
# New paradigms in Recycling

*Extended abstract*

**Benjamin Herzog**
**Alba Ruiz de Alegría**
**Julius Weiss**

Communication Skills 1

Universitat Politècnica de Catalunya

December 15, 2016

# 1 Introduction

The materials that are extracted from the nature and transformed into consumed goods are called raw materials or primary resources. They can be renewables or non-renewables. The first ones are those that once extracted or consumed, can be produced again either by the action of nature or man. In contract, the non-renewable raw materials are those that once exhausted their reserves, cannot be re-exploited, given the impossibility of their production by man.

# 2 State of the art

**Downcycling** is the process of converting waste materials or useless products into new materials or products of lower quality and reduced functionality.

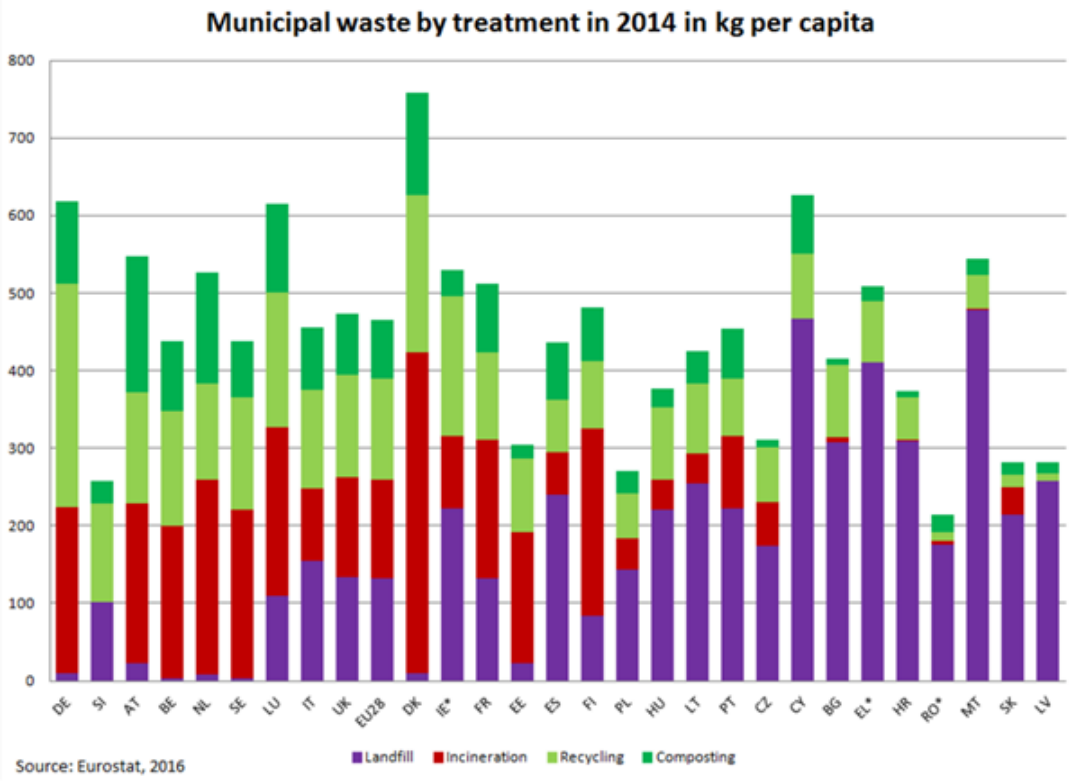
## 2.1 Pros

This process avoids the wearing down of potentially useful materials, reduce consumption of new raw materials, reduce energy use, reduce air pollution and water pollution, and reduce greenhouse gas emissions (although the reuse of chemicals Contaminated for other purposes may have the opposite effect), compared to the production of virgin materials.

## 2.2 Cons

Most recycling is actually Downcycling, which reduces the quality of a material over time. For example, the typical can of soda consists of two kinds of aluminum: the walls are composed of aluminum, manganese alloy with some magnesium, in addition to paints and coatings, while the top and bottom is an alloy of magnesium and aluminum. In recycling these conventional materials melt, resulting in a weaker and less useful product.

**Upcycling** is the process by which discarded materials or damaged products are transformed into new materials and products of equal or greater value that may be useful. This reduction in consumption leads to a reduction of the energy required for its construction (basic cause for air pollution, groundwater and greenhouse gas emissions).




According to the principles of EU waste policies, the disposal of waste should be the last option in waste management. Priority should be given to prevention, reuse, recycling and other forms of recovery. EU countries should recycle at least 50% ot their municipal waste by 2020.

ZWE also notes that Slovenia, a relatively new member state, is today the best EU country implementing waste hierarchy management practices with stable waste generation well below EU average and a high recycling rate. This makes of Slovenia the best performing EU country with the lowest amount of residual waste, just 102 kg per capita in 2014.

## 3 Bioplastic

Since its discovery in the middle of the 19. century, plastic became one of the most used material in the world. Our modern industry of the 21st century wouldn't be imaginable without plastics like Polyvinyl chloride (PVC) or Polyethylene terephthalate (PET) because of their properties, such as flexibility, lightweight and resistance to water and electricity.

Nevertheless, the most used plastic sorts are produced with mineral oil. Due to the increasing demand on plastic and the consumption through fuel for vehicles, experts assume that the oil resources will last for 40 more years. But that is not the only reason why it is time to develop alternatives to the conservative plastic sorts: Most of the plastic material need far more than 100 years to decay in nature, some of them are even known for not being degraded for millennia.

Therefore, organic, non-mineral plastics like the Polylactic acid (PLA) were discovered. The PLA for example can be produced out of starch from corn and has similar properties like conservative plastics: Cups and dishes can be made out of PLA, and even 3D-printers use this organic plastic as printing material. Moreover, PLA is not only produced without usage of fossil resources, but is also biodegradable under certain conditions that mostly only occur in a composting plant. Usually this means a temperature of ca. 60°C and the presence of oxide and humidity. This is the reason why the plastic isn't already decaying during its usage.

Today the plastic-pollution of the oceans are a big issue which could be solved or at least reduced by usage of biodegradable plastic. In addition, you can say that Bioplastics are the nutrient for themselves and is thus recycled: New organic life – like the corn plant which will be used for new PLA – uses the biodegraded plastic cup as a nutrient.

### 3.1 Critical View

All in all it seems that the idea of increasing the production and use of bioplastic is the solution for many issues and problems. Unfortunately, it is necessary to think further than just the material itself: Often the PLA is produced out of genetically modified corn and is transported from America to Europe, which increases the damage on the environment of PLA. Moreover, many composting plants aren't able to degrade bioplastics because of too short retention time: The biodegradable plastic is separated and then treated like conservative plastic. It is also senseless to substitute multi-way-systems with one-way-bioplastic, which increases the waste production remarkably. This is a good example for merchandising a "green" product in order to practice "greenwashing" for the image of a company. A closer look reveals that it is important to think first and act afterwards. Only if innovative materials like Bioplastic is used reasonably, there is a way to overcome today's issues of recycling.

## 4 Ecodesign

Nowadays the high-tech products are often built by a mixture of materials. Materials are mixed to generate the best performance of material as possible. This mixture leads to a big problem when it comes to recycling of those products. Once mixed it becomes

difficult to separate afterwards. Often the companies do not spend thoughts on the life after use of the products. The lack of thinking ahead possible recycling technologies leads to the conclusion that most of the trash will be burned. This cannot be the goal for a society depending on limited resources. To avoid this waste the principles of eco-design should be applied.

Eco-design means a recycling compatible design of products. Therefore the following rules should be considered:

- Do not use composite materials if they are not needed
- Make sure an easy deconstruction of different parts and materials of the product
- Use of secondary raw materials as high as possible
- Preference of renewable material because there is already a recycling process given
- Preference of materials where recycling technology is previously known
- Installation of parts containing pollutants on a well-known space where it can be found and removed before recycling

An example for products where the idea of eco-design often is not implemented yet are those where rare earth elements (REEs) are used, such as consumer electronics, electro-magnets, batteries etc.

REEs have particular properties essential to many industries. Modern high-tech growth industries and clean energy technologies depend on them. Therefor they are considered as critical raw materials. Their demand is highly and steadily increasing in the last years since more and more product contains them. As there is no noteworthy source of REEs in Europe they are imported for a very limited number of producers to the European Union. China has been almost the sole supplier of REEs to the rest of the world. To become more independent on REEs it would be a good opportunity to recycle them and reuse secondary supply of materials. But currently less than 1% of REEs enter the recycling loop.
This is because in most products REEs have only a very little share of the whole product, so main components might be recycled but not the REEs. Techniques for recycling of RREs are not very efficient and very expensive at this time. Only half of the all REE elements are currently capable of being recycled. For the others techniques are not invented yet. Though there should be put lots of effort in research for better collection of trash containing REEs and better techniques to recycle them and making the process profitable.

# 5 Sources

http://www.plastic-planet.at/die-geschichte-des-kunststoffs (13.12.2016)

http://www.urbanara.co.uk/journal/buying-guide/plastic (13.12.2016)

http://www.wiwi.uni-muenster.de/vwt/Veranstaltungen/Ausgewaehlte_Kapitel_der_Energiewirtschaft/WS1112/02a_globale-energiemrkte.pdf (13.12.2016)

http://www.duh.de/presse/pressemitteilung/?no_cache=1&tx_ttnews%5Btt_news%5D=2748&cHash=769b41ab2a3cc6476dadc09ae599826b (13.12.2016)

https://www.oeko.de/oekodoc/1112/2011-003-en.pdf (14.12.2016)

http://www.europarl.europa.eu/RegData/bibliotheque/briefing/2013/130514/LDM_BRI(2013)130514_REV1_EN.pdf (14.12.2016)

Universität Stuttgart, lectures ISWA, Resource management, 2015

Universität Stuttgart, lectures ISWA, Waste treatment, 2015

https://www.zerowasteeurope.eu/2016/03/press-release-eurostat-data-for-2014-confirms-need-for-european-residual-waste-target (12.12.2016)

http://www.dforceblog.com/2010/03/11/%C2%BFque-es-downcycling-o-infraciclado (13.12.2016)

http://www.ecologiaverde.com/el-upcycling-supra-reciclaje (13.12.2016)

http://www.eea.europa.eu/about-us/competitions/waste-smart-competition/recycling-rates-in-europe/image_view_fullscreen (13.12.2016)