SUN
Sustainable Nanotechnologies Project

DTU

Waste flow analysis of nanoproducts
- Cases: EU, Denmark and the UK

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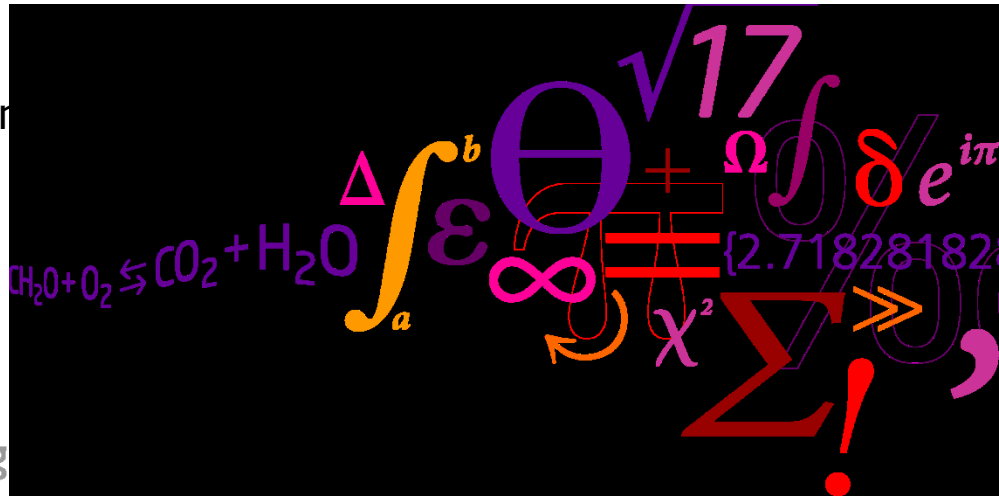


DTU Environment
Department of Environmental Engineering

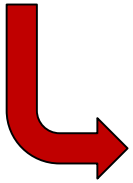
Outline

- Introduction
- Aims of study
- Methodology
  - Steps 1-4
- Cases
  - Denmark, UK
- Perspectives

Introduction

- Nanowaste is generated in increasing amounts
  - How much?
  - Where does it go?
  - What are the risks?
  - How should we manage it?

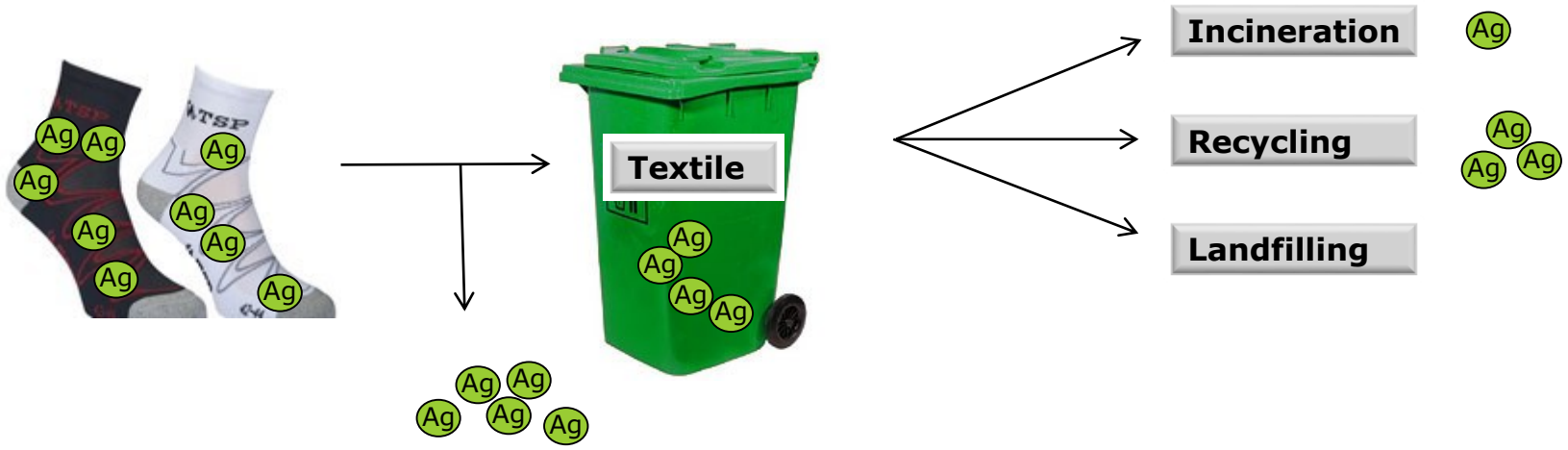
- Mapping flows of nanoproducts to waste treatment systems is needed



  - Help to prioritize research and waste management initiatives
  - Ensure safe and appropriate management

Aim of this study

- Develop tools for the analysis of nanoproducts in waste flows
- Assess the relative importance of ENMs and treatment options

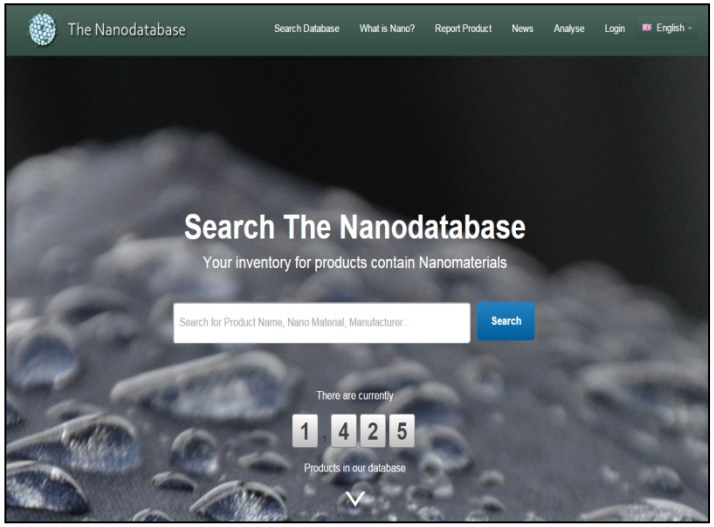


Methodology

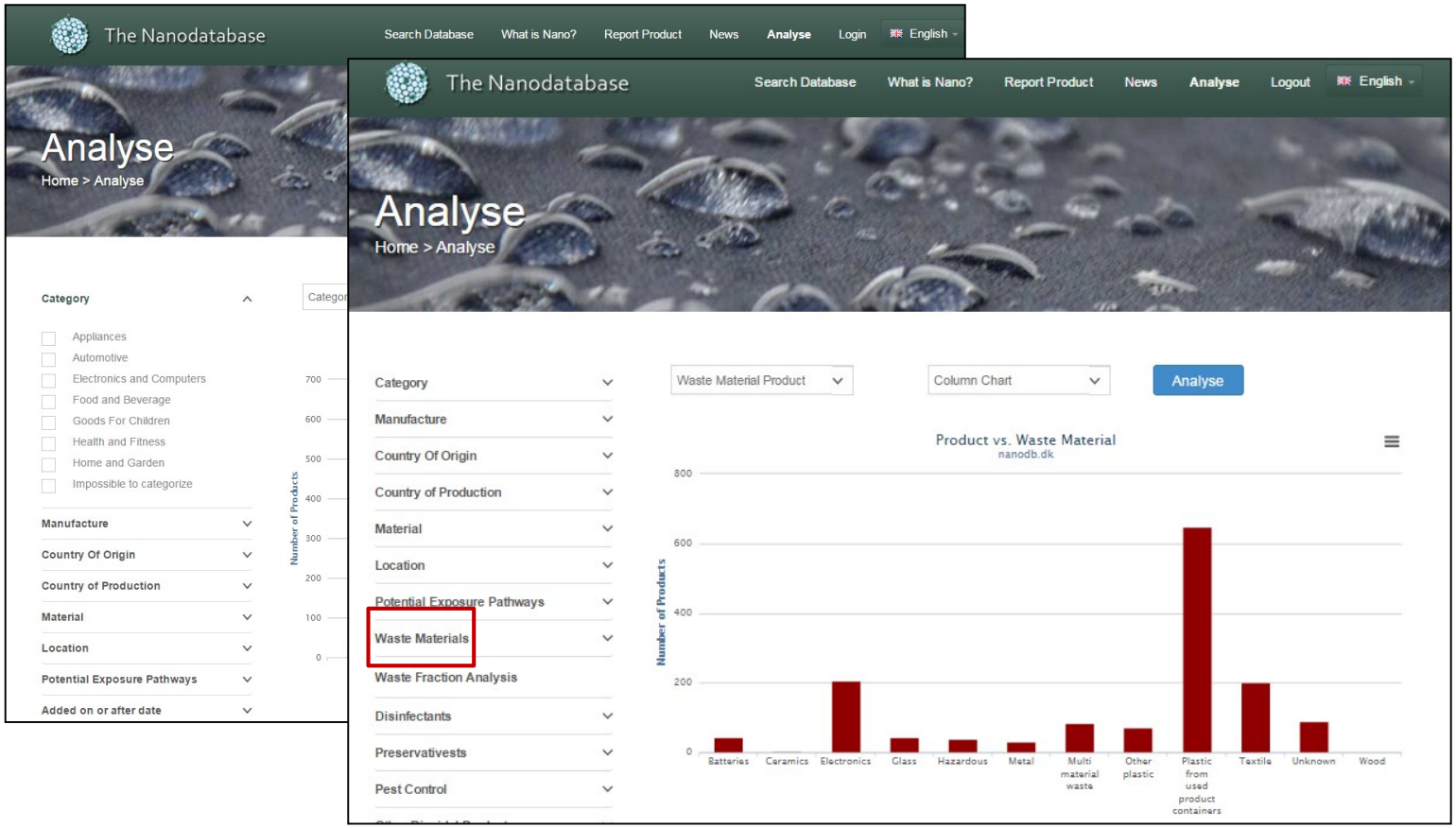
- Semi-quantitative analysis of solid waste flows containing ENM

- 4 steps:

1. Categorize waste material fractions
2. ID ENM types in waste material fractions
3. ID region specific waste management of individual waste material fractions
4. Combine steps 2 +3 to determine the distribution of ENM routed to specific waste management options

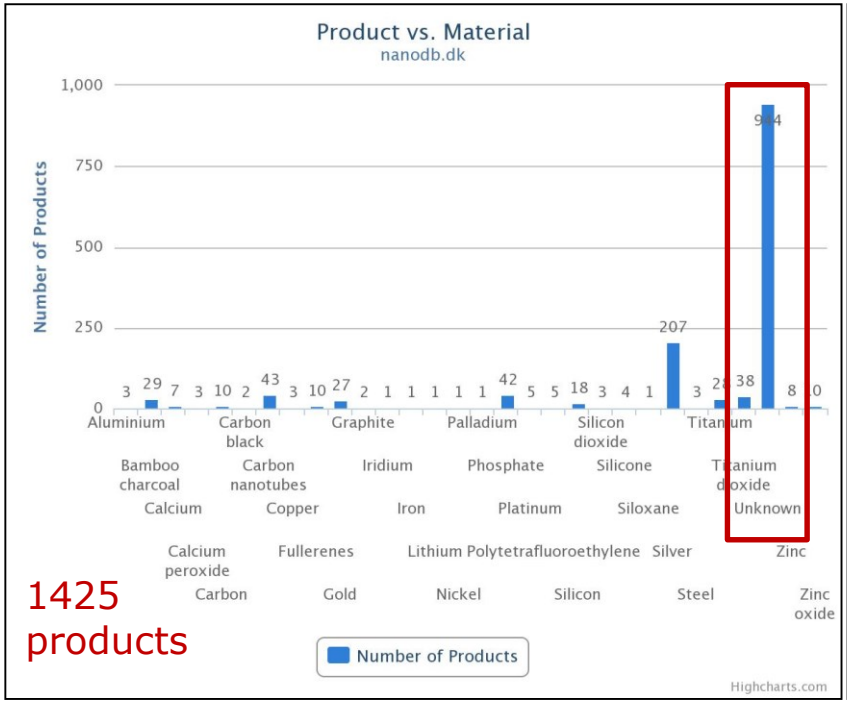


www.nanodb.dk

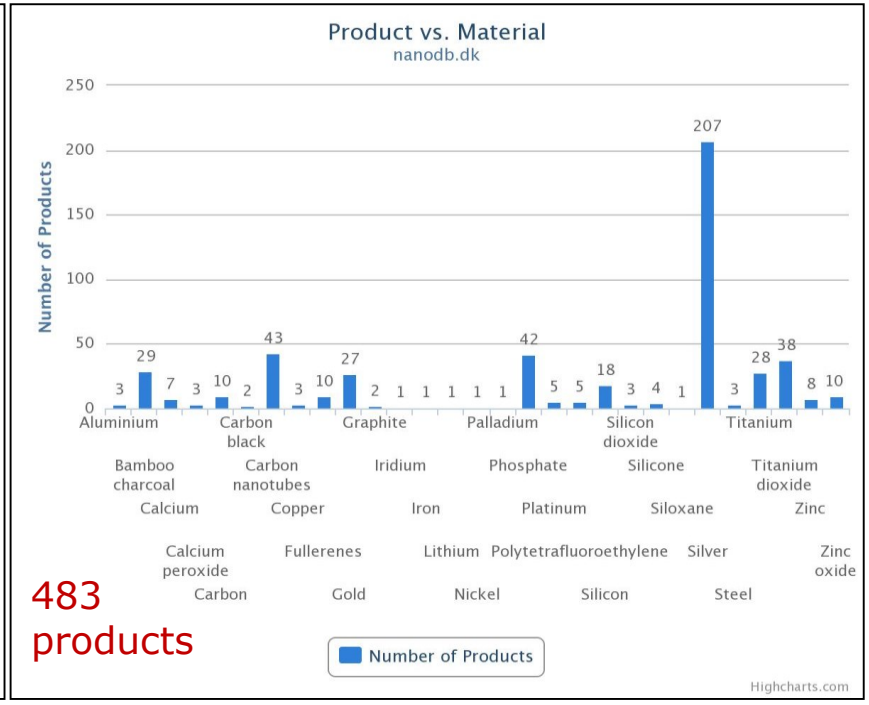


Unknown ENM vs. Known ENM

- Many manufacturers/retailers use a ”nano-claim” but ENM is unknown



1425 products

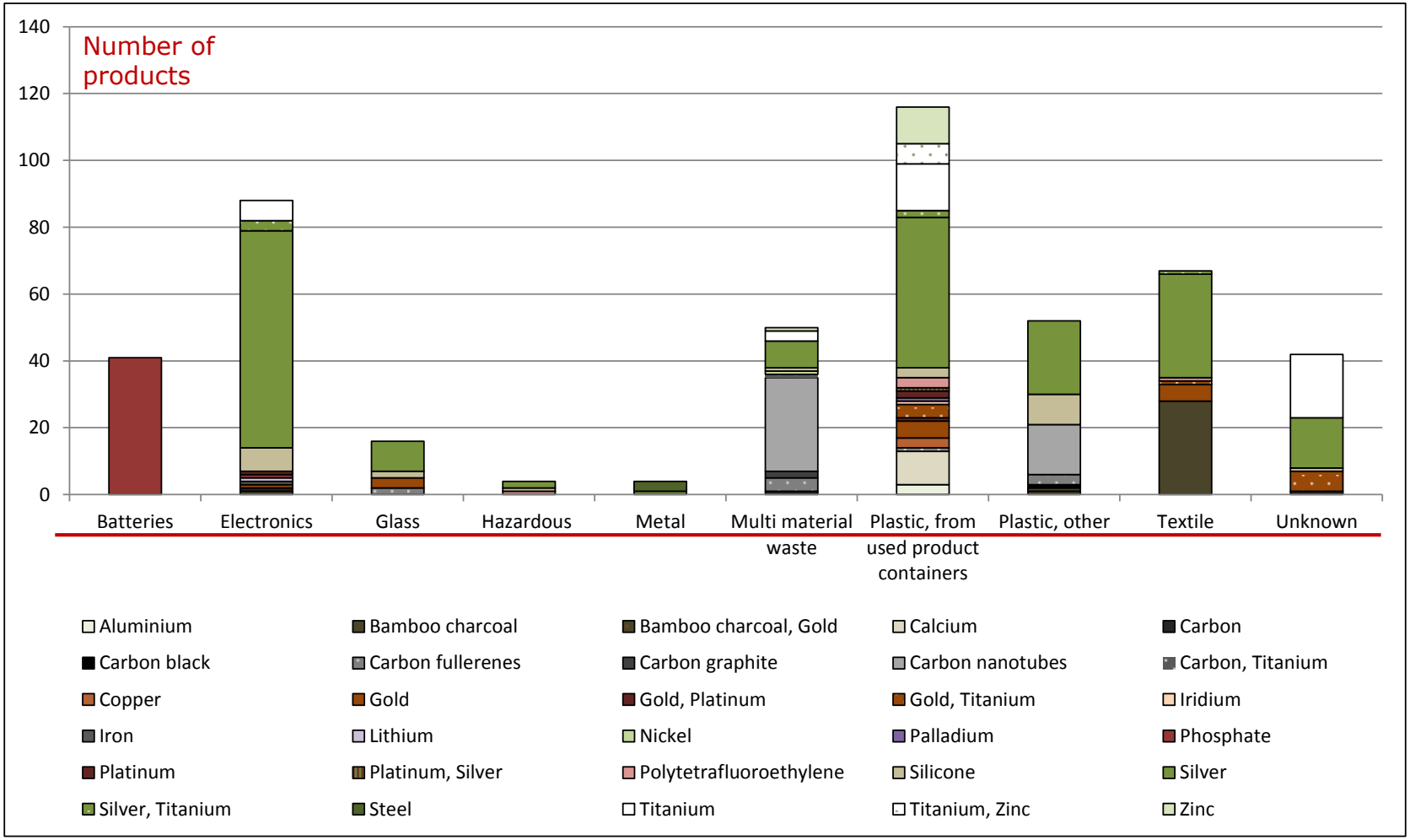


483 products

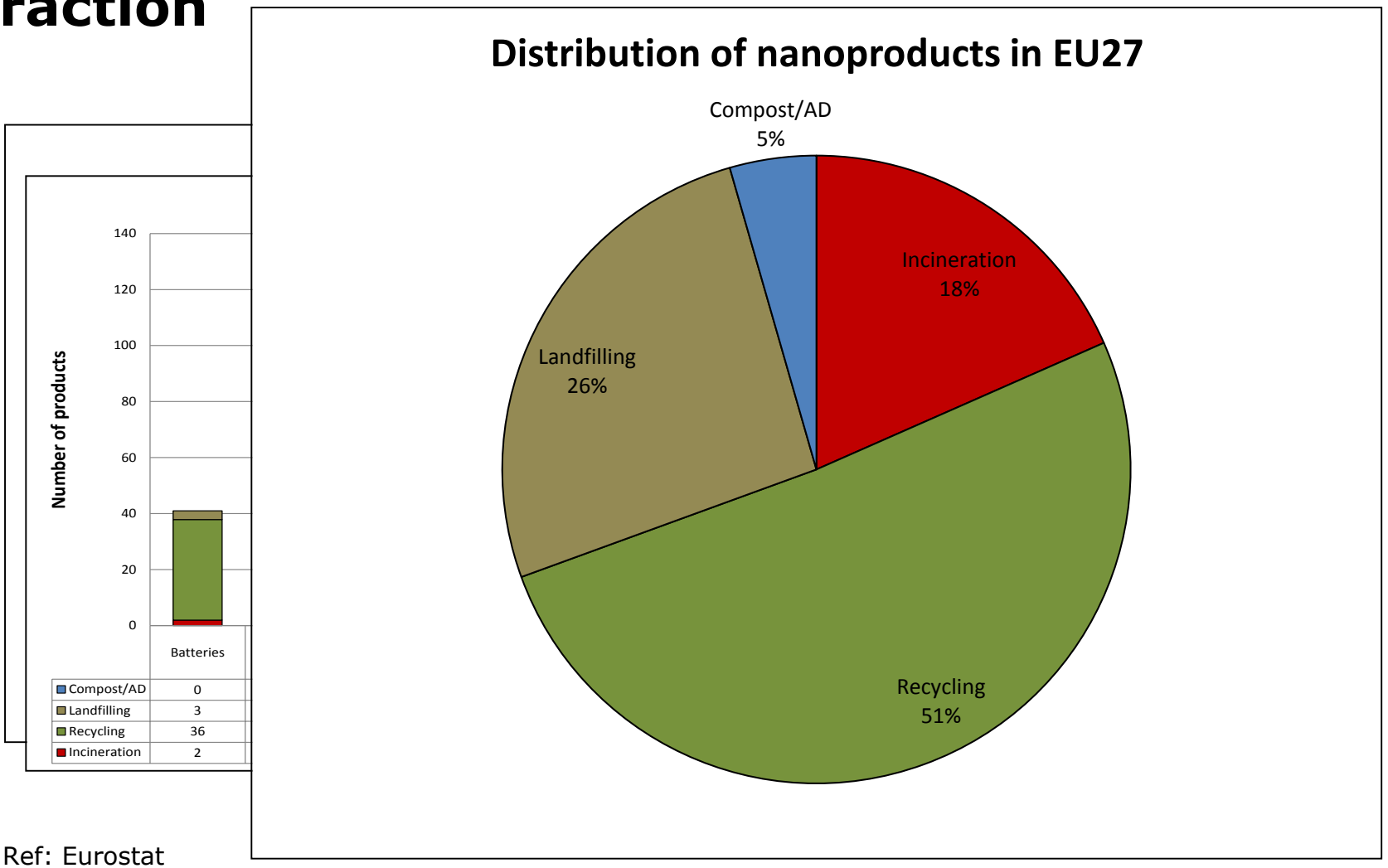
Step 1: Categorization

Waste material fraction	Description and examples
10 different waste material fractions	**Based on online available photo or description** • Categorized according to main matrix material • Easily categorized fractions e.g. WEEE and textile • **Not** easily categorized fractions, or products combining several not separable materials e.g. camera lenses and suitcases • Multimaterial waste • Unknown waste material (lacking suitable photo reference)

Step 2: ENM types vs. waste material fraction

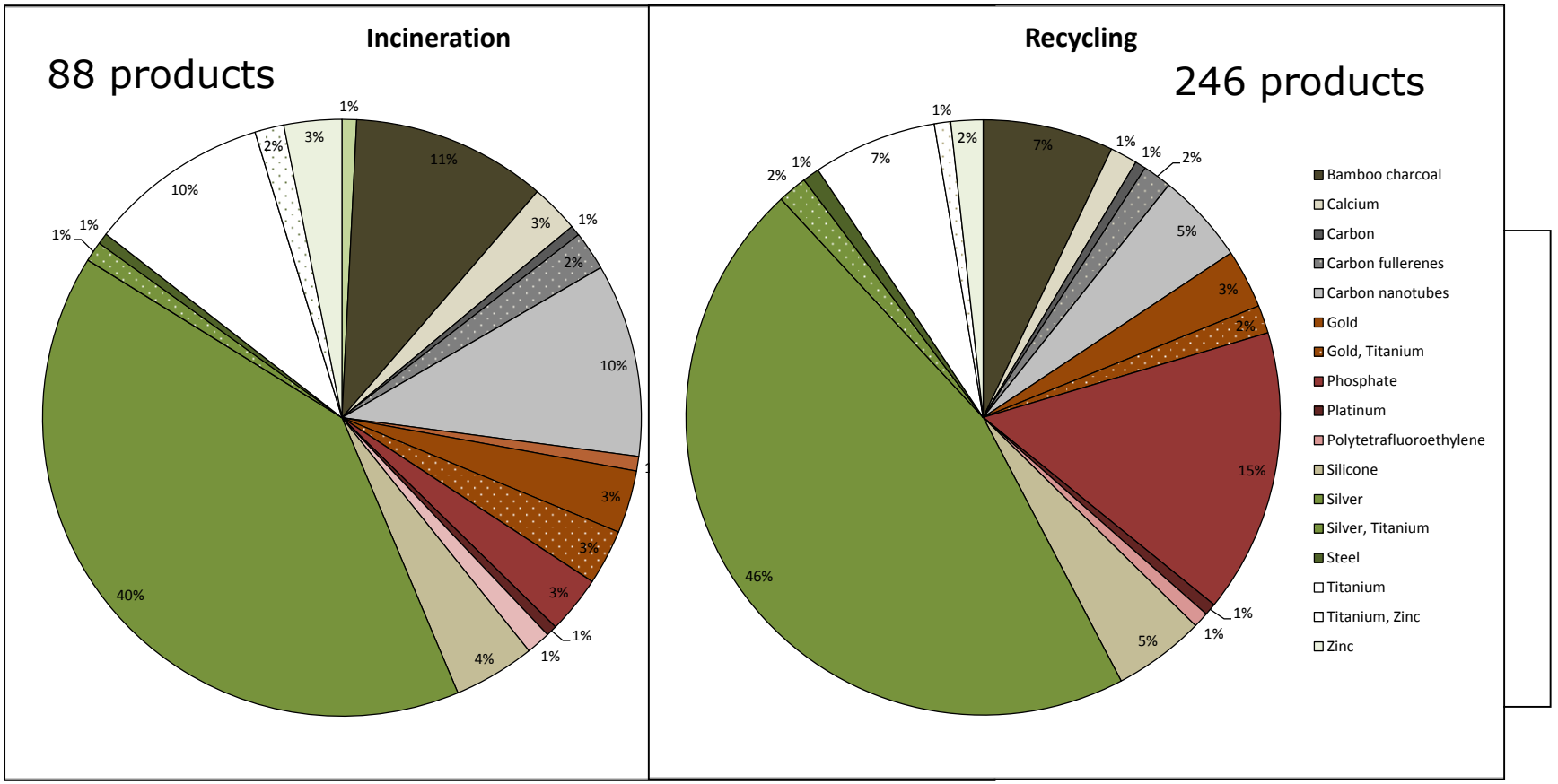


Step 3: Waste mangement of waste material fraction

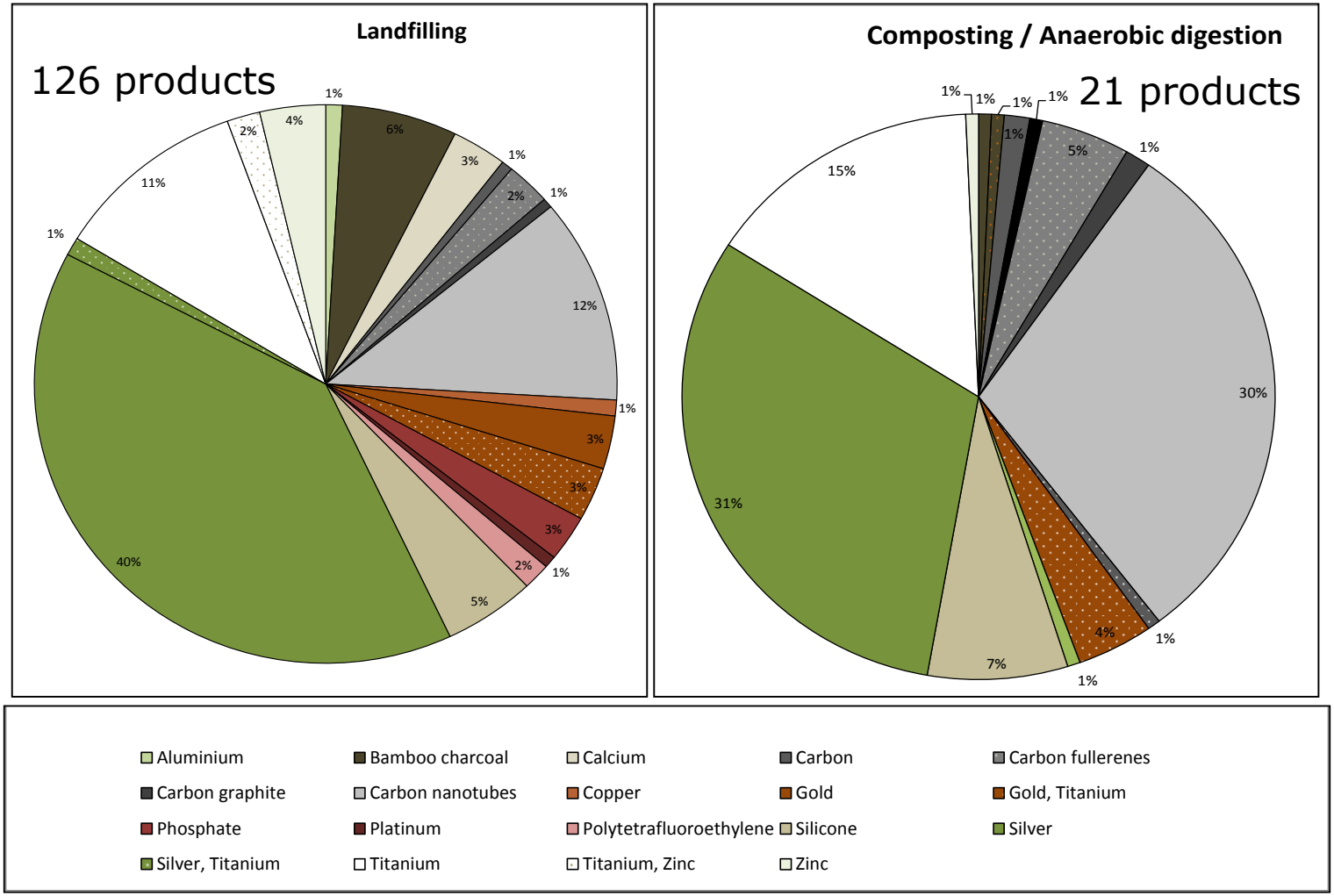


Ref: Eurostat

Step 4: Combine steps 2. and 3.



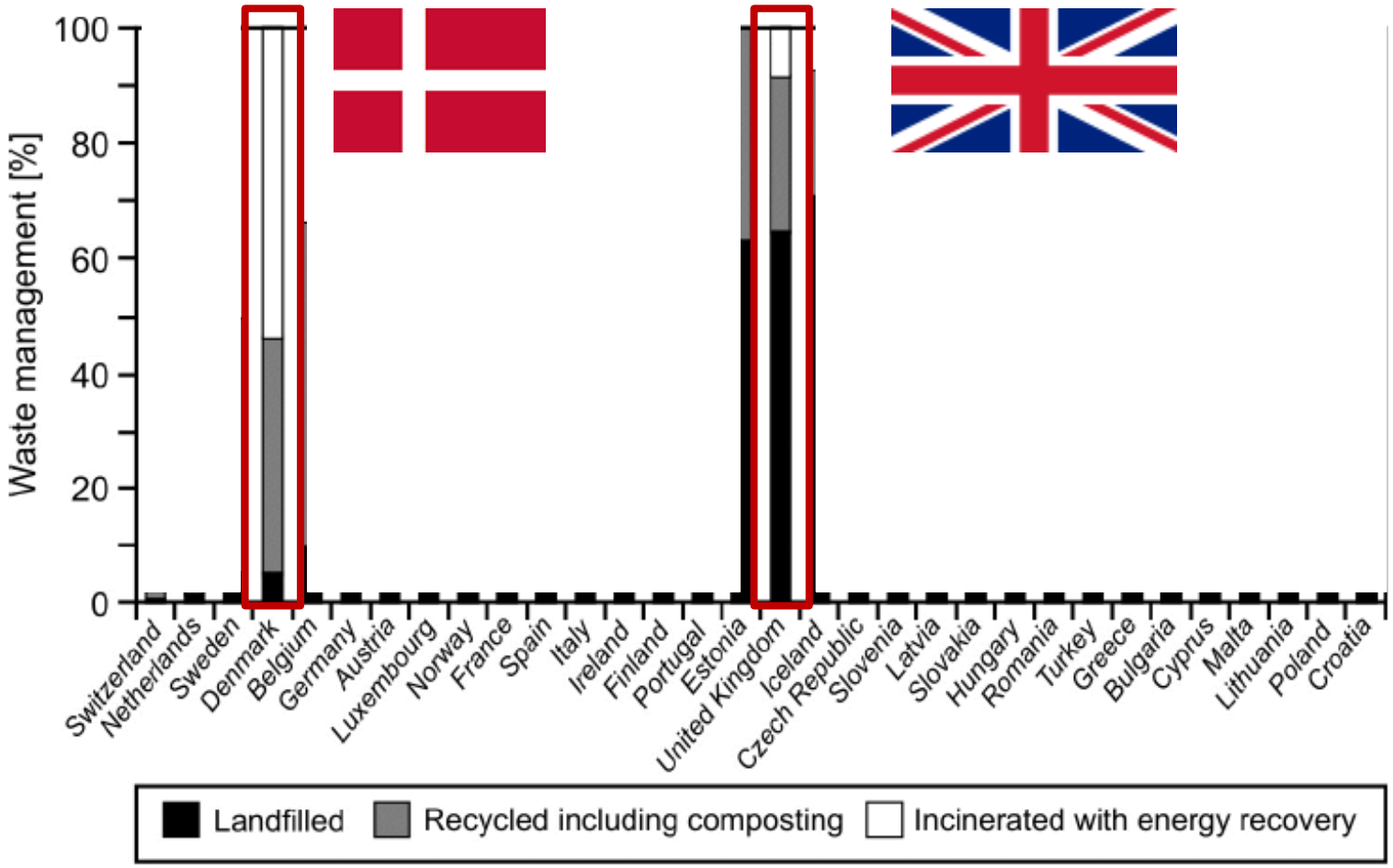
Step 4. Continued



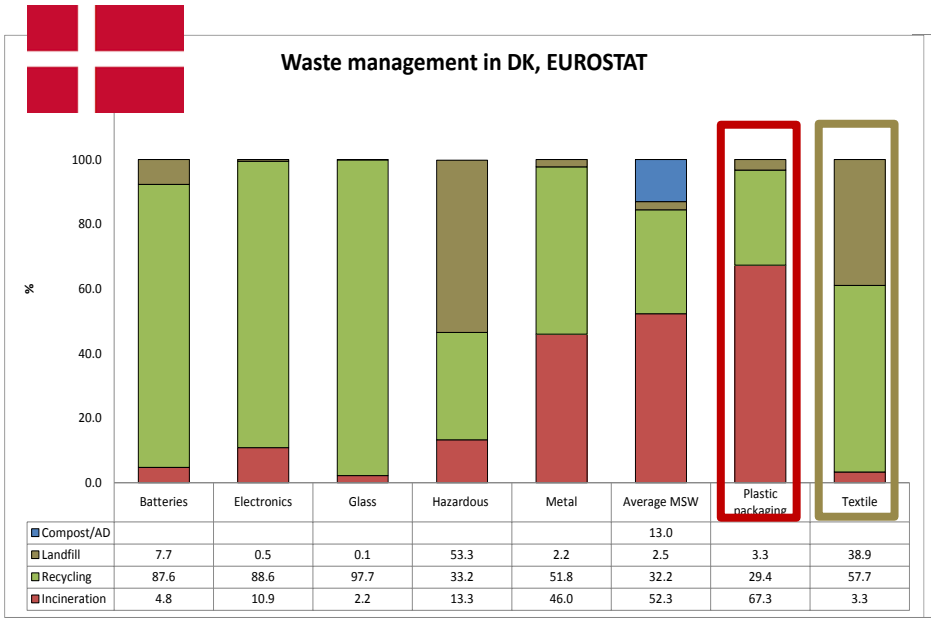
Case studies:

DENMARK & UNITED KINGDOM

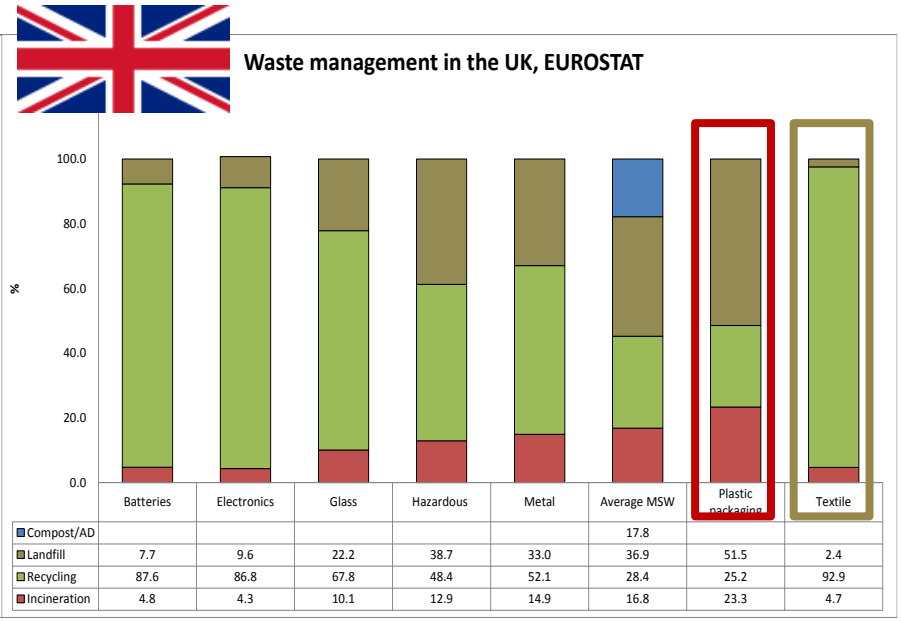
Impact of different waste management systems



Waste management statistics: DK and UK



	Batteries	Electronics	Glass	Hazardous	Metal	Average MSW	Plastic packaging	Textile
Compost/AD						13.0		
Landfill	7.7	0.5	0.1	53.3	2.2	2.5	3.3	38.9
Recycling	87.6	88.6	97.7	33.2	51.8	32.2	29.4	57.7
Incineration	4.8	10.9	2.2	13.3	46.0	52.3	67.3	3.3

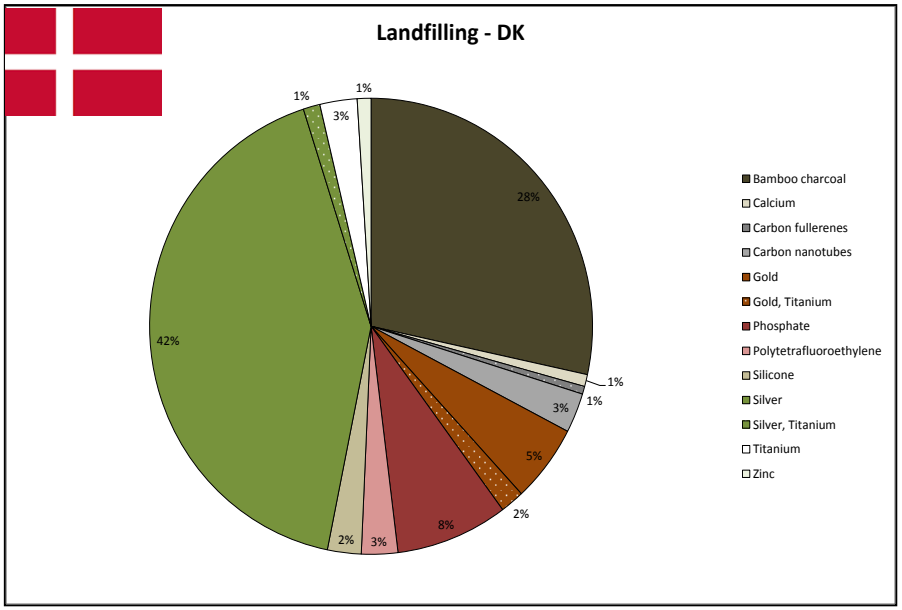


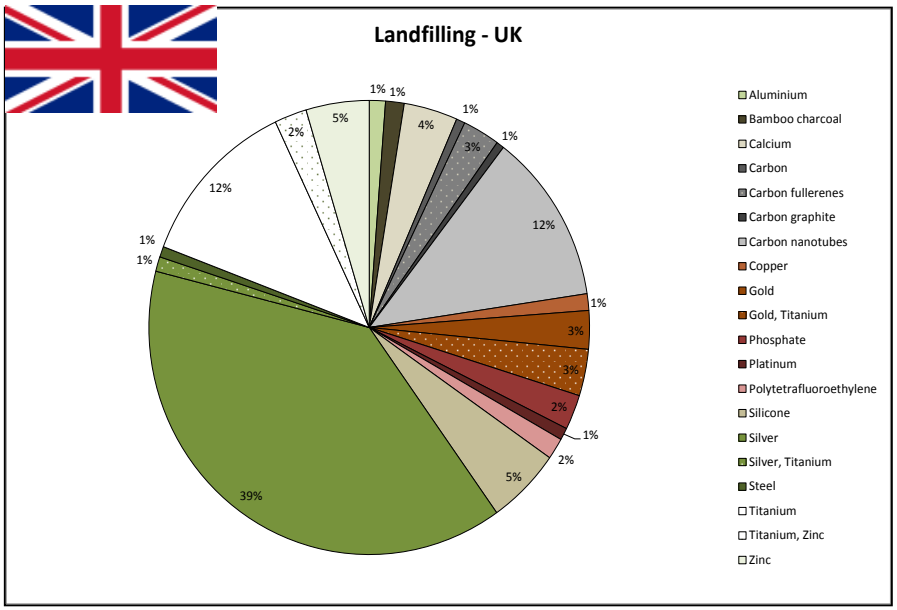
	Batteries	Electronics	Glass	Hazardous	Metal	Average MSW	Plastic packaging	Textile
Compost/AD						17.8		
Landfill	7.7	9.6	22.2	38.7	33.0	36.9	51.5	2.4
Recycling	87.6	86.8	67.8	48.4	52.1	28.4	25.2	92.9
Incineration	4.8	4.3	10.1	12.9	14.9	16.8	23.3	4.7

Ref: Eurostat

Different compositions of landfilled waste

- What causes the differences?
  - Different quanties of waste, Textile waste, Plastic waste





Future aims

- Continue to update product inventory
- Consider mass or volume into the flow analysis
- Data generation e.g.
  - Investigate fate and behavior of ENM in simulated waste treatment scenarios (e.g. artificical leachate solution)
  - Perform standard waste characterization tests on nano-containing matices (e.g. spiked waste matrix or matrix of nanoproducts)
  - Evaluate potential release of ENM from EOL consumer products
- Eva d w ods
- High n fe oproducts

THANK YOU FOR YOUR ATTENTION ☺

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