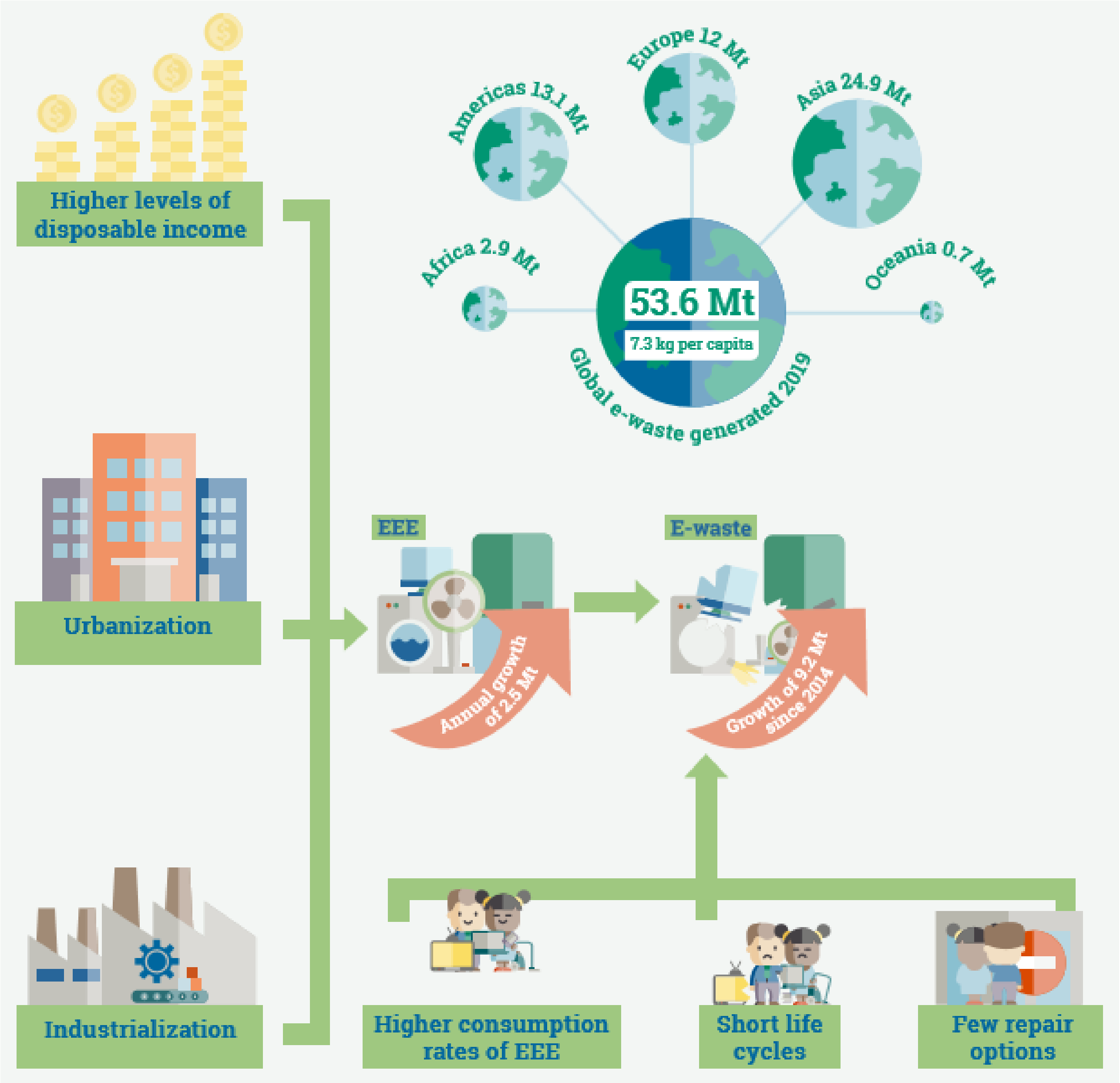
Impact of recycling to recover precious metals from WEEE

SICT - September 2020 - Simon van Walle



Source: UNU E-waste Monitor 2020

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The metal recycling process
– some basics

Metal recycling requires a chain process

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Recycling efficiency is determined by the weakest link in the chain

Collection

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- Accumulate quantity / critical mass
- Pre-sorting into categories
- OUTPUT: different mixed grades, parts or whole equipment

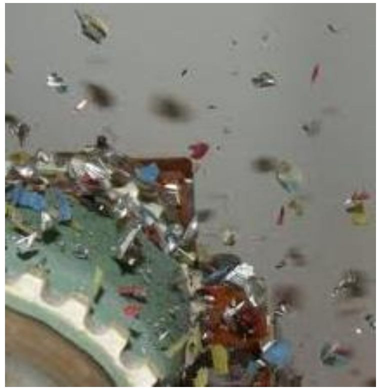
Often the most underestimated recycling step !

Pre-processing: dismantling

- Depollution & removal of critical fractions (i.e. toners, batteries, circuit boards…)
- Highly selective but slow
- Promising evolutions in A.I.+ sensor sorting !

Essential step in efficient recycling !

Pre-processing: mechanical / physical treatment



- Mechanical/physical size reduction & sorting into impure fractions/grades.
- OUTPUT: impure fractions, complex & less complex, shredded

Important for mass materials,

limitations for critical metals*

* critical metals = EU critical metals, conflict minerals (3TG), scarce & precious metals,… mostly present in equipment in low concentration ‘ppm’

End-processing: chemical / metallurgical treatment

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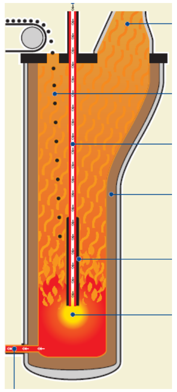

- Recovery of specific range of metals, depending on metallurgical or chemical capabilities and limitations.

- OUTPUT: pure metals, compounds, slags, final waste

Specific range/group of elements

=> good pre-processing required

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Umicore’s role in recycling
- end-processing

Umicore is closing the loop for key functional materials

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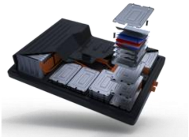
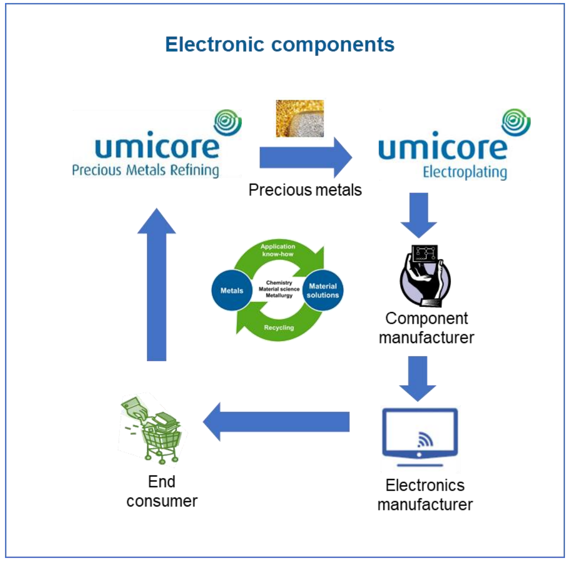
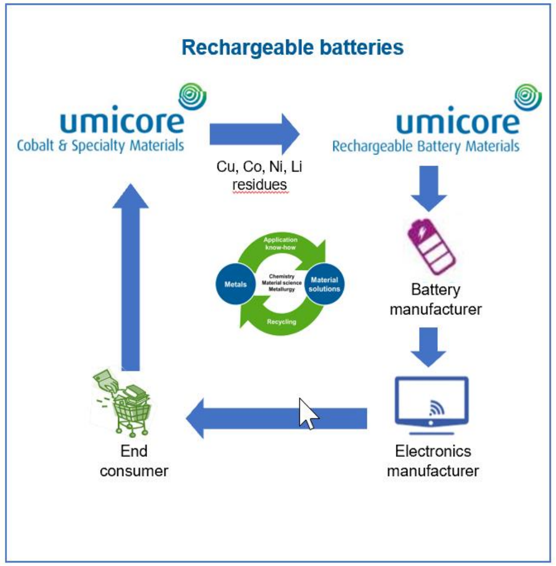
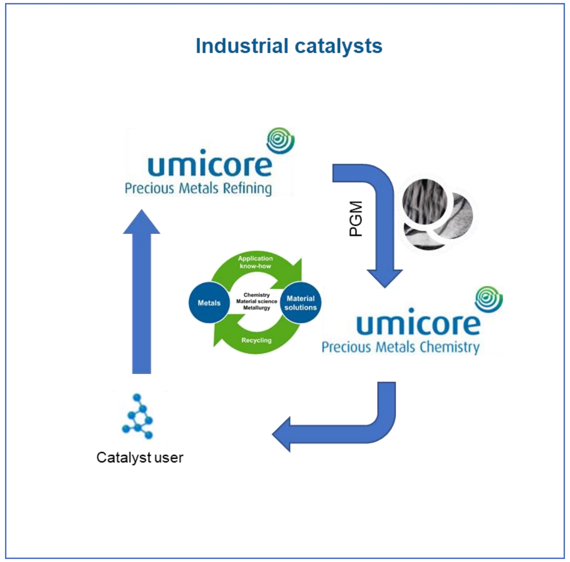
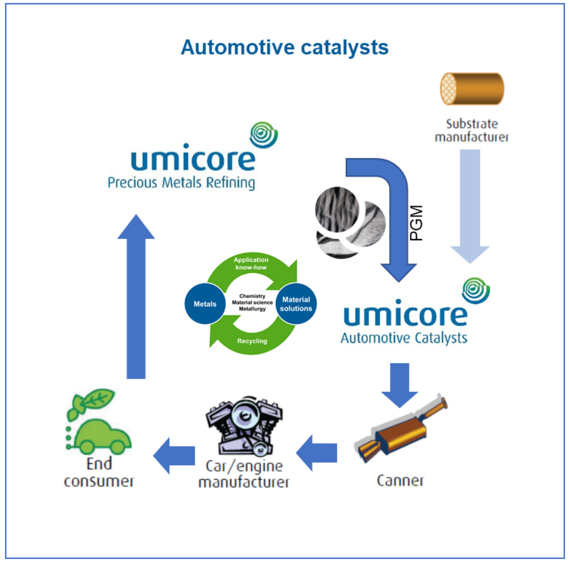


- **<u>19th century</u>**: start as a mining company Union Minière
- **<u>1960s:</u>** first electronic scrap treated at Umicore’s plant in Hoboken
- **<u>1990s</u>**: moving away from mining and commodities/base metals production to high-tech products and recycling
- **<u>2001</u>**: New name: Umicore, in the core of “closing the loop”









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Our process in a nutshell

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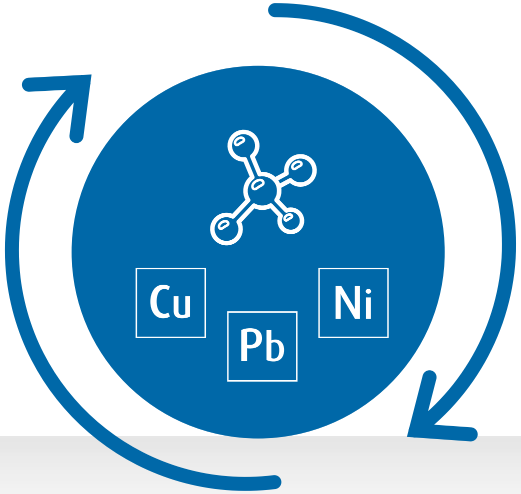
Input

Recyclables

Industrial
by-products

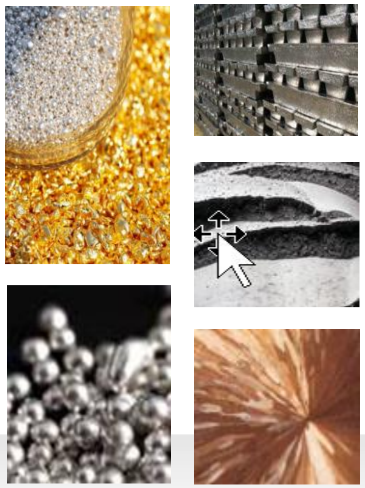
Treatment



3 collector metals,
pyro + hydro process

Output

17 different metals



Au, Ag, Pt, Pd, Rh,
Ru, Ir, Pb, Cu, Ni, In,
Se, Te, As, Sb, Bi,
Sn

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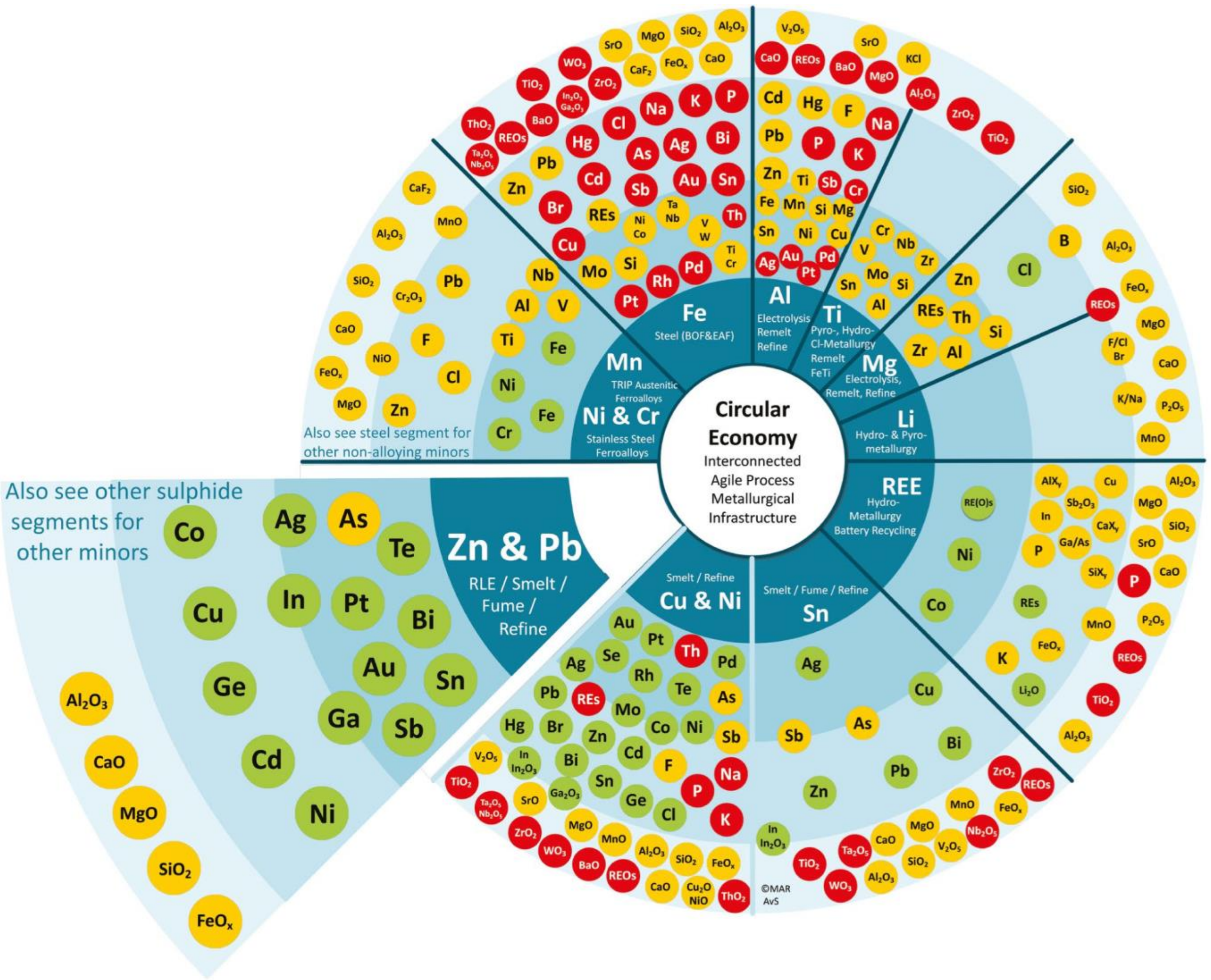
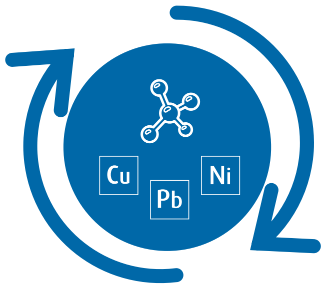
High importance of collector metals



- Society's Essential Carrier Metals: Primary Product
- Dissolves mainly in Carrier Metal if Metallic (Pyro)
- Compounds mainly to Dust, Slime, Speiss, Slag (Hydro)
- Mainly to benign Low Value Products, but inevitable of society

- Mainly Recovered Element: compatible with carrier metal
- Mainly Element in Alloy or compound in Oxidic product, probably lost
- Mainly Element Lost, not always compatible with Carrier Metal or Product



Urban Mining

- **Significant resource and CO2 savings** compared to mining from primary sources.

- **Urban mining "deposits"** are **much richer** than primary mining ores.

- **Primary Mining**
  - **~ 5 g/t Au** in ore
  - Similar for Platinum Group Metals (PGMs)

- **Urban mining**
  - **~ 200 g/t Au** in PC circuit boards
  - ~ 300 g/t Au in cell phones
  - ~ 2000 g/t PGM in automotive catalysts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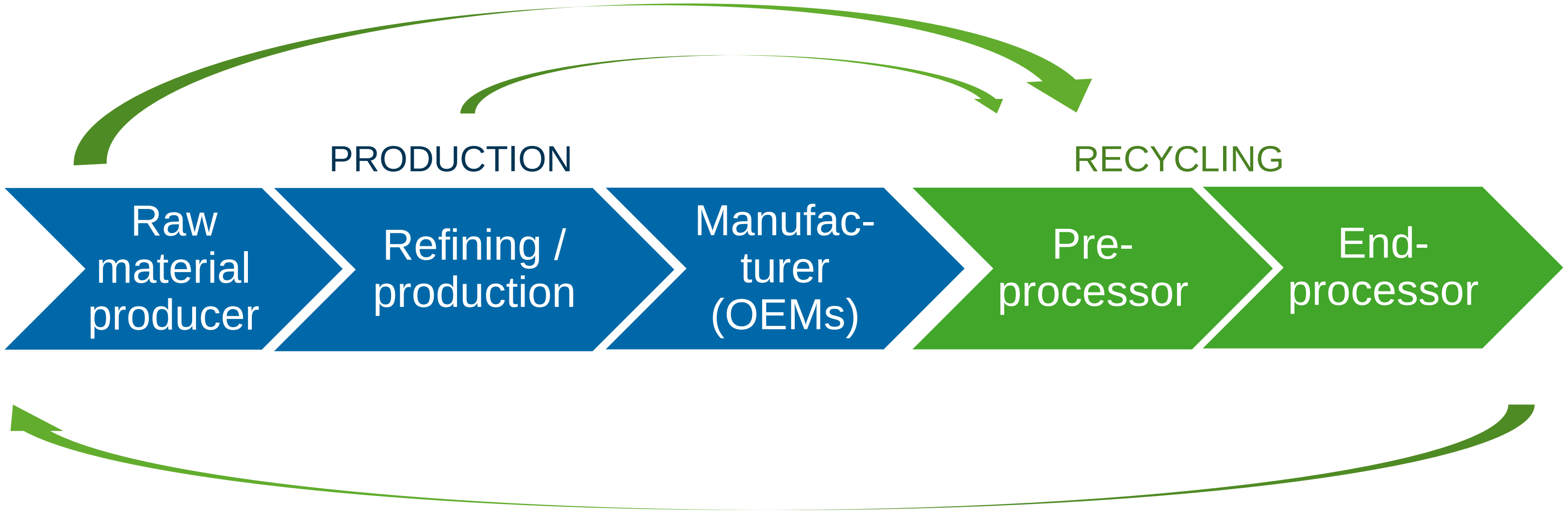
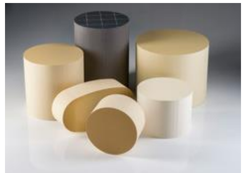
Recycling in a Circular Economy
- its challenges

Production waste & by-products lifecycle (B2B)





Medium/high lifecycle (recycling) **efficiency** thanks to:

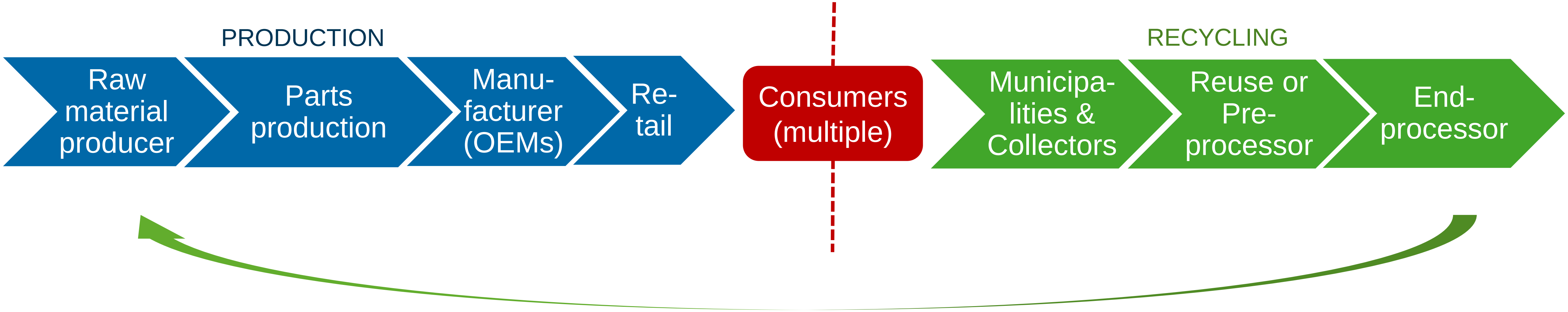
- B2B market, short and closed loop
- Specific or high grade fraction → limited losses
- No collection problem, generally well organized, established recycling business

BUT

- Potential loss due to sub-standard pre- or end-processing

Consumer ‘End-of-Life’ Lifecycle (B2C)

disconnected @ consumer → 2 <u>independent</u> value chains



Low lifecycle (recycling) **efficiency** due to:

- B2C market: long, open loop
- Improper collection
- Recycling rate: focus on mass materials
- Loss of valuable & critical metals (Au, Ag, PGM) during pre-processing (shredding, sorting)
- Metal recovery by sub-standard end-processors

Precious metals in a circular economy
Highly efficient recycling processes available

Reality Check

	Jewellery, ingots, coins	Chemical Process Catalysts	Automotive Catalysts	Electronic Products

= closed loop (B2B)
= open loop (mainly B2C)

Recycling drivers	**+ value**	**+ B2B**	**- B2C , + value**	**- B2C, + legislation**
Real Recycling rates*	**>>90%**	**> 90%**	**~60% (?)**	**~25%**

* of Au, Ag, Pt, Pd, Rh along the entire product lifecycle, **global** averages

Umicore process yields: >> 95%

Circular Economy in electronics
more Reuse than Recycling

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REUSE		RECYCLING
Product		Waste
Value	>	Value
CO_2 impact	<	CO_2 impact
3R Hierarchy	>	3R Hierarchy
Social impact	>	Social impact
Traceability	<	Traceability

- Reuse – in particular export for reuse – often goes hand in hand with shift of ownership & liability.
- Despite of many good Reuse operations/flows, it remains too often a green blanket for illegal export.
- Reuse is postponing EoL recycling. Technological innovation and material wear finally should lead to recycling anyway.

→ Reuse ≠ Excuse for not Recycling

The Way Forward
- some improvements

Need for business as unusual & systemic approach

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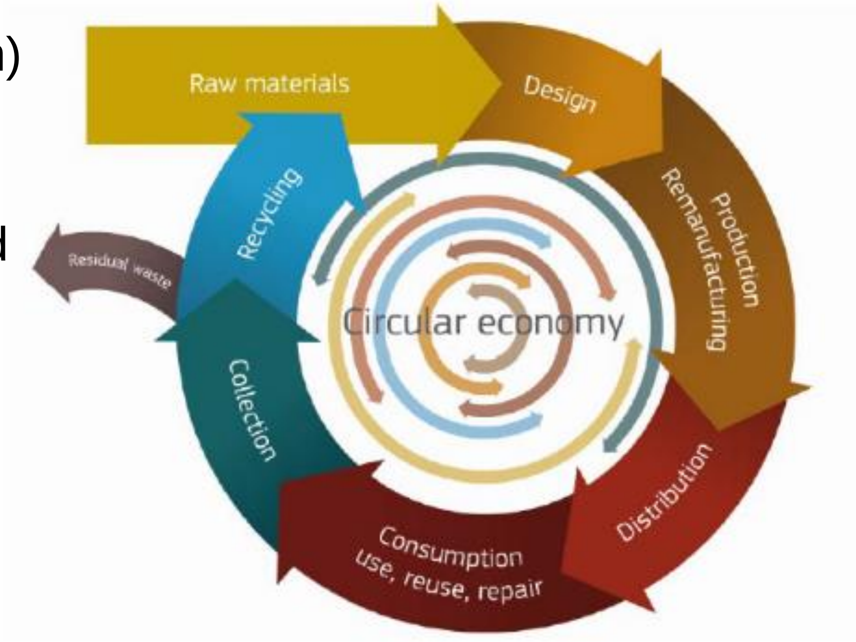
- Manufacturers (OEM's):
  - Develop durable, well repairable/recyclable products (design)
  - Insist on traceability & quality recycling
  - Develop circular business models (e.g. service/lease instead of product/sale → keep ownership)
- Recycling industry:
  - Improve official collection (traceability, determine good from bad reuse channels, determine quality recycling standards)
  - Better cooperation, look for synergies & interface optimisation
  - Give digital tools (AI, tagging) all chances to contribute
  - Keep on challenging the possibilities & limitations of chemistry and metallurgy for innovative recycling



~~Upstream – downstream~~
only "roundstream"

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Thank you for your attention!

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