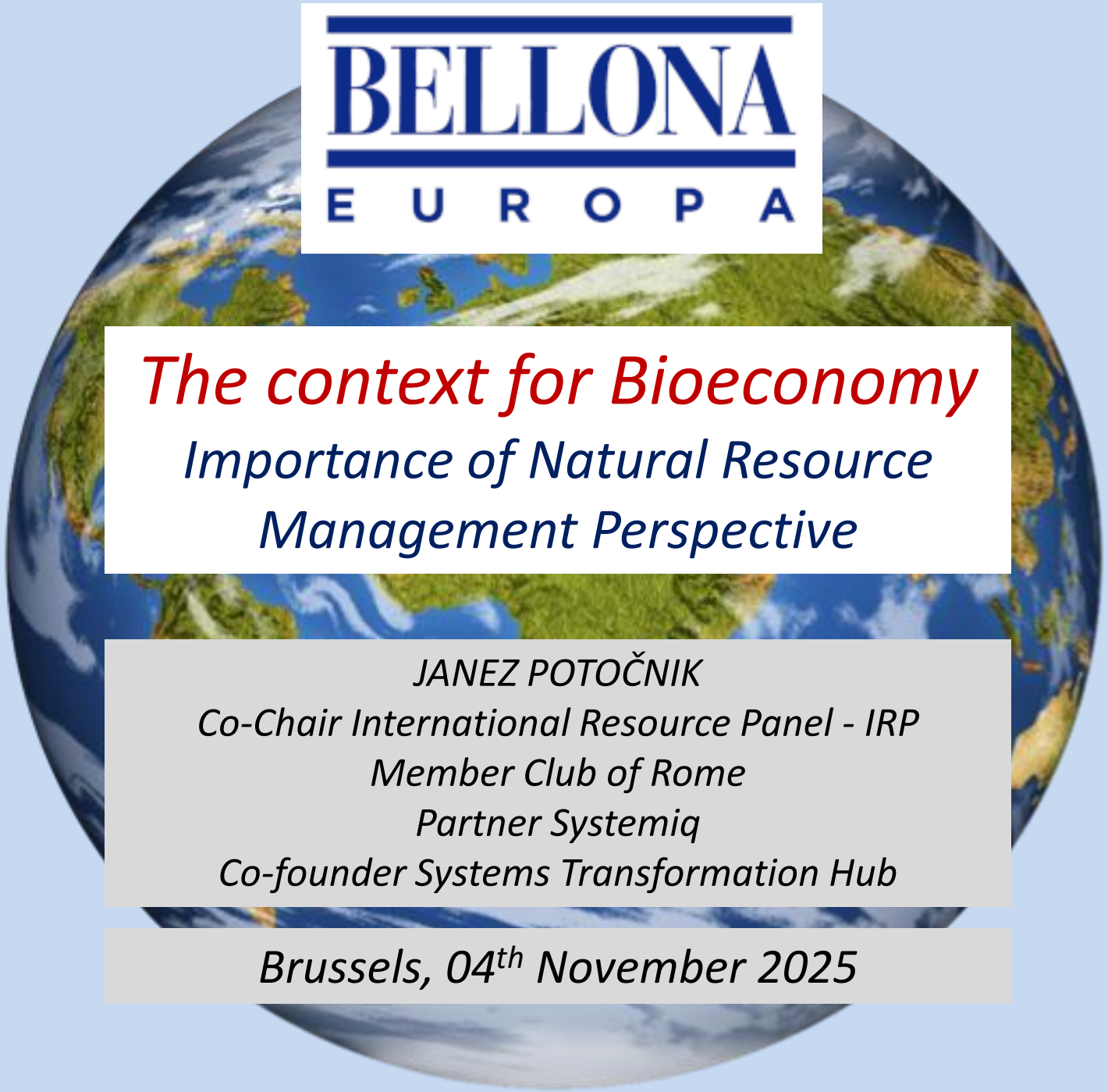


The context for Bioeconomy

Importance of Natural Resource Management Perspective

JANEZ POTOČNIK

Co-Chair International Resource Panel - IRP

Member Club of Rome

Partner Systemiq

Co-founder Systems Transformation Hub

Brussels, 04th November 2025

Quo-Vadis Humanity?

Quo-Vadis Europe?

For the first time in a human history, we face the emergence of a single, tightly coupled human social-ecological system of planetary scope.

We are more interconnected and interdependent than ever.

Our individual and collective responsibility has enormously increased.

We are living in strange times …

Source: Wikipedia

German philosopher Georg Hegel was right:

"The only thing we can learn from the history, is that we learn nothing from history."

We are living in strange times …

Slavoj Žižek

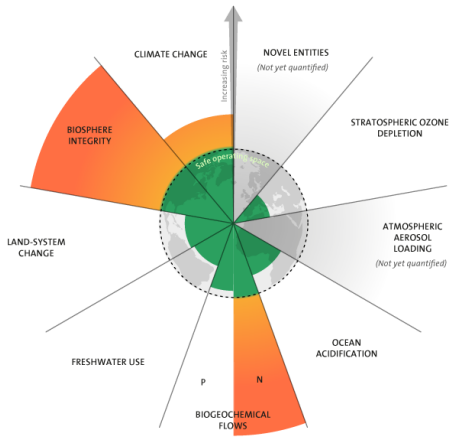
“It is clear that we are approaching the ecological and digital apocalypse … but we should not loose nerves.”

“Everything under heaven is in utter chaos; the situation is excellent.”

“It is easier to imagine the end of the world than the end of capitalism.”

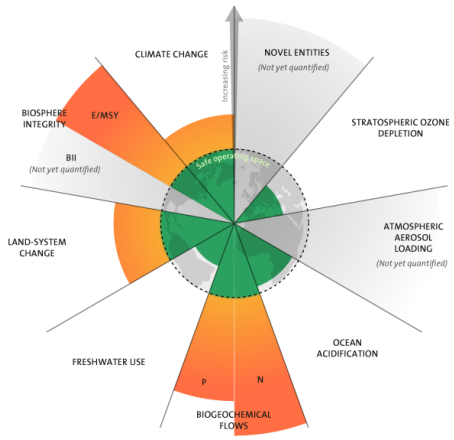
Planetary crises is making instability the norm

2009



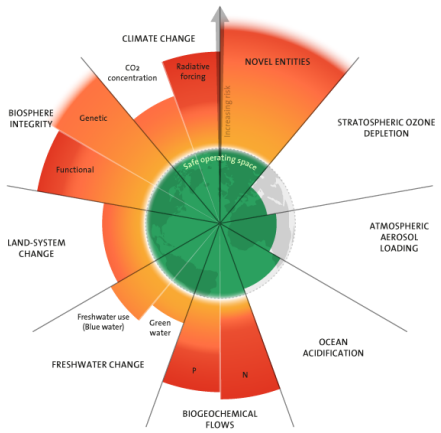
7 boundaries assessed,
3 crossed

2015



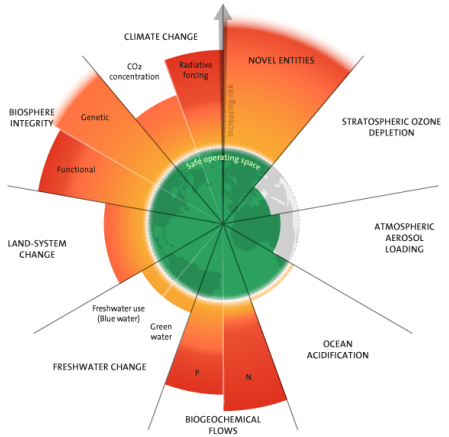
7 boundaries assessed,
4 crossed

2023



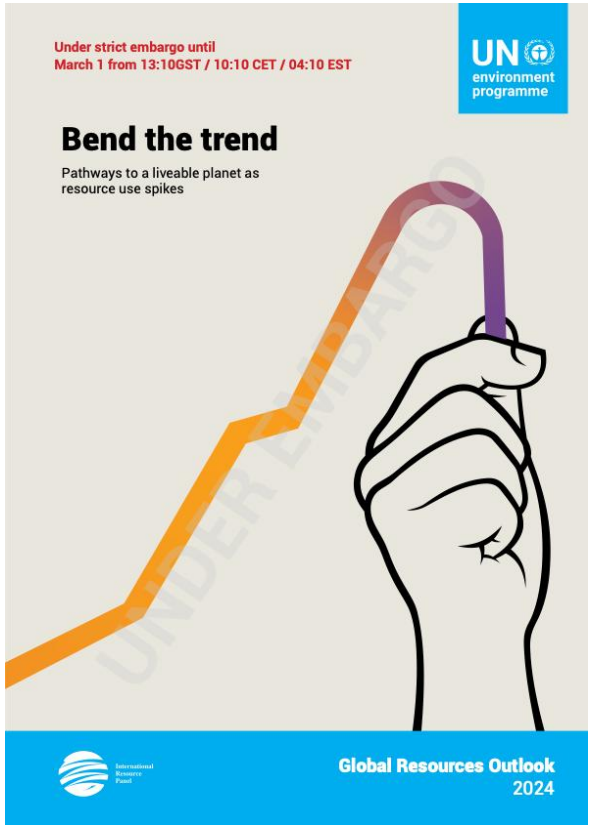
9 boundaries assessed,
6 crossed

2025



9 boundaries assessed,
7 crossed

Source: Azote for Stockholm Resilience Centre, based on analysis Sakschewski and Caesar et al. 2025, Richardson et al. 2023, Steffen et al. 2015, and Rockström et al. 2009



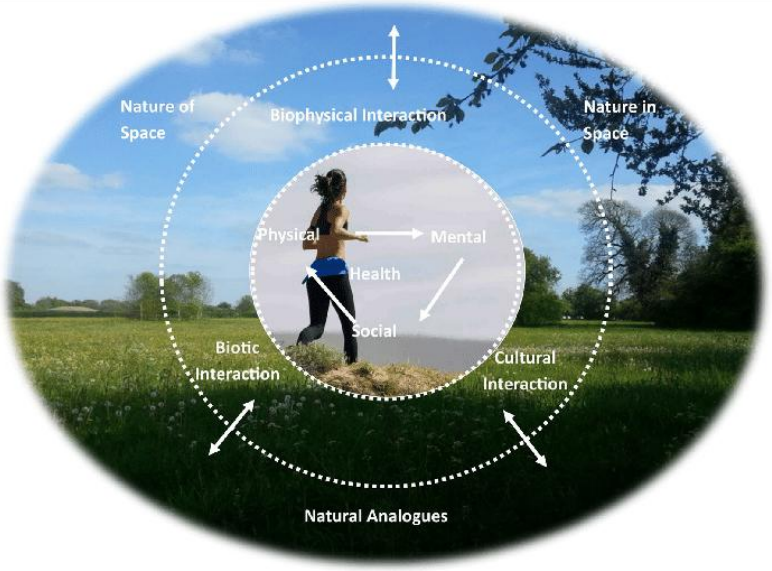
We are indebting future generations, financially and by depleting the Nature. This is simply wrong.

Apparently, we humans are the most intelligent species on this planet. It is high time to prove it.

More than an economic or a technological choice, this is a moral choice.

Changing our Relationship with (the rest of) Nature, is ultimately not only Environmental, but also an Economic, Equity and Security Imperative to strengthen collective Resilience

The lessons learned recently (war, pandemic, the hottest summer) are more than convincing to understood that. This relationship is not stable, nor balanced, and it will be resolved either with collective wisdom and effort, or in a hard and very painful way (conflicts, pandemics, migration …)



The future will be green and fairer and more equal … or there will be no future.

Quo-Vadis European Union

European Union is visionary concept of visionary people.
A model of cooperation, which could today in many ways enlighten and steer also the global community. It is worthy of our efforts and determination to protect and improve it.

Quo-Vadis European Union

Global supply chains are becoming increasingly volatile.
For years it is known that Europe and our economy is very import dependent and fragile when it comes to energy and materials.
But … the times were good and when the times are good, not many really care about that fact.
Competitiveness and strategic autonomy can only be based on responsible resource use and management, including fossil fuels.

Quo-Vadis European Union

One must acknowledge the increased complexity of the current situation, particularly challenging for Europe. In last decade new challenges emerge, in particular in security and competitiveness field, but none of the challenges leading to the proposal of European Green Deal few years ago disappeared. On the contrary, some are getting worse …

How to simultaneously address all of them in a world moving from a rule- to power-based governance, while maintaining core European Union values and science-based policy decision making, is central to our future.

Quo-Vadis European Union

Laurence Tubiana, CEO of European Climate Foundation:

Leverage our power: The European market has weight; access to it can be leveraged. Temporary relief from tariffs cannot justify eroding Europe's hard-won protections for the environment and consumers.

Stick to the plan: We did not move away from Russian gas just to swap one dependency for another. Reducing reliance on volatile fossil fuel imports and accelerating decarbonisation is crucial. Only locally generated renewable energy can truly reduce our exposure.

Defend multilateralism: Europe cannot slide into a transactional, deal-making logic that corrodes international governance.

Diplomacy is indeed an art of compromise. But without a compass rooted in values, Europe risks losing not only leverage, but itself.

Quo-Vadis European Union

Europe is on a strategic crossroad. We are major economic power, important trade partner and leading the World in providing help to those in needs but not considered adequately in international geo-strategical relations.

Going more defensive, defined in a holistic sense, which is broadly direction we are heading to. Focusing on defence and security policy, improving competitiveness, protecting our values, our democracies … while taking into account that EGD challenges are still very much present, is difficult to avoid.

But to become a well-recognised and listened strategic power, more than that would be needed. Building our strategic importance would require a higher level of integration in at least three areas, fiscal, external and defence policy.

Importance of Natural Resource Management

Setting the context for circular economy?

Natural Resources

Access to and use of natural resources have been in the human history closely related to the level of the achieved wellbeing of the nations, but also to stability, security, conflicts, wars (Access to Land, Water, Oil and Gas, Minerals, Precious Metals …)

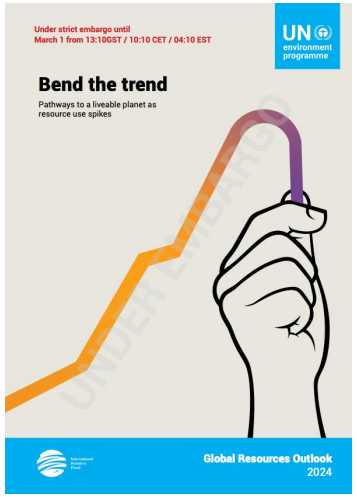
It was driving the geo-political efforts of consumption countries to control the resource rich countries.

The whole history of the colonialisation of nature, is also central to fairness and equity.

Economy Championed by Industrialised Nations is Wasteful and Unjust

We must shift away from the prevailing resource wasteful economic approach based on maximising the output of sectors, simplistically defined by GDP, towards an economy that is efficiently meeting human needs and optimise human wellbeing. The current logic is both ethically and ecologically unsustainable. We must set the order right. Economy was invented to serve humans and our needs, and not the opposite.

Definition: Materials and Resources



***Biomass**: crops for food, energy and bio- based materials, wood for energy and industrial uses*

***Fossil fuels**: covering coal, gas and oil, among other*

***Metals**: such as iron, aluminum and cooper, among other*

***Non-metallic minerals:** sand, gravel, limestone and minerals used for industrial applications*

Land

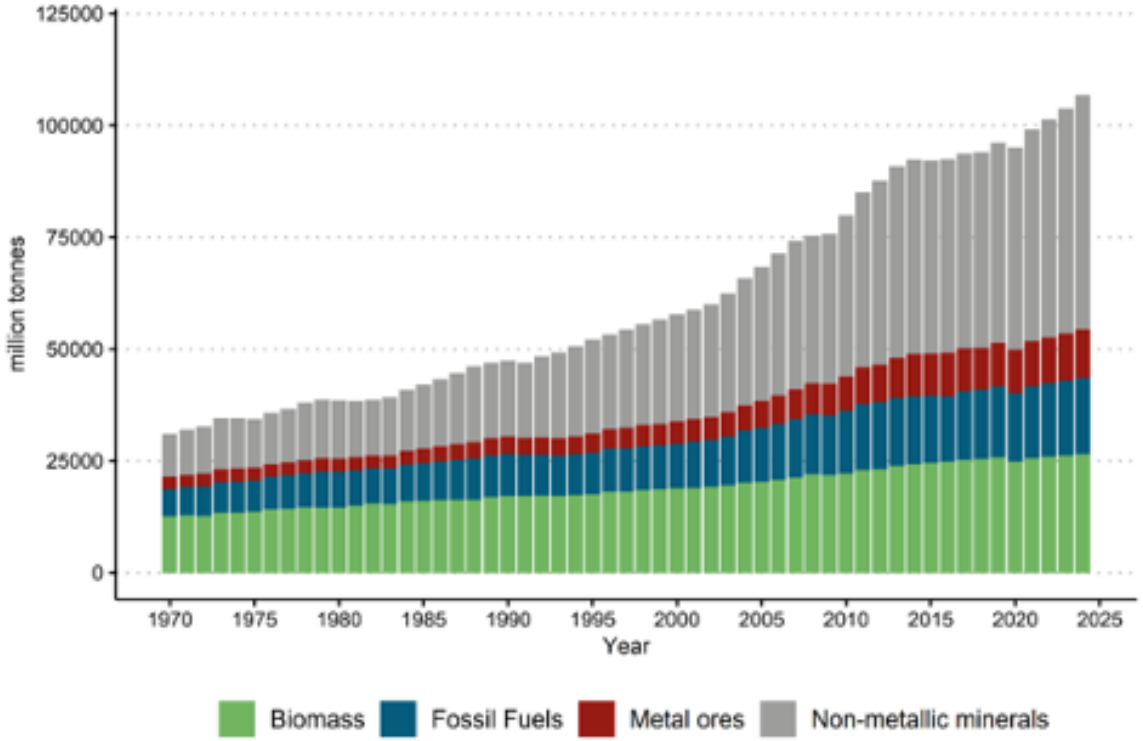
Water

Materials:
Everything extracted from the Earth

Resources:
Materials + Land and Water

Trends: Global Material Use and Share in 1970-2023

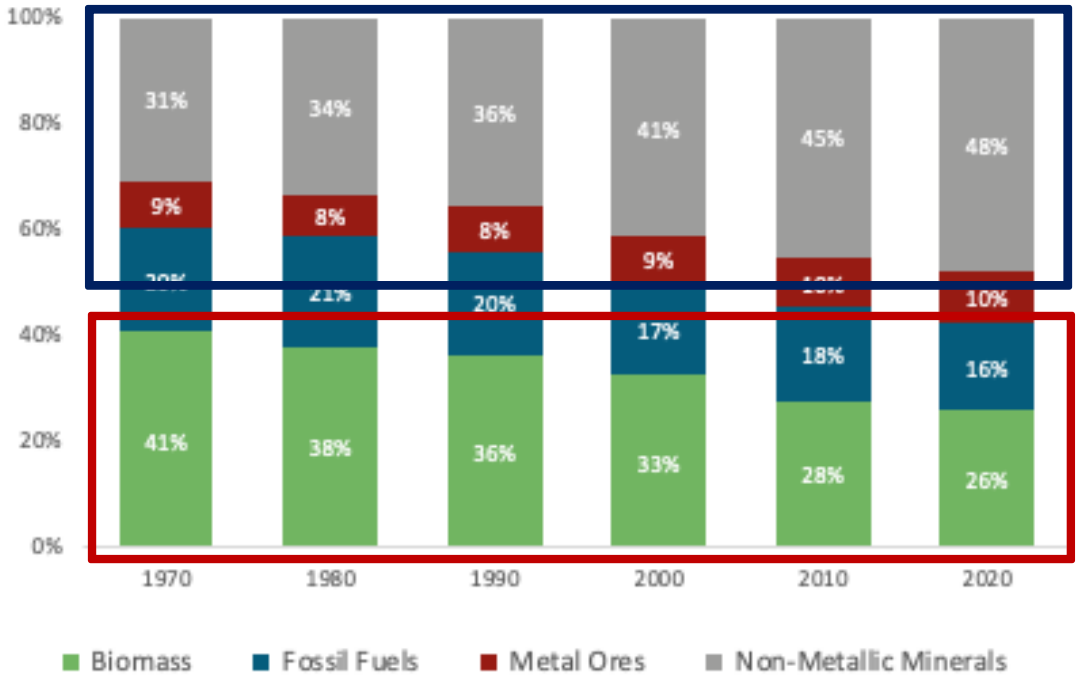
Global Material Use has increased for more than a factor of 3 since 1970 due to urbanisation and industrialisation (and population growth) - 2.3% per year



Global material extraction, four main material categories, 1970 – 2024, million tones.

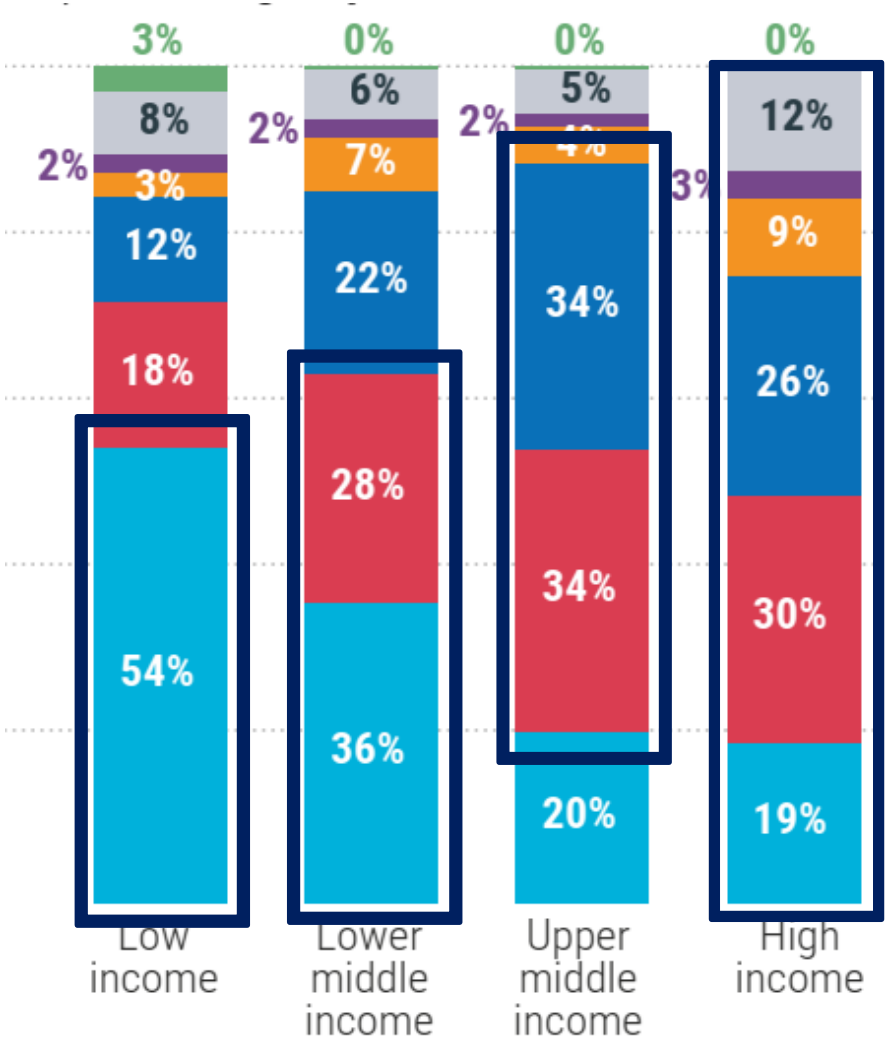
… which is increasing also the share of Non-Metallic Minerals in Global Material Use

(Main Asia-Pacific Region Impact)



Global material extraction, four main material categories, 1970-2020, shares

Trends: The material needs for provisioning systems (built environment, mobility, energy and food) by country income groups (2020)



Food
Mobility
Built environment
Energy
Communication
Other
Waste Management and Resource Recovery

Energy includes household energy consumption
All other provisioning systems include their embodied energy

Built environment and mobility: *(construction, transport sector&infrastructure): 59 billion tonnes*

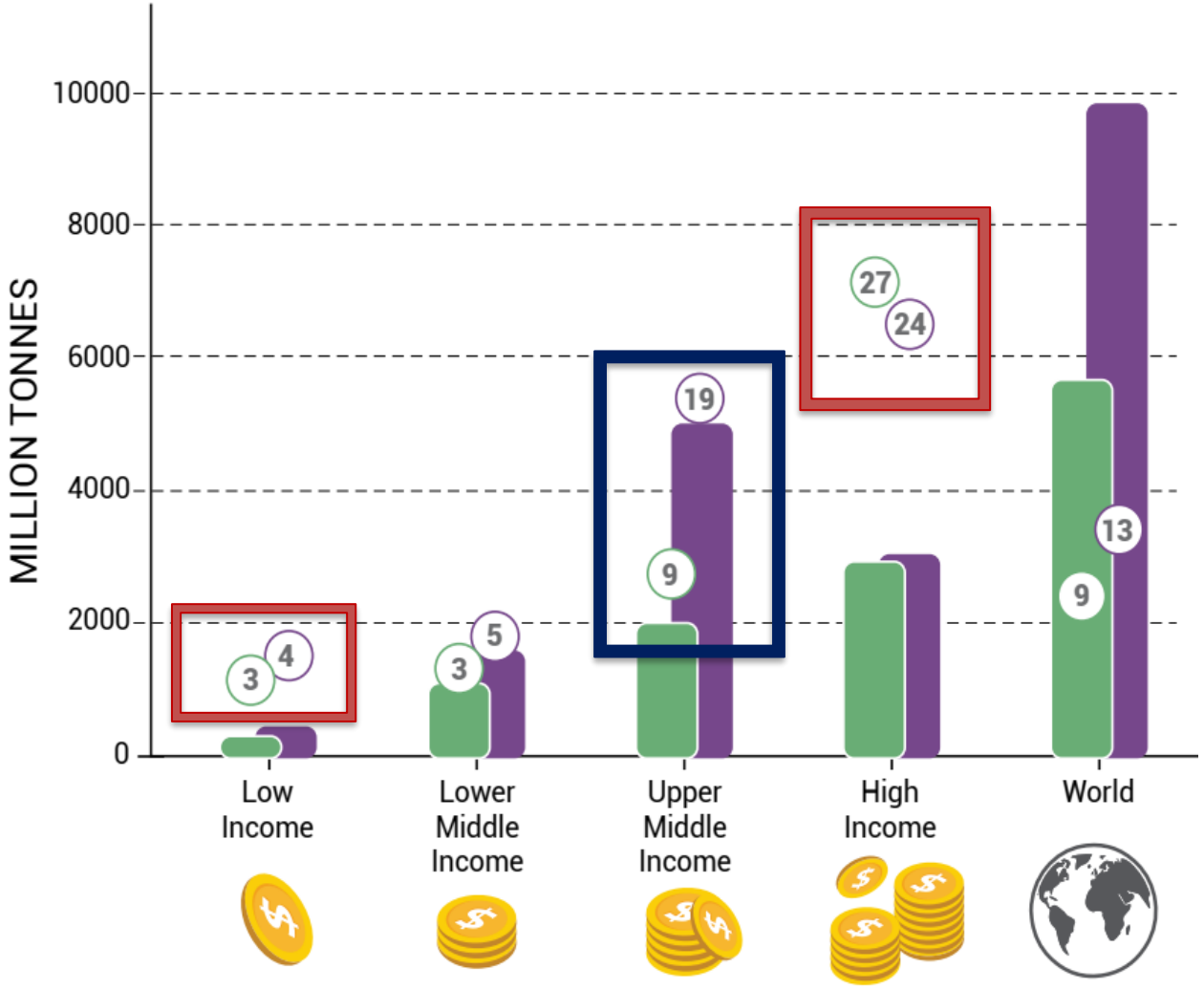
Food*: 23.6 billion tonnes*

Energy: *(electricity, power, heat): 6.1 billion tonnes*

Together = 90% of total global material demand, but differ in importance by income group

Source: Global Material Flows Database (UNEP 2023a)

Trends: High-income countries use six times more materials per capita and are responsible for ten times more climate impacts per capita than low-income countries.

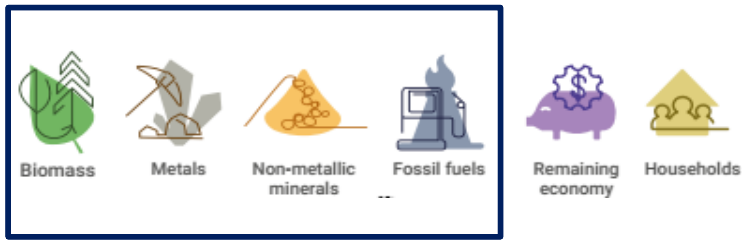


From 2000 … to 2020

- *High-income: Highest material footprint of all groups, relatively constant. Climate impact per capita = 10 x low-income group.*
- *Middle-income: material footprint more than doubled, approaching high-income levels. Climate impact per capita = roughly 50% of high-income group; 6 x low-income group.*
- *Low-income: Remain comparatively low, and mostly unchanged.*

Impacts: Extraction and Processing of Natural Resources Drives all Aspects of the Triple Planetary Crisis

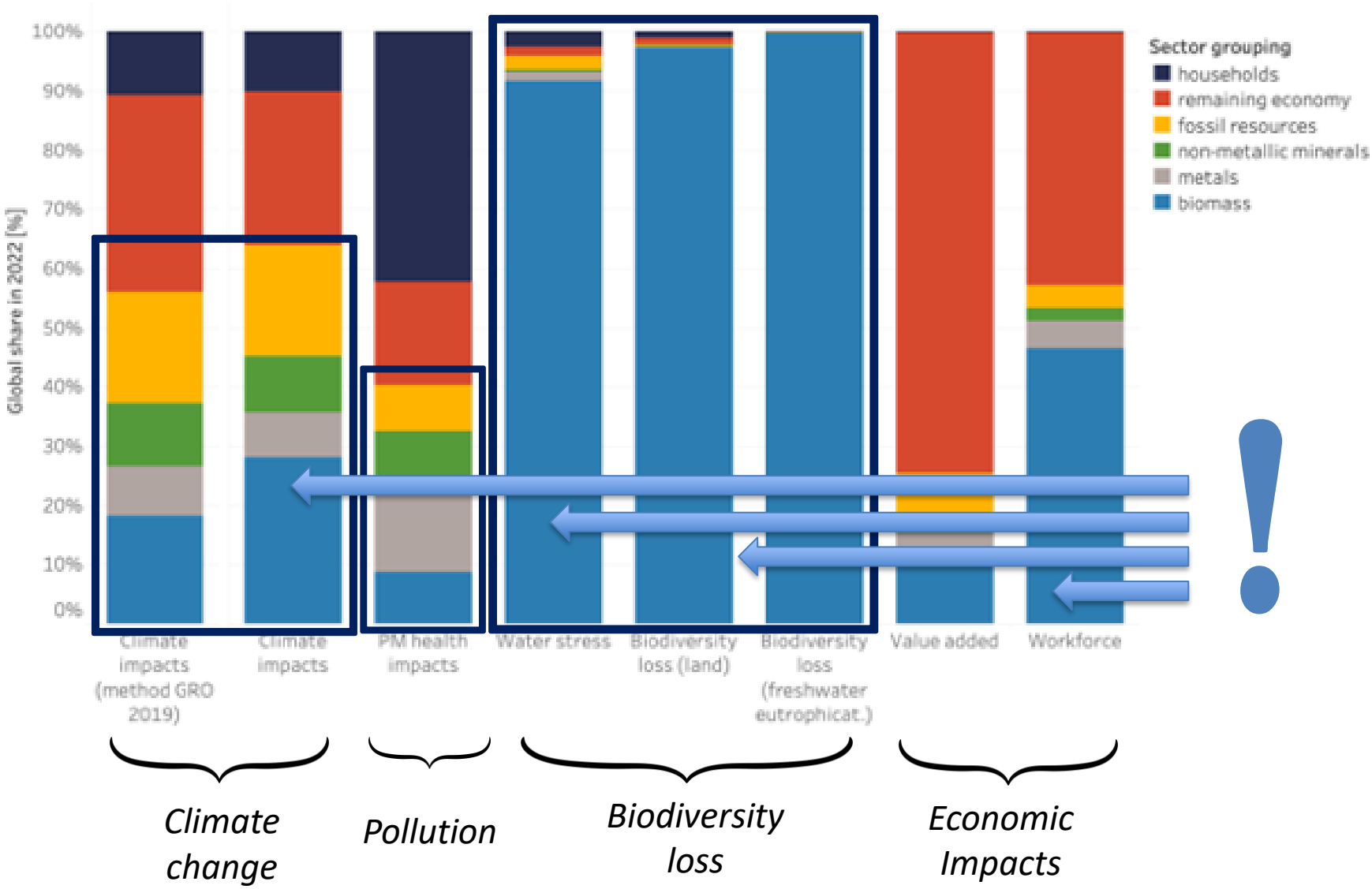
Environmental impacts of materials in the value chain in extraction and processing phase



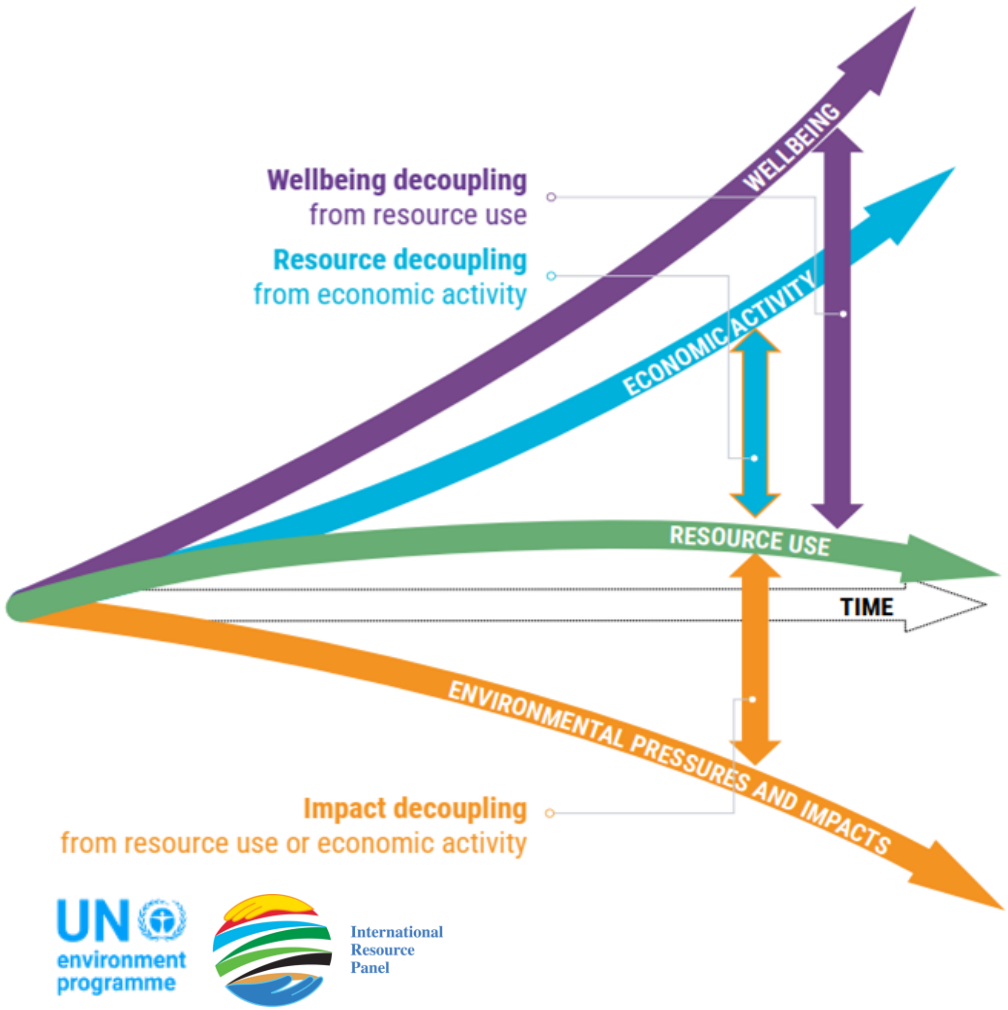
60% of global climate change impacts including land use change

40% of air pollution health impacts

More than 90% of water stress and global land and water eutrophication related biodiversity loss



Solutions: Decoupling resource use from economic activity and human wellbeing & targeting it to human needs through provisioning systems



Natural resources

- Biomass
- Fossil fuels
- Metals ores
- Non-metallic minerals
- Land
- Water

Provisioning systems

- Nutrition
- Built environment
- Mobility
- Energy

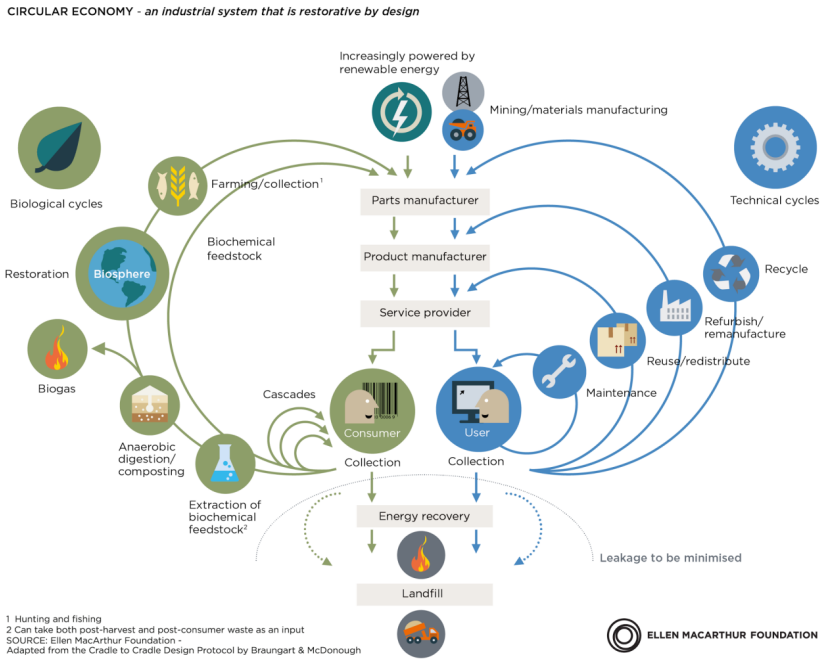
Human needs

- *Adequate, nutritious food for all*
- *Safe, secure, resource-efficient built environment*
- *Sustainable mobility and access to essential services*
- *Access to clean, safe energy*

Source: International Resource Panel (2024), Global Resources Outlook 2024 (https://www.resourcepanel.org/reports/global-resources-outlook-2024)

Why Circular Economy?

The Logic of the Obvious



Circular economy should be seen as an instrument helping delivering decoupling of economic growth from resource use and environmental impacts in practice, as well as a part of the bigger picture of economic, societal and cultural transformation needed to deliver the SDGs and other international commitments.

Main question often-overlooked to be addressed

How to meet human needs in most energy and resource efficient way?

https://edistaffing.com

From Product Maximisation to Providing Human Needs

It is not not about owing it is about using

We do not need cars	*…*	*We need mobility*
We do not need light bulbs	*…*	*We need light*
We do not need chairs	*…*	*We need to sit*
We do not need refrigerators	*…*	*We need chilled and healthy food*
We do not need CDs	*…*	*We want to listen to the music*
We do not need pesticides	*…*	*We want healthy plants*

Dematerialisation, Rethinking Ownership, Efficiency should be Complemented with Sufficiency

Source: Mint

Importance of the Point of Perception

When you complain that you are caught in a traffic jam …

you are wrong.

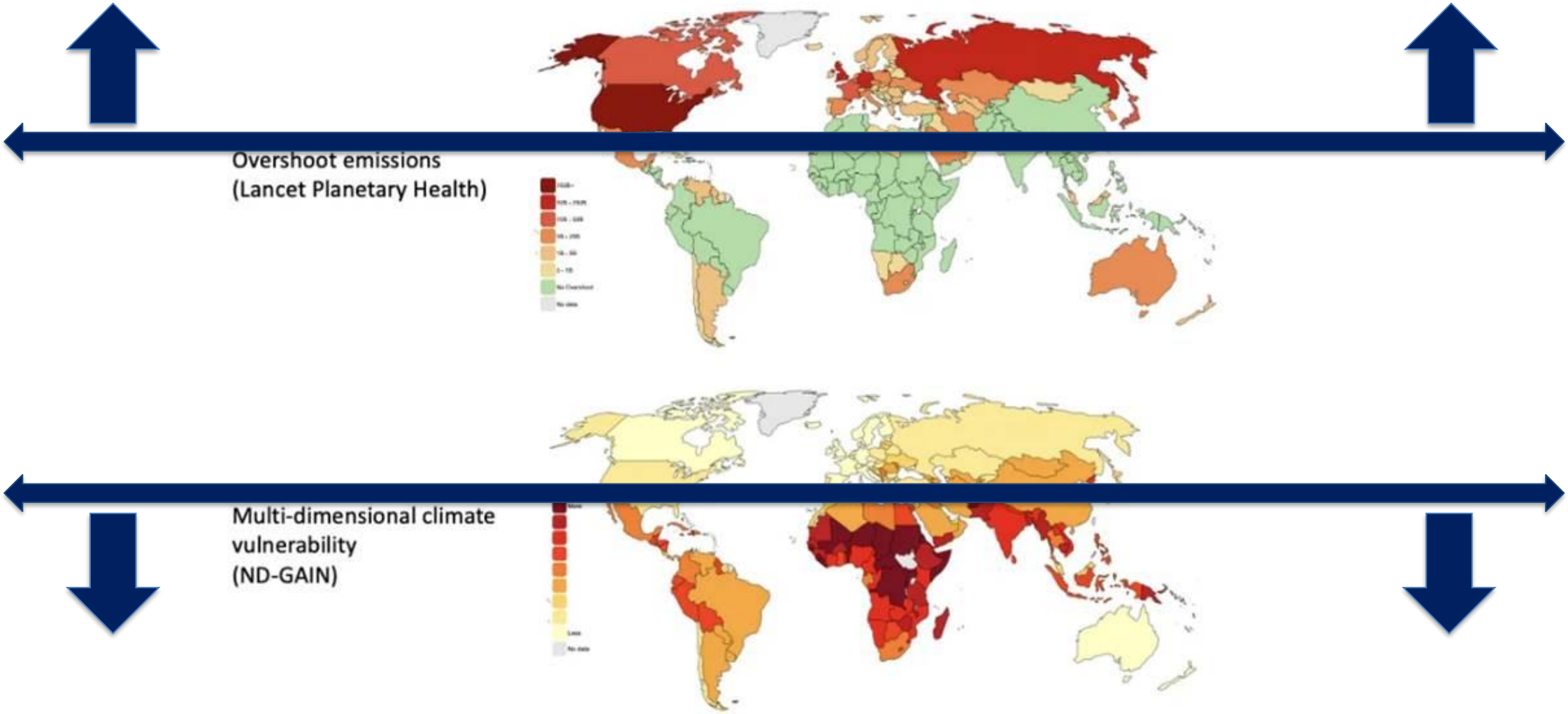
You are traffic jam.

Climate Change

Receiving attention with good reasons, but limited success.

Why is circular economy important part of solution?

Those Benefiting Most, and Those Facing Worst Climate Consequences

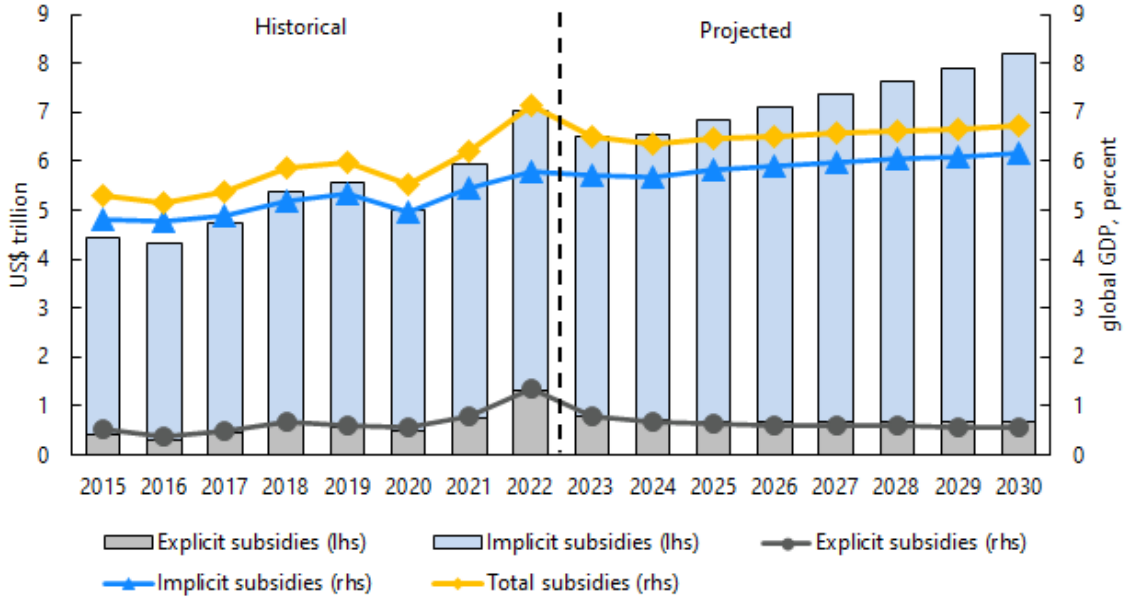


Africa Climate Summit: "Kenya's Ruto says western leaders have broken 'climate blood pact"

Some Climate Change Related Facts

- *Global CO_2 emissions in billion metric tonnes 37.41 highest ever (Source: Statista 2024)*
- *Global surface temperature increase above pre-industrial level 1.5 – 1.7 degrees Celsious (Source Copernicus monthly figures 2023/24)*
- *The system that moves water around the Earth is off balance for the first time in human history (Source: Global Commission on the Economics of Water, The Economics of Water, 2024*
- *Fossil fuel subsidies $7 trillion or 7.1 percent of GDP (Source: IMF Data/Projections 2022)*

The Global Hypocrisy Indicator

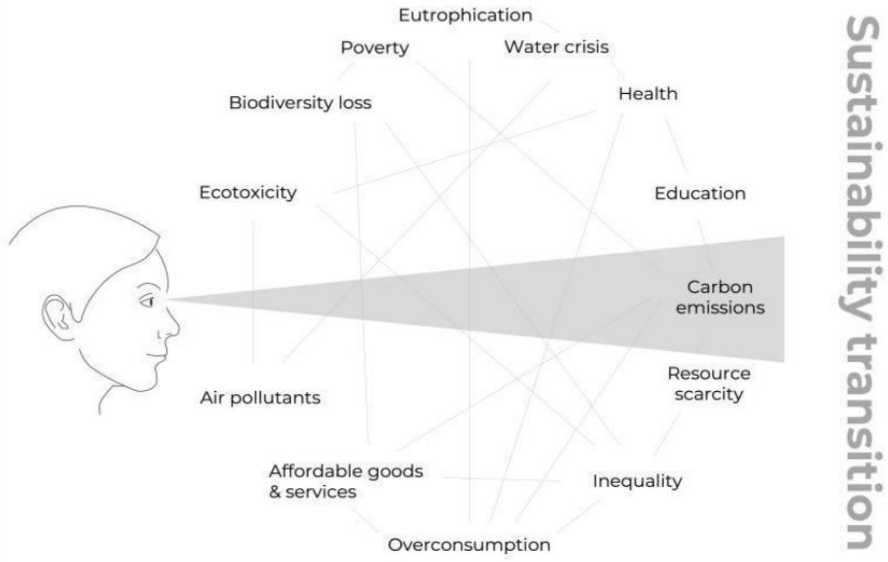


Back to my home country Slovenia

Slavoj Žižek

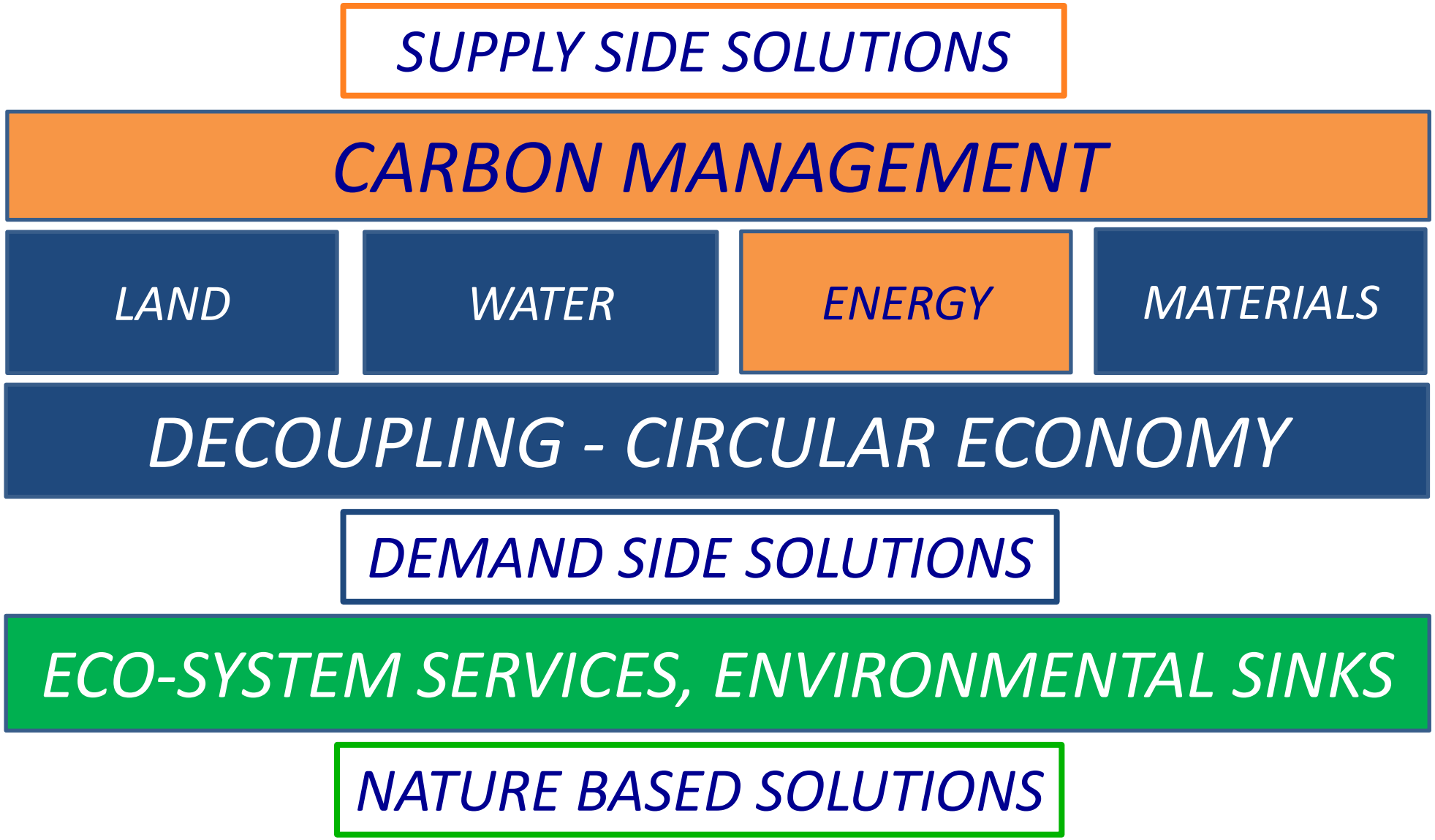
“In short, the truly courageous stance is to admit that the light at the end of the tunnel is most probably the headlight of a train approaching us from the opposite direction.”

Energy transition is important but not enough



Climate breakdown is a symptom of ecological overshoot. The material footprint is dangerously underdiscussed. Most climate solutions lack focus on the root cause of the crisis. A focus on overshoot highlights the material usage (including fossil fuels), waste output (the consequence of the still prevailing wasteful linear economy) and growth of human society, all of which affect the Earth's biosphere.

Climate Change can only be effectively addressed by combining



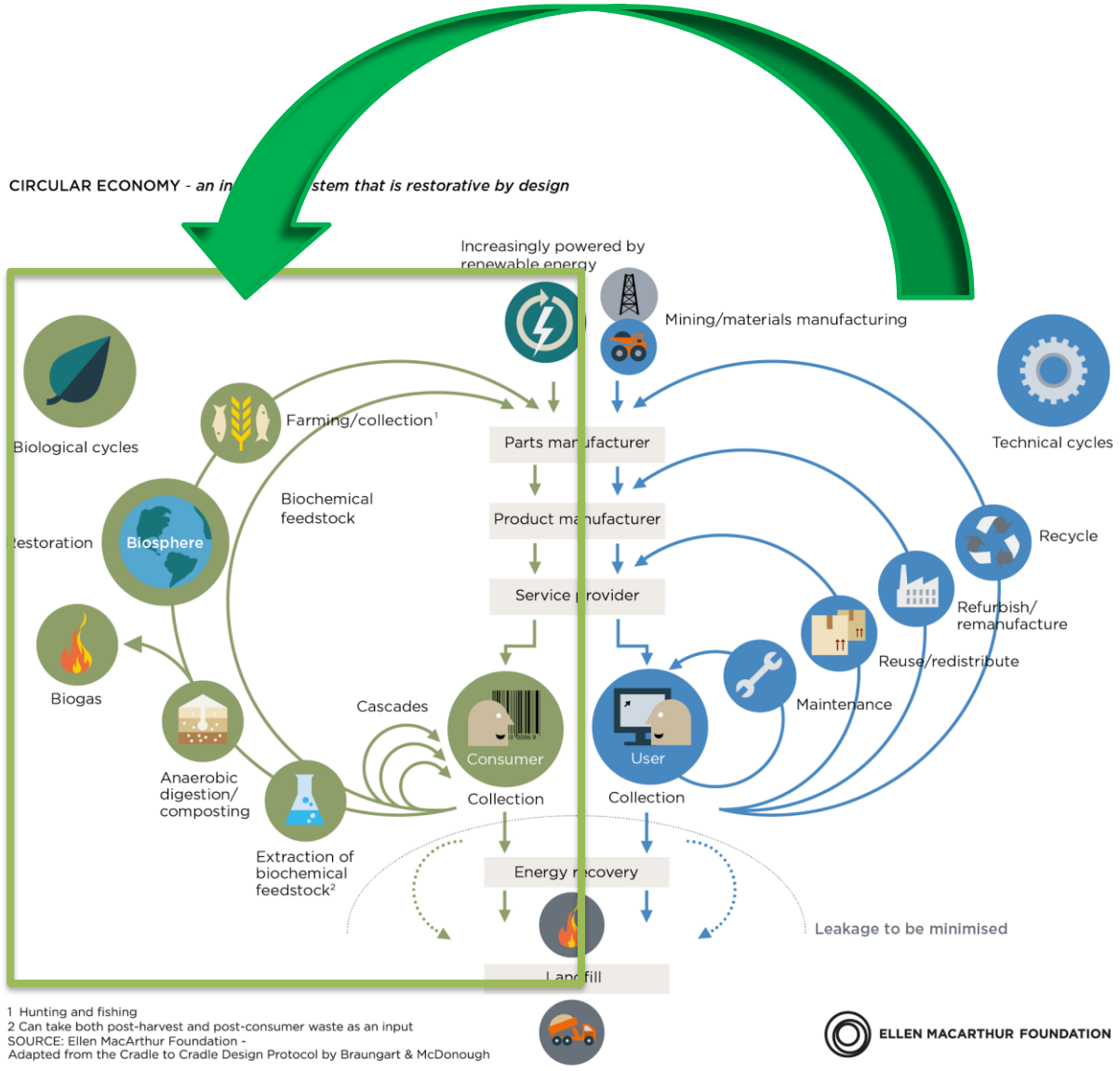
Circular Bioeconomy

Challenges and Opportunities

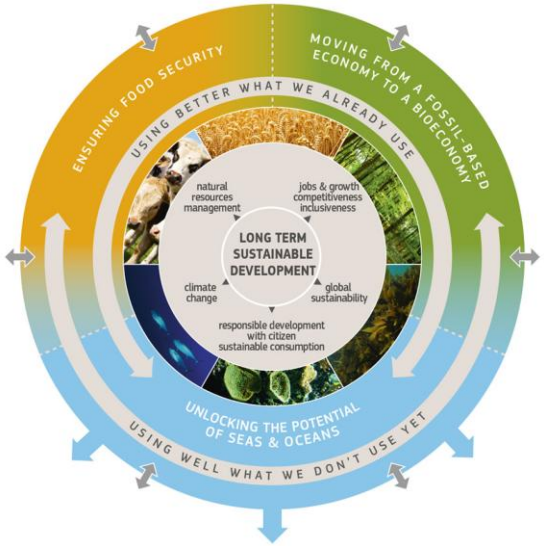
Source: Plant Based Product Council

Circular Bio-Economy is just using common sense

Circular bioeconomy is the oldest concept on planet Earth. All nature is based on the principles of a circular economy: nothing is lost, and everything has its purpose. We humans, as part of nature, should abide by the same principles. Unfortunately, what seems logical in theory isn't so clear in practice.



If famous EMF butterfly would fly, it would be flying in circles



Some Basic Principles which need to be Respected

- *Clear guidelines and agreed sustainability criteria are essential to establish the needed trust.*
- *Greenwashing should be avoided, as it risks to backfire and reduce the credibility and potential of biomass use.*
- *Access to carbon-rich natural systems must be subject to the condition of limiting biodiversity impacts. The bioeconomy's potential to address climate change should not be at the price of biodiversity loss.*
- *Sustainably produced biomass is a scarce resource, thus a "cascading use" approach, establishing a kind of biomass use hierarchy should be the norm.*
- *Biomass sourcing should preferably focus on biomass waste.*
- *Priority should be given to long-term uses, where carbon is stored, and in applications where alternative materials with very large impacts can be substituted.*

BIOECONOMY

Has a major development potential

But it has to respect sustainability criteria and it has to be complementary and in line with decoupling and circular economy principles

EU Bioeconomy Strategy

to be adopted till end of the year

Main goals:

- *Boost innovation & scale-up bio-based sector*
- *Make production & consumption more circular and resource efficient*
- *Ensure sustainable and sufficient supply of biomass*
- *Strengthen EU competitiveness & markets*
- *Ensure food and nutrition security; climate, environment & biodiversity goals*

EU Bioeconomy Strategy

to be adopted till end of the year

Main trade-offs to consider:

- *Balancing biomass supply with environmental protection; overharvesting, land use change, water stress, biodiversity loss are risks*
- *Ensuring that bioeconomy solutions are truly sustainable - not just replacing one problem with another*
- *Scaling up innovation and commercialization is often expensive, risky, and regulatory or market barriers can block development*
- *Ensuring fair benefit distribution, especially to rural, coastal, and forested areas, and to smaller producers*
- *Harmonising different policies & regulations (agriculture, forestry, environment, trade, industry) so they don't conflict*
- *Ensuring market demand for bio-based products; competition from cheaper fossil-based alternatives*

What next?

Policy Recommendations based on GRO24

From fossil to metals/minerals economy

Materials: *Everything extracted from the Earth*

Biomass: *crops for food, energy and bio- based materials, wood for energy and industrial uses*

Fossil fuels: *covering coal, gas and oil, among other*

Metals: *such as iron, aluminum and cooper, among other*

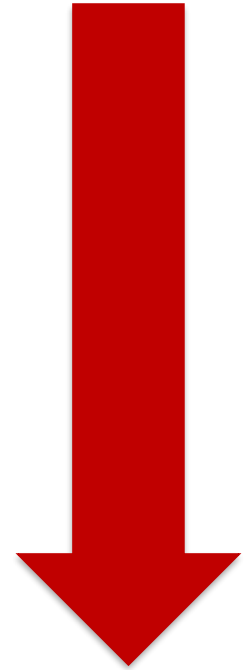
Non-metallic minerals: *sand, gravel, limestone and minerals used for industrial applications*

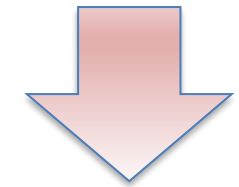
Land

Water

Energy transition

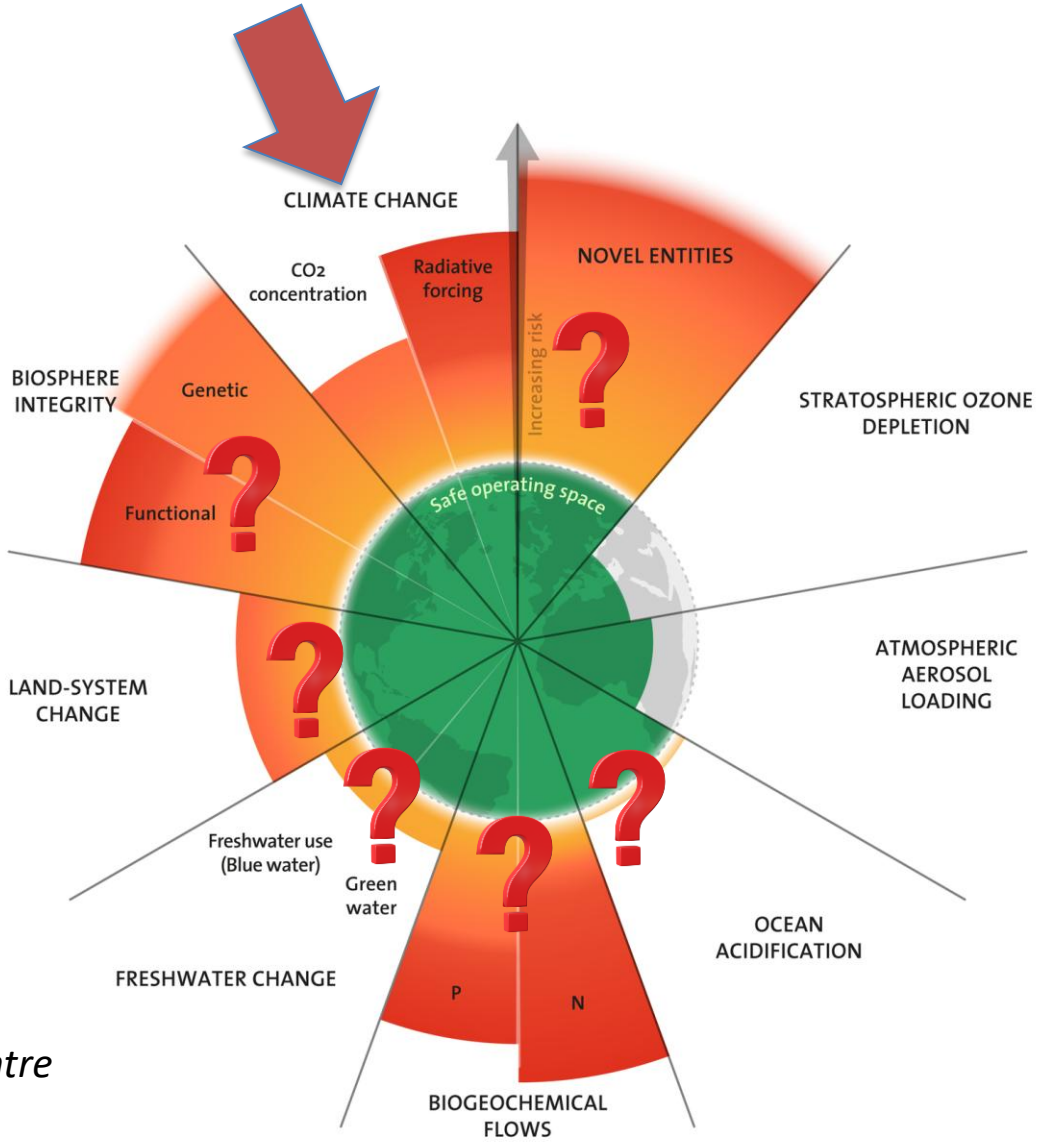
Economy transition





It is not enough to make energy system sustainable

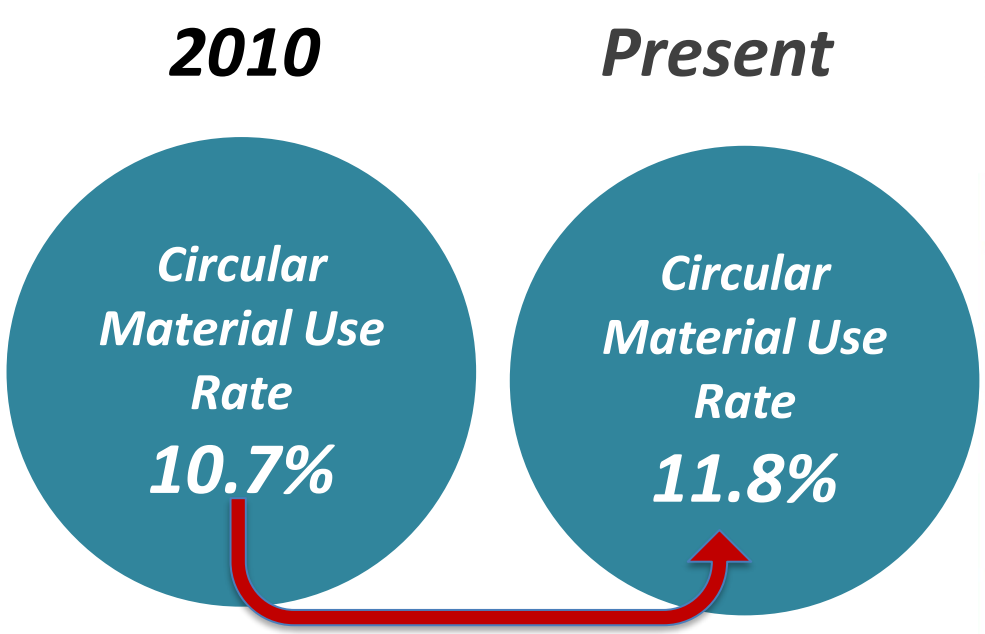
We need to make all economic systems sustainable



Source: Stockholm Resilience centre

Source: Medium, Vecteezy,

Circularity targets and developments SOER 2025 …



In EU documents, the goal for the circular the "circularity rate" is to double the share of materials coming from recycled / secondary sources by 2030, relative to the 2020 baseline.

Target is therefore to reach approximately ***23–24% by 2030****.*

Source: *Eurostat*

Past trends (10-15 years)

Biodiversity and ecosystems	Climate change	Environment and human heal	Circular economy and other enablers of transformative change
State of Europe's biodiversity	Greenhouse gas emissions	Emissions of pollutants to air	Circular design and sustainable production
Pollution of ecosystems	Trends in the mobility system	Air pollution and impacts on human health	Waste generation and material consumption
Protected areas	Trends in the energy system	Environmental noise and impacts on human health	Waste recycling
Water and climate impacts	Carbon dioxide removal from the atmosphere	Water pollution and human health	Circular use of materials
Ecosystems and climate impacts	Ozone-depleting substances and fluorinated greenhouse gases	Chemical pollution and huma health	Circular economy financing and strategies
Land use and land take	Climate risks to the economy	Environmental health inequalities related to air pollution	Benefits of a circular economy
Soil resources	Climate risks to society		Global impacts from EU consumption
Biodiversity investment needs	Climate action financing		Transformative innovation
	Governance of climate change mitigation and adaptation		Green employment
			Green taxation and other economic instruments
			Justice in sustainability transitions
			Financing the transition towards sustainable activities

Source: Medium, Vecteezy,

Improving trends dominate | Trends show mixed picture | Deteriorating trends dominate

There are basically two ways to make CE a reality:

Market signals are leading consumers and producers' behaviour. Our current system does not incentivize sustainable resource use, in fact quite the opposite. We should stop signalling producers that extraction based economic success is most profitable and avoid contradictory signals to consumers, to behave responsibly, but still routinely pay more if they do, instead of the reverse.

Regulation, setting a clear vision designed by policy makers based on science and public interest.

Sending policy signals one way, and market signals the other, is just creating confusion on the markets and leading to the resistance and lobbying by affected companies.

Give a clear message to policymakers:

Many excellent examples of CE practice are encouraging,

but to make CE a norm, we need a system change!

Mario Quintana

Source: Instituto Moreira Salles

Don't waste your time chasing butterflies.
Mend your garden, and the butterflies will come.

Call to Action – Based on GRO24 Recommendations

International organisations need to become proactive stewards of sustainable material use and the circular economy by pursuing four key missions:

Create, consolidate, and make accessible insights

Mission 1
BETTER ORIENTATION

National material use targets and scientific guidance, including a global orientation value

Mission 2
BETTER MEASUREMENT

Indicators measuring the ability of provisioning systems to meet people's needs in material-efficient ways

Mission 3
BETTER ECONOMIC INCENTIVES

Policy and fiscal reforms to reflect environmental and social costs in material prices and shift subsidies

Facilitates and enables

Mission 4
BETTER TRANSPARENCY AND COORDINATION

Access to consolidated material flow and impact data - provided by an International Materials Agency

To summarize:

- *Materials management, including biomass, deserves proper recognition and attention in policy space. Currently it is not matching energy transition and GHG emissions.*
- *Energy transition, as much as needed, will not make our economy less wasteful and more just. We need to focus on all materials we use (including fossil fuels) in all our economic sectors, or better provisioning systems, delivering our needs.*
- *International supply chains are complex. To speed up, better coordinate overall economic transformation something as effective as existing in energy area would be needed also for materials governance.*
- *Circular economy is an instrument helping delivering the necessary decoupling of wellbeing and economic growth from resource use and environmental impacts as well as an economy consistent with SDGs and other international commitments. Many excellent examples of CE practice are encouraging, but to make it a norm, we need a system change.*
- *This should help us steer global material use and make the necessary space for developing countries to be able to meet essential human needs while we would all together stay within the planetary boundaries.*

Quo-Vadis European Union

2025 State of Union Address by President von der Leyen

I am convinced: the future of clean tech will continue to be made in Europe. But for that, we also need to make sure that our industry has the materials here in Europe. And the only answer here is creating a truly circular economy.

So, we need to move faster on the Circular Economy Act.

Towards Circular Economy Act

The opportunity and need to institutionalize resource governance and define resource use paths

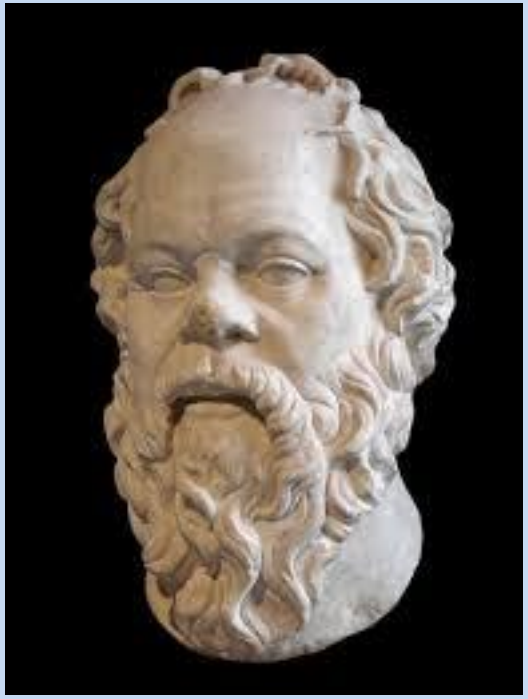
Dimensions	
1 ***BETTER: Minimise product need through better system design***	***Refuse and Rethink strategies***
2 ***LEANER: Optimise product design***	***Reduce strategies in manufacture and use***
3 ***LONGER: Maximise lifespan of products and its parts***	***Reuse, Repair, Refurbish, Remanufacture, Repurpose and Recycle strategies***
4 ***CLEANER: Minimise waste and pollution***	***Recovery strategies***

Resource Efficiency

Still not much present, but critical for effectiveness

Attributed to

Socrates



Source: Wikipedia

Remember:

Strong minds discuss ideas,
average minds discuss events,
weak minds discuss people.

To Conclude

Source: Disney.com

It is not easy being green

Clear message from business sector during recent conferences

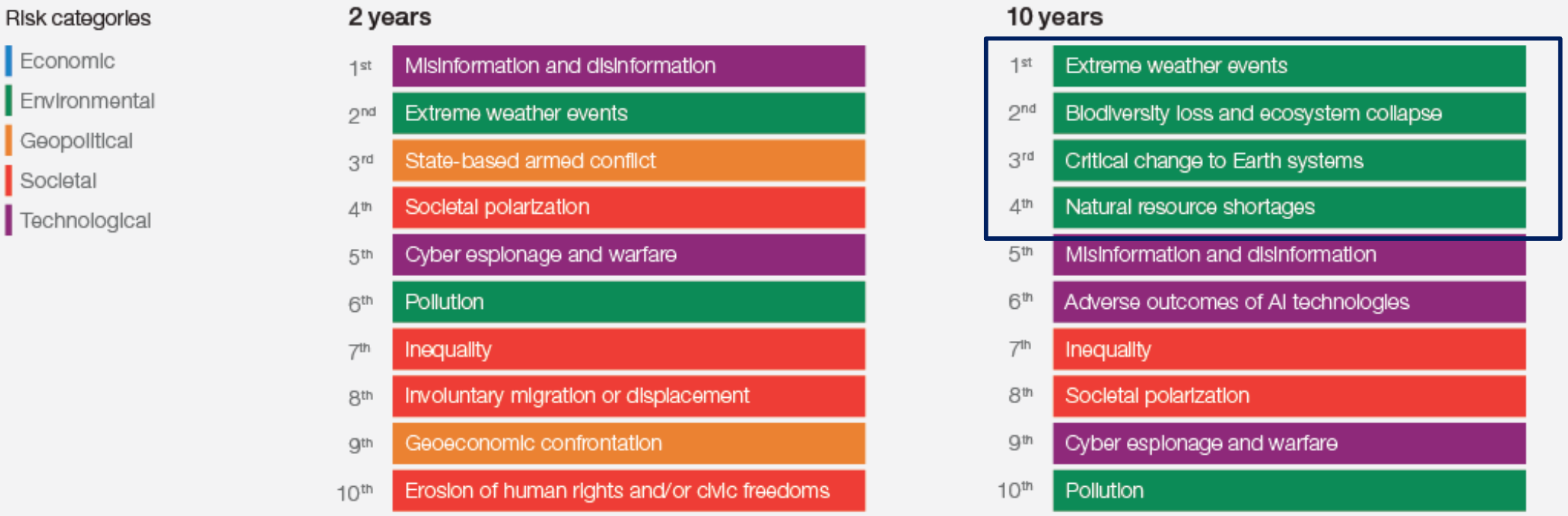
It is unavoidable!

And any transformation is a major business opportunity for those who are innovative, those who dare and those who understand the essence of the challenges ahead of us.

This System Change Transformation is also in the Interest of the Business

FIGURE C **Global risks ranked by severity over the short and long term**

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."



Source

World Economic Forum Global Risks Perception Survey 2024-2025.

Critical to remember

Sustainability is not in opposition to competitiveness, but a critical success factor for competitiveness, security, fairness and democracy, and for the coherence of the European project at large.

Critical for Policymakers

Industry understands the need for sustainability and is not against the direction which they also see as unavoidable. They also see this as potential competitive advantage, and they know they could hardly compete in this globalised world based on costs.

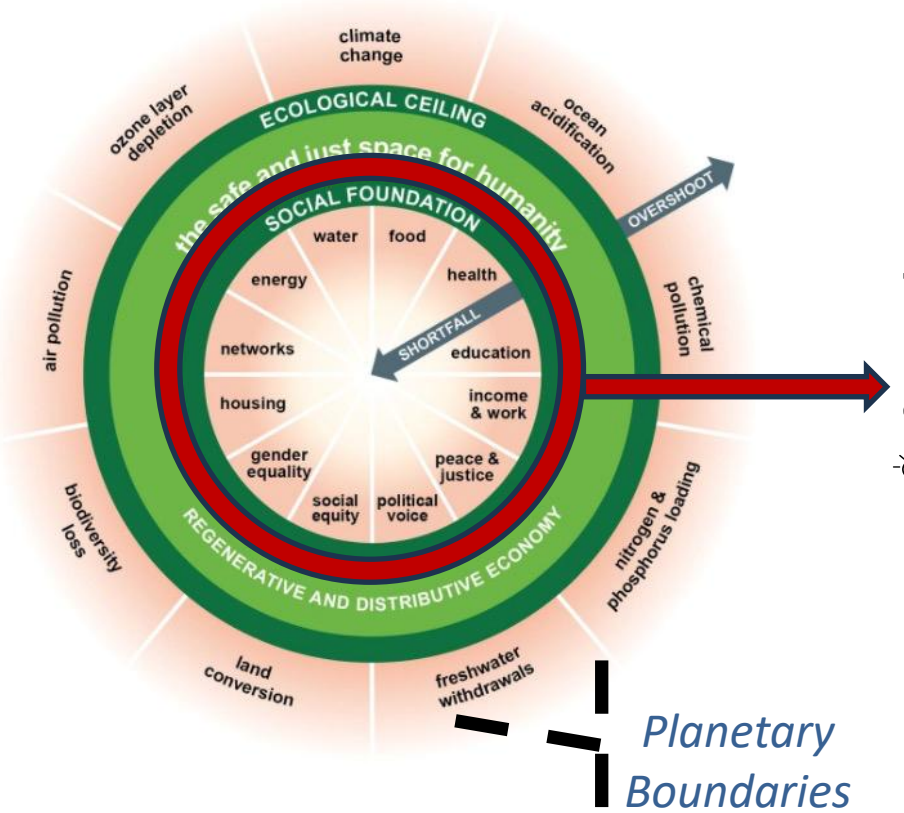
What they need is in the first-place predictability, as good as it gets level playing field, quicker, less time- consuming policy decisions and financial support. Conflicting messages from policymakers and changing clear strategic direction they do not see as helpful.

In short: Do not kill industry with kindness! We have tried that for quite some years and almost succeeded.

Systemic Path to Wellbeing

What?

Meeting Human Needs
Respecting Planetary Boundaries



Planetary Boundaries

Source: Raworth 2017

Policy Focus

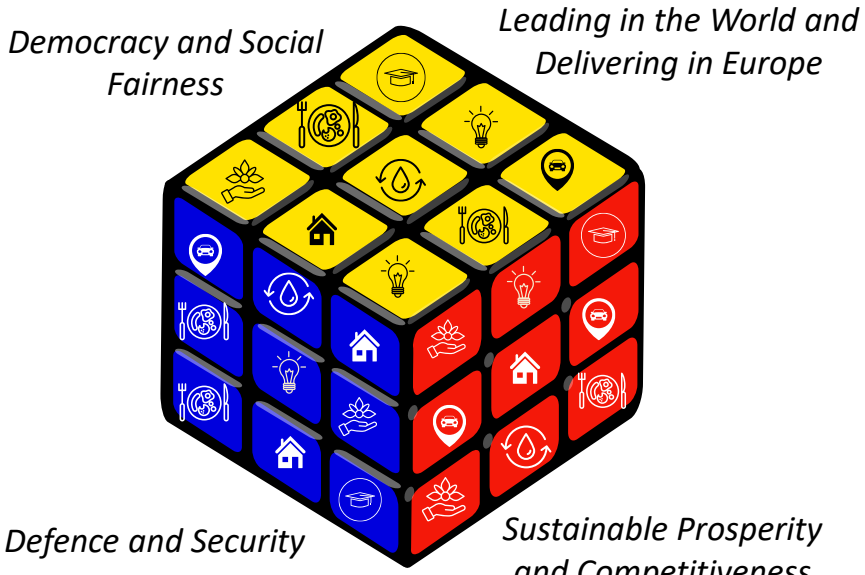
Resource Intensive Provisioning Systems

- *Food*
- *Built Environment*
- *Mobility*
- *Energy*

Source: IRP 2024

How?

System Change Approach



Source: Europe's Choice, Political Guidelines for the next European Commission 2024-2029

Let’s finish again in my home country Slovenia

Slavoj Žižek

“I'm a pessimist in the sense that we are approaching dangerous times. But I'm an optimist for exactly the same reason. Pessimism means things are getting messy. Optimism means these are precisely the times when change is possible.”

And finally, with the most important advice from the famous Belgian, country hosting me last two decades

HERCULE POIROT

When asked why he is speaking about himself always in a third person he replied something like that:

If one is such a genius like me, it is very important to establish a healthy distance to himself.

THANK YOU

for helping us delivering the future we want!