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Corfu2022 9th International Conference on Sustainable Solid Waste Management
15-18 June 2022

Reprioritising Resource Recovery for Sustainability

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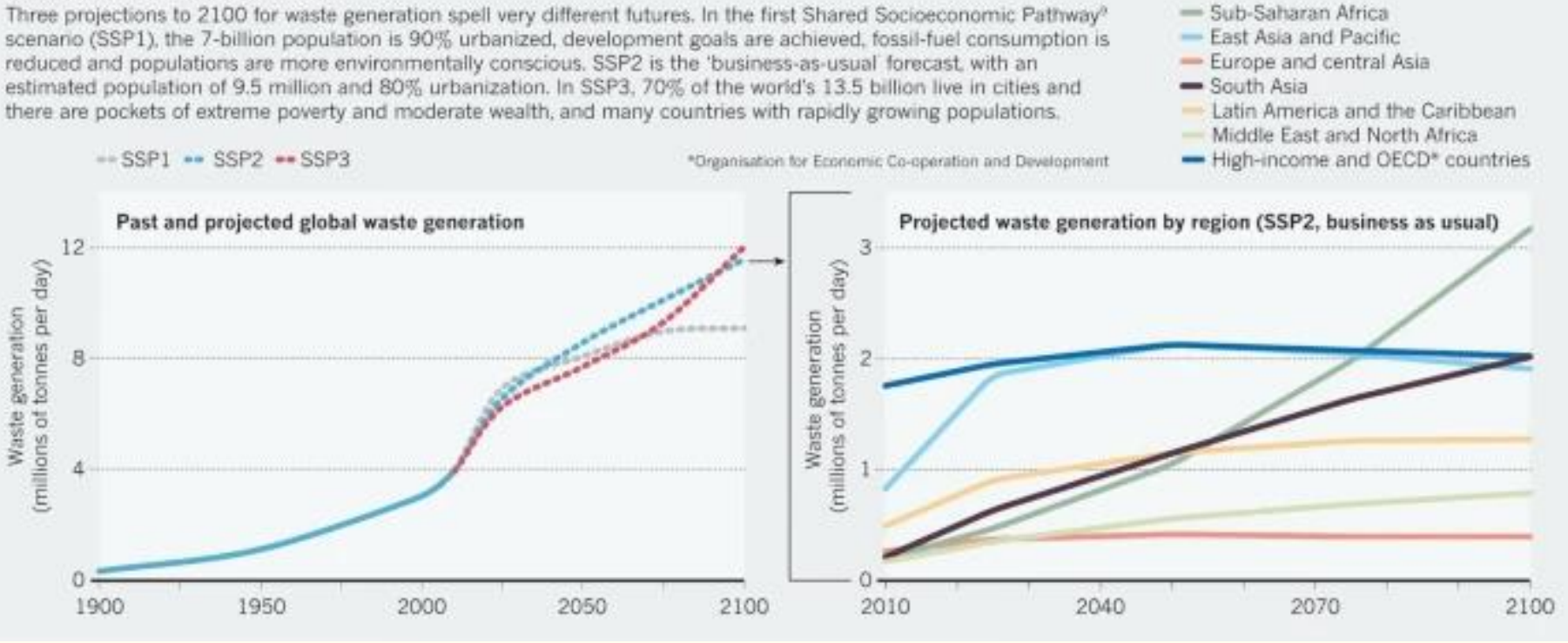
WHEN WILL WASTE PEAK?

Three projections to 2100 for waste generation spell very different futures. In the first Shared Socioeconomic Pathway[2] scenario (SSP1), the 7-billion population is 90% urbanized, development goals are achieved, fossil-fuel consumption is reduced and populations are more environmentally conscious. SSP2 is the 'business-as-usual' forecast, with an estimated population of 9.5 million and 80% urbanization. In SSP3, 70% of the world's 13.5 billion live in cities and there are pockets of extreme poverty and moderate wealth, and many countries with rapidly growing populations.



Hoornweg, D., Bhada-Tata, P. & Kennedy, C. Environment: Waste production must peak this century. Nature 502, 615–617 (2013). https://doi.org/10.1038/502615a

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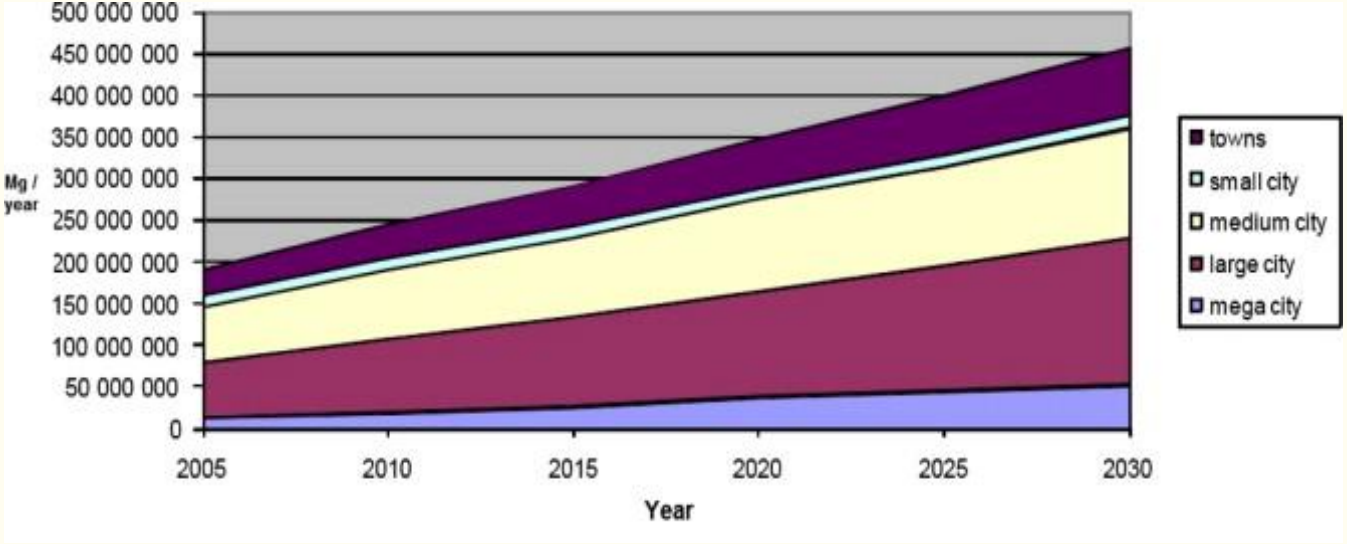
MSW Generation is Linked to Economic Development

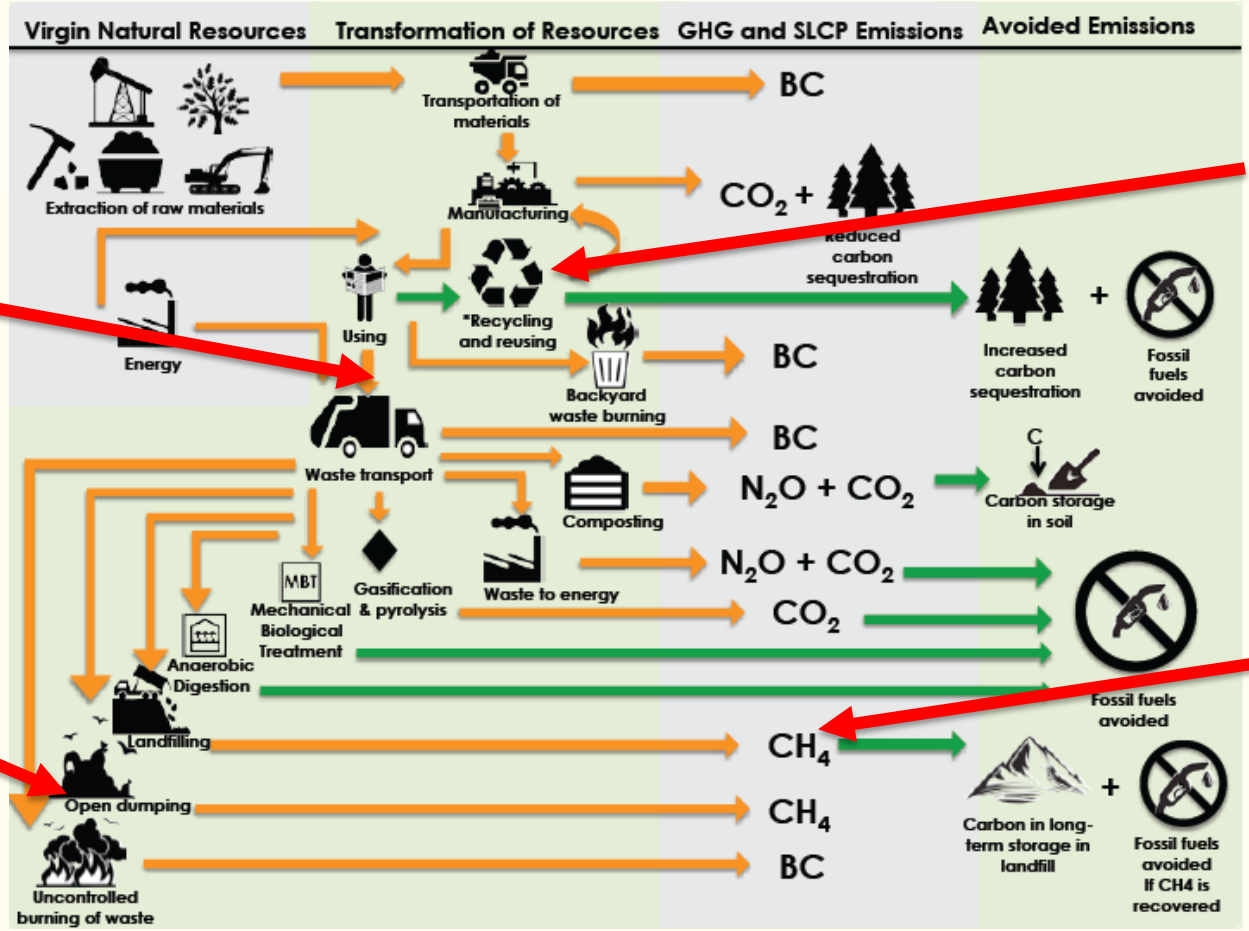
The Situation in China



Dorn et al 2012 Waste Management 32, 2177 – 2184 http://dx.doi.org/10.1016/j.wasman.2012.05.038

4th Objective: Reduce generation of waste

1st Objective: Protect health



3rd Objective: Recover resources

2nd Objective: Protect the environment

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First EU Measures – Reduce Landfill Disposal of Biodegradable Waste

Landfill Directive (1999/31/EC) aims:

‘reduce as far as possible negative effects on the environment,…..,including the greenhouse effect, as well as any resulting risk to human health, from landfilling of waste…. .

- 2010 - reduce biodegradable waste to landfill to 75% of 1995 levels
- 2013 - reduce biodegradable waste to landfill to 50% of 1995 levels
- 2020 - reduce biodegradable waste to landfill to 35% of 1995 levels

Because the UK disposed of >80 % of municipal waste in landfill, the targets were delayed by four years

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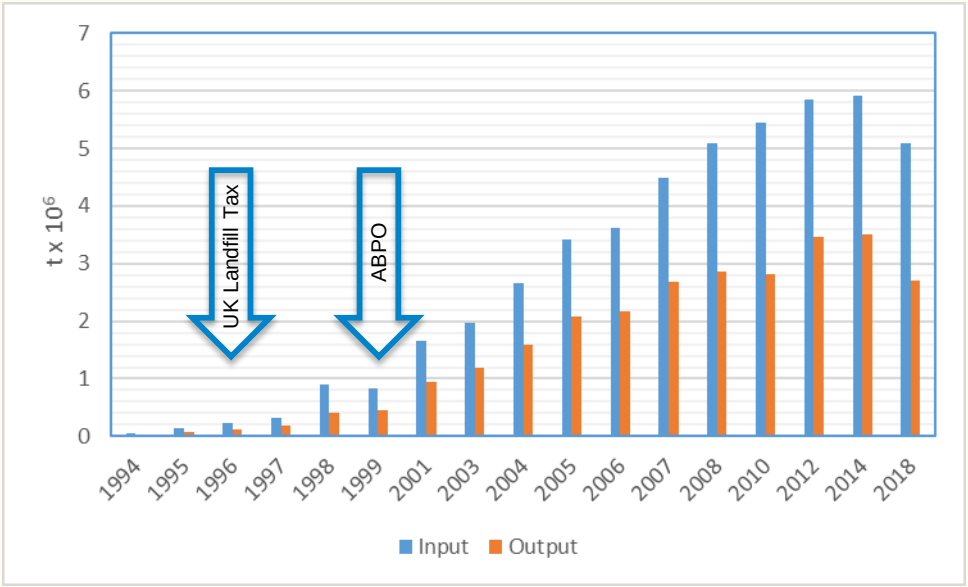
Diverting Biodegradable Waste from Landfill

Trends in Composting Biodegradable Municipal Waste (Input) in the UK



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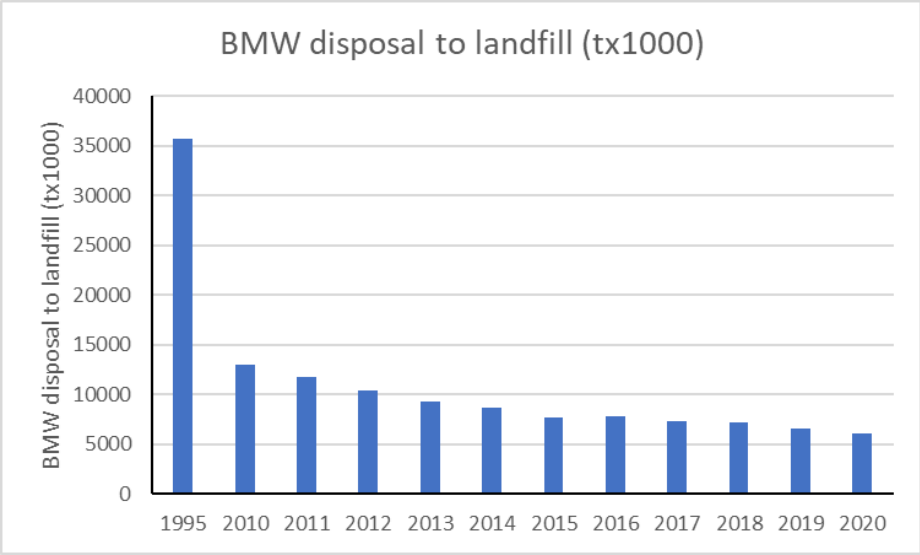
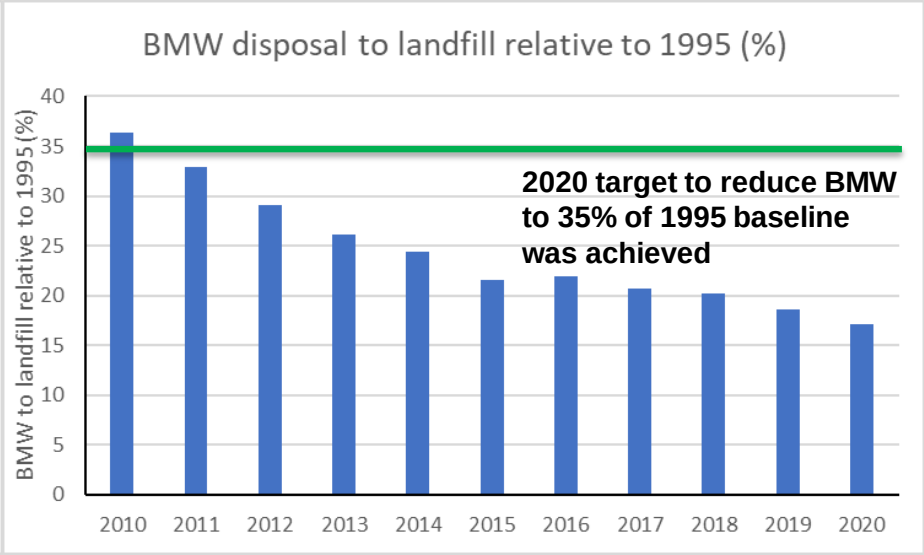
Biodegradable Municipal Waste Disposal to Landfill in the UK





https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1073638/Table_2.csv/preview

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Further EU Measures: WFD, Landfill Directive & Circular Economy Action Plan

- ***Waste Framework Directive 2008/98/EC target:***
- 50% of municipal waste to be recycled by 2020

- ***Amended Waste Framework Directive (EU) 2018/851 targets:***
- Preparation for re-use and recycling of municipal waste increased to:
- 55% by 2025; 60% by 2030; 65% by 2035

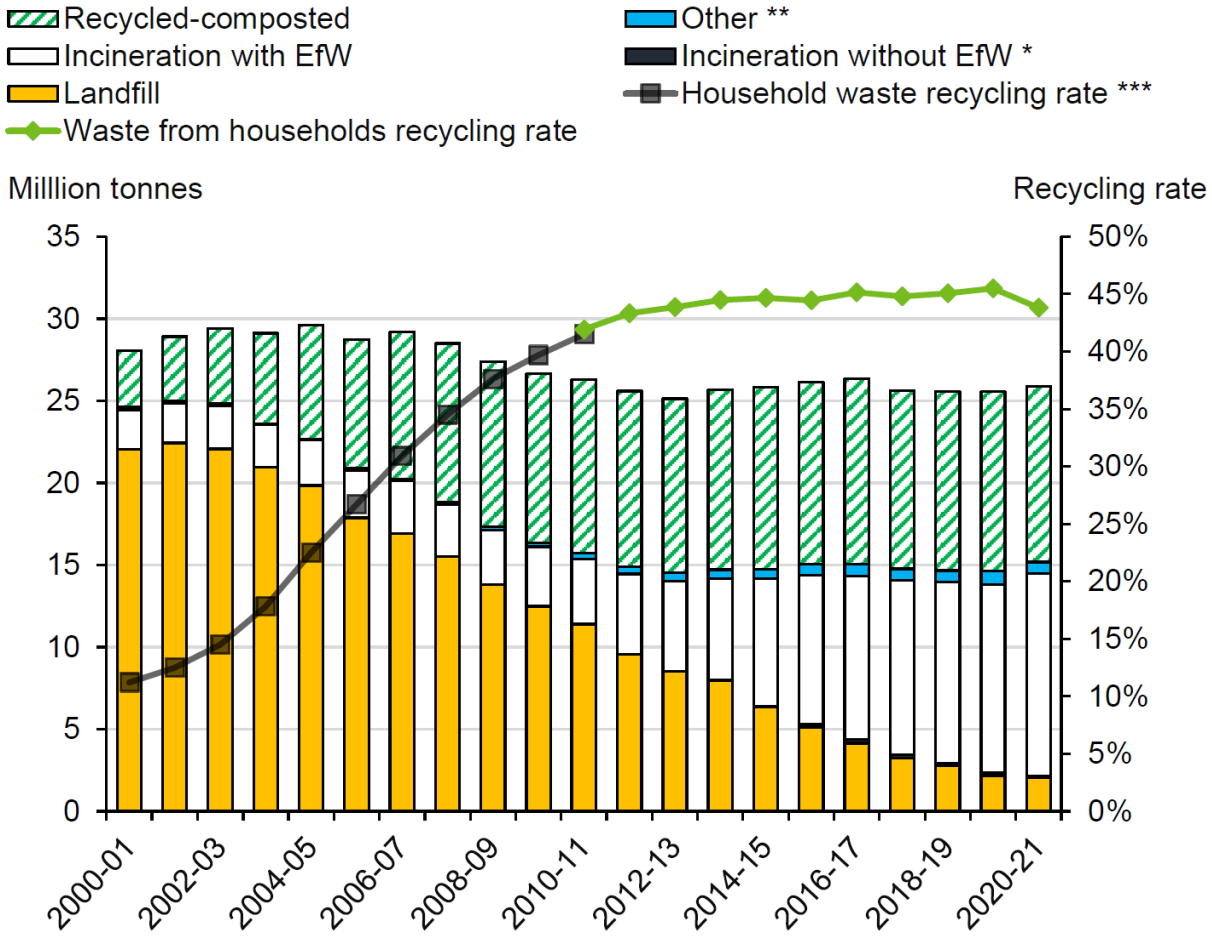
- ***Amended Landfill Directive (EU) 2018/850 target:***
- Reduce the amount of municipal waste landfilled to 10% by 2035

- ***Circular Economy Action Plan target:***
- Reduce the amount of residual (non-recycled) municipal waste by 50% by 2030

Typical kerbside dry recyclables (red, 240L), food and residual (grey, 140L) waste collection bins in the UK

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1040756/Statistics_on_waste_managed_by_local_authorities_in_England_in_2020_v2rev_accessible.pdf

Figure 9: Management of all local authority collected waste and recycling rates, England, 2000/01 – 2020/21



Waste Management Plan for England 2021

by 2020:

- 50% of household waste is prepared for re-use or recycled

by 2035:

- Increase preparation for re-use and recycling of MSW to 65%
- Reduce landfilling MSW to 10%

by 2050:

- Eliminate all avoidable waste

https://www.gov.uk/government/publications/waste-management-plan-for-england-2021

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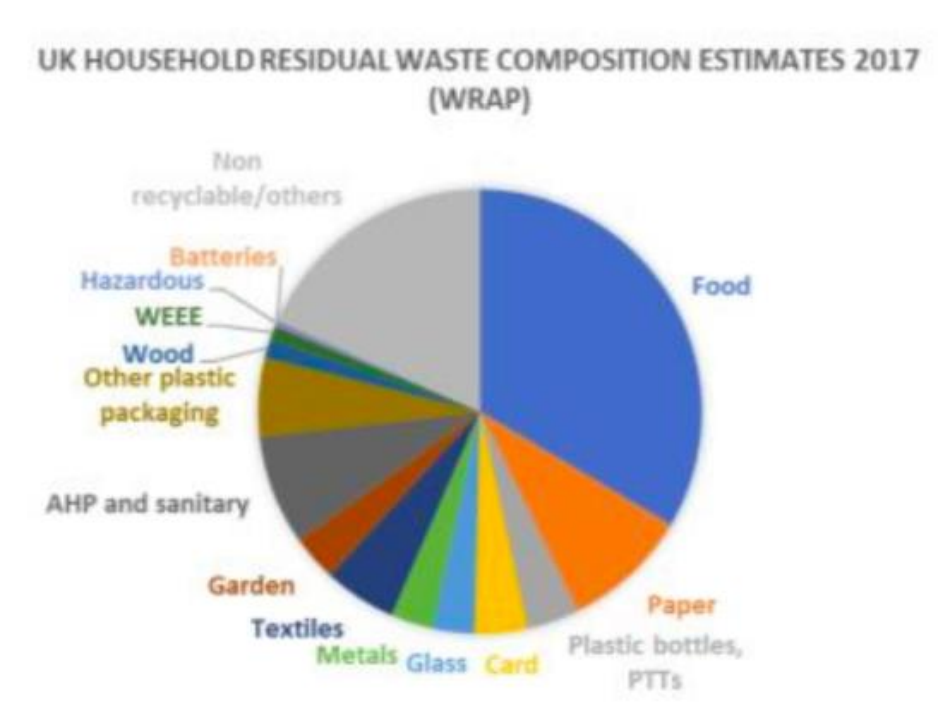
Resources in Residual Household Waste (UK)



- Residual waste contains valuable resources
- Reducing food waste and anaerobic digestion of non-reducible food waste are a priority
- Digestates contain valuable fertiliser resources: 6 kg/m^3 N and 0.3 kg/m^3 P
- N fertiliser price has increased by 300% (~£800/t), and also has high embodied C
- P fertiliser cost has also increased by 220% (~£900/t); P is an EU critical raw material

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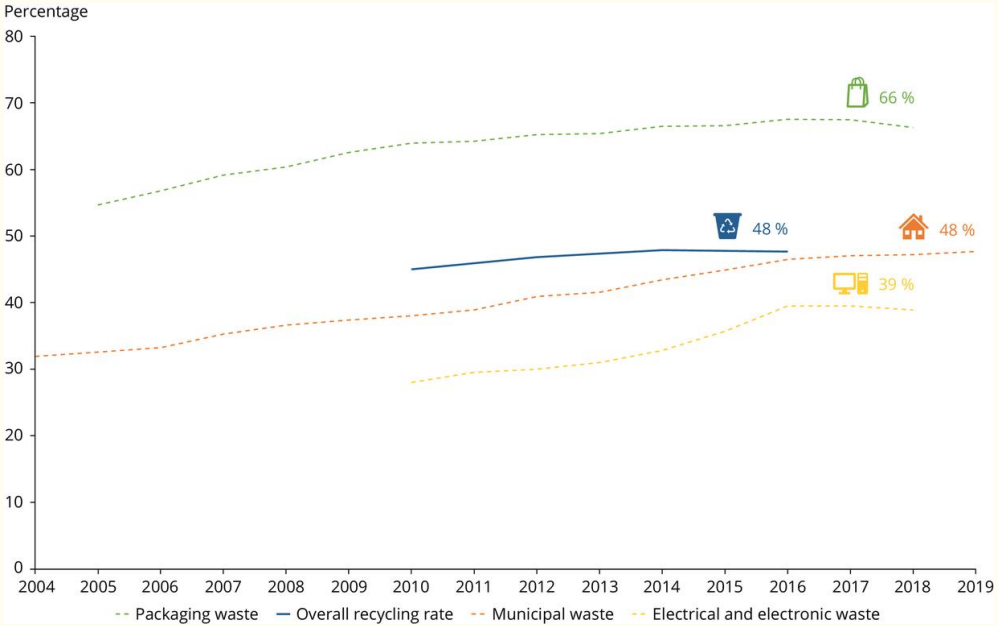
Recycling Waste in Europe



- After significant progress, recycling waste has slowed down or is in decline in Europe
- In 2019, 8 countries exceeded the 2020 WFD target to recycle 50% of MSW (eg 66% in Germany and 58% in Austria)
- 14 EU MS at risk of not meeting the 2020 recycling target
- On 26 April 2022, the EEA published a briefing, finding that the EU is not on track to reduce municipal waste by 50% by 2030

https://www.eea.europa.eu/ims/waste-recycling-in-europe

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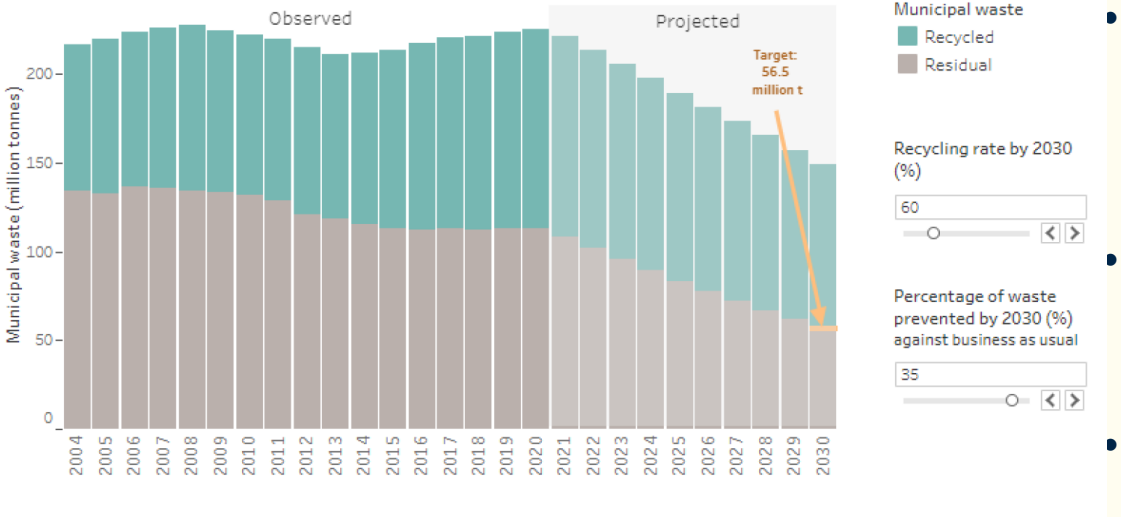
EEA briefing of 26 April 2022

Figure 7. Exploring possible scenarios for meeting waste targets



- Residual waste target (reduce to 50% by 2030) and recycling targets are intrinsically linked
- Projected increases in waste growth indicates 72% would need to be recycled to meet the CEAP target
- This is greater than the WFD binding recycling target of 60% for 2030
- Recommend achieving target by reducing generation by ~30%

https://www.eea.europa.eu/publications/reaching-2030s-residual-municipal-waste/reaching-2030s-residual-municipal-waste

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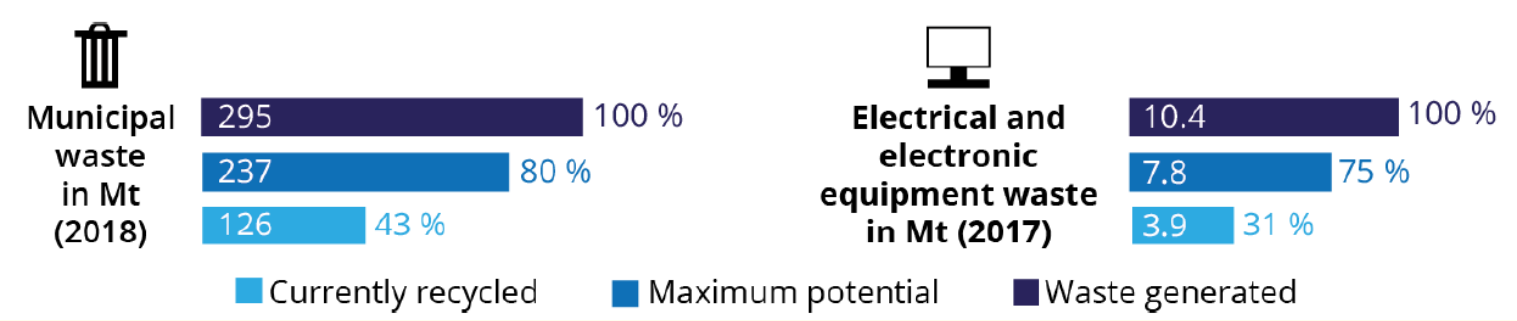
EEA briefing of 18 Jun 2020: The case for increasing recycling: Estimating the potential for recycling in Europe



- There is significant potential to increase the material collected for recycling in Europe from municipal and electronic waste streams
- There is the potential to double recycling of municipal and electronic waste streams

https://www.eea.europa.eu/publications/the-case-for-increasing-recycling

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Why it is imperative to increase recycling:

- Residual waste streams still contain significant amounts of economically valuable resources
- These resources have high embodied value (energy, materials, water etc)
- Global supply chains can be unreliable
- Costs of virgin materials are increasing and access to them is threatened
- Extracting valuable materials from waste is practicable and increasingly economically competitive
- Economic and industrial independence by providing local supplies of essential materials
- Commercial and industrial development opportunities (waste extraction and manufacturing)
- Increase sustainability and resilience of the economy and therefore society
- Minimise residual waste and disposal

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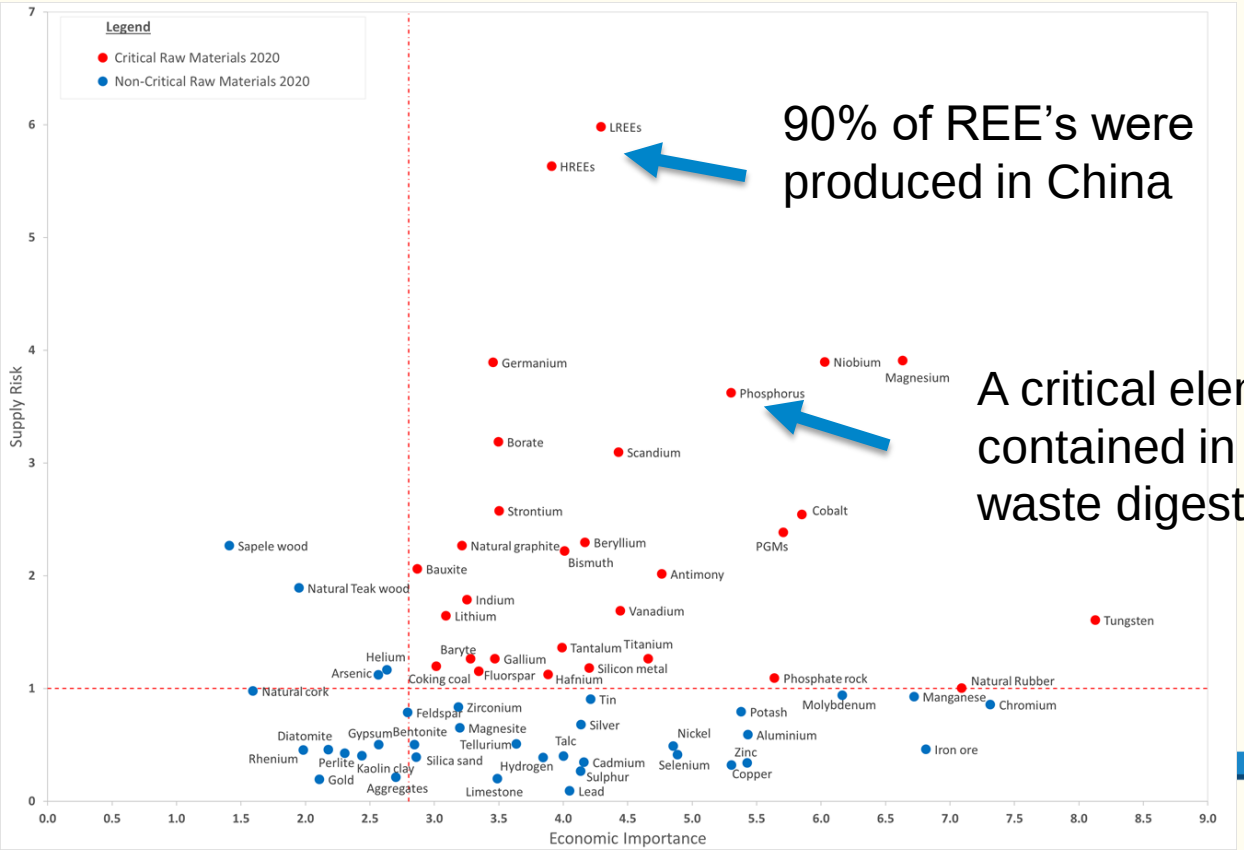
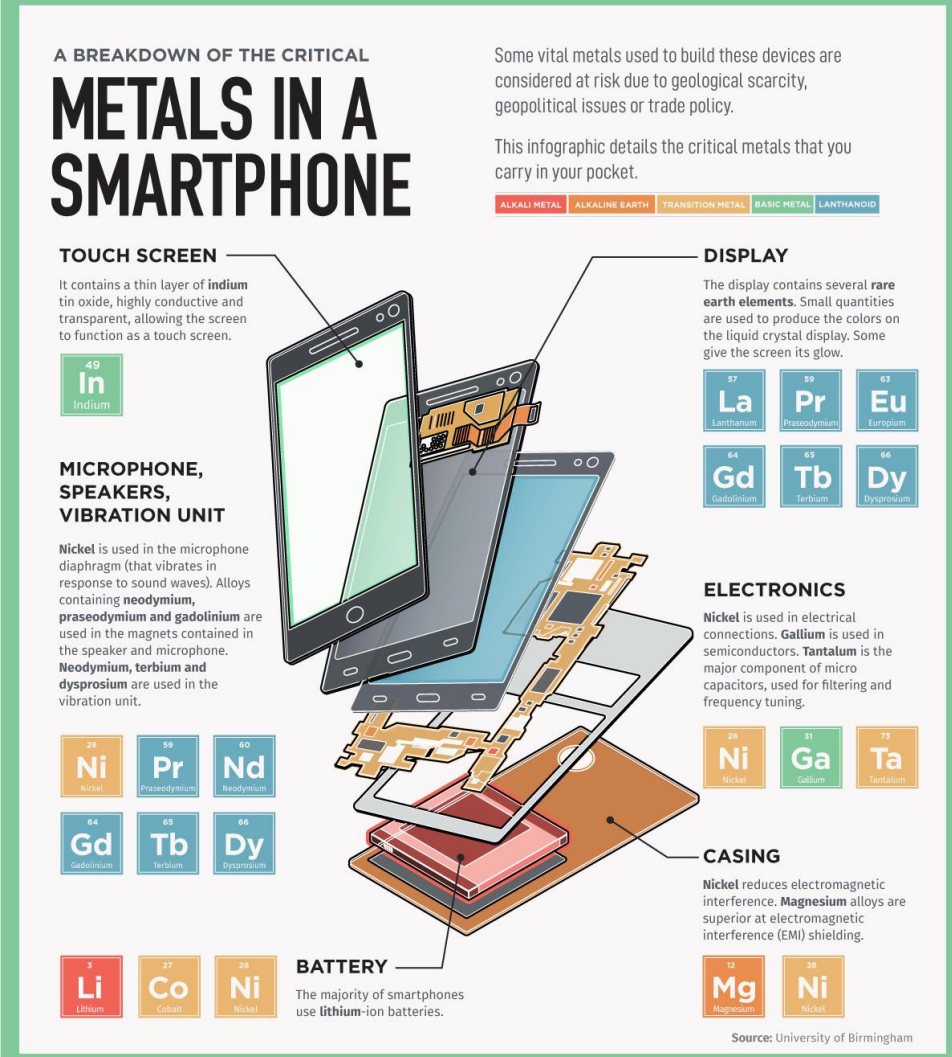
Critical Raw Materials (CRMs) are economically and strategically important for the European economy with a high-risk associated with their supply



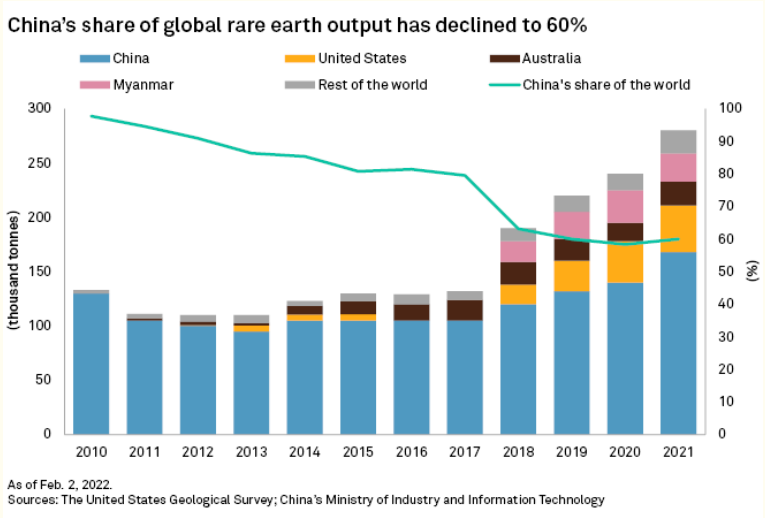
90% of REE's were produced in China

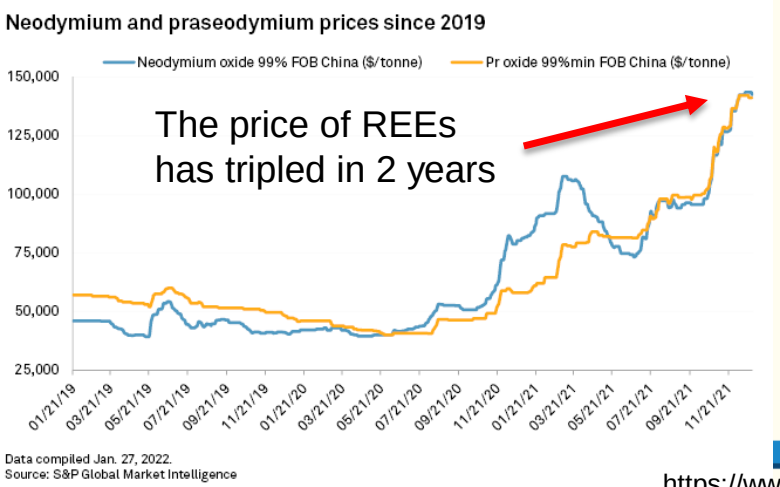
A critical element contained in food waste digestates



- 44.7 Mt of e-waste generated globally in 2016
- Smart phones represent a small fraction of e-waste (~1%)
- BUT, they contain >70 elements and some have high economic importance and supply risk for Europe, which is dependent on imports
- 182 million mobile phones sold in Europe in 2017 and there are 700 million ‘hibernating’ devices
- Only 12-15% of smart phones are recycled in Europe
- Research has optimised recovery processes to achieve >99% purity

https://circulareconomy.europa.eu/platform/sites/default/files/impact_of_ce_on_fmcg_-_mobile_phones_case_study.pdf

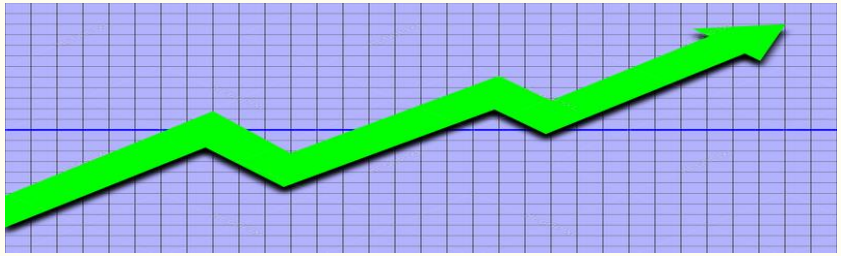




World's largest windfarm is in the UK:

Demand for ELVs rapidly expanding:

https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/clean-energy-transition-to-fuel-growth-for-china-s-rare-earths-sector-in-2022-68604096



Conclusions

- The European (and UK!) economy is vulnerable to global material (and energy) supplies
- It does not have indigenous supplies of many critical resources required by industry
- However, wastes streams generated by the economy are rich in many of these materials
- Current global crises have significantly increased material and energy costs
- Demand for advanced technologies is also driving up costs (eg REEs)
- It is therefore increasingly economic to maximise recovery from waste
- There are major economic and societal advantages from expanding resource recovery from waste