



Conférence Luxembourg Stratégie 2023

**La Vision stratégique ECO2050 :
Une aide prospective pour la
diversification de l'économie**

Grand Auditoire, Maison du Savoir, Esch Belval
26 septembre 2023 de 8h30 à 18h00

Les fondations socioéconomiques

Les enjeux des emplois et des compétences pour la transformation économique

**Gilles de Margerie
Commissaire général, France Stratégie**

MÉTIER S

2030

3ème Conférence
Luxembourg Stratégie

LES MÉTIERS DANS LA TRANSITION ÉCOLOGIQUE

26 septembre 2023

Gilles de Margerie
Commissaire général
France Stratégie

LES INCERTITUDES DE LA TRANSITION ÉCOLOGIQUE

Investissement supplémentaire

Quels montants ?

Débats ouverts sur l'ampleur des investissements nécessaires pour la rénovation thermique des bâtiments

Quels actifs échoués ?

Dégradation brutale de valorisation d'actifs ; conséquences emplois

Quels financements ?

Capacité d'emprunt des ménages, des entreprises et de l'Etat

Taux d'intérêt

Sobriété

Gains escomptés des économies d'énergie

Réinvestis dans d'autres dépenses moins carbonées (éducation, santé, loisirs)

Contraintes de consommation et décroissance

Baisse de la construction neuve

Effets rebond ?

Qui annule les effets des économies réalisées

Progrès technologique

Gains de productivité

R&D et renouvellement des biens

Amélioration de l'efficacité des énergies renouvelables

Mais question de compétitivité et de disponibilité de la main d'œuvre

Aucun progrès

Shift : dépendance trop forte aux énergies fossiles = aucun gain de productivité

PEU DE NOUVEAUX MÉTIERS MAIS DES RÉALLOCATIONS D'EMPLOI

Peu de nouveaux métiers dans la transition écologique

Des compétences qui s'ajoutent ou qui s'hybrident

Ex. couvreur qui pose des panneaux photovoltaïque ou ajouts des compétences informatiques pour optimiser les récoltes

Des compétences environnementales qui doivent irriguer tous les métiers (y compris dans la gestion des entreprises : organisation du travail pour limiter les émissions, les « compter », réduire les déplacements, etc.)

Une interrogation sur l'ampleur des besoins et leur localisation

Quels métiers vont créer plus d'emplois ou en détruire ?

Anticiper les besoins de recrutement pour mieux orienter et former ; nécessité de reconversion des ouvriers de la réparation automobile par exemple

Des besoins qui ne sont pas répartis de manière homogène sur le territoire

Agriculture, industries et passoires thermiques qui sont au cœur de la transition sont concentrés dans certains territoires

Une évaluation quantitative fondée sur des familles professionnelles larges

Des familles qui regroupent des métiers aux gestes professionnels proches : une nécessité pour des questions de robustesse des données, qui a du sens sur la longue durée mais limite la précision des résultats

DES SCÉNARIOS ALTERNATIFS POUR TENIR COMPTE DES INCERTITUDES

RÉFÉRENCE

Télétravail modéré
A mesures climat existantes

1 million d'emplois créés entre
2019 et 2030 dont :

- +1,8 million chez les diplômés du supérieur
- -800 000 chez les non-diplômés du supérieur

BAS CARBONE

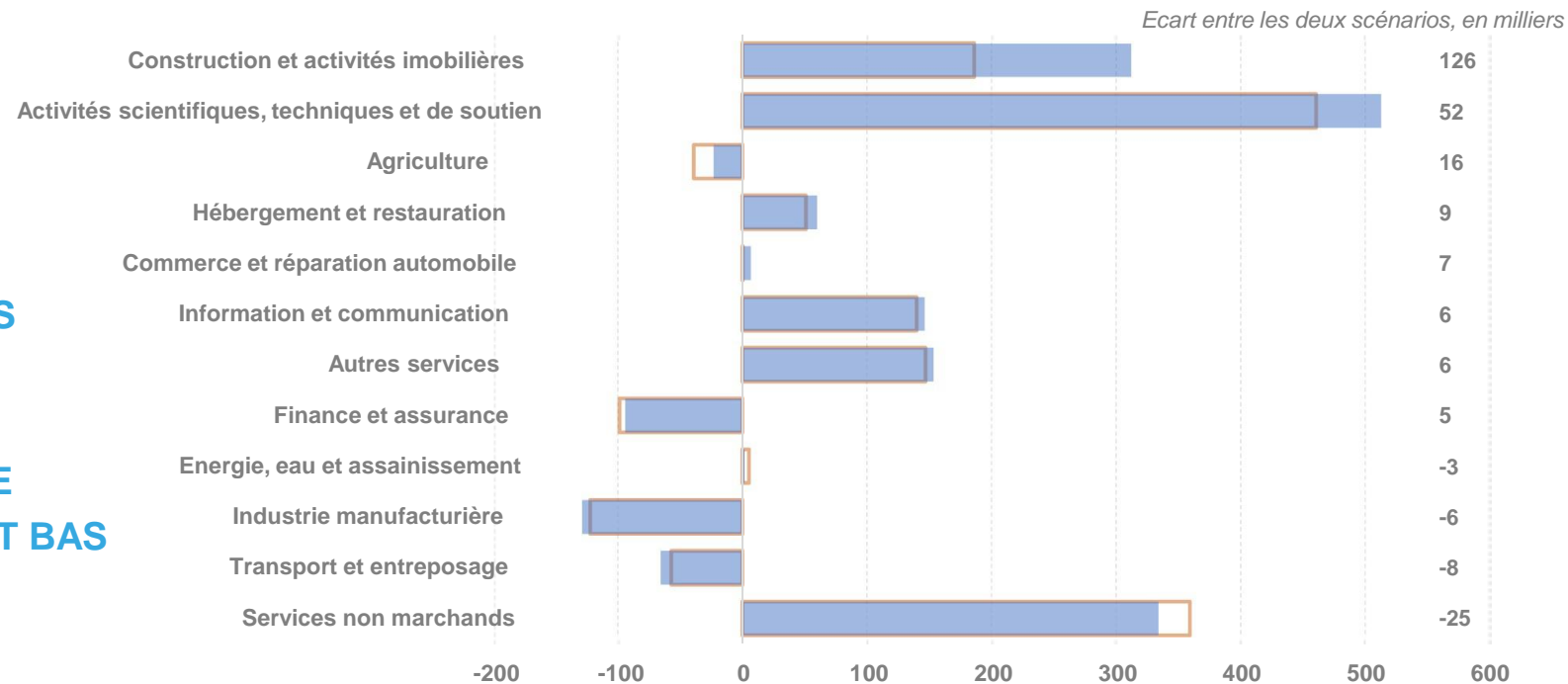
Télétravail modéré
Atteinte des objectifs de la SN
en 2030 (Stratégie nationale bas carbone)

+ 200 000 emplois par rapport au
scénario de référence :

Scénario favorable à la construction
(+ 120 000 emplois) et aux services
aux entreprises

LA CONSTRUCTION, LES ACTIVITÉS SCIENTIFIQUES-TECHNIQUES ET L'AGRICULTURE BÉNÉFICIENT DE LA TRANSITION ÉCOLOGIQUE

CRÉATIONS SECTORIELLES D'EMPLOIS DANS LES SCÉNARIOS DE RÉFÉRENCE ET BAS CARBONE



Champ France métropolitaine.
Source projections France Stratégie/Dares

Série3 ■ scénario bas carbone ■ scénario de référence

MÉTIERS 2030

LES INGÉNIEURS ET CADRES DU PRIVÉ ET LES MÉTIERS DU « CARE » SERAIENT LES PLUS DYNAMIQUES D'ICI 2030

MÉTIERS AVEC LE PLUS DE CRÉATIONS D'EMPLOIS DANS LE SCÉNARIO DE RÉFÉRENCE

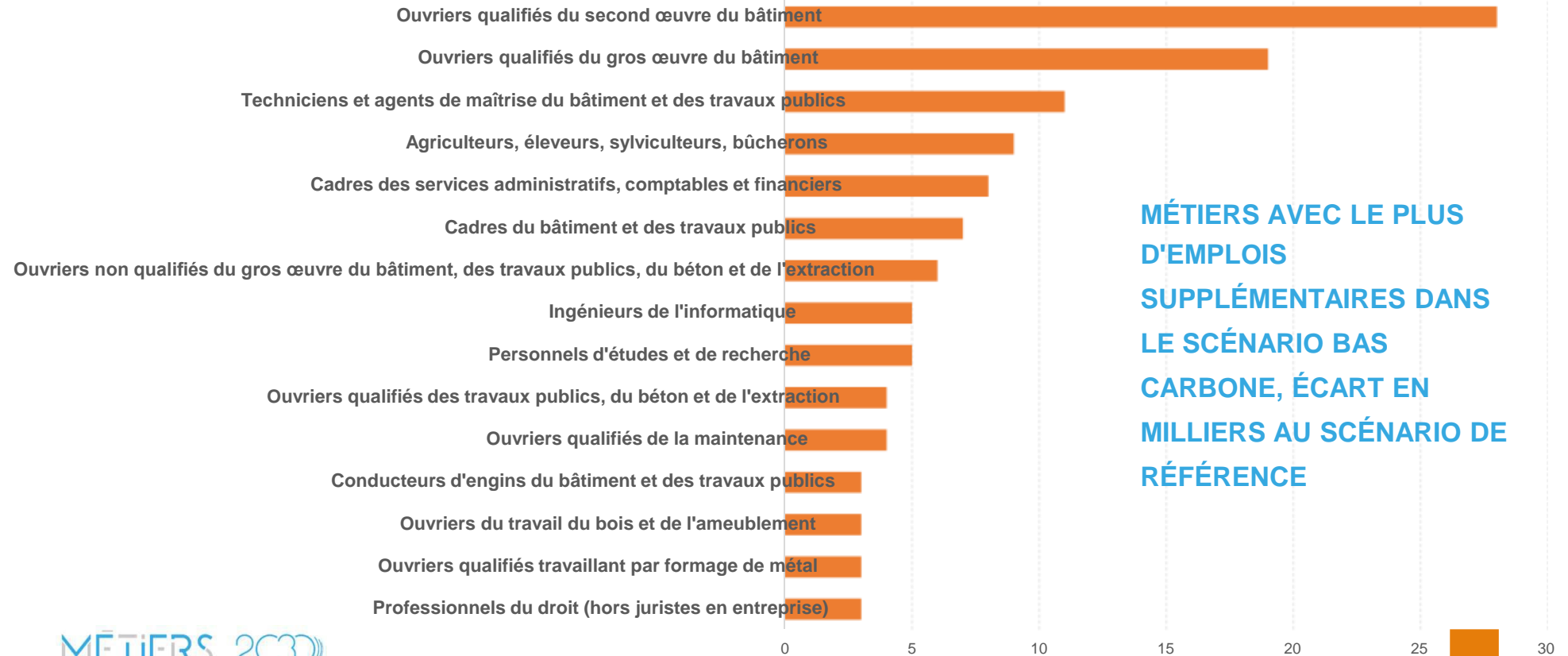
Même hiérarchie des métiers
porteurs dans le scénario bas
carbone

- Besoins structurels d'aide et de
soin (vieillesse)
- Informatique et logistique (e-
commerce et numérisation)
- Gestion des entreprises

Mais des métiers qui bénéficient de
la transition écologique (slide
suivante)

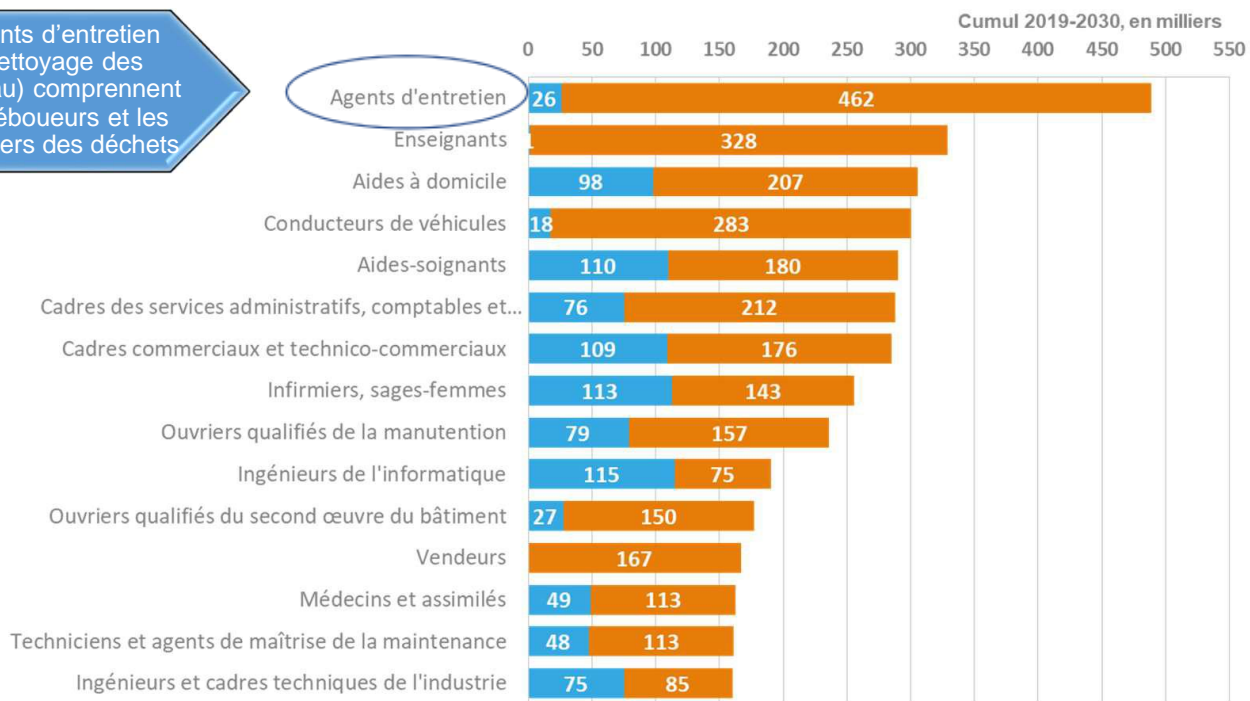


LES MÉTIERS DU BÂTIMENT BÉNÉFICIERAIENT LE PLUS DU SCÉNARIO BAS CARBONE



D'ICI 2030, 800 000 POSTES À POURVOIR PAR AN DU FAIT DES DÉPARTS EN FIN DE CARRIÈRE ET DU DYNAMISME DE L'EMPLOI

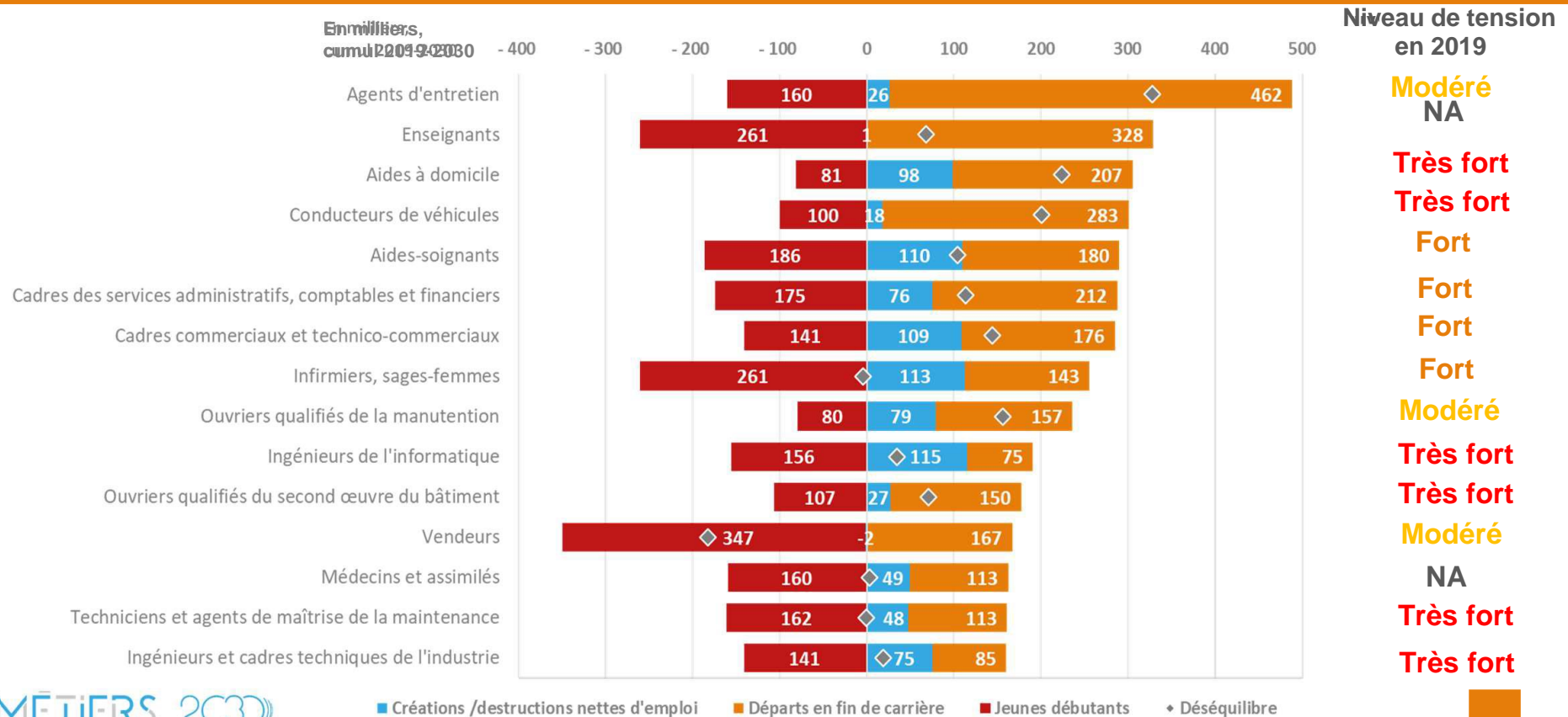
Agents d'entretien (nettoyage des bureaux) comprennent les éboueurs et les ouvriers des déchets



MÉTIERS AVEC LE PLUS DE POSTES À POURVOIR DANS LE SCÉNARIO DE RÉFÉRENCE

Même hiérarchie des métiers à forts besoins de recrutement dans le scénario bas carbone

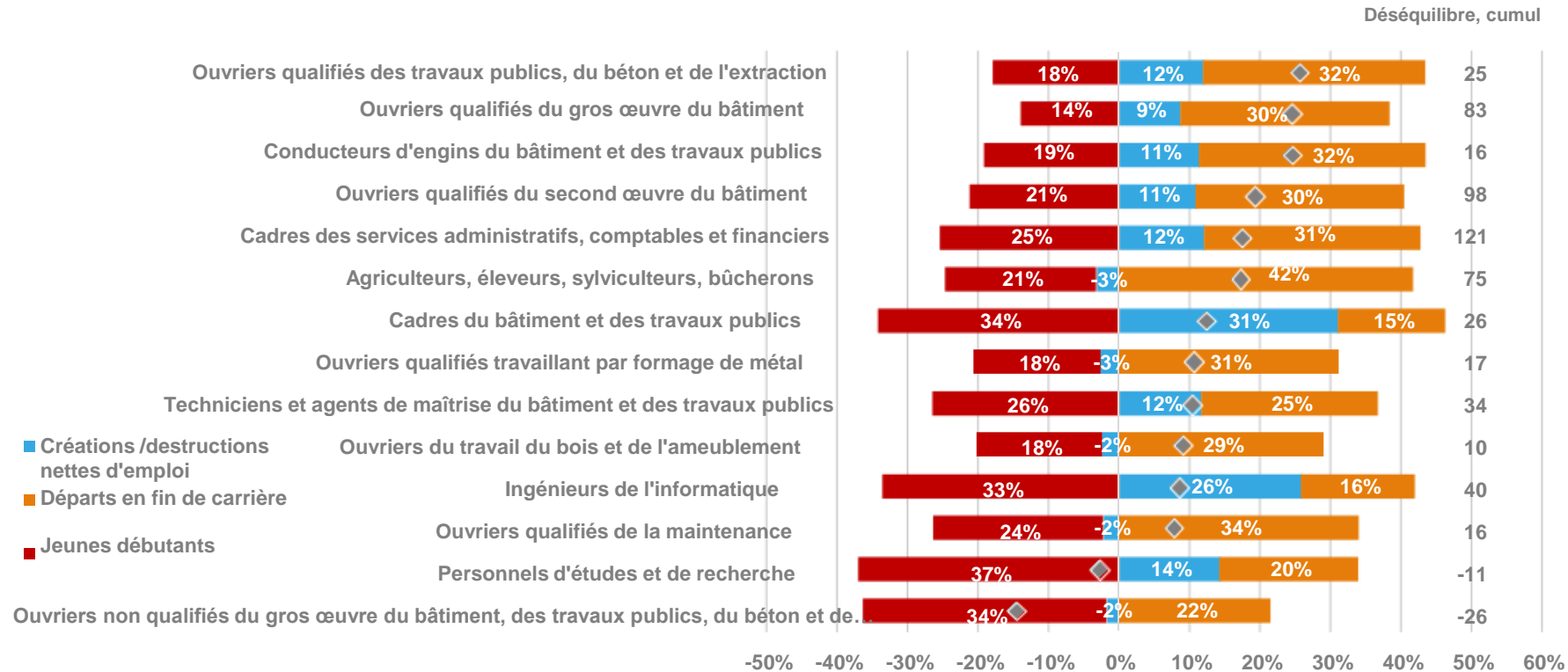
DES DÉSÉQUILIBRES ÉLEVÉS DANS LA PLUPART DES MÉTIERS À FORTS BESOINS DE RECRUTEMENT



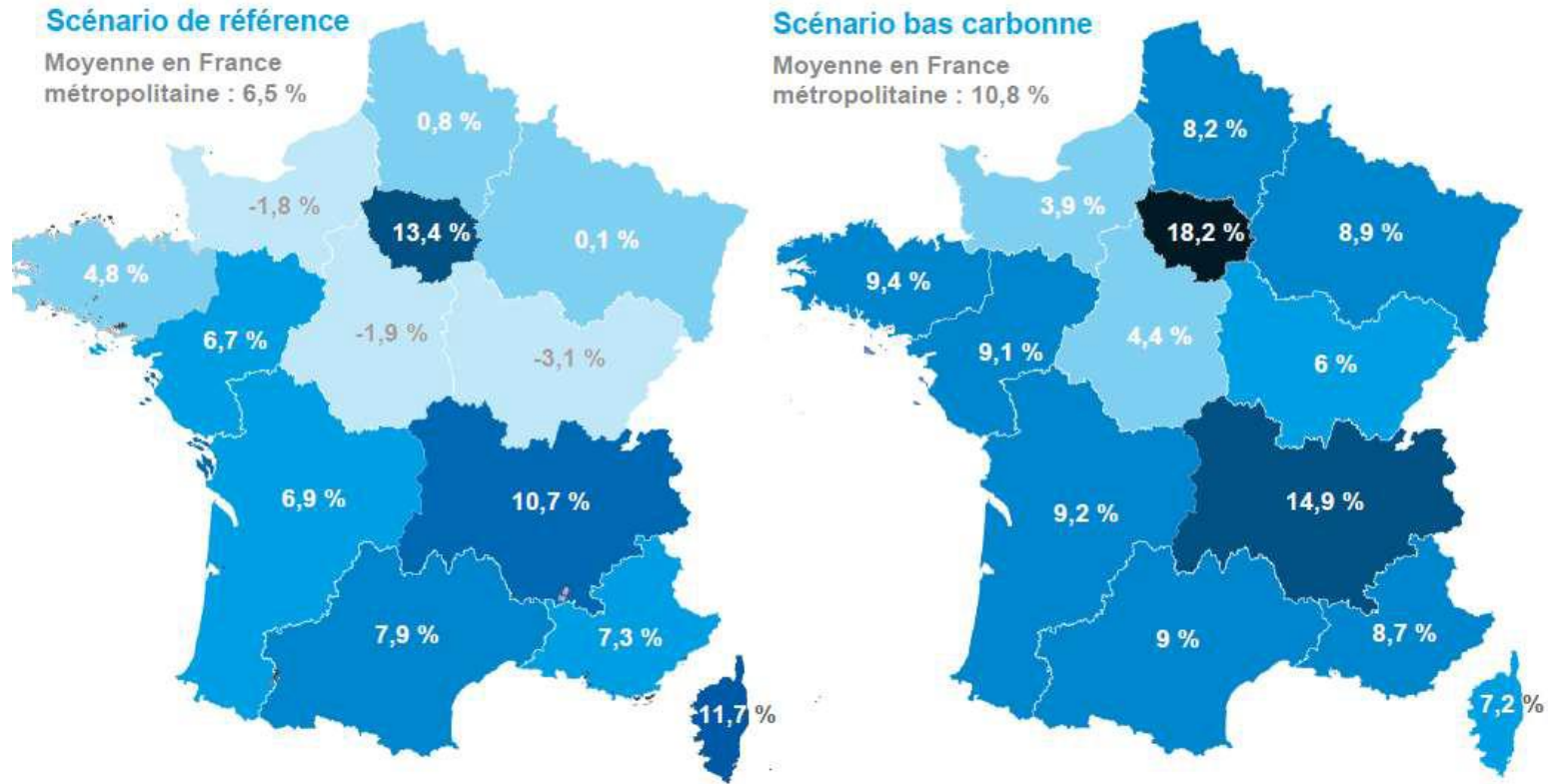
MÉTIERS 2030

Champ : France métropolitaine.
 Source : projections Dares/France Stratégie
 NA : Résultat non disponible

DES DÉSÉQUILIBRES ÉLEVÉS DANS LA PLUPART DES MÉTIERS QUI BÉNÉFICIENT DU SCÉNARIO BAS CARBONE



LA PRISE EN COMPTE DES BESOINS DU BÂTI EXISTANT AVANTAGE L'EMPLOI DES MÉTIERS DU BÂTIMENT* DANS LE QUART NORD-EST (PLUS DE PASSOIRES)



RÉPARTITION DE LA CRÉATION NETTE (2019-2030) PAR RÉGION DANS LE SCÉNARIO DE RÉFÉRENCE ET LE SCÉNARIO BAS CARBONE POUR LES MÉTIERS DU BÂTIMENT*

*Hors OQ des travaux publics, du béton et de l'extraction

CONCLUSION

Les fondations socioéconomiques

Étude SOC2050 : la désirabilité de la transition sociétale vers plus de résilience

Bertrand Verheyden
Senior Researcher, LISER

3ème Conférence Luxembourg Stratégie

26 SEPTEMBRE 2023



Luxembourg
Stratégie

RÉTROSPECTIVE. PERSPECTIVE. PROSPECTIVE.

Etude SOC2050

Comprendre la désirabilité du changement vers plus de résilience

LISER

Dr. Bertrand Verheyden,
Prof. Dr. Philippe Van Kerm, Dr. Michel Tenikue,
Angela Jiang Wang, MA, David Cristelo, MA

- Quelles sont les **contraintes** à une transition durable?
 - Individuelles
 - Sociales
 - Manque de solutions
 - Manque de coordination

- Quel **soutien** pour des **politiques** favorisant une transition ?

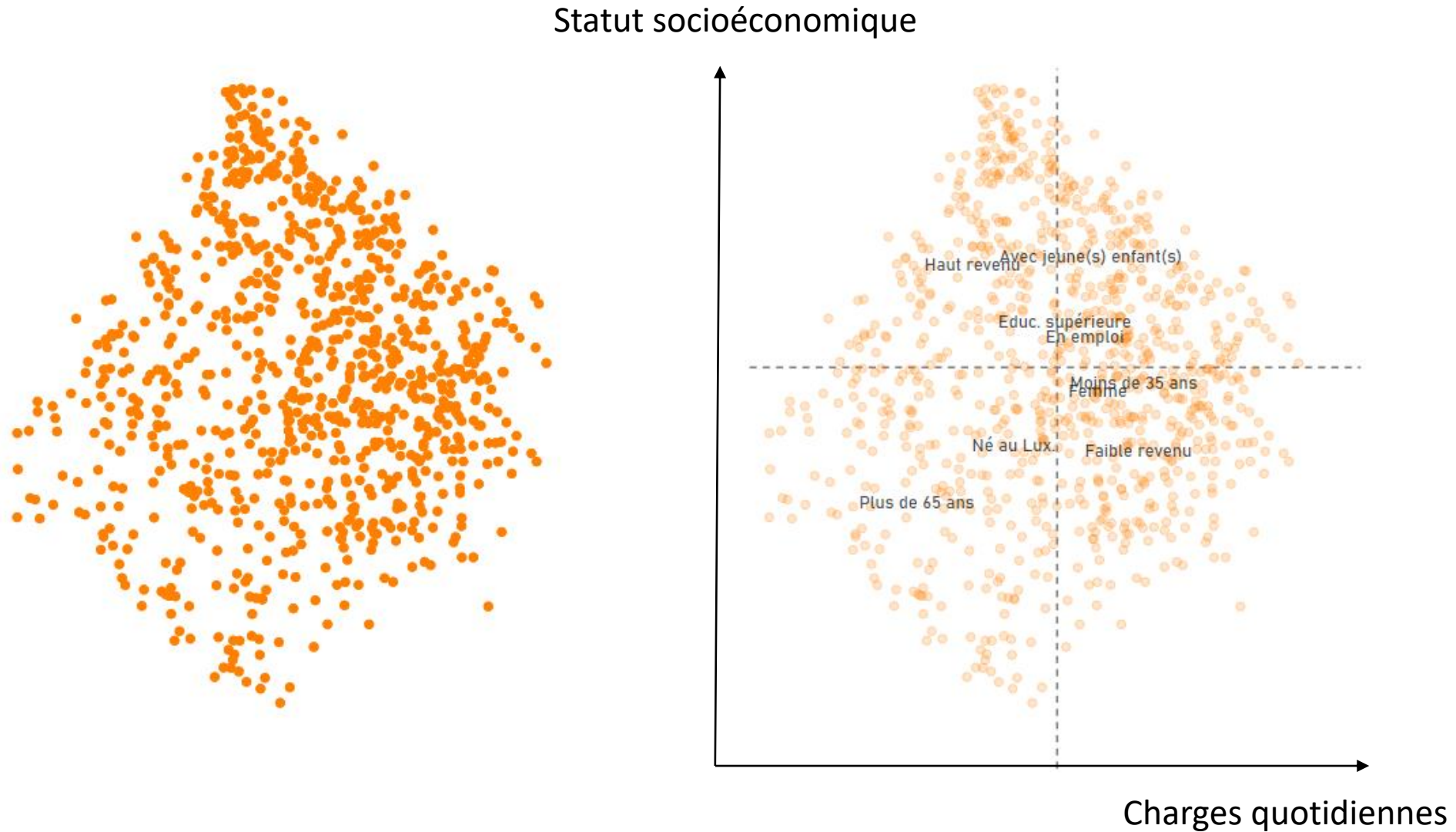
- Comment **faire évoluer** les attitudes et les comportements ?

Une enquête longitudinale

- **Plus de 900 participants suivis pendant 9 mois**
 - Vague 1: Novembre-Décembre 2022
 - Vague 2: Avril-Mai 2023
 - Vague 3: Juillet-Août 2023

- **Comportements mesurés à chaque vague**
 - Focus détaillé sur mobilité, alimentation et logement
 - Soutien envers des politiques hypothétiques
 - Dons pour un projet vert

Les participants à l'étude



Facteurs explicatifs des comportements

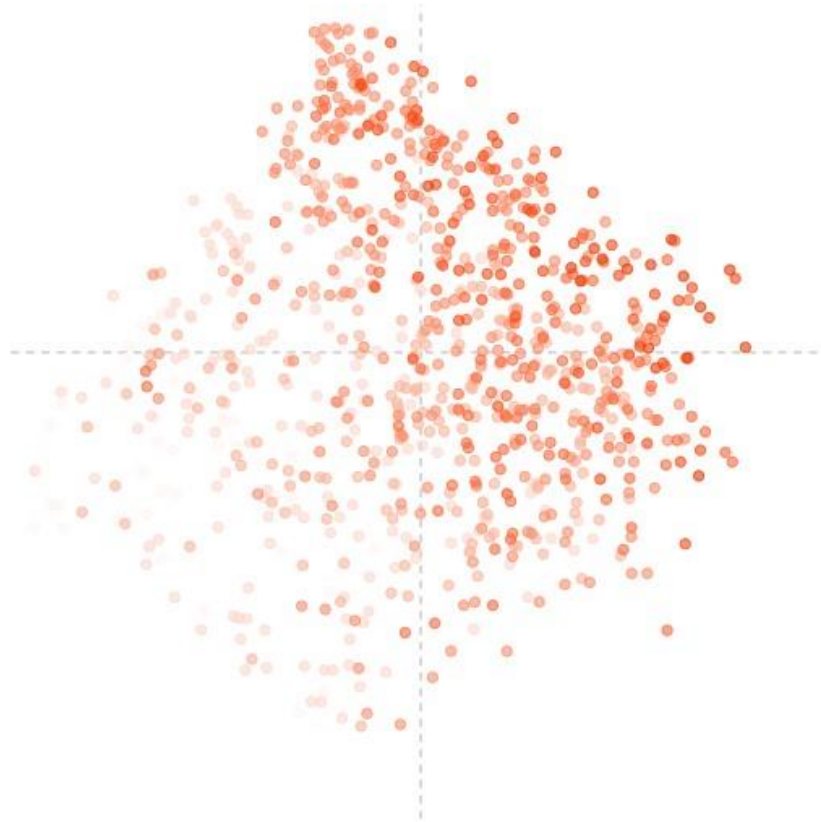
- **Contraintes et préférences individuelles**
 - Revenu, temps, information, manque de solutions

- **Normes sociales**
 - Perceptions des comportements et jugements des autres participants

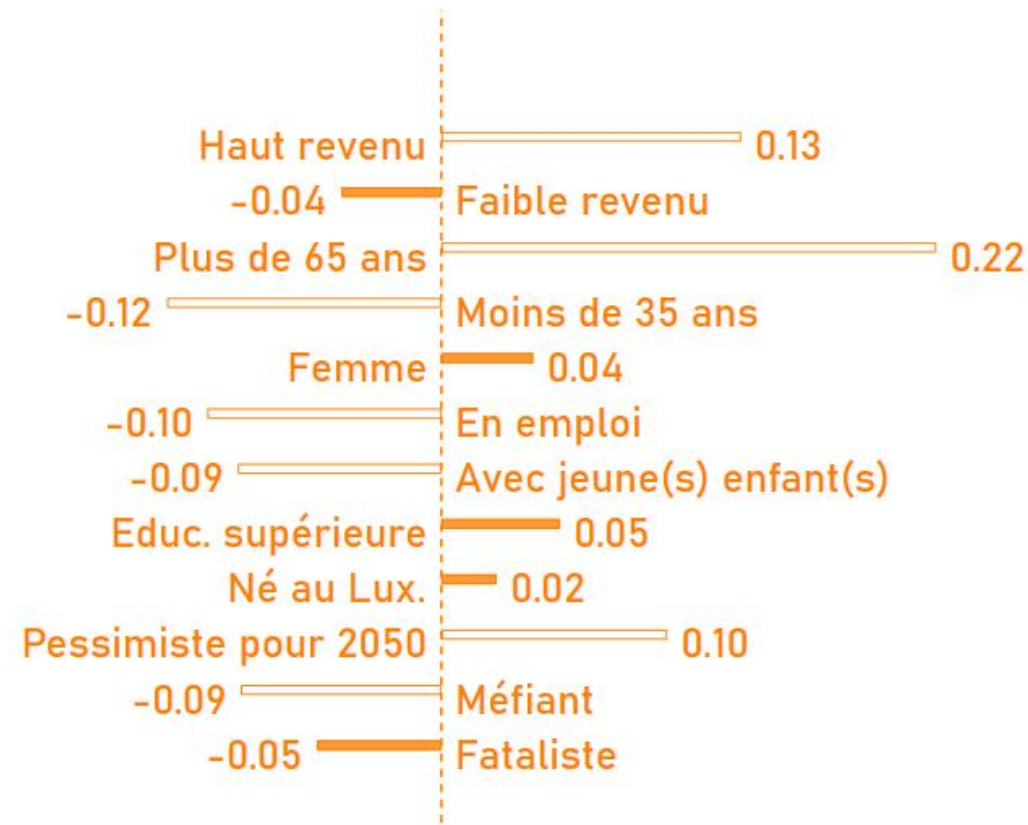
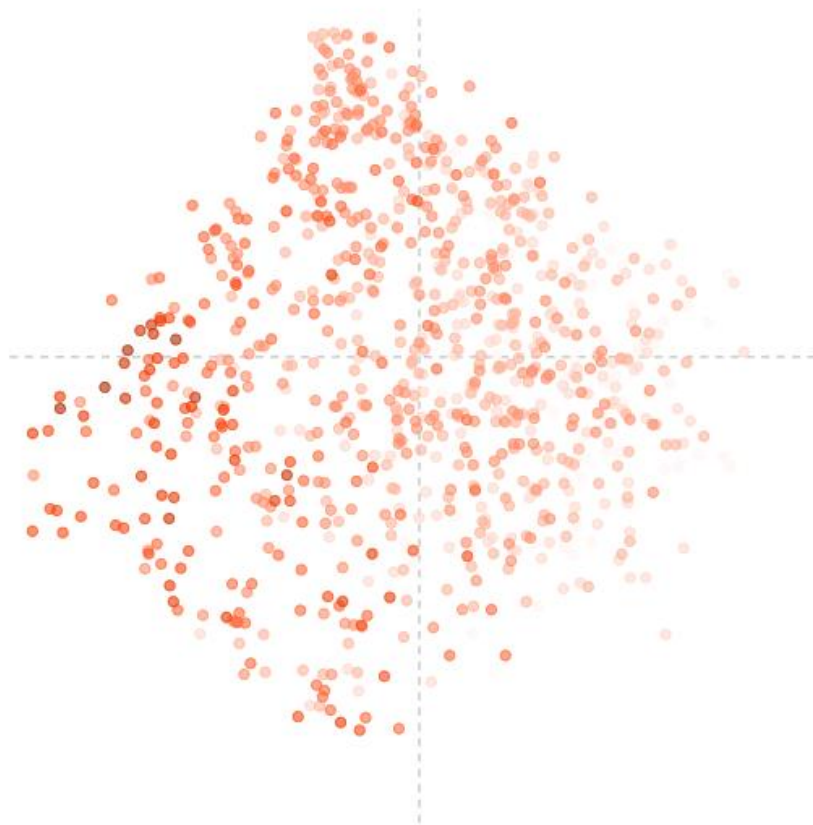
- **Croyances**
 - Confiance dans les institutions et les médias, dans les sciences du climat
 - Pessimisme pour l'avenir, fatalisme

- **Traits de personnalité et biais**
 - Procrastination, altruisme, réciprocité, rationalité,...

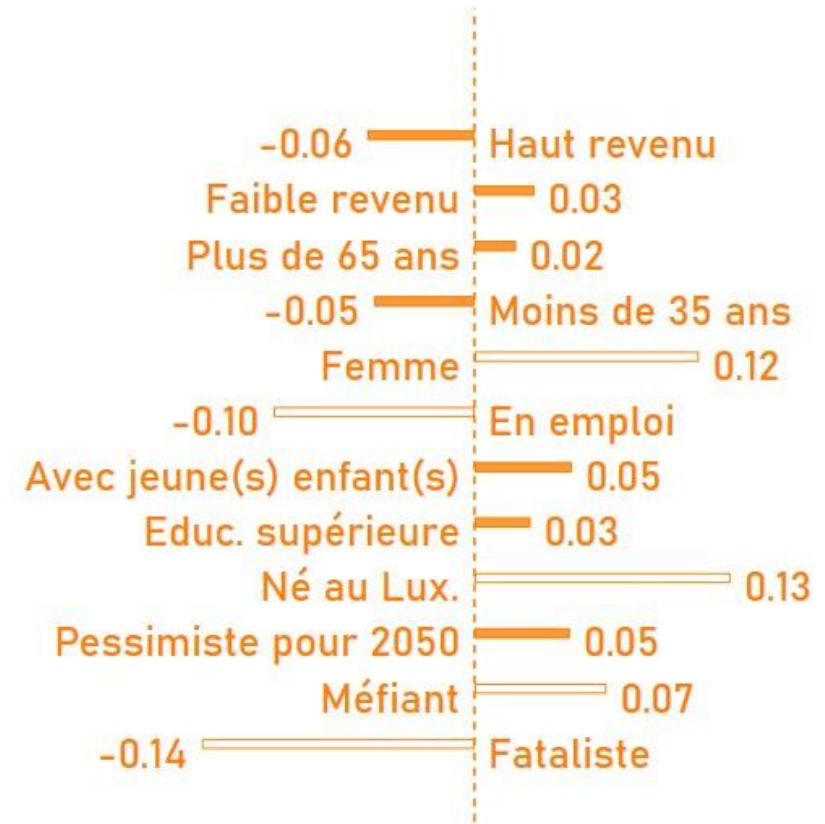
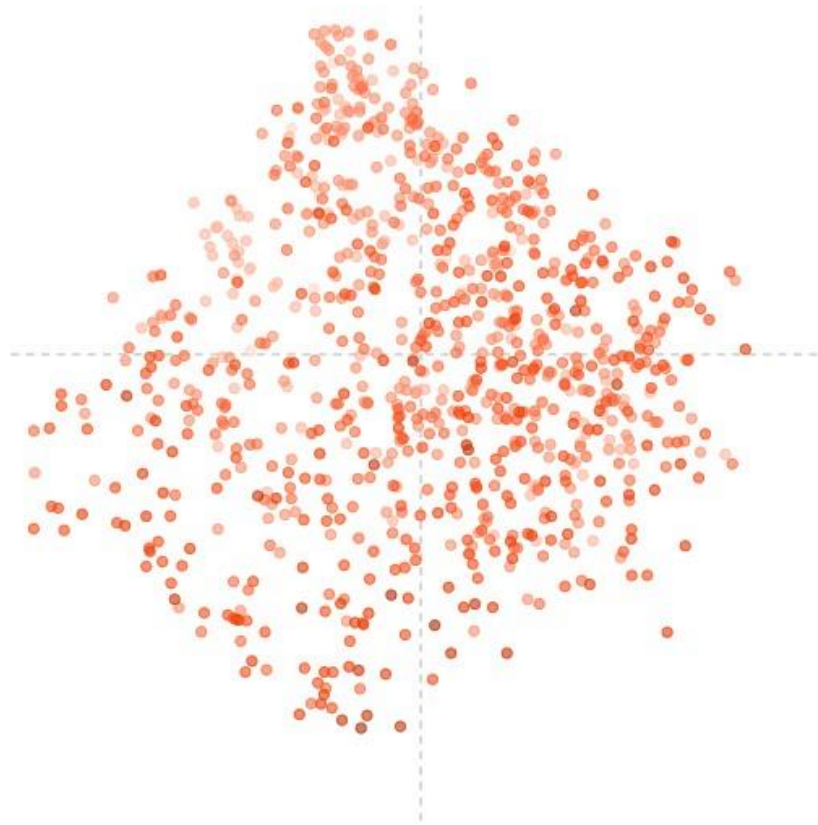
Achats de seconde main



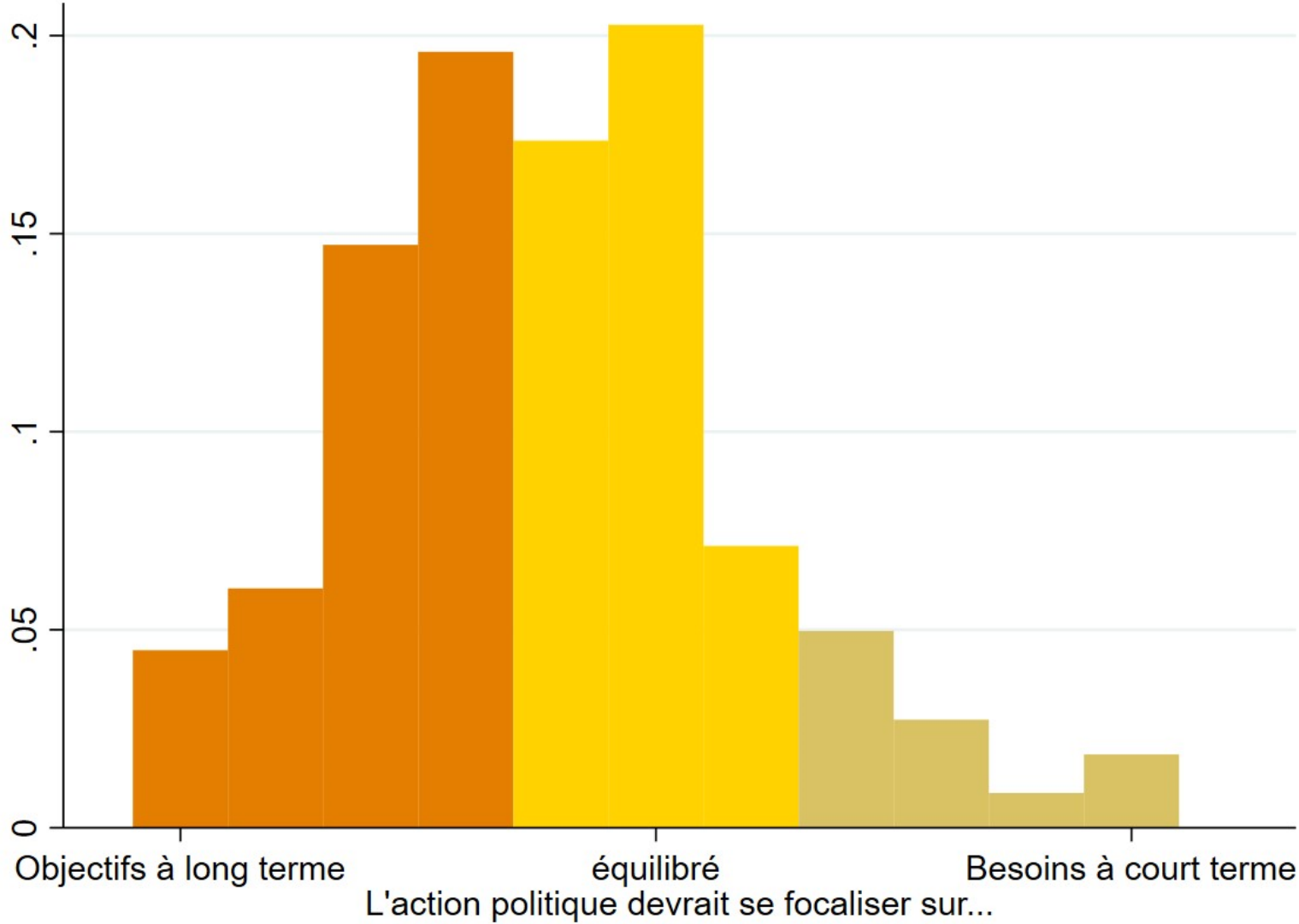
Faire don de sa rémunération pour contribuer à un projet vert



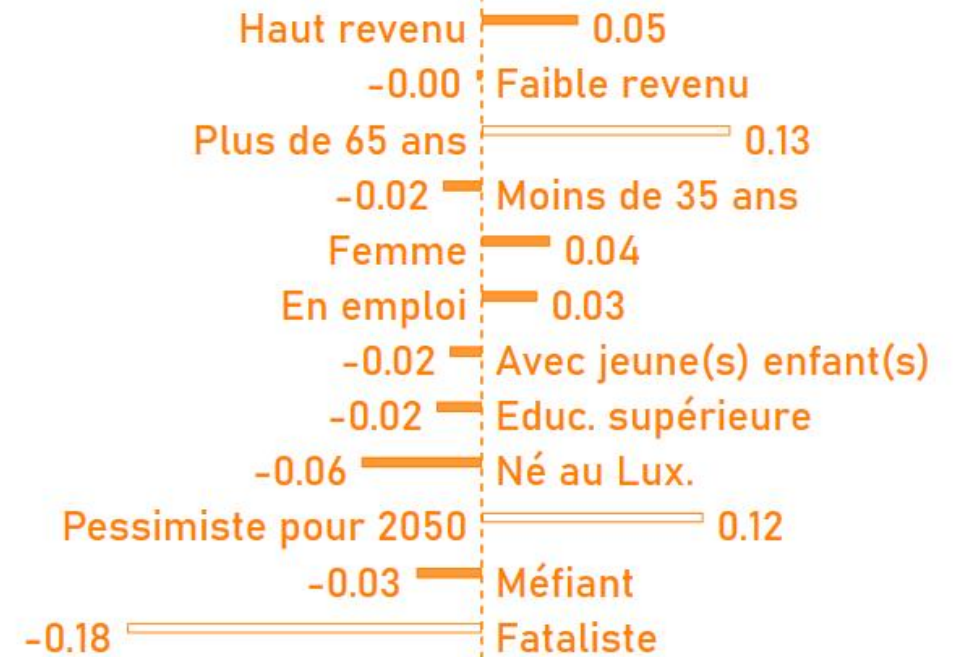
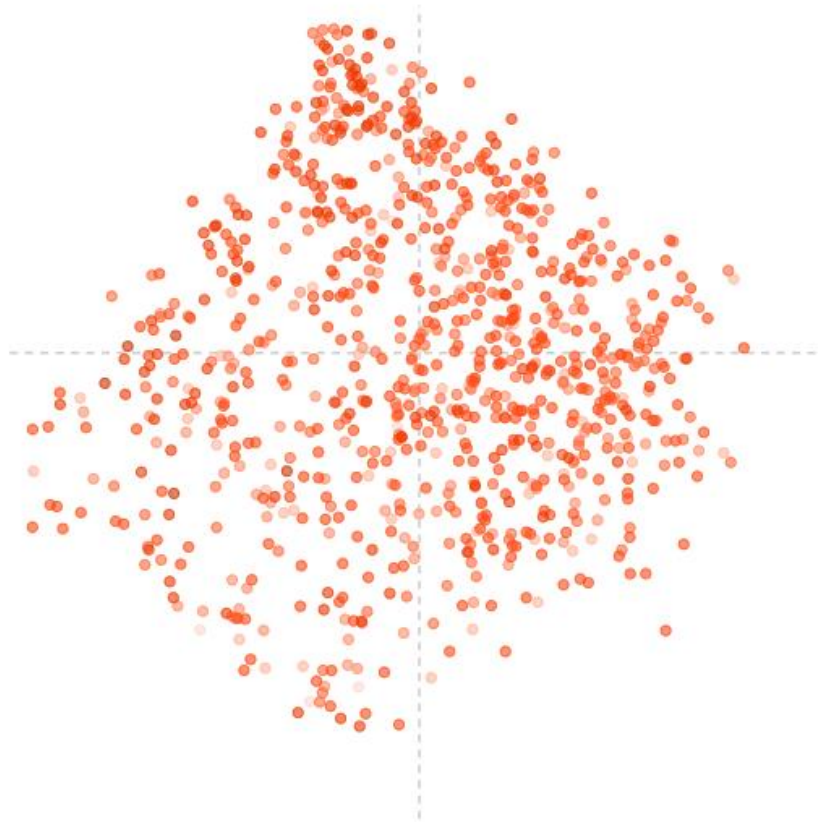
Manger peu de viande (< 5 fois par sem.)



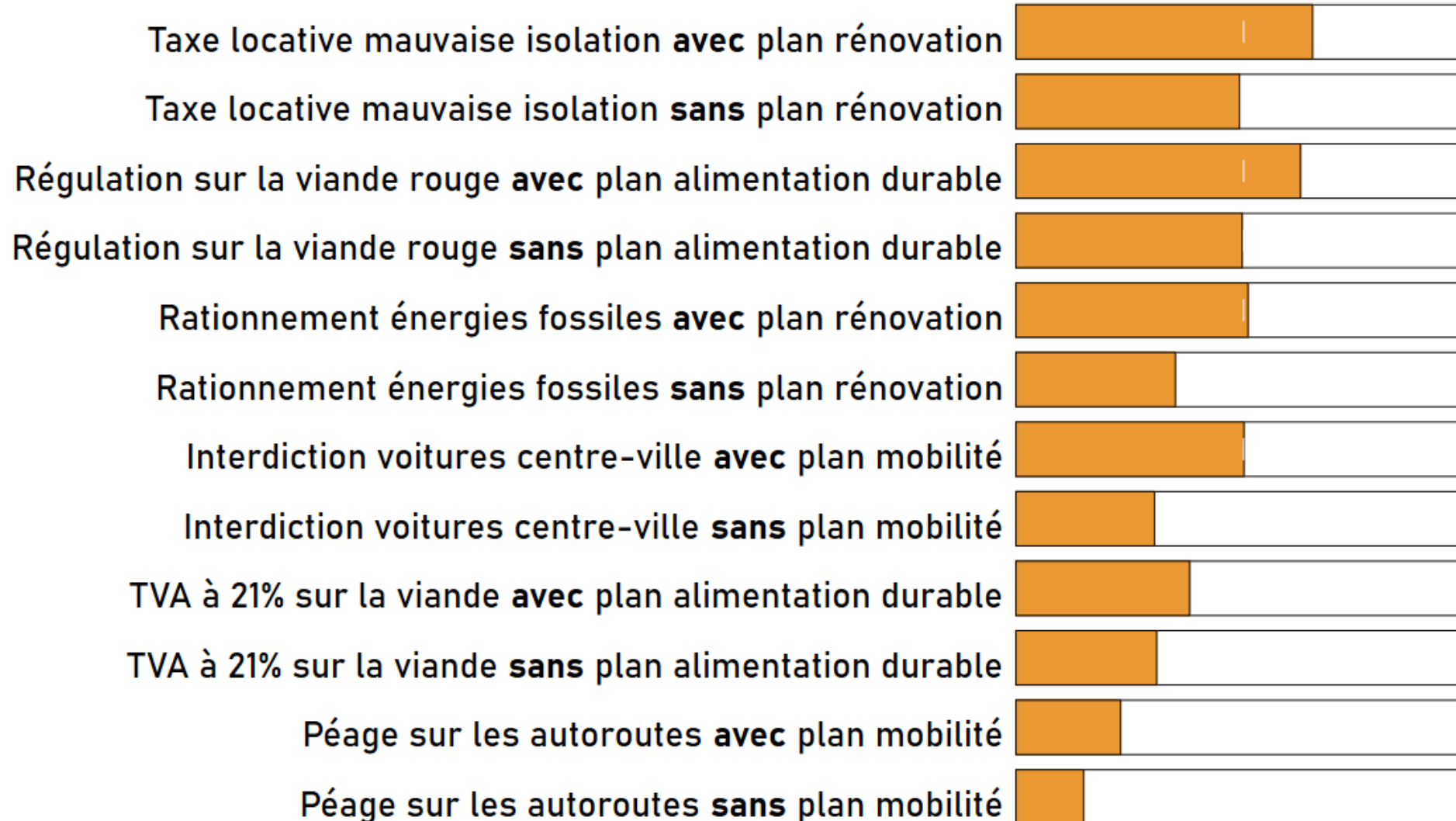
Une demande pour des politiques de long terme



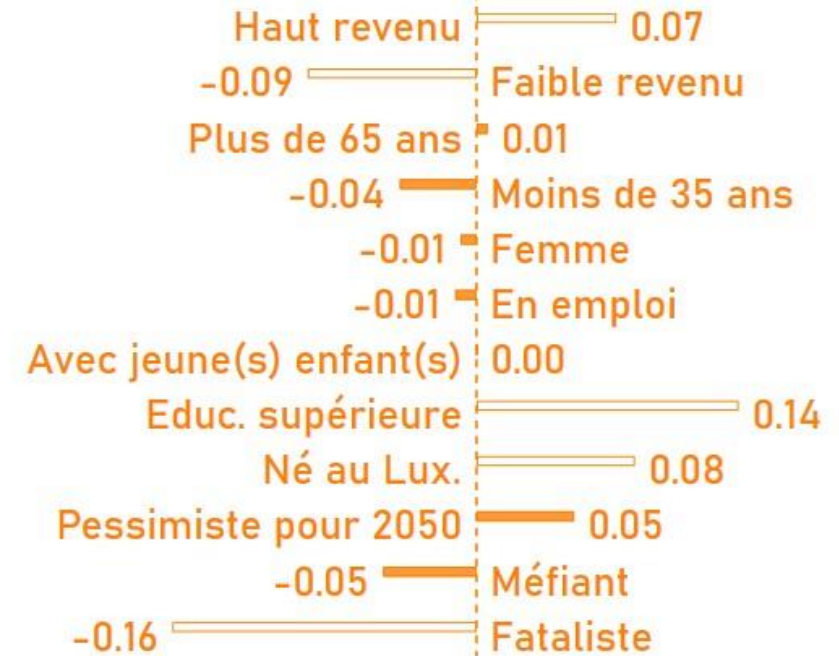
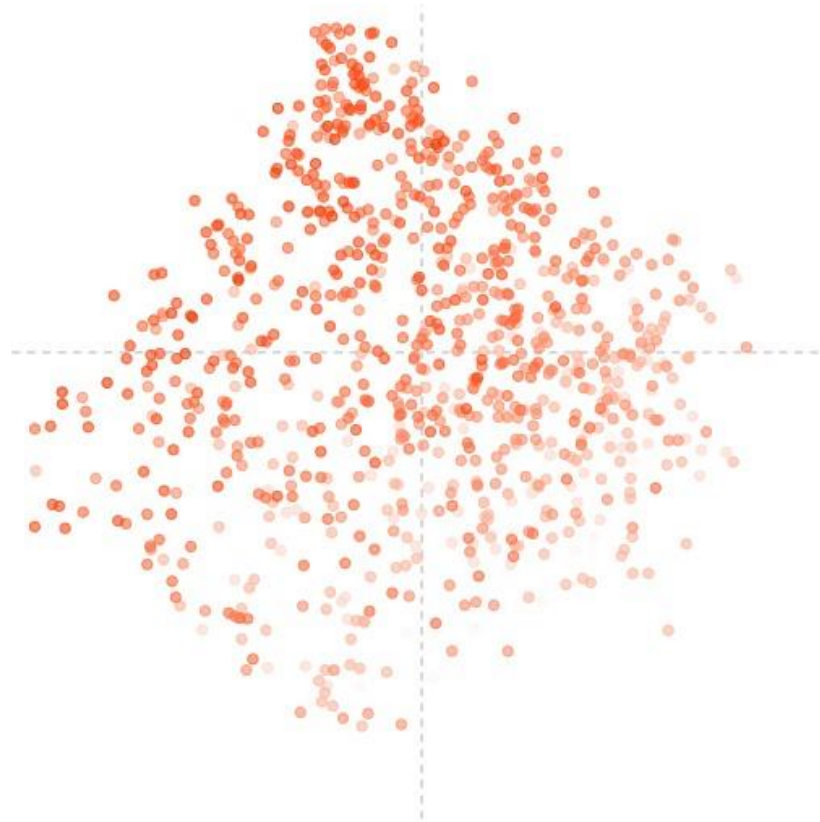
Interdiction des voitures en centre-ville



Plus de régulation (4/6), mais pas sans soutien !



Soutien à une TVA à 17% sur la viande : Importance du revenu

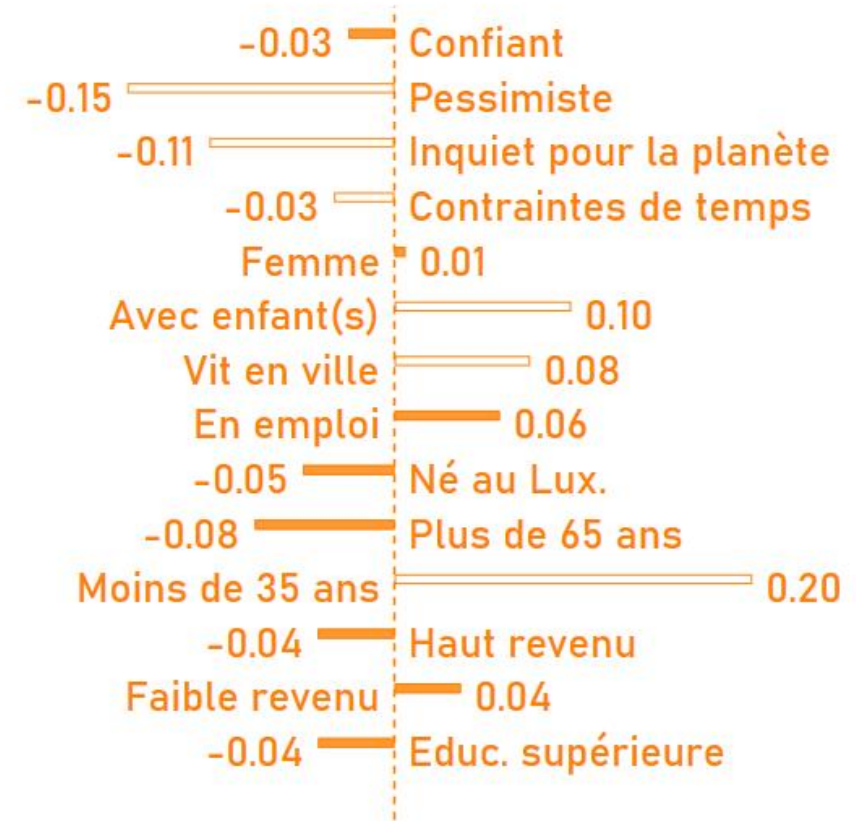
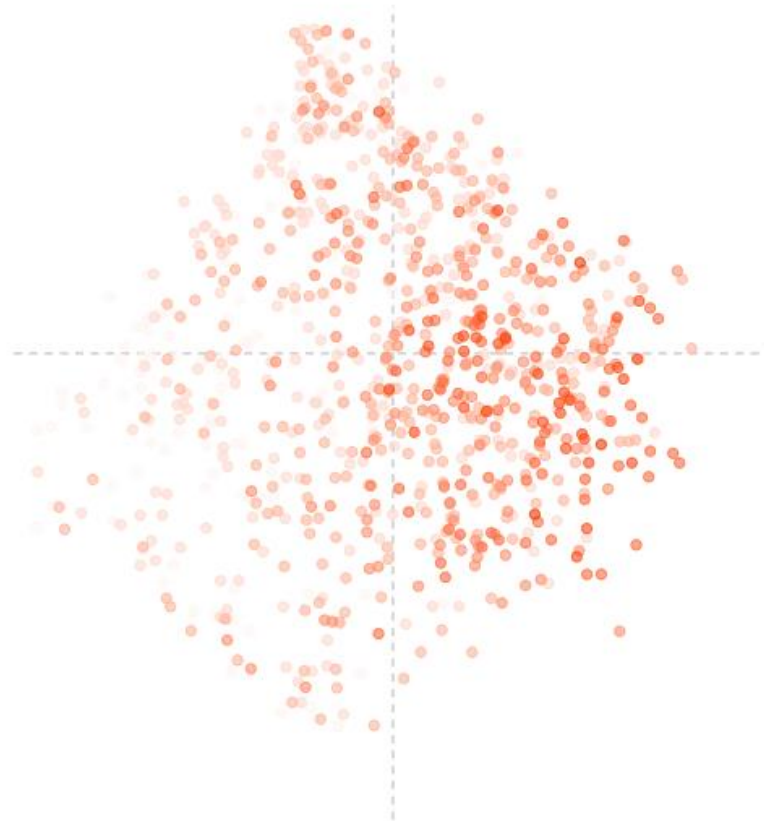
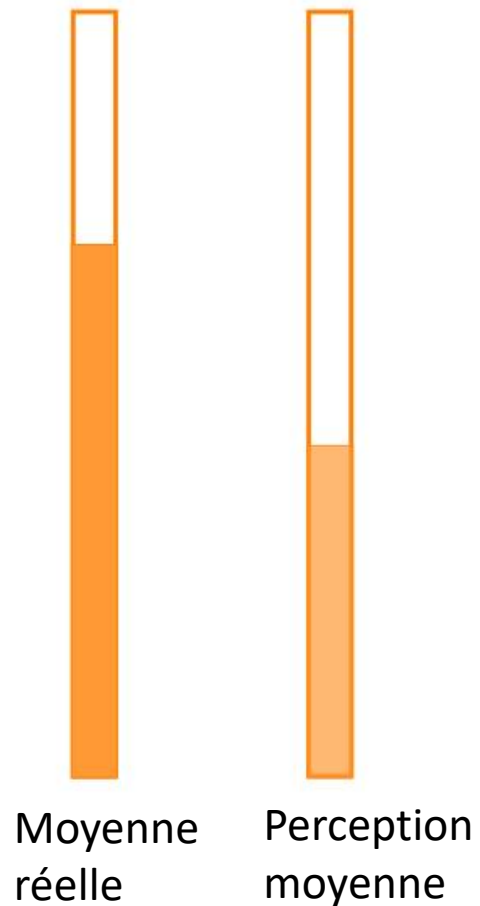


Des perceptions erronées

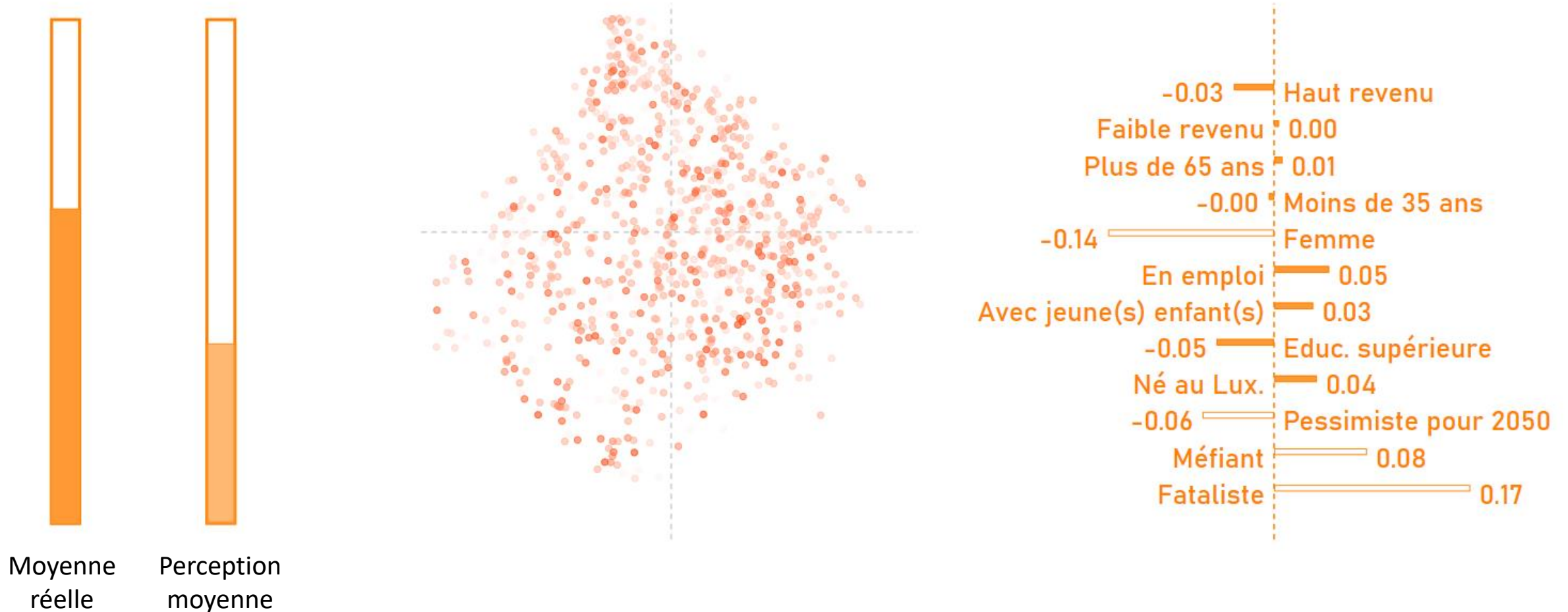
- Les participants **sous-estiment les autres**
- **dans tous les domaines**
 - Mobilité
 - Chauffage domestique
 - Consommation de viande
 - Comportements divers (avion, consommation local,...)
- **sous toutes les formes de perceptions**
 - Comportements
 - Jugements normatifs
 - Soutien pour des politiques de transition
- Ceci contribue à **expliquer la résistance au changement**: « A quoi bon? »



Manger « local »



Régulation sur la viande rouge, soutien majoritaire Mais perception d'un soutien minoritaire

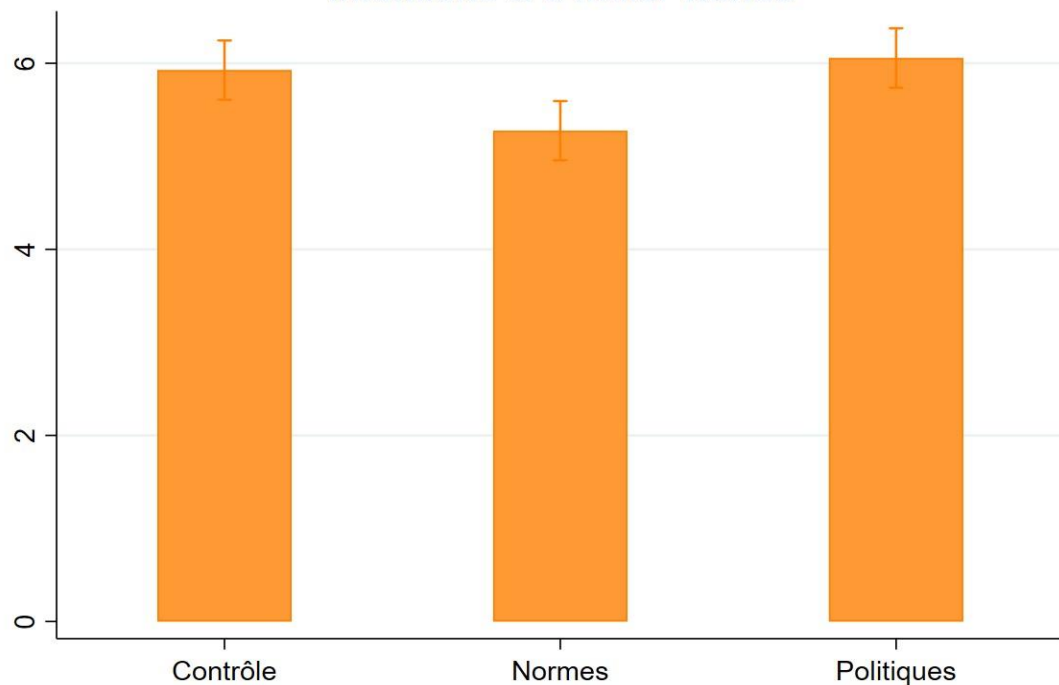


WP3: Traitements d'information randomisés

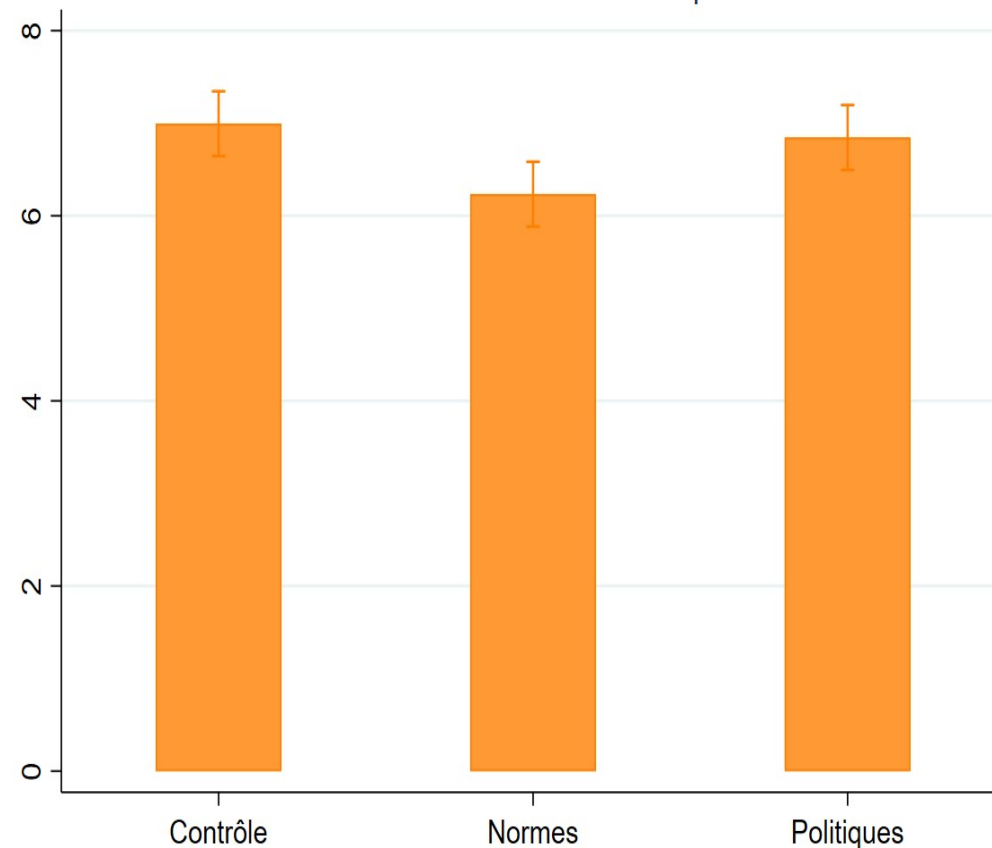
- Dans les vagues 2 et 3, **échantillon scindé en 3 groupes**
- **Traitement "Normes sociales "**
 - Comportements et jugements de la majorité
 - Consommation de viande, chauffage, transports publics et mobilité douce
- **Traitement "Politiques"**
 - Quelles politiques sont soutenues par la majorité ?
 - 4/6 politiques étaient soutenues (perception moyenne = 1/6)
- **Groupe témoin : pas d'information**
- **Question** : par rapport au groupe témoin, les **participants informés**
 - (i) ont-ils **l'intention** de changer davantage leurs comportements ?
 - (ii) changent-ils **réellement** leurs comportements ?

Les normes impactent les intentions et les actes sur la viande (même si excès d'optimisme)

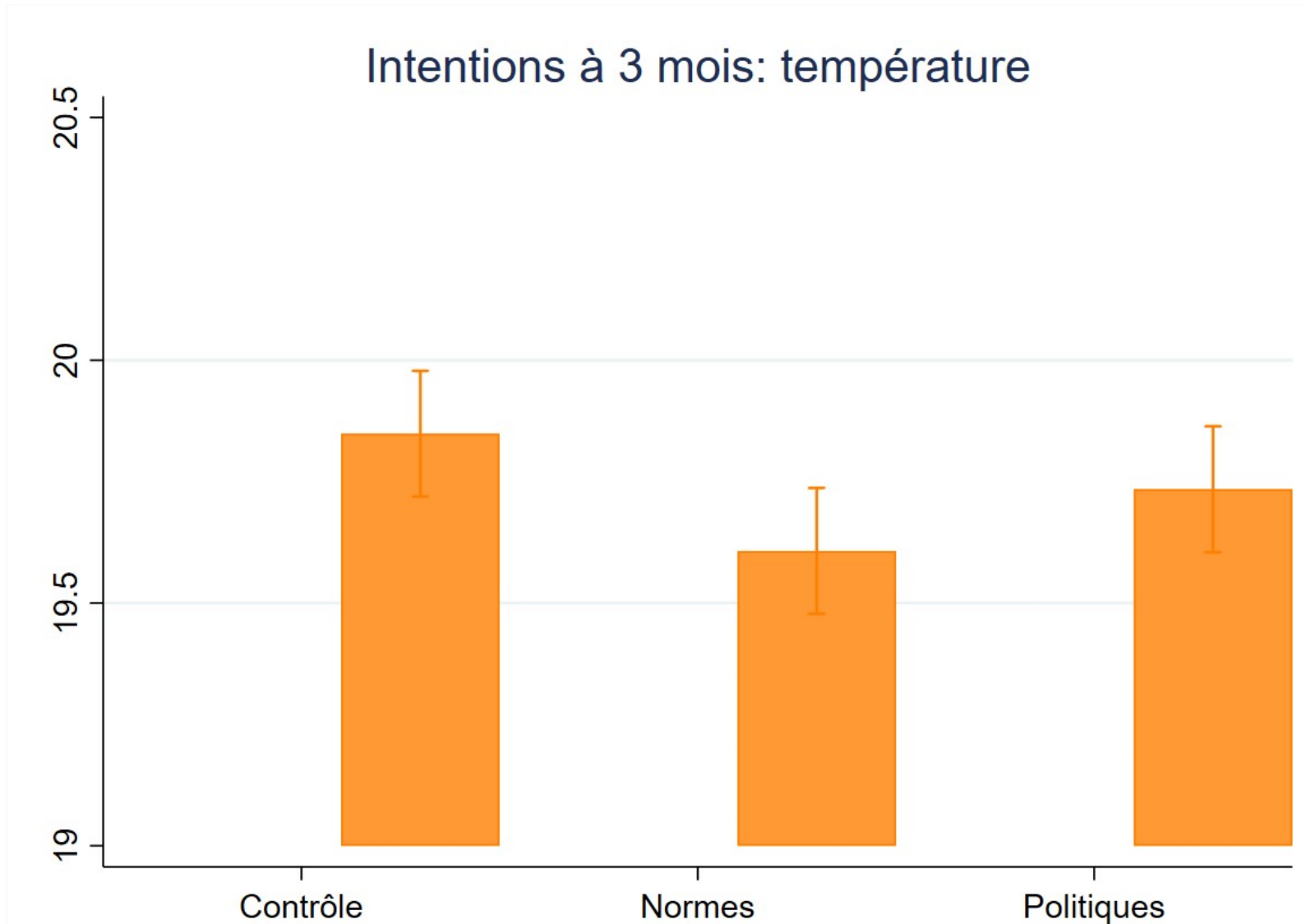
Intentions à 3 mois: viande



Consommation de viande ex-post

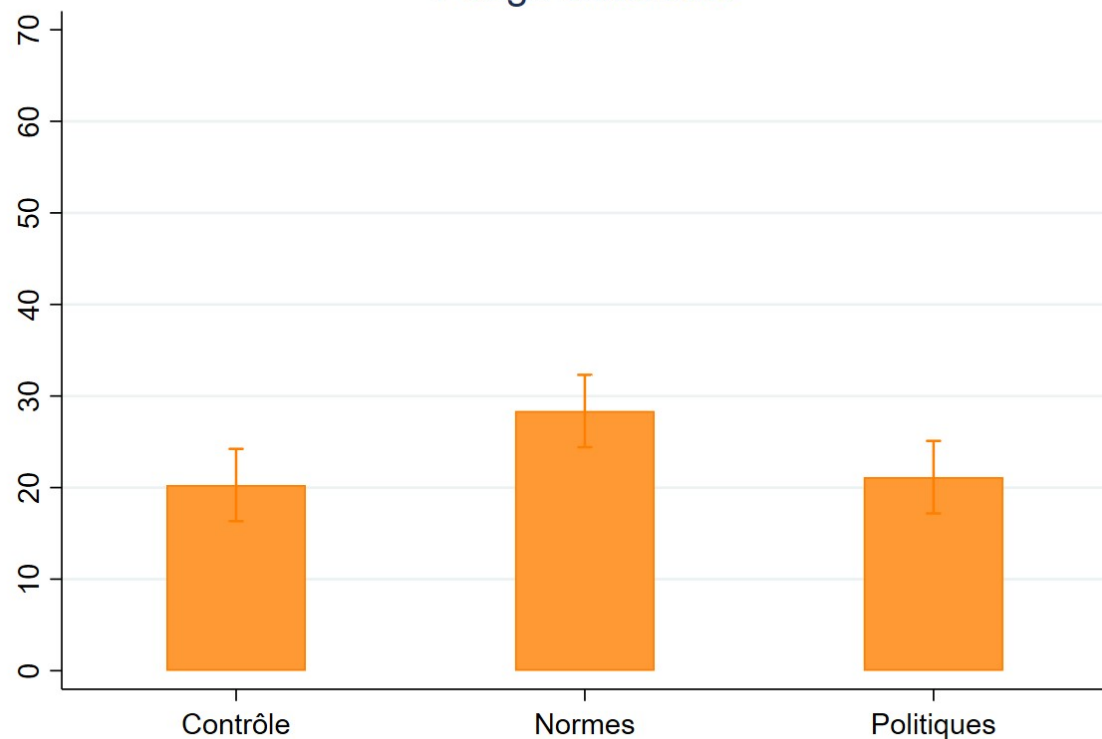


Effet des normes sur les intentions de chauffage

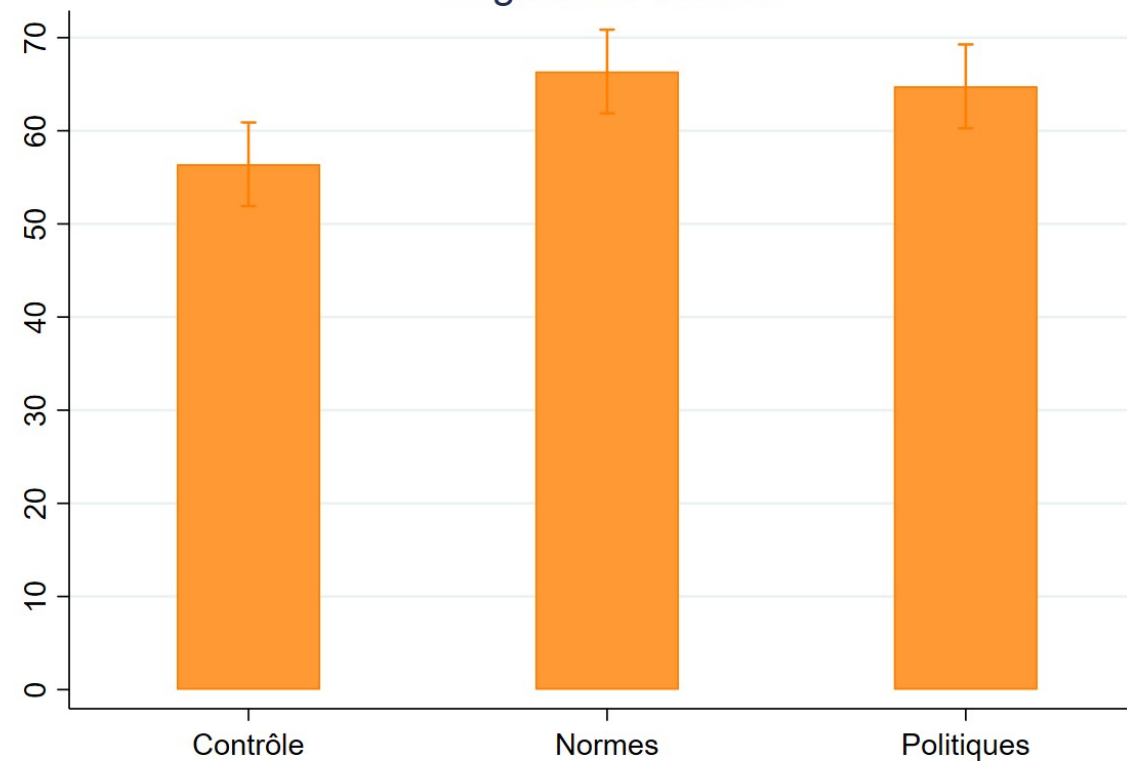


Effets des normes sur le soutien aux politiques

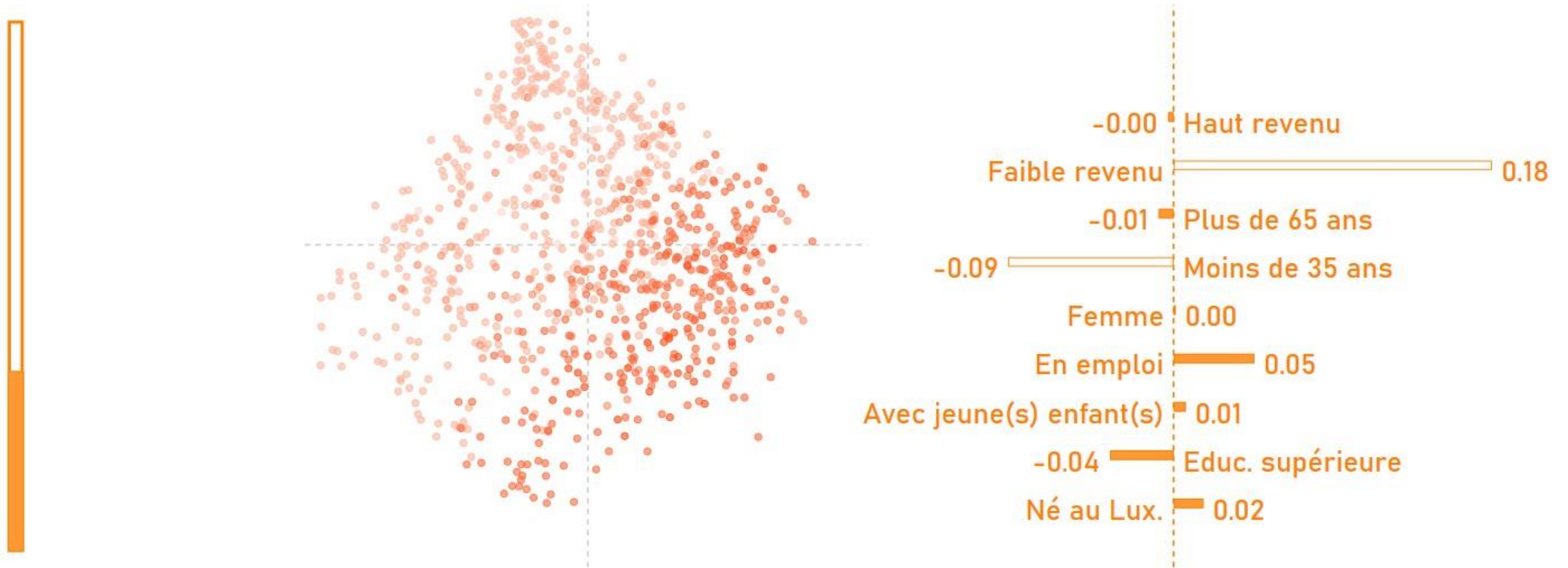
Péage autoroute



Régulation viande



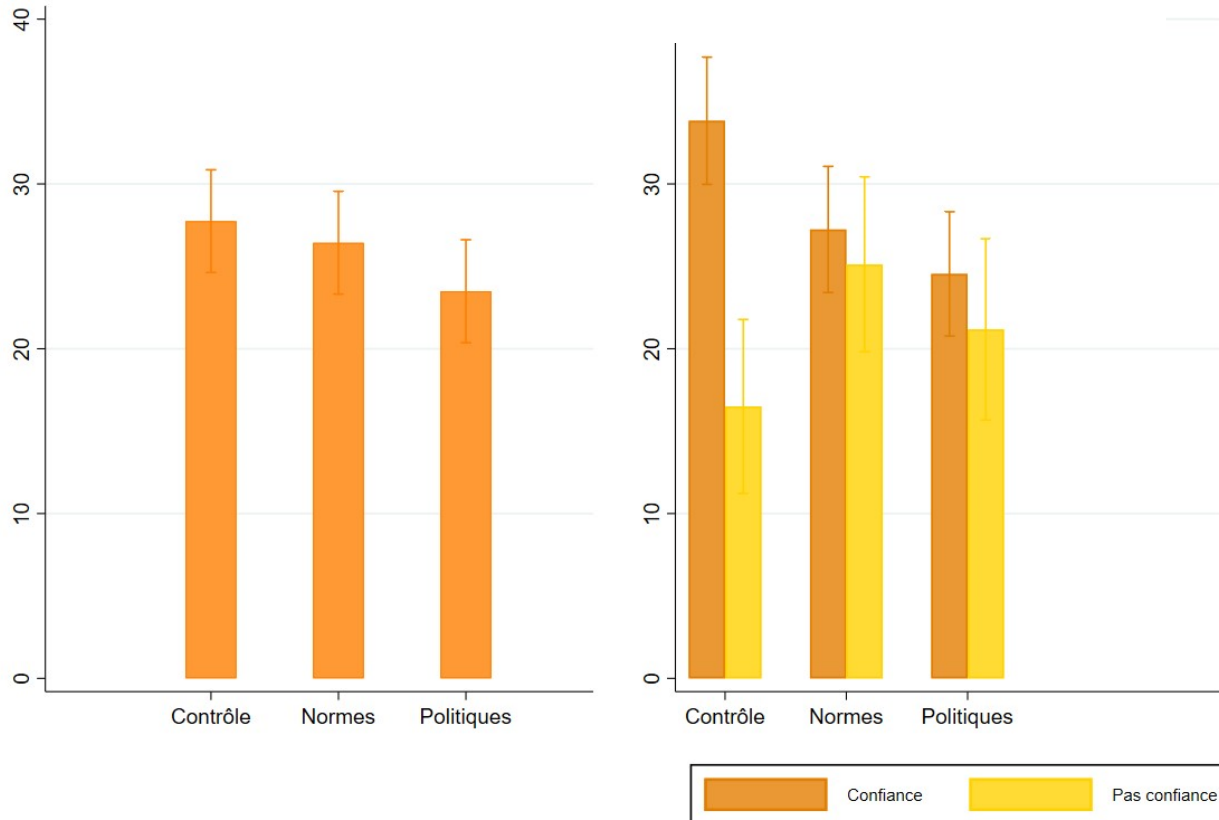
Hétérogénéité des effets : le manque de confiance



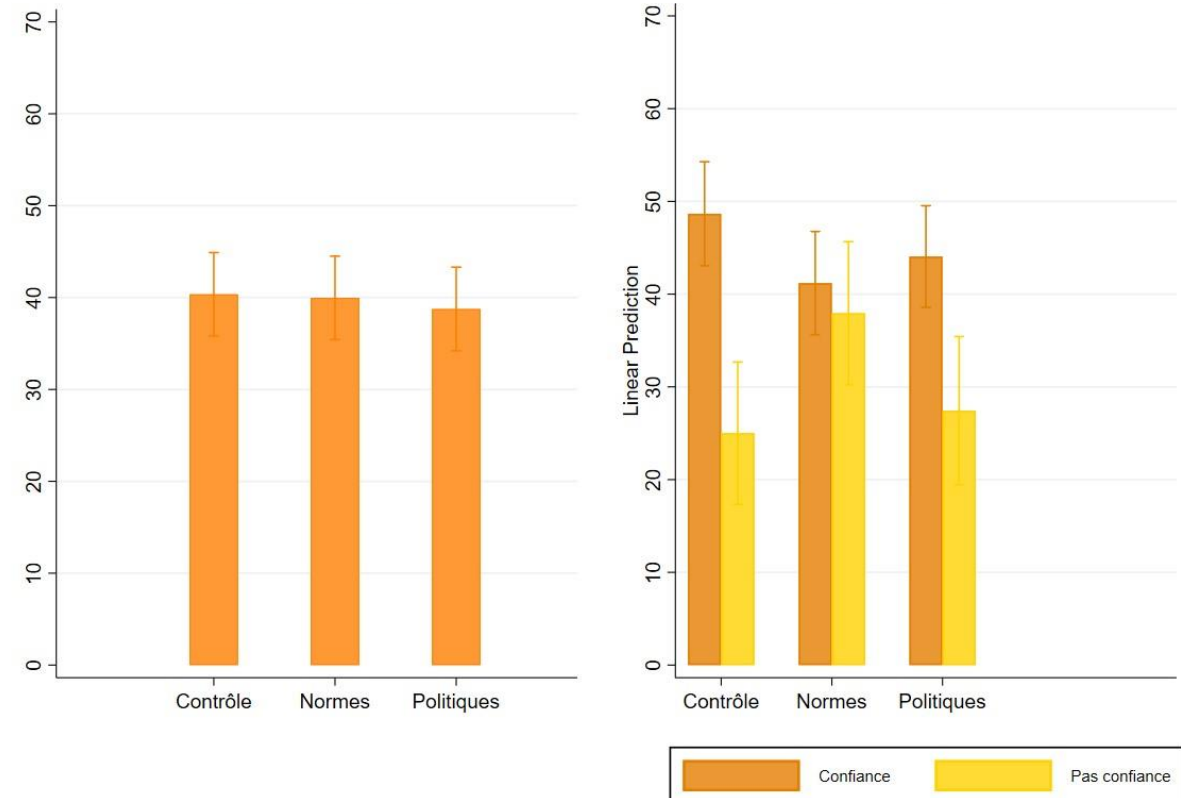
Les traitements réduisent la polarisation

Ex : dons pour projet vert et TVA viande

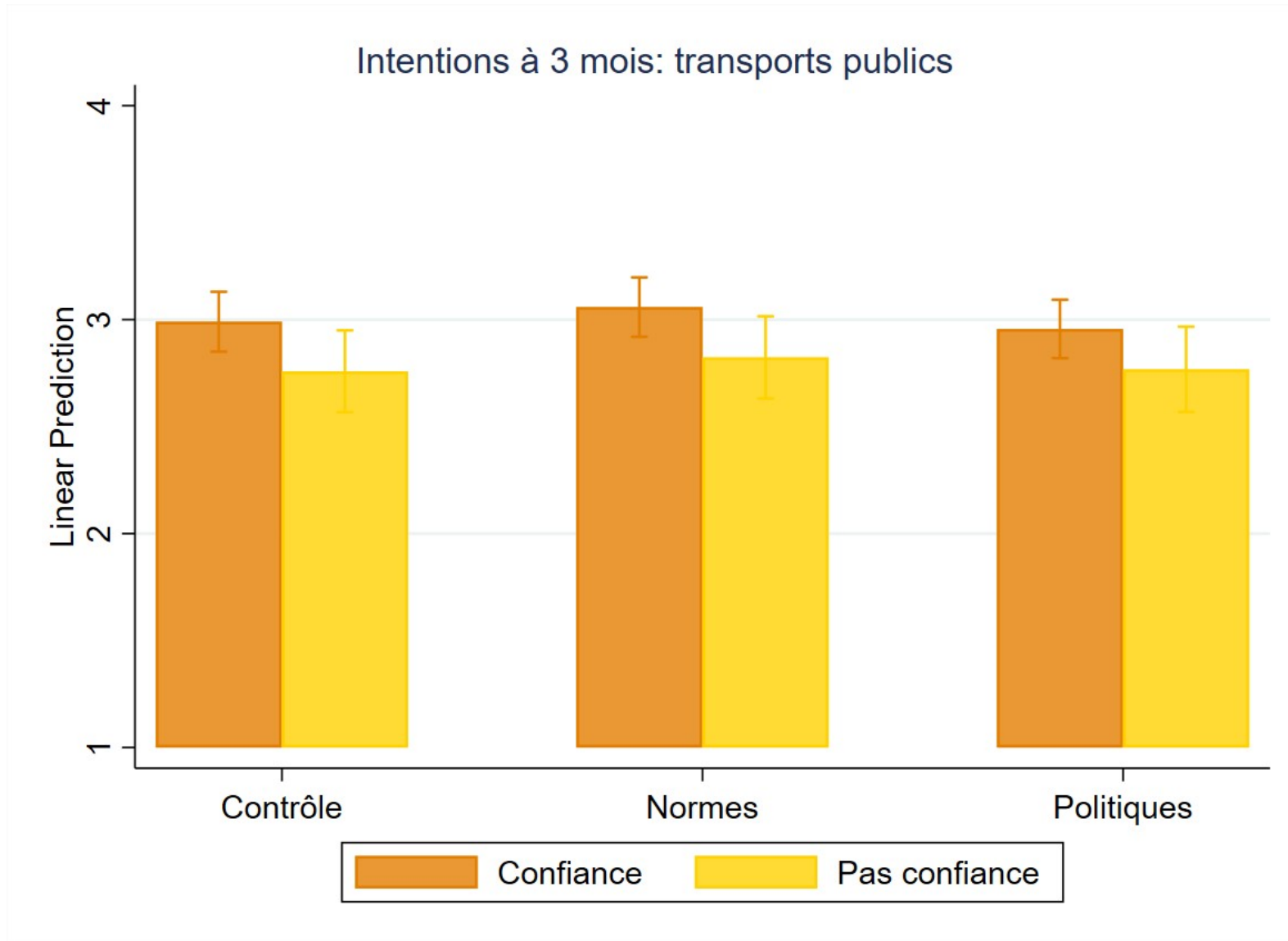
Proportion loterie pour projet vert



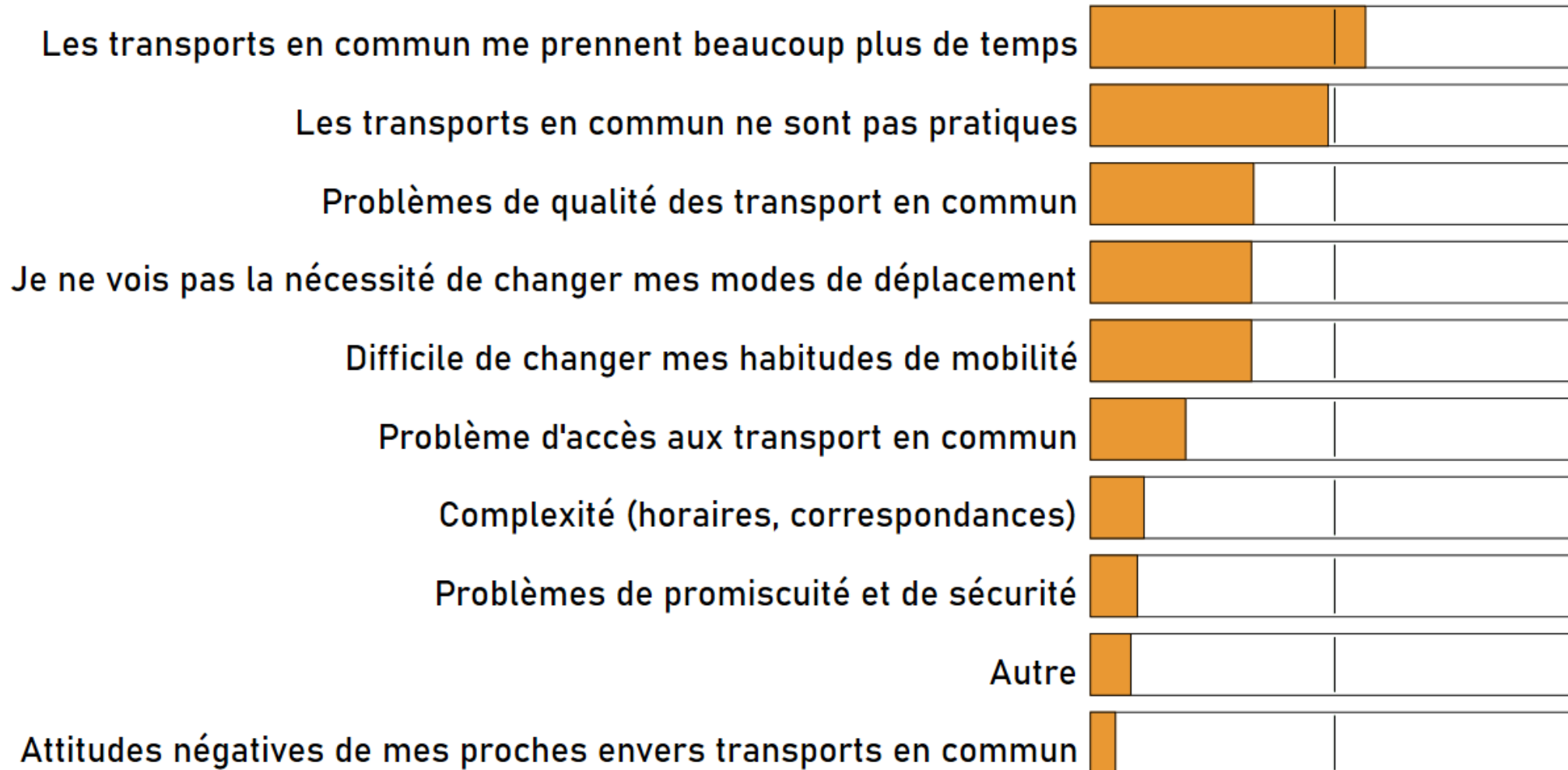
TVA 17% viande



Sauf pour la mobilité



Contraintes sur la mobilité



Conclusions

- Forte hétérogénéité des comportements
 - selon les domaines et les groupes sociaux
- Attention au **découragement**
- Demande d'**actions politiques**, mais pas sans soutien
- **Sous-estimation** des comportements et du soutien aux politiques durables
- **L'impact des traitements d'information**
 - **L'information sur les normes a un impact, pas celle sur les politiques**
 - **Impact positif**: viande, chauffage
 - **Réduction de la polarisation** (écart méfiants-confiants)
 - La mobilité est le domaine le moins flexible

Les résultats finaux de l'étude SOC2050 seront publiés en décembre 2023

- Rapport détaillé
- Résumé exécutif

Disponible au public à

<https://luxstrategie.gouvernement.lu/fr/publicationsbis/soc2050.html>

Les limites biophysiques

Biodiversity implications of economic diversification

Helena Freitas

UNESCO Chair for Biodiversity Conservation and Sustainable Development & Professor, University of Coimbra

THE ECONOMIC IMPLICATIONS OF BIODIVERSITY LOSS

HELENA FREITAS

Centre for Functional Ecology – Science for People & the Planet

University of Coimbra

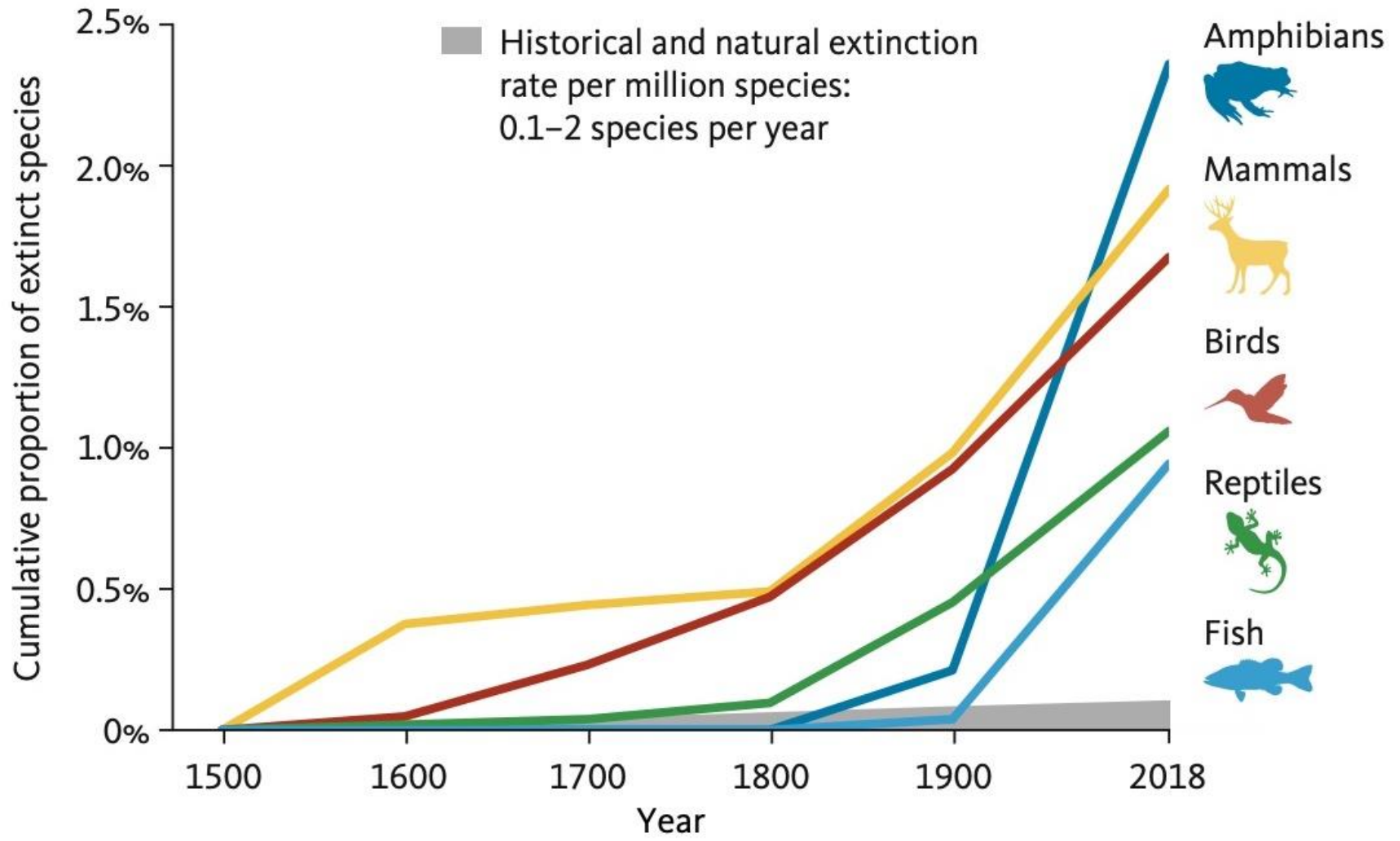
UNESCO Chair in Biodiversity Safeguard for Sustainable Development



We are part of nature, not separate from it. We rely on Nature to provide us with food, water and shelter; regulate our climate and diseases; maintain nutrient cycles and oxygen production; and provide us with spiritual fulfilment and opportunities for recreation and recuperation, which can enhance our health and well-being. We also use the planet as a sink for our waste products, such as carbon dioxide, plastics and other forms of waste, including pollution.

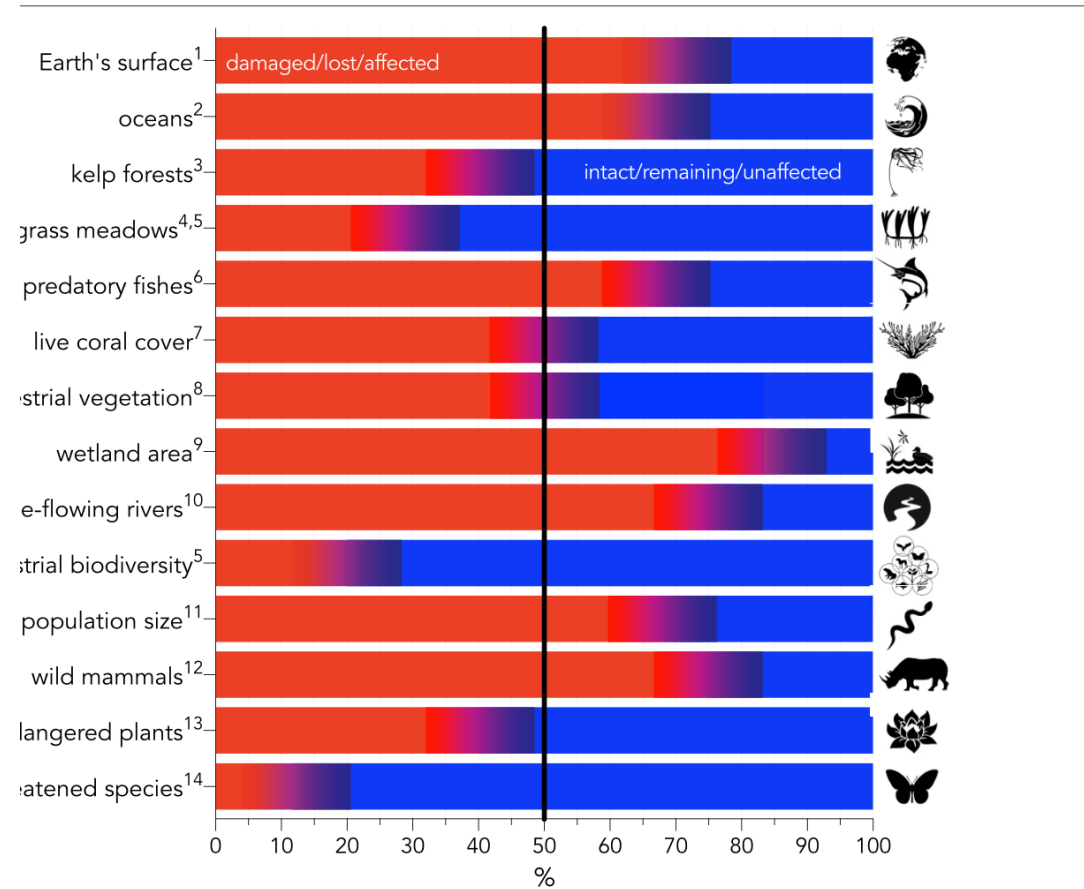
The Economics of Biodiversity: The Dasgupta Review (2021)







All species shown here are protected



Environmental-change categories expressed as a percentage change relative to the baseline given in the text. Red indicates damaged, lost, or otherwise affected, whereas blue indicates the percentage that is intact, remaining, or otherwise unaffected. References: ¹IPBES, 2019; ²Halpern et al., 2015; ³Krumhansl et al., 2016; ⁴Waycott et al., 2009; ⁵Díaz et al., 2013; ⁶Erb et al., 2018; ⁷Davidson, 2014; ⁸Grill et al., 2019; ⁹WWF, 2020; ¹⁰Bar-On et al., 2018; ¹¹Antonelli et

Artificialisation of soil in Luxembourg is well above the European average.



Luxembourg is the most fragmented country in Europe.



2/3 of protected habitats of European importance have an unfavourable conservation status.



4/5 of protected species of European importance have an unfavourable conservation status.



National Plan for the Protection of Nature (PNPN3)

By 2030



biodiversity will be on the road to recovery.

By 2050



the ambition is to restore all the ecosystems in the world; Luxembourg shares the Global Biodiversity Framework's objective of "living in harmony with nature".

The **PNPN3** determines the actions to be implemented and the quantifiable measures to be taken by 2030. By taking these actions, Luxembourg will be helping to achieve European objectives.

Like the **EU Biodiversity Strategy for 2030**, the PNP3 is structured around **four pillars**:



1 Nature Protection



1 Legally protect 30% of the country's territory as protected areas, contributing to a truly coherent and resilient Trans-European Nature Network.

2 Strictly protect one third of protected areas, i.e. around 10% of the national territory.

3 Effectively manage all protected areas.



2 Nature Restoration



- 1** Halt any deterioration and restore, or improve, the favourable conservation status of at least 30% of habitats and species, focusing on
- species and habitats in agricultural environments,
 - farmland species and habitats,
 - pollinating insects,
 - ecosystems contributing to climate change mitigation and adaptation.



1,700,000
trees planted
by 2030

- 2** Enhance or even restore **ecological connectivity** and strengthen **ecosystem resilience**:
- in order to restore ecosystem services,
 - in order to address climate change,
 - in order to sequester and store carbon.
- For example, by planting an additional 1.7 million trees by 2030 and contributing to the greening of urban and rural areas.

ECOSYSTEM SERVICES



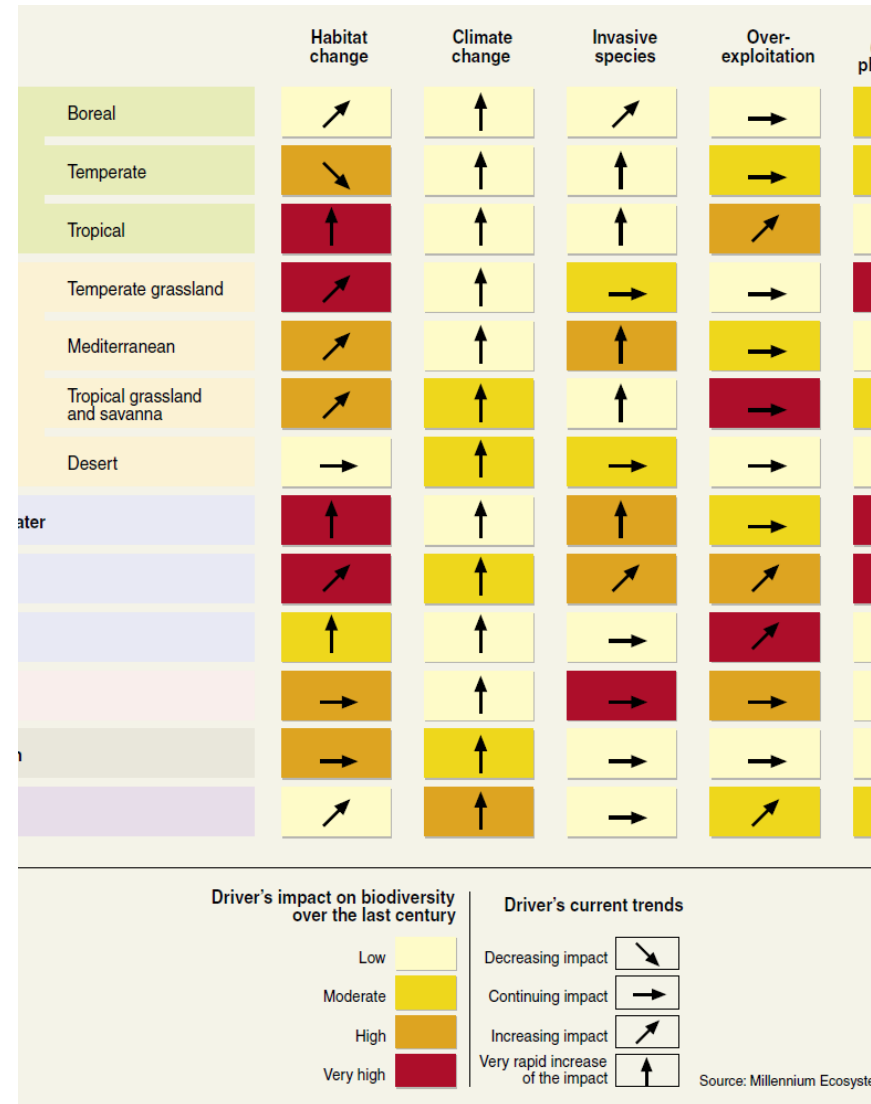
- Costanza et al (2014) estimate that global ecosystem services provide annual benefits in the order of USD 125-140 trillion in 2011. Table 2 provides concrete examples (OECD 2019).
- Costanza R., d'Arge R., de Groot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R.V., Paruelo J., Raskin R.G., Sutton P., van den Belt M., 1997: The value of the world's ecosystem services and natural capital. *Nature* 387, 253–260.
- Costanza R., de Groot R., Sutton P., van der Ploeg S., Anderson S.J., Kubiszewski I., Farber S., Turner R.K., 2014: Changes in the global value of ecosystem services. *Global Environmental Change* 26 (2014) 152-158
- OECD 2019: Biodiversity Finance and the Economic and Business Case for Action. Report prepared for the G7 Environmental Ministers's Meeting 5–6 May 2019.

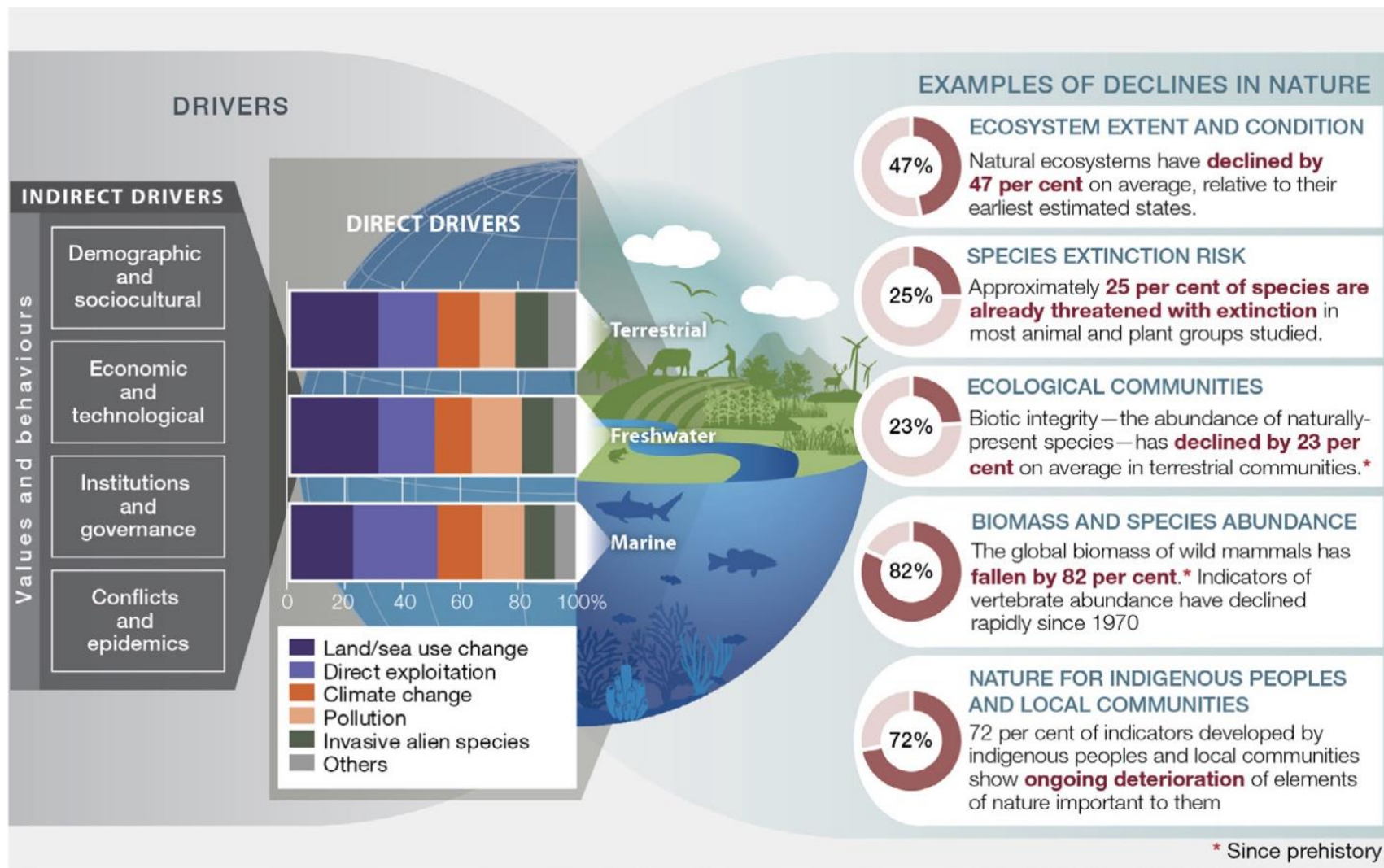
Scale	Good or service	Estimated annual value
Global	Seagrass nutrient cycling	USD 1.9 trillion
Global	Value of animal pollinated crops	USD 235–577 billion
Global	First sale of fisheries and aquaculture	USD 362 billion
Global	Coral reef tourism	USD 36 billion
Europe	Services from the European protected areas network (Natura 2000)	EUR 223–314 billion
Canada	Value of commercial landings from marine and freshwater fisheries	CAD 3.4 billion
France	Recreational benefits of forest ecosystems	EUR 8.5 billion
Germany	Direct and indirect income from recreational fishing	EUR 6.4 billion
Italy	Habitat provision	EUR 13.5 billion
Japan	Water purification from tidal flats and marshes	JPY 674 billion
UK	Physical and mental-health benefits of nature	GBP 2 billion
US	Air purification from trees and forests (avoided morbidity and mortality)	USD 6.8 billion

Source: OECD 2019

Ecosystems' condition

- Degradation of ecosystems
- Most of the mechanisms that drive ecosystem degradation remain constant or increasing in intensity in most ecosystems.
- 60% of the world's ecosystem services are degraded





SOME OF THE KEY ECONOMIC IMPLICATIONS OF BIODIVERSITY LOSS:

- 1. Ecosystem Services and Human Well-being:** Biodiverse ecosystems provide various ecosystem services that directly and indirectly benefit human well-being. These services include pollination of crops, water purification, disease regulation, climate regulation, and recreational opportunities. The loss of biodiversity can lead to a decline in these services, potentially impacting agricultural productivity, water quality, and human health.
- 2. Agricultural Productivity:** Biodiversity loss can disrupt the balance of ecosystems and lead to the proliferation of pests and diseases. Many species, such as bees and other pollinators, play a crucial role in pollinating crops. Without these species, agricultural yields can decline, leading to reduced food production and potential food security challenges.
- 3. Medicine and Pharmaceuticals:** Biodiversity is a rich source of potential new medicines and pharmaceutical compounds. Many of the world's modern drugs are derived from natural sources. The loss of species could lead to missed opportunities for discovering new treatments and cures.
- 4. Tourism and Recreation:** Many ecosystems and species attract tourists and recreational activities, contributing significantly to local economies. Coral reefs, rainforests, and wildlife viewing are examples of attractions that generate revenue through tourism. The decline of these ecosystems and species could negatively impact the tourism industry.
- 5. Fisheries:** Biodiversity loss can disrupt aquatic ecosystems and impact fish populations. Overfishing and habitat destruction can lead to the depletion of fish stocks, affecting the livelihoods of communities that rely on fisheries for food and income.

6. Climate Change and Resilience: Biodiverse ecosystems can play a role in mitigating and adapting to climate change. Forests, for instance, act as carbon sinks, helping to regulate the global carbon cycle. The loss of forests and other carbon-absorbing ecosystems could exacerbate climate change impacts and reduce the Earth's resilience to environmental changes.

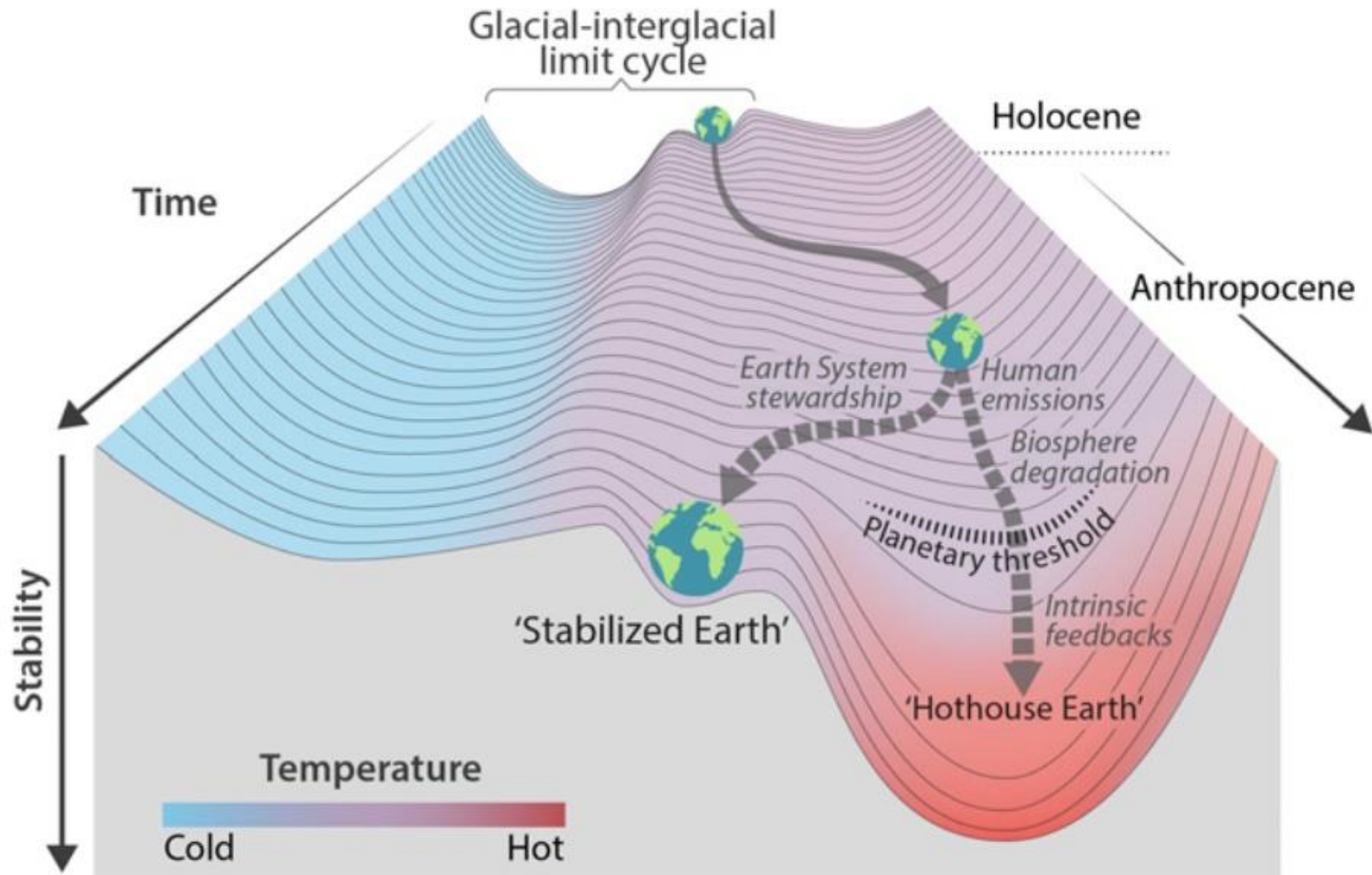
7. Insurance Against Uncertainty: Biodiversity contributes to ecosystem stability and resilience. Diverse ecosystems are better equipped to withstand disturbances such as disease outbreaks, invasive species, and extreme weather events. The loss of biodiversity reduces the ability of ecosystems to recover from such events, increasing the vulnerability of communities and economies.

8. Regulation of Natural Processes: Biodiverse ecosystems contribute to natural processes like nutrient cycling, soil formation, and water regulation. These processes are fundamental for maintaining healthy soils, water quality, and overall ecosystem function. Biodiversity loss can disrupt these processes, leading to decreased productivity in agriculture and increased costs for water treatment.

9. Employment and Livelihoods: Many communities around the world depend on biodiversity for their livelihoods, particularly in sectors like agriculture, forestry, fishing, and ecotourism. Biodiversity loss can lead to job losses and reduced economic opportunities in these sectors.

10. Economic Costs of Restoration: Restoring ecosystems that have been degraded or lost can be expensive. Efforts to rehabilitate ecosystems and reintroduce species can require significant financial investments.

The decline in biodiversity can have cascading effects on multiple sectors of the economy and impact human well-being in numerous ways. Recognizing the economic value of biodiversity and implementing measures to conserve and sustainably manage ecosystems is essential for long-term economic and ecological stability.



Steffen et al. 2018. Trajectories of the Earth System in the Anthropocene. PNAS

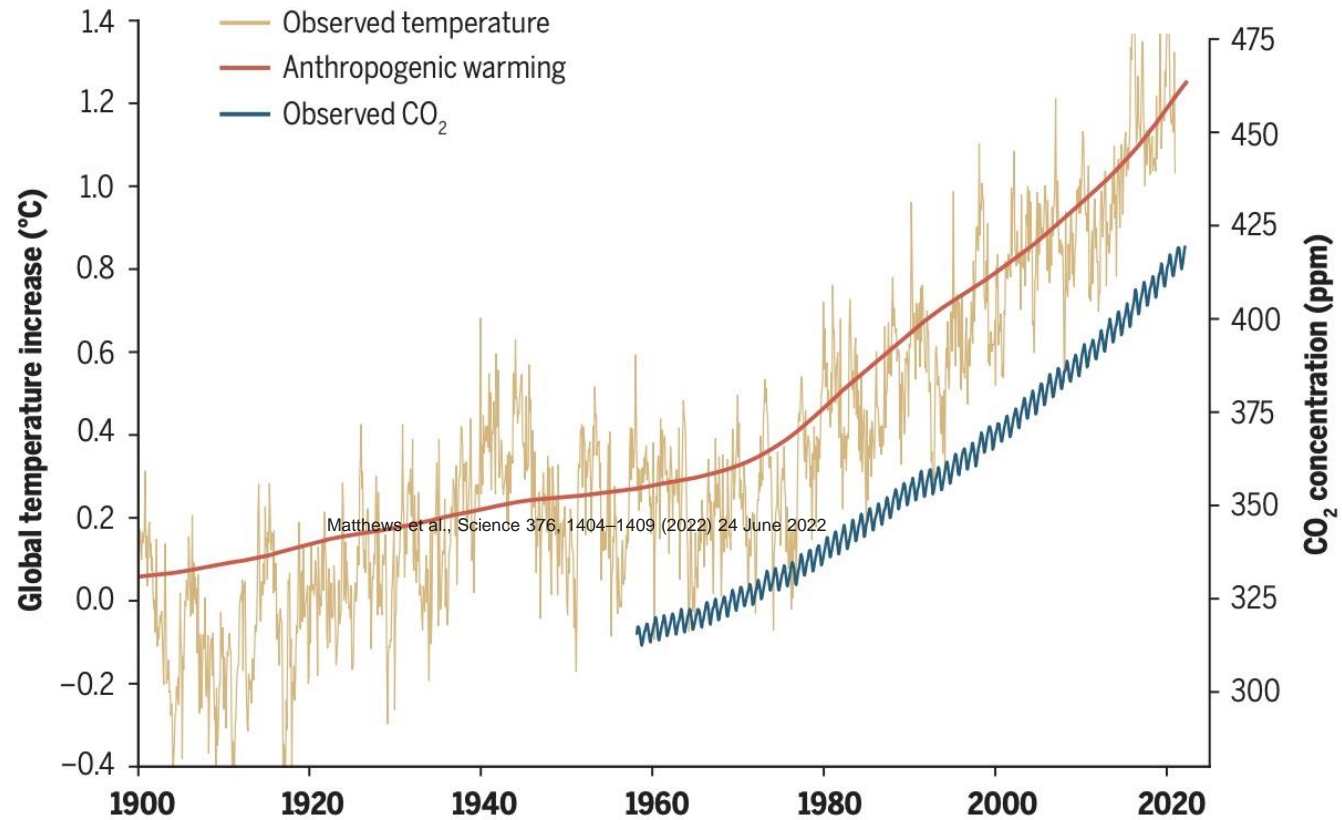
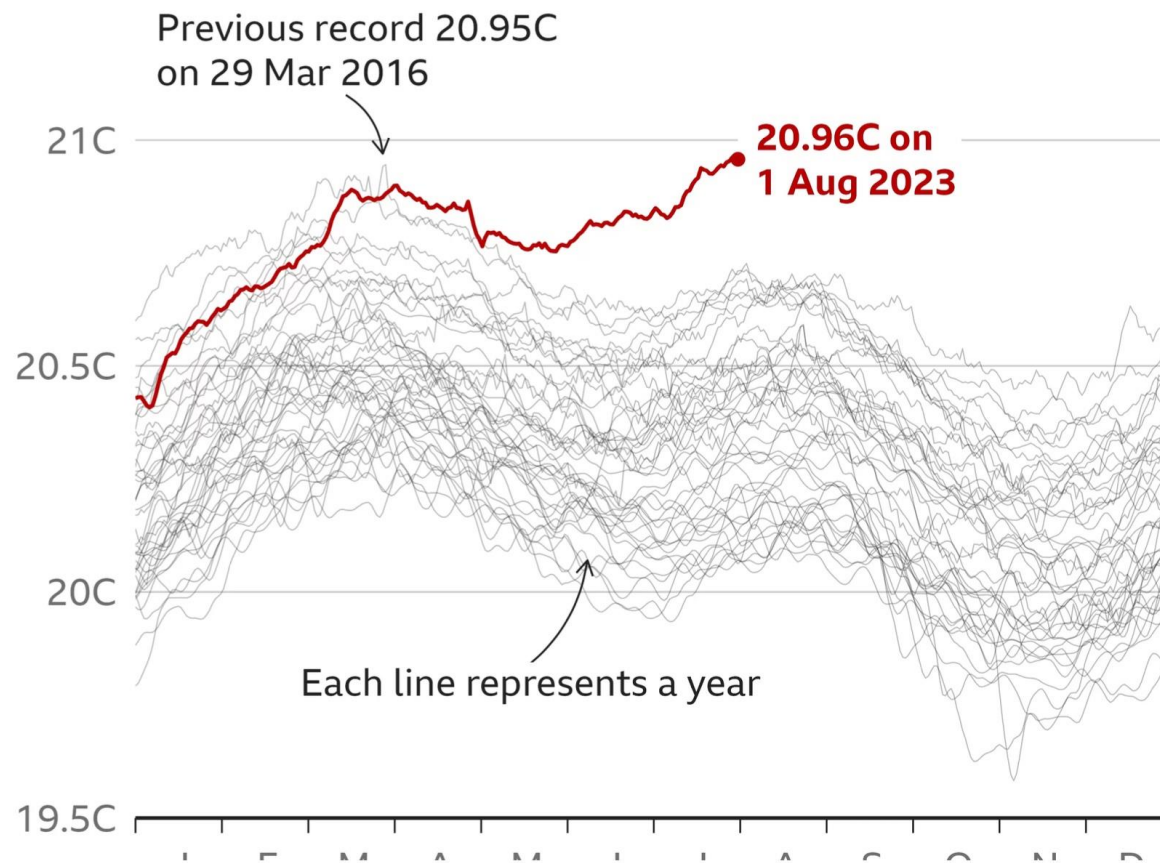


Fig. 1. Global temperature and atmospheric CO₂ change. Observed global temperature has increased by >1.2°C since the 1850 to 1900 baseline period (thin beige line; monthly temperature observations). Virtually all of this increase can be attributed to anthropogenic drivers (red line). The observed atmospheric CO₂ increase (blue line) is the primary driver of anthropogenic global warming.

Ocean temperatures highest on record

Daily average sea surface temperature between 60° North and 60° South, 1979-2023



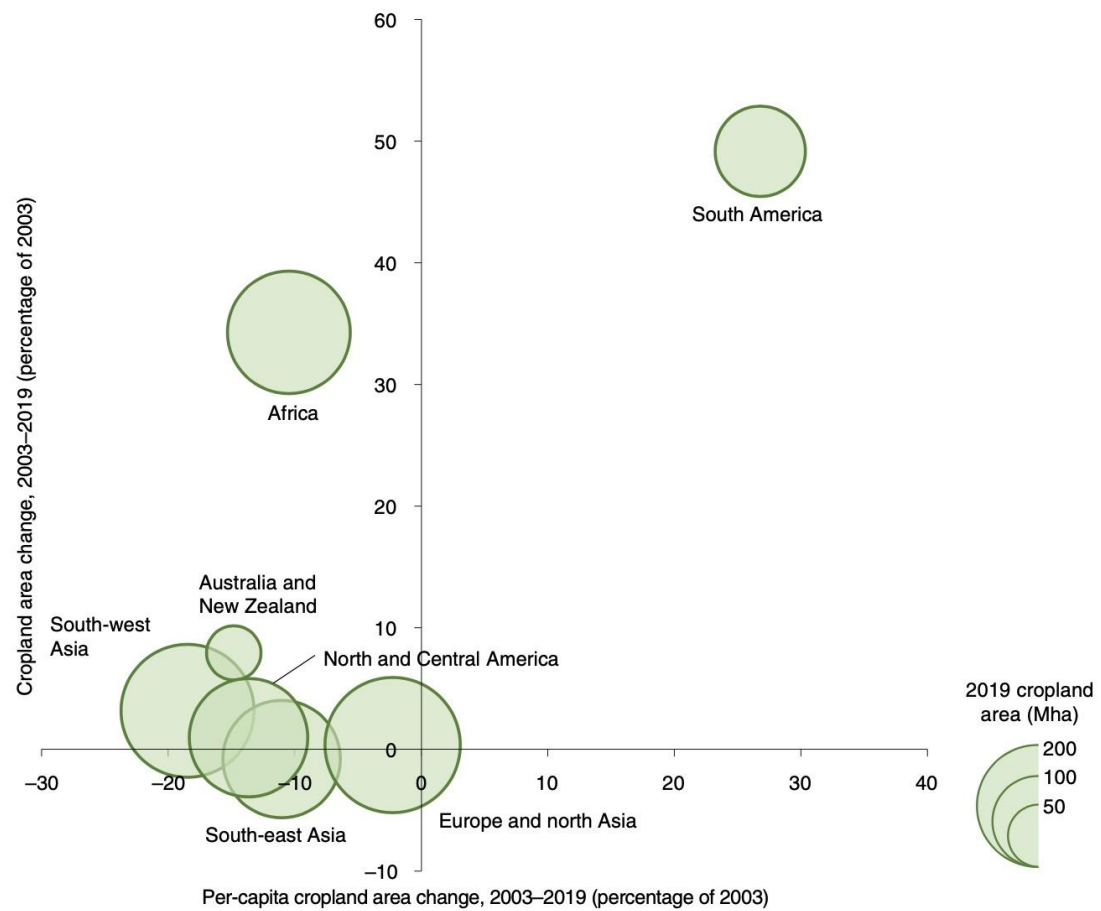
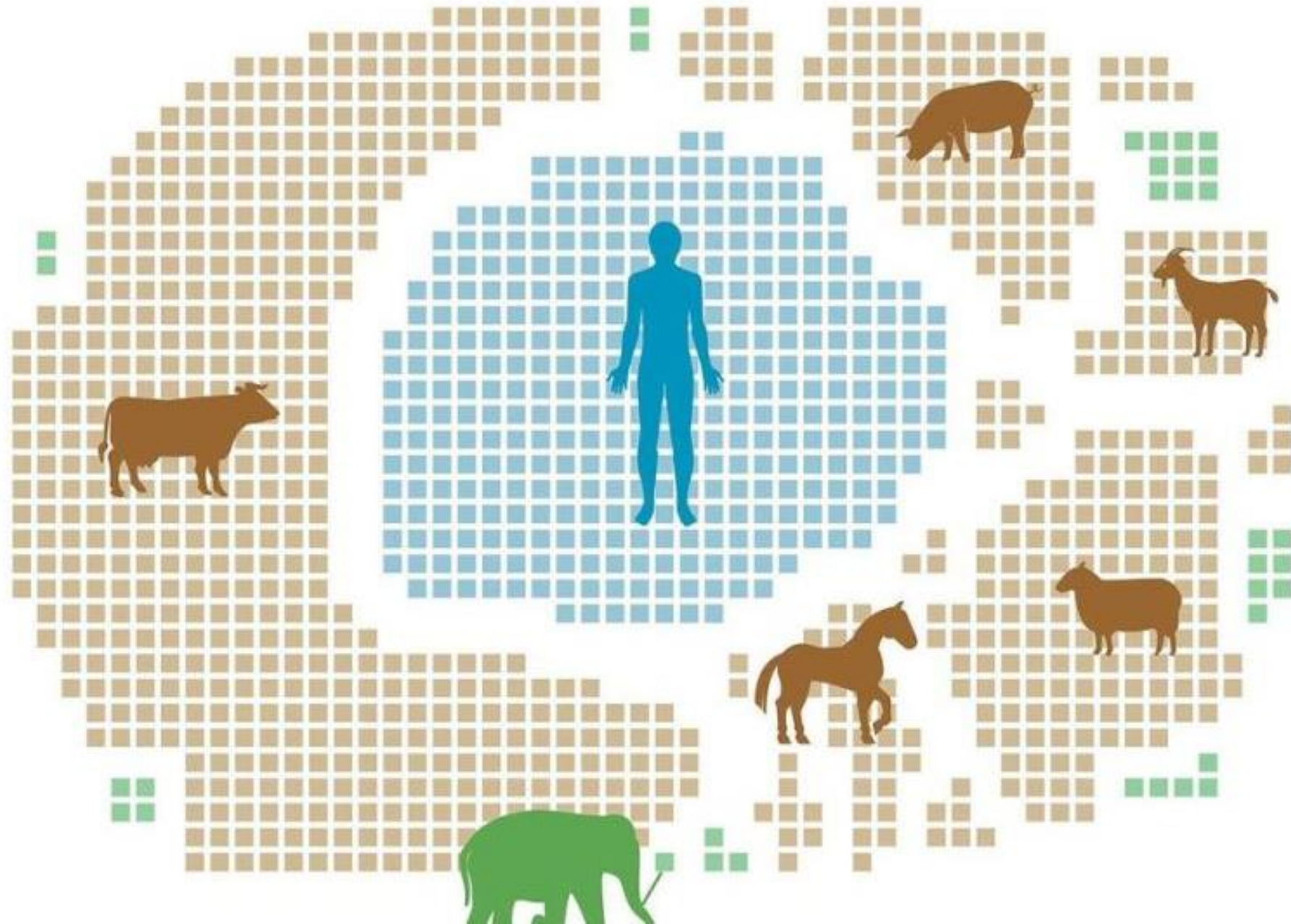


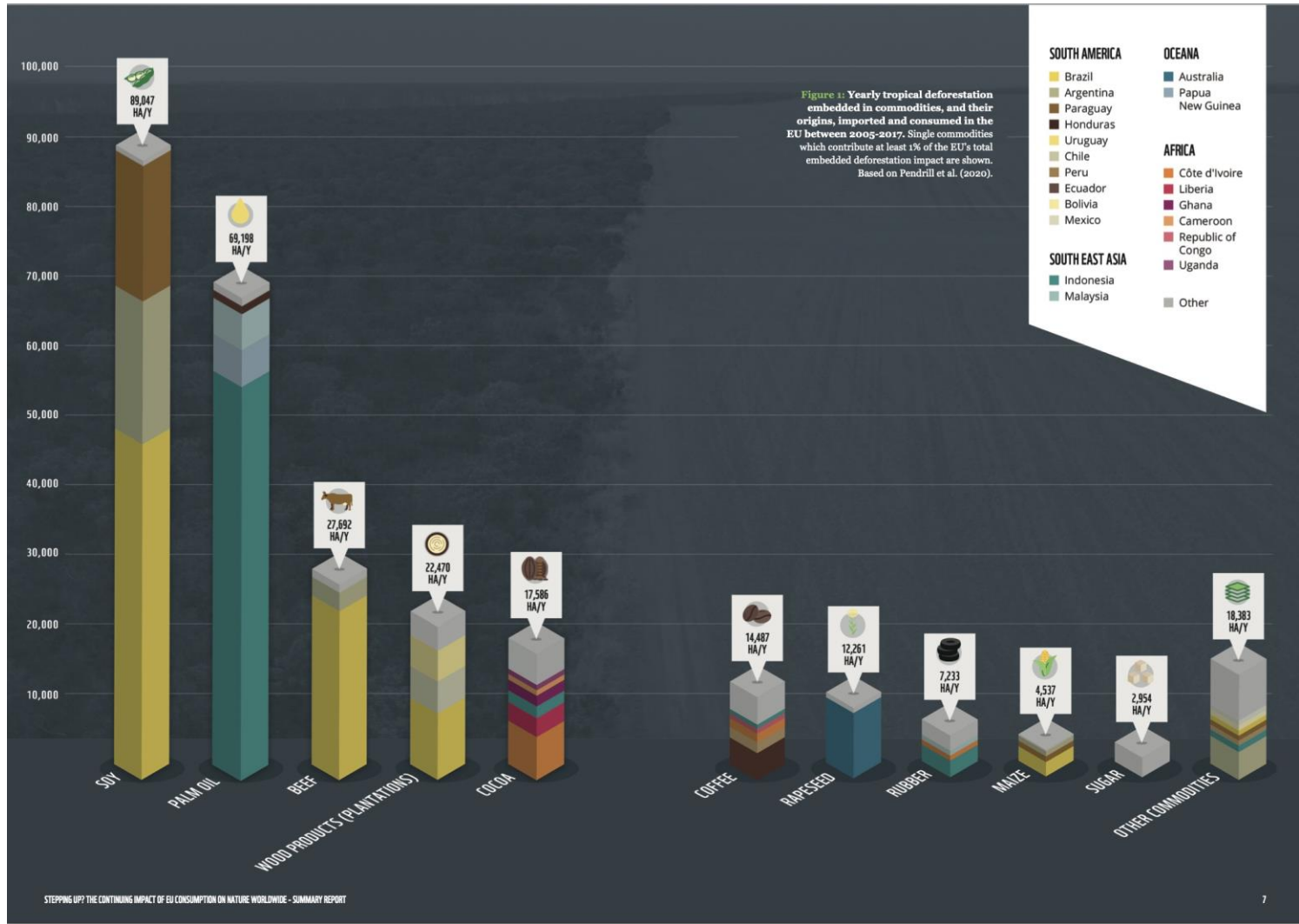
Fig. 2 | Total and per-capita cropland area change, 2003–2019, per geographic region. The size of the bubbles reflects regional 2019 cropland area.

The Earth's Land Mammals by weight

each square is 1,000,000 Tons

- Humans
- Our pets & livestock
- Wild animals





Source: Stepping up? The continuing impact of EU consumption on nature worldwide WWF 2021

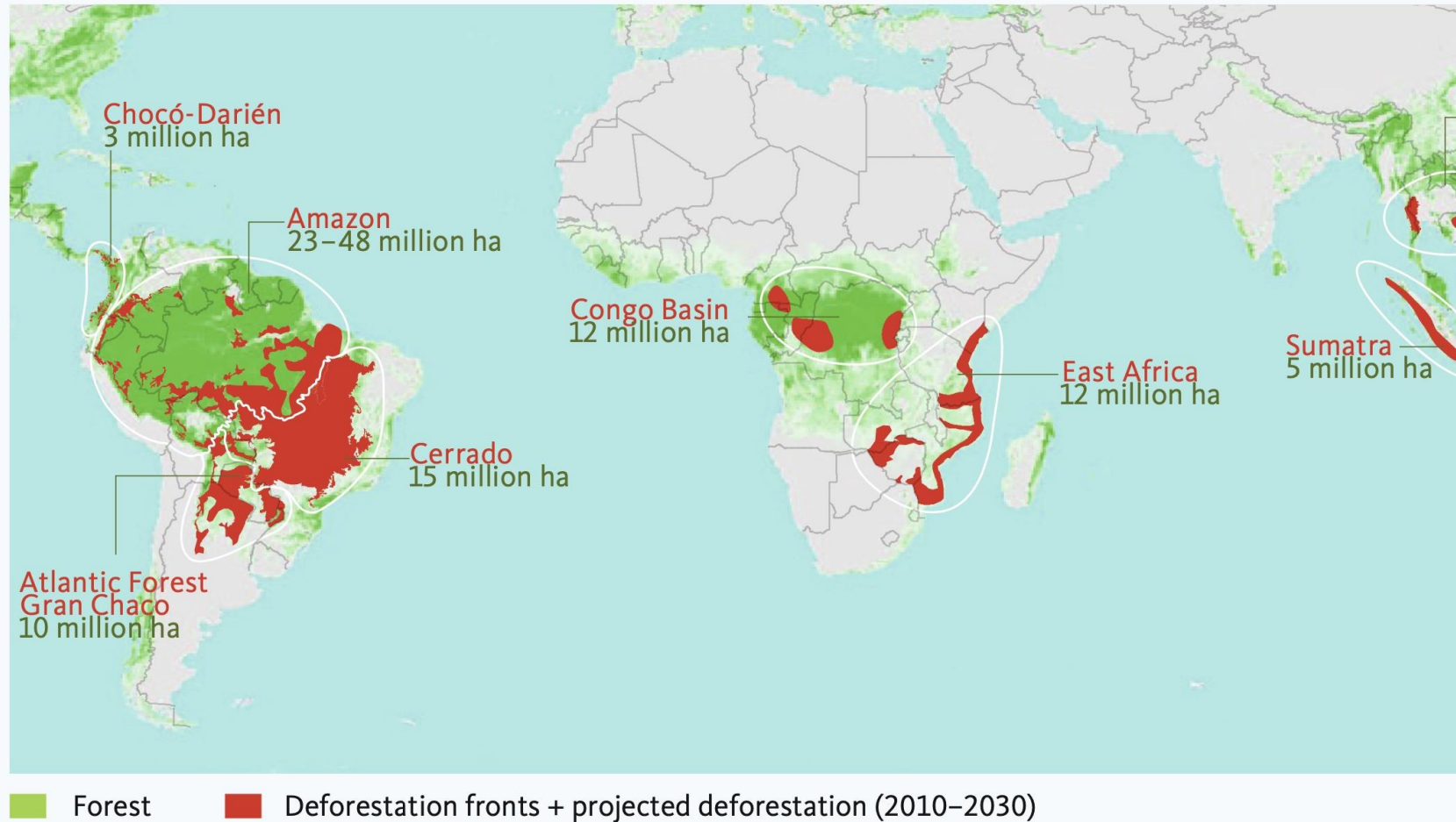


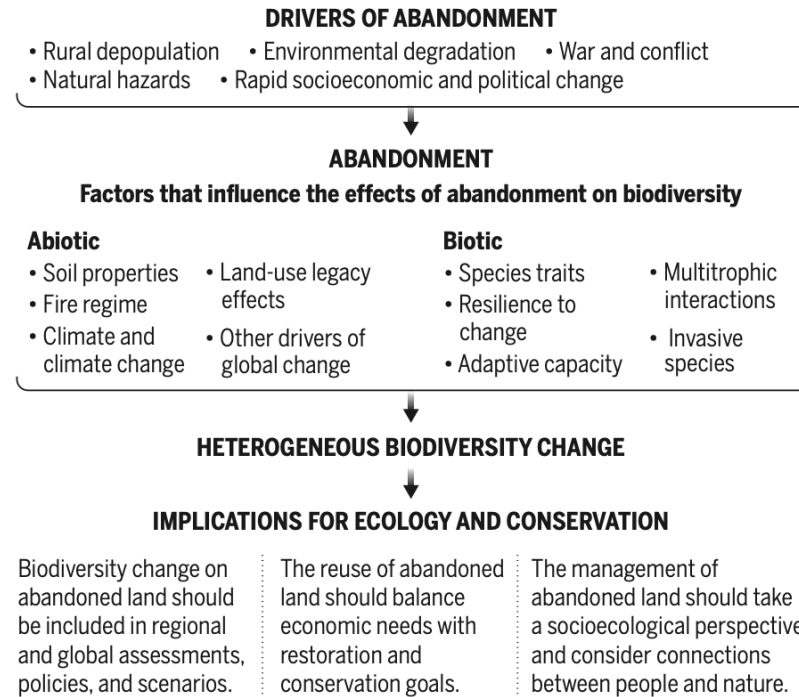
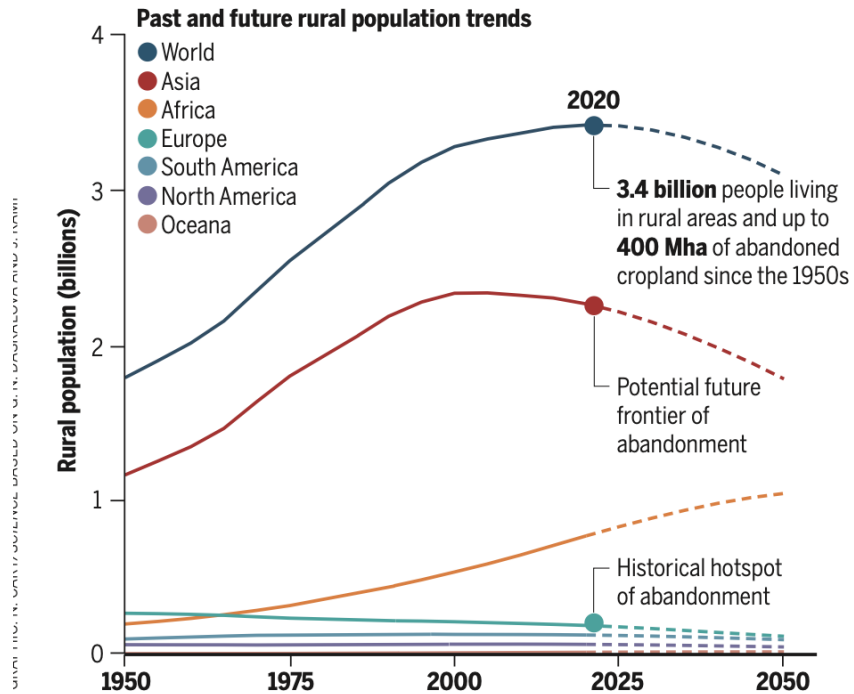
Figure 2.1-4

Expected hotspots of global deforestation up to 2030.

Source: IPBES, 2018a:285; ©Text and graphics: 2015 WWF

Abandonment leads to heterogeneous biodiversity trajectories

Land abandonment is increasing as rural populations decrease. Rural population trends over time and projections for the future (dashed lines) are based on United Nations Population Division statistics. Abandonment is driven by a range of factors, and it influences biodiversity in heterogeneous ways, which have implications for ecology and conservation.

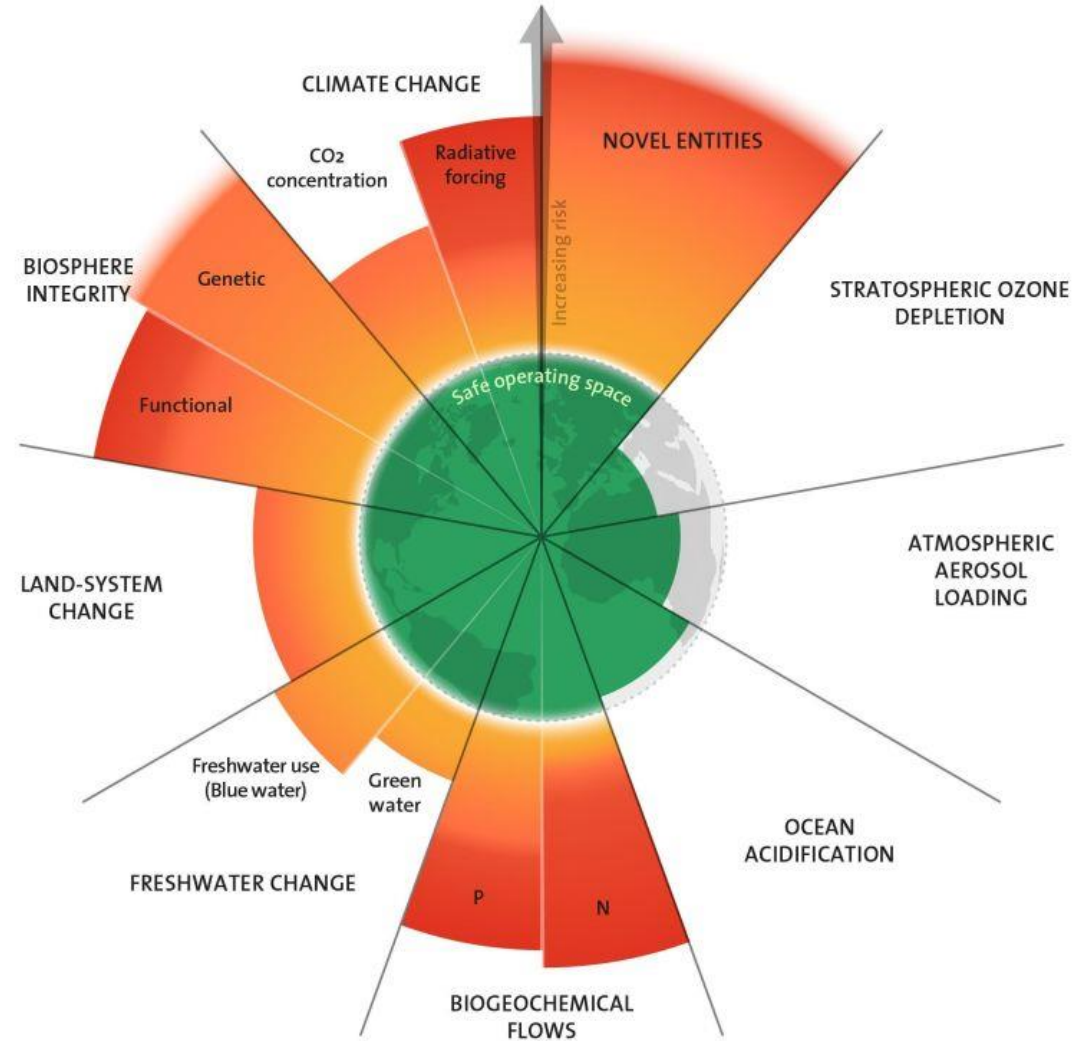


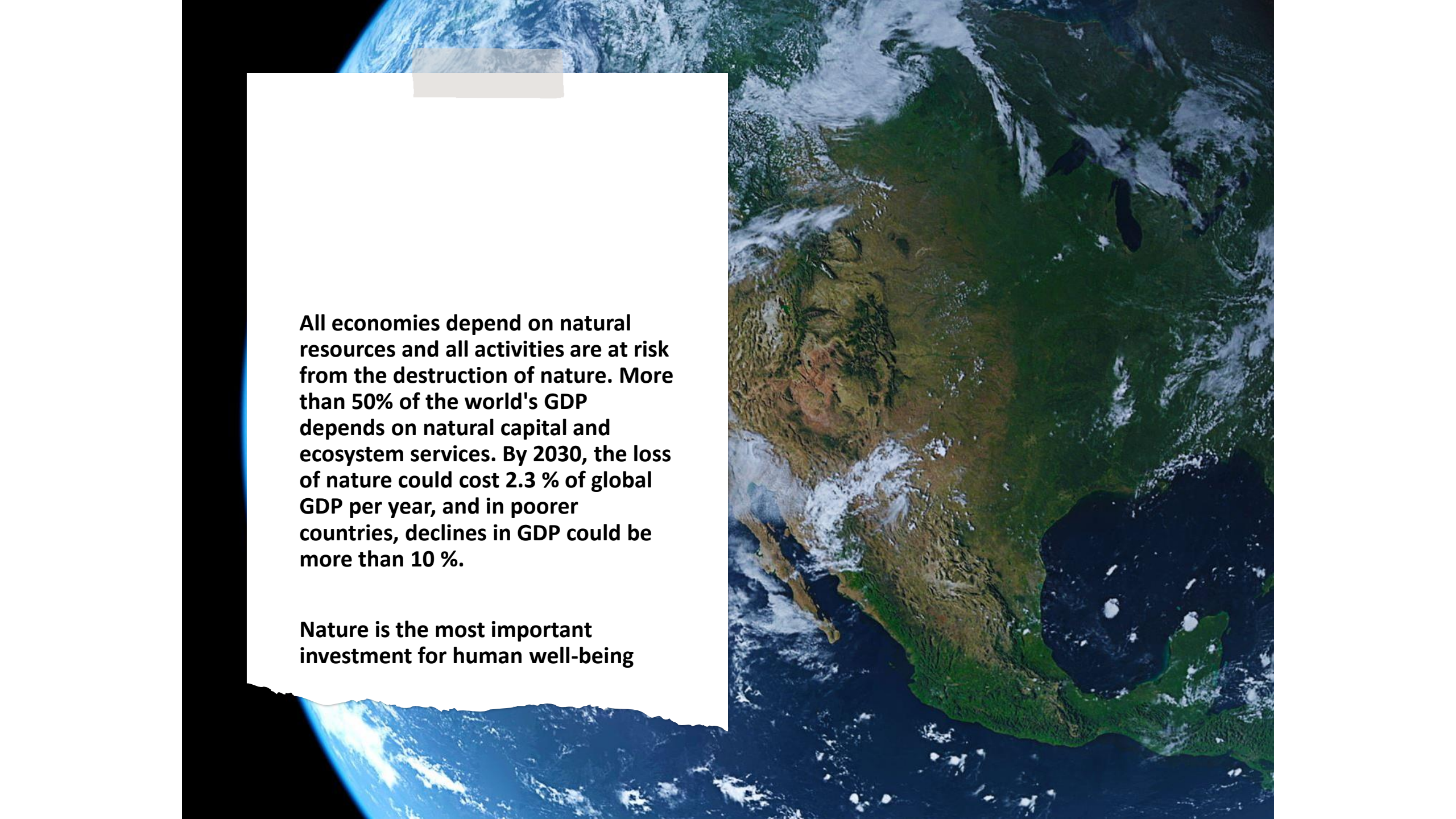
All planetary boundaries are assessed, and six are crossed.

For the first time ever, scientists have quantified all nine planetary boundaries. Six of them are already transgressed and we are increasing pressure on the others.

"This update on Planetary Boundaries clearly depicts a patient that is unwell, as pressure on the planet increases and vital boundaries are being breached,"

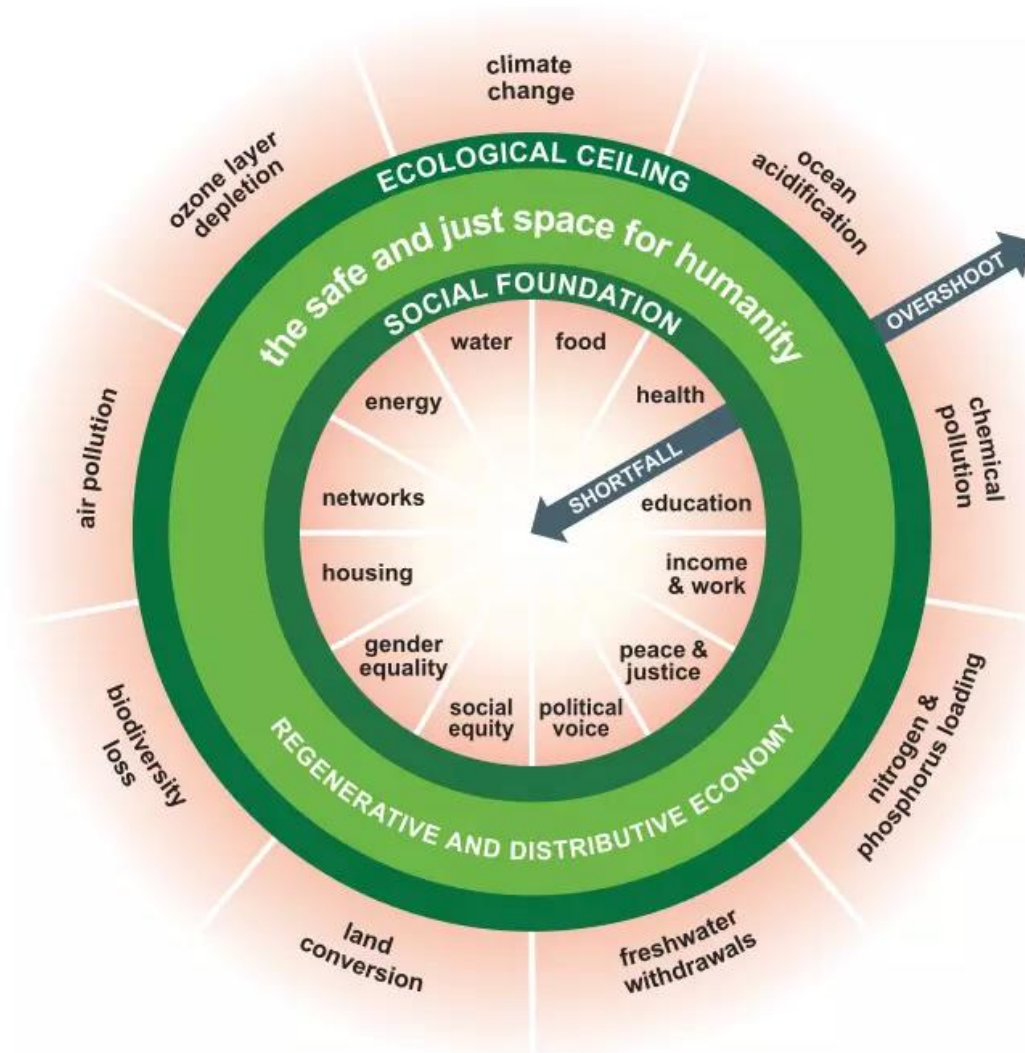
Johan Rockström



A satellite view of Earth from space, showing the Americas and the Pacific Ocean. The image is oriented vertically, with the top of the frame showing the top of the Earth and the bottom showing the bottom. The landmasses are in shades of green and brown, and the oceans are dark blue. White clouds are scattered across the scene. A white rectangular box with a torn bottom edge is overlaid on the left side of the image, containing text.

All economies depend on natural resources and all activities are at risk from the destruction of nature. More than 50% of the world's GDP depends on natural capital and ecosystem services. By 2030, the loss of nature could cost 2.3 % of global GDP per year, and in poorer countries, declines in GDP could be more than 10 %.

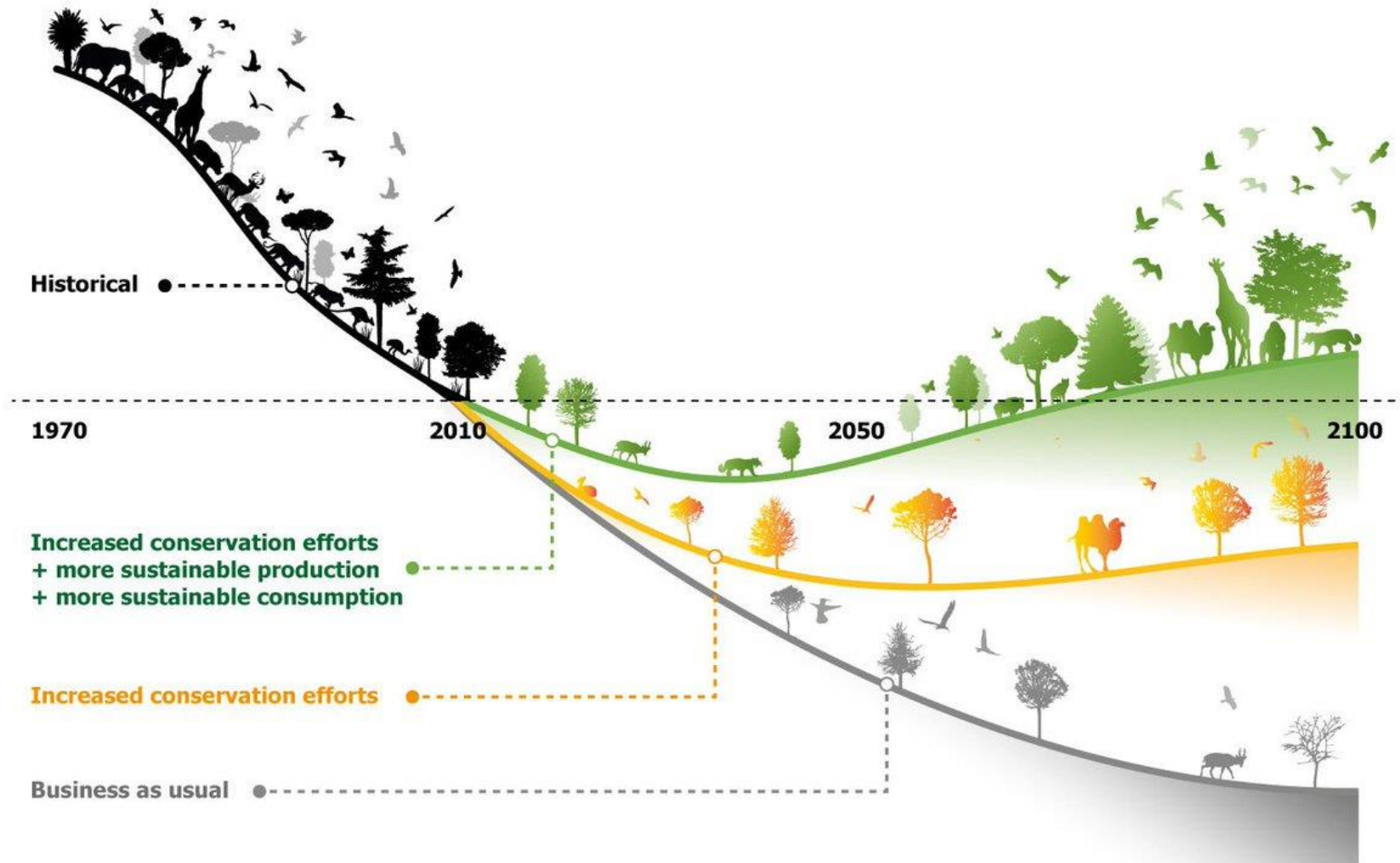
Nature is the most important investment for human well-being



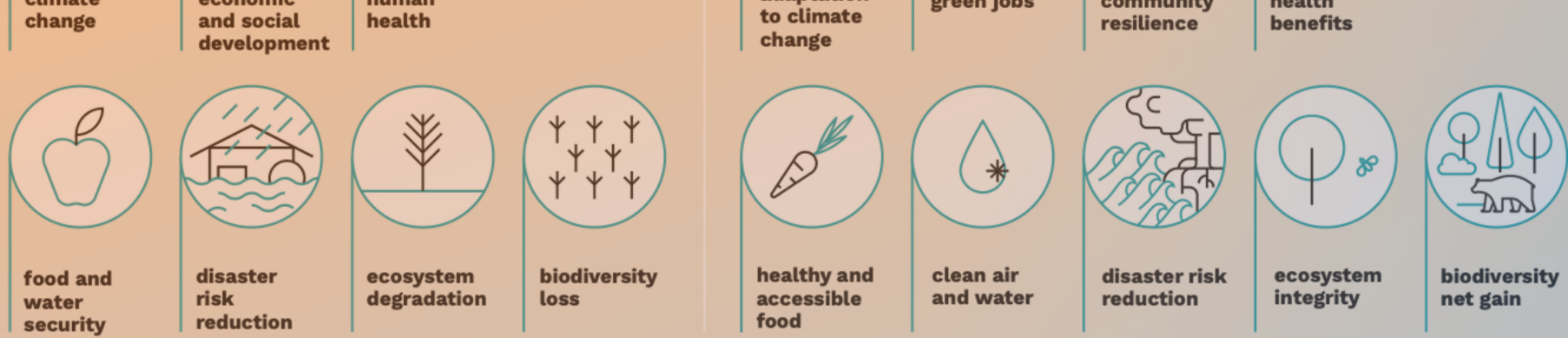
- A social foundation – to ensure that no one is left falling short on life’s essentials, and an ecological ceiling – to ensure that humanity does not collectively overshoot planetary boundaries. Between these two boundaries lies a doughnut-shaped space that is both ecologically safe and socially just – a space in which humanity can thrive.



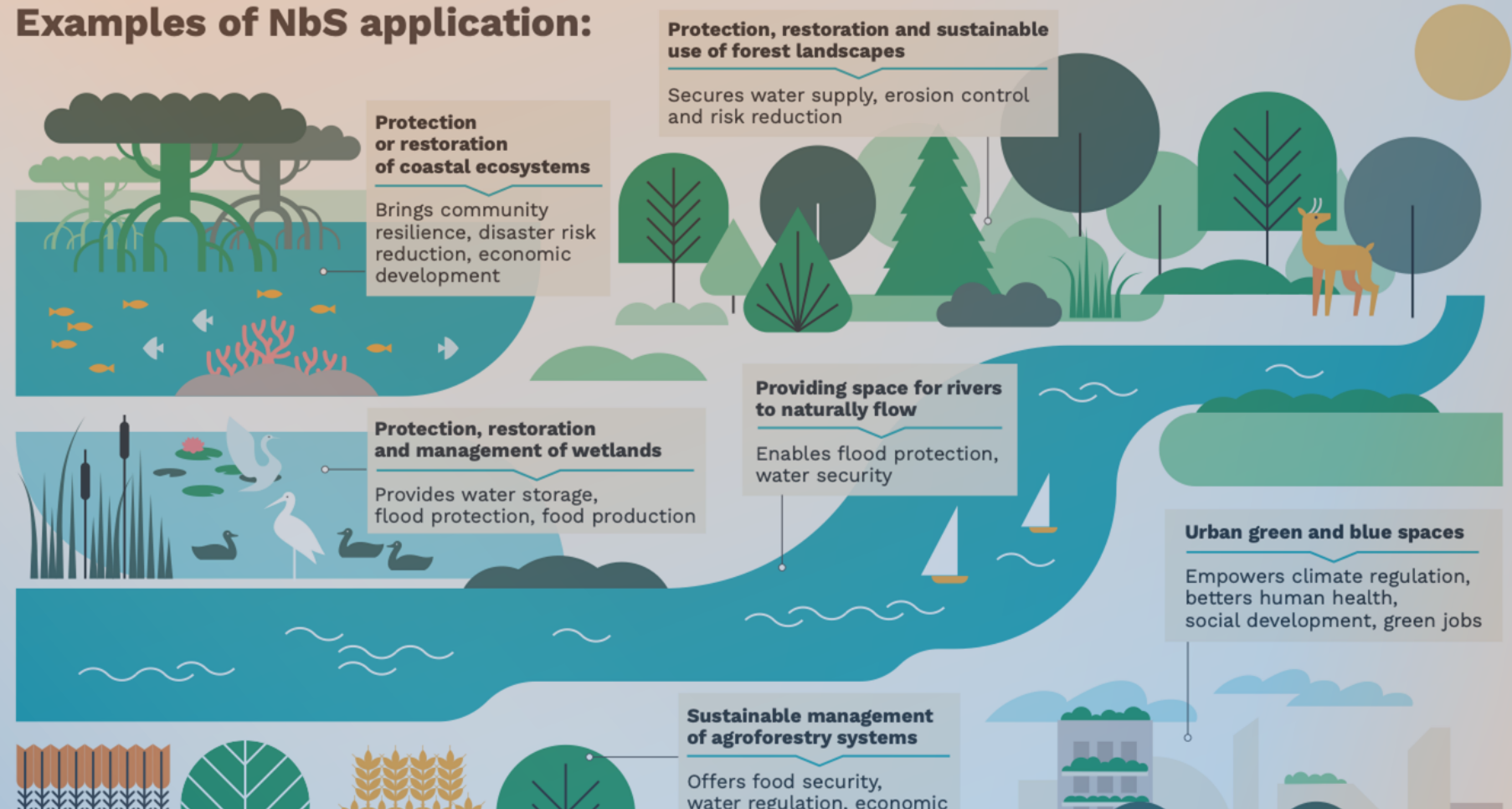
Fig. 1. The two axes on which the four scenarios are laid out on. This is a commonly used method in developing scenarios. The horizontal axis shows the range between giving priority to the individual or collective (community) interests. The vertical axis distinguishes between a focus on GDP growth and materialistic consumption versus a focus on the well-being of humans and the environment.

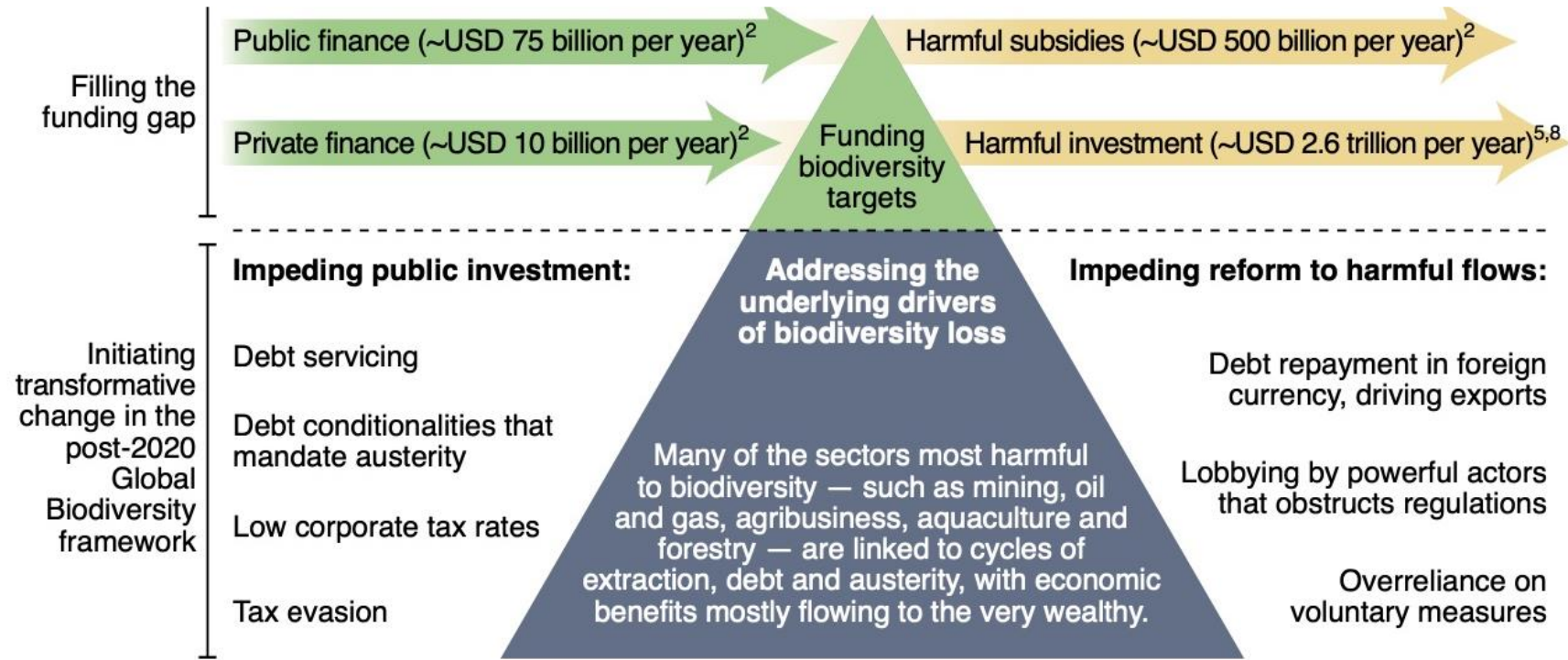


This artwork illustrates the main findings of the article, but does not intend to accurately represent its results (<https://doi.org/10.1038/s41586-020-2705-y>)



Examples of NbS application:





✓□ Financial authorities, in collaboration with pertinent government departments, must proactively identify and categorize business activities with the most detrimental impact on climate and biodiversity. Of particular concern are those activities that contribute to ecological tipping points, such as tropical deforestation, as they pose a dual threat to these critical domains.

✓□ Governments and regulators are examining ways to identify the systemic risks that nature loss poses to the financial system. This involves strategic and policy actions, including the exploration of options to expand climate risk disclosure mechanisms to encompass risks related to nature.

✓□ As the global commitment to safeguarding nature gains momentum, the next crucial phase involves pinpointing the strategic areas where transforming existing business models and production processes can make the most substantial impact in halting and reversing nature loss. Simultaneously, we must explore the means to finance this transformative journey.

✓□ With the ongoing push for greater transparency and accountability, businesses that have not yet incorporated nature into their core operations are likely to face increasing costs. Those who overlook this trend risk falling behind, whereas enterprises that have wholeheartedly embraced this transformation are poised to seize new opportunities and thrive.

FIVE DISTINCT YET MUTUALLY REINFORCING STRATEGIES FOR BRINGING ABOUT TRANSFORMATIVE CHANGE IN HOW BUSINESSES CAN CONTRIBUTE SUBSTANTIVELY TO BIODIVERSITY CONSERVATION:

- (i) making biodiversity protection every business's business—i.e., incentivizing micro, small, and medium enterprises alongside large corporations to adopt biodiversity conservation measures,
- (ii) giving biodiversity a central stage in the corporate sustainability discourse—i.e., correcting the carbon tunnel vision of corporate sustainability,
- (iii) holding companies accountable for biodiversity impacts across their entire supply-chains,
- (iv) developing biodiversity-friendly organizational cultures so that employees become biodiversity champions, and
- (v) creating third-party certifications to benchmark and evaluate biodiversity-friendly business practices. Effective implementation of these five strategies will require voluntary commitment from companies and enabling regulations.

THE KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK OUTLINES 23 TARGETS FOR 2030. In short:

1. Conserve and manage 30% of the world's lands, waters, coastal areas, and oceans, with a focus on vital biodiversity areas. Currently, only 17% of land and 10% of marine areas are protected.
2. Restore or begin restoring 30% of degraded ecosystems on land and in water.
3. Minimize the loss of important biodiversity areas and ecosystems with high ecological integrity.
4. Halve global food waste and reduce overconsumption and waste generation.
5. Cut excess nutrients and reduce the risk from pesticides and hazardous chemicals by 50%.
6. Phase out or reform subsidies harmful to biodiversity by 2030, totalling at least \$500 billion per year, while promoting positive incentives for conservation.
7. Secure at least \$200 billion annually for biodiversity-related funding from all sources by 2030.
8. Increase financial support from developed to developing countries, particularly the least developed countries, small island states, and transitioning economies, to at least \$20 billion annually by 2025 and \$30 billion by 2030.
9. Prevent the introduction of invasive species and reduce their establishment by half. Eradicate or control invasive species on islands and priority sites.
10. Mandate large companies and financial institutions to transparently disclose their biodiversity-related risks, dependencies, and impacts in their operations, supply chains, and portfolios.

Without these actions, the ongoing species extinction rate, already many times higher than historical averages, will continue to accelerate.



"I love nature."

Les limites biophysiques

RISK2050 Study: the physical risks for the economy and its coping potential

Christian Schulz
Professor, University of Luxembourg

Susanne Siebentritt
Professor, University of Luxembourg



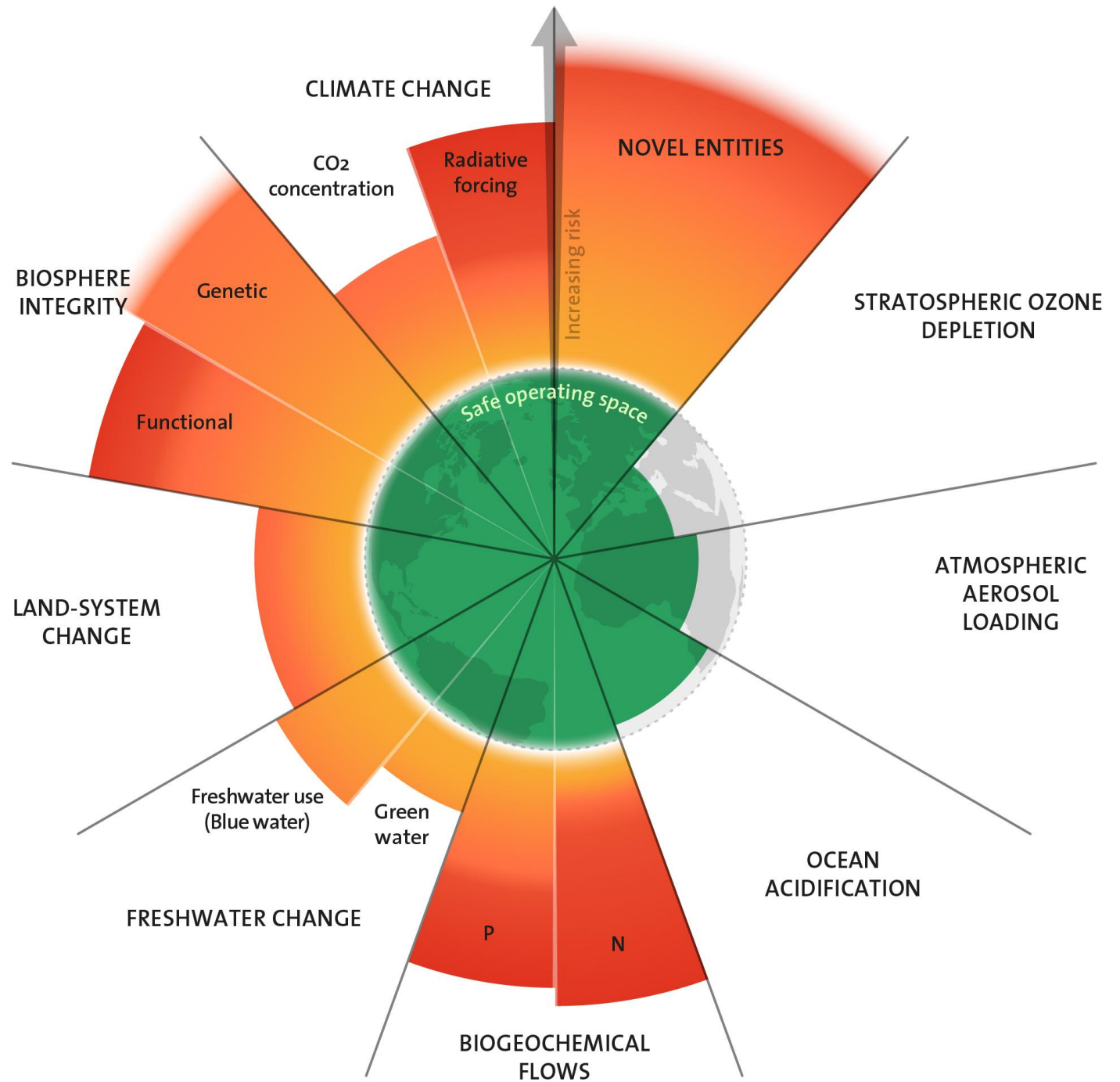
RISK2050 Study

The physical risks for the economy and its vulnerabilities

University of Luxembourg

Prof. Dr. Gilbert Fridgen, Prof. Dr. Joachim Hansen, Prof. Dr. Nils Löhndorf,
Prof. Dr. Benny Mantin, Dr. Laura Palacios Argüello, Sergio Pontenciano Menci, MA,
Prof. Dr. Christian Schulz, Prof. Dr. Emma Schymanski,
Prof. Dr. Susanne Siebentritt, Dr. Silvia Venditti, Kristin Zlatanova, MA

Planetary Boundaries



Physical Risks

Climate Change



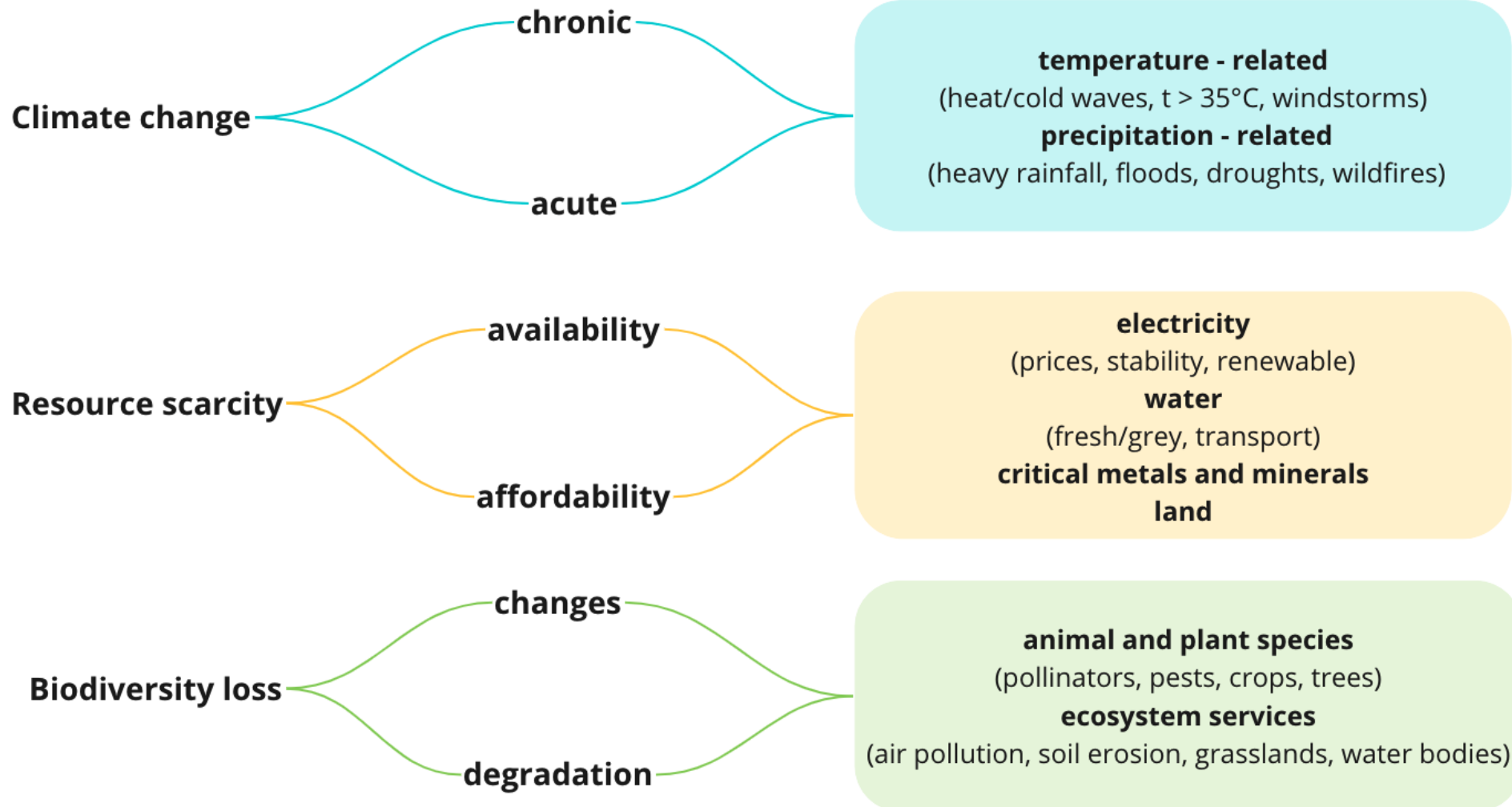
Resource Scarcity



Biodiversity Loss



Scope of the Study: Physical Threats



Scope of the Study: Economic Sectors

Productive

Industrial Manufacturing

Construction

Wood and Forestry

Food Processing

Supportive

Energy

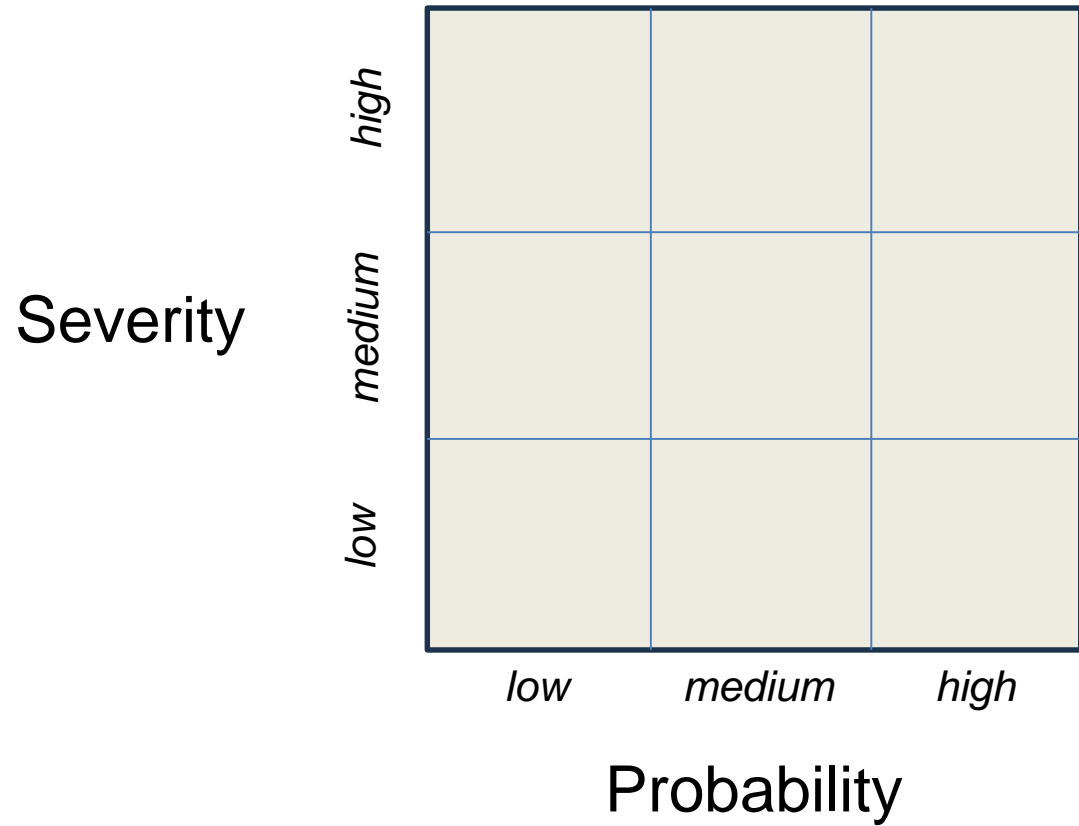
Transportation and Storage

- Step 1: Identify the most pertinent physical risks for Luxembourg
- Step 2: Assess the risk awareness
- Step 3: Identify most urgent needs and derive policy recommendations (ongoing)

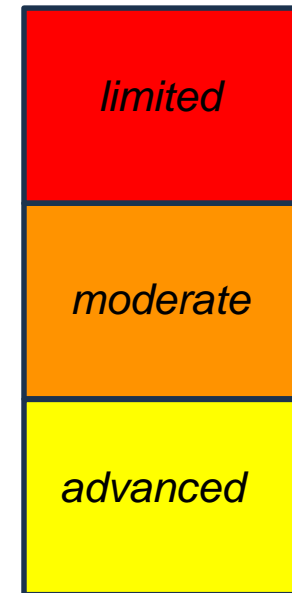
- **Review** of scientific literature, country reports, sectoral studies etc.
- **5 Focus Group Workshops** with local stakeholders from different industries and organisations (n=29)
- Semi-structured **Interviews** with firms, business associations, national and local authorities (n=21)
- Online **Survey** for Luxembourg based enterprises (n=39)
- Reflective Stakeholder **Workshop** (n=16)



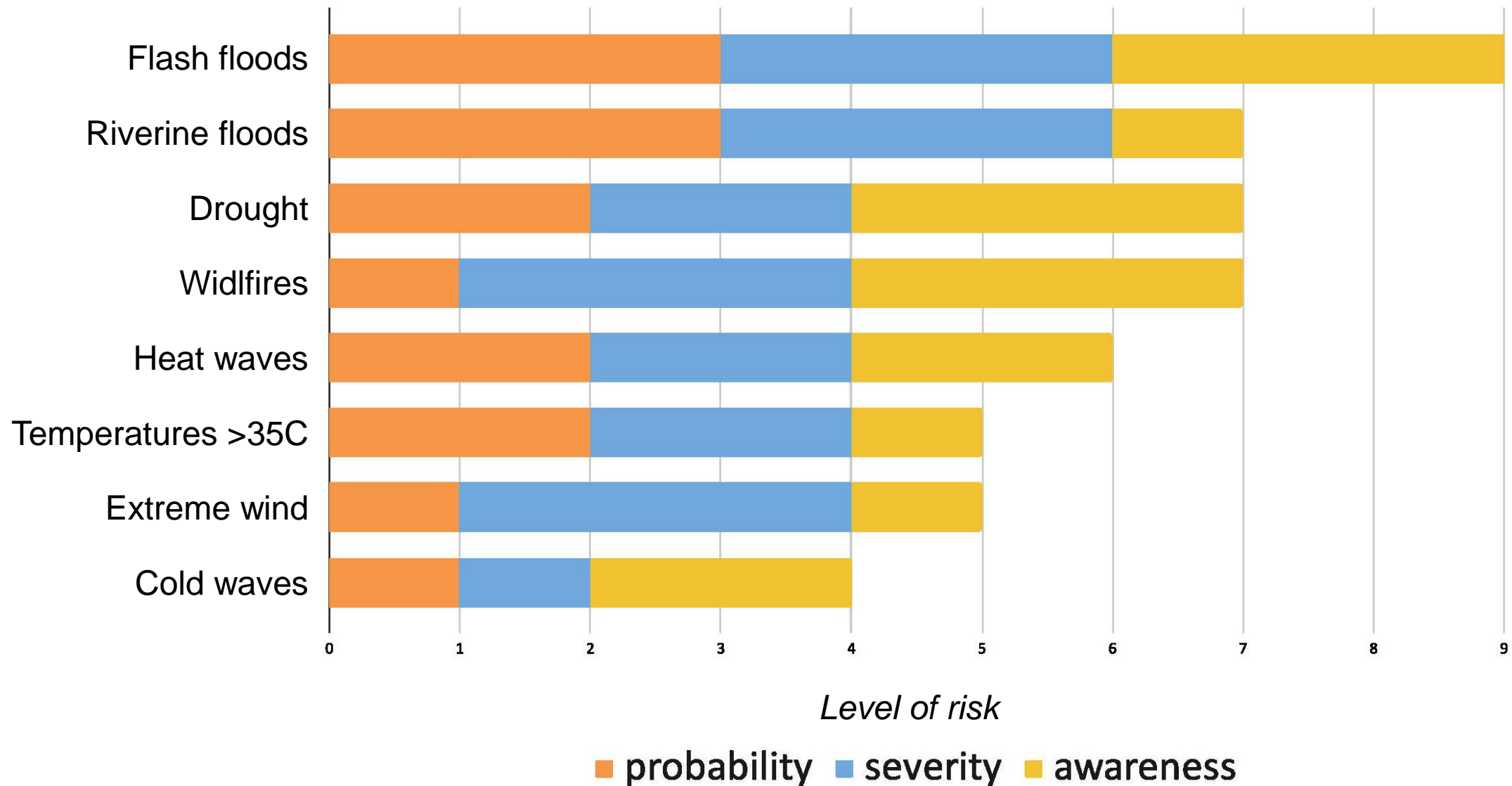
Risk Assessment



+ Awareness



Risk Assessment: Climate Crisis



Risk Assessment: Climate Crisis

Flash floods

River



Tempera

Ex



Level of risk

■ probability ■ severity ■ awareness



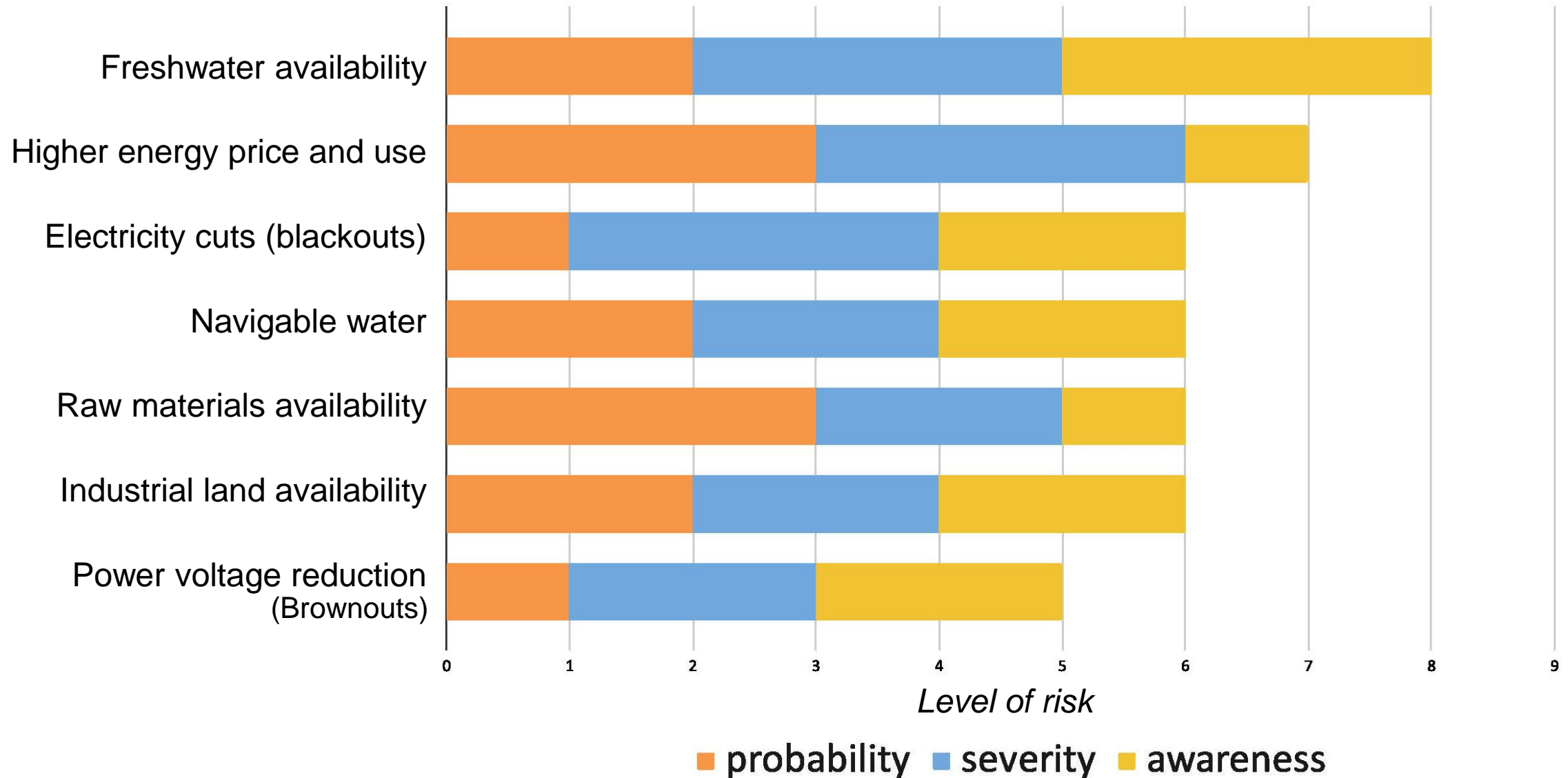
file d'impression: 13/09/2023 09:14

		Flow velocity			
		< 0.2 m/s	0.2 - 0.5 m/s	0.5 - 2 m/s	> 2 m/s
Water depth	4-10 cm	moderate	moderate	high	high
	10 - 40 cm	moderate	high	high	very high
	40 - 100 cm	high	high	very high	very high
	> 100 cm	very high	very high	very high	very high

Water surfaces

Adapted after LUBW (2019): Kommunales Starkregenrisikomanagement in Baden-Württemberg. Anhang 6

Risk Assessment: Resources



Risk Assessment: Resources

Freshwater availability



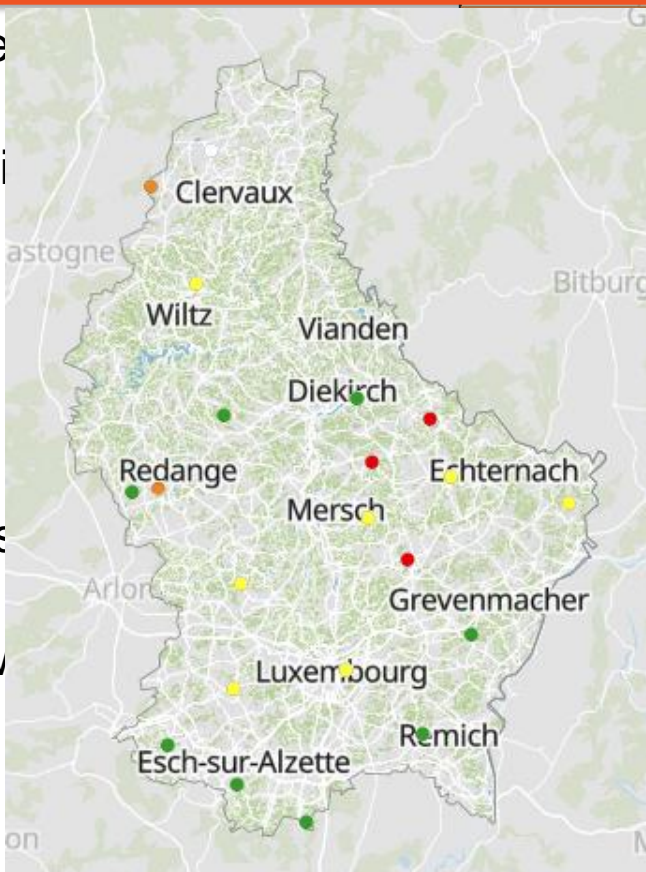
Higher e

Electri

Raw

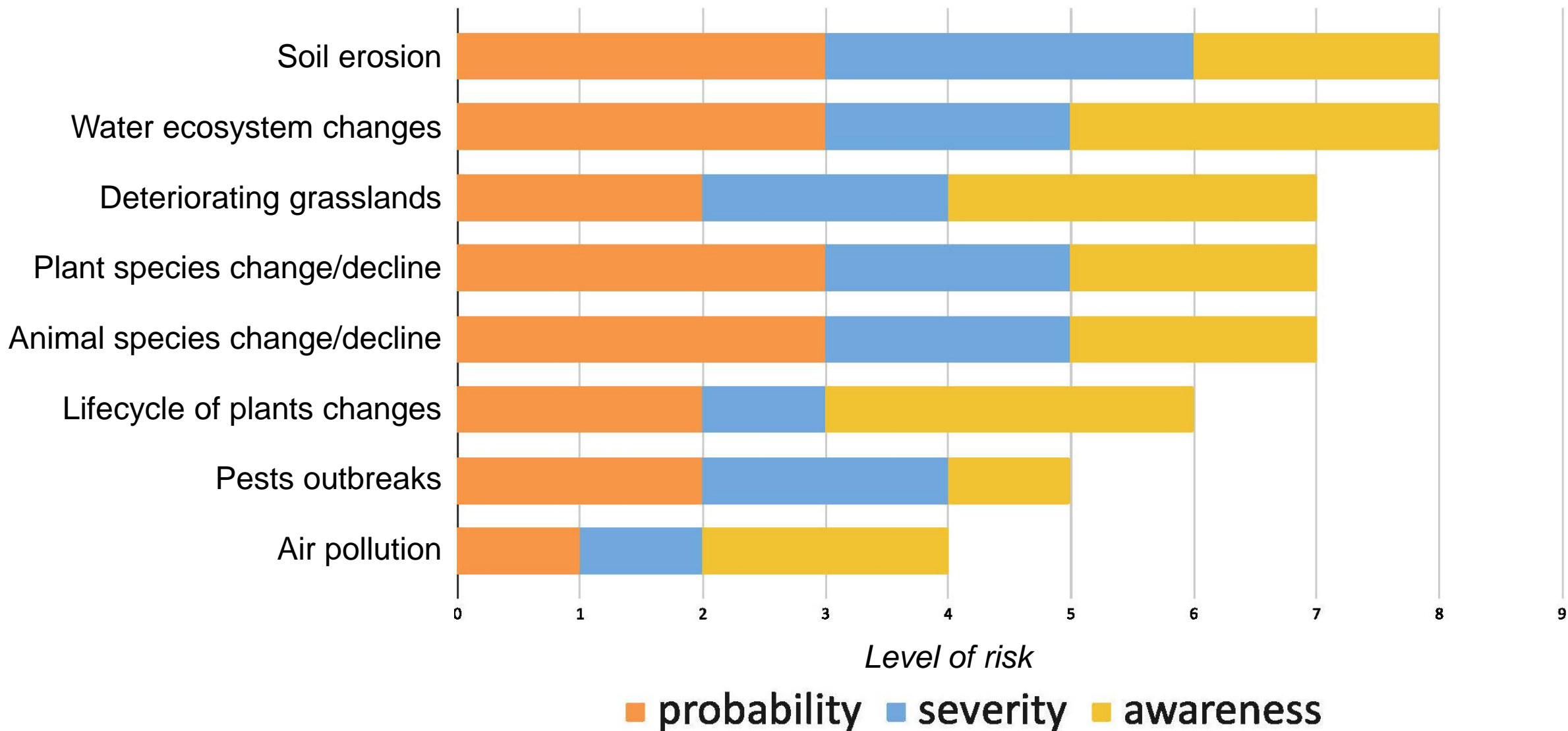
Indus

Pow



■ probability ■ severity ■ awareness

Risk Assessment: Biodiversity



Risk Assessment: Biodiversity

Soil erosion

Water ecosystem changes

Deteriorating grasslands

Plant species change/decline

Animal species change/decline

Lifecycle of plants changes

Pests outbreaks

Air pollution



Preliminary conclusions

- Mismatches between risk level and actual awareness
- Overshadowed by Ukraine war (energy, supply chains) and labor market situation
- Biodiversity related risks underrated / overlooked
- Demand for regulation

Recommendations (*work in progress*)

- Awareness raising measures
- Address sources of threats where possible
- Develop a simple self-assessment mechanism to initiate action by companies to realize exposure points within their businesses
- Map the logistics infrastructure/network: needed to obtain clarity as to where are the weak points on a national level
- Increase adaptive capacity (e.g. through diversification)

Further Research Needs

- In-depth investigation into actual vulnerability of firms (including 'preparedness' level)
- Larger sample / extend to other sectors

For further information

Final results of RISK2050 study to be published this autumn:

- Comprehensive project report (incl. executive summary)
- Summarising video



Available to public at:

<https://luxstrategie.gouvernement.lu/fr/publicationsbis/risk2050.html>

La grande accélération

The Great Acceleration of the Exponential Era

Hans van der Loo

Chairman, Institute for Integrated Economic
Research (IIER)



IIER

www.energyandstuff.org

3^{ème} Conférence Luxembourg Stratégie
La Vision stratégique ECO 2050

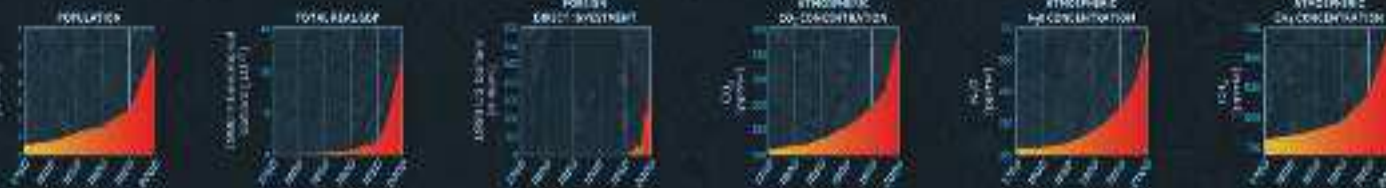
The Great Acceleration of the Exponential Era

Hans van der Loo

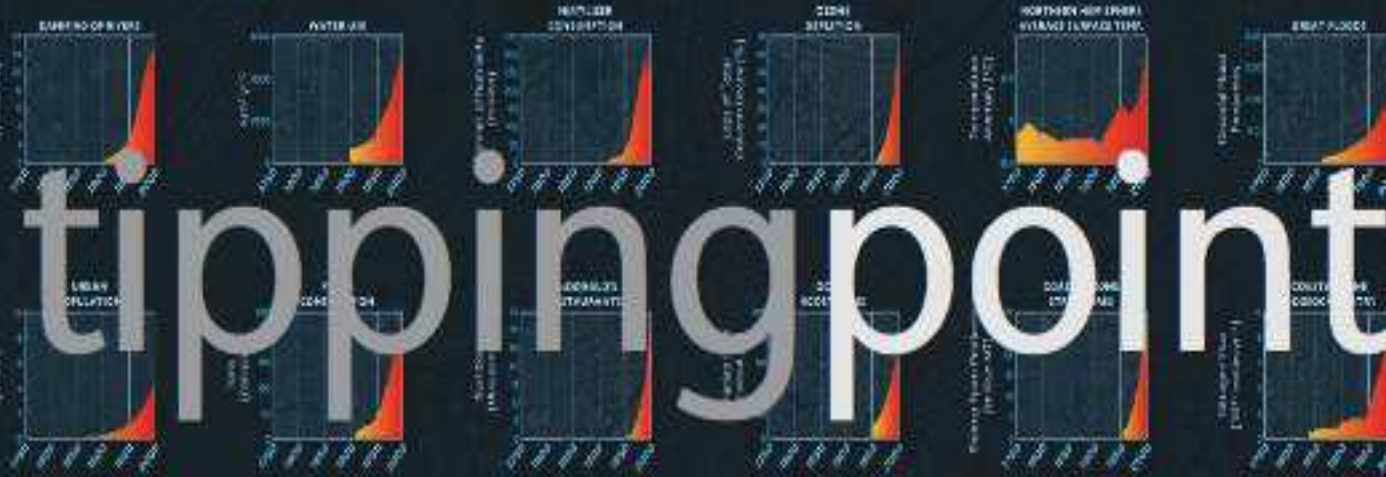
Chairman Advisory Board

Institute for *Integrated* Economic Research

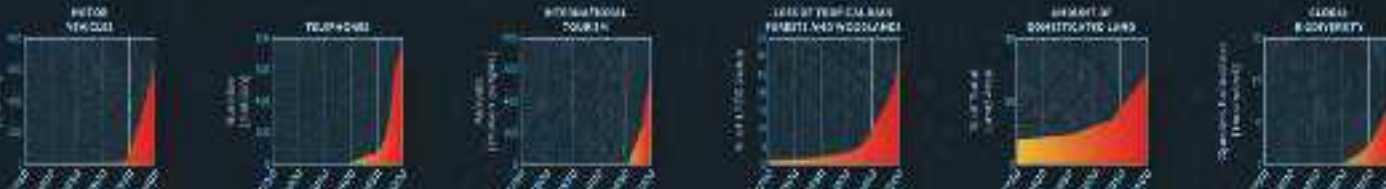
Esch-Belval, 26. September 2023



Today the Dashboard of Spaceship Earth looks like this



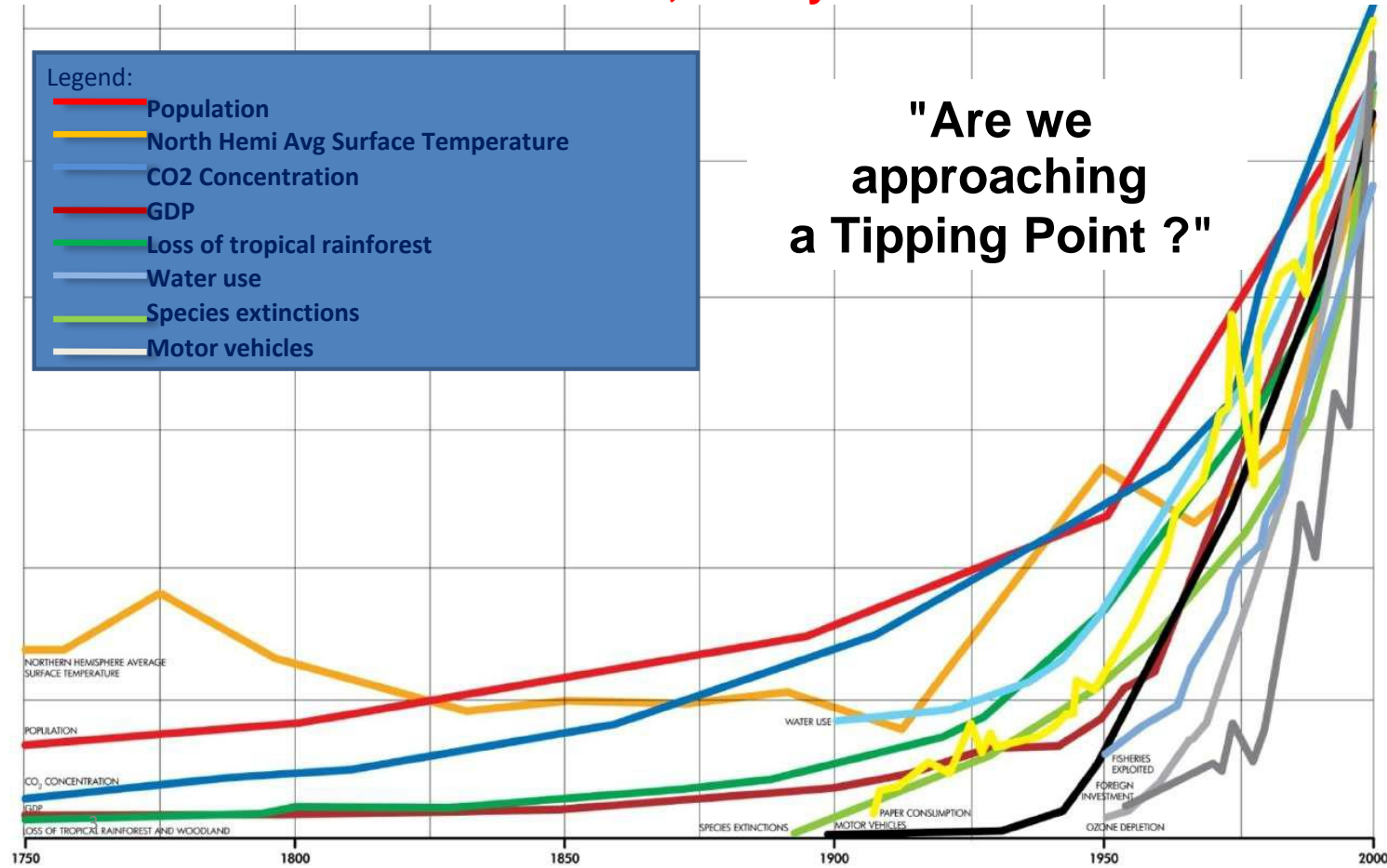
Houston, we've got a problem !



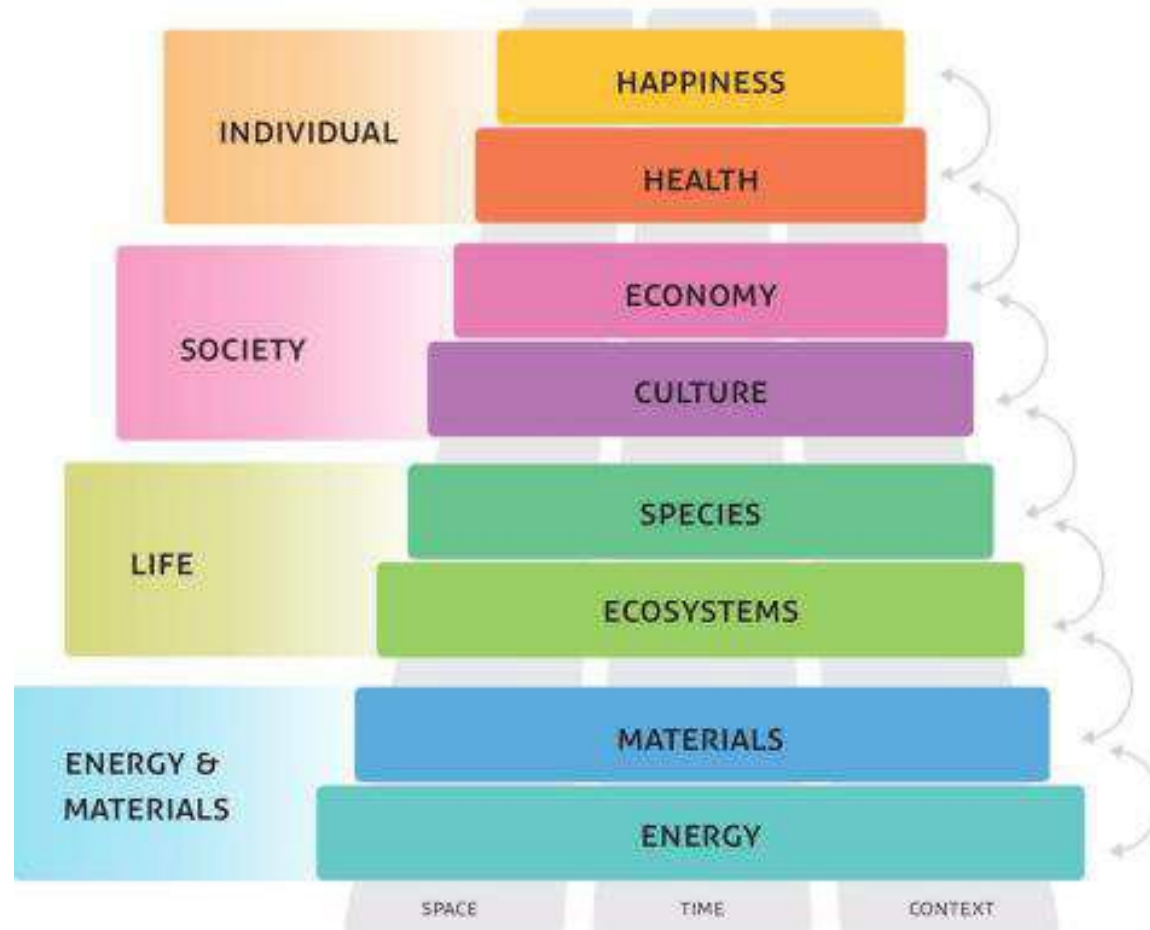
The Fundamental Change of The Great Acceleration

However, J-curves only exist in theoretical mathematics

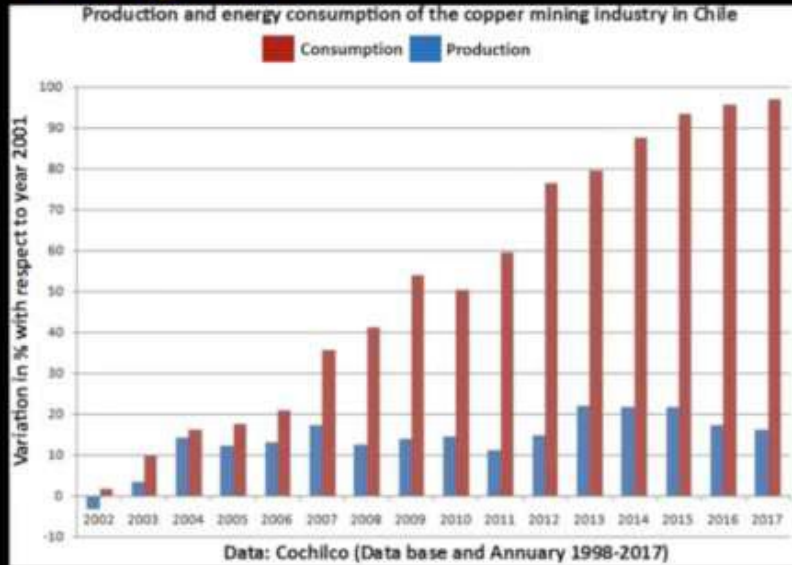
On a Finite Planet, Infinity can not exist



Energy & Materials are the Foundation of Society as we know it



energetic Remoteness



The phenomenon by which everything in society gets more costly or more difficult as energy costs go up

Natural Resources is getting exponentially more difficult

+

Energy Itself also getting exponentially more difficult

=

Exponentially ²

The 'Double Whammy' of the Resource Wende Challenge

Is not about **Availability** but **Accessibility**

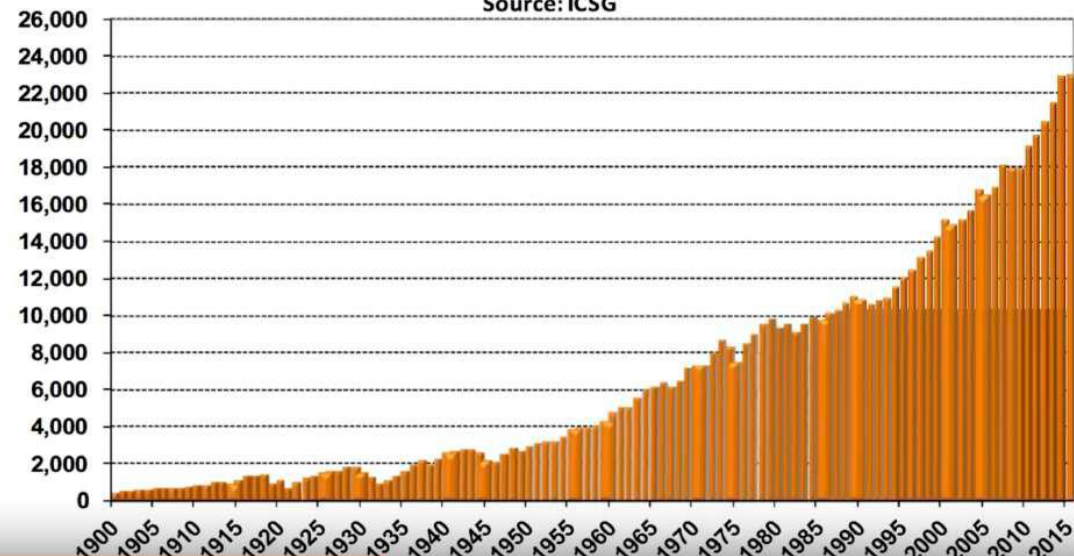
OR

Not **Physical Presence** but **Energetic Remoteness**

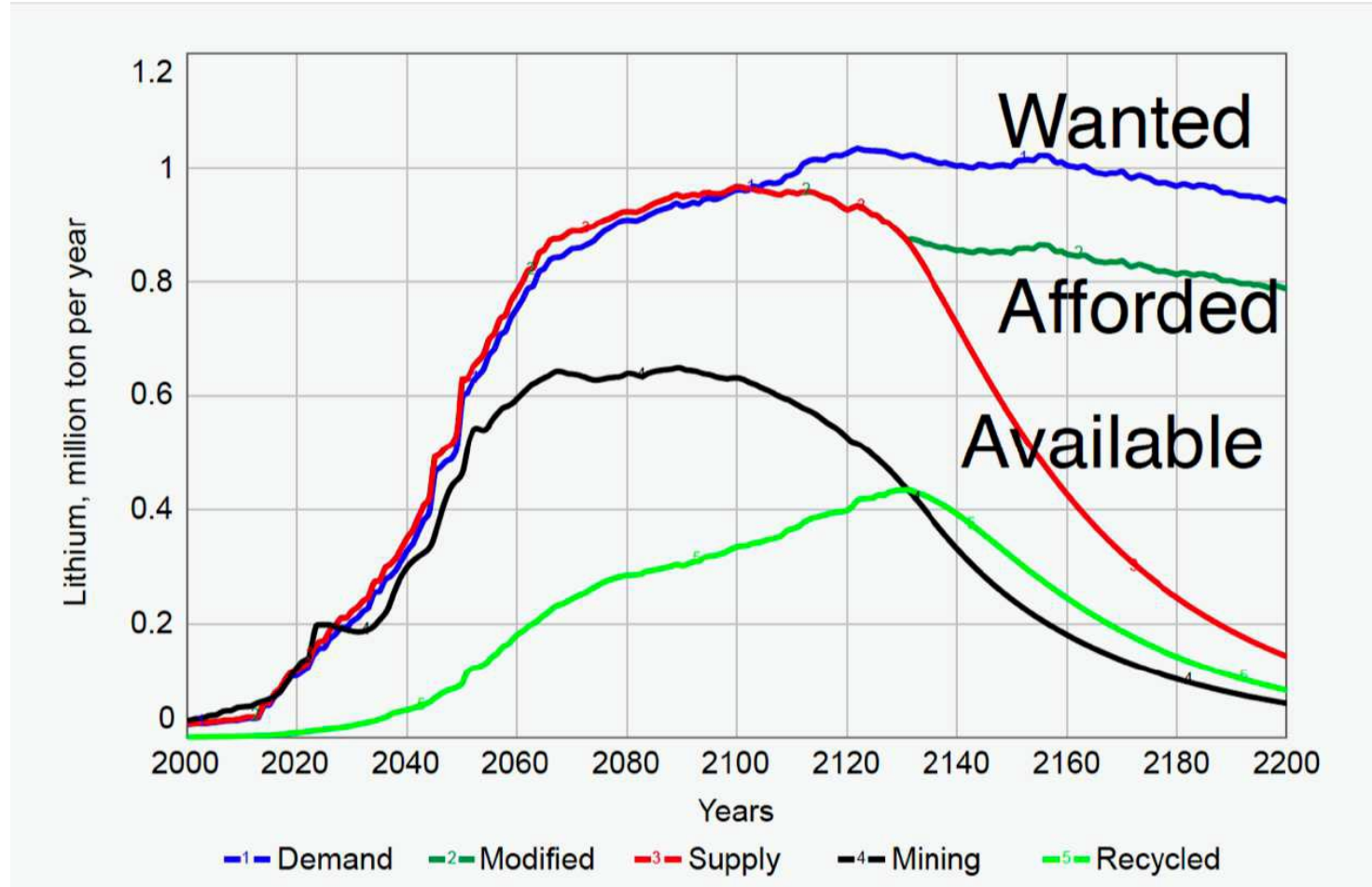
World Refined Copper Usage, 1900-2015

Thousand metric tonnes

Source: ICSG



Impact of declining **ore densities** : First higher prices will curtail what we **want** to what we can **afford**.
As soon as 'unavoidable losses' will exceed 'new virgin resource', even what can be afforded will be curtailed by what is **available**.
Increasing recycling AND extending Longevity - by slowing the 'recycling cycles' - is a form of Redundancy & Resilience



Marginal cost is irreversibly growing

Off-setting **marginally decreasing** 'efficiency, scale & technology improvements'

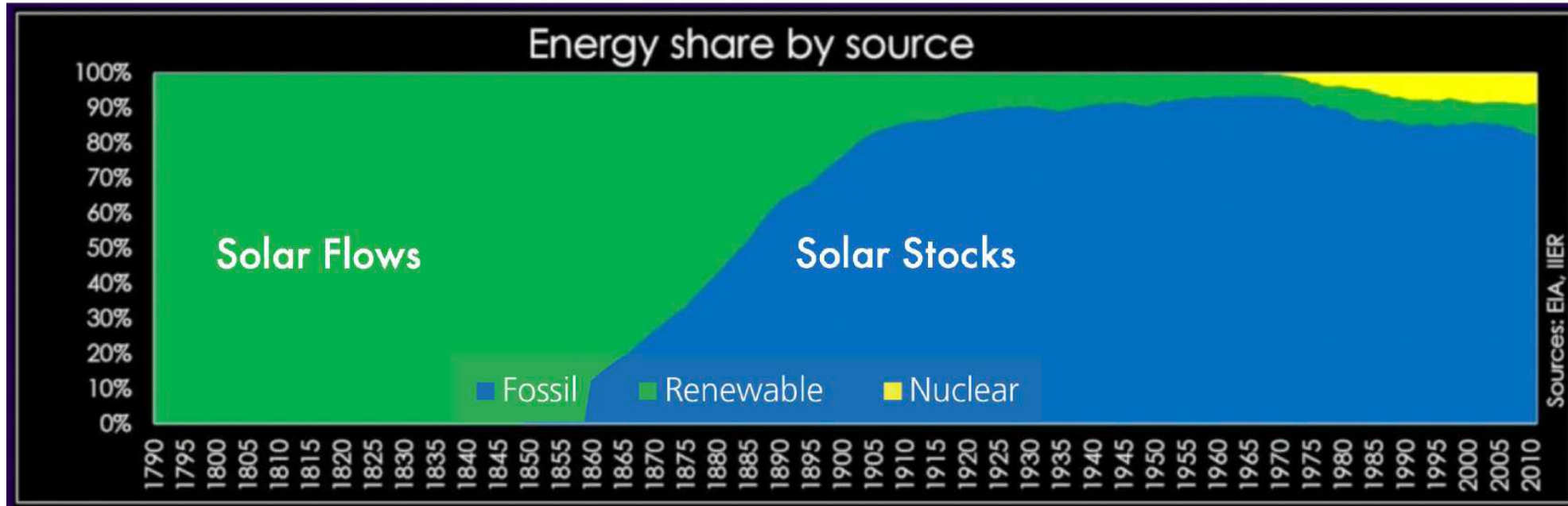
In most production environments, we are used to constantly shifting price curves, leading to lower and lower cost for goods, based on improvements in technology and efficiency.

For resources requiring extraction, the pattern is different. After the easy finds have been used and extraction technology has matured, cost only goes up.

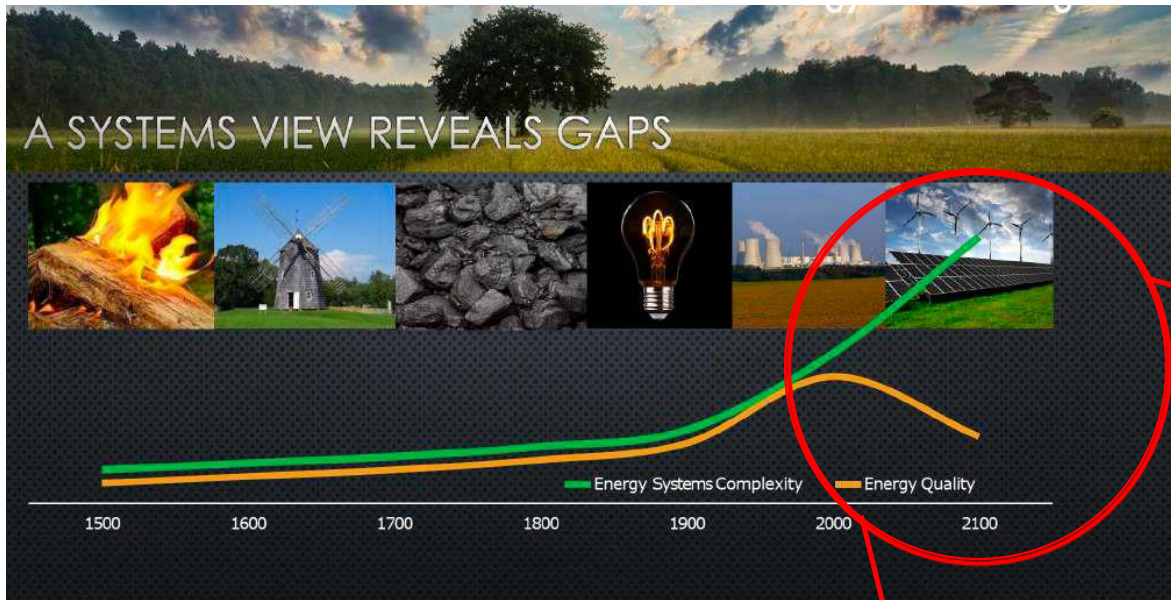


Life in the Temporary Carbon Pulse

From **Solar Flows** to **Solar Stocks** and back again!



SURPLUS energy shaped the **PHYSICAL world** around us. But also our **economic THEORY** and our **future EXPECTATIONS**.



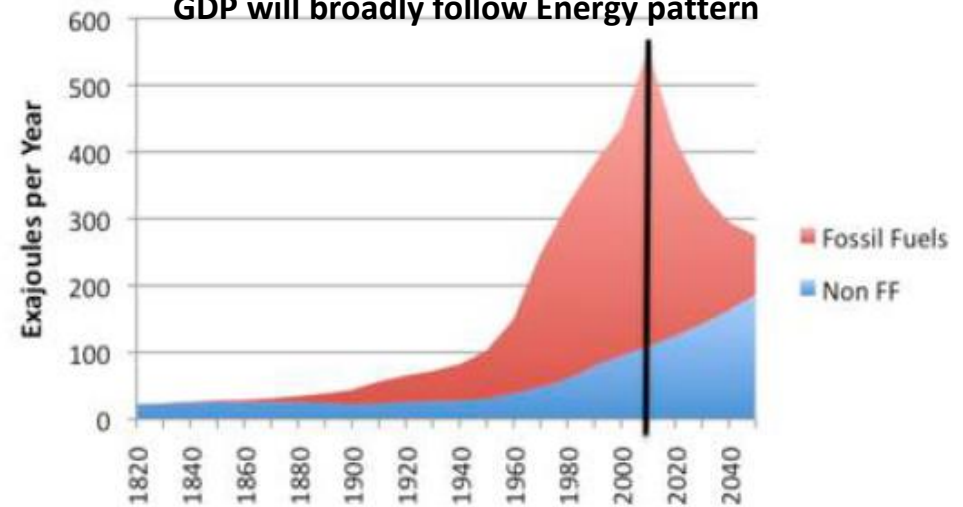
**Poorly understood
energy reality**

The Sun shines for free
making it usable is not

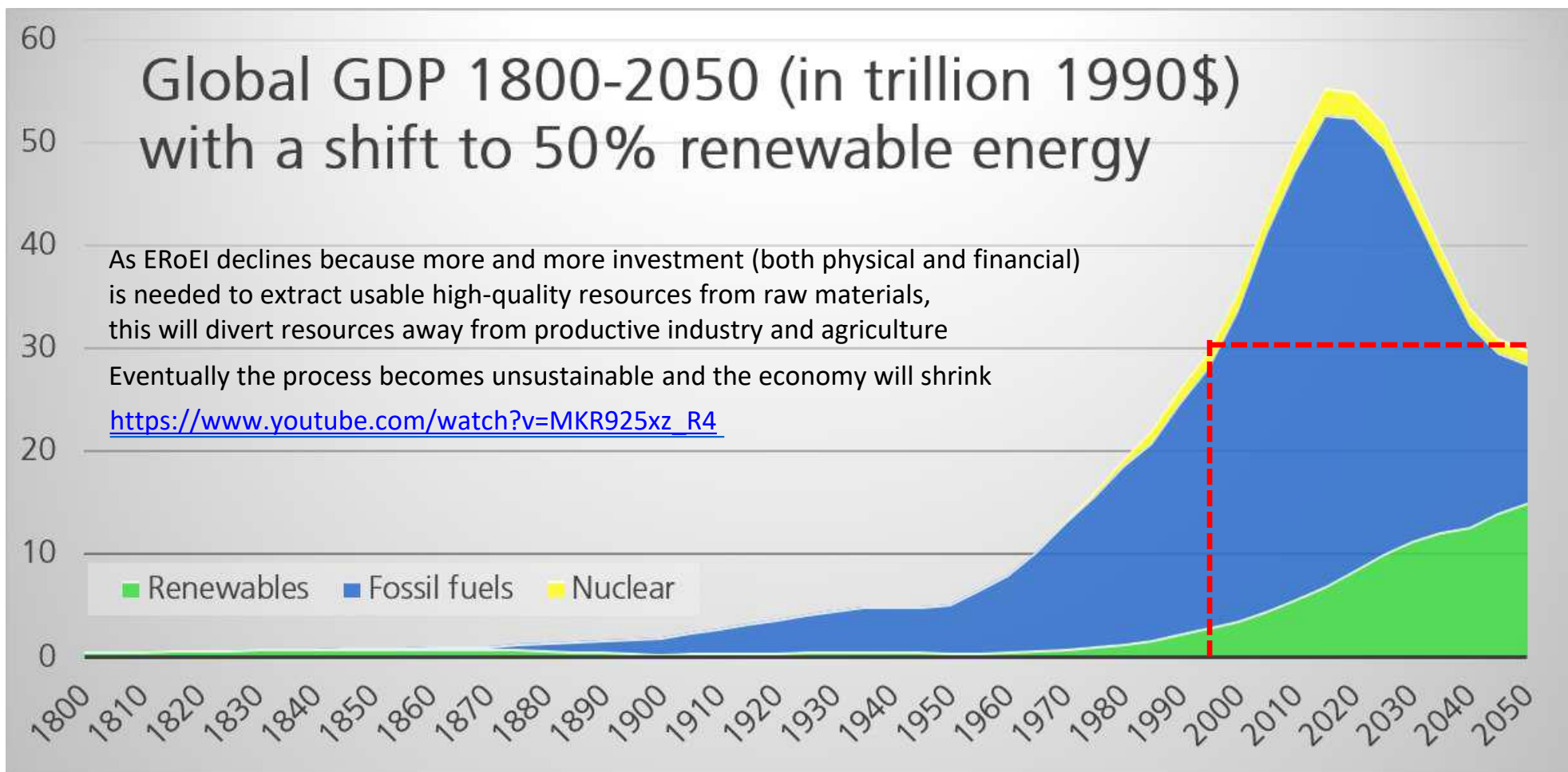
Solar STOCKS ↔ Solar FLOWS

- Energy Quality (caloric value) is decreasing
- Energy System Complexity is increasing
- Mind the Widening Gap !
- Renewables very metal resources intensive

Forecast of World Energy Consumption
GDP will broadly follow Energy pattern

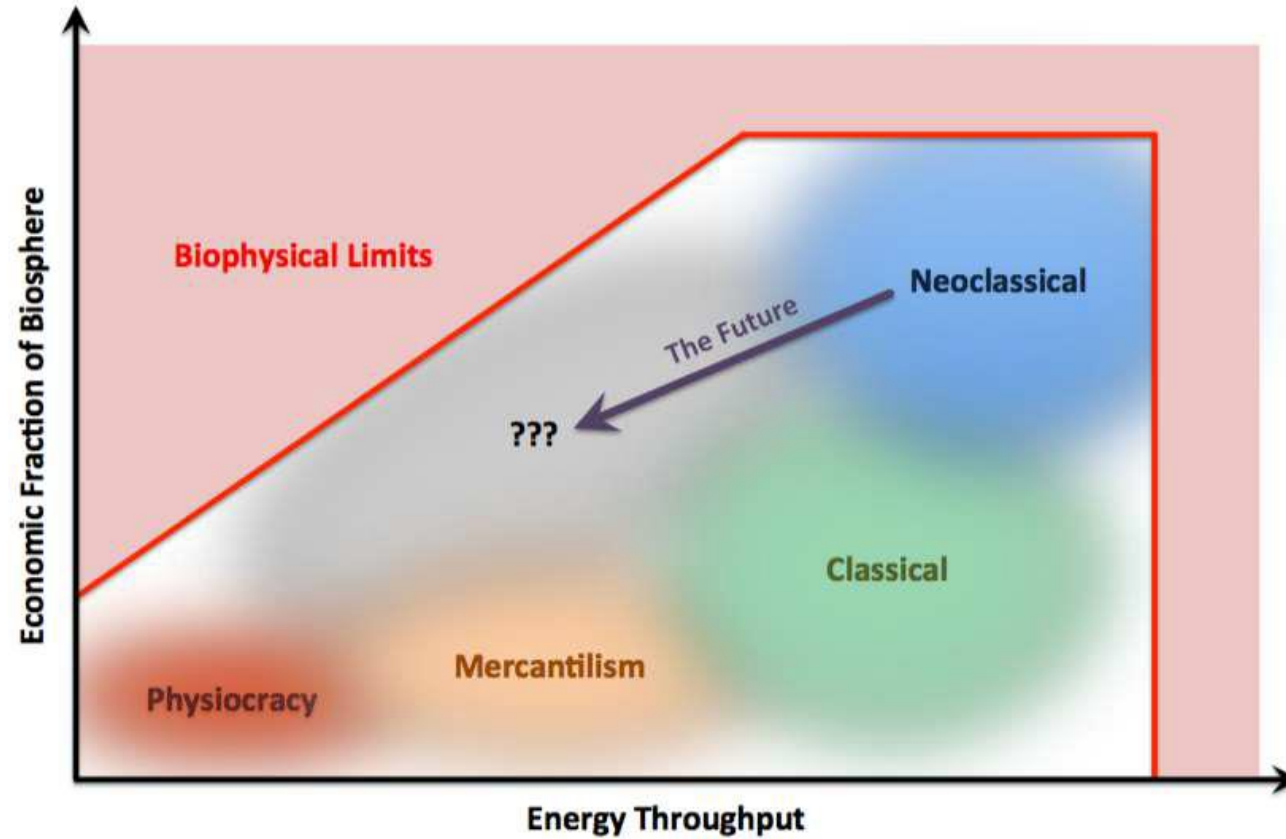


**Davos Consensus for 21th Century: long term 2% growth (=doubling in 35yrs)
This assumption is wrong by a factor of FOUR not 2x bigger but halving in size**

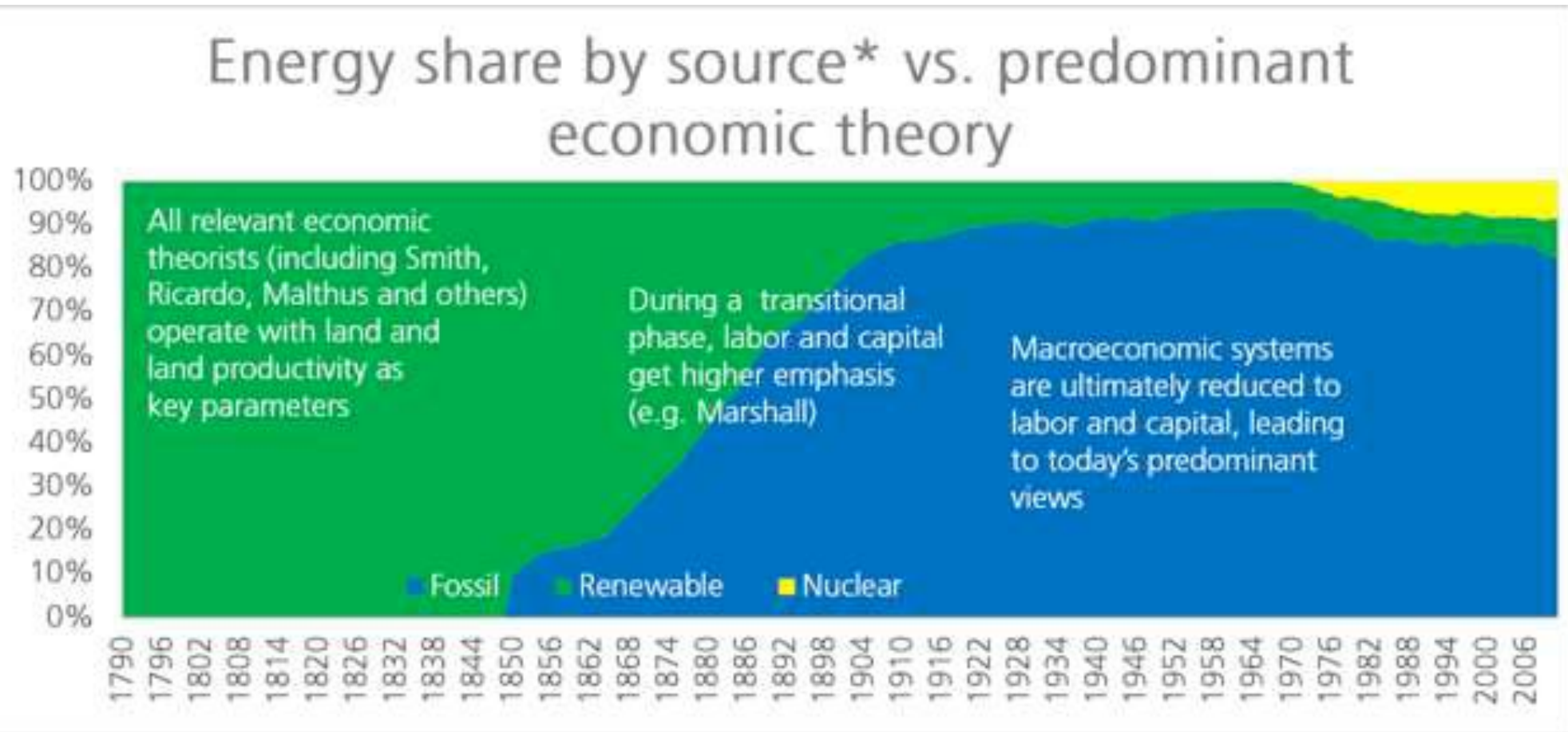


With less energy it will be difficult to grow GDP.
Hence the fraction of the 'Economy' (= biosphere managed by humans) will shrink

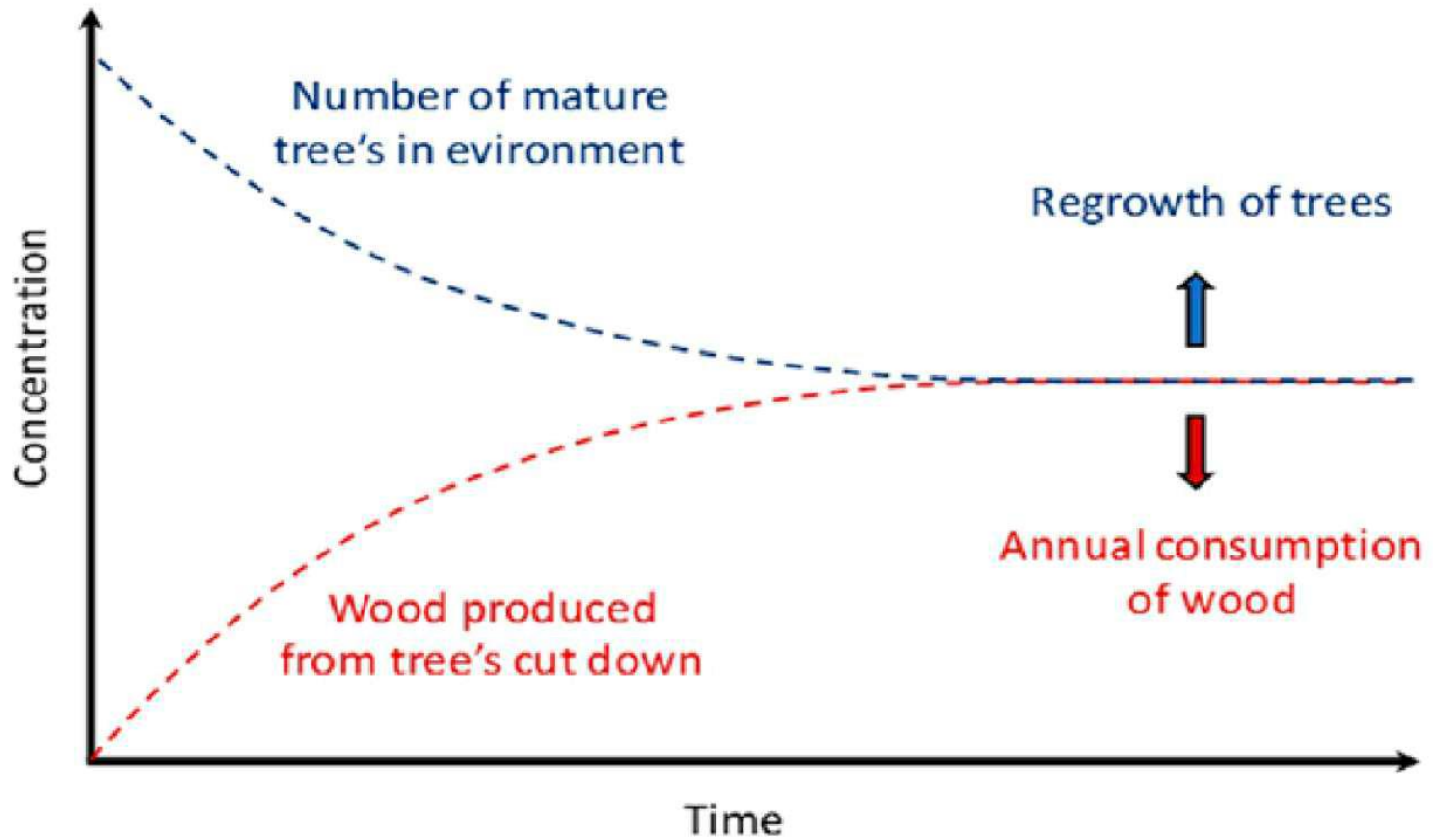
Domains of Validity in Economics



**Prevailing economic theories follow the Energy Mix.
Our Energy supply influences our perception of Reality**



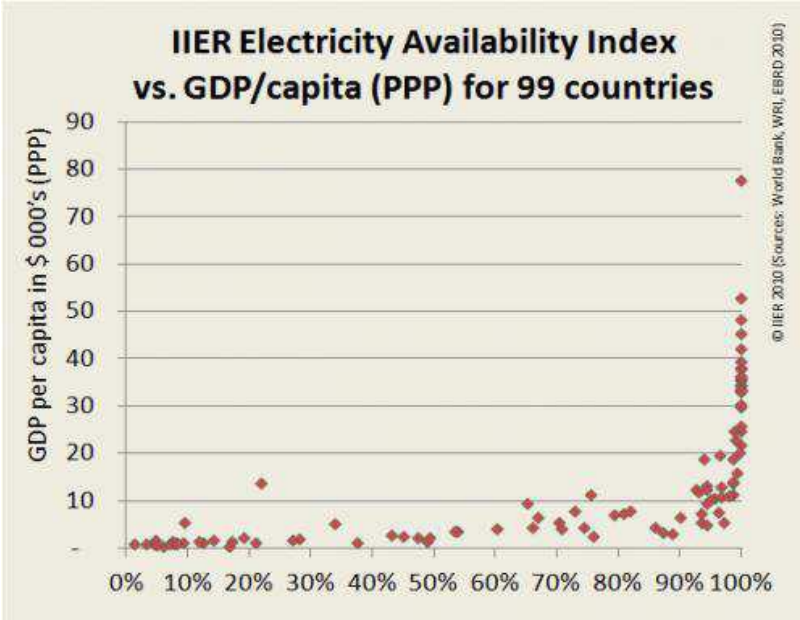
Simple example of a Resource Balanced System
New economic theories will focus on efficiency & **sufficiency**



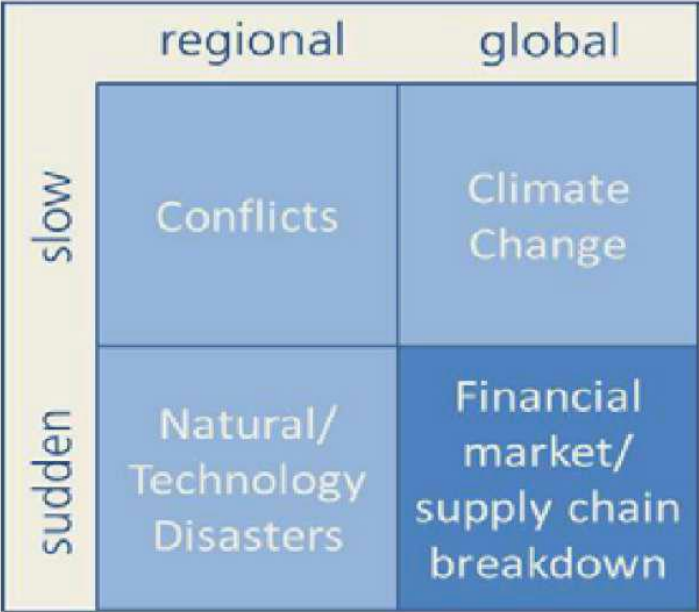
Our economy has become a **sophisticated ‘high wire’ act** of ‘just in time delivery’, ‘near 100% reliability’ & ‘integrated systems’. Efficiency has driven out ‘costly redundancy’. But vulnerability for interruptions/disruptions have increased considerably. Most disasters are regional and can be limited or resolved from an **‘in-tact back-up area’**. But a few unfortunate accidents (Suez canal) or wrong decisions can have the potential to cause global disruptions. The consequences of a **‘supply chain breakdown’ or financial system crisis** has the potential to become humanity’s greatest nightmare.

COVID weakend the system with debts, exhaustion and declining trust levels, weakening resilience to overcome another crisis.

Currently the biggest risks get the least attention !



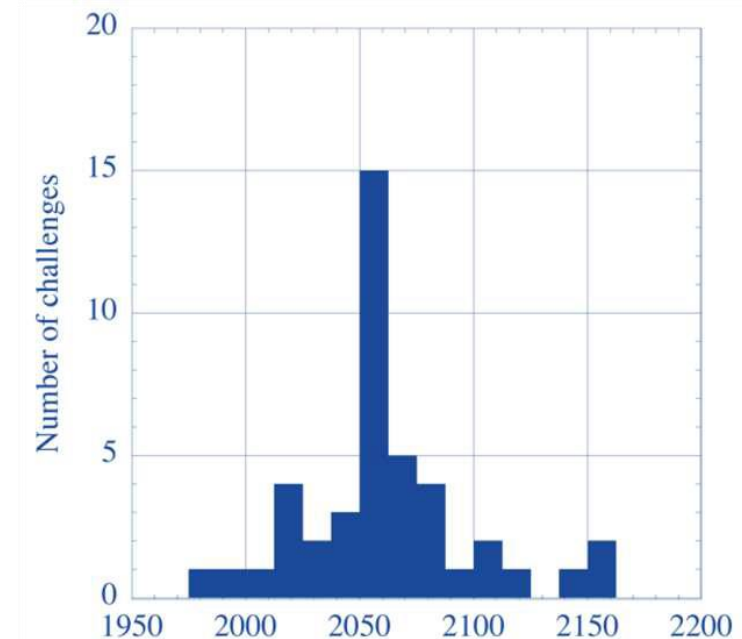
High GDP only possible when high proportion of population can dispose over almost perfectly reliable energy supply



Currently the biggest risks get the least attention.

Congestion of Challenges and the effect of the Russian War on neighbours make redundancy, crisis-preparedness & foresight essential

- Resource crisis come earlier by a decade
- The geopolitical process has changed
- The awareness within business, politics and society that
 - Resources are crucial for quality of life and subsistence in society
 - Need our utmost attention to prevent economic, ecological, geopolitical and human disruptions.
 - Shortages are already ongoing and are problematic in industry, business and society
- Solutions must be implemented 10-20 years before the crisis hits



We are about to enter the
3rd Decade of the 3rd Millenium
Our Most Critical Decade

Limits to Growth Recalculated

*with 21st century
 supercomputing power*

Note Accuracy

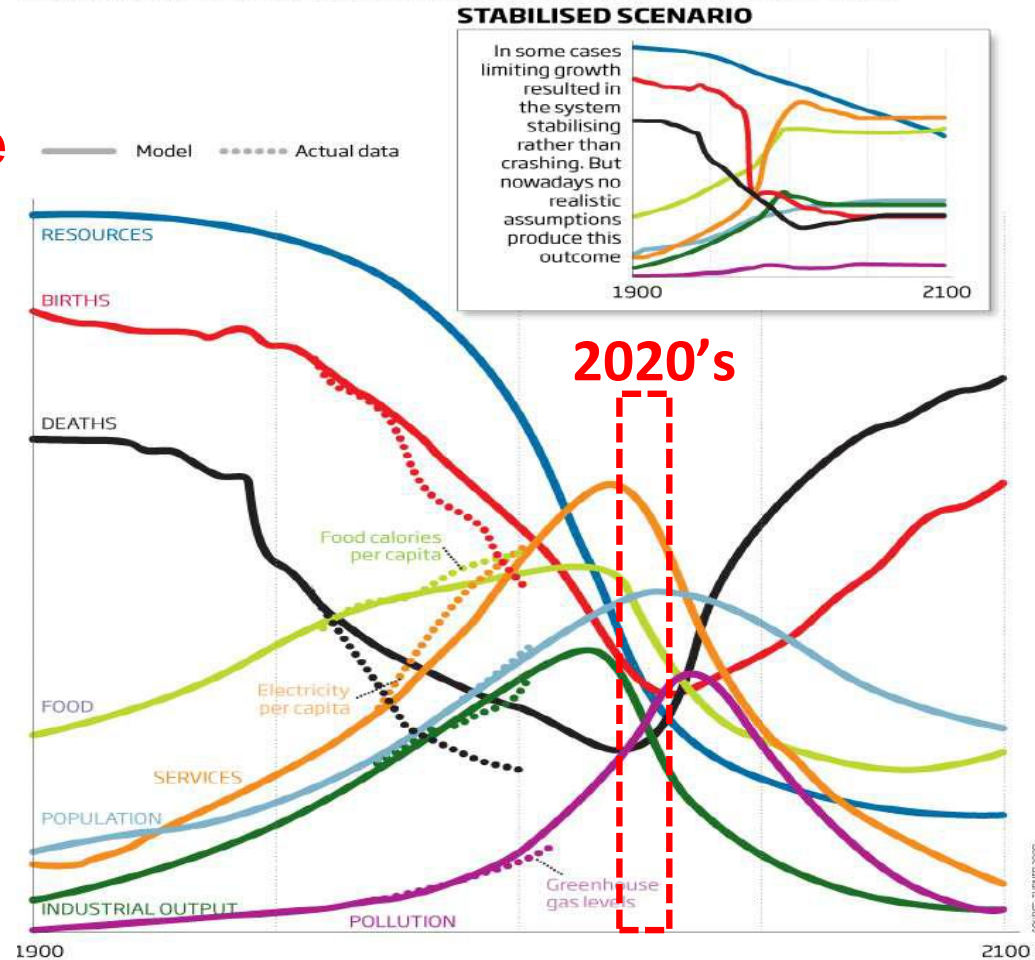
vs
Actuals to Date

Published in NewScientist in 2012

Boom and bust

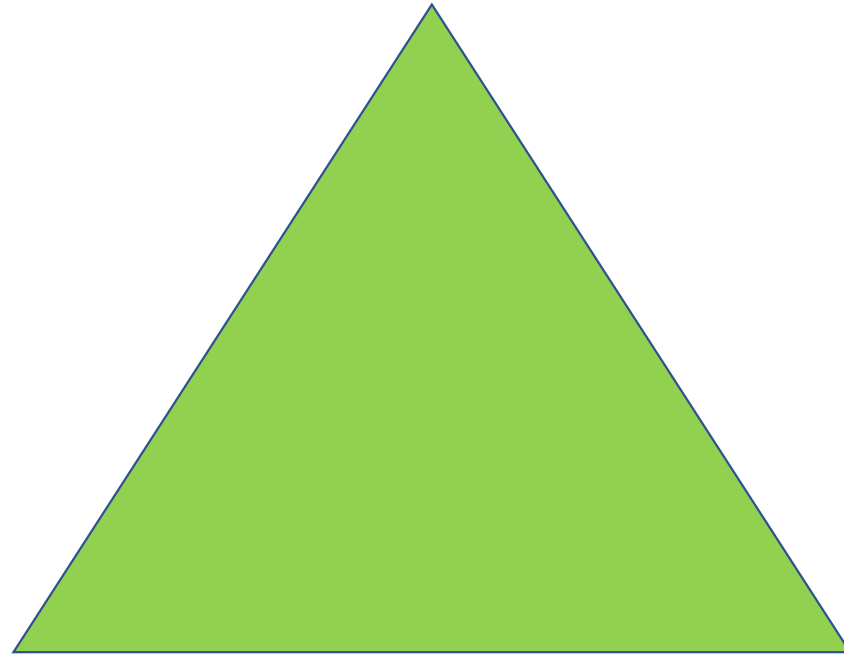
In most runs of the World3 computer model, rapid growth is followed by sharp decline. So far the standard run (main graphic) corresponds well with measurements of real-world equivalents (dotted lines)

©NewScientist



Resilience

- Civilization
- Peace



Resources

- Materials / Storage capacity
- Immaterial (e.g. Talent)

Redundancy

Growing Skills-Mismatch

Talent for Futureproof Europe

Skills mismatch : 23% youth **unemployment** (in some MS over 50%). Yet 2 mio **vacancies** of which 900.000 in ICT. If Europeans can not fill these vacancies, the “innovation, growth and jobs” will go abroad

Share of pupils in upper secondary education choosing STEM is declining in large part of EU and OECD

One in Five 15 year old + 75 mio adults in EU can not read or write (on tot pop of 500 mio)

We are living in an **exponential era**, in which both **challenges & required competences** will rapidly **change** and will be **materially different**
Systemic Thinking & Cope-ability



Nobelprize winners in **2063** ?
How can we help them **NOW** ?

Making Education Future- & Reality- proof is a Non-Regret Option to strengthen Resilience



Education :

- **Enabler** of innovations & solutions
- **Source** of Insight & Understanding for necessity of
 - Acceptance of faster introduction of more new technologies
 - Impact ABC : Actions, Behaviours, Choices on our eco-system
- **Basis** for competitive position in the world and for future wellbeing of human mankind.

Strong Talent Pipeline should become a Strategic Priority :
because Education will shape our Future !

TALENT

Weapons of Math Instruction

US STEM Education Coalition

A National Priority

- STEM education must be elevated as a national priority.
- Our nation's future economic prosperity is closely linked to student success in STEM.
- The U.S. must expand the capacity and diversity of the STEM workforce pipeline.
- Policymakers at every level must be informed about policy issues related to STEM.
- Effective policies to promote STEM education should be bipartisan & evidence-based.

RESOURCES

TECHNOLOGY

<http://www.stemedcoalition.org/>

ENERGY

Foresight & Scenarios:

'internally consistent, possible futures with plausible links to the present'

Economics vs. ecosystems science

Economic science ^{tlsw} ~~x~~

- Simplified models
- No integration of natural science
- Looks at recent history (200 years)
- Little to no interconnection between elements
- No/weak feedback loops outside supply/demand view
- No inclusion of breakpoints

Ecosystems science

- Complex systems
- Integrates physics, chemistry and biology
- Includes long-term human ecosystem history
- Highly interconnected components
- Strong feedback loops
- Systemic failure risks accepted and integrated

In reality, our human economic system is nothing but a (very complex) ecosystem with many more parameters

Antarctica is a huge continent
1/35 of all oceans

Highest average height of 2000m

Peaks of 4500m



Every 35m ice that melt on Antarctic
→ equals 1m sea-level rise

Avg 2000m thickness means :
→ potential to add 70m sealevel rise

An example of what can be done to tackle the Climate Change Overheating SYMPTOMS provided measures to tackle the CAUSES of Climate Change are taken.

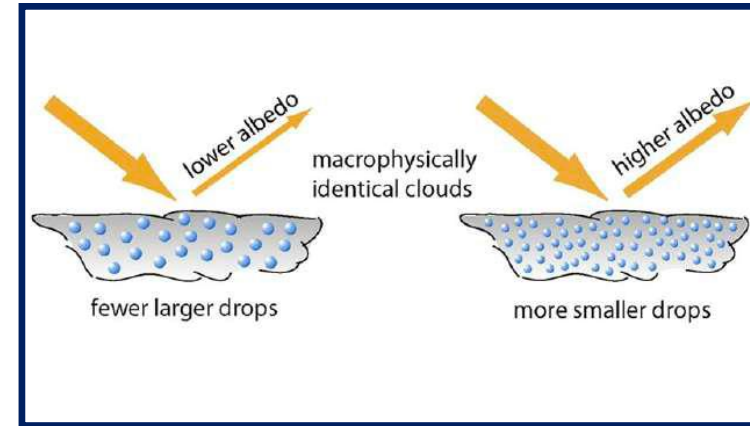
To 'buy time' to overcome the 'time to impact' period of the necessary measures.

MARINE CLOUD BRIGHTENING MECHANISM

Cloud Condensation Nuclei (CCN) from ships' chimney exhausts create smaller cloud droplets, resulting in whiter clouds
(Twomey 1977)



Use sea salt nano particles as CCN to reduce marine cloud droplets, resulting in whiter clouds
(Latham 1990)



La transformation économique

La diversification économique dans la Vision stratégique ECO2050 pour l'économie luxembourgeoise des 30 prochaines années

Pascale Junker
Chargée de direction, Luxembourg Stratégie

La diversification économique

du point de vue de la prospective stratégique – Vision ECO2050

Conférence Luxembourg Stratégie
Esch-Belval, le 26 septembre 2023

Plan

- 1) Contexte et approche de la prospective stratégique
- 2) La Vision ECO2050 déclinée en 10 briques
- 3) Focus sur la diversification économique (brique #7)
- 4) Conclusions



Contexte de l'étude ECO2050



**Luxembourg
Stratégie**

- ✓ direction du Ministère de l'Économie créé en 2021
- ✓ prolonge l'étude stratégique TIR2050 (J. Rifkin)
- ✓ anticipe l'avenir à moyen / long terme pour mieux investir le présent
- ✓ promeut les outils de prospective stratégique au niveau gouvernemental et entrepreneurial

Principes de base de l'étude ECO2050

- **identifier les risques et menaces** que constituent pour le modèle socio-économique actuel
 - l'augmentation des **inégalités**
 - le **ralentissement de la croissance** (relativement à la zone euro)
 - le **franchissement des limites biogéochimiques**
(climat, écosystèmes, biodiversité, disponibilités de ressources)
- **identifier les opportunités à saisir dès aujourd'hui**
- **renforcer la résilience, l'inclusivité et la compétitivité** de l'économie

Gouvernance de Luxembourg Stratégie

Ministère de l'Économie

Luxembourg Stratégie

Conseil de Gouvernement
(notes pour information / approbation)

Comité interministériel
(réunions de pilotage politique)

Ministère de l'Économie
(concertations internes)

Experts
(consultations & échanges réguliers)

- Comité d'experts nationales & grand régionaux
- OECD Strategic Foresight Unit & Government Foresight Community
- EU Commission Strategic Foresight Unit & EU Foresight Network
- Futuribles International & 4Sing

Groupe de travail technique
(ateliers)

- Ministères & administrations
- Observatoires nationaux (19)
- Fédérations & chambres professionnelles
- Syndicats
- Organisations jeunesse

Dirigeants d'entreprises
(ateliers)

- Entreprises multinationales, petites et moyennes entreprises & start-ups
- Intersectorielles
- Publiques & privées

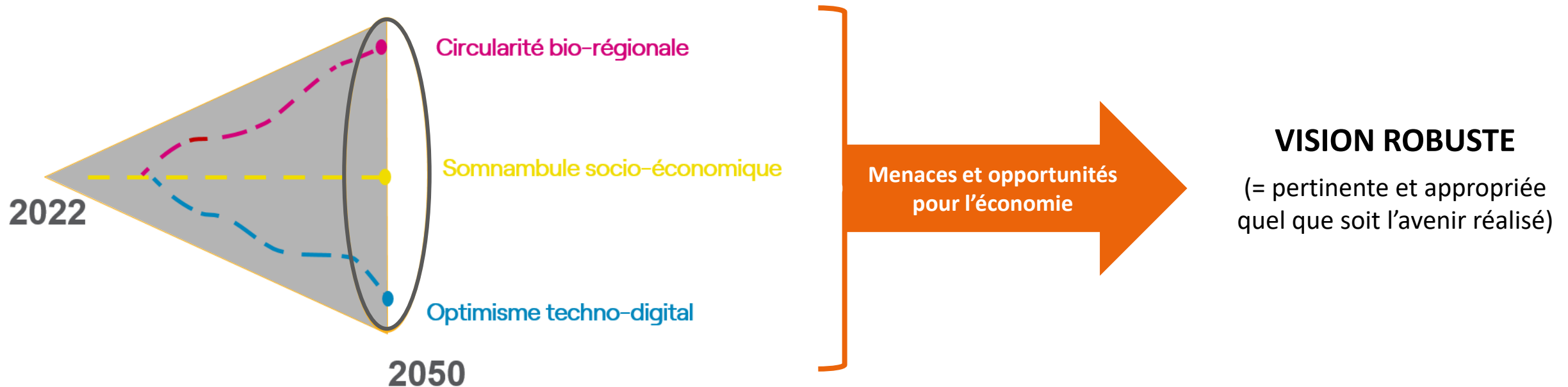
Communes
(ateliers)

- Bureau SYVICOL
- Elus & agents administrations communales

Grand public
(consultations & focus groups)

Approche de la prospective stratégique

- Bien que l'avenir soit incertain, il est possible par une **démarche systémique et rigoureuse** d'en
 - prévoir certaines caractéristiques (en suivant les mégatendances, signaux faibles, innovations)
 - dessiner les contours à l'aide d'un **ensemble restreint de scénarios plausibles**
- Fort de ce constat, la prospective stratégique ambitionne de **dégager une vision d'avenir robuste**



- L'enjeu concret est
 - de faciliter la prise de décision économique aujourd'hui, dans l'intérêt général et des générations futures
 - d'élaborer collaborativement un ensemble de préconisations « sans regrets »

Scénario ≠ Stratégie ≠ Vision

SCÉNARIO – DÉFINITION :

- Les scénarios, au pluriel, concernent l'évolution possible de facteurs hors de notre contrôle
- Les scénarios, imaginaires, ne décrivent pas une situation future désirable et ne sont pas des manifestes politiques
- Les scénarios rassemblent des hypothèses sur la façon dont le monde et le Luxembourg pourraient évoluer d'ici 2050

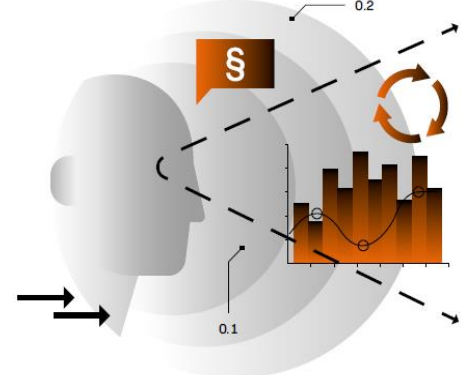
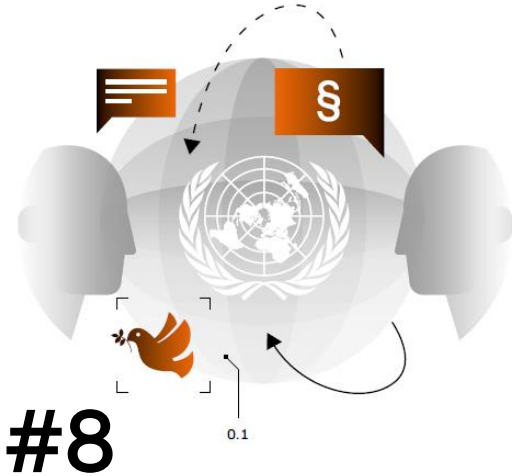
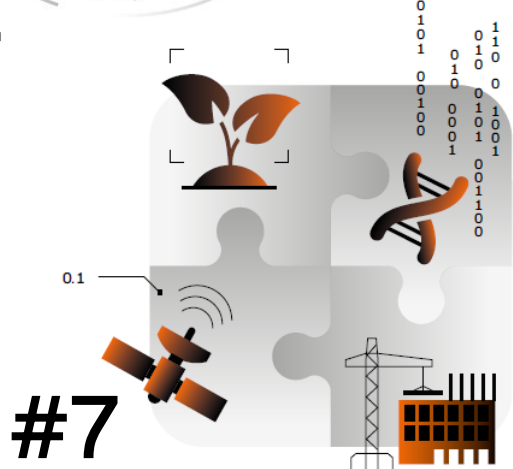
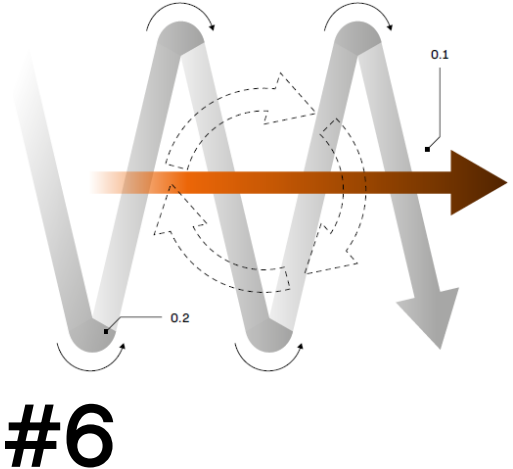
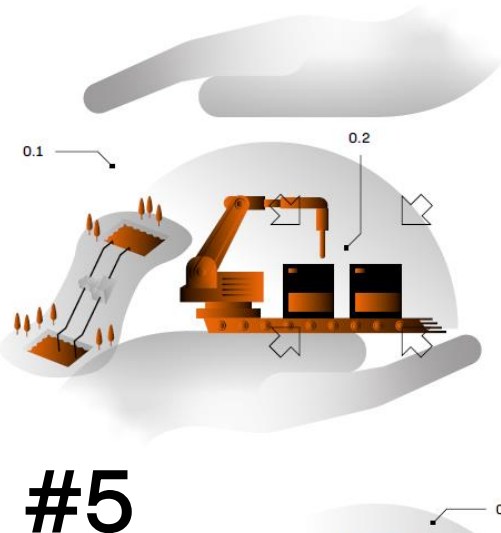
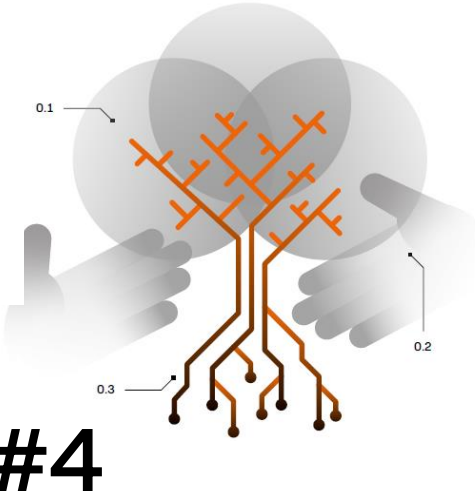
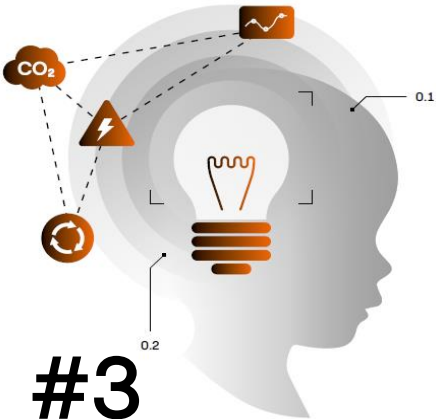
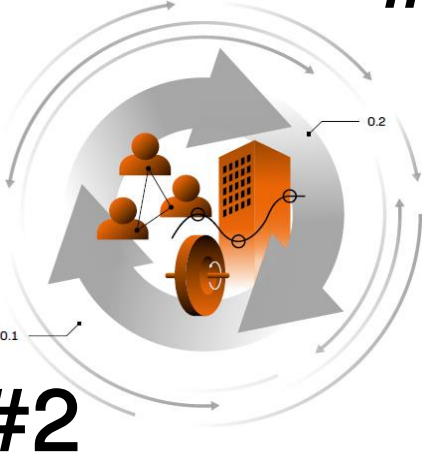
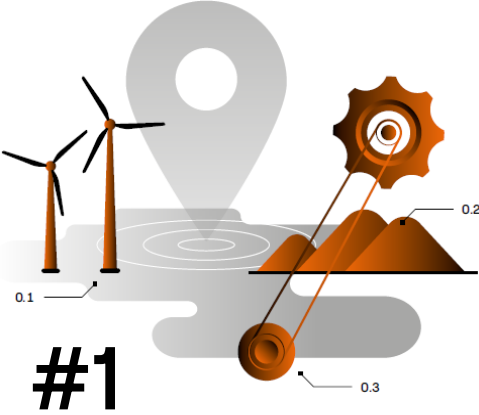
STRATÉGIE – DÉFINITION :

- Une stratégie définit des actions sous notre contrôle, que nous décidons d'entreprendre face à ces différents futurs possibles
- Une stratégie est opérationnelle, vise le court ou moyen-terme, est pourvue de moyens pour sa mise en œuvre et d'un cadre de monitoring
- Une stratégie est robuste si elle reste pertinente quel que soit le futur

VISION – DÉFINITION :

- Une vision, imaginaire, décrit un avenir long-terme tel qu'il pourrait être, en anticipation de la somme des scénarios
- Une vision elle-même n'a pas de volet opérationnel (plan d'actions, ressources humaines et financières, indicateurs, etc.), mais peut être déclinée en stratégies
- Une vision est robuste si elle reste pertinente quel que soit le futur

La vision ECO2050 en 10 briques



Vision robuste déclinée en 10 briques mutuellement bénéfiques et réciproquement habilitantes

1. Améliorer l'**autonomie stratégique ouverte** pour stimuler la production nationale
2. Déployer la **circularité** et la **sobriété** à toute l'économie
3. Placer l'**humain**, les **savoirs** et le **bien-être** au cœur de l'économie
4. **Concilier** les transitions digitale, écologique et sociale
5. Investir dans la **redondance critique**, le **stockage stratégique** et les **solutions dédoublées**
6. **Simplifier** les procédures, raccourcir les chemins et faciliter les transmissions
7. **Diversifier l'économie** en l'adaptant aux enjeux du futur
8. Intégrer les nouveaux défis à la **diplomatie économique**
9. Assurer des **finances publiques soutenables et solides**
10. Tourner l'**anticipation** en avantage économique comparatif



Vision ECO2050 robuste déclinée en 10 briques

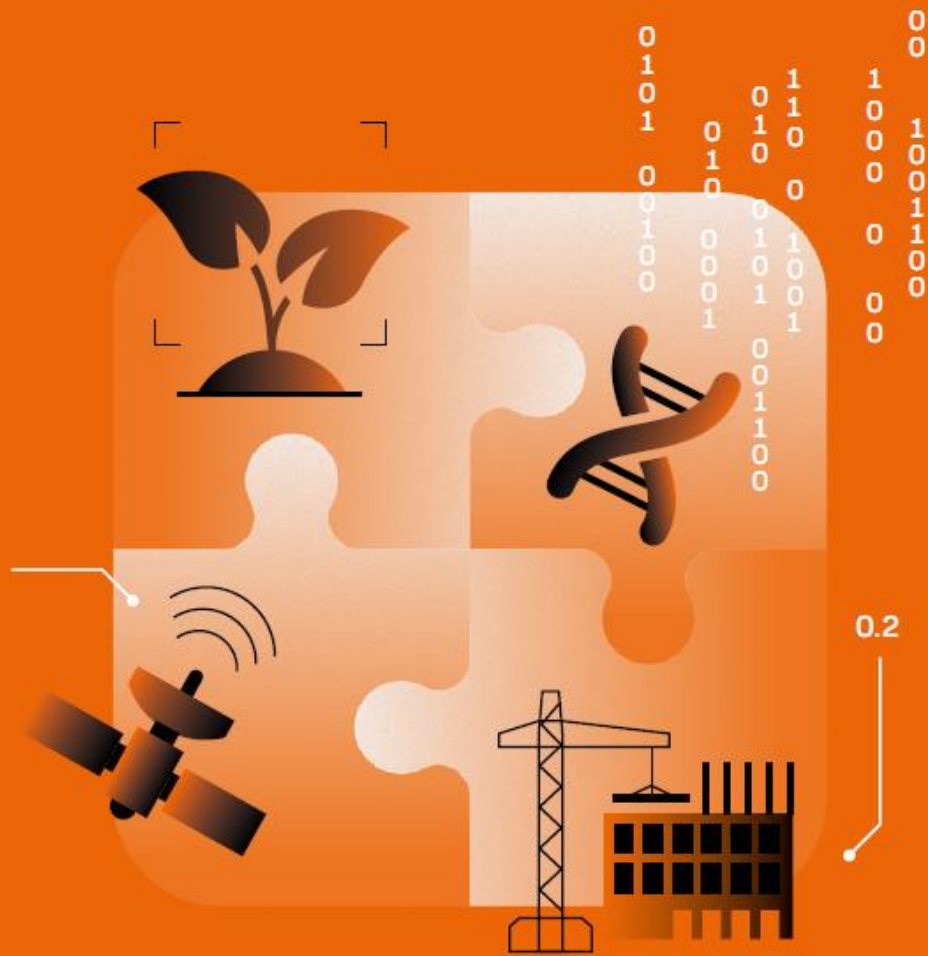
1. Améliorer l'autonomie stratégique ouverte pour renouveler la production nationale
2. Déployer la circularité et la sobriété à toute l'économie
3. Placer l'humain, les savoirs et le bien-être au cœur de l'économie
4. Concilier les transitions digitale, écologique et sociale
5. Investir dans la redondance critique, le stockage stratégique et les solutions dédoublées
6. Simplifier les procédures, raccourcir les chemins, faciliter les transmissions
- 7. Diversifier l'économie en l'adaptant aux enjeux du futur**
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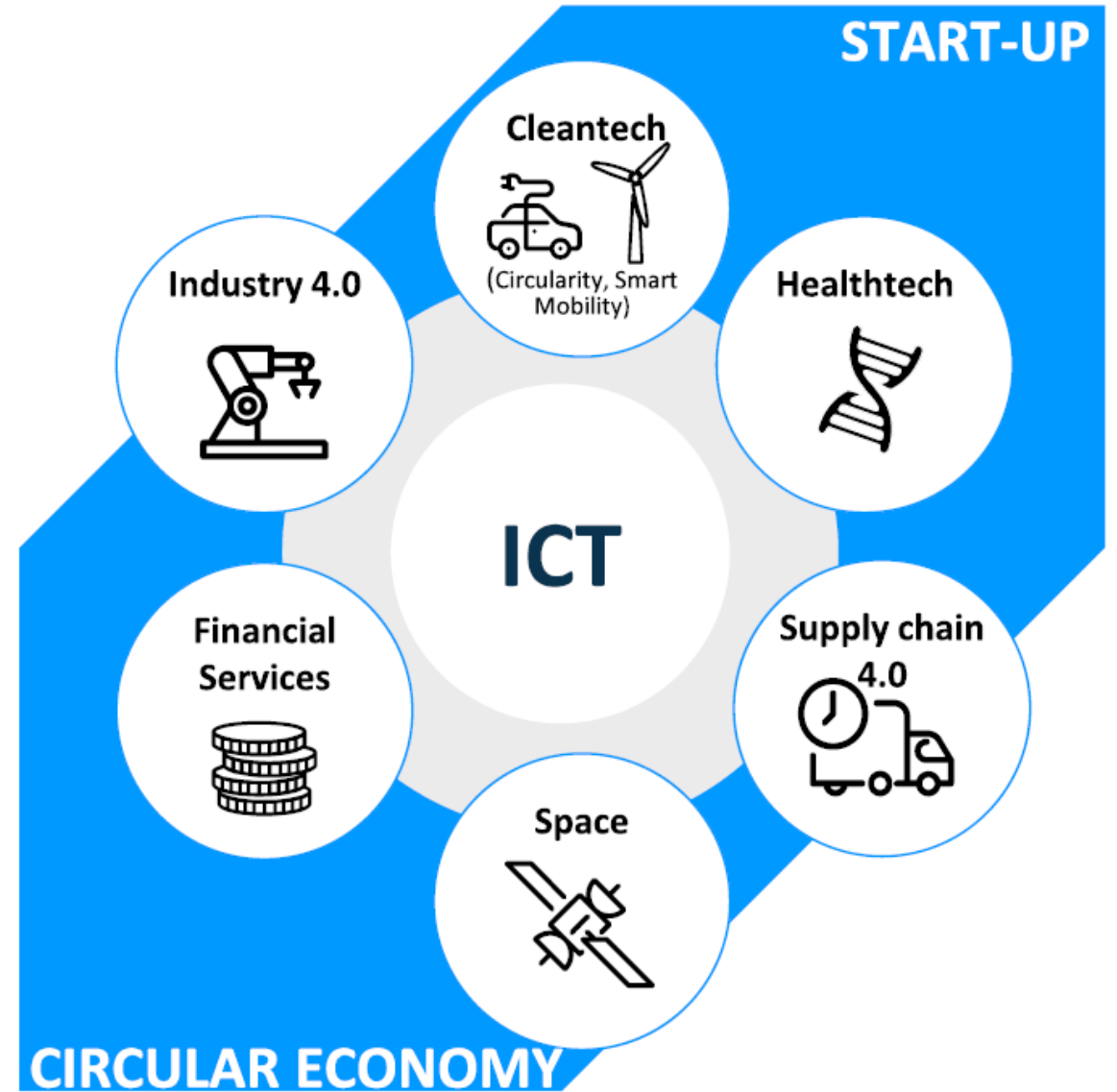
#7

Diversifier l'économie
en l'adaptant aux enjeux
du futur



Pourquoi se diversifier ? Rétrospective

- Parmi les pays à haut revenu, le **Luxembourg a une économie peu diversifiée**
- Les **limites bio-géophysiques** nous enseignent qu'une économie gourmande en bras et ressources (croissance extensive) n'est ni durable, ni souhaitable pour le Luxembourg
- La diversification économique telle que poursuivie depuis début 2000 vise la croissance intensive, basée sur l'innovation, le savoir (KIS - *Knowledge-Intensive Services*) et la donnée




Pourquoi se diversifier ? Perspective

- Pour plus de **résilience**, la diversification permet un rééquilibrage de la grande spécialisation en
 - exploitant les **atouts existants** (positionnement géographique, infrastructure, stabilité, secteur financier, expertise)
 - respectant les **contraintes spécifiques** (désirabilité sociale, disponibilité en terrain, eau, énergie, matières, compétences)
 - atténuant les **vulnérabilités** face aux chocs et disruptions: p.ex.: COVID, UKRAINE, Crues centennales juillet 2021, etc.
- Les **transitions énergétique, écologique, digitale, sociale et climatique** ouvrent un **énorme marché** aux entreprises et constituent des opportunités d'affaires significatives. En 2016, J. Rifkin évaluait les investissements nécessaires à la TIR à **1,4 milliards €/an**
- Le **marché des investissements de transition** d'ici à 2050 est estimé à
 - 1 mrd /an LU
 - 1.000 mrd/an UE
 - 10.000 mrd/an Monde

Pourquoi se diversifier ? Prospective

En partant du passé et du présent, la prospective

- anticipe les **enjeux du futur**, sonde les dynamiques globales et nationales **en cours et à venir**
 - dérèglement climatique
 - érosion de la biodiversité
 - baisse progressive du taux de retour énergétique (EROI)
 - renchérissement des matières premières et de l'énergie (\neq TIR)
 - tendance nationale à l'**expansion des activités scientifiques et techniques** (juridiques, comptables, gestion, architecture, ingénierie, R&D, études de marché) :
 -  de 4% du PIB en 1995 à 11% en 2022
 - amorce d'une transition des **métiers** (ADEM, FEDIL, UEL, etc.)
- imagine différents futurs économiques possibles auxquels il faut se préparer (Plan B)
- dérive des **principes « sans regrets »** dans tous les scénarios de diversification : autonomie, circularité, précaution, sécurité, adaptation, redondance, bien-être, simplification, diversification :



ne pas miser sur une solution exclusive, mais les dédoubler

Quel est donc le « mouton à 5 pattes » que nous recherchons ?

Une **diversification économique *future-proof*** qui, pour croître, devrait :

- Combiner la technologie, le digital, les savoirs et langues, la nature et les comportements
- Produire des biens et services physiques tout comme virtuels
- Émettre peu de gaz à effet de serre et nous mettre à l'abri des menaces environnementales
- Nécessiter peu de bras, d'énergie, de matériaux, d'eau ou de terrains
- Pourvoir des emplois stimulants et retenir les talents
- Agencer les secteurs historiques de l'économie luxembourgeoise avec les secteurs dynamiques et en créant de nouveaux biens et services
- Concourir aux autres politiques majeures à long-terme (PNDD, PNEC, PDAT, PNM, PSN, etc.)
- Contribuer aux biens communs essentiels et, en même temps, offrir des opportunités d'affaires


Une diversification multi-spécialisée

*Il importera aussi de faire des choix [...] pour **décarboner notre économie** : j'ai récemment annoncé l'initiative d'une **'Green Valley'**, un projet d'infrastructures pour regrouper et développer nos entreprises dans le domaine des **éco-technologies** au sens large, c'est-à-dire de tout ce qui relève des **énergies renouvelables**, de l'**adaptation climatique**, de la **construction circulaire** et de la **décarbonation**.*

*Bien évidemment, toutes les entreprises ont ici un rôle à jouer, qu'il s'agisse d'**industriels**, d'**artisans** ou de **start-ups**.*

*D'autres secteurs de diversification choisis par le Luxembourg se développent de manière dynamique, qu'il s'agisse des **technologies de la santé**, de l'**espace** ou encore du **numérique**.*

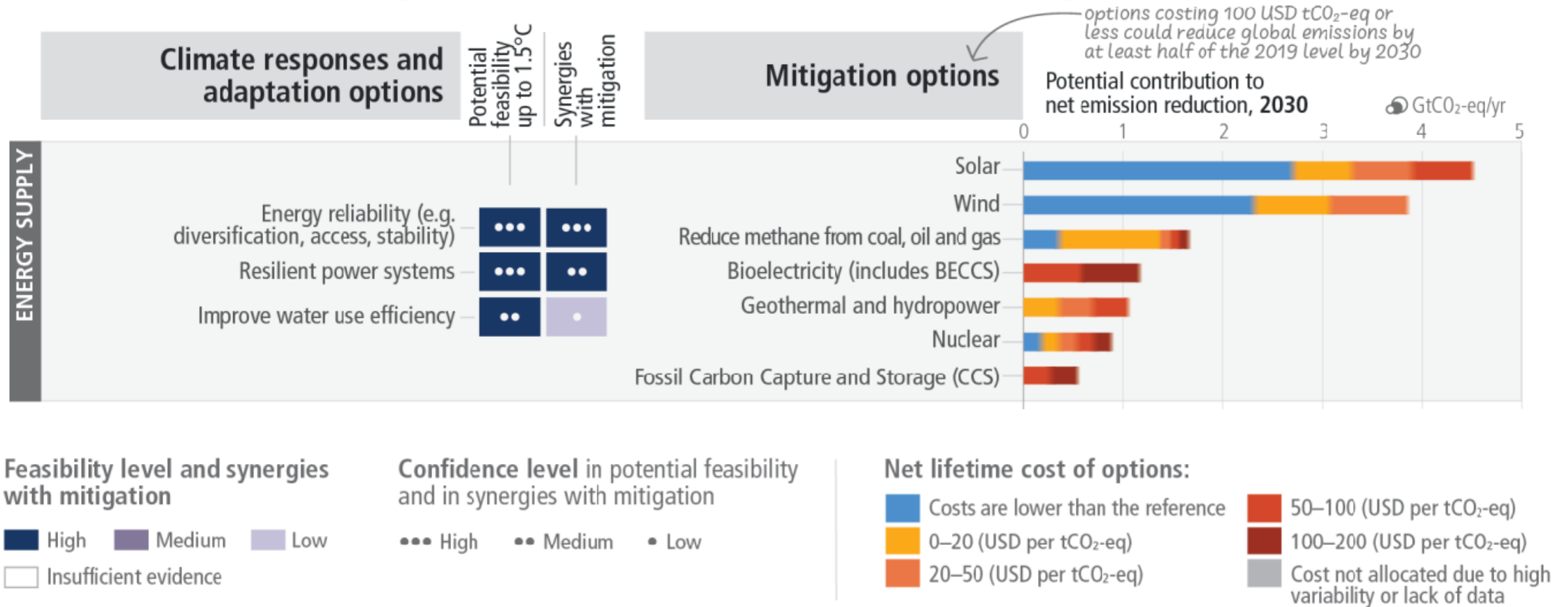
Ministre de l'Économie Franz Fayot,
Carte blanche, Paperjam (22 mai 2023)

A stylized, light gray graphic of a tree or branching structure is positioned on the left side of the slide, extending from the bottom towards the top. It consists of several vertical and diagonal lines that branch out, resembling a network or a tree structure.

ECO2050 : Le Luxembourg
est particulièrement bien
positionné pour **attraper la
vague de l'industrie et des
services *carbone***

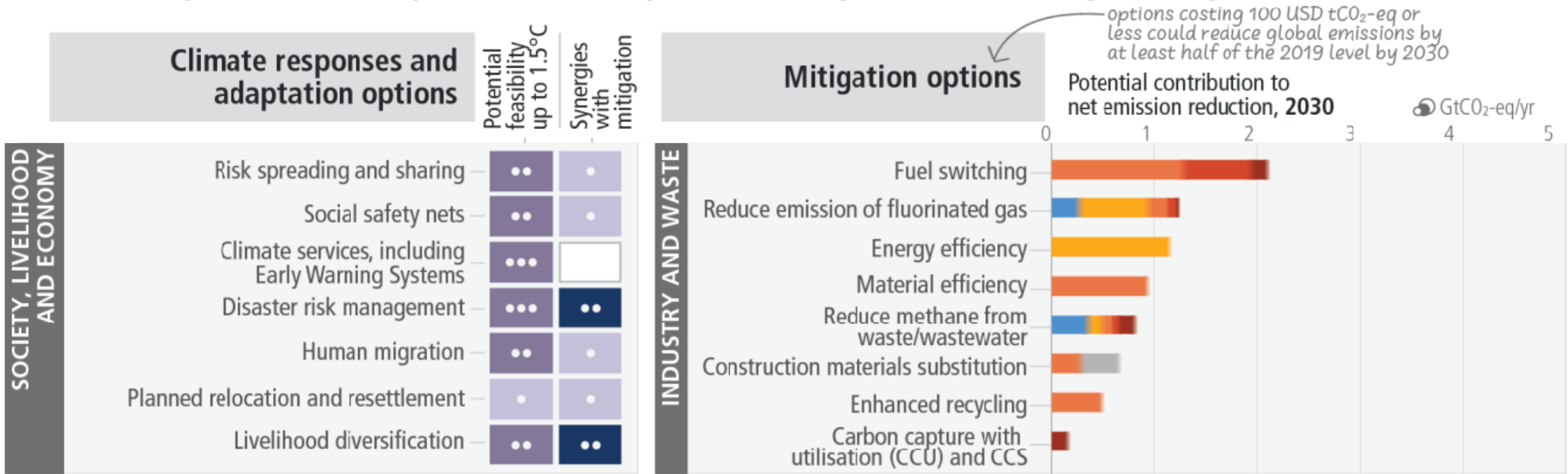
... car la production sera au cœur des transitions

a) Feasibility of climate responses and adaptation, and potential of mitigation options in the near-term



... car l'industrie sera au cœur de l'action climatique

Feasibility of climate responses and adaptation, and potential of mitigation options in the near-term



Feasibility level and synergies with mitigation

High
 Medium
 Low

 Insufficient evidence

Confidence level in potential feasibility and in synergies with mitigation

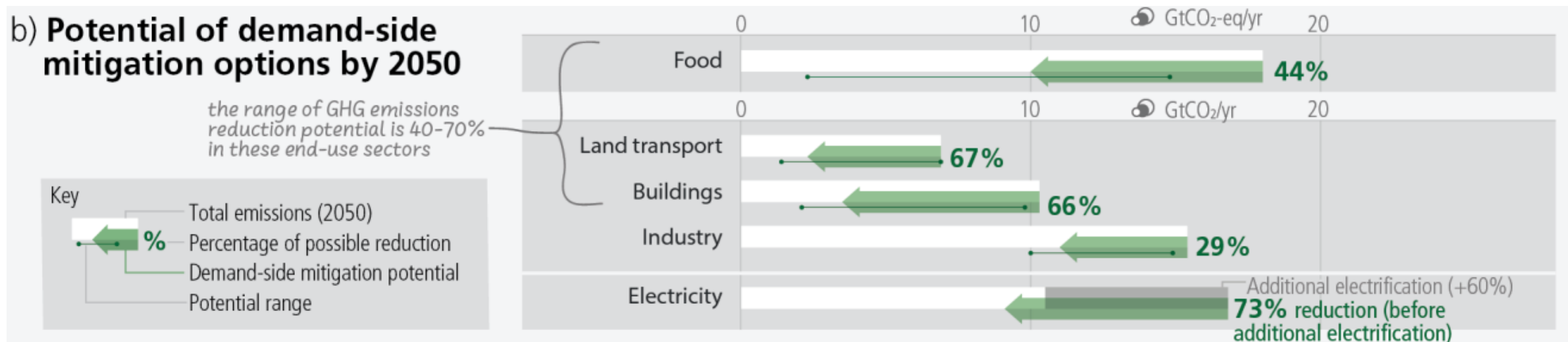
High

 Medium
 Low

Net lifetime cost of options:

Costs are lower than the reference
 0–20 (USD per tCO₂-eq)
 20–50 (USD per tCO₂-eq)
 50–100 (USD per tCO₂-eq)
 100–200 (USD per tCO₂-eq)
 Cost not allocated due to high variability or lack of data

... car le comportement sera au cœur de l'action climatique



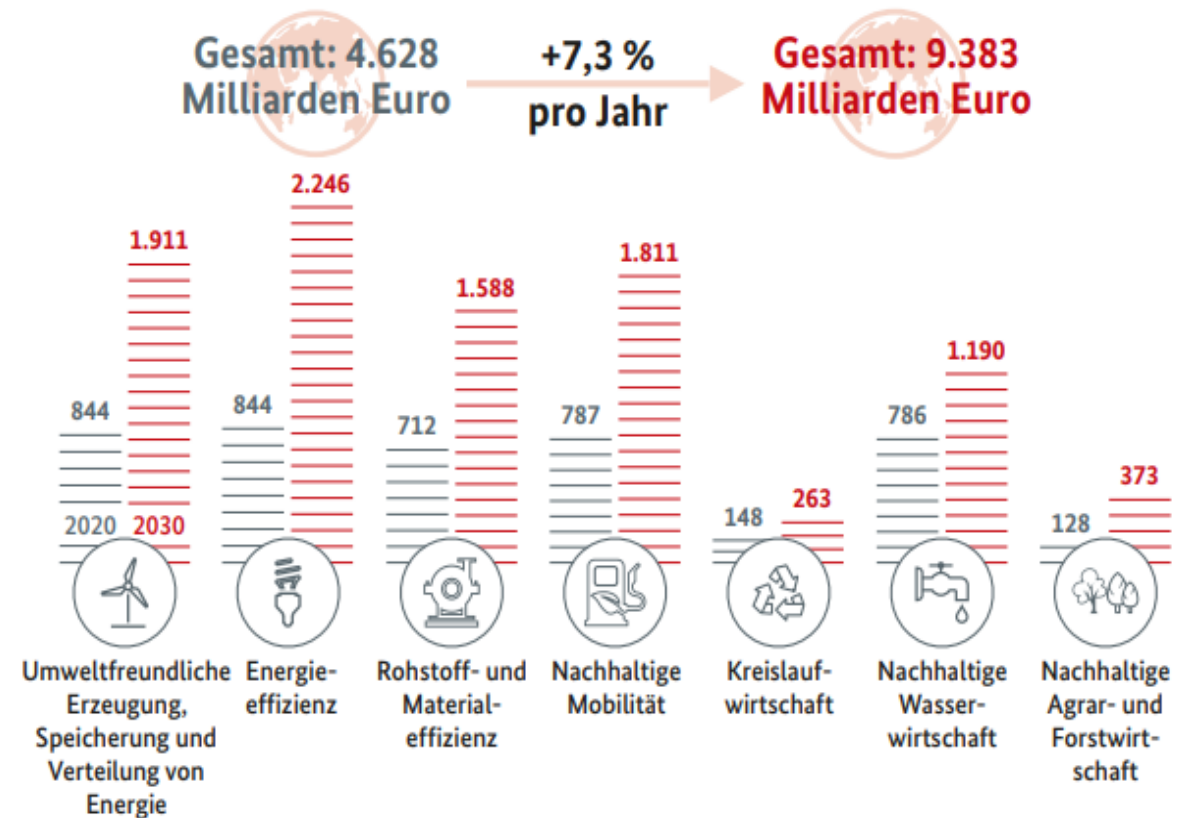
“... the projected increase in electricity demand can be avoided through demand-side mitigation options in the domains of infrastructure use and socio-cultural factors that influence electricity usage in industry, land transport, and buildings”

Focus sur l'industrie *carbone*

La mitigation et l'adaptation climatiques/environnementales tel que prévues dans le PNEC passeront par de nouvelles technologies, infrastructures, biens et services bas carbone, visant à réduire les empreintes sociales et écologiques.

Des opportunités de **production physique** domestique pour **l'industrie et l'artisanat** seraient:

- **Climate proofing** d'infrastructures et activités critiques (santé, énergie, communication, assainissement, etc.)
- Conception et réalisation de **grands travaux** et de constructions robustes faces aux extrêmes climatiques,
- Infrastructures et technologies de **stockage** stratégique (énergie, eau, matériaux, médicaments, etc.)
- **Manufacture** de pièces, outils et équipements nécessaires à la transition énergétique et climatique
- Développement de **matériaux légers, bio-sourcés** robustes et faciles à réutiliser/recycler
- Optimisation des **ressources présentes** sur le territoire (bois, biomasse et matériaux rares importés - à recycler)
- Organisation de la **logistique inverse**
- Travaux physiques pour renforcer les **puits de carbone**, nécessaires à l'atteinte de la neutralité carbone (restauration écologique, agroforesterie, zones humides, conservation de l'eau, prairies permanentes, arbres urbains, etc.)



Stand des globalen Marktvolumens für **Umwelttechnik und Ressourceneffizienz** 2020 und geschätzte Entwicklung bis **2030** in Milliarden Euro, *Green tech made in Germany*, Roland Berger 2021

The Dutch water defences industry, a public good and business case

NL Delta plan for achieving flood protection, freshwater availability and spatial adaptation goals by 2050. Delta Fund 2021-2034, EUR 19 billion

Delta Commissioner Peter Glas:

“The time for freedom of action is over: we need to speed up to keep our delta safe and liveable.”

“The urgency is increasing, due to the changing climate. Such investments are especially crucial now to sustainably foster our economy and to enhance the **resilience of our society**. With Covid, we have experienced, more than ever before, how important it is for our vital sectors such as health care, IT, and the power, gas, and drinking water supply, to continue to operate during a crisis. Measures to **climate-proof vital and vulnerable functions** must be intensified.”



Flood risk management

By 2050, everyone in the Netherlands will have the basic level of protection



Fresh water

The Netherlands will be resilient to water shortages by 2050



Spatial adaptation

The Netherlands will be climate-resilient and water-robust by 2050

Exemple : Protection des actifs par des solutions basées sur la nature



Aerial shot of the Jurong Island pond captures the design in its entirety

Jurong Island, the island that powers Singapore, a world top oil refinery and chemical manufacturing hub, turns to green infrastructures for flood defence

Combiner Infrastructures grises et vertes :
canalisations et pompes et
plaine d'inondation pour gérer l'eau

Combining data-monitored engineered infrastructures with nature-based ones can be cost effective and resilient in case of outages, World Bank (2019) Integrating green and grey infrastructures

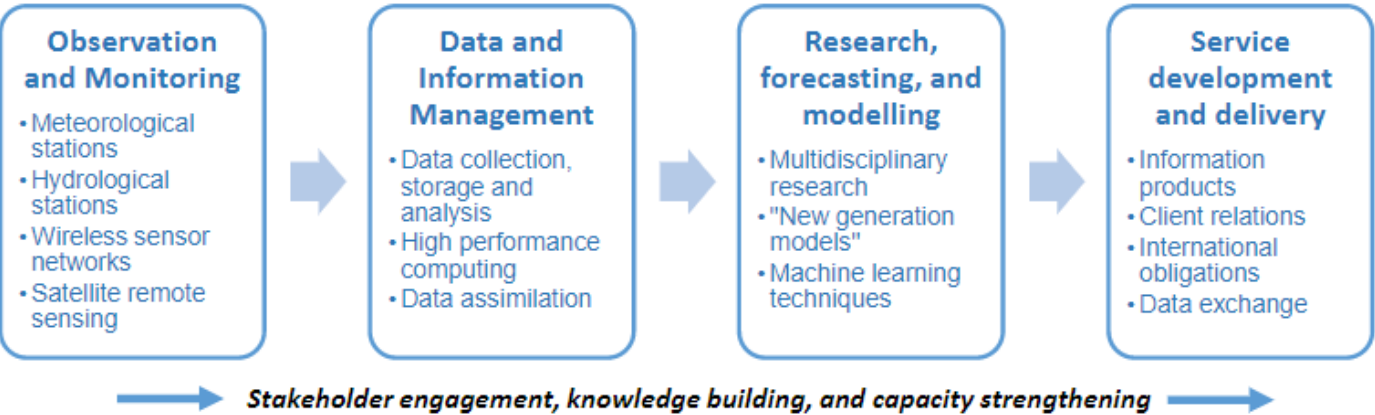


Focus sur les services *carbone*

La mitigation et l'adaptation climatiques/environnementales passeront par de nouvelles technologies, infrastructures, biens et services bas carbone, visant à réduire les empreintes sociales et écologiques. De **nouveaux services carbone vont gagner en importance, le recours aux données et à la science augmentera.**

- **Compliance carbone: comptabilité** des émissions, audits énergétiques, analyse du cycle de vie (p.ex. déclaration environnementale sur les produits de la construction), scope 3
- **Reporting extra-financier** (climat, biodiversité, durabilité)
- Conception et monitoring de **projets carbone nationaux et internationaux** pour alimenter l'industrie des fonds verts
- Levée de fonds pour les transitions, instruments de derisking, Bourse verte
- Développement de **logiciels et applications** (alerte pollution ou désastres, économie de ressources, places de marché virtuel (e-Holzhaft), *Fintech*, etc.)
- **Assurances** pour dommages physiques ou pour sous-émissions de crédits carbone
- **Conseil légal**, intermédiation et litigation carbone (procès contre entreprises et gouvernements pour inaction)
- **Certification**, validation, *benchmarking* et *rating* carbone, analyse de marché carbone
- Sauvegarde de l'intégrité des données environnementales, détection de *greenwashing*
- Expertise en tarification et **fiscalité carbone**, en prévention et **gestion du risque**

Focus sur les services digitaux - opportunité d'affaires et création de bien commun



Source: (OECD, 2021^[5]), adapted from (WMO, 2015^[71]; CIF, 2020^[72]).

Chaînes de valeur de services d'information météorologiques et climatiques. Climate tipping points. Insights for effective policy action, OECD 2022



Focus sur le secteur spatial – Opportunité d'affaires et création de bien commun

- développer les **sciences de la vie** et des matériaux à partir d'expériences spatiales
- favoriser la **collecte de données** à caractère environnemental pour :
 - développer des modèles climatiques
 - planifier l'adaptation climatique
 - suivre l'augmentation du niveau de la mer, le dégel des glaces et du permafrost
 - anticiper les catastrophes et extrêmes climatiques
 - suivre la biodiversité, la restauration écologique, les migrations d'espèces
 - détecter les fuites de CH₄
 - améliorer les prévisions de **navigabilité maritime et fluviale** : eau basse sur la Moselle/Rhin
- assurer les **communications** et les **observations** satellitaires
 - dans le cas de conflits (p.ex. dans le cadre de l'OTAN)
 - en situations de crise / urgence (p.ex. emergency.lu)
- résoudre le problème de l'accumulation des **débris spatiaux**



Focus sur le secteur de l'agriculture – Opportunité d'affaire et création de bien commun

Le PSN vise une **agriculture**

- pérenne et **adaptée aux nouveaux défis**
- **Diversifiée, rémunératrice et compétitive**
- soutenue dans ses actions pour
 - l'auto-suffisance alimentaire
 - la protection de la biodiversité
 - les circuits courts
 - le bien-être animal

L'innovation agricole et écosystémique repose sur

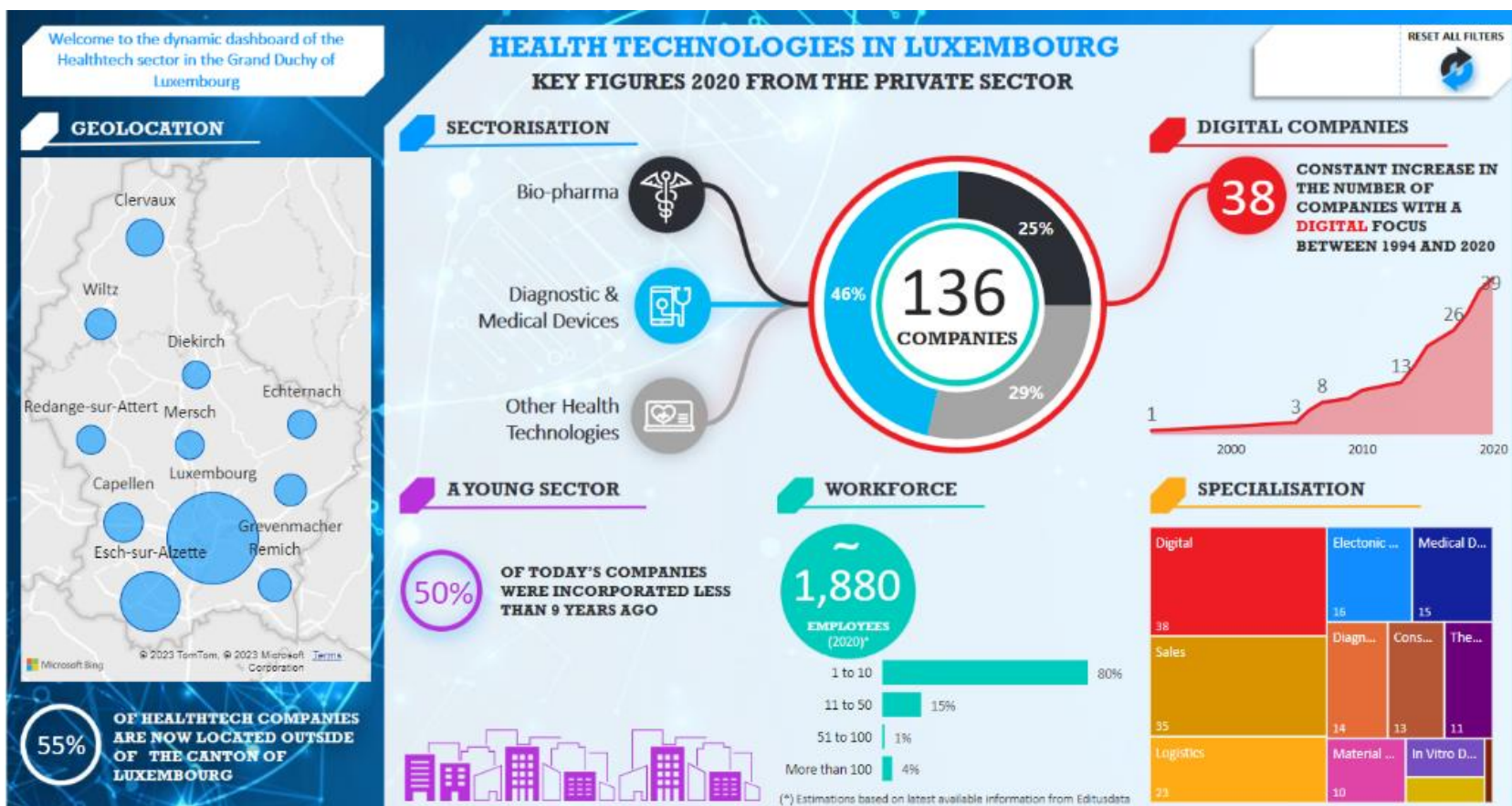
- des **filères agro-alimentaires *climate-proof***
- Une meilleure **efficience** des intrants synthétiques et l'aide à la décision permises par le **digital**
- de nouveaux modèles de production agro-écologique, comme l'**agriculture urbaine** qui permet
 - de rapprocher le producteur du consommateur
 - une logistique douce (p.ex. cyclo-logistique)



Integrated hubs localising production with consumption,
Beyond Luxe (2021), **Luxembourg in Transition**

Focus sur le secteur de la santé - opportunité d'affaires et création de bien commun

L'anticipation des nouveaux vecteurs de maladies et des effets des crises environnementales sur la santé, le renforcement de la prévention, de la santé mentale et du bien-être, la transition digitale et technologique pour optimiser la sécurité et la qualité des soins, l'efficacité dans les établissements de soins créent de nouvelles opportunités et alimentent un écosystème d'entreprises de plus en plus vibrant :



De nombreux acteurs sont déjà engagés ...

LUXEMBOURG SUSTAINABILITY ENABLER ECOSYSTEM

Use / combine filters to see detailed results

Types of enablers

- Accelerators & Institutional Enablers
- Advisors, Consultants
- Certification Organisations
- Investors, Finance
- Products & Services Providers
- Research & Testing
- Technologies Providers

Sustainability topics

- Air Quality
- Awareness & Support
- Circular Economy
- Clean Water
- Energy Efficiency
- Equal Opportunities
- Food Security & Nutrition

Key technologies & specialisation

- 3D Printing
- Advanced Materials
- Air Powered Generator (Air-gen)
- Application Programming Interface (API)
- Artificial Intelligence (AI)
- Augmented Reality (AR)
- Autonomous Systems

Targeted markets

- [Cross-Markets]
- Aerospace & Defense
- Agriculture & Food
- Cleantech
- Education
- Finance
- Government & Administration

TYPES OF ENABLERS

429 ENABLERS

Data collection is ongoing

List of enablers

Enabler name

- + Impakt Luxembourg
- 1nergie
- 4 Energy
- A. Muller & Fils
- AC Biode
- Actif
- Actrium
- Aeronovis
- AG2R La Mondiale
- Agence de l'Energie (EnergieAgence)
- Airboxlab
- ALHO Systembau
- All in One Technologies
- Allen & Overy
- Alliance Bernstein
- Alliance Green Services
- Alma Shop
- Alpha Financial Market Consulting
- AM 4 AM
- Ama Mundu Technologies
- Ampacet Luxembourg
- Antalpi Engineering
- Apateq - PWT S.A
- Aperam
- Apleona Luxembourg
- Aqua Nobilis
- Arendt Regulatory & Consulting
- Argest
- Arval Luxembourg
- Astorg Advisory Services Growth
- Astron
- ATENOR Luxembourg
- Atos Luxembourg PSF
- Audit et Maintenance
- Avantag Energy
- Avanterra
- Avista Oil B.V.B.A.
- AWK Group.(Luxembourg).(Eraneos)

Search by enabler name

- + Impakt Luxembourg
- 1nergie
- 4 Energy
- A. Muller & Fils
- AC Biode

Enabler locations (by LU city)

SUSTAINABILITY DEVELOPMENT GOALS

INDUSTRY, INNOVATION AND INFRASTRU... 158	SUSTAINABLE CITIES AND COM... 130	DECENT WORK ... 99	RESPO... 58
AFFORDABLE AND CLEAN ENERGY 153	CLIMATE ACTION 118	LIFE ON... CLEAN ...	PART... REDU...

Reset all filters by clicking here

Learn more about the mapping methodology

THE GOVERNMENT OF THE GRAND DUCHY OF LUXEMBOURG
Ministry of the Economy

LUXINNOVATION
#MakingInnovationHappen

POWERED BY MARKET INTELLIGENCE

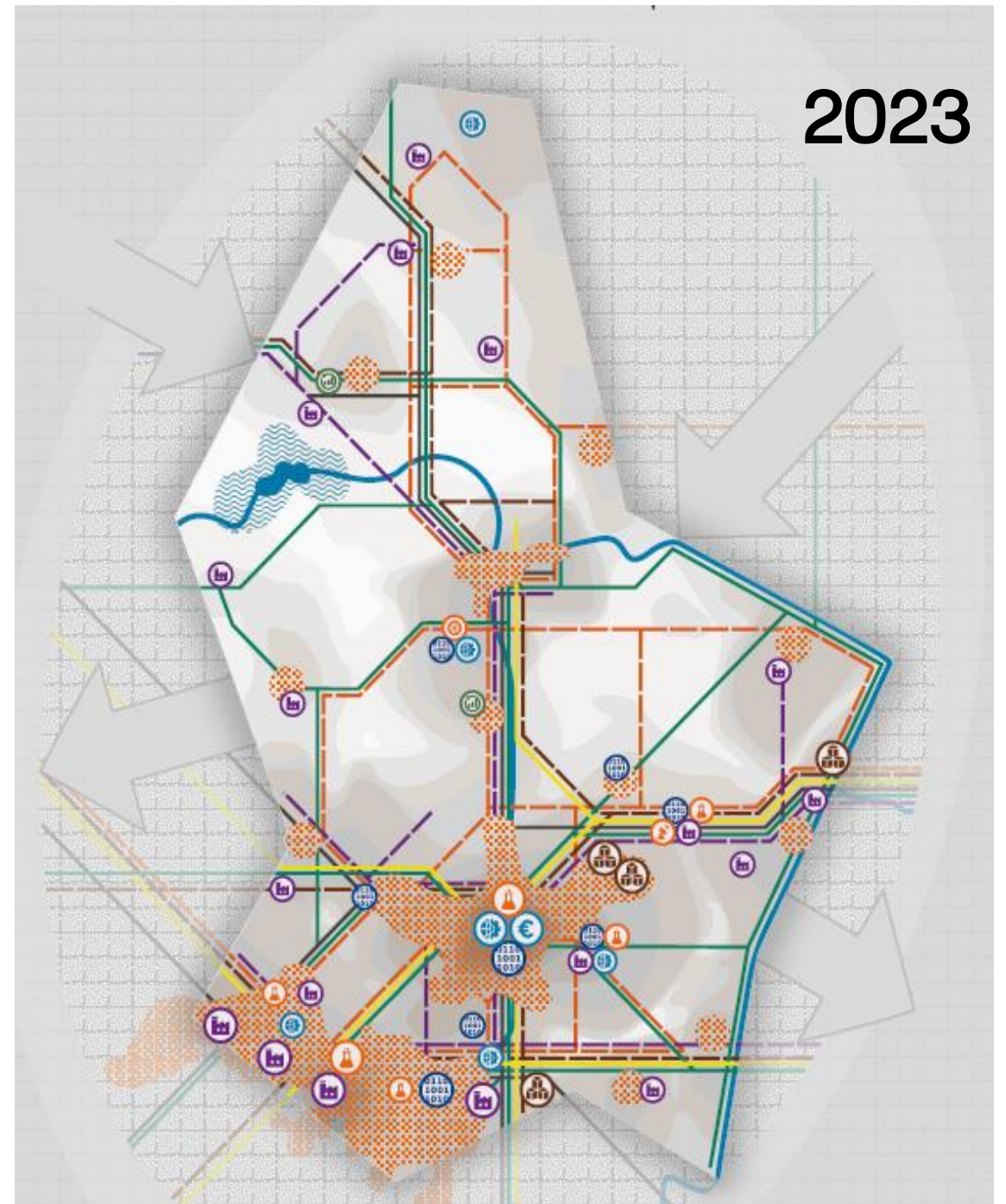
Déclinaison territoriale

2023

Cadre de développement:

- Plan sectoriel Zones d'activités économiques (PSZAE)
- Plan national Energie Climat (PNEC) : décarbonation
- Programme directeur Aménagement du territoire (PDAT) : zéro artificialisation nette des sols
 - multifonctionnalité des ZAE
 - réutilisation des friches
 - approches multi-étages
- ouverture à **davantage de coopération** transfrontalière
- **Circularité** appliquée à toute l'économie
- **Sobriété** dans la consommation des ressources physiques (terrain, eau, énergie, matières premières) et la génération de déchets

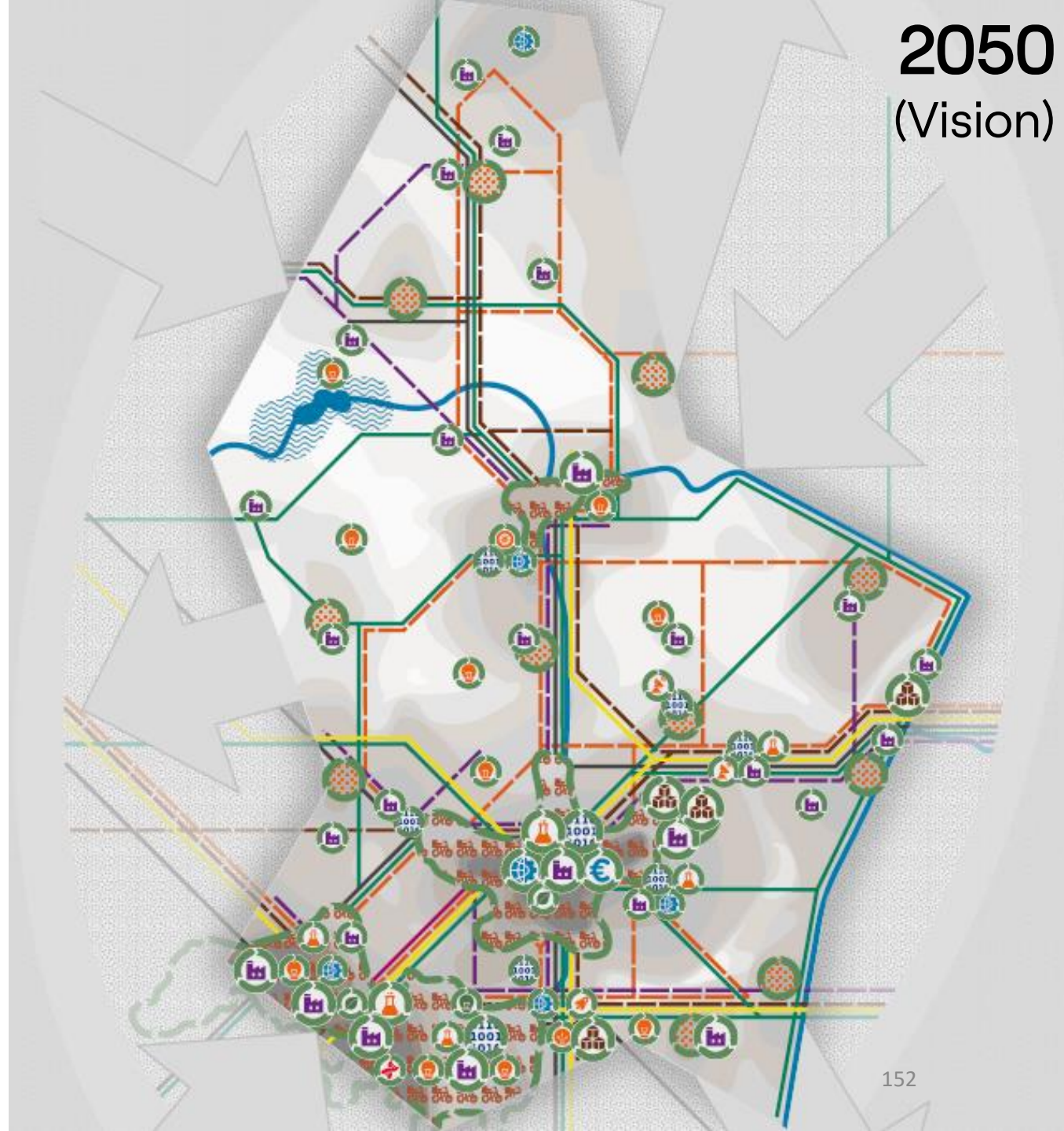
➔ La diversification s'accompagnerait d'une part d'une **spécialisation** (ZAE dédiées) et de l'autre d'une **généralisation** territoriale de l'activité économique (services nomades, télétravail au-delà des frontières, activités économiques en tissu construits existants, etc.)



Déclinaison territoriale

Opportunités de diversification

- nouvelle économie centrée autour du carbone
 - services (*carbon accounting – consulting – rating* etc.)
 - industrie (matériaux légers, équipements de transition, etc.)
 - artisanat *low tech* et *éco-design* (construction, réparation)
- technologies de pointe, *data-driven start-ups* et R&D
 - TIC et IA
 - *health tech*
 - *climate adaptation, clean and eco tech (smart grid)*
 - *space tech*
- construction circulaire et durable / écoconstruction
 - Nouveaux matériaux (*urban mining, bio-sourcés*)
 - Autoconsommation énergétique (PV)
 - Adaptation climatique
- agriculture innovante et durable
 - Adaptation au climat, fermeture du cycle des nutriments
 - Péri-urbaine, voire urbaine (*vertical farming*)
- finance verte et inclusive (notamment via la *FinTech*)



Conditions de réussite de la diversification *carbone* : les 9 autres briques de la Vision ECO2050

1. Avoir un **plus grand contrôle** domestique sur l'énergie, les matériaux, l'eau, le sol. Disposer d'un prix attractif de l'énergie
2. Généraliser la **circULARITÉ, l'efficiEne et la sobriété** à toute l'économie
3. Investissement massif dans les **savoirs, métiers et** modèles de gestion et d'affaires nécessaires à la transformation :
 - de solides **compétences scientifiques** en STEM, sciences naturelles, sociales et comportementales
 - l'**ingénierie** informatique, civile, électronique, agronomique, sylvicole, hydrologique, territoriale, écologique, de la formation
 - Revalorisation des **métiers artisanaux** et des connaissances pratiques
 - Culture d'expérimentation et de **recherche** appliquée
4. La **digitalisation** et l'IA réduiront – et non pas augmenteront – les consommations de ressources
5. **Simplification** des procédures et procédés, harmonisation des standards UE comme autant de facteurs de compétitivité
6. **Grands travaux et Redondance critique**. Plans de contingence en cas de pénuries (constitution de réserves, capacité de production d'urgence)
7. Revigoration du **multilatéralisme**: **partenariats** commerciaux, **diplomatie** des matières, préservation des **biens publics globaux**, échanges au sein du **marché intérieur UE**. **Coopétition** au sein de la Grande Région
8. Sécuriser les investissements stratégiques additionnels nécessaires pour financer les transitions tout en renforçant la **protection sociale** pour tous
9. Mettre à profit l'anticipation afin d'augmenter la rentabilité des entreprises et **planifier et accélérer** les transitions

Merci pour votre attention

Pour plus d'informations...

luxstrategie.gouvernement.lu

linkedin.com/company/luxstrategie/



Qui sommes-nous ?

Luxembourg Stratégie est la direction de **prospective stratégique** du ministère de l'Économie. Etablie fin 2020, elle approfondit et étend l'approche collaborative initiée en 2016 avec l'étude stratégique de long terme sur la Troisième Révolution Industrielle ('processus Rifkin' ou 'TIR2050').

Attributions

Luxembourg Stratégie est chargée d'études de prospective (*foresight studies* ou *Zukunftstudien*). La prospective stratégique (*strategic foresight* ou *strategische Vorausschau*) consiste à explorer, anticiper et objectiver les futurs émergents et possibles afin de mieux prendre les décisions stratégiques aujourd'hui qui permettent d'enclencher, de façonner et de rendre résilientes les transformations souhaitées à long-terme. Luxembourg Stratégie contribue (i) à renforcer la cohérence des stratégies sectorielles du ministère de l'Économie entre elles et avec celles des autres ministères qui impactent l'économie et (ii) à transformer l'économie du pays vers plus de compétitivité et plus de résilience pour les décennies à venir.

[Lire la suite](#)

Ministère de tutelle

- Ministère de l'Économie

Ministre

- Franz Fayot

©SIP / Yves Kortum



Rétrospective. Perspective. Prospective



**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Open strategic autonomy: Manufacturing industry & supply chain

**David Leal-Ayala
World Economic Forum**

Net zero innovation and economic diversification

*“Open strategic autonomy: Manufacturing
industry & supply chain”*

Dr David Leal-Ayala

Institute for Manufacturing, University of
Cambridge / World Economic Forum

26 September 2023



About me

Two hats

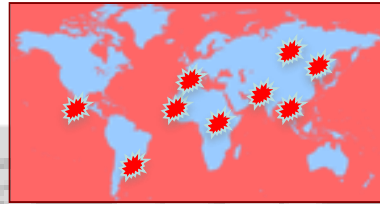


'Megatrends' driving change in industry

High-level / non-sector-specific trends and drivers affecting global industries



Globalisation



Threats to global stability



Demographic change



Urbanisation



Sustainability



Changing consumer habits



Accelerating technology life-cycles



Digitalisation



Changing the drivers of competitiveness:

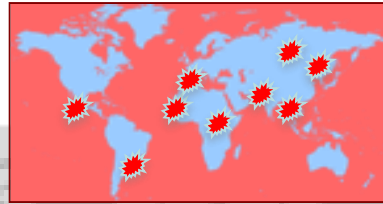
- Changes in product/service demand, technologies, institutions & regulations
- Increasingly complex industrial and technological systems
- New sources of value capture
- Evolving policy challenges

'Megatrends' driving change in industry

High-level / non-sector-specific trends and drivers affecting global industries



Globalisation



Threats to global stability



Demographic change



Urbanisation



Sustainability



Changing consumer habits



Accelerating technology life-cycles



Digitalisation

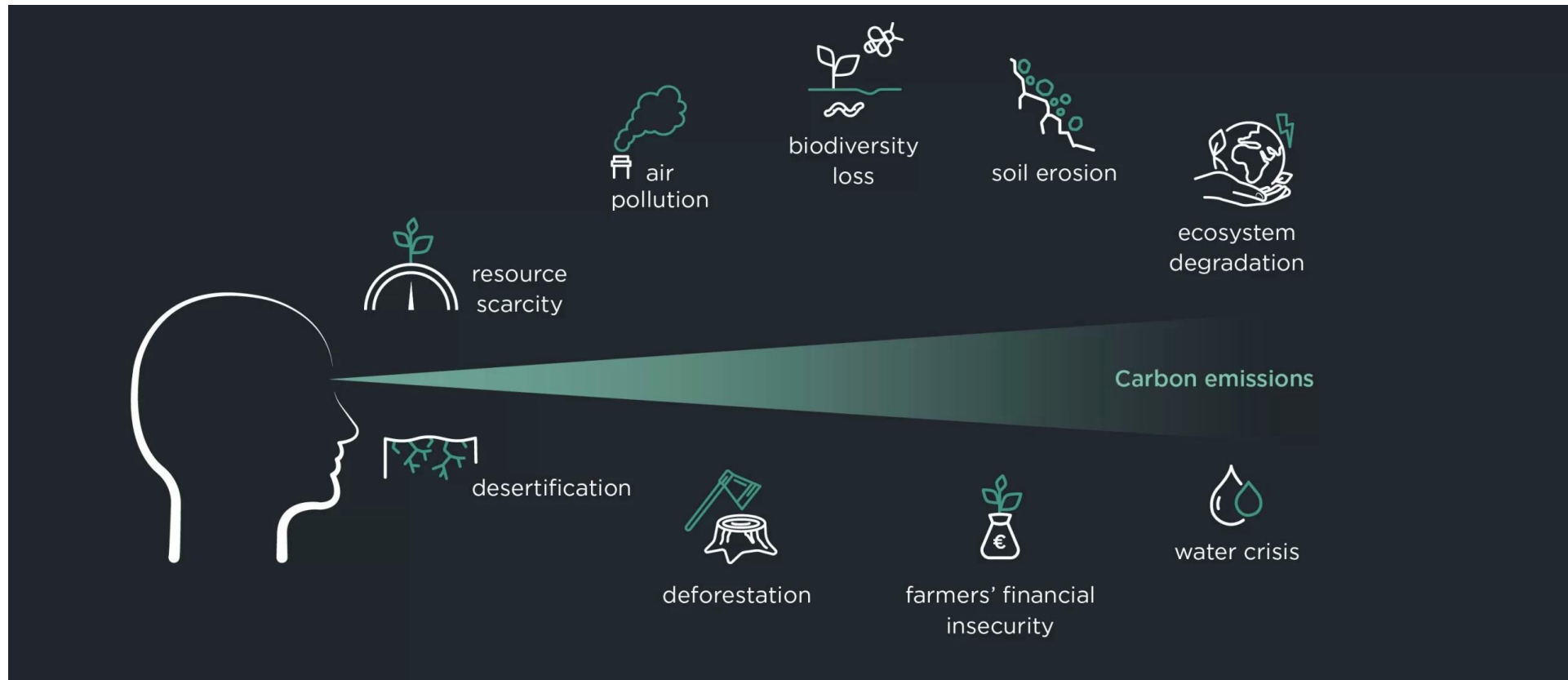


Some impacts:

- **Resiliency:** Improving supply chain control, flexibility and responsiveness to shocks
- **Efficiency:** Maximizing value from scarce resources
- **Sustainability:** Reducing environmental footprints and delivering net-zero goals
- **Innovation:** Adapting what is produced and how

Megatrend: sustainability Carbon tunnel vision

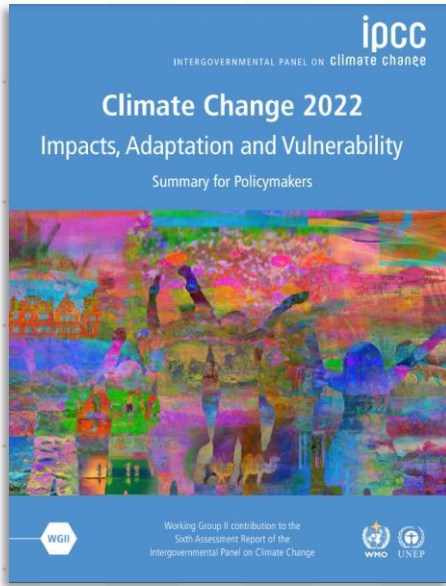
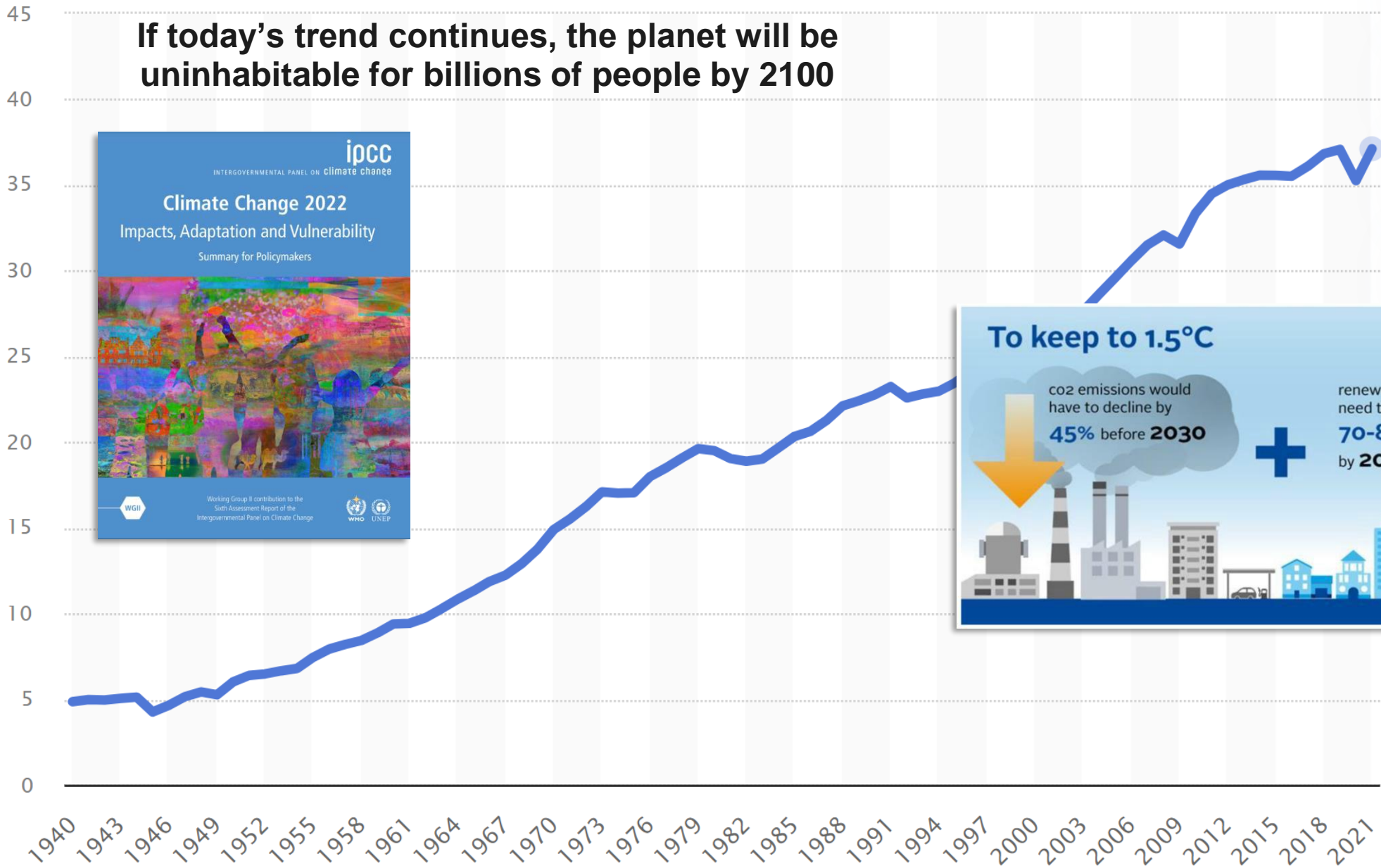
Carbon tunnel vision



Source: <https://www.climatefarmers.org/blog/moving-beyond-carbon-tunnel-vision-in-nature-based-solutions/>

If today's trend continues, the planet will be uninhabitable for billions of people by 2100

CO2 – eq. emissions in billion metric tonnes



To keep to 1.5°C

CO2 emissions would have to decline by **45% before 2030**

renewable energy will need to supply **70-80% of power by 2050**

WEF's Industry Net Zero Accelerator Initiative

Our Vision

Enable the **dissemination of knowledge, best practices and experience** – all focused on how to unpack the net-zero equation and aimed at accelerating the transition.

+20 organisations

Achieving net zero in manufacturing is a global endeavour. Systemic collaboration is fundamental to achieve it

- **No single business** can reach net zero by itself

- All stakeholders – even competitors – can find **mutual benefit** in ensuring their industries net zero future

- Action is still hindered by **limited access to information** on how firms can operationalise their commitments

Examples of current challenges faced by our community

Non exhaustive



Financial



Technical



Organizational

The initiative's operating model

INSPIRE

Disseminate and leverage our **10-action pillar framework on industry net zero** to share **knowledge, experience and best practices** to focus on **Scope 1, 2 & 3 emissions reduction** and benefit the broader industrial community

NETWORK OF EXPERTS

CASE STUDIES COLLECTION



DIGITAL REPOSITORY

INSIGHTS & RESEARCH OUTPUTS

PILOT / DEMONSTRATOR

ENGAGE

Animate **content sharing and activities with private sector, public sector and academia** to foster learning, reapplication, and collaboration on the most complex challenges of net zero faced by companies

“HOW TO” SESSIONS

STRATEGY WORKSHOPS

IN-PERSON EVENTS

ACCELERATE

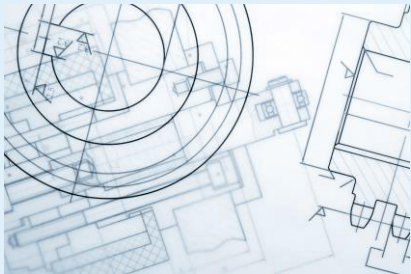
Continue **accelerating and scaling practical initiatives** (e.g. Estainium, COSIRI) by providing the neutral, pre competitive platform and the network needed to support them



INSPIRE: The “No Excuse” Framework to Industry Net Zero

Stage I

Build the foundations



- 1 Build the net-zero Corporate strategy
- 2 Set the capability for carbon footprint monitoring

Stage II

Change the game internally



- 3 Accelerate energy efficiency in operations and transport and decarbonize energy sources
- 4 Pursue material efficiency in operations
- 5 Re-think product design and business models
- 6 Develop carbon capture solutions and offset mechanisms

Stage III

Drive systemic collaboration



- 7 Drive scope 3 value-chain decarbonization (upstream and downstream)
- 8 Mobilize ecosystems for net zero infrastructure and innovation
- 9 Address net zero data and digital standards

Stage IV

Make it simple, inclusive and exciting



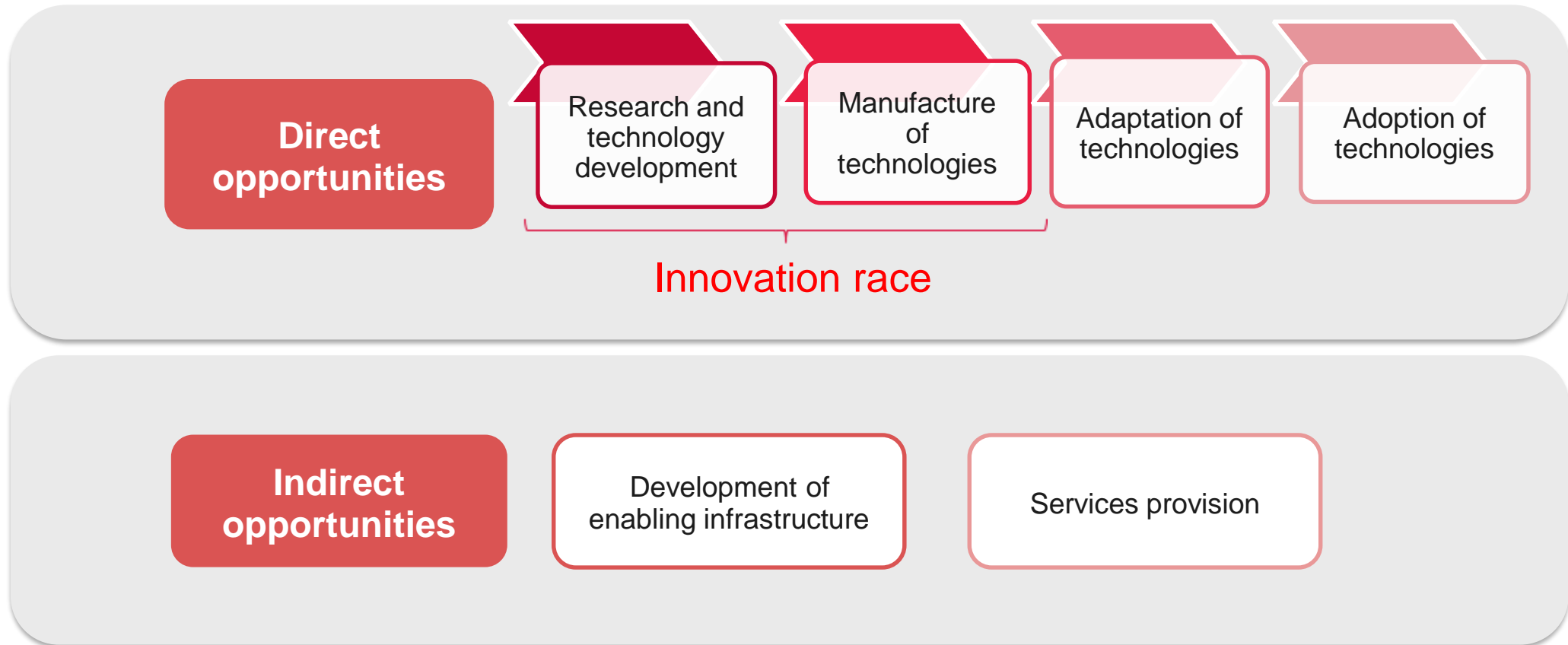
- 10 Implement and drive net-zero culture and practices

- **Demystify industrial Net Zero concepts and share examples of best practice** through a reference framework, aiming to harmonise the language and encourage business collaboration.



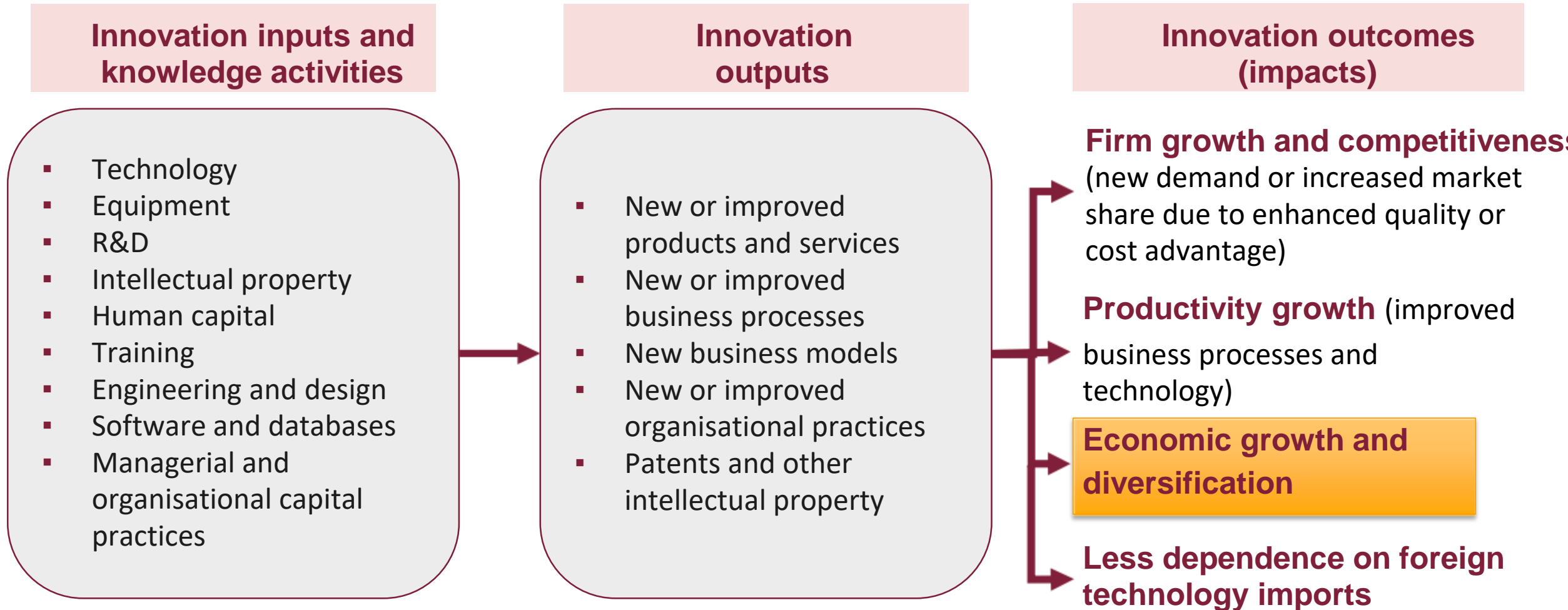
Economic opportunities from Net Zero

How does industrial decarbonisation create value for countries?

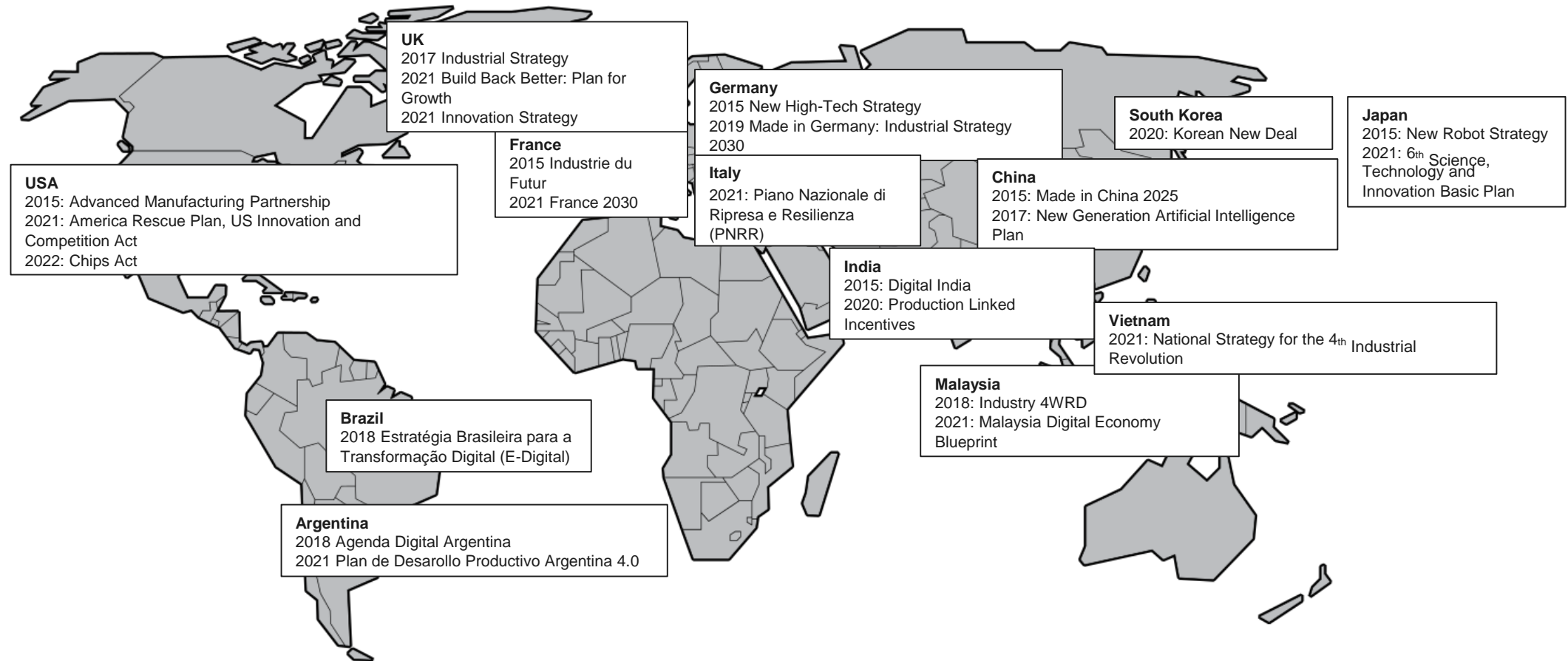


The impact of Net Zero innovation in the economy

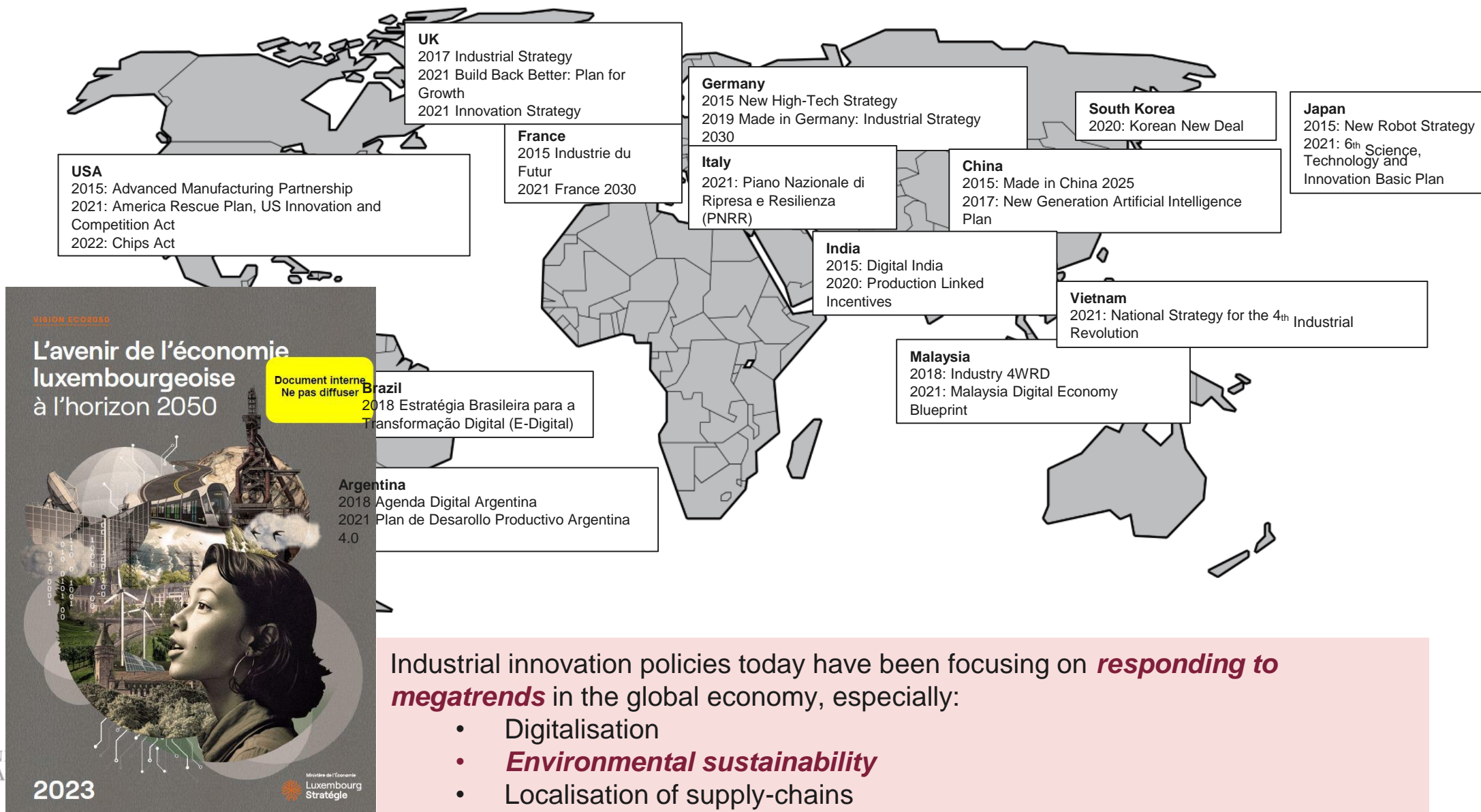
How does industrial decarbonisation create value for countries?



The recent resurgence of industrial innovation policies



The recent resurgence of industrial innovation policies



Industrial innovation policies today have been focusing on **responding to megatrends** in the global economy, especially:

- Digitalisation
- **Environmental sustainability**
- Localisation of supply-chains

Example: United Kingdom



Point 1: Advancing Offshore Wind

Point 2: Driving the Growth of Low Carbon Hydrogen

Point 3: Delivering New and Advanced Nuclear Power

Point 4: Accelerating the Shift to Zero Emission Vehicles

Point 5: Green Public Transport, Cycling and Walking

Point 6: Jet Zero and Green Ships

Point 7: Greener Buildings

Point 8: Investing in Carbon Capture, Usage and Storage

Point 9: Protecting Our Natural Environment

Point 10: Green Finance and Innovation

Comparing the CRMA and NZIA of the EU to the IRA of the United States

Please note that US Treasury guidance has not yet been issued



	NZIA: Manufacturing Capacity Targets	CRMA: Strategic Raw Materials Value Chain	IRA: Domestic Content and Manufacturing Requirements
Total net-zero manufacturing capacity	40% of EU annual deployment needs to meet REPowerEU and Green Deal objectives	Extraction capacity Sufficient to extract ores, minerals, concentrates needed to meet 10% EU annual consumption	Energy projects (including wind facilities, solar energy facilities, landfill gas facilities, fuel cell properties, energy storage technology)
Solar photovoltaics (PV)*	40% of annual deployment needs		
Wind turbines*	85% of annual deployment needs	Processing capacity incl. all intermediate steps Sufficient to produce 40% of annual EU consumption	Electric vehicles
Heat pumps*	60% of annual deployment needs		
Batteries*	85% of annual EU battery demand	EU recycling capacity 15% of EU annual consumption of each raw material	Iron and steel 100% of any iron and steel used in project construction made in the United States
Electrolysers*	50% of renewable and fossil-free hydrogen annual deployment needs		
Diversification	Increase in manufacturing capacity for net-zero technologies for which ≥65% of supply	Diversification No dependence on any third country ≥65% for any strategic raw material	Manufactured products 40% of total cost of all manufactured products in the facility must be produced in the United States, rising to 55% after 2026
			Assembly Final assembly of the vehicle in North America
			Battery manufacture and assembly Percentage of the value of the battery's components manufactured or assembled in North America be ≥ 50% (2023) rising annually to 100% as of 2029
			Critical mineral content Threshold of critical minerals in the EV battery that were extracted or processed in the United States, countries with which the United States has an FTA, or recycled in North America must be ≥40% by end of 2023 rising annually to 80% as of 2027

*Asterisks indicate targets only cited in the leaked version of the NZIA and not included in the final proposal | Source: Authors' own reading of the CRMA, NZIA, and provisions in the IRA (<https://www.whitehouse.gov/cleanenergy/clean-energy-tax-provisions/>)

Takeaway messages

1. Megatrends such as sustainability are changing the drivers of industrial competitiveness.
2. Industrial sustainability offers direct and indirect opportunities for value-added and economic diversification at country level.
3. Revival of industrial innovation policy.
4. Industrial innovation policies today have been focusing on responding to megatrends in the global economy, including sustainability.
5. Net Zero industrial innovation policies becoming more aggressive (e.g. local content).



Thanks for listening



Dr David Leal-Ayala

Institute for Manufacturing, University of
Cambridge / World Economic Forum

26 September 2023



**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Circularity & sufficiency: Circular economy

**Jelmer Hoogzaad
Shifting Paradigms**

Circularity & Sufficiency

3rd Luxemburg Strategy Conference
Jelmer Hoogzaad, Shifting Paradigms, 26 Sep 2023

What we do

1. Align with development priorities

2. Metabolic analysis and workshops

3. Select circular opportunities and quantify impact

4. Develop a roadmap and guide investments



Relative vs absolute impacts

At the level of individual investments we risk pushing:

- relative emissions down (due to efficiency gains),
- absolute emissions up (due to capacity increases).

By exporting industries, the EU reduced its emissions while its consumption-based footprint went up.



Circular economy

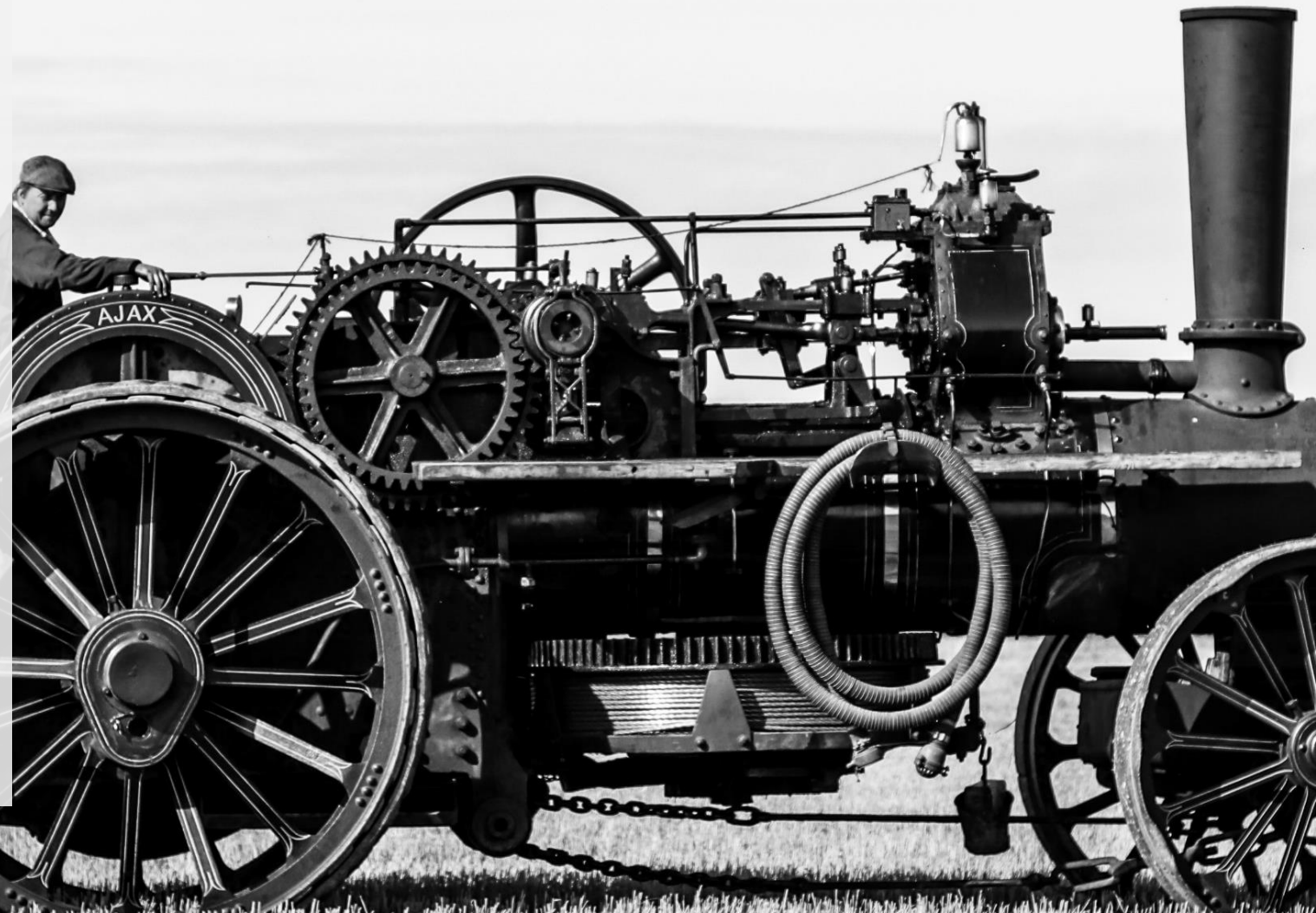
Map out value chains and the **service** which they deliver (nutrition, mobility, shelter).

Then redesign them to:

1. extend the lifetime
2. prioritise regenerative and secondary resources
3. design for the future
4. team up along value chains
5. rethink the business model

Jevons Paradox (rebounds)

1. The efficient use of coal with new technologies increased coal use – it did not preserve resources (Jevons, 1865)
2. Circular economy does not solve this, sufficiency does:
 - “avoid demand for energy, materials, (..) while delivering human wellbeing (..)”
 - involves technologies, infrastructures and lifestyles



Sufficiency-based CE in the global gap reporting

1. Different priorities for low, medium, high-income countries
2. High income countries need to:
 - regulate transport, including air travel and international shipping
 - promote healthy diets
 - incentivize lower per capita m^2 living space
3. IPCC confirms that we need sufficiency

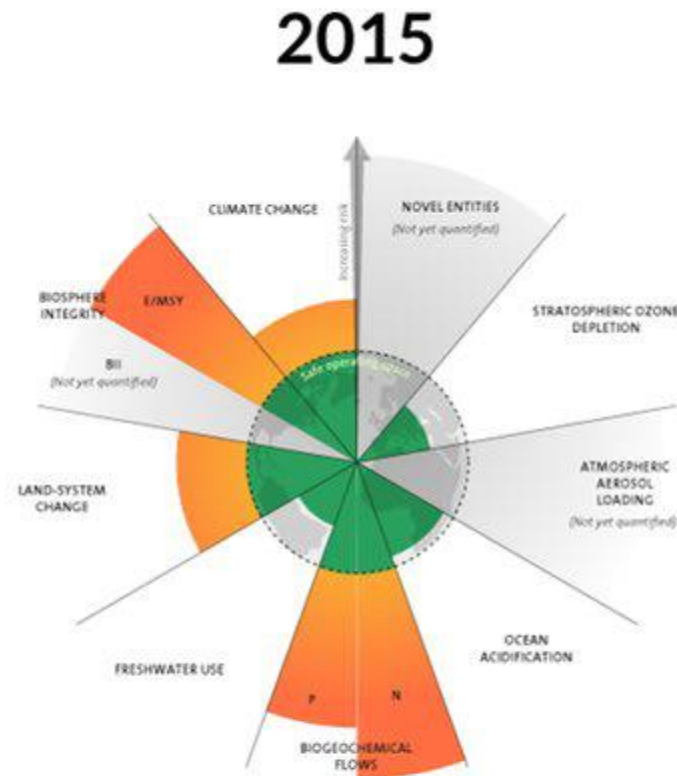


Sources: [Circle Economy, Shifting Paradigms \(2020\)](#). How countries can close the circularity gap; [Circle Economy, Shifting Paradigms \(2021\)](#) Doubling circularity can bring us to 'well below 2 degrees'; [Bocken \(2022\)](#). The Sufficiency-Based Circular Economy; Photo by [Dominik Lückmann](#) on [Unsplash](#)

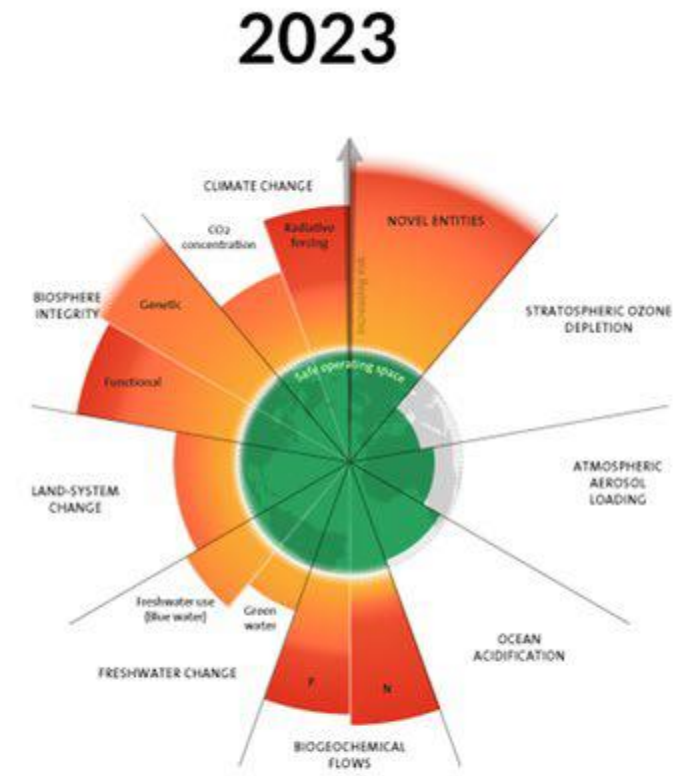
Trade off between sufficiency and CE

1. Reducing demand for relatively circular products, may reduce a country's circularity
2. Sufficiency and CE are both a means to an end
3. The objective is to get back within planetary boundaries

3 boundaries crossed



4 boundaries crossed



6 boundaries crossed

What not to do

(...)



21st Century Urban Planning & Mobility

@urbanthoughts11



1970: One more lane will fix it.
1980: One more lane will fix it.
1990: One more lane will fix it.
2000: One more lane will fix it.
2010: One more lane will fix it.
2020s: ?



640 x 814

Common sufficiency policies

1. Fish quota
2. Protecting natural reserves, urban planning
3. Restrictions on (advertising for) tobacco and alcohol
4. Taxes and subsidies

See: [EU sufficiency Policy Database](#)



Charlie's

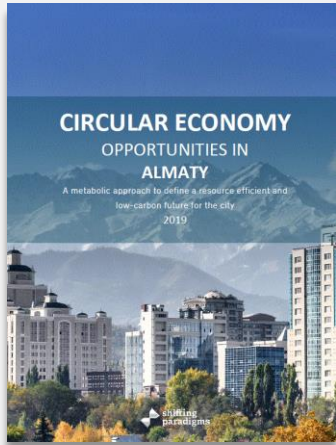


ROUND THE CORNER ICE CREAM

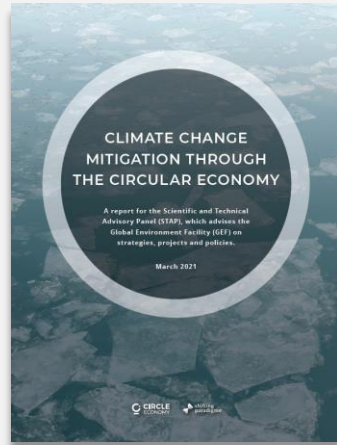
Align all aspects which affect investment decisions and consumer behavior

1. Adjust the tax system (to avoid rebounds)
2. Regulate marketing
3. Remove legal barriers

Further reading



Almaty



The GEF



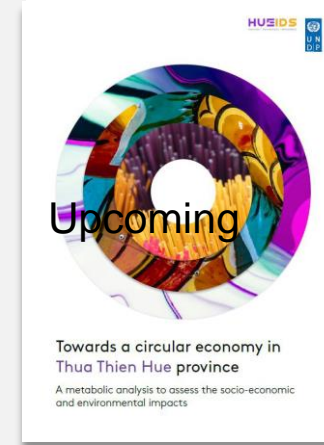
Vanuatu



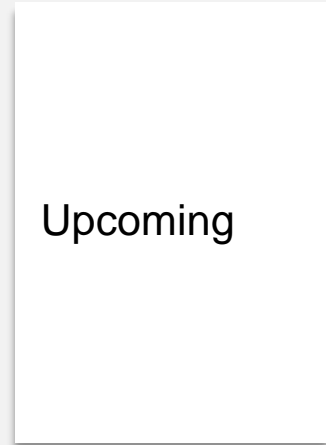
The Gambia



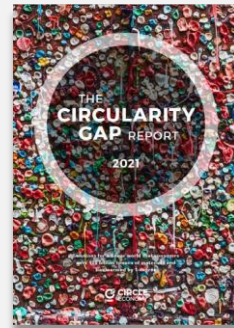
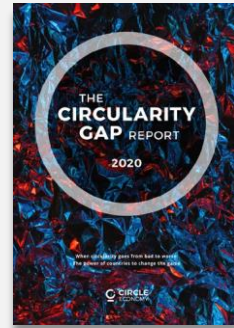
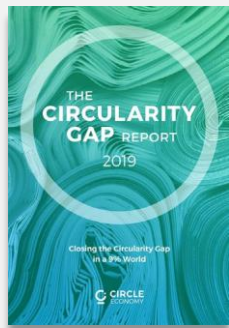
Lao PDR



Hue Province
(Nov 2023)



South Australia



Annual global circularity gap reports

Contacts

www.shiftingparadigms.nl

jelmer@shiftingparadigms.nl

Thank you

A&W
Arthur & Willems



**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Human-centred & knowledge economy: Behavioural change in a diversified economy

**Yanchun Zhang
Human Development Report Office (HDRO)**

Human
Development
Report
Office



Human-centred & knowledge economy: behavioral change in a diversified economy

- development strategies in an uncertain world

Yanchun Zhang, UNDP/HDR0

3rd Luxembourg Strategy Conference

26 September 2023



- 1990: Concept and Measurement
- 1991: Financing
- 1992: Global Dimensions
- 1993: People's Participation
- 1994: Human Security
- 1995: Gender
- 1996: Economic Growth
- 1997: Poverty
- 1998: Consumption
- 1999: Globalization
- 2000: Human Rights
- 2001: New technologies
- 2002: Democracy
- 2003: MDGs
- 2004: Cultural Liberty
- 2005: Aid, trade and security
- 2006: Water
- 2007-8: Climate Change
- 2009: Human Mobility
- 2010: Pathways to Human Development
- 2011: Sustainability and Equity: A Better Future for all
- 2013: The Rise of the South: Human Progress in a Diverse World
- 2014: Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience
- 2015: Work for Human Development
- 2016: Human Development for Everyone
- 2018: Human Development Indices and Indicators: Statistical Update
- 2019: Beyond income, beyond averages, beyond today: inequalities in human development in the 21st Century
- 2020: The next frontier: Human development and the Anthropocene
- 2021-2: Uncertain Times, Unsettled Lives: Shaping our Future in Transforming World**

**Human
Development
Report
Office**



Trilogy of reports

Human Development Report 2019



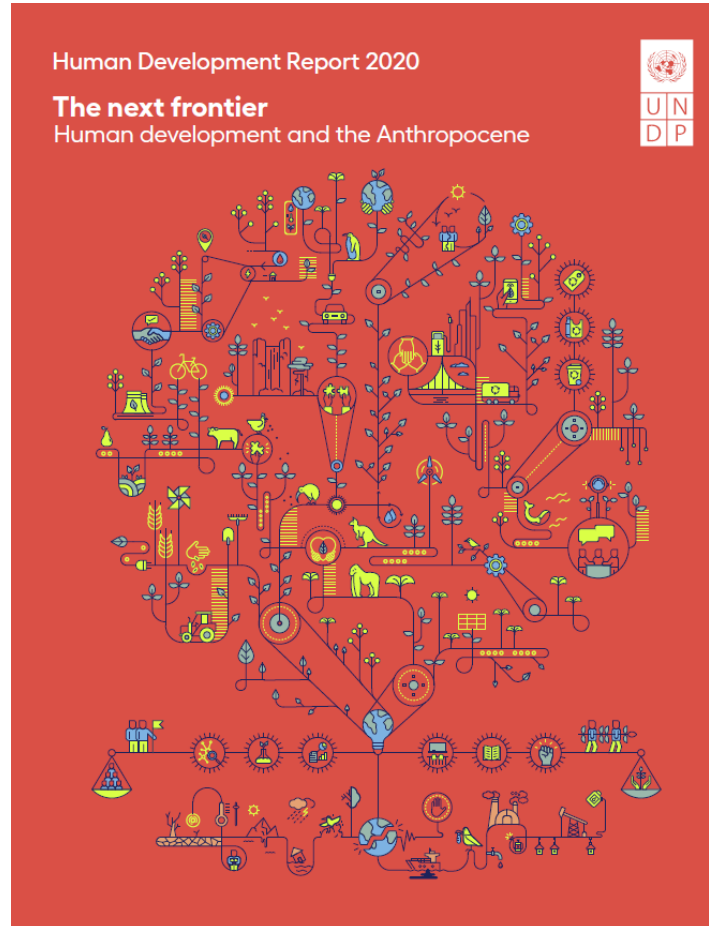
Beyond income, beyond averages, beyond today:
Inequalities in human development in the 21st century



Human Development Report 2020



The next frontier
Human development and the Anthropocene



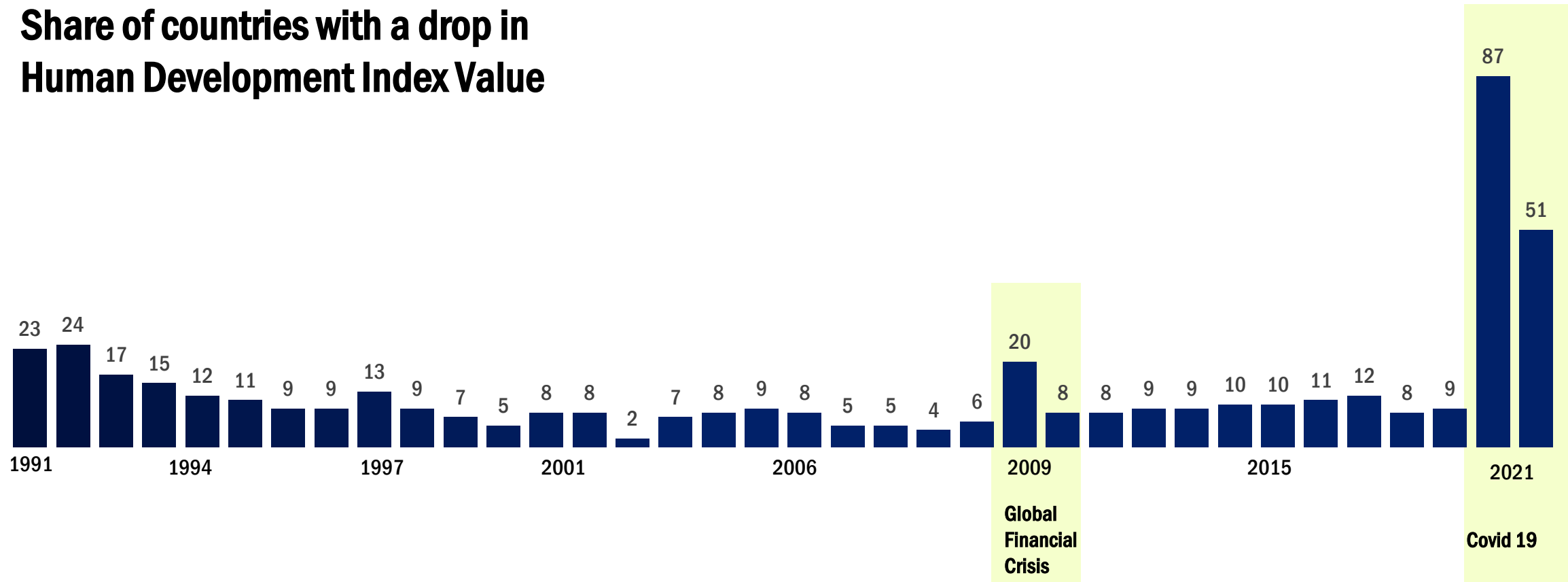
HUMAN DEVELOPMENT REPORT 2021/2022



**Uncertain Times,
Unsettled Lives:
Shaping our Future
in a
Transforming World**

9 out of 10 countries suffered drops in human development index scores during 2020-21

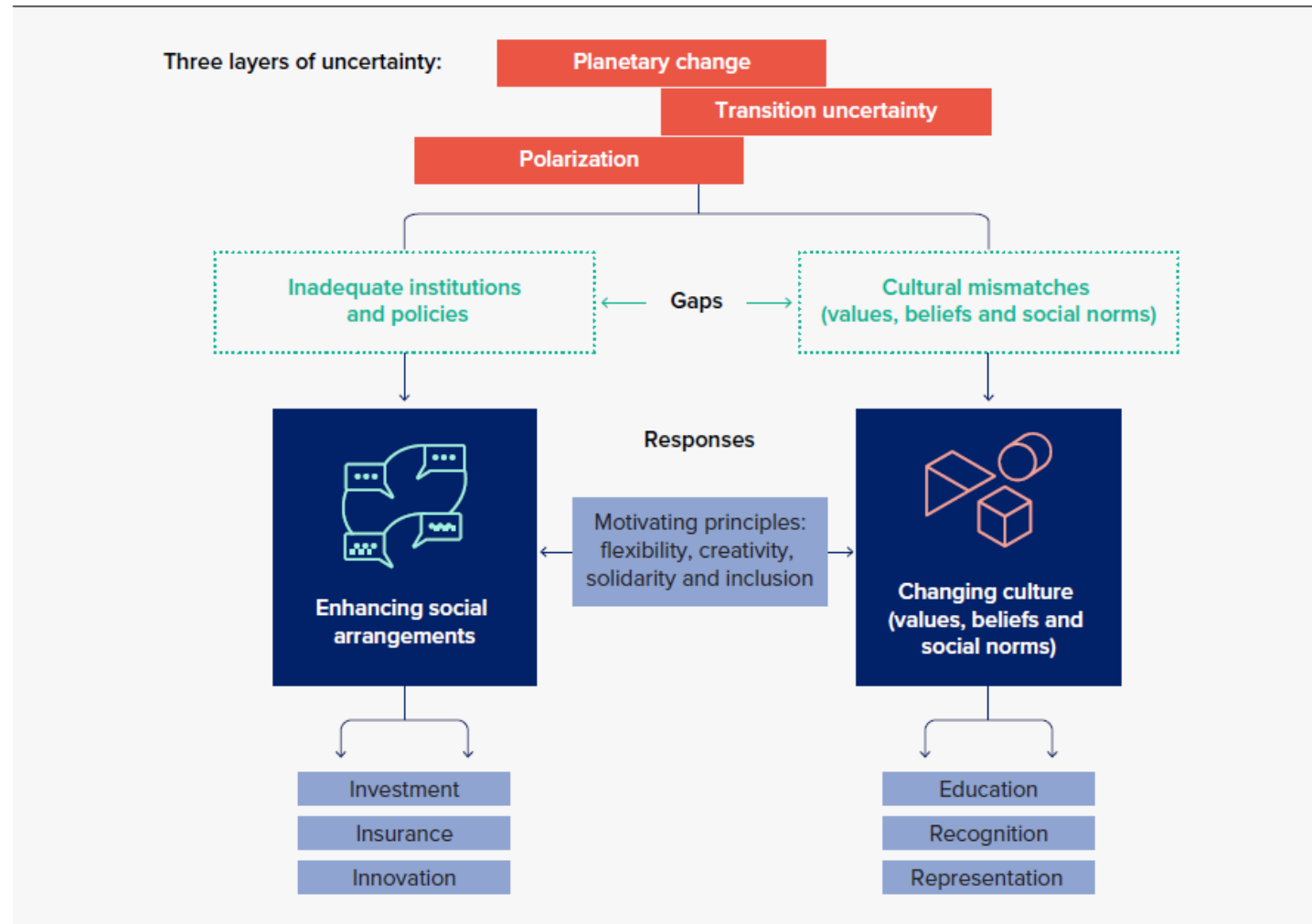
Share of countries with a drop in Human Development Index Value



Source: Human Development Report Office calculations based on data from Barro and Lee (2018), IMF (2021, 2022), UNDESA (2022a, 2022b), UNESCO Institute for Statistics (2022), United Nations Statistics Division (2022) and World Bank (2022).

HDR2021/22: a new uncertainty complex

Figure 6.1 A two-tier framework for transformation



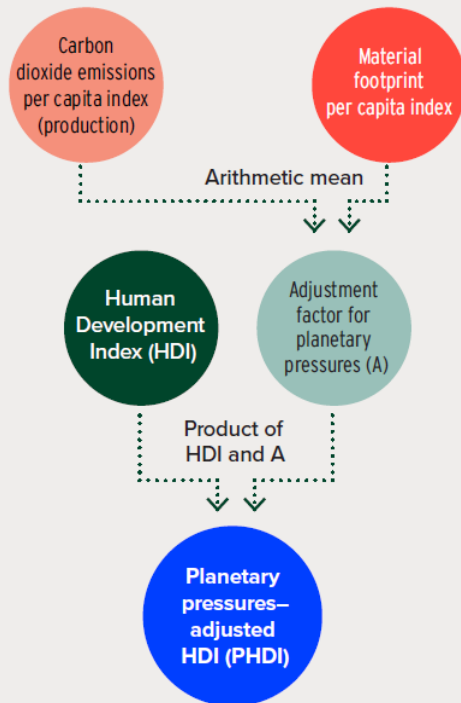
Source: Human Development Report Office.

Uncertainty emerges from complex transitions to ease planetary pressures

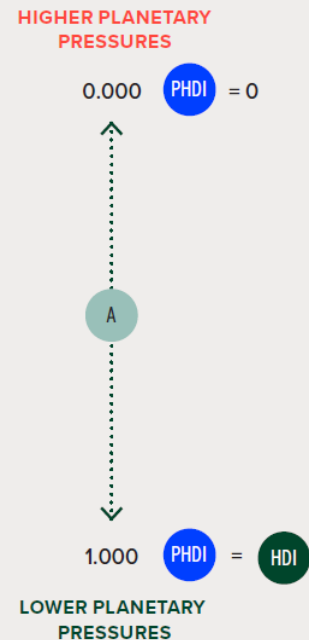
PHDI

$$= \text{HDI} * (1 - \text{index of planetary pressures})$$

PHDI is created by multiplying the HDI
by an adjustment factor

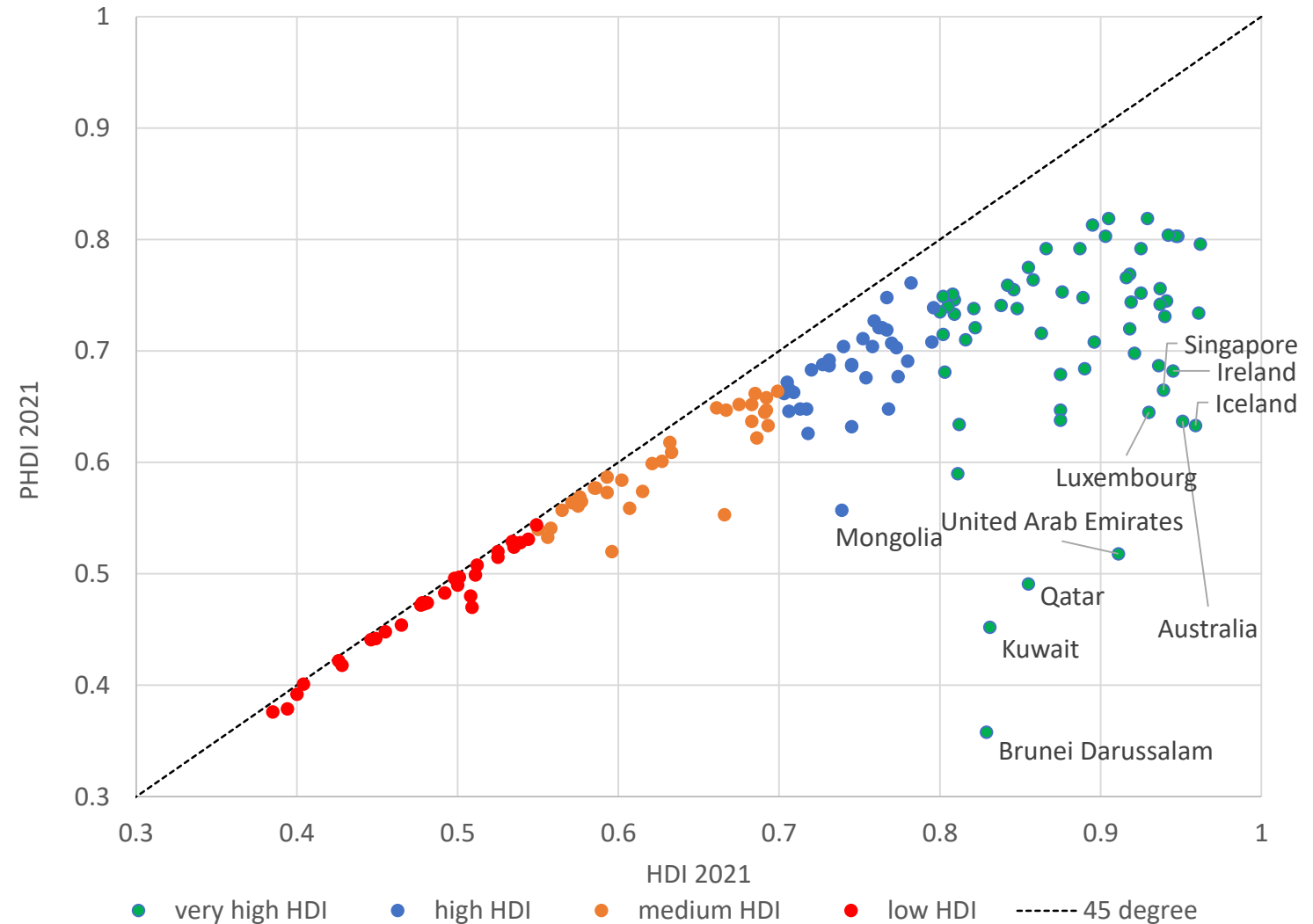


Relationship among
HDI, A and PHDI



Planetary pressures-adjusted HDI (PHDI)

- When there are no pressures on the planet, PHDI=HDI.
- As pressures appear, the PHDI falls below the HDI.
- Only 7 countries remain with very high human development when pressures are considered.



HDI vs. PHDI for Luxembourg

HDI value (2021)
0.930

Human development classification
Very High

Developing region
—



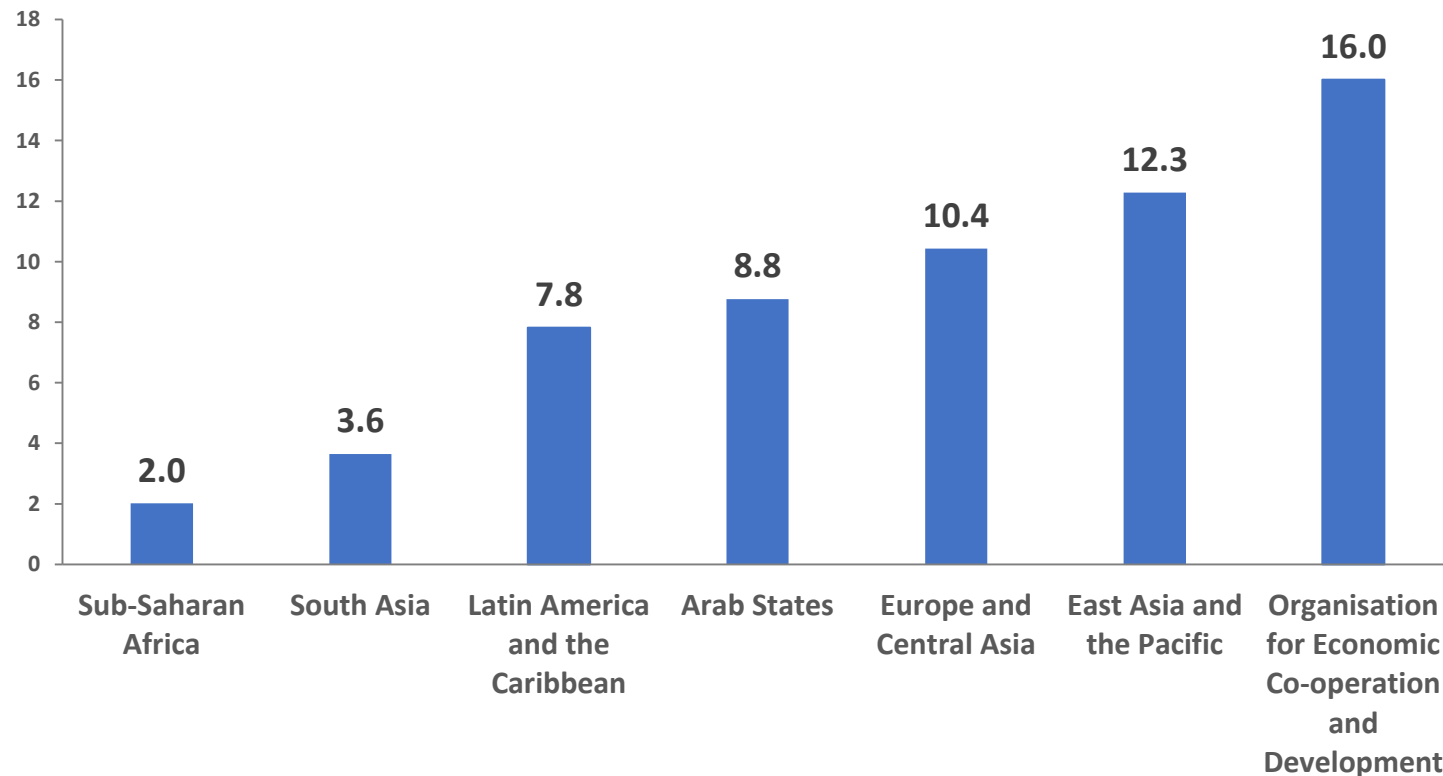
HDI rank	Country	Human Development Index (HDI)	Planetary pressures-adjusted HDI (PHDI)		Adjustment factor for planetary pressures	Carbon dioxide emissions per capita (production)	Carbon dioxide emissions (production) index	Material footprint per capita	Material footprint index	
		Value	Value	Difference from HDI value (%)	Difference from HDI rank	Value	(tonnes)	Value	(tonnes)	Value
		2021	2021	2021	2021 ^a	2021	2020	2020	2019	2019
17	Luxembourg	0.930	0.645	30.6	-73	0.693	13.1	0.810	45.5	0.577

Very high human development

PHDI: Global and Regional Picture

- In the 2021/2022 HDR the PHDI covered 155 countries.
- The global difference from the HDI value is 8.9%.

Difference from HDI value (%)



The message :

Countries should strive to attain (or maintain) very high levels of human development without imposing pressures on the planet.

How to navigate uncertainty?





**Human
Development
Report
Office**

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**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Social Innovation: New business models

**Daniel Nowack
World Economic Forum (WEF)**

WORLD
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COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

Global Alliance For Social Entrepreneurship

Luxembourg Strategy – 3rd Annual Conference



Foundation

Deloitte.



OXFAM



Microsoft

echoing
GREEN



CATALYST 2030
Collaborating to achieve the SDGs



OECD



ASHOKA



UNITED NATIONS
UNCTAD



Unilever



EY



Philips
Foundation



Global Alliance
for Social
Entrepreneurship



100+
Members

100,000
Social Innovators

2bn
Lives Impacted

AI | CLIMATE & HEALTH | SOCIAL PROCUREMENT | SCALING & PARTNERSHIPS
CIRCULARITY | POLICY | DATA | RACIAL EQUITY | OUTCOME-BASED FUNDING

Digital Transition

In the next five years, a population the size of Germany (83 million) may lose their job due to AI. [↓](#)



Green Transition

Half of the world's population lives in areas that are highly vulnerable to climate change.



Social Transition

1 in 4 EU citizens will be 65 years or older by 2030, rising to 1 in 3 citizens by 2100.³



BUSINESS & THE TRANSITIONS

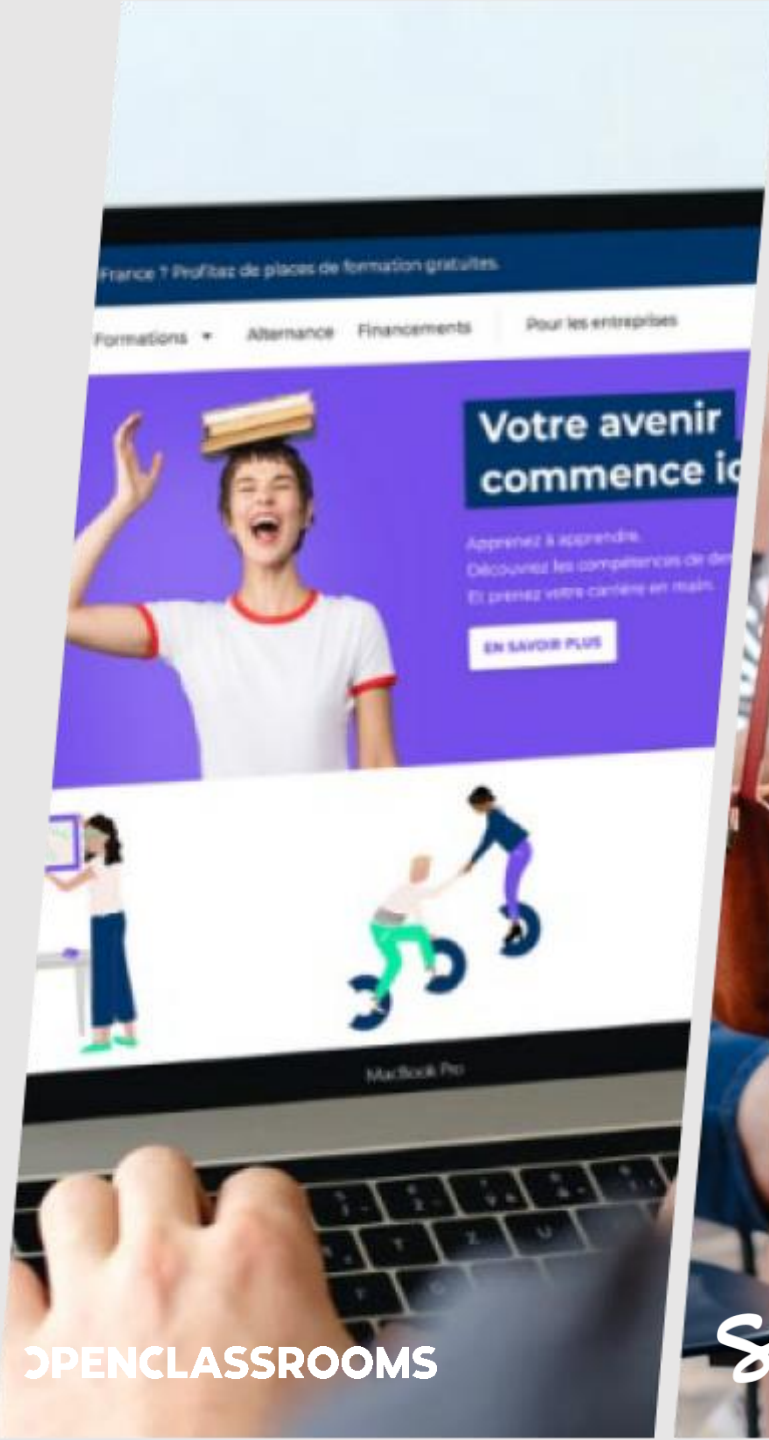
Global Risks Report 2023

2 years



Society's R&D Lab

Social Innovators serve as an R&D lab for society and economy, testing new solutions to some of our most pressing challenges.



OPENCLASSROOMS



Smart



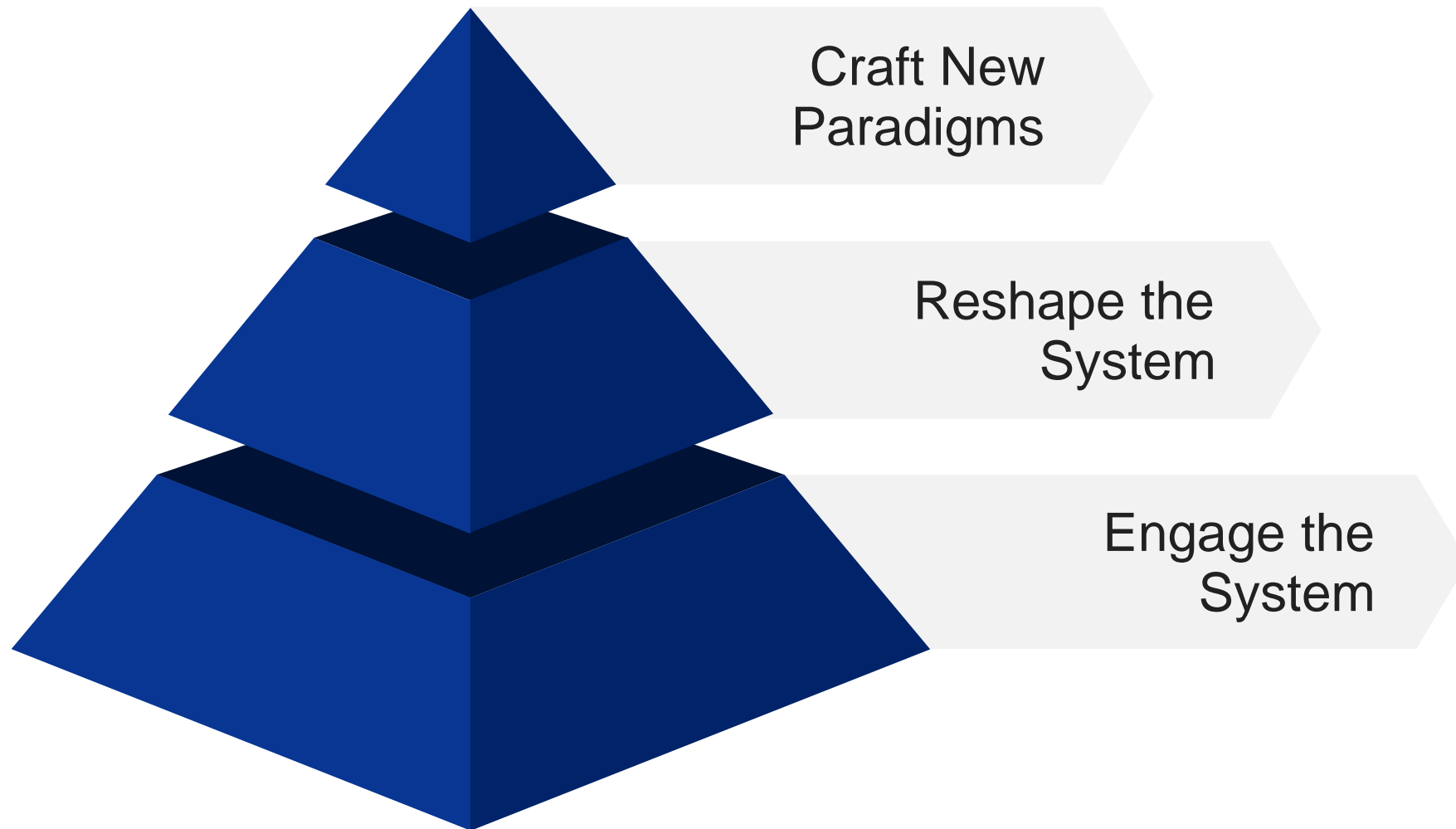
BLOC
POWER

The Social Economy at a Glance

“Social economy organisations put **social and environmental concerns at the heart of their business model** prioritising social impact and sustainability over profit maximisation”



Three Levels of Social Innovation



Trading Externalities

Creating a fair and green economy requires global mechanisms to value and trade externalities – positive and negative.



WORLD
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FORUM

A blue circular graphic element, resembling a stylized globe or a partial circle, is positioned behind the text. It starts at the top left, curves around the right side, and ends at the bottom right, partially overlapping the letters of the text.

**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Double-track solutions: Twin transitions

**Grzegorz Drozd
European Commission**

Grzegorz Drozd
Secretariat General
European Commission



TOWARDS
**A GREEN &
DIGITAL
FUTURE**



European
Commission

EU strategic foresight: science underpins policies



Science for Policy Report



Communication

How do the green and digital transitions interact with each other?

Green transition

twinning or capacity to reinforce each other

Digital transition

Tensions and synergies between green & digital

- + digital tech helps climate neutrality & biodiversity, e.g. data sharing or gamification can increase public participation in steering the transitions and co-creation of innovations.
- + green transformation can help the digital sector, e.g. achieving climate neutrality of data centres and cloud infrastructures by 2030 will support the greening of data-based technologies (big data analytics, blockchain, IoT)
- energy and water consumption, e.g. if the ICT sector were a country, this would make it the fifth largest polluter in the world
- waste, e.g. in the EU, currently only 17.4% of the e-waste is properly treated and recycled

Digital tech to green 5 strategic/most polluting sectors



DIGITALISING
ENERGY



ENABLING GREENER
TRANSPORT
WITH DIGITAL
TECHNOLOGIES



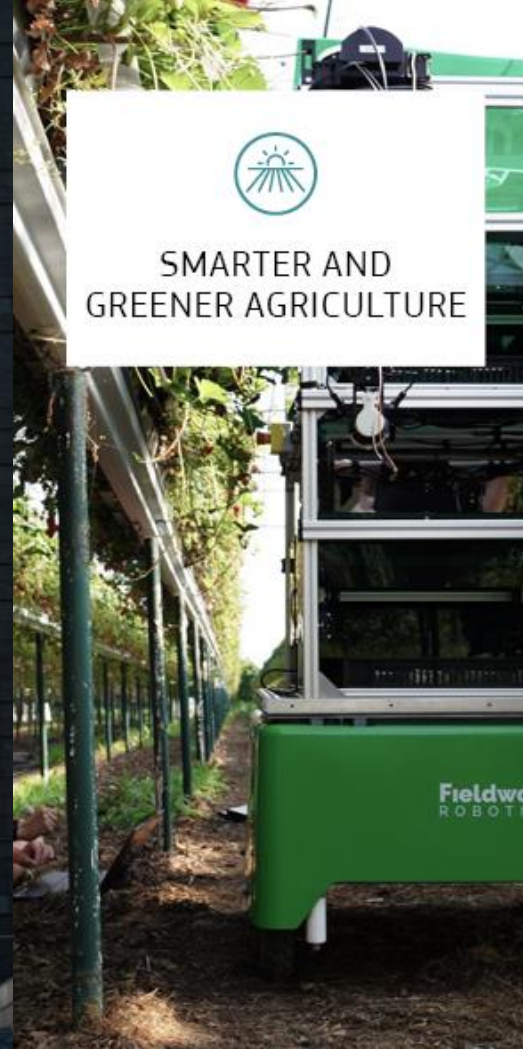
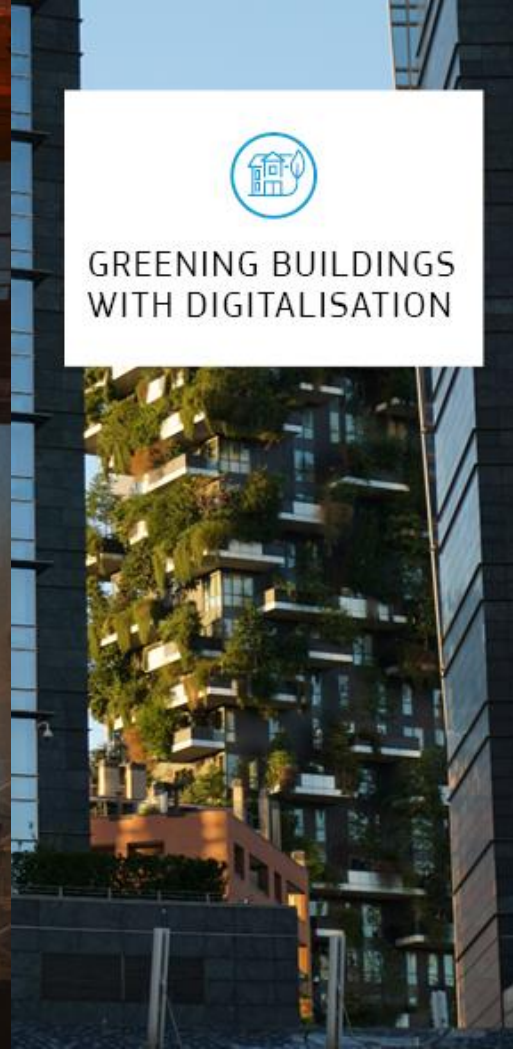
GALVANISING THE
INDUSTRY'S CLIMATE-
NEUTRALITY THROUGH
DIGITAL TECHNOLOGIES



GREENING BUILDINGS
WITH DIGITALISATION

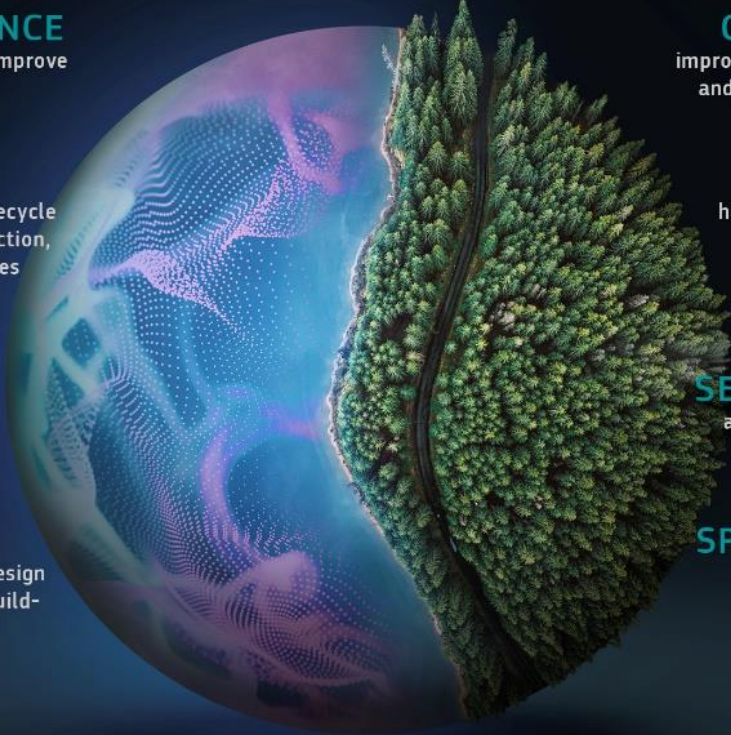


SMARTER AND
GREENER AGRICULTURE



Key cross-cutting digital tech for green

TECHNOLOGIES KEY TO THE TWIN TRANSITIONS



ARTIFICIAL INTELLIGENCE
supports connected mobility, helps to improve traffic management and to lower fuel consumption

BLOCKCHAIN
ensures greater transparency in the lifecycle and value chain of products, e.g. production, reuse, recycling and disposal of batteries

INTERNET OF THINGS
helps to monitor the condition of agricultural land or biodiversity

DIGITAL TWINS
facilitate innovation, testing and the design of more sustainable solutions, e.g. in buildings or urban planning


QUANTUM COMPUTING
improves our understanding of the biological and chemical processes needed to reduce pesticides and fertilizers

SENSORS
help measuring and controlling inputs to improve resource efficiency in industry

MICROGRIDS AND SELF-ORGANISED GRIDS
automatically monitor energy flows and adjust to changes in energy supply and demand, as well as weather conditions

SPACE-BASED SERVICES
supports precision farming to reduce pesticides and keep crops healthy

#StrategicForesight



Non-tech factors

The EU accounts for 4% of global supply chain of CRMs used in the production of digital equipment



Reaching the EU's clean energy goal will require +3500% lithium, +330 % of cobalt by 2050

Geopolitics

- ✓ current geopolitical shifts
- ✓ need for the EU to accelerate the twin transitions, reinforcing the EU's resilience and open strategic autonomy
- ✓ access to critical raw materials & circularity
- ✓ geopolitics of technologies

Economy

- ✓ towards a new economic model focused on resource efficiency, circularity and regeneration
- ✓ additional public and private investments (at least 650 billion euros per year until 2030)

Society

- ✓ inclusiveness and affordability as key conditions
- ✓ shifts in labour market & jobs
- ✓ production & consumption patterns

Regulation

- ✓ standards key for testing, management systems or interoperability

From analysis to action



Resilience and open strategic autonomy in critical twinning-related sectors.



Stepping up green and digital diplomacy vis-à-vis third countries.



Strategically managing critical supplies, including critical raw materials.



Strengthening social protection and the welfare state.

and more action



Transition to new quality jobs, also via adequate skills.



Mobilising additional strategic investments for the twinning.



Developing monitoring frameworks on digital footprint and well-being.



Ensuring a future-proof governance and agile regulatory framework.



Lead in standard-setting, also for greening digitalisation.



Strengthening cyber-security and data policies.

Thank you

[JRC Publications Repository - Towards a green & digital future \(europa.eu\)](#)

https://ec.europa.eu/info/strategy/strategic-planning/strategic-foresight/2022-strategic-foresight-report_en

Grzegorz.Drozd@ec.europa.eu

**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Simplification: dealing with the administrative complexity of diversification

Daniel Trnka

**Organisation for Economic Co-operation &
Development (OECD)**

Navigating Administrative Complexity for Diversification

Daniel Trnka, Regulatory Policy Division, Public Governance Directorate, OECD



- **Simplifying procedures, shortening pathways, facilitating transfers:** improving the business environment for entrepreneurs, investors and researchers by streamlining procedures that will also change the corporate culture to attract young recruits and talent
- Administrative complexity impacts resilience, competitiveness, and inclusivity



Why simplification?

- Stock of regulation has been growing over time – leads to regulatory “jungle”
- Regulation might impede competition, employment, innovation
- Pressures from society– to reduce regulatory burden to stimulate economic activity...but also to protect more
- Opportunity to promote recovery enabling reforms
- Address tendency of government towards an over reliance on rules

- Controlling the “flow” as well as the “stock” of regulations
- More agile regulatory policy to deal with fast technological changes

- Regulatory Impact Assessment – RIA
- Clearly setting objectives of regulation
- Making sure all alternatives are taken into account, including outcome-based regulation, non-regulatory alternatives
- Importance of stakeholder engagement
- Make regulatory experimentation possible – right to failure

- Do not “regulate and forget”
- Administrative simplification
- Frequent and regular *ex post* reviews of regulatory performance
- Taking into account economic, social and environmental impacts
- Social factors: dignity, irritation – regulatory sludge audits

- Consolidation and codification
- Streamlining of procedures, harmonising
- Digitalisation, data sharing
- One-stop shops (electronic & physical)
- Risk-based approaches (licensing, inspections)
- Common commencement dates, One-In X-Out, Sunsetting
- Ex post evaluation of regulatory stock, including measurement and reduction of administrative and regulatory burden.





What review approaches are there?

STOCK MANAGEMENT REVIEWS

- Stock-flow rules
 - Budgets
 - In Out/Offsets
- Red tape reduction targets

PROGRAMMED MECHANISMS

- Sun-setting
- Embedded in statute
- Post implementation reviews

AD-HOC/SPECIAL PURPOSE REVIEWS

- Public stocktakes
- Principles-based
- Benchmarking
- In-depth reviews

Ongoing

At a set time

As needed



Efforts vs Impacts

	Potentially low return	Potentially high return
High effort	<ul style="list-style-type: none">➤ Broad redtape cost estimation➤ Regulatory budgets and one-in one-out^a➤ Frequent stocktakes	<ul style="list-style-type: none">➤ In-depth reviews➤ Embedded statutory reviews➤ Benchmarking➤ Packaged sunset reviews
Low effort	<ul style="list-style-type: none">➤ Sunsetting➤ Regulator stock management➤ Red tape targets^b➤ RIS stock-flow link	<ul style="list-style-type: none">➤ Known high cost areas and known solutions from past reviews➤ Regulator management strategies where weak in the past➤ Periodic stocktakes



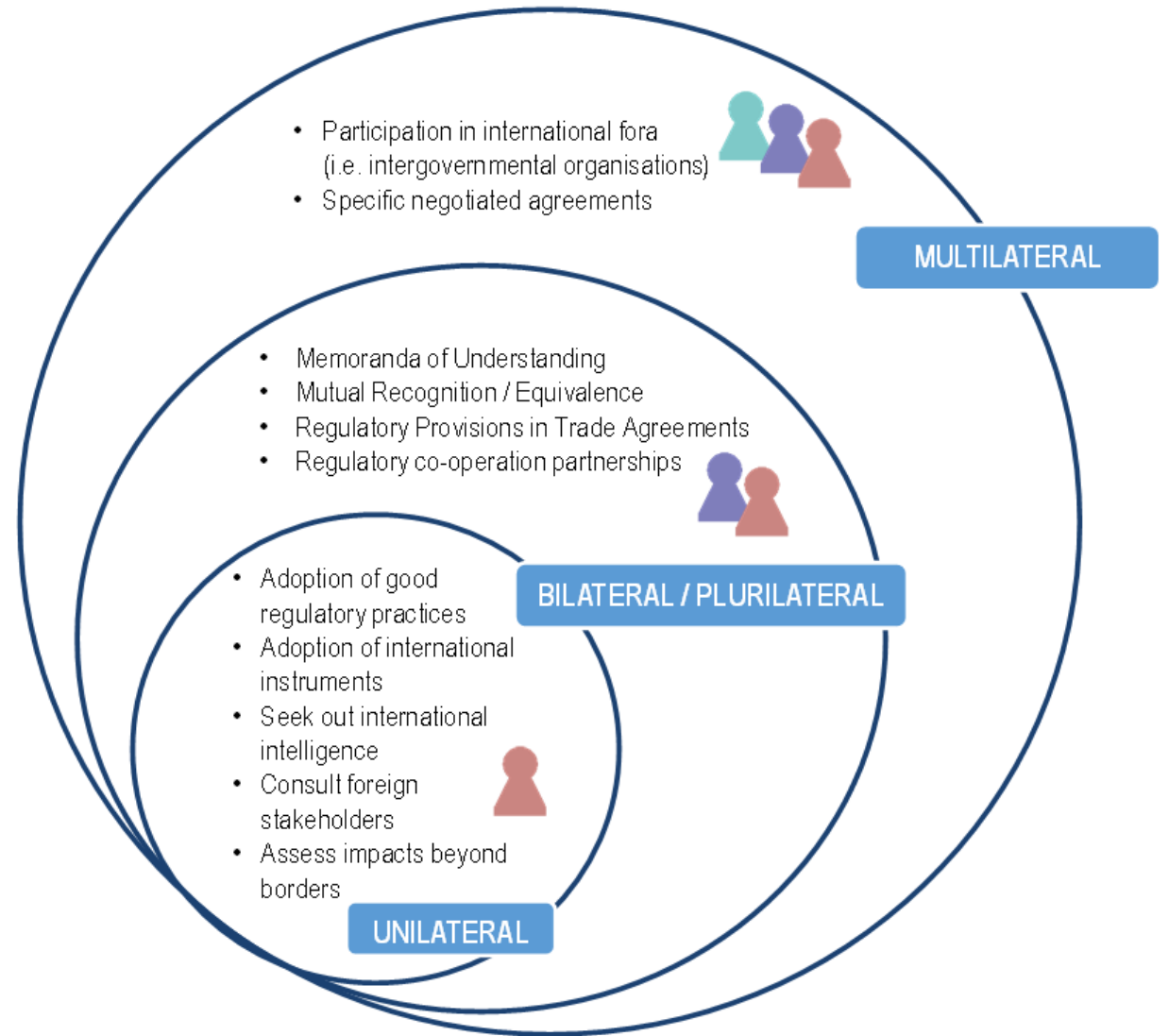
> Four main pillars:

- ▶ Adapting **regulatory management tools**
- ▶ Fostering **cooperation**, including **across borders**
- ▶ Developing **agile** and **future-proof** regulations
- ▶ Adapting **enforcement** to the « new normal »



International Regulatory Co-operation:

A set of IRC mechanisms available to countries: from unilateral to multilateral action





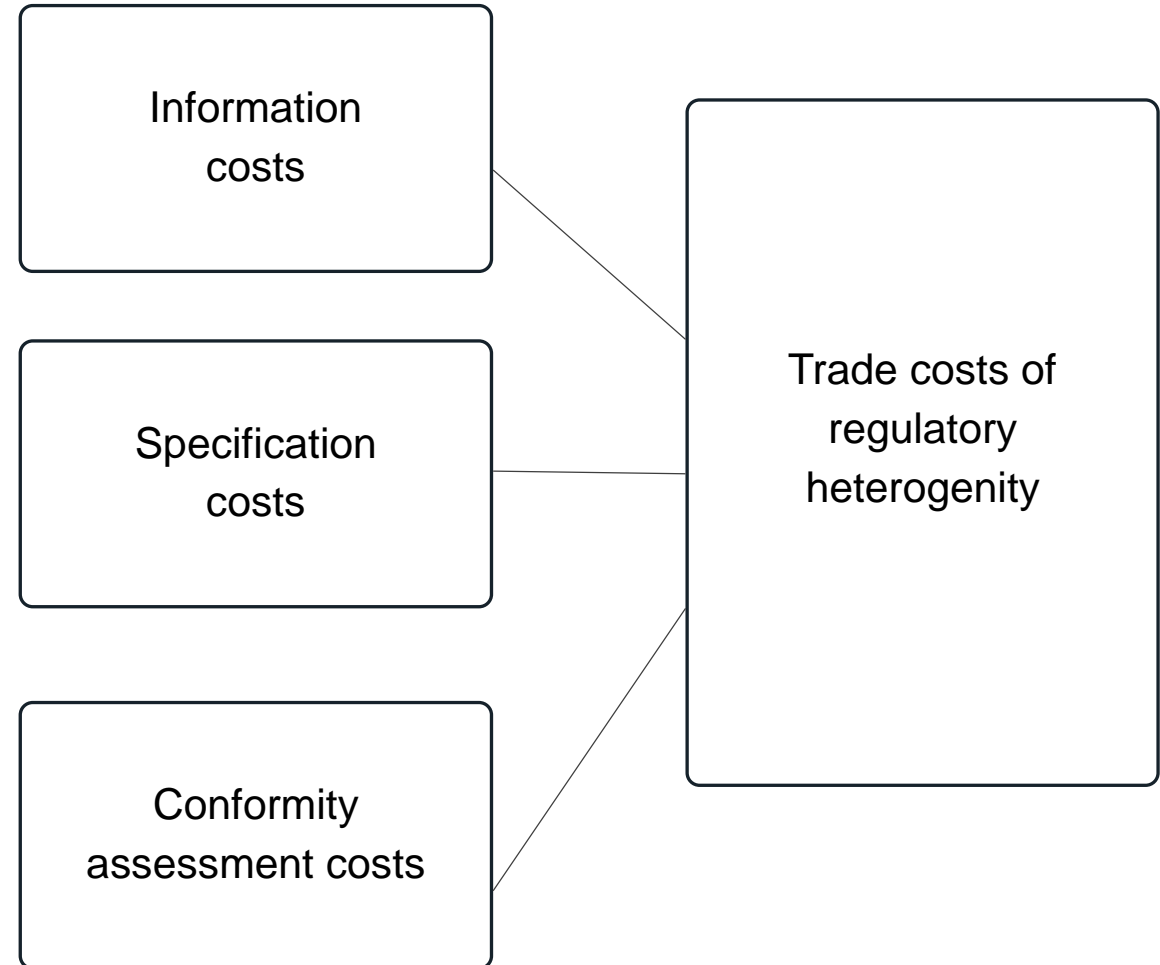
Why does IRC matter?

The costs of “regulatory” heterogeneity may be high

The evidence

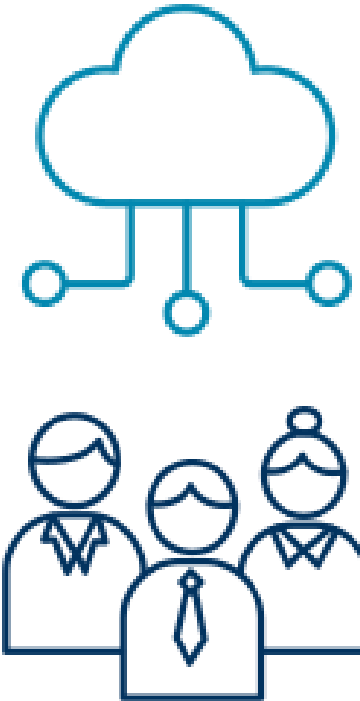
- They are non-negligible in some sectors
- They distort GVC
- They may be fixed (affect market entry) or variable (act as a tariff)
- They are country and sector specific
- They are not the priority in highly restricted markets

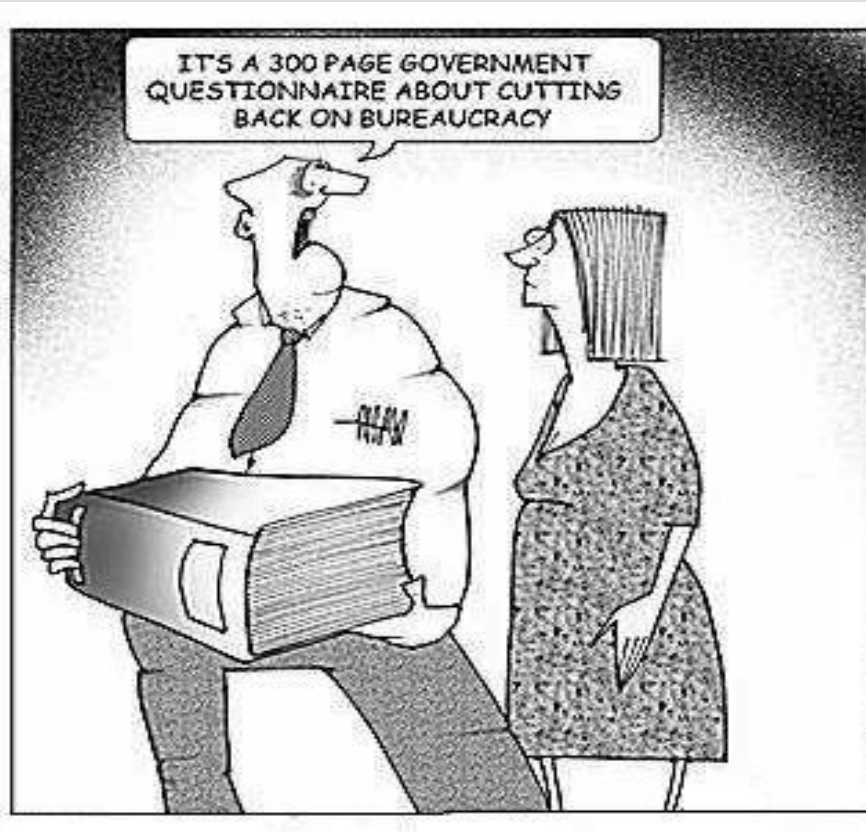
The definition





- Extremely important throughout the whole regulatory cycle:
 - > Defining priorities
 - > Measuring and testing
 - > Looking for simplification proposals
- Help to understand issues at hand
 - > Website for submitting ideas
- Steering and advisory committees, working groups, business fora





Thank you!

Daniel.trnka@oecd.org

[Oe.cd/regpol](https://www.oecd.org/regpol/)



Follow us on LinkedIn: OECD Better Regulation

**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Future-fit diversification: Ability of EU economies to thrive in times of change

**Lydia Korniek
ZOE Institute for Future-fit Economies**

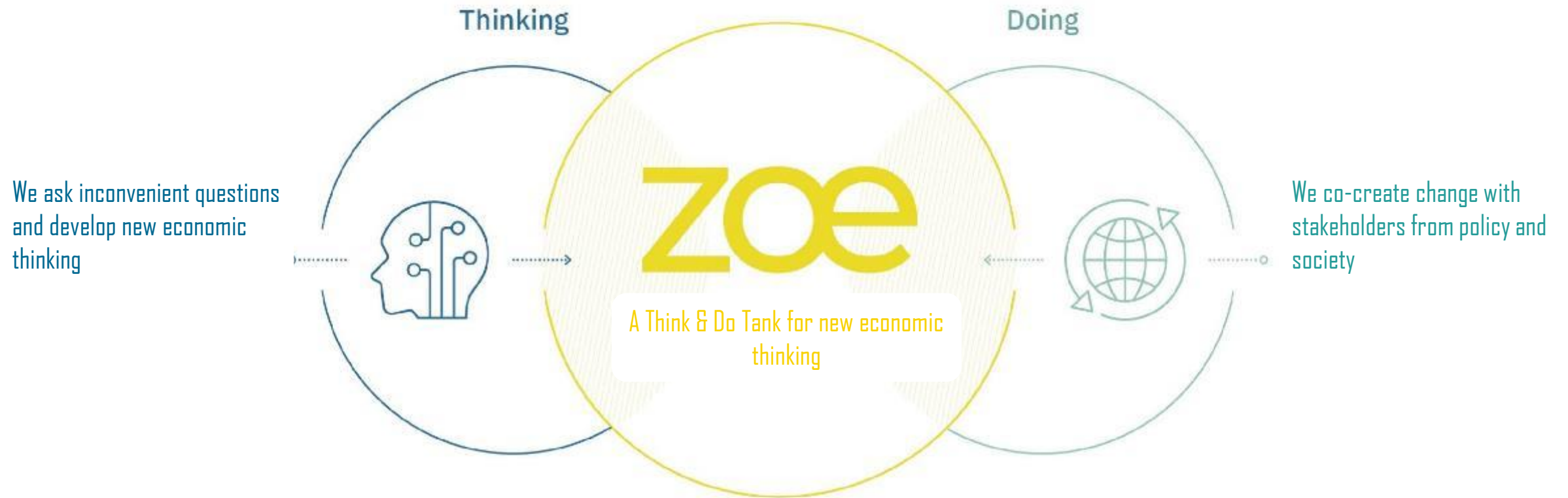
Future-fit diversification
*Ability of EU economies to thrive in times of
change*

Tuesday, 26th September 2023

Lydia Korinek
ZOE Institute for Future-fit Economies

**3rd Luxembourg
Strategy
Conference**

ZOE Institute for Future-fit Economies



A New North Star for Economic Policy

(Picture: Marek Piwnicki)

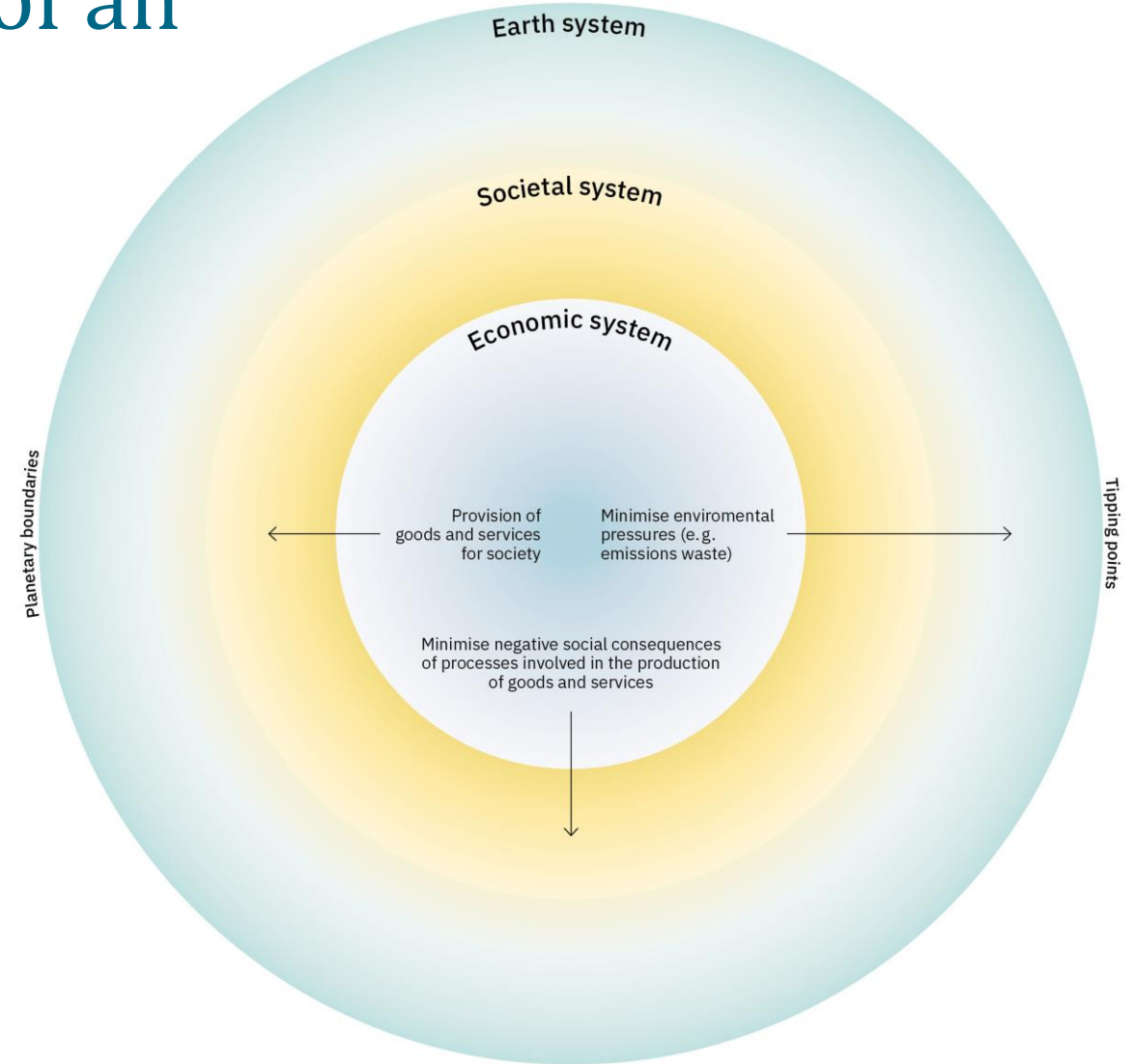
What are the core functions of an economy?

Highest purpose of the economy:

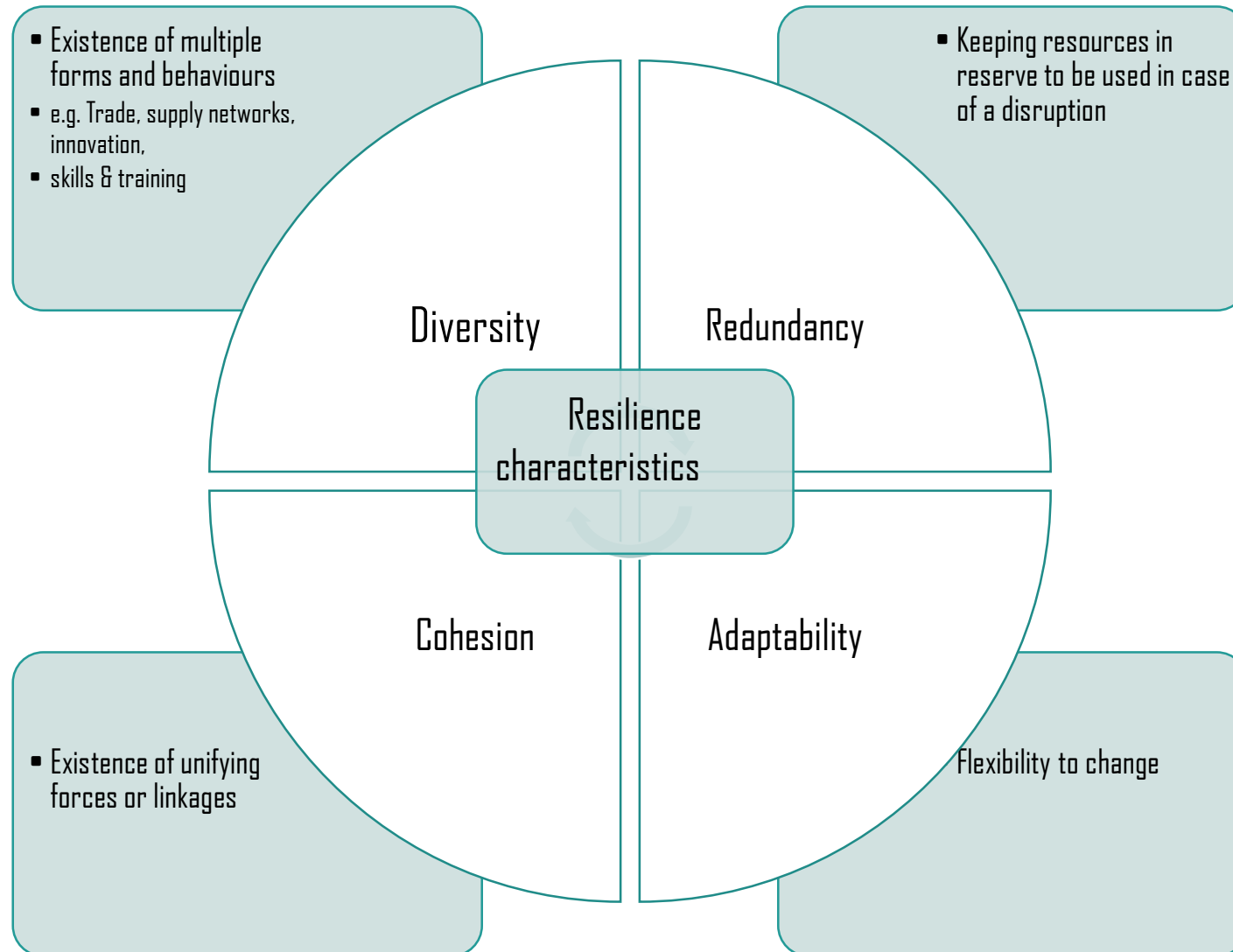
Providing wellbeing for present and future generations within planetary boundaries

The ability to...

- Develop, distribute, and use technology
- Develop, transfer and use suitable skills
- Access financial resources
- Access natural resources
- Create, disseminate, and use knowledge
- Ensure stable institutions
- Distribute paid and unpaid work
- Innovate



Resilience increases with diversity



An aerial photograph of two kayakers on a calm, blue body of water. The kayaker on the left is in a colorful, multi-colored kayak (red, orange, yellow, green, blue). The kayaker on the right is in a white kayak with a blue stripe. The water is dark blue, and the sky is a lighter blue. The kayakers are positioned in the upper half of the frame, with their reflections visible in the water below. The overall scene is serene and suggests a sense of navigation and resilience.

The Economic Resilience Index

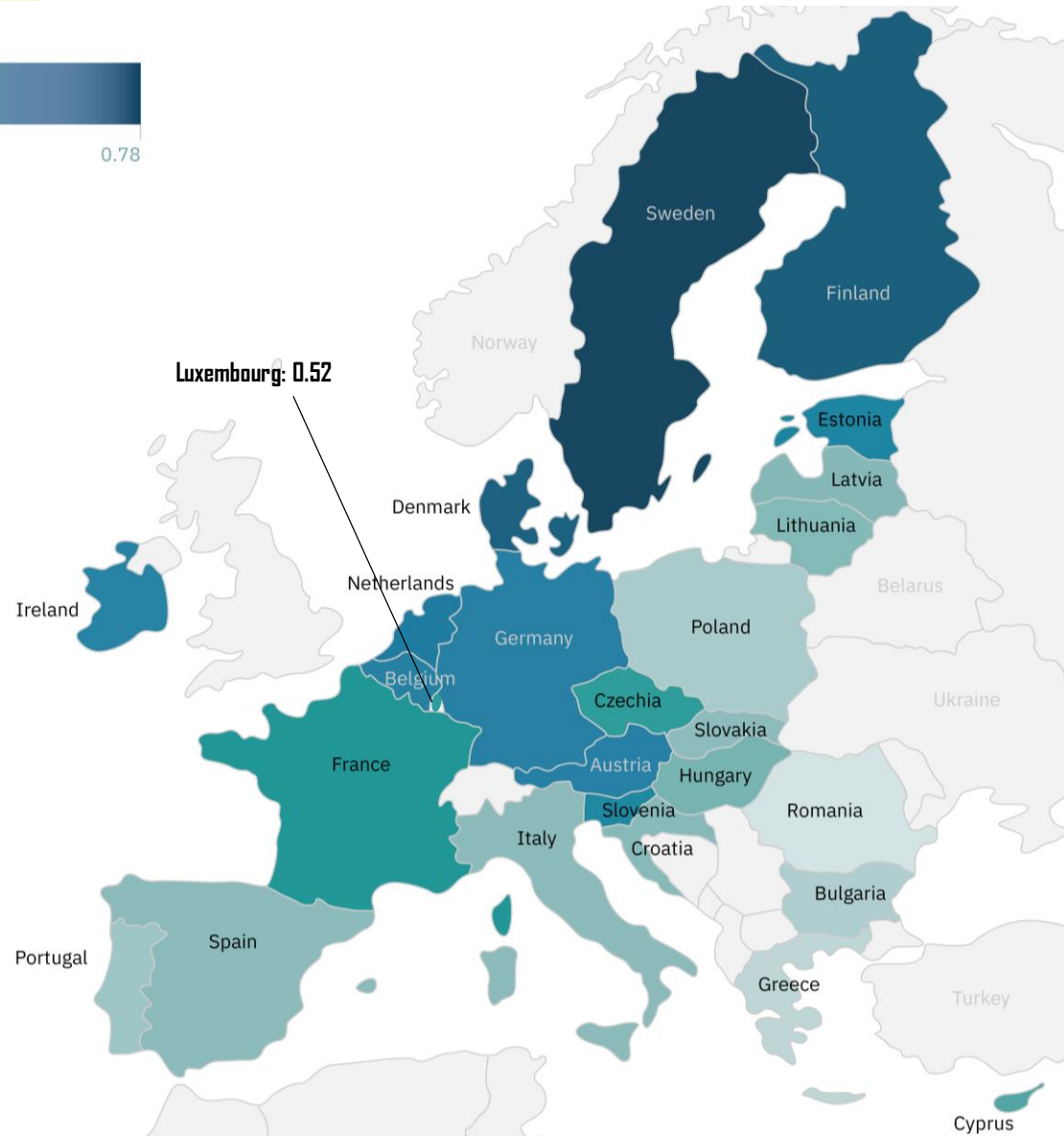
Assessing the ability of EU economies
to thrive in times of change

Indicators of Economic Resilience

Dimension	Determinant	Indicator
Economic Independence	Economic Complexity	Economic Complexity Index
	Energy independence	Energy imports dependency
	Export market diversity	Export partner concentration
	Supply chain vulnerability	Import partner concentration
	Natural resources access	Resource productivity
Education & Skills	Skills	Brain retention
	Reskilling	Adult participation rate in education and training
	Education quality	Programme for International Student Assessment (PISA)
	Research & Development	Scientific publications
Financial Resilience	Corporate finances	Firm's financial constraints ²⁵
	Household finances	Household saving rate
	Public finances	Refinancing cost
	Financial equality	Income quintile share ratio S80/S20

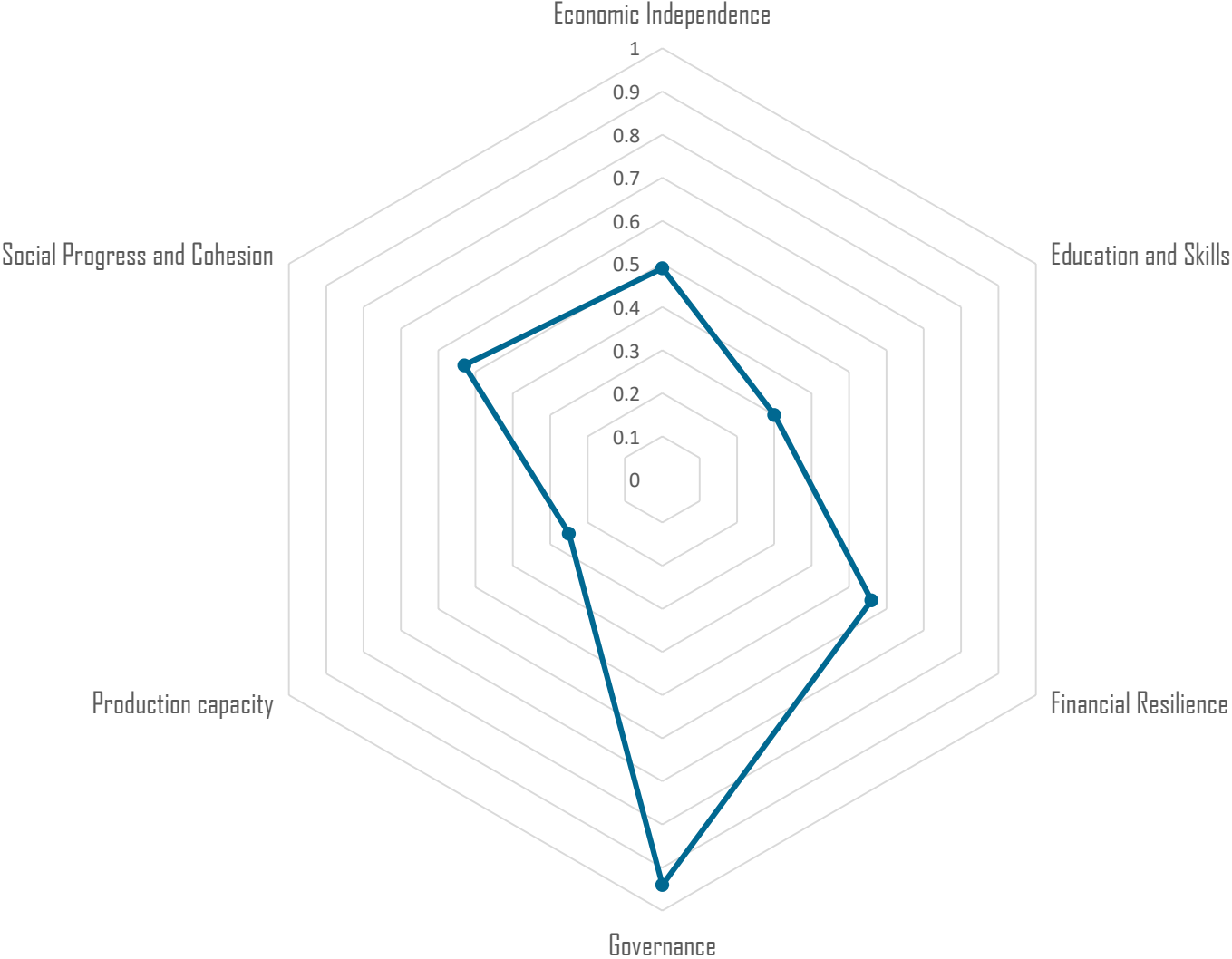
Governance	Government effectiveness	Trust in government
	Institutional quality	Regulatory quality
	International collaboration	International co-operation in research
	Welfare state quality	Government expenditure on health, education, and social protection
Production Capacity	Employment	Long term unemployment rate
	ICT capacity	ICT service sector in GDP
	Innovation	Innovative enterprises
	Investment	Investment share of GDP
Social Progress and Cohesion	Economic participation	Employees in trade unions ²⁶
	Employment quality	Job satisfaction
	Gender equality	Gender employment gap
	Social cohesion	People at risk of poverty or social exclusion
	Regional cohesion	Regional dispersion of income
	Trust	Trust among people in neighbourhood

Overall results



Country	Composite score
Sweden	0.78
Denmark	0.74
Finland	0.74
Netherlands	0.67
Germany	0.65
Austria	0.64
Ireland	0.63
Belgium	0.63
Estonia	0.62
France	0.56
Luxembourg	0.52
Czechia	0.51
Cyprus	0.49
Hungary	0.45
Lithuania	0.41
Latvia	0.41
Croatia	0.4
Spain	0.39
Italy	0.39
Slovakia	0.38
Portugal	0.35
Poland	0.32
Bulgaria	0.29
Greece	0.28
Romania	0.25

Luxembourg's Economic Resilience Index Profile



Conclusions and recommendations



Outstanding performance in governance is a potential for Luxembourg to orchestrate a green and just transformation

May be beneficial in advancing the role of green tech and decarbonization of industry

Sufficiency policy and circularity can be baked in as conditions in the design of industrial policy

Phasing out harmful practices



Diversification can go even further

there is still potential to

- increase the information and communications technology (ICT) capacity
- increase economic independence



Participation is key for a successful rapid just transformation

Engaging a diverse group of actors to shape transformation

The “just” is a precondition “rapid”

Interested to find out more? Get in touch!



Lydia Korinek
Economic Policy Consultant

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Any questions or comments?



**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Diversification of global public goods: Artificial intelligence

Dexter Docherty
**Organisation for Economic Co-operation &
Development (OECD)**



ANTICIPATING AND MANAGING EMERGING GLOBAL EXISTENTIAL RISKS

An OECD collaborative global foresight initiative

Dexter Docherty
OECD Strategic Foresight Unit
26 September 2023



Overview

- Background on overall Xrisks project
- Examples of risks
- AI Futures Expert Group and OECD scenarios
- What can be done?



Existential risk problem statement

- As humanity has become more technologically advanced, it **has become capable of posing risks to its own continued survival**. This class of risks is known as existential risks.
- Better understood existential risks include nuclear war and climate change, but **new risks are emerging**, such as those from engineered pandemics and advanced AI systems.
- Our work seeks to **review the state of knowledge and action** on existential risks, identify existing gaps, and **develop concrete recommendations** to address these gaps.

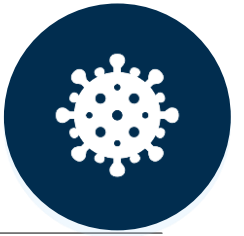


Anticipating and managing emerging global existential risks

- The Strategic Foresight Unit (SFU) is leading a collaborative project to **identify how the OECD can best support members and partners to anticipate and manage emerging global existential risks.**
- An evolution of the **OECD Global Scenarios 2035 (Vulnerable Worlds, Virtual Worlds)**, which supported the development of the **ECO2050 vision.**
- **There is support** from relevant OECD constituencies and a growing interest by governments on this topic.



Example of key risk: engineered pandemics



- Technically possible to **engineer novel pathogens** as infectious as flu and as lethal as Ebola.
 - Could be produced by accident or intentionally by bad actors, detailing potential economic and well-being gains
- Capability to engineer and distribute pathogens already exists, **widespread capability is coming soon.**
 - Advances in AI have made the ability to create pathogens or chemicals far easier—an unfortunate externality of an economically beneficial process of democratisation
- Requires **coordinated multilevel solutions.**
 - Health is an inherently international issue.



Example of key risk: advanced artificial intelligence



- Artificial intelligence systems are becoming **increasingly powerful** and **widely deployed**.
 - This includes critical domains like logistics, military and communications.
- We don't presently have tools to ensure present or future AI systems **behave as intended** or **to prevent misuse**.
 - Need both technical solutions and globally legitimate rules and institutions.
- This could lead to **catastrophic failures** unless risks are proactively managed.
 - Risks include unintended military escalation, adaptive cyberattacks, weaponized misinformation, accelerated bioweapons etc.



OECD AI Futures Expert Group

- Network of **world-leading AI experts** convened to provide reflections on possible trajectories of AI and what can be done to seize opportunities and mitigate risks
- The group is prioritising a wide range of future considerations identified via literature review and expert interviews:
 - Risks
 - Benefits
 - Solutions
- Considering items based on importance and actionability
- Findings to guide the creation of AI scenarios and potential recommendations



AI Futures Expert Group

- Experts have a clear appreciation of AI risks and are much less optimistic about benefits.
- Experts perceive new legal requirements as highly actionable (auditing, accountability, disclosure rules).
- Experts have strong social concerns (e.g., democracy, equality), and on safety and power concentrations.
- Experts see lower importance or perceived actionability in banning/slowing AI development. However, these views vary strongly among the group.
- Issues on misaligned superintelligence and LAWS are also controversial.



Possible AI future scenarios



- **Beguiling Black Boxes:**
 - Open-source AI proliferates. Adopted in business and daily life. Significant alignment, oversight and ethics issues
 - Financial implications: productivity gains with huge risks including unpredictable complex financial crises
- **Governance Vacuum:**
 - Technical alignment is possible but not co-ordinated. Platforms and governments develop their own values-based governance systems
 - Financial implications: Higher transaction costs and lack of interoperability
- **Pulling the Plug:**
 - G7 puts in place licensing regime for frontier AI. One regulator claims a company is ready to deploy artificial general intelligence
 - Financial implications: interrupting technological advancement is disruptive



Need for co-ordinated global action

- Emerging global risks **require shared rules and technological breakthroughs to seize opportunities and mitigate risks.**
- There is a need for a **new model of technological governance** at the domestic and multilateral level that is both anticipatory and reinforces democratic values.
- This is a moment where **we need champions to advocate for better alignment with long-term public interest**



Key threads for positive futures

- Strong technical tools for safe and ethical AI
- Controlled training and deployment of high-risk AI models and applications
- International cooperation to ensure safe and ethical AI
- Widely distributed AI benefits
- Controls to prevent excess power concentrations
- Empowered public with strong democratic and civil society oversight
- Innovative governance models at multiple levels

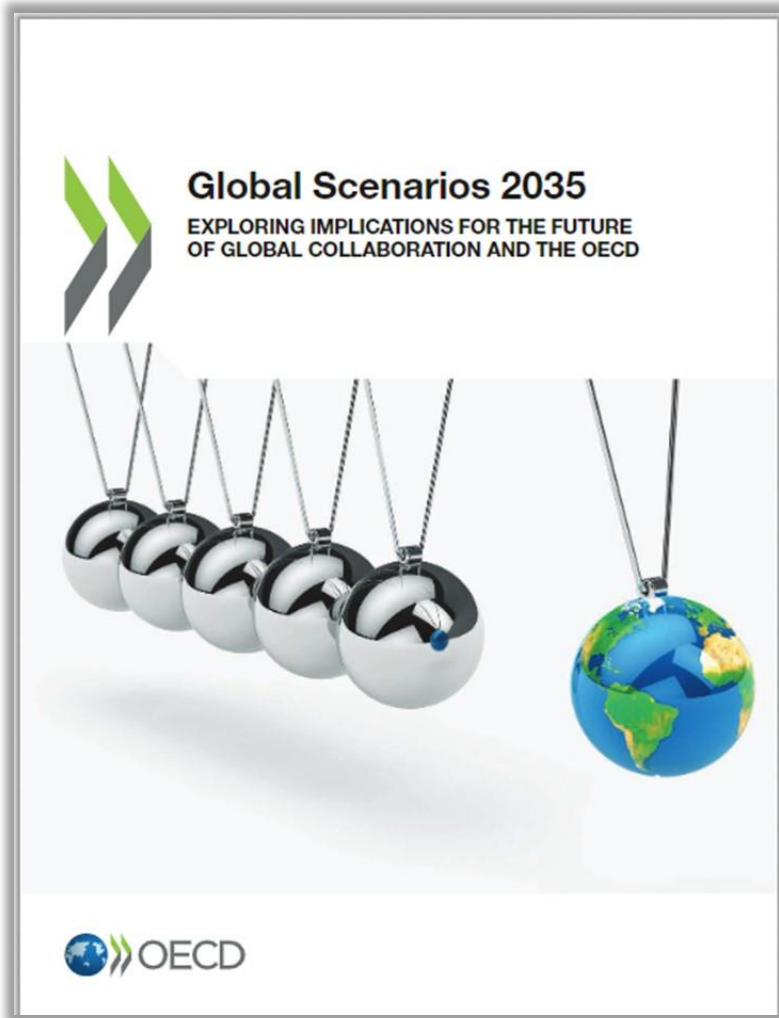


OECD project partners

- **Core project team** and related government networks:
 - Strategic Foresight Unit
 - Secretariat to Working Party on Bio-, Nano-, and Converging technology (STI)
 - AI Policy Observatory
 - High-level Risk Forum
 - International Regulatory Cooperation and Agile Regulation
 - Observatory of Public Sector Innovation
- Several parts of this project **will be looking for implementation partners to develop approaches to manage** existential risks.



Thank you!



Contact us:

foresight@oecd.org

www.oecd.org/strategic-foresight

Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique

Public finances: Tracking and financing the energy transition

Tom Haas
STATEC



Tracking and financing the energy transition

Tom Haas

Chef du département

Conjoncture, modélisation et prévisions

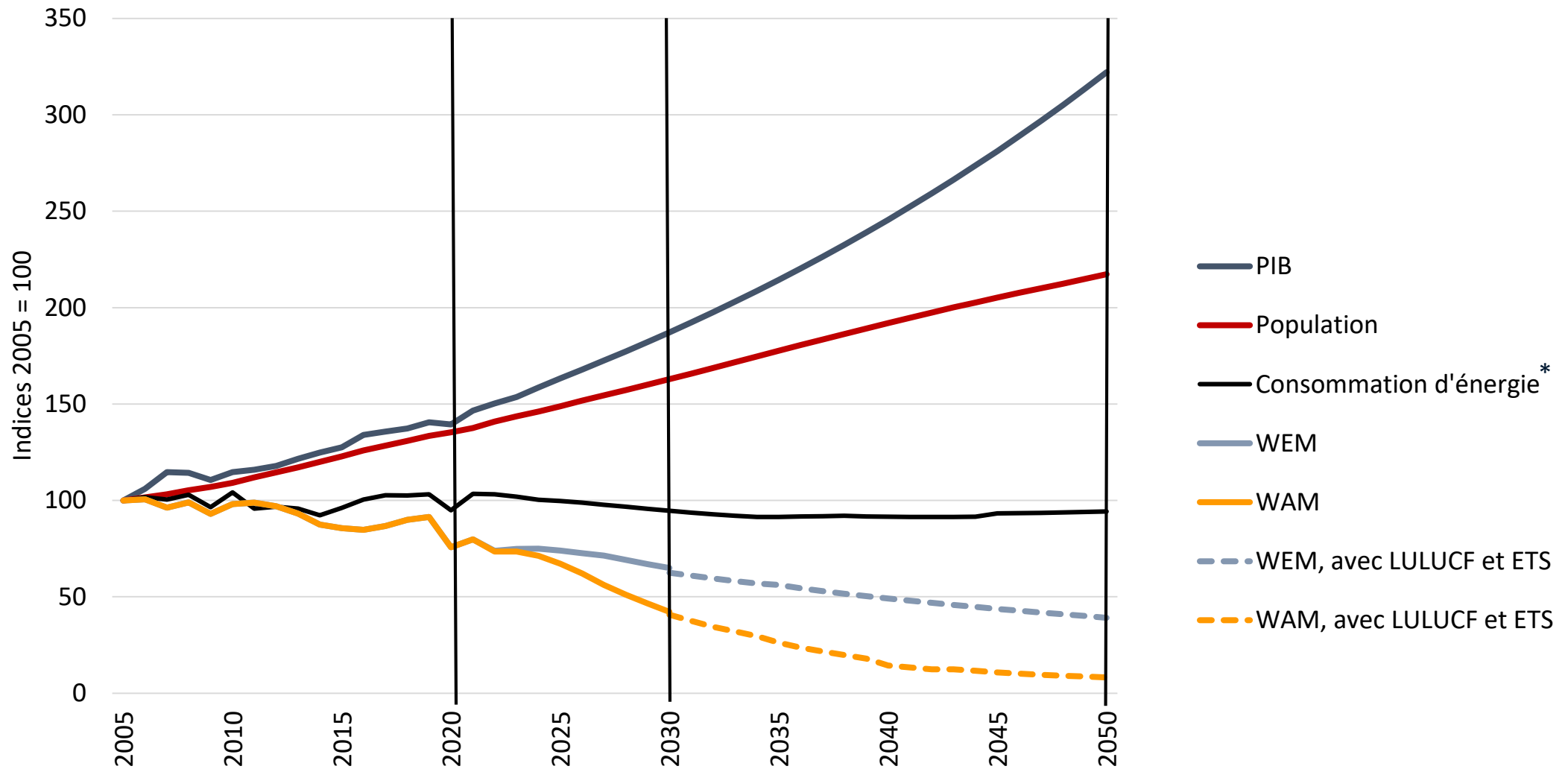
26/09/2023

STATEC

Transition énergétique de l'économie luxembourgeois

- Projections PNEC (Plan National intégré en matière d'Énergie et de Climat):
= scénario de référence + scénario mesures additionnelles **depuis 2022**
- Périmètre: émissions **directes** (inventaire des émissions de GES)
- Boîte à outils: panoplie de statistiques et de **modèles + mesures quantifiées**
- **Interdépendances** entre la démographie, l'économie, l'énergie et les émissions

Découplage entre croissance et émissions



*hors ventes de carburants aux non-résidents

Scénario WAM: décomposition de Kaya...

Evolution

$$CO2e = POP \times \frac{PIB}{POP} \times \frac{Energie}{PIB} \times \frac{CO2e}{Energie}$$

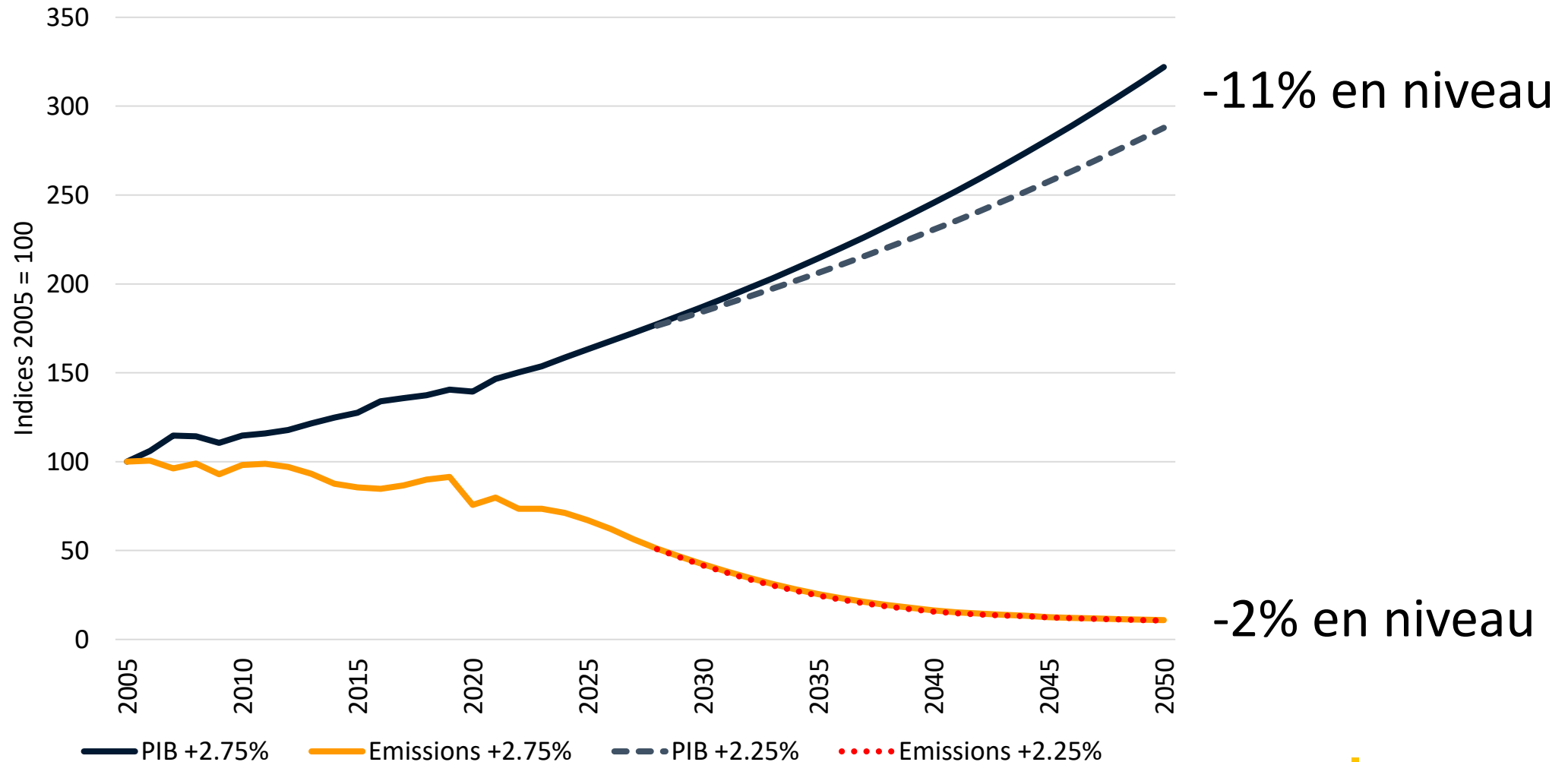
2050/2005: -90% +120% +50% -70% -90%

(chiffres arrondis)

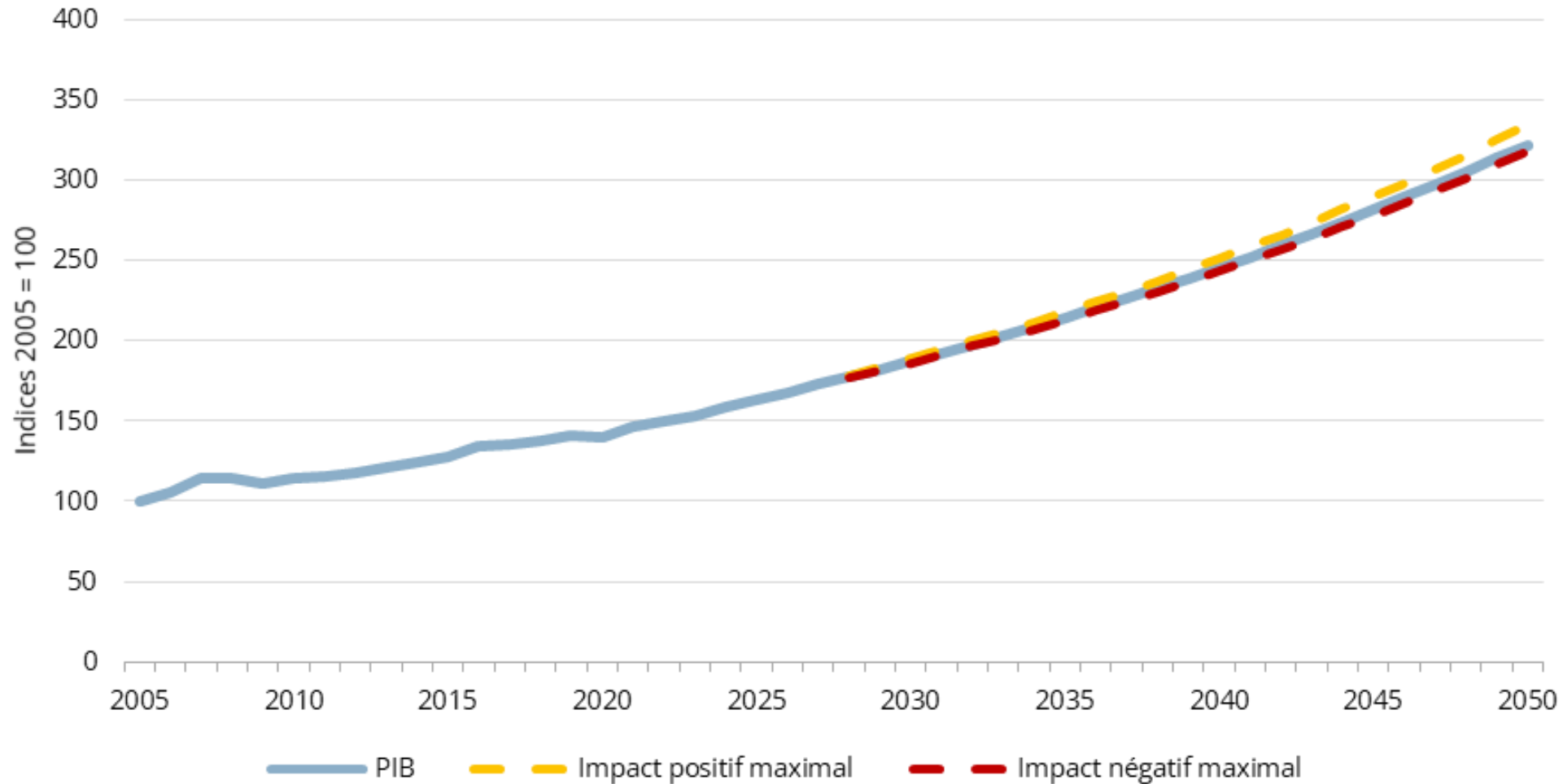


→ Limiter la croissance pour décarboner complètement?

Un demi point de croissance annuelle du PIB en moins...

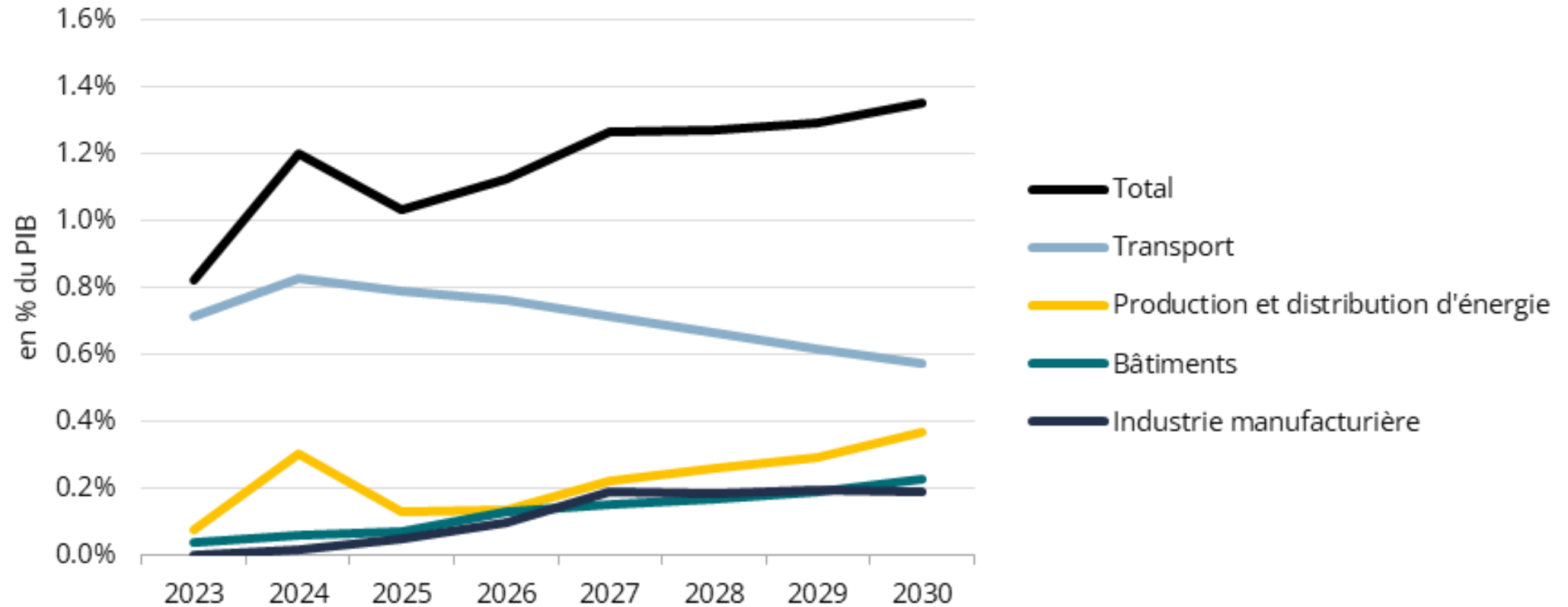


Inversement: est-ce que les mesures de réduction des émissions freinent ou stimulent la croissance au LU?



Source: STATEC

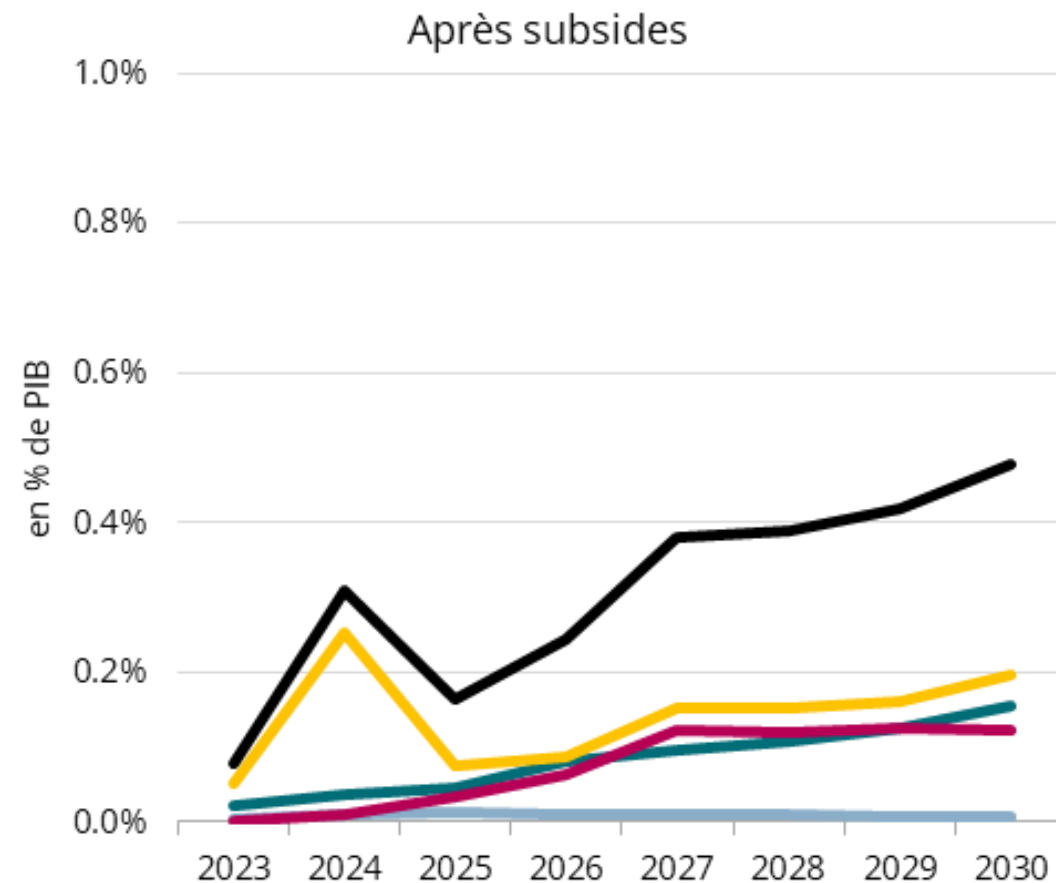
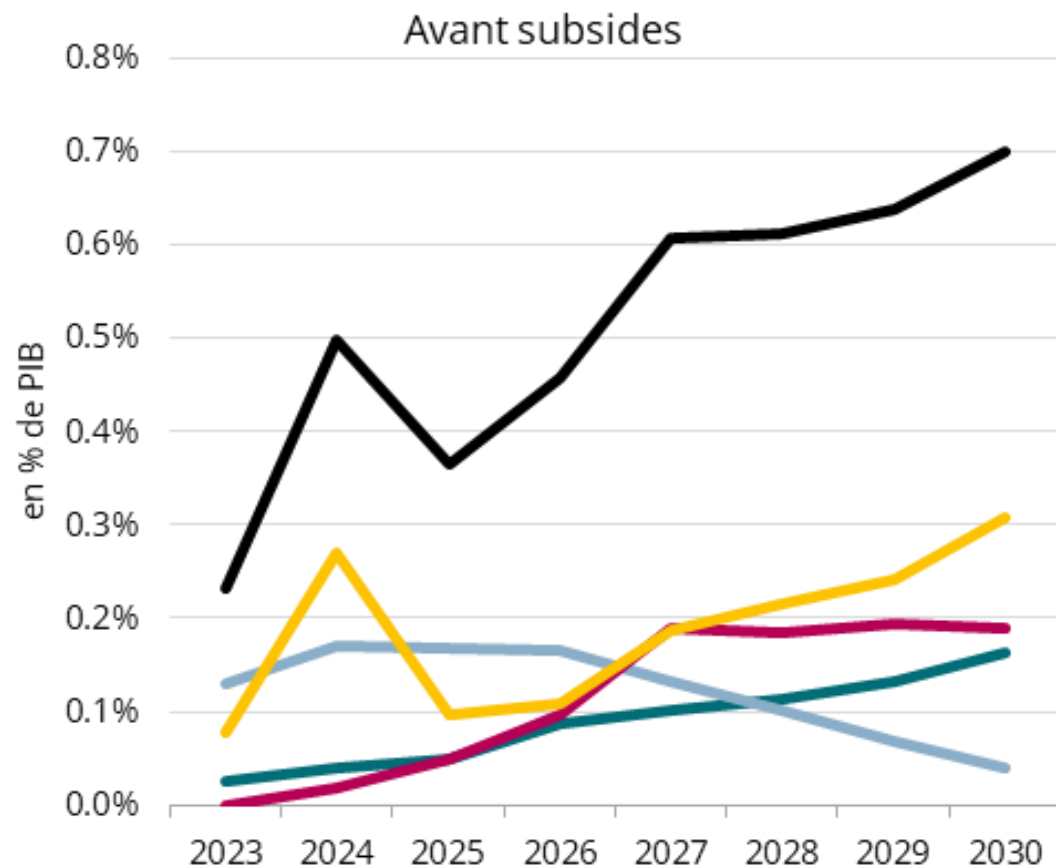
Dépenses totales requises augmenteraient progressivement



Sources : MECDD, MEA, STATEC

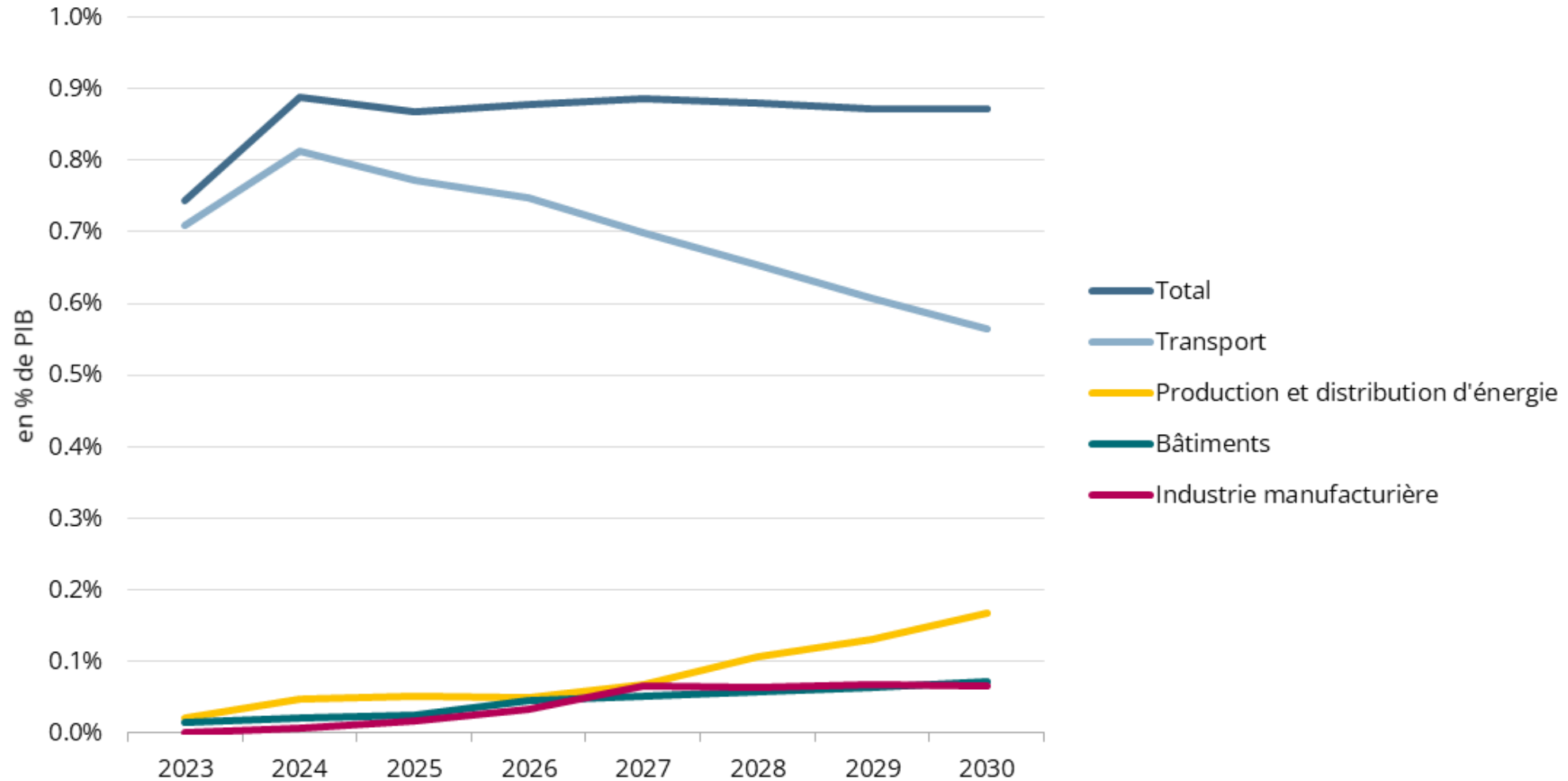
Note : Les dépenses totales comprennent les dépenses publiques (investissements publics, subsides et autres dépenses) et investissements privés.

Dépenses privées seraient limitées par les subsides



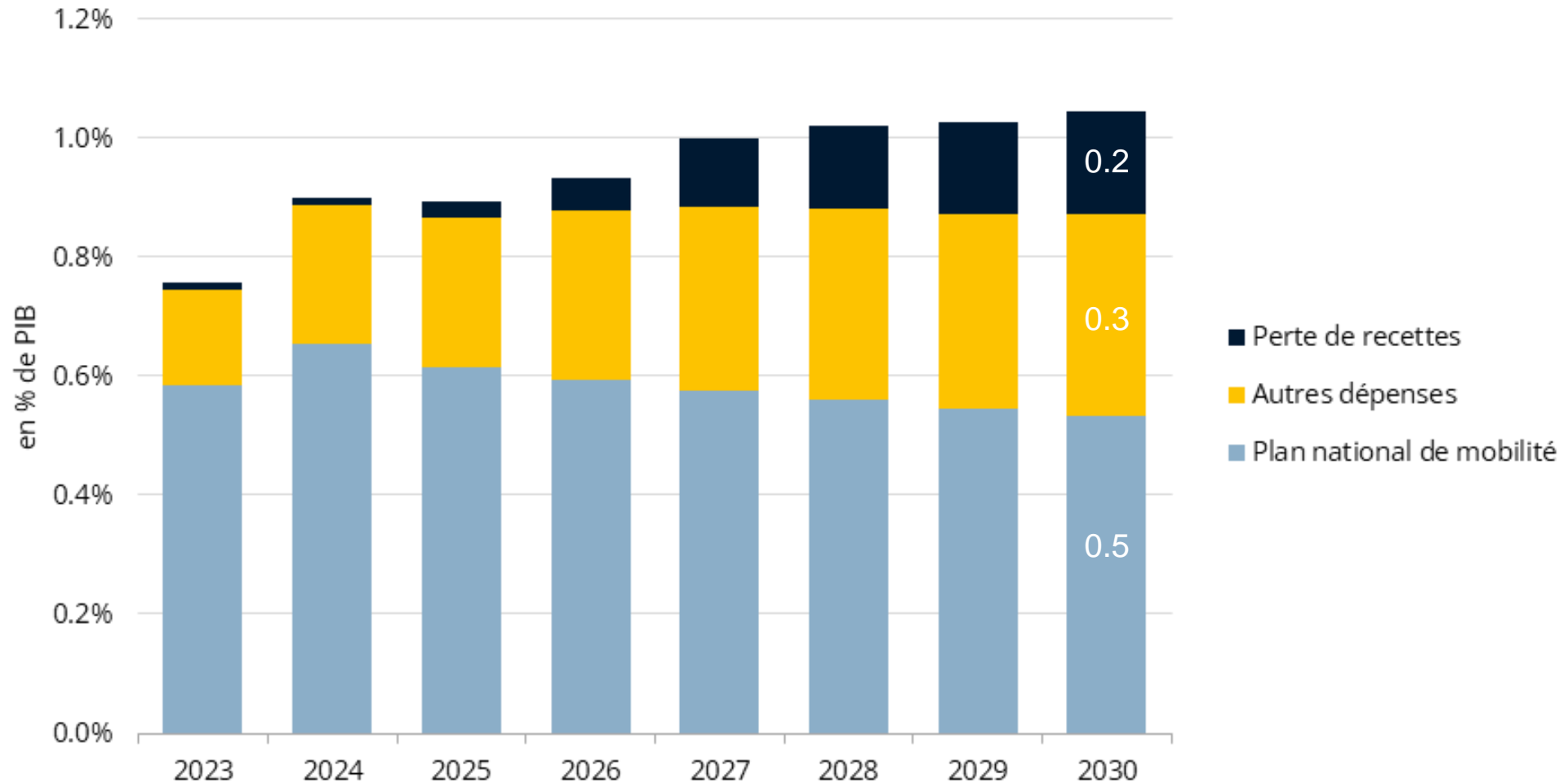
Sources : MECDD, MEA, STATEC

Dépenses publiques se focaliseraient sur le transport



Sources: MECDD, MEA, STATEC

Coût pour les finances publiques inclut les pertes des recettes



Sources : MECDD, MEA, STATEC

Note : L'évolution du coût net dans le scénario WAM par rapport au scénario de référence WEM

Conclusions

- Les émissions dépendent très peu de la croissance
- Les réductions d'émissions affectent très peu la croissance (mais probablement à la hausse)
- Un coût privé limité par les subsides (et une facture énergétique allégée)
- Un coût public limité si on considère que la plupart est déjà budgétisé (PNM)
- Défi: monitoring en temps réel nécessiterait encore des efforts conséquents pour collecter de nouvelles données / suivre les évolutions les plus actuelles

STATEC

Institut national de la statistique
et des études économiques

Thank you! / Merci !



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@STATEC

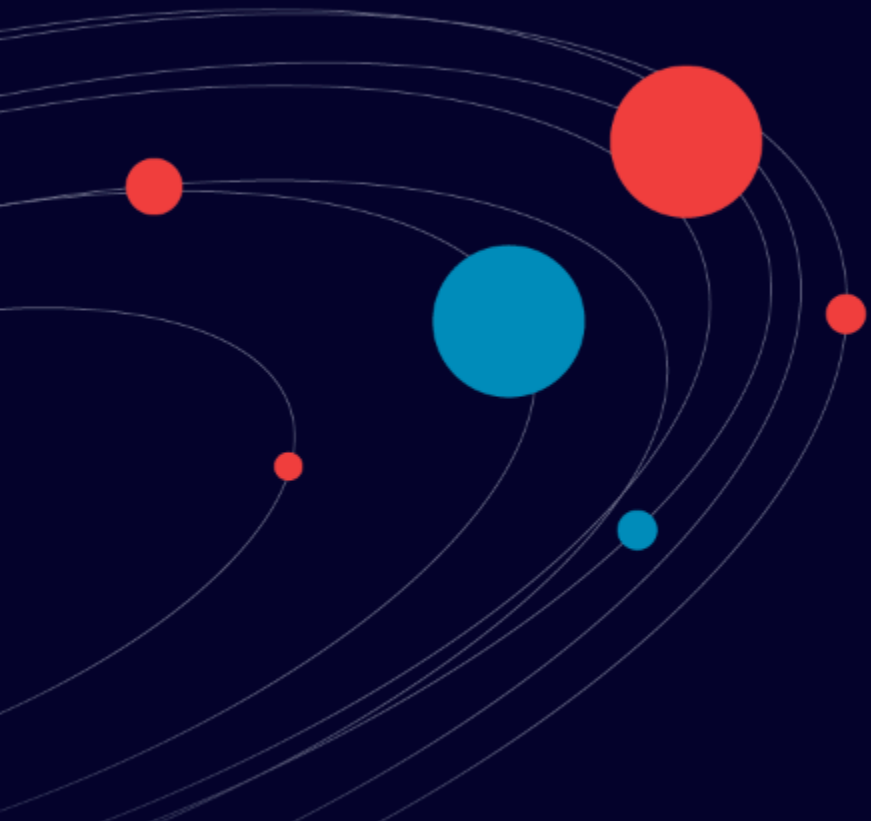


Statec
Luxembourg

**Les principes de la Vision ECO2050 :
des pistes prospectives d'avenir économique**

Anticipating diversification into Space: Space tech

**Kathryn Hadler
European Space Resources Innovation Centre (ESRIC)**



Luxembourg Stratégie

Anticipating diversification into Space

Kathryn Hadler

Director

European Space Resources Innovation Centre

esric

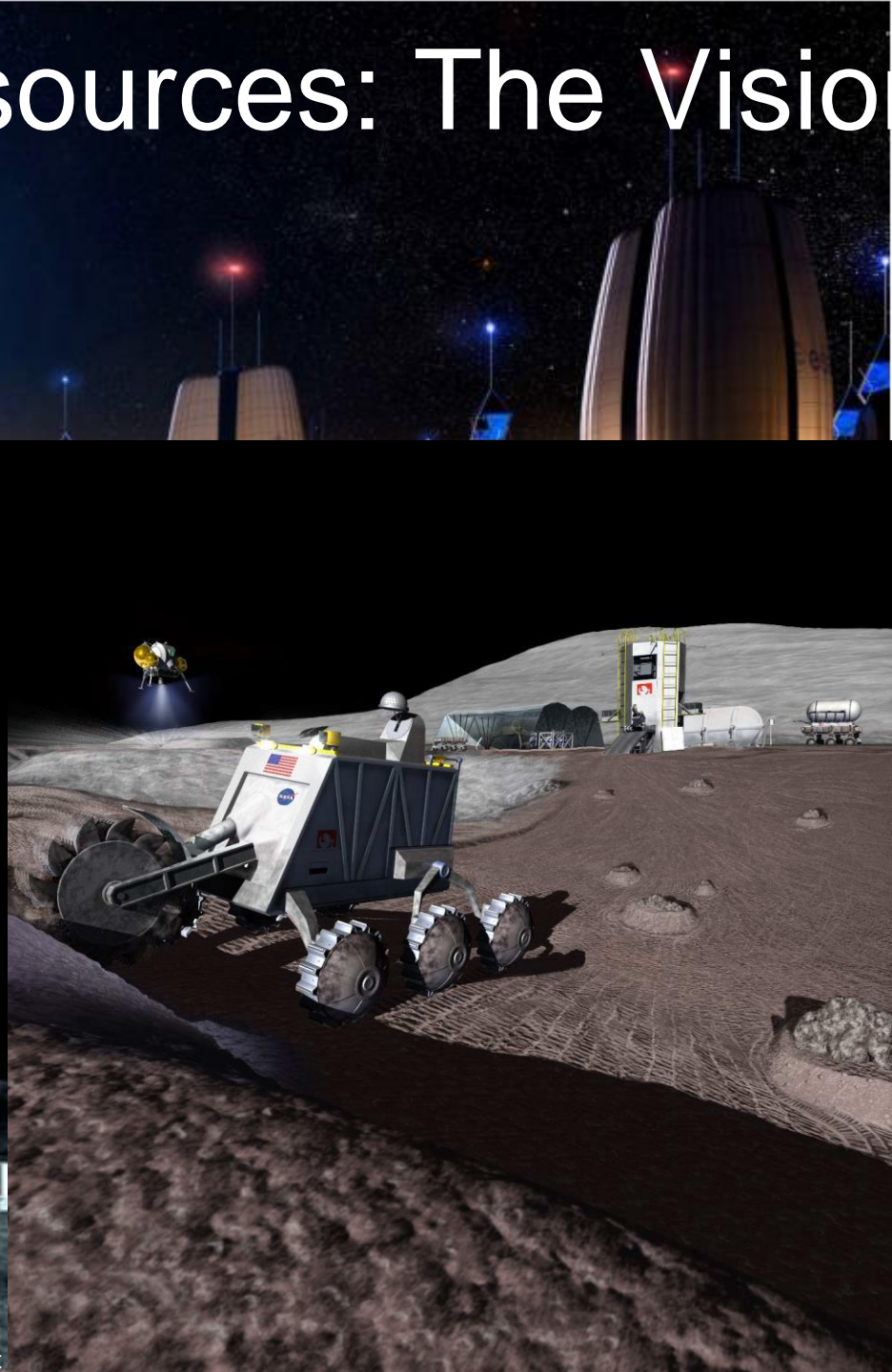
Space Resources: The Vision



Credit: ESA



credit: Anna Nesterova/Alliance for Space Development



Space Resources: The Vision



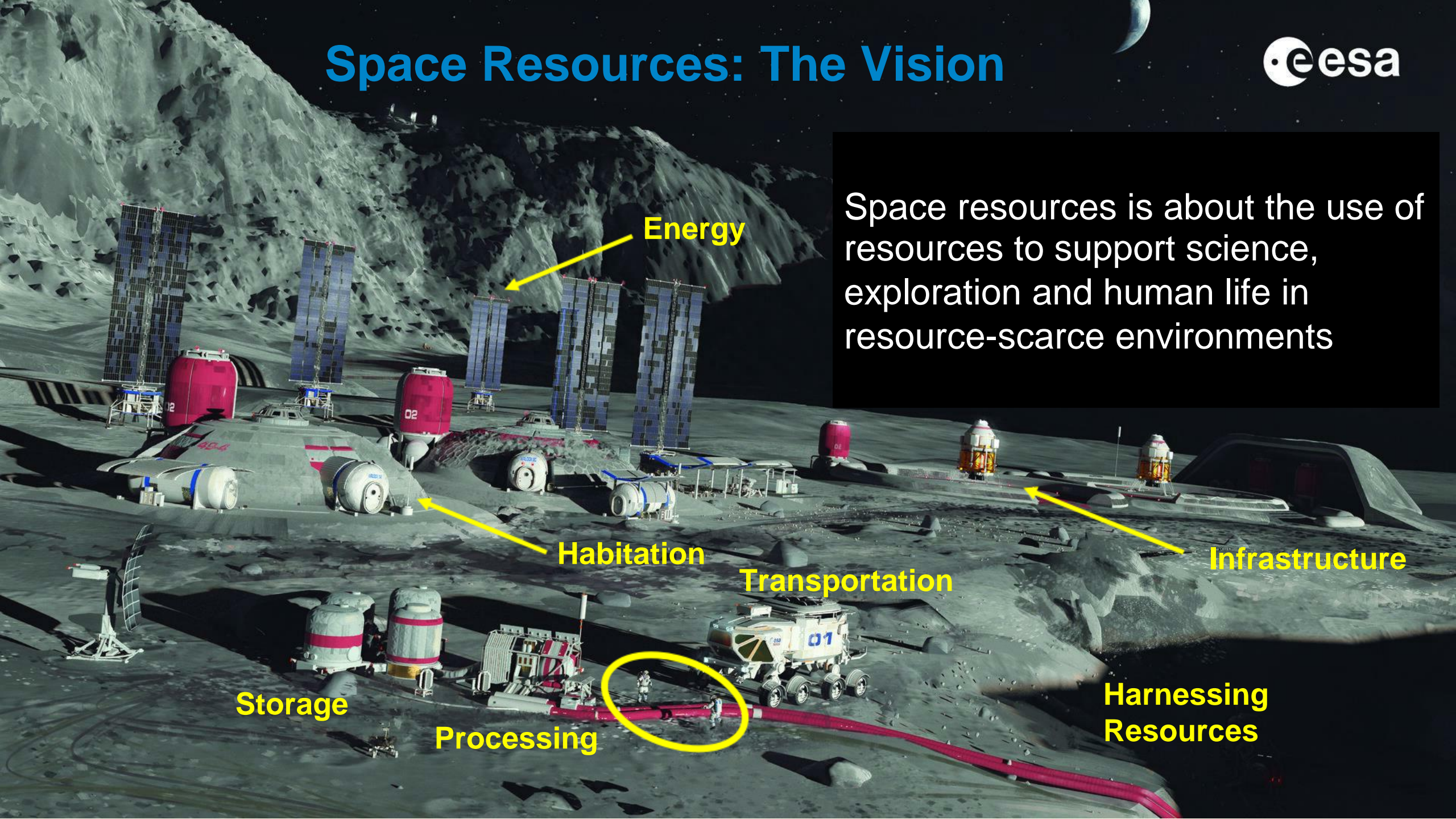
THE MOON AS A SPACEPORT TO THE UNIVERSE



Space Resources: The Vision



Space resources is about the use of resources to support science, exploration and human life in resource-scarce environments



Energy

Habitation

Infrastructure

Storage

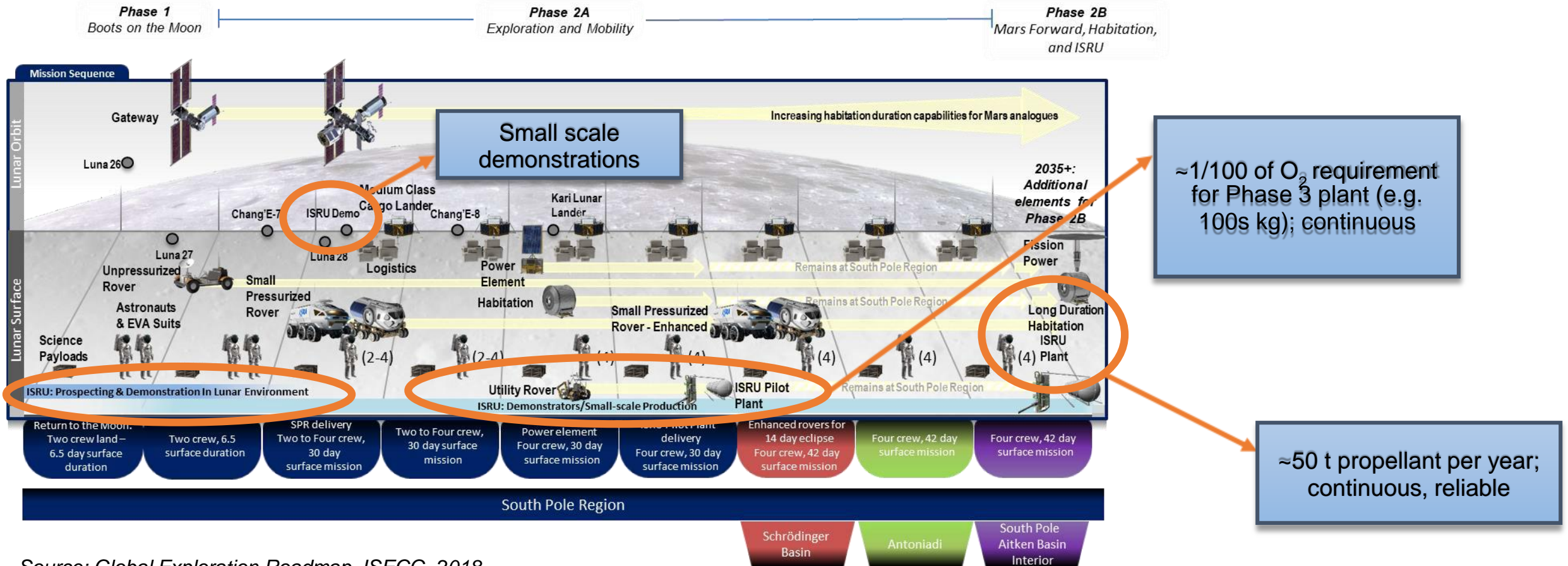
Processing

Transportation

Harnessing Resources

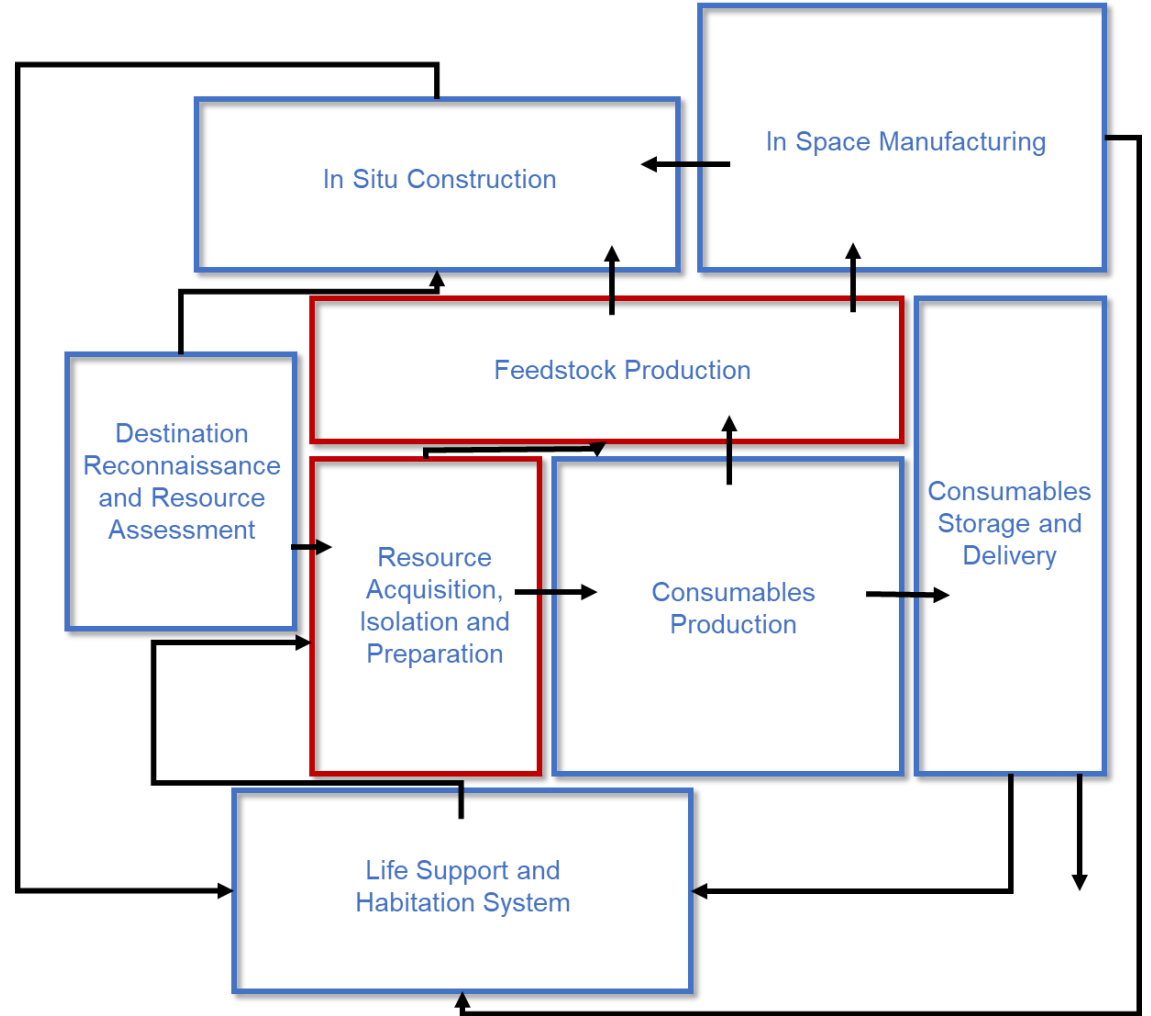
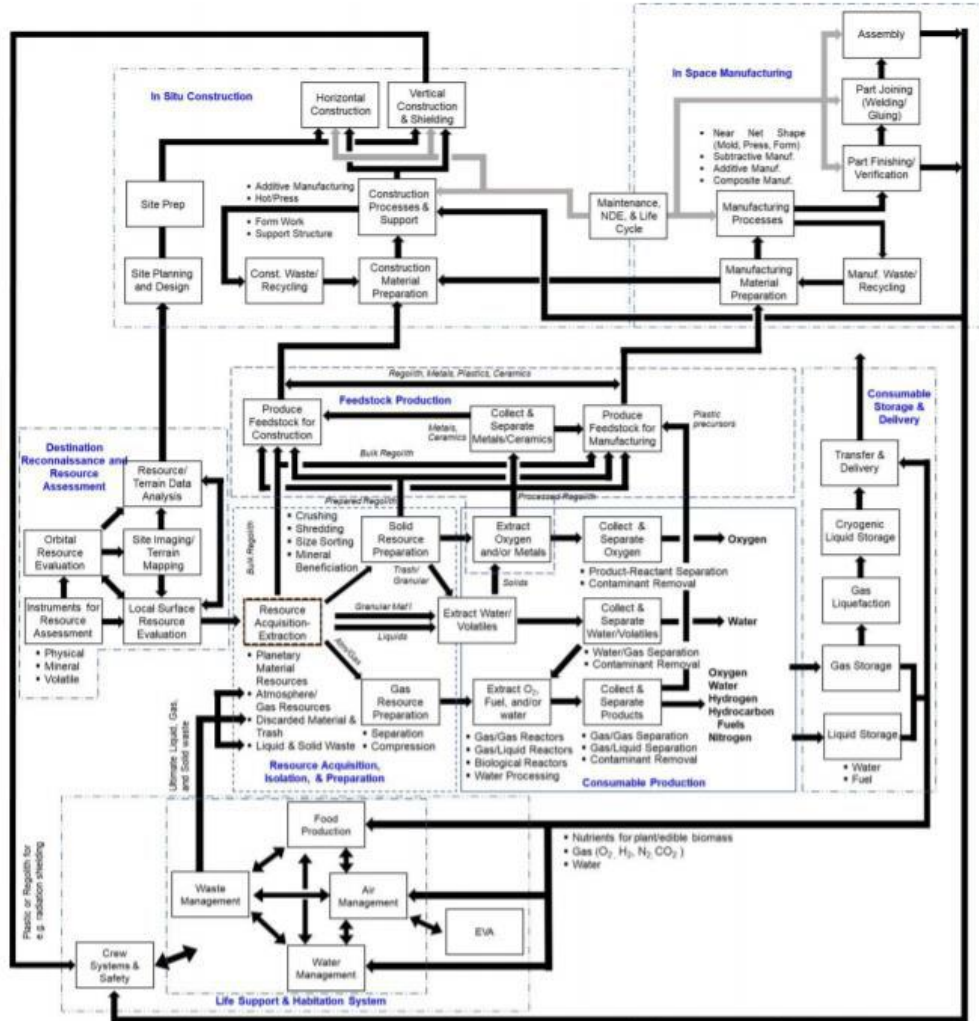
A stepwise approach towards usable resource production

ISECG Mission Scenario for 2024-2030



Source: Global Exploration Roadmap, ISECG, 2018

A complete system is complex



ISRU functional flow diagram from the ISRU Gap Assessment Report, 2021, ISECG



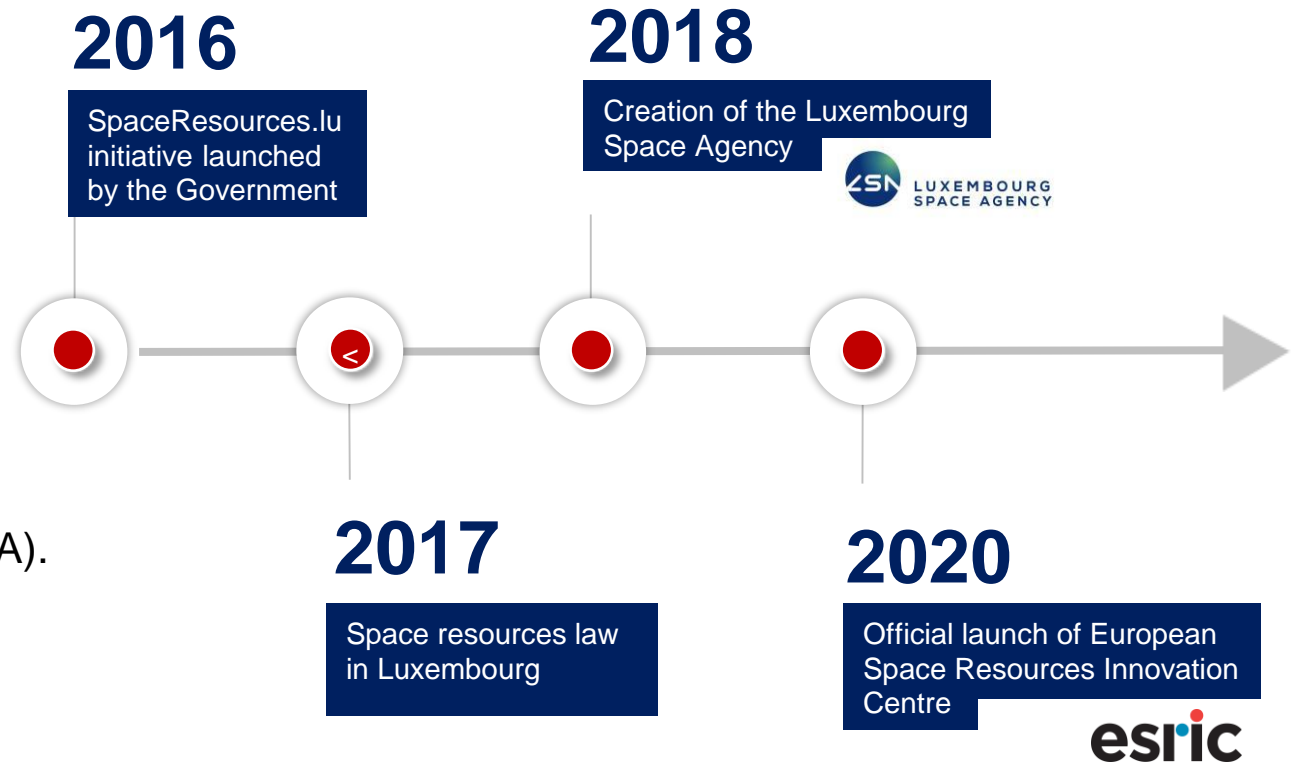
ESRIC: The Centre for Space Resources



Our story

ESRIC aims to become the internationally recognised **centre of expertise** for **scientific, technical, business and economic** aspects related to the use of space resources for human and robotic exploration, as well as for a future in-space economy.

ESRIC is an initiative of the Luxembourg Space Agency (LSA) and the Luxembourg Institute of Science and Technology (LIST) in strategic partnership with the European Space Agency (ESA).



ESRIC's Research Activities



1. **GeMoIDE:** Geology and prospecting of lunar ilmenite deposits
2. **PLASREDREGO:** Plasma-enhanced reduction of regolith using hydrogen
3. **PLASMOONREGO4SLM:** Advanced treatment of regolith for manufacturing
4. **REVERCELL:** Optimisation of reversible fuel cells
5. Ceramic additive manufacturing using regolith (*not yet started*)



- SoISR**
6. Regolith beneficiation
 7. Process Optimisation (*not yet started*)
 8. Recycling of end-of-life equipment (*not yet started*)
 9. Environmental impact and legacy (*not yet started*)
 10. **DUSTMIXR:** Modelling and simulation of lunar dust in XR (*starting Sept 2023*)



11. **PURIST:** Purification of oxygen and water for ISRU processes
12. **INDIWAPUS:** Purification of water from indigenous sources (Moon & Mars)



13. **ALCHEMIST:** Fluidized-bed hydrogen reduction of regolith
14. **ISRULAB:** FFC molten salt electrolysis of regolith

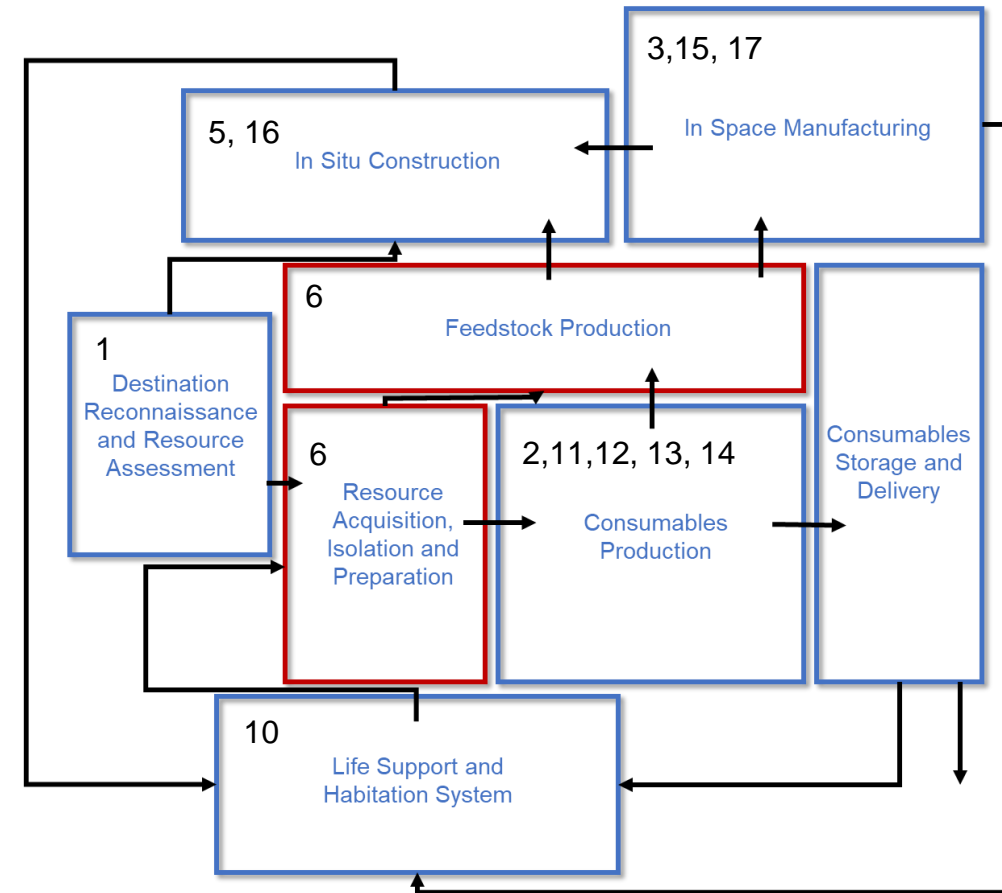


15. **RTFM:** End-to-end processing from oxygen production to metal 3D printing

16. **RISE:** Microwave sintering of regolith



17. **ISMA:** In-space Manufacturing and Assembly (6 month sprint)



ESRIC is developing research capabilities in new fields for Europe

- This requires both expertise and infrastructure
- Large infrastructure will be procured by ESA and made available at ESRIC and for use by researchers and industry

Alchemist Hydrogen Reduction Prototype



• Delivered November 2021

Molten Salt Electrolysis Cells

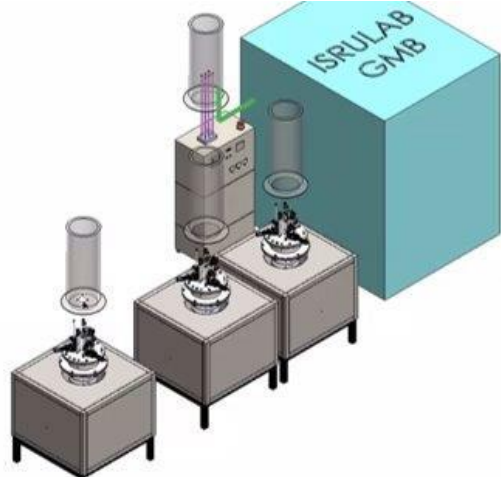


Illustration of FFC cells © SAS

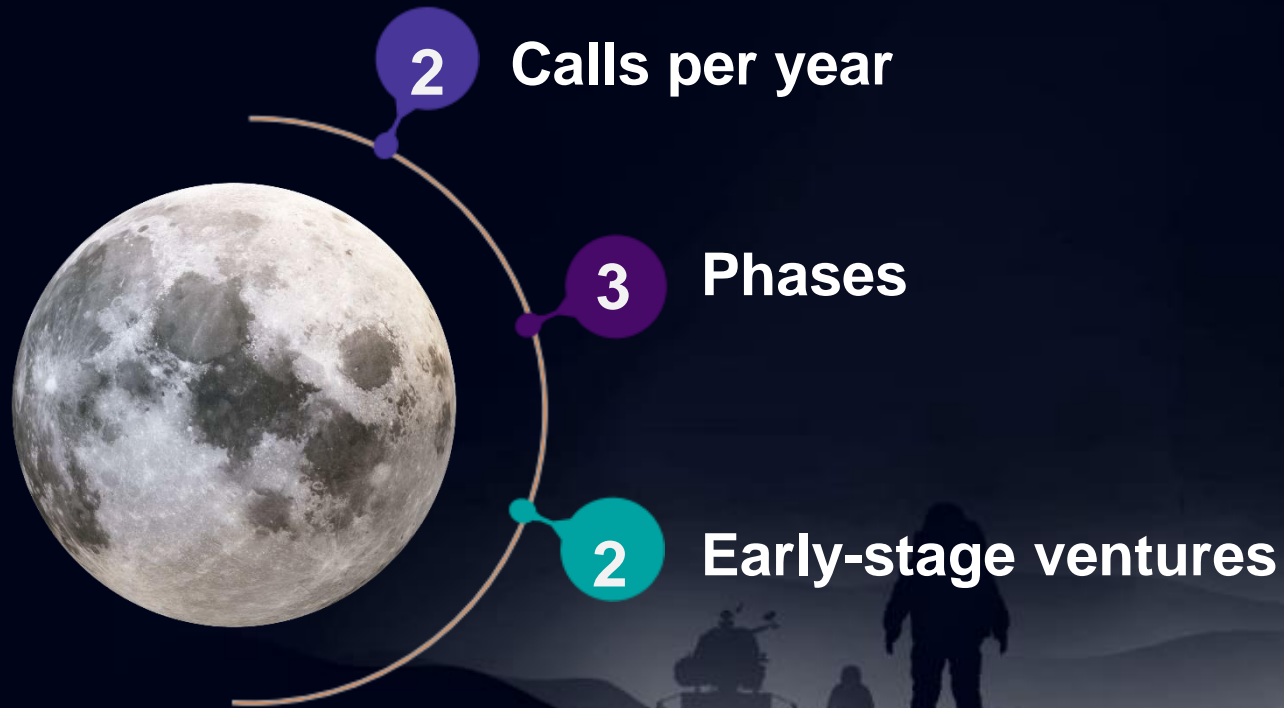
• Currently scheduled for delivery Q4 2023

Dusty Thermal Vacuum Chamber and Terrestrial Pilot Plant



• Delivery date Q2 2025

Start-up Support Programme



- 1 call / semester

- Phase 1: Remote (3 months)
- Phase 2: On-site (up to 24 months)
- Phase 3: On-site (up to 36 months)

- Space Resources Utilization
- Terrestrial & Space Applications

Applications Start-up Support Programme

SSP – Call 1	<ul style="list-style-type: none"> • 33 Applications 	<ul style="list-style-type: none"> • 17 countries 	<ul style="list-style-type: none"> • 15 shortlisted 	<ul style="list-style-type: none"> • 5 pre-incubated 	Incubated Project <ul style="list-style-type: none"> • Four Point (PL)
SSP – Call 2	<ul style="list-style-type: none"> • 13 Applications 44 Registered 	<ul style="list-style-type: none"> • 11 countries 	<ul style="list-style-type: none"> • 8 shortlisted 	<ul style="list-style-type: none"> • 5 pre-incubated 	Incubated Project <ul style="list-style-type: none"> • Lightigo (CZ)
SSP – Call 3	<ul style="list-style-type: none"> • 17 Applications 58 Registered 	<ul style="list-style-type: none"> • 10 countries 	<ul style="list-style-type: none"> • 10 shortlisted 	<ul style="list-style-type: none"> • tbc 	<ul style="list-style-type: none"> • tbc

Space Resources Week 2023

Growing and developing a strong community

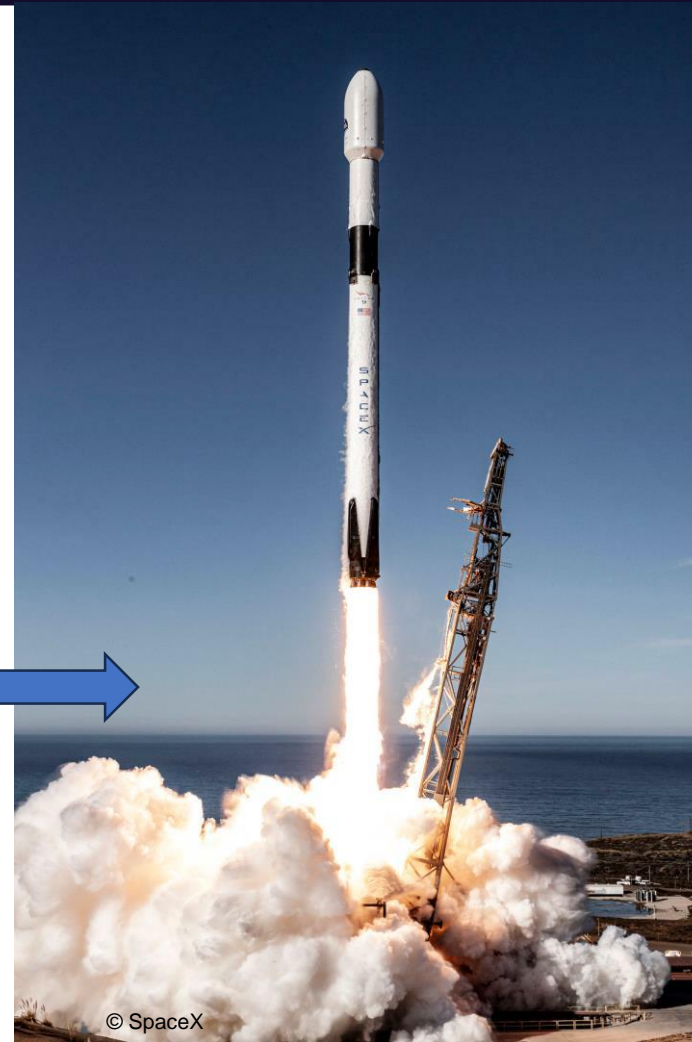
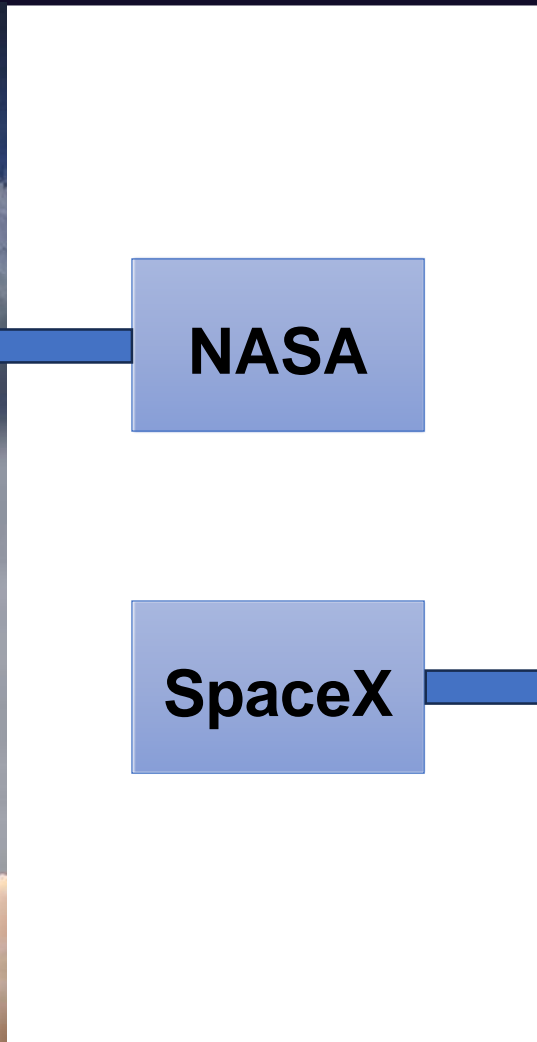


- Largest event worldwide fully dedicated to space resources.
- 2023 edition in numbers:
 - **450** physical attendees, **800** online participants
 - **85** presentations, **35** posters
- Organized together by ESRIC, LSA, ESA and LIST
- Covering general, scientific, technical, business, legal and economic topics

The role of foresight for space



Image credit: NASA



© SpaceX



Thank you



esric

1. Anisoprint: Luxembourg
ISRU 3D Printing



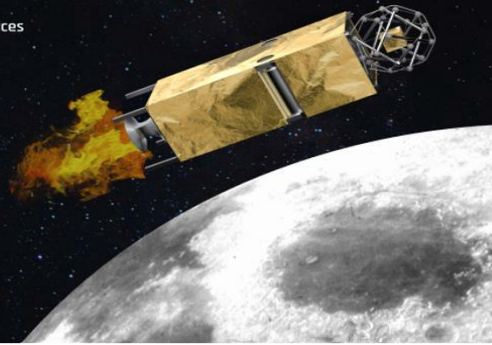
CONTINUOUS FIBER 3D PRINTING SOLUTIONS FOR DRONE LOGISTICS ECOSYSTEM



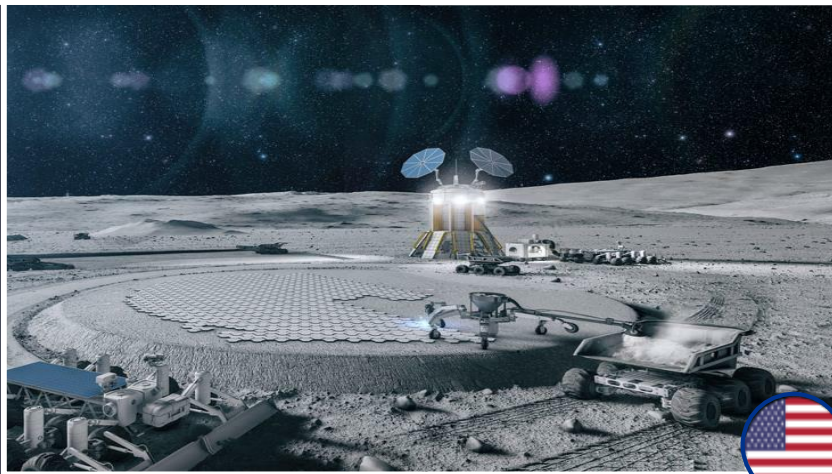
FROM DESKTOP
→ TO INDUSTRIAL



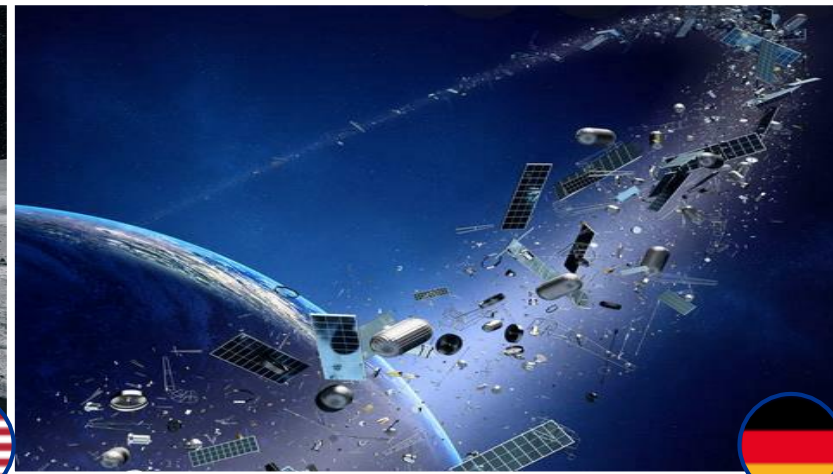
2. Adventus Interstellar: Switzerland
Interplanetary lander



3. Four Point Space: Poland
Autonomous Transport Platform



4. Astroport Space Technologies: USA
Lunar Landing Pad

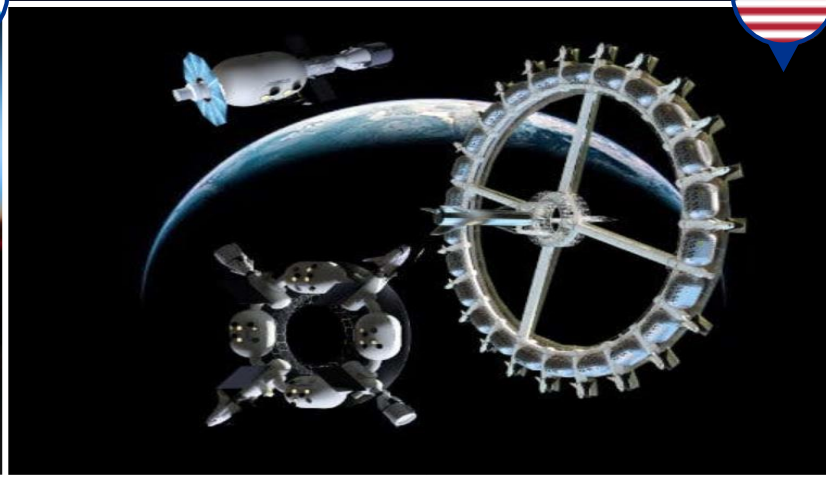


5. Orbital Recycling: Germany
Metal extraction from Space Debris

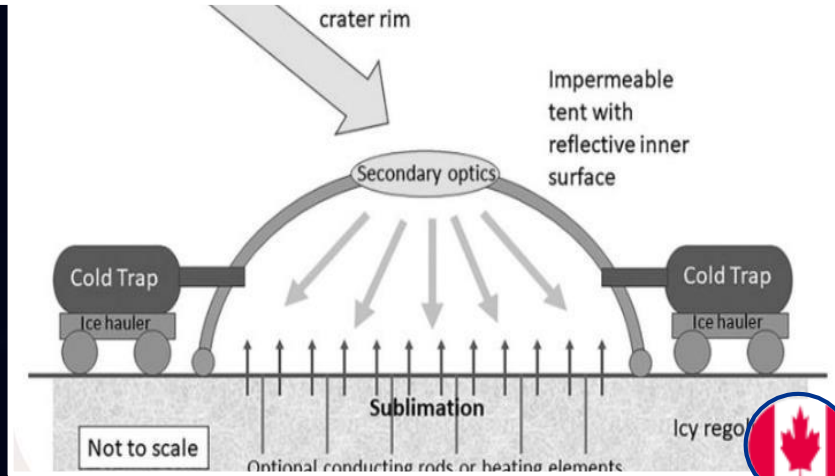
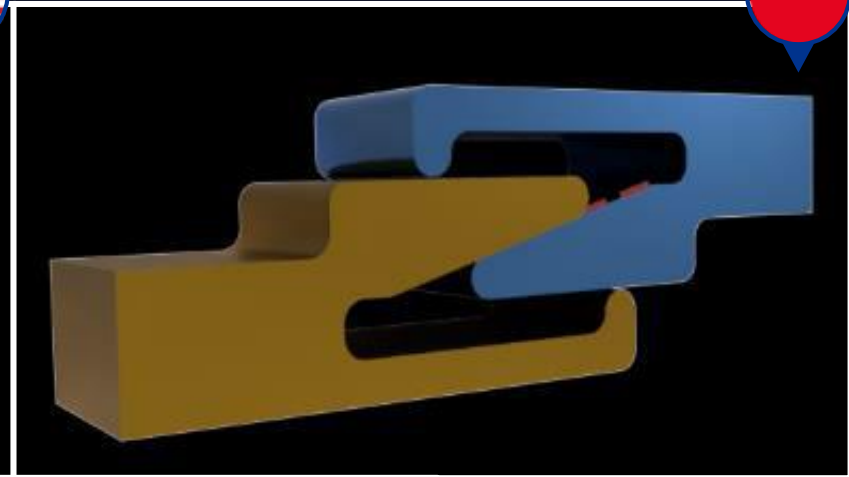
1. Lunar Outpost: Luxembourg ISRU Thermal Energy Storage



2. Orbital Assembly: USA In-space Waste Recycling



3. Aurora Connect: Poland Lunar GDPPC Connectors



4. Terra Luna Resources: Canada ISRU H2O (Water) Purification

25 septembre 2023

5. Lightigo Space: Czech Republic Optics and materials analysis



16 June 2023

La Vision stratégique ECO2050 et la diversification économique

L'utilité de la prospective

Pascale Junker
Chargée de direction, Luxembourg Stratégie

L'utilité de la prospective stratégique – Vision ECO2050

Conférence Luxembourg Stratégie
Esch-Belval, le 26 septembre 2023

Utilité de la prospective stratégique

Dans un monde de plus en plus incertain, volatile, complexe et rapide, ou l'adaptabilité devient une première qualité, la prospective stratégique

- observe les **mégatendances** avec implications potentielles stratégiques pour un secteur, une technologie, une matière, une profession, etc.
P.ex. : réindustrialisation ou désindustrialisation
- détecte des *blind spots* et domaines sous-investigués. P.ex. : crises pétrole 70s
- expose les liens entre variables, générations, secteurs, acteurs, géographies
- crée un nouvel **espace pour l'imagination** et la projection dans le respect des limites biophysiques et réalités sociétales. P.ex. : Silent Spring
- fournit une boussole pour **orienter les choix stratégiques** sur un trajectoire pérenne de long terme

Maroš Šefčovič

*Vice-président de la
Commission européenne*

“As a modern governance tool, foresight helps us to explore, anticipate and shape the future we want. Applying it in a strategic way leads to better, more coherent, anticipatory policymaking.”

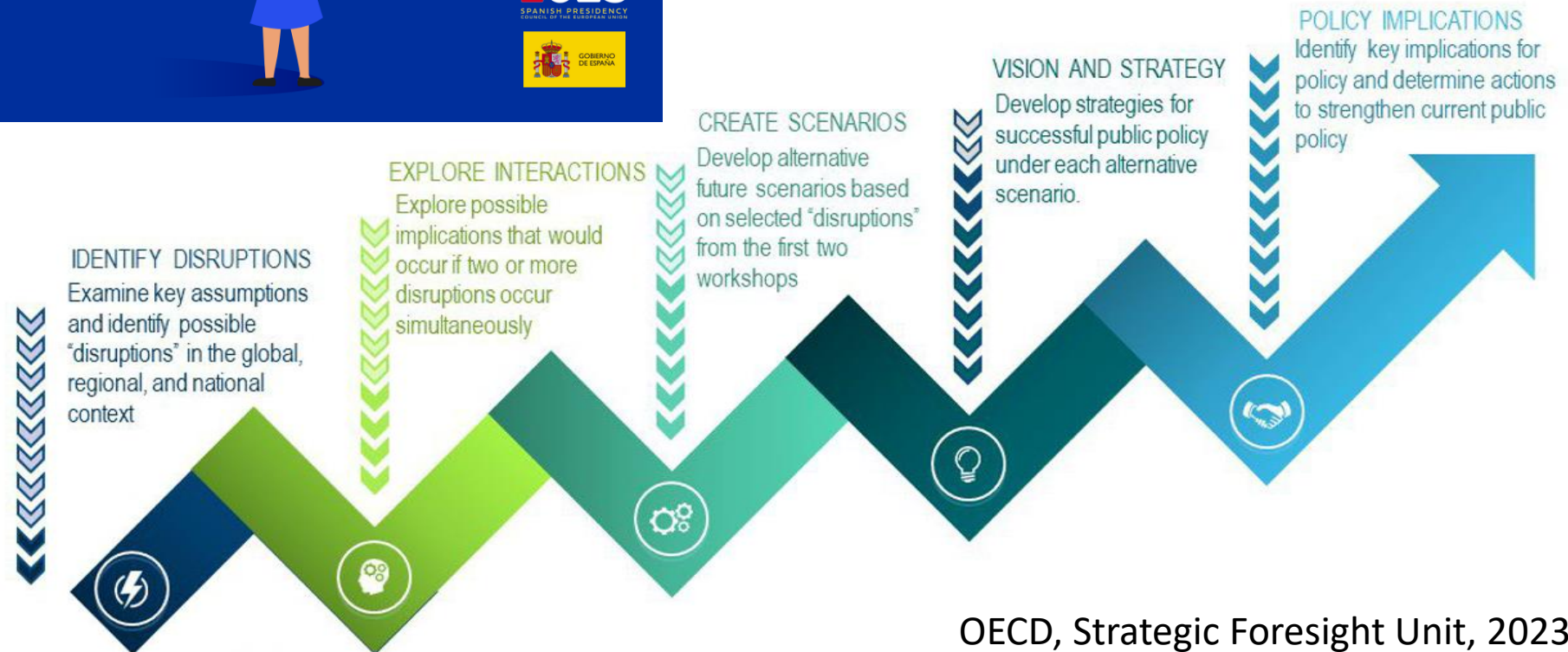
EU Foresight processes to stress-test public policies



National Office of Foresight and Strategy, Spain, Présidence espagnole du Conseil des ministres, 2023

PlanAPP coordinates the drafting of the GO and NRP

Find out more about the main national Planning Instruments: the Major Options (Grandes Opções - GO) and the National Reform Programme (NRP).



OECD, Strategic Foresight Unit, 2023

Utilité de la prospective stratégique dans les entreprises – *Corporate foresight*

- S'ouvrir à différentes alternatives d'investissements, augmenter la prise de risque, ne pas être un observateur passif mais s'octroyer un puissant **avantage compétitif**
- Identifier les tendances dans le comportement des consommateurs, l'évolution de la réglementation et l'émergence de nouveaux marchés ou partenaires, etc.
- Mettre en place un **plan de contingence** en cas de rupture de chaînes d'approvisionnement, de pénurie de main d'oeuvre ou de contraintes énergétiques
- Générer une culture de l'adaptation, de la formation, de l'innovation et de la créativité en vue d'une meilleure productivité et résilience

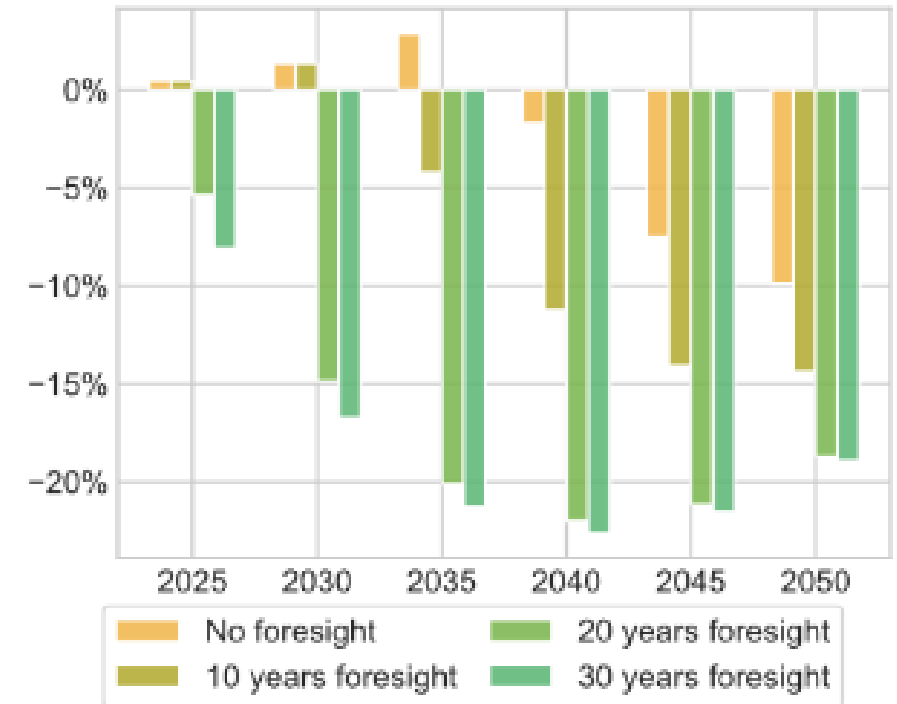
Corporate Foresight: A New Frontier for Strategy and Management
How Organizations Can Create Their Own Futures, Alessandro Ferngani,
Academy of Management Perspectives Vol. 36, No. 2

- Les firmes qui planifient la décarbonation précocement et sur long-terme y parviennent à **moindre coût**
- La recherche enseigne que les firmes « vigilantes » qui pratiquent la prospective et préparent simultanément pour différents avenir ont de meilleurs résultats financiers

Corporate foresight and its impact on firm performance,
René Rohrbeck et al, 2018

[Why corporate foresight matters according to research,](#)
WEF, 2023

“Vigilant firms outperformed the average, showing a 33% higher profitability and a 200% higher market capitalization.”



Impact of firms' climate sentiments on economic decarbonisation,
Gourdel et al. (2022) double materiality of climate physical and transition risks in the euro area, SUERF Policy brief n° 436, oct 2022

Utilité de la Vision stratégique ECO2050

Toute stratégie – gouvernementale ou commerciale – peut être analysée à la lumière des conclusions de l'exercice de prospective stratégique ECO2050

En prolongeant l'étude TIR2050, les trois scénarios et la Vision ECO2050

- matérialise la **cohérence** (ou la tension) entre différentes stratégies nationales
 - partage les **hypothèses de départ** à toute construction de stratégie
 - identifie des **synergies à exploiter**
 - souligne des **dilemmes et antagonismes à surmonter**
- Donne de la **sécurité de planification et prévisibilité aux entreprises dans leurs choix d'investissements**
- apprécie la **compatibilité** d'un projet d'avenir avec les autres objectifs sectoriels
- permettent d'éviter les pièges d'un futur unique (1 seule projection macroéconomique) et de la *tunnelvision*
 - p.ex. se focaliser sur un aspect technique en omettant la dimension sociale (« gilets jaunes »)
- invoquent les **principes de précaution, d'autonomie, de redondance, d'adaptation** et de respect du bien commun

Ex. de mise en pratique : Faut-il promouvoir une nouvelle économie basée sur les données ?

- Certainement. La digitalisation est une tendance de fond et le Luxembourg est déjà très bien positionné (TIR2050)
- Néanmoins, uniquement à condition de prévenir les effets secondaires non-désirés sur le plan environnemental (émissions, ressources) et social (inégalités, solidarité, inclusivité)

Applications de la prospective stratégique économique

La prospective est une activité itérative à mener en continu

Luxembourg Stratégie renforce ses activités de prospective par différentes méthodes :

- *Scenario-planning et visioning*, pour aligner les décisions actuelles avec les objectifs souhaités de long terme et aller vite
- *Forecasting*, pour identifier tôt les technologies, investissements, programmes de recherche ou compétences prometteuses d'avenir
- *Veille*, pour guetter les tendances émergentes et innovations de rupture
- *Alerte*, pour avertir face à des disruptions et informer à propos de potentiels « cygnes noirs »
- *Windtunneling*, pour tester la résistance de stratégies face à différents avènements
- *Backcasting*, pour déduire les étapes nécessaires à l'atteinte d'un objectif commun
- *Causal layered analysis*, pour faire émerger un changement de valeur ou de vision du monde

Prochaines étapes pour Luxembourg Stratégie

La prospective est une activité itérative à mener en continu

Pour accompagner la transformation économique, Luxembourg Stratégie assure des services prospectifs

suivant ses missions propres et en partenariats spécifiques :

- Assurer la mise à jour et l'amélioration continue des scénarios et de la [Vision ECO2050](#), en fonction des mégatendances et signaux faibles émergents
- **Décliner les scénarios et la [Vision ECO2050](#)** par secteurs (p. ex industrie et services carbone), procédures (p. ex marchés publics carbone), métiers (p. ex néo-agriculteurs, *science-based environmental compliance*), territoires (p. ex. Communes, Grande Région, Marché intérieur, ...)
- Accompagner les concepteurs de nouvelles stratégies sectorielles qui partagent les hypothèses et principes ECO2050; **Forecasting** des technologies, investissements, programmes de recherche ou compétences d'avenir
- Publier le rapport final [RISK2050](#) – Vulnérabilité de l'économie face aux risques climat-biodiversité-raréfaction des ressources
- Publier le rapport final [SOC2050](#) – Désirabilité des changements comportementaux en vue de plus de résilience
- Poursuivre l'observation des risques et des désirabilités sociales: **répétition et élargissement des enquêtes lancées sous RISK2050 et SOC2050**
- Contribuer aux stratégies nationales d'**adaptation** au changement climatique et de gestion des **risques** – volet Economie
- **Quantifier** le potentiel de réduction des émissions en cumulant les **solutions technologiques, naturelles et comportementales**
- Promouvoir la **littératie du futur** : Etendre la participation via la formation et un site web interactif où **chacun peut devenir horizon scanner** prospectif
- Renforcer les **réseaux et partenariats internationaux**: Autres initiatives nationales de prospective, Observatoires thématiques nationaux, France Stratégie, Unités prospectives à la Commission européenne et l'OCDE, autres Etats pratiquants la prospective institutionnelle
- Actualiser les [tableaux de suivi prospectifs](#) des mégatendances, des scénarios et des stratégies sectorielles nationales
- **Suivre les indicateurs** pour interpréter l'évolution des critères de dépassement des seuils socio-économiques et biophysiques et de la **résilience économique**
- Initier de **nouvelles études prospectives** pour informer la prise de décision stratégique (twin transition, green finance, carbon services, adaptation services)
- Organiser annuellement une **Conférence publique nationale sur les apports de la prospective pour la réussite des transitions**

Conclusion

- La prospective crée de la confiance et de la direction face à l'avenir
- En matière de diversification, l'objectif pourrait être de faire du **Luxembourg le pionnier de l'économie résiliente, inclusive et compétitive** (c. à d. à faible impact environnemental et socialement désirable)
 - hub internationalement reconnu pour ses solutions industrielles et artisanales **bas carbone et circulaires** et de services multi-spécialisés (notamment spatial, digital, logistique, finance verte, santé, alimentation)
 - Cette façon de faire permet de sensibiliser et d'**associer chaque salarié** aux transitions et à l'amélioration du cadre de vie des citoyens et de donner du sens au travail
 - Cette **industrie et ces services carbone** serviront directement l'atteinte du net zéro, le maintien de l'**Etat providence** et l'adaptation du Luxembourg aux perturbations à venir dans un monde sous contrainte

“ECO2050 is an excellent example of strategic foresight, with its analysis leading to innovative policymaking ideas that will I'm sure prove their merit beyond Luxembourg's borders. It represents a valuable addition to the ongoing foresight work being done across Europe, giving policymakers at all levels inspiration as we seek a credible path towards green growth and enhanced wellbeing.”

Maroš Šefčovič

Vice-président de la Commission européenne



2050

Merci pour votre attention

Pour plus d'informations...

luxstrategie.gouvernement.lu

linkedin.com/company/luxstrategie/



Qui sommes-nous ?

Luxembourg Stratégie est la direction de **prospective stratégique** du ministère de l'Économie. Etablie fin 2020, elle approfondit et étend l'approche collaborative initiée en 2016 avec l'étude stratégique de long terme sur la Troisième Révolution Industrielle ('processus Rifkin' ou 'TIR2050').

Attributions

Luxembourg Stratégie est chargée d'études de prospective (*foresight studies* ou *Zukunftstudien*). La prospective stratégique (*strategic foresight* ou *strategische Vorausschau*) consiste à explorer, anticiper et objectiver les futurs émergents et possibles afin de mieux prendre les décisions stratégiques aujourd'hui qui permettent d'enclencher, de façonner et de rendre résilientes les transformations souhaitées à long-terme. Luxembourg Stratégie contribue (i) à renforcer la cohérence des stratégies sectorielles du ministère de l'Économie entre elles et avec celles des autres ministères qui impactent l'économie et (ii) à transformer l'économie du pays vers plus de compétitivité et plus de résilience pour les décennies à venir.

[Lire la suite](#)

Ministère de tutelle

- Ministère de l'Économie

Ministre

- Franz Fayot

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Rétrospective. Perspective. Prospective

