Towards climate-resilient development in and beyond Luxembourg

Annual Report 2024

Observatoire de la Politique Climatique

Observatoire de la Politique Climatique (OPC)

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The OPC is a scientific council currently composed of nine members with expertise in a field directly related to the Observatory's mandate.

The OPC strives to make a significant contribution to informing climate change policy and practice in a science-based and impactful way. Identifying the leverage points for achieving the broadest and fastest possible change is a priority shared by all its members, given the urgency of the situation. The task of the OPC is to advise on projects, actions or measures that may have an impact on climate policy, to scientifically evaluate existing or planned measures in the field of climate policy and to analyze their effectiveness, and to propose new measures.

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Table of Contents

Executive summary

The OPC Annual Report 2024 focuses primarily on the critical interdependence between the climate system, the biosphere, and the integrity of the sociosphere. These systems cannot be addressed in isolation – they co-constitute each other. Effective adaptation and mitigation must recognise that planetary health, ecological health, human well-being, and a functioning economy are inseparably linked.

Stronger collaboration is essential – through community empowerment and more integrated approaches to governance – to support this transition. The overarching societal goals should include achieving net zero emissions (see glossary for a definition) by transforming production and consumption patterns and meeting human needs through regenerative practices that allow diverse life forms (biodiversity) to thrive across habitats and ecosystems. Here, private capital plays a key – though ambivalent – role.

This year's report focuses on three interrelated priorities:

(1.) **Credibly measuring consumption-based GHG emissions** as a necessary complement to production-based accounting;
(2.) **Supporting a sustainable food system** that respects biosphere integrity, biosphere boundaries and ensures ecologies resilience;
(3.) **Aligning private capital** to avoid structural misinvestment and instead finance regenerative, bio-diverse systems integrated with socio-economic structures and promoting socio-ecological equity.

Together, these actions will help Luxembourg develop a forward-looking economic model that ensures long-term viability, enhances human and ecological well-being, and strengthens the country's environmental leadership within and beyond the EU.

Finally, in the face of growing backtracking on net zero commitments – both by companies and through measures such as the European Commission's "Omnibus package" of simplification measures – it is essential to reaffirm why the **EU's 2050 climate neutrality** matters: it is **only achievable with climate resilient ecosystems** at its core.

The OPC's **key recommendations** are outlined below:

Consumption-based footprint accounts for a safe and just operating space
To achieve net zero by 2050, Luxembourg must begin **tracking its consumption-based emissions**, rather than relying solely on production-based accounting (as it currently does). The country's high level of resource consumption, reflected in indicators such as Earth Overshoot Day, highlights the need for more comprehensive, sustainability-oriented measurement approaches.

Five coordinated policy strategies aim to help Luxembourg quickly tackle both domestic and global impacts of its high consumption. At the same time, they support the country in staying within planetary limits while maintaining a high quality of life.

- **Health-environment integration**: Implement sustainable dietary patterns and improve access to and the quality and amount of green spaces. This would better recognise the essential relationship between ecological and human health.
- **Footprint reduction**: Target a 40-50% reduction in biophysical footprints and prioritise absolute sustainability and well-being-centred consumption.
- **Equitable resource distribution**: Pursue more equitable resource access domestically and globally; align environmental goals with social justice principles for Luxembourg's long-term benefit.
- **Dual accounting system**: Track territorial and consumption-based emissions in parallel. Quantifying impacts embedded in imported goods and international transport informs effective policy-making and acknowledges Luxembourg's responsibility for emissions regardless of where they occur.
- **Resource efficiency**: Optimise material and energy use; eliminate production that does not enhance quality of life.

Measures for a climate resilient food system within and beyond Luxembourg

Develop an **integrated national strategy** and action plan for a **climate-resilient food system**. To avoid siloed thinking, resource and capacity waste, and to improve accountability, there should be close collaboration between the Ministry of the Environment, Climate and Biodiversity's directorate on natural resources, water, and forest; the Department for Spatial Planning; and relevant divisions within the Ministry of Agriculture and the Ministry of Health.

Key elements of an **integrated national strategy** are:

- Prioritise **sustainable land use to support future food security and bio-ecological/environmental resilience**. Preserve fertile land for food production, integrate agroforestry for ecological benefits, reduce reliance on biofuels and intensive livestock farming, and strengthen local vegetable production to improve regional nutritional security.
- Incentivise **nature-based solutions** to progressively reduce the need for pesticides and tilling, and to support nutrients recovery. These efforts should follow the principles of a circular economy.
- **Support dietary shift towards** climate-positive and climate-resilient diets. Replace commodity imports, where possible, with regionally produced, healthy foods to support a shift towards diets that improve human well-being. Future-fit diets will involve reduced meat consumption, reflect the latest insights from nutrition science, and encourage collaboration across neighbouring countries and regional governance structures.
- **Reduce import dependence of synthetic chemicals**, including synthetic pesticides, fertilizers, and fuels. Dependency reduction helps adapt to geopolitical instabilities with impacts on pricing and supply.

Private capital for Luxembourg and the European Green Deal

Private capital plays a vital role in financing the green infrastructure needed to meet Europe's climate and biodiversity goals. As a leading hub for private equity (PE) and asset management, **Luxembourg stands at the heart of this transformation**. Much of this capital is channelled through US-based firms, but Luxembourg's role as a gateway gives it both responsibility and opportunity to lead the shift toward **productive finance**. By implementing targeted fiscal, regulatory, and transparency measures, the government can redirect capital flows away from fossil fuels and harmful subsidies and toward investments that strengthen climate resilience, biodiversity, and social equity. But this transition must be carefully governed: in the context of growing privatisation of utilities, housing, and digital infrastructure, there is a real **risk of deepening inequalities and eroding public value**.

Moreover, **because many PE firms are legally incorporated in Luxembourg while operating abroad, these risks are often exported to other countries**—amplifying social and ecological costs beyond Luxembourg's borders.

To avoid this, Luxembourg must ensure its financial centre supports a **just and inclusive transition**, grounded in accountability and democratic oversight. Productive finance should serve the public good—not hollow it out.

Three urgent priorities stand out:

(1.) **Enhance transparency and accountability** for PE investments in critical infrastructure, with binding long-term commitments to prevent short-term cost-cutting, underinvestment, and asset stripping.

(2.) **Promote municipal and community-led ownership** of renewable energy and digital infrastructure to prevent privatisation and prevent monopolisation.

(3.) **Set enforceable investment criteria** to ensure private capital aligns with net zero goals, labour protections, and fair access to essential infrastructure.

1. Introduction

This 2024 OPC Annual Report aligns with broader national and European reporting efforts on climate change mitigation and adaptation. Notable recent publications such as the European Climate Risk Assessment (EEA, 2024) and the European State of the Climate (C3S and WMO 2025) underscore the accelerating risks and impacts of climate change, as well as the need for immediate, integrated, and decisive action. In response, EU member states have updated their National Energy and Climate Plans (NECPs) and many adopted new policies and legislation.

Luxembourg is no exception. In 2024, the government updated its NECP (better known under its French acronym, PNEC), strengthening measures to reach the 55% GHG emissions reduction target by 2030. In parallel, work is underway on a Social Climate Plan and a revised national climate adaptation strategy, grounded in a participatory process that includes expert consultations and public workshops.

In the financial sphere, the government is currently revising its Sustainable Finance Strategy and International Climate Finance Strategy—both essential for aligning funding and investment with national and international sustainability objectives. The Luxembourg Pension Fund has been identified as a prime candidate for reform, to ensure that its investments are aligned with climate and biodiversity commitments. A key area of focus—reflected in this report—is the restructuring of Luxembourg's financial sector to ensure that investment capital supports, rather than undermines, sustainability and environmental goals.

In addition to its independent work, the OPC provided expert input to the government on the revised PNEC and the consultation process for the revision of the Climate Adaptation Strategy. While much of the OPC's work in 2024 was commissioned by the government, this annual report serves a complementary purpose. It offers a broader perspective, emphasising the need to integrate climate change mitigation, adaptation, biodiversity, and ecological health into a coherent and ambitious policy approach. This was supported by a representative survey on the "Public Opinion on Climate Change and Action in Luxembourg", launched in September 2024 with results published in a separate report in May 2025 (see Dupont et al. 2025).

1.1 Critical links between climate and biodiversity policies

In 2021, a joint workshop held by the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (IPBES-IPCC 2022) highlighted the intrinsic connections between climate change and biodiversity loss:

- **The biosphere—the thin layer of life on and just below the Earth's surface—has co-evolved with the atmosphere. Together, they form key parts of the climate system.**
- **Climate change and biodiversity loss are mutually reinforcing.** Addressing either issue in isolation is insufficient—effective solutions must consider both challenges together.
- Many ecosystems and social-ecological systems lack the adaptive capacity to cope with unabated climate change. Even under ambitious emissions reduction scenarios, **substantial adaptation efforts will be required to manage residual climate impacts**.
- While **Protected Areas** have played an essential role in biodiversity conservation, they have not been sufficient to halt biodiversity destruction and loss at a global scale. Conservation strategies **must go beyond isolated protection efforts**.
- A **new conservation paradigm is needed**—one that simultaneously promotes a habitable climate, self-sustaining biodiversity, and an equitable quality of life for all.

Moreover, a climate-stable future depends on a thriving biosphere. Ecosystems such as woodlands, peatlands, kelp forests, and salt marshes act as vital carbon sinks, locking away vast amounts of carbon. When these ecosystems are degraded, **they become carbon sources rather than stores**, worsening the climate crisis.

In Luxembourg, most wetlands have been drained. Since a series of droughts that began in 2018, forests have also suffered: In 2023, only 15% of trees are undamaged, while over two-thirds are considerably damaged (STATEC 2024).

Healthy ecosystems are **essential for climate adaptation** (Figure 1). For example, planting new woody structures in various land-use settings—such as farmland and urban areas—can reduce flood risks, improve local soil hydrology (including water retention), and increase carbon sequestration. Restoring ecosystems in cities, agricultural landscapes, and protected natural areas—while safeguarding vital ecosystem services—must be a central pillar of Luxembourg's climate strategy, supporting both human well-being and a resilient economy.

These findings underscore the urgent need for **integrated** policies that reflect the **deep interconnection** between climate stability, ecosystem health, and human well-being. Conservation strategies must incorporate climate resilience, while climate policies must include strong safeguards for biodiversity. Only by addressing these challenges together can we secure a sustainable and resilient future for both people and nature.

Restoring nature is good for the climate.

Nature for climate

Source: Figure 1 was designed by the OPC in collaboration with Studio Polenta

1.2 COP29 and COP16: Linking climate with biodiversity action

The year 2024 was marked by two significant international conferences with major implications for climate change and biodiversity action: the 29th Conference of the Parties (COP29) to the United Nations Framework Convention on Climate Change (UNFCCC) in Baku, Azerbaijan, and the 16th Conference of the Parties (COP16) to the United Nations Convention on Biological Diversity (CBD) in Cali, Colombia.

A **key takeaway** from both conferences is the **undeniable link between climate regulation and ecosystem integrity** (see Annex 2 for links between climate change and biodiversity loss). The health of the biosphere directly shapes the impacts of climate change, with consequences for human well-being and economic stability at all levels. In Luxembourg, this means acknowledging that climate policy cannot be developed in isolation from biodiversity protection. Its land degradation, soil sealing, and over-fertilisation must be addressed as core components of its national climate strategy.

One of the most pressing themes at COP29 (climate) and COP16 (biodiversity) was the urgent need to **increase financial resources** for both climate mitigation and biodiversity protection. This includes strengthening funding mechanisms at national and international levels. For example, a key focus of COP29 was securing additional pledges for adaptation finance, including contributions to the **Adaptation Fund** and the **Loss and Damage finance** mechanisms.

The most significant—and contested—outcome of COP29 was the agreement on a **New Collective Quantified Goal (NCQG)** on climate finance, which replaces the previous target set at COP15 in 2009. However, the IPBES cautions that **monetising ecosystem services** alone is not sufficient, as it **risks reinforcing an exploitative rather than respectful relationship with nature**. Instead, it calls for a fundamental shift in how we value and interact with the natural world.

Luxembourg, as a leading global financial centre, holds a key responsibility in aligning international financial flows with the objectives of both Conventions. In sum, the intergovernmental resolutions summarised above emphasise the need to **integrate climate change mitigation and adaptation efforts with a focus on ecological health and biosphere integrity**. Moreover, they highlight the importance of ensuring that national policy-making—and national emissions and impact accounting—does not simply shift the environmental burden to other parts of the world through the offshoring of negative externalities.

The OPC accordingly posits that overarching societal goals must include the pursuit of net zero emissions by transforming production and consumption patterns. This also involves reorganising production to meet essential human needs through regenerative practices that enable diverse life forms to thrive across a range of habitats. While private capital is necessary, it plays an ambivalent role.

1.3 Structure of the report

With reference to these interconnected socio-ecological goals, this year's OPC report focuses its recommendations on three key themes:

(1.) The OPC report offers new insights and recommendations on accounting for both production- and consumption-based carbon emissions (see **Section 2**).

Credibly measuring consumption-based greenhouse gas (GHG) emissions is a necessary complement to tracking production-related emissions. It enables the identification of emissions generated abroad through the production of goods and services consumed in Luxembourg. The OPC strongly encourages the inclusion of consumption-based emissions in climate-related policymaking, to better account for the full carbon footprint associated with domestic consumption.

(2.) The report offers recommendations for meeting essential food needs in Luxembourg, while respecting the need to reduce emissions and enhance carbon sequestration and biosphere integrity—both within and beyond national borders (see **Section 3**).

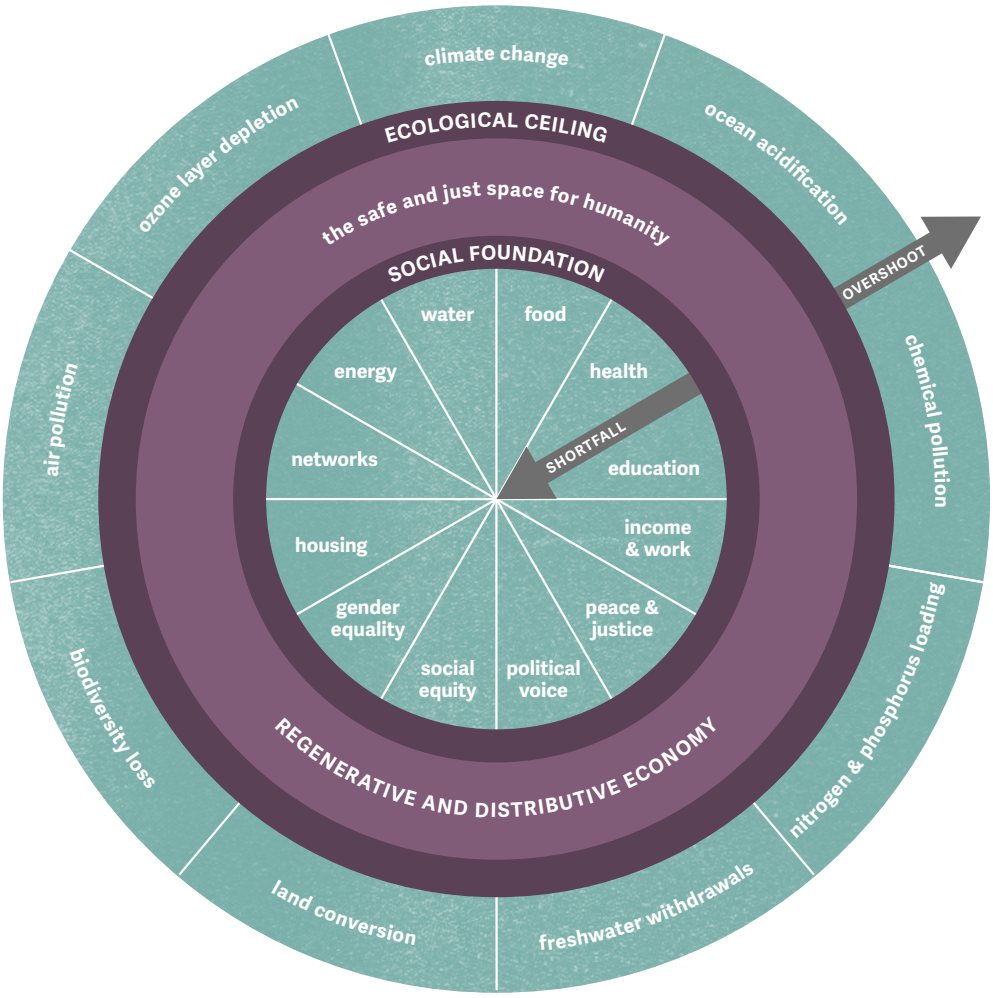
The measures needed to build a climate-resilient food system focus on agricultural policy and highlight the urgency of restoring ecological health in rural areas, while avoiding production extensification. Extensification—reducing yields per unit of farmland—can increase reliance on food imports and shift the ecological burden of food production to other countries.

(3.) The report recommends exploring ways to leverage private capital to finance essential green infrastructure under the Green Deal, while emphasising the need for strong public oversight (see **Section 4**).

It calls for strict compliance and oversight to prevent structural misalignments resulting from overly permissive privatisation. Such measures are essential to ensure that private capital serves the broader public interest—including the financing of agricultural development, regenerative practices, and biodiverse systems—rather than disproportionately benefiting dominant actors like large seed corporations and industrial agribusinesses. This is especially relevant for local communities, which play a vital role in safeguarding climate change adaptation.

However, while policies that address ecological and emissions impacts beyond national borders are essential, lasting success in reversing ecological degradation and climate destabilisation can only be achieved if transformations in production and consumption patterns are just and inclusive ensuring that no one is left behind (see also the principles in the first OPC Annual Report from 2022 reproduced in Annex 1 as well as Figure 2 and **Section 5**).

Figure 2: The Doughnut framework – a diagram to guide humanity in the pursuit of long-term goals



Source: Raworth (2017).

Note: The **social foundation** refers to the minimum standards needed to ensure that everyone can lead a dignified life. This means putting in place policies that guarantee access to, and affordability of, life's essentials—such as food, housing, healthcare, education, and income security—while preventing poverty and reducing inequality. The **ecological ceiling** represents the environmental limits that must not be exceeded if we are to protect the Earth's life-support systems, including the climate. Staying within these boundaries means avoiding the overuse of natural resources and preventing ecological degradation.

To align this year's recommendations with the **principles of a Just Transition**—and with related work by other national and international advisory bodies, such as the *Conseil Supérieur pour un Développement Durable*—the recommendations in this report have also been developed in line with the principles of Doughnut Economics (Raworth, 2017).

Doughnut Economics offers a valuable framework for guiding societal and economic development in a way that respects both ecological ceilings and social foundations (Figure 2). The outer ring represents the ecological ceiling, helping to define the limits within which humanity must operate to preserve planetary boundaries, including climate stability and global biodiversity. These ecological thresholds can also inform national and local policy by highlighting the regional carrying capacity of ecosystems and the levels of resource use that should not be exceeded to avoid ecological collapse.

The inner ring symbolises the social foundation—the minimum standards required for human well-being, including access to food, education, housing, and healthcare. The Doughnut framework is therefore a useful tool for considering both the local and global impacts of proposed measures.

2. Consumption-based footprint as a metric for defining the safe and just operating space

2.1 Luxembourg's open economy and its specificities

The EU has reduced its GHG footprint by 30% over three decades (EEA, 2023). This was driven by more efficient technologies and emissions embodied in **imports**. Therefore, trade flows and consumption growth impact the carbon footprint more than offshoring production (Wood et al., 2020). Consequently, monitoring the consumption footprint is crucial for effective climate policy and ensuring a safe, just operating space.

Luxembourg's environmental footprint is largely driven by its consumption patterns, closely tied to its economic affluence. This underscores the need for policies that mitigate consumption-related environmental impacts, especially those linked to international trade. Luxembourg's current **official measures focus exclusively on production-based emissions**, in line with EU and international reporting guidelines, such as those established under the UNFCCC (UNFCCC, 2019). Figure 3 compares Luxembourg's consumption- and production-based carbon footprint. The term "carbon footprint" actually encompasses all GHG emissions, not just carbon dioxide.

Luxembourg's consumption-based environmental footprint aligns with broader studies on consumption-based indicators. These indicators capture environmental impacts linked to national consumption, including trade-related effects. A study using the EXIOBASE global multi-regional input-output model (Simas et al., 2017) highlights the **strong link between affluence and environmental pressure under consumption-based metrics**, rather than production-based ones. As a high-income country, Luxembourg generates significant environmental impacts through its consumption patterns, driven by its economic affluence.

Luxembourg's consumption-based carbon footprint is heavily shaped by its role as an economic gravitation centre that attracts a high number of cross-border commuters. The resulting surge in transport demand, still dominated by car usage, intensifies environmental pressures. With many workers commuting from neighbouring countries, **Luxembourg's per capita GHG emissions exceed those of other OECD nations**. Given the transport sector's major contribution to global GHG emissions, targeted policies are essential to mitigate the environmental impact of commuting (Baustert et al., 2019).

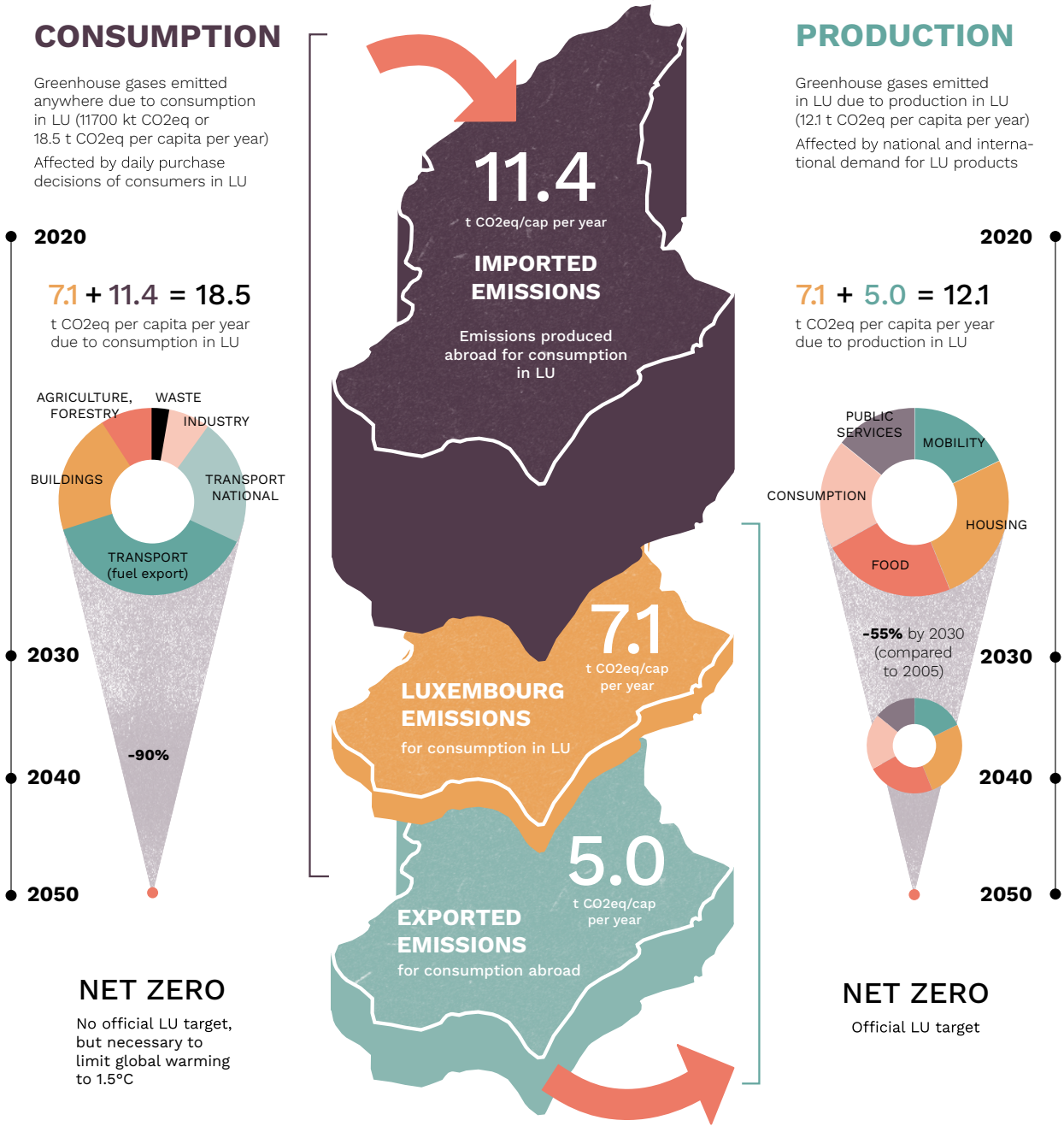
Luxembourg's small size presents **unique environmental challenges**. High population density and intensive economic activity drive significant land use change and air pollution. Lower fuel taxes compared to neighbouring countries further encourage car use, raising per capita carbon emissions. Effective urban and transport planning—alongside strong support and involvement from local planning authorities—is essential to curb urban sprawl and promote sustainable mobility (Lacoere et al., 2025).

To mitigate these environmental impacts of sprawl and mobility, Luxembourg must **strengthen its housing policies and urban planning frameworks**. Promoting public transport and alternative forms of mobility is essential. In addition, further **decarbonising the electricity mix** and enhancing the speed and coverage of public transport are crucial to meeting the growing mobility needs of commuters.

Food consumption is a **major global contributor to GHG**, accounting for about 20% of Luxembourg's carbon footprint (Figure 3). In Luxembourg, as in other high-income countries, its carbon footprint is significant but lower than that of transportation.

Consumption-based and production-based

Carbon footprint



Source: Figure 3 was designed by the OPC in collaboration with Studio Polenta

2.2 Linking Luxembourg's consumption-based carbon footprint with concrete economic activity

Whether it is possible to achieve emissions reductions whilst pursuing economic growth – that is, "decoupling" of GHG emissions from growth - is a contested field (Papież et al. 2021, Freire-González et al. 2024). Quantified "**degrees of decoupling** growth from very specific emissions" vary considerably depending on the methodological approach used to infer levels of emissions and associated impacts (Sanyé-Mengual et al., 2019).

Technological progress, particularly in energy efficiency and production improvements, is seen as key to promoting decoupling. However, in Norway, despite efficiency gains, absolute decoupling has not been achieved (Tenorio and Gomez- Baggethun, 2024). Similarly, the Netherlands' shift to a circular economy shows potential for domestic resource decoupling but has mixed global effects. While it has boosted employment and value added, it has also slightly increased domestic environmental impacts (De Boer et al., 2021). International trade further complicates decoupling, as many developed countries reduce emissions from domestic goods but not from imports, **underscoring the need to account for consumption-based emissions** (Wang et al., 2024).

Therefore, considering consumption-based footprints is crucial when assessing decoupling, as it provides a **more comprehensive view of environmental impacts** beyond domestic production.

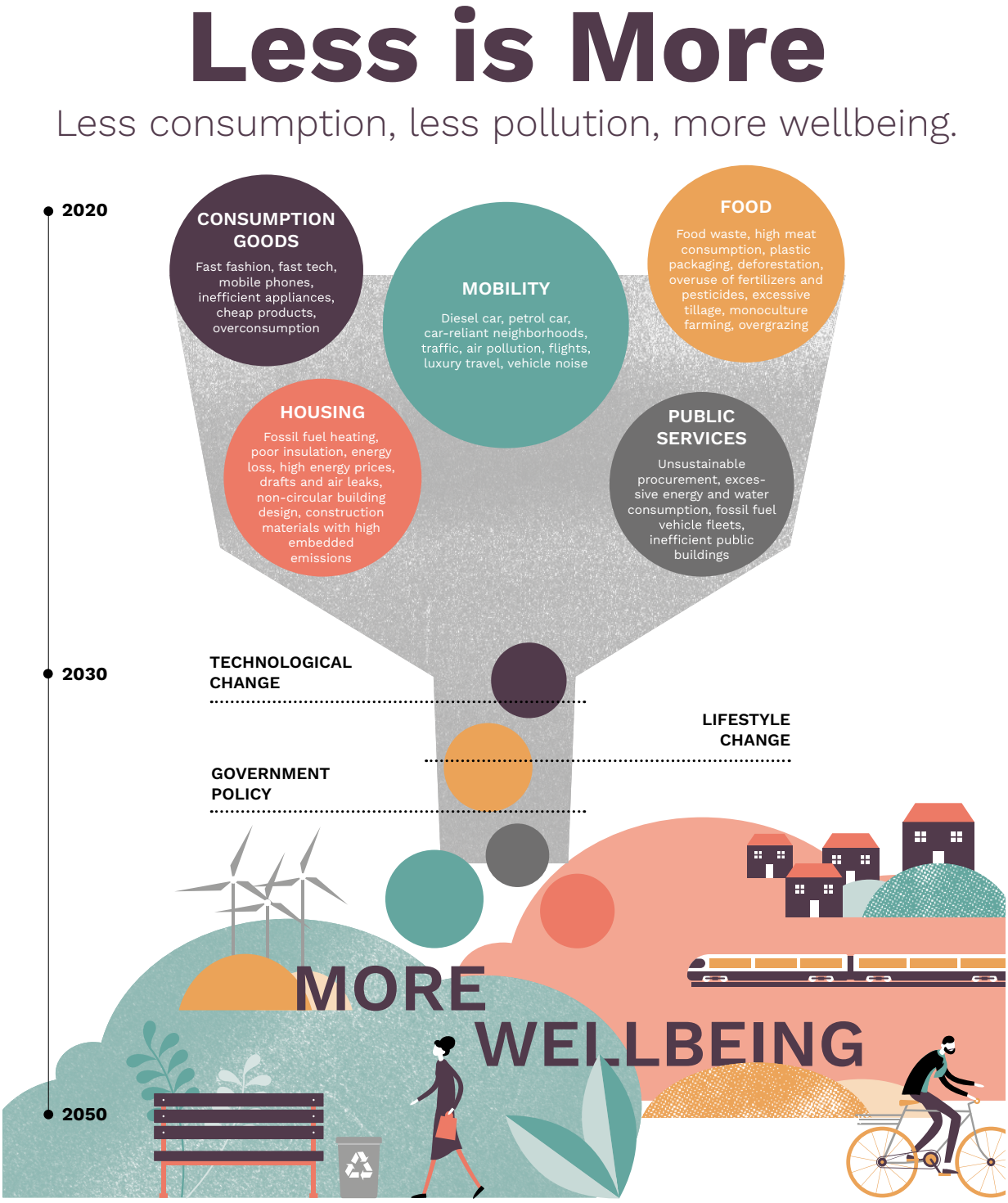
A recent study by Vogel and Hickel (2023) examined whether wealthy countries are managing to reduce their carbon emissions while continuing to grow their economies—a concept known as "absolute decoupling". They found that 11 high-income countries did achieve this between 2013 and 2019, when measuring consumption-based CO_2 emissions:

However, the reductions were far too slow to meet the targets set by the Paris Agreement. For example, if these countries continued at the same pace, **it would take them between 73 and 369 years (on average, 223 years) to reduce their emissions by 95%**—a level broadly consistent with climate safety. In the process, they would use up between five and 162 times more than their fair share of the global carbon budget for keeping global warming below 1.5°C, based on calculations that give each country an equitable portion of the remaining carbon space. This example highlights that **while absolute decoupling is technically possible, current rates are far too slow**. High-income countries such as Luxembourg must deliver much faster and deeper emissions cuts to meet their fair share in limiting global warming.

Unless one assumes a continuous and unprecedented surge in the decoupling rate driven by breakthrough technological innovation, it seems highly improbable—and extremely risky—to expect absolute decoupling to occur at a pace and consistency aligned with climate targets.

Thus, technological progress alone is insufficient to decrease GHG emissions rapidly enough to avoid the **dangerous impacts** of climate change. Behavioural change is another important lever, one that can affect not just GHG emissions within a country's border (e.g. by individuals switching to public transport to reduce domestic transport-related emissions) but also consumption-based emissions occurring abroad (e.g. by individuals opting for sustainably produced imported goods or reducing consumption altogether). The role of these **joint levers** of technological change, behavioural change, and government policy is illustrated in Figure 4.

In wealthy countries where basic human needs are generally met, the concept of "**less is more**" has taken hold. Human needs theory argues that vital dimensions of well-being correlate with consumption, but only up to a threshold. It implies a mitigation strategy that protects minimum levels of consumption but critically analyses excessive consumption (Lamb and Steinberger, 2017).

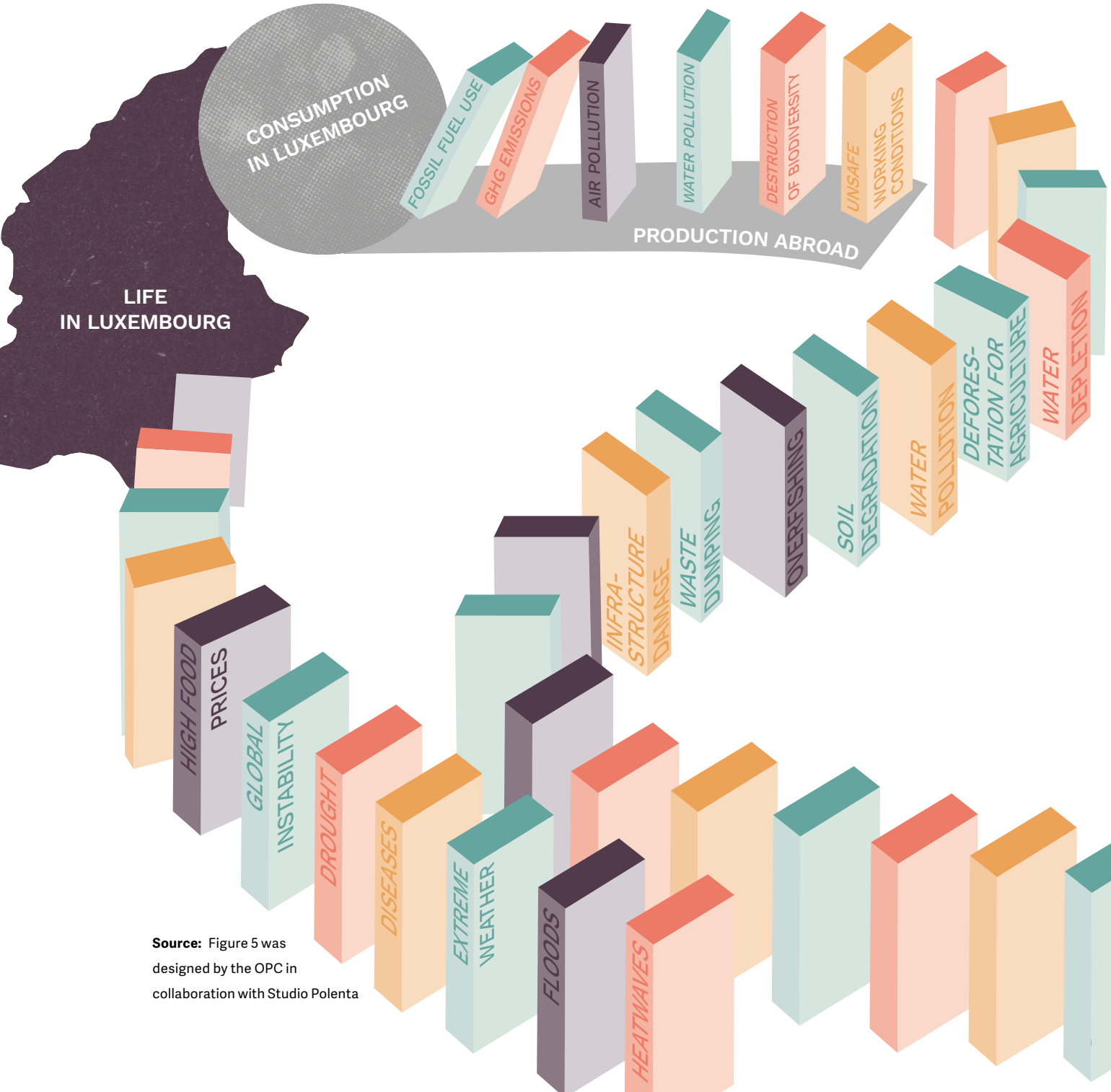


Source: Figure 4 was designed by the OPC in collaboration with Studio Polenta

Efforts to change behaviour to reduce one's impact on climate change can be motivated by a desire to protect human health and wellbeing for oneself and others, both now and in the future (inter-generational equity) and both at home and across the globe (international equity). But not everyone is motivated by altruistic arguments. As the impacts of climate change reverberate around the globe with impacts on the home economy, the case can increasingly be made for self-interest as an important motivator (Figure 5).

Climate change and consequences

What goes around, comes around



Source: Figure 5 was designed by the OPC in collaboration with Studio Polenta

2.3 Recommendations to stay within the "safe and just operating space" of the *Doughnut* framework

Luxembourg can adopt a **multifaceted strategy to stay within planetary boundaries** while maintaining a high quality of life. Key actions include improving resource efficiency, encouraging sustainable diets, reducing biophysical footprints, fostering equity, and aligning national policies with global sustainability goals.

(1.) **Enhance production and consumption efficiency and efficacy**

Increasing resource efficiency is essential for reducing environmental impact while maintaining well-being. This means using materials and energy more effectively across both production and consumption. For example, Tønnessen (2023) suggests that enhancing resource efficiency, cutting out non-beneficial production and economic activity, and encouraging more sufficient consumption can help countries stay within both planetary and social boundaries.

(2.) **Link ecological with human health**

Policies that **reintegrate nature** into people's lives—ranging from promoting sustainable diets to creating more opportunities for time in nature—have clear benefits for both physical and mental well-being. Adopting sustainable dietary patterns is essential, as high-quality diets with low environmental impact can help reduce planetary pressures. However, to ensure widespread adoption, these diets must also be **affordable and culturally acceptable**. Public health strategies should highlight the synergies between health and environmental sustainability (Leydon et al., 2023). **Environmental justice** plays a crucial role in ensuring equitable access to green spaces. The 3-30-300 rule, which suggests that individuals should see at least three trees from their home, have 30% tree canopy cover in their neighbourhood, and be within 300 metres of a green space, is an important benchmark for urban planning and well-being (Konijnendijk, 2023).

(3.) **Reduce biophysical footprints**

Significantly reducing biophysical footprints by 40-50% is essential to staying within the safe and just space framework. However, this reduction is unlikely to be achieved solely through decoupling economic growth from environmental impacts. Instead, a fundamental shift towards new models of absolute sustainability is needed—prioritising well-being-oriented consumption and production patterns over growth-driven approaches.

(4.) **Equity and fair distribution**

Promoting equity in the distribution of resources is essential for advancing global sustainability. Wealthy countries like Luxembourg have both an ethical responsibility and a clear self-interest in supporting fairer access to resources and ecosystem services. Integrating social equity into the planetary boundaries framework is crucial for achieving long-term global sustainability (Steffen and Smith, 2013).

(5.) **National-level implementation**

Luxembourg should implement the Planetary Boundaries Framework (Raworth, 2017) at the national level to assess and manage its consumption-based environmental footprint. This requires setting national limits and priorities for actions based on specific environmental challenges, in particular climate change and biodiversity destruction/loss.

Effective policy instruments for **tracking consumption-based footprint** are:

Building a dual reporting system:

- Track both **territorial** and **consumption-based** emissions in parallel.
- Develop **annual** consumption-based emissions **inventories**, accounting for emissions from imported goods, international transport, and Luxembourg's consumption abroad.

Setting consumption-based targets:

- Establish an environmental policy **goal that explicitly reduces** Luxembourg's global impact.
- Acknowledge responsibility and **ensure accountability** for consumption-driven emissions, regardless of location.

3. Climate resilient food systems and land use

3.1 Accounting for global consequences in agricultural policies: key considerations for Luxembourg

Agricultural policies must consider the risk of shifting emissions to other regions rather than achieving true environmental benefits. Food policy rules often conflict, aiming to increase commodity production while reducing environmental impacts. These contradictions create self-reinforcing feedback loops that degrade interconnected ecological and social systems, significantly affecting rural communities (Hull et al., 2015).

In the Global North, economic, social, and regulatory shifts over the past three decades have led to farm abandonment, afforestation, and de-intensification of land use (van der Zanden et al., 2017; Winkler et al., 2021). However, such de-intensification does not reduce global environmental impacts; instead, it offshores production to countries in the Global South, increasing reliance on longer, more fuel-intensive supply chains (Kastner et al., 2021; Winkler et al., 2021).

In the EU, research on agri-food production often overlooks this offshoring effect, leading to policies that fail to address global sustainability concerns (Sun et al., 2022). This dynamic **exacerbates inequality and fragility** across regions, a concern that also applies to Luxembourg's adoption of the *EU's Common Agricultural Policy Framework* (2023-2027), as elaborated below.

The separation of subsidy schemes for highly productive arable land and extensification encourages more ecologically friendly farming in some areas but also reinforces **high-input, synthetic chemical-based agriculture** on arable land. Both the **production of these chemical inputs** and the **farming practices** involved are highly **energy intensive**. By contrast, extensification reduces agricultural land productivity per hectare, which can shift ecological impacts abroad as more food imports are required. This growing reliance on imports increases dependence on fuel-intensive logistics and lengthens food supply chains (Dörry and Schulz, 2020).

To address this, diversifying production and adopting multi-layered agricultural systems are essential. These approaches – often referred to as "**ecological intensification**" – align with **regenerative farming** by enhancing biodiversity, even on actively cultivated land. They also support the **replacement of chemical pesticides** with proven **nature-based solutions**, such as nitrogen-fixing plants and beneficial insects for pest control (Goulet et al., 2023).

The EU Common Agricultural Policy (CAP) supports ecological practices on productive land through Eco-Schemes (Pillar I) and Agri-Environmental Measures (AEMs) under Pillar II.[1] The 2023-2027 CAP framework places a stronger emphasis on integrating ecological sustainability with agricultural productivity. However, **Luxembourg has not yet fully implemented these advancements**.

A key instrument within the CAP is its "green architecture," which combines both mandatory and voluntary measures to align farm productivity with environmental sustainability. Under Pillar I (direct

1 The legal basis for these measures is embedded in **Regulation (EU) 2021/2115,** which outlines the rules for the **CAP Strategic Plans.**

payments), **Eco-Schemes**[2] reward farmers for eco-friendly practices, such as crop rotation, improving soil health, water management, and biodiversity conservation. These schemes also promote "carbon farming," which focuses on maximising carbon sequestration in soils. Luxembourg has implemented many of these schemes. While participation is **voluntary for farmers**, it is **mandatory for Member States to make them available**.

Under **Pillar II** of the CAP, **Agri-Environmental Measures (AEMs)**[3] support long-term environmental improvements by offering financial incentives for sustainable land management. AEMs can include higher payments for farmers who adopt practices that combine productive land use with ecological benefits—for example, organic and regenerative farming, integrated pest management, and buffer strips along waterways. As AEMs fall under rural development, Member States are not obliged to implement them. Luxembourg has only **partially adopted** these measures.

2 Article 28 of Regulation (EU) 2021/2115 on the CAP Strategic Plan (CSP) outlines the requirements for Eco-Schemes.

3 Articles 65–70 of Regulation (EU) 2021/2116, which relates to rural development, outlines the criteria for AEMs and how member states can design these schemes to provide financial support to farmers who adopt such practices.

3.2 Recommendations for an integrated national strategy on climate-resilient food systems

A climate-resilient food system requires coordinated action across multiple sectors. Climate change poses interconnected threats, making it essential to integrate policies that both reduce GHG emissions from agriculture and land use, and strengthen resilience to extreme weather events such as floods and droughts. **Mitigation and adaptation must go hand in hand**.

To achieve this, Luxembourg needs a comprehensive national strategy to enhance the resilience of its food, water, and ecosystem systems. This will require close collaboration between the Ministry of the Environment, Climate and Biodiversity's directorate on natural resources, water, and forest; the Department for Spatial Planning; and relevant divisions within the Ministry of Agriculture and the Ministry of Health. These **ministries should jointly develop an integrated strategy** for a climate-resilient food system.

The case for an **integrated national strategy** for a climate-resilient food system is supported by the following key elements:

(1.) **Promote future food security and sustainable land use**

To safeguard future food security, fertile land must be protected for food production. Key actions include:

- Developing a national land-use and biomass plan to balance economic and ecological needs.
- Prioritising food over feed and biofuel crops:
  75% of arable land for human food by 2030; 100% by 2050.
  Ban biofuel production from arable crops.
- Promote crop diversification, e.g. soybeans in rotations (5% target by 2030) (see Bayram et al., 2023; 2024).
- Collaborate regionally (Greater Region) on shared food sustainability goals.

(2.) **Strategically diversify in key areas**

Diversification enhances soil health, carbon storage, and food system resilience. Key actions include:

- Boosting production of nutrient-rich, drought-resilient crops like legumes, berries, and oilseeds.
- Supporting small-scale vegetable farming through adapted subsidy schemes.
- Encouraging regenerative farming and citizen-led initiatives like market gardening and urban agriculture.

(3.) **Support dietary shift towards climate-positive and climate-resilient diets (from production to consumption)**

Climate-resilient food policy must align with health and nutrition science. Key actions include:

- Gradually reduce livestock density and support diverse, adaptive grazing systems.
- Expand vegetable production and support community-supported agriculture.
- Engage citizens and employers in healthy, nature-connected food systems.
- Provide long-term access to land for sustainable food ventures, especially on public land.

(4.) **Develop a climate-resilient farming certification**

A new climate-fit farming certification scheme should guide farms towards climate resilience. Key elements would include:

- Recognise practices such as reduced tilling, ecosystem restoration, and crop diversification.
- Link certification to insurance premiums to reward climate-adaptive behaviour.
- Go beyond organic by integrating risk management (e.g. flood and erosion control).

(5.) **Reduce dependency on import of synthetic chemicals**

Luxembourg should build a more self-sufficient, regional food system to buffer against supply chain shocks driven by climate change and geopolitical instability. Key actions include:

- Promoting nature-based solutions to reduce reliance on synthetic inputs.
- Applying circular economy principles to recover nutrients and protect soil health.

4. Investing in Net Zero and the Green Deal

4.1 Luxembourg's role in aligning private finance with public climate goals

As a major global financial centre, Luxembourg has a critical role to play in addressing climate change. The country can leverage its financial expertise to **mobilise sustainable investment, align private capital with climate goals, and support developing countries** in accessing much-needed climate finance. The success of commitments made at COP29 will depend not only on government action but also on the willingness of private finance to step up and take responsibility for a greener, fairer, and more sustainable future.

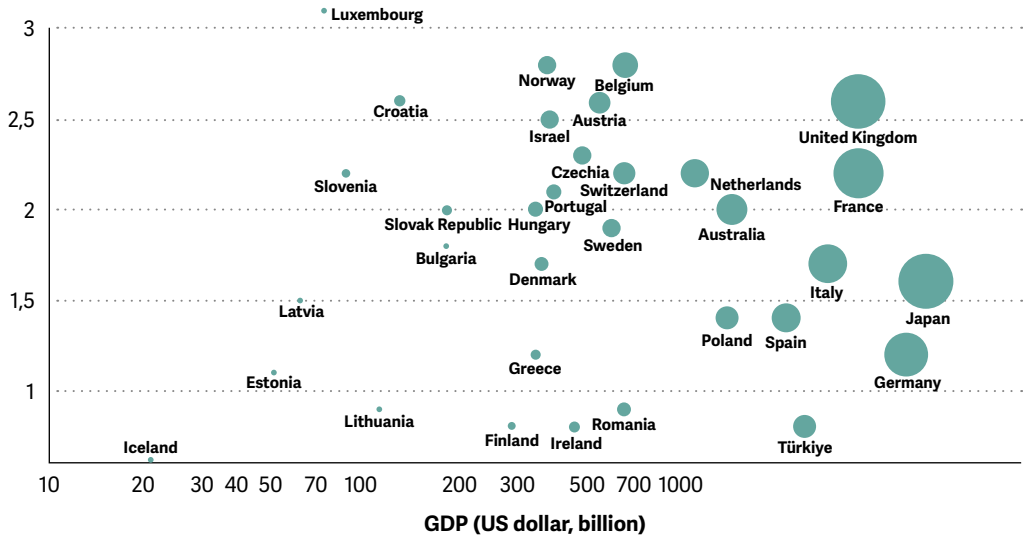
Global climate finance in 2022 was predominantly public, with bilateral and multilateral sources accounting for nearly 80% of total funding (OECD, 2024). However, after several years of stagnation, private finance mobilised through public initiatives increased by 52% from 2021 to 2022 (OECD, 2024). Climate mitigation projects received the largest share of funding (60%), while adaptation accounted for 28%.

The most significant and contested item at COP29 was the agreement on a **new collective quantified goal (NCQG)** on climate finance, which replaced the previous target set at COP15 in 2009. The previous goal required industrialised countries to provide US$100 billion annually to developing nations by 2020. However, progress was slow: it was not until 2022 that this target was finally met, with US$115.9 billion mobilised (OECD, 2024).

At COP29, countries reached a last-minute agreement on the NCQG: mobilising US$300 billion per year by 2035. The OPC acknowledges that the NCQG falls short of meeting actual financial needs but welcomes the consensus reached by all 198 COP countries. The key challenge now is to ensure swift and **effective implementation** through international cooperation and innovative financial mechanisms.

Luxembourg's **public climate finance** is among the highest worldwide relative to GDP, exceeding 3%. According to the UNFCCC Standing Committee on Finance (2024), Luxembourg provides this finance in addition to its official development assistance—set at 1% of gross national income—making it a positive outlier among donor countries (see Figure 6).

Figure 6: Climate significant expenditure/GDP (in percent of GDP)



Source: UNFCCC Standing Committee on Finance (2024)

The OPC commends Luxembourg's continued commitment to international climate finance—particularly in light of its recent decision to increase its pledge from €220 million for 2021–2025 to €320 million for 2026–2030. As a major financial centre, Luxembourg has a unique opportunity to help align global financial flows with the objectives of the *Paris Agreement* and the *Kunming-Montreal Global Biodiversity Framework*.

However, **ongoing investment in fossil fuels continues to undermine both climate and biodiversity goals**.

The *Sixth Biennial Assessment and Overview of Climate Finance Flows* by the UNFCCC Standing Committee on Finance (2024) highlights a major misallocation of resources. While global climate finance remains well below the levels required to meet the Paris targets, sufficient public and private capital exists to fill the gap. Alarmingly, annual fossil fuel investments amount to nearly US$1 trillion, with fossil fuel subsidies reaching US$1.1 trillion (UNFCCC Standing Committee on Finance, 2024). In addition, subsidies for environmentally harmful practices in agriculture, fisheries, and forestry total US$530 billion per year. Altogether, **these US$2.6 trillion in harmful subsidies and investments more than double the US$1.3 trillion currently being directed towards global climate finance**. Redirecting even a portion of these funds towards sustainable investment would represent a major step forward during this decisive decade.

4.2 The price of green: How private equity shapes the climate transition

The financial industry has shifted enormously over the past two decades,[4] revealing a growing tension between **extractive investments**—focused on short-term gains for investors at the expense of communities and the environment—and **productive investments** that create long-term value by supporting sustainable businesses, infrastructure, and local development. Private equity (PE) has been central to this shift. Its business model prioritises short-term, high returns, often through high-risk, low-responsibility ventures (Pike, 2023; Pike et al., 2019).

Today's surge of private investment in green and digital infrastructure marks what scholars describe as a **third wave of privatisation since the 1980s** (Dörry, 2025: 123). Earlier waves frequently led to higher consumer costs, weaker services, and reduced accountability. The danger now is that these patterns may be repeated under the banner of climate action.

Luxembourg, as Europe's leading centre for PE incorporation, sits at the heart of this development. The country plays a key role in shaping the investment strategies of PE firms—through tax planning, legal frameworks, and incorporation rules—and therefore bears responsibility for their wider social and ecological effects elsewhere (Feldman & Kenney, 2024). With the EU Green Deal requiring an estimated €477 billion in annual investment (ECB, 2025), private capital will be indispensable. But if channelled poorly, it risks undermining the very resilience and equity the green transition is meant to deliver.

Opportunities in private capital

PE firms are increasingly active in green finance, investing in renewable energy, battery storage, hydrogen, carbon capture, and digital infrastructure. As Europe's leading PE hub, Luxembourg exports financial services and acts as a key gateway for global capital flows (LPEA, 2020). Public–private instruments such as blended finance, which use public funds to de-risk private investment, offer further opportunities to mobilise capital into sustainable infrastructure and nature-based solutions.

If governed responsibly, PE could help accelerate decarbonisation, modernise infrastructure, and support technological innovation.

Risks of PE dominance

Despite this potential, the PE model carries **systemic risks** when applied to essential services and long-term infrastructure. The typical three-to-ten-year investment horizon of PE firms clashes with the decades-long cycles needed for sustainable energy, housing, or water systems. This mismatch encourages underinvestment in maintenance, aggressive cost-cutting, and strategies that prioritise financial engineering over community resilience.

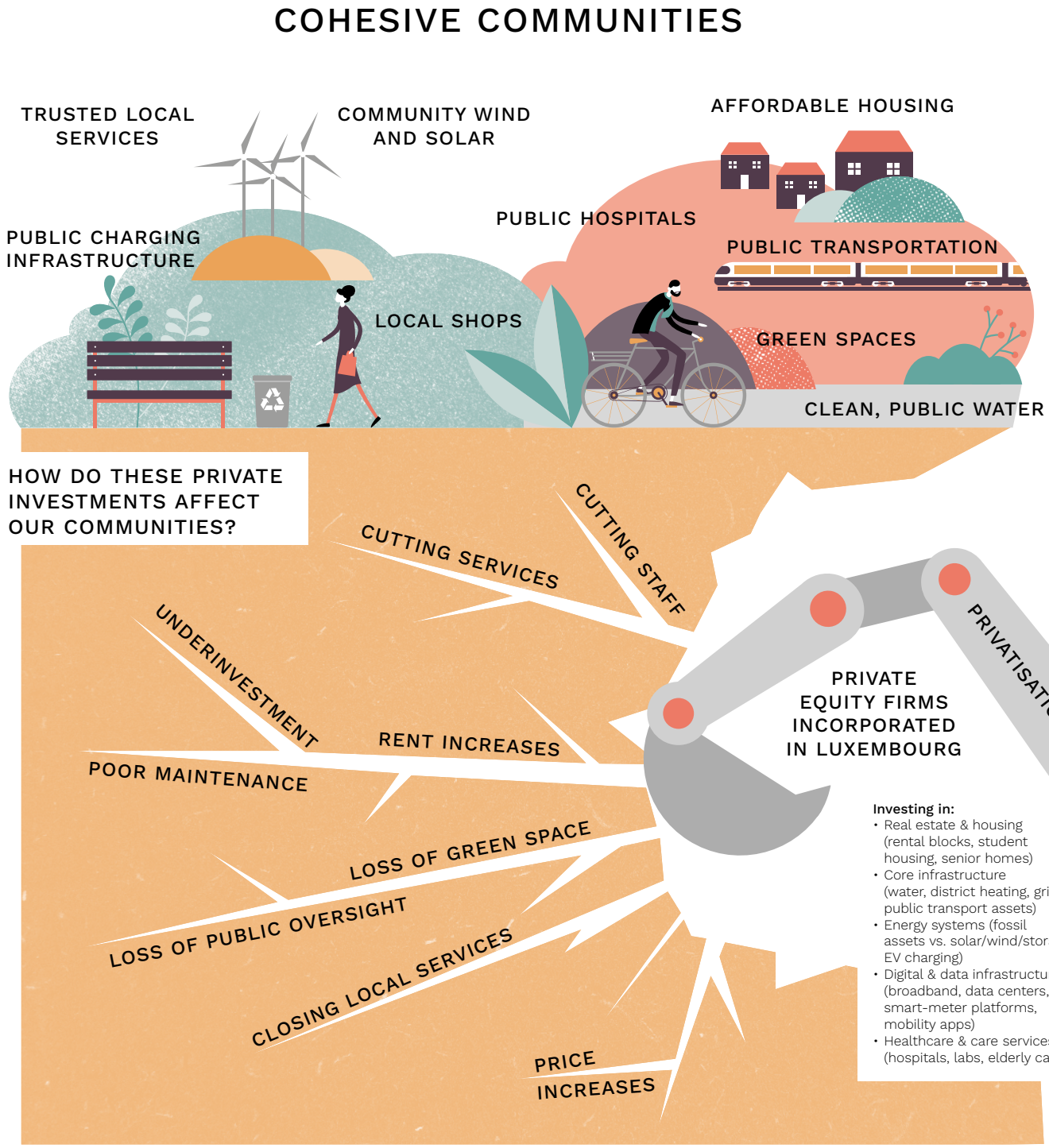
The pressure to maximise returns can divert resources away from public benefit, innovation, and reinvestment. Light regulatory oversight further erodes transparency and accountability. As a result, democratic control over vital infrastructure is weakened, while the costs of risk and failure are shifted onto the public (see also OPC, 2022).

PE's impact becomes clearest when looking at **everyday community essentials** (Figure 7):

- *Housing* – rent hikes, forced "renovations," and profit-driven flips displace tenants.
- *Water & heat* – bills rise while maintenance is deferred, service cuts boost profits.
- *Energy* – fossil assets are retained instead of shifting to clean, local power.
- *Grids & digital platforms* – data extraction, contract lock-ins, and surge pricing hit low-income households hardest.
- *Healthcare & care* – services close if unprofitable, fees rise, staff face burnout.

4 As The Economist (2025) recently put it: "American finance has been transformed. A mix of asset managers, hedge funds, private-equity firms and trading firms – including Apollo, BlackRock, Blackstone, Citadel, Jane Street, KKR and Millennium – have emerged from the shadows to elbow aside the incumbents. They are fundamentally different from the banks, insurers and old-style funds they have replaced. They are also big, complex and untested."

Private capital risks undermining our wellbeing



Source: Figure 7 was designed by the OPC in collaboration with Studio Polenta

- *Retail & everyday services* – big chains push out local shops, creating "service deserts," (including food deserts).
- *Public transport & mobility* – route cuts force car use and raise costs (even when free for the public).
- *Green spaces & nature* – land is sold off for more profitable real estate projects, trees disappear, leaving less shade, more floods, and reduced biodiversity.

The resulting "cracks" (see Figure 7) show how extractive finance can hollow out communities while claiming to fund the green transition. Indeed, PE investments in housing, infrastructure, and utilities generate **mixed outcomes**:

- **Ecological** – some projects cut emissions, others drive sprawl, land conflicts, or ecological disruption.
- **Social** – investments may expand access, but often displace residents, exclude vulnerable groups, or erode social cohesion.
- **Economic** – while offering steady returns to investors, PE often fuels speculation, monopoly pricing, and rising household costs.

In short: without strong governance, the same investment can either build resilience or erode it. Imposing effective regulation on PE firms is notoriously difficult, as they are typically structured as limited partnerships, which limits transparency and shields them from many reporting requirements.[5]

Systemic implications and case studies

Luxembourg's prominence in PE incorporation makes it a **structural enabler** of these dynamics—both domestically and, above all, in the target countries of these private investments. PE firms increasingly acquire not only assets but entire infrastructure ecosystems—transport, utilities, or digital platforms—integrating them into global investment portfolios. While such consolidation may create operational efficiencies, it also entrenches private control over services critical for equitable climate adaptation.

Historical evidence underscores the risks of poorly regulated privatisation. Since the late 1970s, the privatisation of housing, water, and energy has often resulted in:

- higher consumer costs,
- underfunded services, and
- exploitative contracts limiting public oversight.

A striking example is **Thames Water**, privatised in 1989. Over decades, ownership changes—including by Macquarie Group—saddled the company with nearly £19 billion in debt while extracting dividends, leading to chronic underinvestment and repeated environmental breaches (Allen & Pryke, 2013). In 2025, Ofwat, the regulator, fined Thames Water a record £122.7 million, including £104.5 million for sewage pollution. Shareholders have since refused to inject additional equity, casting doubt over the firm's financial stability (AP News, 2025; Young, 2024). The case highlights the long-term consequences of financialising essential services: profits for investors, risks for communities.

Reframing the transition: From growth to justice

Private capital is indispensable for financing the green transition, but **the model** through which it is deployed matters as much as **the volume** invested. The IEA, for example, estimates that global investment needs for energy infrastructure alone will reach **US$1.8 trillion annually** (IEA, 2023a; 2023b; 2024).

Without adequate governance, however, the **commercialisation of sustainability** risks producing:

- unaffordable essential services,
- erosion of local communities and businesses, and
- widening social, ecological, and spatial inequality.

Luxembourg has both responsibility and opportunity. By ensuring transparency, accountability, and equity in how PE is channelled, it can help shape a transition that is not only **green**, but also **just and resilient**.

5 Private equity funds are most often organised as limited partnerships, where the general partner (the PE firm) manages the fund and limited partners (institutional investors such as pension funds or endowments) provide capital. This legal form grants managers wide discretion, restricts investor liability, and exempts the fund from many public disclosure obligations compared to listed companies or mutual funds—making oversight and accountability more challenging (Appelbaum & Batt, 2014; Feldman & Kenney, 2024).

4.3 Recommendations to promote long-term public value

The Luxembourg government has several tools at its disposal to accelerate the reallocation of finance and ensure that its financial centre supports a sustainable transition:

(1.) **Address ecological and financial risks head-on.** Climate- and biodiversity-related risks—such as fossil fuel exposure, land degradation, and unchecked consumption-based emissions—are already material for banks, funds, and asset managers in Luxembourg. Inaction will increase liabilities, reduce asset performance, and eventually damage Luxembourg's reputation as a sustainable finance leader. Proactive measures are not only ethical, but economically essential.

(2.) **Align private capital with public value.** Private equity and institutional investors play a growing role in the green transition, but short-term profit motives often conflict with long-term public interest. Strong oversight and governance safeguards are needed to ensure that PE-backed infrastructure serves transparency, accountability, and resilience rather than extraction.

(3.) **Use fiscal and regulatory tools to steer finance.** Reforms to the taxe d'abonnement could penalise fossil fuel–intensive funds while rewarding alignment with the EU Sustainable Finance Taxonomy. At the same time, stricter sustainability standards and mandatory disclosure of climate-related financial risks would reduce greenwashing and make Luxembourg's fund industry more accountable—especially in the PE sector.

(4.) **Scale up fair and community-based finance.** Public funds can de-risk and leverage private investment in climate solutions. At the same time, Luxembourg should support cooperative, municipal, and non-profit ownership models to maintain democratic control over critical infrastructure such as transport, energy, digital systems, and data.

5. Conclusions

This OPC report highlights the urgent need for **integrated policy approaches** that recognise the interdependence of climate stability, ecosystem health, human well-being, and a future-fit economy. In a globally connected world, national policies—especially in affluent countries like Luxembourg—must also account for their cross-border impacts on people and ecosystems abroad.

Systemic transformation for climate-resilient development will only succeed if equity and justice are placed at the centre—ensuring that "no one is left behind," as emphasised in the European Green Deal.

To support this transition, the report puts forward targeted recommendations across three strategic areas:

(1.) **Rethinking carbon accounting**
Luxembourg must move beyond a narrow focus on production-based emissions (as required by international reporting standards) and also account for **consumption-based emissions**. This more complete picture would capture the climate impact of national lifestyles and externalised emissions, enabling more honest and effective policymaking.

(2.) **Transforming the food system**
A climate-resilient food system must restore ecological health without shifting impacts abroad or increasing dependence on imports. A **regenerative, regionally rooted**, and **ecologically responsible food strategy** is essential to protect biodiversity and nutritional security.

(3.) **Mobilising private capital for the public good**
Private capital will be essential for financing the green transition—but only if it is guided by strong oversight, transparency, and a commitment to equity. Without safeguards, unchecked privatisation risks undermining ecosystems, community resilience, and urgent climate adaptation. Luxembourg must align its policies with international climate and biodiversity targets, ensure its financial centre drives sustainability rather than obstructing it, hold financial actors accountable for their impacts, and **break down policy silos so that climate, finance, agriculture, and industry reinforce one another**.

As a leading financial centre, Luxembourg cannot afford passivity. **Inaction** is not only ethically indefensible—it also **threatens economic resilience and environmental integrity**.

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Glossary

Net-zero emissions – Net zero refers to a state in which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere. We still produce some emissions (like from transport or industry), but we reduce them as much as possible and then remove the rest, so the total equals zero. Reaching net zero is essential to stop climate change from getting worse.

Omnibus Package – The European Commission's Omnibus Simplification Package is a set of legislative updates introduced in February 2025 covering a number of legislative areas, including sustainable finance rules, the carbon border adjustment mechanism and investment with the aim of simplifying EU rules, enhancing competitiveness and attracting investment. The Package sparked debate among various stakeholders. While the European Commission argues it simplifies regulations and boosts competitiveness, critics (including the OPC) fear it will weaken environmental and social protections, potentially undermining the EU's climate goals and corporate accountability.

Earth Overshoot Day – It marks the date each year when humanity has used up all the natural resources that Earth can regenerate in that year. After this day, we are living on ecological "credit"—using more forests, water, land, and emitting more CO2 than the planet can sustainably handle. The earlier the date, the more pressure we are putting on nature. The goal is to move Earth Overshoot Day later each year by living more sustainably. Earth Overshoot Day is calculated by the Global Footprint Network (GFN, 2025).

3-30-300 rule – This "rule" was introduced by C. Konijnendijk and refers to a simple guideline for healthier, greener cities to help improve air quality, reduce stress, support biodiversity, and make urban areas more climate-resilient and pleasant to live in. It maintains that 3 trees should be visible from every home, 30% tree canopy should cover each neighbourhood, and 300 metres is the maximum distance everyone should live from a public green space (Konijnendijk, 2023).

Absolute sustainability – It means staying within the planet's limits—using only as much land, water, energy, or resources as Earth can safely provide and regenerate. Unlike "relative sustainability," which compares progress (like using less energy than before), absolute sustainability asks whether something is sustainable in total, based on science and Earth's boundaries. It is about ensuring our lifestyles, economies, and systems do not cause long-term harm to the planet or future generations.

Absolute and relative decoupling of GHG emissions from economic growth – Absolute decoupling means that a country's GHG emissions are declining in absolute terms, even as the economy continues to grow. This is different from relative decoupling, where emissions grow more slowly than the economy.

Financialisation of sustainability – This means that environmental and social goals—like fighting climate change and protecting nature—are increasingly managed through financial markets, financial products, and financial investors. Instead of relying mainly on government action or community efforts, private investment firms, banks, and asset managers play a growing role in funding green projects, like renewable energy or sustainable agriculture. While this can help bring in much-needed capital, there is also a risk: profit may be prioritised over real environmental or social benefits, unless strong rules and public oversight are in place.

Annex 1 – About the Climate Policy Observatory

In October 2021, the Government of the Grand Duchy of Luxembourg set up the Climate Policy Observatory (OPC; Observatoire de la politique climatique) in accordance with Article 7 of Luxembourg's national climate law. The stated mission includes to advise the government on climate policies and to issue opinions on its own initiative:

> *The OPC's mission encompasses advising on projects, actions or measures that may have an impact on climate policy; scientifically evaluating the measures carried out or envisaged in the field of climate policy and to analyse their effectiveness, as well as to propose new measures; to write an annual report for the Government on the implementation of the climate policy; and to propose research and studies in relevant fields.*

The OPC Scientific Council members are appointed based on their expertise in fields directly related to the Observatory's mandate. In October 2021, the first seven members were appointed, including both national and international experts. In 2025, three additional members joined the Council to replace one that left, bringing the total to nine members. Selection criteria included the complementarity of expertise across relevant fields of knowledge and gender diversity.

The fields of expertise of the current members range from climate modelling, climate economics and climate finance, economic geography and political science, multicriteria analysis and life-cycle assessment, to biochemistry and systems science.

Members are appointed to serve for five years (with a possible extension of another five-year term), in addition to their main employment elsewhere, and are allocated an annual budget from the State budget.

A Secretariat supports the OPC's mission, with additional experts highly skilled in greenhouse gas (GHG) projections, climate policies, and environmental regulation. The Ministry of the Environment hosts the Secretariat. The Bureau of the OPC consists of the President, the Vice-President, and the Secretariat.

The OPC strives to meaningfully inform policy and practice on climate change in a science-based and impactful manner. Given the urgency of the situation, all members share a commitment to identifying leverage points that can enable the broadest and most rapid changes possible. According to the Intergovernmental Panel on Climate Change (IPCC, 2022) "climate governance is most effective when it integrates across multiple policy domains, helps realise synergies and minimize trade-offs, and connects national and sub-national policy-making levels" (page 6). Effective governance depends on empowering a diverse range of actors to engage in making profound changes to prevailing ways of thinking and doing (see Figure A1). With its open legal mandate and the diverse of expertise and experience of its members, the OPC is well positioned to meet these needs. It brings unique strengths and can provide added value in areas that are particularly difficult to address from the position of a single ministry or organisation.

OPC Members

Enrico Benetto

Sabine Dörry

Claire Dupont

Marc Kaufmann

Ariane König

Mirjam Kosch

Ralf Seppelt

Jean-Pascal van Ypersele

Diana Ürge-Vorsatz

Andrew Ferrone
(was an OPC member from October 2021 to October 2024)

OPC Secretariat

Eric De Brabanter

Claudia Hitaj

Main principles for a rapid and just transformation towards a sustainable and decarbonized society

In its 2022 annual report, the OPC put forth its main principles for a rapid and just transformation of Luxembourg to a sustainable and decarbonized society. As the new government forges a coalition agreement and plans for the 2023-28 legislative period, the OPC urges adherence to these main principles (Figure A1).

Main principles for a rapid and just transformation to a sustainable and decarbonised society developed in prior OPC reports

- Reduce the dependence on fossil fuels
- Just Transition towards a climate-resilient development
- New and transformative governance

Sectoral recommendations:

Energy Systems

- Increase the capacity of renewable energy production and thereby decrease the dependency on imports from foreign markets
- Continue and strengthen the measures in place aiming for a reduction of final energy demand
- Stop direct/indirect subsidies to fossil energy
- Increase the share of renewable power production

Food, Agriculture and Forestry

- Shift to balanced, sustainable healthy diets
- Reduce food loss and food waste
- Reduce methane and nitrous oxide emissions in agriculture
- Minimise dependency on production-related inputs
- Increase efficiency in extracting valuable resources
- Promote carbon sequestration in healthy and resilient forests
- Promote carbon sequestration on agricultural land in woody structures and soil
- Promote ecosystem restoration, and planting trees in urbanised areas
- Reduce net land take from about 0.5 ha per day to 0 ha per year

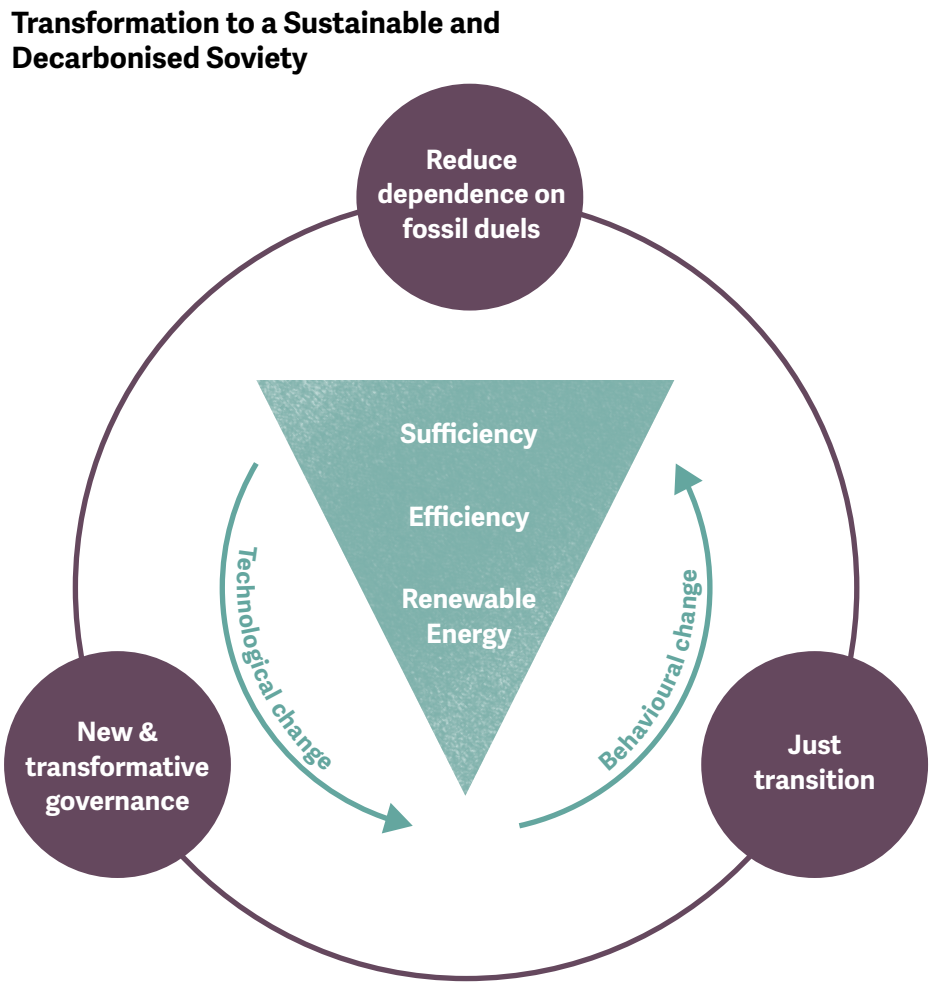
Buildings

- Require landlords to invest in renovations of leased homes or apartments
- Reduce ambient temperature in homes and offices
- Reduce floor area per person
- Promote resilient buildings
- Ban fossil heating systems

Transport

- Land use and urban planning to reduce space for cars
- Develop plans for a 15-minute city
- Promote working from home
- Incentivise the modal shift from a car-centric to a shared, soft mobility system
- Increase share of electric vehicles (EV) and ban fossil fuel vehicles

Figure A1: Main principles for a transformation to a sustainable and decarbonised society (authors)



Source: OPC (2022)

Annex 2 – Links between climate change and biodiversity loss

A **stable climate relies on maintaining the integrity of diverse bio-ecosystems**. Biosphere integrity is fundamental to regulating the climate system. Biosphere integrity influences not only the severity of climate change impacts but also human well-being and economic stability across all scales. The following examples portray this integrated nature:

- *Carbon sequestration and climate mitigation:* Healthy ecosystems, such as forests, wetlands, peatlands, and oceanic ecosystems, act as **natural carbon sinks**, absorbing and storing carbon dioxide in the form of living and dead organic matter in a dynamic process. Degrading these ecosystems leads to increased emissions, exacerbating global warming.
- *Climate resilience and adaptation:* Ecosystems provide **natural buffers** against climate extremes. Plants help the regulation of microclimates in urban and rural environments by providing shade and by 'breathing' out water (transevaporation) – a process that cools the air. Forests and grasslands can reduce the risks of flooding, and the impacts of storms and droughts, diversified plant cover on arable soil reduces erosion, while healthy soils retain water.
- *Biodiversity and ecosystem services:* Naturally diverse ecosystems **enhance their own and climate resilience** by ensuring the stability of food production, water supply, and disease regulation. The destruction and resulting loss of biodiversity weakens ecosystem functions, making societies more vulnerable to climate-induced disruptions.
- *Climate resilient societies: organizing for human well-being and economic activities that are viable over the medium and longer term:* Many industries, including agriculture, forestry, fisheries, and tourism, **depend on intact ecosystems**. Biodiversity loss directly affects food security, water availability, and economic livelihoods. The degradation of nature increases the risks of economic instability and societal collapse.