First Biennial Transparency Report of Luxembourg under the Paris Agreement

15 July 2025

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Environnement, du Climat
et de la Biodiversité

First Biennial Transparency Report of Luxembourg under the Paris Agreement

This report was compiled and partly written by Eric De Brabanter of the Ministry of the Environment, Climate and Biodiversity. It benefits from various contributions, which are acknowledged in the relevant chapters or sections.

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This first BTR presents the situation in Luxembourg on 31 December 2024.

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Content

List of acronyms for Ministries & Administrations

MAAV	Ministry of Agriculture, Food and Viticulture (*Ministère de l'Agriculture, de l'Alimentation et de la Viticulture*) ASTA: Administration of Technical Agricultural Services (*Administration des Services Techniques de l'Agriculture*) SER: Department for Rural Economy (*Service d'Economie Rurale*) Formerly MAVDR Ministry of Agriculture, Viticulture and Rural Development (*Ministère de l'Agriculture, de la Viticulture et du Développement rural*)
MAEE	Ministry of Foreign and European Affairs, Defence, Development Cooperation and Foreign Trade (*Ministère des Affaires étrangères et européennes, la Défense, de la Coopération et du Commerce extérieur*) COOP-MoFEA: Directorate for Development Cooperation and Humanitarian Affairs
MinDigital	Ministry of Digitalisation (*Ministère de la Digitalisation*)
MEA	Former Ministry for Energy and Spatial Planning (*Ministère de l'Énergie et de l'Aménagement du territoire*) Energy → MECO, Energy Directorate / Spatial Planning → MLOGAT
MECB	Ministry of the Environment, Climate and Biodiversity (*Ministère de l'Environnement, du Climat et de la Biodiversité*) AEV: Environment Agency (*Administration de l'Environnement*) AGE: Water Agency (*Administration de la Gestion de l'Eau*) ANF: Nature and Forest Agency (*Administration de la Nature et des Forêts*) Formerly: MECDD – Ministry of the Environment, Climate and Sustainable Development (*Ministère de l'Environnement, du Climat et du Développement durable*) Previously: MDDI-DEV – Ministry of Sustainable Development and Infrastructure – Department of the Environment (*Ministère du Développement durable et des Infrastructures – Département de l'environnement*) & MEV – Ministry of the Environment (*Ministère de l'environnement*)
MECO	Ministry of the Economy (*Ministère de l'Economie*) STATEC = National Statistical Institute (*Institut national de la statistique et des études économiques du Grand-Duché de Luxembourg*)
MENEJ	Ministry of Education, Children and Youth (*Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse*)
MESR	Ministry for Research and Higher Education (*Ministère de la Recherche et de l'Enseignement Supérieur*)
MFIN	Ministry of Finance (*Ministère des Finances*) ADA: Customs & Excises Administration (*Administration des Douanes et Accises*) ACD: Direct Tax Administration (*Administration des Contributions Directes*)
MFSVA	Ministry of Family Affairs, Solidarity, Living Together and Reception of Refugees (*Ministère de la Famille, des Solidarités, du Vivre ensemble et de l'Accueil*)
MFP	Ministry of the Civil Service (*Ministère de la Fonction Publique*)
MAINT	Ministry of Home Affairs (*Ministère des Affaires Intérieures*)
MLOGAT	Ministry of Housing and Spatial Planning (*Ministère du Logement et de l'Aménagement du Territoire*)

MMTP	Ministry of Mobility and Public Works (*Ministère de la Mobilité et des Travaux publics*) ABP: Public Buildings Administration (*Administration des Bâtiments Publics*) DAC: Civil Aviation Authority (*Direction de l'Aviation Civile*) PCH: Public Works Administration (*Administration des Ponts et Chaussées*)
M3S	Ministry of Health and Social Security (*Ministère de la Santé et de la Sécurité Sociale*)
MT	Ministry of Labour (*Ministère du Travail*) ITM : Labour and Mines Inspectorate (*Inspection du travail et des mines*)

Other acronyms that are commonly used

AEA	Annual Emission Allocation (under the ESD/ESR)
ARD	Afforestation, Reforestation, Deforestation
BTR	Biennial Transparency Report
CCS	Carbon Capture and Storage
CCU	Carbon Capture Utilisation
CCUS	Carbon Capture Utilisation and Storage
CEF	Climate and Energy Fund
CRTI-B	Technology and Innovation Resource Centre for the Construction Industry (*Centre de Ressources des Technologies et de l'Innovation pour le Bâtiment*), a department of the LIST.
CRT	Common Reporting Tables
CTF	Common Tabular Format
EEA	European Environment Agency
EED	Energy Efficiency Directive
EC	European Commission
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
EU	European Union
EU ETS	European Union Emission Trading Scheme
FEDIL	Federation of Luxembourg Industry (*Fédération de l'Industrie Luxembourgeoise*)
FNR	Luxembourg National Research Fund (*Fonds National de la Recherche*)
FTC	Finance, Technology Development and Transfer and Capacity-building
GEF	Global Environment Facility
GHG	Greenhouse Gas

ICF	International Climate Finance
ILR	Luxembourg Regulatory Institute (*Institut Luxembourgeois de Régulation*)
IPCC	Intergovernmental Panel on Climate Change
LIST	Luxembourg Institute of Science and Technology
LuxDev	Luxembourg's bilateral Development cooperation Agency
MPGs	Modalities, Procedures and Guidelines for the transparency framework
MRV	Monitoring, Reporting and Verification
NAP	National Adaptation Plan
NAS	National Adaptation Strategy
NDC	Nationally Determined Contribution
NECP	National Energy and Climate Plan
NID	National Inventory Document
NIR	National Inventory Report
ODA	Official Development Assistance
OPC	Climate Policy Observatory (*Observatoire de la Politique Climatique*)
PaMs	Policies and Measures
RED	Renewable Energy Directive
RES	Renewable Energy Source(s)
SNCA	National Automobile Traffic Society (*Société Nationale de Circulation Automobile*)
SNCH	National Certification and Approval Society (*Société Nationale de Certification et d'Homologation*)
SNCI	National Credit and Investment Society (*Société Nationale de Crédit et d'Investissement*)

Chapter I

Introduction

1. This is Luxembourg's first Biennial Transparency Report (BTR). The BTR is a key part of the Enhanced Transparency Framework established by Article 13 of the Paris Agreement. This BTR aims to provide clarity on climate change action in light of the Convention's objective and enhanced implementation, as set out in Article 2 of the Paris Agreement *[→ Section III.D & III.F]*. It also seeks to clarify and track progress towards achieving the individual Nationally Determined Contributions (NDCs) under Article 4 *[→ Section III.B & III.C]*, as well as the support provided to the other Parties *[→ Chapter V]*. Additionally, it aims to clarify the Parties' adaptation actions under Article 7 *[→ Chapter IV]*, including good practices, priorities, needs and gaps, in order to inform the Global Stocktake under Article 14.

2. This BTR complies with the modalities, procedures and guidelines for the transparency framework for action and support, as set out in Article 13 of the Paris Agreement (MPGs – Decision 18/CMA.1). It was primarily written by the Ministry of the Environment, Climate and Biodiversity (MECB), with contributions from other administrations acknowledged in the relevant chapters or sections. This first BTR provides an overview of the situation in Luxembourg as of **31 December 2024**.

3. This BTR comes with the associated CTF tables, which provide the necessary information to track progress in implementing and achieving NDCs (NDC tables), as well as information on financial, technology development and transfer and capacity-building support provided and mobilised (FTC tables).

Chapter II

National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

1. The National GHG Inventory Report is presented as a standalone report in accordance with paragraph 12 of Annex I of Decision 18/CMA.1. However, ***Section III.E*** is devoted to a summary of GHG emissions and removals in accordance with paragraph 91 of said decision.

2. The National Inventory Document (NID) can be found on the UNFCCC portal under "Biennial Transparency Reports".[1] It was submitted on 31 December 2024, alongside the Common Reporting Tables (CRT Tables). This submission's data is used consistently throughout Luxembourg's first BTR.

3. The NID has been written by the Environment Agency of the Ministry of the Environment, Climate and Biodiversity (MECB-AEV).

1 https://unfccc.int/documents/645242.

Chapter III

Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

III.A – National circumstances and institutional arrangements

1. *Section III.A* provides a description of Luxembourg's national circumstances, geography, and socio-economic developments, as requested by paragraph 59 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)] *[→ Sections III.A.1 to III.A.6]*. This section also outlines the institutional arrangements in place at EU and Member State level to track progress made in implementing and achieving the Nationally Determined Contribution (NDC), as requested by paragraph 61 of the MPGs *[→ Section III.A.7]*. *Section III.A* concludes with the legal, institutional, administrative and procedural arrangements for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to the implementation and achievement of the NDC under Article 4 of the Paris Agreement, as requested by paragraph 62 of the MPGs *[→ Section III.A.8]*.

2. A more detailed description of how national circumstances affect GHG emissions and removals, as well as how these circumstances and changes therein affected GHG emissions and removals over time (paragraph 60 of the MPGs) can be found in Luxembourg's 2024 National Inventory Document (NID), Section 2.2 [MECB-AEV (2024), pp. 133-139].[1]

3. This chapter has been written by the Ministry of the Environment, Climate and Biodiversity (MECB).

III.A.1 GOVERNMENT STRUCTURE[2]

4. The Grand Duchy of Luxembourg has been an independent sovereign state since the Treaty of London was signed on 19 April 1839. The country is a parliamentary democracy in the form of a constitutional monarchy and is the second smallest Member State of the EU-27, after Malta. For many years, it has been characterized by high economic and demographic growth rates. The country is located in the heart of North-Western Europe and has direct borders with Belgium, Germany and France *[→ Figure III.A.1-1]*. It is therefore a crossroad for international trade and related transport flows, the most dynamic source of its GHG emissions.

5. The organisation of the Grand Duchy starts from the principle that the responsibilities of the different powers should be given to diverse apparatus of the state. As in every parliamentary democracy, the separation of powers is flexible in Luxembourg: many links exist between the legislative and executive branches, and solely the judicial power remains completely independent.

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1 The NID can be found on the UNFCCC website: https://unfccc.int/documents/645242.

2 Part of this section is based on texts from the "official portal of the Grand-Duchy of Luxembourg": https://luxembourg.public.lu/en/society-and-culture.html.

6. Legislative power resides in the joint action of the Parliament (*Chambre des Députés*), the Government and the Council of State (*Conseil d'Etat*); each entity serving a wholly separate function.

7. Parliament is made up of 60 members of Parliament (hereafter, MPs) elected for a five-year term combining a one-person-one-vote suffrage and a system of proportional representation. Its primary function is to vote on bills submitted by the Government and to control the executive branch. The MPs also possess a right of parliamentary initiative which is exercised by bringing in bills (*propositions de Loi*).

8. The Government has a right of initiative in legislative matters known as governmental initiative, which allows it to bring in bills (*projets de Loi*). After being examined by the Council of State, bills are put to the vote before Parliament, where the government normally holds a majority. After the parliamentary vote, the Grand Duke promulgates the legislative text, i.e. he commands its publication in the compendium of legislation known as the *Mémorial*, whereupon the text acquires legal status ***[→ Box 1]***.

9. The Council of State is composed of 21 councillors. State councillors are formally appointed and dismissed by the Grand Duke on proposal by the Government, Parliament or the Council of State. In Luxembourg's unicameral system, the Council of State exerts the moderating influence of a second legislative assembly. It is required to voice its opinion on all items of legislation; that is to say on all bills brought in before the Parliament prior to voting by the MPs. Its opinion must entail a thorough examination to ensure compliance of the draft texts with the Constitution, international conventions and the rule of law. The role of the Council of State is one of persuasion rather than enforcement and is therefore advisory in nature.

10. Executive power is the prerogative of the Grand Duke, together with the Government and its members, i.e. the Ministers and, eventually, Secretaries of State. In practice, the Grand Duke chooses the Prime Minister based on election results. The elections take place every five years, currently always one year prior to the election of the members of the European Parliament (the "European Elections"). Then, the Prime Minister himself proposes the members of the Government. The Government appointed by the Grand Duke presents its political programme to the Parliament, which takes a vote of confidence, thereby giving the newly appointed Government a parliamentary majority on which it can rely. The actual government resulting from the general election of 8 October 2023 was appointed on 17 November 2023. It is made up of the Prime Minister, one Deputy Prime Minister and 13 members bearing the title of Minister. It is worth noting that the number of ministerial departments generally exceeds the number of

members of the Government called upon to serve in office; thus, a single minister normally holds more than one portfolio.[3]

11. As a conclusion, a parliamentary democracy in the form of a constitutional monarchy suits perfectly well to a country such as Luxembourg where social consensus and dialogue are key words. Consensus and dialogue have been, and will continue to be, of particular relevance for the definition of climate change related policies and action plans, as well as for the designing of related legislative texts. Luxembourg's National Energy and Climate Plan (NECP) [MECDD and MEA (2020)] and its regular updates [MECDD and MEA (2023) and MECB and MECO (2024)] are good examples of bringing these two key words into play *[→ Section III.D.2.2.1]*.

BOX 1 – LEGISLATIVE PROCEDURE IN LUXEMBOURG

Two types of legislative initiative are distinguishable:

> *Projet de Loi*: this preliminary draft of a law is drawn up by the relevant Ministry, approved by the Cabinet and then submitted to the Council of State for its opinion. It is then submitted to the Parliament.
>
> *Proposition de Loi*: one or more MPs may bring in a bill, which is submitted to the Conference of Presidents of the Parliament, which decides on its referral to a committee. The text of the proposal is submitted to the Council of State for its opinion and sent to the Government for its position.

Once the Council of State has given its opinion, the bill is sent to the relevant parliamentary committee, which examines it and reports to the Parliament.

The debate in plenary session of the Parliament is conducted in two stages: a general discussion and a discussion article by article. Any deputy may propose amendments.

In Luxembourg's unicameral system, once the Parliament has voted on the draft, it must vote a second time on the whole text after a period of at least three months. It can however dispense with this vote if the Council of State accepts the waiver. If the latter does not give its consent, the Parliament must hold a second vote after a minimum period of three months.

The law finally adopted by the Parliament enters into force only after it has been promulgated by the Grand Duke, i.e. published in the *Mémorial* (compendium of legislation).

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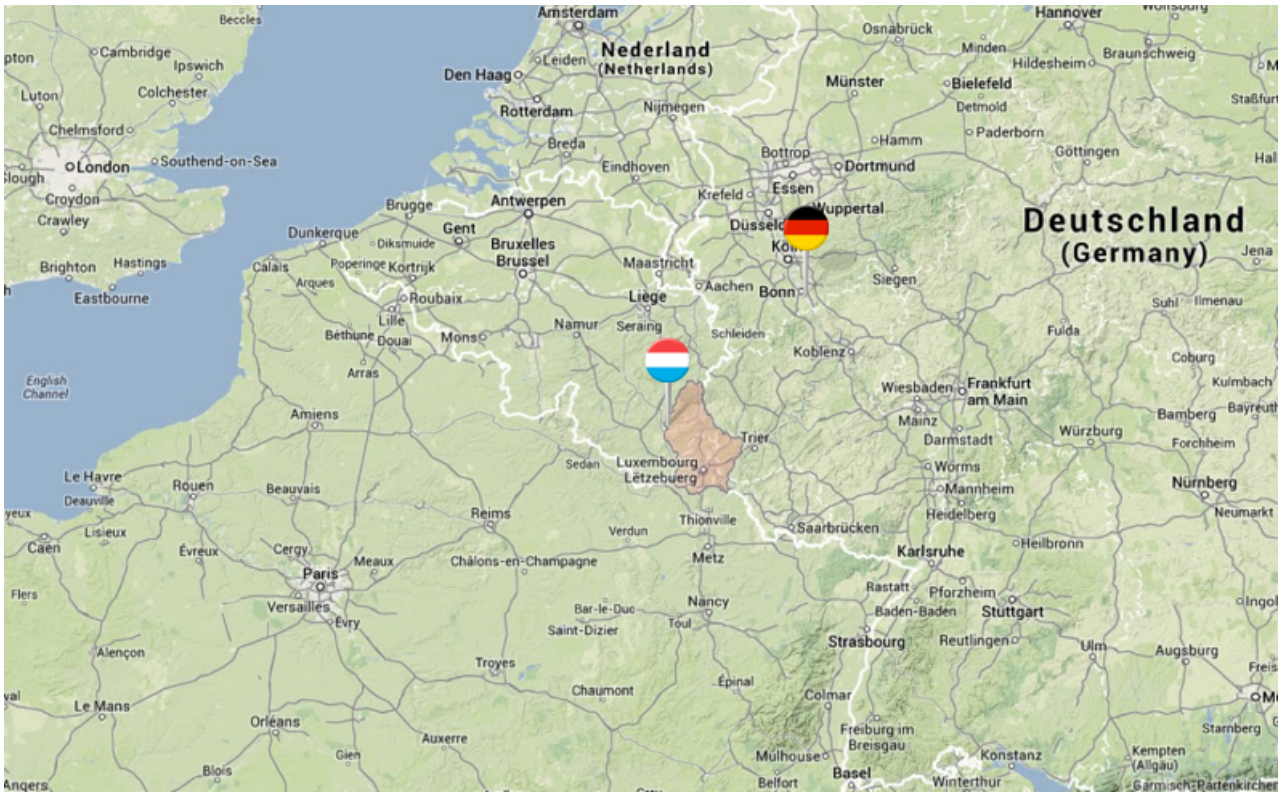
3 For more information on the Government in place in Luxembourg since November 2023, refer to https://gouvernement.lu/fr/gouvernement.html.
For its political programme, see [Government of the Grand Duchy of Luxembourg (2023)]. Climate change related actions are presented on pages 51 to 59.

FIGURE III.A.1-1 – GEOGRAPHIC LOCATION OF LUXEMBOURG



Source: Google Maps.

III.A.2 POPULATION AND WORKFORCE PROFILES

III.A.2.1 A strong population growth driven by immigration

12. At the end of 2022, the population of Luxembourg was estimated to 682 000 inhabitants. Since 1960, the residential population has grown by some 368 000 inhabitants or about 117% – or 79% since 1990 *[→ Figure III.A.2-1]*.

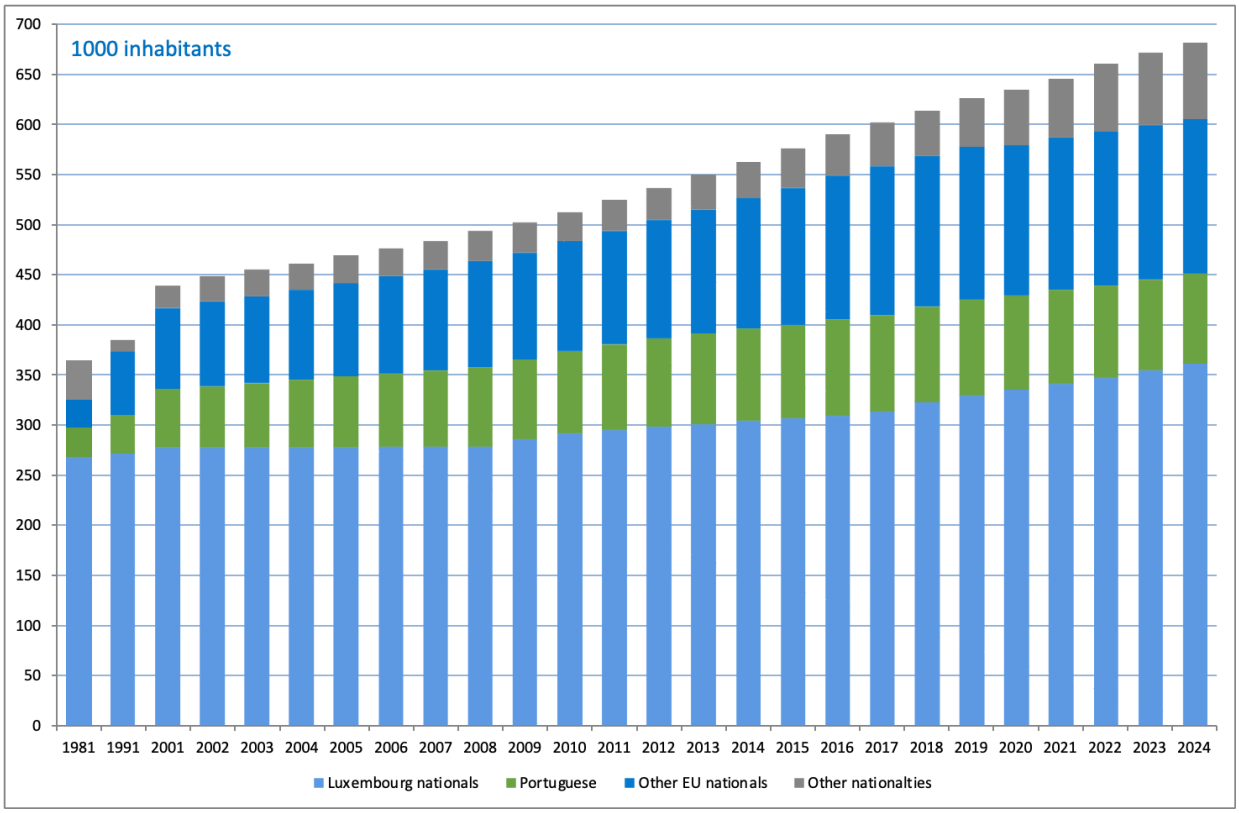
13. In fact, demographic growth in Luxembourg is dominated by immigration. The number of nationals themselves has stagnated and would even have fallen had it not been for immigrants acquiring Luxembourg nationality. This procedure was simplified about 10 years ago, which explains the slightly increasing trend in *Figure III.A.2-1*. At the end of 2024, 47% of the resident population did not have Luxembourg nationality. In 1990, this percentage was only around 30%. The main driver of these demographic trends is the economic restructuring and development of the country towards the tertiary sector, coupled with attractive wages *[→ Section III.A.4]*.

14. As population projections are based on scenarios derived from past statistical data, the population projections represent a continuation of the demographic trend in Luxembourg. Projections calculated by STATEC in 2024 for the update of the NECP predict that, under the "baseline" scenario, Luxembourg could have almost 926 000 inhabitants by 2050 *[→ Figure III.A.2-2]*. As with any forecast, these projections should be treated with caution, as

they cannot predict radical changes in the economic structure or demography of a country, especially a small one whose economy is heavily dependent on a few sectors. However, as population growth is one of the main drivers of domestic energy consumption, mainly in the housing and transport sectors, these projections illustrate the scale of one of the many challenges facing Luxembourg in defining measures to reduce its GHG emissions.

15. It is also worth looking at households when discussing population growth. Based on the population censuses, which usually take place every ten years, the number of households increased by 90.5% between the 1991 and 2021 censuses (from 144 696 households in 1991 to 275 600 in 2021), i.e. more than the population (+65.7% between 1991 and 2021). As a result, the average number of persons per household felt from 2.69 in 1991 to 2.33 in 2021. The projections calculated by STATEC and the Housing Observatory foresee an increase in the number of households in line with the forecasted population growth, combined with a steady decline in the average number of persons per household (2.58 in 2020, 2.41 in 2030 and 2.17 in 2050) *[→ Figure III.A.2-3]*.

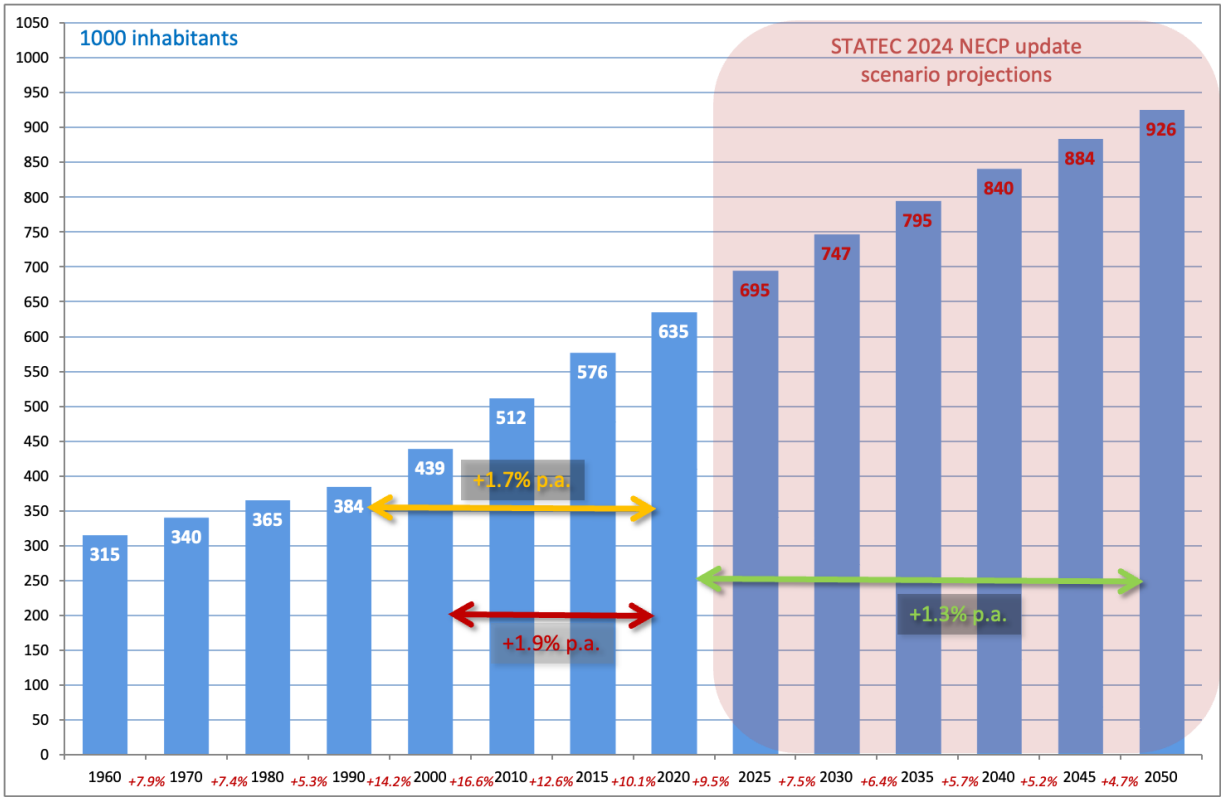
FIGURE III.A.2-1 – EVOLUTION OF THE POPULATION ON 31ST DECEMBER: 1981-2024



Source: STATEC, *Statistical Yearbook*, Table B.1101 (updated 13.05.2025).

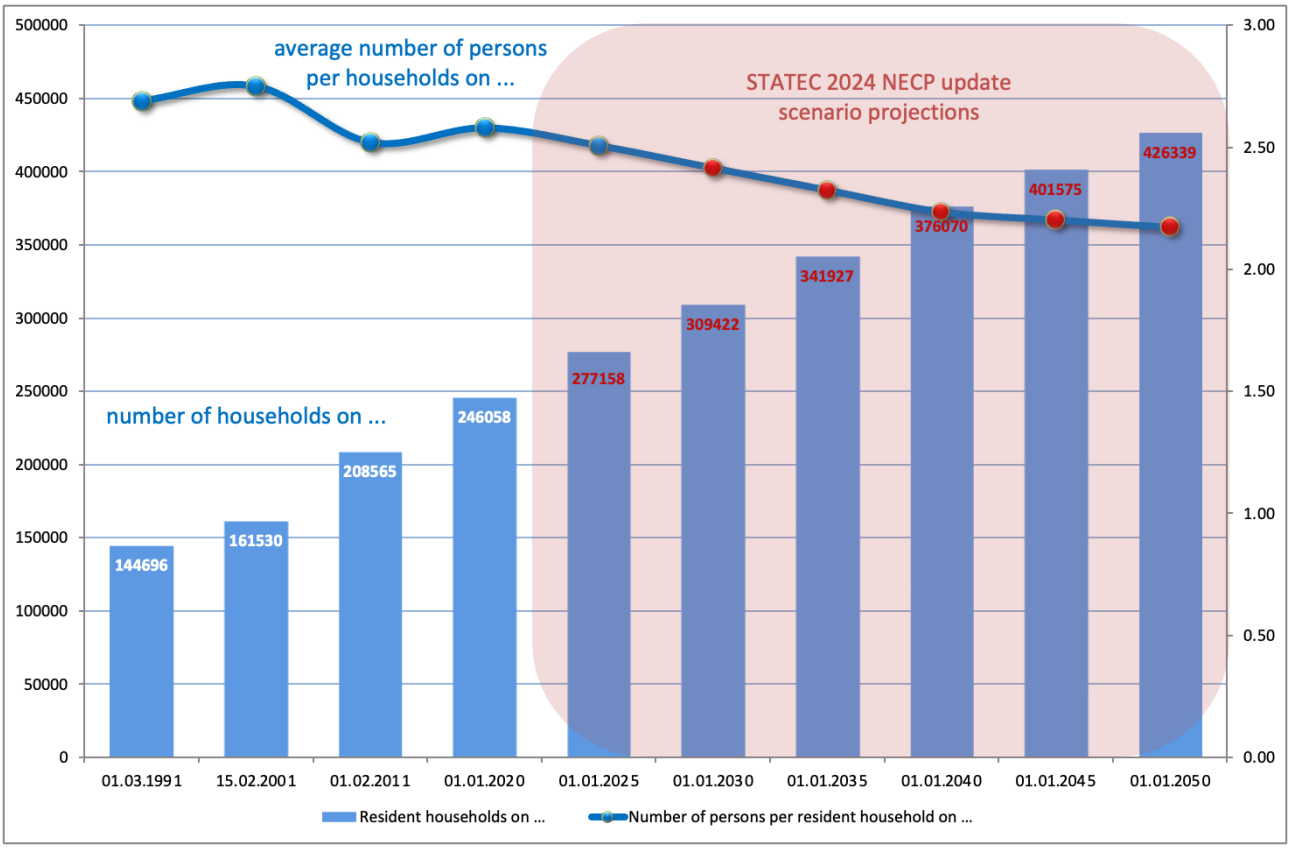
Note: 1981, 1991 & 2001: data from the population censuses.

FIGURE III.A.2-2 – POPULATION GROWTH ON 31ST DECEMBER: 1960-2050



Source: STATEC, *Statistical Yearbook*, Table B.1100 (updated 13.05.2025) and STATEC projections for the 2024 NECP update.

FIGURE III.A.2-3 – HOUSEHOLDS AND AVERAGE NUMBER OF PERSONS PER HOUSEHOLDS: 1991-2050



Source: STATEC, population censuses (updated 06.09.2021) and STATEC projections for the 2024 NECP update.

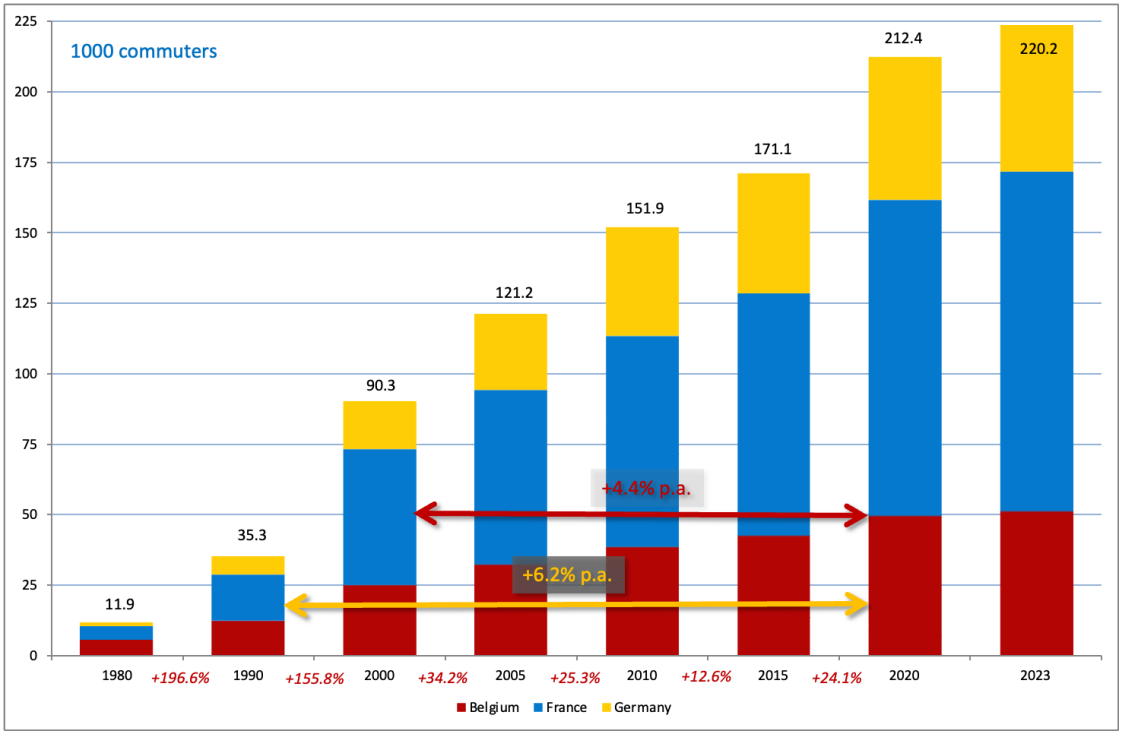
III.A.2.2 Workforce: the importance of cross-border commuters

16. The economic restructuring and development of Luxembourg has led to a near doubling of the labour force over the last 20 years (and a 135% increase over the last 30 years). The resident population of Luxembourg nationality was unable to meet this growing demand for labour. So how could this pressing economic need be met? Today, around 70% of the country's workforce does not have Luxembourg nationality. This part of the workforce is made up of migrant or cross-border workers.

17. Between 1990 and 2023, the number of cross-border workers increased from 35 300 to 223 800 *[→ Figure III.A.2-4]*.[4] In 2023, of the commuters employed in Luxembourg, 53.9% came from France, 23.3% from Germany and 22.8% from Belgium. Overall, commuters accounted for 43.7% of Luxembourg's employed population and 33.3% of the resident population.[5] The commuting flows between the different regions of the "*Grande Région*" *[→ Box 2]* clearly show the economic attractiveness of Luxembourg *[→ Figure III.A.2-5]*.

18. The vast majority of cross-border workers commute by car. However, in order to change the current modal split of home-work journeys, Luxembourg is investing mainly and jointly with neighbouring regions in public transport.

FIGURE III.A.2-4 – CROSS-BORDER COMMUTERS GROWTH: ANNUAL CUMULATIVE AVERAGES 1980-2023

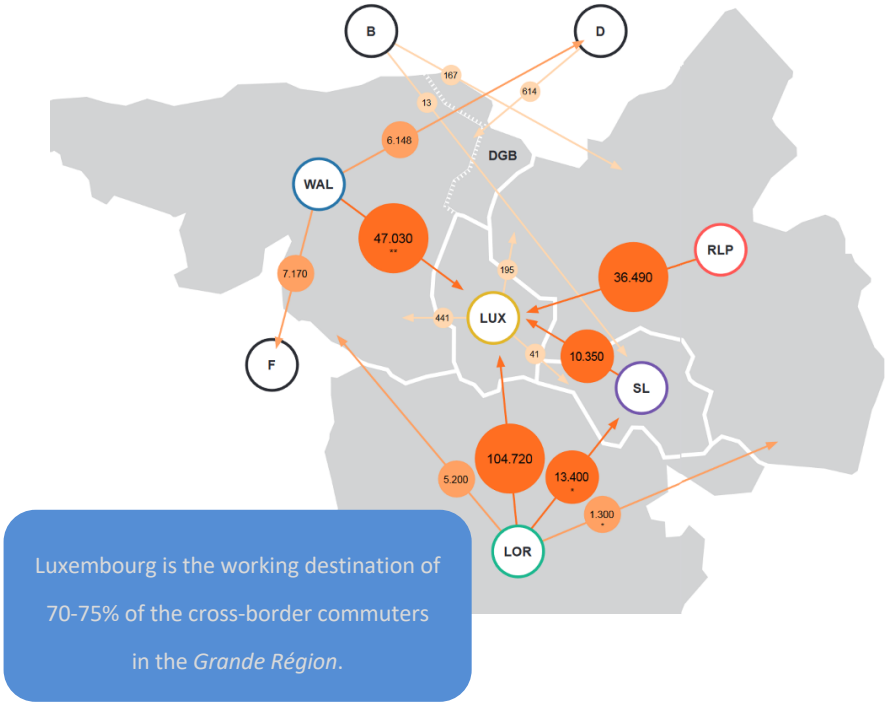


Source: STATEC, *Statistical Yearbook*, Table B.3107 (updated 08.10.2024).

4 Figures indicated in this paragraph are annual cumulative averages. For confidentiality and ethical reasons it is not straightforward to find statistics on foreign workers which reside in Luxembourg.

5 Calculated from STATEC, *Statistical Yearbook*, Tables B.1100 and B.3107.

FIGURE III.A.2-5 – COMMUTING FLOWS 2021



Luxembourg is the working destination of 70-75% of the cross-border commuters in the *Grande Région*.

Source: IBA-OIE, *Chiffres clés 2021 du marché de l'emploi transfrontalier de la Grande Région*. https://granderegion.net/Mediatheque/Publications/Chiffres-cles-2021-du-marche-de-l-emploi-transfrontalier-de-la-Grande-Region

BOX 2 – THE *GRANDE RÉGION*

The *Grande Région* is the geographic unit that includes Luxembourg, the Region of Wallonia in Belgium, Lorraine in France and two German Länder: Saarland and Rhineland-Palatinate.

Today, this structure is more a cooperative space than an effective integrated region defining and modelling its own policies and development. This is the result of the diversity of the territories constituting the *Grande Région*, of its dimension and of the barriers created by institutional and administrative structures in each country. De facto, being a sovereign state amongst country regions, Luxembourg has a special status in this cooperative space: it is the main driving force behind the *Grande Région*, a position re-enforced by its demographic and economic development as shown by the figures in the table below.

Grande Région entity	population change (1st January) % 2000-2020	population annual average growth rate (1st January) % 1990-2020	GDP at current price annual average growth rate % 1990-2020	Salaried employment 2020 2000 = 100
BE-Wallonia	9.15%	0.88%	5.81%	121
DE-Rheinland-Pfalz	1.57%	0.16%	4.25%	114
DE-Saarland	-7.90%	-0.82%	2.86%	102
FR-Lorraine	0.03%	0.00%	3.02%*	91
Luxembourg	**44.40%**	**3.74%**	**10.76%**	**181**

More information on the *Grande Région* can be found on line:

http://www.granderegion.net/

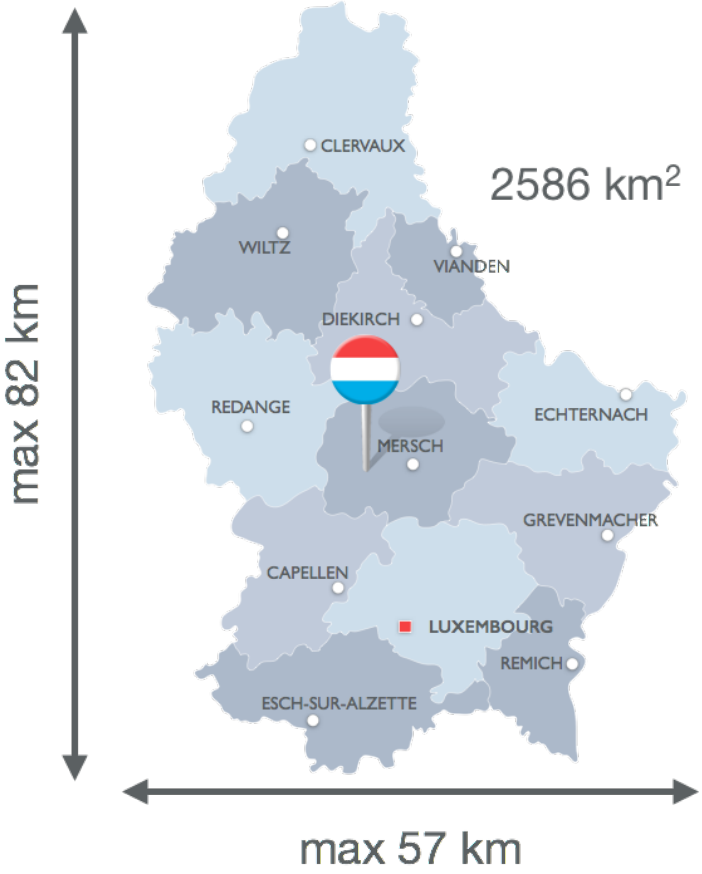
http://www.grande-region.lu/portal/

III.A.3 GEOGRAPHICAL PROFILE

19. Luxembourg is a territory of 2 586 km². The maximum distance from north to south is some 82 km, from west to east about 57 km *[→ Figure III.A.3-1]*. Of the total area of Luxembourg, in 2024, 84.4% was agricultural land and land under forest – with around 60.9% for agriculture and 23.5% for forests. The built-up areas occupied 11.8% of the total surface and land covered by water and transport infrastructure about 5.2% *[→ Table III.A.3-1 & Figure III.A.3-2]*. To complete the picture, a geological map of Luxembourg is presented *[→ Figure III.A.3-3]*.

20. The north of Luxembourg is a part of the Ardennes and is called *Ösling*. Its altitude is at an average of 400 to 500 meters above sea level. The *Ösling* landscape is affected by hills and deep river valleys, as for instance the Sure River (*Sauer*). With 560 m, the highest elevation is called the *Kneiff* in Wilwerdange. In the South of Luxembourg lies the rank *Gutland*, which belongs to the *Lothringer Stufenland*. This area has higher population and industrial densities than *Ösling*. The lowest point in the country, called *Spatz* (129 m above sea level), is located at the confluence of the Moselle and the Sure rivers in Wasserbillig. The most important rivers are the Moselle, the Sure, the Our – all three delimiting the border with Germany – and the Alzette.

FIGURE III.A.3-1 – LUXEMBOURG SIZE



Source: MECB.

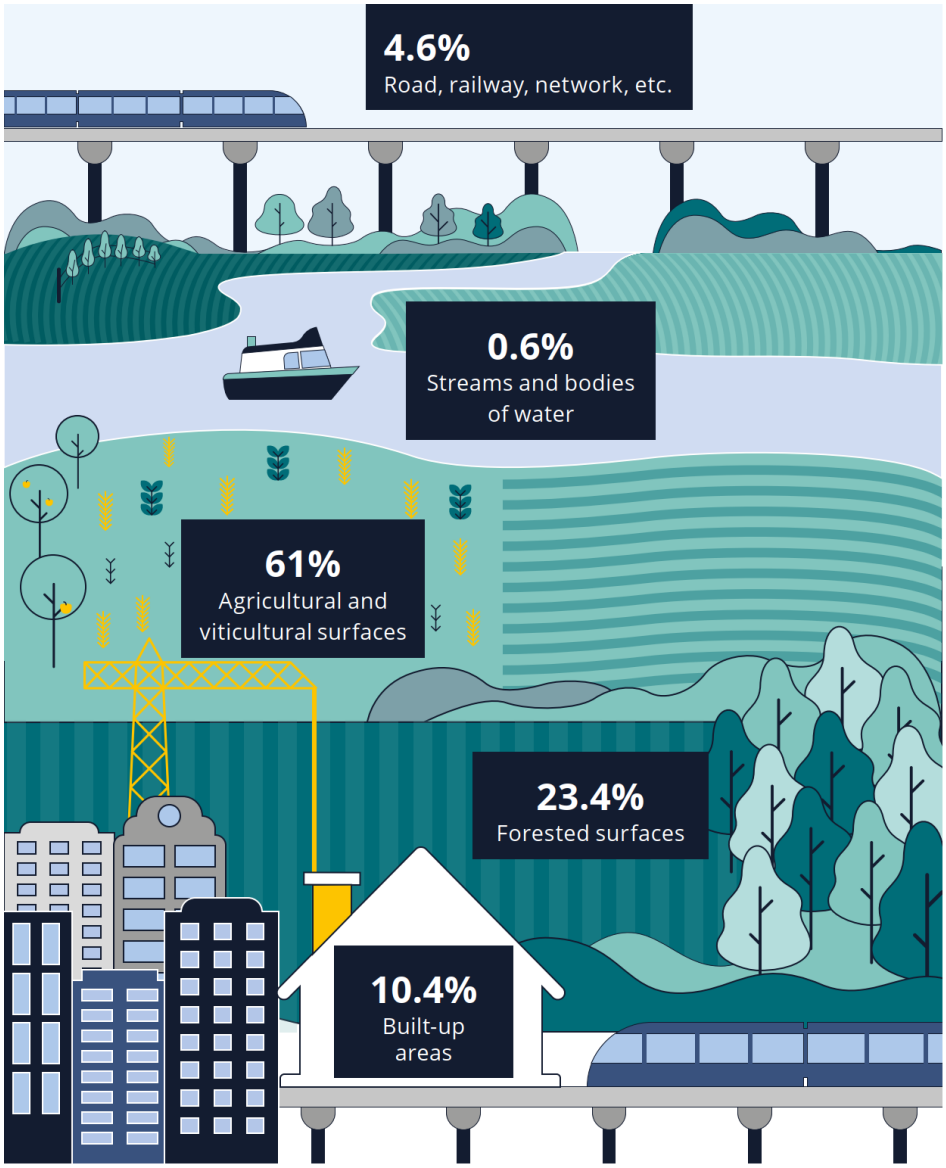
TABLE III.A.3-1 – LAND USE IN LUXEMBOURG: 1972-2024

percentages	1972	1990	2000	2010	2015	2020	2023	2024
Total land	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Agricultural and wine growing area	93.2	91.8	64.1	62.5	62.0	61.3	61.0	60.5
Wooded area	incl. in agriculture		23.3	23.2	23.3	23.4	23.4	23.5
Built-up area	3.1	4.3	8.1	9.3	9.7	10.1	10.4	10.4
of which industrial area & other	*na*	*na*	*2.7*	*3.0*	*3.0*	*3.1*	*3.2*	*3.2*
Transport network	3.2	3.4	3.9	4.4	4.4	4.5	4.6	4.6
Watercourses & sheets of water	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6

Source: STATEC, *Statistical Yearbook*, Table A.1101 (updated 05.06.2025).

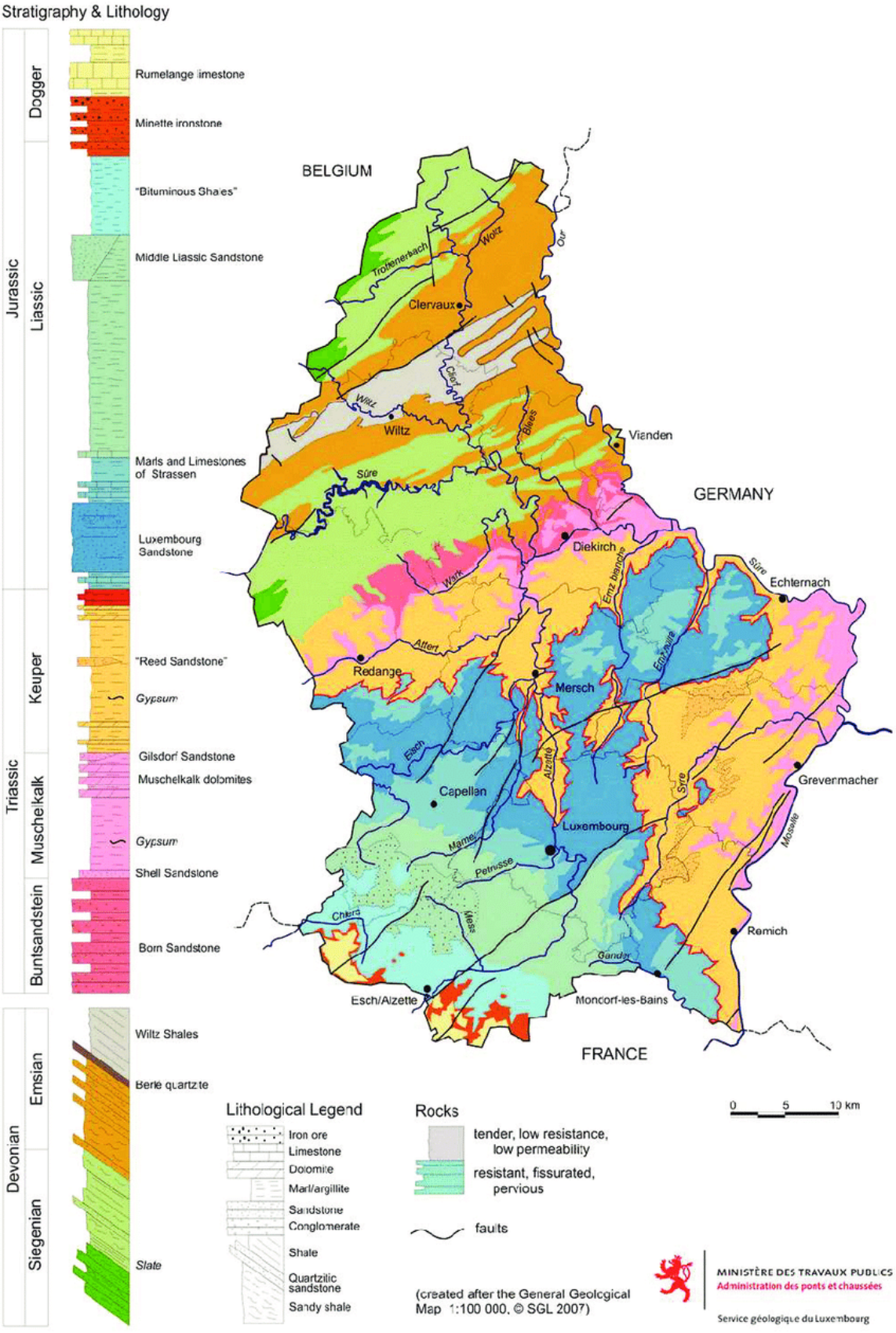
Note: na = not available.

FIGURE III.A.3-2 – LAND USE IN LUXEMBOURG: 2023



Source: STATEC, *Luxembourg in Figures 2024*
https://statistiques.public.lu/dam-assets/catalogue-publications/luxembourg-en-chiffres/2024/luxembourg-in-figures-2024.pdf.

FIGURE III.A.3-3 – GEOLOGICAL MAP OF LUXEMBOURG'S TERRITORY



Source: Public Works Administration (MMTP-PCH), *Service géologique du Luxembourg*: https://pch.gouvernement.lu/fr/administration/organigramme/service-geologique-de-l-Etat.html.

III.A.4 ECONOMIC PROFILE

21. One of the main characteristics of economic growth in Luxembourg is its volatility. In general, the business cycle in Luxembourg follows that of other European countries, but the amplitude of GDP fluctuations is more pronounced. This is a common feature of small economies that are open to the outside world and therefore more vulnerable to external shocks.

III.A.4.1 A bit of history

22. The beginning of the twentieth century until the First World War was characterised by the sustained growth of the steel industry, which attracted new inhabitants and led to a concentration of the population in the city of Luxembourg and the canton of Esch-sur-Alzette (mining region), whereas Luxembourg had previously been a more rural country. Subsequently, until the 1950s, economic development was largely stagnant (average annual GDP growth of 1.6%) due to the crises associated with the two world wars and the economic recession of the early 1930s.

23. After the Second World War, during the "*Trente glorieuses*" (i.e. 1945-1975), GDP growth reached levels of almost 4% per year. The world economic crisis of 1975-1985 put a temporary end to these years of exceptional growth. Average annual GDP growth during this period was "only" 2.3%.

24. Nevertheless, during the 1960s Luxembourg's economic growth was slightly below the percentages recorded for the then Member States of the European Community.[6] This is one of the reasons that encouraged the authorities to diversify the economy, which gradually moved from an industrial to a services-based structure. This led to exceptional growth in Luxembourg from the mid-1980s onwards, largely as a result of a boom in the financial sector: both the level of GDP per capita and GDP growth then exceeded those of the majority of European industrialised countries at the time.[7]

25. More specifically, when looking at the respective contributions of labour productivity and employment to economic growth in Luxembourg, there is a clear break between the periods 1960-1985 and 1985 and after. This reveals a real change in the "economic regime" of the country. Until the mid-1980s, annual fluctuations in GDP were largely due to fluctuations in productivity. The period between the end of the Second World War and the 1980s is characterised by what could be called an "industrial regime". At that time, steel production was at the heart of the Luxembourg economy and the economic somersaults could therefore be attributed to this sector. Then, from the mid-1980s onwards, fluctuations in GDP and labour productivity began to diverge and employment became the main driver of economic growth. In addition, productivity

6 Annual average GDP growth 1960-1974: Luxembourg: +4.1%, UE-15: +4.6%.

7 Annual average GDP growth 1985-2007: Luxembourg: +5.3%, UE-15: +2.3%.

tended to decline. This is the period in which the economy shifted towards a services-based economy, driven by the financial sector, and in which Luxembourg began to significantly outperform its neighbours from the second half of the 1980s onwards. This period is also characterised by the beginnings of high population growth and cross-border commuting (as shown in *Section III.A.2*).

III.A.4.2 Recent economic development: the decline of industry and the growing importance of financial and business services

26. The economic restructuring and development of the country towards the tertiary sector described in the previous section has resulted in the following economic cycles since 1990:

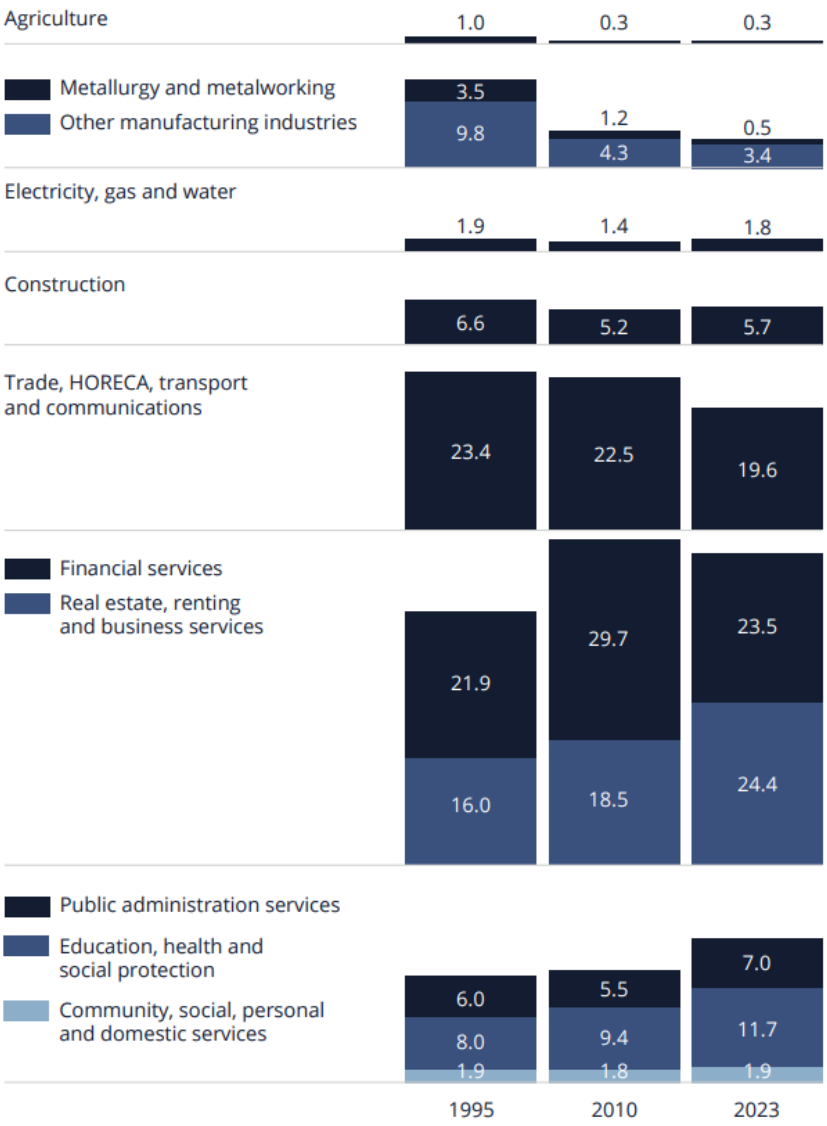
- up to 1992, the continuation of the exceptional growth that began around 1985;
- the effects of the economic slowdown in Luxembourg between 1992 and 1996 and the economic downturn in 2001 – as well as the less impressive growth in 2002-2004 – which is reflected in a stagnation of the level of GDP per inhabitant in Luxembourg compared to the EU-15;
- Luxembourg's good economic performance between 2005 and 2008;
- the financial and economic crisis that began at the end of 2008 and was particularly pronounced in the first half of 2009;
- from 2010 onwards, a very slow recovery was observed, although it flattened out quickly for the industrial and commercial sectors;
- steady growth from 2013, abruptly halted by the Covid-19 pandemic. However, the downturn in economic activity in 2020 was less pronounced than in Europe as a whole;
- then, like most Western countries, Luxembourg was hit by the aftermath of the Covid-19 pandemic, the rise in energy prices, exacerbated by Russia's war of aggression against Ukraine. As a result of this strong pressure on energy prices, the sharp rise in inflation had a negative impact on economic activity. Luxembourg experienced a minor recession in 2022 and 2023 with negative growth of -1.1% in 2022 and -0.7% in 2023, before rebounding to 1.0% in 2024.

27. Today, the financial intermediation (banking and insurance), real estate, and services to business sector predominantly generate gross value added. This branch's share of total gross value added has increased from approximately 38% in 1995 to 48% in 2023.[8] The industry sector's share decreased significantly from 13% in 1995 to 4% in 2023. Trade, HORECA (hotels, restaurants, cafés), transport and communications accounted for 23% and 20% of the total gross value added in 1995 and 2023, while construction maintained a steady share at approximately 5-6%. The

8 Data prior to 1995 are and will not be translated into the new European System of Accounts (ESA).

agricultural sector made a negligible contribution, accounting for less than 1% *[→ Figure III.A.4-1]*.

FIGURE III.A.4-1– SECTORAL GROSS VALUE ADDED AT CURRENT PRICES: 1995-2023



Source: STATEC, *Luxembourg in Figures 2024* https://statistiques.public.lu/dam-assets/catalogue-publications/luxembourg-en-chiffres/2024/luxembourg-in-figures-2024.pdf.
Note: HORECA – Hotels, Restaurants, and Cafés.

28. It is therefore clear that the financial sector has been the main driver of the economy for more than three decades. Luxembourg is a world leader in the investment fund industry and the private banking centre of the euro area. In terms of assets under management, with more than EUR 7.33 trillion, Luxembourg is the largest investment fund centre in Europe. It is the largest global distribution centre for investment funds, with Luxembourg-domiciled investment funds distributed in 80 countries around the world.[9] However, the radical shift from an industrial economy based on steel to a service economy based on banking and finance, which began in the

[9] Source: LFF – Luxembourg for Finance: https://www.luxembourgforfinance.com/en/financial-centre/key-figures/.

1960s, has resulted in an economy that is once again dominated by a small number of activities. So much so that there is currently a high correlation between changes in banking activity and GDP. In order to increase the resilience of the Luxembourg economy, recent governments have therefore promoted economic diversification and transformation through a number of initiatives. One of these is the "Luxembourg Cluster Initiative", launched in 2022, which actively promotes networking between the private and public sectors in areas where Luxembourg may have a comparative advantage. The focus is on key technologies identified as important for the future sustainable development of the Luxembourg economy. The seven "clusters" are (i) Agrifood, (ii) Automobility, (iii) HealthTech, (iv) Creative Industries, (v) CleanTech, (vi) Materials and Manufacturing, and (vii) Wood.[10] The Automobility, CleanTech and, to a lesser extent, the Materials and Manufacturing as well as Wood "clusters" might have implications with regard to measures for reducing GHG emissions in Luxembourg.

29. Today, in addition to the financial centre, which remains the mainstay of the economy, Luxembourg presents itself as a logistics hub and a leader in media and communication (RTL Group), satellite technology and digitalisation.

III.A.5 CLIMATE PROFILE

30. The climate profile is presented in *Chapter IV* on information related to climate change impacts and adaptation under Article 7 of the Paris Agreement.

III.A.6 SECTOR DETAILS

31. The various profiles presented above (social, economic and geographical) and their influence on sectoral GHG emissions are detailed in Luxembourg's 2024 National Inventory Document (NID), Section 2.1, pp. 88 to 132 [MECB-AEV (2024)].

III.A.7 INSTITUTIONAL ARRANGEMENTS FOR TRACKING PROGRESS

32. As an EU Member State, Luxembourg contributes to the implementation of the European Union's updated NDC *[→ Sections III.B and III.C]*.[11] To monitor progress in implementing and achieving the European target for 2030, institutional arrangements have been established at EU and Member State levels, as outlined below. In practice, the sections on specific provisions at the EU level may contain text that is common to the BTRs of the EU and of the Member States.

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10 For more details, see the portal and the website presenting the "innovative clusters": https://www.luxinnovation.lu/innovate-in-luxembourg/luxembourg-cluster-initiative/.

11 The update of the Nationally Determined Contribution of the European Union and its Member States is available here: https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf.

33. The EU and its Member States have specific arrangements in place to track progress towards the implementing and achieving of the EU NDC. These arrangements include the tracking of GHG emissions and removals, the reporting of policies and measures, and projections of GHG emissions and removals. These processes are specified in the Regulation on the Governance of the Energy Union and Climate Action (hereafter referred to as "Governance Regulation")[12] and in the Directive establishing a system for greenhouse gas emission allowance trading within the Community ("ETS Directive").[13]

34. Under the Governance Regulation, the EU has established a Union Inventory System to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the data reported by the EU and its Member States. This inventory system includes a quality assurance and quality control programme, procedures for setting emission estimates, and comprehensive reviews of national inventory data to enable the assessment of compliance towards climate goals.

35. Each EU Member State compiles its GHG inventory in accordance with the requirements of the Paris Agreement[14] and the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines.[15] Inventory data on GHG emissions and removals, including information on methods, are submitted electronically using a reporting system – *Reportnet 3*[16] – managed by the European Environment Agency (EEA). The submitted data are subject to quality control procedures and feed into the compilation of the GHG inventory of the EU. Net GHG emissions, calculated from emissions and removals reported in the GHG inventory of the EU, are the key information used for tracking progress towards the EU NDC target of a -55% net emission reduction by 2030 compared to 1990.

36. The updated scope of the EU NDC is supplemented by additional information that clarifies precisely which international aviation and maritime emissions are covered by the EU NDC. These emissions are calculated using the Integrated Database of the European Energy System (JRC-IDEES) from the Joint Research Centre.[17] Details of the methodology used to identify GHG

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12 Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action (…) (http://data.europa.eu/eli/reg/2018/1999/oj), amended (http://data.europa.eu/eli/reg/2018/1999/2023-11-20).

13 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (http://data.europa.eu/eli/dir/2003/87/oj), amended (http://data.europa.eu/eli/dir/2003/87/2024-03-01).

14 Chapter II of the annex to decision 18/CMA.1 (https://unfccc.int/documents/193408) and decision 5/CMA.3 (https://unfccc.int/documents/460951).

15 2006 IPCC Guidelines for National Greenhouse Gas Inventories (https://www.ipcc-nggip.iges.or.jp/public/2006gl/) and, on a voluntary basis,: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/).

16 https://reportnet.europa.eu/.

17 European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024 (https://publications.jrc.ec.europa.eu/repository/handle/JRC137809).

emissions from international aviation and navigation within the scope of the EU NDC, which are added to the national totals from the EU GHG inventory, can be found in *Section III.B.2*.

37. Under the Governance Regulation, Member States must report to the Commission biennially on the implementation status of their integrated National Energy and Climate Plans (NECPs), which cover climate and energy policies for the period 2021–2030 (for Luxembourg see *Section III.D.2.2.1*).[18] These reports, known as National Energy and Climate Plan Progress Reports (NECPRs), enable the Commission to ensure that the EU and its Member States are on track to achieve climate neutrality and make progress on adaptation. Therefore, the NECPs play a key role in enabling progress towards the 2030 climate and energy targets to be tracked. The recent 2024 updates to the NECPs gave Member States the opportunity to evaluate their progress, identify areas for improvement and develop new measures as necessary.

38. Under the Governance Regulation, Member States further operate national systems for policies and measures and projections and submit standardised information, which is subject to quality and completeness checks (for Luxembourg see *Section III.D.4.1*). Based on the submitted data, the EEA compiles projections of GHG emissions and removals for the EU. The EU-wide information is summarised annually in the "Climate Action Progress Report"[19] by the European Commission and in the "Trends and projections Report" by the EEA.[20] Both the Union and the national systems are subject to continuous improvements.

39. Regarding the arrangements for internationally transferred mitigation outcomes (ITMOs), there are no specific plans in place to monitor progress, as ITMOs are not used to achieve national climate targets or contribute to the EU's NDC.

III.A.8 INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION OF THE NDC

40. The EU and its Member States have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law[21] sets the goal of climate neutrality by 2050 and the intermediate target of reducing net GHG emissions by at least 55% by 2030 compared to 1990 levels (see also *Section III.D.1.3*). This target for 2030 corresponds to the target of the EU NDC.

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18 See https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en.

19 Climate Action Progress Report 2024 (under the Energy Union Reporting set out in the Governance Regulation): https://climate.ec.europa.eu/eu-action/climate-strategies-targets/progress-climate-action_en.

20 Trends and Projections in Europe 2024: https://www.eea.europa.eu/en/analysis/publications/trends-and-projections-in-europe-2024.

21 Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 - "European Climate Law" – (http://data.europa.eu/eli/reg/2021/1119/oj).

41. To ensure that the EU and its Member States achieve their target, the "2030 Climate and Energy Framework"[22] was put in place (see also ***Section III.D.1.2***). The main elements of this framework are the EU Emissions Trading System (EU ETS),[23] which caps GHG emissions in electricity and heat generation, industrial manufacturing, aviation (since 2012) and maritime transport (since 2024); the LULUCF Regulation[24] which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR)[25] which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation, i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste ***[→ Box 3]***. The implementation of the ESR is supported by additional sectoral policies and measures (details for Luxembourg can be found in ***Section III.D.3*** on national mitigation policies and measures). The legislative acts under the "2030 Climate and Energy Framework" require the European Commission and the EU Member States to set up the institutional arrangements for implementing the specific policies and measures.

42. Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the previous year, information on policies and measures, projections, and progress towards the implementation of NECPs. This information helps the EU and its Member State to correct their course if progress towards the targets of the "2030 Climate and Energy Framework" is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States will be subject to comprehensive reviews in 2025, 2027 and 2032.[26]

43. All EU legislation, including the legislation under the "2030 Climate and Energy Framework", is subject to a stakeholder engagement process. So-called "better regulation tools" ensure that

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22 https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2030-climate-targets_en.

23 This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the "Emissions trading system for buildings, road transport and additional sectors" (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

24 Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (http://data.europa.eu/eli/reg/2018/841/oj, revised http://data.europa.eu/eli/reg/2018/841/2023-05-11).

25 Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (https://eur-lex.europa.eu/eli/reg/2018/842/oj) amended by Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999 (http://data.europa.eu/eli/reg/2023/857/oj).

26 Consolidated text (2023) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, https://eur-lex.europa.eu/eli/reg/2018/1999/2023-11-20.

policy is based on evidence and the best available practice.[27] During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder organisations to provide their views on the subject of the new legislation. These comments are documented in a dedicated portal,[28] and the European Commission reports on how it takes these comments into account in the development of the legislative proposals. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

44. Luxembourg's own Climate Law (PaM n°101) is presented in ***Section III.D.2.2.2***, as it is one of the main policies that the country has implemented to enshrine its ambitions and monitor progress towards them in a legally binding document.

BOX 3 – KEY EUROPEAN POLICIES TO REDUCE GREENHOUSE GAS EMISSIONS

The revised ETS Directive increases the level of ambition in the existing system from 43% to 62% emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42% emission reduction target compared to 2005 across the sectors covered. The ESR increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29% to 40% by 2030, compared to 2005, which translates in updated 2030 targets for each Member State (for Luxembourg from minus 40% to minus 50% - however, Luxembourg has an unilateral commitment which is higher, minus 55%: see Section III.D.1.2). The new LULUCF Regulation sets an overall EU-level objective of 310 Mt CO_2 equivalent of net removals in the LULUCF sector in 2030, which is the sum of national targets of the greenhouse gas net emissions and removals by Member States in 2030. The national target for Luxembourg in the LULUCF sector is a net removal of 0.403 Mt CO2e.

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing effort sharing sector GHG emission levels with the relevant annual emission allocations under the legislation (so called Assigned Emissions Allowances or AEA's). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent, which Luxembourg does not intend to do.

Under Article 9(2) of the ESR, any debit (i.e., excess emissions) under the LULUCF Regulation in the period 2021 to 2025 is automatically deducted from Member States' AEAs under the ESR first compliance period.

27 Decision-making process, https://ec.europa.eu/info/strategy/decision-making-process/how-decisions-are-made_en.

28 Have your say – Public consultation and feedback, https://ec.europa.eu/info/law/better-regulation/have-your-say_en.

III.B – Description of a Party's Nationally Determined Contribution under Article 4 of the Paris Agreement, including updates

1. *Section III.B* provides a description of the Nationally Determined Contribution (NDC) under Article 4 of the Paris Agreement, against which its progress will be tracked, as requested by paragraph 64 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)].

2. According to the reporting guidelines, related information that is to be voluntarily reported in tabular format is provided in the appendix of CTF Tables 1-12.

3. This section has been written by the Ministry of the Environment, Climate and Biodiversity (MECB).

III.B.1 Description of the Nationally Determined Contribution

4. Under their updated NDC,[29] the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term "domestic" means without the use of international credits.

5. The NDC consists of a single-year target, and the target type is "economy-wide absolute emission reduction". The scope of the NDC covers the 27 Member States of the EU.

6. The 17 October 2023 updated NDC scope is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU NDC. Details on the EU NDC can be found in *Table II.B.1-1*.

Table II.B.1-1 – Description of the NDC of the EU and its Member States

Information	Description
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term "domestic" means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 699 405 kt CO_2e.
Implementation period	2021-2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).

29 The update of the Nationally Determined Contribution of the European Union and its Member States is available here: https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf.

Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. International aviation: emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO_2 emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024-26 from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. International maritime navigation: waterborne navigation is included in respect of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emissions from maritime transport voyages between the EU Member States.
Gases	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3).
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Source: Updated NDC of the EU and its Member States. See also European Commission (2024b), Table 3.3, p. 41.

Note: This table is identical to table 'Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates,' which has been submitted electronically together with this BTR.

III.B.2 ANNEX
METHODOLOGY APPLIED FOR THE IDENTIFICATION OF GHG EMISSIONS FROM INTERNATIONAL AVIATION AND NAVIGATION IN THE SCOPE OF THE EU NDC

7. The scope of the EU NDC goes beyond national GHG emissions and removals in the scope of the national GHG inventory; it also includes specific emissions from international aviation and navigation. This annex describes the methodology for identifying these emissions.

8. International aviation and maritime emissions are estimated by using the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES).[30] It allows to split the international transport CO_2 emissions reported in the GHG inventory into intra-EU/extra-EU and intra-EEA/extra-EEA categories and the ongoing flights from the EU to UK and Switzerland, backwards in time (i.e. for the time period back to 1990).[31] In this annex, EEA stands for European Economic Area, which comprises the 27 EU Member States, Iceland, Liechtenstein and Norway. For international transport, JRC-IDEES applies a decomposition methodology that reconciles the scopes of available primary statistics and harmonises historical data on international aviation and maritime emissions, energy use, and transport activity. The resulting annual dataset covers 1990-2021 and distinguishes domestic, intra-EU/intra-EEA, and extra-EU/extra-EEA activity for each EU Member State, Norway and Iceland.

30 European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, https://publications.jrc.ec.europa.eu/repository/handle/JRC137809.

31 The JRC-IDEES analytical database is designed to support energy modelling and policy analysis, by combining primary statistics with technical assumptions to compile detailed energy-economy-emissions historical data for each key energy sector. For aviation, EEA emissions includes emissions related to the UK but not to Switzerland, where total CO_2 emissions for the scope are additionally estimated from EUROCONTROL data.

9. In aviation, JRC-IDEES distinguishes passenger and freight modes, with three geographical categories of flight origin/destinations for each mode: domestic, intra-EEA + UK, and extra-EEA + UK. Intra-EU, the UK, and EEA categories are also used internally during calibration but aggregated for reporting. For each mode/category combination, JRC-IDEES estimates activity (as passenger-km or tonnes-km), energy use and CO_2 emissions, aircraft stock (expressed as representative aircraft), load factors, and aircraft efficiencies. As country-specific activity statistics are not available, the decomposition first allocates EU-level activity data from the Transport Pocketbook[32] of the European Commission's Directorate-General for Mobility and Transport to each country and flight category.

10. For passenger modes, this allocation calculates average load factors using Eurostat data on total passengers and flights. These load factors and total flight numbers are combined with average flight distances from EUROCONTROL, the pan-European organisation dedicated to air traffic management, to yield an initial estimate for passenger transport activity. For intra-EU activity, a uniform scaling factor is then applied across Member States to match total EU-level Transport Pocketbook data. Freight activity follows a similar process, using a "representative flight" concept with a common load factor across all Member States to account for mixed passenger-freight flights.

11. Next, the decomposition estimates fuel use from EUROCONTROL data, by deriving a distance-dependent average aircraft efficiency, then applying it to the country-specific ensemble of flights and routes. The final step scales the estimates to meet Eurostat energy balances for total domestic and international consumption back to 1990 values, maintaining intra-EEA/extra-EEA fuel use ratios derived from EUROCONTROL. JRC-IDEES additionally reports resulting differences with submissions by Parties to the UNFCCC. The above process is followed throughout the entire decomposition period (1990-2021). Data gaps are estimated from the existing indicators as follows:
    - The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
    - Average flight distance is kept constant for early years without EUROCONTROL data (generally before 2004).
    - If the load factor (passengers per flight) cannot be calculated due to a lack of passenger and/or flight data, it is estimated from the trend of the existing time series.
    - Missing numbers of flights are calculated from the load factor and the passengers carried.

[32] Statistical pocketbook 2023: https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2023_en.

- If no passenger data is available, the total mileage is estimated from the energy consumption, and combined with average flight distance to estimate the number of flights. The number of flights is then combined with the load factor to estimate the total passengers carried.
- For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) adjust the estimated fuel use to EUROCONTROL data for specific routes, and iii) scale this adjusted fuel use to Eurostat energy balances (e.g. before 1995 for Transport Pocketbook data; before 2004 for EUROCONTROL data).

12. For international maritime transport, JRC-IDEES estimates data both for intra-EU/extra-EU and intra-EEA/extra-EEA geographical categories. The emission estimates in the GHG inventory already include CO_2, CH_4, and N_2O gases. Transport activity (tonnes-km) is estimated from Eurostat data on gross weight of transported goods, using port-level and country-level data for intra-EU and extra-EU categories, respectively. Intra-EU activities are then scaled to match the Transport Pocketbook totals, accounting for domestic coastal shipping (calibrated separately in JRC-IDEES). Next, transport activity is combined with data reported under the monitoring, reporting and verification system for maritime transport under the EU ETS ("THETIS MRV"[33]), namely EU-level mileage data and country-specific vessel sizes to estimate load factors (tonnes per movement). The load factors and resulting annual mileage (km) are calibrated to meet EU-level THETIS MRV mileage. The annual mileage is in turn combined with THETIS MRV average efficiency to yield a total technical energy consumption, with corresponding emissions derived from default emissions factors. This energy consumption is scaled to Eurostat energy balances so as to minimise discrepancy to total intra-EU THETIS MRV emissions. As with aviation, JRC-IDEES reports corresponding differences to submissions under the UNFCCC. Early years with data gaps are estimated from existing indicators as follows:
    - The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
    - Average distance of voyages is kept constant for early years without Eurostat activity data (generally before 1997-2000).
    - If the load factor (tonnes per movement) cannot be estimated due a lack of activity data, it is kept constant.
    - If activity data is not available, it is estimated from Eurostat energy consumption.
    - Missing mileage data is derived from the activity and load factor estimates.
    - For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) scale estimated mileage to meet EU-level THETIS MRV mileage, and iii) scale domestic and intra-EU CO_2 emissions estimated from energy consumption so as to match total THETIS MRV CO_2 emissions.

33 THETIS MRV: https://mrv.emsa.europa.eu/#public/eumrv.

- Finally, the ratios between the estimated MRV emissions and the CO_2 emissions for the reported transport activity (for intra-EU/EEA and extra-EU/EEA categories) between 2018 and 2021 are used to calculate the MRV compliant estimates back to 1990 levels.

13. For the year 2022, the international navigation and aviation emissions under the EU NDC scope have been estimated by applying the same share of those emissions on the total international navigation and aviation emissions (as reported in the GHG inventory) as in 2021.

14. The following tables provide an overview of the net GHG emissions in the scope of the EU NDC as well as summarising aviation and maritime navigation emissions covered by the EU NDC scope.

TABLE II.B.2-1 – SUMMARY OF GHG EMISSIONS IN THE SCOPE OF THE EU NDC

Indicator ($kt\ CO_2e$)	Values in …		
	1990	2021	2022
Total net GHG emissions from the national GHG inventory of the EU	4 649 007	3 215 997	3 132 670
Total GHG emissions from international aviation in the scope of the EU NDC	23 906	26 326	41 405
Total GHG emissions from international navigation in the scope of the EU NDC	26 492	30 327	31 149
Total net GHG emissions consistent with the scope of the EU NDC ***used for tracking progress and presented in CTF Table 4***	4 699 405	3 272 650	3 205 223

Source: European Commission (2024b), Table A-1, p. 183.

TABLE II.B.2-2 – AVIATION EMISSIONS COVERED BY THE EU NDC SCOPE

Emissions	Domestic aviation		Intra-EEA aviation			Extra-EEA aviation
	Domestic EU flights (e.g. Palermo Milan)	Domestic "non-EU EEA" flights (e.g. Oslo to Bergen)	Flights between "non-EU EEA" countries (from Oslo to Reykjavik)	Flights within the EEA, departing from EU airports	Flights to/from EU airports to OMRs	departing flights from EU airports to UK and Switzerland
Current NDC commitment	Yes	No	No	Yes	Yes From Jan 2024	Yes

Source: Netherlands Enterprise Agency (2025), First Biennial Transparency Report of the Netherlands under the Paris Agreement, The Hague, p. 214.

TABLE II.B.2-3 – MARITIME NAVIGATION EMISSIONS COVERED BY THE EU NDC SCOPE

Emissions	Domestic maritime navigation		International maritime navigation				Within ports	
	Voyages within a MS (e.g. Valencia - Barcelona)	Voyages within NO/IS *(e.g. Oslo - Bergen)*	Voyages between two EU MS *(e.g. Valencia - Rotterdam)*	Voyages between a MS and NO/IS *(e.g. Rotterdam - Oslo)*	Voyages between an EU MS and a third country	Voyages between NO/IS and a third country (or IS/ NO)	emissions within a port of an EU MS *(reported under domestic emissions)*	emissions within a port of NO or IS (or another third country)
Current NDC commitment (CO_2; CH_4; N_2O)	Yes	No	Yes	No	No	No	Yes	No

Source: Netherlands Enterprise Agency (2025), First Biennial Transparency Report of the Netherlands under the Paris Agreement, The Hague, p. 214.

III.C – Information necessary to track progress made in implementing and achieving the Nationally Determined Contribution under Article 4 of the Paris Agreement

1. *Section III.C* provides the information necessary to track progress made in implementing and achieving the Nationally Determined Contribution (NDC) under Article 4 of the Paris Agreement. The indicators selected to track progress towards the implementation and achievement of the NDC are presented in *Section III.C.1*, as requested by paragraphs 65 to 73 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)]. In *Section III.C.2*, a description of each methodology and/or accounting approach used is described, as requested by paragraphs 74 and 75 of the MPGs. This section is completed by a structured summary of progress towards implementing and achieving the EU NDC *[→ Section III.C.3]*.

2. According to paragraph 78 of the MPGs, the information to be reported in tabular format is available in CTF Tables 1–4.

3. This section has been written by the Ministry of the Environment, Climate and Biodiversity (MECB).

III.C.1 INDICATORS

4. For the tracking of progress towards implementing and achieving the updated NDC of the EU and its Member States,[34] an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen EU NDC indicator is "annual total net GHG emissions consistent with the scope of the NDC in CO_2e".

5. To track progress by Luxembourg, the annual total GHG emissions covered by the Effort Sharing Regulation (ESR) and the annual total net GHG emissions covered by the EU LULUCF Regulation, both in CO_2e, are the main relevant national-level indicators since their achievements will contribute to the achievement of the EU NDC target. For LULUCF, please refer to *Section III.F.3.5*. For the ESR target, please refer to *Section III.F.3.12*. These two additional indicators ("LU ESR" and "LU LULUCF") are included. *Table III.C.1-1* together with the EU NDC indicator.

[34] The update of the Nationally Determined Contribution of the European Union and its Member States is available here: https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf.

TABLE III.C.1-1 – INDICATORS FOR TRACKING PROGRESS TOWARDS THE EU NDC AND NATIONAL CONTRIBUTIONS

Information	Description
EU NDC	
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO_2e.
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO_2e.
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to the EU NDC	This indicator is defined using the same unit and metric as the EU NDC target. Therefore, it can be used for tracking progress in implementing and achieving the EU NDC target.
Definitions	Definition of the indicator "annual total net GHG emissions in CO_2e": Total net GHG emissions correspond to the annual total of emissions and removals reported in CO_2 equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled "Reporting format for the description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates".
LU ESR (LU Climate Law)	
Selected indicator	Annual total GHG emissions in Luxembourg covered by the EU ESR in CO_2e.
Reference level and base year	The reference level is total GHG emissions of Luxembourg in the base year 2005, that fall within the scope of the ESR. The reference level value is 10116.2 kt CO_2e.
Updates	This is the first time the reference level is reported, hence there are no updates.
Relation to the EU NDC	This indicator relates to progress towards the EU's emissions reduction target for emissions covered by the ESR. Progress towards achieving this target contributes to achieving the EU NDC target. This indicator is defined using the same unit and metric as the EU NDC target. Therefore, it can be used to track Luxembourg's contribution to the implementation and achievement of the EU NDC target.
Definitions	Definition of the indicator "Annual total GHG emissions in Luxembourg covered by the EU ESR in CO_2e": The emissions are defined as the annual total of emissions and removals reported in CO_2e in the latest GHG inventory of Luxembourg, minus Luxembourg's annual emissions covered by the EU ETS and the LULUCF Regulation.
LU LULUCF	
Selected indicator	Annual total net GHG emissions in Luxembourg covered by the EU LULUCF Regulation in CO_2e.
Reference level and base year	According to Annex IIa of the LULUCF Regulation, the target for 2030 is to increase net removals by minus 27 kt CO_2e compared to the average net removals in 2016, 2017 and 2018. Based on the data reported in the inventory submitted in 2020, this would result in a total net removal of minus 403 kt CO_2e in 2030.
Updates	For the period 2026-2029, as required by the LULUCF Regulation, removals will be determined after the comprehensive review of the inventory submitted in 2025: a linear trajectory leading to the 2030 target will start in 2022 at the average of the GHG inventory net removal data for the years 2021, 2022 and 2023.
Relation to the EU NDC	This indicator relates to progress towards the 2030 EU's emissions reduction target for emissions covered by the LULUCF Regulation. Progress towards achieving this target contributes to achieving the EU NDC target. This indicator is defined using the same unit and metric as the EU NDC target. Therefore, it can be used to track Luxembourg's contribution to the implementation and achievement of the EU NDC target.
Definitions	Definition of the indicator "Annual total net GHG emissions in Luxembourg covered by the EU LULUCF Regulation in CO2e": The emissions are defined as the annual total of emissions and removals from the LULUCF sector reported in CO_2e in the latest GHG inventory of Luxembourg.

Sources: European Commission (2024b), Table 3.4, p. 42 and MECB.

Notes: - EU NDC: the reference level is based on the annual European Union GHG inventory from 1990 to 2022.
- LU ESR: Luxembourg has a national target that goes beyond that defined in the ESR: a 50% reduction in ESR emissions by 2030 compared to the emission level in 2005. In its Climate Law (see ***Section III.D.2.2.2***), Luxembourg unilaterally committed to reducing its non-ETS emissions by 55% compared to the 2005 level (using the same reference level as for the ESR). The reference level is based on Luxembourg's GHG inventory from 1990 to 2018 submitted in 2020.
- The information in this table on the EU NDC is identical to the information in Common Tabular Format (CTF) tables 1 ('Description of selected indicators') and 2 ('Definitions needed to understand the NDC'), which were submitted electronically together with this BTR.

III.C.2 METHODOLOGIES AND ACCOUNTING APPROACH

6. The EU and its Member States use the following accounting approach for tracking progress towards the EU NDC: annual GHG data from the national GHG inventory of the EU, complemented for international aviation and navigation with estimations from the Joint

Research Centre's Integrated Database of the European Energy System.[35] The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

7. As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

8. Details on methodologies and accounting approaches consistent with the accounting guidance[36] under the Paris Agreement can be found in CTF table 3 ("Methodologies and accounting approaches"), which was submitted electronically together with this BTR.

III.C.3 STRUCTURED SUMMARY – STATUS OF PROGRESS

9. An important purpose of the BTR is to demonstrate where the EU and its Member States stand in implementing their NDC, and which progress they have made towards achieving it. The most recent information on GHG emissions and removals in the scope of the NDC constitutes the key information for tracking this progress. ***Table III.C.3-1*** summarises the current status of progress.

10. Based on the GHG inventory data and data on international aviation and navigation for 2022, the EU and its Member States reduced net GHG emissions by 31.8 % compared to 1990. The EU and its Member States made progress towards implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

11. Three additional indicators were entered in CTF tables 1, 2 and 4. These are not directly linked to the EU NDC. However, they do reflect specific objectives for Luxembourg within the European and national frameworks. To avoid confusion with the EU NDC, these indicators are discussed in the projections section *[→ Sections III.F.3.5 & 3.12]*, rather than this section.

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35 European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, https://publications.jrc.ec.europa.eu/repository/handle/JRC137809.

36 Decision 4/CMA.1, Further guidance in relation to the mitigation section of decision 1/CP21, https://unfccc.int/documents/193407.

TABLE III.C.3-1 – SUMMARY OF PROGRESS TOWARDS IMPLEMENTING AND ACHIEVING THE NDC AND THE CONTINUATION BY LUXEMBOURG

Indicator ($kt CO_2e$)	Base year value	Values in the implementation period			Target level	Target year	Progress made towards the NDC
		2021	2022	2030			
Total net GHG emissions consistent with the scope of the EU NDC	4 699 405	3 272 650	3 205 223	NA	At least 55% below the base year level (1990).	2030	The most recent level of the indicator is 31.8 % below the base year level.
Annual total GHG emissions in Luxembourg covered by the EU ESR	10 116	8 066	7 059	NA	5 058 (50% below the base year level - 2005)	2030	The most recent level of the indicator is 30.2 % below the base year level.
Annual total GHG emissions in Luxembourg covered by the national Climate Law	10 116	8 066	7 059	NA	4 552 (55% below the base year level - 2005)	2030	The most recent level of the indicator is 30.2 % below the base year level.
Annual total net GHG emissions in Luxembourg covered by the EU LULUCF Regulation	376	605	648	NA	403 (27 kt CO_2e increase in net removals compared to the base year – average 2016-2018)	2030	The most recent level of the indicator is 245 kt CO_2e above the base year level.

Sources: European Commission (2024b), Table 3.5, p. 43 and MECB.

Notes: - NA = not applicable.
- The EU NDC indicator values are based on the annual European Union GHG inventory from 1990 to 2022. In contrast, the related indicator values for Luxembourg are based on the 2024v2 submission, which is now labelled LUX-CRT-2024-V1.0..[37]
- Note that an annual emissions balance consistent with chapter III.B (Application of the corresponding adjustment) will be provided in a subsequent BTR after CMA finalises further relevant guidance, based on the annual information reported under Article 6.2.
- More detailed information can be found in CTF table 4 ("Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement"), which has been submitted electronically together with this BTR.

37 https://unfccc.int/documents/645403.

III.D – MITIGATION POLICIES AND MEASURES, ACTIONS AND PLANS

1. *Section III.D* covers national policies and measures (hereafter referred to as PaMs), as set out in paragraphs 80 to 90 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)]. It begins with a description of the overall policy context and the policy-making process *[→ Sections III.D.1 & III.D.2]*. PaMs and their effects are presented and discussed in *Section III.D.3*, as requested by paragraphs 81 to 83 and 85-86 of the MPGs. This section also covers PaMs that are no longer in place (paragraph 87 of the MPGs) and those influencing GHG emissions from international transport (paragraph 88). It also provides information on how Luxembourg's actions and PaMs are modifying long-term trends in GHG emissions and removals (paragraph 89), before concluding with a discussion of the assessment of the economic and social impacts of response measures (paragraph 90). Domestic institutional arrangements, including institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress towards the EU NDC and the national targets are presented in *Section III.D.4*. Finally, *Annex 1* summarises the changes between the BTR1 and the NC8/BR5 [MECB (2023)], and *Annex 2* indicates whether the recommendations and encouragements from the latest reviews – IDR.8/TRR.5 [UNFCCC (2024)] – have been implemented or not.

2. This chapter has been written by the Ministry of the Environment, Climate and Biodiversity (MECB).

III.D.1 POLICY-MAKING PROCESS – INTERNATIONAL CONTEXT

III.D.1.1 The Convention, the Kyoto Protocol and the Paris Agreement

3. Luxembourg signed the UNFCCC on 9 June 1992 and ratified it on 9 May 1994 so that the Convention entered into force on 7 August 1994. As for the Kyoto Protocol, it has been signed by Luxembourg on 29 April 1998, ratified on 31 May 2002 and entered into force, concomitantly with other European Union (hereafter EU) Annex I Member States, on 16 February 2005.[38] Pursuant to that Protocol and the terms of the European agreement distributing the burden among the, at the time, 15 Member States of the EU, Luxembourg undertook to reduce its GHG emissions by 28% below their 1990 levels over the period 2008-2012. This was the deepest cut agreed by the (then) 15 Member States. In 2004, the Luxembourgish government committed that the bulk of its emission reductions under the Kyoto agreement would be achieved with limited reliance on the Protocol's "flexible mechanisms". However, this commitment had to cope with

38 https://unfccc.int/process/the-kyoto-protocol/status-of-ratification.

the specific circumstances of the country, e.g., its size and "road fuel sales to non-residents",[39] along with the limited GHG reduction potentials within the country.[40]

4. With regard to the "Doha Amendment" to the Kyoto Protocol that establishes the second commitment period of this Protocol – CP2, which began on 1 January 2013 and ended on 31 December 2020 – Luxembourg submitted its instrument of acceptance to the United Nations Framework Convention on Climate Change on 21 September 2017.[41] As it was the case for the first commitment period, an European agreement distributing the burden among the Member States of the EU, but this time also among the sectors, has been put in place: a target compliance architecture was set up within the EU in order to meet the 2010 EU's pledge under the Convention, and indirectly under the Kyoto Protocol; i.e. to reduce, by 2020, its level of GHG emissions by 20% compared to 1990.[42]

5. The Paris Agreement was adopted on 12 December 2015 at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change and entered into force on 4 November 2016.[43] The EU ratified the Agreement on 5 October 2016, whereas Luxembourg's ratification was completed on 4 November 2016.[44]

III.D.1.2 The EU "2030 Climate and Energy Framework" and the Paris Agreement

The initial proposals

6. Following the EU "2020 Climate and Energy Package" – see the Eighth National Communication and Fifth Biennial Report of Luxembourg under the UNFCCC [MECB (2023), pp. IV-2 to IV-4] – the Council adopted in October 2014 the "2030 Climate and Energy Framework" proposed by the European Commission in January 2014 [European Commission (2014)].[45] This proposal was setting out a framework for EU climate and energy policies for the period 2020–2030, providing a basis for the continuation of policies beyond the scope of the 2020 Package. The main elements of the "2030 Climate and Energy Framework" are the EU ETS, the Effort Sharing Regulation (ESR) and the LULUCF Regulation.

7. Building on the "2020 Climate and Energy Package", the new package was in line with the initial EU long-term goal of reducing Europe's GHG emissions by 80% by 2050, compared with 1990 levels, as set out in the EU long-term low-carbon economy and energy roadmaps [European

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39 This concept of "road fuel sales to non-residents" is explained in Section 2.1.7 of the NID [MECB-AEV (2024), pp. 120-124]

40 The limited GHG emissions reduction potential is discussed in Section 2.1.8.3 of the NID [MECB-AEV (2024), pp. 126-127].

41 https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-c&chapter=27&clang=_en.

42 The minus 20% target was proposed to be raised up to minus 30%, provided that other developed countries also commit to achieving comparable emission reductions, and that developing countries contribute adequately, according to their responsibilities and respective capabilities. Nevertheless, as these conditions have not been met, the target remains at minus 20%.

43 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

44 https://unfccc.int/process/the-paris-agreement/status-of-ratification.

45 Details are available here: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2030-climate-targets_en.

Commission (2011a) & (2011b)].[46] The "2030 Climate and Energy Framework" initially endorsed a binding EU target of at least a 40% reduction in domestic GHG by 2030 compared to 1990. This target was submitted to the UNFCCC on 6 March 2015 as EU's joint intended Nationally Determined Contribution (NDC) for the Paris Agreement.[47]

8. The 40% domestic GHG reduction is equivalent to a collective reduction of 43% in the EU ETS sectors and a shared burden reduction among Member States of 30% in the non-ETS sectors compared to 2005 levels. For the latter, the methodology for setting national reduction targets is still based on Member States' relative GDP per capita, as for the 2020 targets. However, for Member States with a GDP per capita above the EU average, the targets have been adjusted to reflect cost-effectiveness in a fair and balanced way. All Member States will thus contribute to the overall EU reduction in 2030, with targets ranging from 0% to minus 40% compared to 2005 levels. According to these criteria, Luxembourg, together with Sweden, again had the highest reduction target among Member States, i.e., minus 40%. These national targets were set in stone in the ESR adopted in May 2018.

9. Although the ESR does not cover the LULUCF sector as such, it allows Member States to use up to 280 million credits from the land-use sector over the entire period 2021-2030 to meet their national targets. However, emissions and removals from the LULUCF sector are included in the EU climate target for the first time through the LULUCF Regulation. Each Member State will have to ensure that the LULUCF sector does not give rise to debits once specific accounting rules are applied. This is known as the "no debit rule".

10. For the fourth phase of the EU ETS (2021-2030), the pace of annual allowance reductions is increased from 1.74% to 2.2%, and the "Market Stability Reserve" (the mechanism set up by the EU in 2015 to reduce the surplus of allowances in the carbon market and make the EU ETS more resilient to future shocks) has been strengthened.

The "European Green Deal" and "Fit for 55"

11. At COP25 in Madrid in late 2019, the European Commission launched its "European Green Deal". This ambitious plan aims to make Europe the first climate neutral continent with zero net GHG emissions by 2050. The "Communication on the European Green Deal" was adopted in 2020. It sets out a list of European Commission policy initiatives to achieve climate neutrality by 2050. The plan is to review each existing law for its climate benefits and also introduce new

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46 For more details see https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en. The "Roadmap for moving to a competitive low carbon economy in 2050" [European Commission (2011a)] is now replaced by the "Long-term low greenhouse gas emission development strategy of the EU and its Member States" submitted to the UNFCCC in March 2020 – https://unfccc.int/documents/210328. Overall frameworks cover the climate and energy initiatives: the "Clean Energy for All Europeans Package" adopted on 30 November 2016 – https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en – and the November 2018 "Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" Communication from the Commission – https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0773.

47 Intended Nationally Determined Contribution of the EU and its Member States (https://unfccc.int/sites/default/files/LV-03-06-EU%20INDC.pdf).

legislation on the circular economy, building renovation, biodiversity, agriculture and innovation.[48] To uphold the commitment established in the "Communication on the European Green Deal", the Commission proposed in 2020 to enhance the EU's efforts to reduce GHG emissions and establish a more ambitious trajectory for the upcoming decade. The proposal aims to lower net GHG emissions to a minimum of 55% below 1990 levels by 2030 in order to guide Europe towards a responsible and economical path to achieving climate neutrality by 2050. This aligns with the objective of the Paris Agreement to keep the global temperature increase well below 2°C and work towards maintaining it at 1.5°C. The proposal aims to promote the growth of green employment in the EU while facilitating the reduction of GHG emissions. It also seeks to further reduce the consequential negative effects of climate change. In this regard, international countries are encouraged to adopt the EU's strategies to limit global temperature rise to 1.5°C.

12. As a result, the EU and its Member States updated their NDCs in 2020 to reflect the commitment to reduce net GHG by at least 55% by 2030 compared to 1990 levels.[49] As existing policies and measures were initially developed in line with the objective of the EU's first NDC, a legislative review was launched to adapt around fifty directives and regulations to the new climate target communicated in the updated NDC, the "Fit for 55" package. A comprehensive set of proposals – the "Fit for 55" proposals – was presented by the European Commission in July 2021.[50]

13. In 2023, the Council of the European Union and the European Parliament formally adopted all the key elements of the legislative framework needed to implement the "Fit for 55" proposals. The Commission estimates that the "Fit for 55" legislative framework, when fully implemented, could enable the EU and its Member States to over-achieve the EU's net domestic GHG emission reduction target of at least 55% by 2030 compared to 1990.

14. In February 2024, as required under the European Climate Law *[→ Section III.D.1.3]*, the Commission recommended an additional intermediate target of reducing net GHG emissions by 90% by 2040 compared to 1990 levels. In July 2025, the Commission proposed this target as an amendment to the European Climate Law, with the aim of ensuring that the EU reaches climate neutrality by 2050.[51] This neutrality objective lies at the heart of the "European Green Deal" (→ §11) and is legally binding under the European Climate Law.

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48 Details are available on the regularly updated website https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en and https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/story-von-der-leyen-commission/european-green-deal_en.

49 The update of the nationally determined contribution of the European Union and its Member States (https://unfccc.int/sites/default/files/NDC/2022-06/EU_NDC_Submission_December%202020.pdf), subsequently updated in October 2023 to prepare for COP28 and reflect the latest policy developments at EU level (https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf).

50 Delivering the European Green Deal (https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en).

51 This 2040 climate target (https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en) has been submitted to the European Parliament and the Council for discussion and adoption under the ordinary legislative procedure. It is expected to be included in the EU's updated NDC, which has to be submitted ahead of COP30.

15. Today, emission reduction targets under EU legislation are covered by the ETS Directive, the ESR and the LULUCF Regulation (see also *Section III.A.8*). Additional legislation and policies on CO_2 emission performance standards for new passenger cars and new light commercial vehicles, new directives on emissions from maritime transport, a regulation on the deployment of alternative fuel infrastructure (AFIR), renewable energy and energy efficiency are all part of the "Fit for 55%" package and will also contribute to achieving the EU's 2030 climate change objectives. The main elements are:[52]

    - a strengthening of emission reduction targets under the EU ETS following the revision of the ETS Directive in 2023.[53] The EU ETS cap aims to reduce emissions by 62% by 2030 compared to 2005 levels. To achieve this, the annual reduction factor has increased to 4.3% between 2024 and 2027, rising to 4.4% from 2028 onwards. At the same time, emissions from maritime transport nave been brought within the scope of the EU ETS from 2024;
    - as part of the 2023 revisions to the ETS Directive, a new emissions trading system named ETS2 was created, operating separately from the existing EU ETS. This new system is expected to become fully operational by 2027 and will address CO_2 emissions from fuel combustion in buildings, road transport, and additional sectors, mainly small industries not currently covered by the EU ETS. The ETS2 cap will be set to reduce emissions by 42% by 2030 compared to 2005 levels;[54]
    - a strengthening of the emission reduction targets set for EU Member States under the amended ESR of 2023, with a new EU-level GHG emission reduction target of 40% by 2030 compared to 2005;[55]
    - strengthened renewable energy and energy efficiency targets. In line with the European Commission's plan to make Europe independent of Russian fossil fuels well before 2030 ("RePowerEU"[56]), the EU has agreed to increase its ambition on energy savings. This includes an enhanced target to reduce final energy consumption by 11.7% at the EU level by 2030, as well as a new target to increase the share of renewable energy in final energy consumption to at least 42.5% by 2030. There is also an additional indicative top-up of 2.5%, which would allow this figure to reach 45%

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52 See this webpage for an overview: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal/fit-55-delivering-proposals_en.

53 Revised and amended version: http://data.europa.eu/eli/dir/2003/87/2024-03-01. See also: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/about-eu-ets_en.

54 See this webpage for all the details: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/ets2-buildings-road-transport-and-additional-sectors_en.

55 Amended version: http://data.europa.eu/eli/reg/2023/857/oj. See also: https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en.

56 REPowerEU, Affordable, secure and sustainable energy for Europe: https://commission.europa.eu/topics/energy/repowereu_en.

- various updates to existing legislation ensuring that all new cars and vans registered in Europe are zero-CO2 emission by 2035. As an intermediate step, the average emissions of new cars must be reduced by 55% by 2030 and by 50% for new vans;
- restoring nature and enabling biodiversity to thrive again is important because it limits the progress of global warming by capturing and storing carbon, adapting to climate change, and mitigating the impact of increasingly violent natural disasters, such as floods, droughts, and heatwaves. Therefore, more synergies are sought with the EU's comprehensive long-term biodiversity strategy for 2030,[57] which aims to protect nature and put Europe's biodiversity on the path to recovery;
- new proposals include the introduction of a carbon tax on products manufactured outside the EU, which is set to be fully operational by 2026 – a "Carbon Border Adjustment Mechanism" (CBAM[58]) – and a Social Climate Fund to support the citizens most affected by energy or mobility poverty, as well as helping small businesses with the green transition.[59]

Luxembourg medium and long-term commitments

16. The "Fit for 55" package increases Luxembourg's burden-sharing under the ESR, requiring a reduction in non-ETS GHG emissions of 50% by 2030 compared to 2005 levels, up from 40%. However, Luxembourg anticipated this and, in December 2019, unilaterally decided to reduce its non-ETS GHG emissions by 55% compared to 2005 levels — further than the ultimate requirement of EU legislation. Similar to the Commission, this move was dictated by:
    - science to be consistent with keeping the global average temperature increase well below 2°C above pre-industrial levels;
    - a willingness to achieve "climate neutrality" or "net zero emissions" by 2050.

    This 55% reduction was included in Luxembourg's first National Energy and Climate Plan (NECP), officially submitted to the European Commission at the end of May 2020 [MECDD and MEA (2020)], which also includes national targets for both renewable energy – 25% of primary energy consumption by 2030 – and energy efficiency - an increase of 40 to 44% compared to the final energy consumption estimated for 2030 in the European Union's 2007 PRIMES modelling scenario. The NECP has been prepared in accordance with the "general framework for integrated national energy and climate plans" annexed to the Governance Regulation.

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57 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en.

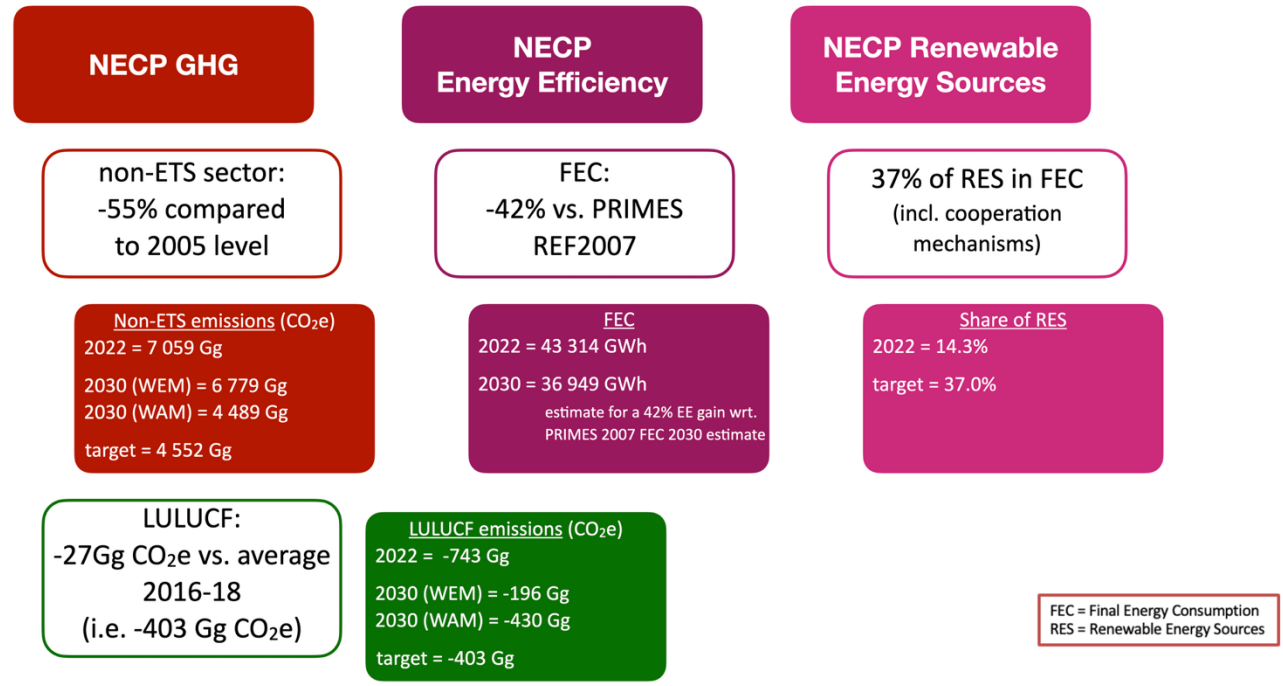
58 https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.

59 https://www.consilium.europa.eu/en/infographics/fit-for-55-social-climate-fund/ and Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2021/1060 (http://data.europa.eu/eli/reg/2023/955/oj).

17. In the summer of 2023, Luxembourg submitted a draft NECP update as required by the Governance Regulation [MECDD and MEA (2023)], and in July 2024, it submitted its final updated version [MECB and MECO (2024)] *[→ Section III.D.2.2.1]*. It is expected that these Member States' NECP updates will allow them to meet the new ambition set at EU level. In its 2024 NECP update, Luxembourg confirms its minus 55% reduction in non-ETS GHG emissions by 2030 compared to 2005 levels and describes the 2021-2030 sectoral budgets that were defined in June 2022 under its national Climate Law *[→ Section III.D.2.2.2]*. The national targets for both renewable energy and energy efficiency have also been strengthened: 37% of primary energy consumption by 2030 and an increase of 44% respectively *[→ Figure III.D.1-1]*.

18. The actual GHG projections show that Luxembourg's non-ETS emissions with additional measures (WAM) are below the linear trajectory for the period 2021-2030. This would not be the case at all with existing measures (WEM) *[→ Figure III.D.1-2]*: see *Section III.F.3.12* for detailed explanations.

FIGURE III.D.1-1 – 2024 NECP UPDATE – OVERVIEW OF LUXEMBOURG'S 2030 OBJECTIVES



Source: MECB.

III.D.1.3 The EU's Long-term Strategy and Climate Law

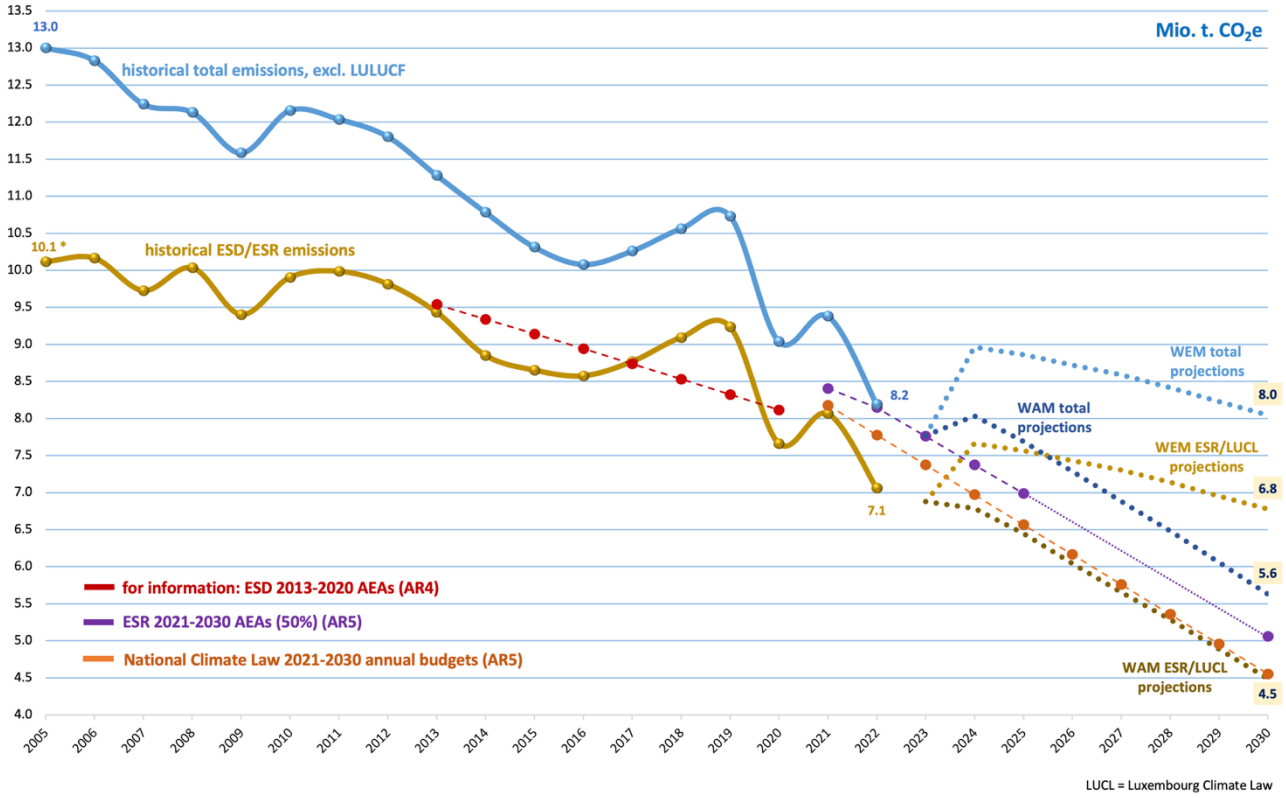
19. The "European Green Deal" target of net zero GHG emissions by 2050 (→ §11) was communicated in March 2020 as part of the EU's Long-term Strategy to reduce GHG emissions in line with the Paris Agreement.[60] With the presentation of its Long-term Strategy (LTS), the EU became the first major economy to commit to climate neutrality. In parallel with the EU as a

[60] https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en.

whole, several Member States have submitted their own LTS under the Paris Agreement. Luxembourg adopted its LTS in 2021, aiming for climate neutrality by 2050 at the latest *[→ Section III.D.2.2.3]*.

20. The binding target of climate neutrality by 2050 was enshrined in the first European Climate Law, which came into force in July 2021.[61] The European Climate Law also sets an increased climate ambition for 2030 to further reduce GHG emissions by 55% compared to 1990 (→ §11 & 12). Luxembourg also published its first national Climate Law in 2021, which enshrines the -55% reduction target as well as the long-term goal of achieving climate neutrality by 2050 at the latest *[→ Section III.D.2.2.2]*.

FIGURE III.D.1-2 – ESR IMPLICATION FOR LUXEMBOURG – 2021-2030 TRAJECTORIES FOR NON-ETS EMISSIONS AND 2023 TO 2030 PROJECTED WEM & WAM EMISSIONS



Sources: MECB-AEV – Submission 2024v2.
MAAV-SER, MECO, MECB, MECB-AEV, MECB-AGE & STATEC – 2024 projections for the NECP update.

Notes: - *2005 value for historical ESD/ESR emissions = the reference level of ESR emissions considered for Luxembourg's compliance under the ESR, which differs from the value that would be calculated using the most recent GHG inventory submission.
- The purple dotted line represents the latest trajectory for Luxembourg's ESR, with a revised target of minus 50% in the 2023 amended ESR (→ §16). The AEAs for 2021 and 2022 will not be modified, as the ESR amendment came into force in 2023. For the 2023 to 2025 AEAs, a new trajectory is calculated, starting from the 2022 AEA and tending towards the revised 2030 ESR target. This explains the bend in the trajectory. The revised AEAs for the period 2026 to 2029 (2030) will be determined in 2026 based on the average GHG emissions from 2021 to 2023.

61 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (http://data.europa.eu/eli/reg/2021/1119/oj). See also: https://climate.ec.europa.eu/eu-action/european-climate-law_en.

III.D.2 POLICY-MAKING PROCESS – NATIONAL CONTEXT

III.D.2.1 The national approach to climate change mitigation and adaptation – 30 years of action

21. Climate change has been a policy priority in Luxembourg for many years. *Figure III.D.2-1* on the next page summarises the main milestones in the development of climate change mitigation and adaptation policies and action plans.

22. The current report focuses on the 2024 NECP update, the latest major instrument for climate change mitigation in line with EU requirements. Descriptions of past actions, plans and strategies can be found in the 7th National Communication of Luxembourg [MDDI-DEV (2018), pp. 142-156] and the 4th Biennial Report [MECDD (2020), pp. 81-87].

III.D.2.2 Beyond 2020 – a set of plans and strategies to mitigate and adapt to climate change

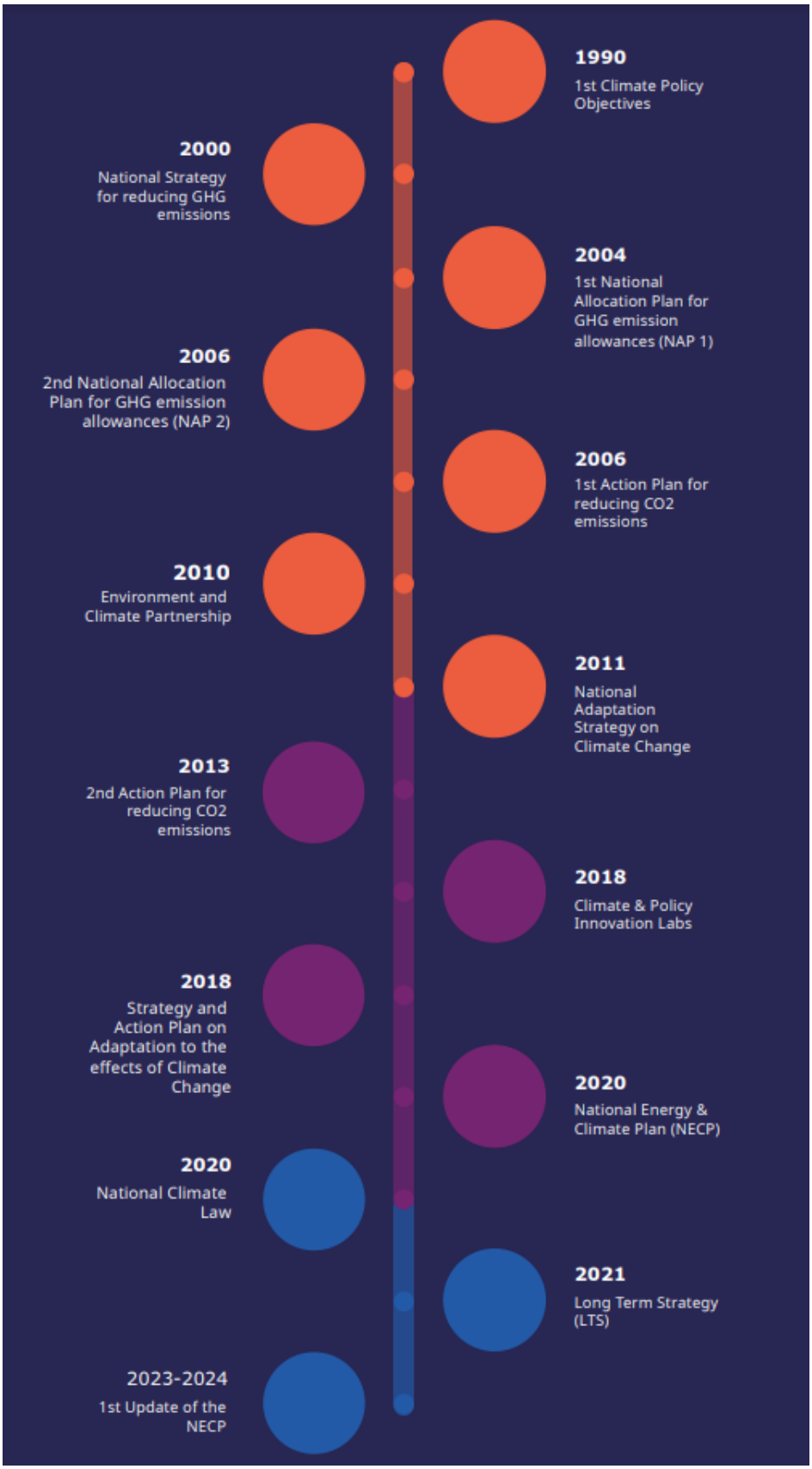
III.D.2.2.1 Mitigating GHG emissions – the National Energy and Climate Plan (NECP) for 2021-2030

23. Under EU commitments, each EU Member State must prepare an integrated National Energy and Climate Plan (NECP) for 2021-2030, setting out detailed policy measures to ensure that Member States collectively meet the EU's energy and climate targets for 2030.

24. The NECPs provide an overview of national energy and climate policies and the current state of planning in these areas to achieve climate and energy objectives for the period up to 2030. Overall, the NECPs cover five dimensions: (1) decarbonisation and renewable energy development; (2) energy efficiency; (3) security of energy supply; (4) internal energy market; and (5) research, innovation and competitiveness. The NECPs are the key strategic planning tool under the EU Governance Regulation, which sets out the structure for coherent EU action on climate and energy. Renewable energy supply and use, together with GHG emissions and removals, constitute the "decarbonisation" dimension of the NECP.

25. The Governance Regulation requires Luxembourg, as well as the other EU Member States, to update their national plans for 2021-2030 by June 2023 (draft updated plans) [MECDD and MEA (2023)] and June 2024 (final updated plans). Luxembourg submitted its final 2024 NECP update in July 2024 [MECB and MECO (2024)]. Given the significant policy and geopolitical developments in energy and climate since the first NECPs were prepared in 2019-2020, these updates were more than timely.

FIGURE III.D.2-1 – OVERVIEW OF LUXEMBOURG'S ACTION PLANS AND STRATEGIES FOR CLIMATE CHANGE MITIGATION AND ADAPTATION – 1990-2024



Source: MECB.

26. Luxembourg sets the following targets in the 2024 update of its NECP (see also ***Figure III.D.1-1*** above):
    - 55% reduction of direct GHG emissions compared to 2005 for the sectors outside the EU ETS (this target is included in the national Climate Law and was already included in the previous version of the plan);
    - increase of the share of renewable energy in final consumption to 37%, up from 25% in the previous plan;
    - improve energy efficiency by 42% compared to the final energy consumption estimated for 2030 in the European Union's 2007 PRIMES modelling scenario (compared to 40-44% in the previous plan).

27. Concrete climate action is planned in six sectors, including:
    - Transportation & Mobility;
    - Residential, Commercial & Institutional Buildings;
    - Agriculture And Forestry;
    - Waste & Wastewater Treatment;
    - Industry, Economy, Small And Medium-Sized Businesses;
    - Land Use, Land Use Changes and Forestry (LULUCF).

28. To this end, the NECP uses a variety of instruments. For example, financing and investment in infrastructure such as public transport and renewable energy, retrofitting of public buildings, electric vehicle charging points and sustainable forestry are key areas of action to achieve the targets. Incentives to support and encourage private action and behavioural change will also be strengthened, such as the multi-pillar support package for sustainable construction, energy retrofitting of existing buildings and the use of renewable energy sources, or purchase bonuses to support the purchase of zero-emission vehicles (including cars, motorcycles, vans and heavy-duty vehicles) ***[→ Section III.D.3.1]***.

29. The sectoral strategies are complemented by cross-sectoral measures, such as the continuation and adaptation of the carbon tax, the national climate law or the voluntary climate agreements with municipalities – Climate Pact 2.0 ("*KlimaPakt 2.0*") and Nature Pact ("*Naturpakt*") – which promote mitigation and adaptation measures at the local level ***[→ Section III.D.3.1.1***, PaM n°106 and PaM n°108***]***. At the same time, the government is committed to a just transition. Thus, socio-economic aspects are taken into account in the design and planning of mitigation measures in order to avoid potential distributional effects. The strategy also incorporates elements from complementary areas such as awareness raising, education and training, sustainable finance, circular economy, climate adaptation and sustainable development.

30. As climate protection is on the agenda of the Luxembourg government, inter-ministerial working groups dealing with the implementation and, if necessary, further development of the agreed measures are an integral part of the climate policy cycle.

31. Various public websites in Luxembourg refer to the NECP. Among these is a dedicated page on the Environment Portal. This webpage contains various versions of the plan, feedback from stakeholders involved in preparing the NECP, communications about the plan, and other important information, as well as a summary of the major measures taken.[62]

32. In addition to the NECP, Luxembourg has mainstreamed climate change into several strategic plans, which are briefly described below.

III.D.2.2.2 "Klimaschutzgesetz" – a climate law and governance for Luxembourg

33. Luxembourg adopted its national Climate Law "*Klimaschutzgesetz*" in December 2020. It enshrines the non-ETS emissions reduction target of minus 55% by 2030 and the "net zero emissions" target by 2050 in a legal and binding document.[63]

34. In its Article 5, the law requires progressive and binding emission targets to be set for 5 sectors, namely:

- LUCL1 Energy and manufacturing industries, construction, excl. ETS installations (CRF 1A1a without incineration, 1A2, 1B2 & 2);
- LUCL2 Transports (CRF 1A3 & 1A5);
- LUCL3 Residential and commercial buildings (CRF 1A4a & 1A4b);
- LUCL4 Agriculture and forestry, incl. combustion (CRF 1A4c & 3);
- LUCL5 Waste and wastewater treatment (CRF 1A1a incineration & 5).

35. These targets are set by a regulation that sets annual sectoral emission allocations *[→ Table III.D.2-1]*.[64]

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62 The webpage can be accessed here: https://environnement.public.lu/fr/klima-an-energie/planpnec.html.

63 *Loi du 15 décembre 2020 relative au climat et modifiant la loi modifiée du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement*, modified by *Loi du 29 juin 2022 modifiant la loi modifiée du 15 décembre 2020 relative au climat* and by *Loi du 29 mai 2024 portant modification de la loi modifiée du 15 décembre 2020 relative au climat* (https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a994/jo, https://legilux.public.lu/eli/etat/leg/loi/2022/06/29/a327/jo and https://legilux.public.lu/eli/etat/leg/loi/2024/05/29/a221/jo).

64 *Règlement grand-ducal du 22 juin 2022 déterminant les allocations d'émissions de gaz à effet de serre annuelles pour la période allant jusqu'au 31 décembre 2030 des secteurs visés à l'article 5 de la loi modifiée du 15 décembre 2020 relative au climat* (https://legilux.public.lu/eli/etat/leg/rgd/2022/06/22/a328/jo).

TABLE III.D.2-1 – NATIONAL CLIMATE LAW ANNUAL SECTORAL EMISSION ALLOCATIONS FOR THE PERIOD UP TO 31 DECEMBER 2030

Annual emission allocation in kt CO_2e	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy and manufacturing industries, construction	455	431	408	384	360	337	313	289	266	242
Transports	5 279	5 018	4 757	4 494	4 228	3 986	3 747	3 504	3 271	3 053
Residential and commercial buildings	1 497	1 396	1 295	1 195	1 094	993	893	792	691	590
Agriculture and forestry	760	752	742	736	731	704	672	645	609	556
Waste and wastewater treatment	189	180	171	163	154	145	137	128	119	111
Total (without EU ETS installations)	**8 180**	**7 777**	**7 373**	**6 972**	**6 567**	**6 165**	**5 762**	**5 358**	**4 956**	**4 552**

Source: MECB.

36. In addition, the law creates two separate bodies to support and autonomously advise national policymakers on how to achieve climate goals.

37. The "Platform for Climate Action and Energy Transition", hereinafter referred to as the "Climate Platform", is a multi-stakeholder group composed of 32 representatives with the aim of promoting joint dialogue between local authorities, civil society organisations, social partners, business representatives, government agencies and other stakeholders, such as youth representatives. The group's role is to create and maintain discussion forums, and to participate in and advise on the development of national plans (including the NECP), policies and measures that may have an impact on climate policy.

38. The "Climate Policy Observatory" (*Observatoire de la Politique Climatique*, hereafter OPC), which started its activities in October 2021. The OPC is a scientific council currently composed of nine members with expertise in various fields of climate-related sciences. Its mission is to advise on any project, action or measure that may have an impact on climate policy, to scientifically evaluate and analyse the effectiveness of measures taken or planned in the field of climate policy (including the NECP), and to propose new measures. Its tasks also include preparing an annual report to the government on the implementation of climate policy and proposing research and studies in all areas related to climate *[→ Box 1]*.[65]

39. In addition to these two bodies established under the National Climate Law, climate-related policies, strategies and plans are also discussed by an "Interministerial Committee for Climate Action", comprising various ministries and administrations involved in climate policy. Although not established under the Climate Law, this committee provides advice and approves climate policy developments (see also *Section III.D.2.4*).

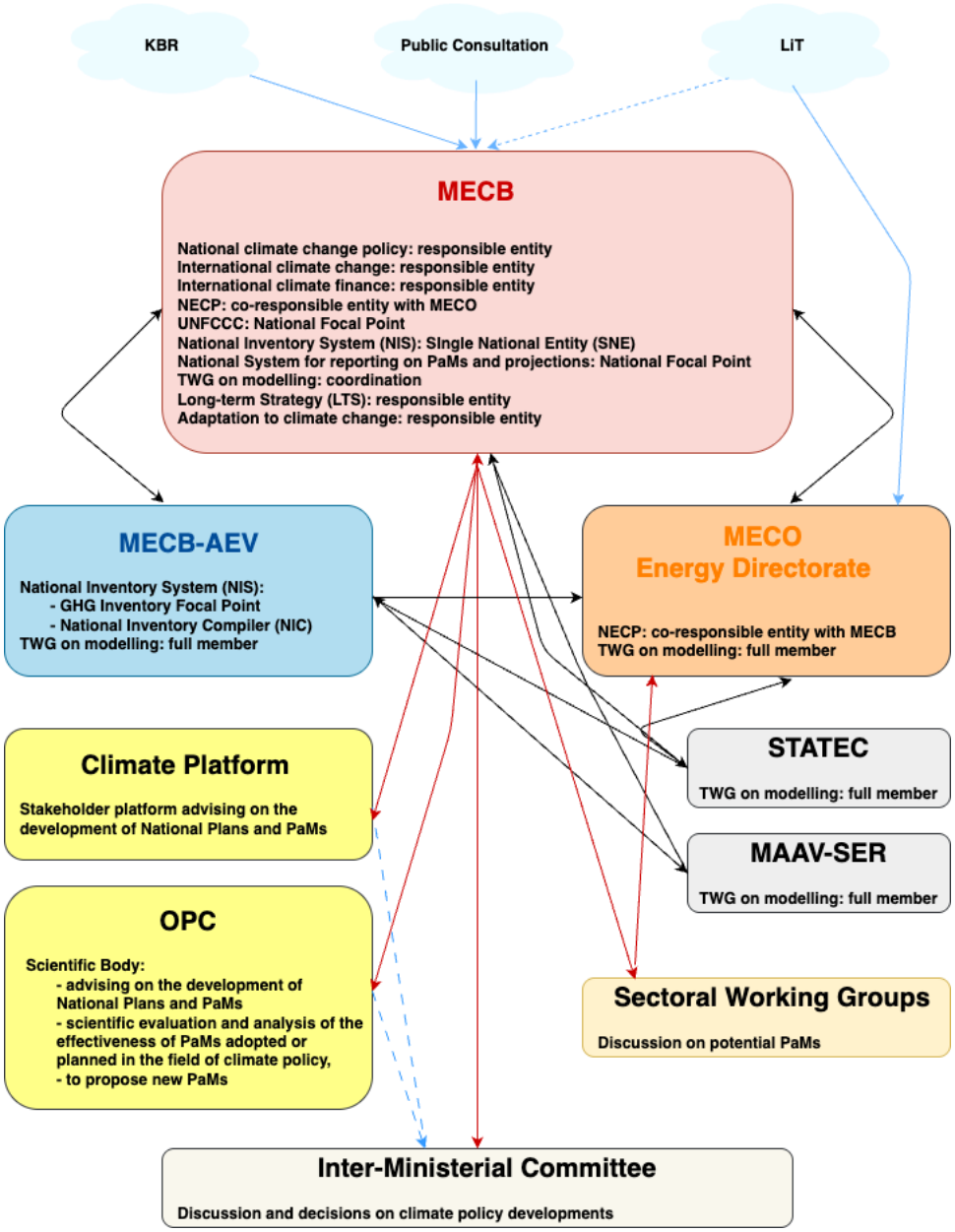
40. Public consultation is a tool that the government used to develop its climate action and plans – under EU legislation, public consultation is compulsory for the NECP. Two citizens' committees are worth mentioning: the "Citizens' Assembly on the Climate", also known as "*Klima-Biergerrot*"

65 https://opc-luxembourg.lu/en/about/.

(KBR), and "Luxembourg in Transition: Citizens' Committee" (LiT). Further information can be found in *Box 2*, and in the Eighth National Communication and Fifth Biennial Report of Luxembourg under the UNFCCC [MECB (2023), Section IX.4.1, pp. IX-29 to IX-31].

41. *Figure III.D.2-2* summarises climate governance in Luxembourg.

FIGURE III.D.2-2 – CLIMATE GOVERNANCE IN LUXEMBOURG



Source: MECB.

Notes: a) The arrows between the blocks represent the interactions between the different entities: advisory relationships in red, technical relationships in black. Dotted arrows indicate indirect interactions.
b) The Technical Working Group (TWG) on Modelling is described in Section III.D.4.2.
c) Sectoral working groups have been established by the MECB and the Energy Directorate of the MECO to discuss possible sectoral PaMs to be included in the NECP update. Sectoral groups are Buildings, Transport & Mobility, Industry, Energy, Waste, Agriculture and LULUCF.
d) Public consultation also took place through two ad hoc citizens' panels, the *Klima Biergerrot* (KBR) *Luxembourg in Transition* platform (LiT), both presented in Box 2.

BOX 1 – THE CLIMATE POLICY OBSERVATORY

In October 2021, the Government of the Grand Duchy of Luxembourg – more precisely the Government in Council – nominated the members of the Climate Policy Observatory (*Observatoire de la Politique Climatique*, OPC), which was set up in accordance with Article 7 of Luxembourg's national Climate Law. The Observatory may issue opinions on its own initiative.

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

The OPC is a scientific council currently composed of nine members chosen from individuals with expertise in a field directly related to the Observatory's mandate. Further selection criteria include the complementarity of expertise across relevant fields of knowledge, and gender diversity. Fields of expertise of the actual members range from climate modelling, climate economics and climate finance, economic geography and political science, multi-criteria analysis and life-cycle assessment, biochemistry, and system science. Four of the members are based in Luxembourg, with the other five members based abroad. The members are appointed to serve for 5 years in addition to their main employment elsewhere and dispose of an annual budget from the State budget.

The OPC's mission is supported by a Secretariat, made up of two highly qualified experts in GHG projections, climate policies, and environmental regulation. The Ministry of the Environment, Climate and Biodiversity (MECB) hosts the Secretariat. The Bureau of the OPC comprises the President, the Vice-President, and the Secretariat.

The OPC aims to make a meaningful contribution to informing climate change policy and practice in a scientifically sound and effective way. Given the urgency of the situation, it is a shared priority of all its members to identify leverage points to bring about the most far-reaching and rapid changes possible. The OPC believes that its open legal remit and the diversity of expertise and experience of its members give it unique strengths that enable it to add value in areas that are particularly difficult to address from a single ministry or organisation perspective. The OPC is particularly well placed to respond to the assessment of the Intergovernmental Panel on Climate Change (IPCC) stating that "climate governance is most effective when it interacts across multiple policy domains, helps establish synergies and minimize trade-offs", as well as connecting different actors across sectors and governance levels (national, municipal, level of individual actors). Moreover, the IPCC points out that effective governance will rely on the empowerment of diverse actors to engage in making profound changes to prevailing ways of thinking and acting.

III.D.2.2.3 Long-term Strategy

42. As mentioned above, the Luxembourg Climate Law aims to achieve climate neutrality by 2050 at the latest. Consequently, a "Long-term National Climate Strategy" (LTS) was adopted in 2021, which defines the strategic vision and identifies the guidelines, key areas of action and strategic measures for a successful transition. It will guide national climate policy until 2050 and help to meet long-term strategic commitments at European and international level. Namely, Art. 15 of the Governance Regulation requires Member States to establish long-term climate action strategies of at least thirty years. In addition, all parties to the Paris Agreement (Art. 4, para. 19) are required to submit long-term low-carbon development strategies to the United Nations Framework Convention on Climate Change (UNFCCC).

BOX 2 – CITIZEN COMMITTEES

Two civil society committees focusing on the transition to net zero have been established in Luxembourg in recent years.

Luxembourg in Transition: Citizens' Committee

Between mid-2020 and the end of 2021, the "Luxembourg in Transition" (LiT) project saw 10 international, multidisciplinary teams of architects, urban planners, landscape designers and other industry professionals envisioning scenarios and proposals for how Luxembourg and its cross-border territories can achieve carbon neutrality by 2050 (https://luxembourgintransition.lu/en/).

The process was accompanied by a citizens' committee, the *Biergerkommitee Lëtzebuerg 2050*. The Committee was tasked with discussing and evaluating the results of the various phases of "Luxembourg in Transition", providing feedback to the different expert teams, and developing an understanding of how Luxembourg should position itself to achieve climate neutrality by 2050. At the end of this process, the *Biergerkommitee* made recommendations to political decision-makers, which contributed to the development of the *Programme Directeur d'Aménagement du Territoire* (PDAT).

Throughout 2021, the members of the Citizens' Committee had the opportunity to attend twenty conferences, discussions, exchanges and information sessions on various aspects of land-use planning, both digitally and in person. National and international experts discussed a wide range of themes and issues with the members of the Citizens' Committee, such as mobility, housing, water management and climate change, to help them understand the challenges that lie ahead.

The research institute TNS Ilres was commissioned to select the 30 committee members and 10 substitutes. A random selection of people was invited to apply via email from an existing database of 18 000 names, alongside a public call launched on 4 December 2020 on social networks and in public media. Based on the applications received, TNS Ilres assembled a group of people who best reflect the diversity of the Luxembourgish population, taking into account factors such as age, gender, level of education, professional background and country of origin. Five of the 30 participants were cross-border commuters, as they are also affected by current land-use planning decisions.

On 18 January 2022, the Citizens' Committee presented the results of their deliberations, consisting of 44 recommendations, which are detailed in an English and French publication (English version: https://luxembourgintransition.lu/wp-content/uploads/2023/06/bk2050-brochure-eng.pdf).

Citizens' Assembly on the Climate – the Klima-Biergerrot

In 2022, the Luxembourg government convened a Citizens' Assembly on Climate ("Klima-Biergerrot" – KBR). Taking place from late January to early July, the KBR brought together a sample of 100 people who were either living or working in Luxembourg. They met around 15 times to discuss Luxembourg's current commitments regarding climate change and to develop possible additional measures or proposals.

The KBR built on existing measures to provide new impetus for current climate policy, drawing directly on Luxembourg society. At the end of the process, the KBR's recommendations were presented to the Luxembourg Parliament for debate. These recommendations then influenced the definition of certain PaMs in the 2023 draft NECP update.

The KBR was supported by an independent advisory committee comprising experts in the field. This committee included experts with diverse perspectives on citizens' participation and deliberative processes, as well as practitioners and researchers. The committee members were not involved in designing the KBR. Instead, their role was to advise and support the KBR coordinating group in their respective areas of expertise.

In September 2022, the KBR published a final report containing 56 recommendations aimed at accelerating and intensifying the fight against climate change in Luxembourg (French version only: *https://gouvernement.lu/fr/publications/rapport-etude-analyse/klima-biergerrot.html*).

Discussions are currently underway regarding the establishment of a KBR 2.0, which would be tasked with, among other things, monitoring and evaluating the implementation of the NECP.

43. The LTS takes a whole-of-society approach, as public acceptance and engagement will remain key to achieving deep economic and societal transformation. This process poses significant challenges, but also offers unique socio-economic and environmental opportunities, such as job creation, innovation, competitiveness, resource use, air and water quality, public health, biodiversity, quality of life and so on. The transition will have social, structural and economic as

well as technological implications. It must therefore be socially equitable and economically efficient, with the aim of maximising co-benefits while ensuring public financial stability.

44. *Box 3* summarises the principles adopted by Luxembourg to achieve climate neutrality by 2050.

BOX 3 - PRINCIPLES FOR LUXEMBOURG'S TRANSITION TO CLIMATE NEUTRALITY

1. Exploiting the potential for reducing anthropogenic GHG emissions so that only the remaining, unavoidable emissions need to be offset by sequestration.
2. A socially just transition: leaving no one behind.
3. An economically efficient and financially viable transition: maintaining and even improving Luxembourg's competitiveness while ensuring that public finances remain healthy and balanced in the long term.
4. A meaningful participation of society and economic actors in shaping the transition.
5. An integrated approach: promoting an approach that respects the Sustainable Development Goals of the 2030 Agenda, while managing administrative complexity.
6. Clear, consistent and stable or predictable regulatory and policy framework: ensure that Luxembourg's regulatory and policy framework (including policies, plans, instruments and investments) is consistent with the objective of climate neutrality.
7. Enabling EU framework: working towards and taking advantage of a favourable European framework, which is essential for a successful transition from a small open economy to climate neutrality.
8. Cooperation in the Greater Region and within the EU to increase the efficiency and speed of the transition.
9. Green finance: leveraging the strengths of the Luxembourg financial market ecosystem for the successful financing of the green transition at national and global level.
10. Post-COVID-19 green recovery: using post-COVID-19 economic recovery programmes to accelerate the transition.
11. Integrated pollution reduction: avoiding actions that are harmful to human health, biodiversity, air quality, water quality or other components of the environment, and optimising co-benefits, in particular with regard to human health.
12. Not to promote nuclear energy.
13. Enhancing resilience: increasing the capacity of the natural environment to adapt to and withstand climate change.

III.D.2.2.4 Adaptation to climate change

45. Although climate change is an inescapable truth, the first step is to limit the extent of these changes. Reducing CO_2 emissions is at the heart of national climate policies. However, to prepare our societies for a changing climate, adapting to climate change is also essential.

46. The first considerations on adaptation in Luxembourg date back to June 2011, when the Luxembourg Council of Ministers adopted a National Adaptation Strategy. This strategy prioritised biodiversity, water, agriculture and forestry, and provided a framework for adapting to the impacts of climate change in Luxembourg. In 2012, a report was published that linked adaptation and spatial planning, titled "Adaptation to Climate Change: Strategies for Spatial Planning".

47. In 2018, a revised, more comprehensive climate change adaptation strategy was finalised, based on the aforementioned documents [MECDD (2018)]. The aim was to enable Luxembourg to face the challenges of climate change and take appropriate precautions by bringing together and

updating the available information. The adaptation strategy itself outlines changes in temperature, precipitation and extreme events, as well as the expected impacts on the biosphere, pedosphere and hydrosphere. A total of 42 broad actions have been developed for 13 sectors or cross-cutting issues. The "National Adaptation Strategy and Plan 2018–2023" was adopted by the government in October 2018.

48. Article 12 of the national Climate Law establishes the legal basis for the "National Adaptation Strategy" (NAS) and the "National Adaptation Plan" (NAP). According to the law, by 1 January 2029 at the latest, and every ten years thereafter, the government must prepare an adaptation strategy for the effects of climate change with a timeframe of at least fifty years.

49. The process of updating the NAS and NAP in accordance with the provisions of the Climate Law began in 2023. Between 2023 and 2024, a large interministerial consultation took place to prepare a new strategy.

50. In November 2024, the government adopted a draft adaptation strategy, intending to launch a wide-ranging public consultation. This process began in February 2025 with the launch of seven thematic workshops, which brought together over 300 public and private stakeholders from all policy sectors. These were followed by five citizen participation meetings, which were attended by over 150 people, to develop the NAS and the measures of the NAP. The results of the public consultation will be presented in autumn 2025 to finalise the NAS and NAP.

51. Unlike the previous strategy, the NAS-NAP will last 10 years (2025–2035) and involve more policy sectors, as well as municipalities. There will be more measures, which will be more targeted, enabling them to be implemented and monitored more effectively.

III.D.2.2.5 Sustainable Development

52. In December 2019, the government adopted the third National Sustainable Development Plan "Luxembourg 2030" – NSDP3 [MECDD (2019b)]. The Plan is based on a national report the implementation of the 2030 Agenda and its 17 Sustainable Development Goals (SDGs). It includes SDG 13 – to take urgent action to combat climate change and its impacts – which underlines the mainstreaming of climate action. In addition, many of the SDGs have indirect implications for GHG emissions in their implementation.

53. Ten priority areas have been identified for the third Plan, with priority 8 – and to a lesser extent priorities 3-7 – directly linked to climate change:
    1. Ensuring social inclusion and education for all;
    2. Ensuring conditions for a population in good health;
    3. Promoting sustainable consumption and production;
    4. Diversifying and ensuring an inclusive and sustainable economy;

5. Planning and coordinating land use;
6. Ensuring a sustainable mobility;
7. Halting environmental degradation and respecting the capacity of natural resources;
8. Protecting the climate, adapting to climate change and ensuring sustainable energy;
9. Contributing to global poverty eradication and policy coherence for sustainable development;
10. Ensuring sustainable finance.

54. A web portal has been created to make available documents related to the NSDP3.[66]

III.D.2.3 Other plans and programmes

55. In addition to the plans, strategies and instruments presented in the previous sections, other plans and programmes may have climate change co-benefits, although this is not their primary concern. They are mainly concerned with energy efficiency and the use of renewable energy sources, emissions and concentrations of air pollutants, road transport and mobility, agriculture, waste management, land use planning and the preservation of ecosystems. They are listed below (not exhaustive):

- The "National Programme aiming at reducing air pollutants" (*Programme National de Réduction Progressive des Emissions de Polluants Atmosphériques (SO2, NOx, COV, NH_3)*) could have some co-benefits with regard to GHG mitigation. This programme was issued in 2003 to implement the National Emission Ceilings (NEC) Directive (Directive No 2001/81/EC)[67] that has been revised by end 2016 to include more stringent emission reduction objectives for Member States. The new text (Directive No 2016/2284)[68] indicates that, as a minimum, Member States shall limit their annual anthropogenic emissions of sulphur dioxide (SO_2), nitrogen oxides (NOx), non-methane volatile organic compounds (NM-VOC), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$) in accordance with compulsory national emission reduction commitments applicable from 2020 to 2029 and from 2030 onwards. The "National Air Pollution Control Programme" (hereafter NAPCP) under Art. 6 of Directive No 2016/2284 is the main governance instrument by which EU Member States must ensure that these emission reduction commitments.[69] The objectives for Luxembourg might be challenging to reach for some gases, in particular NOx, NH_3 and NM-COV. In that regard

66 https://nohalteg.public.lu/fr.html.

67 Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (http://data.europa.eu/eli/dir/2001/81/oj).

68 Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (http://data.europa.eu/eli/dir/2016/2284/oj and http://data.europa.eu/eli/dir/2016/2284/2024-02-06).

69 A presentation of Luxembourg's NAPCP can be found at https://environnement.public.lu/fr/loft/air/plans-air/NAPCP.html.

the plan was updated once more in 2023, as reaching the NOx target is linked with fulfilling Luxembourg's commitments under the ESR (→ §16 and 17).

Responsible entities: MECB and MECB-AEV

- The 2013 "A Clean Air Programme for Europe"[70] is currently implemented at the national level through the "Plan National de la Qualité de l'Air" (hereafter PNQA) adopted in 2021. This PNQA focuses mainly on nitrogen dioxide (NO_2). Measures presented in this programme are either EU wide – complying with Euro standards for private vehicles in real driving conditions e.g. – or national/local – lowering individual motorised transport and shifting it to alternative fuels (reducing the number of diesel vehicles), promoting (clean) public transports, facilitating traffic flows, considering air quality in urban planning development plans, information and awareness.[71] Clearly, these measures have some co-benefits with regard to GHG mitigation.

  Responsible entities: MECB and MECB-AEV

- The "National Mobility Plan 2035" (*Plan National de Mobilité 2035*, hereafter PNM 2035)[72] proposes an overall approach to cope with an increase of 40% in journeys in 2035 compared to 2017 and is based on previous concepts such as MODU 2.0 from May 2018.

  The plan is not limited to improving transport routes for vehicles alone, but focuses on how people will be able to commute in the future. Therefore, the focus shifts to the efficient choice and combination of different modes of transport, either through the basic use of different modes of transport (multimodal mobility) or even several modes of transport within one route (intermodal mobility). However, meeting different mobility types and needs requires not only the coordination of different mobility services, but also the joint, often competing use of the limited space available for transport by different transport users, like moving and parked cars, bicycles and pedestrians. Instead of planning the networks of different transport modes individually, the aim is to find synergies between the different modes to create compact solutions and eliminate duplicate road and rail infrastructure.

  In order to cope with the traffic flows forecast for urban areas in 2035, a key task is to channel transit traffic onto the main transport network and to decongest city centres as much as possible, so that they can be redesigned in favour of urban transport modes such as bus or tram, cycling and walking.

  Responsible entity: MMTP

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70 A Clean Air Programme for Europe (Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0918&from=EN).

71 A presentation of the PNQA can be found at https://environnement.public.lu/content/dam/environnement/documents/air/plans-strategies/2021-PNQA-aev.pdf.

72 The National Mobility Plan 2035 can be found at https://gouvernement.lu/en/dossiers/2022/pnm2035.html.

- The "National Waste and Resources Management Plan" (*Plan national de gestion des déchets et des ressources*, hereafter PNGDR) adopted in 2018, leads to emission reductions from waste management activities by reducing waste generation, increasing waste recovery and reducing the negative impacts of waste disposal. It promotes the concept of circular economy and introduces long-term objectives such as resource preservation, climate protection and effects on future generations.[73]

  In 2021, Luxembourg formulated a strategy for circular economy,[74] and in 2022, five new laws aiming to reduce waste generation in Luxembourg were passed with an emphasis on "zero waste" and "circular economy".[75]

  Responsible entities: MECB and MECB-AEV

- The third "National Plan for Nature Preservation" (*Plan National concernant la Protection de la Nature*, hereafter PNPN3) 2023-2030[76] is based on the EU Biodiversity Strategy for 2030 and structured on four pillars: protection, restauration, transformative change, and international commitments. By preserving biodiversity and protecting ecosystems, or restoring them, there are co-benefits for climate mitigation – for instance, through restoring wetlands that offer bigger carbon absorption possibilities than other types of land uses. One key policy in this framework, which also indirectly benefits GHG absorption, is the "ecological compensation" scheme based on the obligation to repair ecological damage caused by private or public buildings or developments. A tax is levied on contracting authorities whose projects cause ecological damages - this is akin to the polluter-pays principle. Public national and local authorities then use the revenues of this tax for actions to restore or create biotopes or habitats that are concentrated in "compensatory pools". Thus, as a whole, the system pursues the objective of avoiding any net loss of biodiversity ("no net loss").[77]

  Responsible entities: MECB and MECB-ANF

- The "Master Programme for Spatial Planning" (*Programme directeur d'aménagement du territoire*, hereafter PDAT)[78] of 2023 with two horizons to 2035 and 2050 provides concrete strategic orientations to support territorial planning actors and coordinate any transversal and intersectoral action between government and municipal administrations having an impact on the Luxembourg territory. In the context of observed territorial development trends and the climate emergency, the PDAT proposes a territorial strategy to ensure the implementation of the ecological transition of the territory and to contribute to the pursuit of

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73 A presentation of the PNGDR can be found at https://environnement.public.lu/fr/offall-ressourcen/principes-gestion-dechets/Plan_national_de_gestion_des_dechets_PNGD.html.

74 See https://gouvernement.lu/dam-assets/documents/actualites/2021/02-fevrier/08-strategie-economie-circulaire/20210208-Strategie-economie-circulaire-Luxembourg.pdf

75 See https://environnement.public.lu/fr/actualites/2022/05/offall-a-ressoucepak.html

76 The PNPN3 can be found at https://environnement.public.lu/fr/natur/biodiversite/pnpn.html.

77 The principle of "ecological compensation" is explained at https://environnement.public.lu/fr/natur/biodiversite/compensation.html.

78 The PDAT can be found at https://amenagement-territoire.public.lu/fr/strategies-territoriales/programme-directeur.html.

a quality of optimal life of citizens. Two of the main objectives is to concentrate development in the most appropriate locations and to reduce soil sealing. The first ensures that development occurs in such a way to make the future public transportation system more efficient and to preserve Reducing soil sealing has the benefits of reducing the effects of climate change, preserving agricultural and forest areas, reducing the risk of flooding, preserving biodiversity, preserving surfaces capable of sequestering significant quantities of CO_2, and reducing urban sprawl.

Responsible entity: MLOGAT

- A new Forest Law was passed in July 2023 with the aim to establish a necessary balance between the different economic, social and recreational needs of our forests. The law now establishes a legal framework to regulate these various uses and has several objectives: (1) to establish a robust and coherent general legal framework for forests, in order to ensure the sustainable management of forests so that they can fulfil their ecological, economic and social functions in a balanced manner; (2) to protect forests as a natural and landscape environment; (3) conserve and enhance biological diversity in forest ecosystems; (4) to maintain the national extent of forests and their distribution between ecological regions; (5) maintain the health and vitality of forests so that they can contribute to the carbon cycle and the protection of water and soil, and continue to provide all other ecosystem services; and (6) to maintain and promote silviculture and the forest economy.

  Responsible entity: MECB-ANF

- The "Common Agricultural Policy (CAP) Strategic Plan of Luxembourg 2023-2027" (*Plan stratégique national du Luxembourg pour la mise en oeuvre de la PAC 2023-2027*)[79] aims to ensure sustainable development in the agricultural sector, implementing the CAP's economic, environmental, and social objectives. One of the main priorities is to ensure fairer income for agricultural producers and to strengthen the competitiveness of agricultural and agri-food businesses. Focus is also given to ensure generational renewal in farms, specifically by supporting the establishment of young farmers. Lastly, Luxembourg's Plan also aims to further develop organic farming, reduce the use of pesticides, GHG and ammonia emissions, and to promote carbon sequestration.

  Responsible entity: MAAV

- Research, innovation, business development and cross-sector cooperation in the area of eco-technologies are fostered through the "CleanTech" cluster.[80] These activities could have spillover effects that would be beneficial to both climate change adaptation and mitigation.

  Responsible entity: MECO

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79 The CAP Strategic Plan is presented at https://gouvernement.lu/fr/actualites/toutes_actualites/communiques/2022/09-septembre/13-haagen-psn-pac.html.

80 https://www.luxinnovation.lu/cluster/luxembourg-cleantech-cluster/.

56. Next to public national action plans and programmes, there also exist local projects as well as private/corporate initiatives. Some of these are presented in the Eighth National Communication and Fifth Biennial Report of Luxembourg under the UNFCCC [MECB (2023), Chapter IX].

57. Implementation of climate change mitigation measures at the municipality level is aided by the Climate Pact for Municipalities and at the business level by the Climate Pact for Businesses – for details see [MECB (2023), Section IX.1.1.4, pp. IX-5 & IX-6] as well as ***Box 4*** in ***Section III.D.3.1.1***.

58. The Climate Agency (*Klima-Agence*)[81] is a key player for implementing climate change mitigation measures in municipalities and together with residents – for details see [MECB (2023), Section IX.1.1.5, pp. IX-6 to IX-8].

III.D.2.4 Inter-ministerial decision-making process/bodies[82]

59. The MECB has overall responsibility for the coordination and implementation of:
    - the national Climate Law;
    - the overall climate change policy;
    - the integrated National Energy and Climate Plan (NECP) – together with the MECO;
    - the Long-term Strategy for reducing GHG emissions (LTS);
    - the national climate change Adaptation Plan and Strategy (NAP/NAS);
    - EU and UNFCCC reporting requirements.

60. Responsibility for implementing sectoral policies lies with the relevant government ministries.

61. To coordinate inter-ministerial cooperation on climate change, the government has also set up an "Interministerial Committee for Climate Action". Its members include representatives from the:
    - Ministry of the Environment, Climate and Biodiversity (MECB): Chair and Secretariat
    - Ministry of Agriculture, Food and Viticulture (MAAV)
    - Ministry of the Economy (MECO), and more precisely its Energy Directorate
    - Ministry of Finance (MFIN)
    - Ministry of Home Affairs (MAINT)
    - Ministry of Housing and Spatial Planning (MLOGAT)
    - Ministry of Mobility and Public Works (MMTP).

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81 *Klima-Agence* website can be found at https://www.klima-agence.lu/en.

82 See also Figure III.D.2-2.

62. In addition, sub-groups at technical and sectoral levels are responsible for informing and preparing the coordination of policy planning and implementation, as well as monitoring and evaluation. At the technical level, this is the case, for example, of the "Technical Working Group on Modelling" *[→ Section III.D.4.2]*, which was set up to produce GHG projections and assess the impact of the proposed PaMs in the context of the NECP update (→ §17).

III.D.2.5 Monitoring and evaluating PaMs

63. Achieving reduced emissions of GHG requires the implementation of a number of different measures, both technical measures and behavioural changes. Various policy instruments can be used to achieve this. The strategy followed by Luxembourg includes taxes, grants, regulations, information and a market-based system that mainly influence emissions within the energy and transport sectors. Policy instruments introduced in the waste and agricultural sectors, as well as to improve and transform mobility, also influence developments.

64. To improve its structure, transparency and completeness, the presentation of the PaMs has been completely revised for the 2023 draft NECP update. For this initial BTR, only minor modifications have been made to the list of PaMs to reflect those included in the final 2024 NECP update. A total of 206 PaMs are now listed, including both existing and additional PaMs *[→ Table III.D.2-2]*. These are described in more detail in *Section III.D.4*.

65. The revised list of PaMs provides a solid basis for improved monitoring and evaluation of the PaMs. An ex-ante evaluation in terms of GHG emission reductions up to 2050 has been carried out for the 2024 NECP update and is presented in *Section III.D.3.2*. The PaMs are assessed by the five sectors covered by the national climate change legislation. A comprehensive assessment of individual PaMs is not yet available. A particular challenge is to distinguish between the effects of individual PaMs.

66. Regarding the projected costs and non-GHG benefits, the 2024 NECP update includes an assessment of the macroeconomic impact of the planned PaMs and the corresponding investment needs [MECB and MECO (2024), Section 5.2]. The analysis concludes that the increase in investment (private and public) and the decrease in energy expenditure (then available for consumption) are likely to have a positive but very limited impact on economic activity. In fact, the energy transition, which will drastically reduce GHG emissions and involve significant changes at several levels, would probably have only a negligible impact on activity from a macroeconomic point of view, especially by 2030.

TABLE II.D.2-2 – DRAFT NECP UPDATE PAMS

Sector	Number of PaMs (listed in 2024 NECP update)
Cross-sectoral policies and measures	23
Buildings	29
Transport	31
Industry	29
Renewable energies	25
Energy security	12
Internal energy market	10
Waste	14
Agriculture	11
LULUCF	22
Total	**206**

Source: MECB.

67. A bottom-up calculation of the additional investments and expenditure required amounts to up to 1.4% of GDP in 2030. These investments and expenditure would be mobilised by both private and public actors. In addition to public investment, the government would provide financial support for the efforts of businesses and households. Beyond increases in public expenditure, the decline in fuel sales would lead to a decrease in government revenue. The public balance as a percentage of GDP would thus deteriorate by up to 1.3 percentage points by 2030. Households, on the other hand, would benefit from lower energy costs. This reduction would be more pronounced than the required increase in investment.

68. Building on the recent improvements described above, monitoring and evaluation will be developed further in the coming years. It has recently been decided that the reporting on PaMs will take place on a half-yearly basis within the framework of the "Interministerial Committee for Climate Action". This will also cover a "tracking system" regarding PaMs implementation. Hopefully through the "Technical Working Group on Modelling", ex-ante evaluations of the expected impacts of PaMs will be possible, followed later by ex-post and cost evaluations.

III.D.3 SECTORAL AND CROSS-SECTORAL PAMS

69. This section describes PaMs whose primary objective is GHG mitigation, i.e., which could have a significant impact on GHG emissions and removals, in accordance with paragraphs 80 to 82 of the MPGs [UNFCCC (2018)]. The PaMs are included in the 2024 NECP update and are represented in either the WEM or WAM scenario.

70. At this stage Luxembourg cannot report on requirements of paragraph 83 of the MPGs on costs and non-GHG mitigation benefits of the PaMs, as well as on how the mitigation actions interact with each other.

71. As explained in *Section III.D.2.5*, it is not possible at this stage to provide an assessment of the PaMs or groups of PaMs as requested in paragraphs 85 and 86 of the MPGs. The assessment of the mitigation potentials is not yet sufficiently robust and will be the subject of specific work. However, it is possible to present the mitigation potential for each group of PaMs (i.e., five) linked to one of the five sectors under the Luxembourg Climate Law *[→ Section III.D.3.2]*.

72. *Section III.D.3.1* provides a description of the key policies and measures in each sector and cross-sectoral measures, as well as summary tables by sector and by gas. Defining which gases are affected is not a straightforward task, as many measures, although primarily addressing CO_2, may also reduce emissions of other GHGs such as CH_4 and N_2O. In CTF Table 5, the "Gases affected» column indicates the main gas targeted, which in most cases is CO_2.

73. Those PaMs that expired or were repealed during the reporting period between the 5th Biennial Report and the first BTR re discussed in *Section III.D.3.3*.

74. Some plans and policies that could lead to an increase in GHG emissions are listed in *Section III.D.3.4*, and measures to minimise the adverse effects of PaMs are described in *Section III.D.3.6*. In this section, Luxembourg also wishes to communicate its commitments and actions regarding gender equality and human rights in the context of climate change.

75. *Table III.D.3-1* lists the 206 PaMs presented and discussed in *Section III.D.3.1*, indicating their implementation status. The two NECP dimensions which are relevant to GHG emissions mitigation are "decarbonisation" and "renewable energy". These two dimensions group 184 PaMs out of the 206 PaMs described in the Luxembourg 2024 NECP update. *Table III.D.3-2* lists the 184 climate-related PaMs by GHG concerned.

TABLE III.D.3-1 – LIST OF PAMS INCLUDED IN THE 2024 NECP UPDATE – BY SECTOR AND NECP DIMENSIONS

PaM number	Name of the PaM	Status of implementation	Mitigation impact estimated?
101	Climate Law	Implemented	NE
102	Strengthening climate governance within the government administration	Planned	NE
103	Climate and Energy Fund	Implemented	NE
104	Just Transition Fund	Implemented	NE
105	CO_2 tax	Implemented	NE
106	Climate Pact 2.0 with municipalities	Implemented	NE

107	Climate Pact for inter-municipal syndicates	Planned	NE
108	Nature Pact with municipalities	Implemented	NE
109	Decarbonisation strategy pursuing the objective of climate neutrality of state administration as of 2040	Planned	NE
110	PDAT2023: gradual reduction of land take and concentration of development in the most appropriate locations	Implemented	NE
111	Quarter-hour city	Planned	NE
112	Green Belt around Luxembourg City and Interurban Green Zone projects resulting from the international consultation "Luxembourg in Transition" (LiT)	Planned	NE
113	Vocational training in the context of the energy and climate transition	Planned	NE
114	Citizens' awareness, information and advice promoting behavioural change and enabling framework for citizen engagement	Implemented	NE
115	National Centre of Excellence in Research for energy transition and climate action	Planned	NE
116	Strategic RDI programme for the governance of the energy transition and climate action	Planned	NE
117	Support for the establishment of research chairs and public-private or public-public partnerships at the University of Luxembourg and at public research centres	Planned	NE
118	Use of sustainable and climate finance tools to decarbonise	Implemented	NE
119	Scaling up energy and climate transition projects	Planned	NE
120	Energy Efficiency Obligation Scheme (EEOS)	Expired	NE
121	Energy Efficiency Obligation Scheme (EEOS): revision 2021	Implemented	NE
122	Reducing our carbon footprint based on consumption	Planned	NE
123	Development of statistics, models and indicators	Planned	NE
201	Remuneration for electricity from renewable energy sources	Implemented	NE
202	Raising awareness, information and advisory services on renewable energy sources	Implemented	NE
203	Revision of legislation with a view to abolishing, reducing or facilitating or speeding up authorisation procedures	Planned	NE
204	Coordination of procedures relating to renewable energy decisions	Implemented	NE
205	Install photovoltaic system on all residential buildings	Planned	NE
206	Calls for tenders for large power photovoltaic power plants	Implemented	NE
207	PV ready obligation for industrial and agricultural buildings	Implemented	NE

208	Calls for tenders for photovoltaic power plants in self-consumption mode	Implemented	NE
209	Draft call for tender for ground-based photovoltaic installations (agri- PV)	Implemented	NE
210	Framework for promoting self-consumption, communities and energy cooperatives	Implemented	NE
211	Solar Cadastre on the Luxembourgish Geoportal	Implemented	NE
212	Obligation to declare the income of a PV plant: limit increased from 4 kW to 30 kW	Implemented	NE
213	VAT rate fund for photovoltaic installations at 3%	Implemented	NE
214	Remunerations for biogas injected into the natural gas network	Implemented	NE
215	Biogas strategy and new incentives (financial and other) for biogas	Implemented	NE
216	Hydrogen strategy	Adopted	NE
217	Remuneration for the production of renewable hydrogen	Implemented	NE
218	Connection to a European hydrogen transport infrastructure	Planned	NE
219	Facilitating the use of long-term renewable electricity supply contracts through a risk reduction instrument	Implemented	NE
220	Cross-border cooperation: European Renewable Energy Financing Facility	Implemented	NE
221	Cooperation measures with EU Member States on renewable energy: Statistical Transfers	Implemented	NE
222	Promotion of efficient district heating and cooling	Planned	NE
223	Promotion of medium and deep geothermal energy	Implemented	NE
224	Facilitation of authorisations of new sites for the installation of wind turbines	Planned	NE
225	Assessment of the potential of forest biomass available for energy production	Planned	NE
301	Regulation on the energy performance of buildings	Implemented	NE
302	Decarbonisation of buildings: phase out of fossil heating	Planned	NE
303	Energy renovation obligation for public buildings (owned by a public body)	Planned	NE
304	Energy renovation obligation for functional buildings	Planned	NE
305	Energy renovation obligation for residential buildings	Implemented	NE
306	*PRIMe House* aid scheme 2017	Expired	NE
307	*Klimabonus Wunnen* aid scheme	Implemented	NE

308	Digitalisation of *Klimabonus* aid scheme	Implemented	NE
309	Pre-financing under the *Klimabonus Wunnen* scheme	Planned	NE
310	Climate Loans Scheme	Expired	NE
311	Individual housing aid scheme	Implemented	NE
312	Aid scheme for construction (*aide à la pierre*)	Implemented	NE
313	Tax incentives for energy renovation of housing	Implemented	NE
314	Aid scheme for municipalities	Implemented	NE
315	Promoting sustainable construction	Adopted	NE
316	Long-term Building Renovation Strategy	Adopted	NE
317	Building awareness, information, guides and consultancy services	Implemented	NE
318	Training of a skilled and sufficient workforce in the buildings sector	Implemented	NE
319	Preventive role of the State in relation to buildings (see also PaM 303)	Implemented	NE
320	Pioneer role of the public sector in energy efficiency	Planned	NE
321	Primary role of municipalities with regard to buildings	Implemented	NE
322	Reduction of the environmental impacts of construction	Adopted	NE
323	Decarbonation of construction sites	Planned	NE
324	Minimum energy performance requirements for rented dwellings (owner incentives)	Planned	NE
325	Facilitation of energy works in buildings in co-ownership	Implemented	NE
326	Harmonisation of urban planning rules	Planned	NE
327	National entity accompanying energy renovation, decarbonisation and installation of photovoltaic installations for residential buildings	Planned	NE
328	Pilot project “Rehabilitation of neighbourhoods – Differdange”	Implemented	NE
329	Assistance to households in energy poverty	Implemented	NE
401	National Mobility Plan 2035	Implemented	NE
402	Modu 2.0	Implemented	NE
403	MMUST	Implemented	NE
404	Promotion of active mobility	Implemented	NE
405	Promotion of public transport	Implemented	NE

406	Promotion of innovative mobility services	Planned	NE
407	Mobility awareness, information and advisory services	Implemented	NE
408	Establishing a framework for teleworking	Implemented	NE
409	Limitation of the need for mobility – promotion of co-working areas	Planned	NE
410	Promotion of electrification of Luxembourg registered car fleet	Implemented	NE
411	Implementation of a public charge infrastructure	Implemented	NE
412	Electrification of the fleet of contracting authorities and contracting entities (State, municipalities, municipal associations, etc.)	Implemented	NE
413	Electrification of the state car fleet	Implemented	NE
414	Full electrification of the RGTR bus network until 2030	Implemented	NE
415	Obligation to incorporate sustainable biofuels into road fuels	Implemented	NE
416	Biomethane in the transport sector	Implemented	NE
417	Sustainable aviation fuels at national airport	Adopted	NE
418	Alternative Fuels Infrastructure Deployment	Implemented	NE
419	Tax on road vehicles	Implemented	NE
420	Revised registration tax on road vehicles	Planned	NE
421	Tax advantage for service cars	Implemented	NE
422	Leasing social car	Planned	NE
423	Aid scheme for zero-emission vehicles of CO_2	Implemented	NE
424	Aid scheme for the installation of private charging points for electric vehicles	Implemented	NE
425	Aid scheme for undertakings investing in charging infrastructure for electric vehicles	Implemented	NE
426	Aid scheme for the acquisition of zero-emission heavy-duty vehicles	Planned	NE
427	Decarbonisation strategy for freight transport and logistics	Planned	NE
428	Eurovignette	Planned	NE
429	Facilitating the installation of charging stations	Implemented	NE
430	Motorised Traffic Speed Reductions	Planned	NE
431	Scheme for greenhouse gas emission allowance trading (ETS) – aviation	Implemented	NE
501	Greenhouse gas emission allowance trading scheme (EU-ETS)	Implemented	NE

502	Aid scheme to compensate for the additional costs associated with the EU-ETS system for the period 2021-2030	Implemented	NE
503	Voluntary agreement on improving energy efficiency in industry (up to and including 2023)	Implemented	NE
504	Voluntary Agreement on Decarbonisation and Improving Energy Efficiency in Industry (from 2024)	Implemented	NE
505	Energy audits mandatory for companies	Implemented	NE
506	Compulsory energy audits for enterprises (Revision EED 2023)	Planned	NE
507	Energy audit and monitoring/optimisation obligation for functional buildings with a surface area greater than 1,000 m2	Planned	NE
508	Obligation to decarbonise through an accelerated fossil phase-out for functional buildings with a surface area greater than 1.000 m^2	Planned	NE
509	obligations to monitor and improve energy efficiency for data centres	Planned	NE
510	Industry Decarbonisation Roadmap	Implemented	NE
511	Climate Pact for Businesses (SMEs) (*Klimapakt fir Betriber*)	Implemented	NE
512	Enterprise aid scheme – environmental and climate protection	Implemented	NE
513	Fit4Sustainability	Implemented	NE
514	SME Packages Sustainability	Implemented	NE
515	General aid for SMEs – Investment aid (revision)	Implemented	NE
516	Enterprise aid scheme – environmental and climate protection (Revision)	Planned	NE
517	Operating assistance scheme for decarbonisation projects	Planned	NE
518	Risk Sharing Facility for Energy Efficiency and Decarbonisation of Enterprises Projects	Planned	NE
519	Aid scheme for enterprises – research, development and innovation	Implemented	NE
520	Modernisation of the tax rebate for investments made as part of an energy and ecological transition project	Implemented	NE
521	Revision of legislation to speed up permitting procedures for decarbonisation projects	Planned	NE
522	Circular Economy Strategy "*Kreeslafwirtschaft Lëtzebuerg*"	Implemented	NE
523	Framework for Action for the Deployment of Carbon Capture, Utilisation and Storage Technologies	Planned	NE
524	Regulation No 517/2014 (F-Gas II) for the reduction of emissions of fluorinated greenhouse gases	Implemented	NE

525	Reinforcing the regulations on checking the leakage of refrigeration, climate and thermodynamic equipment	Implemented	NE
526	Ratification of the Kigali Amendment	Implemented	NE
527	Advice to companies for the replacement of their HFC-fuelled equipment with HFC- free equipment and collective recovery of discontinuous appliances – *SuperDrecksKëscht* action	Implemented	NE
528	Prohibition of certain fluorinated gases in air conditioning systems in motor vehicles	Implemented	NE
529	Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014	Planned	NE
601	Waste Law and the National Waste and Resource Management Plan (PNGDR)	Implemented	NE
602	Support to a circular economy "*Null Offall Lëtzebuerg*"	Implemented	NE
603	Circular Economy Strategy "*Kreeslafwirtschaft Lëtzebuerg*"	Implemented	NE
604	Incineration of waste	Implemented	NE
605	Methane Recovery Systems	Implemented	NE
606	Valuation of greenery waste	Implemented	NE
607	Valuation of organic waste	Implemented	NE
608	Reduction of single-use materials	Implemented	NE
609	Discharge	Implemented	NE
610	Inert discharge	Planned	NE
611	Waste water management	Adopted	NE
612	Wastewater purification	Implemented	NE
613	Wastewater purification	Adopted	NE
614	Sewage Sludge Recovery Strategy	Planned	NE
701	Aid to reduce the livestock load	Implemented	NE
702	Aid to promote the use of food additives to reduce methane emissions from digestion	Planned	NE
703	Aid for the conversion and maintenance of organic farming	Implemented	NE
704	Aid for manure injection and composting	Implemented	NE
705	Aid for manure incorporation (eco-scheme)	Implemented	NE
706	Prime for sustainable and environmentally-friendly agriculture	Implemented	NE

707	Aid for agricultural investment – Agricultural/viticultural and horticultural machinery and equipment	Implemented	NE
708	Agricultural investment aid – Fixed buildings and installations - Aid for modernisation, innovation or development investments in the processing and marketing of agricultural products	Implemented	NE
709	Legal framework for the use of nitrogen fertilisers in agriculture	Planned	NE
710	Agricultural Council	Implemented	NE
711	Legal framework for capping the number of livestock per holding	Implemented	NE
801	Forestry – forest management	Implemented	NE
802	Protection of total forest area	Implemented	NE
803	Establishment of free-flowing forests without timber harvesting	Implemented	NE
804	Establishment of strictly protected areas in public forests with limited timber harvesting	Implemented	NE
805	Conservation of highly biodiverse trees and deadwood in productive forests	Implemented	NE
806	Limitation of harvesting levels in vulnerable public natural forest ecosystems	Implemented	NE
807	Increased use of wood from Luxembourgish forests as building material	Implemented	NE
808	Sustainable Forest Management of Public Forests	Implemented	NE
809	Support schemes for the sustainable management of private forests (*Klimabonus Bësch*)	Implemented	NE
810	Aid to promote agroforestry on agricultural land	Implemented	NE
811	Aid for the installation of catch crops and undersowing	Implemented	NE
812	Aid for the transformation of arable land into permanent grassland	Implemented	NE
813	Aid for crop rotation and diversification on arable land	Implemented	NE
814	Aid for sustainable and environmentally-friendly agriculture (Viticulture)	Implemented	NE
815	Aid for reduced tillage	Implemented	NE
816	Support for the conversion and maintenance of organic farming (MFA)	Implemented	NE
817	Aid for the installation of non-productive areas	Implemented	NE
818	Aid for the installation of non-productive strips	Implemented	NE
819	Urban land – Improvement of urban soils, vegetation media, with stable organic carbon to maximise their carbon stocks	Planned	NE

820	Urban land – Prohibition of the installation of mineral cutlery for aesthetic purposes ('gravel gardens') and encouragement for conversion of existing gravel gardens	Planned	NE
821	Urbanised land – Launch into production of abandoned urban areas with the aim of producing non-food biomass (productive landscape)	Planned	NE
822	Aid schemes for ecosystem services of marshes and other wetlands of private owners (*Klimabonus Mouer a Wiss*)	Implemented	NE
901	Report on security of supply in the electricity sector in Luxembourg	Implemented	NA
902	Report on security of supply in the gas sector in Luxembourg	Implemented	NA
903	Luxembourg Risk Preparedness Plan for the electricity sector	Adopted	NA
904	Contingency plan for the security of gas supply in Luxembourg	Adopted	NA
905	Preventive Action Plan	Implemented	NA
906	Oil reserve	Planned	NA
907	PLEF Support Group "Security of Supply"	Implemented	NA
908	BeLux Crisis Group for natural gas	Implemented	NA
909	EU Electricity Coordination Group	Implemented	NA
910	EU Gas Coordination Group	Implemented	NA
911	Security of supply in the hydrogen sector in Luxembourg	Planned	NA
912	Network development plans	Planned	NA
1001	Project 380 (building a high voltage line between Germany and Luxembourg)	Implemented	NA
1002	Strengthening the national high voltage network	Implemented	NA
1003	Smart Meter rollout	Implemented	NA
1004	Energy Data Platform	Implemented	NA
1005	Regulatory framework for aggregation	Planned	NA
1006	New tariff structure for network tariffs	Implemented	NA
1007	Dynamic electricity prices	Implemented	NA
1008	Facilitation of electricity sharing and energy communities	Implemented	NA
1009	Support to long-term contracts (power purchase agreements PPA)	Implemented	NA
1010	Express support mechanism for flexibility	Planned	NA

NECP dimensions	
Decarbonisation – Cross-sectoral / Horizontal	101 to 123, excl. 120 & 121
Decarbonisation – Buildings	301 to 329
Decarbonisation – Transport & Mobility	401 to 431
Decarbonisation – Industry	501 to 529
Decarbonisation – Waste	601 to 614
Decarbonisation – Agriculture	701 to 711
Decarbonisation – LULUCF	801 to 822
Renewable Energy	201 to 225
Energy Efficiency	120 to 121
Energy Security	901 to 912
Internal Energy Market	1001 to 1010

Summary			
Cross sectoral / Horizontal	21 PaMs		
Energy Efficiency	2 PaMs		
Buildings	29 PaMs		
Transport	31 PaMs		
Industry	29 PaMs		
Waste	14 PaMs		
Agriculture	11 PaMs		
LULUCF	22 PaMs		
Total decarbonisation	**159 PaMs**		
Renewable Energy	25 PaMs		
Energy security	12 PaMs		
Internal Energy Market	10 PaMs		
Grand Total	**206 PaMs**		
Adopted	9 PaMs	decarbonisation : 8 PaMs	+ Renewable Energy: 1 PaMs
Implemented	137 PaMs	decarbonisation : 119 PaMs	+ Renewable Energy: 18 PaMs
Planned	57 PaMs	decarbonisation : 51 PaMs	+ Renewable Energy: 6 PaMs
Expired	3 PaMs	decarbonisation : 3 PaMs	+ Renewable Energy: 0 PaMs
			Total "climate-related": 184 PaMs
Estimated	0 PaMs		
Not estimated – NE	184 PaMs		
Not applicable – NA	22 PaMs		
Indicated elsewhere – IE	0 PaMs		

Source: MECB.

TABLE III.D.3-2 – LIST OF PAMS FROM THE DECARBONISATION AND RENEWABLE ENERGY DIMENSIONS OF THE 2024 NECP UPDATE – BY GAS

GHG	PaM number
CO_2 – 136 PaMs	101-114; 118-123; 301-329; 401-431; 501-523; 601-604; 606; 608; 703; 706; 707: 708; 710; 801-822
CH_4 – 84 PaMs	101-109; 113; 114; 118-121; 301-329; 501-518; 520; 521; 601; 602; 604-609; 611-614; 701-703; 706-708, 710; 711
N_2O – 24 PaMs	101; 102; 103; 106; 108; 113; 118; 119; 601; 602; 604; 606; 611-614; 703-710
F-gases – 7 PaMs	101; 524-529

Source: MECB.

III.D.3.1 Cross-sectoral and sectoral policies and measures

76. This section summarises the main PaMs from *Table III.D.3.1*. Refer to CTF Table 5 for details.

III.D.3.1.1 Cross-sectoral or horizontal policies and measures

77. Of the 21 cross-sectoral or horizontal PaMs, the most important are as follows:

- PaM n°101: Climate Law establishing the institutional framework and governance of climate policy at national level, including national and sectoral climate targets *[→ Section III.D.2.2.2]*.
- PaM n°105: an annual surcharge of 5 EUR/tCO_2e has been introduced through the implementation of the "CO_2 tax", gradually increasing to 45 EUR/tCO_2e by 2026 – in the WAM scenario there is an additional 5 EUR/tCO_2e annual increases for the years 2024 to 2050, i.e. a tax of 165 EUR/tCO_2e in 2050. The revenues generated will be used to finance initiatives for the transition to a climate-friendly and energy-efficient economy, as well as social compensation measures for low-income households. These measures include a "climate tax credit" for the two lowest income quintiles and an increase in the cost of living allowance.
- PaMs n°106 & n°107: continuous development of the Climate Pact 2.0 with municipalities *[→ Box 4]* [83] and development of a Climate Pact for inter-municipal syndicates.
- PaM n°109: decarbonisation strategy pursuing the objective of climate neutrality of the state administration by 2040.
- Wide range of financial incentives (such as *Klimabonus Wunnen*, *Klimabonus Mobilität*, *Klimabonus Bësch* and *Klimabonus Mouer*, business support schemes) and consolidation of financing tools (such as the Climate and Energy Fund *[→ Box 5]*).
- Supporting citizens and businesses through various awareness-raising offers and programmes, information and advice.
- Initial and continuing vocational training in skills needed in the energy transition and climate action.

83 https://www.pacteclimat.lu/fr/acteur-engage.

- Design of measures ensuring the implementation of a just transition and development of a "Social Climate Plan" in line with Regulation (EU) 2023/955 establishing a Social Climate Fund.[84]

BOX 4 – THE CLIMATE PACT 2.0 WITH MUNICIPALITIES

The Climate Pact 2.0 is the second edition of the Climate Pact, which is a commitment by municipalities to implement measures for a sustainable and environmentally responsible energy transition, in collaboration with the State. It aims to reduce greenhouse gas emissions, improve energy efficiency and increase the use of renewable energies.

Municipalities that sign up to the Climate Pact commit to implementing a catalogue of 64 measures established by the European Energy Award (eea). These measures effectively guide municipalities towards a sustainable policy in the areas of energy transition, climate change mitigation, the circular economy, air quality, climate change adaptation and mobility. This catalogue is also accompanied by key quantitative indicators specific to municipalities that are closely linked to the NECP objectives and is regularly revised to take into account national objectives and regular programme evaluations.

The Luxembourg government supports municipalities in their efforts by subsidising the costs of climate advisors and offering financial assistance based on the level of certification achieved. The government will provide the legislative, financial, technical and advisory framework until 31 December 2030. *Klima-Agence* is responsible for the operational implementation and ongoing development of the programme.

The Climate Pact 2.0 also encourages participation in European programmes such as the Covenant of Mayors and the European Green Capital Award, which promote local efforts to improve the environment, the economy and quality of life in cities on an international level.

Links

Climate Pact 2.0: https://pacteclimat.lu/fr/citoyen
European Energy Award: https://www.european-energy-award.org/ and the catalogue: https://pacteclimat.lu/fr/acteur-engage/les-mesures
Klima-Agence: https://www.klima-agence.lu/en

BOX 5 – THE CLIMATE AND ENERGY FUND (CEF)

On 23 December 2004, Luxembourg established a fund to finance the Kyoto mechanisms (the 'Kyoto Fund'). In January 2011, the fund was renamed the "Climate and Energy Fund" (hereafter CEF) to reflect the fact that, from that year onwards, it would be used to finance not only national measures to combat climate change and the flexibility mechanisms created by the Kyoto Protocol and later by the Paris Agreement, but also to finance energy efficiency and renewable energy projects.

The establishment of the CEF and the appointment of the MECB as its administrator were set out in the Climate Law in December 2020. Under this law, the scope of the CEF's activities has been extended further. The Minister responsible for the environment is advised by a management committee comprising representatives from the MECB, MAEE-COOP, MECO, MFIN and the Inspectorate of Finance (IGF).

Objectives

The CEF is an essential financial instrument for Luxembourg in its fight against climate change. It enables the country to finance and support the actions necessary to achieve the energy and climate policy objectives set out in its NECP. It finances various concrete measures and projects in different sectors, such as buildings, transport, industry and agriculture, to reduce emissions and improve energy efficiency. However, it also aims to finance measures in developing countries, notably through investments in various carbon funds of international financial institutions, as well as in "flexible mechanisms" or ITMOs.

Funding

The FCE is primarily funded by the CO_2 tax on fossil fuels, as well as other sources of revenue, including the proceeds from the auctioning of emission allowances under the EU ETS and a portion of the road vehicle tax. It is also funded by allocations from the state budget, which are currently anecdotal as long as other revenue sources prove to be sufficient. FCE expenditure is regularly reviewed to ensure it aligns with climate objectives.

84 Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2021/1060 (http://data.europa.eu/eli/reg/2023/955/oj and http://data.europa.eu/eli/reg/2023/955/2024-06-30).

III.D.3.1.2 Energy consumption and production (excluding transport)

78. Of the 56 PaMs in the energy sector (excluding transport), 25 relate to the promotion and use of renewable energy sources, while 29 focus on energy efficiency and the use of renewable energy sources in buildings. Also featured here are the two overall energy efficiency PaMs, one of which has expired. The most important are as follows:

- PaM n°327: national entity accompanying energy renovation, decarbonisation and installation of photovoltaic installations for residential building.
- PaMs n°301, 303 & 319: nearly zero-energy buildings (nZEB) must adhere to regulations on energy performance for decarbonised buildings and heating systems. A heat pump serves as the reference for any new construction and for decarbonisation through electrification.
- PaMs n°304, 305 & 316: ambitious renovations of existing building stock are prioritised, with a focus on supporting energy renovation measures.
- PaM n°302, 310 &313: prioritise decarbonising existing residential buildings through heat pumps with a gradual, voluntary fossil phase-out and significant financial incentives.
- PaM n°508: accelerate the transition away from fossil fuels for existing functional buildings larger than 1000 square metres, prioritising those in the non-administrative tertiary sector. This will be achieved through the use of heat pumps and consultation with relevant sectors regarding the timing of the obligation.
- PaMs n°307 to & 309: provide financial incentives for the decarbonisation of residential buildings via the *Klimabonus Wunnen* scheme, supplemented by a social top-up program.
- PaMs n°120 & 121: since 2015, the "Energy Efficiency Obligation Scheme" (EEOS) has been implemented with yearly goals and alternative strategies to attain energy conservation for end-users. Presently, it has been amended and strengthened.

III.D.3.1.3 Transport and mobility

79. Of the 31 PaMs in the transport sector, 10 relate to mobility issues, 6 to electrifying the car park, 4 to biofuels and alternative fuels, 9 to taxes and incentives, and 2 are more general. The most important are as follows:

- PaM n°401: the "National Mobility Plan 2035" (PNM2035) will be put into action along with the promotion of public transport (PaM 405, which covers free public transport) and active mobility.
- PaMs n°410, 411, 423 & 425: the development of electromobility will be accelerated through assistance programs for acquiring zero-emission vehicles and installing charging points (*Klimabonus Mobilitéit*, social leasing of electric cars, and business support schemes). In addition, tax incentives will be offered for electric cars.

- PaM n°424: expand the charging infrastructure through aid schemes and easier installation of charging points (*Klimabonus Mobilitéit*), particularly in buildings with shared ownership and active areas.
- PaM n°419: revised registration tax on road vehicles.
- PaM n°105: continue to reduce "fuel sales to non-residents" by gradually increasing the CO_2 tax.

80. Paragraph 88 of the MPGs [UNFCCC (2018)], requires Parties to identify PaMs that influence GHG emissions from international transport. In the case of Luxembourg, these PaMs could be grouped into three categories:
    - policies that directly influence GHG emissions from international transport. Four PaMs could have direct impacts:
      - PaM n°417 on sustainable aviation fuels;
      - PaM n°427 on the decarbonisation strategy for freight transport and logistics: Luxembourg is situated at the heart of Western Europe's main traffic axes and has traditionally experienced high volumes of road transit traffic, both for freight transport and for tourists travelling to or from Southern Europe;
      - PaM n°428 relating to the "Eurovignette" scheme;[85]
      - PaM n°431 on a GHG emission allowance trading scheme (ETS) for aviation.
    - a second category relates to biofuels and alternative fuels, which are mostly oriented towards national transport. However, due to the location of Luxembourg, they could impact international transport-related emissions.:
      - PaMs n°415 on the obligation to incorporate sustainable biofuels into road fuels;
      - PaM n°418 on alternative fuels infrastructure deployment;
      - PaM n°426 on an aid scheme for the acquisition of zero-emission heavy-duty vehicles.
    - finally, given the high number of cross-border commuter journeys made by car each working day, all mobility and infrastructure measures have an indirect impact on international GHG emissions.[86] These measures are PaMs n°401 to 409, 421, 425 and 429.

III.D.3.1.4 Industry

81. Of the 29 PaMs in the in the industrial sector, 7 deal with F-gases and 2 with the EU ETS. The most important are as follows:
    - PaM n°501: EU ETS.

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85 Like Belgium (until 2016) and the Netherlands, Denmark and Sweden, Luxembourg has been charging the "Eurovignette" for lorries using its motorways since 2001, in accordance with the so-called "Eurovignette Directive": http://data.europa.eu/eli/dir/2022/362/oj. In Luxembourg, this tax is based on pollutant emissions (EURO standards) and the truck's number of axles. It can be paid on a yearly, monthly, weekly or daily basis: see https://douanes.public.lu/fr/vehicules/eurovignette.html.

86 Since the onset of the Covid-19 pandemic crisis, international traffic – or "sales of road transport fuels to non-residents" – has represented around 60% of GHG-related emissions in the road transportation sector.

- PaM n°510: Industry Decarbonisation Roadmap: implementation and update.
- PaM n°511: a "Climate Pact for Businesses" (targeting mainly SMEs).
- PaM n°504: voluntary agreement to decarbonise and improve energy efficiency in industry.
- PaM n°505: mandatory energy audits (with revised criteria and identification of decarbonisation potential).
- PaM n°121: amended and strengthened "Energy Efficiency Obligation Scheme" (EEOS) to identify the largest energy savings potential in industry.
- PaMs n°512 and its planned revision (PaM n°516): revising the enterprise aid schemes to align with European state aid rules by introducing contracts for difference (OPEX aid) in addition to investment aid (CAPEX aid).
- PaM n°518: establishing a risk-sharing mechanism for energy efficiency and business decarbonisation projects.
- PaM n°523: a framework for action for the deployment of Carbon Capture, Utilisation and Storage (CCUS) technologies.

III.D.3.1.5 Agriculture

82. Of the 11 PaMs in the agriculture sector, the most important are as follows:
    - defining a legal framework transposing Luxembourg's National Strategic Plan for the implementation of the Common Agricultural Policy 2023-2027, including farm advice and support for sustainable and environmentally friendly agriculture.
    - PaM n°709: strengthening the regulatory framework for the use of nitrogen fertilisers in agriculture.

III.D.3.1.6 Forestry and LULUCF

83. Of the 22 PaMs in the forestry sector, and beyond in the LULUCF sector, 9 are in relation to forestry and forest management, another 9 are in connection with agricultural soil and related practices and 3 relate to urban land. The most important are as follows:
    - PaM n°801: consolidating sustainable management of public and private forests.
    - PaM n°809 & 822: promote assistance programmes for private landowners for ecosystem services of forests (*Klimabonus Bësch*) and of marshes and other wetlands (*Klimabonus Mouer a Wiss*).
    - PaM n°807: increasing the use of wood from Luxembourg forests as building material.
    - PaMs n°810, 812 & 813: providing financial incentives for arable land management to improve organic carbon content, alongside support for agroforestry.

III.D.3.1.7 Waste management

84. Of the 14 PaMs in the waste sector, 2 are connected to the circular economy, 7 deal with waste management issues (landfilling, incineration and valorisation), and 4 relate to wastewater. One PaM is horizontal. The most important are as follows:

- PaM n°601: implementation and continuous development of the waste legislation and the National Waste and Resource Management Plan (PNGDR).
- PaMs n°602 & 603: promoting the circular economy, including through the implementation of the "*Kreeslafwirtschaft Lëtzebuerg*" and "*Null Offall Lëtzebuerg*" strategies.
- PaMs n°611 & 614: modernisation and extension of wastewater treatment plants and implementation of the strategy for the recovery of sewage sludge.

III.D.3.2 Assessment of the aggregate effects of policies and measures

85. Based on the latest GHG projections included in the 2024 NECP update, the aggregate ex-ante impact of the PaMs in terms of GHG emission reductions by sector is presented in *Table III.D.3-3*. The five sectors are those covered by national climate change legislation. The estimated GHG emission reductions are the result of extensive discussions, expert judgements and calculations in the "Technical Working Group on Modelling" *[→ Section III.D.4.2]*, which were translated into hypotheses on the underlying projection parameters and variables. These reductions include the effects of both existing (WEM) and additional (WAM) measures included in the 2024 NECP update. They are expressed relative to GHG emissions in 2021 – the first year for binding emission targets – as reported in the 2024v2 submission, which is now labelled LUX-CRT-2024-V1.0.[87]

TABLE III.D.3-3 – AGGREGATE EFFECTS OF POLICIES AND MEASURES BY SECTOR COMPARED TO 2021 GHG EMISSIONS

[kt CO_2e (AR5)]	2025	2030	2035	2040	2045	2050
LUCL1 - Energy and manufacturing industries, construction	-141	-290	-365	-443	-503	-516
LUCL2 - Transports	-1047	-2452	-3750	-4599	-4841	-4882
LUCL3 - Residential and commercial buildings	-388	-628	-919	-1194	-1361	-1526
LUCL4 - Agriculture and forestry	-60	-172	-189	-206	-222	-234
LUCL5 - Waste and wastewater treatment	-20	-37	-37	-39	-39	-36
Total	**-1655**	**-3578**	**-5260**	**-6481**	**-6965**	**-7192**

Source: MECB.

87 https://unfccc.int/documents/645403.

86. *Table III.D.3-4* shows the estimated total GHG emission reductions in relative terms compared to GHG emissions in 2021.

TABLE III.D.3-4 – AGGREGATE EFFECTS OF POLICIES AND MEASURES BY SECTOR IN RELATIVE TERMS COMPARED TO 2021 GHG EMISSIONS

[kt CO_2e (AR5)]	2025	2030	2035	2040	2045	2050
Energy and manufacturing industries, construction	-23%	-47%	-59%	-72%	-82%	-84%
Transports	-21%	-50%	-76%	-93%	-98%	-99%
Residential and commercial buildings	-24%	-39%	-57%	-74%	-84%	-94%
Agriculture and forestry	-8%	-24%	-26%	-29%	-31%	-33%
Waste and wastewater treatment	-10%	-19%	-19%	-20%	-20%	-19%

Source: MECB.

III.D.3.3 Policies and measures no longer in place

87. As requested by paragraph 87 of the MPGs [UNFCCC (2018)], Luxembourg reports below on actions, policies and measures that are no longer in place compared with the most recent report – i.e. the NC8/BR5 [MECB (2023)] – and explain why they are no longer in place.

88. As Luxembourg reported the PaMs under the 2023 draft NECP update in the NC8/BR5 and only a small number of amendments were made between this version and the final 2024 NECP update, the changes are very limited.

89. With regard to actions, policies and measures, besides some refinements or light amendments in the PaMs description and objectives as they were presented in the 2023 draft NECP update, the only noticeable change is that PaMs n°306 and 310 have expired and been replaced by the *Klimabonus Wunnen* scheme (PaMs n°307 to 309).

III.D.3.4 Plans and policies that could lead to increasing GHG emissions

90. Luxembourg has identified policies that may lead to increased GHG emissions, as explained below. However, further work would be needed to identify the main programmes and plans, as well as fiscal and tax policies, that are not directly related to climate change or energy issues, but which could lead to increased emissions of GHG or other air pollutants.

91. For example, Luxembourg's overall economic development strategy involves diversifying the economy. One of the "clusters" of diversification being promoted is logistics, specifically air and rail freight-based activities with a focus on added-value logistics. However, this could lead to additional road or air transport activities, which could increase greenhouse gas (GHG) emissions. This is reflected in our WAM projections for CRF 1A3c, where the WAM scenario

results in a greater increase in emissions up to 2050 than the WEM scenario because a greater proportion of freight is shifted from road to rail (see §82 in *Section III.F.3.8*).

92. The development of cogeneration plants in Luxembourg, while increasing energy security and providing less polluting electricity than imported electricity, has led to an increase in GHG emissions in Luxembourg. The response is now to phase out fossil fuel cogeneration plants and to develop such plants using biogenic fuels (biomass), which are considered neutral in terms of CO_2 emissions (but not for the other GHGs).

93. Various harmful subsidies act as incentives for GHG emitting activities. This is the case of the income tax deduction for commuting above a certain threshold. However, Luxembourg has now introduced several measures to encourage the use of alternative means of propulsion for cars (such as electric vehicles) and to increase the use of public transport for commuting (such as free public transport from March 2020).

III.D.3.5 Modification of longer-term trends in GHG emissions

94. Paragraph 89 of the MPGs [UNFCCC (2018)] encourages Parties to report, to the extent possible, on information about how its PaMs are modifying longer-term trends in GHG emissions and removals.

95. Luxembourg's climate and sustainable development policies aim at modifying longer-term trends in anthropogenic GHG emissions and removals consistent with the objective of the Convention, but also with the latest developments in science. The unilateral move made by Luxembourg in December 2019 for reducing its non-ETS emissions by 55% in 2030 compared to 2005 was based on the scientific evidence that the European Commission proposal in the "2030 Climate and Energy Framework" *[→ Section III.D.1.2]* – a domestic reduction in GHG emissions of 40% compared to 1990 – would not be sufficient to limit the increase in the global average temperature to well below 2°C above pre-industrial levels, neither sufficient to reach a carbon neutral society by 2050. Already in 2010, the second NSDP of Luxembourg identified 14 non-sustainable trends, including "GHG emissions that do not slow down due to an increased energy use" and "continuous growth of transport flows with adverse consequences on energy consumption, land use and road safety". The identified non-sustainable trends were tackled with 18 long-term objectives to be reached by 2050. Nowadays, longer-term national objectives will be framed through the implementation of the Agenda 2030 in Luxembourg and the associated NSDP3 [MECDD (2019b)], which covers the 17 Sustainable Development Goals (SDGs), incl. SDG 13 – take urgent action to combat climate change and its impacts *[→ Section III.D.2.2.5]*. Synergies and consistency between the NDSP3 and the NECP are clearly sought.

96. A large share of the current PaMs of Luxembourg contributes to reducing GHG emissions in the longer-term. This is in particular the case for PaMs that have an impact on investments with long

lifetimes such as the construction of low-energy and passive houses and investments in energy supply by renewable fuels. In addition, the promotion of electric vehicles is expected to have a long-term impact as it contributes to the long-term infrastructure development.

97. To ensure taking effective local action against domestic non-compliance with emission reduction targets, under the national Climate Law, Luxembourg has laid down provisions for progressive and binding emission targets for 5 sectors *[→ Section III.D.2.2.2]*.

98. Finally, together with the other EU member States, Luxembourg will collectively contribute to the EU emission reduction target. In case of non-compliance with its targets, the provisions set out in the ESR would be applied to Luxembourg.

III.D.3.6 Minimizing the adverse effects of policies and measures in other countries

99. Paragraph 90 of the MPGs [UNFCCC (2018)] encouraged Parties to provide detailed information, to the extent possible, on the assessment of economic and social impacts of response measures. Some information is provided in the following paragraphs.

100. A small economy such as Luxembourg's is unlikely to have a significant negative impact abroad through its policy choices. As discussed in previous sections, Luxembourg has introduced a variety of measures to reduce national GHG emissions in its NECP and its NECP update. Most of these measures have no direct or indirect negative impact on developing countries.

101. However, where potential adverse effects are identified, Luxembourg shall endeavour to implement its PaMs in such a way as to minimise adverse effects on other Parties, in particular developing country Parties.

102. Furthermore, to minimise the negative impacts of using mechanisms for international cooperation to achieve the NDCs set out in Article 6 of the Paris Agreement, Luxembourg ensures that project-based mechanisms are chosen in line with sustainability criteria. Luxembourg also supports developing countries in combating the adverse effects of climate change. Its cooperation assistance focuses on Least Developed Countries (LDCs), with climate finance additional to Official Development Assistance (ODA) *[→ Section V.A]*. The country's cooperation focuses on several programmes of international financial institutions *[→ Section V.C.2]*.

103. Luxembourg has identified some of the potentially harmful subsidies and disincentives in the tax system, but these negative effects occur within Luxembourg. Potential carbon leakage to developing countries has been addressed in emissions trading.

104. Finally, for some years now, Luxembourg has been addressing key issues such as human rights and gender equality in the context of climate change.

III.D.3.6.1 Cooperative mechanisms under Article 6 of the Paris Agreement

105. Please refer to *Section V.A.1* in the Chapter on support provided and mobilised.

III.D.3.6.2 Biofuels

106. The promotion of biofuels is one policy having potential negative indirect effects on developing countries as it could lead to the destruction of (or adverse shifts in) resources. EU legislation ensures that biofuels imported from such countries are produced in accordance with the principles of sustainable development. The conditions are set out in such a way that biofuels do not compete with food production and are not causing degradation of valuable ecosystems. Luxembourg supports relevant EU activities, such as the Directive on the Promotion of the Use of Energy from Renewable Sources and the Directive on Fuel Quality.

III.D.3.6.3 Harmful subsidies and adverse incentives in tax system

107. Environmentally harmful subsidies and disincentives in the tax system are partially identified. The aim is to gradually eliminate such negative incentives. Tax deductions for commuting to work and tax benefits for company cars are two such negative incentives. For the latter, tax benefits have been revised in favour of electric cars. Tax exemptions for some "occupational" fuels, e.g., in agriculture, are another example of a potential field of action.

III.D.3.6.4 Emission Trading

108. Companies covered by the EU ETS Directive face legal requirements that may incur additional costs, such as reducing GHG emissions through investment or purchasing CO_2 quotas. To prevent carbon leakage from industries and the associated negative effects on countries with less stringent regulations, free allocations were provided to EU ETS-covered companies (e.g. those in the cement, glass, steel and chemical industries). During the first Kyoto commitment period (2008–2012), around 14 installations received a total of 12.44 Mt CO_2e in free allocations, whereas during the second period (2013–2020), 21 installations received around 10.06 Mt CO_2e in free allocations. In the current phase, which covers the years 2021 to 2025, 22 installations are affected by around 5.76 Mt CO_2e of free allocations. Free allocations will gradually disappear alongside the introduction of the "Carbon Border Adjustment Mechanism" (CBAM).

III.D.3.6.5 Gender equality and Human Rights in the context of Climate Change

109. The European Convention on Human Rights is an international treaty under which the 47 Member States of the Council of Europe ensure fundamental, civil and political rights not only to their nationals but also to all the people under their jurisdiction. Signed in Rome on 1 November 1950, this text came into force on 3 September 1953. In accordance with Art. 66 of

the Convention, it is the deposit, in Strasbourg, of the 10th instrument of ratification by the Grand Duchy of Luxembourg that triggered the entry into force of the Convention. From 2012 to 2015, the Luxembourgish judge Dean Spielmann held the Presidency of the European Court of Human Rights.

110. Since 2015, Luxembourg is a proud signatory of the "Geneva Pledge for Human Rights in Climate Action". The protection and the promotion of human rights, gender equality and the fight against climate change figure among the top policy priorities of the Luxembourg government**.** Luxembourg is firm of the view that it is important to take the stance to defend the universal agendas in the international fight against climate change in the context of human rights and gender equality.

111. Luxembourg is in various ways actively involved in the promotion and protection of human rights and gender equality, e.g.:

- focus on gender equality in the programming cycles of international cooperation activities;
- during the selection process of projects applying for international climate finance support a sustainable development assessment is performed, which includes social criteria (e.g., health and safety, quality of employment, access to clean drinking water) and gender criteria looking at aspects of women empowerment and equality and gender sensitive development impacts;
- financial support to the Gold Standard Foundation for the development of "Gender Equality Guidelines and Requirements" and application of the guidelines and requirements in a pilot climate project;
- financial support to the "Energy Sector Management Assistance Program" (ESMAP) of the World Bank with focus on project preparation activities related to the creation of a climate, health and gender results-based finance structure for distributing highly efficient and clean cookstoves and helping women adopting new technologies**;**
- in May 2015, establishment of an Inter-ministerial Committee for Human Rights (CIDH) in order to improve the national coordination as well as the close cooperation with civil society, which forms an integral part of the work of the committee;
- support of the United Nations Office of the High Commissioner for Human Rights.

112. Today, clear political statements and commitments are necessary in order to move to a fair and sustainable climate framework for the years to come. However, political commitment on its own is not enough. Acutely aware that complex challenges, like climate change and human rights, cannot be taken up effectively by one actor alone, but call for coordinated, multidisciplinary and multi-stakeholder responses, Luxembourg has associated itself with partners from like-minded countries, international organizations and civil society to carry on the ongoing works in this regard.

III.D.4 INSTITUTIONAL ARRANGEMENTS FOR EVALUATING PAMS AND PERFORMING GHG PROJECTIONS

113. This section outlines the institutional arrangements and procedures for evaluating PaMs and performing GHG projections.

III.D.4.1 National system for GHG projections and evaluation of PaMs

114. A Grand-Ducal Regulation - hereafter the "GDR 04.2017" – of 24 April 2017 designates roles for the preparation and submission of GHG inventories. It also defines and allocates specific responsibilities for the realization of these GHG inventories both within the "Single National Entity"[88] and within the other administrations and/or services that will be involved in the inventory preparation in the future (see [MECB-AEV (2024), Section 1.2.1, pp. 39-45]. The GDR 04.2017 also proposes a national system for reporting on policies and measures and for reporting on projections of anthropogenic GHG emissions by sources and removals by sinks.[89]

115. The projections, as well as the ex-ante and ex-post evaluation of PaMs, including the related costs, should be carried out as appropriate by sector experts or the competent institutions, as determined in annex 2 to the GDR 04.2017.[90] The sector experts are responsible for:

- choosing appropriate methods for the calculation of projections as well as for the ex-ante and ex-post evaluation of PaMs, including the related costs;
- establishing, if necessary, in consultation with the institutions referred to in annex 2 to the GDR 04.2017, the activity data, parameters and emission factors necessary for the calculations of the projections as well as for the ex-ante evaluation and ex-post of PaMs, including associated costs;
- calculating the projections as well as carry out the ex-ante and ex-post evaluation of PaMs, including the related costs, within the framework defined respectively by the UNFCCC, CLRTAP and the European Union;
- estimating the projections for the categories that fall within their sector(s), when the institution referred to in annex 2 to the GDR 04.2017 does not provide them with the data necessary for the calculation of these projections;
- calculating past projections and reassessing the costs and effects of PaMs when necessary, in particular for the following reasons: refinements or changes in methods, considering new sources of information, bug fixes, among others;

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88 The "Single National Entity" is a service or person located in the MECDD that coordinates the work and officially submit the information to the international institutions (see Art. 4 of the GDR 04.2017).

89 http://legilux.public.lu/eli/etat/leg/rgd/2017/04/24/a446/jo.

90 For each GHG source category or sub-category, responsible entities are defined, whether Ministries, Agencies or the STATEC. This list contains mostly the same implementing entities than those identified in CTF Table 5.

- estimating and calculating uncertainties relating to projections as well as to the ex-ante and ex-post evaluation of PaMs, including the related costs, in particular through sensitivity analyses;
- ensuring the quality assurance of projections and ex-ante and ex-post evaluation of PaMs, including related costs, as well as the control of this quality;
- preparing the necessary information for drafting methodological reports relating to their sector(s) for projections and for the ex-ante and ex-post evaluation of PaMs, including the related costs;
- actively participating in audits, preparing answers to auditors' questions and transmitting them to the "projections focal point" within the deadlines established by the latter;
- informing the "projections focal point", as well as the quality assurance manager of any problem encountered during the execution of their mission(s).

116. The "projections focal point" acts as the projections and PaMs coordinator and is located in the MECB There is one focal; point for the UNFCCC and GHG related reporting and one for the CLRTAP and associated reporting. He/she has the following missions:

- ensuring timeliness, transparency, accuracy, consistency, comparability and completeness of projections and ex-ante and ex-post evaluation of PaMs, including related costs;
- informing sector experts, as well as the institutions referred to in annex II to the GDR 04.2017, of any changes in the requirements, methods and assumptions and assessing, with the sector experts, the impact of these changes on the projections or on the ex-ante and ex-post evaluation of PaMs, including the related costs;
- assisting sectoral experts in their mission;
- taking into account the required deadlines, defining a timetable for the transmission of the various elements necessary for the calculation of projections and of the ex-ante and ex-post evaluation of PaMs, including the related costs, and ensuring that this deadline is respected;
- setting up a coherent system of documentation and archiving of the various information in relation to the projections and the ex-ante and ex-post evaluation of PaMs, including the related costs, and ensuring the compilation of related data;
- developing appropriate methods for collecting baseline data, validating the calculation of projections and the ex-ante and ex-post evaluation of PaMs, including related costs, evaluating the analysis of sensitivity to projections and performing, in collaboration with the manager of quality assurance, control and quality assurance of the aforementioned elements;
- estimating projections and ex-ante and ex-post evaluation of PaMs, including related costs, for a given sector when the expert or institution do not transmit the data necessary to establish these calculations within the period established by the schedule mentioned above;

- analysing projections and carrying out ex-ante and ex-post analysis of PaMs, including related costs;
- compiling all the data and information required for the projections, the ex-ante and ex-post evaluation of PaMs, including the related costs, and the related methodological reports using national, European Commission and UNFCCC IT tools;
- managing the external audit as carried out under the auspices of the European Commission and the UNFCCC. Establishing a plan to improve the calculation of projections and of the ex-ante and ex-post evaluation of PaMs, including the related costs that includes the recommendations and encouragements given. Ensuring their proper execution, in close collaboration with the quality assurance manager;
- providing the "Single National Entity" with information relating to the carrying out of projections and ex-ante and ex-post evaluation of PaMs, including the related costs as well as the possibilities and means of improving them;
- reporting to the "Single National Entity" any problem that could affect the proper functioning of the national system, in particular when the focal point has had to resort to the estimation of projections and ex-ante and ex-post evaluations of PaMs, including the related costs for a given sector, due to the fact that the expert or the institution referred to annex 2 to the GDR 04.2017 did not provide the data necessary to establish these calculations within the time limit established by the timetable.

III.D.4.2 Technical Working Group on Modelling

117. For the preparation of the NECP update, Luxembourg decided to carry out the GHG projections and the assessment of the potential impacts of the PaMs as much as possible "in-house", i.e., between government administrations and services. For this reason, an inter-ministerial "Technical Working Group on Modelling" (hereafter, TWG) was set up in June 2021, i.e., two years before the required date for submission of the 2023 draft NECP update.

118. The TWG includes representatives from STATEC, which is responsible for modelling energy supply and combustion activities, as well as from the Energy Directorate of the MECO, MAAV-SER (modelling agricultural practices) and MECB-AEV (projections and evaluation for non-combustion source categories, excluding agriculture): see ***Sectio III.F.2*** for a presentation of the models and approaches. The group also invited other administrations on an ad hoc basis, e.g., MMTP for mobility issues.

119. The TWG will also monitor and evaluate progress with PaMs to mitigate GHG emissions over time. This development is now on the group's agenda for the coming years, alongside the regular updating of projections and a more precise ex-ante assessment of the impact of PaMs.

Annex 1 – Changes in reporting compared to the latest submission

The table below summarizes the main changes compared to the previous submission – NC8/BR5 [MECB (2023)] – for the sections of this report, as well as for CTF related Tables.

Section or CTF Table in NC8/BR5	Section or CTF Table in BTR1 and revisions
IV.1.1	III.D.1.1 – no revision.
IV.1.2	No longer reported as it is now outdated.
IV.1.3	III.D.1.2 – minor text updates and updated figures.
IV.1.4	III.D.1.3 – no revision.
IV.1.5	No longer reported.
IV.2.1	III.D.2.1 – no revision.
IV.2.2	III.D.2.2 – minor updates and two new boxes (Climate Policy Observatory and Citizen's Committees)
IV.2.3	III.D.2.3 – minor updates.
IV.2.4	III.D.2.4 – Ministries list and names updated.
IV.2.5	III.D.2.5 – updated information on PaMs from the 2024 NECP update compared with the 2023 draft NECP update.
IV.3	Section no longer relevant in the context of the BTR1.
IV.4	III.D.3 – updated information on PaMs from the 2024 NECP update compared with the 2023 draft NECP update.
IV.4.1	III.D.3.1 – updated information on PaMs from the 2024 NECP update compared with the 2023 draft NECP update.
IV.4.2	Merged in III.D.3.1.
IV.4.3	III.D.3.2 – updated information from the 2024 NECP update compared with the 2023 draft NECP update.
IV.4.4	III.D.3.3 – updated text.
IV.4.5	III.D.3.4 – minor updates.
IV.4.6	III.D.3.6 – minor updates and flexible mechanisms information have been removed and replaced by Article 6 of the Paris Agreement, the principles of which are presented in Chapter V of this BTR1.
IV.4.7	Section no longer relevant in the context of the BTR1.
IV.4.8	III.D.3.5 – no revision.
IV.5.1	III.D.4.1 – no revision.
IV.5.2	III.D.4.2 – minor update.
CTF Tables 3, 4, 4(a)I, 4(a)II, 4b	New CTF Table 5.

Annex 2 – Implementation of recommendations and encouragements from the latest review

The table below indicates if recommendations and encouragements from the latest reviews – IDR.8, Table I.1 and TRR.5, Table II.1 [UNFCCC (2024)] – have been included or not in this submission, and if not, why.

Reporting requirement	Issue type	Assessment	Description	Included Y/N
para. 8 (BR)	Transparency	Encouragement	The ERT encourages the Party to clearly report in its next submission the method used for assessing how it minimizes the economic and social consequences of response measures.	Not implemented.
para. 19 (NC) CTF Table 3 (BR)	Completeness	Recommendation	The ERT recommends that Luxembourg improve the completeness of its reporting by providing information on the estimated effects of its mitigation actions. The ERT notes that the Party could improve transparency by including in its next NC the information provided to the ERT during the review, namely by explaining whether some of the PaMs do not have a quantifiable mitigation impact (or the impact can be quantified, but with a very high level of uncertainty). The ERT also notes that the Party could group the PaMs resulting in emission reductions that are interlinked with other PaMs and present the estimated mitigation effect for the group of PaMs, specifying which individual PaMs are included. The ERT also recommends that the Party report year of implementation and gases affected for all mitigation actions.	Very partially implemented: brief explanations in Section III.D.3.5.
para. 21 (NC)	Completeness	Encouragement	The ERT reiterates the encouragement from the previous review report for Luxembourg to report in its next submission information on the costs of PaMs, the non-GHG benefits of PaMs and how PaMs interact with each other at the national level.	Not implemented.
para. 24 (BR)	Transparency	Encouragement	The ERT encourages the Party to clearly document the sectors to which the provisions for self-assessment of compliance with emission reductions apply, including an explanation of how its domestic climate policy and governance arrangements address the issue of self-assessment of compliance with emission reductions.	Very partially implemented: brief explanations in §68.

III.E – Summary of greenhouse gas emissions and removals

1. Each Party that submits a stand-alone national inventory report shall provide a summary of its GHG emissions and removals. This information shall be provided for those reporting years corresponding to the Party's most recent national inventory report, in a tabular format as requested by paragraph 91 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)].

2. In December 2024, Luxembourg submitted its most recent National Inventory Report (NIR) to the UNFCCC, covering the period from 1990 to 2022. The NIR consists of the National Inventory Document (NID – MECB-AEV (2024)) and the Common Reporting Tables (CRT). Together, these provide a complete quantitative and qualitative overview of Luxembourg's GHG inventory.[91] Sections 2.2 to 2.5 of the NID, titled "Description of Emission Trends for Aggregated GHG Emissions/by Gas/by Category/Indirect GHG and SO_2", on pages 133–165, provide a summary of the main trends in national GHG emissions and removals. Summary tables by gas and main sectors can be found in CTF table 6.

3. For more details on the methodology used to identify GHG emissions from international aviation and navigation within the scope of the EU NDC, please refer to *Section III.B.2*.

[91] Both the NID and the accompanying CRF tables can be found on the UNFCCC website.: https://unfccc.int/documents/645242 and https://unfccc.int/documents/645403.

III.F – Projections of greenhouse gas emissions and removals

1. *Section III.F* discusses GHG projections up to 2050 for two scenarios: "with existing measures" (WEM scenario), and "with additional measures" (WAM scenario), as requested by paragraphs 94 and 95 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)]. After short preliminary comments *[→ Section III.F.1]*, this section outlines the methodology behind the projections *[→ Section III.F.2]*, as requested by paragraph 96 of the MPGs. The results of the projection exercise are presented for a series of source categories, as well as by gas *[→ Section III.F.3]*. The projections are in line with most of the recommendations of paragraphs 98 to 101 of the MPGs. After a review of GHG projection methodologies over time *[→ Section III.F.4]*, the estimated and expected impacts of individual policies and measures are reported *[→ Section III.F.5]*, as far as possible in line with paragraph 85 of the MPGs. Finally, *Annex 1* summarises the changes between the BTR1 and the NC8/BR5 [MECB (2023)], and *Annex 2* indicates whether the recommendations and encouragements from the latest reviews – IDR.8/TRR.5 [UNFCCC (2024)] – have been implemented or not.

2. According to the reporting guidelines, the projection-related data to be reported in tabular format is available in CTF Tables 7–11.

3. This chapter has been written by the Ministry of the Environment, Climate and Biodiversity (MECB) and is based on information and texts provided by Laurent Braun, Tom Haas, Lena Rota, Jill Schaul and Olivier Thunus (STATEC); Tim Mirgain, Marc Schuman, Fabien Wahl and Max Wolter (MECB-AEV); and Marie-Josée Mangen (MAAV-SER).

III.F.1 PRELIMINARY REMARKS: PROJECTIONS ASSOCIATED WITH HIGH UNCERTAINTY

4. This report has already emphasised the specific national circumstances of Luxembourg, e.g. in *Section III.A*, which sets the limits of a GHG projections exercise for Luxembourg. The main limitations are described below.

III.F.1.1 Economy size increases the uncertainty of GHG projections

5. The size of Luxembourg's economy creates uncertainties, as even single decisions at the company level – either the opening, closure or shutdown of an industrial installation – can have a major impact on the overall national GHG emissions development. Reliable long-term forecasts are not always easy to make, as demonstrated by the following national examples. The power generation sector is one example of this, with a major gas-fired power plant emitting around 1 Mt CO_2e/year. This plant started up in 2002, then had long maintenance periods in 2008 and 2011 before finally shutting down in 2016. The iron and steel sector provides another example when it switched from blast furnaces to electric arc furnaces between 1994 and 1998. The glass

sector is also worth mentioning, as one of its two on-site furnaces shut down at the end of 2020. As decisions at company level are difficult to predict, emission projections for both the power generation and industrial sectors should be interpreted with caution.

III.F.1.2 Road transportation: "road fuel sales to non-residents" share complicates the projection exercise

6. With 51.4% of total GHG emissions (excluding LULUCF) in 2022 coming from road transport and 31.2% from the "sales of road transport fuels to non-residents" alone, the emissions structure is dominated by one sub-category – namely CRF 1A3b – for which the future evolution will depend not only on national policies and measures (PaMs), but also on the following factors:

   - the international context, such as road fuel prices and taxation in neighbouring countries (e.g. the willingness of the French and Belgian governments to increase excise duties on diesel so that its price is equal to or higher than the price of gasoline, the support schemes introduced in neighbouring countries following the war in Ukraine to limit the price of road fuels, in particular in France in 2022);
   - the choice of mobility options at European Union (EU) level and, in particular, in neighbouring countries or regions (restrictions on heavy goods vehicles, introduction of road pricing or changes in toll policy, etc.);
   - technological developments (electric or hybrid cars, fuel cells vehicles, higher energy-efficient engines, etc.).

   There is therefore a high degree of uncertainty in the projected emissions from road transport. Nevertheless, the projections take into account implemented, adopted or planned national PaMs and, as far as possible, overall transport and traffic developments as estimated in European models.

7. More precisely, the dominant influence of fiscal policy, but also other factors such as the development of road networks in neighbouring countries, which would allow the bypassing of Luxembourg territory, or the introduction or increase of road taxes in these countries,[92] make the projection of fuel sales – and the corresponding GHG emissions – a challenging task. The impact of "road fuel sales to non-residents" can hardly be controlled by unilateral adjustments in national tax policies. As the fuel sales attributed to "road fuel sales to non-residents" are mainly triggered by fuel price differentials, Luxembourg would have to permanently coordinate its tax policy with the policies of all neighbouring countries (Belgium, France and Germany).

[92] Road taxes could be tolls to be paid on certain sections of motorways or other infrastructures, such as it is the case in France or specific taxes levied on specific vehicles categories, such as the "Eurovignette".
Like Belgium (until 2016) and the Netherlands, Denmark and Sweden, Luxembourg has been charging the "Eurovignette" for lorries using its motorways since 2001, in accordance with the so-called "Eurovignette Directive": http://data.europa.eu/eli/dir/2022/362/oj. In Luxembourg, this tax (or user fee – see also PaM n°428) is based on pollutant emissions (EURO standards) and the truck's number of axles. It can be paid on a yearly, monthly, weekly or daily basis: see https://douanes.public.lu/fr/vehicules/eurovignette.html.

This would mean accepting a reduction in the scope of national tax policy options. Nevertheless, in recent years, Luxembourg has adopted policies aimed at reducing price differentials with neighbouring countries, notably through the CO_2 emissions tax (PaM n°105), with the clear objective of reducing its GHG emissions

8. Indeed, the reaction of non-residents to price differentials is quite pronounced, which makes a tax such as the CO_2 tax a particularly effective instrument. Assuming no policy changes in neighbouring countries, each EUR 5 increase per tonne of CO_2e in the tax in Luxembourg reduces the price differential with neighbouring countries by just over 1 euro cent. A series of annual tax increases would gradually reduce price differentials and lead to an increasingly pronounced decline in fuel sales to non-residents [STATEC (2023b), pp. 104-107)].
   In the WEM scenario, the CO_2 tax is assumed to remain at its 2023 level of EUR 30 per tonne of CO_2, whereas in the WAM scenario it is assumed that the tax will gradually increase by EUR 5 per ton each year, reaching EUR 165 by 2050 from an initial level of EUR 30 in 2023.

9. Another difficulty arises when trying to take account of the impact of technological developments. On the one hand, the economic modelling of technological development in general has significant shortcomings, which limits the analysis to the effects of the diffusion of new technologies within existing systems. On the other hand, there are limits to the scope of the analysis. For example, the impact of more energy efficient engines on road transport fuel sales in 5 to 10 years is not clear. EU legislation such as planned EURO standards or the decision to ban the sale of combustion engine cars by 2035 could help to set the framework. However, this underlines the influence of various economic factors that can be controlled by the government and the complexity of making a sound forecast. This is reflected not least in the lack of empirical understanding of the determinants of technological progress, such as the timing of market introduction of new vehicle types, the energy source used – e.g. electricity, fuel cells or compressed air – or public acceptance of the new technology.

III.F.2 MODEL AND METHODOLOGY

III.F.2.1 Overall approach

10. GHG projections for the years 2023 to 2050 were estimated in spring 2024 for the update of the Luxembourg National Energy and Climate Plan (NECP: see ***Section III.D.2.2.1***). The projections are classified by gas, except for PFCs and NF_3 for which Luxembourg does not report emissions, and have been made at the CRF source category or sub-category level. The only sectors not estimated are memo items "international navigation", and "CO_2 emissions from biomass". Projected emissions are reported for both the WEM and WAM scenarios. They are also split

between ETS and non-ETS (ESD until 2020, then ESR)[93] where relevant, as this is of high importance to EU Member States *[→ Section III.D.1.2]*.

11. The most recent inventory submitted to the UNFCCC is the reference for the reported (or "historical") years 1990 to 2022, i.e. the 2024v2 submission, which is now labelled LUX-CRT-2024-V1.0.[94]

12. The projections are the result of modelling exercises or of "bottom-up" or case-by-case approaches *[→ Section III.F.2.4]*. *Table III.F.2-1* on the following pages summarises the different methods, assumptions and data sources used for this exercise by CRF categories or sub-categories.

III.F.2.2 WEM vs WAM scenario

13. While the WEM scenario consists of a "business as usual" (BAU) or "reference" projection that includes the effects of the adopted and implemented PaMs until 31 December 2021, the WAM scenario includes the PaMs of the 2024 NECP update [MECB and MECO (2024)] *[→ Section III.D.2.2.1]*. These planned measures should allow Luxembourg to reach its revised ESR target of minus 50% in 2030 and, moreover, its nationally determined target of minus 55% by 2030 – compared to the 2005 level of ESR emissions *[→ Section III.D.1.2]*. Finally, no optional "without measures" (WOM) projections are yet available for Luxembourg due to a lack of internal capacity (planned improvement in the coming years).

14. *Table III.F.2-2* lists the CRF source categories for which the WEM and WAM projections differ or are identical. It also indicates which CRF categories do not occur in Luxembourg and which ones are not estimated due to lack of basic information (see also *Table III.F.2-1*).

TABLE III.F.2-2 – WEM AND WAM PROJECTIONS BY CRF SOURCE CATEGORIES

Scenarios	CRF source categories
WEM >< WAM	1.A.1.a / 1.A.2 / 1.A.3.b / 1.A.3.c / 1.A.3.d / 1.A.4.a / 1.A.4.b / 1.B.2 / 2.A.1 / 2.C.1 / 2.F / 2.G / 3.A / 3.B / 3.D / 3.H / 3.I / 4.A / 4.B / 5.A / 5.B / 5.D / IB. aviation
WEM = WAM	1.A.3.a / 1.A.4.c / 1.A.5 / 2.A.3 / 2.C.7 / 2.D / 3.G / 4.C / 4.D / 4.E / 4.F
NO	1.A.1.b / 1.A.1.c / 1.A.3.e / 1.B.1 / 1.C / 2.A.x except 2.A.1&3 / 2.B / 2.C.x except 2.C.1&7 / 2.E / 2.H / 3.C / 3.E / 3.F / 3.J / 4.H / 5.E / CO_2 captured / indirect CO_2 emissions
NE	IB. navigation / CO_2 emissions from biomass

Source: MECB.

93 ESD = Effort Sharing Decision: https://eur-lex.europa.eu/eli/dec/2009/406/oj.
ESR = Effort Sharing Regulation: https://eur-lex.europa.eu/eli/reg/2018/842/oj amended by Regulation (EU) 2023/857: http://data.europa.eu/eli/reg/2023/857/oj.

94 https://unfccc.int/documents/645403.

TABLE III.F.2-1 – KEY METHODS AND ASSUMPTIONS FOR GHG PROJECTIONS FOR WEM & WAM SCENARIOS – YEARS 2023 TO 2050

Sector (aggregated)	Projection method/model	Entity responsible for the projections	Main assumptions	Comments
Total excluding LULUCF				
Total including LULUCF				
1 Energy				
1.A Fuel combustion				
1.A.1 Energy industries				
1.A.1.a Public electricity and heat production	1.A.1.a without incineration - Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM). 1.A.1.a waste incineration Assumptions on trends in waste production, recycling and reuse over the coming year, combined with an assumption on waste composition based on average waste fractions in 2016-2018.	1.A.1.a without incineration STATEC 1.A.1.a waste incineration MECB-AEV	1.A.1.a without incineration - WEM & WAM scenarios: no new CHP plant similar to the former TWINerg is starting operations; - WEM & WAM scenarios: new power plants are mostly using biomass (wood, biogas, etc.); - WAM scenario: CO_2 tax increasing by EUR 5 per tonne of CO_2 each year (WEM: tax remains fixed at 2023 level of EUR 30 per tonne of CO_2); - WEM & WAM scenarios: existing combined heat and power plants will gradually phase out fossil fuels, such as natural gas and oil, in favour of biomass. In the WEM scenario, the transition will be completed by 2041 when the existing plants reach the end of their lifespan. In the WAM scenario, the transition will be completed as soon as the plants no longer benefit from the feed-in tariff via the compensation mechanism, which is estimated to be around 2032; - WAM scenario: increasing the capacity of renewable energy sources through new installations or by "repowering" existing ones (replacing imported electricity, with no major impact on national GHG emissions). 1.A.1.a waste incineration - WEM & WAM scenarios: no new waste incineration plant put into operation; - WAM scenario: following the ban on waste being sent to landfill from 2030 onwards (PaM n°609), the last landfill site will close in 2035, i.e. by this time, all residual waste will have to be incinerated.	1.A.1.a without incineration - Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions for the years 2016-2022 only - as the sector experienced dramatic changes with the slowdown and then closure of TWINerg in 2016 - to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals projections in CO_2e; - ETS emissions are estimated separately from ESR emissions and relate to CO_2 emissions only. 1.A.1.a waste incineration - Projections made separately for CO_2, CH_4 & N_2O; - Luxembourg has only one incineration plant, which operates with energy recovery. The heat of combustion transforms the water in the boiler into steam, which is used to produce electrical and thermal energy for the public grid. Consequently, the associated emissions are reported in this category. Additional measures to close landfill sites mean that the WAM scenario results in higher emissions than the WEM scenario from 2044 onwards.
1.A.1.b Petroleum refining	NA	NA	NA	This source sub-category does not exist in Luxembourg.
1.A.1.c Manufacture of solid fuels and other energy industries	NA	NA	NA	This source sub-category does not exist in Luxembourg.

1.A.2 Manufacturing industries and construction	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: historical production trend used to project production for each sector considered under 1.A.2; - WEM & WAM scenarios: historical energy efficiency trend used to project future energy efficiency gains; - WEM & WAM scenarios: gradual but limited electrification of 0.5% per year (i.e. 0.5% of gas and fuel oil consumption is replaced annually by an equivalent consumption of electricity); - WEM & WAM scenarios: no closings of or new operating plants are considered; - WAM scenario: CO_2 tax increasing by EUR 5 per tonne of CO_2 each year (WEM: tax remains fixed at 2023 level of EUR 30 per tonne of CO_2); - WAM scenario: implementation of the "Roadmap for the Decarbonisation of Luxembourg's Manufacturing Industry" (PaM n°510), which expresses the desire to electrify processes and deploy hydrogen as a replacement for natural gas – this will be supported by the establishment of the necessary infrastructure; - WAM scenario: "Hydrogen Strategy" (PaM n°216) intended to promote alternative fuels, particularly after 2035 when Luxembourg will be connected to a cross-border hydrogen network.	Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions for the years 2018-2022 only – as they are different from those before 2018 - to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals in CO_2e; - ETS emissions are estimated separately from ESR emissions and relate to CO_2 emissions only.
1.A.3 Transport				
1.A.3.a Domestic aviation	Hypothesis: projected emissions are a five-year average for each GHG.	MECB	-	- WEM = WAM projections; - The 5 years used to calculate the average CO_2, CH_4 and N_2O emissions are the last five historical years, i.e. 2018–2022.
1.A.3.b Road transportation	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM and WAM scenarios: free public transport maintained (PaM n°405); - WEM & WAM scenarios: European vehicle performance standards, reinforced for the WAM scenario, particularly with regard to the EU-wide ban on the sale of combustion engine vehicles from 2035 onwards (various PaMs); - WEM & WAM scenarios: current "*Clever Fueren*" support scheme for low emission vehicles, reinforced under the "*Klimabonus Mobilitéit*" label for the WAM scenario (various PaMs); - WEM & WAM scenarios: multimodal model and cross-border mobility scenario MMUST (PaM n°403), extended by the new "National Mobility Plan 2035" (PaM n°401) for the WAM scenario. - WAM scenario: CO_2 tax increasing by EUR 5 per tonne of CO_2 each year (WEM: tax remains fixed at 2023 level of EUR 30 per tonne of CO_2); - WAM scenario: tax benefits for low-emitting company cars; - WAM scenario: much lower share of fossil fuels in	Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals in CO_2e (from 2041 on, application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions).

			road transport energy consumption compared to the WEM scenario, due to higher penetration rates of electric vehicles, but also due to the use of hydrogen in heavy-duty road transport (various PaMs); WAM scenario: the share of sustainable biofuels in road fuels would increase to 18.7% in terms of volume by 2040 (PaM n°415), whereas it would remain at 8%, its level in 2022, in the WEM scenario.	
1.A.3.c Railways	Hypothesis: projected emissions are obtained by applying the annual growth rates of the 2021 CO_2e emissions projections (based on the 2020 NAPCP BAU & WAM scenarios) from the last historical year, 2022 (from 2041, linear decrease of emissions by 0.4 kt CO_2e).	MECB & MECB-AEV	WAM scenario: with both passenger and freight rail transport expected to exceed that in a "business-as-usual" scenario, there will be an increase in rail freight and movements in logistics centres using diesel locomotives. The WAM scenario will therefore result in a greater increase in emissions up to 2050 than the WEM scenario because a greater proportion of freight will be diverted from road to rail and to a multimodal intermodal hub in the south of the country that will continue to expand. PS: rail passenger transport is fully electrified.	- Projections disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to projected emissions, so that total [CO_2 + CH_4 + N_2O] equals WEM and WAM totals in CO_2e (from 2041 on, application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions). - The projected emissions in the WAM scenario are higher than in the WEM scenario because rail freight and rail movements in logistics centres are expected to increase more than in the "business as usual" scenario; - NAPCP: National Air Pollution Control Programme.
1.A.3.d Domestic navigation	Hypothesis: projected emissions are obtained by applying the annual growth rates of the 2021 CO_2e emissions projections (based on the 2020 NAPCP BAU & WAM scenarios) from the last historical year, 2022 (from 2041, application of the average growth rate from 2022 to 2040).	MECB & MECB-AEV	-	- Projections disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions for the years 2010 to 2019 and 2022 – as 2020 & 2021 were outliers due to the Covid-19 pandemic - to projected CO_2e emissions, so that total [CO_2 + CH_4 + N_2O] equals WEM and WAM totals in CO_2e; - NAPCP: National Air Pollution Control Programme.
1.A.3.e Other transportation	NA	NA	NA	This source sub-category does not exist in Luxembourg.
1.A.4 Other sectors				
1.A.4.a Commercial/Institutional	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WAM scenario: CO_2 tax increasing by EUR 5 per tonne of CO_2 each year (WEM: tax remains fixed at 2023 level of EUR 30 per tonne of CO_2); - WAM scenario: accelerated phasing out of oil-fired boilers and gas-fired boilers (PaM n°302 a. o.); - WAM scenario: obligation of monitoring and energy renovation for functional buildings (PaM n°304).	Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals in CO_2e (from 2041 on, application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions).
1.A.4.b Residential	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: "*PRIMe House*" support scheme for energy-efficient renovation and use of renewables (PaM n°306) replaced by the new "*Klimabonus Wunnen*" support scheme in 2022 for the WAM scenario (PaM n°307); - WAM scenario: CO_2 tax increasing by EUR 5 per tonne of CO_2 each year (WEM: tax remains fixed at 2023 level of EUR 30 per tonne of CO_2);	Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals in CO_2e (from 2041 on,

			- WAM scenario: accelerated phasing out of oil-fired boilers and gas-fired boilers (PaM n°302 a. o.); - WAM scenario: Long-term Building Renovation Strategy (PaM n°316).	application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions).
1.A.4.c Agriculture/Forestry/ Fishing	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB	WEM & WAM scenarios: forecasts of gasoline, diesel oil, biomass and other fossil fuels consumption and application of the 2021 implied emission factors for each GHG.	- WEM = WAM projections; - Projections made separately for CO_2, CH_4 & N_2O; - After 2030, the projections are almost flat; - Due to breaks in the time series, the years considered for the projections vary from fuel to fuel (10 most recent years for gasoline & diesel, 5 most recent years for biomass & 6 most recent years for other fossil fuels).
1.A.5 Other	Hypothesis: projected emissions are obtained by applying the annual growth rates of the 2021 CO_2e emissions projections (based on the 2020 NAPCP BAU & WAM scenarios) from the last historical year, 2022 (2041 to 2050 = 2040 projected emissions).	MECB & MECB-AEV	-	- WEM = WAM projections; - Projections disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to projected emissions, so that total [CO_2 + CH_4 + N_2O] equals WEM and WAM totals in CO_2e (from 2041 on, application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions); - NAPCP: National Air Pollution Control Programme.
1.B Fugitive emissions from fuels				
1.B.1 Solid fuels	NA	NA	NA	This source sub-category does not exist in Luxembourg.
1.B.2 Oil and natural gas and other emissions from energy production	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- WEM & WAM scenarios: projections of fugitive emissions based on WEM or WAM forecasts of fuel sales and gas distribution; - WEM & WAM scenarios: projected activity data multiplied by constant CO_2 and CH_4 emission factors based on their average values.	- Projections made separately for CO_2 & CH_4.
1.C CO_2 transport and storage	NA	NA	NA	This source category does not exist in Luxembourg.
2 Industrial processes				
2.A Mineral Industry				
2.A.1 of which cement production	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: historical production trend used to project cement production; - WEM & WAM scenarios: historical energy efficiency trend used to project future energy efficiency gains; - WAM scenario: implementation of the "Roadmap for the Decarbonisation of Luxembourg's Manufacturing Industry" (PaM n°510), which expresses the desire to electrify processes and deploy hydrogen as a replacement for natural gas – this will be supported by the establishment of the necessary infrastructure; - WAM scenario: "Hydrogen Strategy" (PaM n°216) intended to promote alternative fuels, particularly after 2035 when Luxembourg will be connected to a cross-border hydrogen network;	- Cement production (one location); - All CO_2 projected emissions are supposed to be ETS emissions.

			WAM scenario: specific technology developments, including CCUS.	
2.A.3 of which other non-cement production	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: historical production trend used to project glass production; - WEM & WAM scenarios: historical energy efficiency trend used to project future energy efficiency gains.	- Glass industry (one location); - CO_2 WEM = WAM projections; - All CO_2 projected emissions are supposed to be ETS emissions.
2.B Chemical industry	NA	NA	NA	This source category does not exist in Luxembourg.
2.C Metal industry				
2.C.1 of which iron and steel production	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: historical production trend used to project steel production; - WEM & WAM scenarios: historical energy efficiency trend used to project future energy efficiency gains; - WAM scenario: implementation of the "Roadmap for the Decarbonisation of Luxembourg's Manufacturing Industry" (PaM n°510), which expresses the desire to electrify processes and deploy hydrogen as a replacement for natural gas – this will be supported by the establishment of the necessary infrastructure; - WAM scenario: "Hydrogen Strategy" (PaM n°216) intended to promote alternative fuels, particularly after 2035 when Luxembourg will be connected to a cross-border hydrogen network; WAM scenario: specific technology developments, including CCUS.	- Steel industry (three locations); - All CO_2 projected emissions are supposed to be ETS emissions; - The projected emissions in the WAM scenario are higher than in the WEM scenario because in this scenario, the national consumption of steel is expected to increase for the renovation or construction of new energy-efficient institutional or commercial buildings and for the public transport network (trains, trams, etc.)
2.C.7 of which other non-iron and steel production	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: historical production trend used to project aluminium production; - WEM & WAM scenarios: historical energy efficiency trend used to project future energy efficiency gains.	- Remelting of aluminium scrap into extrusion ingots (one location); - CO_2 WEM = WAM projections; - All CO_2 projected emissions are supposed to be ETS emissions.
2.D Non-energy products from fuels and solvent use	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- 2.D.1 (lubricants): forecast of activity data (quantity of lubricants from STATEC) based on historical data (2009-2019) showing a declining trend, except for 2020 and 2021 (exceptional years with a sharp drop and strong recovery). The declining trend can be explained by the penetration of electric mobility and the consequent reduction in the amount of motor oil used by combustion engines, and is expected to continue until 2050; - 2.D.2 (paraffin wax): based on a 4-year moving average of activity data starting in 2023 with the years 2016-2019, as imports/exports of paraffin and vaseline were relatively stable over this period. - 2.D.3 (solvent use): based on the 2020 National Air Pollution Control Programme (NAPCP) BAU = WAM scenarios; - 2.D.3 (urea-based catalysts): forecast based on STATEC's WAM diesel sales forecasts. The urea rate is expected to increase between 2023 and 2025 and then stabilise at 42.3 litres of AdBlue per tonne of diesel from 2026.	- CO_2 WEM = WAM projections; - 2.D.1: the difference between WEM and WAM projections in the transport sector has not yet been taken into account in the projections for this sub-category; - 2.D.2: the use of a 4-year moving average results in a relatively stable projection from 2023 to 2050; - 2.D.3 (solvent use): the 2041-2050 period assumes 2040 emissions; - 2.D.3 (urea-based catalysts): hypothesis to consider the WAM scenario for diesel sales to derive the CO_2 emissions associated with the urea-based catalytic converter; - NAPCP: National Air Pollution Control Programme.

2.E Electronics industry	NA	NA	NA	This source category does not exist in Luxembourg.
2.F Product uses as substitutes for ODS	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- WEM & WAM scenarios: EU regulation to reduce emissions of F-gases and tightening of the national regulation on leak testing of refrigeration, air conditioning and thermodynamic equipment; - WEM & WAM scenarios: ban on certain F-gases in motor vehicle air conditioning systems; - WEM & WAM scenarios: advice to companies on replacing their HFC-based equipment with HFC-free equipment and collective recovery of end-of-life equipment; - WEM & WAM scenarios: the WEM scenario considers only the consequences of ratification of the Kigali Amendment, while the WAM scenario considers only the strengthening of EU regulations to reduce F-gases emissions.	- The WAM scenario is higher than the WEM scenario because at the time the projections were calculated it was not clear how ambitious the revision of the F-gases Regulation would be and whether it would be aligned with the Kigali amendment (which has more ambitious reductions, which would also have to be achieved in a shorter timeframe); - The 2041-2050 period assumes 2040 emissions.
2.G Other product manufacture and use	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- WEM & WAM scenarios: EU regulation to reduce emissions of F-gases and tightening of the national regulation on leak testing of refrigeration, air conditioning and thermodynamic equipment; - WEM & WAM scenarios: advice to companies on replacing their HFC-based equipment with HFC-free equipment and collective recovery of end-of-life equipment; - WEM & WAM scenarios: the WEM scenario considers only the consequences of ratification of the Kigali Amendment, while the WAM scenario considers only the strengthening of EU regulations to reduce F-gases emissions.	- Projections made separately for HFCs, SF_6 & N_2O; - HFCs & SF_6: the WAM scenario is higher than the WEM scenario because at the time the projections were calculated it was not clear how ambitious the revision of the F-gases Regulation would be and whether it would be aligned with the Kigali amendment (which has more ambitious reductions, which would also have to be achieved in a shorter timeframe); - N_2O (anaesthesia): WEM = WAM projections based on projected population.
2.H Other	NA	NA	NA	This source category does not exist in Luxembourg.
3 Agriculture				
3.A Enteric fermentation	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAV-SER	Various assumptions are made about the livestock and fed into the model. For the different livestock categories, the average livestock population and production assumptions (relevant for 3.A; 3.B and 3.D) for the WEM are the same as for the WAM, except for cattle and swine, for which there are specific WAM assumptions. Another important WAM assumption concerns feed additives to reduce enteric fermentation in dairy cows (PaM n°702).	There are no N_2O emissions for this source category.
3.B Manure management	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAV-SER	Various assumptions about the livestock and their manure management are made and fed into the model. In addition to the assumptions on average livestock numbers and production (see CRF 3.A), an adaptation of pig diets to reduce their N excretion was only considered in the WAM scenario. Most of the manure management assumptions are common to both the WEM and WAM scenarios, with the exception of a slight increase in grazing time for dairy cows, a	Projections made separately for CH_4 & N_2O.

			decrease in slurry storage under animals with "open" slots, a requirement to cover open tanks (slurry and digestate), and an increase in the proportion of slurry and solid manure used as feedstock in biogas plants in the WAM scenario: The use of animal manure is expected to increase in the WAM scenario due to the introduction of a biogas strategy with financial or other incentives.	
3.C Rice cultivation	NA	NA	NA	This source category does not exist in Luxembourg.
3.D Agricultural soils	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAVR-SER	For crops, the WEM and WAM assumptions are identical for crop yields, but different for crop type and area (incl. energy crops, which increase by 3.5% per year to a maximum of 1,500 ha in the WAM scenario). With regard to fertilisers, the WEM and WAM assumptions are identical for the application of sewage sludge and compost, but different for the rest - application of manure and slurry, digestate and synthetic fertilisers, with a linear reduction for the latter leading to 80 kg N/ha by 2030 in the WAM scenario, triggered by several factors such as an updated legal framework for the use of nitrogen fertilisers (PaM n°709); higher share of organic farming; better use of animal manure. In the WAM scenario, some measures to reduce ammonia emissions will also have an impact on N_2O emissions (e.g. manure, digestate and the liquid fraction of digestate will be banned from spreading after 31 December 2023; after 2028, liquid manure and digestate would have to be incorporated within 4 hours on unvegetated arable land; new measures to promote the quick incorporation of solid manure without vegetation within less than 4 hours) (PaMs n°704 & 705).	There are no CH_4 emissions for this source category.
3.E Prescribed burning of savannahs	NA	NA	NA	This source category does not exist in Luxembourg.
3.F Field burning of agricultural residues	NA	NA	NA	This source category does not exist in Luxembourg.
3.G Liming	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAV-SER	Until the 1980s/beginning of the 1990s, Thomas slag was the only fertiliser used for liming in Luxembourg. However, with the decline and restructuring of the iron industry in Luxembourg, other alternatives were needed and the use of these alternatives has increased since 1990, reaching a ceiling around 2018-2021. On the assumption that the quantities currently used are close to the maximum considered as good agricultural practice, and in the absence of any other satisfactory method to project possible developments in liming, a “flat” projection based on the median of the years 2018-2022 for both dolomite and lime has been applied.	CO_2 WEM = WAM projections and are constant over time.

3.H Urea application	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAV-SER	-	- CO_2 projections: since urea is only marginally applied and the trend is tending to zero, projected emissions are set to zero ("NO") by 2025.
3.I Other carbon-containing fertilizers	Luxembourg Agricultural Emission Model (LUAgriEmissionModel)	MAAV-SER	WAM scenario: lower amounts of synthetic fertiliser are used than in the WEM scenario (see 3.D).	- CO_2 projections are based on assumptions about synthetic fertiliser under the WEM and WAM scenarios under 3.D.
3.J Other	NA	NA	NA	This source category does not exist in Luxembourg.
4 Land Use, Land-Use Change and Forestry				
4.A Forest land	Bottom-up projections based on activity data – mainly harvest – and other variables underlying sectoral emissions.	MECB-AEV	- WEM and WAM scenarios: biomass growth is identical to that measured in the 2010 National Forest Inventory. In terms of harvesting, bark beetle infestation will lead to increased harvesting of coniferous stands over the next 15 years, followed by a recovery; - WEM scenario: forest management practices are assumed to be the same as those observed between 2000 and 2010. The calculations are similar to those used for the determination of the Forest Reference Levels (FRL) according to Decision No 529/2013/EU; - WAM scenario: new near-natural forest management practices lead to a reduction in broadleaf harvesting until 2035, resulting in an increase in carbon stocks and deadwood. From 2035, this scenario envisages a shift from coniferous to broadleaved trees in areas previously affected by bark beetle infestation. This shift would lead to an increase in the growth rate of these younger stands, but also to an increased need for harvesting (thinning).	-
4.B Cropland	Bottom-up projections based on activity data and other variables underlying sectoral emissions, taking into account changes in land use between FL, GL, OL, WL and CL and differences in management practices between areas	MECB-AEV	- WEM and WAM scenarios: the annual land use change between FL, GL, OL, WL and CL is identical to that measured between 2015 and 2018 and remains constant. - The following management practices are calculated: organic farming, reduced tillage, agroforestry, temporary grassland, crop rotation and grass strips around agricultural fields and for the WEM and WAM scenarios, different hypotheses are used to determine the evolution of the areas under these management practices.	Projections made separately for CO_2 & N_2O
4.C Grassland	Bottom-up projections based on activity data - land use changes between FL, GL, OL, WL, and CL – and other variables underlying sectoral emissions.	MECB-AEV	- WEM and WAM scenarios: annual land use changes between FL, GL, OL, WL and CL are identical to those measured between 2015 and 2018, therefore projected emissions are a constant over time; - No management practices are assessed.	- Projections made separately for CO_2 & N_2O; - WEM = WAM projections.
4.D Wetlands	Bottom-up projections based on activity data - land use changes between FL, GL, OL, WL, and CL – and other variables underlying sectoral emissions.	MECB-AEV	- WEM and WAM scenarios: annual land use changes between FL, GL, OL, WL and CL are identical to those measured between 2015 and 2018, therefore projected emissions are a constant over time; - No management practices are assessed.	- Projections made separately for CO_2 & N_2O; - WEM = WAM projections.

4.E Settlements	Bottom-up projections based on activity data - land use changes between FL, GL, OL, WL, and CL – and other variables underlying sectoral emissions.	MECB-AEV	- WEM and WAM scenarios: annual land use changes between FL, GL, OL, WL and CL are identical to those measured between 2015 and 2018, therefore projected emissions are a constant over time; - No management practices are assessed.	- Projections made separately for CO_2 & N_2O; - WEM = WAM projections.
4.F Other Land	Bottom-up projections based on activity data - land use changes between FL, GL, OL, WL, and CL – and other variables underlying sectoral emissions.	MECB-AEV	- WEM and WAM scenarios: annual land use changes between FL, GL, OL, WL and CL are identical to those measured between 2015 and 2018, therefore projected emissions are a constant over time; - No management practices are assessed.	- CO_2 WEM = WAM projections.
4.G Harvested wood products	Bottom-up projections based on activity data – percentage of wood used for HWP – and other variables underlying sectoral emissions.	MECB-AEV	- WEM scenario: the percentage of wood harvested from public forests remains the same as in 2020. - WAM scenario: 2021-2035: 50% of all wood harvested from public forests and 2% from private forests are used for HWP in Luxembourg. 2035 - 2050: The carbon stock in HWP becomes saturated as the annual increase is balanced by the annual decrease.	-
4.H Other	NA	NA	NA	This source category does not exist in Luxembourg.
5 Waste				
5.A Solid Waste Disposal	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- WEM & WAM scenarios: the main actual laws, plans and strategies are taken into account (Zero-waste Strategy (PaM n°602), Circular Economy Strategy (PaM n°603), etc.); - WAM scenario: accelerated recycling rates: 55%, 60% & 65% for the years 2025, 2030 & 2035 vs. 2030, 2040 & 2050 in the WEM scenario; - WAM scenario: reduction of single-use materials (PaM n°608); - WAM scenario: following the ban on waste being sent to landfill from 2030 onwards (PaM n°609), the last landfill site will close in 2035, i.e. by this time, all residual waste will have to be incinerated.	Total waste is calculated with an increased recycling rate and an increased population. Only waste after biological treatment is landfilled in Luxembourg. Landfilling continues until 2050 and 2035 in the WEM and WAM scenarios.
5.B Biological treatment of solid waste	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AEV	- WAM scenario: accelerated composting (PaM n°607) and recycling rates (see 5.A); - WAM scenario: no emissions from biological treatment from 2035 onwards with the closure of the landfill in 2035 and the cessation of mechanical biological treatment; WAM scenario: composting with sewage sludge is phased out in 2028 (PaM n°614).	An increased recycling rate of biological waste in the WAM scenario increases the amount of waste to be composted, which results in higher emissions in the WAM scenario compared to the WEM scenario for all projected years.
5.C Incineration and open burning of waste	IE,NO	NA	NA	- Incineration is reported under CRF 1.A.1.a; - Open burning of waste is not occurring in Luxembourg.
5.D Wastewater treatment and discharge	Bottom-up projections based on activity data and other variables underlying sectoral emissions.	MECB-AGE	- WAM scenario: includes measures from the new measures programme 2021-2027, whereas the WEM scenario keeps the measures from the 2015-2021 programme; - WAM scenario: reduction of the mechanical wastewater treatment plan in favour of biological treatment plants (PaM n°613);	-

			WAM scenario: upgrade of non-denitrified biological WWTPs to denitrified WWTPs (PaM n°613).	
5.E Other	NA	NA	NA	This source category does not exist in Luxembourg.
Memo items				
International bunkers				
Aviation	- Luxembourg General Equilibrium Model (LuxGEM); - National Energy Accounting Model (NEAM).	STATEC	- WEM & WAM scenarios: separate forecasts for passenger and freight air traffic development; - WEM scenario: no sustainable aviation fuels (SAF); - WAM scenario: projected SAF based on the "Hydrogen Strategy" (PaM n°216).	Projections realised by STATEC at aggregated CO_2e level and disaggregated by gas by MECB by applying the respective average weights of CO_2, CH_4 & N_2O in total emissions calculated for the 2021 projections (see BR4, Table IV.3-1) to STATEC's projected emissions, so that total [CO_2 + CH_4 + N_2O] equals STATEC's WEM and WAM totals in CO_2e (from 2041 on, application of the respective 2040 weights of CO_2, CH_4 & N_2O in total emissions).
Navigation	NE	NA	NA	This source category was not estimated.
CO_2 emissions from biomass	NE	NA	NA	- This source category was not estimated; - As the main source categories that also use biomass as an energy source have been estimated at an aggregated CO_2e level, primary or final energy consumption of biomass has been excluded from the calculations, hence "NE" for the projected CO_2 emissions from biomass (this also means that CH_4 & N_2O emissions from biomass are effectively excluded from the projections).
CO_2 captured	NA	NA	NA	This source category does not exist in Luxembourg.
Indirect CO_2	NA	NA	NA	This source category does not exist in Luxembourg.

Notes: 1. submitted inventory data up to 2022; ETS data up to 2022.
2. when projections are only calculated for the "0" or "5" years, in-between years are linear interpolations.
3. where projections are based on or derived from the 2020 National Air Pollution Control Programme BAU or WAM scenarios (NAPCP - https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/national-air-pollution-control-programmes-and-projections_en), Table V.3-1 in BR4 provides an explanation.

NA = not applicable NE = not estimated NO = not occurring IE = indicated elsewhere

15. For the main energy-related emission sources – namely 1A1a (both ETS & non-ETS, excl. waste incineration), 1A2 (both ETS & non-ETS), 1A3b, 1A4a, 1A4b & IB aviation – and ETS emissions from industrial processes – 2A1, 2A3, 2C1 & 2C7 – the projections are derived from a modelling exercise carried out by STATEC for the preparation of the 2024 NECP update *[→ Section III.F.2.4]*. The WAM projections take into account all planned PaMs reported in the 2024 NECP update in relation to its decarbonisation and energy efficiency dimensions.

16. For the agricultural sector – 3A, 3B, 3D, 3G, 3H & 3I – both WEM and WAM projections come from the Rural Economy Department of the MAAV (*Service d'Economie Rurale* - MAAV-SER). Similar to energy or industrial process emissions, the projections are derived from a modelling exercise carried out by the MAAV-SER for the preparation of the 2024 NECP update *[→ Section III.F.2.4]*. For this sector, the WAM projections are not directly in line with the PaMs listed in the 2024 NECP update.

17. Finally, for the remaining source categories – 1A1a-waste incineration, 1A3a, 1A3c, 1A3d, 1A4c, 1A5, 1B2, 2D, 2F, 2G, 4A to 4G, 5A, 5B & 5D – "bottom-up" and case-by-case approaches have been used. This could include ad hoc information, expert judgement and scenarios, or sometimes simple assumptions used to estimate projections up to 2050: see *Table III.F.2-1* for details.

III.F.2.3 Detailed assumptions for emissions projections

18. The key parameter assumptions used to calculate the projected GHG emissions for both WEM and WAM scenarios up to 2050 are listed in CTF Table 11. As the list is quite long, it is not reproduced in this report. These parameters are presented for the years 2025, 2030, 2035, 2040, 2045 & 2050 and come from two main sources, but not only, depending on the institution or service carrying out the projections:
    - STATEC, which carried out projections related to energy and industrial processes;
    - MAAV-SER, which carried out projections related to agricultural practices.

19. According to the models and methods used for emissions projections, the base year varies *[→ Section III.F.2.4]*.

20. GDP growth and sectoral gross value added have not been directly taken into account in the projections. There are obvious reasons for not taking GDP implicitly into account in the projections. Firstly, Luxembourg's GDP is mainly driven by service activities and, more specifically, financial activities. In addition, a large part of Luxembourg's industrial production is exported (small domestic market, most of the largest industrial plants are subsidiaries of foreign companies). Also, the correlation between road freight transport and GDP shows a stronger correlation with the aggregated GDP of the different EU Member States than with the GDP of Luxembourg alone; this is because the associated emissions are mainly caused by transit traffic. Finally, a macro-economic study carried out by STATEC on the basis of the projections of

the 2023 draft NECP update [MECDD and MEA (2023)] concluded that the evolution of GHG emissions is very little dependent on GDP and, vice versa, that a reduction in GHG emissions would have a small but probably positive impact on GDP – as the energy transition represents an opportunity rather than a threat in the current economic structure of Luxembourg.

III.F.2.4 Models used for emissions projections

21. As *Table III.F.2-1* shows, different models or methods have been used to produce the projections up to 2050:
    - the models used by STATEC for energy and industrial process-related emissions;
    - the model used by MAAV-SER for projections related to agricultural practices.

    They are described below.

III.F.2.4.1 Models used by STATEC

22. As indicated in §15, projections of the main sources of GHG emissions in Luxembourg have been estimated using a modelling approach by STATEC combining two models together: NEAM and LuxGEM *[→ Figure III.F.2-1]*.[95] The sources covered, excl. international aviation, represented 87.8% of the total GHG emissions (excl. LULUCF) in 2022.

STATEC – National Energy Accounting Model (NEAM)

CRF (sub-)categories covered by this model	1.A.1.a (excl. waste incineration), 1.A.2, 1.A.3.b, 1.A.4.a, 1.A.4.b, 2.A.1, 2.A.3, 2.C.1, 2.C.7 & IB. aviation (and ETS emissions also estimated as a "category")
Gas(es) covered	CO_2-eq. & CO_2, CH_4, N_2O
Reference/base year	**2021**
Projected years	all years from 2023 to 2050
Interface with other models/approaches	LuxGEM
Input from other models	LuxGEM macro-economic outputs
Reference documents for the calculations	[STATEC (2023a), (2023b) & (2023c)]

23. NEAM is a "bottom-up" trend projection model, which is based on the establishment of stocks and their evolution until 2050. It is an empirical stock-flow energy accounting model at an annual time interval. It was initially developed to provide a reference scenario for Luxembourg based on structural and energy statistics, and subsequently to assess the impact of the government's PaMs aimed at increasing energy efficiency and reducing national greenhouse gas emissions. NEAM is not an optimisation model and it does not cover the costs of technologies.

24. NEAM is based on structural data on buildings and vehicles, which allow stocks to be projected on the basis of past and future flows. It is therefore a trend projection model, calibrated to the

[95] Also refer to the following two-pager: https://statistiques.public.lu/dam-assets/actualite/2024/pnec-7-2024/pnec-modelisations-120724-04.pdf.

energy balance of Luxembourg at an annual frequency. The model structure follows a hybrid "actor-use" typology:

- energy production
- industry;
- transport;
- residential buildings;
- functional/commercial buildings.

25. The main outputs of NEAM are physical quantities of final and primary energy demand and energy production on the national territory, broken down by means of production, energy type and use, as well as the associated GHG emissions.

26. The model consists of three parts:

- historical statistics on population, housing, road vehicles, energy balances derived from NAMEA-Energy[96] and monetary national accounts;
- data and information for the development of a reference or BAU scenario;
- data, information and hypotheses for the development of an "energy trajectory" scenario.

27. Energy demand is modelled for the following sectors: (i) industry (projected production levels, projected energy efficiency gains); (ii) transport - road, rail, sea, air (projected vehicle stocks and mileage, projected activity development for road and sea transport, projected energy efficiency gains, projected fuel sold to foreigners based on national and international fuel prices); (iii) institutional and commercial sector - electricity and heat (projected employment development, projected shares of different energy types, projected energy efficiency gains); and (iv) residential sector - electricity and heat (projected housing stock development, projected population growth, projected energy efficiency gains of buildings and appliances).

28. Energy demand is modelled for four types of energy: coal, natural gas, oil products, electricity and heat.

29. In practice, STATEC uses both NEAM and LuxGEM, a macroeconomic computable general equilibrium model, to produce projections (→ §30-34), by combining projections of the stock-flow "bottom-up" model NEAM with the macro-demographic "top-down" CGE model LuxGEM. While demographic, macroeconomic and price effects are determined by LuxGEM

96 NAMEA (National Accounting Matrix including Environmental Accounts) is an environmental accounting framework developed by Statistics Netherlands at the end of the 1980s. It consists of a conventional national accounting matrix extended with environmental accounts in physical units. NAMEA-Energy - or Energy Accounts - includes the production and consumption of energy in physical units, disaggregated by branches of activity: see e.g. https://statistiques.public.lu/fr/publications/series/economie-statistiques/2012/59-2012.html for explanations.

and fed into NEAM, structural effects derived from NEAM (e.g. energy efficiency, energy mix, etc.) are considered in LuxGEM *[→ Figure III.F.2-1]*.

STATEC – Luxembourg General Equilibrium Model (LuxGEM)

CRF (sub-)categories covered by this model	1.A.1.a (excl. waste incineration), 1.A.2, 1.A.3.b, 1.A.4.a, 1.A.4.b, 2.A.1, 2.A.3, 2.C.1, 2.C.7 & IB. aviation (and ETS emissions also estimated as a "category")
Gas(es) covered	CO_2-eq. & CO_2, CH_4, N_2O
Reference/base year	2015 (model calibration)
Projected years	all years from 2023 to 2050
Interface with other models/approaches	NEAM
Input from other models	NEAM, Modux
Reference documents for the calculations	[STATEC (2010), (2023a), (2023b) & (2023c)]

30. Computable general equilibrium (CGE) models are widely used for economic policy analysis and are based on economic general equilibrium theory. The abstract model structure is combined with detailed micro-data on, for example, relevant production processes, assumptions about supply and demand behaviour or market structure. CGE models can therefore be used to analyse the impact of structural changes, e.g. in input prices, taxes or other framework conditions, on several markets in an economy.

31. LuxGEM is a recursive dynamic CGE model that allows for short-, medium- and long-term simulations. As a dynamic multi-sector CGE model, it is well suited to study the impact of exogenous shocks and policies on the economy, including energy consumption and GHG emissions, and thus to help understand the macro-economic and sectoral impacts of GHG-related policies.

32. LuxGEM is divided into 23 production branches according to the NACE Rev.2 classification (of which 5 are EU ETS related) that produce 33 goods and services (commodities). The representative agents for businesses and households are completed by the public sector and the rest of the world. LuxGEM also has a specific demographic module (where migration is driven by income attractiveness), and fuel sales (to residents and non-residents) and the CO_2 tax are explicitly modelled.

33. The structure of LuxGEM is given by the Social Accounting Matrix (SAM) of the Luxembourg economy and LuxGEM is calibrated to the latest Modux medium-term forecast *[→ Box 1]*. Sequential annual equilibria are linked by laws of motion, e.g. the evolution of investment drives capital accumulation. The main exogenous drivers are energy prices, as well as energy efficiency and energy shares, which come from the NEAM model.

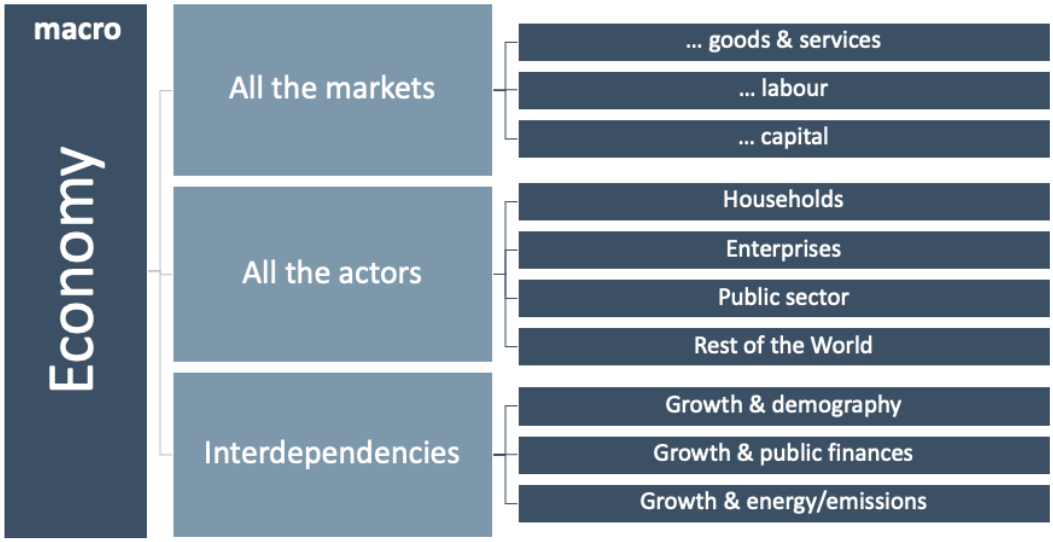
34. The main outputs of LuxGEM are macro-economic aggregates expressed in constant prices and its main inputs are the national accounts "make and use" tables, sectoral accounts and energy balance.

35. Since July 2024, STATEC has transitioned from LuxGEM to ThreeME. ThreeME is an open-source, multi-sector macroeconomic model designed for evaluating environmental and energy policies.[97] It is released under the GPL v3 licence and has been adapted to meet the NECP requirements. Like LuxGEM, ThreeME works with NEAM and Modux, but has a slightly more detailed structure comprising 37 production branches according to the NACE Rev.2 classification (of which 5 are EU ETS related) that produce 36 goods and services (commodities).

36. The coupling of the two models is achieved by applying a single exchange cycle between them. As a first step, LuxGEM, which contains the demographic and econometric hypotheses, is launched to forecast four "interacting" variables", i.e. (i) population; (ii) domestic employment; (iii) cross-border commuter employment; and (iv) manufacturing value added. These LuxGEM forecasts are then introduced into the NEAM model as exogenous variables. Coupled with NEAM's own hypotheses, six variables are estimated: (i) renewable and non-renewable energy production; (ii) energy consumption; (iii) biofuels consumption; (iv) number of buildings and electric vehicles (and other stock variables); (v) energy efficiency rates; and (vi) CO_2 emission factors. As a third step, the six variables will be introduced into LuxGEM, which will be launched a second time to generate output files, such as energy demand and CO_2 emissions by economic sector.

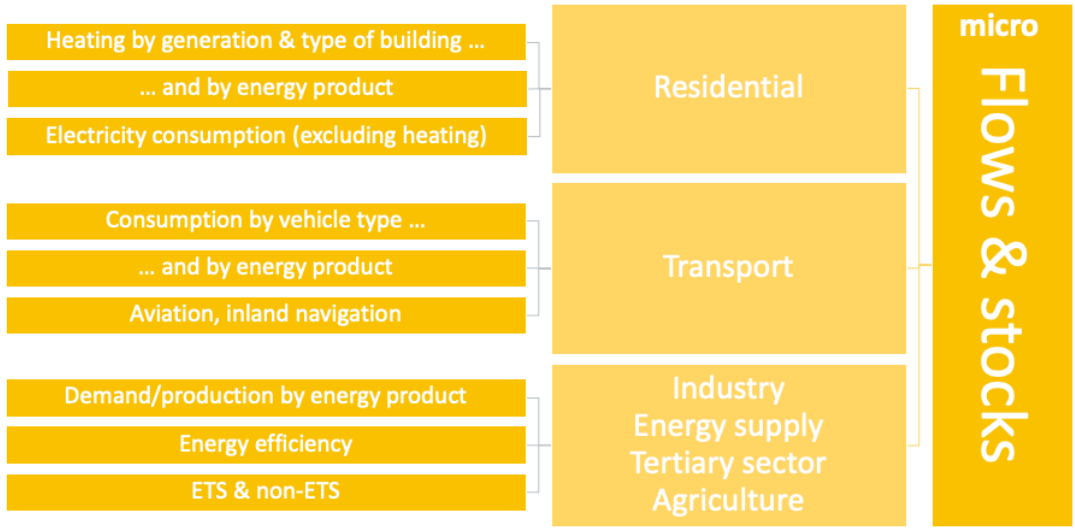
FIGURE III.F.2-1 – NEAM AND LUXGEM INTERACTIONS

LuxGEM: Interactions at the macro-economic level

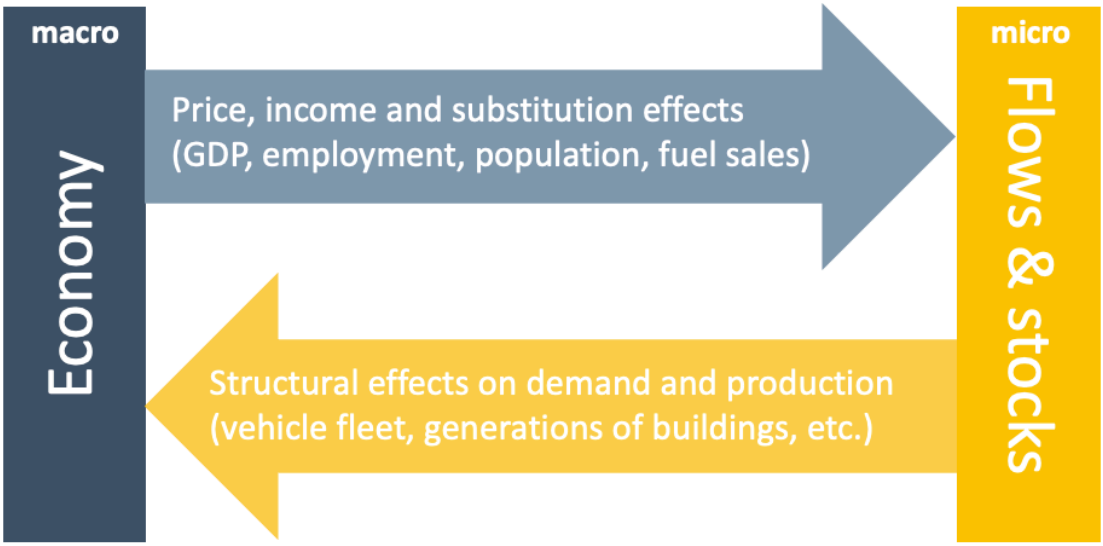


97 https://www.threeme.org/.

NEAM: granularity allows structural effects to be integrated



Coupling (communicating) between models



Source: STATEC.

37. A baseline scenario (or WEM scenario) based on "business as usual" developments in both energy supply and demand has been used as a reference. It considers the PaMs in place until 31 December 2021. The different scenarios proposing different strategies to achieve certain energy efficiency and RES targets by 2030 (target or WAM scenarios) have been identified and discussed with the Luxembourg authorities, mainly the Energy Directorate of the MECO, the MECB, the MMTP and the MECB-AEV. One of these scenarios, which provides options for a substantial reduction in GHG emissions of around 55% by 2030 compared to 2005 *[→ Sections III.D.1.2 III.F.3.12]*, was used for the 2023 draft NECP update, the 2024 NECP update as well as for this first Biennial Transparency Report (→ §13). Finally, the projections

have been extended to 2050 to meet the requirements of EU Regulation 2018/1999 and the NECP guidelines.

38. STATEC's projection models make it possible to simulate major economic and demographic trends and to quantify past and future measures relating to energy and GHG emissions. Energy efficiency gains and the widespread deployment of decarbonised technologies would enable the emission reduction target to be achieved: efficiency improvements would lead to stagnation in energy consumption, despite continued economic and demographic growth. In turn, clean technologies would enable effective emissions reductions by phasing out fossil fuels. However, the speed and origin of decarbonisation vary greatly between sectors *[→ Sections III.F.3.7 to 3.9]*, and all these projections are subject to a number of uncertainties *[→ Section III.F.2.6]*.

BOX 1 – MODUX - STATEC ECONOMETRIC MODEL

Modux is an annual macroeconometric model for Luxembourg designed for short- and medium-term economic forecasting, including population, employment and fuel sales. It covers financial activities, non-financial private activities and the public sector, and includes about 500 variables with about 100 econometric equations for the main economic indicators. The model is used for short-term (1-2 year horizon) and medium-term (3-4 year horizon) forecasting as well as for assessing the impact of policy shocks and other structural measures [STATEC (2000)]. Its medium-term forecasts are used to calibrate LuxGEM.

Modux equations are mostly in error correction form and are specified according to economic theory and institutional considerations. They can be grouped into five main blocks: determination of GDP, factors of production (employment and capital stock), prices and wages, population and unemployment, and the public sector. The structure of the model and the specification of the equations are rather standard, with some specificities related to the particular characteristics of the Luxembourg economy, such as the high degree of openness, the important role of the financial sector and the presence of a large number of non-resident and cross-border workers. The model parameters are estimated by OLS, equation by equation, using a two-step procedure in which first the cointegrating (long-run) parameters are estimated and then the resulting error correction terms are inserted in the equations for the variables in first differences (making them stationary).

Modux is fed by national accounts data, infra-annual forecasting models for Luxembourg and international assumptions from Oxford Economics. Its main outputs are macroeconomic aggregates expressed in current and constant prices.

The latest Modux forecasts are available here: https://statistiques.public.lu/fr/actualites/2024/stn34-projections-moyen-terme.html.

III.F.2.4.2 Other models and approaches

MAAV-SER – Luxembourg Agricultural Emission Model (LUAgriEmissionModel)

CRF (sub-)categories covered by this model	3.A, 3.B, 3.D, 3.G, 3.H & 3.I
Gas(es) covered	CO_2, CH_4 & N_2O ; NH_3, NOx, NM-VOC, $PM_{2.5}$, PM_{10} & TSP, and as using an N-flow approach, also nitrogen (N_2).
Reference/base year	2023 or 2024 according to the parameters
Projected years	2024 to 2050
Interface with other models/approaches	none
Input from other models	none
Reference documents for the calculations	[MAVDR-SER (2023a) & (2023b)]

39. As mentioned in §16, projections of GHG emissions from agriculture in Luxembourg have been estimated by the MAAV-SER using a modelling approach. The sources covered represented 8.1% of total GHG emissions (excluding LULUCF) in 2022.

40. LUAgriEmissionModel is a "bottom-up" model developed in MS™ Excel that simulates agricultural emissions of both GHG emissions and air pollutants emissions. It can be used for deterministic simulations, as well as for stochastic simulations using Monte Carlo simulation techniques. The model and its underlying assumptions are described in the NID [MECB-AEV (2024), pp. 414-458]. It has been extended for projections, where for the period 2022-2050 assumptions had to be made regarding activity data and the uptake of the different measures/commitments, which are described in a separate document [MAVDR-SER (2023a)].

41. For the WEM scenario, mostly trend estimates were used. For the WAM scenarios, assumptions had to be made regarding the uptake of new measures. All assumptions and trend estimates were discussed with experts.

III.F.2.5 A synthesis for emissions projections

42. *Table III.F.2-3* summarises the emissions projections methods presented in *Sections III.F.2.3 & III.F.2.4* (see also *Table III.F.2-1*).

TABLE III.F.2-3 – SUMMARY OF THE EMISSIONS PROJECTIONS METHODS

Methods	Scenarios	CRF source categories	In line with PaMs in Section III.D.3 ?	Share in 2022 total GHG (excl. LULUCF)
STATEC – NEAM & LuxGEM	WEM >< WAM	1.A.1.a (excl. incineration) / 1.A.2 / 1.A.3.b / 1.A.4.a / 1.A.4.b / 2.A.1 / 2.A.3* / 2.C.1/ 2.C.7* / IB. aviation	yes	87.82 % (excl. IB.)
SER – LUAgriEmissionModel	WEM >< WAM	3.A / 3.B / 3.D / 3.G** / 3.H / 3.I	partly	8.12 %
MECB	WEM = WAM	1.A.3.a** / 1.A.4.c	partly	0.29 %
MECB-AEV – "bottom-up" (MECB-AGE for 5.D)	WEM >< WAM	1.A.1.a (incineration) / 1.A.3.c / 1.A.3.d / 1.A.5* / 1.B.2 / 2.D* / 2.F / 2.G*** / 5.A / 5.B / 5.D	partly	3.76 %
MECB-AEV – "bottom-up" LULUCF	WEM >< WAM	4.A / 4.B / 4.C* / 4.D* / 4.E* / 4.F* / 4.G	yes	NA
NE	-	IB. navigation / CO_2 emissions from biomass	NA	NA

Source: MECB.

Note: * WEM = WAM projections.
** simple assumption: constant WEM = WAM projection over time.
*** WEM = WAM projections for N_2O.

III.F.2.6 Weaknesses of the models and approaches used for emissions projections

43. Uncertainties regarding parameters and assumptions – which are sometimes simplistic – are inherent in any long-term projection.

44. In the context of modelling emissions linked to energy combustion carried out by STATEC (see *Table III.F.2-3*), a series of uncertainties accompany the projections. These are not forecasts, but conditional projections (based on the actual fulfilment of certain assumptions, often dictated by

international trends) that aim to quantify the impact of measures, growth or certain technologies. These uncertainties can be summarised as follows:

- uncertainties surrounding decarbonised technologies have generally decreased in recent years, particularly with the rise of electric cars and heat pumps. Industrial-scale production should further reduce the prices of this equipment in the medium term, but in the short term, delivery times may slow down their deployment. There are also major uncertainties about the speed and sectors in which hydrogen will be deployed, as well as the long-term challenge of producing green hydrogen in sufficient quantities and at reasonable prices;
- there is considerable uncertainty surrounding energy prices, as evidenced by the price surge that peaked in the summer of 2022. As long as the price increase affects fossil fuels more, this will promote the energy transition. However, a relative increase in electricity prices is likely to slow it down. In addition, there are uncertainties surrounding fuel taxation in neighbouring countries, which are considered *ceteris paribus* in the modelling exercise. (effects of potential CO_2 taxes and/or the EU's new emissions trading system – ETS 2);
- a range of statistics, such as those relating to the energy efficiency of household and business equipment, are still lacking or incomplete, resulting in simplified modelling. Therefore, the collection of individual data by STATEC or the relevant authorities should be considered (see PaM n°123);
- the "desirability" of change, i.e. the ability and speed with which households and businesses can adapt to climate measures, has not yet been taken into account due to a lack of data and studies in Luxembourg on this issue;
- finally, the WAM projections are based on the effective implementation of the measures announced by all the actors concerned on the dates announced.

45. In addition to STATEC's assessment of the uncertainties and limitations of its projections, weaknesses also appear in emissions projections not produced by STATEC, which are often based on trends that are extrapolated into the future, simplistic assumptions such as averages for the last X years, or emission factors that remain unchanged over time. However, as shown in ***Table III.F.2-3***, these rather 'weak' projections concern only a marginal portion of emissions.

46. For agricultural practices (CRF 3), the projections are based on fairly realistic scenarios and use the same calculation method as for the inventory. They are therefore accompanied by a degree of uncertainty similar to that of the inventory data, increased by the uncertainty surrounding the assumptions made in the scenarios.

47. As requested by paragraph 96(a) of the MPGs, key underlying assumptions are presented in different parts of ***Section III.F***, notably in ***Table III.F.2-1***, and in an aggregated manner in CTF Table 11.

III.F.3 WEM AND WAM PROJECTIONS

48. This chapter presents the WEM and WAM sectoral and total projections of the 2024 NECP update in an aggregated form and in CO_2e. ESD/ESR and ETS projections are shown where relevant. In addition, a table and accompanying graphs show the projections by gas *[→ Table & Figures III.F.3-14]*. Detailed results of the WEM and WAM projections are presented in CTF Tables 7 and 8 for the years 2025, 2030, 2035, 2040, 2045 and 2050.

49. The classical CRF sectors are presented in accordance with paragraph 98 of the MPGs. This is followed by the 5 sectors for which the national Climate Law requires annual budgets for 2021-2030 *[→ Section III.D.2.2.2]*. These 5 sectors are:

- LUCL1 Energy and manufacturing industries, construction, excl. ETS installations (CRF 1A1a without incineration, 1A2, 1B2 & 2);
- LUCL2 Transports (CRF 1A3 & 1A5);
- LUCL3 Residential and commercial buildings (CRF 1A4a & 1A4b);
- LUCL4 Agriculture and forestry, incl. combustion (CRF 1A4c & 3);
- LUCL5 Waste and wastewater treatment (CRF 1A1a incineration & 5).

In ***Sections III.F.3.x***, historical GHG inventory data is taken from the 2024v2 submission, which is now labelled LUX-CRT-2024-V1.0. This was the most recent submission to the UNFCCC on 31 December 2024.

For 2023, we have used the final calculated values instead of the projected values, since these were already available in the 2025 GHG inventory submission at the time of writing the first BTR. This explains why WEM = WAM in 2023 in all subsequent graphics. There is one exception, incinerated waste reported under CRF 1.A.1.a and LUCL5.

The IPCC AR5's Global Warming Potential over a period of 100 years is the basis for all figures in CO_2e.

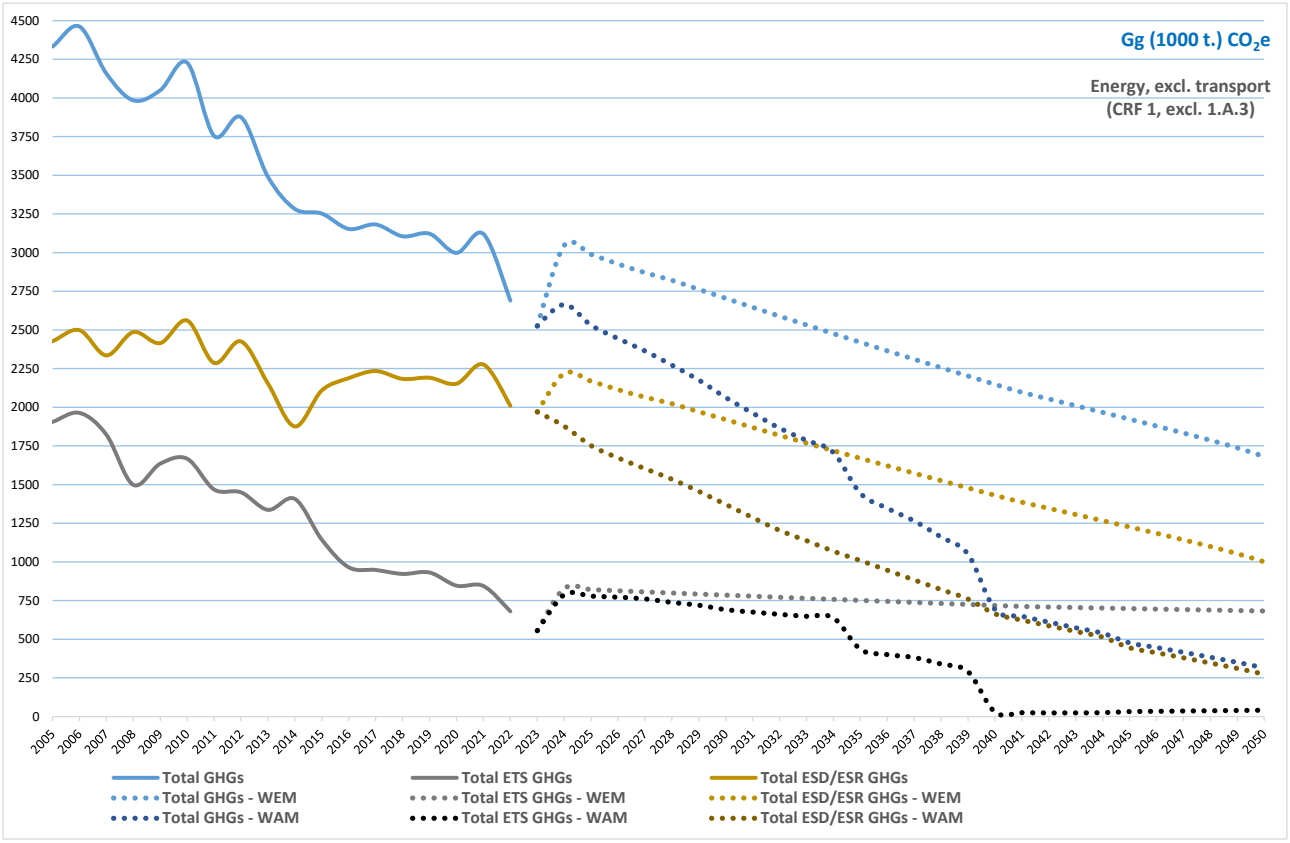
50. ***Tables III.F.3-1 to III.F.3-12 & III.F.3-14*** present data both in 1000 tonnes of CO_2e (kt or Gg) in AR5 GWPs and in indices (where 2005 equals 100), while ***Figures III.F.3-1 to III.F.3-14*** are restricted to emissions in kt or Gg, except for the "compliance" ***Figure III.F.3-13***, which is expressed in Mt. The descriptive text should be read in conjunction with the descriptions of the key assumptions for the GHG projections in ***Table III.F.2-1***.

Traditional CRF sector breakdown

III.F.3.1 Energy, excl. transport (CRF 1, excl. 1A3)

TABLE & FIGURE III.F.3-1 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FOR THE ENERGY SECTOR, EXCL. TRANSPORT

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Energy, excl. transport	1, excl. 1.A.3	Total GHGs	4 332.17	4 228.21	3 252.33	2 998.37	2 988.30	2 704.39	2 420.20	2 148.10	1 922.98	1 681.80	WEM
		Total ETS GHGs	1 905.02	1 666.86	1 143.45	846.22	820.00	784.31	750.49	717.65	697.52	681.85	
		Total ESD/ESR GHGs	2 427.15	2 561.35	2 108.88	2 152.16	2 168.30	1 920.08	1 669.72	1 430.45	1 225.46	999.95	
		Total GHGs	4 332.17	4 228.21	3 252.33	2 998.37	2 529.57	2 061.98	1 443.03	691.58	476.17	314.73	WAM
		Total ETS GHGs	1 905.02	1 666.86	1 143.45	846.22	778.46	691.12	434.64	27.75	31.80	40.72	
		Total ESD/ESR GHGs	2 427.15	2 561.35	2 108.88	2 152.16	1 751.11	1 370.87	1 008.39	663.84	444.37	274.01	
		Total GHGs	100.00	97.60	75.07	69.21	68.98	62.43	55.87	49.58	44.39	38.82	WEM
		Total ETS GHGs	100.00	87.50	60.02	44.42	43.04	41.17	39.40	37.67	36.61	35.79	
		Total ESD/ESR GHGs	100.00	105.53	86.89	88.67	89.34	79.11	68.79	58.94	50.49	41.20	
		Total GHGs	100.00	97.60	75.07	69.21	58.39	47.60	33.31	15.96	10.99	7.26	WAM
		Total ETS GHGs	100.00	87.50	60.02	44.42	40.86	36.28	0.00	0.00	5.00	10.00	
		Total ESD/ESR GHGs	100.00	105.53	86.89	88.67	72.15	56.48	41.55	27.35	18.31	11.29	



Sources: MECB-AEV – Submission 2024v2.
MECO, MECB, MECB-AEV & STATEC – 2024 projections for the NECP update.

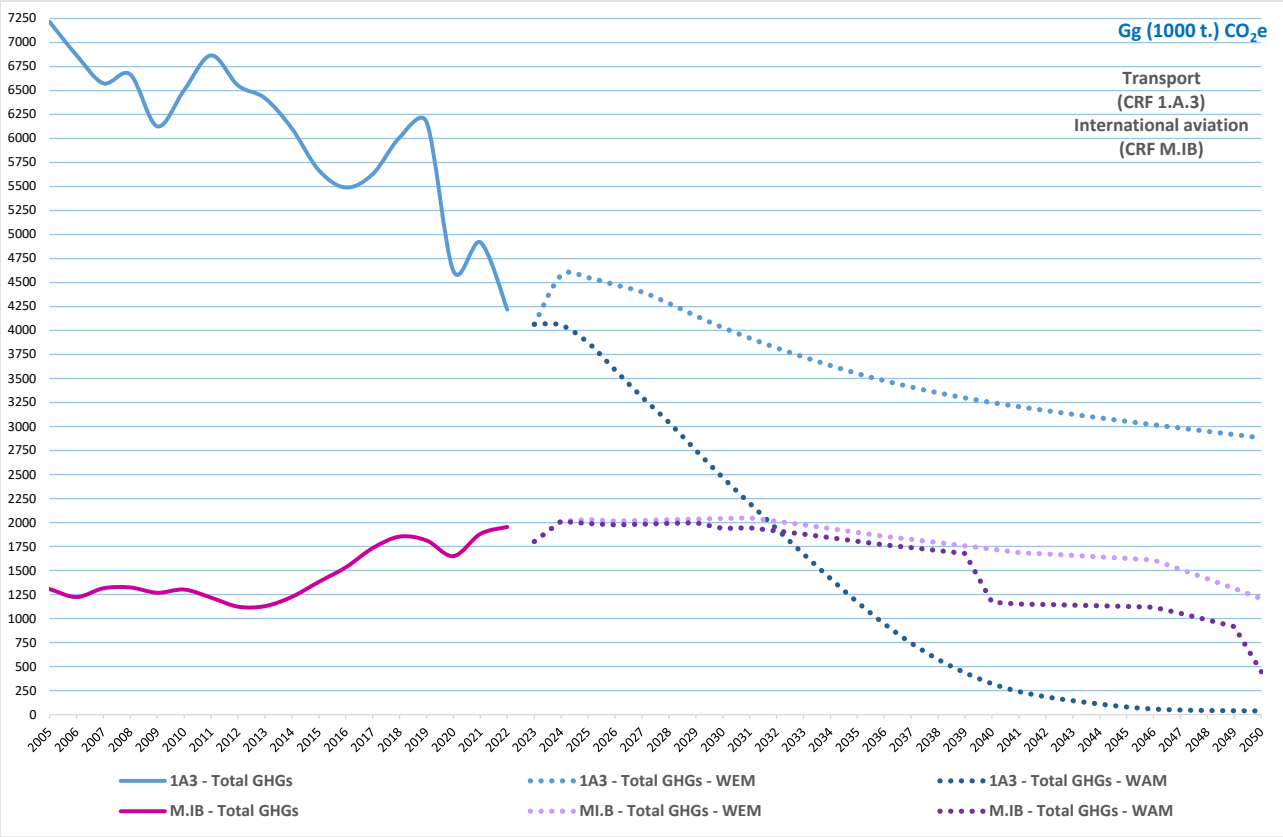
51. See *Sections III.F.3.7 & III.F.3.9* for explanations.

III.F.3.2 Transport (CRF 1A3) and international aviation

TABLE & FIGURE III.F.3-2 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FOR THE TRANSPORT SECTOR

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Transport	1.A.3	Total GHGs	7 216.69	6 505.17	5 670.07	4 618.22	4 550.24	4 030.63	3 551.52	3 249.88	3 054.48	2 882.99	WEM
		Total GHGs	7 216.69	6 505.17	5 670.07	4 618.22	3 871.91	2 467.22	1 169.44	320.55	78.06	37.01	WAM
		Total GHGs	100.00	90.14	78.57	63.99	63.05	55.85	49.21	45.03	42.33	39.95	WEM
		Total GHGs	100.00	90.14	78.57	63.99	53.65	34.19	16.20	4.44	1.08	0.51	WAM

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
International aviation	M.IB	Total GHGs	1 306.77	1 300.90	1 381.00	1 648.80	2 030.56	2 042.72	1 896.44	1 722.57	1 626.73	1 207.45	WEM
		Total GHGs	1 306.77	1 300.90	1 381.00	1 648.80	1 989.88	1 939.26	1 805.55	1 170.91	1 126.14	446.77	WAM
		Total GHGs	100.00	99.55	105.68	126.17	155.39	156.32	145.12	131.82	124.48	92.40	WEM
		Total GHGs	100.00	99.55	105.68	126.17	152.28	148.40	138.17	89.60	86.18	34.19	WAM



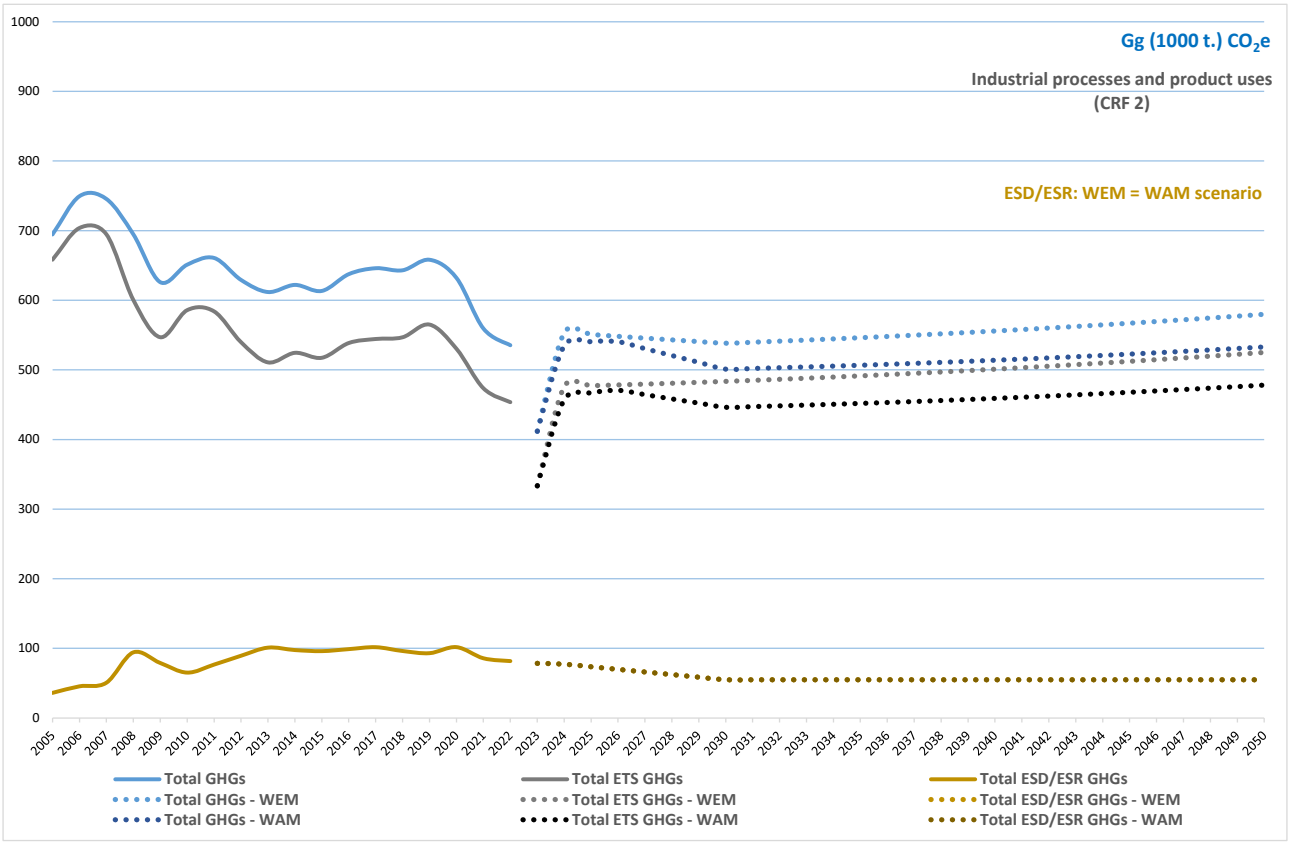
Sources: MECB-AEV – Submission 2024v2.
MECB, MECB-AEV & STATEC – 2024 projections for the NECP update.

52. See *Section III.F.3.8* for explanations.

III.F.3.3 Industrial processes and product uses (CRF 2)

TABLE & FIGURE III.F.3-3 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM INDUSTRIAL PROCESSES AND PRODUCT USES

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Industrial processes & product uses	2	Total GHGs	694.51	651.03	613.36	632.00	550.71	538.18	546.10	555.69	566.91	579.72	WEM
		Total ETS GHGs	658.34	585.80	517.38	530.28	477.21	483.40	491.31	500.90	512.12	524.94	
		Total ESD/ESR GHGs	36.17	65.23	95.99	101.72	73.50	54.79	54.79	54.79	54.79	54.79	
		Total GHGs	694.51	651.03	613.36	632.00	540.56	501.06	506.63	513.83	522.60	532.91	WAM
		Total ETS GHGs	658.34	585.80	517.38	530.28	467.06	446.28	451.85	459.05	467.82	478.12	
		Total ESD/ESR GHGs	36.17	65.23	95.99	101.72	73.50	54.79	54.79	54.79	54.79	54.79	
		Total GHGs	100.00	93.74	88.32	91.00	79.29	77.49	78.63	80.01	81.63	83.47	WEM
		Total ETS GHGs	100.00	88.98	78.59	80.55	72.49	73.43	74.63	76.09	77.79	79.74	
		Total ESD/ESR GHGs	100.00	180.33	265.36	281.20	203.19	151.46	151.46	151.46	151.46	151.46	
		Total GHGs	100.00	93.74	88.32	91.00	77.83	72.15	72.95	73.99	75.25	76.73	WAM
		Total ETS GHGs	100.00	88.98	78.59	80.55	70.95	67.79	68.64	69.73	71.06	72.63	
		Total ESD/ESR GHGs	100.00	180.33	265.36	281.20	203.19	151.46	151.46	151.46	151.46	151.46	



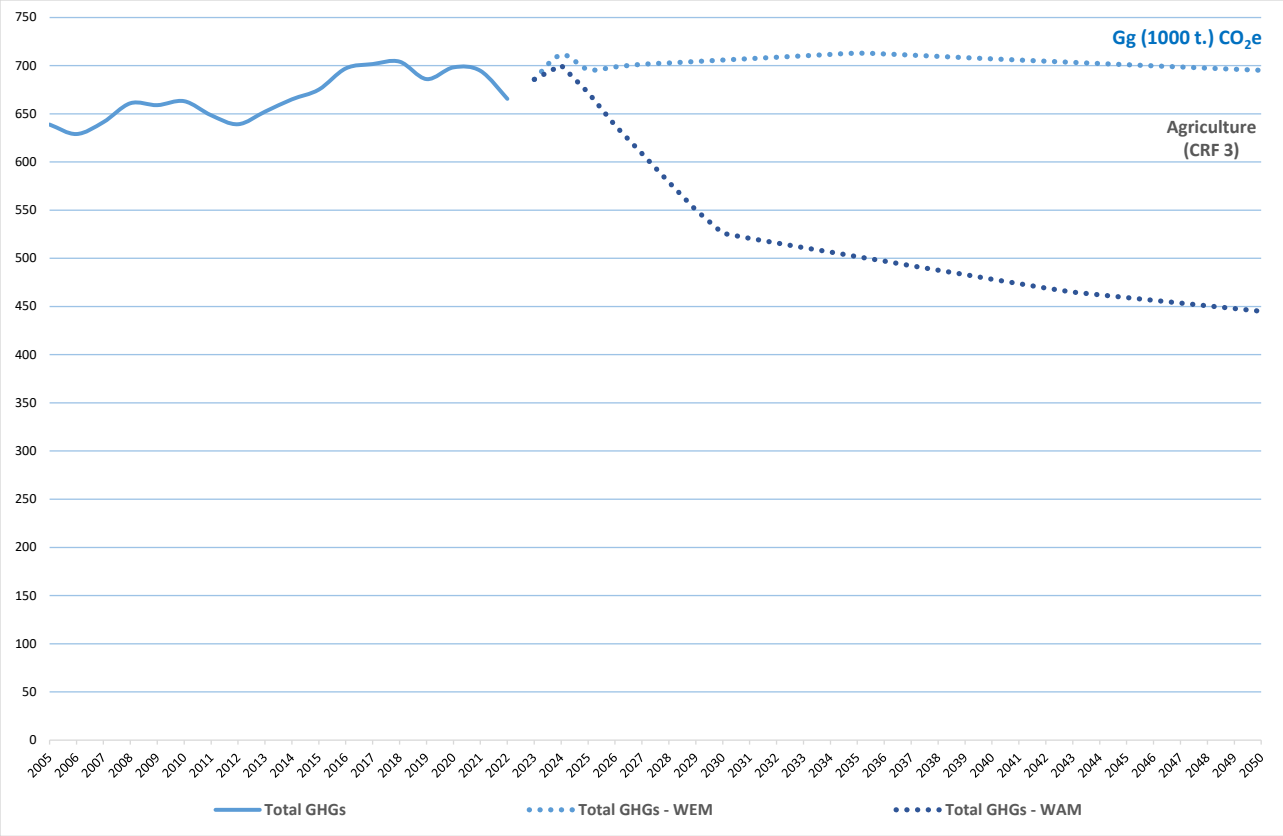
Sources: MECB-AEV – Submission 2024v2.
MECB-AEV & STATEC – 2024 projections for the NECP update.

53. See *Section III.F.3.7* for explanations.

III.F.3.4 Agriculture (CRF 3)

TABLE & FIGURE III.F.3-4 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM AGRICULTURAL PRACTICES

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Agriculture	3	Total GHGs	638.91	663.17	675.20	698.34	695.92	705.89	713.12	707.15	701.04	695.18	WEM
		Total GHGs	638.91	663.17	675.20	698.34	672.12	526.12	501.84	478.39	459.24	445.06	WAM
		Total GHGs	100.00	103.80	105.68	109.30	108.92	110.48	111.62	110.68	109.73	108.81	WEM
		Total GHGs	100.00	103.80	105.68	109.30	105.20	82.35	78.55	74.88	71.88	69.66	WAM



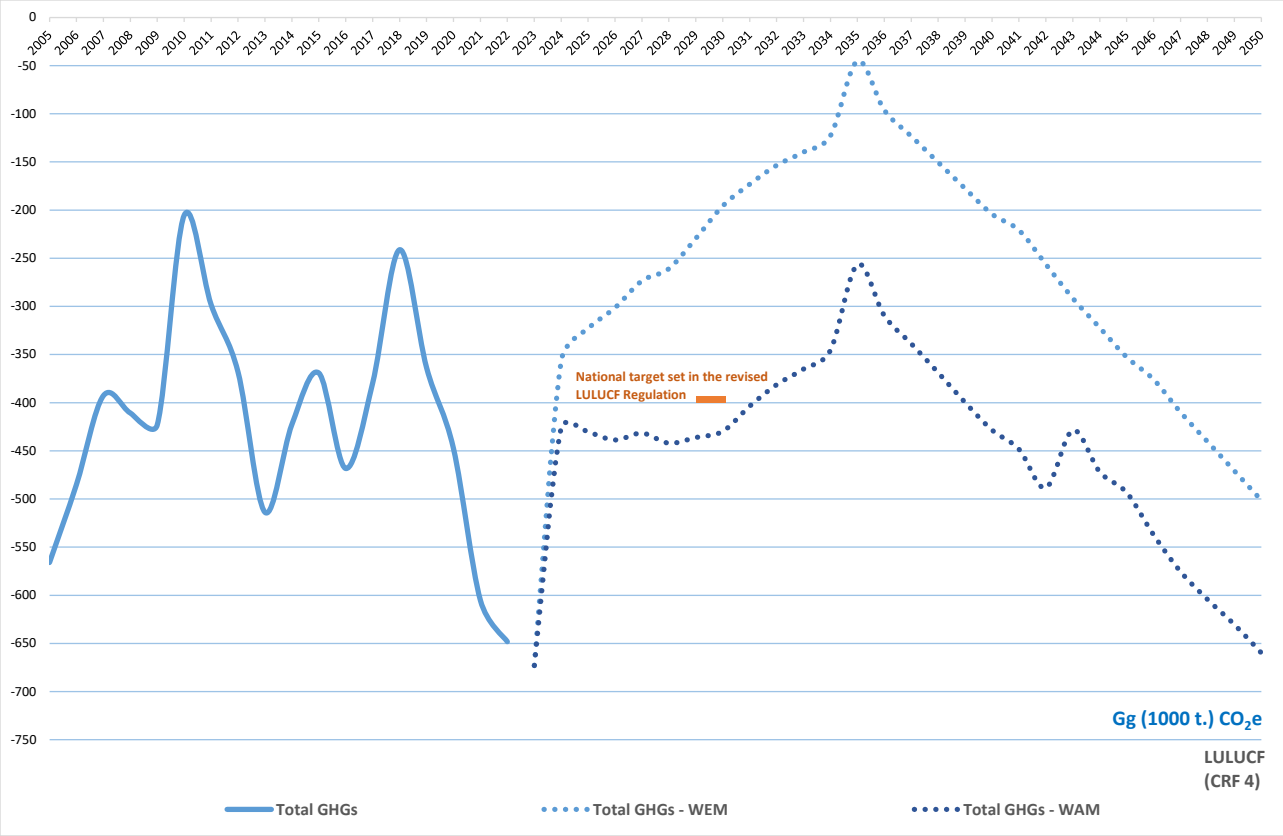
Sources: MECB-AEV – Submission 2024v2.
MAAV-SER – 2024 projections for the NECP update.

54. See *Section III.F.3.10* for explanations.

III.F.3.5 LULUCF (CRF 4)

TABLE & FIGURE III.F.3-5 – HISTORICAL AND PROJECTED WEM & WAM LULUCF EMISSIONS

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
LULUCF	4	Total GHGs	-565.98	-205.40	-369.21	-447.65	-323.02	-195.62	-45.24	-204.14	-352.66	-501.25	WEM
		Total GHGs	-565.98	-205.40	-369.21	-447.65	-430.59	-429.66	-256.44	-428.39	-493.40	-659.80	WAM
		Total GHGs	100.00	36.29	65.23	79.09	57.07	34.56	7.99	36.07	62.31	88.56	WEM
		Total GHGs	100.00	36.29	65.23	79.09	76.08	75.91	45.31	75.69	87.18	116.58	WAM



Sources: MECB-AEV – Submission 2024v2.
MECB-AEV – 2024 projections for the NECP update.

55. The projections for the LULUCF sector are the result of ad hoc methods developed by the MECB-AEV using information on demographic and housing developments in Luxembourg. These projections do not always distinguish between the WEM and WAM scenarios *[→ Table III.F.2-1]*.

56. The two main variables on which the projections are based are, on the one hand, the conversion of grassland and arable land into settlements and, on the other hand, the evolution of harvesting rates in forests, with land use for the development of settlements being the main driver of land use change in Luxembourg.

57. The projection for the WEM scenario is identical to the one used to calculate the "Forest Management Reference Level" and is described in detail in the KP-LULUCF section of the 2022 National Inventory Report [MECDD-AEV (2022), Section 11.4]. The measures planned in the 2024 NECP update focus on new incentives for a more nature-oriented and climate-resilient

forest management. These measures are taken into account in the WAM scenario and will lead to a reduction in harvesting in the long term.

58. In the short term, however, there will be an increase in harvesting due to salvage logging following damage caused by bark beetle infestation and recent droughts. This will lead to a decrease in the carbon sink until 2035, after which the forest is expected to recover and start sequestering carbon from the atmosphere again. Additionally, increased wood usage will lead to an increase in the carbon sink within this carbon pool. It is important to note, however, that harvesting rates show significant inter-annual variability, and projections can only provide long-term trends. Therefore, they will never be able to reproduce these annual changes. Furthermore, extreme weather events followed by windfalls and subsequent salvage logging can result in very high annual harvest rates, which will have a significant impact on the carbon sink.

59. In addition, according to the National Phytosanitary Inventory of 2023,[98] around two thirds of Luxembourg's forest trees are severely damaged or dead. Luxembourg expects to have to recalculate its net removals for recent years, which may lead to a revision of the reference values and targets. Therefore, despite the actual WAM projection, it is unclear whether Luxembourg will meet its 2030 target of -403 Gg CO_2e, as set out in the revised LULUCF Regulation and that should contribute to the achievement of the EU's updated Nationally Determined Contribution (NDC) target (→ §107).

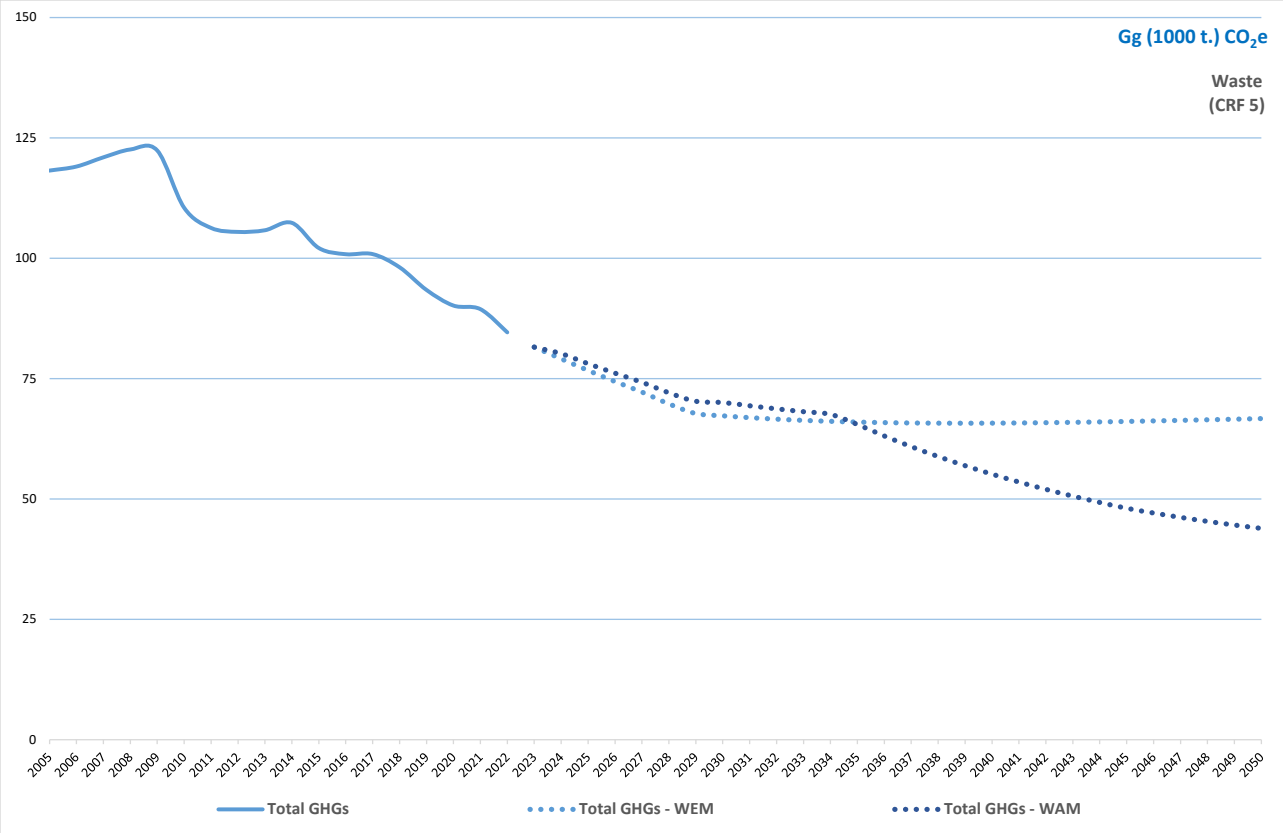
60. In conjunction with forests, the agricultural sector also acts as a carbon sink. The WAM scenario includes measures such as reduced tillage, organic farming and crop rotation. These measures lead to an increase in the carbon sink for 20 years, after which the new carbon stock for these practices is reached. Consequently, a reduction in this carbon sink is expected between 2035 and 2040.

98 https://environnement.public.lu/fr/actualites/2023/09/inventaire-phytosanitaire-2023.html.

III.F.3.6 Waste (CRF 5)

TABLE & FIGURE III.F.3-6 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM WASTE AND WASTEWATER TREATMENT

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Waste	5	Total GHGs	118.22	110.49	102.12	90.16	76.67	67.25	65.95	65.73	66.08	66.67	WEM
		Total GHGs	118.22	110.49	102.12	90.16	78.08	70.03	65.47	55.15	48.06	43.88	WAM
		Total GHGs	100.00	93.46	86.38	76.26	64.85	56.88	55.78	55.60	55.90	56.40	WEM
		Total GHGs	100.00	93.46	86.38	76.26	66.05	59.23	55.38	46.65	40.65	37.12	WAM



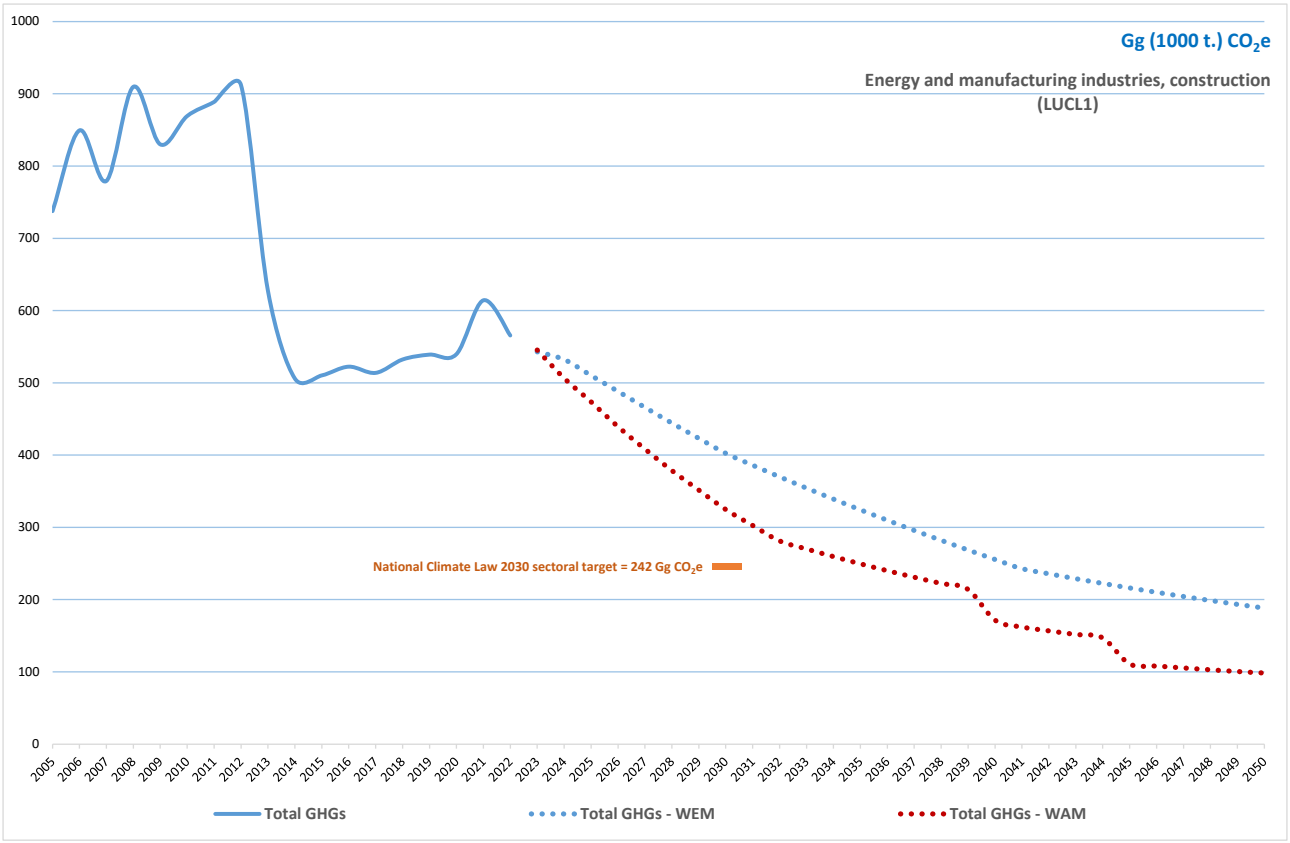
Sources: MECB-AEV – Submission 2024v2.
MECB-AEV & MECB-AGE – 2024 projections for the NECP update.

61. See *Section III.F.3.11* for explanations.

III.F.3.7 Energy and manufacturing industries, construction, excl. EU ETS installations (LUCL1)

TABLE & FIGURE III.F.3-7 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FOR THE ENERGY AND MANUFACTURING INDUSTRIES, CONSTRUCTION

Sector	LUCL1	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Energy and manufacturing industries, construction	1.A.1.a(p)	Total GHGs	737.54	869.09	510.29	539.66	510.13	402.48	324.33	255.65	216.23	188.42	WEM
	1.A.2	Total GHGs	737.54	869.09	510.29	539.66	473.53	324.57	249.45	171.52	110.82	98.33	WAM
	1.B.2	Total GHGs	100.00	117.84	69.19	73.17	69.17	54.57	43.97	34.66	29.32	25.55	WEM
	2	Total GHGs	100.00	117.84	69.19	73.17	64.20	44.01	33.82	23.26	15.03	13.33	WAM



Sources: MECB-AEV – Submission 2024v2.
MECO, MECB, MECB-AEV & STATEC – 2024 projections for the NECP update.

62. Projections for this sector of the Climate Law have been made by STATEC for CRF 1A1a excluding waste incineration, CRF 1A2 and CRF 2A and 2C. The MECB-AEV estimated future GHG emissions for waste incineration (part of CRF 1A1a), fugitive emissions from oil and gas (CRF 1B2) and product use (CRF 2D, 2F and 2G) *[→ Table III.F.2-1]*.

63. . Electricity and heat production (CRF 1A1a) are modelled by technology and by type of energy used. Installed capacity (stocks) and new installations (flows) are explicitly modelled, as is the repowering of existing installations. This renewal of production units (after 20 years for wind power, 25 years for photovoltaic installations) results in:

- a temporary drop in production while the new unit is being dismantled and installed new unit (2 years for wind power, immediate for photovoltaics);

- an increase in installed capacity (compared with the old unit) as soon as the new unit is connected to the grid;
- an increase in production (for a given capacity) which is due to technological developments (e.g. an increase in the operating hours of modern wind turbines).

64. For wind, photovoltaic and biomass production, the projections of the MECO and those of market players have been taken into account. Photovoltaic and wind power generation are projected to increase significantly over the remainder of the 2020s (+15% per year on average), but growth will be less pronounced after 2030 (+3% per year on average) as in the long term, the installation of new wind turbines is expected to slow down to 1 per year, compared to 3-4 per year before 2030. Photovoltaic installations are linked in the long term to the construction of residential buildings, assuming in the WEM that half of all new buildings will be equipped with photovoltaic panels, and in the WAM that all new buildings will have them.

65. The WEM and WAM projections do not take into account the possible commissioning of new fossil fuel-fuelled power plants in Luxembourg. The reason for this assumption is that the development of further fossil fuel or natural gas-fired combined heat and power (CHP) installations is not favourable for Luxembourg in terms of GHG accounting, as it would not replace more polluting plants, but only imported electricity. However, the construction of new power plants based on biomass is an option for the coming years, be it wood, green and organic waste or biogas from agricultural practices. Therefore, the production from fossil-fuelled CHP plants has been estimated by assuming that:
    - in the WEM scenario, the plants are shut down when they reach the end of their life (estimated at 20 years);
    - in the WAM scenario, the plants are shut down as soon as they no longer benefit from the feed-in tariff through the compensation mechanism;
    - the last fossil-fuelled CHP plant would therefore close in 2032 (WAM) and 2041 (WEM), leaving only biomass CHP.

66. The manufacturing industry (CRF 1A2 and CRF 2A & 2C) is divided into several energy-intensive activities (steel, glass, aluminium, cement, i.e. the country's main industrial emitters) and other industrial activities (including construction) in order to model the respective trends in production growth rates and energy efficiency gains. The energy-intensive activities include only companies subject to the EU ETS (not considered in ***Table & Figure III.F.3.7***), while only 14% of the energy consumption of other industrial activities is subject to this scheme. As a result, the non-ETS emissions in the industrial sector – which are the focus of European countries' climate targets – come entirely from these other industrial activities. The modelling of these activities is based on two main sources, namely the energy balance and the production of the different industries, taken from the national accounts. For the manufacturing and construction

sectors, changes in production, energy intensity and energy sources have been extended on the basis of historical trends. The less energy-intensive industrial activities posted average annual production growth of 4.3% between 2001 and 2020. Despite this increase, emissions have fallen thanks to improvements in energy efficiency and greater use of electricity as the main energy source. Fossil fuel energy intensity has thus improved by an average of 7.6% per year. If this trend continues, emissions from the manufacturing industry will continue to fall, completing a reduction in emissions of respectively by 10% and 55% respectively in 2030 and 2050 (compared with 2005). The WEM scenario then assumes a gradual but limited electrification of 0.5% per year (i.e. 0.5% of gas and oil consumption is replaced by equivalent electricity consumption per year).

67. The WAM scenario consists of applying, to the extent possible, the reduction in non-ETS emissions resulting from the "Roadmap for the decarbonisation of Luxembourg manufacturing industry" (see PaM n°510 in ***Table III.D.3-1***) in addition to the downward trajectory of the WEM as this Roadmap is mainly aimed at companies subject to the EU ETS. The Roadmap emphasises, among other things, the desire to electrify processes and use hydrogen as a substitute for natural gas, as well as providing the necessary support to build the infrastructure to do so. In the STATEC projections, the projects identified in the Roadmap have been brought into line with the government's hydrogen strategy, according to which Luxembourg would be connected to a cross-border hydrogen network from 2035.[99] This would allow for more widespread use of hydrogen, especially if the necessary support is provided to make these projects viable. The WAM estimates also take into account the extension of the "Voluntary Energy Efficiency Agreement" between the Luxembourg government and the Luxembourg Federation of Industry – FEDIL (see PaMs n°503 & 504 in ***Table III.D.3-1***).

68. Industrial process emissions cover CRF 2A and 2C in Luxembourg and only installations under the EU ETS. The assumption is that all projected CO_2 emissions are ETS emissions estimated separately by STATEC.

69. For non-energy products from fuel and solvent use (CRF 2D) and F-gases (CRF 2F and 2G), projections are "bottom-up", based on activity data and other variables underlying sectoral emissions. Details are given in ***Table III.F.2-1***.

70. For fugitive emissions from natural gas storage, transmission and distribution (CRF 1B2), decreasing emissions are reported for both the WEM and WAM scenarios, in line with the projected final consumption of natural gas for these two scenarios.

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99 *Stratégie hydrogène du Luxembourg – relever les défis de la décarbonation* (https://gouvernement.lu/fr/actualites/toutes_actualites/communiques/2021/09-septembre/27-turmes-hydrogene.html and https://gouvernement.lu/dam-assets/documents/actualites/2021/09-septembre/27-turmes-hydrogene/Strategie-hydrogene-LU-executive-summary.pdf).

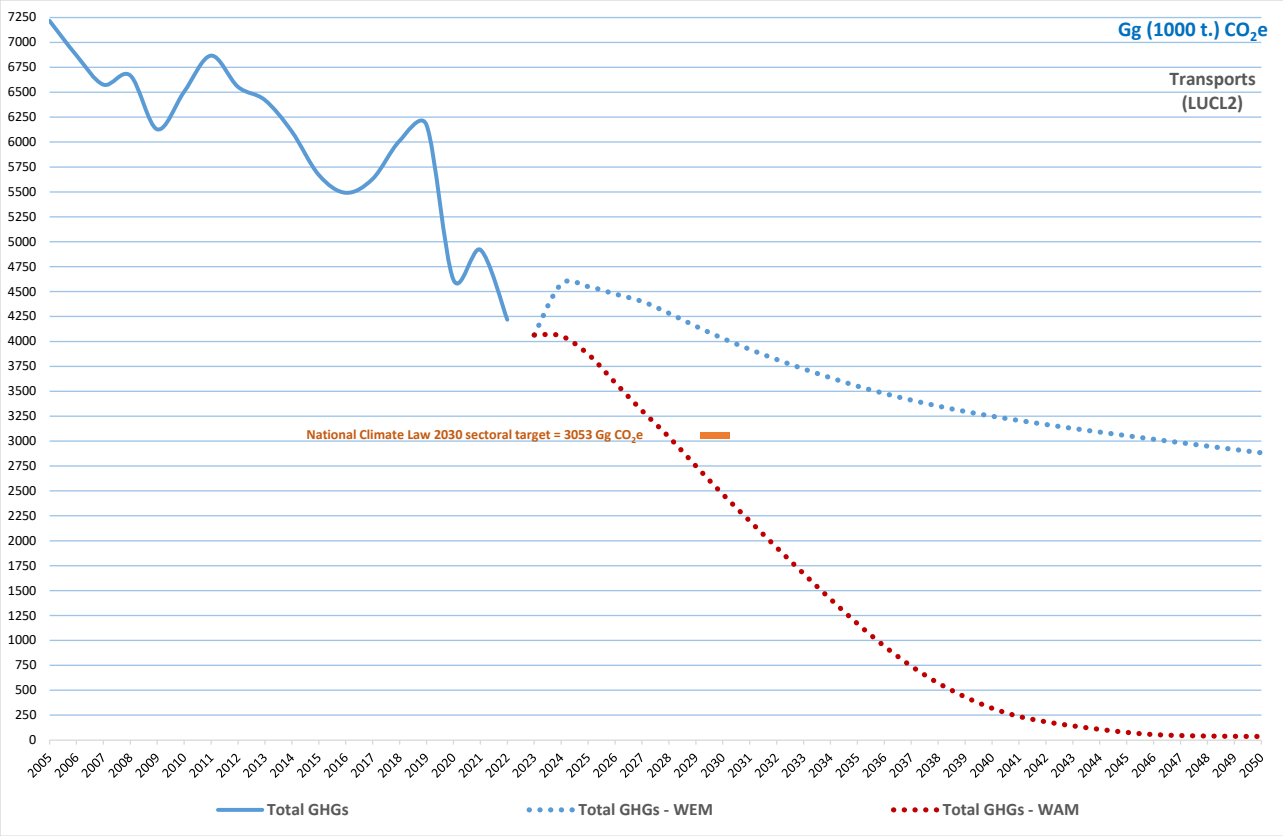
71. In conclusion, in terms of energy production, the expansion of renewable energies would be the main driver of decarbonisation in the WAM scenario through the expansion of current photovoltaic and wind power production capacity and the promotion of electricity produced from biomass and biogas. Centralised renewable heat production, the strengthening and expansion of the electricity grid, which is necessary to enable the electrification of the Luxembourg economy, and the development of a hydrogen network will need to be supported. In industry, in addition to investments in more efficient processes to improve energy efficiency, the main long-term determinant would be access to green hydrogen in order to decarbonise high-temperature processes, thus requiring connection to a cross-border hydrogen network. Where possible, low-temperature processes would be electrified. However, hydrogen is only expected to make a marginal contribution to the energy transition by 2030, as supply cannot be guaranteed until after that date (production is still very limited and transport infrastructure is still lacking).

72. The WAM projections indicate that the national sectoral target will not be met in 2030, with exceeding emissions of 82.6 Gg CO_2e. In addition, the cumulative exceeding emissions between 2021-2030, compared to the annual sectoral budgets, are projected to reach 1109.0 Gg CO_2e.

III.F.3.8 Transports (LUCL2)

TABLE & FIGURE III.F.3-8 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FOR THE TRANSPORT SECTOR

Sector	LUCL2	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Transports	1.A.3	Total GHGs	7 216.82	6 505.29	5 670.19	4 618.33	4 550.35	4 030.75	3 551.63	3 250.00	3 054.60	2 883.11	WEM
	1.A.5	Total GHGs	7 216.82	6 505.29	5 670.19	4 618.33	3 872.03	2 467.33	1 169.55	320.67	78.17	37.12	WAM
		Total GHGs	100.00	90.14	78.57	63.99	63.05	55.85	49.21	45.03	42.33	39.95	WEM
		Total GHGs	100.00	90.14	78.57	63.99	53.65	34.19	16.21	4.44	1.08	0.51	WAM



Sources: MECB-AEV – Submission 2024v2.
MECB & STATEC – 2024 projections for the NECP update.

73. Projections for this sector of the Climate Law were made by STATEC for CRF 1A3b, supplemented by basic estimates by the MECB and/or the MECB-AEV for CRF 1A3a, 1A3c, 1A3d and 1A5 *[→ Table III.F.2-1]*.

74. Road transport (CRF 1A3b) dominates this sector with 99.8% of the GHG emissions in 2021. The modelling of this sector is based on national fleet data. Different vehicle types (cars, motorcycles, buses and coaches, vans and commercial vehicles, trucks and road tractors) and fuel types (petrol, diesel, hybrid (PHEV and non-PHEV), electric, hydrogen) are modelled. Assumptions on the evolution of the different vehicle types and fuels are applied to the new registrations (flows). The vehicle population is calculated by adding new registrations to the previous year's population and subtracting retirements.

75. In addition to the fuel consumed by the national fleet, fuel sales also include sales to non-residents. A notable feature of the transport sector is that a significant proportion of emissions attributed to Luxembourg are generated by non-residents. In the years prior to the Covid-19

pandemic, two-thirds of fuel sales were to international carriers, individuals in transit, and those living in the border region. This was mostly triggered by lower pump prices in Luxembourg than in neighbouring countries. However, this share has been decreasing since then, reaching around 60% in 2022. Even if some subsidies in neighbouring countries stopped,[100] this percentage remains around 60%. This is also one of the consequences of the CO_2 tax.

76. For fuel sales to non-residents, similar trends in fuel consumption (and electrification) are assumed as for the national fleet. Fuel sales increase with the number of cross-border commuters and the transport of goods within the European Union. However, the main determinants of sales to non-residents are the price differences between Luxembourg and neighbouring countries. These prices and the reaction to changes in these prices are explicitly modelled by taking into account increases in the CO_2 tax. In the WEM scenario, only the increases adopted up to 2023 are considered, beyond which the tax is assumed to remain constant at 30 EUR/tCO_2e. The WAM scenario simulates additional 5 EUR/tCO_2e annual increases for the years 2024 to 2050, i.e. a tax of 165 EUR/tCO_2e in 2050 (see PaM n°105 in ***Table III.D.3-1***).

77. The reaction of non-residents to price differentials is quite pronounced, which makes the instrument of a tax such as the one on CO_2 emissions particularly effective. If policies in neighbouring countries remain unchanged, each 5 EUR per tCO_2e increase in the tax in Luxembourg reduces the price differential with neighbouring countries by just over 0.01 EUR (1 eurocent). The sequence of annual tax increases would gradually reduce price differentials and imply an increasingly pronounced decline in fuel sales to non-residents. By 2030, half of the reduction in emissions from this sector would be the result of successive increases in the CO_2 tax, leading to a 60% reduction in fuel sales to non-residents.

78. Another feature of the transport sector is the rapid renewal of the vehicle fleet.[101] The increased penetration of electric and hybrid vehicles would already contribute to a significant reduction in emissions in the business-as-usual or WEM scenario. This effect would be reinforced by the new vehicle performance standards adopted at European level – including the end of the sale of fossil fuel cars by the year 2035 – and by the reform of company car benefits (see, e.g., PaM n°421 in ***Table III.D.3-1***). The tax and subsidy systems, which are likely to be adjusted in the coming years in line with the price evolution of zero-emission cars, should help to ensure that electric cars account for almost 40% of the car fleet by 2030 (almost 50% if plug-in hybrids are included). This electrification requires a rapid breakthrough for electric cars, whose market share is expected to increase from 15% in 2022 to 30% in 2025. This increase is mainly due to the full electrification of company cars, which account for almost half of new registrations in Luxembourg.

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100 In 2022, foreign government measures meant that some foreign prices were temporarily lower than Luxembourg prices, leading to an 11% fall in fuel sales for the year as a whole.

101 The car fleet is younger in Luxembourg than abroad: 6.7 years on average compared with 11.8 years in the EU (source: European Automobile Manufacturers' Association – ACEA).

79. For other vehicle types, decarbonisation is expected to be slower due to insufficient supply in the short term. However, the electrification of vans is expected to start slowly (5% and 15% of the stock in 2025 and 2030 respectively), while the projections also assume a modest penetration of hydrogen-powered trucks (1% and 10% of the stock in 2030 and 2050 respectively). By 2040, most of the remaining emissions from the transport sector will come from trucks, buses, construction machinery and agricultural tractors, while cars would already be electrified and fuel sales to non-residents would be marginal.

80. In addition to the vehicles themselves, the modelling also takes into account the modal choice and length of journeys based on the mobility scenario MMUST (see PaM n°403 in ***Table III.D.3-1***) developed by experts from the MMTP. Their reference scenario is incorporated into the WEM scenario, while the "National Mobility Plan 2035" (PNM2035, see PaM n°401 in ***Table III.D.3-1***) is included in the WAM scenario.

81. Finally, measures such as PaM n°415 in ***Table III.D.3-1*** on the obligation to include sustainable biofuels in road fuels are also considered.

82. As far as CRF 1A3c is concerned, rail passenger transport is fully electrified. Therefore, the planned increase would come from an increase in freight transport performed by diesel locomotives. The WAM scenario triggers a higher increase in emissions up to 2050 than the WEM scenario, because in the former a higher share of freight is shifted from road to rail, more precisely at the multimodal intermodal hub, which continues to expand in the south of the country.

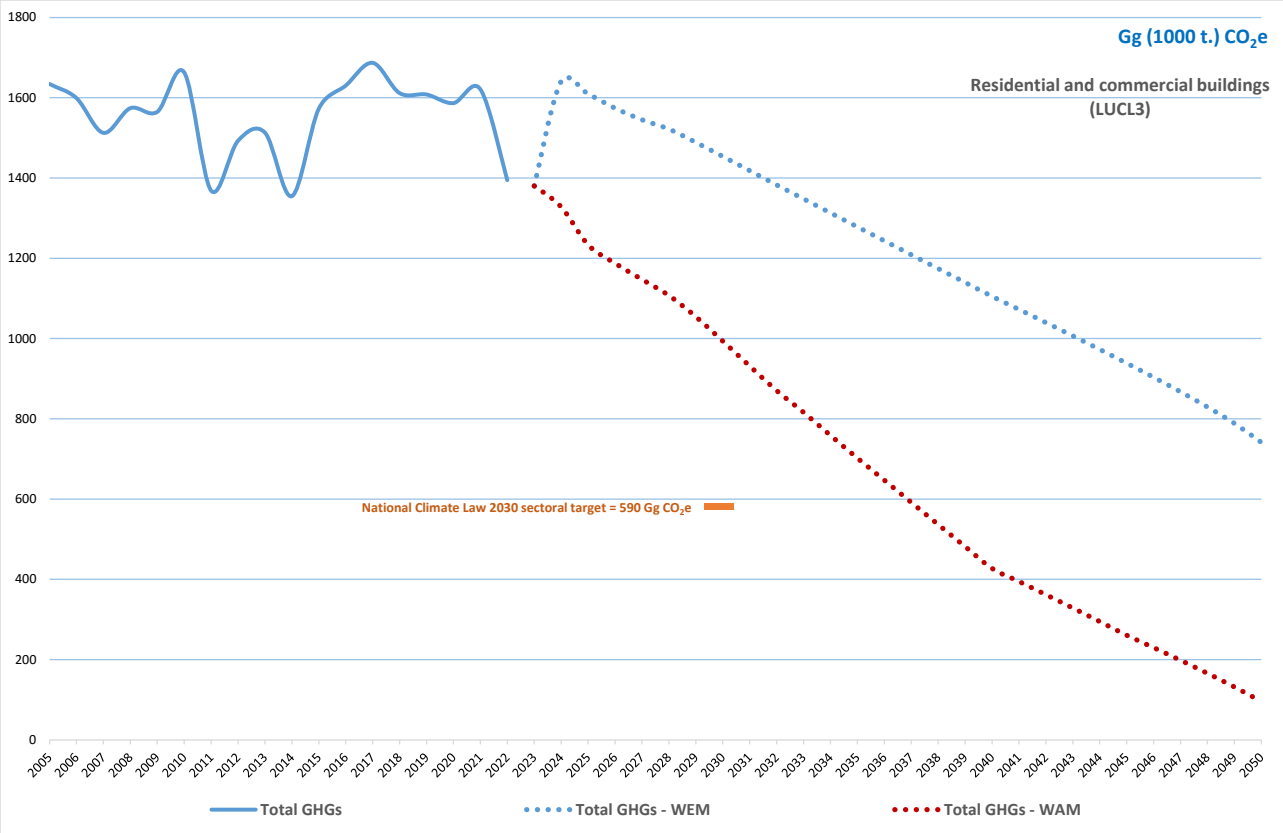
83. In conclusion, in the transport sector, the key factors behind the rapid decline in emissions in the WAM scenario are successive increases in the CO2 tax, leading to a decline in fuel sales to non-residents, and the electrification of the vehicle fleet. The latter would be accelerated by tax incentives for company cars and definitively achieved after the ban on new combustion engine cars in 2035 at European level. However, this will require additional investment in charging infrastructure, for which investment was already high in the reference scenario. Finally, investment in transport will serve to improve and develop mobility infrastructure to enable efficient multimodal mobility.

84. The WAM projections indicate that the national sectoral target will be met in 2030, with emissions 586 Gg CO_2e below the target. In addition, emissions gains of up to 5055.5 Gg CO_2e are expected over the period 2021-2030 compared to the annual sectoral budgets.

III.F.3.9 Residential and commercial buildings (LUCL3)

TABLE & FIGURE III.F.3-9 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM RESIDENTIAL AND COMMERCIAL BUILDINGS

Sector	LUCL3	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Residential and commercial buildings	1.A.4.a	Total GHGs	1 634.52	1 663.71	1 572.81	1 586.90	1 609.64	1 453.97	1 278.31	1 105.21	938.55	741.25	WEM
	1.A.4.b	Total GHGs	1 634.52	1 663.71	1 572.81	1 586.90	1 233.50	993.49	702.02	427.33	260.86	95.82	WAM
		Total GHGs	100.00	101.79	96.22	97.09	98.48	88.95	78.21	67.62	57.42	45.35	WEM
		Total GHGs	100.00	101.79	96.22	97.09	75.47	60.78	42.95	26.14	15.96	5.86	WAM



Sources: MECB-AEV – Submission 2024v2.
MECO, MECB & STATEC – 2024 projections for the NECP update.

85. The modelling of this sector of the Climate Law was done by STATEC and distinguishes between functional buildings (CFR 1A4a) and residential buildings (CFR 1A4b) *[→ Table III.F.2-1]*. Based on population census and statistics on completed buildings, STATEC models the housing stock taking into account the year of construction (<1970, 1971-1995, 1996-2011, 2012-2021, >2022) and the type of dwelling and heating: for dwellings, whether they are detached single-family houses, semi-detached or terraced houses or flats; for heating systems, whether dwellings are heated or connected to gas, oil, biomass, heat pump, heat network. This is combined with data on conversions, a hypothesis on the demolition rate, and the intensity of renovation (light, medium, low) and the energy gains associated with these renovations (reductions in energy consumption of 10%, 45% and 70% respectively).

86. The modelling of functional buildings, on the other hand, is limited to energy intensity (kWh per employee) and projected employment growth due to the lack of complete data on the

characteristics of functional buildings. By default, for the WEM scenario for this category, it has been decided to replicate the energy consumption trends observed for residential buildings.

87. Population growth drives new residential construction, while growth in service sector employment drives growth in functional buildings. Despite strong forecasted population and employment growth, emissions would decrease as a result of energy efficiency standards (WEM scenario) limiting energy consumption (see, e.g. PaMs n°301/303/304/305 in ***Table III.D.3-1***) and the use of heat pumps, including in existing buildings (see, e.g. PaM n°302 in ***Table III.D.3-1***). The "phase-out" of fossil heating, which consists in not replacing fossil boilers at the end of their life (WAM scenario), would thus allow a gradual decarbonisation of systems of heating. Given that their lifetime is estimated to be between 15 and 20 years, if the last fossil boiler is installed before 2030,[102] this would mechanically make it possible to achieve carbon neutrality in this sector in 2050. All assumptions were discussed with experts from the MECO and the MECB.

88. In conclusion, decarbonisation is proving more difficult in the building sector due to the lifespan of buildings and technical installations. For the WAM scenario, the main factors that would contribute to substantial decarbonisation in this sector are regulatory in nature: the introduction of energy efficiency standards for new buildings and the non-replacement of fossil fuel boilers that have reached the end of their service life (heat pumps are already the norm in all new buildings). Renovations and increases in CO_2 tax would also contribute, but to a much lesser extent.

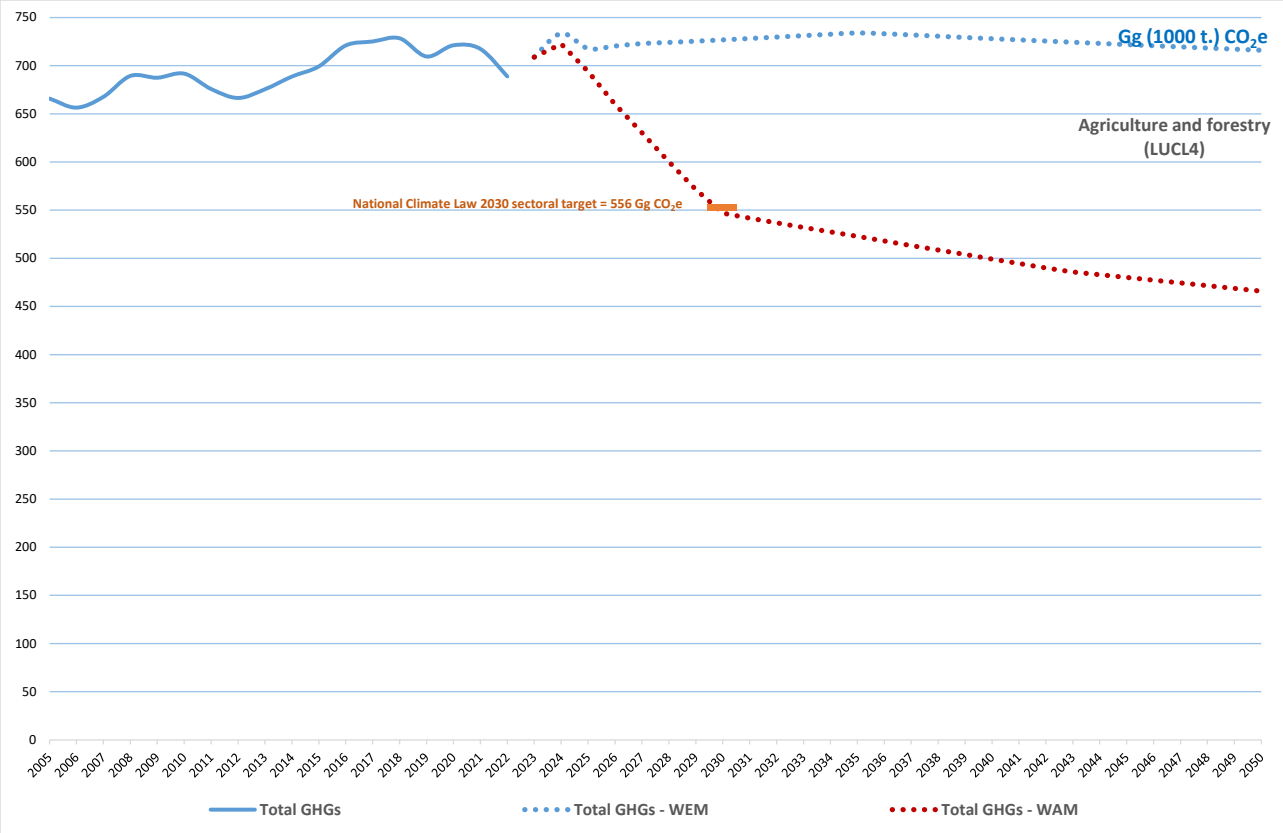
89. The WAM projections indicate that the national sectoral target will not be met in 2030, with exceeding emissions of 403.5 Gg CO_2e. In addition, the cumulative exceeding emissions between 2021-2030, compared to the annual sectoral budgets, are projected to reach 2012.8 Gg CO_2e.

[102] Concretely, the working hypotheses consist of a non-replacement of defective fossil boilers in functional buildings from 2025. In residential buildings, oil-fired boilers would no longer be replaced from 2027 onwards, and gas-fired boilers from 2029 onwards.

III.F.3.10 Agriculture and forestry (LUCL4)

TABLE & FIGURE III.F.3-10 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM AGRICULTURE AND FORESTRY ACTIVITIES

Sector	LUCL4	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Agriculture and forestry	1.A.4.c	Total GHGs	665.75	691.74	699.22	721.22	717.81	726.77	734.00	728.03	721.92	716.05	WEM
	3	Total GHGs	665.75	691.74	699.22	721.22	694.02	547.00	522.72	499.27	480.12	465.93	WAM
		Total GHGs	100.00	103.90	105.03	108.33	107.82	109.16	110.25	109.35	108.44	107.56	WEM
		Total GHGs	100.00	103.90	105.03	108.33	104.25	82.16	78.51	74.99	72.12	69.99	WAM



Sources: MECB-AEV – Submission 2024v2.
MAAV-SER & MECB– 2024 projections for the NECP update.

90. Projections for this sector of the Climate Law were made by the MAAV-SER for agricultural practices (CRF 3) – animal husbandry and manure management, cultivation, and soil related emissions – complemented, for CRF 1A4c, by "bottom-up" projections related to fuel combustion by the MECB based on activity data and other variables underlying the emissions *[→ Table III.F.2-1]*.

91. One pollutant is ammonia, which escapes from fertilisers used in livestock farming and can be converted into nitrous oxide (N_2O), a GHG 265 times more potent than CO_2. Another important factor is the emissions of methane (CH_4), which escapes from livestock during digestion. A key measure to reduce agricultural emissions would therefore be to reduce livestock numbers, which would reduce ammonia and methane emissions. Combined with additional measures, such as the use of food additives in livestock feed to reduce methane emissions, the agricultural sector

would reach its national GHG emission reduction target in 2030 (-20%). After 2030, emissions would decrease more slowly.

92. For the WEM scenario, the expected future emissions from agricultural practices would remain fairly constant until 2050. For both enteric fermentation (CRF 3A) and manure management (CRF 3B) the projected emissions are stable. This is the consequence of "business as usual" assumptions, such as (i) projections for dairy and suckler cows based on the continuation of the observed trend for the years 2015-2021 (2015 is the year when the milk quota ended); (ii) projections for other cattle categories based on estimated cow numbers and the correlation observed in previous years ("bottom-up" approach); (iii) continuation of the observed trend for laying hens and the introduction of a new label affecting the number of broilers; and (iv) unchanged patterns for all other livestock categories and manure management systems. For agricultural soils (CRF 3D), the projections for synthetic nitrogen fertilisers, sewage sludge and compost application are based on recent years' trends, while the expected developments for arable and grassland crops and harvests are based on trend assessments and simple hypotheses.

93. For the WAM scenario, the 2024 NECP update considers several measures and developments, such as (i) a reduction in the number of cattle and pigs; (ii) feed additives to reduce enteric methane emissions in dairy cows; (iii) targeted nutritional advice on nitrogen in feed to reduce nitrogen excretion in pigs (Nex); (iv) climate-friendly housing systems; (v) promoting the use of manure in biogas plants; (vi) the introduction of an obligation to cover manure/digestate tanks; (vii) the ban on spreading manure/digestate from 2024 and more environmentally friendly application of manure/digestate; (viii) organic farming; etc. Most of these are included in the WAM scenario, but could not be estimated with sufficient certainty beyond 2030, which explains the flatter trend after 2030 for the WAM projections in ***Figure III.F.3-10***.

94. In detail, the main measures planned in the 2024 NECP update that could have a direct impact on emissions are as follows:

- the reduction in livestock is triggered by several factors, such as the promotion of organic farming: 20% of the "utilised agricultural area" (UAA) to be organic by 2025 (Luxembourg target) and 25% by 2030 (EU target); a new measure for livestock intensification to be introduced in 2023; and the fact that future livestock expansion would require authorisation from the MAAV;
- methane: feed additives to reduce enteric methane emissions in dairy cows;
- methane: developing a methane reduction strategy, including the use of organic livestock effluent in biogas plants, and designing future housing systems accordingly;
- effluents: promotion of environmentally friendly techniques for the spreading of organic livestock effluents and nitrogenous mineral fertilisers and, from 2024, a ban on the spreading of liquid organic livestock effluents; promotion and, at a later date, an obligation to cover

open tanks (manure and digestate) or a ban on building in future open tanks, the latter from 2024;

- synthetic fertilisers: encouraging farmers to use less or no nitrogen fertilisers, a measure linked to various agri-environmental measures defined in the framework of the EU Common Agricultural Policy (CAP), including programmes to reduce or eliminate nitrogen fertilisation with UAA; and thus also reducing emissions for urea application (CRF 3H) and CAN application (CRF 3I).

95. For liming (CRF 3G), Thomas slag was the only fertiliser used for liming in Luxembourg until the 1980s and 1990s. However, with the decline of the iron industry in Luxembourg, other alternatives were needed and the use of dolomite and lime increased over the years, reaching a ceiling around 2018-2021. Based on the assumption that the amounts currently used are close to the maximum amount considered as good agricultural practice, a "flat" projection based on the median of the dolomite and lime activity data for the years 2018-2022 has been applied.

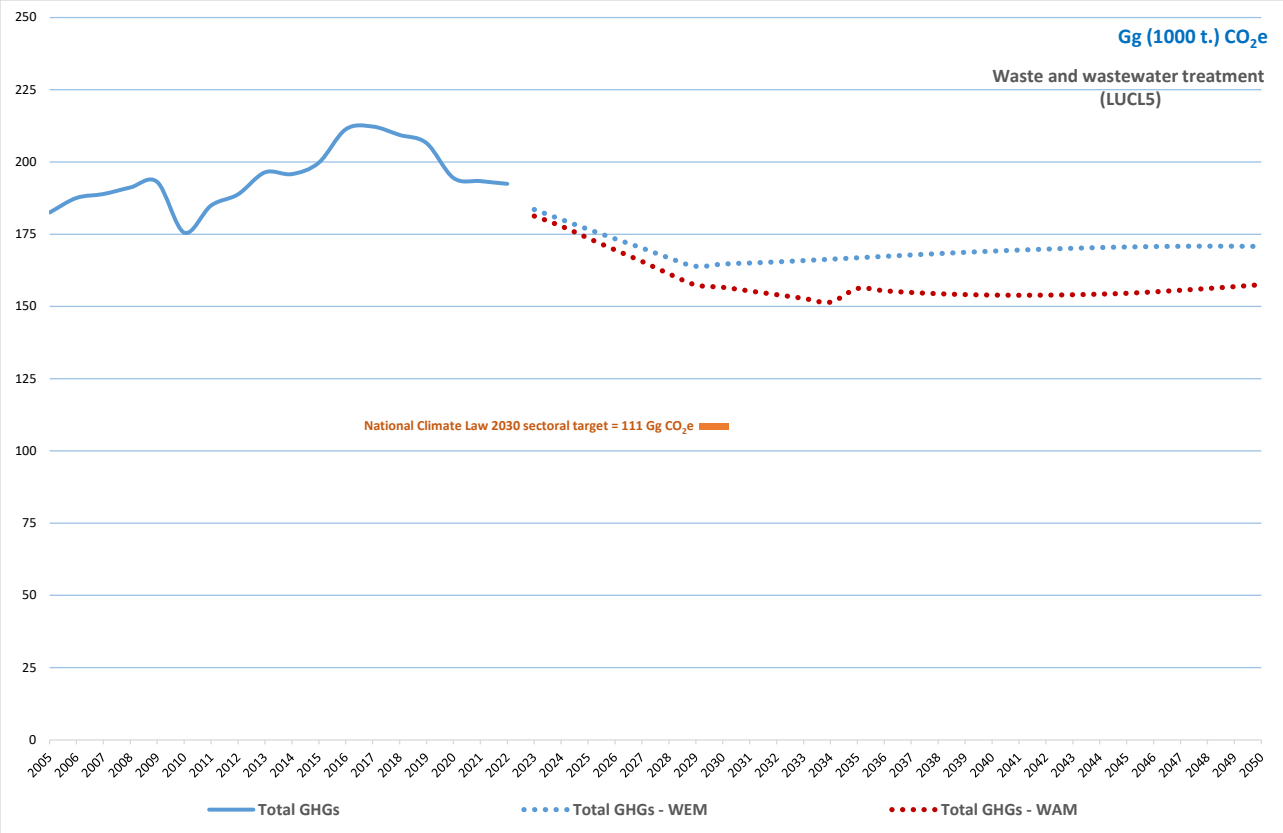
96. Projections for fuel combustion in agriculture and forestry (CRF 1A4c) are identical for the WEM and WAM scenarios. They are based on projected trends in the consumption of gasoline, diesel, biomass, and other fossil fuels, and show almost no change until 2030 and no change at all after this date.

97. The WAM projections indicate that the national sectoral target will be met in 2030 by a very small margin, with emissions 9 Gg CO_2e below the target. In addition, emissions gains of up to 319.5 Gg CO_2e are expected over the period 2021-2030 compared to the annual sectoral budgets.

III.F.3.11 Waste and wastewater (LUCL5)

TABLE & FIGURE III.F.3-11 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FROM WASTE AND WASTEWATER TREATMENT

Sector	LUCL5	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Waste and wastewater treatment	1.A.1.a(p) 5	Total GHGs	182.51	175.58	199.75	194.49	176.69	164.67	166.83	169.12	170.56	170.75	WEM
		Total GHGs	182.51	175.58	199.75	194.49	173.64	156.62	156.19	153.94	154.55	157.54	WAM
		Total GHGs	100.00	96.20	109.45	106.56	96.81	90.23	91.41	92.66	93.46	93.56	WEM
		Total GHGs	100.00	96.20	109.45	106.56	95.14	85.82	85.58	84.34	84.68	86.32	WAM



Sources: MECB-AEV – Submission 2024v2.
MECB-AEV & MECB-AGE – 2024 projections for the NECP update.

98. The projections for this sector of the Climate Law are "bottom-up" projections made by the MECB-AEV (CRF 1A1a-waste incineration, CRF 5A & CRF 5B) or MECB-AGE (CRF 5D) based on activity data and other variables underlying the emissions *[→ Table III.F.2-1]*.

99. For waste incineration, projections are derived from assumptions on trends in waste generation, recycling and reuse in the coming year, combined with an assumption on waste composition based on average waste fractions in 2016-2018. These projections are fairly flat around their 2021 level as it is assumed that no new incineration plants will be built for both the WEM and WAM scenarios. With additional landfill closure measures, the WAM scenario leads to higher emissions than the WEM scenario from 2044 onwards, as all residual waste would then be incinerated.

100. Concerning waste emissions (CRF 5), emissions related to solid waste disposal (CRF 5A) are expected to decrease as a result of Luxembourg's policy to minimise the amount of waste going

to landfills, thus reducing methane generation. The WAM scenario even includes a phase-out of landfilling by 2035, leading to a larger reduction in emissions. In part, composting emissions (CRF 5B) are projected to decrease only slightly, but less in the WAM scenario, resulting in higher emissions than in the WEM scenario.

101. Thanks to the expansion of modern wastewater treatment plants, emissions from wastewater treatment (CRF 5D) will decrease until 2045, after which they will stabilise or increase slightly in the WAM scenario. In contrast, they will continuously increase in the WEM scenario in line with the amount of wastewater to be treated, which obviously depends on population and employment growth.

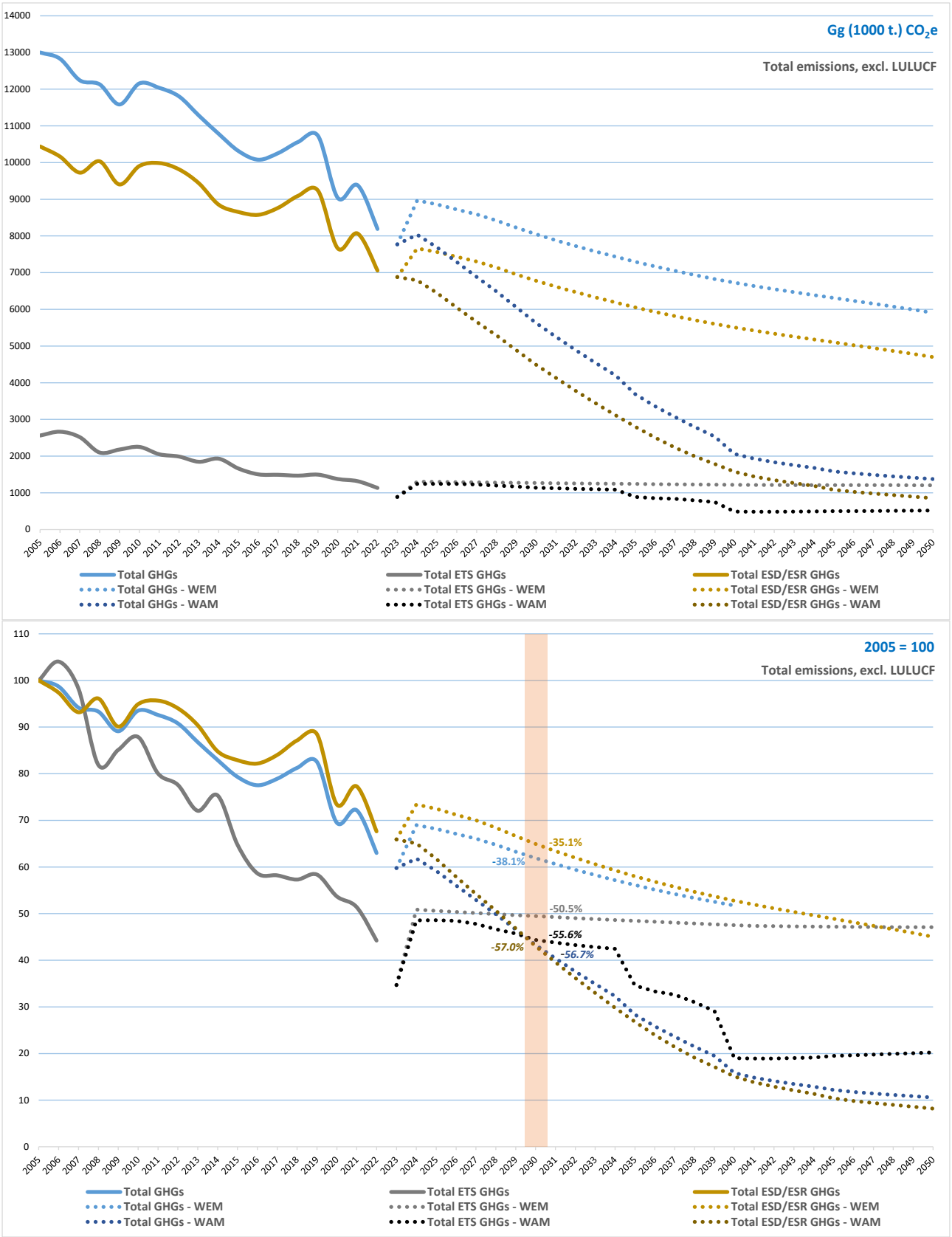
102. The effect of additional measures to divert landfilled waste to incineration or composting is clearly visible in *Figure III.F.3-11*.

103. The WAM projections indicate that the national sectoral target will not be met in 2030, with exceeding emissions of 45.6 Gg CO_2e. In addition, the cumulative exceeding emissions between 2021-2030, compared to the annual sectoral budgets, are projected to reach 239.4 Gg CO_2e.

III.F.3.12 Total GHG (excl. LULUCF)

TABLE & FIGURES III.F.3-12 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS FOR TOTAL (EXCL. LULUCF), ETS AND ESD/ESR

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Total emissions excl. LULUCF	-	Total GHGs	13 000.50	12 158.06	10 313.09	9 037.10	8 861.84	8 046.35	7 296.89	6 726.56	6 311.50	5 906.37	WEM
		Total ETS GHGs	2 563.36	2 252.66	1 660.83	1 376.50	1 297.22	1 267.70	1 241.80	1 218.55	1 209.64	1 206.79	
		Total ESD/ESR GHGs	10 437.14	9 905.40	8 652.26	7 660.60	7 564.62	6 778.64	6 055.09	5 508.01	5 101.86	4 699.58	
		Total GHGs	13 000.50	12 158.06	10 313.09	9 037.10	7 692.24	5 626.41	3 686.41	2 059.51	1 584.13	1 373.58	WAM
		Total ETS GHGs	2 563.36	2 252.66	1 660.83	1 376.50	1 245.52	1 137.39	886.49	486.79	499.61	518.84	
		Total ESD/ESR GHGs	10 437.14	9 905.40	8 652.26	7 660.60	6 446.72	4 489.02	2 799.92	1 572.72	1 084.52	854.74	
		Total GHGs	100.00	93.52	79.33	69.51	68.17	61.89	56.13	51.74	48.55	45.43	WEM
		Total ETS GHGs	100.00	87.88	64.79	53.70	50.61	49.45	48.44	47.54	47.19	47.08	
		Total ESD/ESR GHGs	100.00	94.91	82.90	73.40	72.48	64.95	58.01	52.77	48.88	45.03	
		Total GHGs	100.00	93.52	79.33	69.51	59.17	43.28	28.36	15.84	12.19	10.57	WAM
		Total ETS GHGs	100.00	87.88	64.79	53.70	48.59	44.37	34.58	18.99	19.49	20.24	
		Total ESD/ESR GHGs	100.00	94.91	82.90	73.40	61.77	43.01	26.83	15.07	10.39	8.19	



Sources: MECB-AEV – Submission 2024v2.
MAAV-SER, MECO, MECB, MECB-AEV, MECB-AGE & STATEC – 2024 projections for the NECP update.

104. The results of the projection exercise show that total GHG emissions (excluding LULUCF) in 2050 would be between 54.6% (WEM reference scenario) and 89.4% (WAM planned scenario) below 2005 levels. For non-ETS (ESR) emissions, the reduction would be around 55% in the WEM scenario and 91.8% in the WAM scenario. ETS emissions, on the other hand, would be halved between 2005 and 2050 in the reference scenario (-52.9%) and reduced by 79.8% in the scenario with planned measures. As a result, even in the WAM scenario, emissions do not reach zero in 2050, at 1.37 Mt CO_2e. Including LULUCF, GHG emissions would still be around 0.71 Mt CO_2e – thus not reaching "net-zero" – calling for more efforts or the use of certain technologies such as CCS/CCU (see, e.g. PaMs n°519 and 523 in ***Table III.D.3-1***), knowing that according to the projections, in 2050, 73% of the total GHG emissions including LULUCF would come from the ETS sector, mainly from industrial processes.

105. However, it is the 2030 target that is now crucial for Luxembourg. As explained in ***Section III.D.1.2***, Luxembourg has committed itself to a voluntary 55% reduction in non-ETS (ESR) emissions by 2030 compared to 2005. Therefore, looking at 2030, the corresponding reductions would be - 38.1%, - 35.1% and – 50.5% for the WEM scenario and – 56.7%, - 57.0% and -55.6% for the WAM scenario: see ***Figures III.F.3-12***. Therefore, according to the projections with additional and planned measures, Luxembourg would reach its nationally determined target in 2030: see §109 and ***Figure III.F.3-13***. However, as indicated above (→ §72, §84, §89, §97 and §103), the target would be achieved by overachieving the targets in the transport sector.[103]

106. ***Figure III.F.3-13*** shows historical and projected total GHG (excluding LULUCF) and non-ETS (ESR) emissions up to 2030. The different mandatory trajectories under the EU legislation – ESD until 2020 and ESR from 2021 to 2030 – and for Luxembourg's unilateral commitment are also shown. The trajectories consist of "Annual Emission Allocations" (AEAs) or "budgets" *[→ Section III.D.1.2]*. Detailed explanations are given in the following paragraphs.

107. The annual total GHG emissions covered by the EU ESR and the annual total net GHG emissions covered by the EU LULUCF Regulation, both in CO_2e, are the main relevant national-level indicators for tracking progress towards achieving the EU's updated Nationally Determined Contribution (NDC) target[104] since their achievements will contribute to the achievement of this target. For LULUCF, please refer to ***Section III.F.3.5***. For the ESR target, please refer to ***Figure III.F.3-13*** and the subsequent paragraphs.

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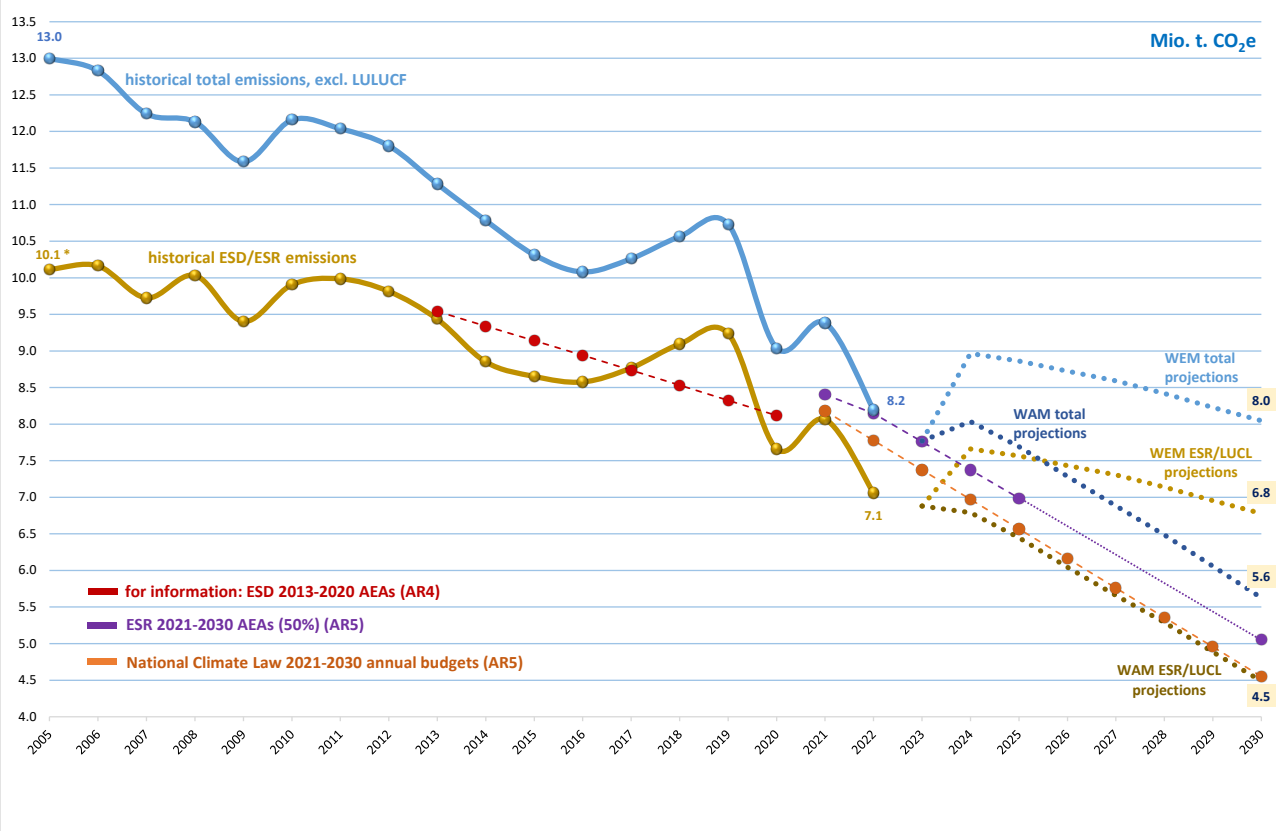
103 The sectoral target would also be exceeded in the agriculture and forestry sector, but only by a small margin.

104 The EU updated NDC is available here - https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf – and reproduced in the appendix to the CTF NDC Tables.

FIGURE III.F.3-13 – HISTORICAL, PROJECTED AND TARGET WEM & WAM EMISSIONS FOR TOTAL (EXCL. LULUCF) AND ESD/ESR



Sources: MECB-AEV – Submission 2024v2.
MAAV-SER, MECO, MECB, MECB-AEV, MECB-AGE & STATEC – 2024 projections for the NECP update.

Notes: - *2005 value for historical ESD/ESR emissions = the reference level of ESR emissions considered for Luxembourg's compliance under the ESR, which differs from the value that would be calculated using the most recent GHG inventory submission.
- The purple dotted line represents the latest trajectory for Luxembourg's ESR, with a revised target of minus 50% in the 2023 amended ESR (→ §108). The AEAs for 2021 and 2022 will not be modified, as the ESR amendment came into force in 2023. For the 2023 to 2025 AEAs, a new trajectory is calculated, starting from the 2022 AEA and tending towards the revised 2030 ESR target. This explains the bend in the trajectory. The revised AEAs for the period 2026 to 2029 (2030) will be determined in 2026 based on the average GHG emissions from 2021 to 2023.

108. Under the "2030 Climate and Energy Framework", the ESR defined the burden-sharing among Member States *[→ Section III.D.1.2]*. For Luxembourg, this meant reducing non-ETS/ESR emissions by 40% by 2030 compared to 2005 ESR emissions levels, as well as having binding annual GHG targets, or AEAs, for the period 2021–2030. In April 2023, this target was increased to a 50% reduction in non-ETS/ESR emissions by 2030 as part of the "Fit for 55" package *[→ Section III.D.1.2]*.[105] *Figure III.F.3-13* above shows that Luxembourg's projected ESR emissions under the 2024 NECP update WEM scenario (gold dotted line) would be mostly above this linear trajectory (purple dots), but below it under the WAM scenario (brown dotted line).

[105] Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999 (http://data.europa.eu/eli/reg/2023/857/oj).

109. However, even before its ESR target was increased from minus 40% to minus 50%, Luxembourg announced that it will go beyond its ESR commitment with a nationally determined target of minus 55% by 2030 compared to 2005 ESR emissions. In this case, the 2030 WEM projection would be well above target, with an over-achievement of 2.23 Mt CO_2e (or 48.9%), while the 2030 WAM projection would be slightly below target, with an under-achievement of 0.06 Mt CO_2e (or 1.4%), mainly due to the transport sector over-achieving its sectoral target and annual emission budgets 2021-2030 (→ §105). During the 2021–2030 ESR period, the 2024 NECP update anticipates that WAM ESR emissions will remain below the AEAs every year. In other words, Luxembourg is expected to comply with a surplus of just 2.06 Mt CO_2e over this period. *[→ Figure III.F.3-13 & Table III.F.3-13]*. Such a development would therefore be in line with Luxembourg's current intended climate policy for the coming years, i.e. to reduce emissions without recourse to carbon sinks (LULUCF) and AEAs and/or project-based credits.

TABLE III.F.3-13 – ESR IMPLICATION FOR LUXEMBOURG – 2021-2030 AEAS AND WEM & WAM EMISSIONS – LUXEMBOURG UNILATERAL COMMITMENT SCENARIO – MINUS 55%

ESR emissions - WEM (kt CO2e)	2005	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	10 116.19	8 065.79	7 058.78	6 879.94	7 662.07	7 564.62	7 432.08	7 305.79	7 140.25	6 953.88	6 778.64
LU Budget/AEAs		8 180.00	7 777.00	7 373.00	6 972.00	6 567.00	6 165.00	5 762.00	5 358.00	4 956.00	4 552.00
Surplus Gap		-114.21	-718.22	-493.06	690.07	997.62	1 267.08	1 543.79	1 782.25	1 997.88	2 226.64
	cumulative	-114.21	-832.43	-1 325.49	-635.43	362.20	1 629.28	3 173.08	4 955.33	6 953.21	9 179.85

ESR emissions - WAM (kt CO2e)	2005	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	10 116.19	8 065.79	7 058.78	6 879.94	6 789.29	6 446.72	6 043.28	5 657.23	5 289.20	4 885.86	4 489.02
LU Budget/AEAs		8 180.00	7 777.00	7 373.00	6 972.00	6 567.00	6 165.00	5 762.00	5 358.00	4 956.00	4 552.00
Surplus Gap		-114.21	-718.22	-493.06	-182.71	-120.28	-121.72	-104.77	-68.80	-70.14	-62.98
	cumulative	-114.21	-832.43	-1 325.49	-1 508.20	-1 628.48	-1 750.20	-1 854.97	-1 923.76	-1 993.91	-2 056.89

Source: MECB calculations.

Note: 2005 value = the reference level of ESR emissions considered for Luxembourg's compliance under the ESR, which differs from the value that would be calculated using the most recent GHG inventory submission.

III.F.3.13 WEM and WAM projections by gas

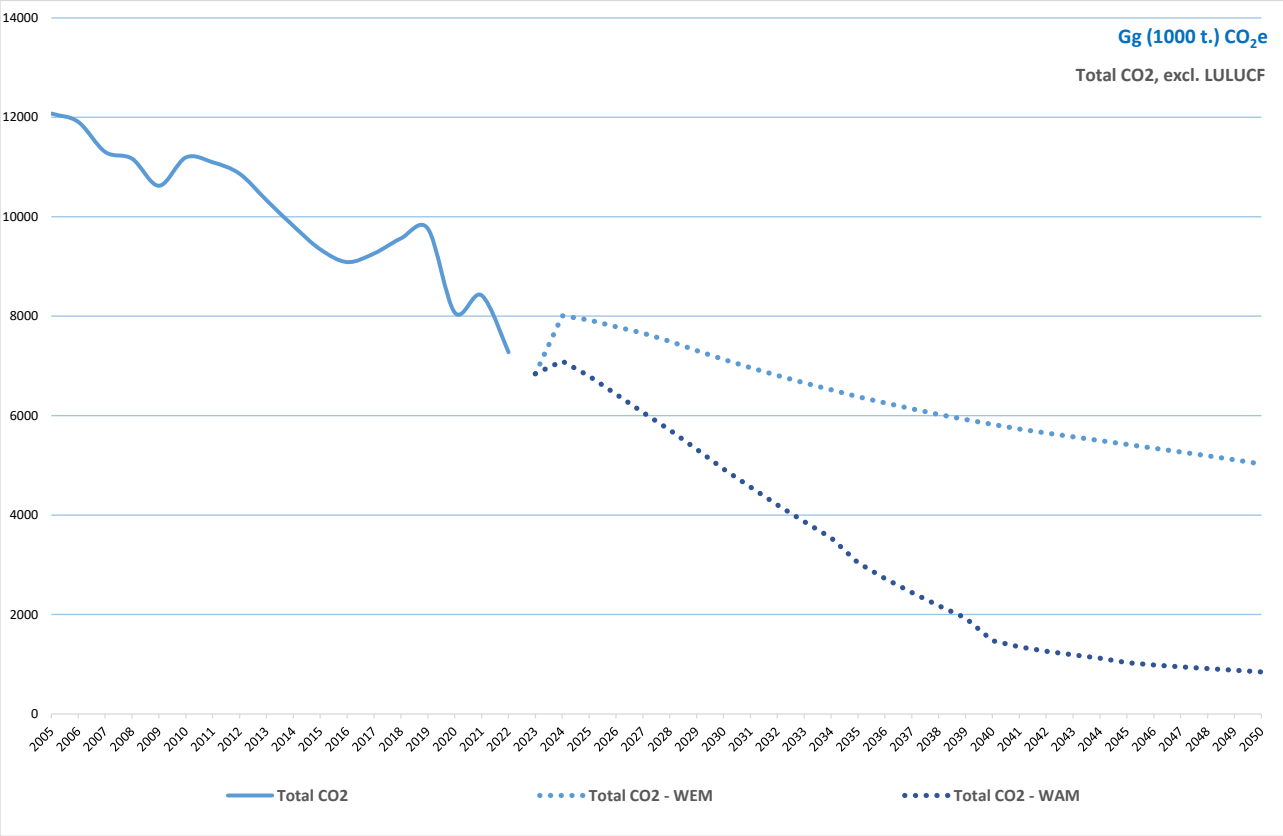
110. Concerning the projections by sector, *Table III.F.3-14* present data both in 1000 tonnes CO_2e (kt or Gg) and in indices (where 2005 equals 100), whereas *Figures III.F.3-14* are limited to emissions in kt or Gg. One figure shows only CO_2 emissions and another shows the other GHGs.

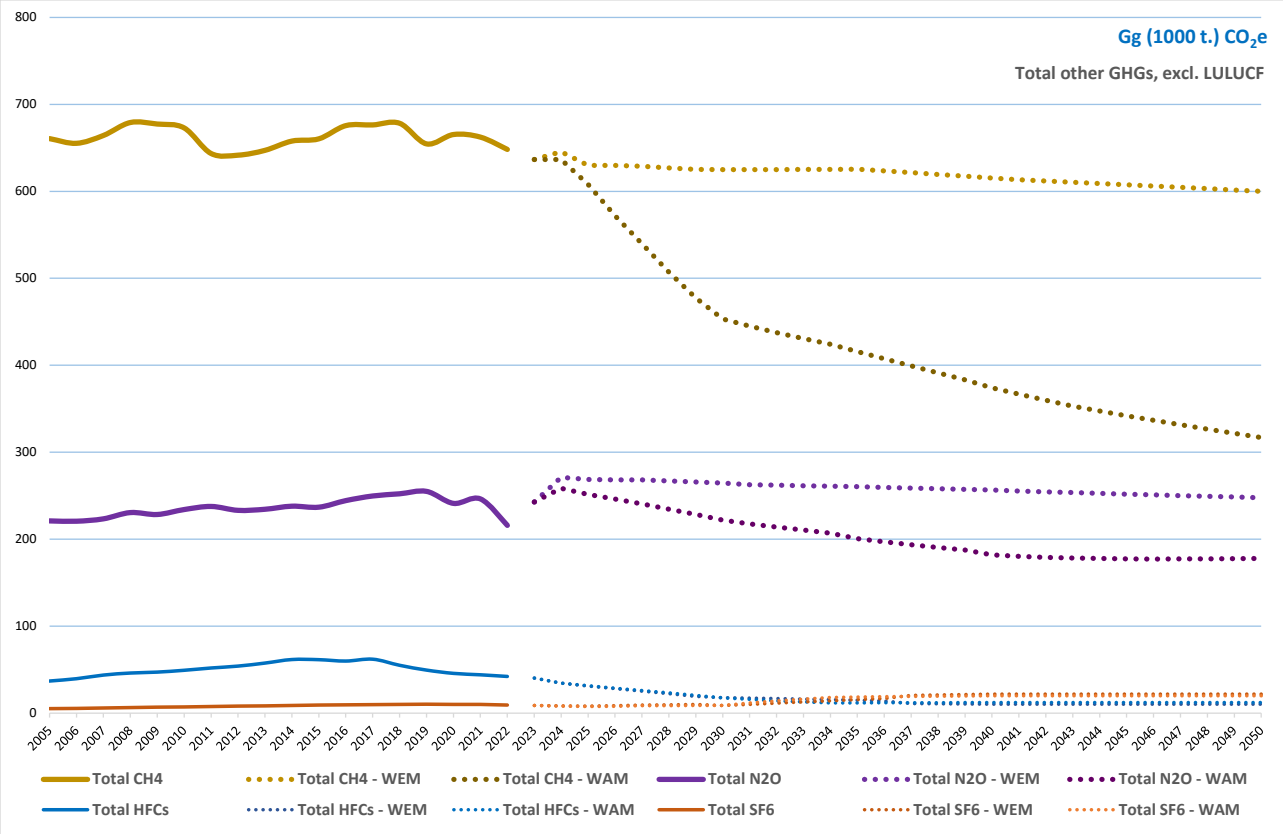
111. The pattern of historical and projected carbon dioxide emissions is very similar to that of total emissions. In fact, on average, CO_2 emissions account for about 90% of total GHG emissions (excluding LULUCF) until 2030 and then decrease regularly to reach 62% in 2050 under the WAM scenario. Therefore, the details and explanations given in the previous sections also apply here. Moreover, the graph is very similar to the one for the transport sector (CRF 1A3) *[→ Figure III.F.3-2]*, which is not surprising, given that the related CO_2 emissions have represented an average of 60% of the total historical CO_2 emissions since 2005.

112. For methane, the parallel can be made with the figure for the agriculture sector *[→ Figure III.F.3-4*] as CH_4 emissions from this sector are on average about 80% of the total methane emissions in the recent historical and projected emissions. Similarly, with an average of 65% of nitrous oxide emissions coming from agriculture for the historical years, N_2O emissions developments are similar to those reported for the CRF 3 source category.

TABLE AND FIGURES III.F.3-14 – HISTORICAL AND PROJECTED WEM & WAM EMISSIONS BY GAS

Sector	CRF	GHG	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Total emissions excl. LULUCF	-	CO2	12 076.77	11 194.66	9 345.27	8 074.93	7 924.38	7 130.47	6 380.94	5 822.72	5 420.18	5 026.67	WEM
		CH4	660.65	672.90	660.39	665.33	629.81	625.08	625.33	615.34	607.46	600.02	
		N2O	221.09	234.14	236.86	241.21	268.58	264.43	260.41	256.56	251.78	247.64	
		HFCs	36.95	49.25	61.38	45.72	31.08	17.73	14.73	10.18	10.21	10.21	
		SF6	5.03	7.11	9.19	9.91	8.00	8.63	15.49	21.76	21.86	21.84	
		CO2	12 076.77	11 194.66	9 345.27	8 074.93	6 793.67	4 925.03	3 039.81	1 471.59	1 032.95	846.84	WAM
		CH4	660.65	672.90	660.39	665.33	608.07	453.20	415.79	374.11	341.87	316.93	
		N2O	221.09	234.14	236.86	241.21	251.42	221.82	200.59	181.88	177.24	177.76	
		HFCs	36.95	49.25	61.38	45.72	31.48	17.58	11.70	12.12	12.16	12.15	
		SF6	5.03	7.11	9.19	9.91	7.60	8.79	18.51	19.81	19.92	19.90	
		CO2	100.00	92.70	77.38	66.86	65.62	59.04	52.84	48.21	44.88	41.62	WEM
		CH4	100.00	101.85	99.96	100.71	95.33	94.62	94.65	93.14	91.95	90.82	
		N2O	100.00	105.90	107.13	109.10	121.48	119.60	117.78	116.04	113.88	112.01	
		HFCs	100.00	133.27	166.10	123.71	84.10	47.99	39.85	27.54	27.64	27.62	
		SF6	100.00	141.30	182.57	196.87	158.90	171.43	307.58	432.11	434.21	433.77	
		CO2	100.00	92.70	77.38	66.86	56.25	40.78	25.17	12.19	8.55	7.01	WAM
		CH4	100.00	101.85	99.96	100.71	92.04	68.60	62.94	56.63	51.75	47.97	
		N2O	100.00	105.90	107.13	109.10	113.72	100.33	90.73	82.27	80.17	80.40	
		HFCs	100.00	133.27	166.10	123.71	85.18	47.57	31.66	32.80	32.90	32.88	
		SF6	100.00	141.30	182.57	196.87	150.97	174.49	367.73	393.48	395.60	395.15	





Sources: MECB-AEV – Submission 2024v2.
MAAV-SER, MECO, MECB, MECB-AEV, MECB-AGE & STATEC – 2024 projections for the NECP update.

Note: There are no PFCs and NF_3 emissions reported for Luxembourg.

III.F.3.14 Sensitivity analyses

113. It is not a simple matter to carry out sensitivity analyses of the projections. Indeed, such an exercise is complicated by the extremely high sensitivity of the projections to internal and external parameters. Luxembourg is a small country and economy where, for example, a single industrial project – internal parameter – or changes in relative fuel prices or VAT differences compared to neighbouring countries – external parameters – could strongly influence the projected emissions *[→ Section III.F.1]*.

114. For example, if a large company ceases its activities or a new company sets up in Luxembourg, this could have a significant impact on GHG emissions and therefore on the projections. Changes in processes in existing units could also lead to noticeable changes in emissions *[→ Section III.F.1.1]*.

115. In terms of external parameters, policy changes in a neighbouring country could have a strong impact on national GHG emissions, as "road fuel sales to non-residents" accounted for about 31.2% of total GHG emissions (excluding LULUCF) in Luxembourg in 2022 *[→ Section III.F.1.2]*.

116. A thorough sensitivity analysis stricto sensu has not been performed yet but some lessons could be drawn from the macro-economic impact analysis of the GHG projections done by STATEC in the context of the 2023 draft NECP update. A basic sensitivity analysis was performed to estimate the impact of changes in GDP on emissions. Assuming a lower annual GDP growth of 0.5 percentage points, emissions in 2050 would be about 50 kt CO_2e lower than in the original WAM scenario (-2% deviation). This figure should be seen in the context of the 7 000 kt CO_2e reduction in non-ETS emissions already achieved between 2021 and 2050 in the WAM scenario. This clearly illustrates the weak influence of the evolution of activity on emissions up to 2050 [STATEC (2023c)].

117. Planned improvements in sensitivity analysis could include analysing the impact on emissions of new industrial projects or the closure of activities. Different scenarios for the road transport sector should also be considered as an option for a sound sensitivity analysis of Luxembourg's emission projections (e.g. different penetration rates for electric mobility). It could also be explored whether it is possible to play with different hypotheses on population growth, number of inhabitants per dwelling, fuel prices, taxes and other fiscal instruments. Testing these hypotheses is possible thanks to the use of an equilibrium model such as STATEC's ThreeME (→ §35).

118. For the agricultural sector, it may be possible to implement and run a "Monte Carlo simulation" and thus obtain not only a "most likely value" but also an uncertainty range. This is particularly interesting for N_2O emission factors, which are highly uncertain.

III.F.4 IMPROVEMENT OF METHODOLOGIES

119. The first well-designed projection exercise dates back to 2007-2008, when projections were based on an ad hoc energy balance prepared by MECO, FiFo-Köln and MEV. The projected emissions were obtained using the MS™ Windows-based TRAMO-SEATS time series analysis software, with 2005 as the base year [MEV (2008)].

120. Later in 2008, data from the GHG inventory submission of January 2008 could be used, which significantly improved the quality of the projections. In addition, the results of the "National Energy Efficiency Action Plan" (NEEAP) submission of February 2008 could be used to quantitatively assess the impact of measures on the GHG emission projections, as well as the results of a study by Thöne (2008) analysing the specific feature of "road fuel sales to non-residents". The baseline emissions projections were based on the PRIMES baseline of July 2007. However, the PRIMES projections were modified where necessary and two framing scenarios were introduced for the transport sector [MEV (2009)].

121. The 2009 exercise was based on detailed data from the GHG inventory submission of May 2009. As for the 2008 exercise, most of the impacts of the different PaMs identified came from the

NEEAP and the Thöne (2008) study. Projected baseline emissions for the main gas (CO_2) and sectors (CRF 1A, CRF 2A-C) were calculated using the ECONOTEC EPM tool [MDDI-DEV (2009)].

122. The projections performed in 2011 were mostly updates of the 2008 results, but using the April 2011 GHG inventory submission as the reference year. The impact of the PaMs was identical to that reported for the 2009 exercise [MDDI-DEV (2011)].

123. In 2013, the projections were carried out in two stages. In early 2013, a "quick" update of the 2011 projections was carried out to allow Luxembourg to comply with EU-level reporting requirements [MDDI-DEV (2013) and ECONOTEC Consultants (2013a)]. This first update was then revised and completed in the autumn in view of the preparation of Luxembourg's NC6 and BR1 [ECONOTEC Consultants (2013b) and MDDI-DEV (2014a)]. These end-2013 projections were based on the March 2013 GHG inventory submission and ECONOTEC's EPM tool.

124. The projections were refined again, first in 2014 and then in 2015. Based on the GHG inventory submission of April 2015 for the latter, they combined results from different sources and approaches: (i) ECONOTEC's updated results [ECONOTEC Consultants (2015)], in particular through its specific "Residential-Tertiary Tool" [ECONOTEC Consultants (2013c)]; (ii) Komobile's "bottom-up" models for the transport sector [Komobile and FVT (2014)]; and (iii) several national sources (STATEC, Customs & Excises Administration) – for detailed assumptions and methodology see [MDDI-DEV (2014b) & (2015)]. These 2015 projections have been slightly revised in 2016 to reflect the latest historical developments – the March 2016 GHG inventory submission – as well as updated figures and forecasts for road fuel sales communicated to the Department of the Environment [MDDI-DEV (2016)].

125. A very similar approach was used for the projections carried out in April 2017. They are essentially an update of the 2015 and 2016 exercises, taking into account (i) the results of the revised 2015 Komobile study [Komobile and FVT (2017a) & (2017b)]; (ii) the latest results of the STATEC models; and (iii) the July 2016 PRIMES reference scenario [European Commission (2016)].

126. The April 2019 projections were a combination of new projections developed by a "consortium" of consultants involved in the preparation of Luxembourg's first NECP (CRF sectors 1A2 (non-ETS emissions), 1A3b (CO_2 emissions), 1A4a & 1A4b) [Konsortium (2019a), (2019b), (2019c) & (2019d)] and, for the first time, by the MAAV-SER for the agriculture sector (CRF 3), replacing the GAINS projections used until then. They have been complemented by (un)adjusted projections carried out in 2017 (ECONOTEC, Komobile and FVT, MECDD-AEV, MECDD-AGE). The use of PRIMES or GAINS 2016 reference scenario projections was limited to GAINS for CRF sector 5B (N_2O emissions), and the POTENCIA 2018 DCS v2 scenario [European Commission (2025)] was used instead of PRIMES for international aviation projections.

127. The May 2020 projections and their October 2020 update for the Luxembourg BR4 represented a further step towards more elaborated projections. For a number of CRF source categories, the activity data used to forecast various air pollutants have been used to calculate related GHG projections (2020 NAPCP projections for CRF categories 1A3c, 1A3d, 1A4c, 1A5, 1B2, 2D & 5B). This improvement is in addition to the projections developed in the context of Luxembourg's first NECP. For the agricultural sector, projections were made by the MAAV-SER, which then started to develop its LUAgriEmissionModel. Consequently, there were no more projections based on PRIMES or GAINS. Detailed assumptions and methodology regarding the 2020 exercises are presented in Luxembourg's BR4 [MECDD (2020), Sections IV.3, pp. 166-187].

128. The May 2021 projections were the first under Art. 18 of the Regulation on Governance of the Energy Union and Climate Action (Regulation (EU) 2018/1999) – Governance Regulation – which replaces the Regulation No 525/2013 on a mechanism for monitoring and reporting GHG emissions (MMR). They were a simple update of the 2020 projections, taking into account the latest GHG inventory data and developments in the parameters and variables underlying the projections.

129. The above summary of GHG projections over time shows their continuous improvement, and 2022 marked a milestone in the projections work. In view of the 2023 reporting under Art. 18 of the Governance Regulation and the preparation of the draft NECP update to be submitted by the end of June 2023, it was decided to produce all projections within the country (a first), taking advantage – for emissions related to energy combustion – of the modelling development work carried out by STATEC in recent years on its macro-economic CGE model LuxGEM, as well as on NEAM. An inter-ministerial Technical Working Group on modelling was set up in June 2021 to lead this exercise *[→ Section III.D.4.2]*. The projections presented in this section of the BTR1 are the result of this new approach since STATEC only made marginal changes and a few minor updates to the projections made in 2023 for the 2024 NECP final update.

130. Nevertheless, significant progress can be expected in the future. Firstly, this is thanks to the work that has been and will be done on mitigation measures. The mere fact of having precisely listed and described the PaMs (without necessarily quantifying them) through interministerial working groups enables us to identify those that will significantly impact projections, helping us to prioritise them for quantification and integration into projections. Understanding and quantifying these measures helps produce more realistic projections. Furthermore, the transition to a more sophisticated GHG projection system would offer better opportunities to conduct relevant sensitivity analyses of these projections. Secondly, STATEC has replaced its former CGE model (LuxGEM) with another more powerful and customisable CGE model (ThreeME), which will offer better possibilities for carrying out more accurate projection exercises. In general, STATEC, in collaboration with European academics, is continuously improving and expanding its modelling tools. In a later phase of the project, STATEC even plans to integrate other

dimensions of the ecological transition into the models developed, such as water consumption, mobility, land use planning and indirect emissions.

131. To conclude this summary of modelling exercises, Luxembourg continues to believe that the bottom-up and top-down approaches are complementary.

132. It should also be noted that a new cross-cutting PaM – PaM n°123 - deals specifically with projections. The projections prepared by STATEC for the 2023 draft NECP update and the 2024 final NECP update are a first step to quantify economic and technological trends as well as measures adopted at national and international level. The aim is to monitor energy production, consumption and direct emissions at short notice. The collection and provision of new data sources to STATEC will allow quantified monitoring of measures and regular monitoring in relation to climate and energy objectives. They will also further develop STATEC's projection models, the granularity of which is currently limited by the unavailability of certain data. In addition to the direct emissions approach, data on emissions associated with imported goods and services (indirect emissions) could be collected to estimate demand-based (or footprint) emissions (→ PaM n°122).

III.F.5 ASSESSMENT OF THE AGGREGATE EFFECTS OF POLICIES AND MEASURES

133. An ex-ante evaluation of the aggregated effects of implemented and adopted PaMs in terms of GHG emission reductions up to 2050 has been carried out for the 2024 NECP update and is presented in *Section III.D.3.2*.

134. According to this exercise, the total impact of PaMs on non-ETS (ESR) emissions would be 3.58 Mt CO_2e in 2030 and 7.19 Mt CO_2e in 2050 *[→ Table III.D.3-3]*.

Annex 1 – Changes in reporting compared to the latest submission

The table below summarizes the main changes compared to the previous submission – NC8/BR5 [MECB (2023)] – for the sections of this report, as well as for CTF related Tables.

Section or CTF Table in NC8/BR5	Section or CTF Table in BTR1 and revisions
V.1.1	III.F.1.1 – no revision.
V.1.2	III.F.1.2 – minor revision and updated figures.
V.2.1	III.F.2.1 – revision to reflect updated projections from the 2024 NECP update.
V.2.2	III.F.2.2 – revision to reflect updated projections from the 2024 NECP update.
V.2.3	III.F.2.3 – no revision.
V.2.4	III.F.2.4 – revision to reflect updated projections from the 2024 NECP update and deletion of the description of a model that is no longer used.
V.2.5	III.F.2.5 – revision to reflect updated projections from the 2024 NECP update.
-	III.F.2.6 – new section added in response to an encouragement during the NC8 review to report on the weaknesses of the projection models used.
V.3.1 to V.3.11	III.F.3.1 to III.F.3.11 – revision to reflect updated projections from the 2024 NECP update.
V.3.12	III.F.3.12 – revision to reflect updated projections from the 2024 NECP update and deletion of a paragraph and a table relating to the 2020 ESD target.
V.3.13	III.F.3.13 – revision to reflect updated projections from the 2024 NECP update.
V.3.14	III.F.3.14 – no revision.
V.4	III.F.4 – minor updates.
V.5	III.F.5 – updated figures.
V.6	Section no longer relevant in the context of the BTR1.
CTF Table 5	CTF Table 11 – revision to reflect updated parameters from the 2024 NECP update.
CTF Tables 6(a) & 6(b)	CTF Tables 7 & 8 – revision to reflect updated WEM & WAM projections from the 2024 NECP update.

Annex 2 – Implementation of recommendations and encouragements from the latest review

The table below indicates if recommendations and encouragements from the latest reviews – IDR.8, Table I.2 and TRR.5, Table II.2 [UNFCCC (2024)] – have been included or not in this submission, and if not, why.

Reporting requirement	Issue type	Assessment	Description	Included Y/N
para. 32 (NC) **para. 32 (BR)**	Completeness	Encouragement	The ERT reiterates the encouragement from the previous review report for Luxembourg to improve the completeness of its reporting by providing projections of indirect GHGs.	No but MPGs do not request to report projections of indirect GHGs.
para. 40 (NC) **para. 40 (BR)**	Transparency	Encouragement	The ERT encourages the Party to report in its next submission on the weaknesses of the projection models used.	Yes: a text on the weaknesses of the projections model used has been included as a section in this report (see III.F.2.5).

III.G – Other information

1. According to paragraph 103 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)], "each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement". As all the information relevant to tracking progress can be found in sections III.A to III.F above, no additional information is provided here.

References

LEGAL & ASSOCIATED TEXTS

Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union.

http://data.europa.eu/eli/dir/2003/87/oj and http://data.europa.eu/eli/dir/2003/87/2024-03-01

Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

➔ http://data.europa.eu/eli/dec/2009/406/oj

Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU.

➔ http://data.europa.eu/eli/reg/2018/841/oj and http://data.europa.eu/eli/reg/2018/841/2023-05-11

Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013.

➔ http://data.europa.eu/eli/reg/2018/842/oj and http://data.europa.eu/eli/reg/2018/842/2023-05-16

Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council.

➔ http://data.europa.eu/eli/reg/2018/1999/oj and http://data.europa.eu/eli/reg/2018/1999/2023-11-20

Commission implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014.

➔ http://data.europa.eu/eli/reg_impl/2020/1208/oj and http://data.europa.eu/eli/reg_impl/2020/1208/2024-05-14

Commission Implementing Decision (EU) 2020/2126 of 16 December 2020 on setting out the annual emission allocations of the Member States for the period from 2021 to 2030 pursuant to Regulation (EU) 2018/842 of the European Parliament and of the Council.

➔ http://data.europa.eu/eli/dec_impl/2020/2126/oj and http://data.europa.eu/eli/dec_impl/2020/2126/2024-07-31

Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').

➔ http://data.europa.eu/eli/reg/2021/1119/oj

Commission Implementing Regulation (EU) 2022/2299 of 15 November 2022 laying down rules for the application of Regulation (EU) 2018/1999 of the European Parliament and of the Council as regards the structure, format, technical details and process for the integrated national energy and climate progress reports.

➔ http://data.europa.eu/eli/reg_impl/2022/2299/oj

Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999.

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Loi du 15 décembre 2020 relative au climat et modifiant la loi modifiée du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement.

➔ https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a994/jo modified by

https://legilux.public.lu/eli/etat/leg/loi/2022/06/29/a327/jo and by https://legilux.public.lu/eli/etat/leg/loi/2024/05/29/a221/jo

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Chapter IV

Information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

1. Paragraph 104 of the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)] states that "each Party should provide information related to climate change impacts and adaptation under Article 7 of the Paris Agreement, as appropriate. Providing such information is not mandatory". For its first BTR, Luxembourg decided to report this information.

2. Therefore, this chapter begins with ***Section IV.A***, which presents the national circumstances relevant to Luxembourg's adaptation actions, as well as the related institutional arrangements, governance, legal frameworks, policies and regulations, in accordance with paragraph 106 of the MPGs. ***Section IV.B*** discusses information on impacts, risks and vulnerabilities in line with paragraph 107 of the MPGs. ***Section IV.C*** then presents domestic adaptation priorities and progress towards these, as well as adaptation challenges, gaps and barriers, as requested by paragraph 108 of the MPGs. Paragraph 109 of the MPGs focuses on adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies. This is presented in ***Section IV.D***. Progress on the implementation of adaptation policies and actions is discussed in ***Section IV.E***, as requested by paragraph 110 of the MPGs. This progress is subject to monitoring and evaluation, the results of which are reported in ***Section IV.F***, in line with paragraphs 112 to 114 of the MPGs. The issue of loss and damage is also addressed, as requested by paragraph 115 of the MPGs. This is covered in ***Section IV.G***, followed by ***Section IV.H***, which covers cooperation, good practices, experience and lessons learned (paragraph 116 of the MPGs).

3. For this Chapter, we are not providing an annex summarising the changes between the BTR1 and the NC8/BR5 [MECB (2023)], since Luxembourg did not use the reporting structure suggested in paragraph 47 of the UNFCCC reporting guidelines on NCs for its NC8 and since the reporting of this topic has been completely overhauled for the BTR. However, an annex is joined (***Annex 1***) which indicates whether the encouragement from the latest review – IDR.8/TRR.5 [UNFCCC (2024)] – has been implemented or not.

4. This chapter has been written in December 2024 by Bruno Alvès of the Ministry of the Environment, Climate and Biodiversity (MECB). It is based on information and texts provided by the MAAV-ASTA (Dana Lang), the LIST (Jürgen Jünk) and the MECB-AGE.

IV.A – National circumstances and institutional arrangements

IV.A.1 National Circumstances

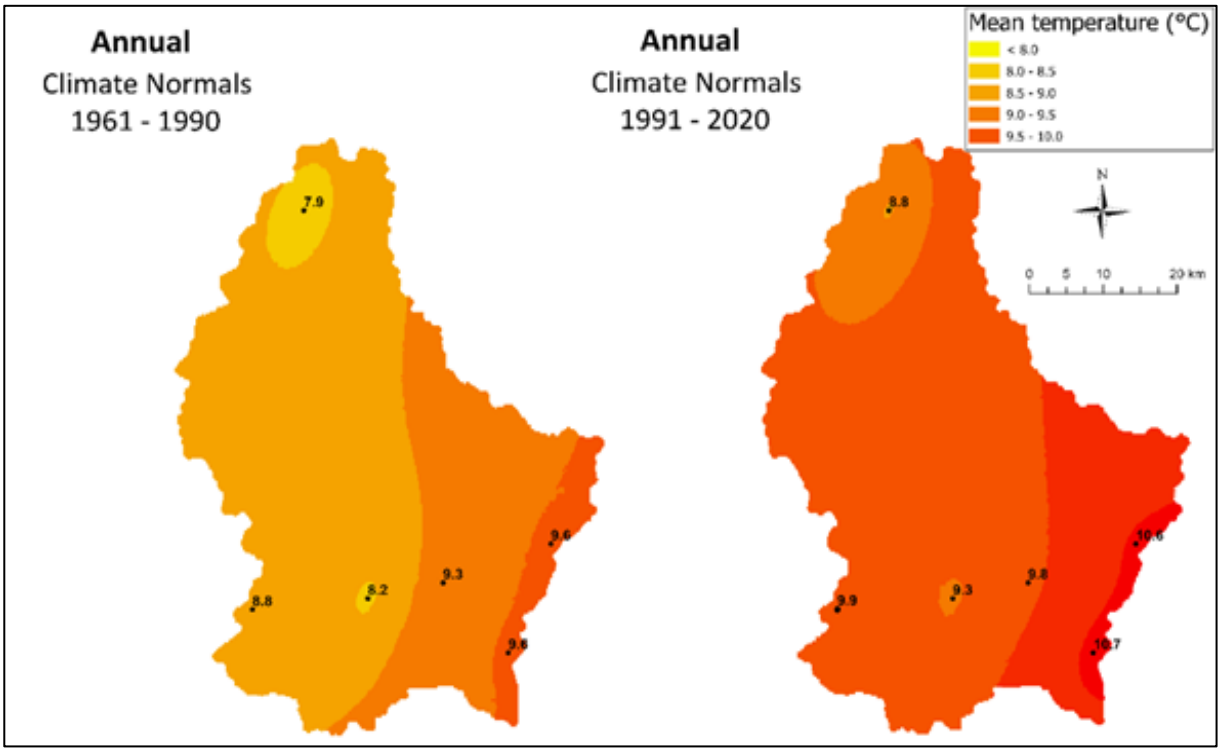
5. Although Luxembourg is a small country, covering an area of 2 586 km², it is geographically very diverse. In the north, the *Ösling* occupies a third of the country, forming part of the Ardennes plateau, with an average altitude of 400 to 500 metres above sea level. The *Ösling* landscape is characterised by hills and deep river valleys, carved out by the tributaries of the Moselle (e.g. Sûre, Wiltz, Clerve). The highest point is the *Kneiff* in Wilwerdange, which rises to an altitude of 560 m. To the south, *Gutland* is part of the Paris Basin, with its coastal relief. The lowest point in the country, called *Spatz* (129 m above sea level), is located at the confluence of the Moselle and Sûre rivers at Wasserbillig – see also ***Section III.A.3***.

6. Of the total area of Luxembourg, in 2024, 84.4% was agricultural land and land under forest – with around 60.9% for agriculture and 23.5% for forests. The built-up areas occupied 11.8% of the total surface and land covered by water and transport infrastructure about 5.2% ***[→ Table III.A.3-1 & Figure III.A.3-2]***.

7. According to Köppen's climate classification, Luxembourg's climate can be characterised as a temperate oceanic climate with mild winters and comfortable summers (coldest month with an average above 0°C, all months with average temperatures below 22°C and at least four months with an average above 10°C). A regional analysis of different stations across Luxembourg shows that temperatures in the north of the country (*Ösling*) are on average 1°C lower than those at Luxembourg airport (Findel), while in the Moselle valley they are on average almost 1°C higher ***[→ Figure IV.A.1-1]***.

8. The regional distribution of precipitation shows greater regional variability. There is a general gradient from the north-west to the south-east of the country, with the highest average annual values recorded in the west ***[→ Figure IV.A.1-2]***.

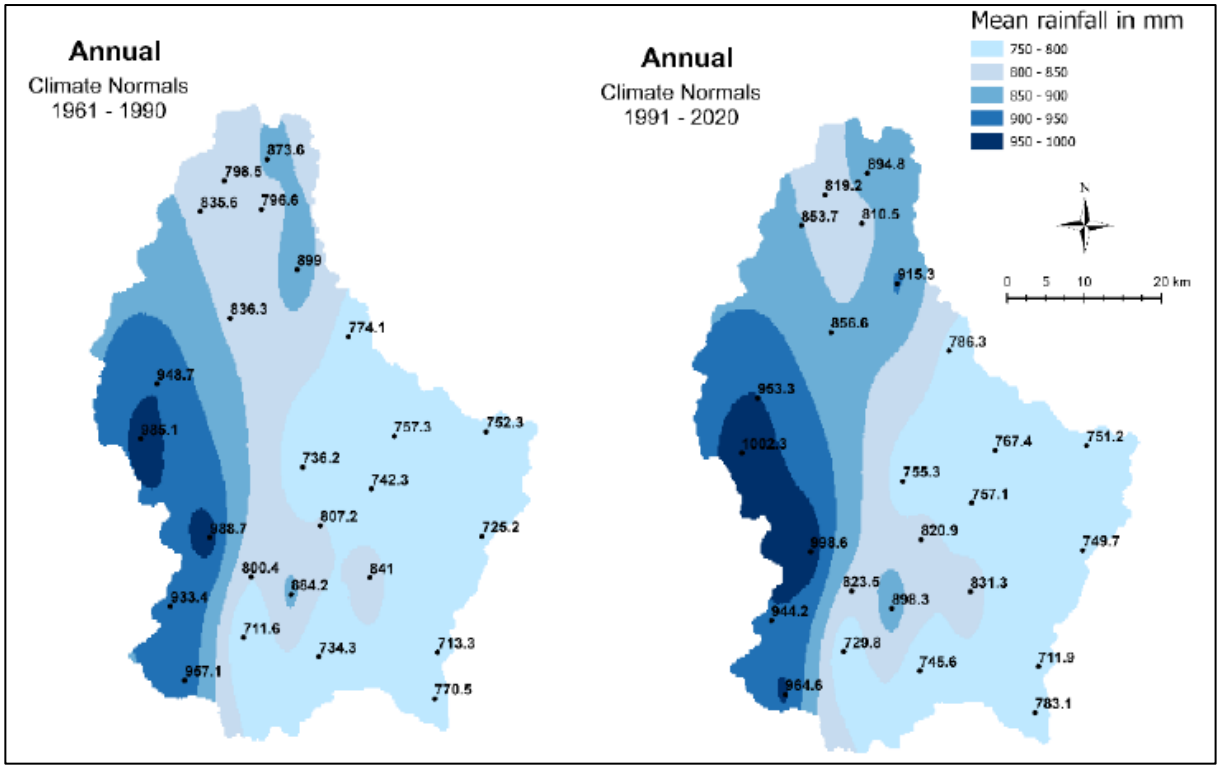
FIGURE IV.A.1-1 – LONG-TERM MEAN TEMPERATURES (1961-1990 & 1991-2020) FOR MAAV-ASTA STATIONS.



Sources: MAAV and MAAV-SER.

Note: The long-term average temperature maps show regional differences between the north, centre and east of Luxembourg.

FIGURE IV.A.1-2 – LONG-TERM MEAN PRECIPITATION (1961-1990 & 1991-2020) FOR MAAV-ASTA STATIONS.



Sources: MAAV and MAAV-SER.

Note: The long-term average precipitation maps show regional variability with a general gradient from the north-west to the south-east.

IV.A.2 LEGAL FRAMEWORKS

9. At national level, the amended Climate Law of 15 December 2020[1] establishes an institutional framework for climate policy *[→ Section III.D.2.2.2]*. Article 12 of the law establishes the legal basis for the "National Adaptation Strategy" (NAS) and the "National Adaptation Plan" (NAP). According to the law, by 1 January 2029 at the latest, and every ten years thereafter, the government must prepare an adaptation strategy for the effects of climate change with a timeframe of at least fifty years.

10. With this adaptation strategy the law aims to reduce vulnerability to the consequences of climate change. Its aim is to identify adaptive capacities, increase resilience and reduce vulnerability to climate change, thereby strengthening Luxembourg's capacity to adapt to the adverse effects of climate change.

11. At the European level, the strategy and action plan for adaptation to the effects of climate change is based on the "European Union Strategy on Adaptation to Climate Change" presented in February 2021.[2] The European Union Strategy sets out how the European Union can adapt to the inevitable consequences of climate change and become resilient to climate change by 2050. The focus is on measures to increase water and food security in the face of changing weather patterns, and to protect human health from extreme temperatures, particularly in cities. Nature-based solutions and ecosystem restoration for climate resilience are given high priority.

12. In addition, the European Climate Law[3] came into force in July 2021 and establishes a "duty" to adapt, in line with the commitments made under the Paris Agreement. Specifically, the Climate Law contains provisions relating to national adaptation strategies and plans and sets out expectations for the quality of an adaptation policy and its outcomes.

IV.A.3 INSTITUTIONAL ARRANGEMENTS[4]

13. Although the national Climate Law assigns responsibility for drawing up a draft NAS to the minister responsible for climate, it is the Government in Council that adopts the document, which commits the entire Government to implementing the adaptation measures defined. The main elements of the implementation of the NAS are therefore addressed to government bodies,

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1 *Loi du 15 décembre 2020 relative au climat et modifiant la loi modifiée du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement*, modified by *Loi du 29 juin 2022 modifiant la loi modifiée du 15 décembre 2020 relative au climat and by Loi du 29 mai 2024 portant modification de la loi modifiée du 15 décembre 2020 relative au climat* (https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a994/jo, https://legilux.public.lu/eli/etat/leg/loi/2022/06/29/a327/jo and https://legilux.public.lu/eli/etat/leg/loi/2024/05/29/a221/jo).

2 Communication of the Commission « Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change" (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:82:FIN). See also: https://climate.ec.europa.eu/eu-action/adaptation-climate-change/eu-adaptation-strategy_en.

3 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (http://data.europa.eu/eli/reg/2021/1119/oj). See also: https://climate.ec.europa.eu/eu-action/european-climate-law_en.

4 See also Sections III.D.2.2.2, III.D.2.2.4 & III.D.2.4.

i.e. ministries and administrations. The action plan thus includes concrete measures to be implemented for each policy sector, which will therefore be the responsibility of the respective bodies according to the allocation of ministerial responsibilities. Inter-ministerial coordination is therefore organised during the preparation of the draft strategy and for the implementation and monitoring of the measures. An inter-ministerial climate committee can serve as a platform for discussion of climate-related issues.

14. Since adaptation to climate change also presents local challenges, the involvement of municipal actors in the implementation of measures is essential to increase resilience to the effects of climate change. Thanks to the legal instruments of the Climate Pact[5] and the Nature Pact[6], Luxembourg is in an excellent position to facilitate the coordination of adaptation measures and learning at all levels of governance.

15. As the wider participation of several public and private stakeholders is important, the national Climate Law also established a "Platform for Climate Action and Energy Transition", bringing together nationwide stakeholders from the public sector, organised civil society including youth, employers' organisations and chambers, employee organisations, as well as a range of other stakeholders and observers from related organisations and institutions. One of the platform's tasks is to act as a forum for discussion on climate issues, and to issue opinions, at the request of the Government in Council, on national climate policy taken or envisaged.

16. Given the importance of cooperation with the scientific sector, the national Climate Law created a "Climate Policy Observatory" (*Observatoire de la Politique Climatique*, hereafter OPC),[7] whose role is to give opinions on projects, actions or measures that could have an impact on climate policy, to scientifically evaluate the measures carried out or planned in the field of climate policy and to analyse their effectiveness. The OPC may also propose new measures, draw up an annual report for the government on the implementation of climate policy and propose research and studies in the areas concerned. Composed of nine members chosen from among people with expertise in a field directly related to the Observatory's mandate, the OPC is a scientific council that is consulted when adaptation measures are drawn up and implemented.

5 www.pacteclimat.lu. See also Box 4 in Section III.D.3.1.1.

6 www.pactenature.lu.

7 https://opc-luxembourg.lu/en/about/.

IV.B – Impacts, risks and vulnerabilities

IV.B.1 CURRENT CLIMATE IN LUXEMBOURG – OBSERVED IMPACTS

IV.B.1.1 Rising temperatures

17. According to the definitions for GHG reporting, Luxembourg is located in a cool climate region, since the average annual air temperature is below 10°C.

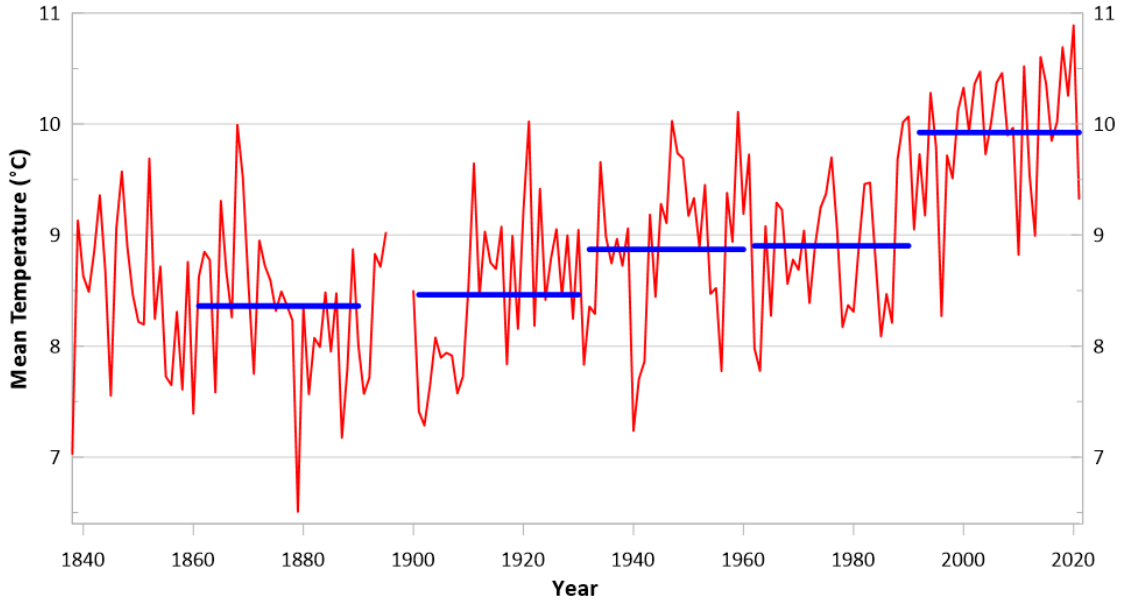
18. However, observations over the last few decades have shown a gradual increase in long-term average annual temperatures *[→ Figure IV.B.1-1]*. From 1990 onwards, the average annual temperature began to rise quite sharply, reaching around +1.5°C compared with the pre-industrial era. The ten warmest years all fall within the period 2002-2021, and each of the last three decades has been successively warmer than any previous decade since 1840. The long-term average temperature rose from 8.2°C for the reference period 1861-1890, 8.9°C for the reference period 1961-1990, and to 9.7°C for the reference period 1991-2020.

19. *Figure IV.A.1-1* above shows that the increase in average annual temperatures affects the whole country. Temperatures in the north of the country (Asselborn) are on average 1°C lower than those at Luxembourg airport (Findel), while in the Moselle valley (Grevenmacher and Remich) they are on average almost 1°C higher. Nevertheless, a general increase in temperatures has been observed for all the measurement stations operated by the ASTA between the reference periods 1961 to 1990 and 1991 to 2020.

20. The increase in temperature can also be observed over time for the different weather seasons. *[→ Figure IV.B.1-2]*. For all four weather seasons, the average air temperature in the reference period 1991 to 2020 is significantly higher than in the reference period 1961 to 1990. If we look at air temperature trends over the weather seasons, the greatest increases are recorded in spring and summer, with temperatures rising by 1.8°C each. In winter and autumn, the increase in average air temperature is 1.2°C and 1.0°C respectively.

21. The steady rise in average temperatures can also be seen from the anomalies in average annual temperatures measured since 1838 *[→ Figure IV.B.1-3]*. Since 1988, all air temperature anomalies – except for 1996 – have been above the reference average. The highest anomaly, 3.0°C, was recorded in 2020.

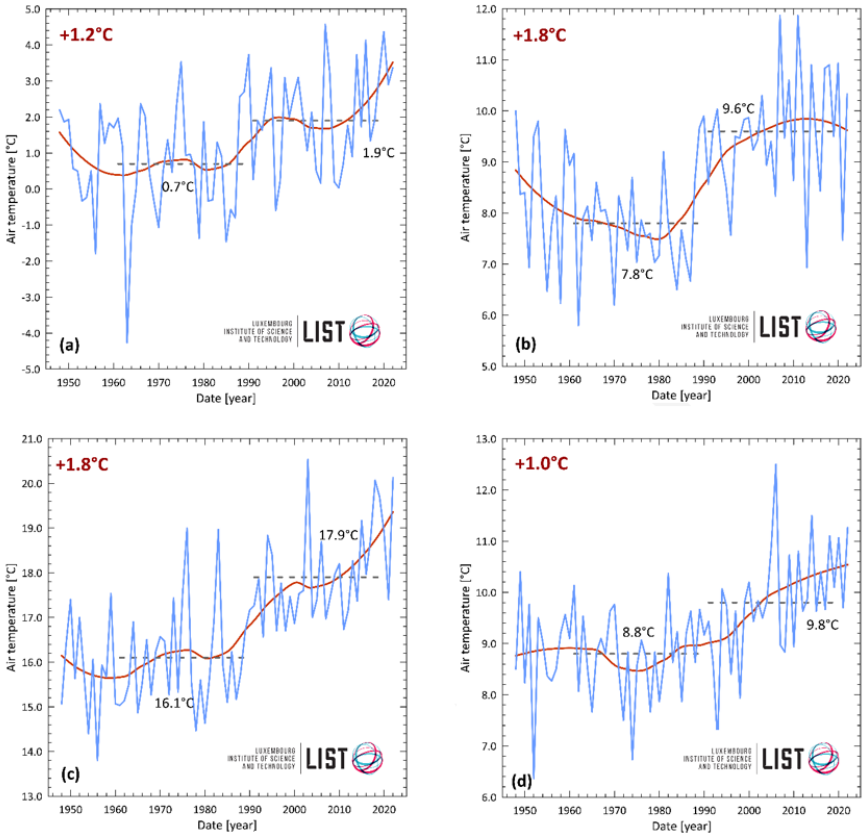
FIGURE IV.B.1-1 – LONG-TERM AVERAGE AIR TEMPERATURE VALUES FOR MAAV-ASTA STATIONS



Sources: MAAV and MAAV-SER (non-published).

Note: Average air temperatures (red) and climate normals (blue lines) for Luxembourg. The break in the red line (between 1896 and 1899) represents a gap in the data.

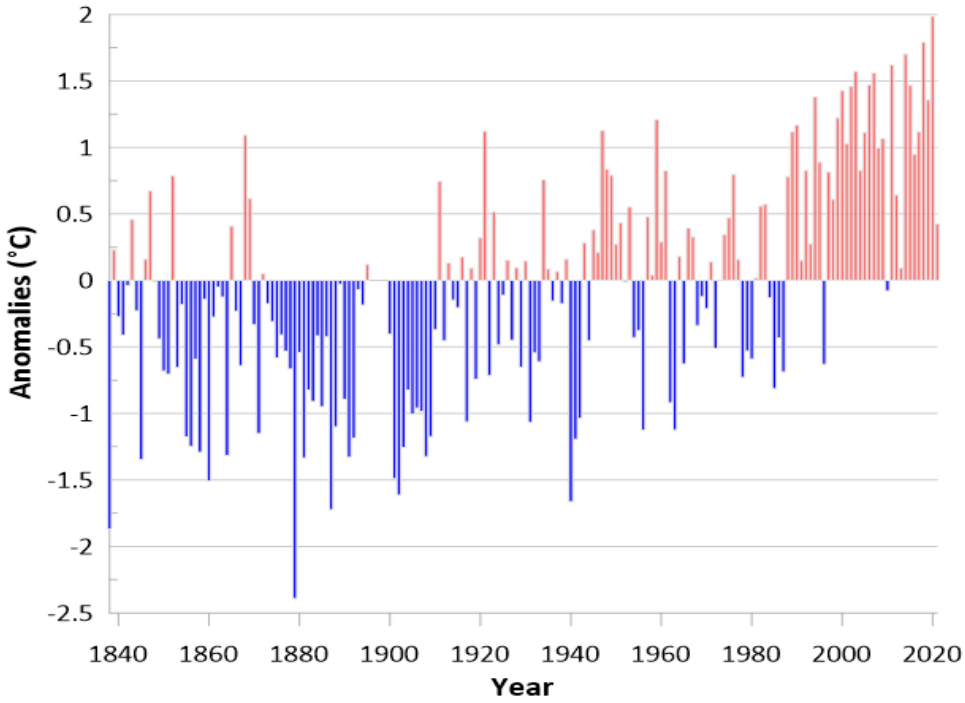
FIGURE IV.B.1-2 – AVERAGE AIR TEMPERATURES FOR METEOROLOGICAL SEASONS FOR FINDEL STATION



Source: Junk et al., *Annual Report CHAPEL project*, 2023

Note: December to February = (a), March to May = (b), June to August = (c), September to November = (d). Blue lines: average temperature over years. Red line: Loess function. Dotted lines: Air temperature averages for the two reference periods 1961 to 1990 and 1991 to 2020; assessment period 01/1947 to 12/2022.

FIGURE IV.B.1-3 – ANNUAL AIR TEMPERATURE ANOMALIES



Sources: MAAV-SER and MeteoLux.

Note: 1838-2021, reference period: 1961-1990.

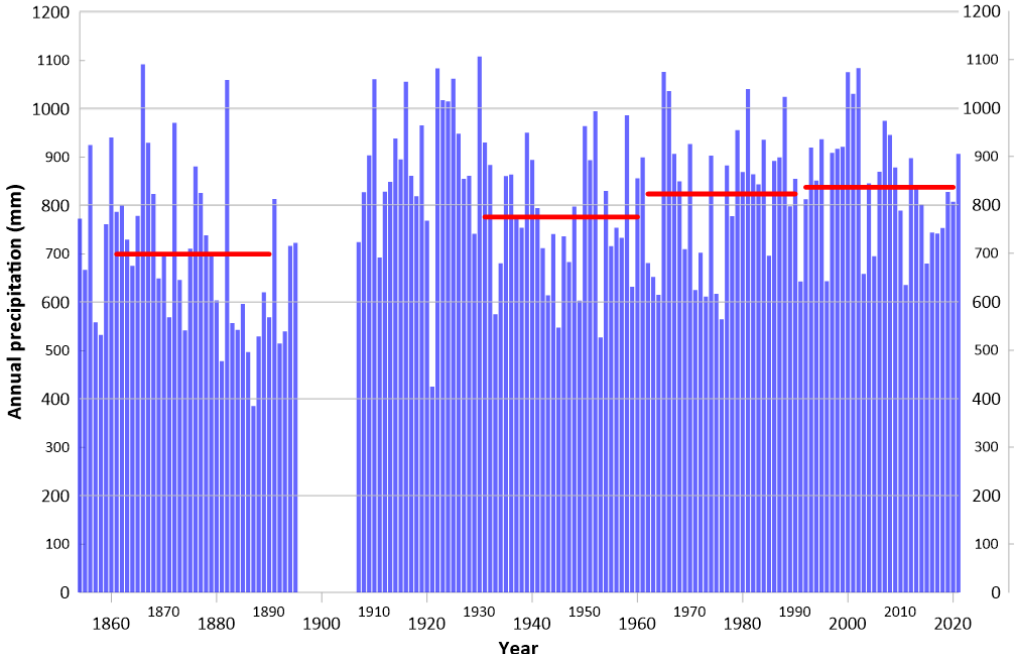
IV.B.1.2 Seasonal change in precipitation

22. Just as Luxembourg shows regional variations in temperature, there is also great regional variability in rainfall distribution. There is a general gradient from the north-west to the south-east of the country, with the highest mean annual values recorded in the west of the country, notably at Koerich (988.7 mm) for the period 1961-1990 and at Roodt (1002.2 mm) for the period 1991-2020. The lowest values were recorded in Obercorn (711.6 mm) for the period 1961-1990 and in Remich (711.8 mm) for the period 1991-2020 *[→ Figure IV.A.1-2]*.

23. Unlike air temperature, mean annual precipitation values do not differ significantly in Luxembourg. Variations from one year to the next are smaller and not statistically significant, so it is difficult to deduce a trend. *[→ Figure IV.B.1-4]*.

24. Nevertheless, according to MAAV-ASTA analyses and analyses measured at the Findel station, rainfall has changed over time, particularly in terms of the weather seasons. There was a significant drop in spring (+26 l/m²) and a slightly significant increase in winter (+19 l/m²) *[→ Figure IV.B.1-5]*.

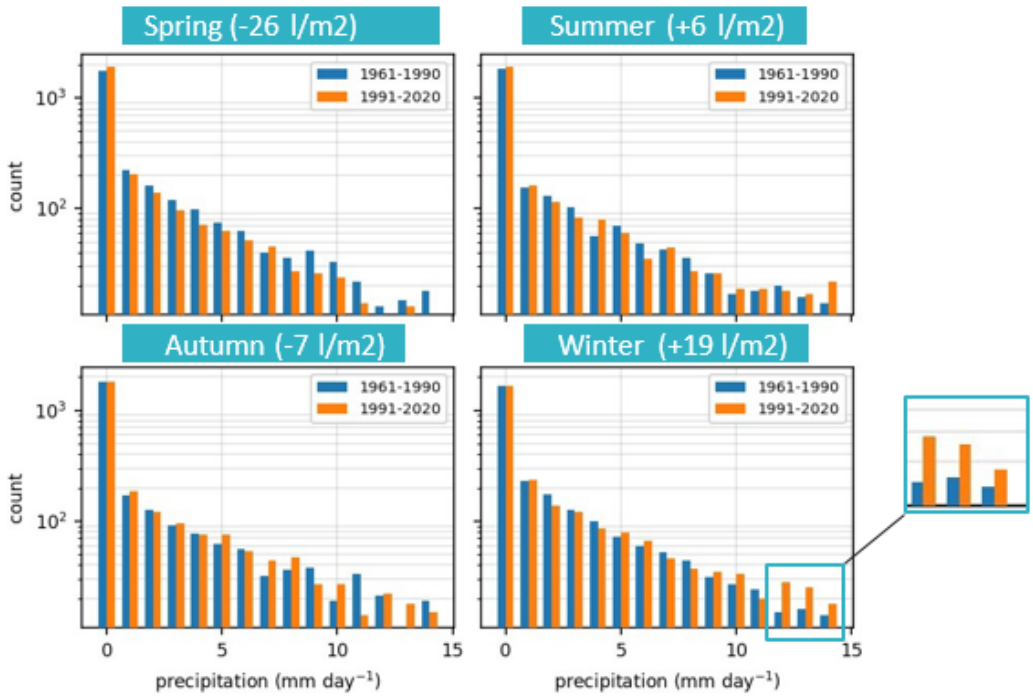
FIGURE IV.B.1-4 – ANNUAL RAINFALL TOTALS



Sources: MAAV-SER and MeteoLux.

Note: Annual precipitation totals (blue columns) and climate normals (red lines) for Luxembourg from 1854 to 2021. The discontinuity in the red line (between 1896 and 1899) represents a gap in the data.

FIGURE IV.B.1-5 – SEASONAL RAINFALL TRENDS



Sources: MAAV-SER and MeteoLux.

Note: 1961-1990 and 1991-2020 reference periods (City of Luxembourg).

IV.B.2 CLIMATE SCENARIOS

IV.B.2.1 Air Temperatures

25. As part of the CHAPEL project (2020 - 2024)[8] run by the Luxembourg Institute for Science and Technology (LIST), regional climate projections are being made and the results analysed. Different Representative Concentration Pathways (RCP), namely RCP26, RCP45 and RCP85, are being evaluated in the project.

26. One of the main trends linked to climate change is the rise in global temperatures. According to forecasts, Luxembourg will also experience warmer average temperatures. Winters will be milder and the spring and summer months warmer.

27. Projected changes in annual minimum, maximum and mean air temperatures for the three different RCPs were analysed using a multi-model ensemble approach. *[→ Figure IV.B.2-1]*. Future climate projections from the nested regional climate models show a consistent increase in air temperatures for all three variables and all RCPs. The increase in mean annual air temperature for the multi-model mean based on RCP2.6 is 1.1°C above the 1971-2000 mean by the end of the century. The second RCP is the intermediate scenario RCP4.5. The projected increase in near-surface air temperatures between now and the end of the century is 2.1°C for annual minimum and maximum temperatures and 2.2°C for the annual mean temperature compared with 1971-2000. The RCP8.5 scenario leads to an increase of 3.7°C over the 1971-2000 period by the end of the century. The increase predicted by this scenario for the near future (2021-2050) is of the same order as that of the RCP2.6 scenario for the distant future (2070-2098). The sharp increase of between 3.6°C and 3.7°C compared with 1971-2000 has been observed for minimum and maximum temperatures, as well as for the mean annual air temperature.

28. To sum up, depending on the emissions scenarios assessed, we can therefore expect an average increase in air temperature of between 1.1°C (RCP2.6) and 3.7°C (RCP8.5) in the distant future compared with the reference period for Luxembourg.

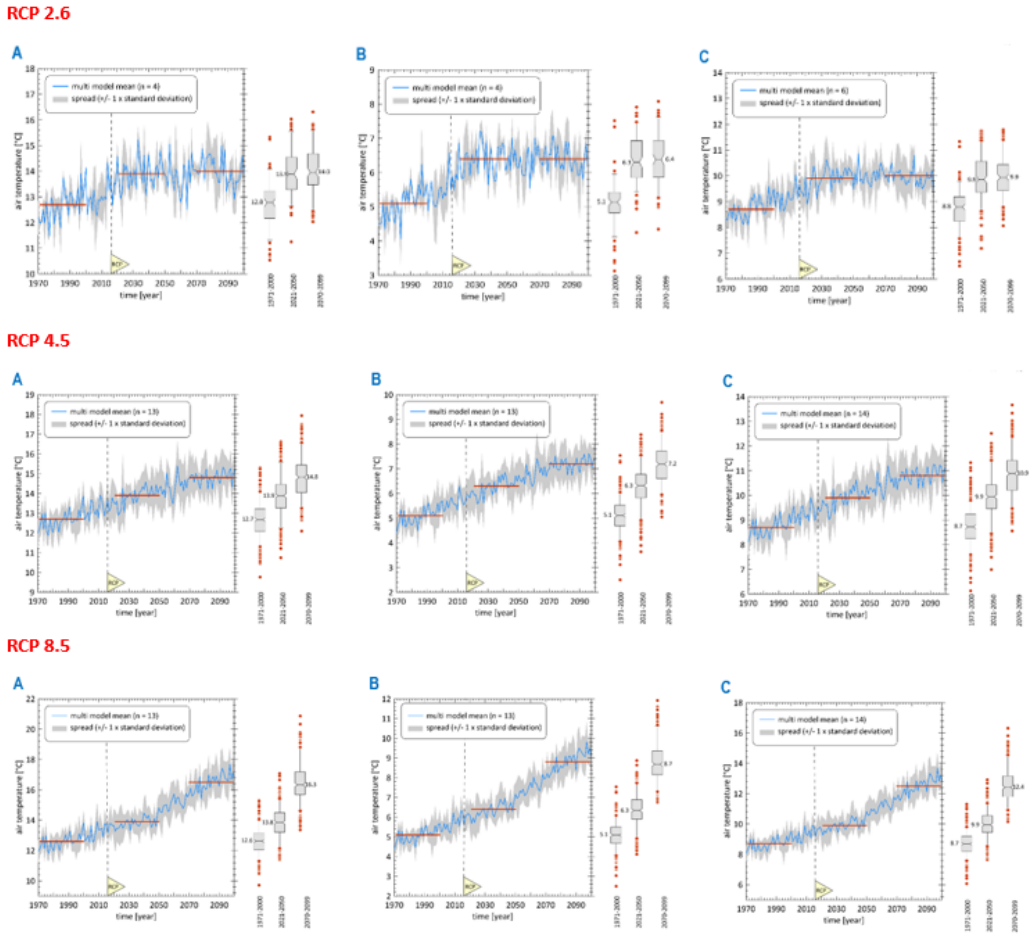
IV.B.2.2 Precipitation

29. The precipitation projections do not clearly show any major variations in average annual precipitation, which would remain much the same as at present *[→ Figure IV.B.2-2]*.

30. Climate projections indicate changes in rainfall patterns for Luxembourg. The trend is towards more variable and potentially more intense rainfall, leading to an increased risk of flooding and erosion. At the same time, drought periods could be longer, which could have a negative impact on water resources due to greater water consumption and more pronounced low-water periods.

8 https://www.list.lu/en/environment/project/chapel/.

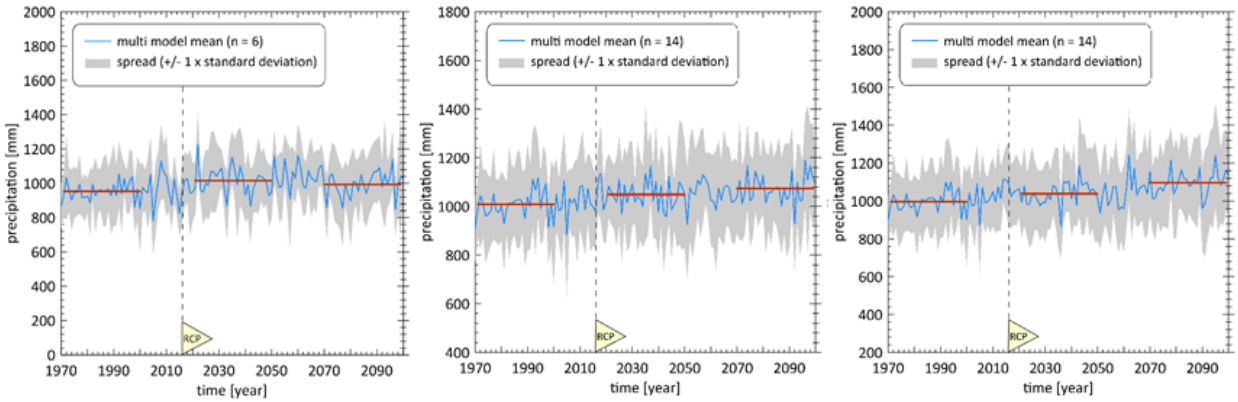
FIGURE IV.B.2-1 – PROJECTED CHANGES IN AIR TEMPERATURE FOR THREE DIFFERENT RCPS



Source: LIST, Chapel Report.

Note: Predicted evolution of annual minimum, mean and maximum air temperatures RCP2.6, RCP4.5 and RCP8.5.
Left-hand side of figures: time series of the multimodel ensemble of annual maximum (A), minimum (B) and mean (C) air temperatures. The range (grey area) is defined by +/- one standard deviation of the ensemble. In addition, the mean values of the 30-year time slices (reference period (REF) 1971-1990, near future (NF) 2021-2050 and far future (FF) 2070-2099) are represented by red lines. On the right of the figures: box plots of daily values for REF, NF and FF. The whiskers extend up to 1.5 x the interquartile range. Data outside this range are represented by red dots.

FIGURE IV.B.2-2 – PROJECTED CHANGES IN PRECIPITATION FOR THREE DIFFERENT RCPS



Source: LIST, Chapel Report.

Note: Left-hand side of each figure: time series of the multi-model ensemble of and mean annual precipitation sums for RCP26, RCP45 and RCP85. The dispersion (grey hatched area) is defined by +/- one standard deviation of the ensemble. In addition, the mean values for the 30-year time slice (reference period (REF) 1971-1990, near future (NF) 2021-2050 and far future (FF) 2070-2099) are represented by red lines plots of daily values for REF, NF and FF. The whiskers extend up to 1.5 x the interquartile range. Data outside this range are represented by red dots.

IV.B.3 RISKS AND VULNERABILITIES

31. Climate change will threaten the "Continental Region" biogeographical zone to which Luxembourg belongs, as defined by the Convention on the Conservation of European Wildlife and Natural Habitats, with an increase in extremes of heat, an increase in evapotranspiration in general, greater variability in precipitation leading to droughts, disturbance to vegetation and natural habitats and an increase in the risk of both winter and summer flooding (fluvial and flash floods).

32. Although the phenomena may be more or less regionalised, all these threats are a major concern for Luxembourg and all sectors of society will be impacted by the effects of climate change (water, health, energy, agriculture, transport, biodiversity, economy, forestry, etc.).

IV.B.3.1 Floods and flash floods

33. The risk of flooding is the most present natural risk in Luxembourg that could affect a large number of people and cause the most economic damage *[→ Section IV.G]*.

34. With climate change, the risk of flooding will even be higher in the future. An increase in the frequency and intensity of floods can affect human safety and health and cause environmental damage, damage to property and infrastructure and a shutdown of economic activities.

35. According to climate projections increased winter precipitation (less snow, more rain) will occur in Luxembourg and is likely to result in higher average winter river flows and increased flood risk. Removing intermediate storage of snow is likely to result in increased frequency, depth and duration of floods. On the other hand, the decrease in precipitation in spring, combined with heavier rain events concentrated in summer increases the risk of pronounced flash floods during the summer.

IV.B.3.2 – Heat waves

36. With average annual temperatures rising, climate change will have a considerable impact on the occurrence, intensity and frequency of heatwaves in Luxembourg.

37. Extreme temperatures harm people and the environment by having a significant impact on human health. Heatwaves place heavy demands on the cardiovascular system, which can lead to serious illness and, in extreme cases, death. These effects can also lead to direct or indirect health problems, such as the intensification of existing infectious diseases and the spread of new infectious diseases.

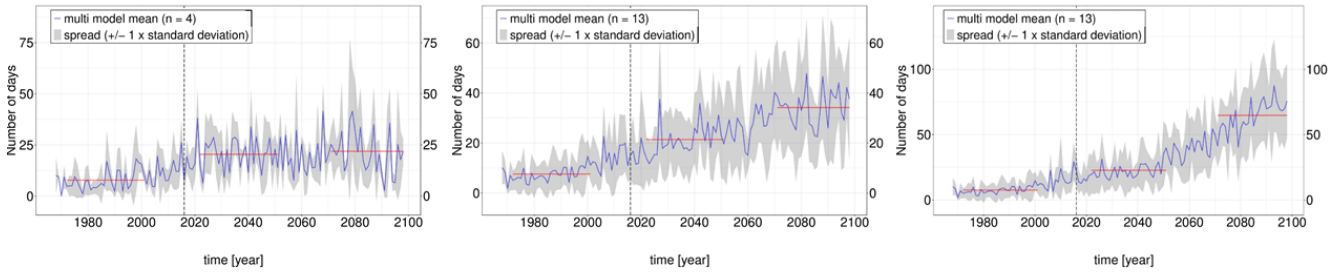
38. Different population groups are affected to varying degrees. The elderly, infants, young children and people suffering from pre-existing illnesses can be considered as groups at risk. The danger of increasing heat exposure for the population of Luxembourg is greatest in urban areas with a

high density of buildings, due to the increased capacity for thermal storage and nocturnal heat emissions. Even relatively moderate levels of heat stress could be associated with adverse health effects, and characteristic relationships between temperature and mortality have been established for air temperatures below 30°C.

39. It should also be noted that heat waves during sensitive phenological stages, such as flowering, can lead to a lack of fruit set and significant yield losses in the main cereal crops (winter wheat, maize, spring barley, etc.).

40. During the 1970-2000 reference period, Luxembourg experienced an average of 7.6 heatwave days per year. According to modelling carried out by LIST, heatwave days in Luxembourg for the period 2021-2050 will average 20.4 days/year (RCP26), 21.4 days/year (RCP45) or 22.7 days/year (RCP85), depending on the climate scenario. For all three climate scenarios, this means a virtual tripling of heatwave days. In the long term, heatwave days in Luxembourg for the period 2070-2099 would average, depending on the climate scenario, 21.9 days/year (RCP26), 34.1 days/year (RCP45) or 64.7 days/year (RCP85) *[→ Figure IV.B.3-1]*.

FIGURE IV.B.3-1 – PROJECTED OCCURRENCE OF HEATWAVES IN LUXEMBOURG FOR THREE DIFFERENT RCPS



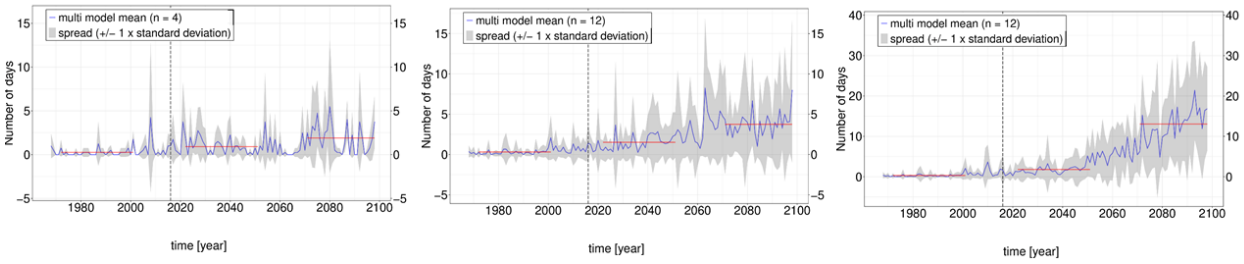
Source: LIST, Chapel Report

Note: Multi-model mean of days during heat waves per year for RCP26, RCP45 and RCP85. The dispersion of the multi-model ensemble (+/- one standard deviation) is represented by a grey shaded area. In red, the 30-year averages for the reference period (RF; 1971-2000), the near future (NF; 2021-2050) and the far future (FF; 2070-2099).

41. Rising temperatures will contribute to an increase in urban heat islands, leading to greater bioclimatic stress, especially in summer. The heat island effect describes the difference in temperature between the warm city and its colder surroundings and reaches its peak during the night and in weather conditions of low wind radiation. These situations occur regularly in Luxembourg, most often in August. While air temperatures in the city during the day are almost as high as in the surrounding area, the urban heat island emerges at night. The highest night-time overheating is found in the city centres, where the highest building densities are found, and especially in areas of economic activity where the levels of impermeability are very high. Overheating decreases the further you move away from the centres or from very impermeable areas.

42. These heatwave periods will also be accentuated by an increase in "tropical nights", which could have a particularly serious impact on the health of the most vulnerable. During the 1970-2000 reference period, Luxembourg experienced an average of 0.3 tropical nights per year. According to the modelling carried out by LIST, the number of tropical nights in Luxembourg for the period 2021-2050 would be on average, and depending on the climate scenario, 0.9 days/year (RCP26), 1.5 days/year (RCP45) or 1.8 days/year (RCP85). In the long term, the number of tropical nights in Luxembourg for the period 2070-2099 would be on average, and depending on the climate scenarios, 1.9 days/year (RCP26), 3.7 days/year (RCP45) or 13 days/year (RCP85) *[→ Figure IV.B.3-2]*.

FIGURE IV.B.3-2 – PROJECTED OCCURRENCE OF TROPICAL NIGHTS IN LUXEMBOURG FOR THREE DIFFERENT RCPS



Source: LIST, Chapel Report

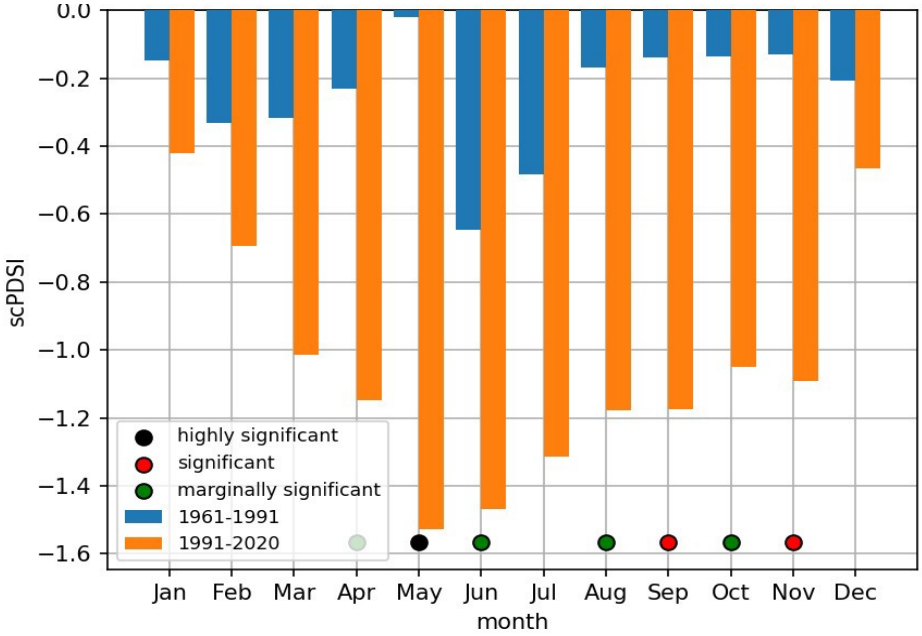
Note: Multi-model mean of tropical nights (Tmin > 20°C) per year for RCP26, RCP45 and RCP85. The dispersion of the multi-model ensemble (+/- one standard deviation) is represented by a shaded grey area. In red, the 30-year averages for the reference period (RF; 1971-2000), the near future (NF; 2021-2050) and the far future (FF; 2070-2099).

IV.B.3.3 Droughts

43. Climate projections indicate changes in precipitation patterns in Luxembourg. Rising temperatures and more variable precipitation lead to lower water levels and flows in rivers, and to a drying out of soil layers close to the surface. Combined with high temperatures, low water levels have an impact on aquatic habitats. Species dependent on cool water temperatures are particularly at risk.

44. Increasing temperatures promote evapotranspiration and therefore droughts, which are indicated by an index greater than 0.5. In addition, increased evaporation and evapotranspiration promote convective precipitation that produces pluvial floods. Figure 25 shows a significant increase in the drought index for the months of April to November (with the exception of July). For the period 1961-1990, only June and July had an index greater than or equal to 0.5 on average. While for the period 1991-2020, 10 months (except January and December) were marked by droughts) *[→ Figure IV.B.3-3]*.

FIGURE IV.B.3-3 – DROUGHT INDEX FOR LUXEMBOURG



Source: MAAV-ASTA.

Note: Periods 1961-1990 and 1992-2020.

45. Added to this are increased evaporation rates due to high temperatures and increased plant water requirements through transpiration. These conditions will lead to more frequent and severe water stress conditions for agricultural plants and forestry, impacting agricultural crops and perennial forest trees more severely.

46. As regards forests, observations on the phytosanitary state of Luxembourg's forests show a strong degradation resulting, among other factors, from climate change. Indeed, the lengthening of the growing season, the increasing drying out of forest soils at the end of the seasonal cycle combined with insufficient winter recharge, accentuates the water stress of trees after several consecutive years of increased evapotranspiration.

47. This thermal stress has a particular impact on young trees and therefore on the natural rejuvenation of forests. This is also reinforced by the fact that climate change induces changes in the chemical and biological characteristics of forest soils, particularly at the level of the symbiotic association between roots and fungi.

48. The predicted climate changes will also affect agricultural production, both in terms of the main processes of plant growth and development and in terms of the occurrence and severity of plant diseases and pests. Greater variability in yields has been observed in recent years, with "extreme" events occurring more frequently (dry years, late springs, late frosts, longer rainy periods, etc.). As a result, harvests are more irregular.

IV.B.3.4 Changing rain patterns and securing the drinking water supply

49. The variability of precipitation will have an impact on the population's consumption needs for primary goods. Luxembourg would thus be increasingly confronted with the challenge of ensuring sustainable management of its water resources: whether it be the problem of low water levels in watercourses or securing the population's drinking water supply.

50. In Luxembourg, the drinking water supply of the population is guaranteed approximately 50% by the waters of the Haute-Sûre reservoir and 50% by groundwater, captured by approximately 300 springs and boreholes, mainly in the geologies of the Gutland. While the securing of supply from the resource coming from the Esch-sur-Sûre reservoir has been improved with, on the one hand, the construction of a new treatment plant in Eschdorf by the SEBES, and on the other hand by the delimitation of protection zones around the lake, groundwater, which also has delimited protection zones for almost 80% of the catchments, will be particularly impacted by the effects of climate change.

51. In order to maintain a supply through groundwater, it is necessary for springs and catchments to continue to provide quality water. To do this, it is necessary for groundwater recharge to be ensured. It must be considered that groundwater recharge does not occur throughout the year, but is currently concentrated in Luxembourg between November and April, and depends on many factors such as:
    - infiltration and permeability of the soil and subsoil;
    - the water deficit in the soil at the end of the growing season;
    - the seasons, knowing that approximately 80% of the recharge occurs when the vegetation is dormant and the sunshine, temperatures, etc. are such that less evaporation and less use of precipitation by plants cannot occur;
    - land use (sealed surfaces preventing precipitation from infiltrating into the soil);
    - the spatio-temporal distribution of precipitation and the distribution of rainfall intensity;
    - the presence of snow.

52. With an extension of the growing season, this conversely induces a reduction in the groundwater recharge period. The average increase in temperatures and the variability of precipitation will therefore impact the supply of drinking water from groundwater resources. Thanks to the data collected via the monitoring of groundwater levels and spring flow rates as well as precipitation data, the Water Management Administration has been able to highlight that soil saturation plays a key role in groundwater recharge. It is increasingly clear that a significant groundwater recharge requires not only that autumn and winter (November to April) are particularly rainy, but also that a certain amount of rain can infiltrate during the summer period and percolate deep down. This part certainly plays a secondary, but not insignificant role, especially in sandy soils.

In fact, regular rains during the summer make it possible to keep the soils mainly sandy beyond the point of field capacity to allow percolation of drainage water in depth and to promote recharge from the start of the hydrological year, at the end of October, beginning of November.

53. However, climate projections indicate that summer precipitation will tend to be less regular and concentrated in episodes of heavy precipitation. Sudden rains regularly exceed the natural infiltration capacity of soils, even the most filtering, and create surface flows beyond a certain level that can also increase the risk of flooding.

54. In addition, the demand for water will increase on the one hand with economic and demographic growth, but also during periods of heat waves, which will become more and more frequent with climate change.

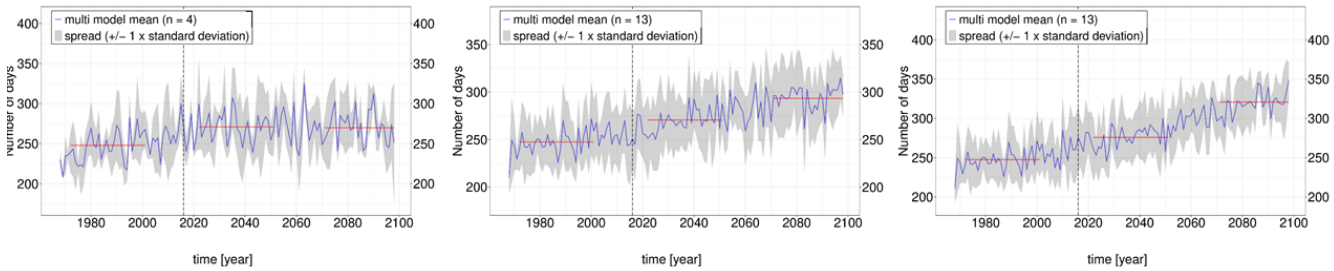
IV.B.3.5 – Disturbance of vegetation and natural habitats

55. All these climate changes and trends will primarily impact vegetation, therefore both agriculture and forestry as well as biodiversity. The growing season is directly dependent on air temperature. This is the time of year when the climate and environmental conditions are favourable for plant growth. During this period, plants absorb nutrients, carry out photosynthesis and develop by producing leaves, flowers, fruits and roots. If the average daily temperatures exceed 5°C for at least five days, this represents the beginning of the growing season; if this condition is not met in autumn, this represents the end of the growing season. The growing season is crucial for agriculture because it determines which plant species and varieties can be grown in a given region and how often harvests can be carried out. With climate change and the increase in average annual temperatures, the growing season will lengthen.

56. During the reference period 1970-2000, the vegetation period in Luxembourg lasted on average 247.9 days per year. According to the models carried out by LIST, the vegetation period in Luxembourg for the period 2021-2050 would be on average, and depending on the climate scenarios, 270.6 days/year (RCP26), 270.8 days/year (RCP45) or 275.8 days/year (RCP85). In the long term, the vegetation period in Luxembourg for the period 2070-2099 would be on average, and depending on the climate scenarios, 270 days/year (RCP26), 293.4 days/year (RCP45) or 330.6 days/year (RCP85) *[→ Figure IV.B.3-4]*.

57. It should be noted that these assessments are based on a purely thermal definition of the growing season. In addition to temperature, plants obviously need water. However, with variability in precipitation and increasing average annual temperatures, water availability for plants would not necessarily be ensured, which would disrupt plant growth and impact harvests

FIGURE IV.B.3-4 – AVERAGE LENGTH OF THE VEGETATION GROWING SEASON



Source: LIST.

Note: Multi-model mean of the mean duration of the thermal growing season for RCP26, RCP45 and RCP85. The spread of the multi-model ensemble (+/- one standard deviation) is shown as a shaded grey area. In red are the 30-year means for the reference period (RF; 1971-2000), the near future (NF; 2021-2050) and the far future (FF; 2070-2099).

IV.B.3.6 Decrease in frost events

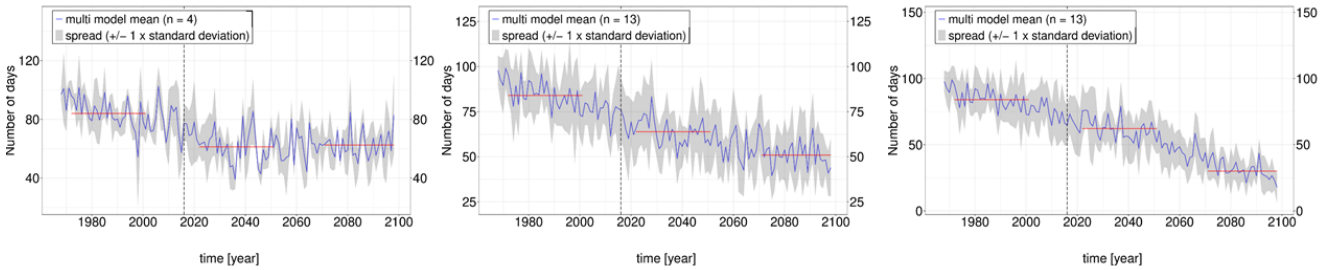
58. In addition to these drought-related crop constraints, there are also problems associated with frost events, which will tend to decrease and be less regular. Frost can help control pests and pathogens in agricultural crops. Severe frost can kill some pests and their eggs, delaying or preventing the establishment of a pest population that impacts yield. This is particularly important in the event of frost-related mortality of sucking insects, which are vectors of economically important plant pathogens (e.g., virus diseases of potatoes or barley).

59. In addition, some cereal and fruit varieties require what is known as vernalisation. This is a biological process in which plants need a cold period to trigger flowering. This process is particularly important for some cereals (winter wheat, winter barley), the induction of flowering in winter rapeseed and for fruit trees (apple, cherry), because it regulates the flowering period and fruit formation. In addition, early flowering increases the risk of damage during late frosts, which can lead to considerable losses.

60. In addition, frost can help to restructure and loosen the soil and release certain nutrients. This can improve soil quality and structure (soil fertility) and therefore promote plant resilience.

61. *Figure IV.B.3-5* shows the evolution of the average frequency of frost episodes in Luxembourg according to the different emission scenarios. During the reference period 1970-2000, Luxembourg experienced an average of 84 frost days per year. According to the models carried out by LIST, the frost days in Luxembourg for the period 2021-2050 would be on average, and depending on the climate scenarios, 61.5 days/year (RCP26), 63.9 days/year (RCP45) or 62.2 days/year (RCP85). For the three climate scenarios, this practically means a decrease of 25%. In the long term, the frost days in Luxembourg for the period 2070-2099 would be on average, and depending on the climate scenarios, 62.5 days/year (RCP26), 50.9 days/year (RCP45) or 30.2 days/year (RCP85).

FIGURE IV.B.3-5 – AVERAGE OCCURRENCE OF FROST EVENTS



Source: LIST.

Note: Multi-model mean of the annual average number of frost days (blue line) for RCP26, RCP45, RCP85. The multi-model ensemble spread (+/- one standard deviation) is shown as a shaded grey area. In red, the 30-year averages for the reference period (RF; 1971-2000), the near future (NF; 2021-2050) and the far future (FF; 2070-2099).

62. The lack of frost will result in some pest species not being regulated. New species that are better adapted to warmer conditions will be able to proliferate more easily, which will encourage the multiplication of invasive alien species. The weakening of forests and agricultural crops due to water stress and drought will make them more vulnerable to the threat of invasive species, pests and harmful organisms. The ageing of the forest also increases the risk of the appearance of diseases and infestation by insects and other parasites that could proliferate if milder winters and generally higher air temperatures are recorded in Luxembourg.

IV.C – Adaptation priorities and barriers

63. As detailed in *Section IV.B*, the impacts of climate change are being felt with increasing intensity in Luxembourg and it is imperative to remedy the situation through policies and actions as soon as possible in order to adapt to this situation. Adapting to climate change is becoming a necessity in order to reduce the risks to safety, health, society, the economy, infrastructure, nature and ecosystems, as well as to the ecosystem services that nature provides.

64. In order to meet the challenges of climate change, the "National Adaptation Strategy" (NAS) [MECDD (2018)] includes 16 areas of action: risk and natural disaster management, human health, water, society, urban areas, spatial planning, housing and construction, transport, economy and finance, energy, soil protection, agriculture – food – viticulture, biodiversity and ecosystems, regional and international cooperation, as well as communication and awareness-raising.

65. Nevertheless, these areas of action should not be considered isolated, but one of the key principles set by the NAS is the policy coherence and integrated measures.

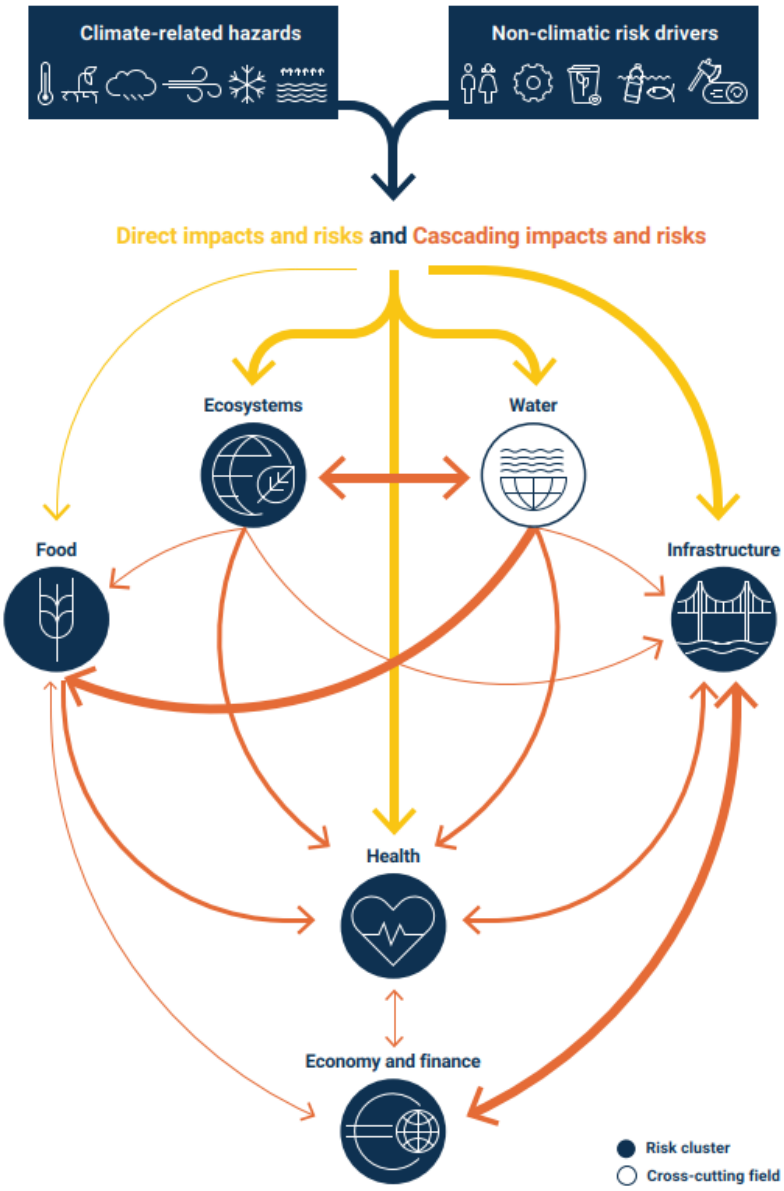
66. In countries such as Luxembourg, with its relatively small surface area and rapidly increasing population density, there may be specific interferences between energy system transitions, between urban development and soil protection, between water security and food supply, or between environmental health. The implications for land use and land-use change, and by extension also for biodiversity and for water resources that become scarcer with each passing season, must be seen as essential. Integrated solutions, often nature based, can contribute to climate change mitigation, adaptation and progress towards climate-resilient development and a sustainable society.

67. It is important that the various sectoral policies do not conflict or cause mutual harm. Policy coherence is essential if the "Do No Significant Harm" principle is to be respected, i.e. not to cause significant harm to any of the six environmental objectives established by the European Union.[9]

68. Climatic impacts can cascade from one system or region to another. A climatic event impacting one sector can also indirectly be the source of a major risk for another sector. A good understanding of risk cascades is essential for reducing climate risks, as it enables different possible objectives to be targeted for risk reduction strategies. It is often more effective to tackle a risk at the beginning of the cascade than at the point where its effects are felt most [European Environment Agency (2024)] *[→ Figure IV.C-1]*.

[9] Commission Notice Technical guidance on the application of 'do no significant harm' under the Recovery and Resilience Facility Regulation 2021/C 58/01 (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021XC0218(01)).

FIGURE IV.C-1 –CASCADING RISKS

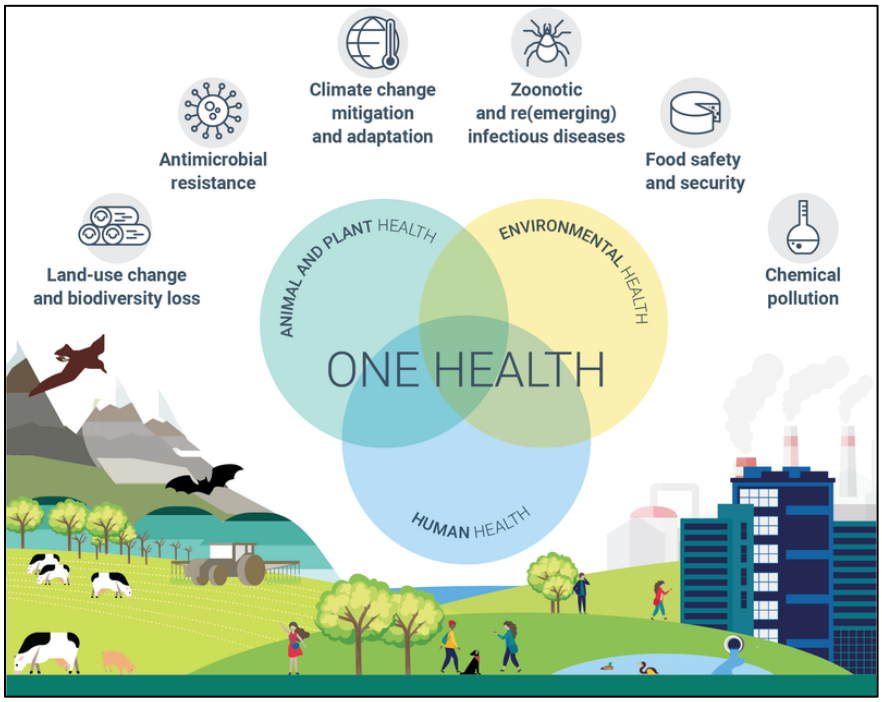


Source: European Environment Agency (2024), p. 17.

Note: The figure illustrates the interconnections and risk transmission pathways from key climate-related hazards and selected non-climatic risk drivers (on top) via the main climate impacts for five clusters of interrelated risks and the cross-cutting field 'Water'.

69. This need for coherent policies is also highlighted by the World Health Organisation's "One Health" approach, which is also at the heart of the NAS. It is widely recognised that no single discipline or sector of society can succeed in solving these problems by acting in isolation. Applying the "One Health" approach means that all actions aimed at preventing, predicting, detecting and responding to health threats must consider the links between human, animal, plant and ecosystem health.

FIGURE IV.16 – "ONE HEALTH" APPROACH[10]



Source: EFSA.

Note: One Health' approach - interconnection between human health, animal health and environmental health.

70. Working in silos continues to be a barrier to an integrated approach. The diversity of interests of the players involved is a challenge for the implementation of systematic and effective adaptation measures.

10 See, e.g., https://www.efsa.europa.eu/en/topics/one-health.

IV.D – Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies

71. As mentioned in ***Section IV.C***, the NAS [MECDD (2018)] includes 16 areas of action (→ §64).

72. For each area of action, the climate impacts and the objectives are detailed in the NAS. An analysis of their respective vulnerabilities and a catalogue of concrete measures aimed at countering the negative consequences of climate change and increasing resilience are detailed. Where possible, nature-based solutions have always been preferred when identifying measures for each sector.

73. The NAS however does not prioritise one sector over another. As detailed in ***Section IV.C***, the sectors are all interdependent and interrelated. Cascading effects can occur in all directions and the priority is therefore the integrated approach in the implementation of adaptation measures. It is therefore not a strategy covering one single sector or dependent on a single Ministry, but a document approved by the whole Government in Council applying to all ministries and state administrations.

74. Similarly, there is no geographical prioritisation of measures. The measures set out in the NAS apply to the whole country and address the various challenges. The risk of flooding, for example, is certainly dealt with along rivers, but the measures adopted in the strategy make no distinction between the more rural north of the country and the more urban south.

75. Applying an integrated approach, respecting the "do no significant harm" principle and taking account of the "One Health" approach ***[→ Section IV.C]*** are at the heart of the NAS.

76. Given the need to integrate adaptation into all public policies, the draft Adaptation Strategy 2025-2035 was drawn up in consultation with all the ministries concerned. Prepared under the coordination of the MECB, and based on the scientific observations from the agrometeorological service of the MAAV-ASTA[11] and projections of the LIST, the document was completed with the active participation of all the ministries concerned.

77. In the same vein, the importance of incorporating the knowledge of all other stakeholders, whether public or private, national or local, experts or citizens, is a key element in the development of the NAS. A national workshop and public consultation were held when the 2018-2023 NAS was drawn up. This approach will be further developed for the revision of the 2025-2035 document. Seven thematic workshops will be organised, as well as five information and public participation meetings. The aim is to gather ideas and recommendations from all stakeholders. These public events will be organised in collaboration with a number of civil

11 https://www.agrimeteo.lu/.

society players, and the participatory events will be advertised and promoted in order to be as inclusive as possible.

78. Although the NAS is also partly aimed at municipalities, it is first and foremost a strategy and measures for the Government as a whole. Nevertheless, through the Climate Pact, the MECB is encouraging and supporting municipalities to strengthen their exemplary role in climate policy, to reduce their GHG emissions, to contribute to efforts to adapt to climate change, to promote efficient management of resources, and thus to stimulate sustainable local and regional investment. An "adaptation" certificate rewards the municipalities that have done the most to adapt to climate change.

IV.E – Progress on implementation of adaptation

79. The NAS [MECDD (2018)] approved for the period 2018-2023 presented 42 measures. These measures were formulated in a very broad way, containing a general description of the objective of the measure as well as examples of concrete actions that could meet this objective. To implement these actions, one or more ministries and/or government departments were identified for each measure.

80. During the assessment of the 42 measures proposed in the strategy for the period 2018-2023, it was difficult to determine if the measure could be considered as completed. The measures were very broadly formulated, and many actions were likely to contribute to achieving the objective of the measures. It was therefore decided to assess the implementation of the various measures according to the number of concrete actions carried out: ≥ 3 concrete actions; 1-2 concrete actions, no action (or no information).

81. According to the survey, for 35 measures out of a total of 42 (83.3%), at least one concrete action has been taken as part of the strategy and action plan. For more than half of the measures, i.e. 24 out of 42 (57.1%), at least 3 concrete actions have been implemented by the respective ministries. However, for 7 measures (16.6%), no action has been reported *[→ Figure IV.E-1]*.

FIGURE IV.E-1 – IMPLEMENTATION OF THE 2018-2023 ADAPTATION STRATEGY

Number of concrete actions	Measures concerned	%
≥ 3 **concrete actions**	24/42	57.1%
1-2 **concrete actions**	11/42	26,2%
0 **actions (or no information)**	7/42	16.6%

Source: MECB.

Note: Survey based on information provided by the different ministries and administrations.

82. Based on this survey, it can be seen that concrete action has been taken on more than 84% of the measures.

83. It should be noted that the overly 'broad' formulation of the measures was problematic for the identification of the concrete actions carried out. Some actions could indirectly or marginally fall within the scope of a measure, which sometimes made it difficult to determine whether the action could be considered as an adaptation measure. In addition, some measures had several entities responsible for their implementation, which led to coordination difficulties during implementation. Finally, the 42 measures proposed as part of the 2018-2023 NAS did not have any precise indicators that would enable to easily assess the implementation. These various shortcomings identified during the evaluation of the 2018-2023 NAS were taken into account during the revision of the NAS for the draft 2025-2035 strategy.

84. The NAS is currently being updated. A draft strategy covering the period 2025-2035 was adopted by the Government Council on 15 November 2024. Drawn up under the coordination of the MECB in consultation with all the ministries concerned, this draft strategy will be put out to public consultation for several months before being adopted by the Government Council.

85. In accordance with Article 12 of the amended national Climate Law of 15 December 2020, the Government in Council draws up an adaptation strategy every ten years (→ §9), with an update every five years. A review of the strategy every five years will allow the strategy document to be updated in line with new scientific knowledge on climate change. An update every five years will also provide a framework for monitoring the implementation of the measures set out in the strategy. This mid-term review will make it possible to identify areas where additional efforts need to be made to implement the measures set out.

86. The NAS will therefore have a timetable for implementation from 2025 to 2035, with a mid-term review in 2030.

IV.F – Monitoring and evaluation of adaptation actions and processes

87. In order to be able to evaluate the implementation of the NAS [MECDD (2018)], it is essential to define clear and quantifiable objectives for each measure. Each measure in the 2025-2035 strategy contains a sufficiently ambitious and measurable objective, with one or more indicators enabling the progress of the measure to be monitored.

88. As the ministry responsible for implementing a strategy for adapting to the effects of climate change, the MECB will evaluate the "monitoring of implementation" of the action plan on the basis of information received by the other ministries and administrations concerned. This evaluation will show whether or not the measures defined in the action plan have been implemented. This is also known as "output monitoring". Based on the monitoring of implementation, a report on the progress of the measures can be published on a regular basis.

89. In addition to this analysis of the implementation of measures, there is also the possibility of "evaluating the real impacts" of the implementation of the measure. This is also known as "outcome monitoring. It is more difficult to know whether the measure has had the expected impact. The qualitative evaluation of measures requires the advice of experts. Similarly, it is possible that the expected impact has not been achieved due to other factors, or that more time is needed to assess the effects of a measure. It is therefore not certain that this evaluation can be carried out.

90. The monitoring report will be drawn up every 5 years and will form the basis for any updating of the NAS, as defined by the national Climate Law. The impacts will be assessed every 10 years, when a new draft adaptation strategy is drawn up.

91. Given that the draft adaptation strategy will cover the period 2025-2035, the next mid-term review is scheduled for 2030.

IV.G – Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

92. In Luxembourg, flooding is the main natural risk that could affect the largest number of people. Flood risk and flood hazard maps for the 17 main rivers show that 4 401 ha of land would be affected by HQ10 flooding, 5 956 ha by HQ100 flooding and 7 029 ha by HQext flooding. According to the second "Flood Risk Management Plan 2021-2027" [MECDD-AGE (2021)], a total of 4 211 people (HQ10), respectively 12 392 people (HQ100) and 20 998 people (HQext) are potentially affected by flooding, which represents 3.35% of the population. In order to assess the potential financial damage, monetary estimates of damage to property were carried out. These estimates indicate that the potential damage could reach the sum of 1 054 278 000 EUR taking into account the HQext for the 17 watercourses identified. The main rivers Alzette, Moselle and Sûre alone have potential damage of 880 million EUR.

93. In order to avert, minimize and address losses and damage caused by climate change, one priority is to put in place flood prevention and protection measures, according to the second Flood Risk Management Plan 2021-2027.

94. Coherent policies ensure averting, minimizing and addressing loss and damage. This requires a comprehensive approach that includes complementary activities between mitigation and adaptation policy. Reducing GHG emissions while strengthening resilience and adaptive capacities are therefore part of Luxembourg's activities to avert, minimize and address loss and damage. Furthermore, incorporating mitigation and adaptation planning into disaster risk management frameworks and vice versa will contribute to this policy coherence.

IV.H – Cooperation, good practices, experience and lessons learned

95. Municipalities are important partners in the field of environmental and climate protection and can make an essential contribution to efforts to adapt to the effects of climate change. Not only can they act on the land they own, but they can make environmental and climate-friendly policy decisions, serving as role models for their citizens, and even offering incentives to citizens, companies and operators located on their municipal territory. In the past years, Luxembourg has carried out several cooperation programs with municipalities that can be considered good practice tools.

IV.H.1 CLIMATE PACT

96. To create the appropriate tools for municipalities, the MECB has created a national structure for the promotion of a sustainable energy transition, to ensure project management and technical assistance. In 2012, a law creating a "Climate Pact"[12] with the municipalities created this tool authorizing the State to support the municipalities financially and technically by offering them the possibility of structuring their climate and energy policies, of reducing their energy costs thanks to improving energy efficiency and stimulating local and regional economic activities *[→ Box 4 in Section III.D.3.1.1]*.[13] In 2021, the Climate Pact was extended with the law creating the "Climate Pact 2.0"[14]. In addition to mitigation measures, Climate Pact 2.0 also contains adaptation measures.

97. The municipalities involved are assessed during an audit and certified according to their performance based on a catalogue of measures. There are four levels of performance: "basic certification" (40%), "bronze" (50%), "silver" (60%) and "gold" (70%). Thematic certifications, such as the circular economy, adaptation to climate change and air quality allow municipalities to specialize and obtain additional subsidies. The "Climate Pact 2.0" is therefore a perfect tool for implementing climate measures at the local level.

IV.H.2 GREENING PUBLIC SPACES CAMPAIGN

98. In order to support municipalities to introduce adaptation measures, the MECB has since 2022 launched a yearly targeted calls for projects called "*Méi Natur an eise Stied an Dierfer*" ("more nature in our cities and villages").

99. The aim of the call for projects is to encourage the greening of urban areas by demineralizing existing sealed surfaces and replacing them mainly with grassed areas, planting trees or shrubs. Eligible projects had to meet the criteria of adapting to the effects of climate change while

12 https://legilux.public.lu/eli/etat/leg/loi/2012/09/13/n1/jo.

13 https://pacteclimat.lu/fr/acteur-engage.

14 https://legilux.public.lu/eli/etat/leg/loi/2021/06/25/a482/jo.

promoting the development of green spaces that enhance the quality of life of citizens and the development of biodiversity in the urban environment. By financing such local projects, the aim is to create positive example that inspire other actors and other municipalities by helping them to become more familiar with adaptation measures.

100. The first call for projects in 2022 rewarded 5 municipalities with financial assistance of between 500 000 EUR and 250 000 EUR per project.[15] In 2023, the call was focused on the greening of public schoolyards, which will make it possible to raise awareness more widely among a younger population. Seven municipalities have been awarded grants of up to 500 000 EUR per project.[16]

101. Following the success of the previous calls for projects, which rewarded 12 local authorities with a total budget of 4 million EUR, the MECB is extending this campaign for its 3rd edition. Local authorities can now submit projects in 4 different categories. This will give local authorities more opportunities to put in place concrete measures to adapt to the inevitable effects of climate change, so as to better protect the population while creating greener, more pleasant urban and village centres. With the help of nature-based solutions the projects will make it possible to increase the resilience of urban environments to heatwaves and improve and increase the well-being of the population.[17]

15 https://gouvernement.lu/fr/actualites/toutes_actualites/communiques/2023/06-juin/06-welfring-prix.html.

16 https://gouvernement.lu/fr/gouvernement/serge-wilmes/actualites.gouvernement2024%2Bfr%2Bactualites%2Btoutes_actualites%2Bcommuniques%2B2024%2B09-septembre%2B18-wilmes-natur-schoulhaeff.html.

17 https://environnement.public.lu/fr/actualites/2024/12/approjet-mei-natur-stied-duerf.html.

IV.I – Any other information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

102. Luxembourg has no further information to report in this section.

Annex 1 – Implementation of recommendations and encouragements from the latest review

The table below indicates if the encouragement from the latest review – IDR.8, Table I.4 [UNFCCC (2024)] – has been included or not in this submission, and if not, why.

Reporting requirement	Issue type	Assessment	Description	Included Y/N
para. 47	Transparency	Encouragement	The ERT encourages Luxembourg to use the reporting structure set out in paragraph 47 of the UNFCCC reporting guidelines on NCs in its next NC and to report information on climate modelling, projections and scenarios and on the approaches used for monitoring and evaluating implemented adaptation strategies or plans.	Yes: more information is now reported on climate modelling in Section IV.B.2. The other encouragement – that is to use the reporting structure set out in paragraph 47 of the UNFCCC reporting guidelines on NCs – is not relevant under the BTR, which has its own reporting structure in the MPGs.

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➔ http://data.europa.eu/eli/reg/2018/1999/oj and http://data.europa.eu/eli/reg/2018/1999/2023-11-20

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Chapter V

Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

1. Pursuant to Article 13, paragraph 9, of the Paris Agreement in accordance with the relevant modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement (MPGs) [UNFCCC (2018)], Luxembourg has, in this chapter and the accompanying common tabular format (CTF) tables, provided information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9 -11 of the Paris Agreement. To provide this information in a clear and consistent manner, this chapter is structured along the lines with paragraphs 118 to 129 of the MPGs.

2. For this Chapter, we are not providing an annex summarising the changes between the BTR1 and the NC8/BR5 [MECB (2023)], since the reporting of this topic has been completely overhauled for the BTR. However, an annex is joined (***Annex 1***) which indicates whether the encouragement from the latest review – IDR.8/TRR.5 [UNFCCC (2024)] – has been implemented or not.

3. This chapter has been written by the Ministry of the Environment, Climate and Biodiversity (MECB) in collaboration with the Directorate for Development Cooperation and Humanitarian Affairs of the Ministry of Foreign and European Affairs, Defence, Development Cooperation and Foreign Trade (COOP-MoFEA).[1]

1 https://cooperation.gouvernement.lu/en.html.

V.A – National circumstances and institutional arrangements

4. Over the past decades, Luxembourg has provided substantial financial, technological and capacity building support, for climate adaptation and mitigation action in developing countries. This international climate action support is provided by two distinct sources of funding and mainly administered by two ministries:
   - the MECB is responsible for the programming and planning of Luxembourg's International Climate Finance (hereafter, ICF) budget.
   - the COOP-MoFEA is responsible for the programming and planning of Luxembourg's Official Development Assistance (hereafter, ODA).

5. Luxembourg upholds the *principle of additionality* between ODA and ICF. Indeed, the poverty eradication challenge is made more complex due to climate change impacts, especially in developing countries, and therefore calls for additional financial means on top of existing ODA commitments.

6. Consequently, *new and additional* means that the resources that Luxembourg commits to deliver are not taken over from earlier commitments and are thus "new". "Additional" means that they come *on top of* Luxembourg's ODA commitments and thus are not "double counted" or draining on other resources dedicated to poverty eradication.

7. In recent years, the Ministry of Finance (MFIN),[2] often in partnership with the MECB (but not only), has contributed to climate change projects and programmes in developing countries through its "sustainable finance budget". For the purposes of this report, climate-specific contributions made by the MFIN are considered as ICF, while contributions made by the MFIN to multilateral channels, such as the GEF for example, are considered as ODA.

Luxembourg's International Climate Finance (ICF) – provided by the MECB

8. Ahead of the Paris COP21 (2015), the Government of the Grand Duchy of Luxembourg committed to continuing to support climate action in developing countries - with a particular focus on Least Developed Countries (LDCs) and Small Island Developing States (SIDS) - with a contribution of EUR 120 million for the period 2014-2020. This contribution, provided through the national *Climate and Energy Fund* (CEF)[3] (see also Box 5 in ***Section III.D.3.1***), included an annual contribution of EUR 5 million to the *Green Climate Fund* (GCF), representing a total contribution of EUR 35 million over the said period.

2 https://mfin.gouvernement.lu/en.html.

3 https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a994/jo.

9. As already mentioned, ICF funding is new and additional to ODA. In this context, Luxembourg clearly stands out from other countries which divert a large part of their ODA to ICF. Since 2017, the distribution of ICF has been based on the requirements of the national *Strategy for the allocation of funds for international financing of the fight against climate change* [MDDI-DEV (2017)].

10. In September 2019, the Government of Luxembourg adopted the 2021-2025 multi-year programming of the ICF as part of the national CEF, for a total amount of EUR 200 million. This envelope was increased to EUR 220 million during the Glasgow COP26 (2021) to intensify Luxembourg's ambition in reaching the USD 100 billion goal.

11. In 2021, the MECB updated the national Strategy for the allocation of ICF for the period 2021-2025, defining new priority themes, the geographical scope and eligibility, selection and exclusion criteria [MECB (2021)]. The main features of the 2021-2025 ICF Strategy[4] are presented below.

12. The 2021-2025 ICF Strategy considers the developments in climate change negotiations (entry into force of the Paris Agreement, adoption of the Paris Rulebook, update of Nationally Determined Contributions (NDCs), etc.), as well as the development of new financial instruments, in particular with regard to private sector engagement.

13. In recent years, Luxembourg has adopted a new legislative framework and a series of measures to promote the ecological transition at national level, including the Integrated National Energy and Climate Plan (NECP) for the period 2021-2030 [MECB and MECO (2024)][5] *[→ Section III.D.2.2.1]*, the Strategy and Action Plan for Adaptation to the Effects of Climate Change 2018-2023 [MECDD (2018)][6] *[→ Section IV.C]* and the amended national Climate Law of 15 December 2020[7] *[→ Section III.D.2.2.2]*, which establishes, inter alia, the CEF and the MECB, as the administration in charge of the CEF, whose international component ICF, enables the financing of climate mitigation and adaptation projects in developing countries, and which are additional to ODA.

14. The ICF strategy for the period 2021-2025 is aligned with Luxembourg's 3rd National Sustainable Development Plan (NSDP3) [MECDD (2019)][8] *[→ Section III.D.2.2.5]*, which is based on the 2030 Agenda for the definition of measures and actions to be implemented in Luxembourg to ensure the coherence of sustainable development policies at national and international levels.

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4 https://environnement.public.lu/content/dam/environnement/fr/climat-energie/financement-climatique-international/stratgie-fci-2021-2025-final-2023.pdf.

5 https://environnement.public.lu/fr/klima-an-energie/planpnec.html.

6 https://environnement.public.lu/content/dam/environnement/documents/klima_an_energie/Strategie-Adaptation-Changement-climatique-Clean.pdf. This Strategy is currently under revision.

7 *Loi du 15 décembre 2020 relative au climat et modifiant la loi modifiée du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement*, modified by *Loi du 29 juin 2022 modifiant la loi modifiée du 15 décembre 2020 relative au climat* and by *Loi du 29 mai 2024 portant modification de la loi modifiée du 15 décembre 2020 relative au climat* (https://legilux.public.lu/eli/etat/leg/loi/2020/12/15/a994/jo, https://legilux.public.lu/eli/etat/leg/loi/2022/06/29/a327/jo and https://legilux.public.lu/eli/etat/leg/loi/2024/05/29/a221/jo).

8 https://environnement.public.lu/content/dam/environnement/documents/developpement-durable/PNDD.pdf.

The ICF strategy is also consistent with the "National Strategy on Sustainable Finance" adopted in February 2021, which aims to support the Luxembourg financial sector in its transition to sustainable finance, making it a leading international hub in this field. The Sustainable Finance Strategy[9] has been updated in 2025 to reflect the recent developments in Luxembourg and beyond.

15. The Paris Agreement reiterates the objective of significantly increasing financing for adaptation. The ICF strategy aims for a balanced distribution between adaptation activities (at least 50%), mitigation of greenhouse gas emissions and reduction of deforestation and forest degradation (REDD+) to keep more flexibility in the choice of projects.

16. ICF Funds provided under the 2021-2025 ICF strategy should seek to augment the climate response while at the same time yielding sustainability benefits in accordance with the Sustainable Development Goals (SDGs), including with respect to health, resilient infrastructure, sustainable consumption, gender equality, and more. Integrated action will also be sought on the level of climate and pollution control.

17. The project portfolio is targeting seven priority ICF themes:
    1. Natural capital, biodiversity, forestry and land use
    2. Clean air and water resources
    3. Resource efficiency and waste management
    4. Community-based adaptation and resilience
    5. Leveraging and mainstreaming climate and sustainable finance
    6. Support for transparency requirements of the Paris Agreement
    7. Climate change induced migration

18. Energy projects are eligible, if integrated as a component in one of the priority themes or under the combined lens of mitigation and adaptation. Large energy projects can use indirect financing through intermediaries supported by the ICF (e.g., LU-EIB Climate Finance Platform (LCFP), International Climate Finance Accelerator Luxembourg (ICFA), City Climate Finance Gap Fund, Green Climate Fund (GCF)).

19. In addition, the focus is on mobilizing private climate finance for which different types of financing can be possible. While direct grants remain the main source of financing, other public-private instruments can be further explored, such as loans, guarantees and "first loss equity", direct and indirect investments (e.g. by the GCF or the LCFP).

9 https://lsfi.lu/wp-content/uploads/2025/03/FINAL-EN-LSFI-Luxembourg-SF-Strategy-2030-2.pdf.

20. All developing countries are eligible, but special attention is paid to Luxembourg's "climate dialogue" and partner countries, Small Island Developing States (SIDS) and Least Developed Countries (LDCs). Projects may also be developed in emerging countries. In the latter case, however, stricter criteria are applied and a strong potential for mobilizing financing by the private sector is sought.

21. The ICF strategy clarifies environmental and social safeguards, gender requirements and includes an exclusion list of activities that are not eligible for the Luxembourg ICF.

22. The ICF strategy includes general eligibility requirements:
    - Clear and direct climate change focus
    - Additionality of support
    - Alignment with host country climate strategies and NDCs
    - Safeguards and Gender
    - Exclusions

23. Submissions that have been approved eligible for funding need to respect the following set of selection criteria:
    - Strong Climate impacts
    - Other sustainable development benefits
    - Mobilisation of private sector funding
    - Transformation, innovation and lasting outcomes
    - Efficiency
    - Gender equality contribution

24. Generally, a wide spectrum of entities, from Luxembourg and abroad, qualify as implementation partners and applicants for receiving funding to implement ICF-sponsored programs and activities in developing countries. They include:
    - Public organizations/agencies (e.g., LuxDev)
    - National finance institutions
    - Bilateral and multilateral development finance institutions and regional development banks
    - Multilateral organizations such as United Nations organizations and programs
    - Experienced national and international organizations leading in a specific thematic area
    - Dedicated climate funds and facilities, including (micro) financing institutions
    - Research institutions, institutes, and universities
    - Non-governmental organizations (NGOs) and not-for-profit environmental organizations accredited by the COOP-MoFEA or approved by the MECB

25. Applicants need to show sufficient climate-relevant and recent experience in the thematic areas, presence in the field, ability to manage projects or climate assets, and financial capacity to carry out the project/program. With regard to NGOs, their selection is made on the basis of simple and easily verifiable criteria (proof of the realization of previous activities, experience in the field, financial health). All applications must be submitted to the MECB by using a specific template.[10]

26. Luxembourg has adopted a dual approach to the allocation of its ICF. On the one hand, support for the activities of multilateral channels and funds, in particular the GCF, to which a contribution of EUR 40 million is allocated for the period 2021-2024 and a contribution of EUR 50 million for the period 2025-2028, and, on the other hand, the financing of bilateral and regional projects, including a budget of EUR 25 million for Luxembourg NGO projects for the period 2021-2025. Within the framework of bilateral projects, Luxembourg concludes conventions or agreements directly with the authorities of the partner countries or with national and/or international organisations in charge of the implementation of selected projects.

27. During the Baku COP29 (2024), the Minister of the Environment, Climate and Biodiversity announced Luxembourg's ICF commitment of EUR 320 million for the period 2026-2030. The new ICF strategy for 2026-2030 is currently being developed by the MECB.

Luxembourg's Official Development Assistance (ODA) – provided by the COOP-MoFEA

28. The primary objective of Luxembourg's Development Cooperation is to contribute to the eradication of extreme poverty and the promotion of economic, social and environmental sustainability, notably in LDCs. Its activities are conceived in the light of the 2030 Agenda and the SDGs for 2020-2030. The actions carried out by Luxembourg's COOP-MoFEA aim to be inclusive and to leave no one behind.

29. In 2023, Luxembourg's ODA amounted to 536.47 million euros and represented 0.99% of the gross national income (GNI) [COOP-MoFEA (2023)].[11] In real terms, taking into account inflation, Luxembourg's ODA decreased by 1.8% compared to the year 2022, but considered in absolute terms, Luxembourg's ODA experienced an increase by 6.5% compared to 2022. Luxembourg therefore still appears among the small number of OECD member countries that have kept their ODA at 0.7% or more of their GNI.

30. As in the past, this ODA consists of grants only and is implemented through bilateral and multilateral cooperation instruments, technical cooperation and cooperation with development NGOs, sustainable and inclusive finance instruments, and humanitarian actors.

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10 https://environnement.public.lu/fr/klima-an-energie/financement-climatique-international.html → see on the bottom page under "Documents" (General Submission Template for ICF Funding OR Luxembourg NGO Submission Template for ICF Funding).

11 https://www.cooperation.lu/fr/2023/laide-publique-au-developpement-en-2023/evolution-de-laide-publique-au-developpement-en-2023.

31. From a geographical point of view, in the interests of effectiveness and impact, Luxembourg's Development Cooperation is pursuing a policy of targeted action in a limited number of partner countries. The geographical concentration of the Luxembourg Development Cooperation considers the United Nations Development Programme's (UNDP) human development index as well as considerations relating to the regional approach and situations of fragility. Nowadays, the partner countries are among the LDCs and SIDS – Cabo Verde, Senegal, and Laos. In addition, Luxembourg supports projects in "project countries", including Costa Rica, El Salvador, Kosovo, Benin, Togo, Rwanda, Burkina Faso, Mali, Niger, Mongolia, Occupied Palestinian Territories and Vietnam.

32. Development cooperation activities with these countries are distinguished by a heightened sense of partnership with both public authorities and civil society. This spirit of partnership, which is achieved through actual ownership of the programmes and projects by the beneficiaries themselves, is the cornerstone of the multi-annual cooperation programmes, the *Indicative Cooperation Programmes* (ICPs).

33. Luxembourg's development cooperation focuses on four thematic priorities:
    - improving access to quality basic social services,
    - enhancing socio-economic integration of women and youth,
    - promoting inclusive and sustainable growth, as well as
    - strengthening inclusive governance.

34. Underlying each theme is a focus on cross-cutting priorities including human rights, gender equality as well as environmental sustainability. By ensuring the systematic inclusion of cross-cutting priorities Luxembourg aims to provide a holistic and multi-faceted approach to supporting sustainable development. Based on partner country contexts and national priorities and needs, targeted programme and project interventions are being developed. The thematic and cross-cutting priorities are closely aligned with the SDGs and aim to contribute to meaningful progress towards achieving the 2030 Agenda goals.

35. Building on Luxembourg's four thematic priorities and recognising that current development challenges cannot be addressed by any one country alone, Luxembourg focus its support on a limited number of targets as defined through the indicators of its 12 priority SDGs. In accordance with its focus on *Leaving no one behind*, Luxembourg will promote and support multi-stakeholder partnerships adopting an integrated graduation approach, focused on ensuring that basic needs of vulnerable populations are met to enable their progressive transition towards more sustainable livelihoods.

36. In order to improve reporting of ODA statistics to the OECD's Development Assistance Committee (DAC), Luxembourg has mainstreamed the DAC policy marker system in all projects and programmes. This system includes an *Aid to Environment* marker, as well as the four so-called *Rio markers*, covering biodiversity, combat against desertification, climate change mitigation and adaptation.

37. In 2009, the COOP-MoFEA elaborated a policy paper on environment and climate change and in 2014 it developed a strategy for environment and climate change action [COOP-MoFEA (2014)]. Both have been replaced by the new environment and climate change strategy to 2030 [COOP-MoFEA (2021)].[12] Through this new strategy, which has been developed according to the priorities of the general strategy and with consistency with the new gender strategy, the Luxembourg Development Cooperation is thus specifically committed by 2030 to:

    - On the one hand, increasing the environmental and/or climate co-benefits of its portfolio of interventions in its priority sectors.
    - On the other hand, financing a greater number of dedicated projects promoting the resilience of human and natural systems to climate risks and/or environmental degradation.

38. Luxembourg recognizes the intrinsic link between environmental and climate issues and gender equality, ensuring they are addressed in an integrated manner. As a result, gender and environmental/climate strategies have been developed simultaneously, along with the necessary tools for their effective implementation.[13]

39. Furthermore, a whole-of-government approach is applied to strengthen the coherence of actions in the partner countries, in particular with the MECB, with which a first joint programme has been signed with Cabo Verde in 2020, the *ICP V Development, Climate, Energy* (DCE) programme.[14]

V.A.1 DESCRIPTION OF THE SYSTEMS AND PROCESSES USED TO IDENTIFY, TRACK AND REPORT ON SUPPORT PROVIDED AND MOBILIZED THROUGH PUBLIC INTERVENTIONS

Luxembourg's International Climate Finance (ICF)

40. The MECB is responsible for identifying, tracking and reporting on the provision of public ICF and the mobilisation of ICF through public interventions.

41. The 2021-2025 ICF Strategy lists the eligibility (pp. 21-28) and selection criteria (pp. 28-27) for the allocation of Luxembourg's ICF. The first and most important eligibility criterion is the clear and

12 https://cooperation.gouvernement.lu/dam-assets/publications/strat%C3%A9gies/strategie-environnement/2021-2023-environement-an-climate-change-strategy-en.pdf.

13 https://cooperation.gouvernement.lu/en/cooperation-au-developpement/thematiques-transversales/durabilite-environnementale.html.

14 https://cooperation.gouvernement.lu/fr/cooperation-au-developpement/pays-partenaires/cabo-verde.html.

direct climate change focus of the supported activity. The MECB uses two leading and mutually compatible methodologies to define and categorise the scope of its ICF:

- The Climate Components Methodology used by Multilateral Development Banks (MDBs) and International Development Finance Corporations (IDFCs), based on the MDB-IDFC Common Principles for Climate Finance Tracking[15,16].
- OECD Rio Marker methodology[17].

42. To a certain extent, Luxembourg also considers those activities eligible that apply the "EU Taxonomy of Sustainable Activities"[18] for climate change mitigation and adaptation.

43. In applying these methodologies, Luxembourg will, as a rule, only consider as eligible:
    - Activities, that are directly and clearly related to mitigation, adaptation or REDD+ with a significant climate impact.
    - Activities for which the climate objective is the principal element of the activity, and which would not have been achieved without this climate objective (e.g. OECD Rio Marker Climate 2).
    - Activities that directly contribute to making finance flows consistent with a pathway towards low GHG emissions and climate-resilience investments (Art. 2.1.c Paris Agreement) targeting climate investments in developing countries.

44. In practice, each ICF-supported activity is reviewed internally during the application process. This review includes an assessment of whether the activity has a clear and direct climate change focus (up to workplan level where information is available) using the methodologies above. As part of this assessment, a general judgement will be made as to whether, for a supported activity, the climate objective is a main or principal element of the activity (in the sense of the OECD Rio Marker Climate 2) and whether there is a clear and direct link between the activity and the climate objective.

45. In exceptional cases, the ICF can be used to finance activities where climate impact is a significant element (OECD Rio Marker Climate 1), but not the main element of the activity. However, this requires that the activity in question brings significant climate and sustainable development benefits, has a transformative effect on the fight against climate change, and would have little chance of being developed without funding from Luxembourg (additionality).

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15 https://www.eib.org/attachments/documents/mdb_idfc_mitigation_common_principles_en.pdf.

16 https://thedocs.worldbank.org/en/doc/20cd787e947dbf44598741469538a4ab-0020012022/original/20220242-mdbs-joint-methodology-climate-change-adaptation-finance-en.pdf.

17 https://capacity4dev.europa.eu/library/rio-markers-handbook-oecd-dac-climate-markers_en?refpage=search

18 https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

46. The MECB does not classify the supported activities as OECD DAC Rio Markers for Climate (0, 1, 2) but rather applies its definitions and their meaning in the review process of ICF applications.

47. Regarding the Climate Components Methodology: during the review process the MECB assesses whether all the components of the activities fit the clear and direct climate impact check. If that impact check cannot be established for a specific activity item, discussions are held with the applicant on whether to include a specific component or not in the ICF support. As stated in the 2021-2025 ICF Strategy (p. 22), sometimes the ICF may be used to also fund those elements in a measure that go beyond having a direct climate benefit (as long as it is an integral part of the program). The Climate Component Methodology is usually applied to development finance by multilateral development banks. The MECB does not have the capacity to do a detailed climate component analysis for each supported activity. For climate adaptation projects the ICF covers the costs of the proposed activities, without attempting to capture only the incremental costs of adaptation activities through an incremental costs analysis.

48. The internal review process also includes an analysis of the main selection criteria. The first and most important selection criterion is a strong climate impact. During the internal review process, the MECB assesses whether there is sufficient, good or very good evidence of strong climate impact in the proposed activity. This assessment also looks at the impact logframe based on the theory of change of the reviewed activities and the proposed Key Performance Indicators (KPIs) leading to the climate impact. A KPI monitoring plan is required. In particular, the MECB monitors the output and outcome KPIs of an ICF-supported activity. Often, the MECB requires a calculation of tCO_2e reduced or sequestered for climate change activities, with an indication of the calculation methodology used. This information cannot be provided for all supported activities.

49. Through its ICF, Luxembourg has launched several initiatives with the aim of mobilizing private finance. This has been done through de-risking mechanisms and by providing technical assistance and capacity building. Luxembourg is currently in the process of defining its methodology for measuring and reporting on mobilised private finance. Luxembourg will only report the mobilised private finance that can be attributed to Luxembourg, the amounts contributed by other public actors will not be taken into consideration. Within this calculation, Luxembourg will probably mainly follow the agreed OECD methodologies.

50. Where agreed OECD methodologies do not prove adequate for activities financed by the ICF, the MDB Reference Guide[19] on how Multilateral Development Banks (MDBs) and European Development Financing Institutions (EDFIs) calculate and report on private investment

[19] https://documents1.worldbank.org/curated/en/495061492543870701/pdf/114403-REVISED-June25-DocumentsPrivInvestMob-Draft-Ref-Guide-Master-June2018-v4.pdf.

mobilization might be taken into account. The applied methodology will be clearly stated in the BTR2, CTF reporting Table III.3.

Luxembourg's Official Development Assistance (ODA)

51. The COOP-MoFEA is responsible for identifying, tracking and reporting on the provision of ODA and the mobilization of private funding through public interventions. The COOP-MoFEA's tracking system[20] integrates specific indicators that are directly aligned with the five environmental and climate markers identified by the OECD/DAC, focusing on:
    - Environmental protection and management (Aid to Environment marker)
    - Mitigation of climate change
    - Adaptation to climate change
    - Biodiversity
    - Combating desertification

52. Specific Indicators: For each thematic area, the tracking system assigns projects a DAC marker value of 0, 1 or 2, representing "not targeted", "significant objective" and "main objective", respectively. These are underpinned by detailed criteria (established during identification/formulation) for justifying the scores based on the projects' objectives and documentation.

53. Delivery Mechanisms: The DAC markers are applied once the project or programme has been validated, i.e. the project document has been approved by the COOP-MoFEA. However, these markers are considered at the identification stage of the project, in order to integrate environmental, climate and gender considerations from the outset.

54. Allocation Channels: the gender, environment and Rio markers guide decision-making on the allocation of funds, ensuring that financial resources are directed to projects that have been formulated or adapted to address relevant gender, climate and environmental concerns. For example, a project that contributes to sustainable forest management may qualify for multiple Rio markers that address biodiversity, climate mitigation and desertification.

    Practical examples:
    - Projects that secure land rights to avoid land-use changes that could increase GHG emissions have received a DAC mitigation marker (value 1).
    - Initiatives that increase the resilience of rural communities and ecosystems to climate change have received an adaptation marker (value 1 or 2).

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20 https://cooperation.gouvernement.lu/fr/publications/brochure-livre/minist-affaires-etrangeres-europeennes/dir-cooperation-action-humanitaire/strategies-et-orientation/2023/marquage-cad-ocde.html.

- Gender-specific markers are applied to projects that, for example, improve girls' access to education or promote gender equality in health services.

55. In summary, the specific indicators, delivery mechanisms and allocation channels within the tracking system are well aligned with the DAC marker system, ensuring that ODA support to non-Annex I countries is accurately recorded, monitored and reported, in line with Luxembourg's commitment to transparency and accountability within international development cooperation frameworks.

V.A.2 DESCRIPTION OF CHALLENGES AND LIMITATIONS

56. There is room for further improvements in defining, measuring and reporting on the impacts of the climate actions supported such as reduction of CO_2 emissions and/or increase in climate change resilience.

57. It is recognized that tracking and measuring climate finance based on Environment and Rio markers is an approximation at best and therefore not perfect. In the absence of a generally accepted definition of ICF, the Luxembourg ICF programme uses both, the joint approach to monitoring climate financing of multilateral development banks (MDBs) and the OECD DAC Rio Markers for Climate.

58. With regards to using the OECD methodology for measuring and reporting of mobilized private finance, Luxembourg would like to highlight that the OECD methodology does not take into account technical assistance provided to beneficiaries that may impact subsequent private investment activity or private capital flows. Such activities can be referred to as catalysing or enabling private capital mobilisation and extend beyond the scope of the OECD definitions. Luxembourg supports with ICF a number of financing facilities that offer funds for private sector project preparation as well as the preparation for the establishment of climate funds or other financing vehicles with private sector participation. There are currently no generally accepted methodologies to report such catalysing or enabling activities, besides some industry collaboration efforts to agree on definitions and approaches.[21]

[21] https://www.publishwhatyoufund.org/app/uploads/dlm_uploads/2024/10/What-Works.pdf.

V.A.3 INFORMATION ON EXPERIENCE AND GOOD PRACTICES IN RELATION TO PUBLIC POLICY AND REGULATORY FRAMEWORKS TO INCENTIVIZE FURTHER PRIVATE CLIMATE FINANCING AND INVESTMENT

59. Luxembourg's financial centre is developing fast into an internationally recognized leading hub for sustainable finance. The *Luxembourg Sustainable Finance Roadmap* (LSFR) developed in 2018 in close collaboration between the MECB and the MFIN, specifies actions to foster a sustainable finance ecosystem in Luxembourg and offers a key reference point for engagement.

60. In 2021, Luxembourg adopted its first Sustainable Finance Strategy and launched its implementing organisation, the *Luxembourg Sustainable Finance Initiative* (LSFI).[22] The Luxembourg Sustainable Finance Strategy has been updated in February 2025[23] to reflect the recent developments in Luxembourg and beyond.

61. While preparing the national path for the transformation of its financial sector, Luxembourg seeks to offer its expertise and capacity building to help developing countries who wish to set equally ambitious objectives. With that perspective, Luxembourg's ICF strategy is oriented towards existing and new financial instruments that strengthen the focus on climate interventions in developing countries and leverage new funding, including from private sources. Special focus is put on collective investment vehicles and financial risk mitigation structures for low carbon and resilient infrastructure for sustainable cities, clean energy production and efficient use, nature-based solutions as well as wider measures aimed at realizing NDC commitments. Under the ICF strategy, the mobilisation of private sector funding is indeed a selection criterion in the allocation of ICF.

62. The selection of instruments can have a determining effect on the amount of private sector finance leveraged, depending on the projects' local and sectoral context and needs in different stages of the investment cycle. In order to mobilize private investment at scale, it is important to identify the unique investment criteria and barriers faced by different private sector segments in order to offer the appropriate de-risking support or risk/return enhancement for private sector investments.

63. Over the past few years, a great number of activities were launched in the field of climate and sustainable finance to leverage private sector funding in the areas of adaptation and mitigation, and targeting activities that can become investable and bankable: e.g.,
    - the Luxembourg-EIB Climate Finance Platform[24] (LCFP), a de-risking mechanism for private investments (supported by MECB and MFIN);

22 https://lsfi.lu/.

23 https://lsfi.lu/wp-content/uploads/2025/03/FINAL-EN-LSFI-Luxembourg-SF-Strategy-2030-2.pdf.

24 https://www.eib.org/en/products/mandates-partnerships/donor-partnerships/trust-funds/luxembourg-climate-finance-platform

- the Forestry and Climate Change Fund[25] (FCCF), a pioneering impact fund aiming at sustainable forestry within secondary and degraded tropical forests (supported by COOP-MoFEA, MECB and MFIN);
- the Luxembourg International Climate Finance Accelerator[26] (ICFA), a public-private partnership set up to support new and innovative climate finance fund managers (supported by MECB and MFIN);
- the Restoration Seed Capital Facility[27] (RSCF), a technical assistance facility to co-finance the development and establishment of new investment funds and support pipeline and project development for existing funds that invest in Forest Landscape Restoration (supported by MECB);
- the City Climate Finance Gap Fund,[28] an early-stage project incubator to turn resilient low-carbon ideas in urban contexts into strategies and finance-ready projects (supported by MECB);
- the Global Trust Fund on Sustainable Finance Instruments (GTF) - Scaling-up Thematic Bond Markets in Developing Countries, an innovative approach to mobilize capital markets to close the NDC and SDG financing gap (supported by COOP-MoFEA, MECB and MFIN);
- the Green Earth Impact Fund[29] (GEIF) allows professional private clients to invest in a diversified portfolio of funds targeting climate change, water protection, and biodiversity in emerging markets, and to benefit from de-risking mechanisms (supported by MFIN);
- the Resilient Landscapes Luxembourg[30] (RLL) launched in 2023, an innovative project incubator to design science-based high-quality Nature-based Solution projects that are investment-ready (supported by MECB).

V.A.4 EFFORTS TAKEN TO ENHANCE COMPARABILITY AND ACCURACY OF INFORMATION REPORTED ON FINANCIAL SUPPORT PROVIDED AND MOBILIZED THROUGH PUBLIC INTERVENTIONS, SUCH AS THROUGH USE OF INTERNATIONAL STANDARDS OR HARMONIZATION WITH OTHER COUNTRIES, INSTITUTIONS, AND INTERNATIONAL SYSTEMS

64. As already outlined in *Section V.A.2*, Luxembourg uses international standards and definitions in order to provide the most accurate information while reporting on its climate finance support.

25 https://fccf.lu/
26 https://www.icfa.lu/
27 https://restorationfacility.org/.
28 https://www.citygapfund.org/.
29 https://innpact.com/references/green-earth-impact-fund/.
30 https://resilient-landscapes.org/rl-luxembourg/.

65. The MECB uses two leading and mutually compatible methodologies to define and categorise the scope of its ICF: the Climate Components Methodology based on the MDB-IDFC Common Principles for Climate Finance Tracking and the OECD Rio Marker methodology.

66. The COOP-MoFEA's tracking system for ODA integrates specific indicators that are directly aligned with the five environmental and climate markers identified by the OECD/DAC.

V.A.5 INFORMATION, IF AVAILABLE, ON NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS FOR THE PROVISION OF TECHNOLOGY DEVELOPMENT AND TRANSFER AND CAPACITY-BUILDING SUPPORT

67. There are no specific national circumstances and institutional arrangements for the provision of technology development and transfer and capacity-building support. The same circumstances and arrangements as for the provision of financial support apply.

V.B – Underlying assumptions, definitions and methodologies

68. In line with the MPGs, and to enhance the transparency of reporting, this section provides a description of the underlying assumptions, methodologies, and definitions, as applicable, used to identify and/or report the financial, capacity development and technology development and transfer support.

V.B.1 DESCRIPTION OF THE UNDERLYING ASSUMPTIONS, METHODOLOGIES, AND DEFINITIONS FOR THE CURRENT REPORTING

69. This section provides information in relation to the different MPGs/questions in sub-sections (a) – (t) below.

(a) The chosen reporting year (calendar year, fiscal year)

Luxembourg reports its support based on calendar years (January-December).

(b) The conversion between domestic currency and United States dollars

According to OECD operational exchange rate:

- For year 2021: 1 USD = 0.8456 EUR
- For year 2022: 1 USD= 0.9509 EUR

(c) The status (committed, disbursed)

The status of Luxembourg's climate finance reported is as follows:

- For ICF:
  - Disbursed: amount disbursed (provided) per year (2021 or 2022)
  - Committed: new commitments per year (2021 or 2022) – only reported once for each project or activity, whereas disbursements related to these commitments can occur at a later stage (post2021 or post2022)
- For climate-related ODA:
  - Disbursed: amount disbursed (provided) per year (2021 and 2022)
  - Committed: amount committed per year (2021 and 2022)

(d) The channel (bilateral, regional, multi-bilateral, multilateral)

The channel of Luxembourg's climate finance reported is described as follows:

- Bilateral flows are provided directly to another country (through implementing partners or NGOs). (→ cf. CTF Table III.1)
- Regional flows are provided to a specific region, consisting of different countries (through implementing partners or NGOs). (→ cf. CTF Table III.1)

- Multi-bilateral/-regional flows are channelled through multilateral agencies but earmarked for specific countries or regions. (→ cf. CTF Table III.1)
- Multilateral flows are channelled through multilateral agencies and/or trust funds with a global reach that can allocate these flows at their discretion in accordance with agreed rules and procedures. (→ cf. CTF Table III.2)

(e) The funding source (official development assistance (ODA), other official flows (OOF), other)

The source of Luxembourg's climate finance is described as follows:

- ODA: Climate-related ODA as defined by OECD/DAC.
- OOF (ICF): ICF as defined in the 2021-2025 ICF Strategy.
- OOF (ICF*): ICF provided by the MFIN "sustainable finance budget".

(f) The financial instrument (e.g., grant, concessional loan, non-concessional loan, equity, guarantee, insurance, other (specify))

Luxembourg's public ODA and ICF are mainly provided as grants and in some cases as loans or first-loss guarantees.

(g) Information on instruments and funding sources reported, including how a Party has determined finance to be concessional and/or ODA, including by using information such as grant equivalency, institution and/or instrument-based approaches

Please refer to sections (e) and (f) above.

(h) The type of support (e.g., adaptation, mitigation, cross-cutting)

Luxembourg is providing support to climate change adaptation (e.g. projects with a clear and direct link between the climate vulnerability context and the specific project activities) and/or mitigation (limiting of GHGs, protection and/or enhancement of natural carbon sinks and reservoirs, institution building, strengthening the regulatory and policy framework, activities that are compatible with low-emissions pathways…) activities. In some cases, the adaptation and mitigation components cannot be easily separated within the same project. In this case, the project is categorised as cross-cutting.

(i) The sector

For the purposes of this report, Luxembourg uses the classification of sectors in line with the OECD DAC Creditor Reporting System (CRS). When none of the proposed sectors is suitable, Luxembourg uses "Other (sector)".

(j) The subsector.

Luxembourg is using the 5-digit OECD/DAC CRS purpose code[31] for the subsector identification of its ODA funding.

[31] https://webfs.oecd.org/oda/DataCollection/Resources/DAC-CRS-CODES.xls.

The MECB does not classify the ICF supported activities as OECD DAC Rio climate markers but rather applies its definitions and their meaning in the review process of ICF applications. For the purposes of this report, the MECB attributed the 5-digit OECD/DAC CRS purpose code for the subsector identification of its ICF.

(k) Whether it supported capacity-building and/or technology development and transfer objectives

Technology development and transfer and capacity-building in developing countries form an integral part of many activities supported by Luxembourg's climate-related ODA and ICF. Given the multitude of activities and the variation in types and scope of capacity and technology development activities, and in the absence of common markers, activities have, based on a project-by-project review, been identified to contribute to capacity and/or technology development and transfer.

(l) The support as being climate specific

In terms of bilateral finance, Luxembourg's ICF support is considered 100% climate-specific, while its ODA is not necessarily so. When a specific link between an ODA project and climate is established, a DAC mitigation or adaptation marker is assigned.

In terms of multilateral finance, Luxembourg's ICF support is considered to be mainly climate specific. Luxembourg reports its climate specific ICF contribution to specific multilateral climate funds and initiatives, such as for example, the Green Climate Fund or the City Climate Finance Gap Fund.

(m) Information on the efforts taken to avoid double counting

Luxembourg reports public climate finance on the basis of inflows. Hence there is no risk of double counting with support provided by other countries.

(i) Information on how double counting among multiple Parties involved in the provision of support was avoided.

As indicated above, since Luxembourg is reporting on the basis of inflows, double counting of public climate finance among multiple parties is avoided.

(ii) Information on how double counting among multiple Parties involved in the mobilization of private finance through public interventions was avoided, including the methodologies and assumptions used to attribute the mobilized resources through public interventions reported to the Party that reports them, if possible relative to the type of instrument used for the mobilization.

Luxembourg is currently in the process of defining its methodology for measuring and reporting on mobilised private finance. Luxembourg will only report the mobilised private finance that can be attributed to Luxembourg, the amounts contributed by other public actors will not be taken into consideration. Within this calculation, Luxembourg will probably mainly follow the agreed OECD methodologies, with the caveats outlined under Section V.A.2.

Where agreed OECD methodologies do not prove adequate for activities financed by the ICF, the MDB Reference Guide on how Multilateral Development Banks (MDBs) and European Development Financing Institutions (EDFIs) calculate and report on private investment mobilization might be taken into account.

The applied methodology will be clearly stated in the BTR2, CTF reporting Table III.3.

At the same time Luxembourg follows the progress on the development of internationally agreed methodologies to take into account the funding of activities that catalyse and enable the mobilisation of private capital.

(iii) Information on how double counting was avoided between the resources reported as provided or mobilized, and the resources used under Article 6 of the Paris Agreement by the acquiring Party for use towards the achievement of its NDC.

Please refer to sections (i) and (ii) above.

(iv) How support is attributed between multiple recipient countries, in cases where a project involves multiple recipient countries and where this information is reported on a country-by-country basis.

Since the support to projects involving multiple countries is not reported on a country-by-country basis but on the basis of total disbursements for the projects as a whole, there is no risk of double counting.

(n) The definition of public and private finance, in particular where entities or funds are mixed

Public finance for international climate action support is provided by two distinct sources of funding and administered by two ministries:

- The MECB is responsible for the programming and planning of Luxembourg's International Climate Finance (ICF) budget.
- The COOP-MoFEA is responsible for the programming and planning of Luxembourg's Official Development Assistance (ODA).

In recent years, the Ministry of Finance (MFIN), often in partnership with the MECB (but not only), has contributed to climate change projects and programmes in developing countries through its "sustainable finance budget". For the purposes of this report, climate-specific contributions made by the MFIN are considered as ICF, while contributions made by the MFIN to multilateral channels, such as the GEF for example, are considered as ODA.

Luxembourg is currently in the process of defining its methodology for measuring and reporting on mobilised private finance. Luxembourg will only report the mobilised private finance that can be attributed to Luxembourg, the amounts contributed by other public actors will not be taken into consideration. Within this calculation, Luxembourg will probably follow mainly the agreed OECD methodologies, with the caveats outlined under Section V.A.2.

Where agreed OECD methodologies do not prove adequate for activities financed by the ICF, the MDB Reference Guide on how Multilateral Development Banks (MDBs) and European Development Financing Institutions (EDFIs) calculate and report on private investment mobilization might be taken into account.

The applied methodology will be clearly stated in the BTR2, CTF reporting Table III.3.

(o) How private finance was assessed as mobilized through public interventions

(i) Identify a clear causal link between a public intervention and mobilized private finance, where the activity would not have moved forward, or moved forward at scale, in the absence of the Party's intervention.

For all interventions, but specifically for commercial business and private sector investments, projects and programs, an additionality analysis is required at the investment level to assess what form of support is needed and appropriate. This analysis is done to ensure that the support meets the test of additionality – the

measure in question would not be implemented to the proposed extent without the support – and does not crowd out other private or public investments.

To ensure additionality and to be eligible for ICF funding, applicants must demonstrate (a) that the commercial projects/programs in question are economically and financially sound, and at the same time, that (b) the need for concessional support exists (see description of barriers in the strategy).

(ii) *Provide information on the point of measurement (e.g. point of commitment, point of disbursement) of the private finance mobilized as a result of the public intervention, to the extent possible in relation to the type of instrument or mechanism used for the mobilization.*

Luxembourg will be using the commitment stage when reporting on mobilized private finance as a result of public intervention.

(iii) *Provide information on the boundaries used to identify finance as mobilized by public intervention.*

The instruments that are most commonly used by ODA and ICF for mobilizing private finance are simple grants for co-financing arrangements. In some cases, ICF funding is provided through shares in collective investment vehicles (through first loss capital tranches).

(p) How it seeks to ensure that support provided and mobilized through public interventions effectively addresses the needs and priorities of developing country Parties for the implementation of the Paris Agreement, as identified in country-driven strategies and instruments, such as biennial transparency reports, NDCs and national adaptation plans

- **Luxembourg's International Climate Finance (ICF)**

One of the five eligibility criteria of the ICF strategy is "Alignment with host country climate strategies and NDCs", which includes the analysis of national priorities, political will, and the needs of the beneficiaries. Political will and coherence of activities with national climate change measures, regulations and planning are of great importance. It is suggested to assess all ICF activities according to the criteria of national priority, political will/host country ownership, funding need, vulnerability of beneficiaries.

Luxembourg's ICF strategy is guided by the principles and approaches defined in the Paris Agreement. It recognises, in particular, the principle of country-driven assistance. That means, as countries make their own choices concerning the nationally determined contributions (NDCs) and identify their climate change priorities, targets and implementation pathways, Luxembourg seeks to give support to those interventions which are anchored in and aligned with these national choices of the target countries. A country's NDC as well as national adaptation plans and strategies and other national policies with a direct climate change impact are of specific relevance.

While the alignment with host country priorities is essential, this requirement is not restrictive in the sense that only those elements explicitly referred to in an NDC would be supported and only to the level of ambition reflected therein. On the contrary, measures that seek to realise an additional premium in or on mitigation and/or adaptation benefits, and that generally reflect a higher level of ambition, are encouraged under the Luxembourg ICF strategy, as long as they fit into a country's broader strategic framework and do not run counter to specific policies and country choices. In practice, applicants for ICF support will need to provide evidence of the positive strategic (country-led) framework, including - where appropriate - by providing relevant letters of support from government agencies.

- **Luxembourg's Official Development Assistance (ODA)**

When it comes to climate-related ODA, each bilateral programme begins with an identification phase to match Luxembourg expertise with needs on the ground, under the umbrella of their national development and climate plans. National and local authorities, as well as beneficiaries, are directly involved in this phase. In the formulation phase, for which Luxembourg's cooperation agency LuxDev is being commissioned, an operational guide[32] is applied. This guide was developed in parallel with the COOP-MoFEA's and the NGO's environment and climate tools. Although the requirements are less stringent for NGOs, the COOP-MoFEA nevertheless requires that their programmes and projects be formulated at the request of, and with, a local partner, who will also play a leading role in implementing the project.

Since 2021, Luxembourg applies a whole-of-government approach, so that the various forms of support are coherent and tailored to the ambitions of the partner country. Example: in Cabo Verde, a programme is being implemented with the support of three LU ministries (Indicative Cooperation Programme – Development-Climate-Energy [PIC DCE]).

(q) How it seeks to ensure that support provided and mobilized through public interventions is in line with the long-term goals of the Paris Agreement

Coalition Agreement 2023-2028:[33]

- Sets the Government's priorities and policy directions for the period. It outlines the Government's commitment to step up its efforts to combat global warming and take all the necessary measures to comply with the Paris Agreement and meet national and European climate targets as quickly as possible.
- For development cooperation, it emphasizes:
    - Strengthening commitments to international climate finance.
    - Prioritizing projects that align with the Paris Agreement objectives, including reducing greenhouse gas emissions and enhancing climate resilience.
    - Reduce the vulnerability of populations to the effects of climate change by improving their socio-economic resilience.
    - Include cooperation policy in the implementation of the United Nations' Agenda 2030 and the achievement of sustainable development objectives.
    - Intensify cooperation in the field of climate and environmental protection with partner countries.
    - Create synergies in renewable energies, in particular renewable hydrogen.
    - Develop private sector capabilities and strengthen fair trade and equal relations with partner countries.
    - A platform of actors with expertise in emergency aid and the establishment of a humanitarian stockpile and logistical arrangements for emergency response, particularly with a view to building capacity to respond to climate and environmental disasters in vulnerable countries.

32 https://luxdev.lu/sites/default/files/upload/media/document/2025-04/Guide_ope%CC%81rationnel_Inte%CC%81gration_des_the%CC%81matiques_environnement_et_changement_climatique1.pdf.

33 https://gouvernement.lu/dam-assets/documents/dossier/formation-gouvernement-2023/accord-coalition.pdf.

Development Cooperation Strategy (2018-2023):[34]

- Defines the environmental sustainability as a mainstreaming theme of the Luxembourg Cooperation to support efforts to achieve sustainable development through a holistic and multi-dimensional approach.
- This objective, which relates to ODA, is part of Luxembourg Development Cooperation's central mission of poverty eradication. It is thus additional to the other resources made available by Luxembourg to combat climate change in developing countries, particularly through the MECB's ICF (principle of additionality of funds). This objective is also consistent with the country's broader commitment to strengthen its support of international climate finance.

LU Cooperation Strategy: Environment and Climate Change:[35]

- Outlines Luxembourg's commitment to integrating environment and climate issues into its cooperation activities. It highlights the need to:
    - Contribute to the establishment of sustainable energy, food and water supply systems that are resilient to climate risks, in order to ensure the provision of sustainable, reliable, accessible and affordable basic services to all segments of the population.
    - Identify and support the development of environmental and green value chains, which create jobs and value.
    - Encourage the sustainable management of natural resources, in particular through supporting the establishment of sustainable and agro-ecological production systems for the benefit of small farmers, thereby contributing to food security among local communities. It will also encourage the valuation of natural resources through the development of environmentally friendly and income-generating value chains, which could particularly target women, helping to empower them.
    - Support inclusive sectoral and territorial governance, taking into account the national commitments of partner countries on major environmental and climate issues.
- This strategy ensures that all development projects consider their environmental impact and contribute positively to climate goals.

Guidance and Operational Frameworks:

- LU provides specific tools[36] to its development agency, NGOs, other partners, on incorporating environmental and climate issues into every step of project cycle management, in a crosscutting approach with the gender equality issues. Tools and checklists ensure that development projects are consistent with the Paris Agreement goals.

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34 https://cooperation.gouvernement.lu/content/dam/gouv_cooperation/publications/strat%C3%A9gies/strategie-generale/Strat%C3%A9gie-MAEE-EN.pdf.

35 https://cooperation.gouvernement.lu/dam-assets/publications/strat%C3%A9gies/strategie-environnement/2021-2023-environement-an-climate-change-strategy-en.pdf.

36 https://cooperation.gouvernement.lu/en/cooperation-au-developpement/thematiques-transversales/durabilite-environnementale.html.

Luxembourg's 2021-2025 ICF Strategy

In accordance with the objectives of Article 2 of the Paris Agreement, Luxembourg's ICF strategy aims at strengthening the global response to the threat of climate change, in the context of sustainable development, by assisting developing countries with measures directed at:

- Holding the increase in global average temperatures to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
- Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
- Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

The specific support Luxembourg provides is directed at interventions across the spectrum of mitigation and adaptation measures in developing countries with a number of key priorities. The priorities have been selected for their potential to achieve significant mitigation and adaptation impacts, their synergetic value of integrating wider benefits in the context of achieving the Sustainable Development Goals (SDGs) and their ability to leverage additional climate finance from the private sector.

The selected funding themes are:

- Natural capital, biodiversity, forestry & land-use
- Clean air and water resources
- Resource efficiency and waste management
- Support for transparency requirements of the Paris Agreement
- Leveraging and mainstreaming climate and sustainable finance
- Climate change induced migration

Generally, Luxembourg puts a strong emphasis on activities that are promising for mobilizing financing from the private sector. It is assumed, but not required, that such activities are predominantly located in more advanced developing countries equipped with an appropriate enabling environment, policies and a strong recognition of the rule of law that attract private sector investments. For measures meant to enhance sustainable finance flows (Art. 2.1.c Paris Agreement), there is no geographic or income-dependent country scope per se; however, such measures need to target regions or countries with a clear strategic vision and aptitude for transformational change in this regard and which demonstrate a strong willingness to introduce relevant reforms for green finance.

(r) An indication of what new and additional financial resources have been provided, and how it has been determined that such resources are new and additional

Luxembourg upholds the principle of "additionality" between ODA and ICF. Indeed, the poverty eradication challenge is made more complex due to climate change impacts, especially in developing countries, and therefore calls for additional financial means on top of existing ODA commitments. Luxembourg, through its COOP-MoFEA, is committed to delivering 1% of its GNI as ODA.

Consequently, "new and additional" means that the resources that Luxembourg commits to deliver are not taken over from earlier commitments and are thus "new". "Additional" means that they come "on top of" Luxembourg's ODA commitments and thus are not "double counted" or draining on other resources dedicated to poverty eradication.

In the run-up to COP21, Luxembourg made the commitment to provide a total amount of EUR 120 million for ICF from 2014 to 2020. The disbursements of the funds were in accordance with Luxembourg's strategy for the allocation of Luxembourg's ICF pledge. The strategy called "*Attribution des fonds pour le financement international de la lutte contre le changement climatique*" was finalized and published in the first half of 2017 [MDDI-DEV (2017)].

In 2021, Luxembourg adopted a revised ICF strategy for the years 2021-2025 and committed a new financial envelope of EUR 200 million for that same period. An additional EUR 20 million was pledged at the Glasgow COP26 in 2021, elevating Luxembourg's total projected level of ICF to 220 million euros for the period 2021 to 2025.

The Luxembourg ICF pledge is delivered through Luxembourg's CEF (under the authority of the MECB). As of today, a total budget of approximately EUR 300 million of the whole ICF envelope (EUR 340 million; 2014-2025) has been committed. In the run-up to COP29 and the anticipated announcement of the New Collective Quantified Goal on Climate Finance (NCQG), Luxembourg approved a more ambitious ICF budget of EUR 320 million for the next commitment period 2026-2030.

In the absence of a generally accepted definition of ICF, the Luxembourg ICF programme uses both, the joint approach to monitoring climate financing of multilateral development banks (MDBs) and the OECD Development Assistance Committee (DAC) Rio markers for climate (MC).

In recent years, the Ministry of Finance (MFIN), often in partnership with the MECB (but not only), has contributed to climate change projects and programmes in developing countries through its "sustainable finance budget". For the purposes of this report, climate-specific contributions made by the MFIN are considered as ICF, while contributions made by the MFIN to multilateral channels, such as the GEF for example, are considered as ODA.

Table V.B.1-1 provides an overview of climate-specific public funding committed and provided to developing countries in 2021 and 2022.

TABLE V.B.1-1 – OVERVIEW OF CLIMATE-SPECIFIC FUNDING TO DEVELOPING COUNTRIES IN 2021 AND 2022 (IN MILLIONS OF EUR)

Source	Committed		Provided (disbursed)	
	2021	2022	2021	2022
International climate finance (ICF)	10.07	46.55	30.33	35.40
Climate-related ODA	29.05	26.51	29.05	26.51
Total	**39.12**	**73.06**	**59.38**	**61.91**

Sources: MECB, COOP-MoEFA, MFIN.

A summary of the total provision of climate-specific public funding to developing countries for the period 2015–2022 is provided in Table V.B.1-2 below.

TABLE V.B.1-2 – TOTAL OF CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES FROM 2015 - 2022 (IN MILLIONS OF EUR)

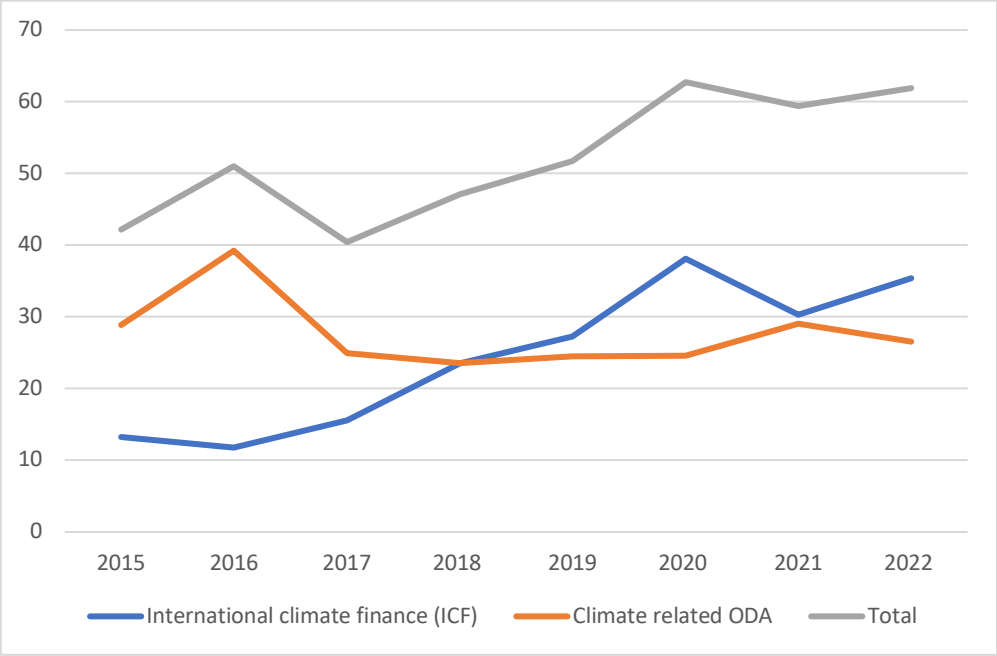
	2015	2016	2017	2018	2019	2020	2021	2022
International climate finance (ICF)	13.27	11.77	15.53	23.50	27.25	38.11	30.33	35.40
Climate-related ODA	28.88	39.23	24.90	23.55	24.48	24.62	29.05	26.51
Total	**42.15**	**51.00**	**40.43**	**47.05**	**51.73**	**62.73**	**59.38**	**61.91**

Sources: MECB, COOP-MoEFA, MFIN.

(s) How the information provided reflects a progression from previous levels in the provision and mobilization of finance under the Paris Agreement

The following figure provides an overview of the progression of Luxembourg's climate-specific contributions provided to developing countries from 2015 to 2022.

FIGURE V.B.1-1 – PROGRESSION OF LUXEMBOURG'S CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES FROM 2015 - 2022 (IN MILLIONS OF EUR)



Sources: MECB, COOP-MoEFA, MFIN.

(t) Information on reporting on multilateral finance

Additional information on reporting on multilateral finance is provided per sub question as follows:

(i) Information on whether the multilateral finance reported is based on the Party's inflow contribution to a multilateral institution and/or on the Party's share in the outflow of the multilateral institution.

Multilateral finance reported by Luxembourg is based on its contribution (inflow) to the respective multilateral institutions.

(ii) Information on whether and how multilateral finance has been reported as climate-specific and how the climate-specific share was calculated, including by, for example, using existing international standards.

Luxembourg reports its multilateral finance as "core/general" and "climate-specific" contributions.

(iii) Information on whether multilateral finance has been reported as core/general, with the understanding that the actual climate finance amount it would transfer into depends on the programming choices of the multilateral institutions.

Support to multilateral institutions and organisations that is not climate-specific, is reported as core/general contributions.

(iv) Information on whether and how multilateral finance has been attributed to the reporting Party.

As indicated above, attribution to Luxembourg of public climate finance is calculated as being the funds provided (inflow) to the multilateral institution.

V.B.2 DESCRIPTION OF THE UNDERLYING ASSUMPTIONS, DEFINITIONS AND METHODOLOGIES USED TO PROVIDE INFORMATION ON TECHNOLOGY DEVELOPMENT AND TRANSFER AND CAPACITY-BUILDING SUPPORT

70. Technology development and transfer and capacity-building support is integrated in most of Luxembourg's ICF and ODA activities (especially in bilateral projects).

71. There are no specific assumptions, definitions and methodologies specifically used to provide information on technology development and transfer and capacity-building support. The information included in CTF Tables III.4 and III.5 are projects with a strong capacity-building and/or technology development and transfer component, as identified by the project-level information of these projects. A more detailed description of some project examples is provided under *Sections V.D & V.E*.

V.C – Information on financial support provided and mobilized under Article 9 of the Paris Agreement

72. Luxembourg works with a wide range of global, regional, national and local partners including governmental institutions, multilateral organisations and funds, private sector organisations, knowledge and research institutes, and non-governmental organisations (NGOs) to support climate action in developing countries.

V.C.1 BILATERAL, REGIONAL AND OTHER CHANNELS

73. Total climate-specific contributions provided through bilateral and regional channels amount to EUR 38.4 million in 2021 and EUR 38.1 million in 2022 *[→ Table V.C.1-1]*. CTF Tables III.1_2021 and Table III.1_2022 provide a detailed overview of Luxembourg's bilateral and regional climate finance contributions for the years 2021 and 2022 (in both EUR and USD).

TABLE V.C.1-1 – OVERVIEW OF CLIMATE-SPECIFIC CONTRIBUTIONS COMMITTED AND PROVIDED TO DEVELOPING COUNTRIES THROUGH BILATERAL AND REGIONAL CHANNELS FOR THE YEARS 2021 AND 2022 (IN MILLIONS OF EUR)

Source	Committed		Provided (disbursed)	
	2021	2022	2021	2022
International climate finance (ICF)	10.07	16.55	9.33	13.15
Climate-related ODA	29.05	24.95	29.05	24.95
Total	**39.12**	**41.50**	**38.38**	**38.10**

Sources: MECB, COOP-MoEFA, MFIN.

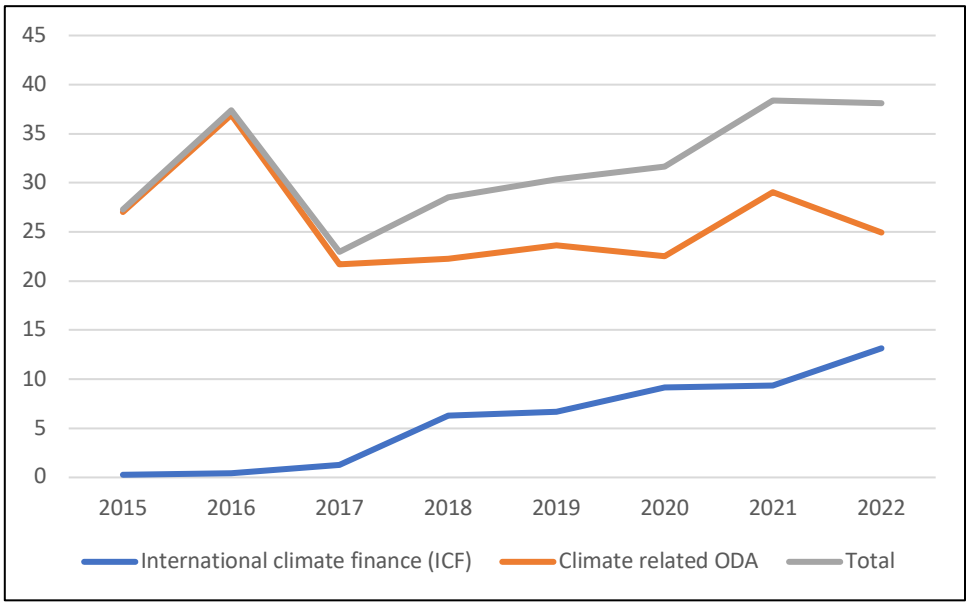
74. A summary of the total provision of climate-specific public finance contributions through bilateral and regional channels for the period 2015–2022 is provided in *Table V.C.1-2* and *Figure V.C.1-1* below.

TABLE V.C.1-2 – TOTAL OF CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES THROUGH BILATERAL AND REGIONAL CHANNELS FOR THE YEARS 2015 - 2022 (IN MILLIONS OF EUR)

	2015	2016	2017	2018	2019	2020	2021	2022
International climate finance (ICF)	0.27	0.46	1.27	6.28	6.70	9.15	9.33	13.15
Climate-related ODA	27.00	36.92	21.70	22.27	23.64	22.52	29.05	24.95
Total	**27.27**	**37.38**	**22.97**	**28.55**	**30.34**	**31.67**	**38.38**	**38.10**

Sources: MECB, COOP-MoEFA, MFIN.

FIGURE V.C.1-1 – PROGRESSION OF LUXEMBOURG'S CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES THROUGH BILATERAL AND REGIONAL CHANNELS FOR THE YEARS 2015 - 2022 (IN MILLIONS OF EUR)



Sources: MECB, COOP-MoEFA, MFIN.

V.C.2 MULTILATERAL CHANNELS

75. Total climate-specific contributions provided through multilateral channels amount to EUR 21.00 million in 2021 and EUR 23.81 million in 2022 *[→ Table V.C.2-1]*. CTF Tables III.2_2021 and Table III.2_2022 provide a detailed overview of Luxembourg's multilateral climate finance contributions for the years 2021 and 2022 (in both EUR and USD).

TABLE V.C.2-1 – OVERVIEW OF CLIMATE-SPECIFIC CONTRIBUTIONS COMMITTED AND PROVIDED TO DEVELOPING COUNTRIES THROUGH MULTILATERAL CHANNELS FOR THE YEARS 2021 AND 2022 (IN MILLIONS OF EUR)

Source	Committed		Provided (disbursed)	
	2021	2022	2021	2022
International climate finance (ICF)	0.00	30.00	21.00	22.25
Climate-related ODA	0.00	1.56	0.00	1.56
Total	**0.00**	**31.56**	**21.00**	**23.81**

Sources: MECB, COOP-MoEFA, MFIN.

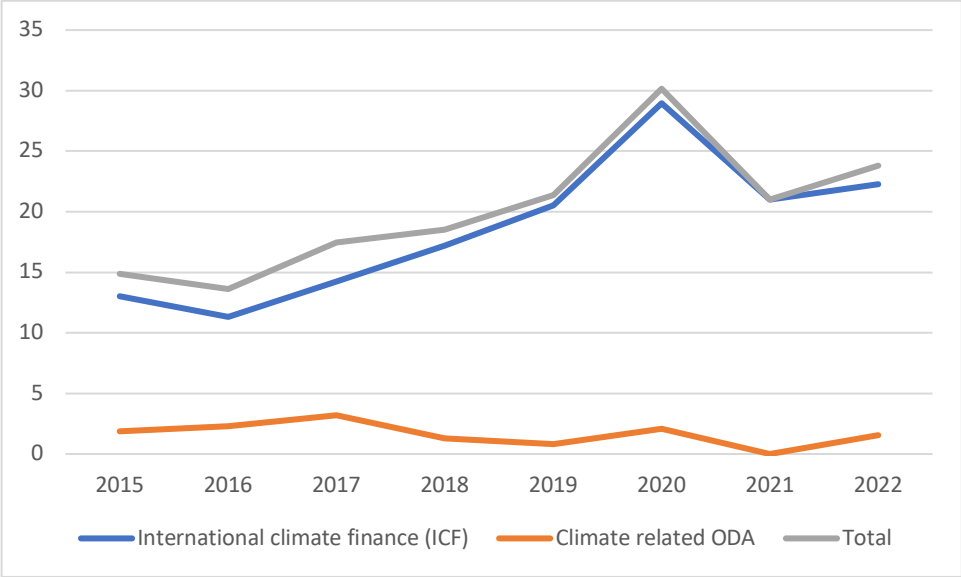
76. A summary of the total provision of climate-specific public finance contributions through multilateral channels for the period 2015–2022 is provided *Table V.C.2-2* and *Figure V.C.2-1* below.

TABLE V.C.2-2 – TOTAL OF CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES THROUGH MULTILATERAL CHANNELS FOR THE YEARS 2015 - 2022 (IN MILLIONS OF EUR)

	2015	2016	2017	2018	2019	2020	2021	2022
International climate finance (ICF)	13.00	11.32	14.26	17.21	20.55	28.96	21.00	22.25
Climate-related ODA	1.88	2.30	3.20	1.29	0.84	2.10	0.00	1.56
Total	**14.88**	**13.62**	**17.46**	**18.50**	**21.39**	**30.16**	**21.00**	**23.81**

Sources: MECB, COOP-MoEFA, MFIN.

FIGURE V.C.2-1 – PROGRESSION OF LUXEMBOURG'S CLIMATE-SPECIFIC CONTRIBUTIONS PROVIDED TO DEVELOPING COUNTRIES THROUGH MULTILATERAL CHANNELS FOR THE YEARS 2015 - 2022 (IN MILLIONS OF EUR)



Sources: MECB, COOP-MoEFA, MFIN.

Luxembourg's Official Development Assistance (ODA)

77. Cooperation with multilateral partners is an important component of Luxembourg's development cooperation policy, notably in the context of achieving the SDGs. In order to achieve a high degree of predictability, multilateral aid is principally delivered through multi-annual framework agreements.

78. The interventions of Luxembourg's development cooperation are firmly based on the four principles of effective development cooperation, i.e. ownership by the partner countries, focus on results, inclusive partnerships as well as transparency and mutual accountability. The principles of untied aid, predictability of funds through multi-annual indicative programmes, concentration in sectors where Luxembourg has a real added value and full alignment on the priorities and development strategies of our partner countries remain at the heart of Luxembourg's development cooperation. Over the past years, Luxembourg has made considerable progress in terms of aid transparency, in the use of country-led results frameworks

and has developed innovative means of implementation that fully respect and strengthen national public finance systems.

79. Following the summits in Rome, Paris and Accra, Luxembourg participated in 2016 at the second high-level meeting of the Global Partnership for Effective Development Cooperation in Nairobi. The conference enabled to take stock of the implementation of commitments in terms of development effectiveness and Luxembourg's development cooperation has in fact been used as an example in the brochure "*Effective Development Cooperation: Has the European Union delivered?*" [European Commission (2016)]. In the light of the commitments made in Nairobi and the new development paradigms agreed both at the international level – through Agenda 2030 and the Addis Ababa action programme on financing development – and at the European level – through the new European consensus on development – Luxembourg reviewed its "*Action plan for effective development cooperation*" that covers the years 2017 to 2019.

80. In 2022, the share of multilateral cooperation in the total ODA was 30.80 %[37] *[→ Table V.C.2-3]*.

TABLE V.C.2-3 – OVERALL MULTILATERAL COOPERATION FOR THE YEARS 2021 AND 2022 (IN EUR)

Institution	Total in EUR		% of multilateral ODA		% of total ODA	
	2021	2022	2021	2022	2021	2022
United Nations (Agencies, Programmes, etc.)	61 161 008	58 897 189	41 %	39 %	13 %	12 %
European Union	42 654 621	57 348 385	29 %	38 %	9 %	11 %
World Bank & IMF	19 760 000	21 330 000	13 %	14 %	4 %	4 %
Regional Development Banks	14 977 072	4 095 414	10 %	3 %	3 %	1 %
Other	9 437 240	7 495 022	6 %	5 %	2 %	1 %
Total	147 989 942	149 166 009	100%	100%	32 %	30 %

Source: COOP-MoFEA.

81. Luxembourg is represented in the "Global Environment Facility" (GEF) by its MFIN and has been a member of the GEF since 1997. Luxembourg's contributions to the GEF are considered ODA and are depicted below *[→ Table V.C.2-4]*.

TABLE V.C.2-4 – LUXEMBOURG'S FINANCIAL CONTRIBUTIONS TO THE GEF FOR THE YEARS 2015-2022 IN EUR

2015	2016	2017	2018	2019	2020	2021	2022
1 030 500	**952 400**	**904 500**	**862 350**	**1 164 500**	**1 195 450**	**1 192 550**	**1 196 800**

Source: MFIN.

37 It was 28.15% in 2019 and 28.42% in 2018.

Luxembourg's international Climate Finance (ICF)

82. Luxembourg continues to play an active role in the *Green Climate Fund* through its ICF commitment of EUR 35 million during the Initial Resource Mobilisation in 2014 and EUR 40 million at the First Replenishment in 2019 and EUR 50 million at the second replenishment in 2023. Luxembourg shares a GCF Board seat with the Netherlands and Denmark. In the GCF board, our priorities are focused on: mobilising private sector engagement and funding; maximizing the impact of the available funds; facilitating access to the fund and increase the efficiency of the GCF Board and Secretariat; enhancing access for the most vulnerable countries, such as Least Developed Countries (LDCs); strengthening ESG safeguards and gender policies; increasing the engagement with the civil society.

83. Over the years 2021 and 2022, Luxembourg contributed to the following multilateral organisations and global trust funds through its ICF budget: Green Climate Fund (climate-specific), WMO (core funding), UNEP (core funding and climate specific [Restoration Seed Capital Facility]), EIB (climate-specific [Luxembourg-EIB Climate Finance Platform, City Climate Finance Gap Fund]), Global Trust Fund on Sustainable Finance Instruments (climate-specific), Green Earth Impact Fund (climate-specific).

V.C.3 INFORMATION ON FINANCE MOBILIZED THROUGH PUBLIC INTERVENTIONS

84. As stated in the 2021-2025 ICF Strategy (pp.10, 34, 35), leveraging and mainstreaming climate and sustainable finance is one of the seven key funding themes of the ICF programme.

85. During the internal review process of ICF supported activities, the mobilisation of private sector funding is part of the seven selection criteria. While assessing this criterium the MECB is checking if the mobilisation of private funding is a clear objective/aim of the ICF activity, what is the level of private sector funding/finance that is expected to be mobilized, as well as how strong is the causal link between the supported ICF activities and the leveraged private finance and if there is a direct link or indirect link. If the mobilisation is a key objective of the proposed activity, the MECB requires that an appropriate mobilisation KPI is integrated into the log frame and will be part of the monitoring and reporting process. For activities that have a private sector finance leveraging focus, the MECB is also closer analysing the additionality requirement of support.

86. Some of the ICF funding is used in-directly e.g., for activities, which support the regulatory environment, capacity, and strategy development or technical assistance, which may lead to the mobilization of private finance. However, establishing the causal link in such cases is complex and often difficult to demonstrate.

87. Complete and consistent information is not always available from the ICF supported entities, information is often lacking on the strength of the direct link as well as pro-rata attribution information and we record what can we get from the ICF recipients. Due to the incompleteness of monitoring data, there is a reluctance to report this data officially towards the UNFCCC.

88. ICF is one of the priorities of the Government policy. Ambitious targets have been set at COP21 in Paris. It turns out that public investment will not be sufficient and that it is necessary that the latter constitutes a lever for the mobilization of other sources of financing, including financing from the private sector.

89. To this end, the "Climate Finance Task Force" (CFTF) has been convened early 2015, in an informal, interdisciplinary and multi-stakeholder format, bringing together representatives of the public sector and the private finance sector with the double aim to make a meaningful contribution to the international fight against climate change and advising the Government on ways to establish Luxembourg as an international centre for climate finance. The initial work of the CFTF was aiming at sensitizing the private sector partners to both the challenge of climate finance and the economic opportunities that come with serious investment mainly in economically viable infrastructure for the production of renewable energy around the world.

90. Luxembourg's ICF can use different funding instruments ranging from grants to first loss equity, guarantees and loans. During both funding periods 2014-2020 and 2021-2025, most ICF funding has been provided through grants. Grants have partially been placed into intermediaries or financial vehicles, which have used this capital to provide equity, guarantees or loans, generating reflows to these intermediaries (e.g. GCF contribution). Luxembourg also provided, in several cases directly and in-directly first loss and junior equity investments into themed impact funds (e.g. FCCF, LCFP).

91. Luxembourg's 2021-2025 ICF Strategy is oriented towards existing and new financial instruments that strengthen the focus on climate interventions in developing countries and leverage new and additional funding, including from private sources. Special focus is put on collective investment vehicles and financial risk mitigation structures for low carbon and resilient infrastructure for sustainable cities, clean energy production and efficient use, as well as wider measures aimed at realizing NDC commitments.

92. Worth mentioning initiatives related to sustainable and climate finance:
    - In September 2017, a Contribution Agreement between the Government and the European Investment Bank (EIB) has been signed, with the aim to implement a platform dedicated to climate finance, the *Luxembourg-EIB Climate Finance Platform* (LCFP). The objective of this joint initiative is, on the one hand, to finance innovative investment projects with high impact in the fight against climate change, and on the other, to increase the leverage effect on investments from the private sector by reducing the financial risk of private partners

investing in innovative climate action. An initial participation of 30 Mio. EUR for the years 2017-2019 had been secured.

In 2019, the Government decided to make available an additional funding of 40 Mio. EUR for the period 2020-2024. Those contributions are divided between the MECB and the MFIN. OECD method likely applicable.

- In October 2017, the Government, together with the *Banque et Caisse d'Epargne de l'Etat* (BCEE) and the *Banque Internationale à Luxembourg* (BIL) and the insurance company *Foyer*, and in collaboration with *Luxembourg Microfinance and Development Fund SICAV*, have launched the *Forestry and Climate Change Fund* (FCCF). This public-private partnership will provide financing for companies, communities and small farmers to manage secondary and degraded forests in the tropics. By creating the enabling environment for business models that allow the generation of revenues, deforestation can be stopped so to yield a substantial positive climate impact. A participation of 11.5 Mio. EUR over 5 years, divided between the MECB and the MFIN, has been made available. OECD method likely applicable.
- Since 2018, Luxembourg is supporting the *International Climate Finance Accelerator Luxembourg* (ICFA Luxembourg), which has been established to allow for small and innovative climate-related funds and asset managers to set up successfully in Luxembourg and attract private investment. The Accelerator has the form of a public-private partnership and is directly complementary to the LCFP. Funding is provided by the MECB and the MFIN. The ICFA provides training and coaching services as well as repayable grants for climate fund managers to set up their fund and raise capital. Contributions from Luxembourg are used to provide guarantees for working capital loans offered by the *Banque et Caisse d'Epargne de l'Etat* (BCEE) to the fund managers to start fund operations and prepare investment pipelines. The funds are selected through an open tender process. OECD method likely applicable.
- In 2018, Luxembourg, through its MECB, signed an agreement with the International Union for Conservation of Nature (IUCN) to set up the *Blue Natural Capital Financing Facility* (BNCFF). The BNCFF focuses on coastal ecosystems as the main providers of biodiversity and ecosystem services. The facility aims to target commercial opportunities and value creation in the coastal natural capital economy, integrating coastal science and marine data technology and exploiting opportunities to create policy frameworks for climate change and experience for project finance. The facility aims to mobilise donor funds to attract new private investment for sustainable coasts. The BNCFF has been successful in mobilizing funds from other donors and foundations on the financing facility level. Individual BNCFF supported projects have also been successful in mobilizing donor funds, philanthropic capital, loan investments from commercial banks and private carbon finance.

- In 2018, the Government of Luxembourg, through its MFIN, provided 1 Mio. EUR to IFC's *Green Cornerstone Bond Fund Support Program*, a technical assistance program managed by IFC to complement the Amundi Planet Emerging Green One Fund—the world's largest targeted green bond fund focused on emerging markets. OECD method likely applicable.
- In November 2019, the *European Microfinance Award*, co-organised by the MoFEA, the European Microfinance Platform (eMFP) and the Inclusive Finance Network Luxembourg (InFiNe.lu) were awarded at the EIB. The Award with the theme "Strengthening Resilience to Climate Change", aims at highlighting the critical role of the financial inclusion sector in increasing the resilience of communities vulnerable to the effects of climate change. Applicants were expected to submit initiatives that respond to the problems caused by climate change, and to demonstrate a proven or potential positive impact on the lives and livelihood of target groups. This means enabling groups to reduce their exposure to risks, reducing the sensitivity of livelihoods to shocks and increasing target populations' adaptive capacity.
- In February 2020, Luxembourg, through its MECB, started to support the *Vietnam Green Bond Readiness Program*, initiated and implemented by the Green Growth Institute (GGGI) in Vietnam. This program has a mixed support envelope consisting of enhancing the regulatory framework for corporate and municipal bonds in Vietnam, building capacity of private and public players through knowledge exchange, training and toolkits. An important component of this program is direct support to corporate and municipal green bond issuers to prepare green bonds, which can demonstrate a direct mobilisation of private capital through the capital markets in Vietnam. OECD method likely applicable.
- In September 2020, the *City Climate Finance Gap Fund* was officially launched in partnership with Germany. Implemented by the World Bank and European Investment Bank, the City Climate Finance Gap Fund aims to help bridge the urban financing gap to achieve low carbon, climate resilient urbanization pathways. The objective of the Fund is to provide direct early-stage project preparation support to cities in Lower- and Middle-Income Countries that have already made commitments consistent with the Paris Climate Agreement. Overall, the Gap Fund Initiative is intended to mobilise MEUR 100 in contributions to finance project preparation support with a view to unlocking a pipeline of low-carbon and climate resilient infrastructure projects with a total value of at least EUR 4 billion. These are expected to be in areas such as water and sewerage, sustainable urban mobility, energy efficient affordable housing, climate-smart urbanisation and urban climate resilience and adaptation. Support is provided by the MECB. OECD method likely applicable.
- In October 2020, Luxembourg through its MECB, again in partnership with Germany, launched the *Restoration Seed Capital Facility* (RSCF). The objective of the programme (which will run for 7 years) led by UNEP is to increase the number of funds that invest in forest landscape restoration projects by providing support to investment funds (support line (SL)

1) and other investors on a cost-sharing and co-financing basis for pipeline (SL2) and early-stage project development (SL3) through grants or reimbursable grants. In doing so, this facility could act as one of several vehicles to implement the UN Decade on Ecosystem Restoration 2021-2030, which aims to bring at least 350 million hectares of degraded ecosystems under restoration by 2030. OECD method likely applicable for SL3, maybe SL1.

- Launched in 2022 and building on the first phase (2018) of the UNEP *Land Use Finance project: Scaling up private finance towards "net zero, nature positive" land use* continues working on leveraging blended finance (demand side) towards net-zero and nature positive investment in land use sectors, while expanding the work on business incubation (supply side). This project has a more targeted approach to business and finance solutions using a value chain approach, as well as need for systemic changes ("rules of the game"), based on lessons, successes and failures over the past 3 years. Support is provided by the MECB.
- Since 2022, Luxembourg is supporting the *Global Trust Fund on Sustainable Finance Instruments: Scaling-up the Bonds Markets in Developing Countries* (GGGI) with an initial EUR 5 Mio. grant split between MECB, COOP-MoFEA and MFIN. The aim of the programme is to strengthen the market for green/sustainable bond issuances and debt for nature swaps in developing countries. According to GGGI's preliminary estimates, the programme will save around 100 million tCO2e and provide climate adaptation benefits to around 1 million people (at least 50% women). The expected results are fourfold: i) Strengthening of national policy frameworks leading to an increase in the volume and ambition of thematic bond issues. ii) Strengthening of the capacity of public and private players to participate in and contribute to the global thematic bond market. iii) Completion of USD 2 billion in thematic bond issues. iv) Sharing of knowledge about the programme at global, regional, and local levels. OECD method likely applicable.
- Initiated by the Luxembourg MFIN in 2023, the *Green Earth Impact Fund* (GEIF) allows professional private clients to invest in a diversified portfolio of funds targeting climate change, water protection, and biodiversity in emerging markets, and to benefit from de-risking mechanisms such as a EUR 25 million first-loss protection provided by the Luxembourg MFIN. The fund is set up as a fund of funds (FoF) strategy providing capital to innovative private equity, sustainable real assets and private debt funds. In addition, the fund benefits from a de-risking mechanism as a result of the anchor investment by the MFIN within a blended finance structure. With *Schroders-BlueOrchard Finance ltd* as an Investment Manager, the GEIF will operate as a value-added vehicle to drive and channel sustainable and impact investments in climate mitigation, climate adaptation, and the protection of water and biodiversity. OECD method likely applicable.
- In 2023, the *Resilient Landscapes Luxembourg* (RLL) was launched by the MECB in partnership with CIFOR/ICRF, as an innovative project incubator for science-based high-quality Nature-based Solution projects to develop investment-ready projects.

BOX 1 – LIST OF ICF PROJECTS AND PROGRAMMES WITH A PRIVATE SECTOR MOBILIZATION COMPONENT

Mobilization under OECD: mostly simple co-financing arrangements, shares in collective investment vehicles, guarantees, potentially also loans or equity.

- Luxembourg-EIB Climate Finance Platform (LCFP), shares in collective investment vehicles, first loss.
- Forestry and Climate Change Fund (FCCF), shares in collective investment vehicles.
- International Climate Finance Accelerator (ICFA), simple co-financing arrangements, guarantee (via BCEE).
- IFC Green Cornerstone Bond Fund Support Program, simple co-financing arrangements.
- GGGI Vietnam Green Bond Readiness Program, simple co-financing arrangements
- City Climate Finance Gap Fund, simple co-financing arrangements, syndicated loans or direct investment loans, equity.
- Restoration Seed Capital Facility (RSCF), simple co-financing arrangements.
- GGGI Sustainable Finance Global Trust Fund (green bond, debt for nature swap support), simple co-financing arrangements
- Green Earth Impact Fund (GEIF), shares in collective investment vehicles, first loss.

Possible mobilization under OECD (simple co-financing arrangements), or demonstration through MDB or other approach:

- UNEP Land Use Finance Project, technical assistance under other approach.
- Blue Natural Capital Financing Facility (IUCN BNCFF), simple co-financing arrangements, technical assistance under other approach.
- Resilient Landscapes Luxembourg (CIFOR-ICRAF RLL), simple co-financing arrangements, technical assistance under other approach (2023).

V.D – Information on support for technology development and transfer provided under Article 10 of the Paris Agreement

93. It is proposed to provide a few concrete examples of projects supported by Luxembourg in the context of its support for technology development and transfer in this section.

94. The following projects and programmes illustrate the efforts of Luxembourg's COOP-MoFEA and MECB's support for technology development and transfer to developing countries. A full overview of the projects with a technology development and transfer component can be found in CTF Table III.4.

95. In this context it is worth noting the new *fifth Indicative Cooperation Programme (ICP) for Cabo Verde* was conducted in 2020 as a whole-of-government approach (involving three, line ministries from Luxembourg side: the MoFEA, the MECB and the Ministry of Economy with a triple focus on development, climate and energy (DCE). The ICP covers the period 2021 - 2025 and commits a total of EUR 78 million EUR for projects covering five thematic areas: employability and employment, water and sanitation, local development, climate governance and action, and energy transition.

96. The list below is highlighting some ICF MECB projects:

International Union for Conservation of Nature (IUCN): Blue Natural Capital Financing Facility (BNCFF)[38] – EUR 5.32 Mio. EUR (2018-ongoing; new agreement signed in 2022)

In 2018, Luxembourg signed an agreement with the International Union for Conservation of Nature (IUCN) to set up the Blue Natural Capital Financing Facility (BNCFF). The BNCFF focuses on coastal ecosystems as the main providers of biodiversity and ecosystem services. The facility aims to target commercial opportunities and value creation in the coastal natural capital economy, integrating coastal science and marine data technology and exploiting opportunities to create policy frameworks for climate change and experience for project finance. The facility aims to mobilise donor funds to attract new private investment for sustainable coasts. Blue Natural Capital projects aim to protect, restore and enhance natural ecosystems to better support climate change adaptation and mitigation efforts while conserving biodiversity and other vital coastal and marine natural resources. The projects aim to use an innovative blended finance model to access different financial streams and attract new investors. To date, 16 projects in 12 countries have benefited from BNCFF support. The Blue Natural Capital Financing Facility has been successful in mobilizing funds from other donors and foundations on the financing facility level. Individual BNCFF supported projects have also been successful in mobilizing donor funds, philanthropic capital, loan investments from commercial banks and private carbon finance. (→ also included in CTF Table III.4).

38 https://bluenaturalcapital.org/bncff/.

Rwanda - Waste to Resources: Improving Municipal Solid Waste and Hazardous Waste Management (GGGI) – 2021-2024 - EUR 4 Mio.

In 2020, the MECB initiated a Memorandum of Understanding with the Ministry of Environment of Rwanda to strengthen their cooperation on technology transfer between the two countries and embark on the project "Waste to Resources: Improving Municipal Solid Waste and Hazardous Waste Management in Rwanda". The project aims to adopt integrated sustainable waste management approaches and circular economy business models to increase the capacity of the current waste management system in the city of Kigali and in some urban areas of the country with the following results: i) Separation and recovery of organic and plastic waste to minimize waste disposal at the Nduba landfill site in Kigali. ii) Improved e-waste collection rate and management in Kigali and secondary cities. iii) Improved policy and regulatory framework and capacity building through skills development and knowledge exchange. (→ also included in CTF Table III.4)

Burkina Faso – Clean Energy 4 People Resilience (UNCDF) – 2019-2023 - EUR 3.23 Mio.

The overall objective of the project implemented by the United Nations Capital Development Fund (UNCDF) is to contribute to improving the economic resilience and adaptation to climate change of the most vulnerable segments of the population (women, youth, small farmers and entrepreneurs, micro and small enterprises, refugees) in rural and sub-urban areas of Burkina Faso. This is done by promoting access to clean energy solutions, especially for productive uses and income-generating activities, provided by private sector energy service companies and accelerated by innovative business models and digital financing solutions. (→ also included in CTF Table III.4)

Vanuatu - Enhancing resilience to climate change through solar power-driven access to water in rural areas of Outer Islands (GGGI) – 2018-2021 / 2021-2025 – EUR 3.1 Mio.

The project aims to increase resilience in rural communities in Vanuatu to cope with the consequences of climate change, such as droughts and tropical cyclones, through the implementation of solar-powered water pumps. Another component of the project is the strengthening of the institutional environment and the training of the communities for the management and maintenance of the solar pumping systems and the water resources. The project is also working on the development of a replication mechanism in order to ensure the sustainability and scale up of the activities. (→ also included in CTF Table III.4)

Senegal - Green Secondary Cities Wastewater, Plastic Waste and WEEE Management: Innovative Business Model for Recycling and Valorisation (GGGI) – 2018-2024 – EUR 3 Mio.

The project aims to design innovative business models for recycling and waste recovery in secondary cities of Senegal to create green jobs and improve the sanitation quality in the cities of Tivaouane, Touba and Dakar. The project will have an impact on the environment, unemployment and behaviour with improved standard of living by bringing lasting improvements on the incomes and lives of beneficiaries with creation of green jobs and green services while promoting a green perspective in terms of access to a sustainable, reliable and affordable management of plastic, faecal sludge and waste from electrical and electronic equipment. (→ also included in CTF Table III.4)

97. The list below is pinpointing some emblematic COOP-MoFEA projects:

Cabo Verde - Water & Sanitation Programme – LuxDev-CVE/389[39] - under the ICP DCE 2021-2025 – COOP-MoFEA EUR 7 Mio. and MECB EUR 2 Mio. (2022-2026)

The programme CVE/389 is a continuation of Luxembourg's previous interventions in Cabo Verde. It aims to contribute to ensuring universal access to safe drinking water of adequate quality and quantity, at an affordable price, as well as to ensure quality sanitation services, in Cabo Verde, particularly by the most vulnerable families.

The objective is to increase the availability and reduce the cost of drinking water (mainly desalinated water), and to ensure sustainable access to sanitation services. More specifically, the MECB's contribution will enable the installation of solar energy systems to increase energy efficiency in the production and distribution/pumping of drinking water and wastewater treatment respectively. (→ also included in CTF Table III.4)

Cabo Verde – 100% Solar Desalination Unit, Brava – LuxDev- CVE/087[40] – 2021-2023 – 3.45 Mio. EUR

In 2018, Luxembourg Development Cooperation initiated the development of a technical and economic feasibility study that was launched in 2020 in the framework of the "Brava - sustainable island" project in Cabo Verde, whose goal is to achieve a 100 % renewable energy penetration rate on the island of Brava through the installation of a photovoltaic power station and a wind power plant. Opportunities were also explored to build a multi-stakeholder partnership to support the implementation of the "Brava – sustainable island" project which already includes the construction of a 300 m^3/day solar powered desalinisation unit financed by Luxembourg. (→ also included in CTF Table III.4)

Mali - Support Programme to Agropastoral Value Chains, Phase II (PAFA II) – LuxDev - MLI/026[41] – 2021-2025 – 16 Mio. EUR

The Programme aims to increase the income of agro-pastoral family farms, businesses, and vulnerable populations in southern Mali. The programme focuses on enhancing the productivity and employability within the local milk and potato sectors by strengthening the capacities of stakeholders, improving production techniques, and facilitating market access. Key objectives include ensuring that quality products from these value chains reach markets competitively, professionalizing and inclusively developing the various links in the chains and improving overall performance through effective collaboration among private sector entities, civil society, professional organizations, and public institutions. (→ also included in CTF Table III.4)

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39 https://luxdev.lu/en/activities/project/CVE/389

40 https://luxdev.lu/en/activities/project/CVE/

41 https://luxdev.lu/fr/activities/project/MLI/026

Cabo Verde – Supporting the partnership between the Cabo Verde Centre for Renewable Energies and Industrial Maintenance (CERMI) and the Centre of Competence-Technical Engineering of Luxembourg (CdC-GTB) – LuxDev- CVE/085[42] *– 2018-2021 – EUR 4 Mio.*

An innovative project was launched in 2018 in Cabo Verde to create a public enterprise between Cabo Verde's "Centre for Renewable Energy and Industrial Maintenance" and a Luxembourg based economic interest group, the "Centre of Competence-Technical Engineering of Luxembourg". Through this alliance, the two entities with the support of Luxembourg's Development Cooperation established a private company in Cabo Verde known as "3C". The aim of the company is to facilitate the energy transition of the country by providing training in renewable energy technology. Besides training activities, the project also supports the creation of consulting poles which are covering educational engineering, engineering and energy efficiency and renewable energy consulting. Clusters in the fields of certification, metrology and Research / Development / Innovation (RDI) are also being implemented. Furthermore, the "3C" aims at becoming a regional/international centre for training certification, audit, research and development as well as entrepreneurship in the field of renewable energy. (→ also included in CTF Table III.4)

42 https://caboverde.luxdev.lu/en/activities/project/CVE/085

V.E – Information on capacity-building support provided under Article 11 of the Paris Agreement

98. Capacity building is an essential element of all programs and projects of Luxembourg's climate action. It is proposed to provide a few concrete examples of projects supported by Luxembourg in the context of its capacity building support in this section.

99. The following projects and programmes illustrate the efforts of Luxembourg's COOP-MoFEA and MECB's capacity building support to developing countries. It should be noted that capacity building is one of the cornerstones to Luxembourg's programmes in developing countries. A full overview of the projects with a capacity building component can be found in CTF Table III.5.

100. As already mentioned in ***Section V.D***, it is worth noting the new *fifth Indicative Cooperation Programme* (ICP) for Cabo Verde was conducted in 2020 as a whole-of-government approach (involving three-line ministries from Luxembourg side: the MoFEA, the MECB and the Ministry of Economy with a triple focus on development, climate and energy). The ICP covers the period 2021 - 2025 and commits a total of EUR 78 million EUR for projects covering five thematic areas: employability and employment, water and sanitation, local development, climate governance and action, and energy transition.

101. The list below is highlighting some ICF MECB projects:

Cabo Verde – Climate Action Programme – LuxDev-CVE/401[43] - under the ICP DCE 2021-2025 – EUR 10 Mio.

The overall objective of this intervention is to support Cabo Verde in the implementation of its new climate policy by 2025, as embodied in the Nationally Determined Contribution and in the National Adaptation Plan. This will result in a consolidated climate governance that will make Cabo Verde a low carbon and more resilient country to climate change. Reinforced effectiveness and efficiency of climate governance and action will operationalise the enhanced transparency framework and thus help the country to meet its international climate commitments as defined in the Paris Agreement signed by Cabo Verde in 2016. (→ also included in CTF Table III.5)

Developing countries - Global Trust Fund on Sustainable Finance Instruments: Scaling-up the Bonds Markets in Developing Countries (GGGI) – EUR 5 Mio. split between MECB, COOP-MoEFA and MFIN (2022-2026)

The aim of the programme is to strengthen the market for green/sustainable bond issuances in developing countries. According to GGGI's preliminary estimates, the programme will save around 100 million tCO2e and provide climate adaptation benefits to around 1 million people (at least 50% women). The expected results are fourfold: i) Strengthening of national policy frameworks leading to an increase in the volume and ambition of thematic bond issues. ii) Strengthening of the capacity of public and private players to participate in and contribute to the global thematic bond market. iii) Completion of USD 2 billion in thematic bond issues.

43 https://luxdev.lu/fr/activities/project/CVE/401

iv) Sharing of knowledge about the programme at global, regional, and local levels. OECD method likely applicable. (→ also included in CTF Table III.5)

Latin America: 20x20 Initiative[44] (WRI) – EUR 730 000 (2022-2024)

Second partnership between Luxembourg and the World Resources Institute (WRI) to strengthen the 20x20 Initiative. The project contributes directly to the recovery and maintenance of the functionality of degraded lands in Latin America and the Caribbean by initiating and achieving ambitious new restoration objectives in the region. The project aimed at

- catalysing the implementation of restoration objectives – anchored in countries' NCDs - through Landscape Policy and Monitoring Accelerators,
- the development of gender transformational business models, and
- the drafting and launch of a new 20x20 Strategy.
  (→ also included in CTF Table III.5)

Developing Countries: Luxembourg-GLF Finance for Nature Platform[45] (CIFOR-ICRAF) – EUR 1.58 Mio. (2021-2024)

The financial sector has been slow to recognise the threat that unsustainable land use poses to climate change, biodiversity, water use, rural poverty and inequality. Established in 2021, the aim of the Luxembourg-GLF Finance for Nature Platform is to catalyse and accelerate the mainstreaming of sustainable finance through knowledge sharing and capacity building activities to scale appropriate finance models that contribute to nature-based solutions to climate change mitigation and adaptation on the ground. The platform aims to channel financial flows towards sustainable land use models that are sustainable, equitable, inclusive and cost-effective. This approach will not only increase economic returns, but also close the huge funding gap to meet targets on climate change, biodiversity and land degradation, all of which are essential for our health and well-being. (→ also included in CTF Table III.5)

Global – Human rights and Climate Change (CIEL[46]) – 600 000 EUR (2021-2024)

In 2021, the MECB renewed its partnership with the Centre for International Environmental Law (CIEL) for a period of 3 years. The objective was to improve human rights-based policies in the implementation of UN climate agreements, including through the work of the Human Rights Council as well as through national and regional institutions, with the aim of strengthening synergies between these work and other relevant global processes and areas related to climate finance. (→ also included in CTF Table III.5)

Chile - Implementing an integrated solid household waste management strategy in the province of Chiloé (UNDP) – 2020-2023 - EUR 1.3 Mio.

The project aims to install mechanisms, tools, and capacities to promote the circular economy from the different actors of the province, progressively decreasing the total volume of solid household waste for the final disposal in landfills, as well as the emission of greenhouse gases. The implementation of the project includes three strategic axes, complementary and articulated in the Province of Chiloé, which are:

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44 https://initiative20x20.org/

45 https://www.globallandscapesforum.org/luxembourg-glf-platform/

46 https://www.ciel.org/

i) Capacities: Strengthen capacities of local technical teams and citizens, in the prevention and management of household solid waste; ii) Equipment: Promote the development of conventional and innovative solutions in household solid waste management; iii) Public Policy: Promote local environmental institutions and management, through public instruments for prevention and management of household solid waste. (→ also included in CTF Table III.5)

Vietnam - Climate Adaptation and Resilience in Thua Thien Hue Province (LuxDev VIE/433[47]) - 2018-2022 – EUR 2.96 Mio.

VIE/433 aims to contribute to Vietnam's goal of strengthening the resilience of people and the natural system to climate change, and specifically to assist local authorities and communities in coastal and lagoon communes to increase their understanding and resilience and decrease their vulnerabilities to climate change. To achieve these objectives, the project aimed for the following results: i) Climate Change and Disaster Risk Reduction (DRR) – Government and community capacities to respond to climate change are enhanced, ii) Small-scale infrastructure is better protecting people and their livelihoods; iii) Resilient Ecosystems help people better adapt to climate change. (→ also included in CTF Table III.5)

List of newly committed ICF projects implemented by national NGOs in 2021 and 2022

Croix-Rouge_3	Amélioration des capacités d'adaptation des communautés vulnérables face aux changements climatiques par la promotion des Biodigesteurs	Burkina Faso	2021-2025
ADA_3	Integrating Green Inclusive and Climate Smart Finance in Microfinance Institutions	Philippines	2021-2023
ASTM_5	Promotion des techniques et technologies d'adaptation aux changements climatiques pour la résilience des populations vulnérables : Phase II	Burkina Faso	2021-2024
Caritas Luxembourg_4	Climate Change Resilience and Food Security (CCRFS) Dacope and Mongla Upazilas, Bangladesh	Bangladesh	2021-2026
Graine de Vie_1	Projet pilote d'accompagnement des communes et des communautés locales en vue de la réhabilitation de leur milieu naturel, suite à la loi de décentralisation intervenue au Cameroun	Cameroun	2021-2025
Kindernothilfe Luxemburg_1	Climate Change Adaptation and Mitigation in most vulnerable areas in Argusan del Sur, Philippines	Philippines	2021-2024
Rainforest_2	« COBIGA – Corredor Biologico La Gamba, Costa Rica. Intelligent and ecological CO2 Sequestration and Creation of a Biological Corridor in the Golfo Dulce Region	Costa Rica	2022-2024
Handicap International _1	Projet d'amélioration de la gestion des chocs climatiques (PAG2C)	Mali	2022-2024
PADEM_5	Souveraineté alimentaire et résilience au changement climatique en Mongolie rurale	Mongolia	2022-2025
Graine de Vie_2	Projet de restauration de la réserve spéciale malgache d'Ambohitantely (Phase I)	Madagascar	2022-2026
AEIN_4	Phase II) Towards Climate Smart Villages: promotion of affordable and replicable adaptation and mitigation practices to enhance livelihoods of vulnerable communities in the Ananthapur District of Andhra Pradesh, India	India	2022-2026

47 https://luxdev.lu/en/activities/project/VIE/433

AEIN_5	(Phase II) Towards Climate Smart Villages: promotion of affordable and replicable adaptation and mitigation practices to enhance livelihoods of vulnerable communities in the Kavrepalanchowk District, Nepal	Nepal	2022-2026
Fundacion Jocotoco_1	Climate Adaptation in the Chocó Biodiversity Hotspot	Ecuador	2023-2027

102. The list below is pinpointing some emblematic COOP-MoFEA projects:

Cabo Verde – Energy Transition Support Programme – LuxDev-CVE/390[48] – under the ICP DCE 2021-2025 – EUR 12 Mio. (COOP-MoEFA EUR 7 Mio. and Ministry of Economy (CEF) EUR 5 Mio.)

The project (which is the follow-up project of CVE/083 listed below) aims to advance the country's transition towards sustainable and affordable energy access for all. Given the country's high dependency on imported fossil fuels due to its insular nature and limited market size, the project focuses on leveraging Cabo Verde's abundant renewable energy resources, such as wind and solar. In terms of technology development and transfer, the project supports the promotion and operationalization of renewable energy production through micro-production systems, independent power producers (IPPs), and the deployment of energy management systems, including smart grids and storage solutions. Several initiatives are aimed at improving the infrastructure for renewable energy, such as feasibility studies for large-scale energy storage projects and the expansion of meteorological stations to optimize energy production potential. Additionally, the project provides significant capacity-building support, strengthening institutional governance and professionalizing services in the energy sector through targeted training for public and private sector actors. This includes the creation of tailored capacity-building strategies, fostering institutional reforms, and engaging the private sector as a key driver of change. The overall objective aligns with Cabo Verde's national energy sustainability plans and climate commitments, with a particular focus on achieving a 24% reduction in greenhouse gas emissions by 2030. (→ also included in CTF Table III.5)

Burkina Faso – BKF/023[49] and BKF/024[50] – support to the sustainable management of the forest resources & project for land reclamation efforts towards pastoral usage and in conservation areas – 2018-2025 – EUR 34 & 6.5 Mio.

In Burkina Faso, Luxembourg's development cooperation projects include interventions in the forestry sector and natural resources management and are worth being highlighted:

The BKF/023 project focuses on strengthening the sustainable management of Burkina Faso's forest resources by improving planning, monitoring, and governance capacities within the Ministry for Environment, Green Economy and Climate Change (MEGECC). In terms of technology development and transfer, the project builds on the achievements of the Forest Sector Support Programme (FSSP) and the second national forest inventory, enhancing the use of modern tools for forest resource planning and monitoring. These include geospatial technologies and data-driven forest management systems, which support evidence-based decision-making and policy implementation. Additionally, the project invests heavily in capacity building by supporting the implementation of sectoral policies, budgeted action plans, and decentralized governance mechanisms that empower local communities to take an active role in forest resource management. The

48 https://luxdev.lu/en/activities/project/CVE/390

49 https://luxdev.lu/en/activities/project/BKF/023

50 https://luxdev.lu/en/activities/project/BKF/024

strengthening of institutional and technical capacities ensures long-term sustainability by enabling national and local actors to effectively manage and protect timber and non-timber forest resources. Although both elements are significant, the project primarily qualifies as capacity-building support, as it focuses extensively on institutional strengthening and the empowerment of local and national stakeholders for effective forest governance.

In parallel, the BKF/024 project aimed to reclaim and secure pastoral lands in Burkina Faso to support sustainable livestock production and environmental conservation efforts. Throughout its implementation, the project introduced innovative land reclamation techniques, including the establishment of water points, pasture improvement through mowing and hay conservation, and the integration of climate-smart technologies to promote sustainable land use. It also facilitated the development of a carbon credit initiative using the Plan Vivo Standard, enabling local communities to benefit from climate finance opportunities. In terms of capacity building, the project supported the development of 15 land charters, which provided governance frameworks for managing restored areas, and delivered extensive training programs for local authorities and community-based organizations. These efforts equipped stakeholders with the necessary skills to manage pastoral resources effectively, resolve conflicts between pastoralists and farmers, and diversify income through small livestock farming and related economic activities. As a result, the project contributed to the increase in functional pastoral areas, improved food security for livestock, and enhanced income opportunities for women and vulnerable populations. The project primary impact was in capacity strengthening, ensuring that local communities and institutions were better prepared to manage and sustain pastoral areas in the long term. The BKF/024 project came to an end in 2023. (→ also included in CTF Table III.5)

Myanmar – Eastern Shan State rural development and inclusion project – LuxDEV-MYA/002[51] *– 2018-2022 – EUR 10 Mio.*

"Eastern Shan State Rural Development and Inclusion Project aims" (i) to improve the means and resources for legal livelihood activities of the local communities and (ii) to promote the interaction, interdependence, cooperation and capacity in the community's development of participatory governance. This project is currently in the closing phase due to the political situation in Myanmar. (→ also included in CTF Table III.5)

Cabo Verde – Renewable energies programme – LuxDev-CVE/083[52] *–2017-2021– EUR 5.5 Mio.*

Renewable energy is one of the three key sectors under the 4th Indicative Cooperation Programme (ICP IV) in Cabo Verde, and the aim of the programme is to ensure access to clean, reliable modern and affordable energy for all, while increasing energy independence. It also seeks to reinforce governance, regulation and business climate of the renewable energy sector in Cabo Verde. The activities further aim at increasing national fundraising capacities for renewable energies. (→ also included in CTF Table III.5)

51 https://luxdev.lu/en/activities/project/MYA/002

52 https://luxdev.lu/en/activities/project/CVE/083

Mali - Rural development and food security – LuxDev-MLI/021[53] *– 2016-2022 – EUR 39.4 Mio.*

The overall objective of this programme is to diversify and build sustainable sources of agricultural income and household food security. The specific objective is to develop and increase the productivity, sustainability and profitability of three agricultural sectors.

The program operates in the districts of Segou, San, Tominian, Bla, Barouéli (Segou Region) and Yorosso (Sikasso Region). The targeted direct beneficiaries include 190 selected Producer Organisations (POs) in the rice, sesame and fonio sectors, including POs working on irrigation schemes, as well as a hundred micro and small businesses specialised in rice and fonio processing.

The results identified for achieving this goal are to:

- develop pathways for sesame and fonio by supporting 90 POs and 50 micro and small businesses in sesame and fonio production and processing;
- improve food security, in particular through the development of the rice sector;
- contribute to the achievement of environmental and climate performance in terms of agricultural policies and strategies; and
- promote investment and business environment for better sector development.

(→ also included in CTF Table III.5)

Viet Nam –- Cao Bang/Wise Use of water and agriculture – LuxDev-VIE/036[54] *– 2015-2020 – 6.6 Mio. EUR*

The "Cao Bang/Wise Use of water and agriculture Project" objective is to assist sustainable trends of poverty reduction and food security in mountainous areas of Cao Bang province.
The specific objective of VIE/036 is to improve effective natural and financial resource management focused on agricultural production while meeting the needs of ethnic minorities and other population segments with difficulties.
The anticipated outcome of the project is threefold:

- improved and sustainable agriculture service delivery mechanisms in Cao Bang that are demand oriented linking farmers to markets and applying improved (optimised, diversified and more resilient) agricultural production systems with improved productivity;
- strengthened local authorities providing efficient and effective participatory investments services for small-scale roads and irrigation, thus allowing farmers better access to markets and better productivity from irrigation systems; and
- improved irrigation development by the Department of Agriculture and Rural Development by applying the principles of participatory irrigation management in (i) prioritization, (ii) planning and design, (iii) monitoring of investments and quality control, and (iv) operation and maintenance optimizing available resources.

(→ also included in CTF Table III.5)

53 https://mali.luxdev.lu/en/activities/project/MLI/021

54 https://vientiane.luxdev.lu/en/activities/project/VIE/036)

Annex 1 – Implementation of recommendations and encouragements from the latest review

The table below indicates if the encouragement from the latest review – IDR.8, Table I.3 and TRR.5, Table II.3 [UNFCCC (2024)] – has been included or not in this submission, and if not, why.

Reporting requirement	Issue type	Assessment	Description	Included Y/N
para. 55 (NC) **para. 19 (BR)**	Transparency	Encouragement	The ERT encourages Luxembourg to improve the transparency of its reporting in its next submission by providing, to the extent possible, information on private financial flows leveraged by bilateral climate finance towards mitigation and adaptation activities in non-Annex I Parties.	Yes, more information on mobilising private finance is now reported, particularly in Sections V.A.2 and V.A.3.

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➔ http://data.europa.eu/eli/reg_impl/2020/1208/oj and http://data.europa.eu/eli/reg_impl/2020/1208/2024-05-14

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