Grand Duchy of Luxembourg
Ministry of the Economy
GLOBAL MEGATRENDS ANALYSIS (2025)
Lessons from the *EU Global Trends 2040* for the Luxembourg Economy

What is this booklet about?

The EUROPEAN STRATEGY AND POLICY ANALYSIS SYSTEM (ESPAS) publishes every 5 years a Global Trends Report for the next 15 years, ahead of the renewal of the EU Commission and Parliament.

The Luxembourg Ministry of the Economy has analysed the 10 megatrends (MT) identified by ESPAS in its Global Trends Report 2024[1] for 2040 with respect to their relevance and importance for the Luxembourg economy. The result is a concise Megatrends Booklet for the use of the Ministry's agents in their strategic outlook and planning practices.

This **Megatrends Booklet (2025)** complies 10 impact sheets, one for each of the 10 MT identified and discussed by ESPAS and which are the following:

1/10:	Geopolitical chessboard: a world in flux
2/10:	Mounting pressures on economic growth
3/10:	Uneven demographic ramifications
4/10:	Environmental emergency
5/10:	Energy transition
6/10:	Equality: a complex and multidimensional picture
7/10:	Nexus of technological convergence and acceleration
8/10:	Health: a global challenge
9/10:	What will change in how we live and work?
10/10:	Democracy between threats and renewal

Foresight method and deliverables

Each of these 10 MT is assessed for its relevance to the Luxembourg economy and for its coherence with other major global MT publications. The template for this assessment is adapted from the Megatrends Analysis Sheet developed by the Australian Prime Minister's Office (2024). [2] Behind this simple 1-page presentation lies a continuous process of global trends inventory, comparison and signals assessment.

To evolve from the big picture of global MT to a manageable picture of national economy-relevant trends and their implications, the following prior steps have been implemented in order to provide the Luxembourg Ministry of the Economy with a minimal internal foresight service while avoiding information overload for the users:

- Identify and collect megatrends, as published by international authoritative institutions and private sector agencies
- Characterise, analyse and continuously monitor megatrends

[1] Global Trends 2040, EUROPEAN STRATEGY AND POLICY ANALYSIS SYSTEM (ESPAS), April 2024.
[2] Policy fit for the future: the Australian Government Futures Primer, 23 Jul 2024

- Select the megatrends potentially relevant for the Luxembourg economy and its industry segments, including, where available, those with quantitative/qualitative data on Luxembourg
- Present and share the synthesis of this work

Acronyms

CCS(U)	Carbon Capture and Storage (and Use)
EV	Electric Vehicle
EE	Energy Efficiency
FF	Fossil Fuels
GW	Gigawatt
NECP	National Energy and Climate Plan
H_2	Hydrogen
PV	Photovoltaic
RE	Renewable Energies
STEP / PHS	*Stations de transfert d'énergie par pompage* / Pumped Hydro Storage
WEF	World Economic Forum

Limitations

Considering the resources at hand, the result of this process is not a comprehensive, dynamic or collaborative megatrend (MT) analysis, but rather an informed snapshot of existing MT observations generated by other entities. Also, separating MTs for the sake of presentation risks to distort their complex and interconnected nature. The process has not benefited from participative in person discussions, collective in-house or industry wide assessments, confrontation with the operational economic realities and experience of external foresight institutions or consensus finding team exercises. Data have been manually compiled from available literature. No digital foresight scanning or dynamic real time radar have been used. The findings are not visualised or graphically embellished. Given this, and despite the structured and rigorous method applied, the deliverables are not contextual products which tie into organisational plans and strategies

A regular update of the booklet would help to keep up with the fast evolving, disruptive events of our time.

The deliverables do not necessarily reflect the opinion of the Luxembourg Ministry of the Economy.

Pascale Junker, Senior Megatrends Advisor, Luxembourg,2025

MEGATREND 1/10
Geopolitical chessboard. A world in flux

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant — Important

Shift from cooperation to competition and confrontation. International rules & duties lose meaning in the face of selfish brute force.

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

End of stable rules-based world order, start of a prolonged period of high risk and deep uncertainty.[viii] Rising unilateralism, democratic backsliding, supercharged economic tensions: World military expenditure at an all-time high, while humanitarian funding decreased since 2022. National interests and security considerations dominate government agendas. Record number of armed conflicts.[ix] Development aid dwindles[x]

Geoeconomic confrontation: nations restrict goods, knowledge, services, or technology with the intent of **building self-sufficiency**, constraining geopolitical rivals and/or consolidating spheres of influence. This includes currency measures; investment controls; sanctions; tariffs, state aid and subsidies; and trade controls.[xi] Trade concentration and slow down. **Near and Friend-shoring**.

The future of NATO is uncertain. EU-UK econ reset.
US government steps on everyone and **exacerbates the race for vital resources**[xii]: Fragile states and new frontier areas[xiii] are in the firing line. Underregulated outer Space is commercialized, weaponised. The ice-free Artic opens new trade routes[xiv] - economic boom and environmental catastrophe. Artic Council dissolves. Global **land reshuffle** with illegal landgrab for access to critical resources, infrastructure, business opportunities. Land degradation is a conflict multiplier.[xv] **US retreat from protecting global commons protection** (atmos-, bio-, cryo-spheres, human rights and health …) is emulated by other nations and corporations, accelerating **climate collapse and resources conflicts.**

Migration increases globally.[xvi] Forced displacement, ethnic cleansing of populations, internal economic and climate migrants.
UN and international community unable to prevent or stop escalation of violence against civilians. International security treaties are being dismantled. **Power vacuum** is filled by big corporations, bribery, kleptocracy, violent extremist organisations, organised crime, citizens self-protection.[xvii] #guerilla #militia
Military activities emit 5.5% of GHG[xviii]

NEXT 10 YEARS

World war breaks out[xxv] as a foreseeable consequence of competition and confrontation based on the use of force in a rules-deprived global order. **Escalation** Russia-NATO, Israel-Iran/Middle East, US-China, China-Indo-pacific, US-EU/Canada, RDC-Rwanda? [xxvi] Civil war erupts in US, democratic systems breakdown.[xxvii]

Water/Food/Energy wars within EU?

New regional niche powers and global geopol centres of gravity: Brazil, India, Egypt, Indonesia, Iran, Kenya, Mexico, Nigeria, the Philippines, Turkey, Viet Nam …
Weaponisation of everything: trade and economic relations do not overcome security dilemmas anymore.[xxviii]
Another pandemic. Crises in space, which is congested, contested.
Megadroughts, Megafloods that span over large EU regions and continue for years.
Megafires in the boreal forests. The structural **scarcity of natural resources** is key in defining the future global geostrategic balance of power.[xxix]

Continued **overshoot of ecological limits** results in chronic food and water scarcity, decreased industrial output and trade, ocean collapse in most parts of the world. National bankruptcies, authoritarian regimes, political instability, lack of crisis leadership.

EU Enlargement to 35 countries could reduce the decline of its economic and demographic weight and strengthen its position as security actor on the European continent, or it could seal confrontation with Russia.

Cyberattacks or drones disable critical infra (IT systems, hospitals, offshore wind parcs, nuclear powerplants,

NEXT 20 YEARS

Permanent instability. World population continues decline.

Countries and regions with a pluralistic, democratic, well-educated society, low inequality and resources needs, robust infrastructure and high adaptation to environmental disruptions fare better than authoritarian regimes.

Scenarios
Successful reform of UN, rule of law, international cooperation, human values and trust in multilateral institutions revive. The former resources depleting and inequality generating globalisation is replaced by a more balanced mutually beneficial and sober international cooperation regime.

New World order of resources-rich and resources-poor places. Fragmentation in regional self-sufficient blocs. Resources-poor EU reduces material and energy consumptions. Sufficiency as a new geostrategic lever.[xxxii] Circularity, cloud and data sovereignty, food-fertiliser-water sufficiency, continent-wide railway, waterways and sailing boat harbour network, adaptation to climate change, businesses with a social and environmental mission, trade agreements with the willing world

China becomes the green leader, champion of double materiality and low-carbon energy, through population control, innovation for

IMPLICATIONS FOR THE ECONOMY?

Opportunities:

- **Grande Région** : new metropolitan territorial order, regional cross-border economic co-development (PDAT, 2023)
- Learn from US debacle: oppose oligarchy, kleptocracy, authoritarianism. Survival of democracy depends on **rebuilding trust in institutions and leaders**.
- Critical sovereignty over energy, food, water, data, currency, materials is essential to maintain functioning institutions, public services, quality of life, purchasing power and social cohesion.
- Adopt norms for transparency and accountability and quotas around critical resources extraction and allocation.
- Build resources- and climate- **diplomacy,** strengthen traditional alliances, building new ones with middle powers.
- Evolution of a common EU defence structure and update of EU economic security strategy[i]
- Protection of EU and national critical infrastructures.
- Strengthen **citizens resilience**, civilian-led disaster response, culture of preparedness, risk education, critical thinking, ability to recognize manipulation, media and digital literacy, physical condition, alert apps, community-led action, vulnerable groups provisions, household level 72 hrs self-sufficiency and crisis equipment[ii]
- Map **workforce needs**, mobilise young people and increase appeal of careers in risk prevention and management, adaptation to disruptions, build back better, defence, security, robustness, redundancy emergency response.[iii]
- EU leverages its regulatory power to set up common rules for the resilience, safety and sustainability of **space**.[iv]
- Enhance public-private cooperation to facilitate resilience-building and emergency response

Threats:

- A reversal of globalization and increased regionalization. Global cooperation falls amid superpower competition and anti-democratic leadership. Private companies displace governments[v]
- Commercial entities and non-state actors to become the forefront of space exploration.
- The cost of unpreparedness may become astronomically higher than the investment required upfront to confront climate change impacts, resources insecurity, trade disruptions[vi]
- Defence and AI cancel net zero ambitions. Massive emissions increase during war[vii]

ACTIONS WE CAN TAKE TO PREPARE?

- Develop a comprehensive EU and national risk assessment, based on scenarios
- Strengthen **partnerships with likeminded countries**, integrate **environmental security** into planning, recognize the links between ecological disruption and security challenges. prepare for the impacts of climate change, biodiversity loss and resource scarcity on global stability. Enhancing cyber and space capabilities[xxxiii]
- Make the case that human, ecological, food and health, national and planetary security go hand in hand, reverse the indoctrination saying otherwise[xxxiv]
- Advocate for geopolitical **de-escalation** and international governance of world critical resources and vital common goods.[xxxv]

Loss in trust in leaders since Irak war, bailout of banks 2008, management of Covid pandemic[xix], election of a convicted felon as President. Leading by contempt[xx] **Cognitive Warfare**[xxi] and FIMI[xxii], battle of narratives pitting one against the other based on unchecked information manipulation. Russia and China expand in North Africa[xxiii], league Global South and BRICS against "the West".[xxiv] De-dollarisation. The relative economic influence of **Asia** (and of its middle class) grows.	electricity grids& storage, H_2 pipelines…). Billionaires run the world.[xxx] **Informal extractive economy**, not taxed, not captured in national accounts, irrespective of human rights, located in key biodiversity areas gains terrain. **Ecological plundering**. **Security dilemmas** reach their peak. Mining for energy and digital transitions opens up not only environmental, but planetary risks.[xxxi]	resources efficiency and recycling, global control of critical materials. Or **Implosion of EU** back into rivalling nation states as a result of US-Russia instigation	• EU transactional approach: acting with others when it can, acting alone when it wishes or is obliged to do so • Build a Coalition of the preservers of a rules- and limits-based world order • Strengthen EU defence, security industrial, and energy capacities, enhance dual-use and civil-military cooperation • Develop a comprehensive **EU Stockpiling strategy** (public-private reserves of foodstuffs, energy, critical raw materials, water, medical equipment, spare parts, …). Balancing act between building resilience and autonomy and remaining open and efficient. • Budget and invest long term in EU **preparedness by design**, climate resilience, disaster-robustness, biotechnological attacks, critical infra redundancy and crisis recovery, for **all-hazards** and **triple use**: civilian protection, economic competitiveness and industrial expansion, as well as military readiness.[xxxvi] • Secure **EU cloud and data sovereignty** and reinforce the European Critical Communication System and Intelligence sharing • Monitor and report carbon and resources footprints of military activities (peace and war time)[xxxvii] • Improve foresight to prepare for emerging and cascading risk scenarios and decision making[xxxviii] pascale junker, 2025

MEGATREND 1/10 *GEOPOLITICS* IS ALSO EXPLICIT IN:

- Deloitte, Beyond the noise. The megatrends of tomorrow's world (2017): "Polarisation, resource disputes, allocation conflicts, rise of ideology"
- EU Foresight Megatrends Hub (2022): "Aggravating resource scarcity. Changing security paradigm"
- Horizon Canada, Disruptions (2024): "**World war breaks out**."
- UNDP Trends Report (2024): "Conflicts proliferate, Developing countries assert themselves."
- UK Ministry Defence, Global Strategic Trends 2055 (2024): Inequality and pressure on governance
- NATO Future Series (2024) [xxxix]
- WEF Global Risk Report (2025): "State-based armed conflict, geoeconomic confrontation, bio-chem-nuclear hazards, intrastate violence".

GLOBAL MEGATRENDS ANALYSIS (2024)[xl] 2/10 ECO GROWTH

Relevance of *EU 10 Global Trends 2040*[xli] for the Luxembourg Economy

MEGATREND 2/10

"Mounting pressures on economic growth"

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant ⟷ Important

"Geopolitical fragmentation and the climate transition threaten economic growth"

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

Decreasing global economic productivity growth[xlvii]. End of cheap money[xlviii] GDP growth negatively impacts biodiv, water, food, health, climate[xlix]

Shift in EU narrative: from competitiveness, to security, to inter-generational fairness (U v. d. Leyen 2024)

Lux. social security system, build on embedded economic growth obligation. Fiscal revenues derived largely from FF diminish, costs of RE increase.[l]

Energy is the economy. Unprecedented costs of energy and climate transitions become key pressures on economic growth. Energy transition perceived as on track, but only 10% of the required efforts are achieved globally.[li]

Low domestic climate adaptation measures.

Spending for defence and AI goes up. High econ impetus expected from AI.
Global trade is low and more among friends.[lii] Global uncertainty complex.

Lux. Human Development Index stagnates at a high level since 2012.[liii]. Lux wealth inequality rises. Low confidence of lux CEO's in econ future.[liv]

NEXT 10 YEARS

Peak growth? In production, consumption, food[lv], global trade, cars, living space, wellbeing,

Skyrocketing prices for essential commodities and raw materials—such as fertilizers, grain, oil[lvi]

Slowdown in population and consumer growth? Decrease in active population + increase in retirement and health spending may reduce econ growth[lvii]

Debt increases, but also significant rise in public spending to secure ageing and vulnerable critical infrastructure[lviii]

Transitions harder than expected. Higher energy prices, continued greenflation and supply constraints. **Green backlash**[lix]

Technological progress expected to decrease adaptation cost.

Crime, debt, illicit economic activities, concentration of[lx] and competition for natural resources exacerbate.[lxi]

EU enlargement or fragmentation? BRIC's weight in the global economy grows

NEXT 20 YEARS

Slowdown in population and consumer growth?

High debt levels to finance multiple transitions as well as social protection, so as to leave nobody behind, mitigate political polarisation, social exclusion and digital division.

Low-cost energy era is over.

Exponential costs of climate damage and biodiversity loss.

Green transition delivers long-term EU competitive advantage. Lux benefits from a legacy of strong physical and digital infrastructures.

China's weight in the global economy may stabilize.

Risk of Ruin: Global economy could face 50% GDP loss between 2070-2090 from climate shocks, with no realistic plan in place to avert this.[lxii]

Scenarios:
Single dominant econ. system replaced by plethora of new econ approaches[lxiii]:
Good Economy?[lxiv],
Corporate Welfare Economy (Arbed building housing and hospitals…)?
Self-actualising Economy[lxv],
Brain Economy?[lxvi]
Fluid Economy[lxvii],
Adaptation Economy,
Beyond GDP Economy[lxviii]?

MEGATREND 2/10 *GROWTH* IS ALSO EXPLICIT IN:

- OECD (2020), EU Parliament (2023): "Beyond Growth";
- WEF Global Risk report 2023: "Economic downturn =short term risk n°1 (EU, US, others)"
- CIFS Global megatrends: "Future of economic growth less certain"
- Finland Futures Platform: "Is the global economy on the brink? Scenarios of potential collapse"
- Horizon Canada (2024): "Demographics may reduce growth, Lower social protection and access to insurance hinders entrepreneurship and innovation. Public and household debt crisis"
- UNDP Trends Report 2024: "Is the economic paradigm waning? Debt hampers green transition" biodiv loss accelerates, health costs from pollution grow"
- UK Ministry Defence, Global Strategic Trends 2055 (2024): "Economic transformation"

IMPLICATIONS FOR THE ECONOMY?

Opportunities:

- EU Open strategic autonomy, greater Lux independence from imported resources.
- Re-industrialisation of least energy intense firms (AI?, datacentres?)
- Tax on digital assets, data, the ultra-wealthy
- CSRD, CSDDD create level playing field, increased resilience and first-mover benefits for firms
- Financial centre raises private funding for green transition.
- Repair, robustness, resilience become new businesses
- Turn green premium[xlii] into green multiplier[xliii]

Threats:

- Vulnerable supply chains[xliv]
- AI runs wild, and massively takes energy away from other sectors; Economic insecurity; cyberattacks disable critical infrastructure. Household and State debt crises. Vital terrestrial resources being overexploited, space is commercialised, biodata is monetised[xlv]
- Efficiency gains stall due to rebound effect, repatriation of outsourced production and physical limits
- Exports penalised by uncompetitive prices
- EU share of global GDP declines
- Green labour shortage
- Aggravating energy, water, food, minerals, land scarcity[xlvi]
- Carbon intense space activities threatened by energy shortages and space congestion
- Back to ownership over usage, the end of the functional, sharing economy?

ACTIONS WE CAN TAKE TO PREPARE?

- Evaluate EU going alone on sustainability (≠ US, BRICS), open to new international allies
- Prepare the economy and society for running on low growth
- Set aside resources for climate adaptation and unplanned disaster relief.[lxix]
- Retrain, reskill, STEM for all transitions
- Prioritize scarce resources allocation and reduce excessive material consumption[lxx]. Rank for «priority use », « conditional use » or « use to be reduced ».
- Protect and expand Lux cloud sovereignty pioneering position in EU[lxxi]
- Decide which clean tech/product to manufacture, assemble, purchase, forgo[lxxii]
- Make circular and regenerative the default economy, to escape resources shortages
- Stockpile materials, spare parts, energy, seeds
- Open and flexible for trade and migration
- Institutionalise foresight capacity: decision-makers focus on those elements of the future they can shape.[lxxiii]
- Investing in nature brings as high returns than in tech. It is profitable and lasting.[lxxiv]

pascale junker, 2024

GLOBAL MEGATRENDS ANALYSIS (2025)[lxxv] 4/10 ENVIRO

Relevance of *EU 10 Global Trends 2040*[lxxvi] for the Luxembourg Economy

MEGATREND (MT) 4/10

"Environmental emergency"

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant ⟷ Important

"Climate change accelerates and risks to tip. The cumulative disastrous effects of human overshoot of planetary boundaries is being widely ignored"

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

Climate COP29
Biodiversity COP16
Planetary Boundaries (PB)[lxxxv]: 6 of 9 are breached. 2024 = 1.5°C warming breached.
UN Decade of ecosystem restoration 2021 -2030

Missing awareness of the existential risk cumulated PB overshoot poses for the future of civilization. Potential for system failure, pressure on public finance and exponential economic losses (Luxembourg = 2d EU country with highest losses per cap.[lxxxvi])

Focus on GHG **mitigation before adaptation** (43% drop in emissions needed by 2030; 69% by 2040). Europeans still want climate action, but don't trust governments to deliver.[lxxxvii]

2024, the 1st year to breach 1.5°C warming threshold. The Arctic is warming 4x faster than the global average. Sea ice is shrinking. Sea levels are rising. Jetstream is stalling. Permafrost is thawing. Amazon is drying out.[lxxxviii] Despite visible signs, global GHG emission projections are increasing beyond 2040. Climate change, the West's downfall?[lxxxix]

Environmental polarisation: climate skepticism, fueled by unchecked social media. **Overshoot ideology**[xc], **green backlash**[xci] to pro-nature regulatory development[xcii] confronts green radicalization.[xciii] (X-rebellion, Last Generation…)

GDP growth negatively impacts biodiv, water, food, health, climate.[xciv]. Food insecurity, geopolitical instability, migration, inequalities rise. 50%+ of global GDP depend on nature, 1% of global GDP is enough to close the biodiversity funding gap.[xcv]
Immense potential of **nature-based solutions** (regenerated forests, soils, agriculture, wetlands …) as carbon sinks and adaptation enablers[xcvi].
Forest dieback in Lux harms biodiv, water, energy, tourism. Insurance costs rise

NEXT 10 YEARS

Climate COP39?
Biodiversity COP26?
Several environmental tipping points breached,
Some regions are uninhabitable.[xcvii]

Even if emissions peak, climate keeps warming (inertia).
Water scarcity and heatwaves provoke higher human fatalities, crop and H_2 failures, higher energy costs, power cuts. Assets may no longer be insurable, imposing strains on public service, financial system and business continuity.

Megadroughts and megafloods result in incommensurable human and asset damage.[xcviii]
Mitigation and adaptation are now equally important.
The green transition and adaptation narrative evolves from costs and losses to benefits for quality of live, continuity of public services and businesses, industrial sovereignty and societal resilience. Reducing energy needs becomes first priority.

Governments, science invest heavily in **explaining vulnerability** and the necessity of environmental protection for self-preservation, resulting in a **societal coping** movement that benefits all.
Protection is being offered to the most vulnerable to preempt **social backlash** against change. Corporates adopt a social and environmental mission. Continued societal support for the green transitions, especially in Luxembourg where financial and social indicators are still good.
Resilience becomes a comparative commercial advantage, env destruction a symptom of business as usual.

Some shift towards bioregional **cooperation** and local env. regeneration. Others choose competition between countries and global **geoengineering**. Resources use and waste quotas are imposed, monitored by AI.

NEXT 20 YEARS

Climate COP49?
Biodiversity COP36?
Irreversible environmental tipping cascade?[xcix]

Risk of Ruin is known:
Global economy could face 50% GDP loss between 2070-2090 from climate shocks, with no realistic plan in place to avert this.[c]
Arctic summers potentially ice free before 2050. After the Artic, Europe warms fastest[ci]. Could microbes, locked in Arctic ice for millennia, unleash a wave of deadly diseases?[cii]

Reaching net zero by 2050 without sufficiency turns out impossible.

Food and water scarcity[ciii]
Conflicts deteriorate the environment, food security infrastructure further (Ukraine…)

EU move to prioritise **adaptation before mitigation**. Premature heat-deaths could rise to 95,000 every summer by 2040.[civ]

Forest plantations lack water and suffer from extreme weather.

Scenarios may be:
Panic sets in. Some governments, pressured by laggard industry and society, opt for continued PB overshoot, FF combustion along with unprecedented CCSU or DAC. In the hope to control the situation.
Or
#GenerationRestoration is unearthed.[cv] Fascination for nature comes back[cvi] for want of psychological stability. Nature based solutions prove effective.

IMPLICATIONS FOR THE ECONOMY?

(convergence with those for the MTs growth, technology, energy)

Opportunities

- Luxembourg has agency in territorial and grande regional nature resources preservation, sustainable use and adaption to changing climate. Water, waste, soil, agro-sylvo-genetic cooperation within the Greater Region
- Businesses wake up to the threat of nature-related risks and adopt nature-positive strategies. Early movers stand to gain the most[lxxvii]
- Circular economy based on lux PCDS/ISO
- Diversification of the economy away from focus on resources-intensive high- and virtual tech, AI and computing
- Education in Planetary Boundaries, vocational training in low tech and environmental regeneration; Societal and monetary revalorisation of craftmanship
- Resources saving plans, behaviours and technologies. Plant nurseries comeback
- Reconfigurate financial system and reroute capital flows.[lxxviii] Green financial center finances the green transition: Finance Nature, biodiversity credits… Use ENCORE to test exposure of business to natural capital risks[lxxix]
- Systems and sectors synergies instead of siloed approach[lxxx]
- R&D and job creation in all the above
- **Transparent environment**: real-time data increases env. accountability and enforcement[lxxxi]

Threats:

- Luxembourg is unequipped for competition for natural virgin resources and therefore increases its stockpiling of resources, spare parts, food, seeds, basic equipment, medication
- Allocation conflicts over natural resources and critical rare earth resulting in mass forced displacements, breakdown of the rule of law, widening inequalities, pollution, declining trust and weakened institutions, mis/disinformation[lxxxii]
- Lack of skills and knowledge for fostering ecosystem synergies and human adaptability.
- Exposure to severe commodity and supply crisis[lxxxiii]
- Failure of climate change mitigation
- Disasters and extreme weather events, failure of climate change adaptation[lxxxiv]
- AI and digital transition, deep sea and space mining increase environmental problem

ACTIONS WE CAN TAKE TO PREPARE?

- CEO-led alliance committed to reversing nature loss and transitioning to a nature-positive economy[cvii]
- To reduce economic downturn due to nature loss, choose reversing env. deterioration and catching up on decades of Nature-based solutions neglect, rather than flight towards irreversible

	Attempts to replace natural forest by plantations.		geoengineering and "plundering the planet in the name of decarbonisation (**the ultimate irony**)" [cviii] • Plan for resettlement away from areas unsave to life or work and for migration influx • Adopt foresight and adaptive governance, based on short term indicators that guide actions and testify success and emerging risks, so as to amplify positive signals and avoid ill-considered decisions of the past (FF, Plastics, PASF, overexploitation…) • "From now on nature will decide" [cix] • "Climate change will set the rules of the game" [cx] pascale junker, Dec 2024

MEGATREND 4/10 *ENVIRONMENT* IS ALSO EXPLICIT IN:

- EU Foresight Megatrends Hub (2022): "Climate Change and environmental degradation", "growing consumption and urbanisation", "aggravating resource scarcity";
- UNEP Trends report (2024): "Sustainable finance and nature positive investments grow, FF subsidies persist, Debt hampers green transition, biodiv loss accelerates, health costs from pollution grow"
- UK Ministry Defense Global Strategic Trends 2055 (2024): Climate change, pressure on environment
- Horizon Canada, Disruptions (2024): "**Biodiversity lost, ecosystems collapse, emergency response too late**"
- IPBES Interlinkages among biodiversity, water, food and health (nexus assessment) (2024)
- World Economic Forum, Global Risk Report (2025): 4 of 10 most likely risks are environment related.

GLOBAL MEGATRENDS ANALYSIS (2024)[cxi] 5/10 ENERGY

Relevance of *EU 10 Global Trends 2040*[cxii] for the Luxembourg Economy

MEGATREND 5/10

"Costly Energy transition"

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant ⟷ Important

"Energy transition at risk from continued investments in FF, the price and availability of critical minerals, grid capacity, social acceptance"

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

Electrification revolution: Less energy, more electricity.

Global energy consumption, FF - as well as RE - uses are rising, incompatible with the 1.5°C climate target. Global power sector emissions are plateauing.[cxxii] Peak of conventional oil production?[cxxiii]
AI, datacentres, 5G, EVs, heatwaves, air conditioning drive global (esp. China, followed by India) demand for electricity. Globally, hydro remains the 1st single renewable electricity source.

Energy transition and management of variable renewables-based power systems are **daunting efforts**.[cxxiv] Only 10% are achieved globally,[cxxv] 44% in EU (2023).[cxxvi] +/- 50% RE is what a grid can support without total techn overhaul and exponential cost increases.

The **reality of the cheap RE fallacy** now sets in, after decades of illusions:[cxxvii] continuous cost reductions in RE technologies and batteries less likely.[cxxviii] High interest rates, grid connection queues, offshore meshification, intermittency problem, insufficient storage capacity, rising component prices and supply chain pressures[cxxix] slow the energy transition. Cannibalisation lower solar capture prices[cxxx]

2024 all-time record of global energy capex of $2.5 trn,[cxxxi] thereof $400 bn for **grid spending**. High initial CAPEX for RE[cxxxii], whereas power resell prices are low and borrowing costs high. Households and companies lack financing and request public aid. EU's funding gap is higher than that of the US[cxxxiii]

Global demand for minerals for EVs and batteries to grow 6-fold. Time to market for new tech and mines is 5 to 15 yrs**, to late for the net zero agenda**. FF public subsidies rise (7% of global GDP in 2022). China invests heavily in African resources.

Lux depends on German electricity imports. Lux power demand x3 by 2030, x5 by 2040. Lux's high FF per cap consumption / revenues due to "FF tourism" starts to decrease.

NEXT 10 YEARS

Peak of oil production 2030. ⅓ of the world's recoverable oil would become stranded due to decreased funding in its exploitation.[cxxxiv]
Something has to give, as it is no longer feasible to meet climate ambitions, geopolitical realities, and yet also keep pace in AI/digital growth.

Re-materialisation and environmental degradation induced by energy and digital transition become obvious.[cxxxv] Availability and price of raw materials, immature recycling tech are barriers to transition.[cxxxvi]

Costs of transition keep escalating.[cxxxvii]
Electricity nationalism and the end of shared EU energy security: European countries with stable grids (hydro, nuclear, geothermal… in Scandinavia, France…) shield themselves from exporting or interconnecting with intermittent countries.[cxxxviii] High CAPEX for energy transitions benefits the building sector.
High energy prices can provoke a cost-of-living crisis. Opposition of those less well off. Localised energy distribution and efficiency savings. expected to lower costs.
REPowerEU foresees 72% of power from RE by 2030. This has never been done.[cxxxix] 1st generation PV and wind needs to be replaced. Global EE to improve from 2%/yr to 4%/yr by 2030[cxl]

Renaissance of nuclear power, with Asia leading fast construction[cxli]
Deployment of EU **energy storage,** key to succeed energy trilemma: ramp-up to 200 GW by 2030 and 600 GW in 2050.[cxlii] With higher energy and CO_2 prices, (non-battery) energy storage becomes economically profitable, expands and diversifies slowly.[cxliii]

DE: H_2 *Kernnetz* planned to be fully operational by 2031, 9000 km, 19bn cost, 60% repurposed, 40% new.
Green H_2 produced primarily to replace existing grey H_2 in fertilizer (food production) and steel (construction) production.[cxliv]

New Turkmenistan-Afghanistan, Pakistan-India gas pipeline projected to enter service in 2030.

NEXT 20 YEARS

What demographic degrowth, efficiency and sufficiency save in energy is made up by the additional energy needs of Ai and defense. If successful, decarbonisation and decentralisation of EU energy system can enhance competitivity, reduce geopolitical friction and strategic dependence.

Global demand for energy and natural resources increases, reliance on FF decreases.[cxlv]

Fierce competition for the control of critical minerals supply chains, slows renewal of end-of-life PV and wind generator fleets.

CAPEX flattens for energy transitions, energy prices expected to stabilise at high levels. **Low-cost energy era is over.** Energy prices are dictated by the weather and water availability.[cxlvi]

New China-Russia gas pipelines might render EU industries uncompetitive.

Lux shaves peak demand by (EV, electric motorway) battery storage and demand shift in time (flexing).[cxlvii]

80 mio km of additional and refurbished grid needed by 2040.

Environmental regulation is significantly reduced to speed up permitting.

IMPLICATIONS FOR THE ECONOMY

Opportunities:

- Major training, R&D, business and job opportunities in power engineering
- Manufacturing of middleware for electricity and thermal storage solutions
- Set up a local recycling industry for solar panels and wind generators
- Massively expand Luxembourg green finance, free of greenwashing
- Public bank guarantees to mobilize private capital for bringing emerging technologies to commercial scale rapidly[cxiii]
- Innovate and diversify energy tech and sources[cxiv]: geothermal, biogas, micro-hydro… Storage: battery and non-battery, short and long duration, centralised, regional or distributed, gravitational, thermal, mechanical, electrical, chemical…addition of storage function to existing hydroelectric dams[cxv]; Hybrid multipurpose solutions: pumped storage + water reservoirs + aquatic floating PV.
- Intensify natural CCS: forest, soil and wetland restoration, use CO_2 to produce algae converted to biofuel
- Build and connect electric truck motorways BE-NL-LUX-FR-DE

Threats:

- Continued investments in FF infrastructure, high price and low availability of critical minerals and land, low grid capacity
- Need for backup power when demand is not met by RE[cxvi], long-duration energy storage facilities, remuneration schemes[cxvii]
- EU conflict with US, Russia, its energy exporters
- Legacy and new (datacentres, AI[cxviii]) energy-intensive industries
- Rising frequency of negative prices signals the urgent need to increase system flexibility[cxix]
- Public support for transition depends on achieving **energy trilemma**.[cxx]
- Loading up electric trucks, decarbonizing industrial heat, performance of heat pumps in cold weather, mining critical materials, scaling green H_2 are huge challenges[cxxi]

ACTIONS WE CAN TAKE TO PREPARE

- Ramp up energy transition, reduce all imports, incentivise all domestic resources (biogas, geotherm, wind-solar, storage…)
- Forecast and diversify energy technologies, mix and import countries
- Adopt a systemic, cross-border, diversified intergenerational approach, aim for solving the energy trilemma

MEGATREND 5/10 *ENERGY* IS ALSO EXPLICIT IN:	
• ESPAS Horizon scanning 05 (2023): "New "OPECs" for mineral resources"; • UK Ministry Defense, Global Strategic Trends 2055 (2024): "Energy transition" • WEF, Global Risk Report (2024 and 2025): "Disruption of critical infrastructure and systemic supply chains, Concentration of strategic resources" • Dubai Futures Forum Global 50 (2024): "Energy Boundaries"; • Horizons Canada's Disruptions on the Horizon 2024 report: "Energy is inaccessible and unreliable"	• Prepare the economy for increasing energy and electricity prices, f. i. in case of failure of the DE *Energiewende* • Consider (regional) energy storage, flexibility and cross-border transmission strategy[cxlviii] • Adapt energy infrastructure to extreme weather and disasters and extend longevity through high quality and robustness construction pascale junker, 2024

GLOBAL MEGATRENDS ANALYSIS (2024)[cxlix] 7/10 TECH

Relevance of *EU 10 Global Trends 2040* for the Luxembourg Economy[cl]

MEGATREND 7/10

Technological Convergence and Acceleration

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant — Important

The acceleration and global homogenisation of new tech are increasing (see back page for tech list)

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

30 bn connected devices.

Green tech market est. to grow from 5 to 12 trillion by 2030.[clxi] **Green Industrial Deal** announced by EUCom 2024-2029.[clxii] EU Data Act enters into force 2025. NZIA (2024) aims to manufacture 40% of net-zero tech. needs in Europe, and increase CO_2 storage capacity by 2030.

Declining cost curves for clean tech rise revenue expectations: tech. seen as the answer to resources and energy constraints. The tech forecasting **converges** across all nations, industries, firms, academics, futurists around AI and automation.[clxiii] Little room for low tech, adaptation tech, nature-based and behavioural solutions.

Technology often perceived as less desirable but more realistic than sustainability.[clxiv]

AI expected to bring back growth & competitiveness, financial and environmental savings, geopolitical leadership.

OECD classifies AI as an existential risk. EU considers AI the biggest disruptor since its foundation. Risk of provoking catastrophes, conflict, mistrust, manipulation, inequality, resources overuse.

AI and datacenters provoke new uses and needs and drive carbon footprint and demand for clean electricity, water, land.[clxv]

Legislation is too slow to regulate AI. Blurring of roles between governments and "BIG TECH" corporations.

Phasing out of FF requires to find alternative heat and feedstock sources for industry[clxvi]
Declining metal ore densities and increasing demand for extracted materials lead to exploding prices, starting with copper.

After solar and wind, EU to lose yet another tech advance to Asia, USA, Golf States: (small) nuclear energy?

NEXT 10 YEARS

200 bn connected devices.

NZIA resilience (independence from imports) results in hoarding of critical materials for digitalisation and electrification.

Issues of economic insecurity, malign takeover of firms, cities, states dominate tech choices.

Tech doesn't live up to expectations: Material-energy prices go up, emissions stay high, democracy declines. ICT is power-hungry because society is data-hungry. AI doubles the consumption of datacenters. Conflicting energy uses.
EV battery swaps instead of fast-charging. next-gen solar (perovskite modules), security tech and cyber-protection.

Humans spend more time in virtual than real worlds. Excessive screentime lowers economic performance and mental health.[clxvii] The state of the planet is getting ignored.

EU single market tries to catch up in fundamental and applied research, skills training, better protection of its innovations, standard setting, human rights, food and water security, inter-generational fairness. "**Brussels Effect**" may be waning.

India, world 2d largest (and most populous) economy, and innovation epicenter? [clxviii] Non-EU datacenters and AI equipped with nuclear SMR

6G, 3D and quantum and cloud tech will make national borders irrelevant. Dilemma of lawmakers, tax collectors and public sector. Non-state actors shape governments and privatise public commons?

Cyber slowdown[clxix]: the dark side of digitalisation leads to an economic downturn and virtual overexposure to **digital fatigue**

NEXT 20 YEARS

Singularity?[clxx] Production of synthetic life forms and conscious tech?
Humans become code?

Digital security lagging behind speed of tech evolution so fast. Impossible to catch up.

Public investment runs dry, whereas tech evolution keeps accelerating and leaves no time to train or regulate.

60% growth in resource use by 2060 could derail efforts to achieve global climate, biodiversity, and pollution targets but also economic prosperity and human well-being.[clxxi]

With scarcer resources and rising energy needs to extract them, price premiums and profits from investing in climate tech. decline.

The great electrification of the EU may run late.
In 2023, share of electricity in EU final energy demand is 20% since 2016, for an objective of 51% by 2040.
EVs remain a rich country phenomenon.[clxxii]

Future depends on whether we succeed in balancing between the development of new tech and the protection of society from risks they entail.

Scenarios:
an EU economy dependent on infrastructures owned by Big Tech or BRICs,
or
an economy dictated by regulation and stricter borders, leading to more fragmented supply chains within mega-regions of preferential partners.[clxxiii]
or

IMPLICATIONS FOR THE ECONOMY?

Opportunities:

- Lux is a leader in passenger load e-mobility (train, tram, truck, boat) and per cap biogas and solar.[cli]
- Rising value of data[clii] with lower digital footprints: Policy regulation, frugal AI, behavioural change reins in data volume, **standardisation** for a sustainable AI[cliii]
- Decarbonisation and circularity as economic engines. Luxembourg's financial actors mobilise venture capital and private equity for growing clean and adaptation tech markets; Enter into binding green tech offtake agreements; Set up a **critical infrastructure fund** for long duration energy storage and hardware investments[cliv]
- Luxembourg organizes grand-regional recycling economy, based on its Product Circularity Data-Sheet (PCDS/ISO)
- Overcome critical material dependences: end-to-end vertical supply chain integration, decrease materials needed, produce lighter products, remove features, eliminate carbon-intensive components, choose local suppliers, select close plant location with shared functions.[clv]
- Prioritize EE which leads to direct operational cost reductions
- Breakthrough in low carbon energy storage, distributed power and heat, geothermal, hydro, green H_2 fertilizer production, islands of energy-, materials-, water-, nutrient-resilience, electric truck motorways, urban heat networks…

Threats:

- Tech convergence creates blind spots for econ. diversification and vulnerability in an uncertain future. **Green tech failure** necessitates larger behavioural shifts[clvi]
- Tech is enriching some, leaving many behind[clvii], creating high unemployment rates
- Societies and economies automated and AI dependent[clviii].
- Ban on **controversial, speculative tech** (geo/gene-engineering, AI-enabled weapons, solar radiation management, deep sea and space mining, conscious tech …
- Space is commercialized before it is regulated[clix]
- Additive, composite materials are difficult and expensive to debond and recyclable.
- Skills gap in STEM, engineering, carbon services, low tech, adaptation tech, nature-based solutions
- Lux is an EU laggard with low share of territorial energy production, only 17% electrification of total energy consumption, low per cap share of heat pumps and wind. No clean tech are designed and manufactured in Lux.[clx]

ACTIONS WE CAN TAKE TO PREPARE?

- The numerous tech forecasting reports are not sufficient to identify the latest emerging trends. Keep track of **signals and blind spots** in different fields[clxxvi] (food production, water management, climate adaptation tech, ecosystems regeneration and natural carbon sinks enhancement, resilient infrastructure, recycling, energy storage …)

	Digitalisation dilludes leadership and administrative responsibility, resulting in **overregulation**.	Désautomatisation?[clxxiv] : Slow and low tech. La tech pour ralentir la tech ?[clxxv]	• Critically forecast technologies relevant for Luxembourg, within the EU Taxonomy, NZIA and planetary boundaries, distill what is strategic, sustainable and profitable for the common good, forge a diversified **national manufacturing policy,** different from global tech convergence. • EU cloud and data sovereignty, global AI governance, ethical guidelines for disruptive technologies[clxxvii] • Avoid the notion that technology can solve all problems[clxxviii], supplement the supply-side (production) with demand-side (consumption) measures.[clxxix] • Set strategic priorities for the usage of scarce low carbon electricity and finite resources. • Extend *feuille de route decarbonation of the industry* from GHGs to industrial feedstocks, energy and waste stream security, for a full *bouclage biophysique* of production[clxxx] pascale junker, 2024
MEGATREND 7/10 *TECHNOLOGY* IS ALSO EXPLICIT IN: • EU Foresight, Megatrends Hub (2022): "Accelerating techno change and hyperconnectivity"; • IAEA (2020): Emerging technologies • Dubai Future Foundation Global 50 (2024): "Technological Vulnerabilities, The future of progress" • CIFS Global Megatrends: "Greater interconnectedness and Engineering advances"; • Horizon Canada, Disruptions (2024): "AI runs wild. People cannot tell right from wrong" • UNEP Trends report (2024): "Next Digital frontier: ethics. Increasing RE but FF subsidies continue" • Roland Berger (2024) Trends compendium 2050: "Frontier tech (digital, green, biotech)" • UK Ministry Defense, Global Strategic Trends 2055 (2024): "Technological advances, increased connectivity, fierce competition" • WEF Global Risk Report (2025): "Adverse outcomes of AI and frontier tech[clxxxi]: online harm, mis/disinformation, surveillance, censorship, cyber espionage and war"			

GLOBAL MEGATRENDS ANALYSIS (2025)[clxxxii] 9/10

Life&Work

Relevance of *EU 10 Global Trends 2040*[clxxxiii] for the Luxembourg Economy

MEGATREND 9/10
"How we life and work"

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant — Important

"More urbanised and climate-exposed, with technology shifting power and challenging traditional forms of workplace accountability, social rights and equality erode, while shortages in high and low-skilled occupations loom"

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

Jobs: From the Great Resignation[cxcv] to the Great Reshuffle of jobs due to AI and automation.
Growing jobs: ICT, truck drivers, care workers[cxcvi], farmers! and food production, teachers, retail …
Declining jobs: white collar knowledge[cxcvii], manufacturing, machinery, semi-skilled jobs, cashiers, accountants, assistants
Skills: AI-data-cybersecurity, creative thinking, resilience, flexibility, agility, curiosity, lifelong learning, empathy, leadership[cxcviii]

Education systems struggle to keep up with rapid labour-market transitions. Education crisis of legitimacy: Education and socialisation done by social media.[cxcix] Peak human brain power? Decline in IQ, adult literacy, student performance.[cc]

Always-on, burn-out economy[cci], incl in higher management. Work absenteeism.[ccii] Mental health crisis due to smartphone, social media.[cciii]
EU (and Lux) Life expectancy is back to pre-Covid levels: men 80 yrs, women 84 yrs.[cciv]

Collapsing Youth since smartphone[ccv]: rising levels of stress, anxiety and suicidality, esp. girls.[ccvi] ***Sanitarisation*** of children's despair.[ccvii] **Job-hopping**.[ccviii] Delay of adulthood, decline of parenthood[ccix], conjugality, fertility.

Urbanisation continues, **Housing crisis**: due to high interest rates and construction prices, unaffordable offers, speculation, hoarding…[ccx]. Multi-generational living more widely accepted.[ccxi]

Green, Social, Gender backlash[ccxii]: stronger male-female polarisation, uninhibited masculinism, sexism[ccxiii]. Young men become more conservative; women more liberal.[ccxiv] Precarisation fosters extreme right votes and environmental indifference.[ccxv]

Lost sense of control over one's life.[ccxvi] Digital fatigue, digital productivity illusion. Less workers, more code. Technology often perceived as less desirable but as inevitable when compared with Sustainability.[ccxvii] Europeans still want climate action, but don't trust governments to deliver.[ccxviii]

NEXT 10 YEARS

Self-employment as a new norm.[ccxxi]
Algorithmification of our lives.[ccxxii] AI writes scientific publications, undermines women's, minority's rights. Tech evolves faster than human skills, retraining and upskilling. Time spent in direct human contact reduces.[ccxxiii]

Work divided in human-contact/non-human contact jobs. **Humanity** become a luxury.[ccxxiv] Dehumanisation although 75% of customers prefer to speak to a human when dealing with customer service[ccxxv]

Travel: Flying is expensive and elitist. Set-jetting to places where Netflix series were produced.

Exposed to environmental disruptions and risks, labour productivity decreases. Office productivity plummets amidst **coffee collapse**.[ccxxvi] Higher basic goods prices mark end of resources waste.[ccxxvii]

Brands invest in earning customer's trust, help people make informed purchases.

Living conditions in cities decline. Coastal cities submerge. Areas become uninhabitable.[ccxxviii]
Urban exodus to rural areas.[ccxxix] Weak demographics encourage **immigration** and training of skilled workers.

Men are losing ground; women are gaining leadership (**testosterone fury**)[ccxxx]

With defence and AI investments, climate action, social security, education, health expenses decline.

Digital environments make **people feel insecure**. They become more indecisive, overwhelmed by options and therefore ask AI to choose for them.[ccxxxi]

2027, Lux **pension** system expenditures outweigh revenues.

NEXT 20 YEARS

The return of (manual) work. FF jobs phase out, circular and manufacturing jobs phase in, with digital occupations reshuffle amidst educational performance drops. Energy and resources scarcity result in people working more physically, not less.[ccxxxiii] End of universal basic income systems, 4 hrs working week.

Coalition of farmers and SMEs lead the transitions, AI takes over the administrative burden.

Travel&Trade: Flying is expensive and dangerous due to extreme winds, downpours …People and goods move less. Tourism, a major source of pollution, becomes regional, by train, EV, bike, boat

Sources of **hope**: 'nature', 'family', 'problem solving', trust in self and others come first.[ccxxxiv] Rediscovery of fascination for nature.[ccxxxv] Healthy environment become a human right.[ccxxxvi]

Lux **pension** deficit worsened, depletion of pension reserves exp. in 2040.[ccxxxvii] People work longer.[ccxxxviii] Pension prospects of younger generation decline. Long academic studies lose ground.[ccxxxix]

Scenarios[ccxl]:
Ethics as the next digital frontier.[ccxli] AI hype fades? Too simplistic, polarising, energy-intensive, past and magic thinking, decreasing human agency. End of *exponential nurse, talent cloud, virtually incarcerated offenders* folklore.[ccxlii]

EU welfare state: EU best places in the world to life&work, with highly educated low- and high tech workforce, social protection model, more SMEs than multinationals.

Robustness before performance[ccxliii]. Some places opt out of acceleration and performance, invest in

IMPLICATIONS FOR THE ECONOMY?

Opportunities:

- Lux Tripartite model.
- Organisations, companies and employees create **ethical, aesthetic, and social value** and joint cultural activities with other countries, in addition to economic and material value[clxxxiv]
- Hope originates in trust & confidence in self and others. Nurture them[clxxxv] and ensure human control over people's data (See MT democracy).
- Strengthen non-profit associations, communities of practices, DIY groups, arts/media alliances to create and help new social movements.
- Include futures as we include history in school curriculum. Teach alternative visions of the future.[clxxxvi]
- Offer jobs-that-make-sense[clxxxvii] and protect workers from climate change physical risks (climate leave. *Hitzefrei*, protection from wet bulb effect, …)[clxxxviii]
- Orientate youth and continual training towards green and manual jobs[clxxxix]
- Protect architectural heritage, renovate old instead of building new, to give sense of community identity and belonging
- Flexible transitions between working life and retirement (part-time work for a partial pension. earlier retirement for lower pension...).
- Improve working conditions to counter physical and mental degradations
- Demystify AI, reclaim autonomy back and make informed decisions about tech, put ethical and moral judgment first, do critical AI literacy and question who benefits from AI?[cxc]

Threats:

- As a result of AI and automation, massive unemployment causes societal and political turmoil and conflict between technologically augmented humans (via AI, genetics, electronics or other means) and non-augmented citizens[cxci] Psychological burden of feeling obsolete and of having no control over one's data.
- AI and automation do not bring back productivity, exclusively focused on max profits. Technology favoured by men over women. Men/women, old/young, West/Est … inhabit separate virtual bubbles.
- Data protection made impossible by quantum computing, banks and security exposed.[cxcii]
- US gov. attacks public servants, scientists, rangers, workers, human, env rights…
- Heat, food and water stress rise, esp. in big cities
- Destruction of cultural heritage and community identity to solve the housing crisis by building new instead of restoring old.
- Among sources of hope, 'successful political engagement" comes last, something worrisome[cxciii]
- Ageing population and youth in distress have no support[cxciv]

ACTIONS WE CAN TAKE TO PREPARE?

- Great job Reshuffle requires unprecedented **reconversion planning effort**: Ecological transition creates new jobs, whereas AI risks to destroy jobs.

Luxbg: pension expenditures = 8% GDP Young residents figure among the 10 most happiest.[ccxix] Highest p. c. consumption in EU.[ccxx]	**Intergenerational fairness.** Mission Restore Childhood.[ccxxxii]	robustness, redundancy, and maintenance and extension of lifetime of machines, nature-based solutions, time for children, lower material wellbeing.	Extend training offer, orientate and reskill for the energy, econ, ecol transitions, incl manual jobs[ccxliv] • Revise higher education objectives and develop low tech manual jobs as a competitive advantage, a reindustrialisation booster and a resilience factor for high tech (plumbers, electricians, builders, gardeners, foresters, food processing, retrofitters …) • **Mission: Restore Childhood**. Invest in our children, not invest our children.[ccxlv] No smartphone before 14 yrs. No social media before 16. Phone free schools. Much more independence, free play and responsibility."[ccxlvi] pascale junker, 2025

MEGATREND 1/10 *WORK LIFE* IS ALSO EXPLICIT IN:

- EU Foresight Megatrends Hub (2022): "Changing work. Continued urbanisation. Diversified education"
- UNDP Trends Report (2024): "Ethics, the next digital frontier. Debt servicing crowds out education, health"
- CIFS Global Megatrends: "Individualisation and Empowerment. Urbanisation"
- Horizon Canada, Disruptions (2024): "Values-based clashes divide society. People cannot tell what is true and what is not"
- WEF Global Risk Report (2025): "Talent and labour shortages"

GLOBAL MEGATRENDS ANALYSIS (2025)[ccxlvii] 10/10

DEMOCRACY

Relevance of *EU 10 Global Trends 2040*[ccxlviii] for the Luxembourg Economy

MEGATREND 10/10
"Democracy between threats and renewal"

IMPORTANCE OF THIS TREND TO THE ECONOMY

Unimportant — Important

"Trust in institutions and tech is falling. Economic policy and tech regulation, equal sharing of costs and benefits of the transitions could foster a renewal"

HOW IS THIS MEGATREND SHAPING CHANGE?

NOW

Continued **decline of democracy**, with only 8% of the world population enjoying a full democracy.[cclix] **Economic factors** are dominant in democracy decline: growth is being captured by the wealthy, particularly in the USA[cclx], whereas the cost of transitions is likely being borne by the poor.[cclxi] **Tech anxiety**, climate scepticism rise.

Multilateral, multipolar, fragmented or networked world order with state and non-state actors (corporations, megacities, organised crime, dissident groups, AI, tech billionaires…), confronted to existential threats, either **cooperate or compete**[cclxii]

Truth decay[cclxiii]: Trump/Musk post-truth power presidency (01.2025-11.2028?), a threat to nation's democracy and sovereignty. Fascism. Dismantlement of **public services**. Tech Oligarchy[cclxiv] Civil war breaks out in the US[cclxv]

Civil society disengages, participation in elections goes down, **young people** adopt anti-democratic, anti-social, violent behaviour. **Tax morale** declines. Support grows for polarisation[cclxvi], authoritarian regimes and fake news and degrows for scientific facts and the energy and climate transitions. End of local journalism.[cclxvii] Hostile activism (X-Rebellion, Last Generation...) is seen as a legitimate tool to drive change

Lux citizens disinterested in elections, constitution, pension reform, trade unions.[cclxviii] Distrust in NGOs (Caritas…)
Crisis of grievance: Loss in trust in leaders since Irak war, amplified through **Covid**[cclxix] and **climate change mismanagement,** led to distrust in formerly recognized authorities (government, science, church, NGOs, press…) and respected sources of factual information (statistical indicators, press…).[cclxx] **Crisis of wisdom**.[cclxxi]

NEXT 10 YEARS

Aggressive self-interest. Zero sum mentality: descent into grievance is profound and universal. Capitalism does not work. Political system is broken. **Deep suspicion of the wealthy, AI, innovation, geoengineering.** Rejection of digitalisation.

Violence is endorsed**.**[cclxxiv]
Civil war erupts in US. Democratic systems breakdown.[cclxxv]

Increasing disagreement about facts and data. Blurring line between opinion and fact. Conspiration theories bloom and go unchallenged.

Human deference to algorithmic "authority". Billionaires and AI run the world[cclxxvi] AI evolves so fast, humans cannot build a culture around it[cclxxvii] and unlearn to take responsibility.

Gridlocks in decision-making.[cclxxviii] Erosion of civil discourse, political paralysis, alienation, uncertainty.[cclxxix]

Erratic **change in political direction, g**reenwashing, backpaddling on Green Deal, CSRD …add to **disillusionment. Hope** of pro-sustainability lies with businesses, citizens, activists.

Post-truth, fear of discrimination and manipulation make action in favour of protecting the global commons impossible. **Overshooting planetary boundaries accelerates**. Shortage- and disaster-**preparedness** declines.

States fail to stop climate change or protect their populations. **Lack of sense of responsibility and inaction on existential threats** discredits leadership, leads to civil disobedience and self-protection movements (literal and mental **bunkerisation**[cclxxx]). #guerilla # militia. **Solitarity fate**

NEXT 20 YEARS

The **survival of democracy** depends on rebuilding trust. Critical sovereignty over energy, food, water, data, currency, materials is essential to maintain functioning institutions, public services, quality of life, purchasing power and social cohesion.

Tech amplifies anti- or pro-democratic / social trends. Autocracy, breakdown of social cohesion and national union in countries which life beyond their means.

Radical transparence? citizens have access to commercial intelligence, contracts, mandates, salaries, fees … Representative, participatory, deliberative (citizens assemble), direct (referendum, participatory budgeting…) democracies, sortition (selection by lottery)?

Regulated digital tools allow for more direct, real-time participation of citizens in political decision making (referenda, consultations, surveys…)

Scenarios are:
Ultra-liberal systems let the market take over and reduce public services
or
Institutional **resistance to the dismantling of democracy** (#wearestillin). New definition of progress and redistribution of wealth with strong public institutions but lower monetary wealth
or
Collapse of conventional institutions replaced by **bottom-up counter**

IMPLICATIONS FOR THE ECONOMY?

Opportunities:

- Reinvigorate the collective dimensions of public life, incentivize political participation through leading by example
- Prepare for fair resources allocation in times of scarcity and adapt population to environmental disruptions
- Interdisciplinary research to understand truth decay and grievance processes and propose solutions[ccxlix]
- Regulate tech, the information market and social media for fact-checking, eliminating hate speech, reducing cognitive biases.
- Protect children on the screen. Smartphone ban for children, pro-social education.
- Cultivate the benefits of ethnic, cultural, sociological and linguistical diversity.
- Strengthen investigative, fact-checked press and media as well as effective and independent NGOs. NGOs need to stand up and lead[ccl]
- Gov needs to deliver results that benefit everyone fairly. Avoid that the cost of the green economic transition be borne by the poor Economic optimism doubles if there is trust in institutions. **Reskilling for the transitions** is first priority to fight fear of losing their jobs. [ccli]
- Business too has a **license to act**, perceived as not doing enough to address societal issues[cclii]
- Bureaucracy has distrust as a starting point. Digitalisation deludes responsibility. Rebuild trust by reducing red tape and rehumanising administration.

Threats:

- Cost of mistrust.
- Politisation of science, technisation of agriculture[ccliii], Sanitarisation of bad health.[ccliv]
- AI cyberattacks disable critical infrastructures which has democratic systems break down.[cclv]
- Human and AI biases add up. **Human AI oversight** often follows AI recommendations, amplifying discrimination[cclvi] and mental decay.
- Corporates and the super-rich prepare for institutional break down[cclvii] Survivalism, prepping for end times[cclviii]
- AI runs government
- The fiercer the undemocratic regimes, the stronger the bottom-up counter movements

ACTIONS WE CAN TAKE TO PREPARE?

- **Trust unlocks hope**. To stop societal breakdown, governments, businesses, press, NGOs, experts, scientists, trade unions to work together to enable trust and hope about the future. Repair the social fabric, challenge conspiration theories, combat misinformation, prevent systemic abuse of the environment, rebuild economic optimism.[cclxxxii]
- Trust is local (media, NGOs, politicians, firms…)
- Trusted knowledge can bring us back together. Teach planetary boundaries in schools. Explore

Authority shifts towards those entities that promise simplification, certitude, tech fixes, individual immediate interest over long term collective interest. Ideology becomes identity. Lack of belief in a better future. Planning horizon gets constantly shorter.[cclxxii] **Sense of Future gets lost[cclxxiii]. End of the era of reason and empathy.**	as a response to a hollowed-out state. **EU** - build on freedom and solidarity – either disintegrates[cclxxxi] or succeeds in federating around rule of law, human rights, democracy? **Era of irresponsibility**	**movements**, either as decentralized, self-organising open regional communities or weaponised, gated, self-sufficient individual or kin compounds?	the roots of the problems and debate them respectfully. Civic and logical education. • Foresight and long-term planning for alternative futures can give new **legitimacy**[cclxxxiii] and fight **fatalism** • **Reckoning with** initiatives which misled the public (Irak war, Covid19…), is necessary for populations to trust gov, corporates, press, scientists again[cclxxxiv] • Depolarize the economic debate and offer realistic alternatives to growth – degrowth deadlock. • Develop guidelines on when and how to override AI recommendations, monitor AI performance and fairness[cclxxxv] • Allow a representation of future generations, and of nature, in today's policy making and legal system • Cultivate a **European patriotism**[cclxxxvi] pascale junker, 2025

MEGATREND 10/10 *DEMOCRACY* IS ALSO EXPLICIT IN:

- Deloitte, Megatrends of tomorrow's world (2017): "Nation State 2.0. Political defiance"
- EU Foresight Megatrends Hub (2022): "Widening inequalities", "New governments systems";
- Roland Berger Trend Compendium 2050 (2023): "Future of democracy under threat";
- CIFS Global Megatrends: "Concentration of wealth", "Individualisation"
- Horizon Canada, Disruptions (2024): "Democratic systems breakdown. US civil war."
- UK Ministry Defence, Global Strategic Trends 2055 (2024): "Inequality and pressure on governance";
- WEF (2025): "Social polarisation, mis/dis-information, erosion of human rights and civic freedoms, …"

MT 1/10, GEOPOLITICS - ENDNOTES

[i] La stratégie de sécurité économique de la Commission européenne de 2023 identifie 4 grands types de risques de sécurité économique :

- Les risques pour la résilience des chaînes d'approvisionnement et la sécurité énergétique ;
- Les risques pour la sécurité physique et la cybersécurité des infrastructures critiques ;
- Les risques liés à la sécurité technologique et aux fuites technologiques ;
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[cciv] Following the COVID-19 pandemic, global life expectancy is rising once again. Globally, life expectancy at birth reached 73.3 yrs in 2024, an increase of 8.4 yrs since 1995. Further reductions in mortality are projected to result in an average longevity of around 77.4 years globally in 2054. Since 2022, life expectancy has returned to pre-COVID-19 levels in nearly all countries and areas. UN population World Population Prospects 2024, July 2024.

[ccv] Prof. Jonathan Haidt, WEF Davos, Feb 2025. We overprotect our children in real live, depriving them of play, and underprotect them online. Teens don't hang out with friends, spend 8 hrs on screen, less laughter, touching, sunlight, book reading, more cyberbullying and loneliness, ... New norms needed: No smartphone before 14 yrs. No social media before 16. Phone free schools. Much more independence, free play and responsibility. Mission: restore childhood.

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MT 10/10 DEMOCRACY - ENDOTES

Notes

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[cclxviii] Ex du désintérêt du public luxembourgeois, particulièrement des jeunes 18-25 ans, pour la chose publique :

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- Constitution : peu de participation citoyenne à sa révision 2022, malgré introduction de l'initiative législative citoyenne dans la Constitution, 2023,
- réforme du système de pension : la campagne *Schwaetz mat* (2024) avait 2000 contributeurs, soit 0.3% des 650 000 assurés
- Désyndicalisation : Les syndicats en déclin dans un monde du travail en mutation, Statec, 2022

[cclxix] L'épreuve de la démocratie ou la démocratie à l'épreuve? Elena Danescu, Université du Luxembourg, Luxembourg Centre for Contemporary and Digital History in Luxemburger Wort, 25-26.9.2021 : « La crise du Covid-19 a révélé une crise plus profonde – celle de l'État de droit, dont les structures sont aussi fragilisées sous l'impact des processus incontournables que sont la globalisation et la digitalisation. Les poussées populistes et nationalistes augmentent, tout comme la corruption, et donnent naissance à des réactions sécuritaires et autoritaires, qui minent les démocraties européennes … Le virus ne doit pas tuer la démocratie ».

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