

## **NEXUS Futures – Common Good Scenario**

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## Governance of the commons for the common good

**Gemeinwohl und Wissen – By way of an introduction:** *what would Luxembourg look like in 2045 when water, its most important common good, is governed by its regions? What would it feel like when the central government has delegated parts of its jurisdiction to the regions and citizens in terms of the management of water supply? The scenario Governance of the commons for the common good takes place in 2045 and describes how a series of external and internal events have influenced decision-making and elevated regionalisation as the key governance structure to manage natural resources, in the light of previous non-reversible events. The scenario is drafted with the perspective from the future, i.e. looking back from the future and as if we were now already in the year 2045. Hence the present and past tenses are used as appropriate. The following paragraphs present the core ideas that developed the concept of the scenario. The subsequent section presents a snapshot of the series of events whose impact affected the concept of the scenario. The ways in which different sectors and aspects of everyday life are affected by the scenario are presented further on. The storyline is supported by a number of textboxes with a distinct layout. The textboxes are divided into: ‘Facts and figures’, presenting some key properties of the different topics and further explanations, as well as some future projections; and a ‘Time witness’ part, which describes an imaginary story of a person living in 2045 and how they feel about their situation. The textboxes are intended to help the reader to grasp the defining aspects of the scenario, as well as offering a creative perspective on what the future might look like and be like to live in. Furthermore, two Case studies, one on the Éislek region and one on Luxembourg City, describe in more detail two regional examples covering water governance, land use and economic orientation. The section on the integrated picture summarises the chronological order of key events, as well as the relations and interactions between them. The scenario concludes with some overall key messages and policy pointers.*

### **United regions in Luxembourg for the general “bien-être”/well-being of the human populations.**

By 2045 Luxembourg has put in practice a ‘governance of the commons’, an innovative governance arrangement led by Luxembourg’s regions to manage the common goods of the country, with a particular emphasis on water. This does not mean an abolishment of the state, but a power shift to the regional level when it comes to water management and some other selected issues. Policies of nationwide character, such as pension systems, stay with the national government. Notwithstanding their differences and older regional rivalries, the regions, communities and people in Luxembourg already began to realise in the early and mid-2020’s that the consequences of climate change and the distance of people from decision making were more problematic than ever, mentally, emotionally and to some extent physically. As a result, a focus on regional management of regional water catchments would be essential for the overall quality of life, physical and mental health and overall *bien-être* of Luxembourg’s residents. This regionalisation was not an easy process. Rather, it was the result of a variety of forces coming together from different directions at the right time. Environmental, political and social developments during the 2020’s were the drivers for this radical change in the country.

**Environment: The underlying force.** Devastating climate change effects, mainly human induced, at both global and European level, such as droughts, floods, tornados, torrential rains, forest fires and non-native insect invasions, were understood across the globe as being the results of ever more unstable weather systems. Countries’ failure to deal effectively with climate change in the 2020’s following the Paris Agreement of 2015 sparked global school movements, with younger generations ever more vocal in demanding effective action. The situation in Luxembourg was very much in line with the global trends.

The people of Luxembourg could see and feel the consequences of climate change and the related environmental degradation, with excessively warm summers and unusual temperatures. A long-term projection, formulated back in the 2010, of a putative sea level rise of up to 370 meters, presenting a threat to put most of Luxembourg under water, with only the north remaining inhabitable, provided a powerful mental picture of the hitherto unanticipated potential hazardous impacts that such environmental risks might be associated with (based on Ramponi, 2013). Today, in 2045, in this scenario, looking back three decades, temperatures had increased by an annual average of 1.1°C compared to 1980-2010 (2.4°C compared to preindustrial temperatures) (Ferrone, 2020). The precipitations sums over the year and the seasons remained similar to 1980-2010. The number of days with strong precipitation raised to 17 per year on average and the increased evapotranspiration continues to lead to a drying out of the upper soil levels, in particular in the summer, which poses a difficulty for agriculture.

**Common good: The altruistic force for physical, mental and emotional well-being.** At the same time, it became apparent that the desire for economic progress had led to a mismanagement of natural resources. It was the time when more and more data centres and bigger factories were established in Luxembourg, their requirements including large amounts of energy, as well as water for their cooling and operation. Going hand in hand with the climate change consequences already visible in the country, such developments put at risk both Luxembourg's natural resources and its water provision. This situation sparked a reaction from the population: Luxembourg's citizens were feeling distant both from the central government's decision processes, particularly with respect to spatial planning - where decisions had historically often not been transparent (based on Hesse, 2015) – and from the management of the country's common goods, which had a direct impact on their everyday needs. In order to institute better management of the common goods, notably of fresh water, and to obtain greater involvement in decision-making, citizens demanded more power to the regions. They wanted to be involved in the management of common goods in order to avoid potentially dystopian future outcomes.

**Common good: The anthropocentric shift.** As a result of the above, the way common goods are delivered has changed. The balance of the decision-making authority and management of key infrastructures, including the water, information, electricity grids, health care and education has shifted from central government to five increasingly independent regions, while the central government remains in charge for important nationwide issues. These regions are increasingly cohesive. A series of mergers of, and improved collaboration between, municipalities and regional currencies have helped. Meanwhile various syndicates, notably for drinking water provision and waste water treatment, were merged. Their responsibilities were expanded and they generally gained in both importance and capacity to raise funds.

**Knowledge: The driving force.** These citizens' movements would not have been possible if Luxembourg had not been developing into a knowledge society. People became fully aware that their well-being was not dependent only on GDP figures, nor their quality of life tied to economic progress alone. Instead, they realised that de-growth (based on Büchs & Koch, 2019) and less intense manufacturing can result in a healthier physical environment and greater availability of resources for future generations. Knowledge is here understood as an enlightenment of the citizens, bringing a shift in their attitudes and a change in their values towards a better quality of life and overall well-being rather than economic growth and GDP measurements. This shift in citizens' mind-sets highlighted the values

that became prevalent in Luxembourg society in the 2020's, characterising a polymath community. This maturity in people's way of thinking was not only included in the formal education system of the country, but goes beyond it towards a more knowledgeable population. The younger generation slowly becomes a bona fide polymath, i.e. a homo universalis: it increasingly invests time and resources in its vocation, collects insights and educates itself through a variety of sources incl. internet (e.g. online course), social networks in addition to the formal education system.

**Discontent in Europe: The game-changing force.** Luxembourg's citizens were not the only ones to feel let down by the policy-makers' decisions. People's dissatisfaction with EU policies in numerous regions in the EU sparked a long debate in the 2010's and 2020's about forgotten places – those that “don't matter”, or are “left behind” (based on Rodríguez-Pose 2018). This was also reflected in numerous election results of the time, and in growing political populism. The rise of populism at the global level, opposing globalisation and rejecting the increasing power of inter-governmental organisations, shook the global power balance. This resulted in protectionist trade policies and the introduction of tariffs, in turn causing a ripple effect of escalating trade wars that led to fragmentation and contraction across many of the world's largest economies. There were similar developments at European level, where the financial and refugee crises strengthened anti-EU feelings, while BREXIT, growing independence movements in Catalonia and Scotland, and the overall political and civil dissatisfaction all helped to trigger intense debates over the responsibilities and priorities of the EU institutions in delegating decision-making to the Member States and regional or local authorities. These developments revived a concept that had long been in limbo: the subsidiarity principle (see Facts and figures 2). More and more regions in Europe thus obtained increased power to manage their own futures, bringing governance nearer to the individual, both physically and emotionally.

## Facts and figures 1 The process of merging municipalities

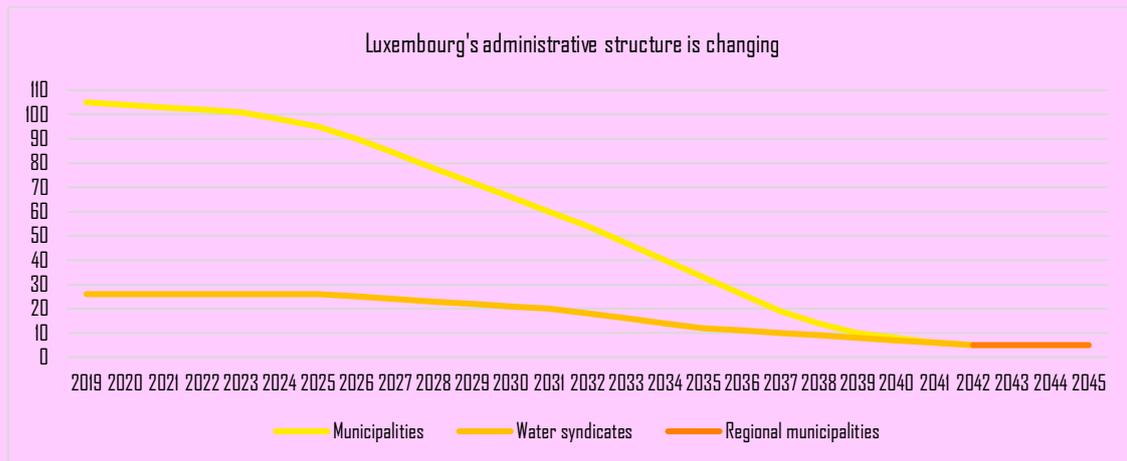
Local power, expressed and demonstrated through the commitment of the citizens, played an important role in the process of reshaping and reorganising Luxembourg from 2020 to 2045. Several developments taking place in Europe and the world sparked a reaction from citizens, who decided to take over the governance of their most important common good: water.

### 2019 – Basic information:

- Number of Luxembourg's municipalities (communes): 105
- Number of Water Syndicates: 26 (6 regional syndicates and 20 syndicates for individual municipalities)

### 2045 – Basic information:

- Number of Luxembourg's regional municipalities (communes): 5
- These municipalities benefit from a high degree of liberty and organise services for their territory, e.g. the water provision.



### Key driver 1: The Water management crisis

The summers over the 2020's have been among the warmest in Luxembourg's history. This situation continued in the following years when long summers and limited rainfalls became the norm. A water management crisis was on Luxembourg's doorstep and the risk of not being able to provide properly for the physical needs of its people evident. This development shocked the population of the country, who realised once and for all the importance of the situation and demanded action. This water management crisis in Luxembourg was one of the consequences of the severe effects of climate change. It highlighted the lack of political commitment to take action to mitigate climate change.

### Key driver 2: Citizens react "It's OUR water!"

At the same time, Luxembourg had experienced a number of events that fuelled citizens' reaction. During the 2010's and 2020's there were long discussions on building large data centres in the north of Luxembourg as well as big factories in its south, all of which require substantial volumes of water for their maintenance. Whilst at the national level these investments were pushed, citizens were concerned, amongst other things, about the water requirements of these structures. Citizens were feeling detached from the national level which pushed decisions with considerable impacts over the most important common good, water. Citizens felt that the state should no longer have the right to take decisions directly affecting the use of water, which has is so important for people's lives and physical health.

### Key driver 3: "Power to the people"

To increase individuals' responsibility for water management, citizens decided to take matters into their own hands. The municipalities, the closest political level to citizens' life, played a key role, following similar movements in Europe that gave more power to the regional and local level. This was a gradual process. Seeing the devastating consequences of the water crisis, municipalities in Luxembourg agreed gradually to cede more of their formal power to the respective water syndicates. With water having been recognised as the most important common good, water syndicates, the most important and most knowledgeable bodies when it comes to water provision, had a crucial role. They therefore intensified and formalised their already existing cooperation. With this progressive power shift from municipalities to the water syndicates, the various municipalities that were members of a given water syndicate began to see the potential wisdom of merging. This had first started in the North of Luxembourg; the Oesling / Éislek became the first merged municipality. This new governance structure increased efficiency in decision-making and boosted cooperation. Other regions' municipalities recognised the benefits of this good practice and followed a similar approach, delegating some power to the respective water syndicates for the management of the common good. They eventually also merged into larger municipalities, based around Luxembourg's water catchment areas. By 2045, the 102 municipalities of Luxembourg had agreed on the importance of self-governance of water resources and had formally decided to strengthen their cooperation. They therefore consolidated the previous 102 to 5 large merged municipalities - or as people preferred to call them 'regional municipalities'. This would not have been possible if it weren't for the results of the second referendum in 2028 on the extension of the voting rights to all residents of Luxembourg, including its foreign residents, taking up the issue after the failed referendum in 2015. This revolutionary democratic move allowed all residents having a vote and hence a voice on topics of the common good. Of course,

this does not mean that the state power is abolished. Instead there is a power shift towards the regional level when it comes particularly to water management, while policies of nationwide character still stay with the national government.

#### 2045 – A new age

This people-driven regionalisation process, made the population more committed and involved in water management. It was intended to avert potential future dystopias. The resulting 5 regional municipalities are based on Luxembourg's water catchment areas and are Oesling / Éislek (the North Region), Minett (the South Region), Guttland (the West Region), Moselle / Mullerthal (the East Region) and City (the Central Region). Despite some competition and rivalries, municipalities improved their cooperation and put effort into issues contributing to better water governance.

**Governance of the commons: People coming together.** The governance of the commons resulted in the end from all of these forces coming together. Concerned with the potential for discontent and populism, or even independence movements, similar to those at global and EU levels, the government of Luxembourg initiated a process of devolution: it granted to its regions the power to manage their own natural resources. This process followed the eight principles of managing a commons, according to Nobel Prize winner Elinor Ostrom<sup>1</sup>: i) clear definition of group boundaries; ii) matching of rules governing the commons to local needs; iii) participation in the modification of the rules by those affected by them; iv) respect by outside authorities of the rule-making rights of the community; v) monitoring of the members' behaviour; vi) application of sanctions when rules are violated; vii) provision of accessible and low-cost means of dispute resolution, and viii) increased responsibility for the common good governance in close tiers from the lowest level to the whole interconnected system (based on Walljasper, 2011).

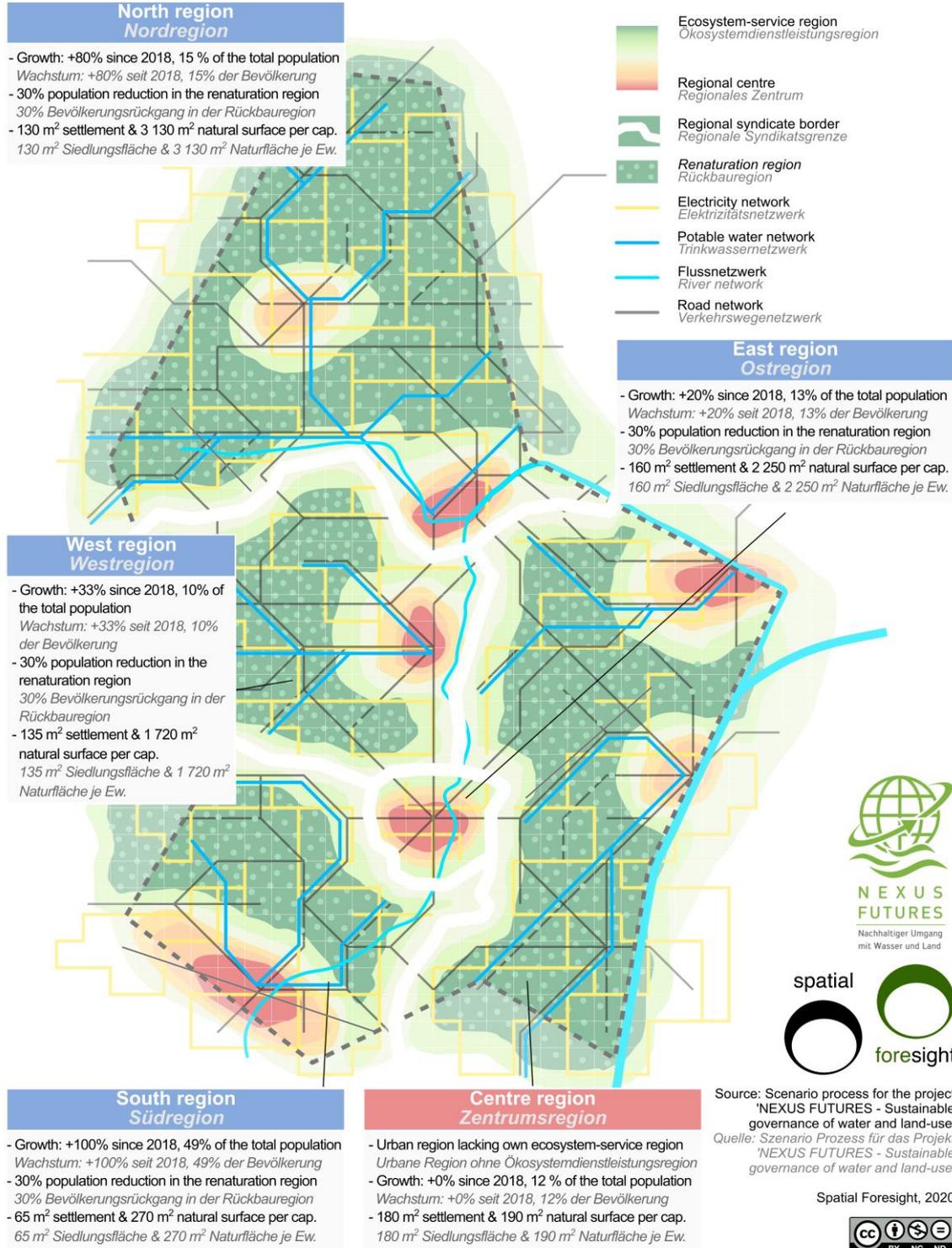
**Water the common good to govern.** Governance of the commons can touch upon different aspects, ranging from natural resources to digital commons (based on Dossier, 2016). In Luxembourg it took the form of governance of the common water resources. In the 2030's municipalities were merged into five regions, based mainly on the water catchment areas of the country: Oesling / Éislek (the North Region), Minett (the South Region), Guttland (the West Region), Moselle / Mullerthal (the East Region) and City (the Central Region), as shown in Map 1. This organisation is based on concentration settlements in each region, with the Minett region hosting the largest settlement corridor containing Differdange, Esch-sur-Alzette and Dudelange and being home to more than 40% of the inhabitants (see Map 1 and Facts and figures 5). The economy of each of the five regions is structured largely along a circular economy model, as also shown in Map 2. People have abandoned the linear economic model and shifted towards the circular one, supporting the reuse, recycle and repair of products. This has developed further the cooperative structures and regional manufacturing. Cooperation not only amongst the regions in Luxembourg but also across borders with areas in the Greater Region further supports this model, and thus sustainable practices in the wider territory.

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<sup>1</sup> Nobel Prize winner in economics (2009) for her analysis of economic governance, especially the commons (<https://www.nobelprize.org/prizes/economic-sciences/2009/ostrom/facts/>)

Map 1 Luxembourg territorial organisation 2045, scenario 'Governance of the commons for the common good'

## Common Good - Land-use Gemeinwohl - Landnutzung



Source: Spatial Foresight, 2019

Map 2 Luxembourg economy 2045, scenario 'Governance of the commons for the common good'

Common Good - Economy

Gemeinwohl - Wirtschaftsstruktur



Source: Spatial Foresight, 2019

Today in 2045, these five regions are responsible for the management of their regional water syndicates, water quality and supply, improving and maintaining the well-being, health and quality of life of Luxembourg's inhabitants. These developments have influenced every aspect of people's life ranging from taxation to society and politics, the economic situation, water governance, land use and others. The following sections describe how external events and changes have had a big influence on Luxembourg and the lives of its people. Subsequent specific sections will go into more detail.

## 1 Snapshot: How did it all start?

### **From global challenges to Luxembourg's governance of the commons for the common good.**

The impacts of global challenges on European peoples are visible to different extents in the various territories. Already in the 2010's different studies (among others, Böhme, Antikainen, Zillmer, Hans, & Pyykkonen, 2016; Toptsidou & Böhme, 2018; Toptsidou, Böhme, Hans, Corbineau, Lüer, Spule, Zillmer, Aguiar Borges, Wang, Norlén, Gustaf, Giacometti, Spiekermann, Schwarze, Komornicki, Rosik, Wiśniewski, & Cerić, 2019) made it clear that various trends, drivers and wild cards were not far from having an impact; they urged the need for action. These are reflected in the lengthy process of Luxembourg's regionalisation to establish the governance of the commons for the common good.

**Climate under pressure.** The effects of climate change have been remorseless over the last decades. Devastating extreme weather and related events including floods, droughts, tornados, torrential rains, forest fires and non-native insect invasions occurred across the world, leaving the human race mentally and physically shaken. The first warning signs could already be seen in the 2010's. In 2018 the Intergovernmental Panel on Climate Change highlighted the dramatic effects that a global warming of +1.5°C will have on our planet (based on Intergovernmental Panel on Climate Change, 2018). Meanwhile 'Fridays for future' school movements were initiated in Sweden and then spread across Europe and much of the world to sound the alarm and raise awareness about the consequences of climate change and the need to take urgent action (based on Fridays for Future Organisation, 2019). During the decade from 2020 governments began to take serious steps towards effectively addressing climate change and thus fulfilling their commitments under the Paris Climate Agreement, which had already been signed in 2015.

**Europe in a Green Deal.** The consequences of climate change have not left the European Union unaffected. Record high temperature peaks during summers, unusually warm winters and a three-year drought led to large-scale soil and forest degradation. The European Union had already proposed an objective to reach net-zero greenhouse gas emissions (based on European Commission, 2018), a strategy which was blocked in the 2010's. Implementation of the European Green Deal began under the new European Commission from 2019, when the first steps were taken (based on von der Leyen, n.d.). The goal of carbon neutrality by 2050 remains, while the circular economy and the European Climate Pact were slowly implemented.

**Populism on the rise.** Political and social changes have also characterised the last decades. The rise of populist governments opposing the power of intergovernmental organisations, globalisation and global migration, along with re-settlement of migrants, increased fragmentation and tensions across the world. This resurgence of nationalism starting from the mid-2010's resulted in protectionist trade policies and escalating trade wars, putting global economies at risk.

**Europe reaching the edge.** Social and political unrest also emerged across the European Union, increasing instability, fragmentation and disintegration and putting core European values at stake (based on Ulled, Noguera, Biosca, Kruijlx, Böhme, Toptsidou, Lüer, Zuleeg, Hunter, Huguenot-Noël, Capello, Camagini, & Caragliu, 2019). The migration crisis of the 2010's fuelled the rise of populist movements, reflected in the support of the electorate across Europe during the 2010's for far-right movements and politicians (based on BBC news 2019). BREXIT destabilised the EU and increased people's political

and civil dissatisfaction. This was confirmed in a number of national election results which changed the European political scene and increased discontent across those European regions that felt ‘we don’t matter’, as a feeling of neglect spread across them (based on Rodríguez-Pose 2018). At the same time, growing people-powered independence movements in regions such as Scotland and Catalonia have demanded more regional power and self-determination, reflecting a loss of trust in national governments and the European Union.

**Time for a new push for European democracy** (based on European Commission, 2020). All these incidents showed that European Union citizens feel detached from the decision making bodies, be that in their own countries or at EU level. Hence a stronger citizen engagement, through the support of citizen initiatives, will shift the importance of decision making to people, bringing issues that matter closer to the citizens. To operationalise this, each country in the EU dealt with addressing discontent in a different way, operationalising the objectives of the new European Commission of the early 2020s. Luxembourg followed a different approach and managed to address it through the governance of the commons for the common good.

**Time to rewind and take some action.** Given all these developments and reflecting a will to prevent further global disorders, an international movement of nation states started, claiming that the only way forward for stability and economic prosperity across the world would be to transfer more power to federal states and particularly to the regions. These tendencies also emerged in the European Union context where action had to be taken to avoid further crises. The Treaty of Valetta<sup>2</sup> in 2030 revived the long-neglected concept of subsidiarity (based on European Union 2007). The Treaty made it clear that from 2030 on, subsidiarity meant that more power (see Facts and figures 2) would be given to the European Union regions. The EU would only take action if the regions could not deal with different issues effectively and action at EU level was thus deemed necessary and of added value. The Treaty of Valetta in 2030 made this ‘active’ subsidiarity equivalent to the status of the European Council, giving the regions equal standing to that of the member states. This accelerated the process of regionalisation in Europe during the 2030’s – bringing power closer to the citizens.

**Taking one step at a time.** The shift of responsibilities to European regions impacted first and foremost the environmental regulations. This was because global and European developments at the time highlighted the need for more action. With the shift of powers to the regions, such issues took a new form. The new so-called ‘Nexus Directives’, for instance, merging 2010’s Water Framework Directive (based on European Parliament & Council of the European Union, 2000) (see also Facts and figures 9) and the Energy Efficiency Directive (based on European Parliament & European Council, 2012), comprising water, soil, land use and energy, are examples of this change. These directives mean that water quality monitoring and the setting of standards for micro-pollutants rely solely on regions’ priorities and actions.

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<sup>2</sup> The name of the Treaty derives from the EU member state that holds the presidency of the European Council the respective year.

## Facts and figures 2 The role of the subsidiarity principle

The subsidiarity principle, a fundamental principle of the EU since the 1992 Maastricht Treaty, has gained importance and relevance. It provided the underlying rationale of redistributing more decision-making power to regions and local authorities, in order to bring the union closer to the people. The subsidiarity principle ...

*[...] guarantees a degree of independence for a lower authority in relation to a higher body or for a local authority in relation to central government. It therefore involves the sharing of powers between several levels of authority, a principle which forms the institutional basis for federal states. (European Parliament, 2019)*

The recommendations in the White Paper on the Future of Europe (European Commission, 2017) stress that the 'Task force on Subsidiarity', established in 2017, should set the tone and course for the trickling down effect of power after 2020. These recommendations were further developed and adopted as strategy for the European Committee of the Regions for the 2019-2024 period, recognising the importance of engaging regional and local authorities to increase cohesion in the EU. The strategy established three fundamental principles for subsidiarity in the EU, giving a new understanding to the subsidiarity principle:

**Principle 1:** 'Active subsidiarity': involving cities and regions in the EU decision-making process.

**Principle 2:** Multi-level governance: bringing all levels of work together for the EU's future.

**Principle 3:** Permanent dialogue: shaping the EU's future together with our citizens (European Committee of the Regions, 2019).

**In 2045, every local or regional independent authority is represented at EU level, with at least one representative. Taking the principles seriously, power was shifted significantly between the EU democratic functions. National governments and the European Council lost influence whilst the role of the European Parliament and the European Committee of the Regions increased.**

## Time witness | New representative to the European Committee of the Regions



308rd plenary session, 11-12 June 2045

ECON-VI/0989 / COMMUNICATION

on the new representative to the EUCoR from the Éislek region (LU)

THE EUROPEAN COMMITTEE OF THE REGIONS WELCOMES

**Francine Schwartz**, the new representative from the autonomous Éislek region in Luxembourg to the European Committee of the Regions, was sworn in this Monday during the opening ceremony of the second trimester of the EUCoR 2045 legislative advisory year.

Francine Schwartz, born in Clervaux, Luxembourg, is an elected official of the Éislek national council. An experienced lawyer in sustainable law, elected representative to the regional parliament, worked as chairwomen of the legislative advisory group on water as public commodity. She is an entrusted advisor of the president of the Éislek autonomous region Paul Majerus.

During her political career, she underlined the importance of transferring more decision-making power to local and regional authorities in the struggle for more place-based policy making and a more efficient and smarter use of resources for the benefit of the citizens of Éislek. At the EUCoR, Schwartz will be leading the working group on the regional water framework directives, doing her best in representing the interests of Éislek at EU level. She stated that despite decision-making power at local level, water framework directives must be coordinated between regions.

During the past, Schwartz has gained experience in supra-regional legislative processes, when the autonomous Éislek region and the independent Bitburg-Slate Region in Germany have decided to develop a joint water framework directive.

**Bio-regionalism for citizens' well-being.** Bio-regionalism was introduced in the 2030's as a response to regions' being heavily occupied with securing and protecting their natural resources for their ecosystem services to ensure the survival and the well-being of their people. This resulted in tougher controls and difficulties with neighbouring regions often competing for better and higher standards, given that the wealth and the future physical and mental quality of life of their citizens depended on the protection of their ecosystem services. In order better to manage these, the re-alignment of regional borders within countries was agreed, based on the physical features of the landscape, such as river basins and forest areas, which now shape the regional management in 2045. A characteristic example of such a re-alignment can be seen in Luxembourg. It was the first country that not only managed to implement new regional borders based on such ecological features of its landscapes, but also developed a strong regional governance, a governance of the commons, to manage its common goods for the greater well-being of its people.

**Post environmental shock recovery.** The consequences of climate change did not leave Luxembourg unaffected; it left its scars. The very high summer temperatures and reduced rainfall significantly affected the soil and caused forest fires, while at the end of the 2020's one third of Luxembourg's forests were in a critical condition. These events created major challenges for both soil loss and drinking water availability and quality, and hence for food production. As a result, water shortages and emergency actions to ensure its availability, and thus demand for imported water, food and energy, rose sharply. Communities then realised that a focus on local production, food, water supply and energy would be essential for maintaining the quality of life of Luxembourg's residents. Local food systems - where foods are produced, processed and sold in a defined geographical area and considered as bringing social, environmental and economic benefits (based on Kneafsey, Venn, Schmutz, Balázs, Trenchard, Eyden-Wood, Bos, Sutton, & Blackett, 2013) - have now been further evolved and developed. Particularly since the government introduced an agricultural policy in 2026 incentivizing food production for local consumption, more and more local cooperatives for energy, food and water production were established in the country. This was just the beginning.

**Luxembourg's people determine their own future.** At the same time, Luxembourg citizens followed closely the developments at the European level, asking for greater subsidiarity and regionalisation. In Luxembourg, local communes and municipalities were also feeling significantly disconnected from the centralised decision making process. This sense of disempowerment and loss of self-determination reached a peak of feelings of frustration in the 2020's. At the same time, the national government and citizens were seriously concerned by the extreme weather events and their physical and mental impacts on their daily lives and well-being. Long and heated debates started in the late 2020's with the national government decentralising some of its authority to empower communities and citizens through a regional form of governance. Such a change would not have been possible if it weren't for the extension of the voting rights to all residents of Luxembourg, i.e. including its foreign population during 2020s (see also Facts and figures 2). Municipalities and people took the situation into their own hands, agreeing to merge into five regional governments. This form of governance of the commons was the only way to ensure that each region could take care of its resources for the benefit of both the region and the country.

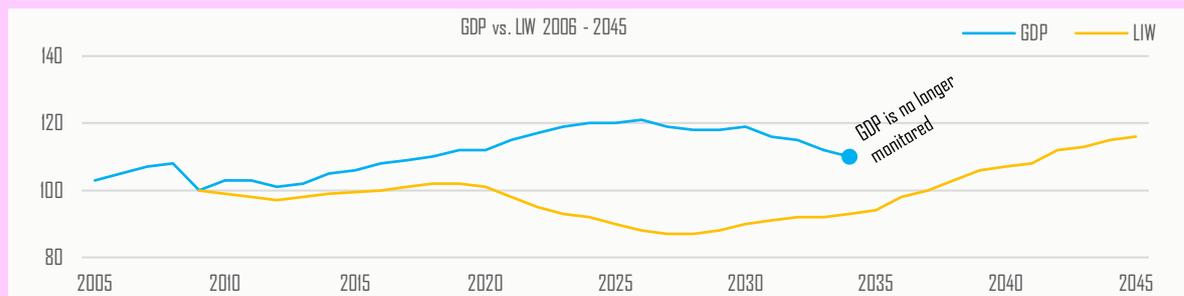
### Facts and figures 3 Measuring economic success – The Luxembourg Index of Well-Being

In the aftermath of the 2008 financial crisis, economic productivity quickly attained pre-crisis levels in Luxembourg. Despite economic success, in 2016, a study observed that the OECD Well-Being Index took much longer to get back to its initial 2009 level in Luxembourg (Le Gouvernement du Grand-Duché de Luxembourg, 2017). To reflect the quality of life of the people of Luxembourg and not merely take the economic development as proxy for well-being, the **Luxembourg Index of Well-Being** was created.

**Definition:** The Luxembourg Index of Well-Being monitors the quality of life of the people of Luxembourg from 2009, analysing the distribution of a set of indicators, covering eleven areas of life of the population. It is a synthetic index, summarising the many indicators of the discussions around the 'PIBien-être' (Fumarco, Peroni, & Sarracino, 2018).

**Composition:** The Luxembourg Index of Well-Being is based on several indicators, ranging from income and wealth distribution (e.g. total household wealth), to occupation (e.g. temporary job rate), to health situation (e.g. life expectancy) over to work-life balance (e.g. time spent commuting), social relationships (e.g. time spent volunteering) and more (Fumarco et al., 2018). Its composition has been adapted several times since its introduction, catering for shifting societal objectives and definitions of well-being and advancements therein.

**Development:** After 2009, the Luxembourg Index of Well-Being decreased slightly, reflecting the worsening economic situation of many residents of Luxembourg. With GDP subsequently growing back to pre-2009 levels, the Index also attained and surpassed the pre-crisis values, showing a higher quality of life in the country during the late 2010's. After 2020, the worsening environmental situation in Luxembourg and the resulting consequences for its inhabitants – rising unemployment in farming and production because of droughts and water shortages or lowering life expectancy due to extreme weather events for example – led to a downward trend in the Luxembourg Index of Well-Being. Due to these developments, the idea of the Universal Basic Income was widely discussed as a possible solution to improve people's lives, without providing, however, a solid proposal. Nevertheless, measures introduced in the late 2020's and early 2030's took effect and improved people's subjective and objective well-being incrementally until the LIW reached today's values. GDP failed to reflect the worsening situation of the well-being after 2020 and monitoring was subsequently halted in 2034. As the GDP was no longer monitored, it was questionable on how the Universal Basic Income could be funded and hence this idea remained still in 2045 under discussion.



### Time witness II A pensioner's perspective on the LIW

#### A pensioner's perspective on the LIW

RE LIW has again increased

Dear Mr Schaus,

I read with great pleasure your article from last Monday about the renewed increase of the Luxembourg Index of Well-Being in the Guttland autonomous province. I had a discussion with my wife and our housemates in our multi-generational house and we all came to the conclusion that the development you described is not worth a straw!

I followed the articles about the past increases and expansions of the LIW and I have to admit that the indicator does not reflect sufficiently enough elements that I personally consider as well-being. I value being surrounded with people who are close to me. I value having a relevant role in society to give something back as an elderly person and I value that I don't need to care about what shall I do and what happens tomorrow. I also value that I can do whatever I wish whenever pleases

me. For me, this is quality of life. How will these things eventually be covered by the numerical indicators of the LIW?

I remember during the 2020's we made the same mistake: well-being was equated with GDP growth, an indicator displaying the increase of productivity. Keeping people employed (and exploited), competitiveness and growth were the mantra for politics, with tremendous negative impact on the cohesion and solidarity of our society and an even worse impact on the environment.

We must not make the same mistake again! Therefore, I am calling for an update of the LIW to reflect what well-being really means in our everyday lives!

**Antonio Nunes Polver, Bous**

## 2 What does Luxembourg look like in 2045?

The governance of the commons for the common good has influenced to a different extent various aspects of people's lives in Luxembourg, and how they feel about them. These aspects include society and politics, land-use change, economy and economic activities, taxation, the biosphere, the governance structure, as well as digitalisation, legal basis and education.

### 2.1 Population

**How many are there of us?** The population in Luxembourg has increased significantly from 2020 to 2045, mainly due to immigration over these years. Cross-border commuters and immigration to Luxembourg reached a peak and started decreasing due to the change in the country's economic model. Despite the immigration figures, the population in the five regions continues ageing in 2045 with elderly people remaining in the workforce for as long as possible (see Facts and figures 3).

### 2.2 Society and politics

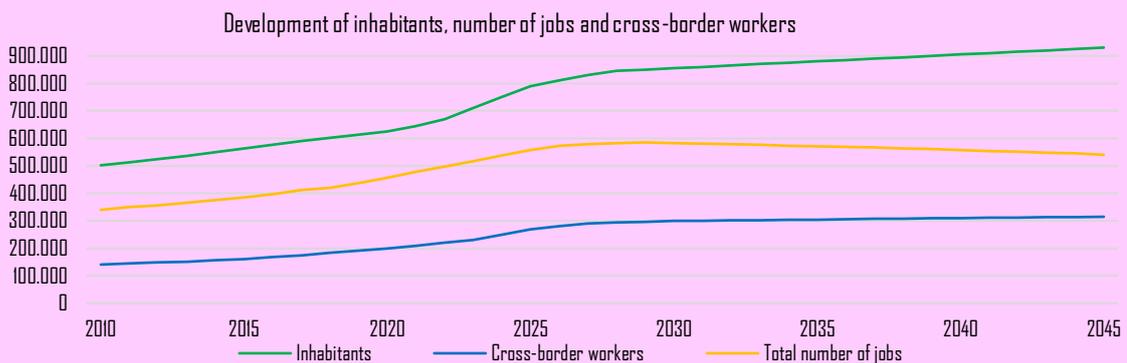
**It has been a long way to regional governance.** Achieving a governance of the commons for the common good has not been an easy task. Instead, Luxembourg's regionalisation process has been a result of a variety of forces from different directions coming together at the right time. Environmental degradation was the underlying motivation for this regionalisation process. Already before 2020 Luxembourg was taking some actions towards climate change mitigation by investing in the circular economy, environmentally friendly mobility, sustainability and corporate social responsibility (based on Inspiring More Sustainability n.d.). , These actions were not however deemed sufficient in the 2020's and more action at all levels had to be taken. Meanwhile, more and more people felt detached from central decision-making, especially with respect to the management of natural resources and particularly water. People were feeling disconnected from decisions that had a great impact on their regions' water supplies. This reached a peak when government supported the establishment of data centres or factories requiring large amounts of water, without initiating a dialogue with, or obtaining consent from, local people. In combination with the impacts of climate change, such decisions could put citizens' well-being at risk. As a result, in the end people demanded more power to the regions and asked to take over the water management.

### Facts and figures 3 Luxembourg's demographics

Luxembourg's population has increased by 47% since the 2020's to 930,000 in 2045 (based on STATEC 2017). In 2018, the population of Luxembourg was 602,000. The period after 2020 was marked by a critical increase in immigration due to accelerating economic development. In the 2020's, economic success was the main motivation for people to come to Luxembourg.

Despite a high quality of life within the several autonomous regions, immigration decelerated after the 2020's because of lower economic development, resulting in weaker pull factors after 2030. Immigration consolidated at around 5,000 new inhabitants each year. The slower economic development has also impacted the cross-border workers. After the 2020's, the growth in the number of cross-border workers stalled and it evened out at around 300,000 in 2045.

The people of Luxembourg are getting older. Despite positive net inward migration of young people from generation Alpha and Beta (see Facts and figures 4), older people slowly start to outweigh the younger generation (STATEC, 2017). The pensionable age was incrementally increased, until pensions were abolished completely. Older people work in cooperative structures where they feel able to contribute to the well-being of the population: childcare, food production, cultural activities and environmental management are dominated by an elderly workforce.



Based on (STATEC, 2017)

### Time witness III Feuilleton: The Luxembourgier? A chimera, hoped for but illusory?

Apparently, Sean Joos from the Luxembourg Optional Democratic Reform Party (DDR), a right-wing party, has serious memory loss. In a recent speech, he said that he wants to halt immigration. Many immigrants are young and footloose, which is for him an indication that they do not fit in with the Luxembourgish population, which is significantly older and strongly rooted in traditional national values.

He might be surprised to discover how Luxembourg ended up with a population of 933,419 in 2045. As reported by the regional statistical institutes, Éislekstat, Statguttland Stadstat, Mosellestat and Minettstat, most of Luxembourg's inhabitants migrated to the country since 2000. The low average fertility rate in Luxembourg of 1.15 children per woman since 2020 could not have yielded such impressive growth.

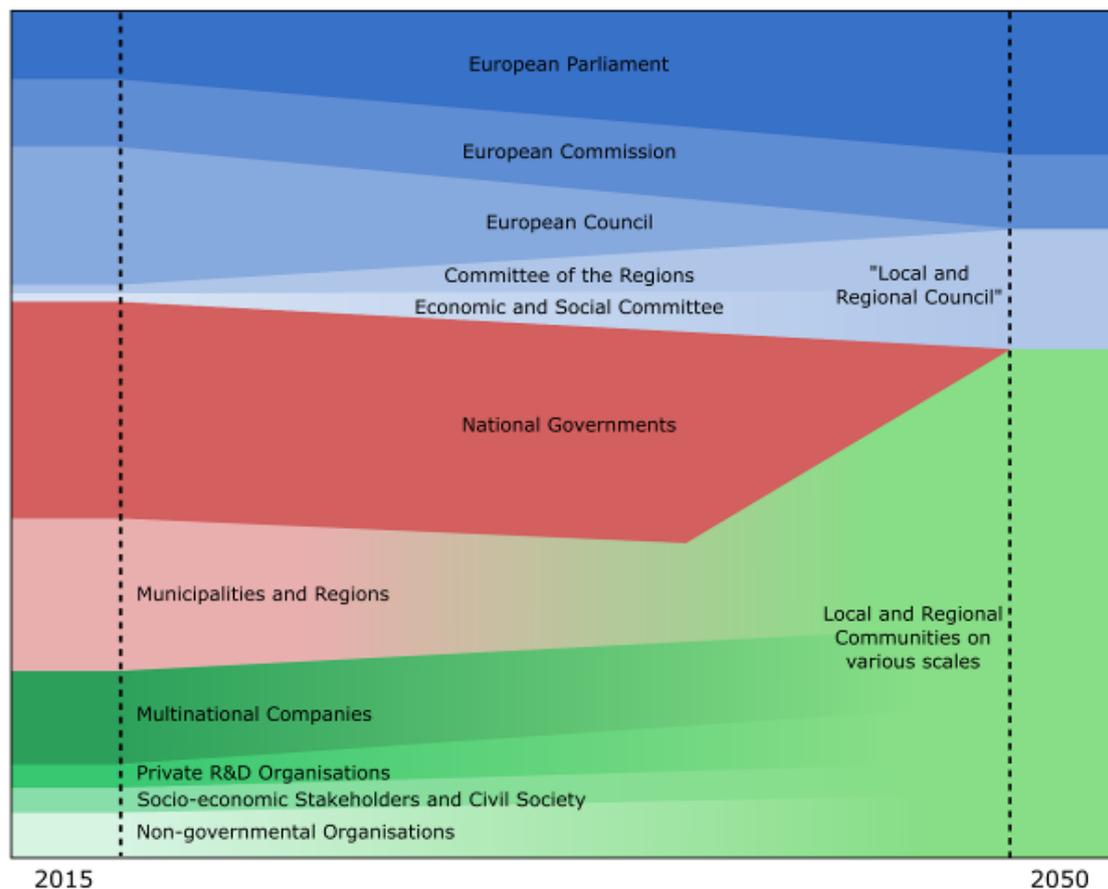
When in 2018, the threshold of 600,000 inhabitants was exceeded, debates about the capacity of the country arose. Given the small size and the over-stretched traffic and housing infrastructure, such comments were understandable. Back then, questions were raised about the 1 million inhabitant mark, portraying the future in horror scenarios. Since then, we have grown by another 46 % and most people see that the country is capable of hosting such a population. Despite a high LIW indicator of 115.8 in Luxembourg, we need every immigrant we can attract in the competition in Europe for young people, given our ageing population!

Luxembourg has always had immigration and always will have. The truly Luxembourg values Joos stresses are the values of more than 180 nations across the world that made this country great. Immigrants, expats and cross-border workers, or whatever you like to call them, have contributed to social, cultural and economic development, rendering Luxembourg one of the most exemplary 'Völkermühle', 'melting pot' of the 21st century!

Mark-Clément Henges

**‘Places left behind’ forcing change.** The general disappointment of different regions in the EU, often referred to as ‘places that don’t matter’ or ‘places left behind’ sparked a long debate in the 2010’s and 2020’s (based on Rodríguez-Pose 2018) and reflected people’s dissatisfaction with EU policies. This was also clear in various election results at the time and the rise of populism. The shortcomings in the governance systems were now visible and discussions about more power to citizens and regions were emerging with the power of national governments reducing over time, a trend that was also already observable in the 2010’s (based on Böhme & Lüer, 2016). However, the situation in Luxembourg has not developed as dramatically as in the figure below, as the national government of Luxembourg remains in charge of some nationwide policy domains.

**Figure 1 Shifts in power for selected players (Metamorphosis Vision)**



Source: (Lüer, Böhme, Jæger, Hans, Madeira, Holstein, Toptsidou, Tulumello, Bina, & Ferrão, 2015)

These developments led to another influence tending towards stronger regional governance. People across Europe demanded more power to the regions, reviving the concept of subsidiarity and thus enabling them to become masters of their own territory. Luxembourg was not unaffected by these changes. To avoid any risk of discontent and turbulence in the country and with a view to respecting the subsidiarity principle, Luxembourg’s government went through a *devolution* and granted its regions the power to manage their own natural resources. In 2045 the boundaries of Luxembourg’s self-governing regions are based on the country’s most important common good, water. The regional governance structure reflects the principle of governance of the commons.

**Governance of the commons made in Luxembourg.** Luxembourg was the first country formally to adopt a governance of the commons. As advocated by Nobel Prize winner Elinor Ostrom, the governance of the commons is an innovative governance arrangement, in which collective action comes bottom-up and the people build shared cooperative mechanisms and institutions through various networks of different actors (based on GovInn, 2014). Managing the common resources top-down or through privatisation is no longer sustainable and instead a common governance of the commons can create resilient and long-lasting governance results (based on GovInn, 2014).

**Serving a higher purpose.** The empowerment of regional government has been a priority in Luxembourg over recent years. Already since the end of the 2010's, studies had shown that the administrative capacity of public institutions is crucial in order to achieve highly effective government, low corruption and high quality of public services at the regional level (based on Widuto 2018). This can lead to better outcomes for the people in terms of economic performance, social inclusion, environmental sustainability, education, health and overall well-being within the regions. The environmental and other changes implemented over recent years show that Luxembourg has taken these ideas a step further. Governing and managing natural resources in a more sustainable and just way is the overarching societal and political aim for 2050. Governance of the commons for the common good has thus been the key to maintaining well-being, good quality of life and resilience. This higher purpose, of acknowledging the importance of a shared management of natural resources, has overcome any difference and rivalry among the different parts of the country, which agreed to be organised into five regions.

**Employment's "new wave".** This shared governance and the shared management of natural resources have brought fundamental changes to people's concept of employment and to employment itself. Public-private partnership projects have been set up, the so-called Social Impact Bonds (explained further in Facts and figures 8). With many civil society organisations and social enterprises embedded in every part of social life, from caring for children and the elderly to environmental protection, arts and health, Social Impact Bonds support more effective integration. The work for the common good in these Social Impact Bonds projects engages a large part of the workforce. Importantly, employment is no longer measured simply as a number of jobs, but rather as a cumulative number of hours of engagement.



of technology, combine working remotely with normal life (based on Chayka 2018). Freelancing and self-employment have become relatively mainstream, while working from home, with the support of increasing automation, has shifted the familiar notions of traditional jobs from the 2020's and 2030's (based on European Commission n.d.). Digital nomads belong to networked teams and earn income from a variety of resources. Co-working spaces have increased, bringing together different professionals, digital nomads, freelancers and innovation entrepreneurs. There is now global competition to attract more of the highly mobile generation Alpha to settle. In this context Luxembourg developed national and regional incentive programmes to offer digital nomads a feel-good environment for social connection, comfortable and affordable co-housing and co-working spaces, as well as annual bonus payment for extended stays. Since the introduction of this scheme in 2033, it has attracted many digital nomads to Luxembourg, particularly to the Minett and City regions.

**Next generation policy makers of all three genders.** All this would not have been possible without a 'new age' of politicians and policy makers with a different mind-set and values, who are more committed to bringing change to the system (see Facts and figures 4) and which represent all genders. While the old inequalities between women and men have been overcome on the 2030s, the "new", third gender "diverse" is on a good way to equal treatment in policy making and beyond. Millennials are now the majority of the decision makers in regional and national politics in Luxembourg, as well as in the private sector, and shape political priorities, seeking to make a positive impact on the world, while the new Alpha and Beta generations share similar principles. This derives particularly from Millennials' personal experiences, dating back to the 2010's, when it was hard for many of them to enter the workforce. Millennials in 2050 continue to show little enthusiasm for ownership and possession and are more driven by concepts related to the sharing economy (based on Goldman Sachs n.d.). They feel positive about concepts like social well-being, management of goods, industrial ecology, blue biotechnologies, circular and sharing economies and do not see well-being as primarily a consequence of wealth and GDP (see also Facts and figures 3).

**Surpassing competition, building strong community bonds.** Strong inter-personal community bonds constitute another characteristic of the current age. Regionalisation and the associated changing dynamics in society and politics initially played out as rivalry and competition. Gradually the Luxembourg regions matured into a form of collaborative competition. At the smaller scale, local and regional circular well-being economies have come into being to various degrees. At the same time, the various regions have different strengths and levels of access to ecosystem services. This remains a cause of competition and of a degree of power struggle amongst the wealthy and/or powerful regions and between them and the national government, all of which are involved in a competition to attract the younger generations.

## Facts and figures 5 The territorial organisation of Luxembourg in 2045

After 2020, Luxembourg's territorial organisation gradually fragmented into five autonomous regions: Minett, Guttland, Éislek, Moselle and Luxembourg City (see Map 1), with widely varying human populations and environmental assets:

Region	Regional centres	Population in 2045	Share of total population	Settlement area per capita	Natural capital surface per capita
<b>Minett region</b>	Sudstad (Differdange, Esch-sur-Alzette, Dudelange)	450,000	49 %	65 m <sup>2</sup>	273 m <sup>2</sup>
<b>Guttland region</b>	Mersch	100,000	10 %	135 m <sup>2</sup>	1,720 m <sup>2</sup>
<b>Éislek region</b>	Nordstad and Wiltz	140,000	15 %	126m <sup>2</sup>	3,130 m <sup>2</sup>
<b>Moselle region</b>	Echternach and Grevenmacher	120,000	13 %	155 m <sup>2</sup>	2,250 m <sup>2</sup>
<b>Luxembourg City</b>	City region	120,000	13 %	175 m <sup>2</sup>	190 m <sup>2</sup>
<b>Luxembourg country</b>		<b>930,000</b>		<b>107 m<sup>2</sup></b>	<b>1,103 m<sup>2</sup></b>

Infrastructure and services such as transport arteries, electricity supply, meshed internet network, drinking water supply and wastewater treatment are organised on a regional basis around the regional centres, with less emphasis on interconnection between the individual regions.

### Time witness V Newspaper article Treaty of Kleinbettingen: Affiliation of the communality of Stengefort

Today, the Treaty of Kleinbettingen was adopted by the regional parliaments of Guttland and Minett, leading to the inclusion of the communality of Stengefort into the region of Guttland. This became necessary as the artificially drawn border between Guttland and Minett of the Treaty of Mersch in 2026 did not take account of the borders of the natural eco-systems: even though its water catchment lies within the Guttland region, Stengefort was affiliated to Minett region.

This 2026 affiliation was the result of a political tug-of-war between, on the one hand, the College of Aldermen, which preferred an affiliation to the wealthier Minett region and promising subsidies and investment, and on the other hand the citizens' initiatives calling for affiliation to the poorer Guttland region, which, they argued, offered higher environmental quality. The College of Aldermen went ahead with the choice of affiliation to Minett, which was then punished by local voters in the communal elections. However it proved impossible to revoke the existing decision; Stengefort remained affiliated to Minett. This has led to numerous governance problems: legislative and organisational issues, as well as questions of water purity, water commodity and pollutants, had to be dealt with at the inter-regional level, between the Minett and Guttland regions. On occasions the national government was required to intervene in these disputes between the two autonomous regions.

The conflict came to a head in 2040, when a whistleblower made it known that the Minett region had been illegally channelling off considerable volumes of source water from the Guttland region via Stengefort. This led to a break in diplomatic relations and cooperation between the two autonomous regions. The national government had no choice but to intervene, and managed to carry out a successful effort of mediation in the dispute. Following expert environmental studies, a referendum held among the remaining 100 citizens of Stengefort led to the formalisation of a decision to transfer Stengefort into the Guttland autonomous region, together with the requisite re-drawing of the regional boundary. This change was formalised under the Treaty of Kleinbettingen.

This transition is however not yet complete. It still remains for the municipality of Stengefort to be physically connected to the Guttland regional infrastructure; its networks for the supply of water and ecosystem services must be connected to those of the Guttland and upgraded to Guttland standards. It should be noted that citizens are now being offered bonuses to move to Mersch under the current Guttland resettlement programme.

*Manou Schmitt* for Guttland Daily News, 10.09.2045

## 2.3 Land-use change

**Changing land-use in post-regionalisation Luxembourg.** Between 2030 and 2037 the regionalisation effort transformed the 102 local municipalities that made up Luxembourg in 2020 into the five regions that we know today - Éislek, Moselle/Mullerthal, Minett, Gutland and the City (see Facts and figures 5). Now, in 2045, each of these regions has one or two main settlement centres, with the largest population centres being in the Minett around the settlement development corridors of Differdange, Esch-sur-Alzette and Dudelange, home to 49% of the population. The Éislek and Moselle/Mullerthal regions have two settlement centres each, in the north around 'Nordstadt' and Wiltz and in the east around Echternach and Grevenmacher. The settlement centre of Gutland is around Mersch, while Luxembourg City is its own region, consisting mostly of urban settlement with very little undeveloped land. All infrastructure and services – transport arteries, electricity supply, meshed internet network, drinking water supply and waste water treatment - function on a regional basis around the regional urban centres.

**Co-housing to fit all.** The new regional centres have attracted immigrants, who received incentives to move to the expanded regional centres in the period between 2030-2045. In parallel the older people of Luxembourg moved from the rural areas to the regional centres for easier access to medical services and support. As a result there has been no net-land take for the past 15 years. With all this influx of people to the regional centres, demand for co-housing and co-living has expanded substantially. This has become a significant housing trend; in 2045 co-housing and co-working spaces are the norm. Older buildings are renovated and new buildings are specifically designed and fitted out to accommodate inter and intra generational co-housing needs. People live together, share common facilities and not only save money and resources, but also benefit from developing new social contacts and relationships (based on Stevens-Wood 2018).

**Rural areas gain importance.** Ecosystem services are now fully integrated into the national accounts of societal prosperity, which jointly monitor both natural and social capital. These resources are therefore highly valued as being key indicators of Luxembourg's overall well-being. Rural areas are thus of great importance because of their capacity to provide ecosystem services such as drinking water, renewable energy, biodiversity and food supply, as well as offering people opportunities for enjoyable activities like recreation and tourism. Natural resources management has in some cases sparked intense competition between the different regional centres, especially for water, with Luxembourg City being among the least well-served regions by this criterion.

## 2.4 Economy

**Making the world a better place.** The economic model in Luxembourg has changed. Successive generations, from the older Millennials to the new Alpha and Beta generations, have focused on improving human well-being by improving ecosystems, the biosphere and resilience - making the world feel like a better place to live by creating the societal conditions for human well-being. It was these generations who pushed the government towards adopting a broad new policy approach in 2033, based on the circular economy and human well-being. The people developed a new mindset and influenced the government for a holistic shift towards the circular economy, thus abandoning the linear economic norms and expectations of the pre-2030 era.

## Facts and figures 6 Monetary situation in Luxembourg and economic values

Figure 2 Beki regional



Source: (Beki de Kär 2019)

In line with the different regional economic profiles, each of the five regions in Luxembourg has now created its own local currency. The “Beki” in the municipality of Redange was the pioneer when it was introduced in 2012 (Beki de Kär, 2019). The Beki is a regional currency, which was created to support the regional economy. It is linked to the Euro with an exchange deficit of 5 %, i.e. when exchanged to Euros, 5 % of the value are skimmed off for investments into the region. This incentive encourages economic actors, like companies and customers, to buy other products and services with their Beki before exchanging them for Euro, thereby closing the regional currency circle (Beki de Kär, 2019).

With the rise of Blockchain technologies, regional currencies were progressively adapted and transformed into regional cryptocurrencies. One prominent early example was the “emCash” in Dubai, which boosted local economies using Blockchain technology (Coin Telegraph, 2019).

## Time witness VI New economic values and principles

Extract from the Official Journal of the Grand Duchy of Luxembourg – Publication of the “Code économique” of 20 October 2028, modifying the law of 13 January 2023 on the 15 universal economic principles, signed by Guillaume, Grand Duke of Luxembourg.

Today, among Luxembourg political and business decision-makers, the following values and principles form the predominant narrative of the economy:

1. The economy exists to serve the collective well-being of all of the people.
2. The priority of economic activity is to create the conditions for well-being, which measures prosperity by how contented, healthy in body and mind and resilient the people are.
3. The needs of society are met, to the extent possible, out of the resources available within the regions of Luxembourg; business models aim to maximize the use of locally/regionally available resources.
4. Economic and material innovations are inspired from nature and generate multiple benefits, including: meaningful engagement for the many; increasing social capital; supporting and restoring ecosystem services, and doing more with less.
5. As a broad principle, prevention is better than cure – this applies in the areas of health, ecosystems and cultural conservation, with the precautionary principle taking precedence.
6. Zero-waste and maximum biodegradability are primary goals of any product design. Waste, as a matter of principle, does not or should not exist – any by-product of production processes is to be understood as a resource for a new product.
7. Economic terminology is understood as follows: wealth = diversity; waste = resource; growth = improved societal and personal well-being, as measured by the LIW; the economy develops from scarcity principle to sufficiency to abundance; economies of scope replace economies of scale; productivity = the number of hours worked that contribute to the common good in cooperative initiatives.
8. Industrial standards are set at the regional level.
9. Diversity is recognised as a key factor of ecological, social, cultural and economic resilience and is essential for the long-term success of a circular well-being economy.
10. Public/private partnerships through Social Impact Bonds are the government’s main tool for providing meaningful work and resolving individual and collective well-being challenges.
11. Sources of energy include hydro- and solar power, and geothermal heat recovery.
12. Water, air, forests, soils and grasslands are managed as commons.
13. Infrastructure for water, energy, internet and transport is designed and managed to supply the needs of the regional economy and communities.
14. Some degree of protectionism may support the security and stability of supplies and services, with the ultimate aim of increasing resilience.
15. The concept of economies of scale is replaced by “economies of scope” by creating efficiencies from variety not volume.

**The new economic narrative.** In 2045, GDP indicators are considered to be outdated. They are no longer used for decision making in politics or business. Today, people perceive productivity, societal prosperity and wealth very differently. New well-being indicators, particularly the Luxembourg Index Well-being, have taken over and shape 2045 economic policy (for more details on the new indicators, see Facts and figures 3). The new economic narrative is perceived as a state of individual, societal and natural health that depends on the synergy of a variety of factors supporting and working in relation to each other. This changing understanding of prosperity that goes beyond GDP depicts a post-materialistic social model and behavioural and societal patterns tending towards a more sustainable, sharing and local economy (Böhme, Holstein, Wergles, Ulied, Biosca, Nogera, Guevara, Kruljac, Spiekermann, Klaus, Kluge, Lina, Sessa, Enei, & Faberi, 2017). The new economic narrative goes beyond material well-being to include a vibrant social fabric, quality of relationships and connections, offering individuals a good life in a broad sense. The natural environment, managed primarily as a web of common resources, is valued as essential for survival and well-being of the people.

**Be fair and share.** The take-make-waste economy which was prominent decades ago is now outdated, having lost credibility within and across society. Instead, new values and principles have been introduced that form and demonstrate this shifting economic narrative. The sharing economy has been widely spread and sharing takes different forms. People share their cars and apartments; they also share and exchange different skills (Toptsidou et al., 2019). Rather than product ownership, many products are available for lease in a product-service system, where equipment and products are rented to provide a service whilst ownership stays with the producer or service provider. The idea of leasing and sharing products has become economically profitable for businesses (based on World Economic Forum 2015). It also helps to lengthen the product life span and eliminate the practice of planned obsolescence from product design cycles. In 2045, the idea of sharing platforms (like “Ding Dong<sup>3</sup>” that already existed some 30 years ago), through which people could share, exchange and borrow tools and small equipment, has evolved and broadened greatly. Today, across Luxembourg’s regions, household equipment, tools, transport vehicles and agricultural equipment are shared and available for hire via mobile applications and sharing platforms.

**Local cryptocurrencies for national consumption.** Part of the new economic narrative is also the development of local cryptocurrencies (see Facts and figures 6). Cryptocurrencies are digital currencies based on the blockchain technology and are characterised by their secure transactions and decentralised controls. Luxembourg had already published a ‘Bitcoin Communiqué 2014’ and made efforts towards more security and regulation since the 2010’s (based on Silicon Luxembourg, 2018). In 2045, cryptocurrencies have long been mainstream and people are encouraged to use them for buying most of their personal and household items within the regions. Frontrunners in local currencies included the community of Redange, which introduced the Beki currency in 2012, followed later by the creation of the RC4G’s, the Regional-Crypto-for-Good cryptocurrencies for use in commerce and consumption in Luxembourg in parallel to the Euro. The Euro continues to be used e.g. for paying employees for international work, as well as for European and international trade, although the volumes of both imports and exports from Luxembourg have decreased since the 2020’s.

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<sup>3</sup> <https://dingdong.lu/>

## Facts and figures 7 Agriculture and the issue of nutrient pollution in Luxembourg

### The organisation of agriculture

Agricultural land in Luxembourg has remained relatively stable until 2045, taking up about half of the country's surface. It is mostly farmed by regional cooperatives under Sustainable Land Bonds (SLB's) (see Facts and figures 8). These cooperatives take the responsibility for managing and monitoring soil, plant and water quality, while using and regenerating the land for food production. The organisation of agricultural production through cooperatives makes it easier to withstand market power and pursue alternative production and employment policies (Tortia, Valentinov, & Iliopoulos, 2013). Agricultural cooperatives in Luxembourg exercise an important function as producers of high-quality foodstuffs within the five autonomous regions. They also function as social employers, providing many jobs for elderly people (Delgado, Dorion, Laliberté, International Labour Office, Bureau for Workers' Activities, International Labour Office, & Cooperatives Unit, 2014).

### The matter of nutrient pollution

The quality of ground- and surface waters in Luxembourg was in an alarming state in the 2010's. Nutrient pollution worsened the quality of drinking water, resulting in freshwater sources becoming unusable and increasing costs for water purification (Zwank, 2018). Plans for reducing nutrient pollution were drafted and thresholds for animal manure as fertiliser were agreed (MDDI, 2015) as well as implementing recapturing technologies, following the successful example of phosphorous recovery in wastewater facilities from the 2010's (Phos4You, 2016).

### Time witness VII Speech of Marie Schroeder during the opening ceremony of the new nitrogen recuperation stage in the wastewater treatment plant in Beggen, 12.01.2045

Ladies and gentlemen, I am happy to welcome you to the wastewater treatment plant in Beggen. Today, we will celebrate the inauguration of the newest facility for nitrogen fixation. With this facility, which is the last in the country of Luxembourg, we are able to recover 100 % of the nitrogen fixed in grey and wastewater. The technology, and I am particularly proud to say this, was developed here in Luxembourg with the support of our nitrogen fixation grant, that was called into life after the nitrogen crisis in the 2020's.

I am sure you all remember the nitrogen crisis, and the impact on us and our environment: we saw high pollution, not only in water but also in soil and air bodies, we saw large areas becoming unusable to humans, decreasing the potential for our regional agricultural production systems and increasing the costs of water excessively. The lake Upper Sûre became unusable for recreational purposes and as drinking water reservoir for years. This was the moment we knew state action was required in order to invest in researching new technologies, that would help us to combat the pollution.

Technologies funded under the grant had some teething problems providing innovations in nitrogen fixation and they remained underdeveloped or not market ready. But we never gave up because we knew that we were on the right track. At least, some innovations in smart farming and some first small-scale nitrogen fixation technologies showed some progress and pollution levels stagnated.

Then in 2038, we celebrated the breakthrough with the new technology, that you may all know, which is capable to recover 100 % of nitrogen from greywater and wastewater in an easy and fast manner. This unorthodox and cheap approach is easy to implement in existing wastewater treatment plants and also next to streams, recovering the nitrogen excess from source water.

This means that we have closed the nitrogen cycle in Luxembourg and costs for water cleaning and fertiliser will significantly decrease in future. The technology, developed by researchers from the Minett University, will eventually be exported to be used in other regions of Europe, e.g. the pork belt in Germany and the Netherlands. A mobile plant is also on at the lake Upper Sûre in order to react to small-scale local pollutions to avoid the decay of the entire drinking water reservoir as observed during the nitrogen crisis after 2020.

**Cooperatives and networks as a backbone.** Cooperatives and collaborative networks form the backbone of economic activity in Luxembourg in 2045 (based on Böhme, Hans, Lürer, & Faber, 2018). Cooperatives have played a key role, especially in dealing with climate change adaptation and mitigation. Collective actions are required in order to respond effectively to different challenges posed on different territories, as multi-faceted topics such as climate change require coordinated action by people and coherent organisation (based on Committee for the Promotion and advancement of cooperatives 2019). Cooperatives can also strengthen resilience and the capacity of local communities to adapt to natural disasters (based on Committee for the Promotion and advancement of cooperatives 2019). Cooperatives allow many sectors within the regions to come together and share resources (see also Facts and figures 7). Many of the cooperatives and social impact bond service providers rely on collective responsibility for following the rules, communicating about the state of the commons resources and keeping good relationships in maintaining the commons in the interest of the regional economies and local people. They share the risk; the practices that are promoted build collective responsibility and trust within organisations, projects and cooperatives. Furthermore, they have developed extensive conflict resolution and mediation processes often facilitated by citizens' juries initiated by the regional governments. Each region in Luxembourg relies today on its own energy cooperatives, using co-located power plants, transport cooperatives, food cooperatives and combined drinking water and water treatment syndicates for essential supplies and the functioning of the regional economies.

**From farm to table.** Cooperatives play a major role in regional food production and processing, as most of the agricultural land is today owned by cooperatives of farmers, which produce most of all the food consumed in Luxembourg. Movements like slow food increased in importance in Luxembourg and shape large parts of its agricultural production, organised through the cooperatives. The slow food trend already started in the 2010's, to support local production and consumption that respect nature and offer health benefits (based on Slow Food Luxembourg, n.d.). Hence a farm-to-table form of consumption has, by 2045, become more popular.

**Well-being at your service.** Health and well-being services make up a large part of the regional economies. They include not only doctors and natural health practitioners, but also a wider variety of alternative medicine and practices that promote prevention of physical and mental illness. Well-being is today a wider concept than simply being in good health. It seeks to promote: a good standard of living; meaningful occupation; comfortable housing; good balance between working and social life; life-long access to learning opportunities; education and skills development; positive social relationships and opportunities for collective social learning; well-functioning participatory multi-level governance processes; a healthy and flourishing environment, and feeling good - the individual experience of life satisfaction and meaning in life (based on OECD, 2017). Many services, initiatives and programmes are available to support individuals and communities in achieving mental and physical health benefits in all of these areas.

**Regional health hotspots.** Health care and related services of general interest are now more decentralised, following the successful example of the Südspidol in Esch/Alzette from the 2020s. This highlights the importance of having the services closer to the citizens, keeping at the same time the overall organisation of the healthcare system is at the central national level. Specialist doctors and special medical devices are mainly in the capital, while other general doctors and other specialist doctors

are located also in the four regional municipalities, reducing the distance of citizens to the regional healthcare services.

**Social Impact Bonds, Resilience Bonds and Sustainable Land Bonds shaping the stock exchange.** Although the financial sector and the stock market continue to be important in Luxembourg, they have adjusted to the new economic reality and Luxembourg's worldwide reputation as a leading green bond trading hub since the 2020's (based on Luxembourg for Finance, 2019). In 2045, there are three major types of bonds shaping the stock exchange market in Luxembourg - the Sustainable Land Bonds, the Social Impact Bonds and the Resilience Bonds (see Facts and figures 8).

## Facts and figures 8 Social Impact Bonds, Resilience Bonds, Sustainable Land Bonds – A successful business model

**Social Impact Bonds** are a financing mechanism where governments, social service providers and investors enter into agreement to pay for predefined social outcomes (OECD & LEED, 2016) in cases where the traditional models failed to deliver results in various social issues (GOV.UK, 2017). Investors in Social Impact Bonds are not only interested in the financial return of the bonds, but also care about their social impact as a means of increasing their social responsibility and community involvement (Chen, 2019).

**Resilience Bonds** support communities in dealing with the effects of natural disasters and also make them more resilient to future natural disasters. Given that the costs of natural disasters are becoming unbearable, the Resilience Bonds issued by private-sector organisations, mainly insurance companies, give an innovative solution. (Ruggeri, 2017)

**Sustainable Land Bonds** emerged in 2018 as a way to promote sustainable land use management initially in tropical forest countries as part of working towards achieving Agenda 2030 and the Paris Climate Agreement. They support commitments to fight climate change by helping governments to fund large scale operations based on a funding agreement. The borrowing cost is close to zero, as long as the emission reductions agreed in the funding agreement are met (The Nature Conservancy, 2018).

## Time witness VIII A critical review: The wealth tax reform of 2030 was a theft! Views of an investor

Today in 2045, we look back 15 years from the wealth tax reform, that brought many profound changes on how we do business and what is valued. Since 2000, we've been working very hard to achieve the 2020 economic status and we could've continued to grow. As we all know, taxes for corporations have increased and especially the private wealth tax was an act of theft!

The tax reform brought new taxation models, such as the Sustainable Land Bonds. This is a system paying the owner of land or the cooperative land owner for provision of ecosystem services and not for labour! Should we just continue to give people money for free for no actual work?

In contrast to eco-system services, labour back then created an actual value that could be measured on the balance sheet of my company. These times have long passed. I still remember when I was in my working age, I held many stakes and shares of companies from the real estate, ICT and car manufacturing sector. I possessed a lot of valuable building land that gained value with every year it was kept vacant. It was a wonderful time to be alive, I could afford many beautiful things in life.

But then came the tax reform. Instead of applying a reduced tax level, my ownerships and their profits generated were taxed to the same level as regular labour and then even further increased. Tax level became so high that instead of creating revenue, my ownerships transformed into costs. I was forced to sell my assets to a cooperative that benefited from Sustainable Land Bonds and could afford owning the property. This was expropriation! It is not surprising that the capital market turned the back on Luxembourg.

But if we think about the time then; everybody had its own car, everybody could live everywhere in the country, there was no need to engage with the neighbours and the so-called communities, people seeking for a job got one in financial business and everybody with a decent pay had a good quality of life (with the exception of some cross-border workers). Maybe we should think about this past and reflect whether it is not about time to go back?

*Antoine Delcourt*

**Social Impact Bonds – the state inclusive support.** The Social Impact Bonds are issued through a coordinated action between the government and the regions. They fund projects that deliver benefits and services to Luxembourg society, ranging from employment opportunities to combating health issues and environmental challenges. Social Impact Bonds are a financing mechanism whereby governments, social service providers and investors enter into an agreement to pay for predefined social outcomes (based on OECD & LEED, 2016), in cases where the traditional models failed to deliver results in various social issues (based on GOV.UK, 2017).

**Resilience Bonds – when the private sector kicks in.** The Resilience Bonds are issued by the private sector and in most cases by insurance companies. They emerged in the late 2010's due to the climate change risks from destructive weather events such as flooding, storms and droughts becoming uninsurable. They can change the way natural disasters may influence people, not only by supporting communities after a physical disaster, but also helping them becoming more resilient and less vulnerable (based on Ruggeri, 2017). Resilience Bonds were created in Luxembourg as incentives for regional governments to invest in proactive risk reduction projects analogous to funding preventive health initiatives. This includes a number of renaturing projects along some of the river systems in Luxembourg, to reinstate flood plains and improve natural systems' capability of dealing with flooding or to restore previously disrupted ecosystems. The Resilience Bonds involve: government agencies of all levels who are responsible for climate adaptation and resilience building; the insurer who will pay for any losses; utility operators who are at risk, and engineering, construction and landscape planners who can reduce risk within their businesses. The multiple sponsors pay the insurance premium and receive the pay-out in the event of a disaster. This broad involvement of different players is well aligned with the concept and proliferation of cooperatives throughout Luxembourg's society and economy.

**Sustainable Land Bonds – when the state fights climate change.** The Sustainable Land Bonds support the funding of commitments against climate change to strengthen rural economies and enable sustainable practices (based on The Nature Conservancy, 2018). They target institutional investors in capital markets; governments can make large environmental investments based on their funding agreements, with the guarantee that the borrowing cost will remain the lowest, almost zero, under the condition that the emission reductions agreed are realised (based on The Nature Conservancy, 2018). They enable authorities to access large amounts of inexpensive long-term capital in the mainstream capital markets, linked to result-based payments for annual emissions reductions achieved by improving natural and agricultural management. The issuer of the bonds commits to using the proceeds for sustainable land management initiatives to reduce greenhouse gas emissions. At the same time the government enters into long-term results-based payment agreements with third parties (such as a social enterprise or co-operatives) who work on improving land management, soil health, water and air quality and biodiversity. The third party provider of sustainable land management will receive results-based payments for achieved improvements in soil health, water and air quality and biodiversity, whilst generating income from the land for the co-operative or social enterprise.

## Facts and figures 9 European Directives and Treaties applicable

European Directives have played a key role in setting up the fundamental framework for regulating water quality and waste treatment.

**Drinking Water Directive** (Council of the European Union, 1998). Adopted in 1998 and concerns the quality of the water that is intended for healthy human consumption. The Directive sets a number of requirements to be met in order to ensure the health benefits of clean drinking water within the EU.

**Nitrates Directive** (Council of the European Union, 1991). Adopted in 1991, the Nitrates Directive concerns the protection of waters against pollution caused by the nitrates from agricultural sources and supports the promotion of good farming practices.

**Water Framework Directive** (European Parliament & Council of the European Union, 2000). Adopted in 2000, the Water Framework Directive establishes a framework for Community action in the field of water policy to achieve good status of water resources across the EU. An important element of the Directive is the identification and introduction of the River Basin Districts, areas that go beyond national borders and are made up of one or more neighbouring river basins.

**Waste Framework Directive** (Council of the European Union, 2008). Adopted in 2008 and establishes the legislative framework for the handling of waste in the Community. It defines concepts such as waste, recovery and disposal, as well as recycling setting the floor towards a community that recycles more.

By 2045, the regeneration of water and air quality through the natural processes of ecosystems is recognised for its value and service to society. The classification of Bioregions takes account of subsurface and above surface ecosystems, in particular to integrate assessments of ground water and surface water habitats. Local communities protect their local ecosystems, such as the water sources and rivers. Despite Luxembourg being a late starter on climate change mitigation efforts, it has caught up since the early 2030's. It has made major strides towards CO<sub>2</sub> emissions mitigation by regulatory measures and technologies.

## Time witness IX State of the bodies of water address – Communiqué on regional water monitoring in Moselle

The quality of water bodies in the Moselle region has again increased in 2045 comparison to past years. Based on the recent water monitoring report, investigating the quality of all ground and surface water bodies in the region, water bodies in the Moselle region now comply to the A+++ rating of the European Communities water framework directive of 2024. This rating is usually only attributed to Communities with low human activities, that can be found in Carpathia, Romania and Lapland, Finland.

However, water quality has not increased everywhere – water bodies in vicinity to settlements have slightly decreased in quality. This can be explained by the recent population increases around Echternach and Grevenmacher. Water consumption rose and treatment plants were not prepared for the resulting higher volume of wastewater. To make sure that this does not happen again, we will start working with scenarios on future demographic developments in order to evaluate treatment capacities in light of future demographic variations within their catchment areas.

Nevertheless, the increasing water body quality in the remaining parts of the have mitigated this local worsening of the water quality. Water quality assessments are based on the quantity and quality of contaminants to be found in samples, such as pathogens, organic, inorganic and macroscopic contaminants. The overall observed lower levels of contamination show that resettlement from and re-naturalisation measures in the ecosystem service regions are taking effect.

As consequence of the good water quality, water needs to go through less purification stages in order to become drinkable. This means that costs for water purification have further decreased, following the trend of the past years. Therefore, the regional government has decided to launch an investigation in possibilities to provide water for private households free of charge. At the same time, possibilities to further decrease water consumption levels in Moselle will be investigated.

Department for water purity, Moselle regional ministry for water

## 2.5 Taxation model and public finance

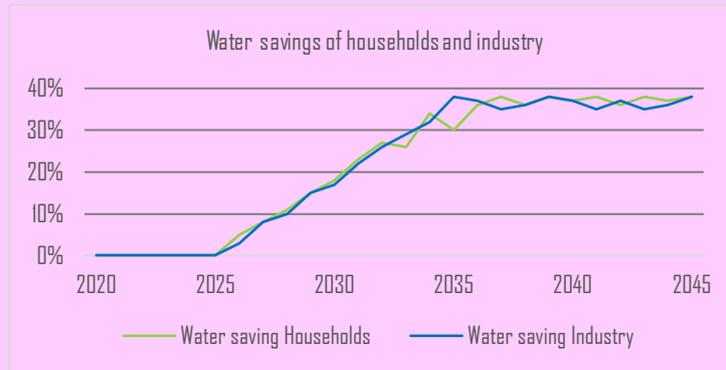
**Taxing the rich.** The key change in taxation policy regards the move from taxing incomes to taxing labour to taxing wealth. There was thus a shift in sources of public funds available for education, health services and environmental protection and welfare. The Luxembourg government, following many other European countries, introduced a wealth tax in 2030, affecting Luxembourg's wealthiest 10% of families and individuals, who owned more than 50% of Luxembourg's wealth (based on Luxembourg Times, 2014). Also, the trend in the late 2010's of decreasing corporate taxes was reversed in the 2020's and by the early 2030's company income tax rates were consecutively increased. Over time, Small and Medium-Sized enterprises came to constitute the majority of Luxembourg's companies and generated the bulk of corporate tax income for the government.

**Taxing, not compromising.** Another shift in taxation policy regards the taxing of anything that may compromise the physical, or indeed mental, well-being of the people. Eco-taxes apply to energy consumption, car usage and transport, CO<sub>2</sub> emissions, fertilizers, fossil fuels for transport etc. (based on Erwingmann, 2013). This was a trend emerging across EU member states during the late 2020's and it influenced Luxembourg's policy makers to follow suit. Particularly in Luxembourg, further revenue started flowing in from increases in fuel taxes. Luxembourg had been heavily criticised by the European Commission during the 2010's (based on Bauldry, 2019) for its low fuel taxes that created a phenomenon known as 'fuel-tourism' during the early 2000's and 2010's. As a result, for a long time Luxembourg had the highest per capita CO<sub>2</sub> emissions of all EU member states (based on Muntean, Guizzardi, Schaaf, Crippa, Solazzo, Olivier, & Vignati, 2018).

**The dark side of pensions.** The changes in taxation have had a major impact on the country's pension system. In 2045, pensions are no longer guaranteed. Layered pension structures including national public plans, private plans and regional plans are the norm. Since as early as 2035 there have no longer been any state-funded pension schemes and there is no longer a pension age limit. This was mainly due to the low sustainability rank of Luxembourg: the country failed to keep its high promises on pensions, given its past implicit debt and increasing population over time. Although the explicit public debt of the country was very low, the implicit, future, debt that Luxembourg built up over recent decades was very high. The European sustainability ranking shows that Luxembourg has a high sustainability gap, as it failed to cope with demographic change and to develop structural pension reforms to accommodate it and adjust to it (based on Fehling, 2014; Zenthöfer, 2013). This means that most people are contributing to society, through activities like food production or ecosystem maintenance, well into their eighties, if they are physically healthy enough to. Pensions are being phased out and the remaining workforce that relies on state pensions will be funded from the wealth tax until state pensions are fully replaced by the regional currency credit system, which is based on the self-reinforcing circular well-being economy model. The elderly are mainly cared for through the earning credits system - based on their work that contributed to the common good in the regional economies - which pays out when they are of pensionable age. This system is still under trial, as the aim is to make it self-reinforcing, despite the anxiety that many people feel about their future and how they will be looked after in their old age.

## Facts and figures 10 The value of water in Luxembourg

The fresh water available for consumption in a territory, including both groundwater and surface water such as lakes, rivers and streams, is referred to as water resources. In 2019 Luxembourg had 1.6 billion m<sup>3</sup> of fresh water resources, of which 0.7 billion m<sup>3</sup> came from external inflow, i.e. water coming into the country from rivers or groundwater in neighbouring countries (Eurostat, 2019).



Water consumption per person is a good indicator of the resource's sustainability. In Luxembourg, drinking water consumption has become more efficient over the years. In 2010 the drinking water consumption per person was 242.8 litres per day, but in 2017 it reduced to 200.5 litres per person per day (STATEC, 2019).

After the population and industry started to become increasingly aware of the value of water, it took some time until water saving measures became effective. In 2025, one started to see first water savings from household and industry consumers. Every year, the demand for water decreased by about four percentage points until end 2030s. Until then, the savings in water

consumption slowly started to stabilise at around 37% savings in comparison to 2025 consumption values. Nevertheless, despite the saving efforts, the water supply risk remained at a high level, compared to the 2020 values, levelling at around 20% for a countrywide risk of supply and round 40% for a local risk to supply for the municipalities (Cornelissen, 2020).

This led to an increasing awareness and understanding among the population of Luxembourg of how the hydrological water cycle works at the global, national, regional and local scales. The people have become very aware of the impacts of their actions and behaviour on water quality.

The national average household consumption of water has reduced despite the population increase to 930,000 by 2045. At the same time, drinking water consumption has reduced to 110 litres per person per day.

### Time witness X Touyube video: advertisement for the new Tyson Vacuum Toilet®

Had enough of cleaning your toilet? Does it still use water? Do you get annoyed that your toilet uses more water than anything else in your household? Are you mad at having to wait between flushes?

Good news! The new Tyson Vacuum Toilet® is just what you need!

The globally proven Tyson® technology from vacuum cleaners is now being used to make your toilet environmentally friendly! The Tyson Vacuum Toilet® uses innovative vacuum technology to suck out the content of your toilet. The high-pressure vacuum of 50 % creates sufficient force to keep your toilet spotlessly clean whilst hardly using any water. Just 1.5 litres per flush!

Tyson Vacuum Toilets® are already installed in every home in Luxembourg City, confirming the effectiveness of the new Tyson® technology. Drinking water flushed down the toilet has been reduced by 30 % in Luxembourg City, making all that water available for other uses.

And connecting your toilet to a biogas generator is a deal you should not miss! Generate energy by using the toilet! The content of your toilet is directly sucked into your nearest biogas digester where it is transformed into energy for lamps, heating, cooking and washing - or to operate your new Tyson® Vacuum Toilet! Ask your local Tyson® franchise now about these possibilities!

Keep your environment and your toilet clean with Tyson Vacuum Toilet®!



## 2.6 Biosphere and climate change

**Luxembourg's flora changing.** The environmental effects of the last decades have had an impact on the country's biosphere. Very high summer temperatures and low rainfalls disrupted the soil and caused forest fires, while at the end of the 2020's one third of Luxembourg's forests were in a critical condition. Woodland has now become more highly valued for its ecosystem services and is only exploited to a limited extent across the regions. Reforestation is a key national objective, with all the challenges that that implies.

**Water and air quality.** The natural processes of ecosystems, enabling the regeneration of water and air quality, are recognised for their value and service to society. Ecosystem services offer both a direct and an indirect contribution to people's well-being and their value has increased more and more over the last years. Luxembourg was assessed with a high value of ecosystem services, according to the total ecosystem services index (based on European Parliamentary Research Service, 2015). Bioregion classifications now include subsurface and above surface ecosystems in particular to integrate ground water and surface water habitat assessments. It is up to local communities to protect their local ecosystems such as the water sources and rivers; this causes frequent conflicts between communities. Water quality is better than for the last 50 years, as regional governments' responsibility for water supply and water quality led to many innovations in governance, households and businesses. Combining the drinking water supply with the water treatment syndicates meant that many processes were streamlined and better coordinated, whilst the implementation of new infrastructure projects has been sped up and water savings and recycling technology and practices are optimised.

**Water in the spotlight.** Moderate water shortages in 2020 and 2021 did have some political impact but mainly the changing attitudes and loss of cohesion and increasing competition between the Luxembourg regions, who have taken over many responsibilities which were previously in communal hands, including the responsibility for water quality and security of supply, mean that there is an increasing focus on having "own" water supplies. Local sources, no matter their size are lovingly restored (+40000 m<sup>3</sup>/day) and used, even without the necessary formal approvals, the lack of this water is resulting in a decrease of river water levels, creating tensions between farmers and environmentalist lobbies on the one side and home-owners on the other. However, this leads to the "rediscovery" and strict local/regional control of the 970 sources, 1020 drillings (of which 770 previous drinking water abstraction points) of which in 2019 only about 270 are still monitored/registered as active drinking water abstractions.

**Water supplies, now home-made.** Home-made, parallel (or "dual") water supplies for flushing toilets from local sources are springing up everywhere with the Luxembourg regulator powerless to stop these practices. Local water bottling initiatives in glass bottles means that piped drinking water is not often used for oral consumption anymore. Rainwater catchment and utilisation is widespread. (-25%) As a result, there are some pollution events where "drinking" water is contaminated with faecal bacteria but the effects on the population because of this is trivial. A decreased dependence on nationwide sources is observed and the SEBES is therefore forced to decrease its operations. SEBES water therefore becomes increasingly expensive and even less used. The infrastructure is aging and without enough maintenance there is an incident in the summer of 2030 where a SEBES trunk main bursts and water supply cannot be restored for months. This results in an even more widespread independence of SEBES water and some people even start to produce their own drinking water in the home (to -40%), both from rainwater and grey water, or drilling own (wild) dwells, some being completely independent from the

public water supply. Again, the regulator is powerless to stop these practices. (based on Cornelissen, 2020)

**Mitigating and adapting to climate change.** Since the 2030's Luxembourg has caught up in climate mitigation actions, especially through innovative technology for carbon capture directly from the air, removing carbon that has accumulated in the atmosphere over the past 200 years. Climate change adaptation efforts already gathered momentum in the 2020's, as a direct reaction to the drought and fire events of the decade. The focus on the country's own food production and improved water governance are just two examples of such efforts.

**Saying yes to more renewables.** Gradually, since 2022, Luxembourg started becoming more self-sufficient in power generation. Each region is now building upon its specific advantages for energy production, ranging from biogas from vacuum toilet systems to a combination of wind/solar, hydro power generation systems and geothermal energy. Renewable energies have become the preferred energy sources and Luxembourg has managed over recent years to increase its solar and wind energy by more than 25% (based on RTL, 2019). All this mix of energy generation made it possible to phase out energy imports, particularly nuclear power from across the border.

## Facts and figures 11 Data centres: do they benefit citizens?

Data centres are facilities that store large volumes of often sensitive data and information on behalf of different enterprises. Already since the 2010's, Luxembourg has been home to a large number of data centres and has the highest density of TIER IV data centres in Europe. Furthermore, Luxembourg became the first country to host the first data embassy: Estonia now bases its government data in Luxembourg's data centre (e-estonia, 2017).

Although data centres may bring economic benefit to the country, their implementation is an environmental challenge. Overall, the ICT sector accounts for about 2% of global CO<sub>2</sub> emissions, with data centres having the fastest growing carbon footprint of the sector (Avgerinou, Bertoldi, & Castellazzi, 2017). They are highly energy intensive, requiring both power to run the machines and huge cooling systems, including water chillers, cooling towers and water pumps, which account for 40% of the energy demand of a data centre (Avgerinou et al., 2017). This also increases demand for water.

By 2045, as a result of the evolution of technology and the introduction of more regional energy centres, data centres have become more sustainable. Meanwhile, the final go-ahead decisions on them were left to the citizens, so the latter had the final say on and responsibility for their implementation. The stability and new social model established in Luxembourg, creating a strong community feeling and high degree of social harmony, have led to greater trust from several other countries, increasing the country's and regions' attractiveness as targets for investments in data centres.

## Time witness XI Newspaper article. A view back in history – data centres and their societal function.

During the past, data centres were seen as highly critical by citizens. But today, we accept them as one urban element. How did we get there and why has our perspective on data centres has made a U-turn?

Because the country of Luxembourg is seen as 'safe haven', data centres within the country are mostly used to store information from foreign governments, regions and communities. The high levels of political stability and high ICT security standards have also motivated many private firms, increasingly being subject to global hacker attacks, to store information in Luxembourg.

Because of their international role, data centres brought little added value to local residents and were thus mostly built beyond the view of the public, hidden within forest or in areas of economic activities (Calvert, 2019). These areas were also criticised for their high water and energy consumption, challenging the regional renewable energy networks in providing the data centres' sheer endless need for energy.

In 2029, when the amount of data centres had doubled in Luxembourg in comparison to 2020, speaking of the fast pick-up and the great attractiveness of Luxembourg for ICT sector and businesses. Despite modern technologies, server centres and thus this economic sector became a risk to the environmental situation in the country and its regions: warm water, used for cooling servers could not be used as drinking water due to heat and resulting blooming of algae in the network.

The Minett region, which implemented a much larger number of servers than the other four regions, started to feel some consequences: the river water temperatures rose drastically, threatening the lives of native species. In proximity to data centres, where excess water was collected in open basins, co-called "hot data springs" were opened as tourist attraction and leisure activity for residents. However, this was only a short fix for a permanent problem; warm water, slowly percolating into the groundwater bodies, changed the temperature of the aquifers, requiring spring water to be cooled before further purification, requiring a tremendous amount of energy.

The breakthrough came, when one engineer remembered the technology of 'district heat', invented during the 19<sup>th</sup> century. This way, it was possible to distribute the excess heat through the agent of drinking water into the households and provide the heat for household application. This way, data centres, that were previously seen critically by residents because of their energy and water consumption, have been accepted and provide cheap warm water to their surroundings.

The new 'Data-centres for Luxembourg' strategy aims at increasing the number of data centres further. The strategy also envisages investigating possibilities to use excess heat for steam power plants, enlarging the portfolio of services data centres provide to citizens with electric power.

**Urban transport on the move.** When it comes to urban mobility, the regional transport systems rely on the local and regional energy cooperatives. Mobility mostly involves electric vehicles, which were already popular in the country from the 2020's, and have gradually become more available for hire on local platforms. Multimodal transport systems have also expanded in Luxembourg with buses, tram lines and public bikes available for its citizens and connecting the different regions. In 2045, due to an increased sharing mentality, very few people own their own cars, car sharing having become mainstream. Soft transport, i.e. preferring to walk or use bikes has also become more popular. Given particularly the focus on regions and the regional economies, workers' average travel time to work or leisure has decreased compared to 30 years ago. Activities and work take place within the regional settlements and people like these soft means of transport.

## 2.7 Water governance – value of water, water supply and consumption

**Water governance a priority.** The need for integrated water management became a government priority after the drought and forest damage events that affected the country. The water governance and regionalisation began with the merger of the drinking and wastewater syndicates in each region in 2025. The five governing regions are thus each responsible for their own water management. Since the early 2030's, the organising principle has essentially been around the river basins. These enjoyed a strengthened identity due to the river partnerships, which slowly grew in importance during the 2010's (see also Case studies on Éislek region and Luxembourg City). Cross-border collaboration on river basin management also intensified.

**Conflict resolution in the name of the common good.** Luxembourg City, not having any river basins itself, was in the least favourable position and dependent on other regions. There were thus conflicts to be resolved between the city and some of the regions. This is because many of the water sources that the city bought before and during the 2010's now fall within the boundaries of other regions. This is an ongoing and unresolved source of tension between the city and the regions. The role of SEBES, the Syndicat des Eaux du Barrage d'Esch-sur-Sûre, supplier of 50% of the country's drinking water from the Upper Sûre reservoir in 2020, has also been the subject of lengthy negotiations between the national government and the Éislek region.

**The high value of clean water.** People put a high value on clean and plentiful water, like all other ecosystem services. It is seen as the basis for the well-being of the individual and society (see also Facts and figures 10). The size of the Natura 2000 areas and of the drinking water protection zones has increased across the country. The price of water also grew drastically after the long hot summers and forest damage of the 2020's, which raised awareness of the value of water as a resource. Today, water is perceived as the bloodstream of the biosphere, understood as a closed system with a constant and limited volume that continually circulates through the biosphere, atmosphere, geosphere and hydrosphere. Although there are large volumes of water in circulation, only a very limited supply of fresh water suitable for drinking is available, and this is continually under pressure from pollution and ground water extraction. Improvements in governance, technological advances and awareness have together meant that there is less pollution than before running into the rivers from waste water treatment and agriculture. Water quality in the river basins has improved compared to the 2010's and safe and good quality drinking water can now be provided. In addition, the water price for industry has been aligned with those for all other users. Outdated industries had used water cooling technologies and water-intensive industrial processes were subject to higher taxes in the late 2020's. It therefore became

essential for many water-intensive industries to find new solutions to reduce or eliminate water consumption. Many of the data centres based in Luxembourg (see section 1.2.9 Digitalisation and its impacts) are connected to the regional renewable energy cooperatives to convert their excess heat into usable energy, eliminating water use altogether.

**Saving water.** Different policies for saving water have been introduced. Since 2030, rainwater capture and storage at individual household level has been promoted, together with technological advancements. This helped to reduce the amount of drinking water used for other purposes. Although some Luxembourg industries have moved to using substitutes for water and have thereby reduced their water consumption drastically, the increase in agricultural activity and the savings in households have shifted the ratio of water used by households versus industry from 70/30 in 2020's to 60/40 today.

## 2.8 Digitalisation and its impacts

**Accelerating digitalisation.** The rate of digitalisation has been increasing over the last decades. Since the 4<sup>th</sup> industrial revolution, cloud computing revolutionised IT platforms and communication and big data shapes citizens' digital footprint. Economic and industrial competitiveness is dependent on the development and mastery of digital technologies. This means that industries that fail to adjust to these developments or are using outdated technologies are bound to be disconnected from global markets (based on European Strategy and Policy Analysis System, 2015). Meanwhile the data footprint of digital citizens is increasing hugely. Anything that people search, shop, discuss or upload is traceable and stored online, raising questions about internet safety and privacy.

**Digital citizens' rights.** Digital rights, i.e. human rights in a digital era have become more important, particularly people's rights to privacy and freedom of expression (based on Hutt, 2015). To better manage those rights, Luxembourg transferred the organisation of digitalisation and data sharing to the regional level and by 2045 decisions around digitalisation and data ownership were managed regionally. Luxembourg was one of the few EU countries to tighten the EU GDPR (based on European Parliament & European Council, 2016) digital rights of citizens. This meant that data ownership was held locally and people in Luxembourg had full rights and ability to keep their data as private as they wanted. Luxembourg residents can choose freely whether their data and online behaviour is accessible beyond Luxembourg as part of global big data streams.

**Share your data and get paid.** Over the last decades, Luxembourg has also adopted the data dividends system. According to this system, consumers and internet users would be allowed a payment or reward, in exchange for the use of their data (based on Cowan, 2019). A consensus was agreed by the companies collecting, distributing and analysing data as a pre-emptive strike against many governments in the world who wanted to tax big companies. The companies agreed that they would rather offer data dividends directly to consumers than pay more taxes to the governments of all the countries from which user data was sourced. The companies justified data dividends as being a more efficient way to share wealth than the universal basic income. Particularly the latter is still being discussed and debated in 2045. In short, those who choose for their data to be used are eligible for data dividends, i.e. an allowance for the provision of their data. This has been especially popular with younger generations, who allow their data to be included in big data analysis as a small but consistent income stream.

**Data embassies haven.** During the 2010's and 2020's Luxembourg invested heavily in its fibre optic network, creating a highly-meshed internet network with the aim of providing the highest data security worldwide (see also Facts and figures 11). Already in the 2010's Luxembourg was home to more than 20 high-tech data centres and entrusted with storing data for NATO and the EU, before hosting the first data embassy on behalf of a sovereign country: Estonia's (based on Talmazan, 2019). Estonia was the first country to open such a data embassy; it was set up in Luxembourg to ensure cyber security for its people in Luxembourg's safe digital "nerve centre" (based on e-estonia, 2017). Starting in the 2020's, new initiatives saw the emergence of more data centre facilities. These provide a data centre building with cooling, power, bandwidth and physical security to lease out to a diverse range of customers who add their servers and storage. It was however not only the technological characteristics and provisions in Luxembourg that attracted data embassies. Luxembourg has been highly attractive as it is a socially and politically stable state due to the *devolution* process and because of the mature new governance of the commons framework that offered more stability and insurance to any countries wishing to establish a data embassy here. With the regionalisation process, new regulations required that data centres feed into the regional energy systems, using heat pump technology to convert excess heat from the data centres to create heat or energy for the regions. Any new data centres from 2035 on needed to include a power plant to reuse all of the waste heat generated by data storage by the companies collecting, distributing and analysing data. Due to the move towards energy self-sufficiency and the emergence of many regional energy cooperatives by the early 2030's, data centres could source energy relatively cheaply. All of these benefits contributed to Luxembourg's attractiveness as a safe, secure and affordable data storage location. As a result each of the five regions in Luxembourg possessed highly secure and advanced data centre infrastructures and the country became home to leading European and global data embassies.

**Blockchain technology as the basis.** Blockchain technology attracted much enthusiasm and generated considerable hype in the 2010's. It allowed people to exchange currencies or other assets without relying on an intermediary to manage these transactions, with all the changes in business processes that this could imply (based on World Economic Forum, 2018). Blockchain and cryptocurrencies constitute the basic technology to track data and its use, opening the door to monitoring how personal data is used. Together they form the backbone of Luxembourg's data privacy and protection technology and the data dividend scheme. Blockchain is also part of everyday economic life, as it supports the regional cryptocurrencies and intra-regional trade in products and services.

**Robots in everyday life and agriculture.** Artificial intelligence and robots are also part of everyday life in 2045. Robots have replaced repetitive and manual jobs, while artificial intelligence and robotisation changed both the way people work and the skills required (based on European Commission, 2019). Robotisation and automation have also played a role in agriculture. Soil and plant monitoring and management were automated and the robot dominated harvesting technologies. Smart farming, including precision farming and livestock farming, uses sensors, robots and relevant data. It boosts efficiency by monitoring the needs of crops and livestock whilst optimising the human muscle-power that is necessary for agricultural work (based on Sciforce, 2019).

**3D printers.** Production technology has also taken big leaps 3D printers play an important role, especially in urban centres. They can produce a wide range of equipment, tools and materials. People can print most things that they need: household items; furniture; their own shoe soles and clothing, or

any spare parts for repairing broken equipment. Not every household has a 3D printer; rather, access to these technologies is possible in small local centres and shops, where people can print different replacement parts, quickly and at limited cost. 3D printing and additive manufacturing has revolutionised manufacturing, allowing more localised production. It has also unveiled the potential for a more systematic recycling of raw materials (based on European Strategy and Policy Analysis System, 2015). Building on the country's forest resources, products based on recycled wood have also been made using 3D printers.

**Eco-vation for Luxembourg.** Several steps have been taken towards eco-vation, i.e. ecological innovation, for climate mitigation actions. Luxembourg had scored among the first positions in the EU's eco-innovation scoreboard during the 2010's and continued to develop in this field over the following years (based on European Commission, n.d.-a). The University of Luxembourg developed an innovative technology for direct air capture of carbon, removing carbon that has accumulated in the atmosphere over the past 200 years. The university then enhanced air to fuels technology by combining it with synthetic fuel production from hydrogen and CO<sub>2</sub>, through implementing a breakthrough innovation. This innovation, celebrated as a superstar of the circular economy model, offered a carbon neutral method, even making Luxembourg's airport neutral by 2035.

## 2.9 Knowledge and education

**Governance of the commons needs an open society.** Such an innovative new political system requires a thorough awareness of the common good and common values, i.e. a deep understanding of the motivations, appetites and forces that drove people to take such a decision. An open society that embraces changes, understands the common good, does not support division but fights for unity, a society that keeps the 'drawbridge down' (based on The Economist, 2016) and is pro-open, is necessary to keep such a new structure going and progressing.

**Becoming a knowledge society.** Developing such an advanced social system, where common goods are managed under a governance of the commons, requires a thorough knowledge society. To achieve this, education needed to be cultivated from the early school years towards social education, with high-level early childhood education and pre-school education (based on European Political Strategy Centre, 2017). Greater knowledge was required at the local level, together with transfer of knowledge within individual regions. Luxembourg has become a true polymath society, where younger generations exploit every possibility to build on new traits and invest time and resources in their vocation. They collect insights and knowledge and educate themselves through a variety of sources incl. online course, social networks in addition to their formal education system. At the same time, education has become more decentralised, where school complexes are built in the new regional municipalities. This decentralised educational system has also environmental benefits, as pupils do not have to travel every day to school.

**Education as an implementation mechanism.** Different types of knowledge are required for effective governance of ecosystem services. In particular, local knowledge, place-based knowledge and experiential knowledge needed nurturing and to be given importance in society through life-long learning initiatives. Furthermore, skills in new technological developments, such as artificial intelligence, require specialised education (based on European Commission, 2019). Due to the many participatory processes requiring extensive dialogue between divergent stakeholders, the opportunities for social learning are high. Local and interdisciplinary knowledge is important and included in most governance

processes. While these participatory processes and their social learning potential are highly valued, there is also frustration amongst the participants and citizens that many decisions take a very long time.

## 2.10 Luxembourg and beyond

**Luxembourg is not an island.** In 2045 Luxembourg continues to be connected to the Greater Region. Long lasting cooperation has existed along Luxembourg's borders and this cooperation has been extended in the framework of the new governance structure. Luxembourg is not an island and particularly in a world where what people do in one place influences other people in other places, it was clear that the new developments could not leave its neighbourhood unaffected.

**Involving neighbours.** Following Luxembourg's experience, the border regions of Belgium, France and Germany started testing similar structures and solutions. River partnerships already existed in the 2010's: the 'Attert-Kontrakt', 'Water contract Obersauer', already signed in 2001, 'Alzette contract', Naturpark Our' and 'Syr river contract' (Luxembourgs Flusspartnerschaften, n.d.). These served as the initial spark to expand similar structures to Luxembourg's neighbours. Regional governance was no longer based on historical borders, but rather on physical features, and was intended to allow people to manage their own water resources. This resulted in bringing the relevant border regions together and increased the cooperation that had already existed back in the 2020's. The cooperation has been institutionalised in the beginning of the 2040's by forming so-called European Groupings of Territorial Cooperation (EGTCs) along the cross-border river catchment areas, with water governance as the key issue.

**Becoming a role model for the Greater Region.** Luxembourg's change and achievement became a role model for the wider Greater Region. The country has served as an example for change in the Greater Region, as it inspired countries beyond its immediate borders to initiate similar forms of governance of the commons for the common good. Seeing the benefits that merging the municipalities brought in Luxembourg, other places followed and established a similar process, whereby municipalities where merged and shaped in line with the respective water catchment areas.

**Commuters still on the move.** People from cross-border regions still commute daily to Luxembourg. The art of commuting has, however, slightly changed due to the fundamental changes that Luxembourg has undergone in the last decades. Commuter movement patterns are now more dispersed to the five new regional centres, with Luxembourg City receiving the majority. The four other regional centres also attract substantial numbers of commuters. However Wiltz and Mersch in the North of Luxembourg in particular have most difficulties in attracting workers across the borders, due to less favourable transport infrastructure. Making all five regional centres more attractive and improving the transport connectivity along the borders is today key for attracting more workers from Luxembourg's cross-border regions.

## 2.11 Case studies

### Regional examples of water governance, land use and economic orientation

The regionalisation in Luxembourg after 2020, which followed socio-cultural and natural logic, notably the logic of river catchment areas, has split the country into five autonomous regions. As a consequence, each region features different economic, social, natural, cultural and other structures. In order to highlight differences, two examples will be illustrated:

### 2.11.1 The Éislek region

The regionalisation process in the early 2030's involved the Éislek region being drawn around the river basins of the Upper Sûre and the Our, including their surrounding natural parks and the regional urban centre of Nordstad.

#### Water governance

The Éislek region in the north of Luxembourg is the most advanced in making regionalised governance in Luxembourg work well for the common good of the communities, having access to large bodies of water and numerous fresh water sources. The bodies of water are managed by a regional water treatment cooperative, being the result of a merger of several municipal groupings of water provision facilities.



Because of this advantageous situation, the region produces more fresh water than it can consume. This enables the Éislek region to charge an equitable price for drinking water within its urban centres whilst benefiting from selling water at market prices to the other regions, including Luxembourg City. However, this good news comes with a bitter pill for the region. The economic benefit from selling drinking water will not be as significant as it could have been earlier. The other regions of Luxembourg have reduced their reliance on the Upper Sûre reservoir since the nitrogen crisis after the 2020's, resulting in water supply bottlenecks in the short term and large nitrogen fixation costs for keeping the Upper Sûre reservoir pollutant free.

#### Water quality

The drinking water protection zones around the Upper Sûre lake have been in place for more than two decades. Water quality in the river basin has improved and is the best it has been in 50 years due to less pollution from pesticides and herbicides, more targeted use of manure on agricultural lands and less effluent being discharged into bodies of water. Also, new technologies for nitrogen fixation from water have contributed to the restoration of high-quality bodies of water following the nitrogen crisis in the 2020's.

The long-standing cross-border collaboration with the Parc Naturel de la Haute-Sûre Forêt d'Anlier in Belgium, beginning in the 2010's, became even more critical during the drought period in the early 2020's. The water protection zones were extended in 2024 to protect the two-thirds of the Upper Sûre river basin that lie in Belgium. This provides the opportunity for the region to sell water from the lake back to Belgium and thereby increase the incentive for continued collaboration on water and ecosystem protection.

#### Sustainable Land Bonds

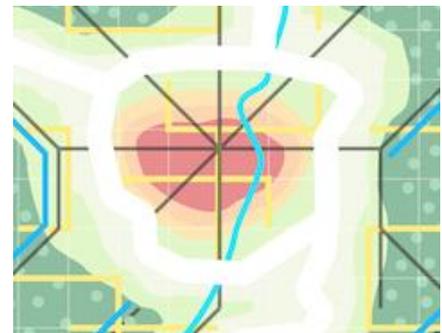
Similarly to other regions, agricultural land in the Éislek region was nearly fully covered by SLB's as of the 2030's. A large proportion of agricultural lands became co-operatively owned by the people of the region and a small number of investors from Luxembourg. SLB's allow all residents of the regions to invest in co-operative agricultural lands, be involved in food production if they so wish, and enjoy the benefits of sharing risks in cooperative sustainable management of the land. Funding for SLB's is made available by the European Investment Bank (EIB), which initiated a new funding mechanism in 2028 as part of a set of tools to help achieve the country's net-zero carbon policy by 2050. A result of several cooperatives merging their production in a co-cooperative, is the new label "vum Séi", with a range including meat, cheese, beer, bread, hemp and miscanthus. These new products are primarily produced for the domestic market within Luxembourg.

## Tourism

Tourism in the Éislek region in the past was dominated by camping and recreation tourism, characterised by short stays and low levels of contribution to the economy. However, during the 2030's tourism around the Upper Sûre started to shift from day visits for recreation to well-integrated longer-stay heritage and nature-based well-being experiences. A tourism study undertaken by the Éislek Regional Tourism Office in collaboration with the Upper Sûre natural park and adjacent natural parks in Belgium resulted in a tourism strategy focussing on the capitalisation of heritage and nature. The strategy attracted longer-stay visitors, providing unique accommodation experiences and connecting the many nature-based activities and restaurant offerings in the Éislek region. The experiences were and still are promoted as active well-being tourism that aimed to highlight the physical and mental benefits of time spent in nature and nutrition using high quality locally grown food as the foundations for individual and ultimately societal well-being.

### 2.11.2 Luxembourg City

Cities are usually in a dominant position, however in this case Luxembourg City as part of the Luxembourg City region is dependent on the other regions for its food and water supply. The autonomous regions and their regulators have bilateral agreements with Luxembourg City region for the provision of water, energy and other ecosystem services for relatively high prices. As the region constitutes a large ecosystem service consumer, it is dependent on this cooperation., The city region therefore started various initiatives to reduce this dependency by improving resource efficiency.



## Water governance

Luxembourg City, despite being part of the river catchment area of the Alzette, only possesses small ecosystem service regions. The few areas left untouched by the land taken up by urbanisation after the 1900s are efficiently used for providing high water quality. Strong regulation protects the vast regional forest, the city's "lungs", and the natural land within the borders of the city region. Nevertheless, with a similar number of inhabitants as in 2020, the city is still living beyond its means. As it is a major consumer

of water, the city region depends heavily on the provision of clean water from the other autonomous regions Minett, Éislek, Guttland and Moselle.

Water supply is managed by the competent municipal department, responsible for collecting drinking water within the region as well as collecting and distributing imported drinking water. In the past the department has put major efforts into the smart collection and processing of grey and black water from households, allowing the reuse of grey water for applications where no drinking water is necessary. The department has also invested large amounts of funding in researching and adopting innovative technologies, targeting the reduction of water consumption through reuse, decentralised cleaning or investigating alternatives to water.

### **Water quality**

As the water provision of the area depends to a large degree on the provision from the surrounding autonomous regions, Luxembourg City region cannot always influence the quality of the water delivered. Nevertheless, under the influence of the predominant value system, which puts a high value on water quality, the region only purchases “the best” water from its surrounding regions. This comes at a high cost.

In the 2020's, bad water quality in Luxembourg City led to a national crisis. In 2029 large amounts of chemical pollutants were channelled into the Alzette from a wastewater treatment plant in Luxembourg City region. Guttland and Éislek regions imposed sanctions as the chemical pollutants impaired the quality of bodies of surface water further downstream. As a consequence, the two regions stopped supplying freshwater; the situation was resolved following mediation by central government. Since then, water security systems have been installed in the area, monitoring the state of the water, allowing for targeted policy actions towards reducing environmental hazards due to black water.

### **Sustainable Land Bonds**

Luxembourg City region does not include large amounts of agricultural land. As an alternative, the city has invested strongly in the development of urban and vertical gardening. These efforts started with the adoption of the national urban farming strategy in 2019 (Emwelt.lu Portail de l'environnement, 2019). During the following decades, the strategy was seen as a useful instrument in decreasing dependency from food imports from abroad and from the other autonomous regions in Luxembourg. Today, every newly built house or office is required to provide greenhouse and vertical installations to accommodate farming and food production either by residents or by the many food production cooperatives, using SLB's.

Despite the limited agricultural spaces available, Luxembourg City has turned into an international hub for SLB's. This is primarily due to the major green bonds, that are administered, funded and monitored by various Sustainability Funds. In this way, the city region exercises a certain control and leverage on much of the agricultural land in the other autonomous regions in Luxembourg. It has developed into an intermediary between the global green bond market and the local implementation, with considerable relevant expertise and knowledge being concentrated in the small city region.

The green bond market has developed into a sustainable financial cluster, which continues to generate above average economic growth, resulting in over 1 % GDP growth for the entire country. Whilst the revenues generated from the green bonds and the SLB's are being used to purchase ecosystem services from the neighbouring regions, expertise on SLB's remains concentrated in the city region.

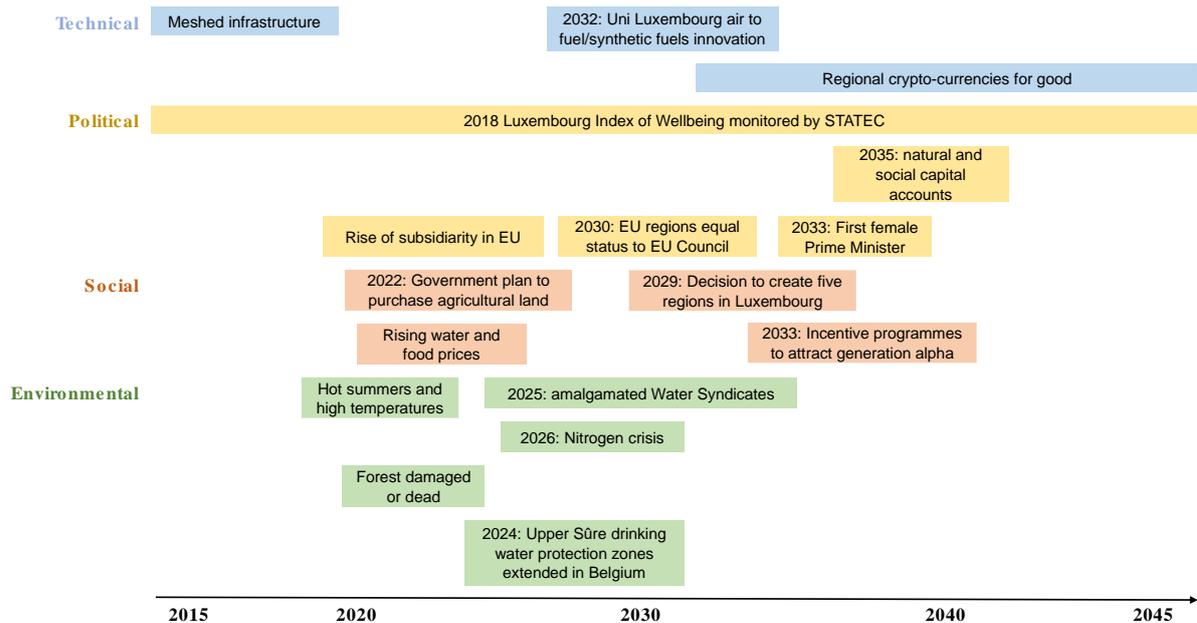
As a consequence, many alternative and innovative solutions to minimise environmental impacts developed in the city region. It was also pro-active in implementing new regulative and technological solutions, e.g. related to water consumption. Through green bonds for example, the Luxembourg City region was the first city to fully install vacuum toilets, enabling water consumption per flush to be reduced to 1.5 litres. This has freed freshwater resources for other purposes and reducing the city's dependency on freshwater imports from the surrounding areas.

### **Tourism**

The capital city region is still the main access to the country for tourists because of the railway and airport infrastructures. Many foreign tourists spend a night or two in Luxembourg City, before continuing their travel to the natural tourism areas. Luxembourg City region has thus been transformed into a prominent destination for medium- and short-term visits, meaning limited revenues for local businesses.

### 3 Integrated picture

**The right timing.** The developments that have led to this scenario on the ‘Governance of the commons for the common good’ for Luxembourg in 2045 took place in a sequence over time, reflecting their dependence on one another. Figure 3 shows the sequence in which the different events happened. The earliest developments began in the 2010’s and continued through the subsequent decades.



Source: Spatial Foresight, 2019

**Looking at the broader picture.** All the changes that have been elaborated in section 2 are mutually interconnected. The emergence of one has a direct impact on the emergence of another, while further impacts and consequences can be seen due to the interconnection of other developments happening during that period. The most prominent of these interconnections are shown graphically in the systems diagram in Figure 4 below, illustrating that our actions, together with other events, in one place have an effect in another place.



## 4 Conclusion

Scenarios do not do fortune telling. They provide different aspects and serve as eye-openers to stimulate thinking 'out-of-the-box' to inspire policy making. The scenario on the 'Governance of the commons for the common good' gives a perspective of what Luxembourg would look like in 2045 if the country went into a regionalisation process and its common good, water, were governed by its regions.

The scenario looks into the anthropocentric approach, putting humans in the epicentre of the development by elevating their needs to top priorities in the country. The changes occurring in the country derive from the need of bringing policy making closer to citizens, combatting the feelings of feeling detached from the higher political levels and decisions. A highly knowledgeable society and population has been a key driver for taking the decision of shifting parts of the central powers to the regions and the people, especially when it comes to the management of the most valuable common good – the water. The following paragraphs present some key conclusions that are still discussed in 2045 in this scenario, some challenges that the scenario may pose and concludes with some policy take-aways.

**What do we still discuss in 2045?** There are still a few issues under discussion in 2045 that have not yet been solved. To start with, this regards the water supply, which is not clearly defined how it will be done in every region and how it will be organised. Furthermore, the population in Luxembourg continues ageing, putting the pension and welfare system at risk, leaving still some question marks on how to deal with this. Concrete measures on how to address this aspect require further discussion. International competitiveness is another important element still under discussion in 2045. In this scenario, Luxembourg's economy is largely based on a circular economy model. Despite the establishment of data centres, the question remains how Luxembourg can maintain its international profile and remain internationally competitive in 2045. Although the idea of implementing a Universal Basic Income fits with the notion of the scenario, it is still being discussed on how this can be operationalised in practice.

**What are current challenges in 2045?** To begin with, the level of EU integration may be threatened due to developments in various trends and challenges at the global and European levels, challenging EU integration. As Luxembourg is not an island, climate change actions going beyond Luxembourg need to be considered. Climate change needs to be tackled collectively through actions beyond Luxembourg. Initiatives and actions at global and EU level are necessary for effectively addressing its effects. In addition, issues related to global economy, competition and protectionism need further attention. Trends with respect to the global economy are further challenges to this scenario. Trade wars and on-going protectionism may influence the current developments. Last but not least, digital change consequences are crucial, i.e. the changes in digitalisation are enormous and policy makers cannot always keep pace with them. Following the 4<sup>th</sup> industrial revolution, developments have been huge and adaptation measures must be further discussed.

**What do the policy makers need to take home?** Reflecting on the key topics of the scenario, policy makers of the future need to consider the following four policy take-aways:

- Environmental issues need "comprehensive" responses and not just environmental policies.
- Subsidiarity needs to be taken seriously and turned into place-based development.
- Autonomy requires knowledge and insights among the citizens.
- Well-being instead of GDP is a realistic possibility.

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