Toward green electronic:
A real challenge for Europe

Moving from recycling by opportunity to recycling by design

Green ECS Task force

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Assises de l’ embarqué - January 12th, 2022

Green ECS task force

Task force hosted in the EPOSS (European PlatfOrm and Smart Ssystems integration) cluster.

Work on proposal to make ECS(**E**lectronic and **C**omponents **S**ystems) with lower environmental footprint.

Will deliver a white paper and a presentation by mid 2022

Mainly work on e-waste reduction and management

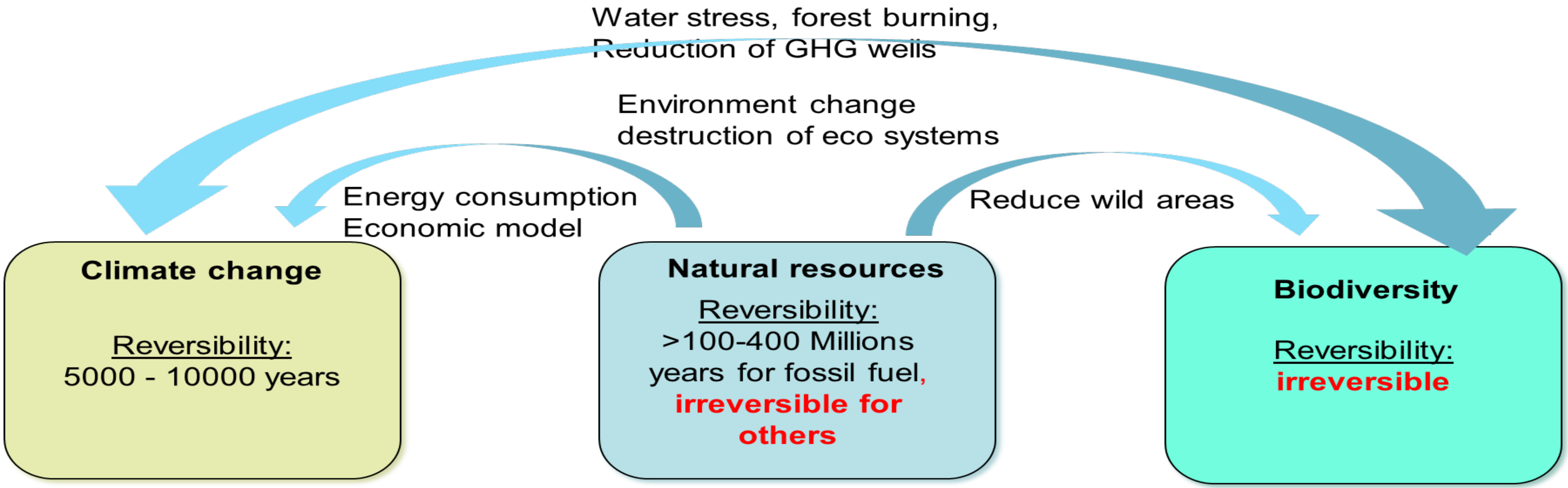
Composed of industrials and RTO’s and any volunteer concerned by the topic ☺

1 Global environmental context

2 Electronic and Components system (ECS) and E-waste

3 Green ECS task force

Climate change…. but not only



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Situation is very critical !!!

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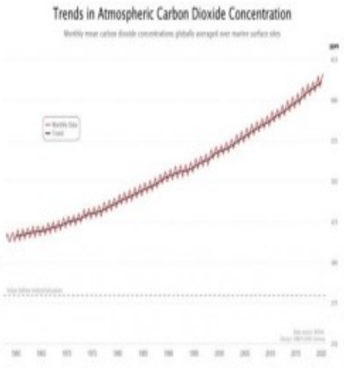
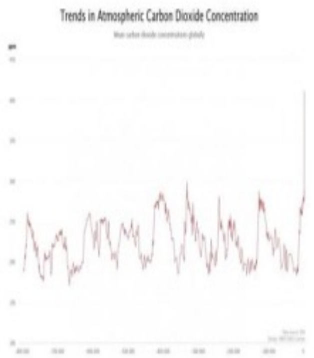
Looking into the future… Global warming

Major impact forecasted in our daily life's especially in industrialized countries.

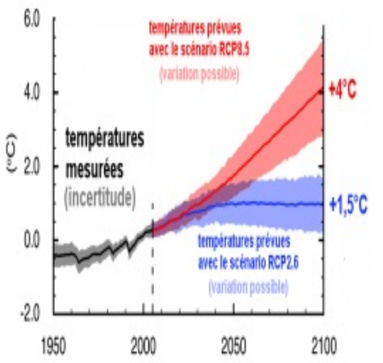
Today trend is clearly above 2°C, except if we achieve 2030 and 2050 targets regarding GHG emission but they seem out of reach, more in the range of 3°C - 4°C and even more !!!



Source: United Nation Environmental Program



Source: United Nation Environmental Program



Source twi-terre.net, GIEC 5th report – 2013

Whatever the ways, for sure our life will be substantially impacted before 2050!!

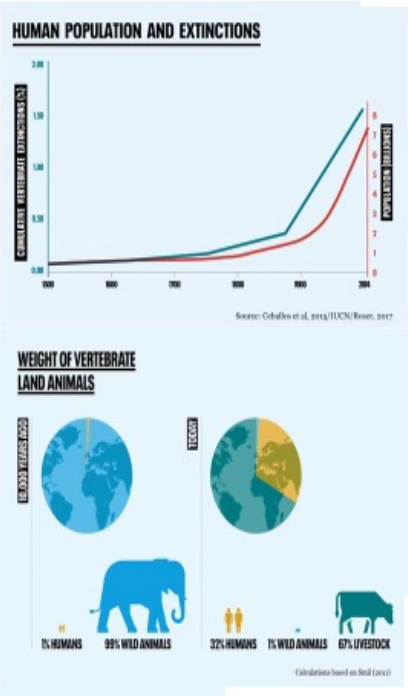
Biodiversity… already a disaster

Within the next 80 years, we are on track to lose over one million known species. (1 out of 8!!!) Source UNEP

Population of remaining species drastically decreasing (Tiger have lost 97%) Source:UNEP/wild)

Migratory birds have lost approximately 70% of their populations. Source wild

In the span of only a few decades, the biomass of humans and our livestock has come to total 24x more than that of all other wild mammals! Source: wild



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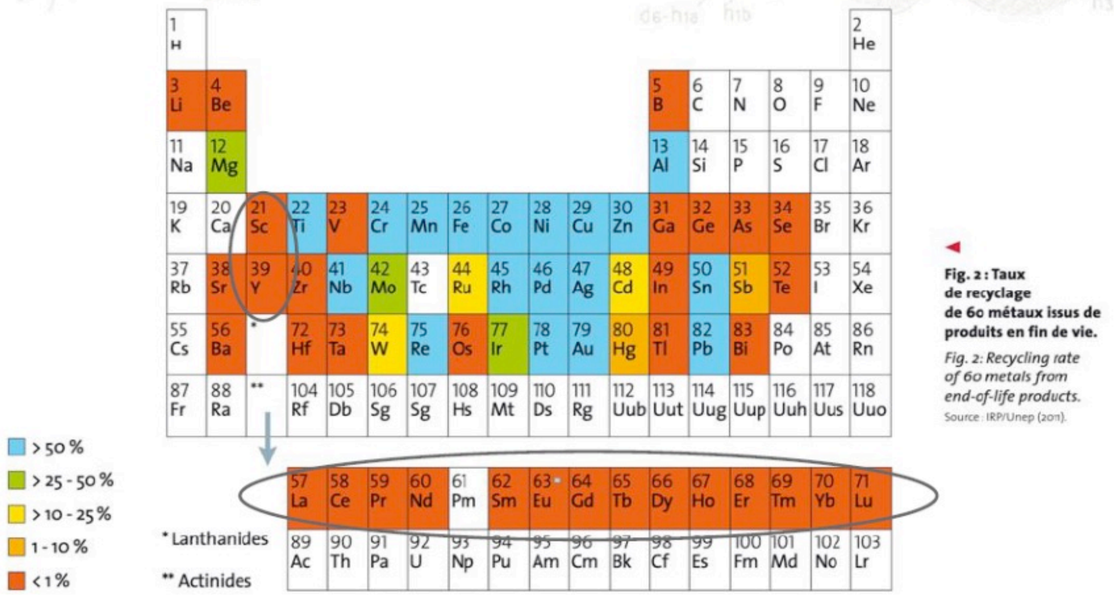
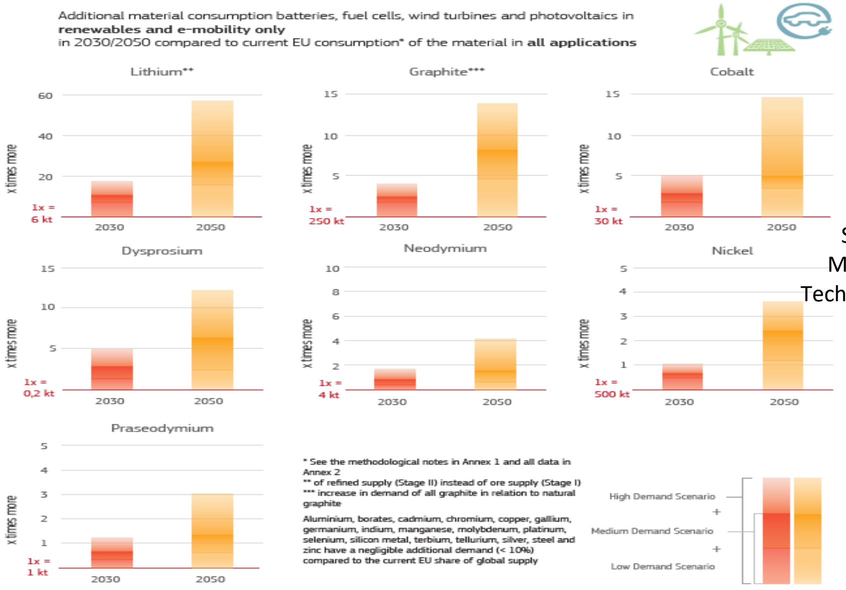
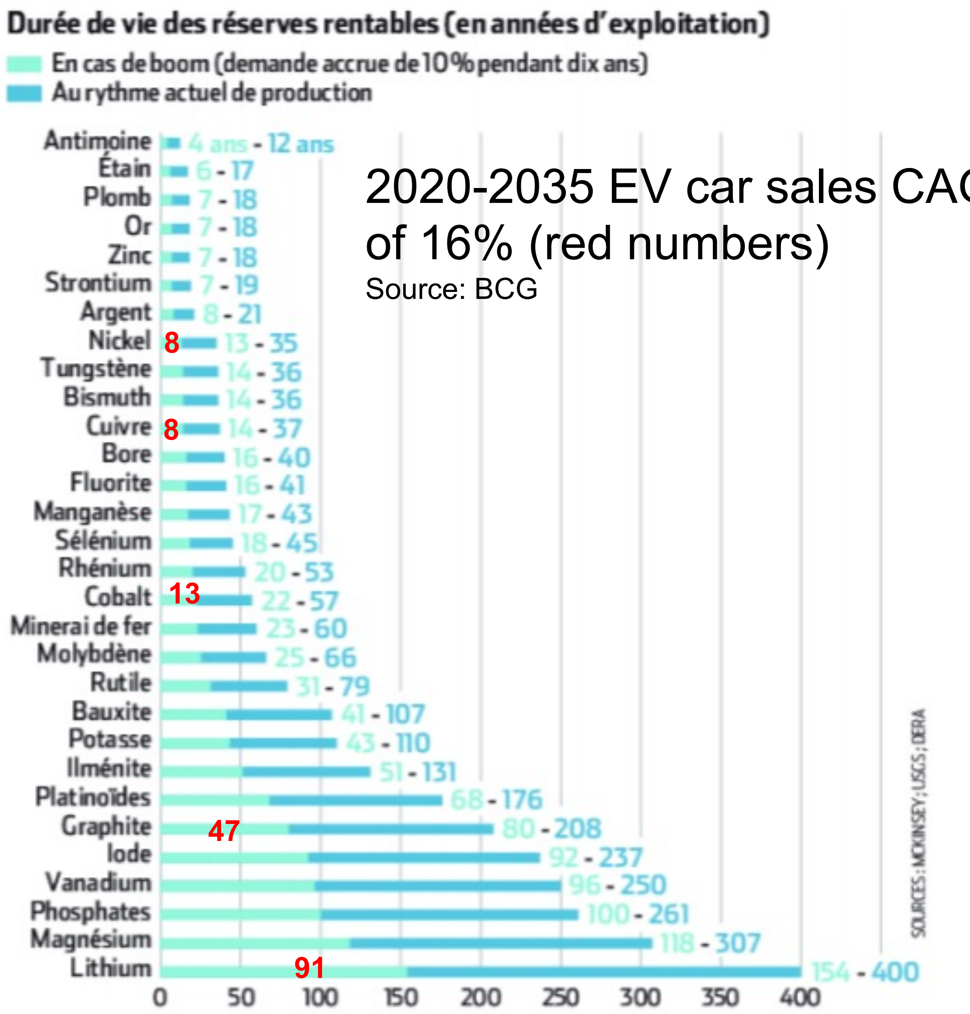
Our industry is at risk, recycling is mandatory





Source: Critical Raw Materials for Strategic Technologies and Sectors in the EU (2020)



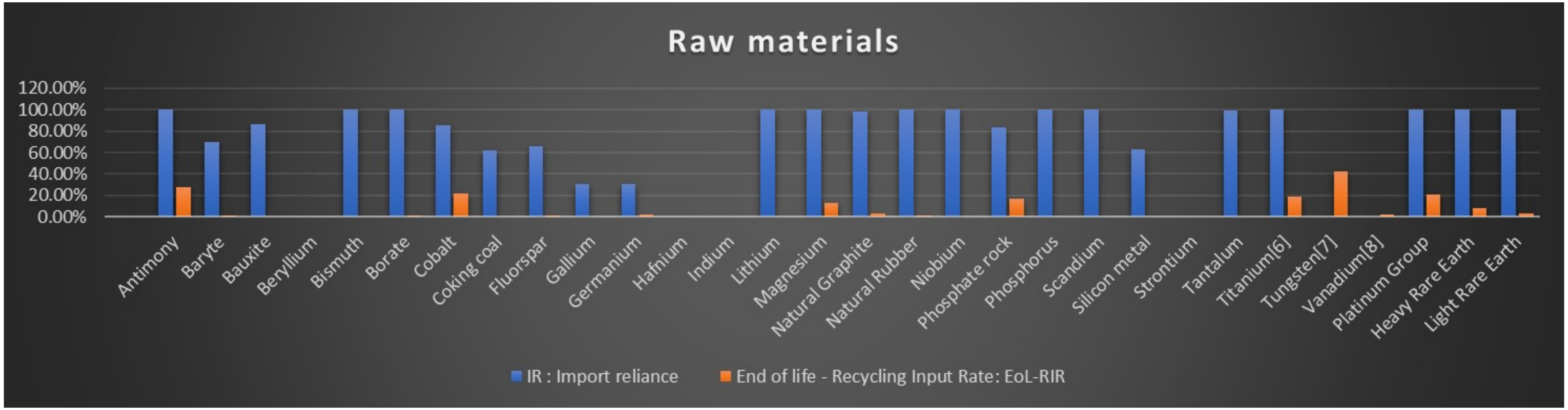
2020-2035 EV car sales CAGR of 16% (red numbers)

Source: BCG

* *Les matières premières critiques sont définies comme étant « celles qui présentent un risque particulièrement élevé de pénurie d'approvisionnement dans les dix prochaines années et qui jouent un rôle particulièrement important dans la chaîne de valeur »*

EU27 critical raw materials

	2011	2014	2017	2020
# of critical raw materials for EU27	11	14	20	30



Source : EU 2020 COM 424(final) - Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability

IR = (Import – Export) / (Domestic production + Import – Export)

EoL-RIR is the percentage of overall demand that can be satisfied through secondary raw materials

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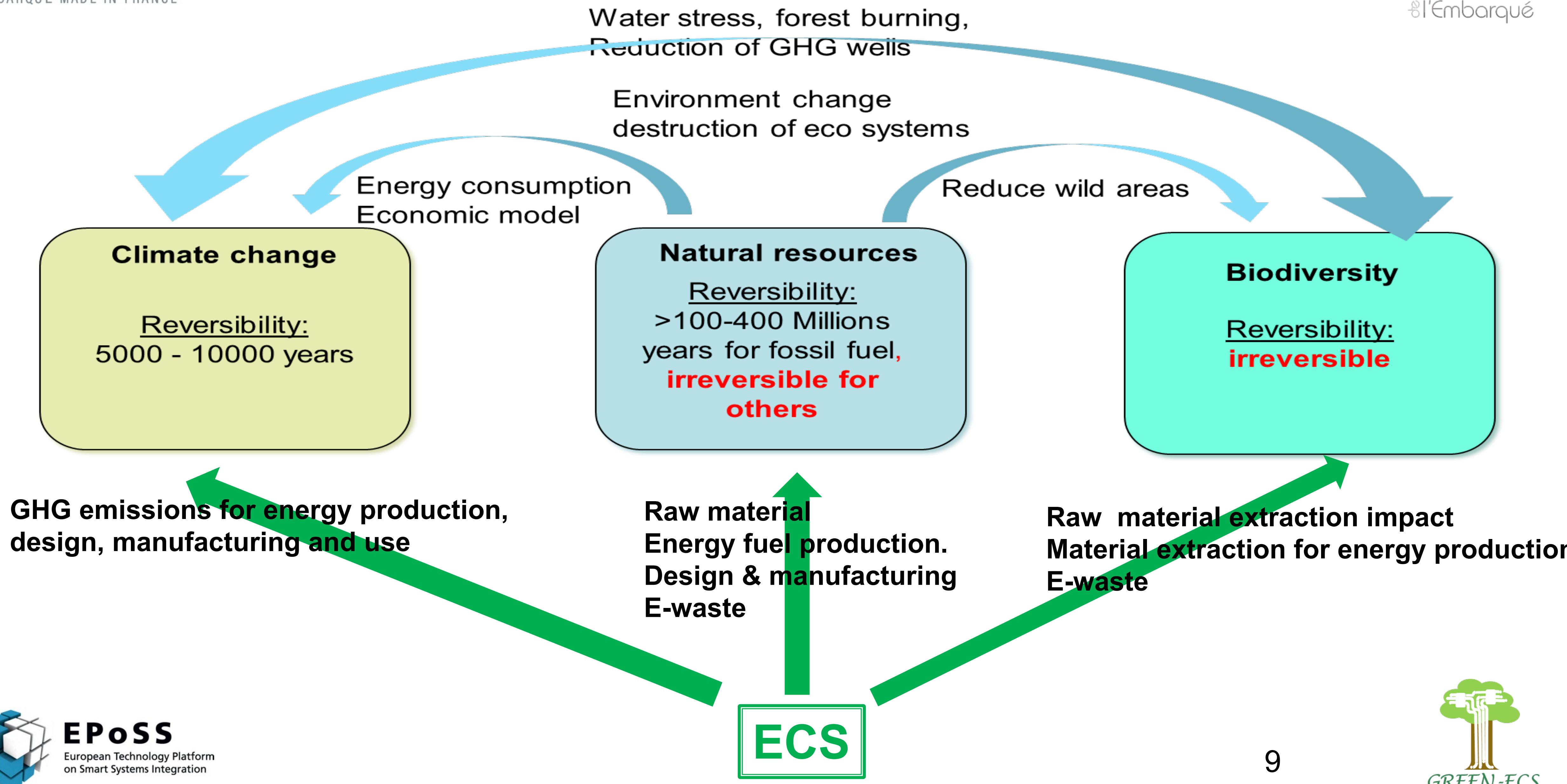
What is the impact of ECS?



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ICT CO2 emission evolution… not neglectable!!

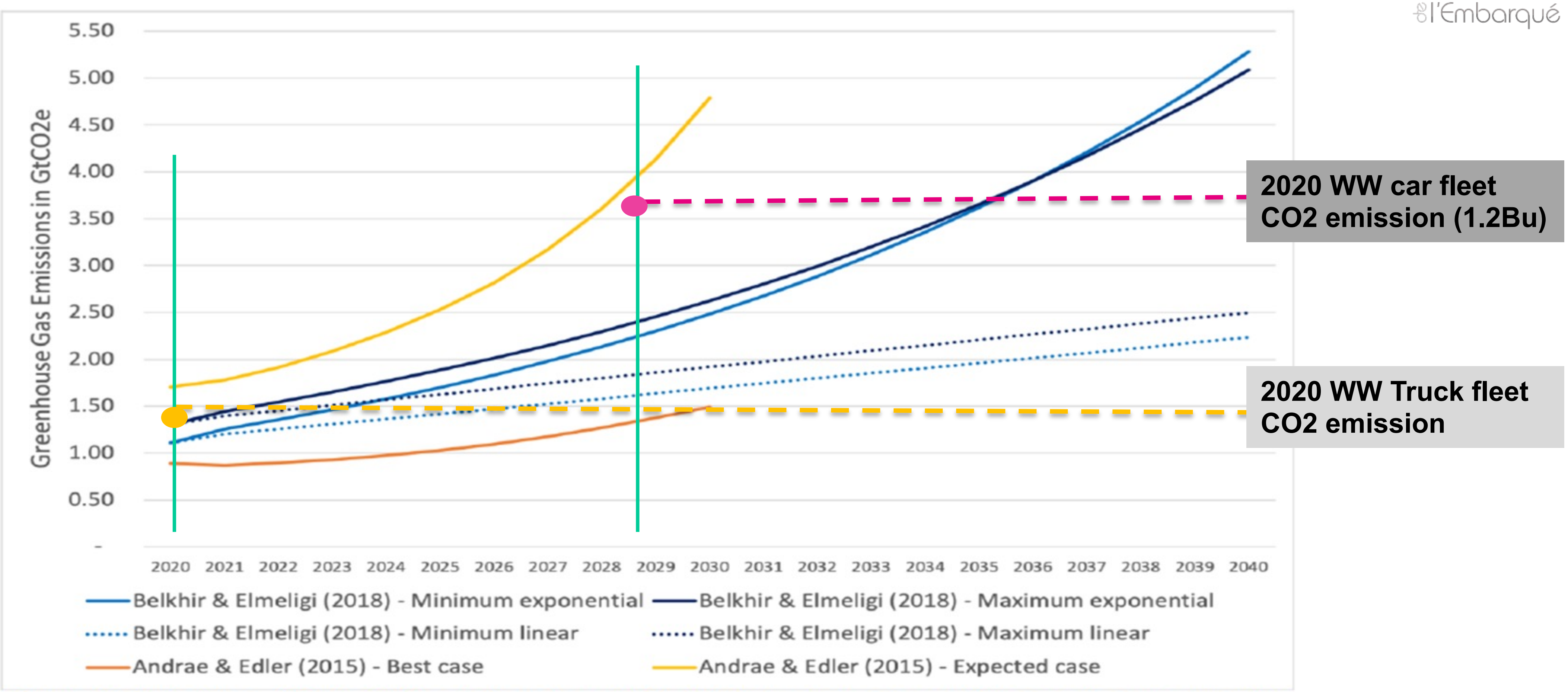
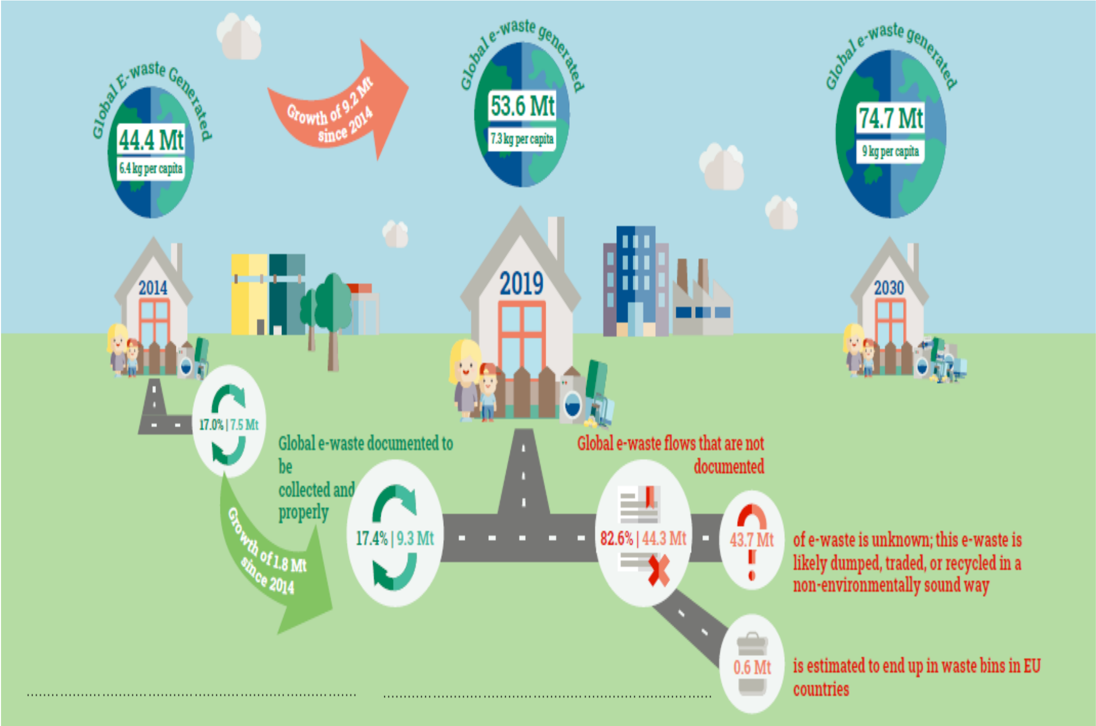
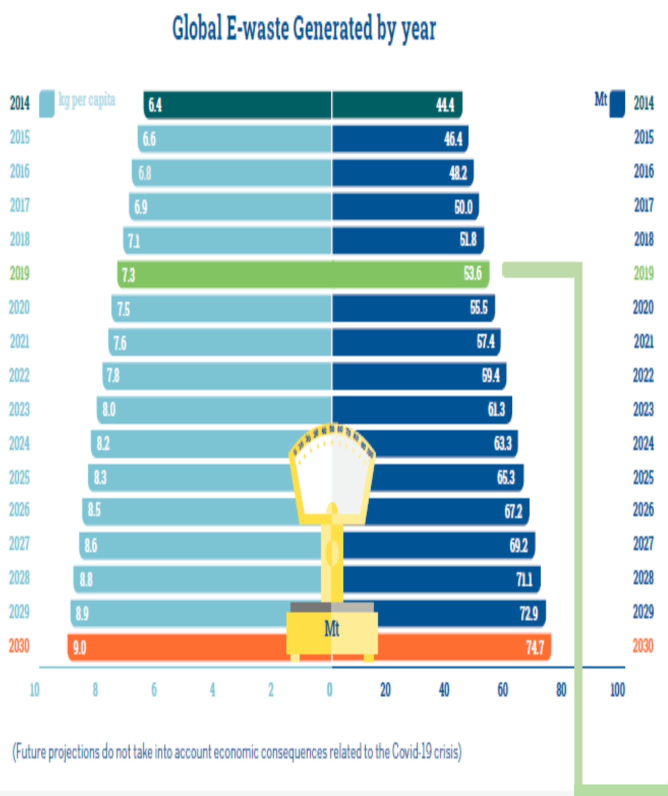


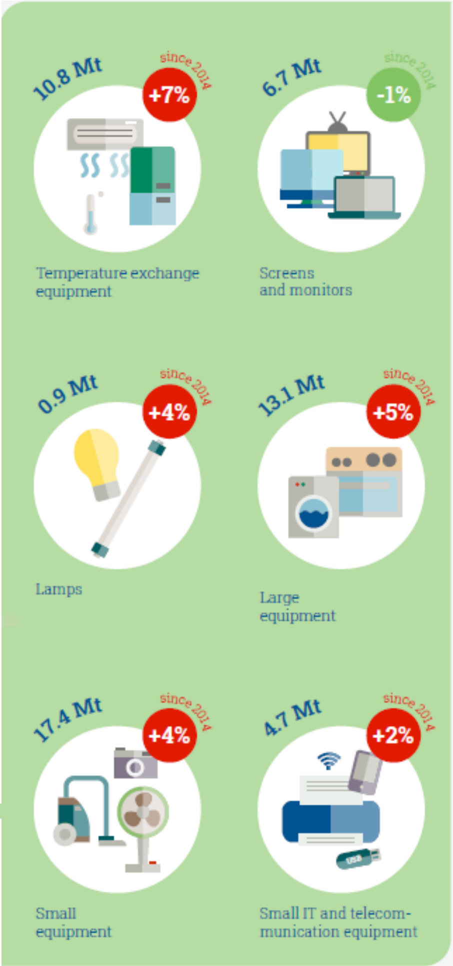
Figure 2.4 *Projections of ICT's GHG emissions from 2020. B&E judge their exponential scenario as most realistic while the linear growth scenario is more conservative and reflects the impact of mitigating actions between now and 2040. M&L [2018] did not make concrete estimates beyond 2020, but Malmodin suggests ICT's carbon footprint in 2020 could halve by 2030 – offering a 2030 estimate of 365 MtCO₂e in a recent techUK talk [Malmodin, 2020].*

Source : IPCC WG3 AR5 – Ch8, IEA, U. of Lancaster- The climate impact of ICT: A review of estimates, trends and regulations (2020)

E-waste worldwide context







Source: :Forti V., Baldé C.P., Kuehr R., Bel G. The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential. United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR) – co-hosted SCYCLE Programme, International Telecommunication Union (ITU) & International Solid Waste Association

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E-waste in Europe

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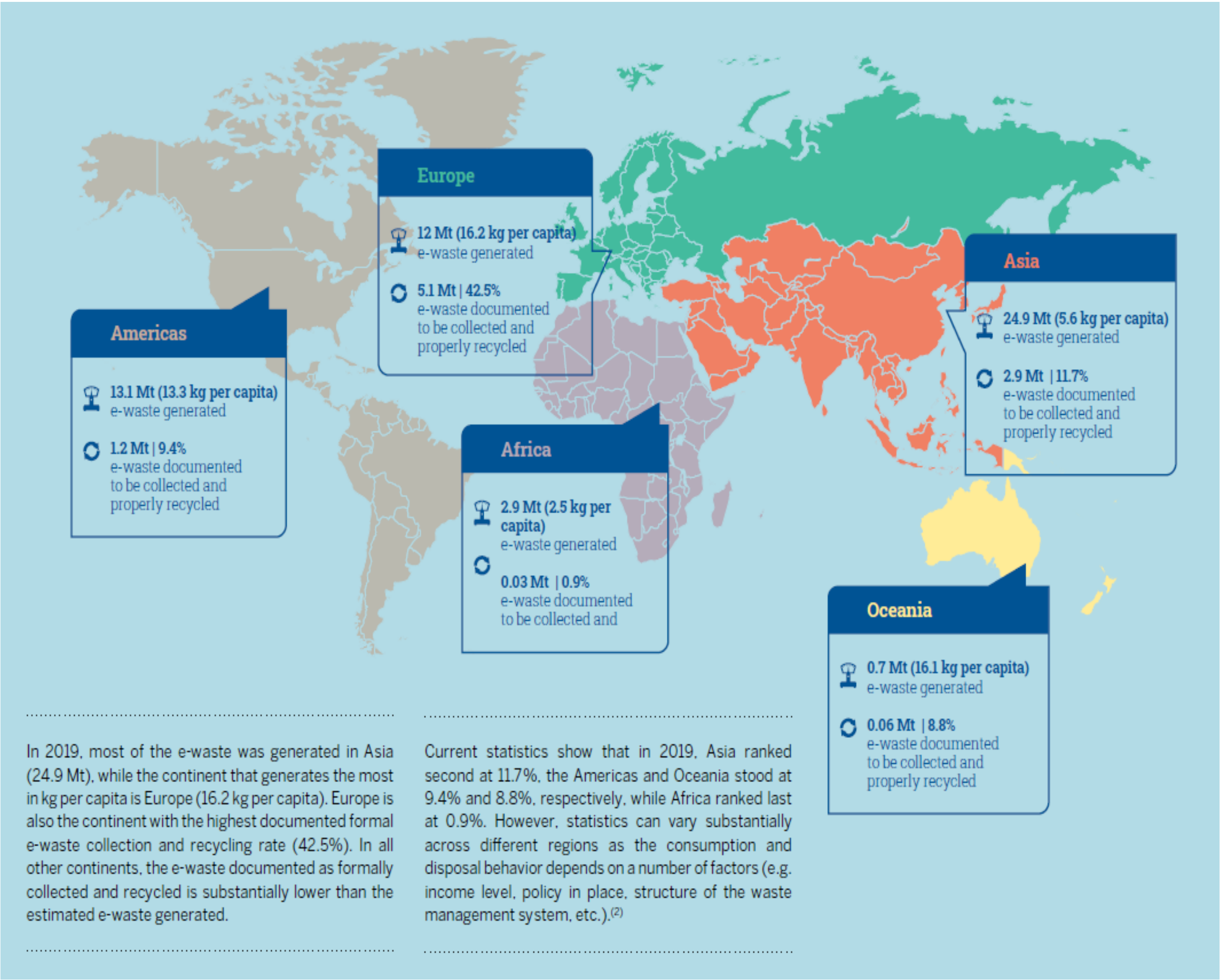

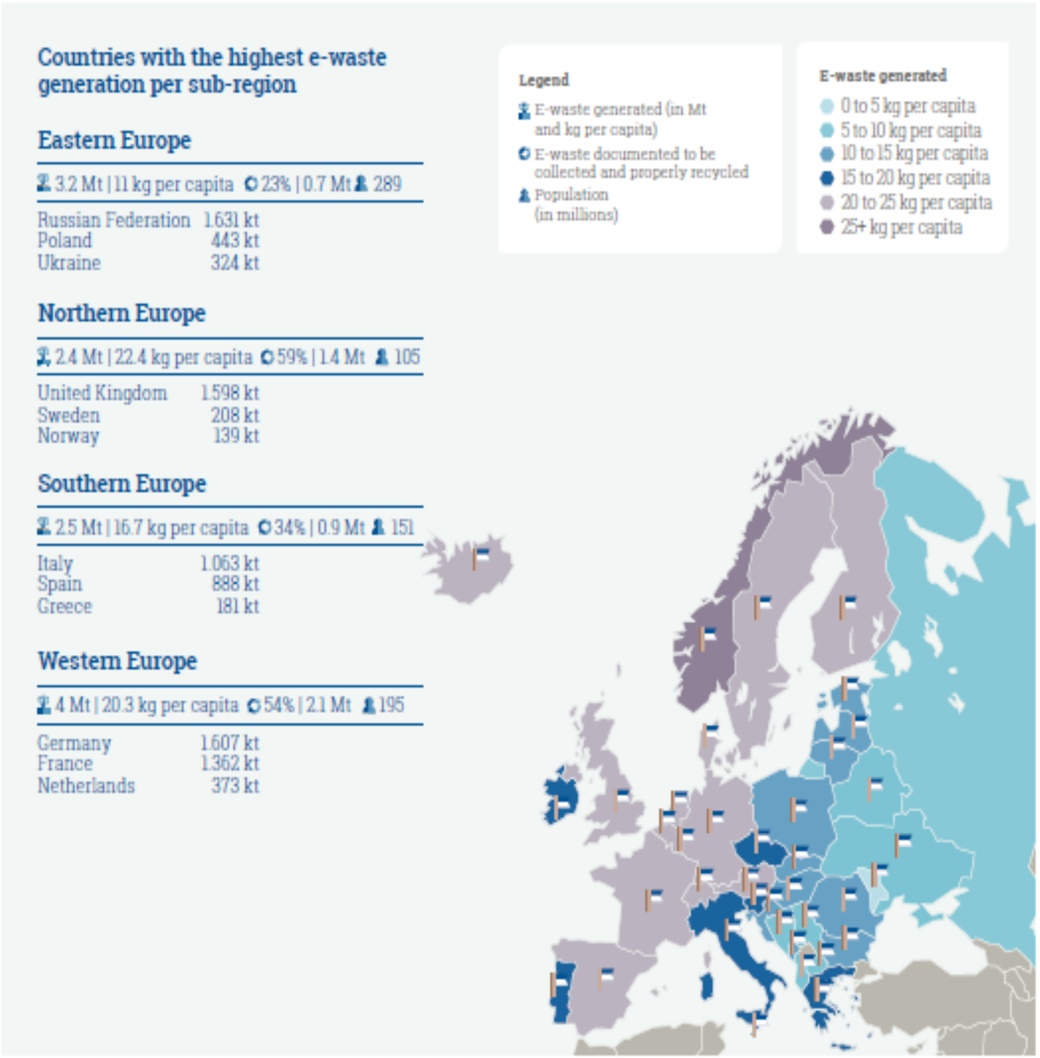

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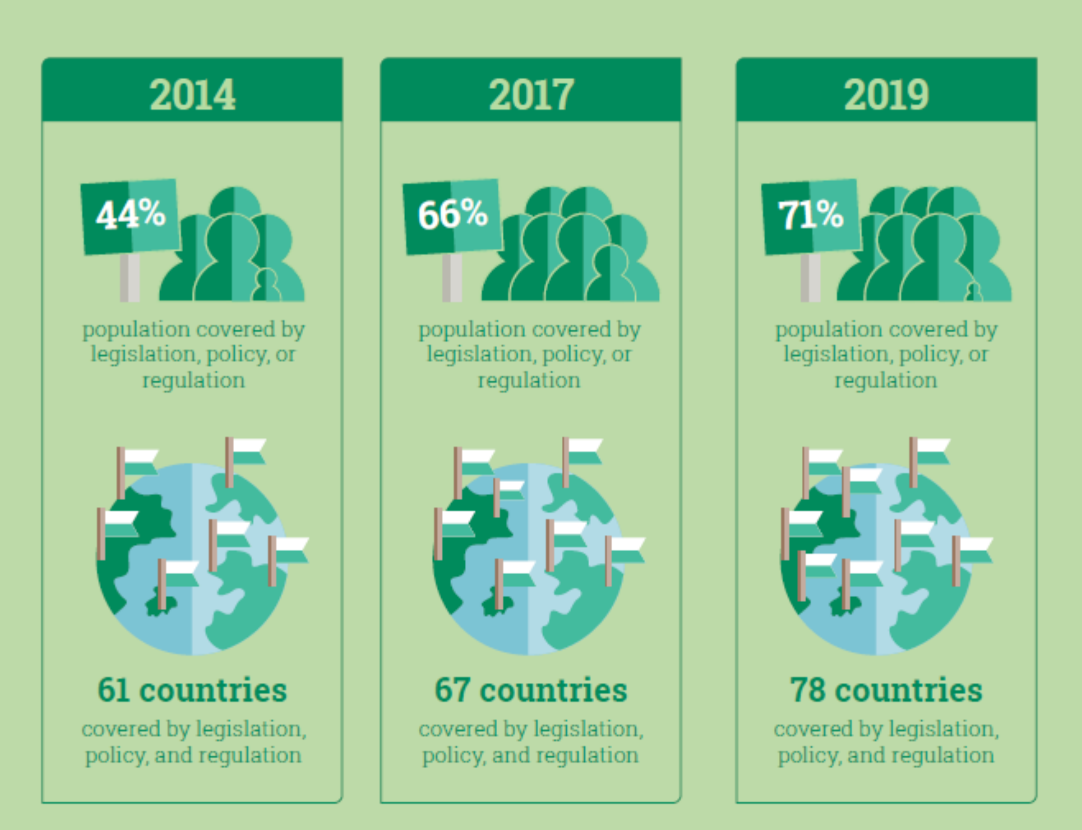
Worldwide regulation is moving fast



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- restrictions on e-waste import/export,
- regulations for recycling specific categories of e-waste,
- Extended Producer Responsibility (EPR).
- Reparability/sustainability index
  - Reparability index in France since January 1st, 2021

  - Sustainability index in France starting January 1st,2024
- Some companies put in place very strong policies
  - Apple: return and dismantling program for iPhone
  - Intel: Reverse supply chain for boards.

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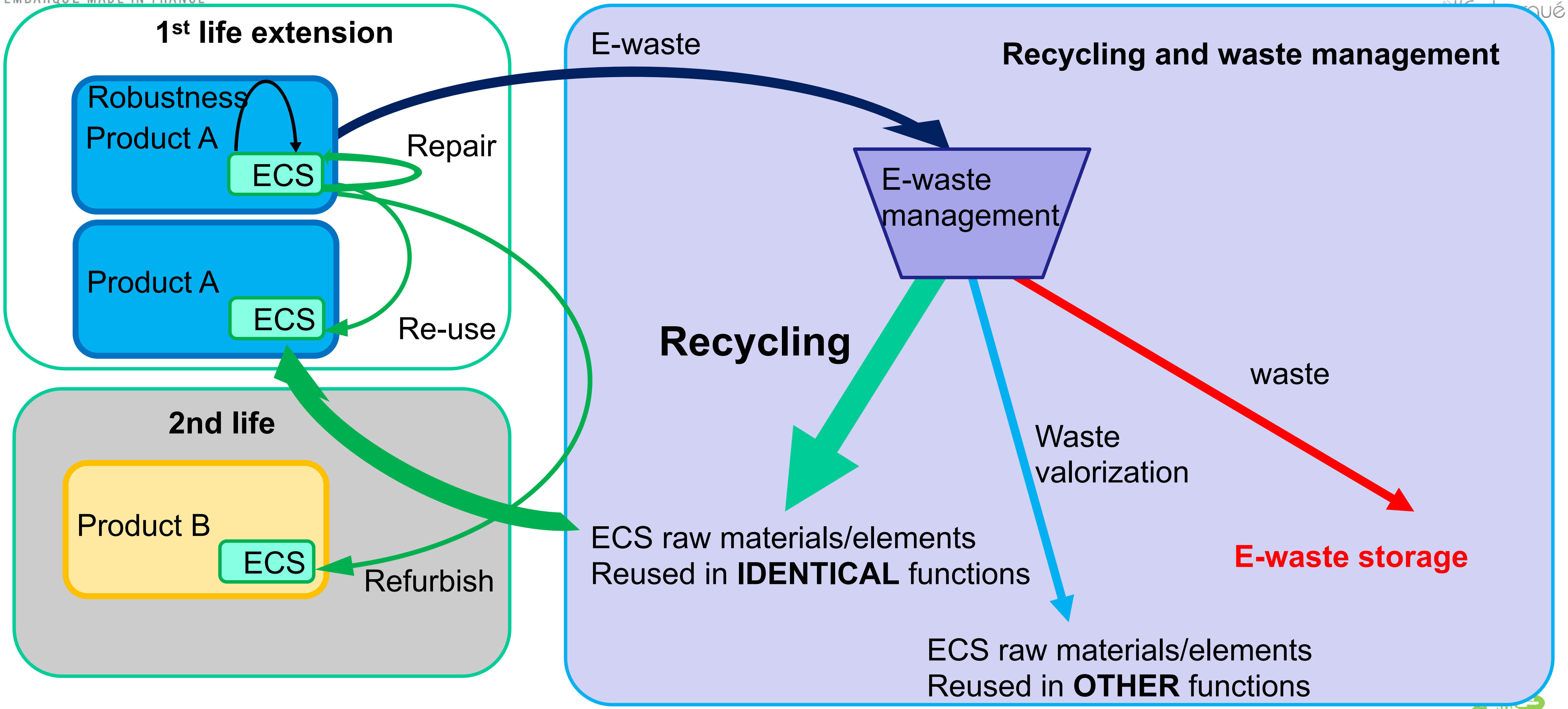
Recycling… what do we mean?



The shorter is the loop, the lower is the end-of-life environmental impact !!

Requirements for components and subsystems (1/2)

Robustness – guarantee the longer lifetime of a given product

- Avoid architecture/design decision reducing performance margin or product lifetime.

Repair – be able to extend product lifetime after failure

- Make product reparable (mounting/unmounting, …)
- Self repairing function
- Self diagnostic, self testing
- Re-testing, re-characterization.
- Fall back modes.
- Spares parts availability, schematics, testing modes, ..
- Integration in supply chain (spare part supply, repairing skills, repairing network,…)

Re-use – Capability of reusing part of a product in another one from the type

- Support all repair constraints.
- Avoid very close pairing to a product.
- Allow pairing to another product.
- Reverse supply chain

Refurbish – Use of electronic subsystems in product different from the one it has been designed initially

- Safe partial features working conditions
- Qualification, characterization.
- Liability constraints.
- New functional constraints
- Reverse and new supply chain.

Requirements for components and subsystems (2/2)

Recycling

- The **true** recycling path. Raw material are extracted from waste and reused in the same function (purity, physical/ chemical properties,…)
- Ease separation of elements/materials, …
- Design recycling process during product design phase

Waste valorization

- Raw materials are extracted but not good enough for the initial function but acceptable for another function.
- Ease separation of elements/materials, …
- Define new usage target and waste valorization process during product design phase

waste storage

- This is the part that is not reused. Ideally it should be properly documented and stored according to clear standards.
- **Must be reduced at the minimum, ideally to 0**

What is a good idea to reduce environmental impact?

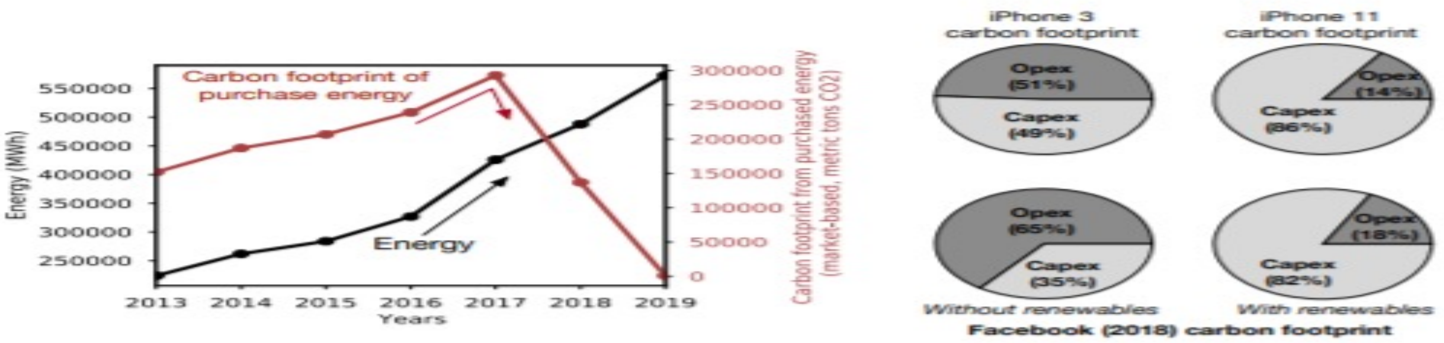


Fig. 2. Carbon footprint depends on more than just energy consumption (left). Although the energy consumption of Facebook's Prineville data center increased between 2013 and 2019, its operational carbon output decreased because of renewable-energy purchases. The carbon-emission breakdown has shifted from primarily opex-related activities to overwhelmingly capex-related activities (right). The top two pie charts show the breakdown for the iPhone 3 (2008) versus the iPhone 11 (2019); the bottom two show the breakdown for Facebook's data centers with and without renewable energy.

Source : Chasing Carbon: The Elusive Environmental Footprint of Computing Udit Gupta1,2 , Young Geun Kim3 , Sylvia Lee2 , Jordan Tse2 , Hsien-Hsin S. Lee2 , Gu-Yeon Wei1 , David Brooks1 , Carole-Jean Wu2 1Harvard University, 2Facebook Inc., 3Arizona State University

- Good environmental solution must absolutely have 2 characteristics:
  - **Systemic attribute** : local improvements must result in a global one
  - **Scale-up attribute** : improvements should be able to scale-up and move from demonstrator to large scale (town, region, country, world)

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Growth without economic growth…Dream or reality?

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Growth without economic growth

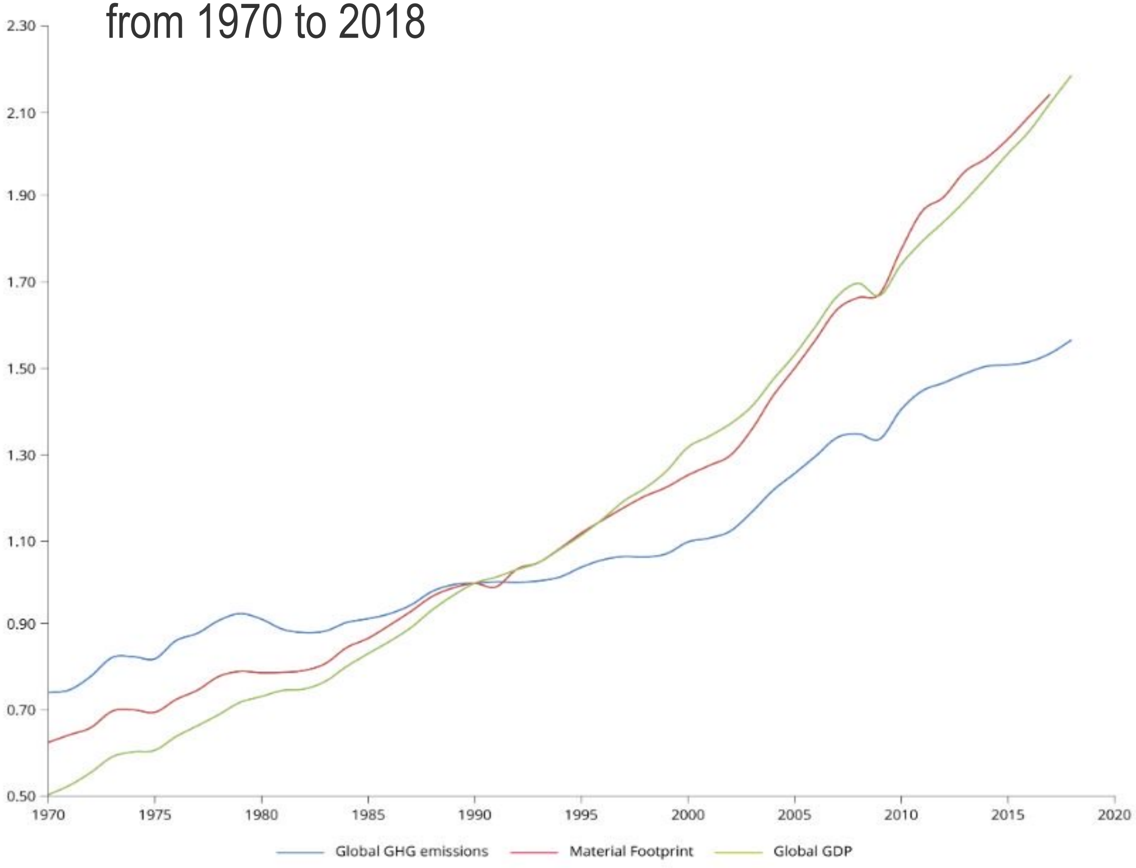
Economic growth is closely linked to increases in production, consumption and resource use and has detrimental effects on the natural environment and human health. It is unlikely that a long-lasting, absolute decoupling of economic growth from environmental pressures and impacts can be achieved at the global scale; therefore, societies need to rethink what is meant by growth and progress and their meaning for global sustainability.

Published 11 Jan 2021 — Last modified 11 Jan 2021 — 14 min read — Photo: © Ricardo Gomez Angel on Unsplash PDF

Key messages

- The ongoing 'Great Acceleration' [1] in loss of biodiversity, climate change, pollution and loss of natural capital is tightly coupled to economic activities and economic growth.
- Full decoupling of economic growth and resource consumption may not be possible.
- Doughnut economics, post-growth and degrowth are alternatives to mainstream conceptions of economic growth that offer valuable insights.
- The European Green Deal and other political initiatives for a sustainable future require not only technological change but also changes in consumption and social practices.
- Growth is culturally, politically and institutionally ingrained. Change requires us to address these barriers democratically. The various communities that live simply offer inspiration for social innovation.

Relative change in main global economic and environmental indicators from 1970 to 2018



Sources: Modified from Wiedmann et al. (2020). Reproduced under the terms and conditions of the Creative Commons CC BY 4.0 licence (https://creativecommons.org/licenses/by/4.0/).
Data from Olivier and Peters (2020) for greenhouse gas (GHG) emissions; UNEP and IRP (2018) for material footprint; and World Bank (2020a) for GDP.
More info

Source: European Environment Agency - published in January 2021

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TAKE AWAY

Environmental impact reduction is a concern for everybody which must be considered **from day 1 in the development of a new product**.

Evaluate environmental impact reduction and **the needed change in economic model**.

Identify adjacent stake holders and **move them at the same pace**.

Always ask yourself what is the REAL problem to solve, avoid performance/function overshoot/unusefulness.

Always look at the environmental problems and solutions **GLOBALLY**

Thank you