



**National Technical University of Athens  
School of Chemical Engineering  
Unit of Environmental Science & Technology (UEST)**

# **Sustainable Municipal Solid Waste (MSW) Management**

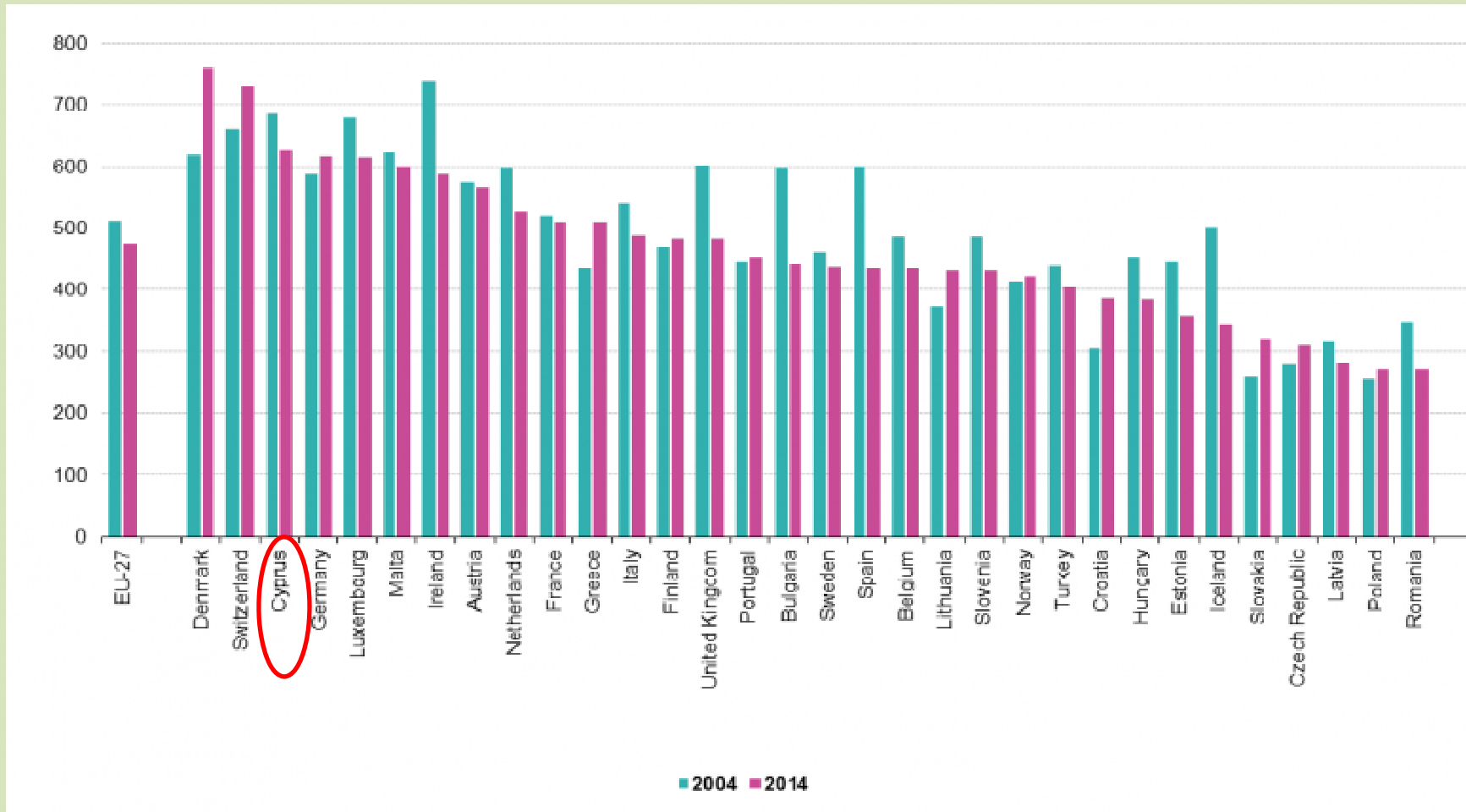
**Prof. Maria Loizidou**

[www.uest.gr](http://www.uest.gr)

**CYPRUS 2016**

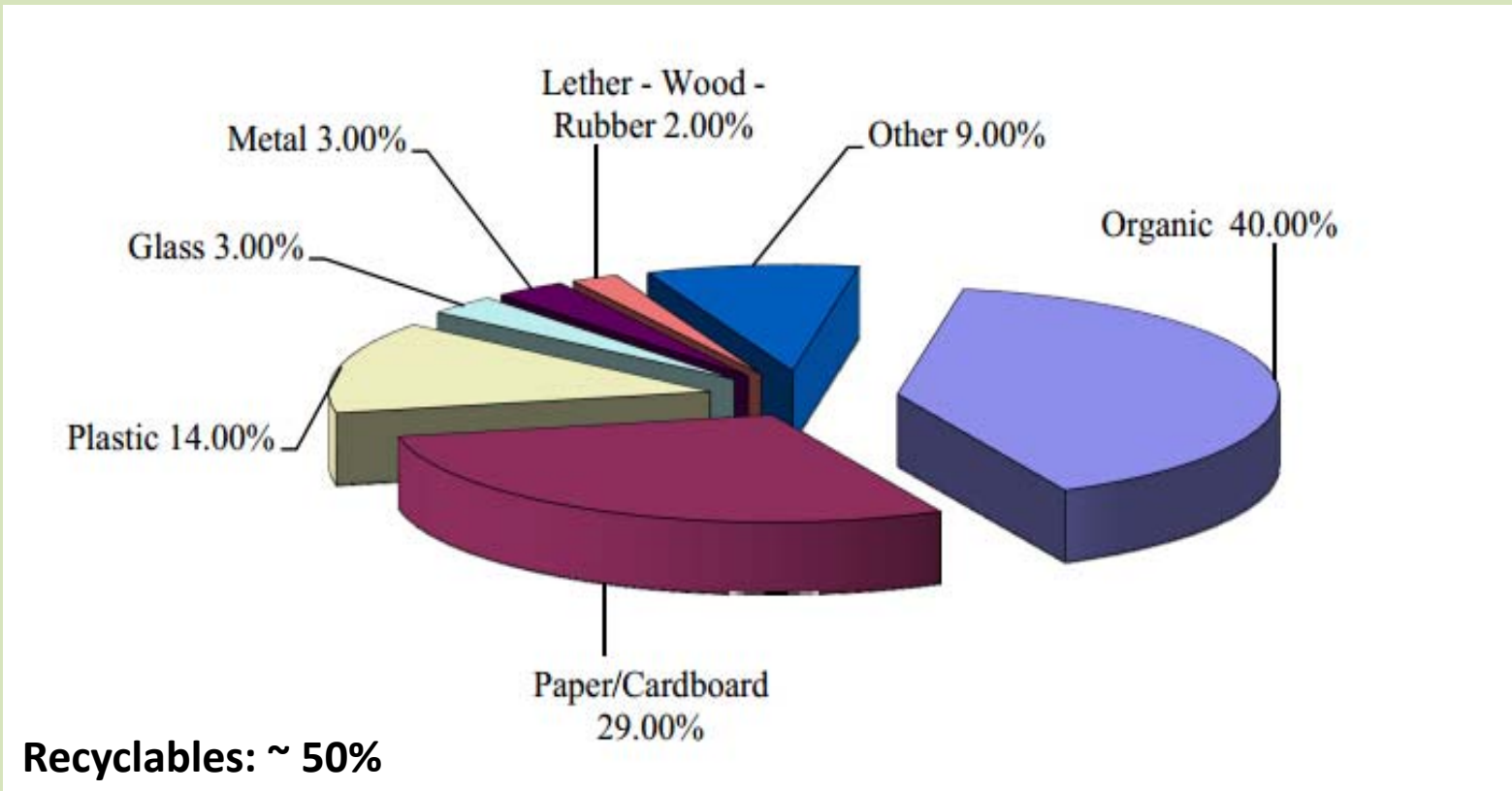
**4th International Conference on Sustainable Solid Waste Management.  
Limassol, 23-25 June 2016**

# MSW generation (2014)

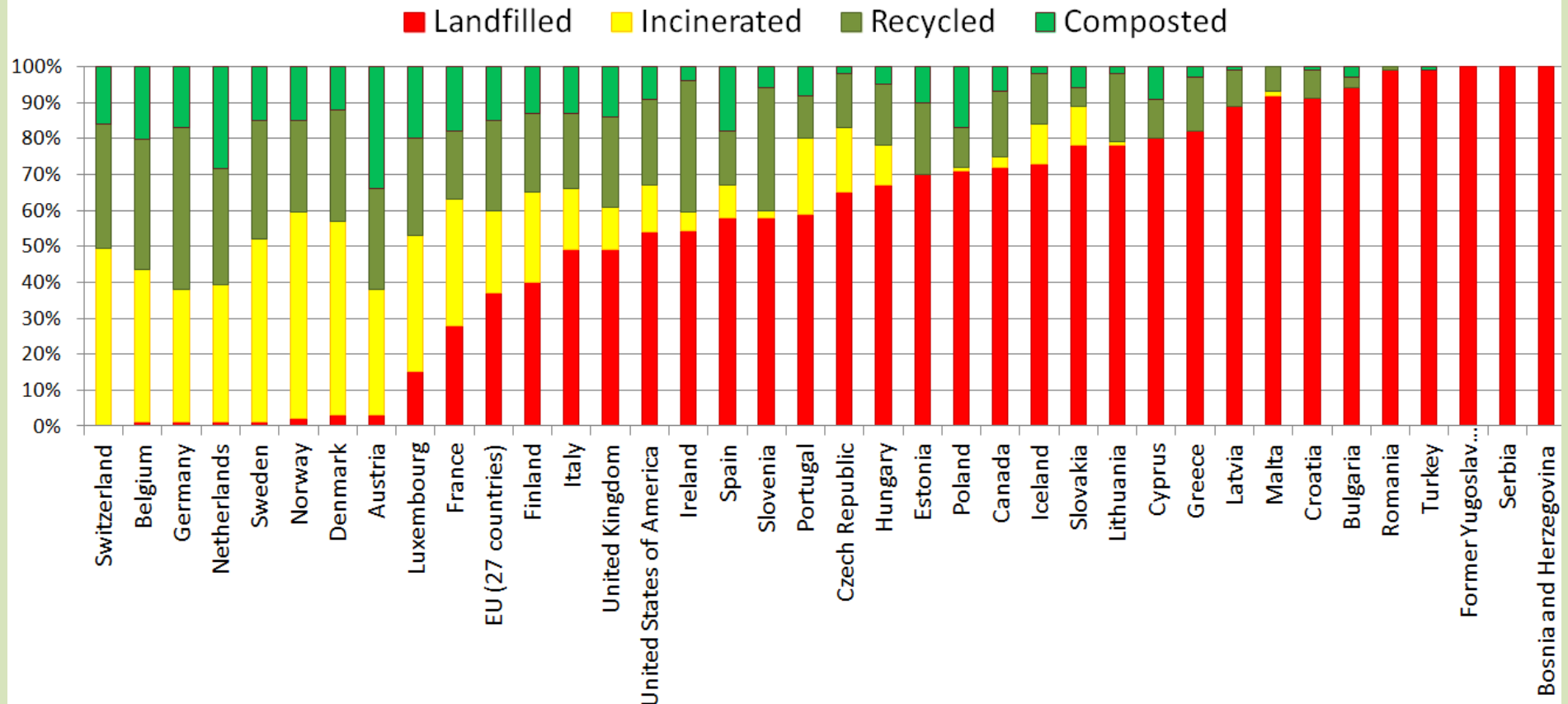


Municipal waste generated by country in 2004 and 2014  
(kg per capita)

# MSW Composition

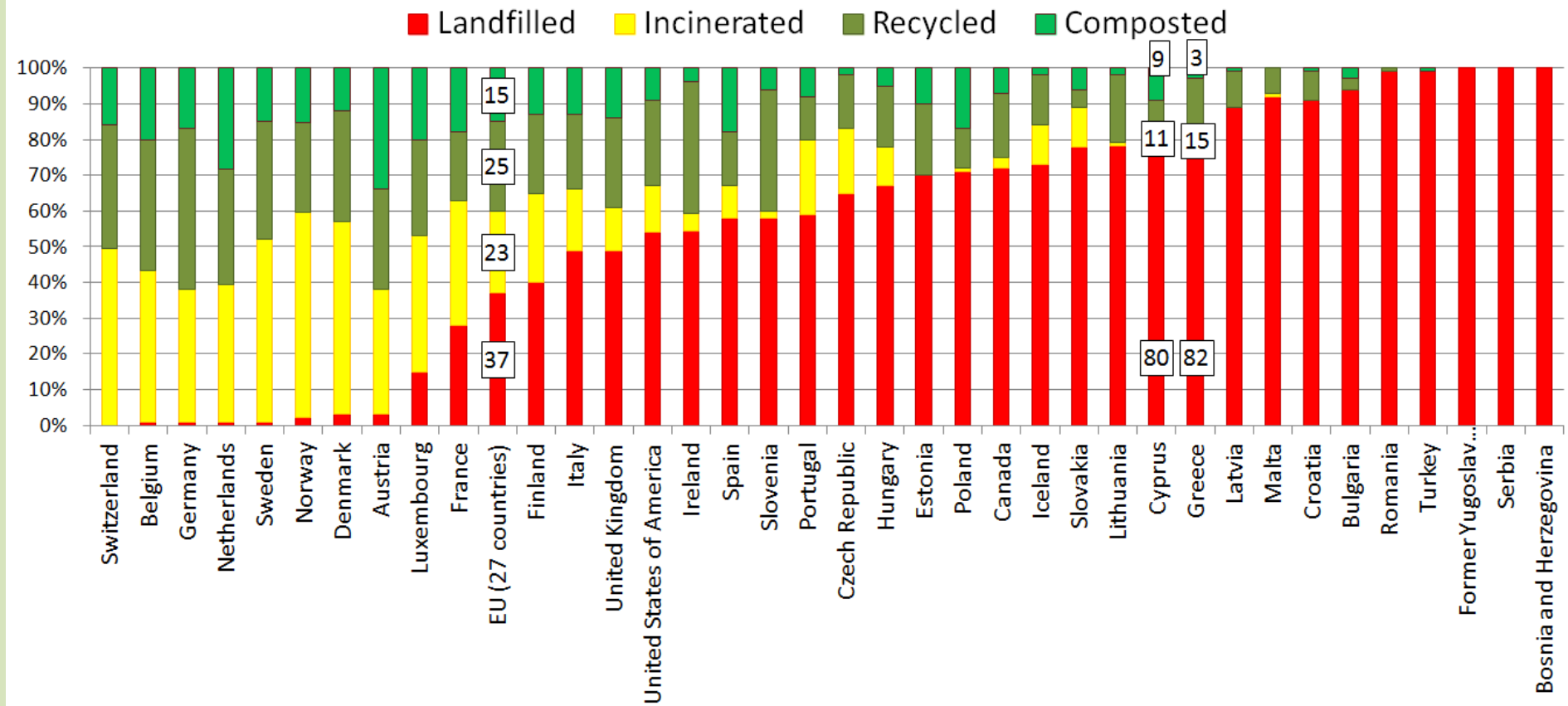


# MSW Management in EU27+ Canada & USA



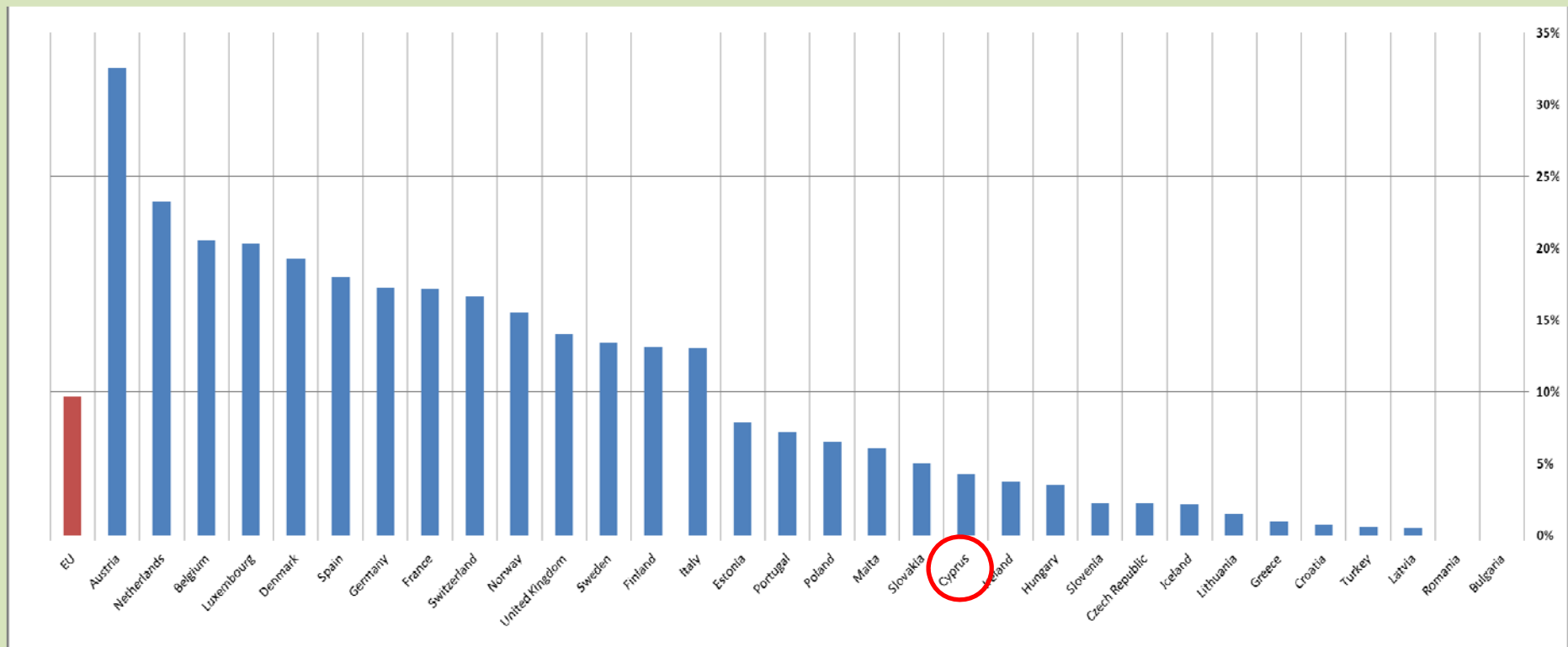
Source: Eurostat, press release 33/2013 (March 2013)

# MSW Management in EU countries (Eurostat 2013)



In the EU during 2013, 40% of total MSW was recycled or composted

# Biowaste Management in EU countries (Eurostat 2013)



# Environmental policy on waste



According to Framework Directive on Waste 98/2008

# Circular Economy





## Basic MSW management Legislation (1/3)

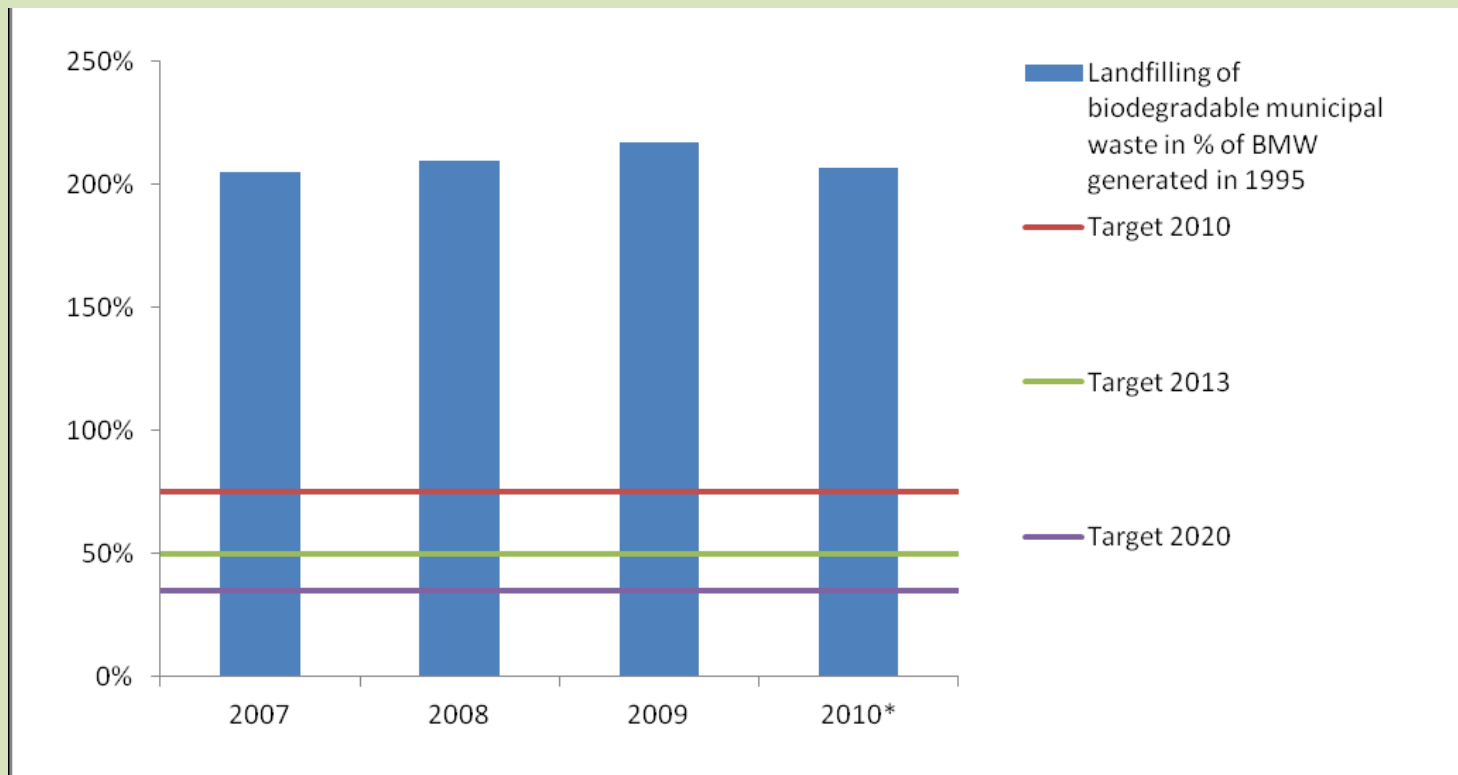
### Framework Directive on Waste 98/2008

Priorities include:

- Prevention – Reduction – Separate collection of at least paper, glass, plastics and metals from 2015.
- The separate collection of organic waste is also encouraged.
- High reuse and recycling targets for materials (at least 50% for municipal solid waste until 2020), & energy recovery.

## Basic MSW management Legislation (2/3)

### Reduction targets for biodegradable municipal waste (1999/31/EC)



Substantial efforts will have to be undertaken for the fulfillment of the 50% and 35% targets of the EU Landfill Directive for diverting biodegradable municipal waste from landfill.

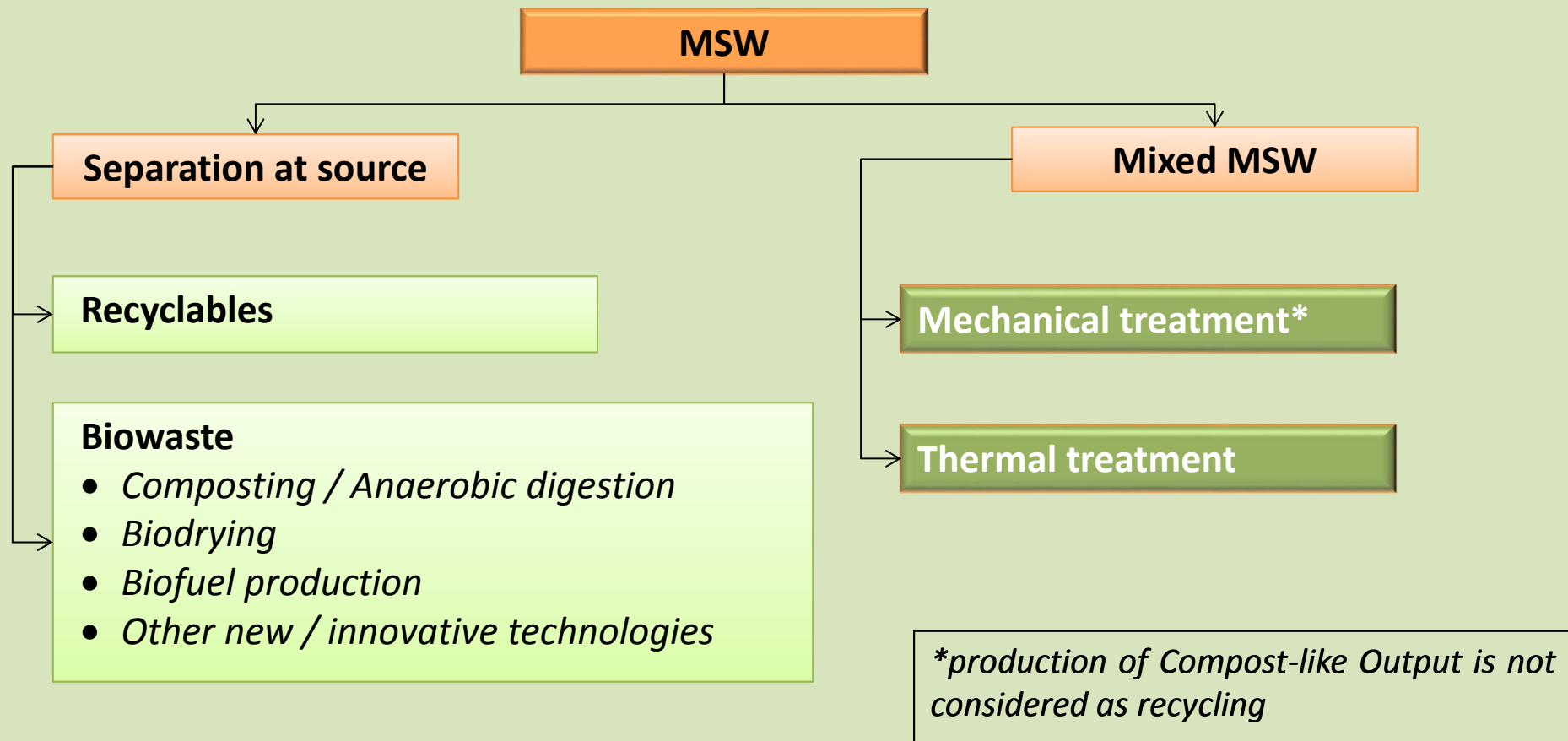
## Basic MSW management Legislation (3/3)

### Minimum recycling targets for materials contained in packaging waste (Packaging Directive 94/62/EC)

Minimum 55% & maximum 80% for packaging waste as a whole

- 60 % by weight for glass
- 60 % by weight for paper and board
- 50 % by weight for metals
- 22,5 % by weight for plastics, counting exclusively material that is recycled back into plastics
- 15 % by weight for wood

# MSW management outline



## Problems to be tackled in MSW management

- Collection, transport, treatment / recycling and disposal of Municipal Solid Wastes (MSW), have become a relatively difficult problem to be solved by the competent authorities in a sustainable way.
- High quantities of waste being landfilled, low rates of recycling and separation at source, are the main reasons for non-sustainable MSW management.
- EU and National legislation sets demanding targets.
- The solution should be sought through the decentralized solid waste management at municipality level while the central facilities should accept much smaller quantities for final treatment.

## Key points & benefits of sustainable decentralized MSW management

### Separation at source!

- Recyclables (constitutes ~50% of MSW)
- Biowaste (constitutes ~40% of MSW)

### Local treatment of separated wastes

- Minimization of transfer costs

*(MSW collection and transportation, is considered to be the most fuel-intensive step in waste management)*

- Growth of local economy

The decentralisation of waste management enables the population to be actively involved in organising and financing waste management services.

- Higher recycling rates & better quality of end products  
Higher prices → Less management costs

## Outline of a Sustainable decentralized MSW management plan

- The special characteristics of the region (seasonal variations of the generated quantities, availability of land for waste management facilities, size of the served areas, need for cooperation with neighboring municipalities, etc.).
- Adoption of the priorities of environmental policy and legislation.
- The current progress in the methods, practices and technologies for the treatment of municipal solid waste.
- Assessment of alternative waste management scenarios for separation at source, based on specific criteria (e.g. population density, costs etc).
- Planning awareness raising campaign (*informative campaigns, distribution of printed informative material, organization of workshops and other informative events*).

# Separation at source

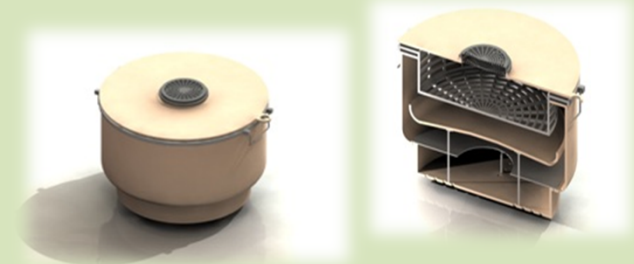




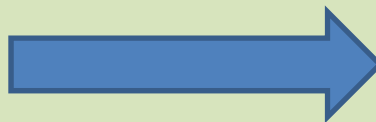
## New biowaste treatment

### Household biowaste drying

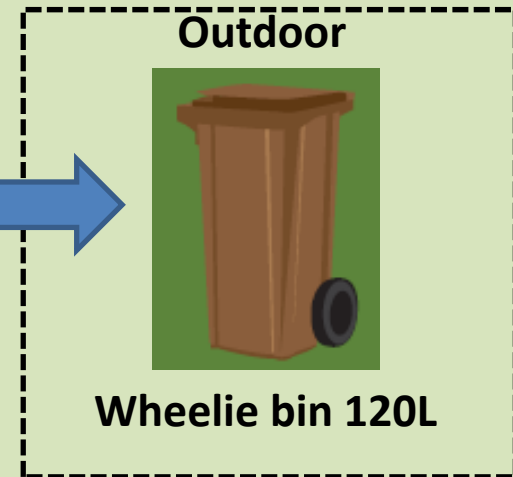
- Significant reduction of biowaste mass & volume at source (70 to 90% reduction)
- Significant reduction of waste collection & transportation cost → **Cost minimization: ~ 60%**
- Absence of nuisance
- Production of high added value biomass



### Biofuel (bioethanol) production from biowaste



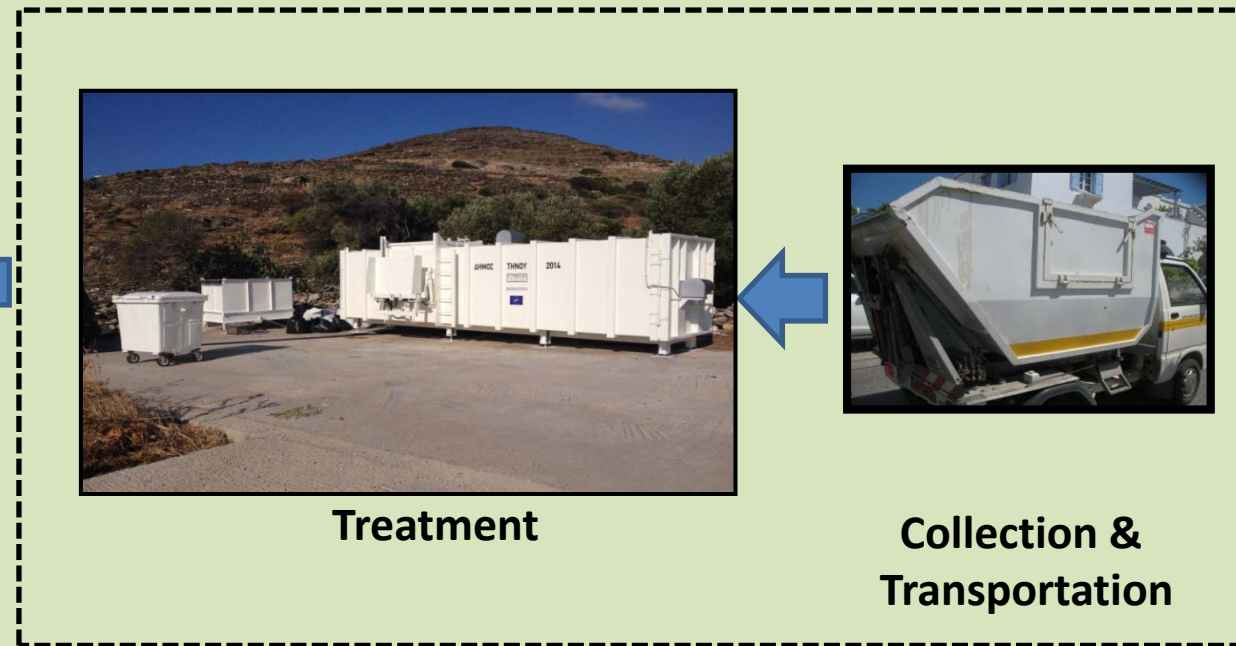
# Setup scheme for biowaste



**Compost**



**Fuels**



## Alternative set up scheme for biowaste (1/2)

120-360L bin for apartment blocks

10L bin per household  
(including biobags)



35-50L for single-family detached residences

## Alternative set up scheme for biowaste (2/2)

**Biowaste weighting**



**Biowaste reception area**



**Biowaste unloading**

## Conclusions

- Key objective should be the **decentralization of solid waste management (municipality level) & public awareness raising and involvement.**
- Focus should be given on **separation at source of Biowaste** (*which constitute around 40% of MSW*) and **Recyclables** (*around 50% of MSW*).
- Benefits include:
  - Minimization of transfer costs, high rates of separation at source / better quality of end products / higher selling prices, growth of local economy / jobs creation.



**Thank you for your attention!**

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