



# Circular Economics: An Acquired Waste

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1) What is waste?



Is this waste?



Is this waste?



Is this waste?





Is this waste?



Is this waste?



What is waste?



human use

misplace



no human  
use/natural place

(but human  
production)



human use

rejection symbol





use symbol

=value



rejection symbol



# What is waste?

Legal definition: Waste means any substance or object which the holder discards or intends or is required to discard (EU Waste Framework Directive)

- Will/need of rejection (pollutant, space requirement, taste)



# Is waste relative?

- Is my waste also waste to you?
- Acquired taste or innate taste?

Relative waste	Absolute waste

*To what extent can we speak of relativity?*



The scope of the waste concept ranges from new unsold goods to hazardous waste.

# Is waste relative?

- Relative waste: could be considered a good (consumption opportunity: pure or input) by at least one agent
- Transformation costs small enough for the agent
- The lower the transformation costs, the more “relativity” (the more people)



# What is waste?

Why is it usually a solid? ( $\neq$  pollution)

Matter resulting from human use containing an object of nuisance, which calls for an intervention with the aim of reducing this nuisance, and the consideration that at least a fraction of it could have been/will be recovered and/or used for another purpose.

- *object of nuisance*: for the one who witnesses the rejection
- *intervention*: something should (could) be done

# Object of nuisance

## Psychological

- Symbol of finitude (Cavé)
- Sense of waste/loss/anticipated shortage (gâchis)
- “Hunger and sickness” at the same time
- Not in the right place

# Object of nuisance

- Douglas, *De la souillure: essai sur les notions de pollution et de tabou*

“dirt is an offense against order”

- Monsaingeon, *Homo Detritus*

“it [waste] must be eliminated because it challenges the organisation of society, the social order, its foundations”

“by seeking to eliminate waste, it is as if we have tried to erase the tangible evidence of the unsustainability of our lifestyles”

“making waste an autonomous technical problem”



# Object of nuisance

## Health/environment

- Non biodegradable waste
- Biodegradable waste in a non-natural environmental
- Waste containing harmful substances (pollution)
- Bulky, in the way
- Smell

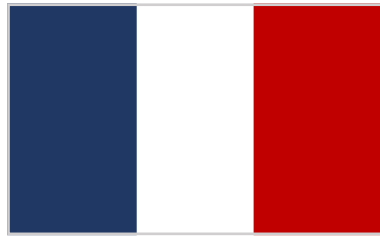
We will come back to: *why wouldn't I use this sofa ?*





## 2) State of play: waste generation in France

# Waste generation in France



2018

342 million tonnes of waste

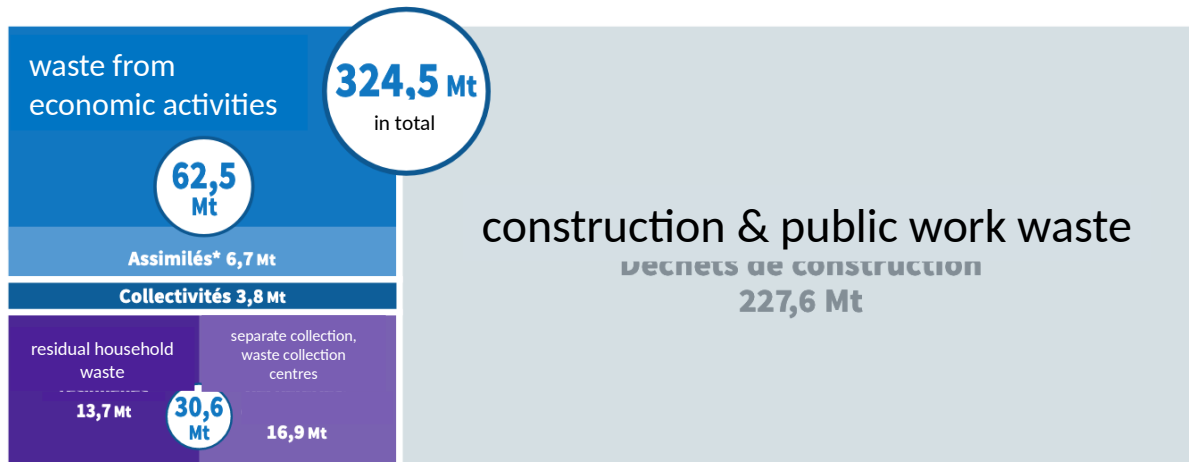
(all activities)

13 million tonnes of packaging waste



# Waste generation in France

## Waste generation in France in 2015



\* Déchets des activités économiques (DAE) collectés par le service public

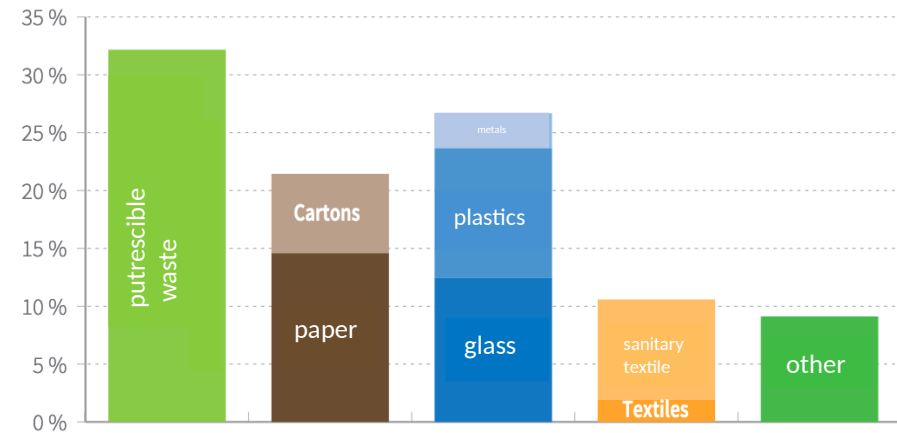
Source : ADEME. RSD. 2014 - Enquête Collecte 2015 - Estimations IN NUMERi

Les données de la figure 5 ont été actualisées par rapport au RSD pour tenir compte des résultats de l'enquête Collecte, en accord avec le ministère de l'Environnement

- Household waste: a majority of 'putrescible' waste

- Building and construction waste still represents the largest tonnage.
- A lot of inert waste, large volumes, storage problems.

## Composition of all residual household waste and separate collections in 2007



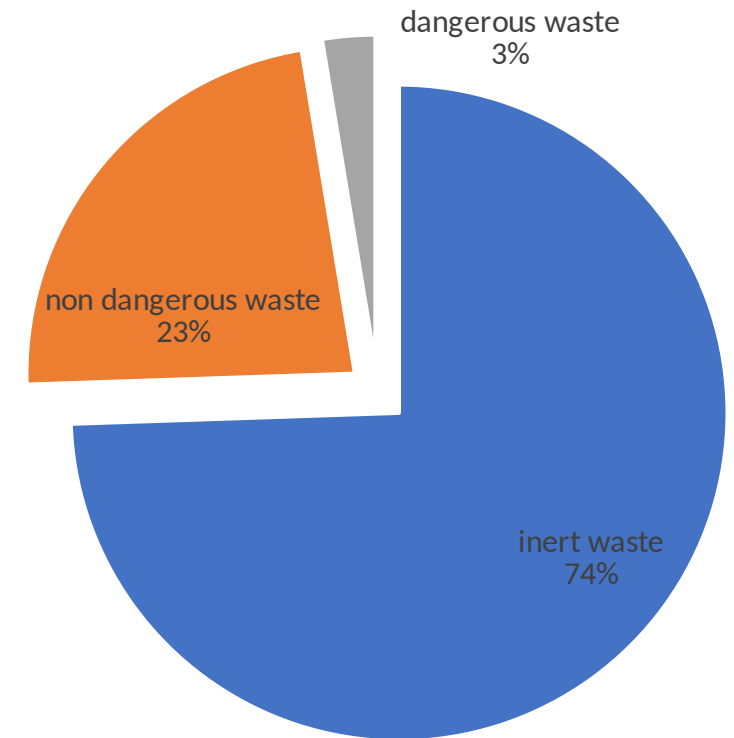
Source : ADEME. MODECOM\*

# Construction waste

construction & public work 227,5 Mt in 2014, of which 42,2 Mt for construction. Repartition of the 42,2 Mt construction waste:

- inert waste (31,5 Mt): reused as construction materials  
concrete, brick, glass, stone
- non dangerous waste (9,7 Mt): low recovery  
metals, wood, cartons without dangerous substances, plastics
- dangerous waste (1,1 Mt): specific management  
batteries, dangerous substances

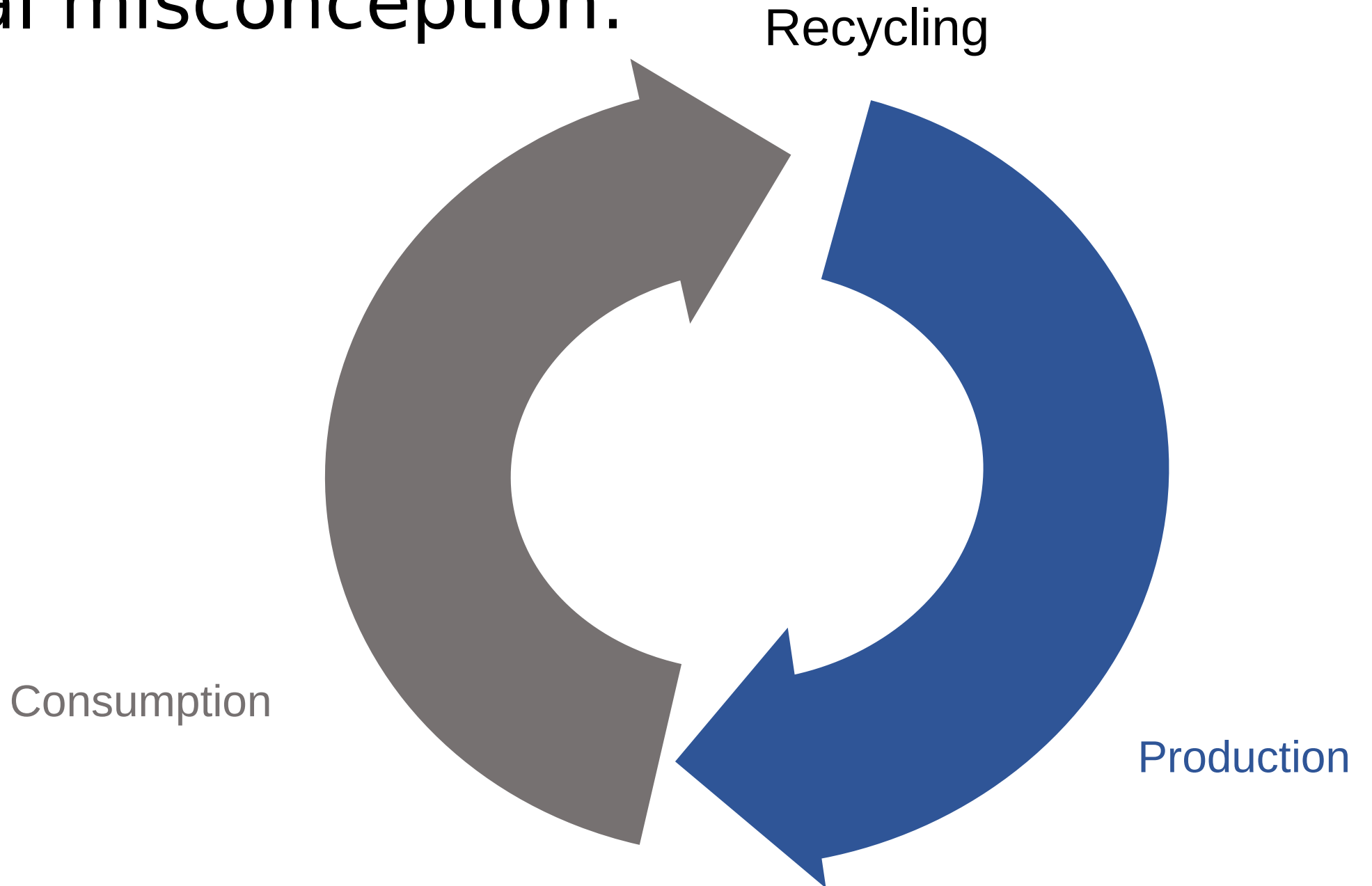
Nature of construction waste  
(data 2014, ADEME)

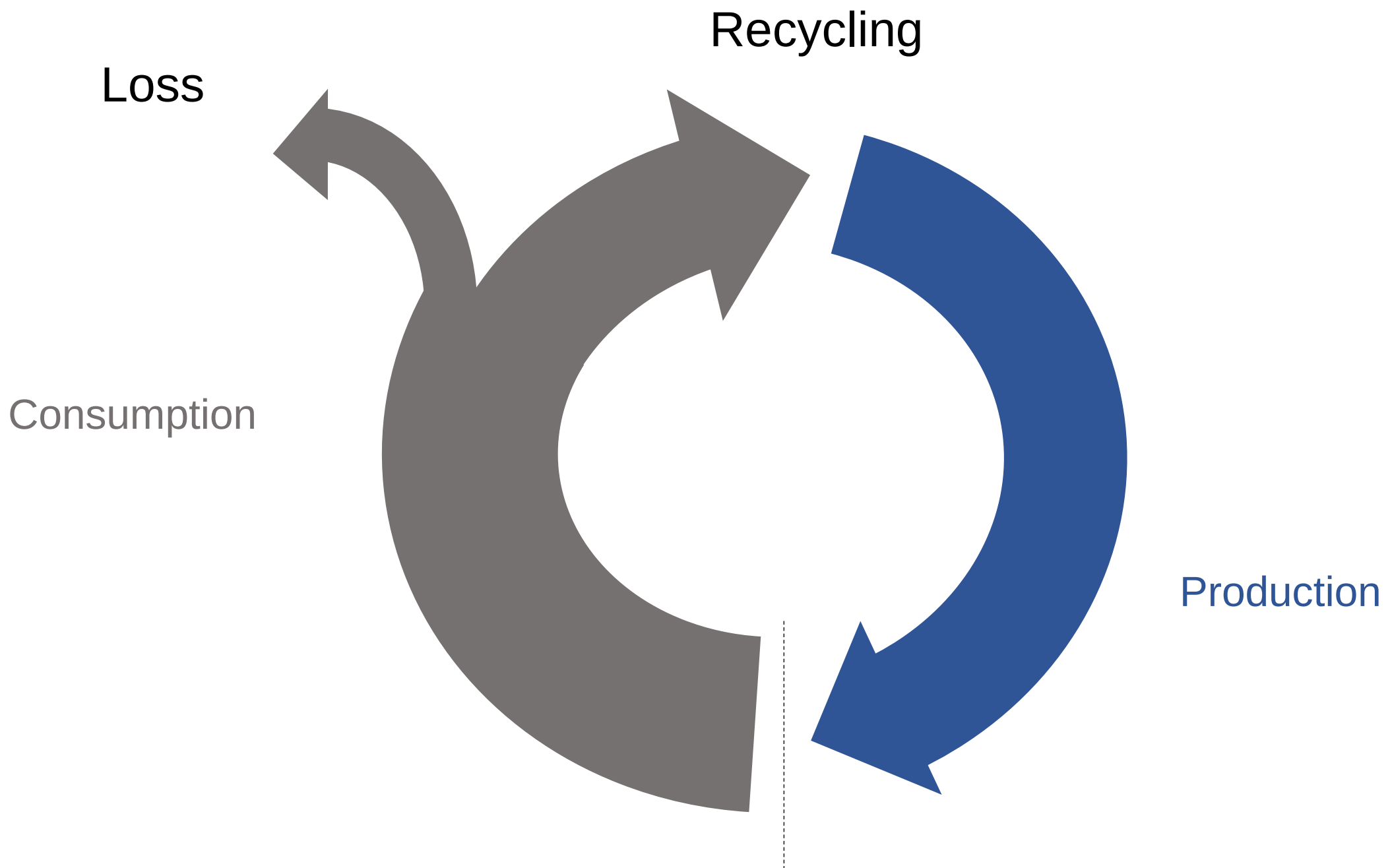




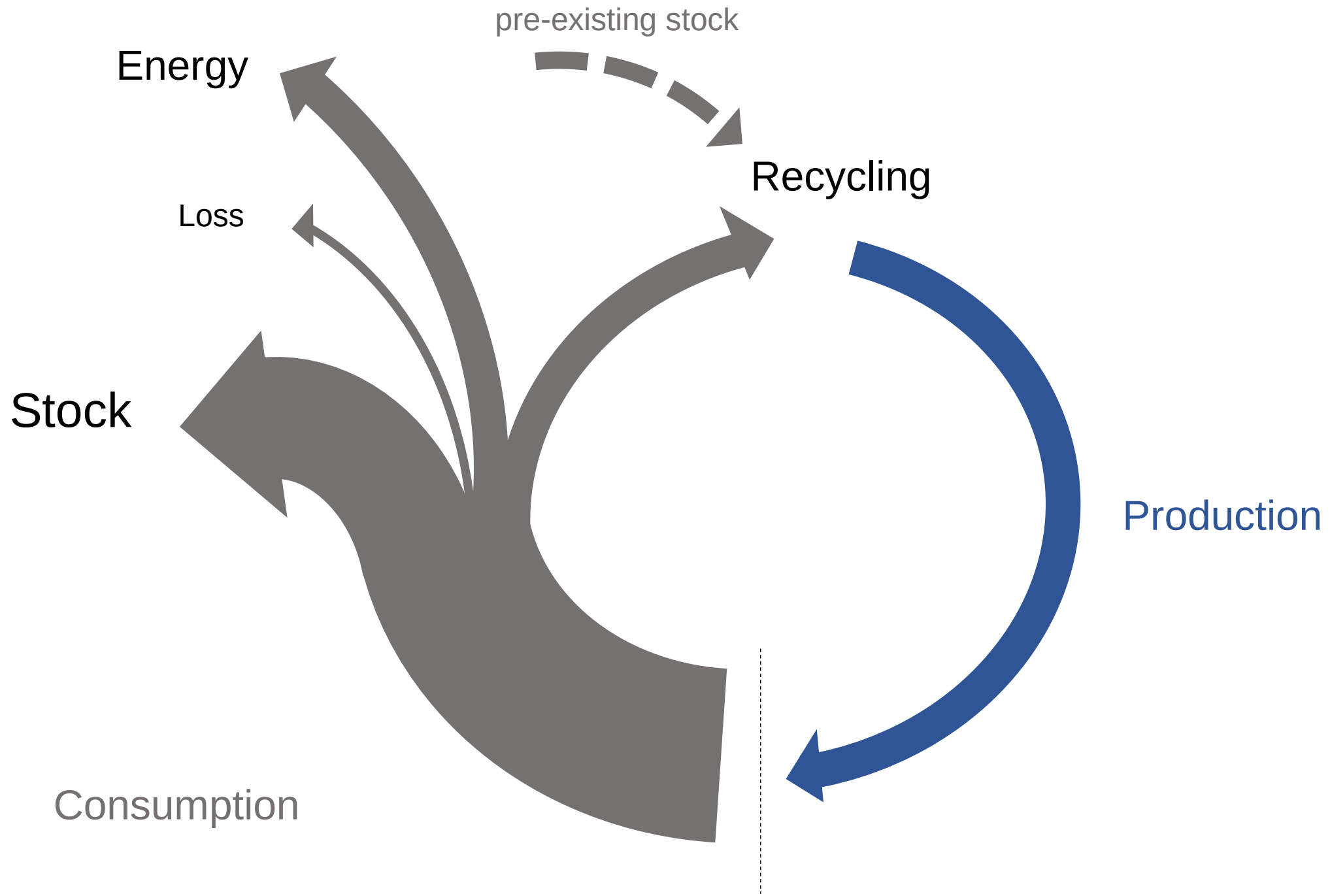
3) Can the  
economy be  
circular?

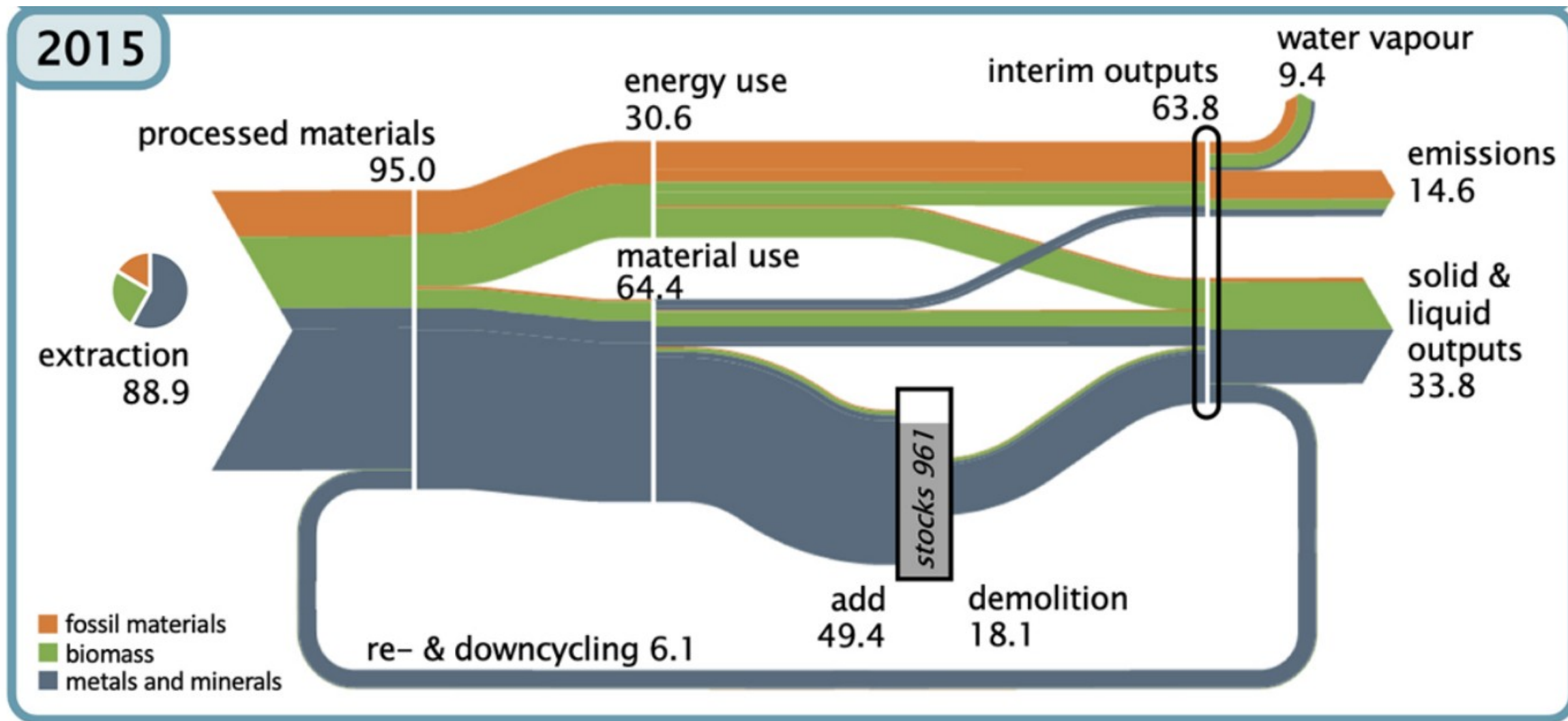
# Practical misconception:












Source: Haas et al. (2020)

# Georgescu-Roegen (1906-1994)

- Mineral resources are irrevocably finite
- Within each recycling cycle, there is material loss
- Passionate debate about the theoretical possibility of complete recycling - example of G-R's car 
- Georgescu-Roegen (1977, p.268)

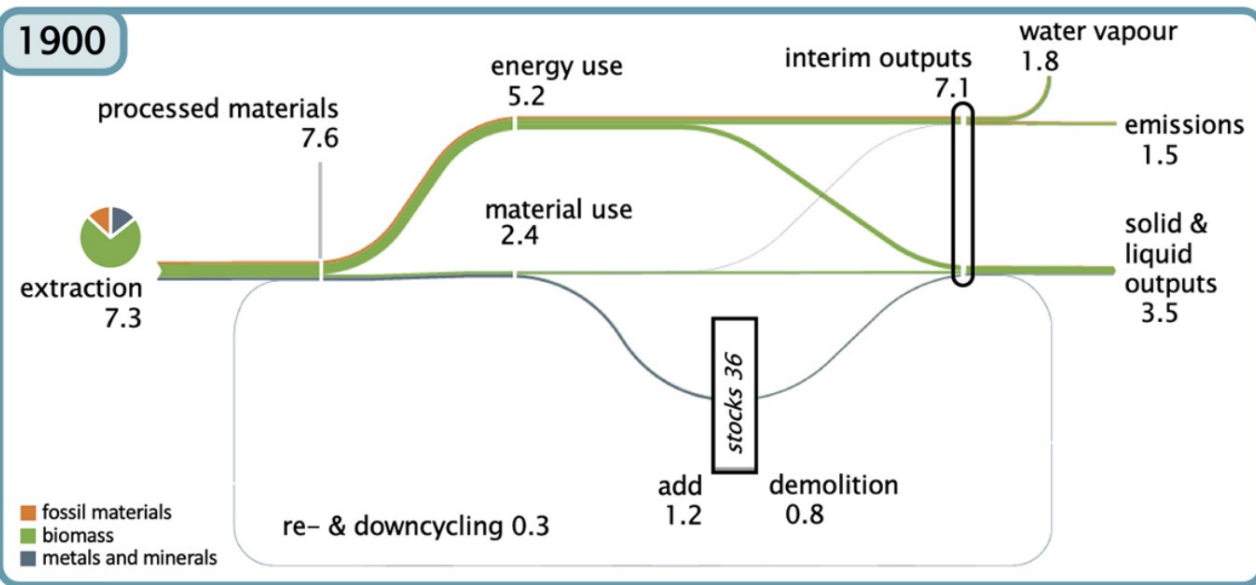
"No energy conversion is possible without a material support, friction dissipates not only energy but also matter. The wear and tear of most devices in a single experiment may be imperceptible, but that is no reason to ignore it. In the long run, or on the immense scale of the "world engine", the dissipation of matter reaches palpable proportions. All around us there is oxidation, flaking, blowing, leaching and so on. There are no eternal material structures because matter, like energy, is continually and irrevocably dissipating."

# Ayres (1932-...)

- Ayres (1999) demonstrates that complete recycling is (theoretically) possible (but not within the same period: losses do occur)
- Inactive reservoir VS active reservoir + infinite energy from the sun
- Impact of the inactive reservoir on the environment? Impact on mining the inactive reservoir?

What is circularity?



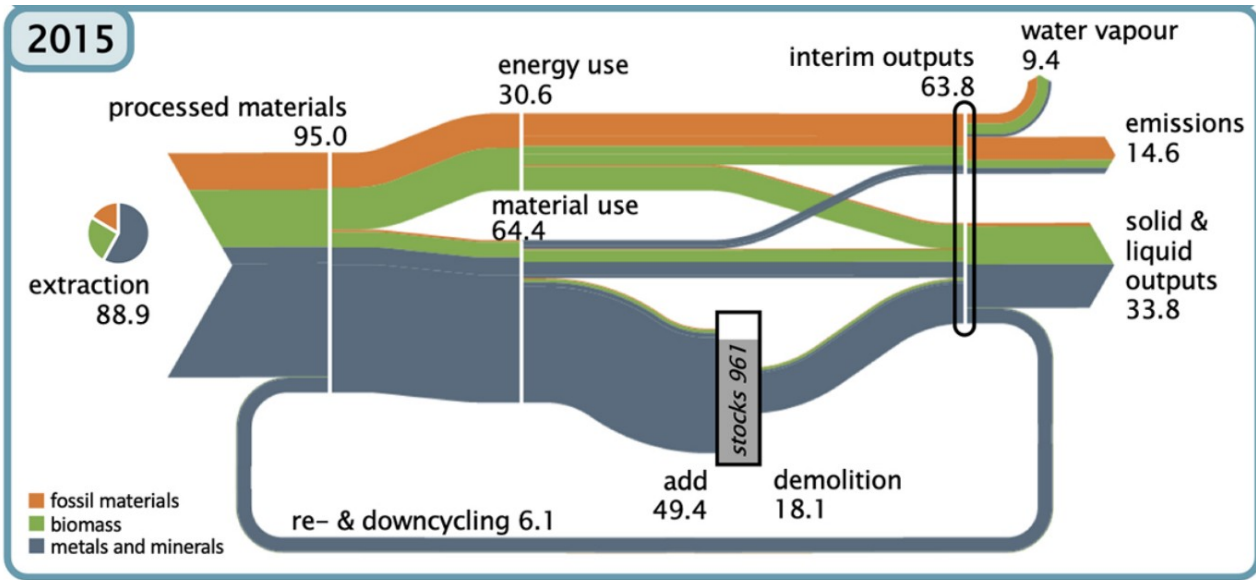


**1900**

43% of circularity

91% ecological cycling

9% industrial recycling



**2015**

27% of circularity

76% ecological cycling \*

24% industrial recycling

Source: Haas et al. (2020)

\* contribution of ecological cycling to circularity

# Size of flows

- United Nations “Should the global population reach 9.6 billion by 2050, the equivalent of almost **three** planets could be required to provide the natural resources needed to sustain current lifestyles”
- Haas et al. (2020) - 4 key challenges
  - tackle the growth of material stocks
  - eliminate unsustainable biomass production
  - integrate the decarbonization of the energy system with the circular economy
  - prioritize absolute reductions of non-circular flows over maximizing (re) cycling rates.

# Open CE

- Korhonen et al. 2018: “Circular economy is an economy constructed from societal production-consumption systems that maximizes the service produced from the linear nature-society-nature material and energy throughput flow. This is done by using cyclical materials flows, renewable energy sources and cascading-type energy flows. Successful circular economy contributes to all the three dimensions of sustainable development. Circular economy limits the throughput flow to a level that nature tolerates and utilises ecosystem cycles in economic cycles by respecting their natural reproduction rates.”
- Zotti and Bigano (2019) “Since circular flows (loops) cannot be completely closed, a (fully) circular economy is, strictly speaking, unrealizable, i.e., it cannot exist. By contrast it is scientifically (physically) correct and (technically, economically ...) feasible to adopt the idea of partially closed, i.e. open energy and matter circles.”



## 4) An economic problem



# Why a perfectly reusable good is lost to the economy?



# “Relative waste”: a simple allocation/matching problem?

Matching supply and demand: encourage the creation of markets

- second-hand stores, flea markets, garage sale
- digital applications: Vinted, Le bon coin

``Relative waste”: a simple allocation/matching problem?

What are the barriers to reuse?

What reasons will prevent me from re-using waste, e.g., the sofa on the street?

# ` `Relative waste": a simple allocation/matching problem?

- Risk aversion and trust: why doesn't the other one want it anymore?
- Relationship to the other: sense of inferiority? cultural representation of waste

# “Relative waste”: a simple allocation/matching problem?

Maximising expected utility:  $U(\text{sofa})$

- Having a sofa would increase my utility =  $f(\text{sofas already owned})$
- Sense of inferiority: immediate
- Expected risk: known at  $t+1$ 
  - The sofa is of excellent/mediocre quality (e.g. bed bugs)



# ` `Relative waste”: a simple allocation/matching problem?

## Not only

- Market forces  $\Rightarrow$  sofas demand, preferences
- A problem of information, guarantee  $\Rightarrow$  are there bugs?
- Supply: How much costs a new sofa with certainly no bugs?
- Reuse technology/costs: cleaning, transportation

# Can the economy be based on waste?

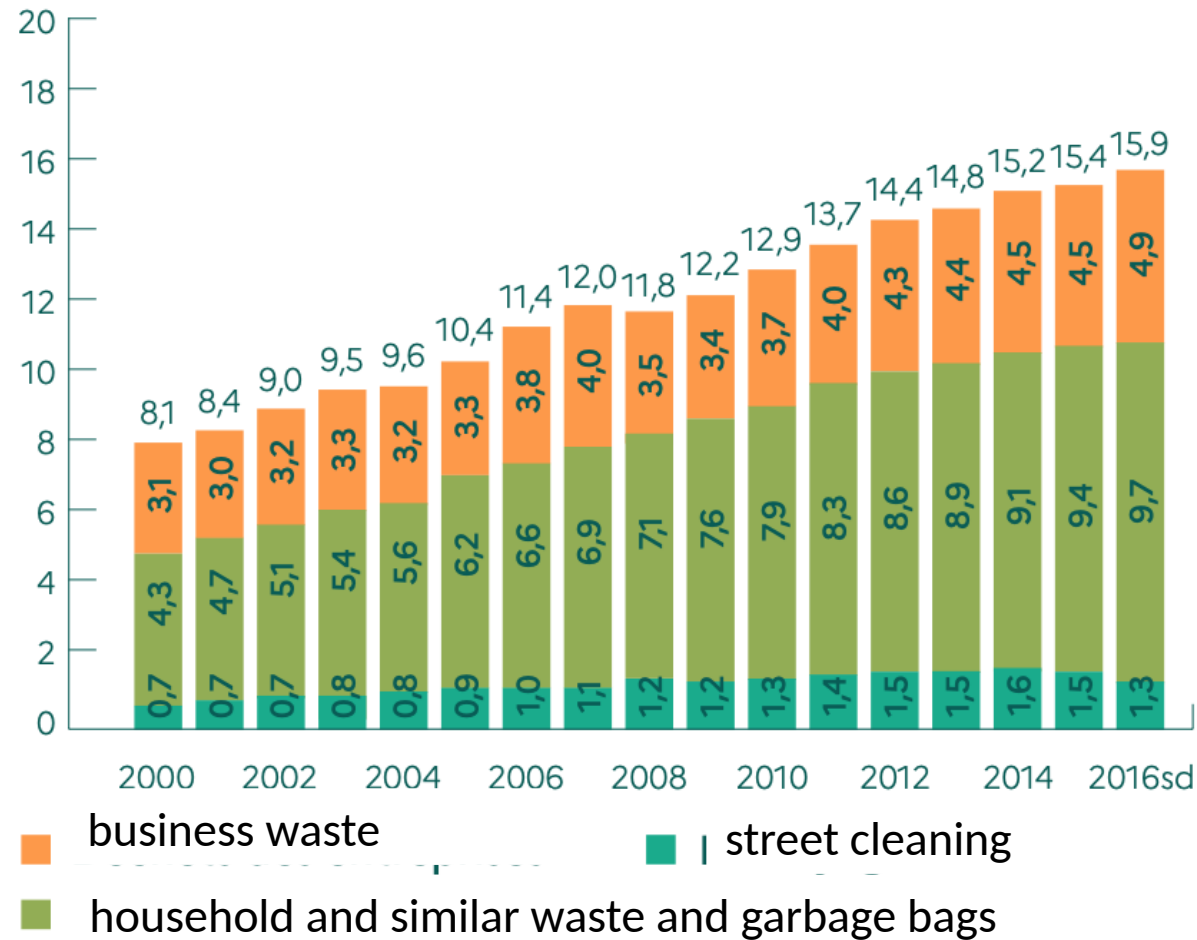
Different dispersion

- spatial dispersion (collection)
- chemical dispersion (recycling)
- informational dispersion

What is the dispersion of the substitute?

## Evolution of current expenditure by waste manager

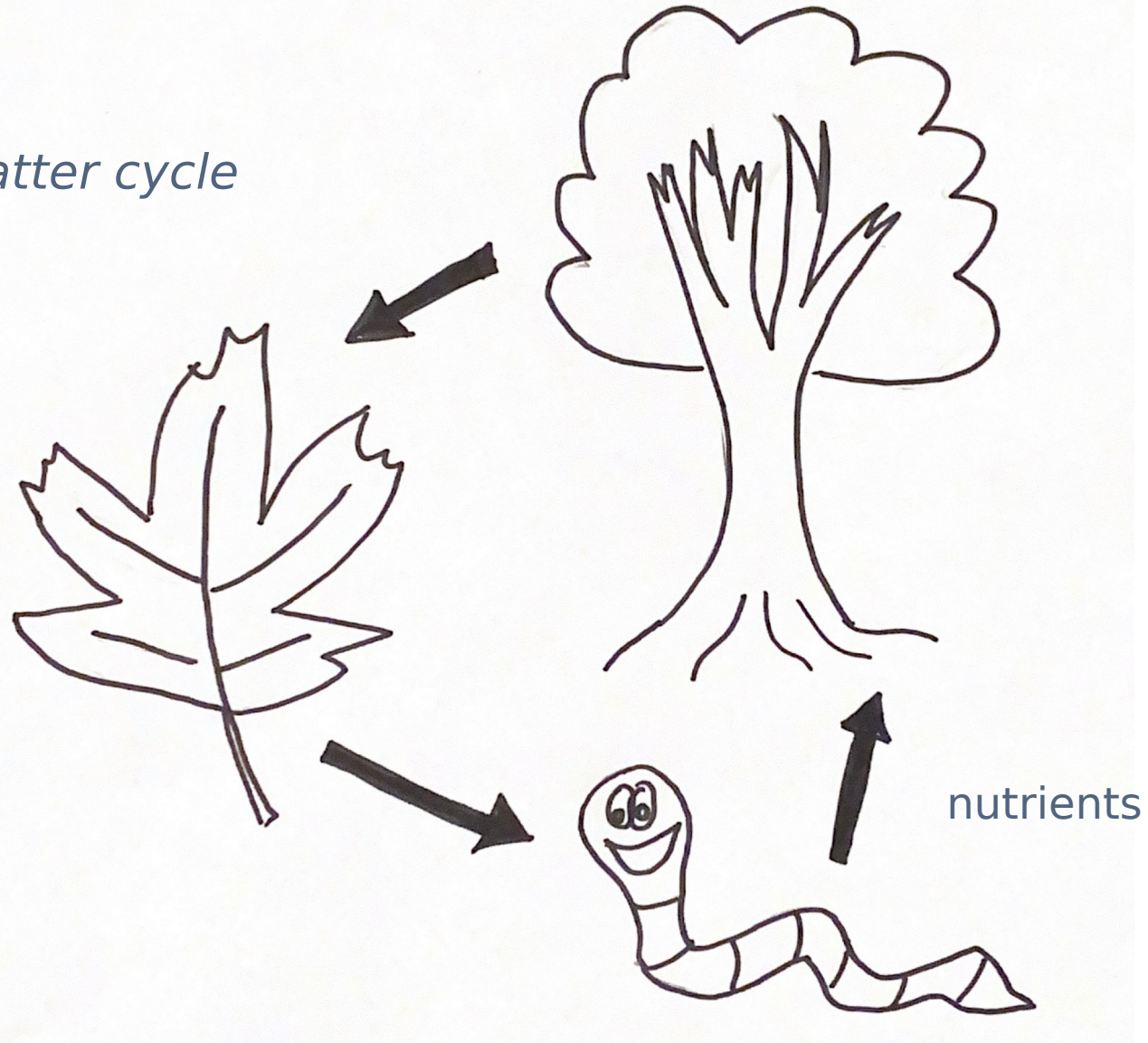
billion euros



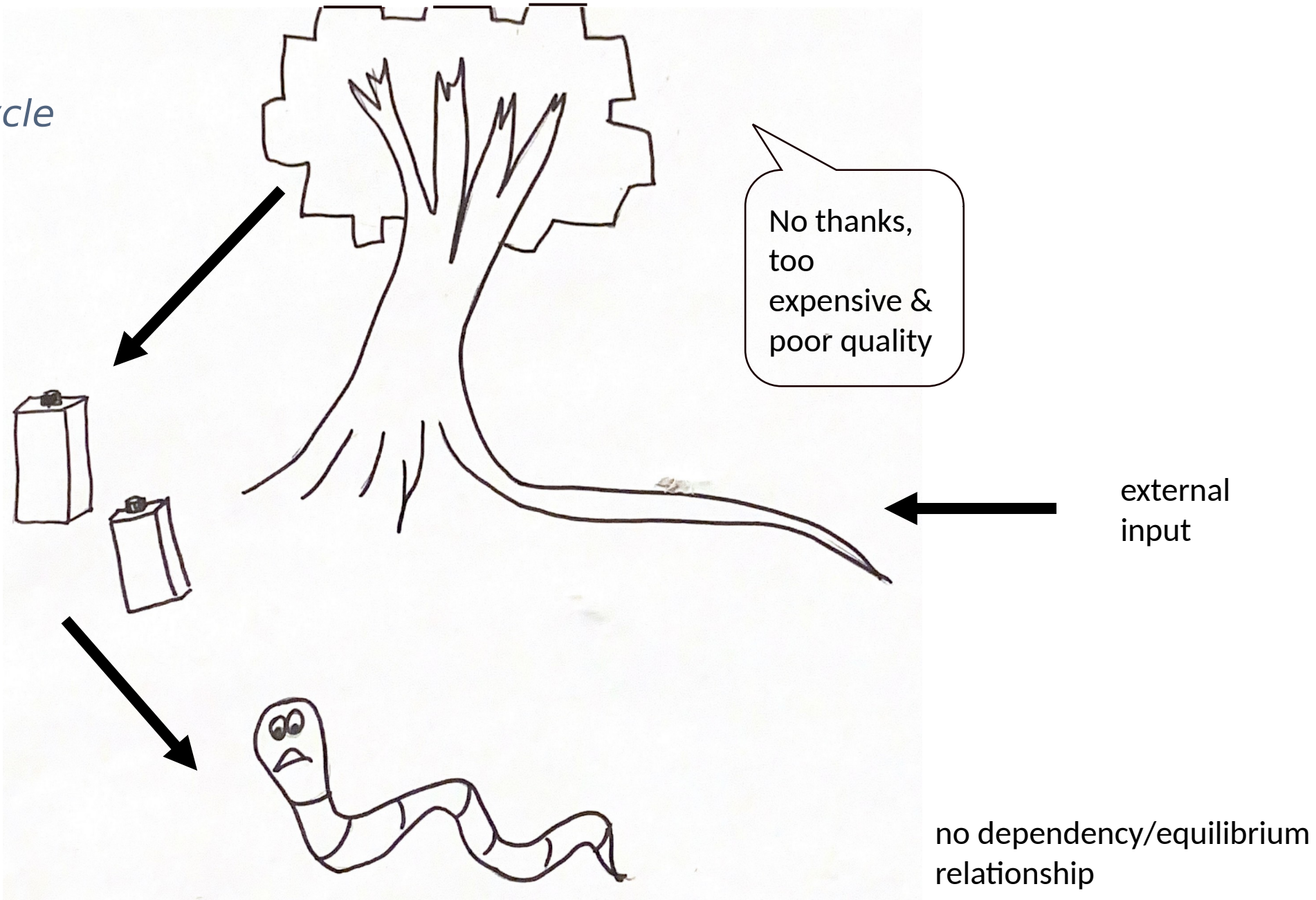
Sd = semi-définitif

Source : SDES – L'économie de l'environnement en 2015, mise à jour CGDD pour 2016

## *Organic matter cycle*



*Economic matter cycle*



# Who wants to buy my waste? An ambiguous price

- Waste is an intermediate economic object ( $\neq$  good,  $\neq$  pollution)
- Matter resulting from a production or consumption process that has a negative externality and can be reallocated as a productive input at a defined or undefined economic and environmental cost.



# Who wants to buy my waste? An ambiguous price

- Baumgärtner and Winkler (2003) explain that in Germany the price of paper waste is sometimes positive, sometimes negative, or equal to zero.
- Waste price ambivalence
- Driven by environmental policies, market forces ( $f(\text{preferences})$ ), technology

# What is waste value?

- **Value of waste = (Revenue from recovery) - ( Collection/Treatment costs)**
- Revenue: Value of the material to be recovered (scarcity, industrial application, calorific value if incinerated, preferences)
- Costs: Labour costs, Available technology, Environmental and quality standards, Design and hazardousness of the material to be recycled, treated
- Example, hazardous waste to be disposed of:
  - Anticipated revenues: 0€, because no recovery
  - Anticipated costs: high

# Rebound effect and environmental consideration

- Automatic substitution with virgin resources?
- E.g.: I decide to buy/sell cloths on Vinted
- Makov and Vivanco (2018) : smartphone reuse in the US
  - Imperfect substitution between “re-circulated” (recycled, reused, etc.) and new products (e.g., exports)
  - Re-spending due to economic savings
  - They estimate that about one third, and potentially the entirety, of emission savings resulting from smartphone reuse could be lost due to the rebound effect

# Rebound effect and environmental consideration

Sorting efforts tend to increase resource consumption

The “belief” in recycling reduces the waste disutility/externality

- Ma et al. (2019) sorting behaviour for recycling program in China.
  - Online survey data of 356 participants in China
- Catlin and Wang (2012): paper use for scissors and restroom paper hand towel



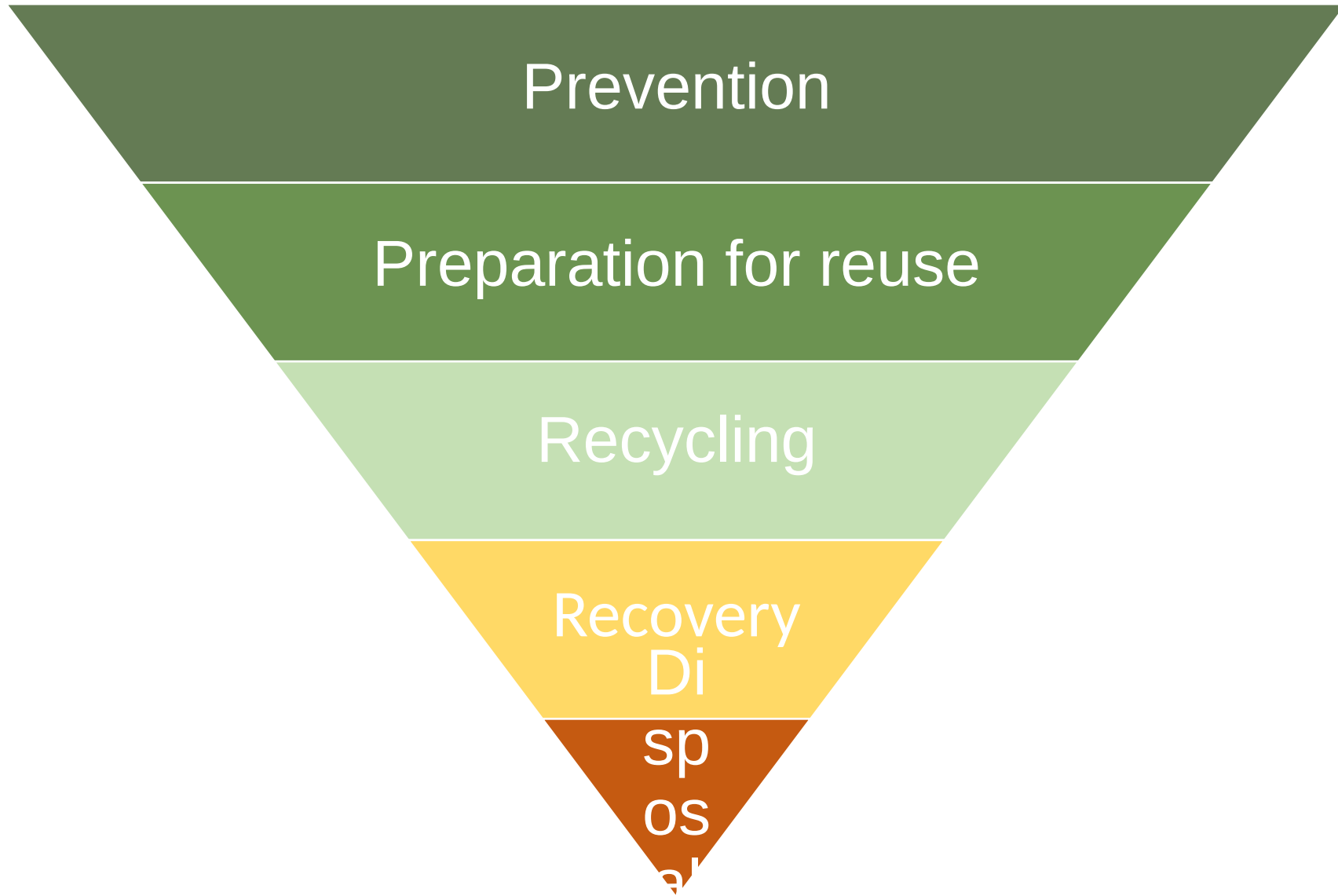
## 5) Waste policies

# Waste management principles

The hierarchy of waste treatment methods (Directive 2008/98/EC translated into the French Environment Code):

- **Prevention** (reducing the quantity and content of harmful substances), including reuse (extending the life of the product before it becomes waste)
- **Preparation for reuse** (checking, cleaning, repairing a product that has become waste)
- Material **recycling** and recovery of organic waste by returning it to the soil (compost)
- **Energy recovery**
- **Disposal** (incineration without energy recovery, landfill)

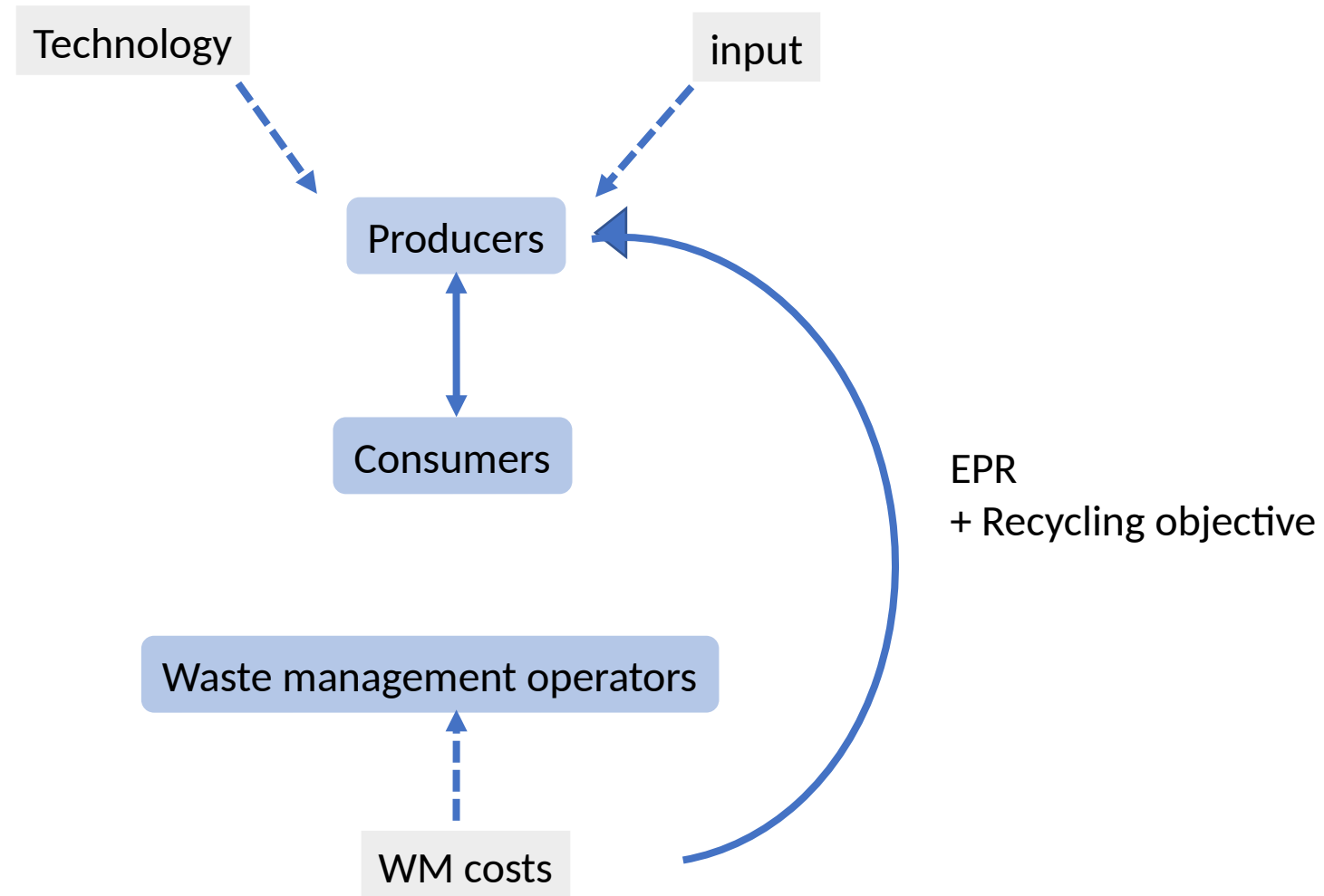




# Extended Producer Responsibility

- Cost allocation
- Environmental performance/objectives
- Information recovery

# Extended Producer Responsibility: eco-design



# Extended Producer Responsibility: limits

- Use of virgin materials
- Long-term efficiency of the price incentive

# Command and control instruments

## End-of-life

- Collection targets
- Recovery targets

# Recycling objectives

**Objective France:**  
75% of hh pack waste

**70% in 2018**

- **packaging**

(%)	France, 2018	EU28, 2020	target 2025 (%)	target 2030 (%)
total	65,7	65,7	65	70
total	26,9	41,8	50	55
wood	31,2	34,6	25	30
Metals (incl. Alu)	87,1	80,1	70	80
Aluminium	62,4	nd	50	60
glass	76,2	74,7	70	75
Paper carton	92,1	82,9	75	85

**AGEC:**  
**100% in 2025**

Source: Eurostat

Note: nouvelle méthodologie à venir (harmonisation des méthodes au niveau européen)



# Command and control instruments

## Design stage

- Incorporation rate

### Directive on single-use plastics

25% incorporation of recycled plastic in PET bottles by 2025

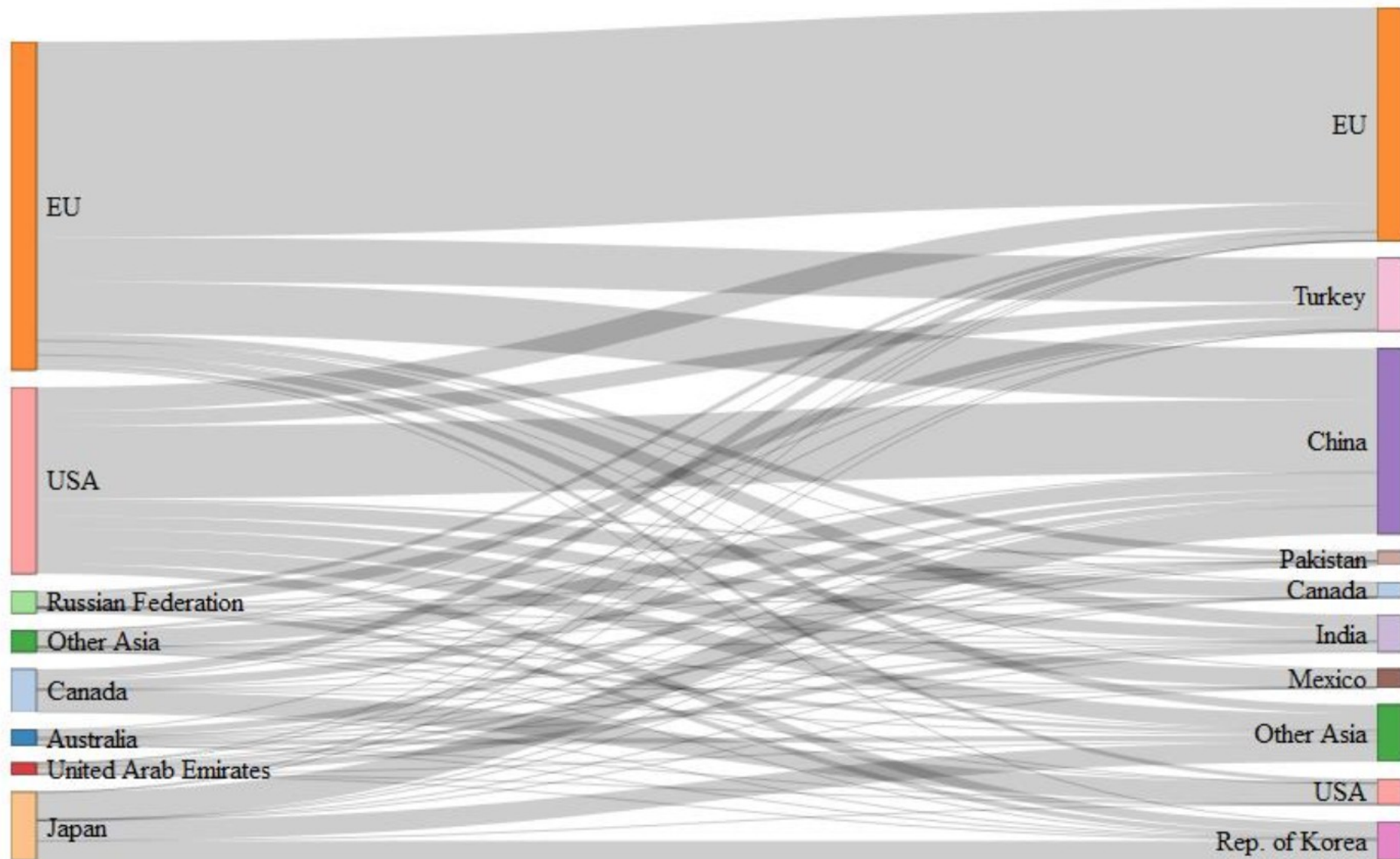
30% incorporation in all plastic bottles by 2030



5) A geopolitical  
object and economic  
interests

# Optimisation of waste value

- Demand (material/energy/second-hand needs)
- Supply (economies of scale, costs of collection, sorting, transportation)



*Who is paying?*

*Note:* Traded weight of waste and scrap items from countries of origins (left-hand side) to countries of destinations (right-hand side) in 2016. Waste and scrap items are those contained in the list of 62 Harmonized System (HS) codes provided in Kellenberg (2012).

*Source:* BACI International Trade Database.

Source: OCDE, 2018

# International convention

- **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)** entered into force in 1992
  - Classification of hazardous waste in the Convention's annexes (**amber list**) and non-hazardous waste (**green list**) = Basel Code
  - Principle of environmentally sound management (Article 4), from which follows
  - Prohibition to export to a country that refuses hazardous waste or to a State where there is reason to believe that the waste is not managed in an environmentally sound manner
  - Principle of prior written informed consent before exporting hazardous waste to another country.
- **Amendment to the Basel Convention (1995)**: Ban on exports of hazardous waste to developing countries (for disposal or recycling), entered into force on 05/12/2019
- **Bamako Convention (1998)**: Ban on imports into Africa of hazardous and radioactive waste

# Environmental policy

“Packaging waste sent to other Member States or **exported** out of the European Union shall be counted as recovered or recycled **only if there is sound evidence that the recovery and/or recycling took place under conditions that are broadly equivalent to those prescribed by the European Union legislation on the matter.**”

Source: Eurostat, description des données.