



Aalto University  
School of Engineering

# Waste Management and Recycling

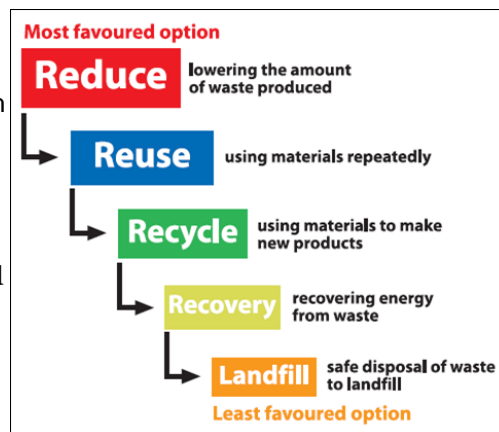
## Source separation systems and recycling economy

*Dr, Dos. Petri Kouvo*

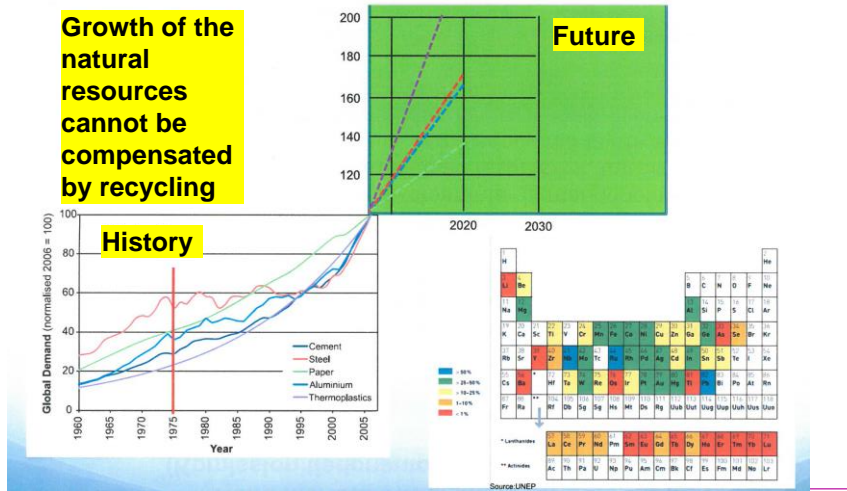
### Why to recycle?

#### Waste act § 8

- **Waste Hierarchy** means  
General obligation to comply with order of priority
- Order of priority is a binding option but
  - Priority order may change if better overall result is achieved
  - Example: recycling of packaging waste versus energy utilization



## Natural resources do not last forever



## But do we recycle only because it is obligatory and regulated or for some other reasons as well? 1/5



Yes, there is other reasons

- **Biowaste or biodegradable waste**
  - The goal is to recycle at least 50 % of Municipal Solid Waste until 2016
    - *To reach this goal is not possible without separate collection and recycling of biowaste*
  - Based on landfill decree the landfilling of biowaste and biodegradable waste is prohibited from 2016 on (Finland)
    - *To mitigate the harm full environmental effects of landfill gas (methane) and other harm full emissions (odours) formed in anaerobic digestion process at landfills*
    - *To promote the recovery of bio based energy (biogas, biofuel) and nutrients*
    - *Reduce the amount of waste landfilled*

## But do we recycle only because it is obligatory and regulated or for some other reasons as well? 2/5

Yes, there is other reasons

- **Metals, Glass, Plastics, Cardboard and Wood packages**
    - Based on decree on packages and packages waste producer must organize the separate collection and recycling so that from 2016 on of:
      - *Cardboard packages 80 % (cartons etc.)*
      - *Wood packages 17 %*
      - *Glass packages 27 %*
      - *Metal 75 %*
      - *Plastic packages 16 %*
- at least is recycled

## But do we recycle only because it is obligatory and regulated or for some other reasons as well? 3/5

Yes, there is other reasons

- **Metals**
  - Metals are valuable recyclables but amount of metals in household MSW is low only 5-6 kilos/person/a
  - Main part of the metals ending up to recycling origins from industry and other metals than packages
  - But
    - *To reduce the amount of metal in household mix waste reduces also inert material in combustion and lowers the amount of the bottoms ash*

## But do we recycle only because it is obligatory and regulated or for some other reasons as well? 4/5

Yes, there are other reasons

- **Cardboard**
  - Amount of cardboard in household MSW is high, 22-26 kilos/person/a
  - Cardboard fibers have a market value, but the cost of collecting and transportation is high is low due to the lightness of the material (low density)
  - Energy utilization? Yes, but does not serve recycling
- **Glass packages**
  - Amount of glass packages low in household MSW, 3-5 kilos/person/year
  - But glass in combustion is useless and increases the amount of waste and bottom ash
  - Finland differs from other countries because of enhanced refund system for glass and plastic bottles -> ends up to reuse
  - Can be used as raw material in glass industry or as construction material (substituting virgin materials like gravel)

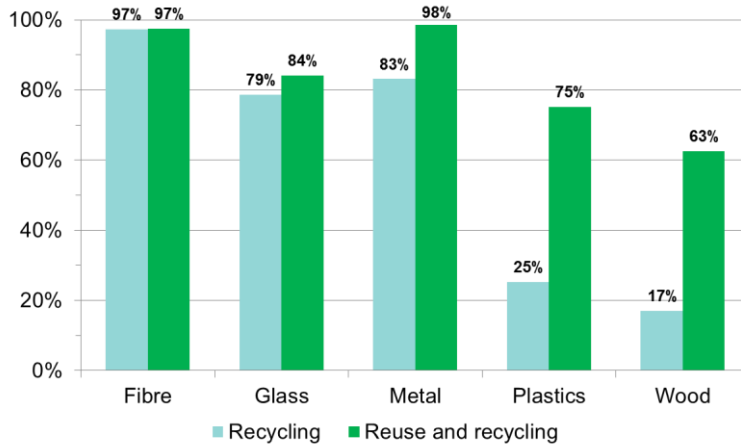
## But do we recycle only because it is obligatory and regulated or for some other reasons as well? 5/5

Yes, there are other reasons

- **Plastic packages**
  - Amount of plastic packages in household MSW is high, nearly 30 kilos/person/a
  - But plastic packages are difficult to recycle (use as raw material for new plastic goods) because of the wide variety of the plastic types used in packages
  - In Finland PET bottles are part of the refund system
  - In many other European countries they end up to MSW and are separated mechanically

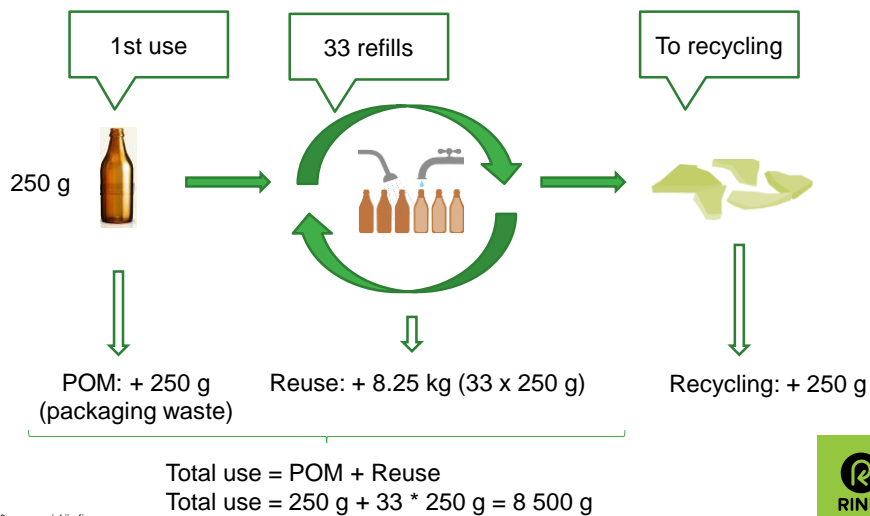
## How good we are in recycling and reuse of packages

OVERALL RECYCLING VS. COMBINED REUSE AND RECYCLING IN FINLAND (YEAR 2013)



9 • www.rinkin.fi

### CALCULATION METHOD FOR REUSE OF PACKAGING: - A REFILLABLE GLASS BOTTLE AS AN EXAMPLE



10 • www.rinkin.fi

## Paper, batteries, clothes, cars and tires 1/2

**Paper:**

- Separate collection of paper waste started in twenties in Finland
- Paper fiber can be recycled 3-5 times
- Around 75 % recycling rate, 750 000 tons collected
- Reused in toilet paper, kitchen paper and newspaper production

**Batteries:**

- Collected at stores (red cardboard box)
- Valuable metals recycled

**Clothes:**

- Flee markets, Red Cross etc. -> reuse or recycling
- Cleaning cloth

**Cars:**

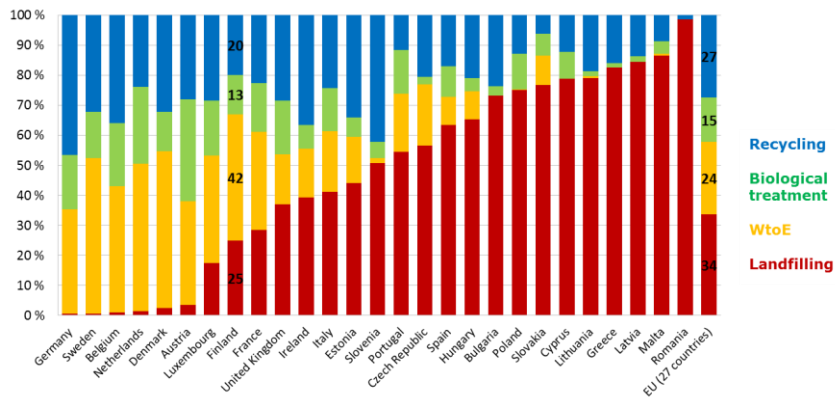
Demolition and recycling arranged by Licensed operators (Kuusakoski Oy)

- Owner of the car gets demolition certificate and operator is responsible for treatment of the car

**Tires:**

- Customer leaves old tires for reuse or recycling while buying new tires
- Tyre can be vulcanized again or used as crushed grain in noise barrier constructions or asphalt filling
- Truck tires also used as explosion rugs

## Recycling rates in European Union area



# Metropolitan Area Waste Management System

## Reuse

- Recycling centres
- Flea markets

## Containers of hazardous waste (approx. 70 units)



- Medicines to pharmacies

## Sorti-stations

- Kivikko
- Konala
- Ämmässuo
- Ruskeasanta (in 2015)
- K-nummi (in 2018)
- Munkinmäki waste station



## Source separation



## Local recycling points (approx. 120 units)



- Glass
- Paper
- Cardboard
- Metal
- Textiles

## Collecting trucks



To recycling

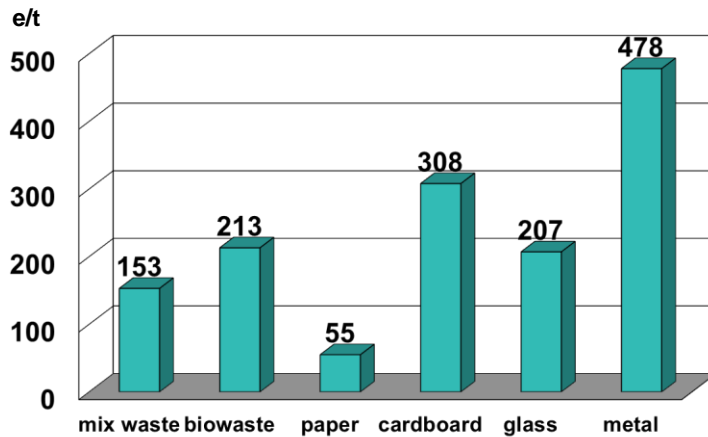
Dr Petri Kouvo, HSY Waste Management 16.9.2015

## Source separation and Collection

- In households source separated wastes collected at property waste rooms or shelters
- Own bin (code colored) for each waste type
- One truck for waste type or multilocker trucks (metal + glass)
- Frequency of emptying by waste type or by property owners order
  - Biowaste once a week (not deep collection)
  - Mix waste varies per waste generated at property
  - Glass and metal normally 4 or 8 week frequency



## Waste costs/ton of waste for property holder (including VAT and rent of the bin)



## Main problem of recycling is the loss of value, not the collection efficiency

