

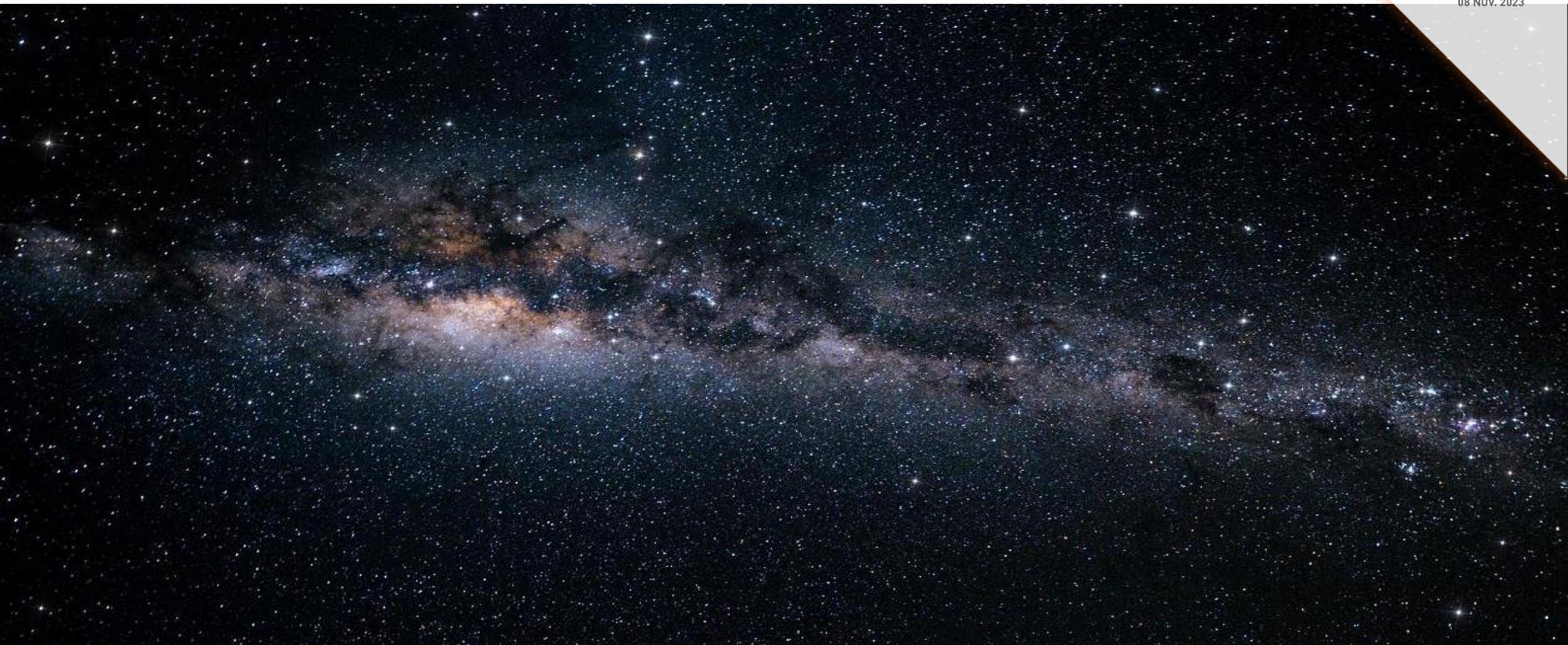
XVI
**JORNADAS
TÉCNICAS**
ANIET

08 NOV. 2023

Importância das
Matérias-Primas para a
transição energética,
climática e digital

Jorge Cristino

Num Universo com 13,7 mil milhões de anos...



Existe uma Galáxia, com um Sistema Solar



E um Planeta Azul

3º mais próximo do SOL

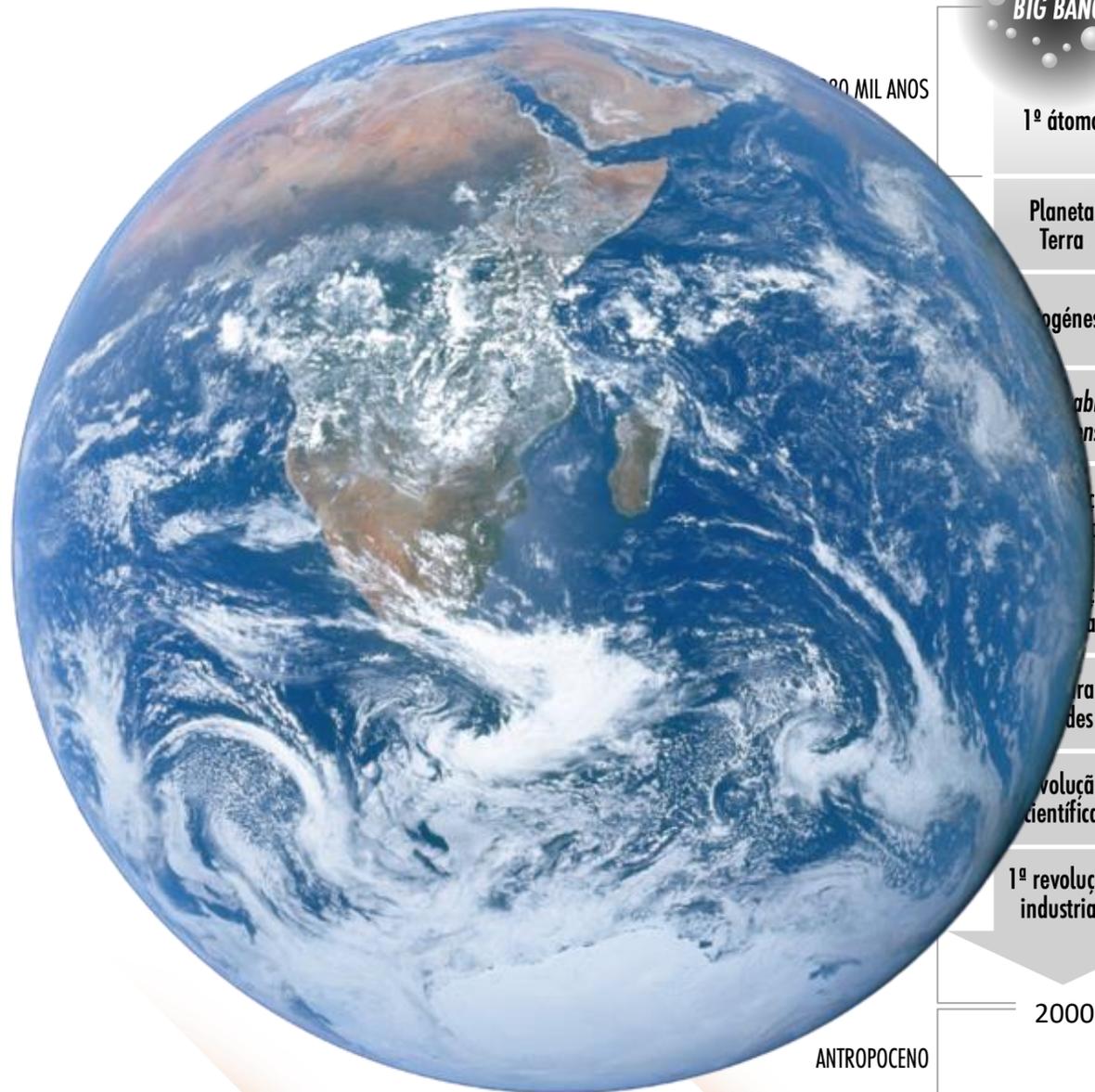
5º maior de oito planetas

O mais denso

6 300 km de r

100 mil km/h de vel. orbital

1 675 km/h de vel. rotação



90 MIL ANOS

BIG BANG

13,7 mil milhões de anos

1º átomo

13,3 mil milhões de anos

Planeta Terra

4,5 mil milhões de anos

origénese

4,4 a 3,5 mil milhões de anos

abilis

2,4 a 0,3 milhões de anos

4 milhões de anos de evolução da espécie

ção

70 mil anos

ção

11,7 mil anos

ras

11 a 6,5 mil anos

volução científica

500 anos

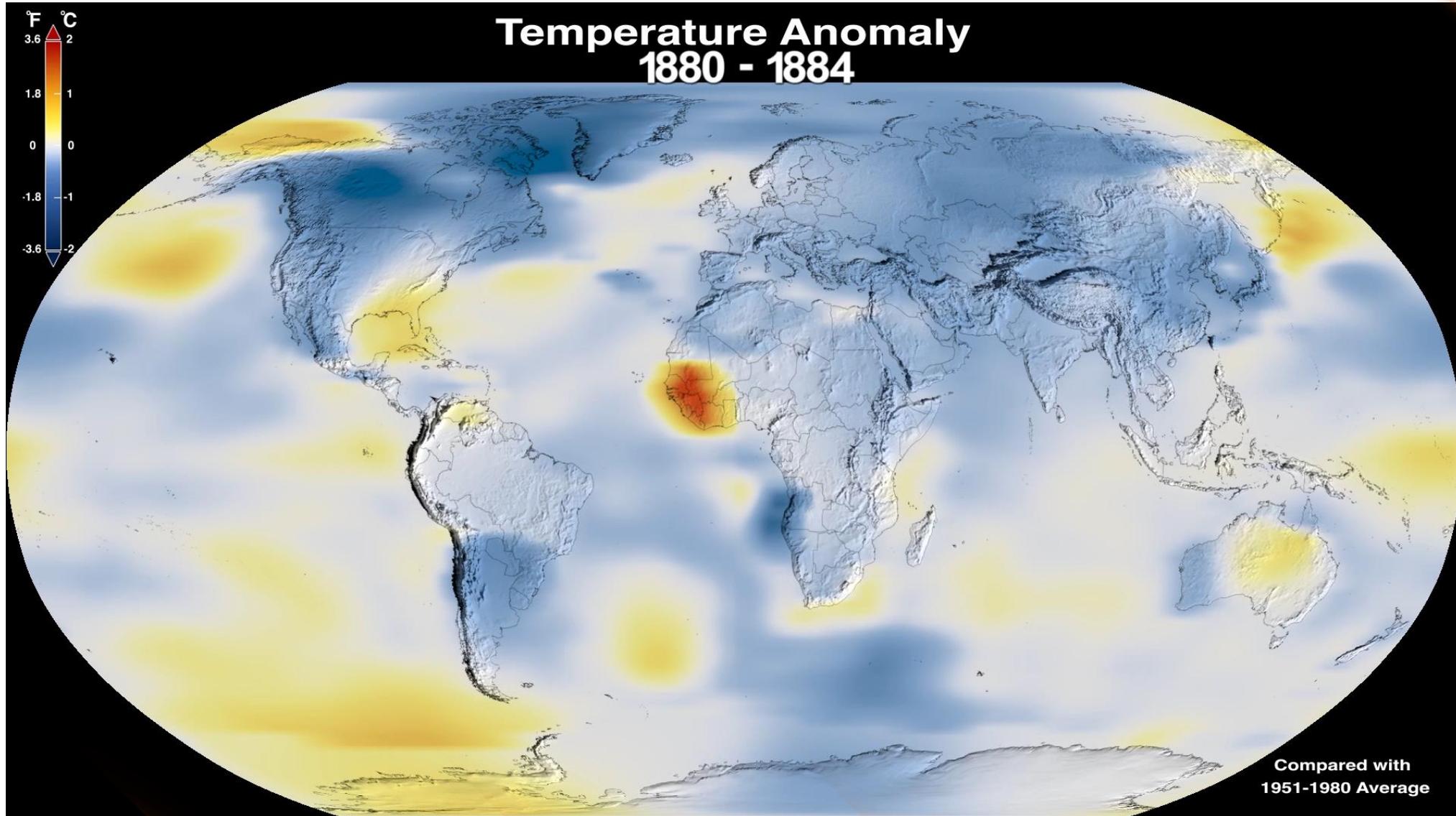
1ª revolução industrial

300 anos

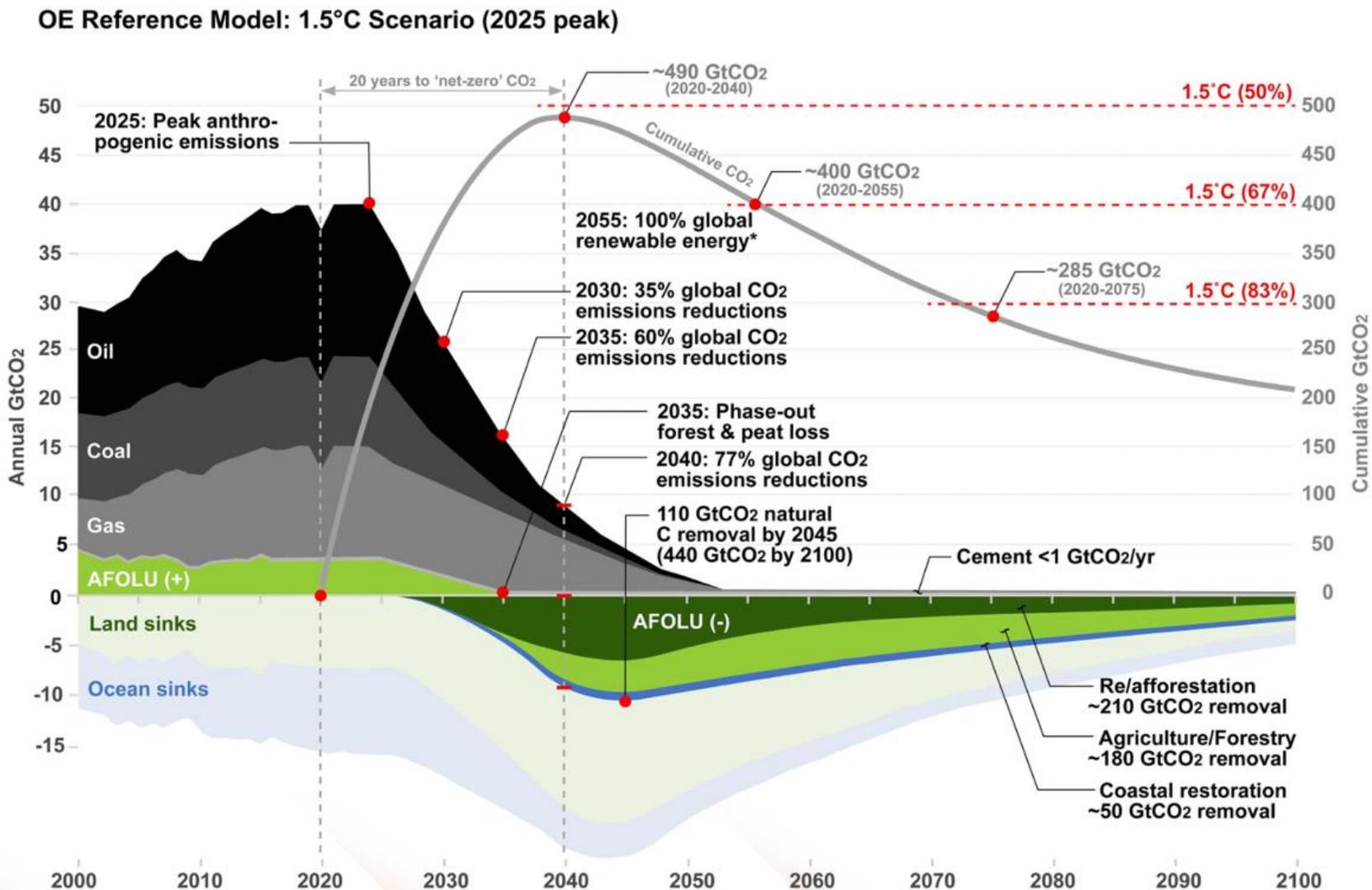
2000

ANTROPOCENO

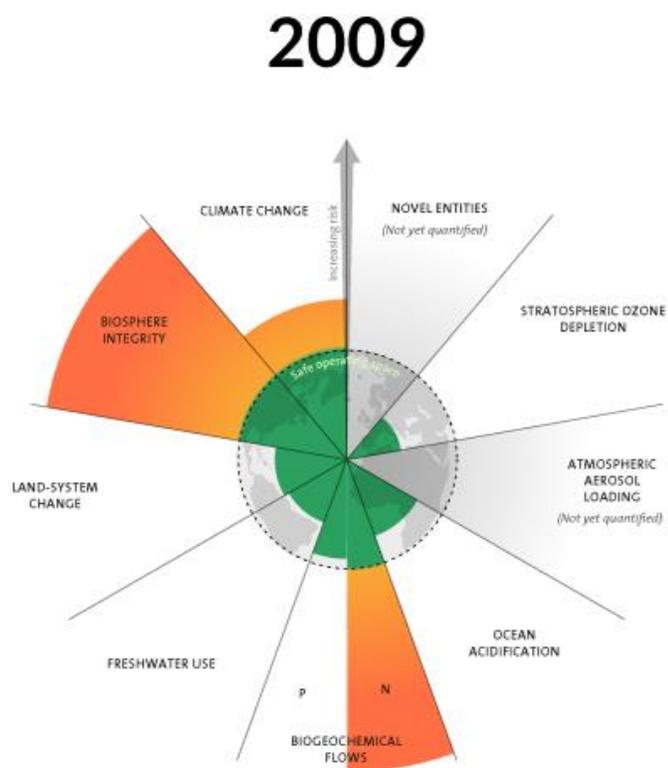
O desafio das nossas gerações...



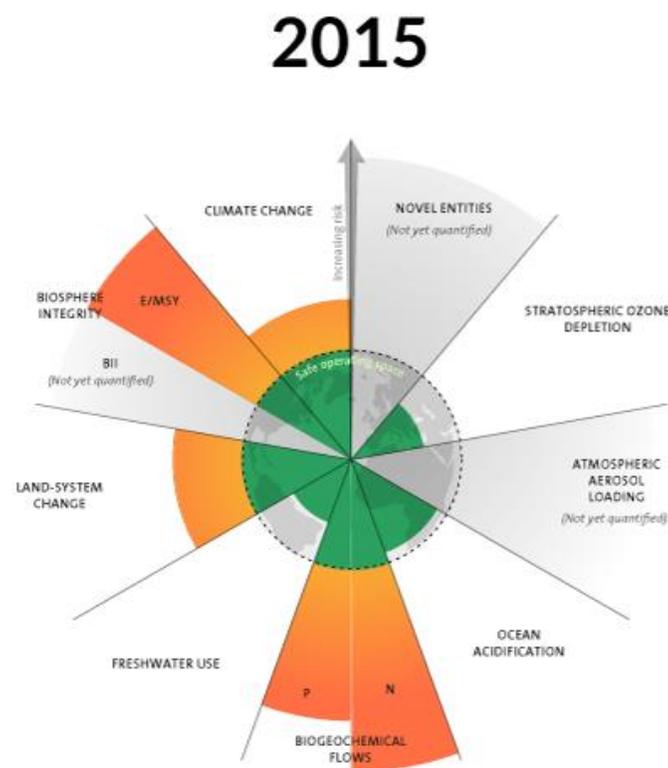
O combate às alterações climáticas



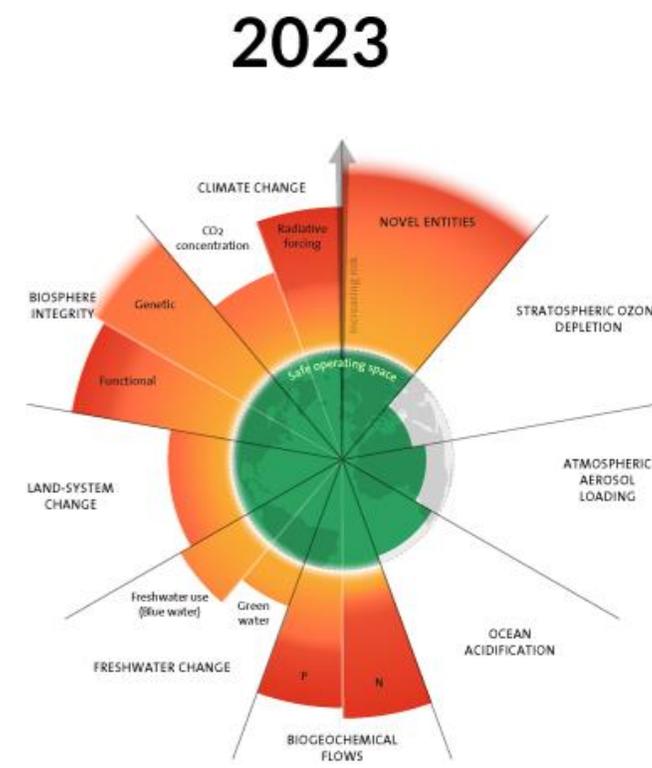
Dentro dos limites do planeta



3 boundaries crossed



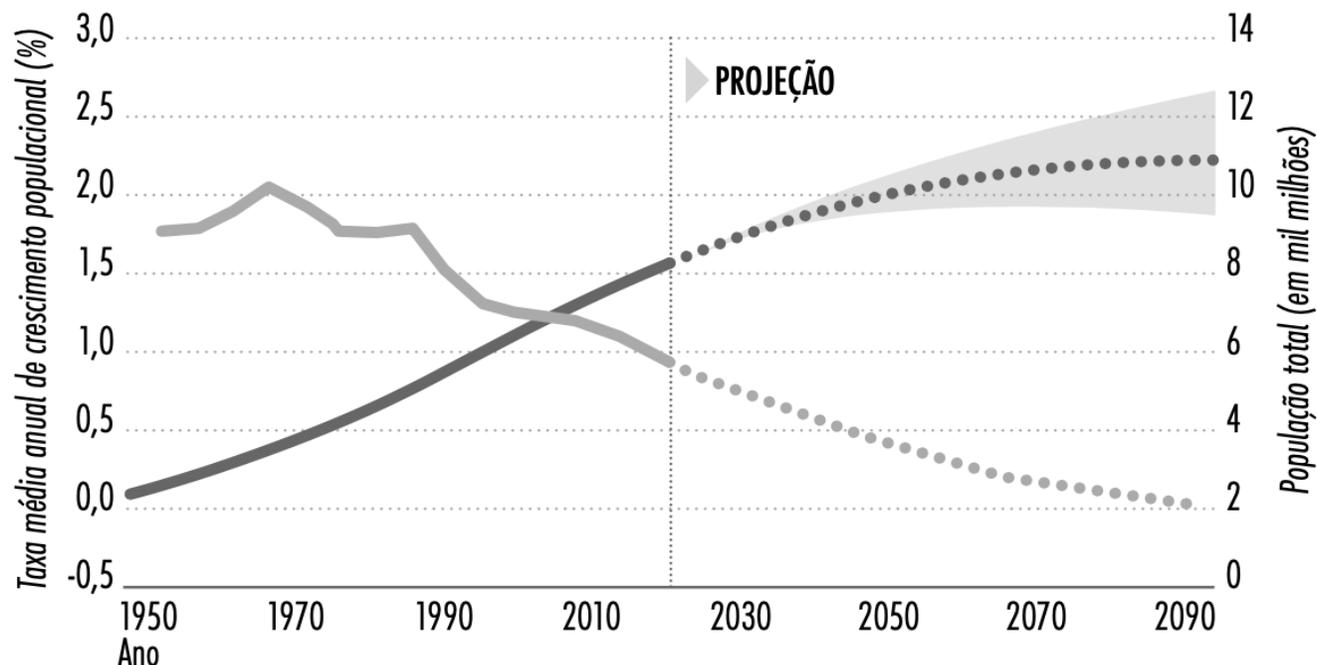
4 boundaries crossed



6 boundaries crossed

Com uma evolução demográfica sem precedentes

Em termos globais, a população continua a crescer, mas a taxa de crescimento está a diminuir, pelo que a população mundial poderá parar de crescer por volta do final do século XXI



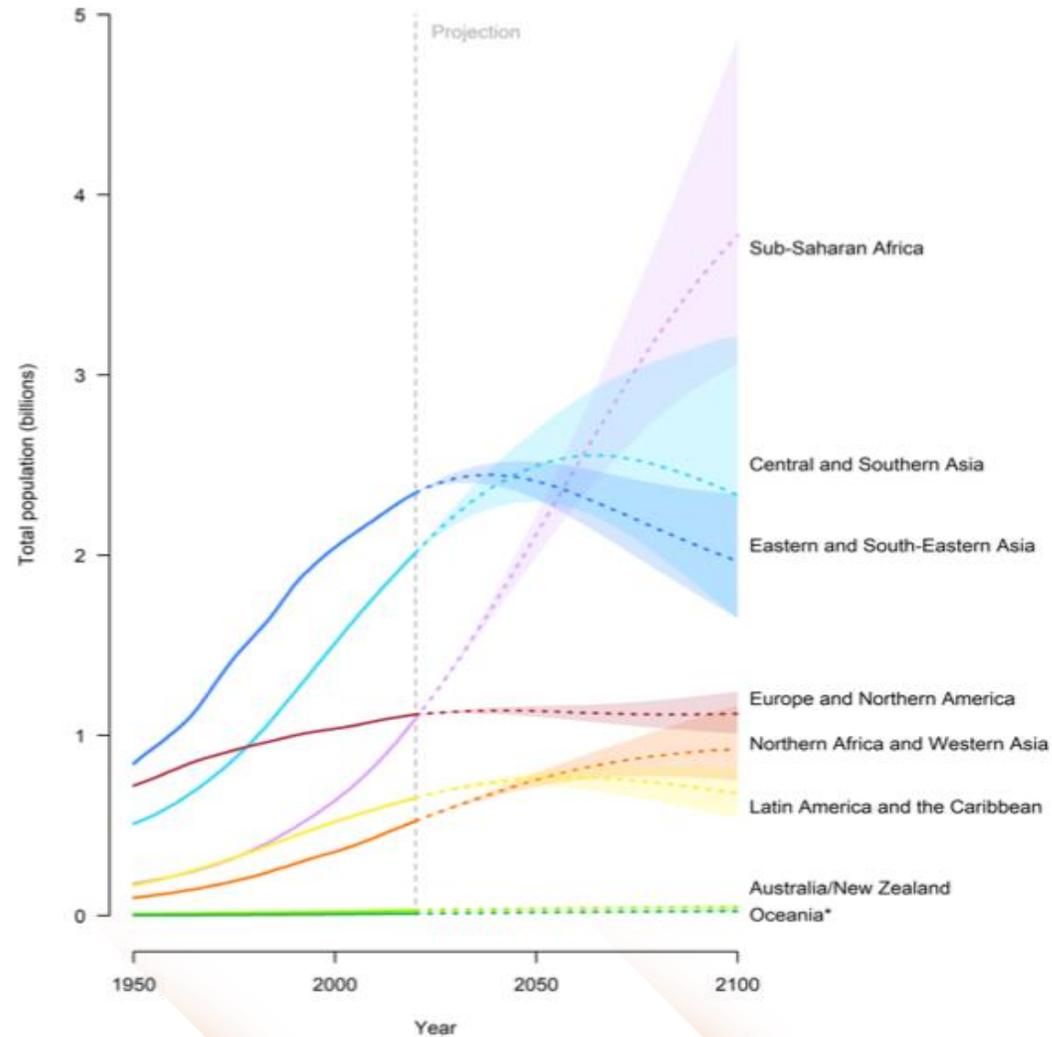
Crescimento demográfico no mundo e projeção para 2020-2100

Fonte: Nações Unidas, Departamento Económico e Assuntos Sociais, Divisão

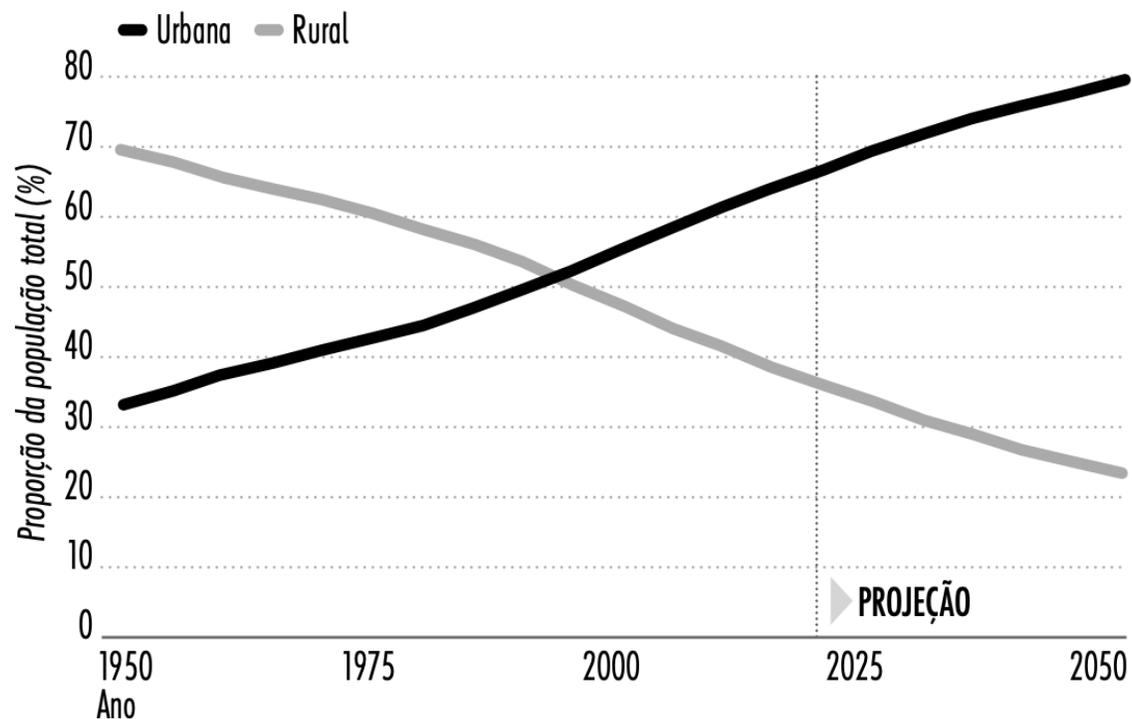
População: *World Population Prospects 2019* (p. 5) (tradução e adaptação)

Com uma evolução demográfica sem precedentes

Of the eight SDG regions, only sub-Saharan Africa is projected to sustain rapid population growth through the end of the century, according to the medium-variant projection



Com uma concentração em aglomerados urbanos



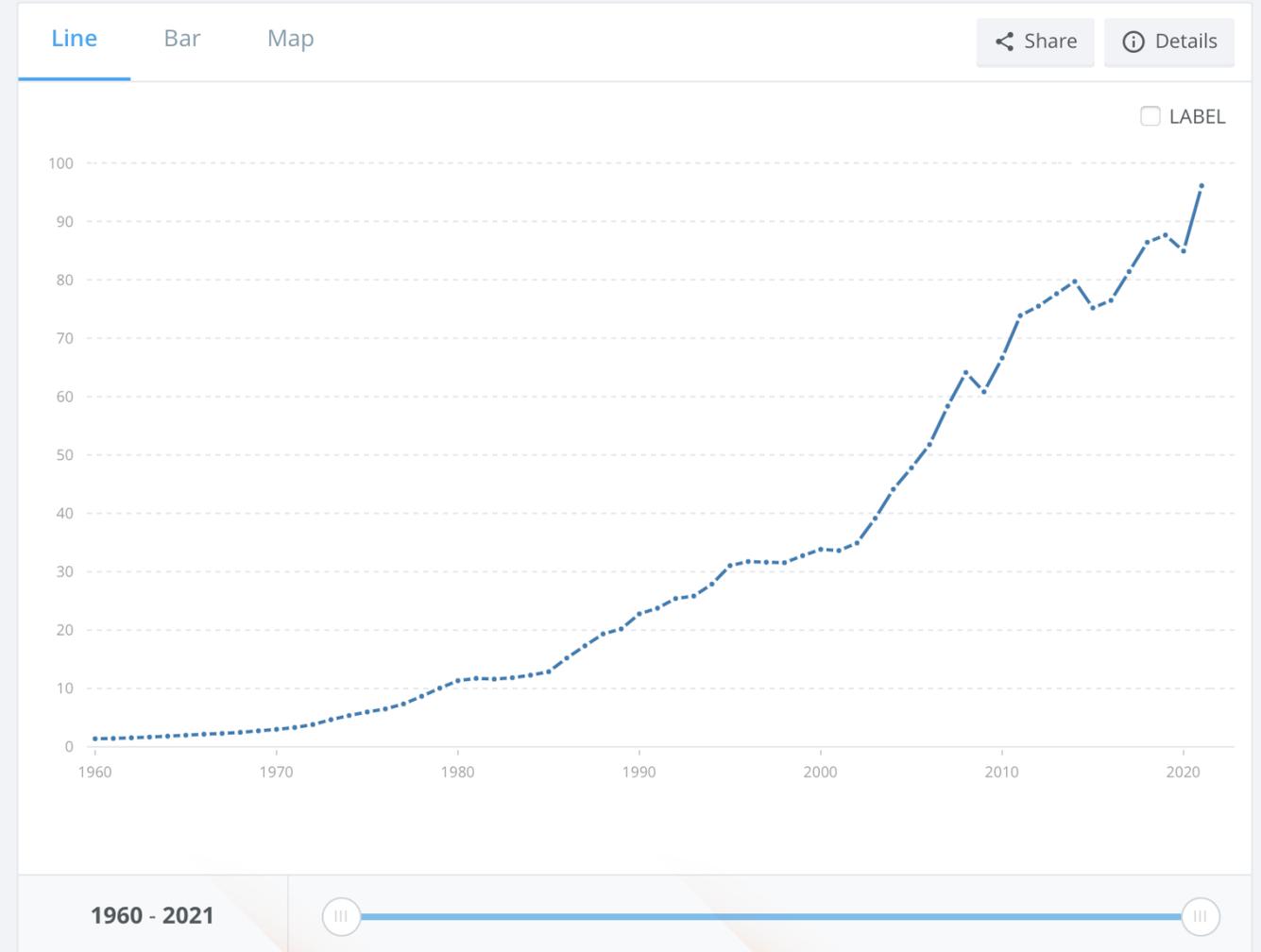
Percentagem da população nas áreas urbanas e rurais em Portugal

Fonte: Nações Unidas, Departamento Económico e Assuntos Sociais, Divisão População (2018)

Com uma evolução económica vertiginosa

GDP (current US\$)

World Bank national accounts data, and OECD National Accounts data files.



Com impactos brutais de danos e perdas

Economic impacts of climate change

Average real GDP loss by 2050



Source: Economist Intelligence Unit © AFP

Climate impacts will cost \$7.9 trillion' by 2050

...preços de energia em crescendo...

FRED  — Global price of Energy index



Source: International Monetary Fund

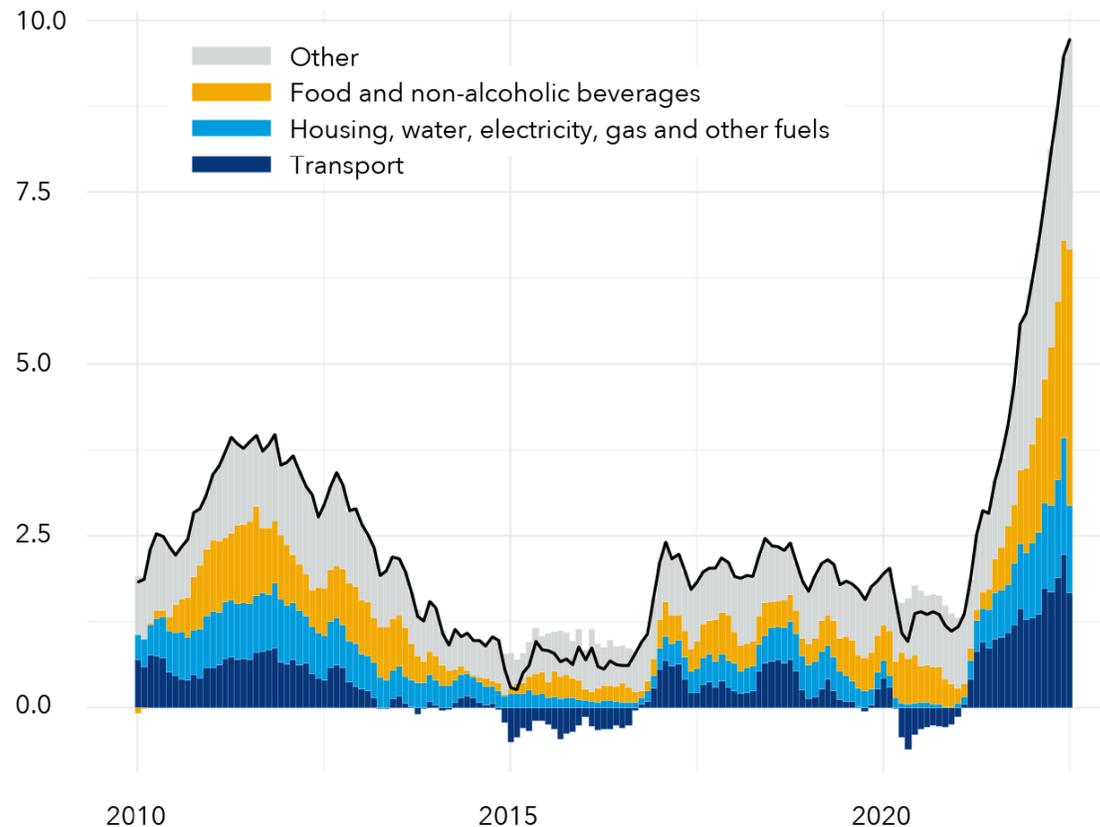
fred.stlouisfed.org



...inflação...

Inflation drivers

Food and energy prices continue to drive the global inflation surge.
(percent, median inflation rate)



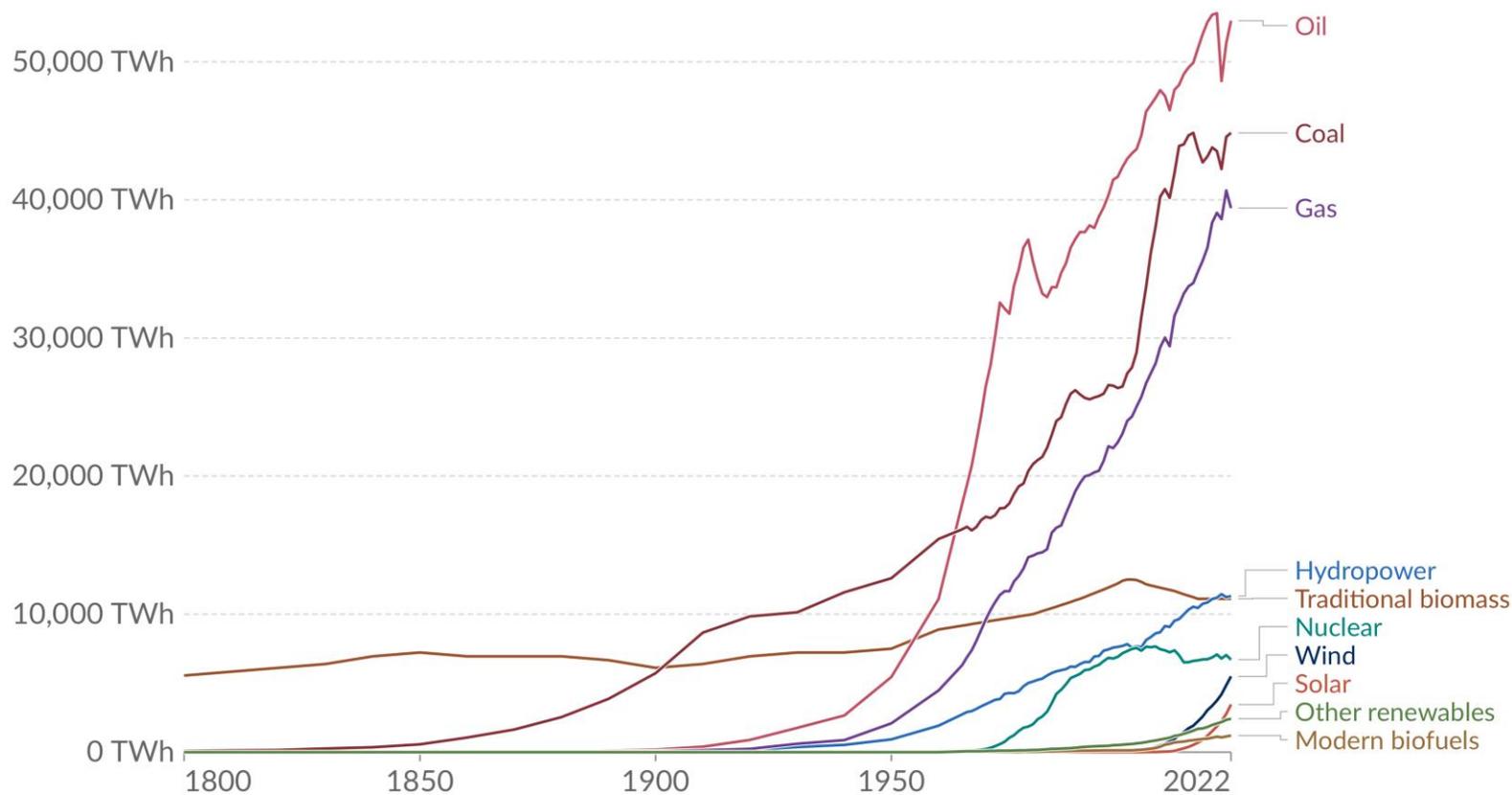
Source: IMF CPI database and IMF staff calculations.
Note: Chart shows median total inflation and in select categories across 88 countries, including 28 advanced economies and 60 emerging and developing economies.

...consumo energético...

Our World
in Data

Global primary energy consumption by source

Global primary energy consumption here is measured by the 'substitution' method which takes account of the inefficiencies of fossil fuel production.



Data source: Energy Institute Statistical Review of World Energy (2023); Vaclav Smil (2017)
OurWorldInData.org/energy | CC BY

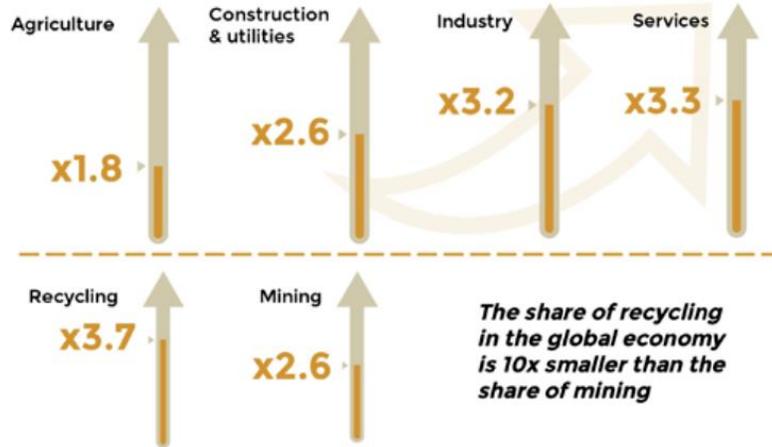
...consumo e fornecimento de matérias-primas...



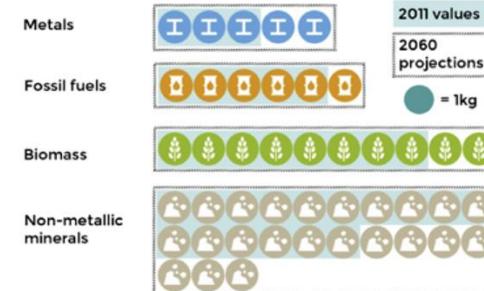
Construction materials use stabilises in China after 2025



Global economic growth, 2011-2060



Materials use per capita per day

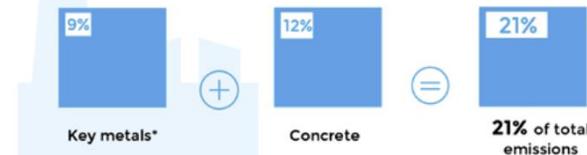


Materials use increase



	2011	2060
Metals	8Gt	20Gt
Fossil fuels	14Gt	24Gt
Biomass	20Gt	37Gt
Non-metallic minerals	37Gt	86Gt

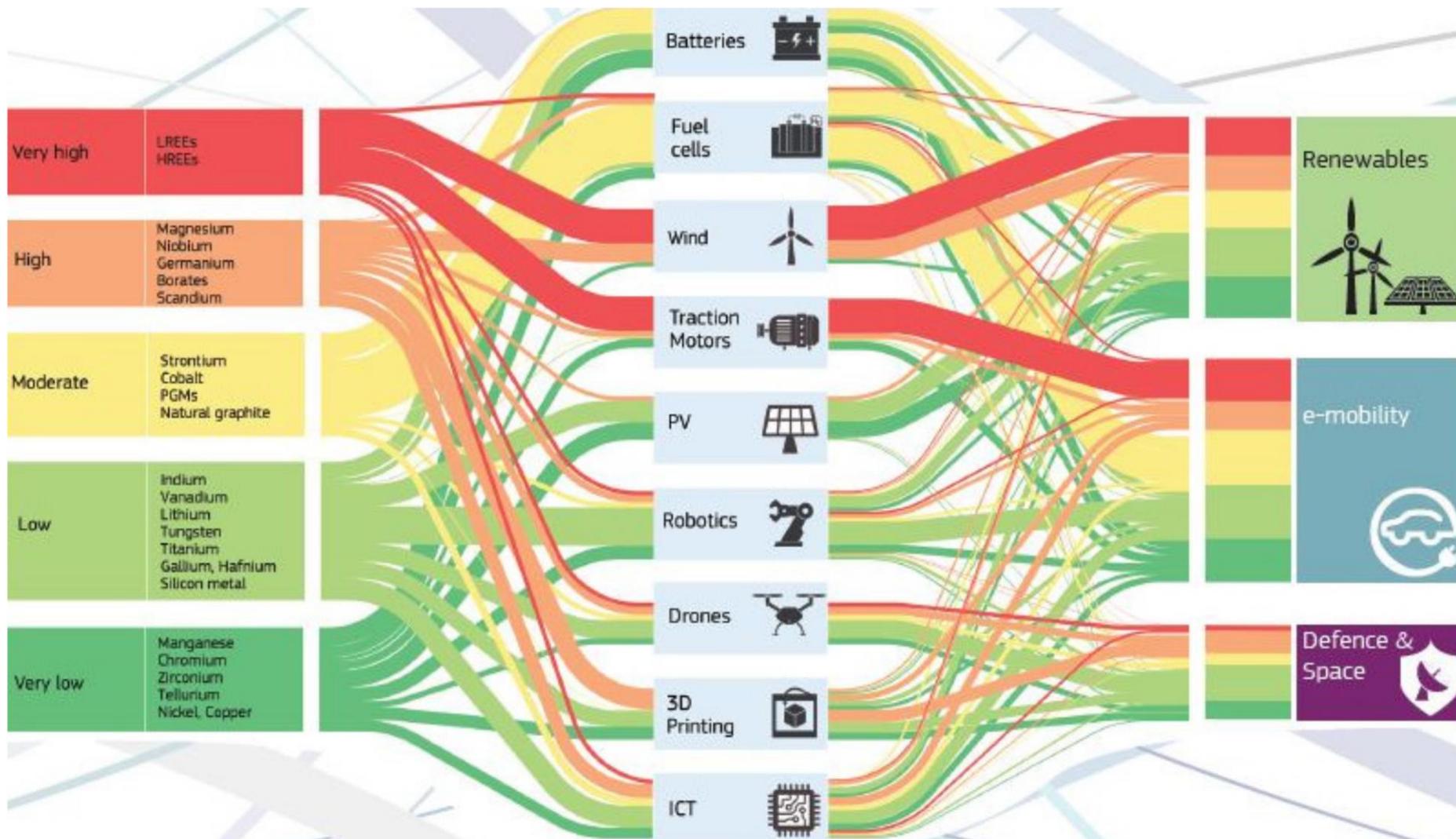
Greenhouse gas emissions in 2060 from materials extraction and processing



*The key metals are Al, Cu, Fe, Mn, Ni, Pb, Zn

Primary copper and primary nickel have the highest cradle-to-gate environmental impacts per kg

...para uma transição...

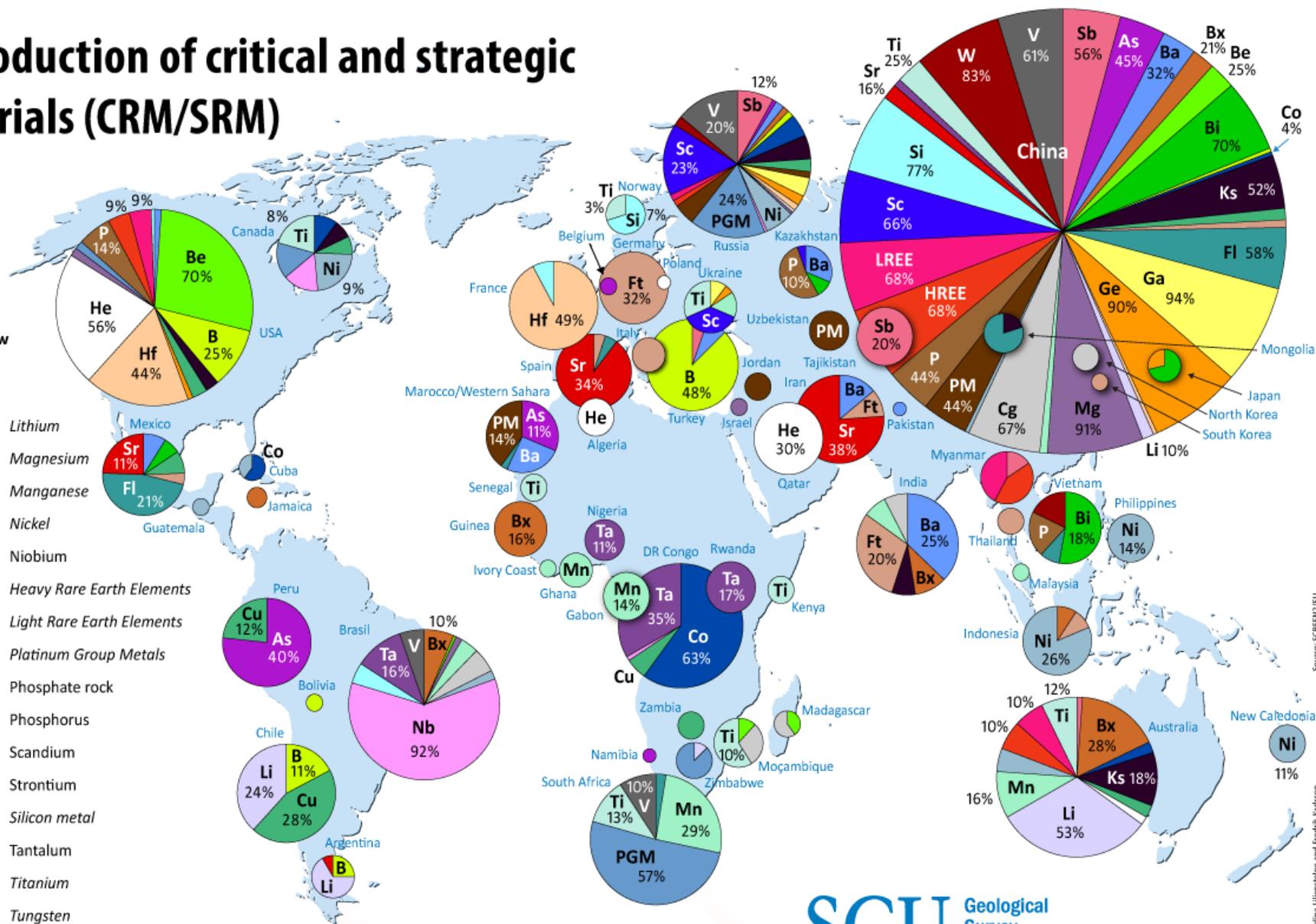


energética, digital, mobilidade sustentável, segurança alimentar, saúde e segurança

Global production of critical and strategic raw materials (CRM/SRM)

Critical and strategic raw materials included in the EU list

- | | |
|----------------------------|---------------------------------------|
| Sb Antimony | Li Lithium |
| As Arsenic | Mg Magnesium |
| Bx Bauxite | Mn Manganese |
| Ba Baryte | Ni Nickel |
| Be Beryllium | Nb Niobium |
| Bi Bismuth | HREE Heavy Rare Earth Elements |
| B Borate | LREE Light Rare Earth Elements |
| Cg Natural graphite | PGM Platinum Group Metals |
| Co Cobalt | PM Phosphate rock |
| Fl Fluorspar | P Phosphorus |
| Ft Feldspar | Sc Scandium |
| Ga Gallium | Sr Strontium |
| Ge Germanium | Si Silicon metal |
| Hf Hafnium | Ta Tantalum |
| He Helium | Ti Titanium |
| Ks Coking coal | W Tungsten |
| Cu Copper | V Vanadium |
- italic= strategic*



Source: SCREEN2/EU

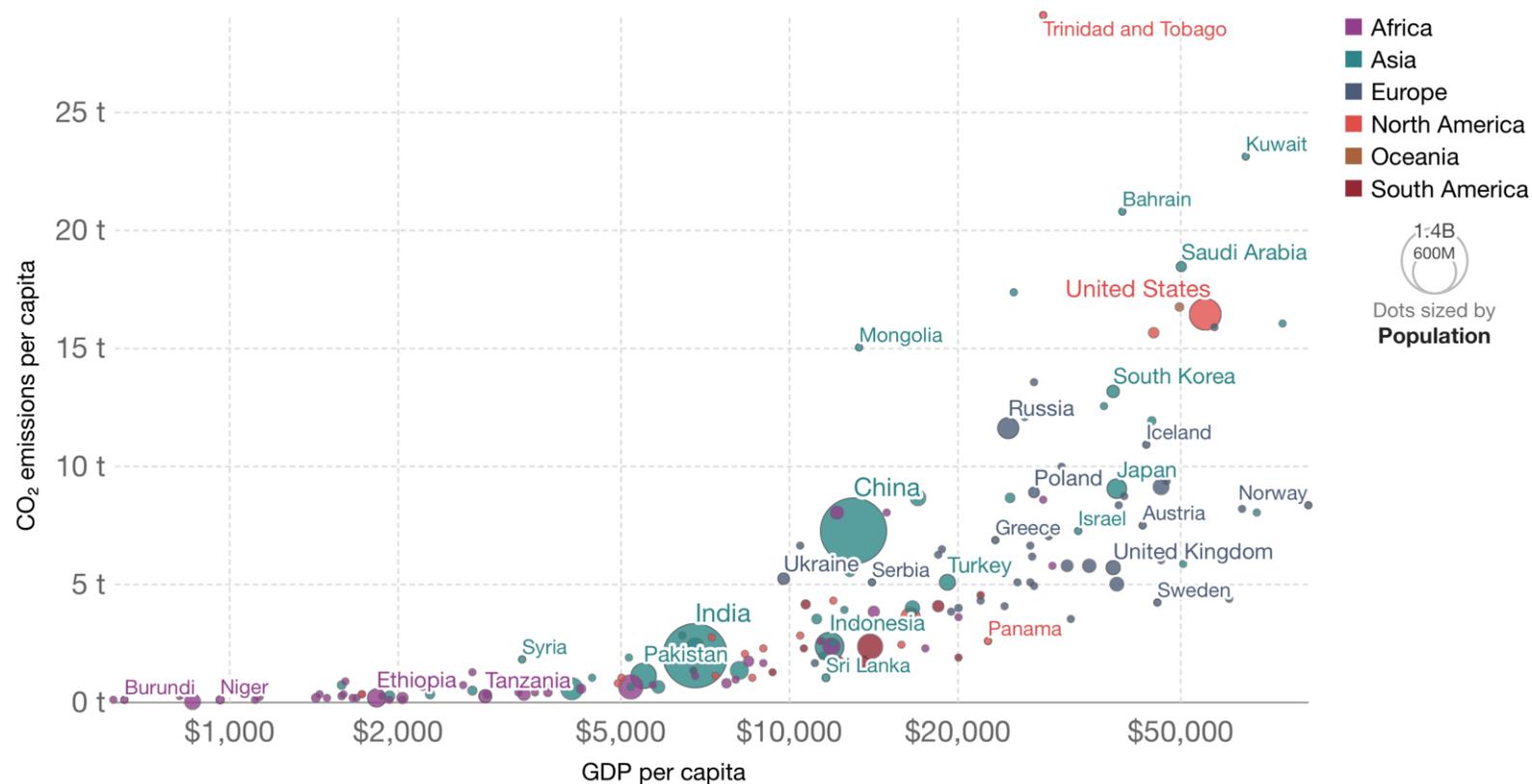
SGU 2023. Carolina Ujjenstälpe and Fredrik Karlsson

...a transição climática...

CO₂ emissions per capita vs GDP per capita, 2018

This measures CO₂ emissions from fossil fuels and cement production only – land use change is not included. Gross domestic product (GDP) per capita is measured in international-\$ in 2011 prices to adjust for price differences between countries and adjust for inflation.

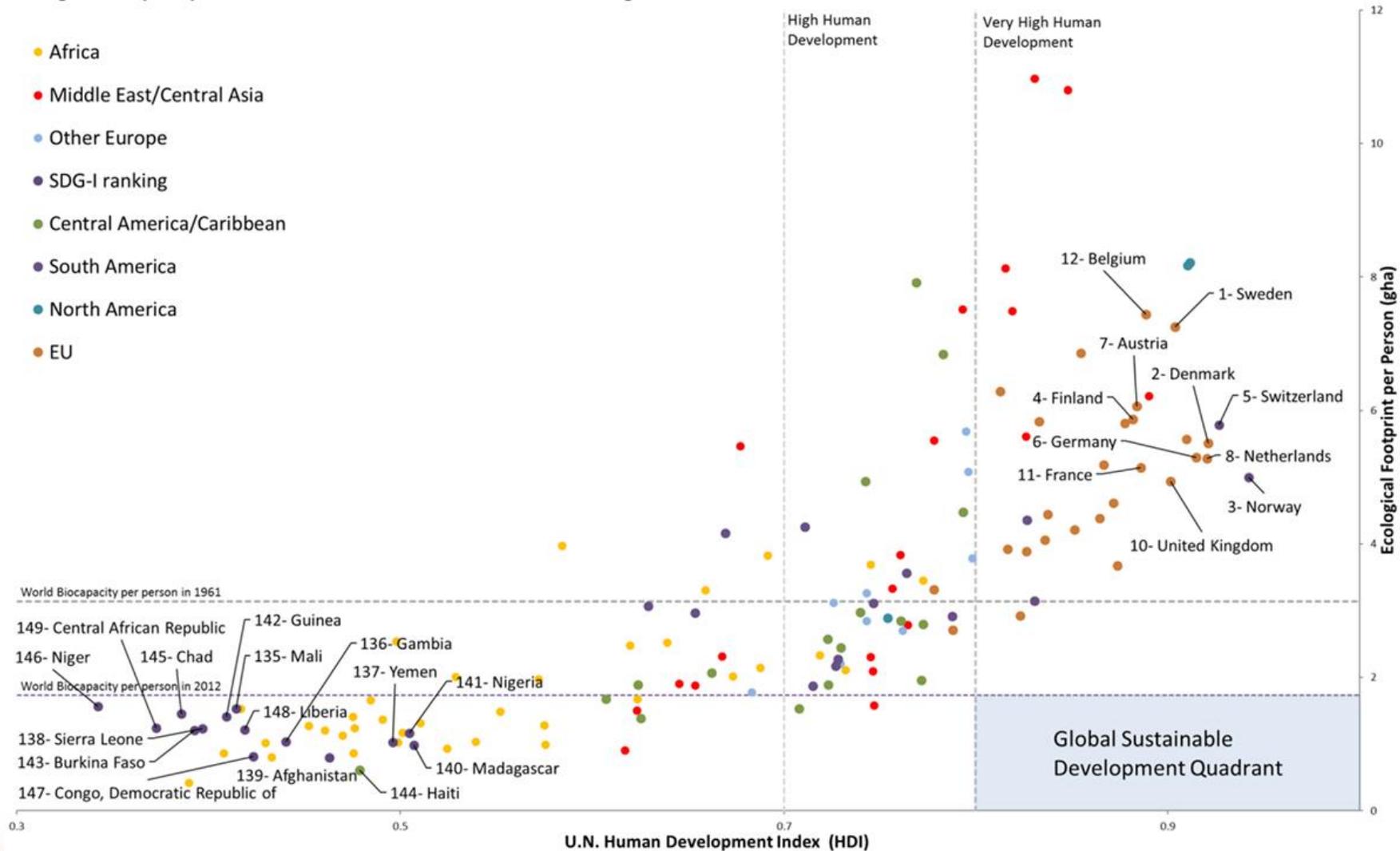
Our World
in Data



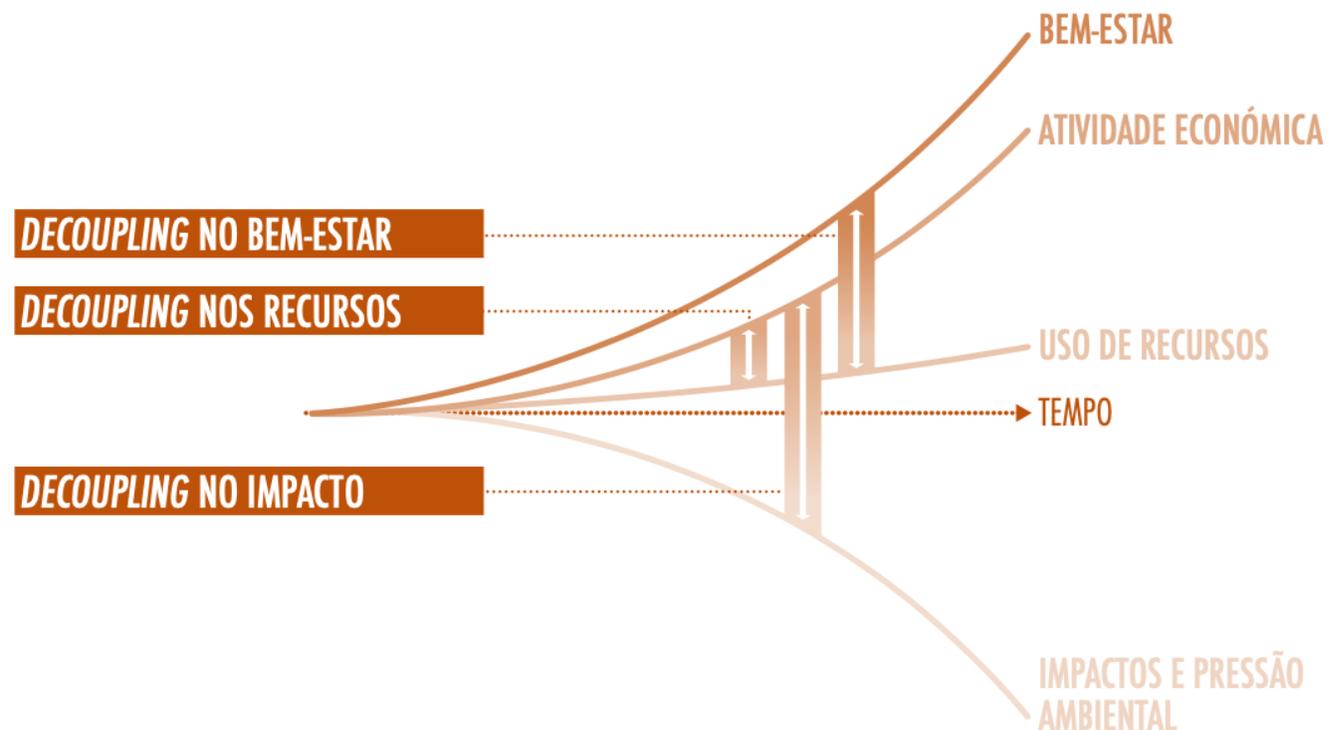
Source: Our World in Data based on the Global Carbon Project, Maddison Project Database 2020 (Bolt and van Zanden, 2020)
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

...faz-se com uma verdadeira sustentabilidade...

Ecological Footprint per Person and HDI of Nations with SDG-I Ranking



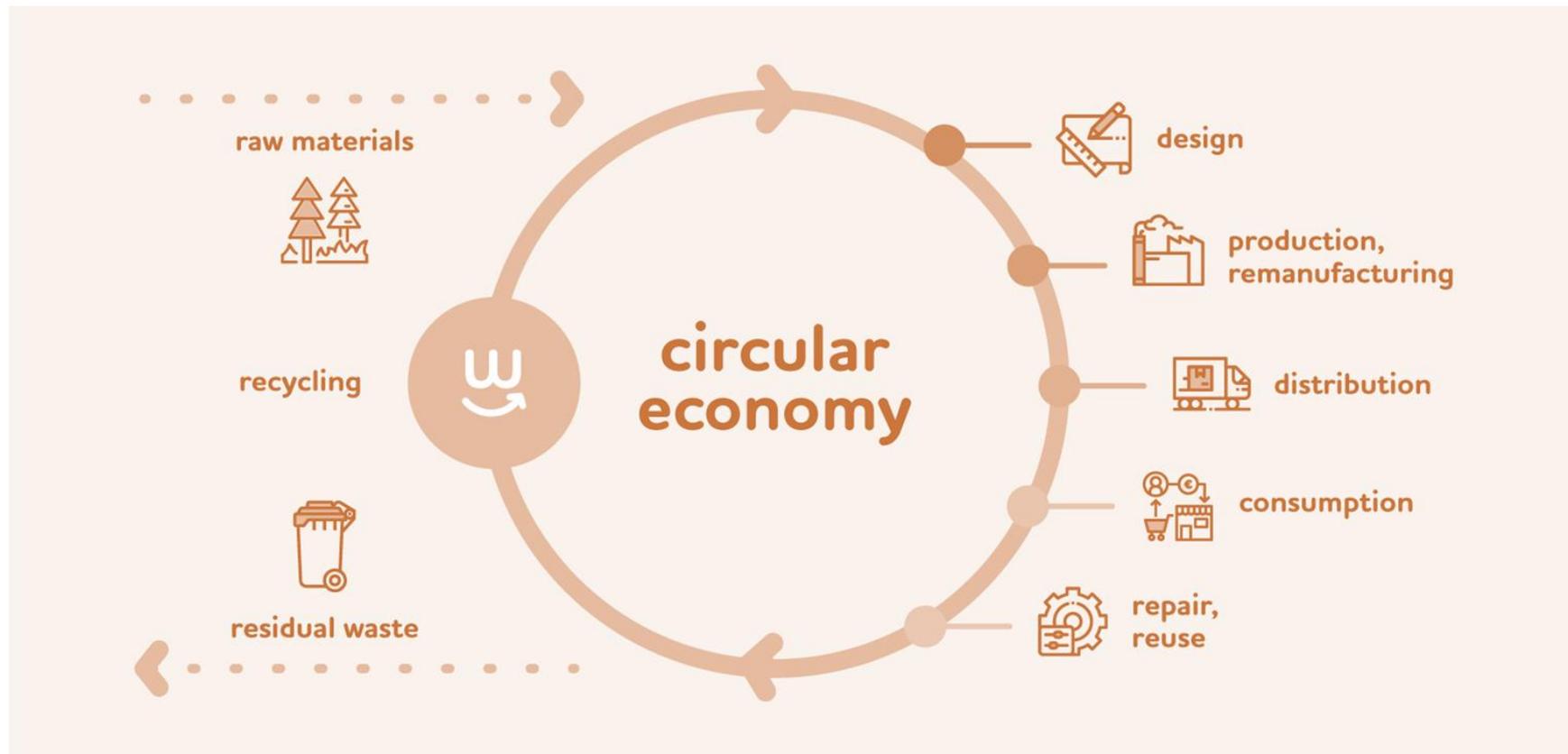
... com dissociação...



Processo de *decoupling* entre o crescimento económico, bem-estar e impactos ambientais

Fonte: UNEP/IRP – *Global Resources Outlook 2019* (p. 34) (tradução e adaptação)

...com economia circular...



...com economia regenerativa...

THE PLANET



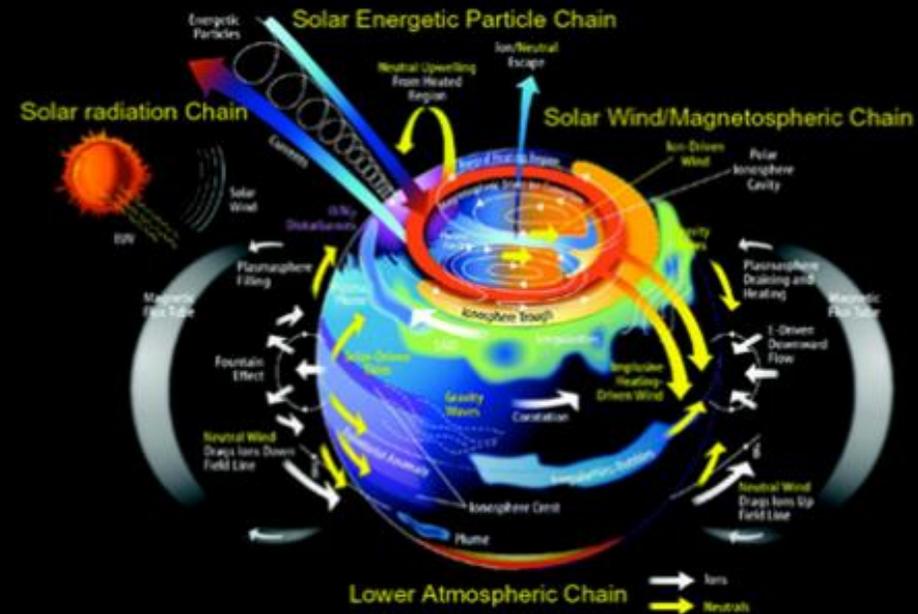
Blueturn
www.blueturn.earth

THE HARDWARE

Tangible physical space, where the territorial division is possible (Sovereignties)

blueturn.earth

THE SYSTEM

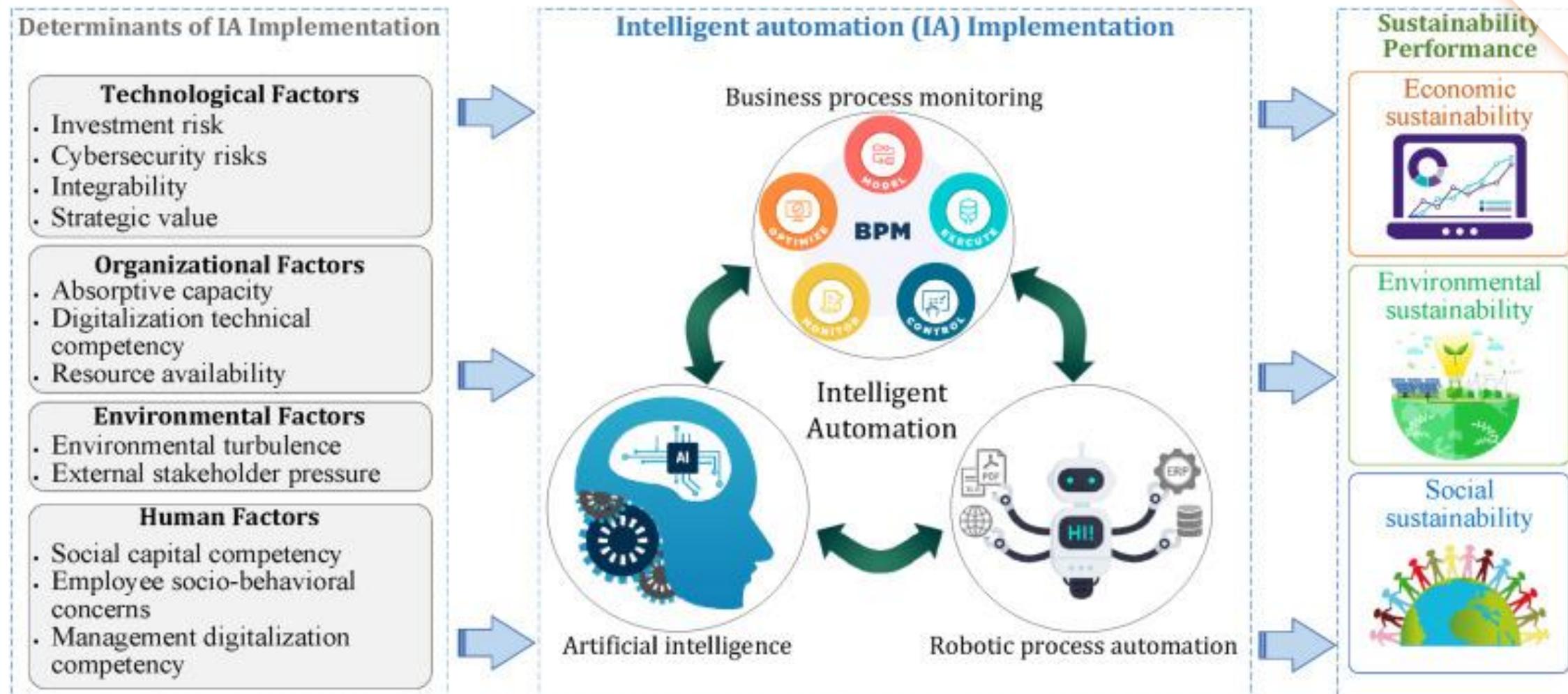


THE SOFTWARE

Functional and Intangible space, with no specific territorial character and where any type of division is impossible (SOS - Safe Operating Space)

J. Grobowsky / NASA GSFC

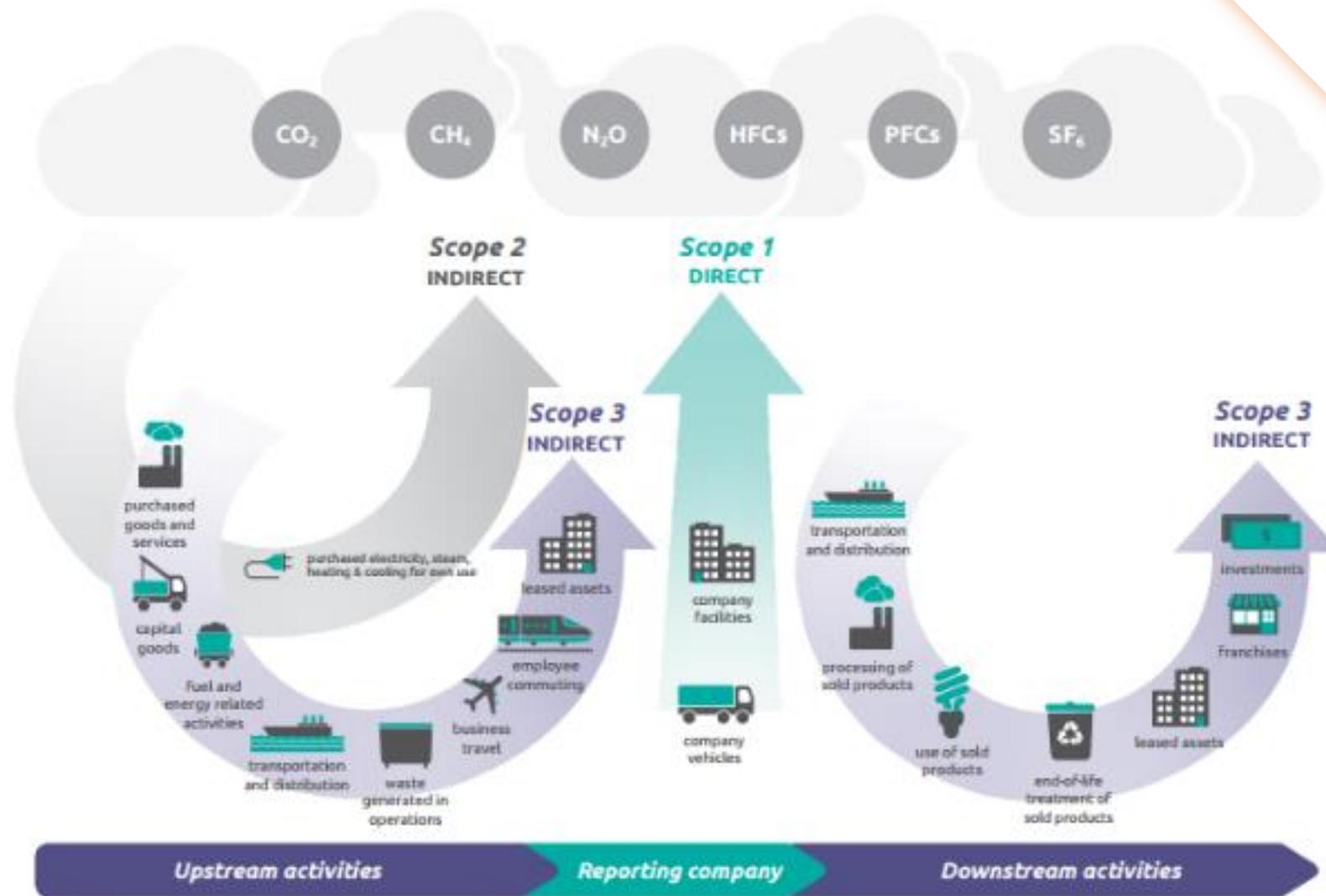
...a monitorizar, avaliar e otimizar indicadores ESG...



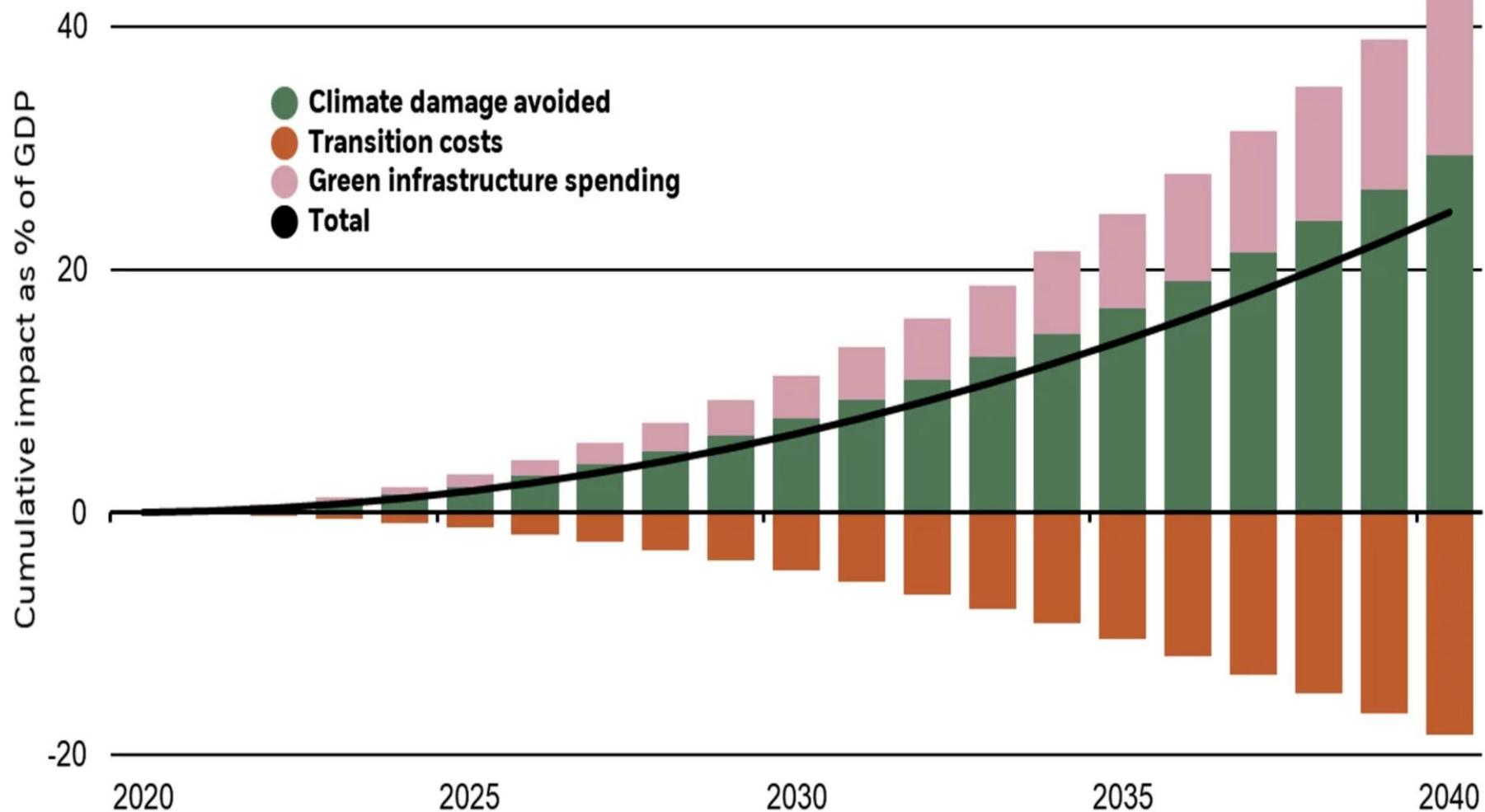
...a monitorizar, avaliar e otimizar através CSRD...



GREENHOUSE
GAS PROTOCOL

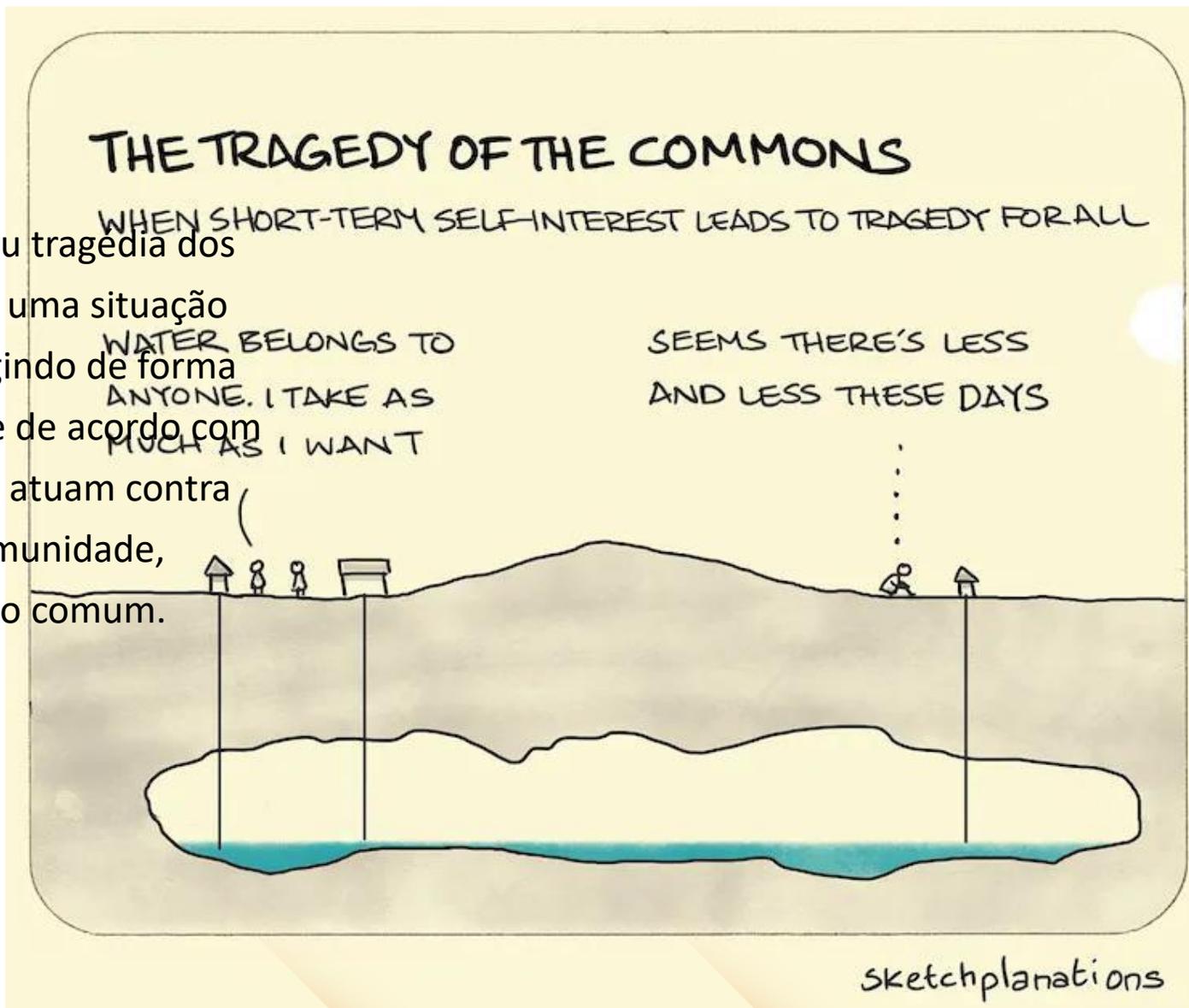


...ganhos no bem comum é internalizar as externalidades...



...a tragédia dos comuns...

A tragédia dos comuns ou tragédia dos bens comuns refere-se a uma situação em que os indivíduos, agindo de forma independente, racional e de acordo com seus próprios interesses, atuam contra os interesses de uma comunidade, esgotando os bens de uso comum.



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