	Low density polyethylene	Plastic bags, various containers, dispensing bottles, wash bottles, tubing, and various molded laboratory equipment.
5		PP	Polypropylene	Auto parts, industrial fibers, and food containers.
6		PS	Polystyrene	Desk accessories, cafeteria trays, toys, video cassettes and cases, and insulation board and other expanded polystyrene products (e.g., Styrofoam).
7		OTHER	Other plastics, including acrylic, acrylonitrile butadiene styrene, fiberglass, nylon, polycarbonate, and polyactic acid.	

In 1988, the Society of Plastic Industries developed Resin Identification Codes. However, while all these plastic types are technically recyclable, only PETE/PET and HDPE are widely recycled due to economic reasons.

http://en.wikipedia.org/wiki/Resin_identification_code

Potential solutions :

improve recycling technology

WORLD'S FIRST MIXED PLASTIC BOTTLE RECYCLING PLANT IN LONDON

A new plant which will enable soft drink and milk bottles to be turned back into food packaging has opened in London, UK. The project will keep a significant amount of packaging away from landfill as it turns 35,000 tonnes of recovered plastic bottles into raw material which can then be used to create new packaging.

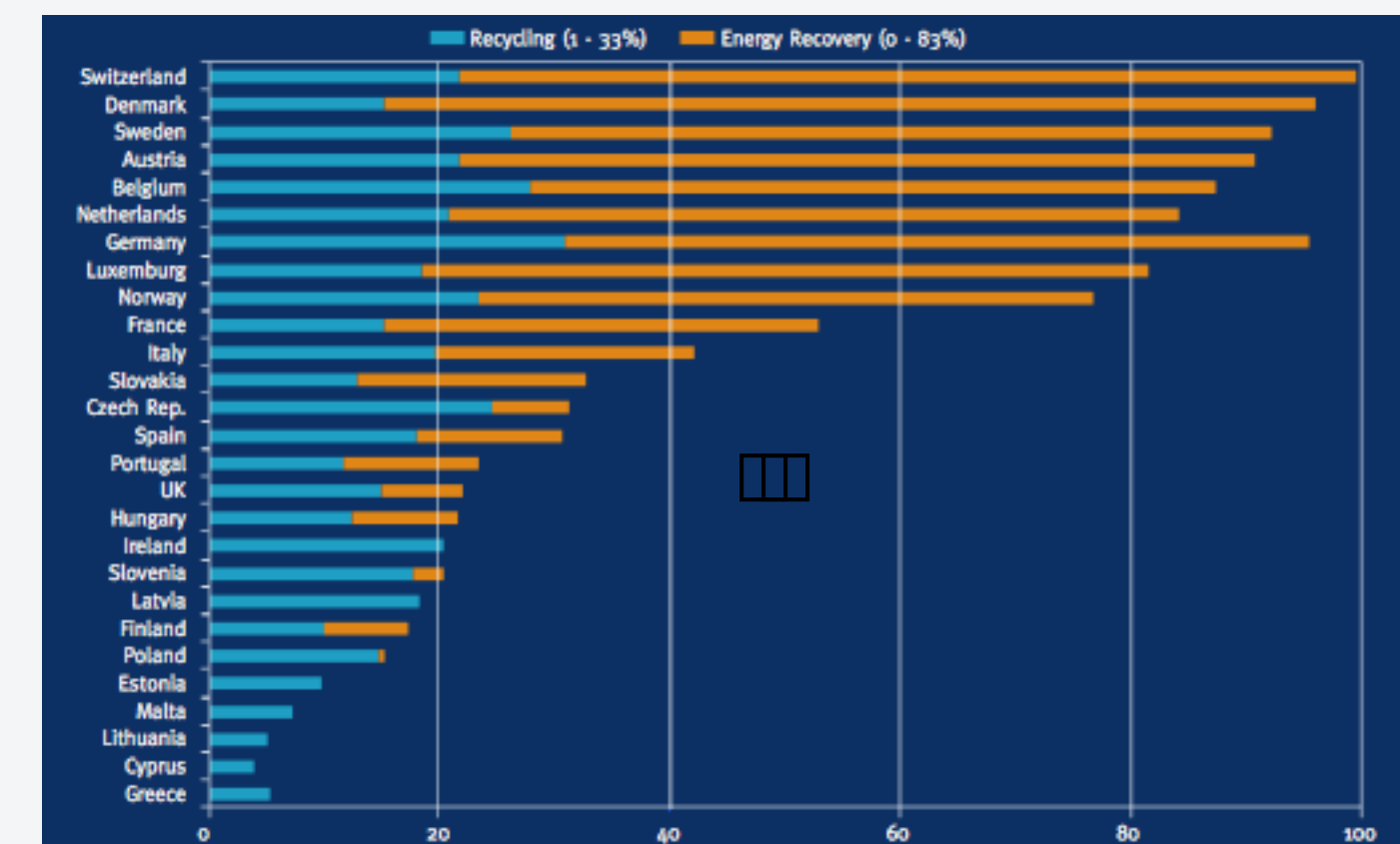
The plant has been funded by Foresight Group along with seed funding from Cleantech Environmental Solutions in Australia and grants from government-backed organization WRAP and the London Development Agency.

The first customers to buy the recycled material from the plant include Coca-Cola Enterprises, Marks & Spencer, Plamag, Plastics Europe and Solo Cup (Europe).



Currently, recycling technology is a limitation: Some recycling plants may take some types of PET/PETE, but reject slightly different polymers that are also labelled as PET. These technological hurdles are gradually being addressed.

combustion & WTE



Much of the EU is moving away from landfilling plastics, either by increased recycling or by energy recovery via combustion. Countries most successful at this, do a healthy mix of both.

reduction & carbon sequestration

Mazda develops plastic molding technology that reduces resin consumption by 30%

Wednesday 10th September, 05:07 AM JST

HIROSHIMA —

As part of its efforts to reduce vehicle weight, Mazda Motor Corp has developed a new plastic molding technology that enables a substantial reduction in the weight of plastic parts used in vehicles.



This plastic molding manufacturing technique cuts the consumption of plastic resins that are used as raw material by approximately 20 to 30%, with associated reductions in vehicle weight.

The most common manufacturing method for producing automobile plastic parts is injection molding. Mazda's improved injection molding process involves mixing supercritical fluid (SCF), made from common inert gases such as nitrogen or carbon dioxide, with the plastic resin raw material. The process utilizes a particular characteristic of SCF to mix readily with other substances at the molecular level to raise the fluidity of the liquid plastic resin and cause it to expand rapidly when injected into a mold. As a result, smaller amounts of the raw material resin are needed to fill molds.

Technology is emerging that may both reduce plastic consumption as well as sequester carbon dioxide into the plastic.

biodegradable plastics



plastic to liquid fuel



The potential for converting non-recyclable plastics back to fuels exists, but commercial viability is a long ways off.

creative reuse....?

